Research Report
Agreement T2695, Task 68
Camber Prediction

Improving Predictions for Camber in Precast, Prestressed Concrete Bridge Girders

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16. ABSTRACT

This research was conducted to develop improved methods of predicting camber in prestressed concrete girders. A computer program was written to calculate camber as a function of time. It takes into account instantaneous and time-dependent behavior of the concrete and steel and performs the calculations in a series of time steps. It was calibrated by comparing its predictions with the camber from 146 girders, measured in the fabricators yard both after release and at a later time. Its long-term predictions were then compared with the responses of 91 girders that were monitored during construction at the Keys Road Bridge site.

The results showed that the response was sensitive to the predicted prestress losses, and that the 2006 AASHTO values for prestress loss provided much better estimates than did the 2004 provisions. In addition, the camber was found to depend on the elastic modulus of the concrete, its creep coefficient, and the use of the prestress losses in the calculation of the creep camber. To achieve the best match with the measured cambers, the AASHTO-recommended values for the elastic modulus and the creep coefficient had to be multiplied by adjustment factors and the prestress losses had to be taken into account when computing the creep component of camber.

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EXECUTIVE SUMMARY

This research was conducted to develop improved methods of predicting camber in prestressed concrete girders. A computer program was written to calculate camber as a function of time. It takes into account instantaneous and time-dependent behavior of the concrete and steel and performs the calculations in a series of time steps. It was calibrated by comparing its predictions with the camber from 146 girders, measured in the fabricator's yard both after release and at a later time. The program's long-term predictions were then compared with the responses of 91 girders that were monitored during construction at the Keys Road Bridge site. The measured deflections due to temporary strand release and deck casting were compared to calculated values by using variations in pier continuity. Long-term creep deflections were also monitored after deck placement.

The results showed that the response was sensitive to the predicted prestress losses and that the 2006 AASHTO values for prestress loss provided much better estimates than did the 2004 provisions. In addition, the camber was found to depend on the elastic modulus of the concrete, its creep coefficient, and the use of the prestress losses in the calculation of creep camber. Predicted cambers were compared to the measured cambers to calculate a predicted error. To achieve the best match with the measured cambers, the AASHTO-recommended values for the elastic modulus and the creep coefficient had to be multiplied by adjustment factors. The adjustment factor for the elastic modulus was found by minimizing the predicted error on the camber immediately after release, resulting in a factor of 1.15. The adjustment factor for the creep coefficient was found by minimizing the predicted error on the second camber measurement, resulting in an adjustment factor of 1.4. The prestress losses had to be taken into account when computing the creep component of camber.

The cambers measured after placement of the girders in their final locations were compared with predicted values to evaluate the influence of the support conditions. The supports provided partial restraint to longitudinal movement of the girder's bottom flange and clearly affected the camber. However, significant scatter in the recorded data made trends difficult to see and reinforced the need for further measurement and analysis of the issue. As an indication of the importance of the end conditions, it may be noted that, in the evaluation of the changes in camber due to release of the temporary strands and placement of the deck, the girders that were seated on oak blocks at both ends were 41 percent to 46 percent stiffer than those seated on elastomeric bearings,

After placement of the deck, some downward creep deflection was observed. This is contradictory to the current assumption that the composite section "locks" the deck system. However, the magnitude of the creep deflection was small in comparison to the various other components of camber.

CHAPTER 1

INTRODUCTION

1.1 Context

Prestressing can be defined as “the deliberate creation of permanent internal stresses in a structure or system in order to improve its performance” (Naaman 2004). Since concrete is strong in compression and comparatively weak in tension, prestressing produces compression stresses in areas that will counteract tensile stresses. The prestressing allows for more economical structures, with a reduction in cross-sectional dimensions and consequent weight savings.

Prestressed concrete has made significant contributions to the precast manufacturing and construction industry. Prestressed concrete has been used in a variety of structural applications, ranging from bridges to nuclear power vessels, from buildings to ships, and smaller products, such as ties and piles to offshore drilling platforms (Naaman 2004).

The Washington State Department of Transportation (WSDOT) has been using precast prestressed concrete girders in bridge applications for many years. These girders have allowed for longer spans, provided economical design, and accelerated construction times by allowing precast fabricators to deliver ready-made products at the contractor’s convenience. The girders are often built with an upward camber after initial stressing. However, because of material and environmental properties, this initial camber at release can change over time.

WSDOT typically uses standard designs for prestressed concrete girder cross sections. These sections were designed in collaboration with precast fabricators to provide economical fabrication in conjunction with increased span capabilities. WSDOT will typically design a bridge by using design programs, such as PGSuper (PGSuper 2006), and provide the contractor with detailed plans and specifications to fabricate the girders. The fabricator will then build the girder according to the details provided and deliver the girder to the contractor on site.

1.2 Camber Prediction Challenges to WSDOT

Most of the bridges built in Washington State today are constructed with precast, prestressed concrete girders. However, the uncertainty of the predicted camber in precast, prestressed girders can lead to problems during construction. Excessive camber leads to interference between the top of the girder and the deck reinforcement. Insufficient camber leads to an increase in the concrete required to meet the bottom of the deck slab, resulting in additional weight to the superstructure. Both are undesirable conditions that can lead to construction delays, as well as increased material and labor costs.

1.3 Research Objectives

The primary objective of this research was to improve the methods of predicting camber in precast, prestressed concrete girders. The research focused on evaluating current methods of predicting camber, collecting fabricator camber data to calibrate a model based on current methods, and implementing the methods. Specific objectives included the following:

- Evaluating current camber prediction methods.
- Developing a model to predict the camber history for a girder.
- Collecting girder design information and measured camber data for projects fabricated in Washington State.
- Evaluating the camber data collected in comparison with behavior predicted by current camber models.
- Providing recommendations to improve current camber prediction methods.

1.4 Organization of Report

This report is organized as follows:

- Chapter 2 describes current methods used to predict several of the characteristics that influence camber. These include the concrete compressive strength, elastic modulus, shrinkage, creep, and prestress losses. Also included are the equations used to calculate deflection due to the individual components of self-weight, prestress, and dead load.
- Chapter 3 describes the camber prediction program that was developed to model the camber history for a girder and compare the prediction errors for a set of girders.
- Chapter 4 describes the camber monitoring of eight girders from the Snake Lake Bridge project at Concrete Technology Corporation in Tacoma, Washington.
- Chapter 5 describes the corresponding materials tests for six of the eight girders from the Snake Lake Bridge project. These test included concrete compressive strength, elastic modulus, shrinkage, and creep.
- Chapter 6 describes the camber monitoring of 91 girders from the Keys Road Bridge project in Yakima, Washington, to measure the effects on camber the of removal of temporary strands and deck placement.
- Chapter 7 describes tests performed to evaluate the influence on camber of support conditions that restrict the girder axially from shrinking and creeping. This restraint can impose an additional moment in the girder and change the observed camber.
- Chapter 8 describes data collected from two precast fabricators in Washington State. The data are categorized by girder section type, age of concrete at release, and seasonal variations. Also described are the data collection procedure and the observed influences on camber of the

concrete maturity, compressive strength at release, and compressive strength at 28 days,

- Chapter 9 presents the calibration of the model developed by minimizing the predicted error. The chapter also investigates several changes to the current method used by the WSDOT to more accurately predict camber in precast, prestressed concrete girders.
- Chapter 10 summarizes the research and its conclusions. It also provides recommendations for practice and for future research.

CHAPTER 2

CAMBER PREDICTION METHODS

2.1 Introduction

This chapter discusses several methods available for calculating camber in prestressed concrete girders. Methods are available for each of the following properties: concrete compressive strength (Section 2.2), elastic modulus (Section 2.3), shrinkage (Section 2.4), creep (Section 2.5), and prestress loss (Section 2.6). Section 2.7 discusses the deflection calculations for each of the loading conditions, while Section 2.8 discusses the method that WSDOT currently uses to predict camber.

2.2 Concrete Compressive Strength

The 28-day compressive strength is often used as a reference parameter, but concrete strength actually varies over time and depends on many variables, including the type of cement and curing history. The prediction of the time dependence of concrete properties for prestressed concrete girders is important because the prestress is usually released when the girder is young and the strength is changing quickly. If the actual release and 28-day compressive strength tests are known, then Equation 2.1 (Naaman 2004) can be easily calibrated.

$$f'_c(t) = f'_c(28)\frac{t_{str}}{b + ct_{str}} \tag{2.1}$$

where:

t_{str} = time after concrete starts to gain strength

b = constant that changes the rate of increase

c = constant that changes the ultimate value

$f'_c(28)$ = 28-day concrete compressive strength

$f'_c(t)$ = concrete compressive strength

It is important to note that if the 28-day compressive strength test differs from the design 28-day strength, the actual camber can be influenced. Often, the fabricator will use a higher-strength mix design to achieve the required release strengths within the first 24 hours. As a result, the ultimate strength is often higher than the strength used to estimate the camber.

2.3 Elastic Modulus

The elastic modulus of concrete is traditionally estimated on the basis of the concrete compressive strength. Two methods are discussed in this section. The AASHTO LRFD equation is used for normal-weight concrete. However, ACI Committee 363 recommends a different equation for high-strength concrete. The recommended equations are time dependent because the compressive strength is a function of time.

2.3.1 AASHTO LRFD Method

The AASHTO LRFD method for calculating the elastic modulus is shown in Equation 2.2 (AASHTO 2006). This equation is recommended by AASHTO for concrete with a unit weight of between 0.090 kcf and 0.155 kcf.

$$E_c(t) = 33{,}000\gamma^{1.5}\sqrt{f'_c(t)} \quad \text{(ksi)} \qquad 2.2$$

where:

γ = unit weight of concrete (kcf)

$f'_c(t)$ = concrete compressive strength (ksi)

2.3.2 ACI Committee 363 Method

The ACI Committee 363 recommends using Equation 2.3 to predict the elastic modulus because the AASHTO LRFD method tends to overestimate the value of concrete that has a compressive strength higher that 6,000 psi (ACI 1992). The equation is more complex but is still only a function of the unit weight and the compressive strength of the concrete.

$$E_c(t) = \left(\frac{\gamma}{0.145}\right)^{1.5}\left(1000 + 1265\sqrt{f'_c(t)}\right) \text{ (ksi)} \tag{2.3}$$

2.3.3 NCHRP Report 496 Method

The ASHTO LRFD and ACI-363 methods do not account for material properties other that the unit weight and compressive strength of concrete. Tadros et al. (2003) evaluated the effect of the coarse aggregate used. The proposed formula is shown in Equation 2.4.

$$E_c(t) = 33{,}000K_1K_2\left(0.140 + \frac{f'_c(t)}{1000}\right)^{1.5}\sqrt{f'_c(t)} \text{ (ksi)} \tag{2.4}$$

where:

K_1 = factor representing the difference between national average and local average

K_2 = factor representing whether an upper-bound or lower-bound value is desired in the calculations

For Washington, Tadros et al. (2003) recommended using $K_1 = 1.154$. $K_2 = 1.0$ should be used to represent the mean of the data. However K_2 can be modified to represent the 90th percentile upper-bound (K2 = 1.182) or 10th percentile lower-bound (K2 = 0.817) value.

The equation also removes the unit weight dependence from the calculation. The research observed a relationship between the unit weight and compressive strength of the concrete. However, the equation is only recommended for concrete with a unit weight of less than 0.155 kcf.

2.3.4 CEB-FIP Method

The CEB-FIP Model Code 1990 recommends using Equation 2.5 to predict the elastic modulus (CEB-FIP 1993). This equation is only a function of the concrete compressive strength.

$$E_c(t) = \alpha_E 21500\left(\frac{f'_c(t)}{10}\right)^{1/3} \text{ (MPa)} \qquad 2.5$$

where:

α_E = aggregate correction coefficient (use 1.1 for Washington State aggregates)

$f'_c(t)$ = concrete compressive strength (MPa)

Like the NCHRP method, this equation is independent of the unit weight of the concrete.

2.4 Shrinkage

It is important to predict the shrinkage strain that the girder will experience. Shrinkage itself does not affect camber, but because the prestressing steel will experience the same change in axial strain, shrinkage reduces the prestress force and the camber over time.

Equation 2.6 estimates axial free shrinkage strain as a function of time and is used to provide the time dependence needed for predicting the prestress losses (AASHTO 2006). This equation does not include the resistance of shrinkage by the steel reinforcement. Prestress losses due to shrinkage are discussed in Section 2.6.1.2.

$$\varepsilon_{sh}(t) = -k_{vs}k_{hs}k_f k_{td}\, 0.48\times 10^{-3} \qquad 2.6$$

where:

k_{vs} = factor for the effect of the volume-to-surface ratio

$$= 1.45 - 0.13\left(\frac{V}{S}\right) \geq 1.0$$

k_{hs} = humidity factor for shrinkage

$$= 2.00 - 0.014H$$

k_f = factor for the effect of concrete strength

$$= \left(\frac{5}{1 + f'_{ci}} \right)$$

k_{td} = time development factor

$$= \left(\frac{t}{61 - 4f'_{ci} + t} \right)$$

V/S = volume-to-surface ratio (in.)

H = relative humidity (%)

= 80% for Western Washington

= 70% for Eastern Washington

f'_{ci} = compressive strength at the time of prestressing (ksi)

t = age of the concrete between time of loading for creep calculations, or end of curing for shrinkage calculations, and the time being considered for analysis for creep or shrinkage effect (days)

The total shrinkage is a contribution of two components, the autogenous and drying shrinkage. Autogenous shrinkage is the change in volume due to the hydration of the cement paste. Drying shrinkage is due to evaporation of free water from within the concrete. As the concrete dries, it shrinks in volume (Nilson 2004).

2.5 Creep

When a girder is loaded, the concrete will initially deform elastically. With time, the girder will continue to deform. The total deformation is only partially recoverable once the load has been removed. This continued deformation is called creep. Creep deflection depends on many of the same factors that govern shrinkage. However, creep also depends on the age and magnitude of the load.

Three methods for predicting the amount of creep are discussed in this section, including the AASHTO LRFD Method, Rate of Creep Theory, and the Branson Method. All three methods characterize creep as a coefficient that, when multiplied by the elastic deformation, gives the creep deformation.

2.5.1 AASHTO LRFD Method

The AASHTO LRFD Method uses a time dependent function that is multiplied by factors that represent material and environmental influences, as shown in Equation 2.7 (AASHTO 2006). This equation not only provides a time dependent relation but is also influenced by the age of the concrete at the time of loading, t_a.

$$\psi(t,t_a) = 1.9 k_{vs} k_{hc} k_f k_{td} t_a^{-0.118} \qquad 2.7$$

where:

k_{hc} = humidity factor for creep

$= 1.56 - 0.008H$

t_a = age of concrete when load is initially applied (day). One day of accelerated-cure is equivalent to seven days of moist-cure

All other factors are as defined in Section 2.4.1.

2.5.2 Rate of Creep Theory

The Rate of Creep Theory is composed of two parts as shown in Equation 2.8. The first is a function of the age of loading, and the second is a function of time after loading. Both these parts are given a coefficient to change their behavior. β_1 controls the rate of creep, while β_2 controls the ultimate creep as it relates to the concrete age (Stanton 2004).

$$\psi(t,t_a) = C_{cu} e^{-\beta_2 t_a}\left(1 - e^{-\beta_1 (t - t_a)}\right) \qquad 2.8$$

where:

C_{cu} = ultimate creep coefficient

β_1 = coefficient controlling creep rate

β_2 = coefficient controlling the effect of the age of loading

The Rate of Creep Theory does not have explicit coefficients for environmental and material properties. Variations on the properties that affect creep require calibration to determine the β_1 and β_2 coefficients (Stanton 2004).

2.5.3 Branson Model

The Branson Model is similar to the AASHTO approach, using multipliers to control the rate and magnitude of the creep coefficient. However, it has different equations that are influenced by the material and environmental variables. Equation 2.9 has coefficients for relative humidity, age of loading, and the size and shape of the girder. The Branson Model does not factor in the influence of the concrete compressive strength (Naaman 2004).

$$\psi(t,t_a) = C_{cu} K_{CH} K_{CA} K_{CS} \frac{(t-t_a)^{0.6}}{10+(t-t_a)^{0.6}} \qquad 2.9$$

where:

K_{CH} = humidity factor

$= 1.27 - 0.0067H$

K_{CA} = age at loading factor

$= 1.13 t_a^{-0.095}$

K_{CS} = shape and size factor

$= 1.14 - 0.09\frac{V}{S}$

2.6 Prestress Losses

The reduction in the prestressing force during the life of a girder is called the prestress loss. The total losses are the cumulative result of many components and are important to predict because they can affect the observed camber in the prestressed member. The components that AASHTO considers are discussed in this section.

The AASHTO Refined Method for estimating prestress losses estimates the amount of prestress loss in a girder by summing the losses from different components. The losses are divided into two main categories: instantaneous losses and time dependent losses. The instantaneous losses are those provided by the elastic shortening of the member as a result of the prestressing force. The time dependent losses are a combination of losses associated with creep and shrinkage of the concrete and relaxation of the prestressing strands. Each time dependent component is estimated during two time intervals. These are defined as the time between release of the prestressing and deck casting and the time between deck casting and a final time.

Equation 2.10 estimates the prestress losses from the time that the girder is released (AASHTO 2006).

$$\Delta f_{pT} = \Delta f_{pES} + \Delta f_{pTL} \qquad 2.10$$

where:

Δf_{pES} = sum of all losses or gains due to elastic shortening or elongation at the time of application of prestress and/or external loads

Δf_{pTL} = prestress losses due to long-term shrinkage and creep of the concrete, and relaxation of the steel

$$\Delta f_{pTL} = \left(\Delta f_{pSR} + \Delta f_{pCR} + \Delta f_{pR1}\right)_{id} + \left(\Delta f_{pSD} + \Delta f_{pCD} + \Delta f_{pR2} + \Delta f_{pSS}\right)_{df} \qquad 2.11$$

Δf_{pSR} = prestress loss due to shrinkage of the girder concrete between transfer and deck placement

Δf_{pCR} = prestress loss due to creep of the girder concrete between transfer and deck placement

Δf_{pR1} = prestress loss due to relaxation of the prestressing strands between time of transfer and deck placement

Δf_{pSD} = prestress loss due to shrinkage of the girder concrete between time of deck placement and final time

Δf_{pCD} = prestress loss due to creep of the girder concrete between time of deck placement and final time

Δf_{pR2} = prestress loss due to relaxation of the prestressing strands in the composite section between time of deck placement and final time

Δf_{pSS} = prestress loss due to shrinkage of the deck composite section

2.6.1 Elastic Shortening Loss

At transfer of the prestress, the force is applied to the girder, and elastic bending and shortening occurs. Because the prestressing is bonded to the concrete, the strands shorten as well, reducing the strain and tension stress. Equation 2.12 is an estimate of the elastic prestress loss that can occur as a result of elastic shortening (AASHTO 2006). This is a loss that occurs only when the load is applied and is not time dependent.

$$\Delta f_{pES} = \frac{E_p}{E_{ci}} f_{cgp} \qquad 2.12$$

where:

E_p = modulus of elasticity of the prestressing strand

E_{ci} = modulus of elasticity of the concrete at release

f_{cgp} = concrete stress at the center of gravity of the prestressing strands due to the prestressing force and self-weight of the member directly after transfer

$$= \frac{P_i}{A_g} + \frac{P_i e_{pg}{}^2}{I_g} - \frac{M_g e_{pg}}{I_g}$$

P_i = initial prestress force directly after transfer (positive)

$= A_{ps} 0.7 f_{pu}$

A_g = gross –cross-sectional area of the girder

e_{pg} = eccentricity of strands with respect to the center of the girder

I_g = gross section moment of inertia of the girder

M_g = self-weight moment of girder (positive)

$$= \frac{\omega_{SW} L^2}{8}$$

f_{pu} = ultimate strength of the prestress strands

A_{ps} = total are of the prestress strands

ω_{SW} = self-weight linearly distributed

L = girder length

In this calculation, the initial prestress force is needed, but f_{cgp} is not known until after release. The initial prestress force can instead be calculated through equilibrium of forces and strain compatibility. (See Equation 2.13.) This requires an accurate estimate of the elastic modulus of the concrete at release.

$$P_i = \frac{P_j + M_{sw} e_p A_p n}{1 + n\rho\left(1 + e_p{}^2 \frac{A_c}{I_g}\right)} \qquad 2.13$$

where:

P_j = prestress force just before release

n = modular ratio

$$= \frac{E_p}{E_c}$$

ρ = reinforcement ratio

$$= \frac{A_{ps}}{A_c}$$

2.6.2 Shrinkage Loss

AASHTO estimates the total prestress loss due to shrinkage in two stages. The first is an estimate of loss between the time of transfer and deck placement, and the second is an estimate of loss between deck placement and a final time. Equations 2.14 and 2.15 estimate these losses, respectively (AASHTO 2006).

- Time of transfer to time of deck placement:

$$\Delta f_{pSH} = \varepsilon_{bid} E_p K_{id} \qquad 2.14$$

where:

ε_{bid} = concrete shrinkage strain of the girder between the time of transfer and deck placement (see Equation 2.6)

E_p = modulus of elasticity of the prestressing tendons

K_{id} = transformed section coefficient that accounts for the time-dependent interaction between the concrete and bonded steel in the section being considered for the time period between transfer and deck placement.

$$= \frac{1}{1 + \frac{E_p}{E_{ci}} \frac{A_{ps}}{A_g} \left(1 + \frac{A_g e_{pg}{}^2}{I_g}\right) \left[1 + 0.7\psi_b\left(t_f, t_i\right)\right]}$$

$\psi_b(t_f, t_i)$ = creep coefficient at a final time due to loading introduced at transfer

- Time of deck placement to final time

$$\Delta f_{pSD} = \varepsilon_{bdf} E_p K_{df} \qquad 2.15$$

where:

ε_{bdf} = concrete shrinkage strain of the girder between the time of deck placement and a final time (see Equation 2.6)

K_{df} = transformed section coefficient that accounts for the time-dependent interaction between the concrete and bonded steel in the section being considered for the time period between deck placement and a final time

$$= \frac{1}{1+\frac{E_p}{E_{ci}}\frac{A_{ps}}{A_c}\left(1+\frac{A_c e_{pc}{}^2}{I_c}\right)\left[1+0.7\psi_b\left(t_f,t_i\right)\right]}$$

A_c = area of section calculated by using the net concrete section properties of the girder and the deck and the deck-to-girder modular ratio

e_{pc} =eccentricity of strands with respect to the centroid of the composite section

I_c = moment of inertia of the section calculated by using the net concrete section properties of the girder and the deck and the deck-to-girder modular ratio at service

The third shrinkage component is calculated for the same time period; however, it is due to the shrinkage of the deck concrete between deck placement and a final time. This is estimated in Equation 2.16 (AASHTO 2006).

$$\Delta f_{pSS} = \frac{E_p}{E_c} f_{cdp} K_{df} \left[1+0.7\psi_b\left(t_f,t_d\right)\right] \qquad 2.16$$

where:

Δf_{cdf} = change in concrete stress at the centroid of the prestressing strands due to shrinkage of the deck concrete

$$= \frac{\varepsilon_{ddf} A_d E_{cd}}{\left[1+0.7\psi_d\left(t_f,t_d\right)\right]}\left(\frac{1}{A_c}+\frac{e_{pc}e_d}{I_c}\right)$$

The shrinkage losses calculated for the time periods are then time rated on the ultimate free shrinkage strain, as calculated in Equation 2.17, by using a ratio of the present value to the ultimate. The time-dependency of the shrinkage strain is given in Section 2.4

$$\Delta f_{pSR}(t) = \Delta f_{pSR} \frac{\varepsilon_{sr}(t)}{\varepsilon_{sr}(\infty)} \qquad 2.17$$

2.6.3 Creep Loss

AASHTO estimates the total prestress loss due to creep similarly to the way it estimates shrinkage. Two time periods are used. One is an estimate of loss between the time of transfer and deck placement, and the other is an estimate of loss between deck placement and the final time. Equations 2.18 and 2.19 estimate these losses, respectively (AASHTO 2006).

- Time of transfer to time of deck placement:

$$\Delta f_{pCR} = \frac{E_p}{E_{ci}} f_{cgp} \psi_b (t_d, t_i) K_{id} \qquad 2.18$$

where:

$\psi_b(t_d,t_i)$ = girder creep coefficient at the time of deck placement due to loading introduced at transfer (see Equation 2.9)

t_d = age at deck placement

- Time of deck placement to the final time:

$$\Delta f_{pCD} = \frac{E_p}{E_{ci}} f_{cgp} \left[\psi_b(t_f, t_i) - \psi_b(t_d, t_i)\right] K_{id} + \frac{E_p}{E_{ci}} \Delta f_{cd} \psi_b (t_f, t_d) K_{df} \geq 0.0 \qquad 2.19$$

where:

$\psi_b(t_f,t_i)$ = girder creep coefficient at the time of deck placement due to loading introduced at transfer (see Equation 2.9)

Δf_{cd} = change in concrete stress at the centroid of the prestressing strands due to long-term losses between transfer and deck placement, combined with deck weight and superimposed loads

The creep losses calculated for each time period are time rated on the ultimate creep coefficient, as calculated in Equation 2.20, by using a ratio of the present value to the ultimate. The time dependency for creep is given in Section 2.5.

$$\Delta f_{pCR}(t) = \Delta f_{pCR}(t)\frac{\psi(t)}{\psi(\infty)} \tag{2.20}$$

2.6.4 Relaxation Loss

AASHTO estimates the losses due to relaxation of the prestressing steel in two time intervals, similarly to the way it estimates creep and shrinkage (AASHTO 2006). Equations 2.21 and 2.22 calculate the losses during the indicated time periods.

- Time of transfer to time of deck placement:

$$\Delta f_{pR1} = \frac{f_{pt}}{K_L}\left(\frac{f_{pt}}{f_{py}} - 0.55\right) \tag{2.21}$$

where:

f_{pt} = stress in the prestressing strands immediately after transfer, taken as not less than $0.55f_{py}$

f_{py} = yield strength of the prestressing steel

K_L = factor accounting for the type of steel, taken as 30 for low relaxation strands and 7 for other prestressing steel, unless more accurate manufacturer's data are available

- Time of deck placement to final time

$$\Delta f_{pR2} = \Delta f_{pR1} \tag{2.22}$$

The time function of the relaxation component is derived from the time-dependency of the shrinkage and creep components.

Losses due to relaxation are typically much smaller than those due to shrinkage, creep, and elastic shortening.

2.7 Camber Calculations

Deflection at midspan of the girder relative to the ends is called camber. Camber is calculated by summing the individual loading components that cause changes in deflection, including self-weight, prestress, and additional dead loads.

2.7.1 Self-Weight Deflection

Self-weight deflection is calculated by using a uniformly distributed load over the length of the girder. Because the supports of the girder are typically not located at the ends, the equation for a simply supported beam does not apply. Therefore, Equation 2.23 is used to calculate the total camber from the end of the girder to the midspan. Positive camber is considered to be upward deflection.

$$\Delta_{SW} = \Delta_{OVERHANG} + \Delta_{MIDSPAN} \tag{2.23}$$

where:

$\Delta_{OVERHANG}$ = the deflection of the overhang relative to the support

$$= \frac{\omega_{sw} L_c}{24 E_c I_g}\left[3{L_c}^2\left(L_c + 2L_n\right) - {L_n}^3\right]$$

$\Delta_{MISDPAN}$ = the deflection at midspan relative to the support

$$= \frac{\omega_{sw} {L_n}^2}{384 E_c I_g}\left[5{L_n}^2 - 24{L_c}^2\right]$$

ω_{sw} = self-weight per unit length

$= \gamma A_g$

L_n = distance between supports

L_c = length of overhang

E_c = modulus of elasticity of the concrete when the load is applied

These two components are summed to give the total elastic deflection at midspan relative to the ends of the girder. Self-weight is applied at the time of prestressing, and the girder is lifted from the casting bed. The deflection due to self-weight will change if the support conditions change. Casting of the diaphragms and slab is considered to be a separate loading component, as discussed in Section 2.7.3.

Including the overhang in the calculation of deflection due to self-weight is more accurate but more complicated than treating the span as simply supported at its ends. For a girder of total length *L*, supported on rollers a distance αL from each end, Equation 2.23 can be expressed as

$$\Delta = \Delta_0 f\left(\alpha\right) \tag{2.24}$$

where

$$\Delta_0 = \frac{5\omega_{sw}}{384}\frac{\omega_{sw}L^{4}}{E_c I_g} \tag{2.25}$$

is the deflection for the girder supported at its ends, and

$$f\left(\alpha\right) = \left(1-2\alpha\right)^2\left(1-4\alpha-0.8\alpha^2\right) \tag{2.26}$$

The function $f(\alpha)$,is plotted against α in Figure 2.1. The initial slope of the curve is -8, so an overhang of 1% of the total length causes the mid-span deflection due to self weight to be multiplied by a factor of approximately (1-8*0.01) = 0.92. The overhang reduces the mid-span deflection in two ways; it shortens the central span, thereby reducing the deflection, and it causes an end moment, which further reduces the mid-span deflection.

In most girders, the final overhang beyond the centerline of the bearing will be very small, but the support conditions between release and final bearing can vary significantly. Since most of the cambers for this study were measured in the storage yard, the overhang was accounted for in calculating the self-weight deflection. In this way modeling errors were minimized and the camber model was calibrated as accurately as possible. However, for computing the camber of girders in their final locations in the field, use of Equation 2.25 is expected to be sufficiently accurate for practical purposes.

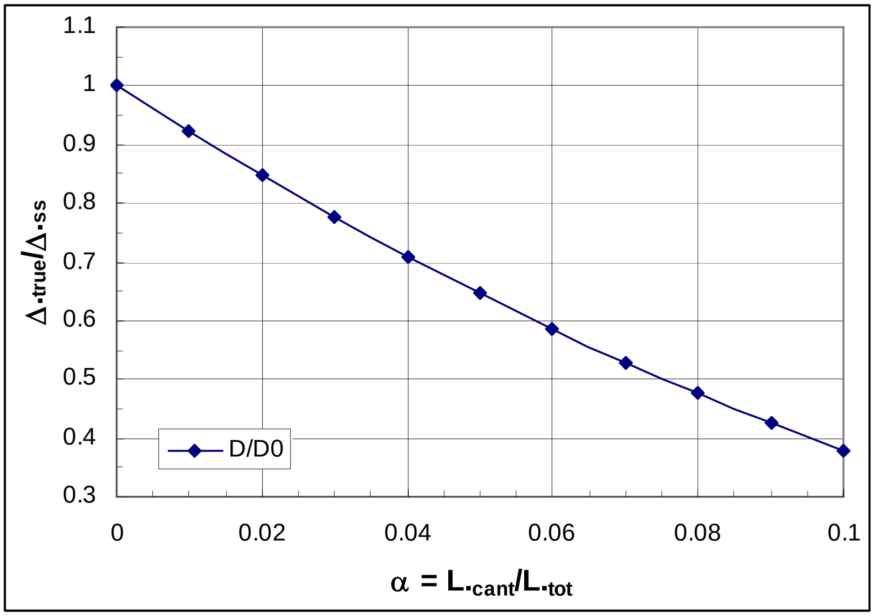


Figure 2.1 Effect of Overhang on Girder Deflection.

2.7.2 Prestress Deflection

The deflection due to the prestress force is given by Equation 2.27. The effective eccentricity is used at the end and midspan to include all the strands that contribute to that deflection component. Often the deflections caused by the permanent (straight and harped) and temporary strands are calculated separately.

$$\Delta_{ps} = \frac{PL^2}{8E_c I_g}\left[e_{mid} + \left(e_{end} - e_{mid}\right)\frac{4a^2}{3L^2}\right] \qquad 2.27$$

where:

P_i = initial prestress force directly after transfer

L = girder length

E_c = elastic modulus of the concrete

I_g = gross-cross sectional moment of inertia

a = distance from the end of the girder to the harping point

e_{mid} = eccentricity of the prestressing at the end of the girder

e_{end} = eccentricity of the prestressing at midspan of the girder

2.7.3 *Uniform Dead Load Deflection*

The self-weight of the diaphragms and deck is applied as a separate load at a time after permanent placement of the girders. This load is assumed to be uniformly distributed over the length of the girder.

$$\Delta_{DL} = \frac{5\omega_{DL}L^4}{384E_c I_g} \qquad 2.28$$

where:

ω_{DL} = dead load linearly distributed over the length of the girder

2.8 WSDOT Practice for Camber Prediction

The WSDOT uses the method recommended by the AASHTO LRFD (WSDOT 2006). Until recently, the 2004 edition was used. However, the 2006 Interim updates to the AASHTO LRFD Specifications were adopted for the WSDOT Bridge Design Manual (BDM).

PGSuper is a design and analysis program for the AASHTO LRFD Bridge Design Specifications and is a product of the WSDOT Bridge and Structures Office (PGSuper 2006). PGSuper uses the AASHTO methods described in this chapter to calculate the effects of shrinkage and creep and to estimate deflection.

The camber model shown in Figure 2.2 illustrates the components of camber that WSDOT calculates to approximate the camber changes during the life of a girder (PGSuper 2006).

All of the deflections calculated are elastic except for two creep deflections indicated by Δ_{creep1} and Δ_{creep2}. In PGSuper, creep is computed in two stages to facilitate the camber equations. The first stage of creep is computed during the time from release of the prestressing strands until the time when the temporary strands are cut and the diaphragms are cast. The second creep stage is computed from the end of the first stage until the section is made composite (PGSuper 2006).

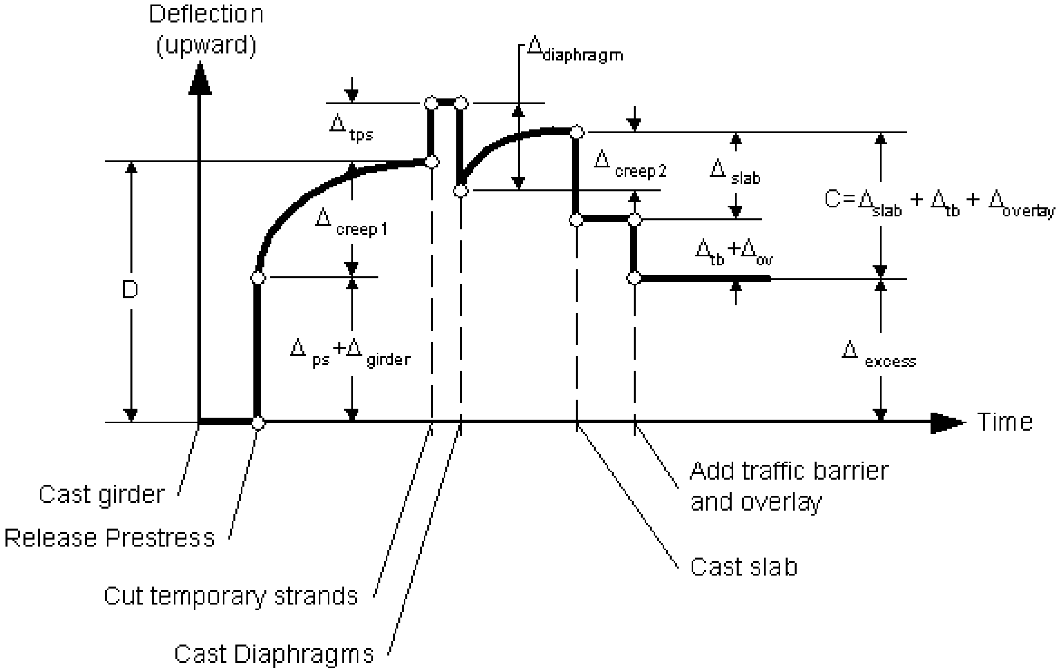


Figure 2.2 WSDOT Camber History Model (PGSuper 2006)

WSDOT does not develop a full time history of camber for the girder. Instead, minimum and maximum timings are given for critical events, as shown in Table 2.1. Then the camber is calculated at the time just before the deck is to be cast. This is considered the most critical camber because it has the most impact on construction delays and costs.

Table 2.1 WSDOT Timeline for Construction

	*Timeline (days)		
Construction Type	1	2	3
Minimum Timing	7	30	40
Maximum Timing	7	90	120
1 – Release Strands 2 – Cut Temporary Strands and Cast Diaphragms 3 – Composite System			

* Normal Cure. One day of accelerated curing is taken as equal to seven days of normal curing (AASHTO 2006).

Creep coefficients are then calculated as recommended by the AASHTO LRFD for the following elastic loads:

- Permanent Strands – from release until the time of deck casting
- Temporary Strands – from release until removal
- Diaphragms – from the time cast until the time of deck casting.

The creep deflection is calculated by multiplying the creep coefficients by the corresponding elastic deflections. Time dependent changes in prestress are not considered in the prestress deflection at any time after release. The total estimated camber before the deck has been cast is considered the “D” dimension and is the sum of the component elastic deflections and the creep deflection.

PGSuper also makes several important assumptions that are documented in the program notes. The design length of the girder is defined as the length from the centerline of the final bearing at both ends. All deflection calculations are based on the span length using a simply supported model. The procedures of Concrete Technology and Central Pre-Mix Prestress for supporting the girders at release and storage were observed by the researchers to be different than those assumed by WSDOT. At release, the girder is typically supported by lifting loops that vary in distance from the ends. When placed in the storage yard before shipping, the girder is supported on bunks anywhere from 2 to 3 feet in from the ends. Because creep deflection is proportional to the elastic deflection, small variations in elastic deflection caused by different support conditions carry over to the creep deflection.

PGSuper assumes that once the deck has been cast, the stiffness of the superstructure increases because the composite action and the effects of creep will not be significant. However, by then, the camber of the girders is generally not considered to be a problem

CHAPTER 3

CAMBER PREDICTION PROGRAM

3.1 Introduction

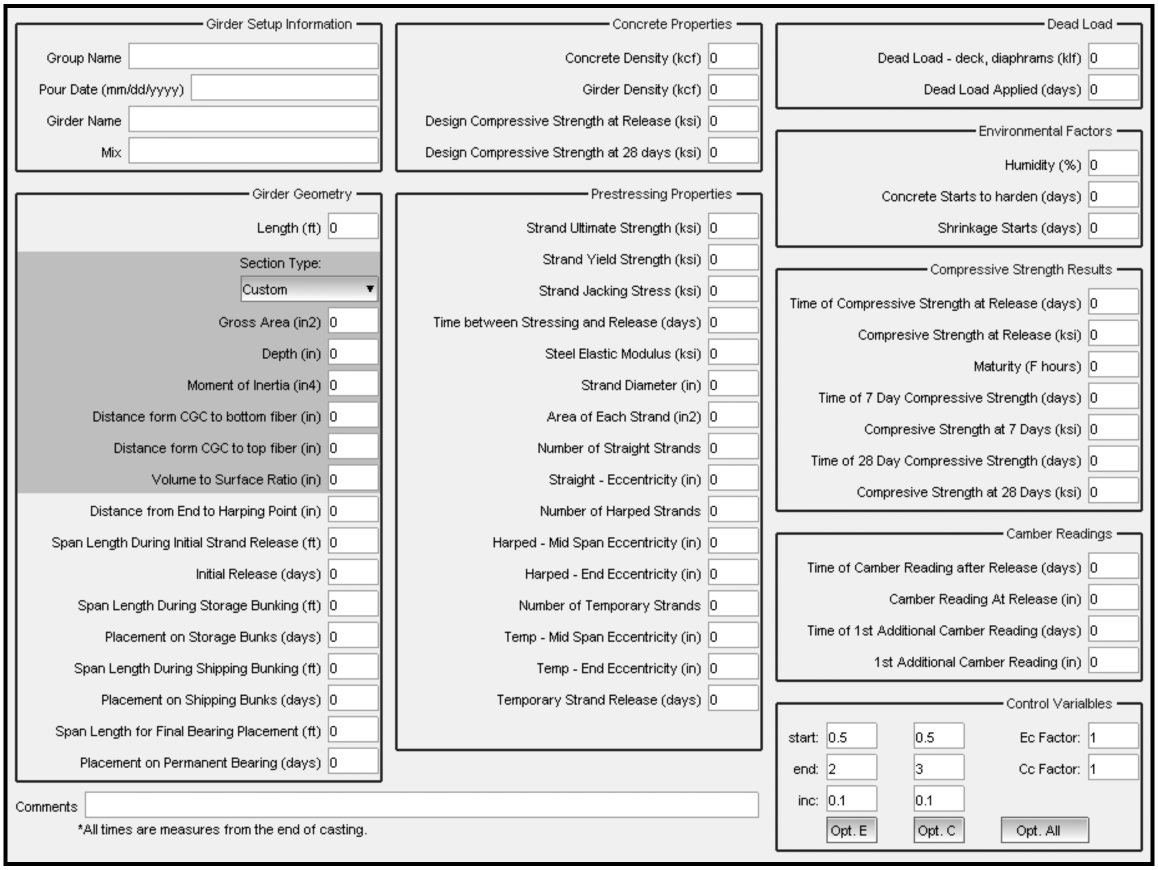
A camber prediction program was written to combine various methods of predicting compressive strength, elastic modulus, creep, shrinkage, prestress loss, and deflection. Because several methods exist for each characteristic, the program was developed to be able to easily select the desired method and run an analysis on one or multiple girders. Section 3.2 discusses the program interface developed to enter input data. Section 3.3 gives a detailed description of the calculation steps used by the program to predict the time history of camber. Section 3.4 discusses the output the program offers to evaluate a girder or set of girders.

3.2 Input

To begin a time history analysis of camber for a girder, the user must first enter all the information that the program needs to run. The variable setup page includes input fields for casting date and time, shipping and placement times, girder geometry, concrete properties, and prestressing properties (see Figure 3.1).

Multiple girders may be entered into a single analysis by adding new girders to the list or copying a girder that was already created. The list can then be saved to a file for access at a later time.

The user has the option to select which method of calculation. All of the methods discussed in Chapter 2 were included in the program model. If the WSDOT Camber Method is chosen, the program automatically selects the current methods that WSDOT uses to calculate the elastic modulus and deflection (see Figure 3.2). The Modified WSDOT Method recognizes that the deflection due to the prestressing force is influenced by prestress losses.



Girder Setup Information
Group Name
Pour Date (mm/dd/yyyy)
Girder Name
Mix

Girder Geometry
Length (ft) 0
Section Type: Custom
Gross Area (in2) 0
Depth (in) 0
Moment of Inertia (in4) 0
Distance form CGC to bottom fiber (in) 0
Distance form CGC to top fiber (in) 0
Volume to Surface Ratio (in) 0
Distance from End to Harping Point (in) 0
Span Length During Initial Strand Release (ft) 0
Initial Release (days) 0
Span Length During Storage Bunking (ft) 0
Placement on Storage Bunks (days) 0
Span Length During Shipping Bunking (ft) 0
Placement on Shipping Bunks (days) 0
Span Length for Final Bearing Placement (ft) 0
Placement on Permanent Bearing (days) 0

Concrete Properties
Concrete Density (kcf) 0
Girder Density (kcf) 0
Design Compressive Strength at Release (ksi) 0
Design Compressive Strength at 28 days (ksi) 0

Prestressing Properties
Strand Ultimate Strength (ksi) 0
Strand Yield Strength (ksi) 0
Strand Jacking Stress (ksi) 0
Time between Stressing and Release (days) 0
Steel Elastic Modulus (ksi) 0
Strand Diameter (in) 0
Area of Each Strand (in2) 0
Number of Straight Strands 0
Straight - Eccentricity (in) 0
Number of Harped Strands 0
Harped - Mid Span Eccentricity (in) 0
Harped - End Eccentricity (in) 0
Number of Temporary Strands 0
Temp - Mid Span Eccentricity (in) 0
Temp - End Eccentricity (in) 0
Temporary Strand Release (days) 0

Dead Load
Dead Load - deck, diaphrams (klf) 0
Dead Load Applied (days) 0

Environmental Factors
Humidity (%) 0
Concrete Starts to harden (days) 0
Shrinkage Starts (days) 0

Compressive Strength Results
Time of Compressive Strength at Release (days) 0
Compresive Strength at Release (ksi) 0
Maturity (F hours) 0
Time of 7 Day Compressive Strength (days) 0
Compresive Strength at 7 Days (ksi) 0
Time of 28 Day Compressive Strength (days) 0
Compresive Strength at 28 Days (ksi) 0

Camber Readings
Time of Camber Reading after Release (days) 0
Camber Reading At Release (in) 0
Time of 1st Additional Camber Reading (days) 0
1st Additional Camber Reading (in) 0

Control Variablies
start: 0.5 0.5 Ec Factor: 1
end: 2 3 Cc Factor: 1
inc: 0.1 0.1

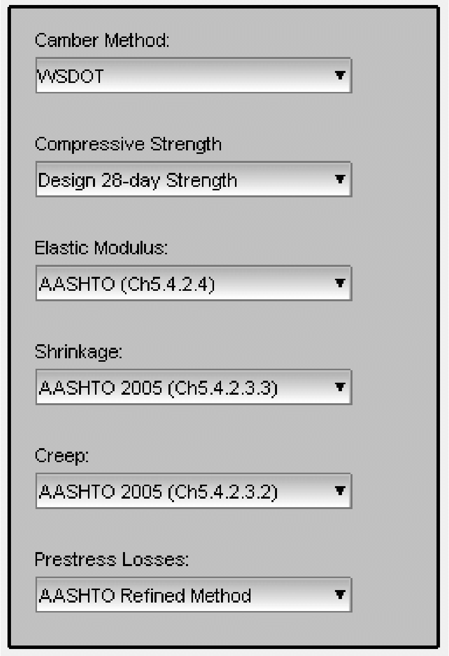
Comments

*All times are measures from the end of casting.

Figure 3.1 Camber Prediction Program Input Fields

The time series is customizable on the basis of the girders to be evaluated. Because the program calculates the prestress deflection on the basis of the incremental changes in prestress loss, it is best to use a time series with a fine mesh. Although increasing the number of time steps increases the program run time, that increase is only substantial with large sets of girders. Figure 3.3 shows the three time series that are available.

The first time series is called the Geospace Series. The user specifies the ending time, number of time steps, and progression ratio. The program then constructs a time series with the number of time steps specified, but each time step is larger than the previous time step by the ratio specified. This type gives the user control of the rate at which the mesh changes over time.



Camber Method:
WSDOT

Compressive Strength
Design 28-day Strength

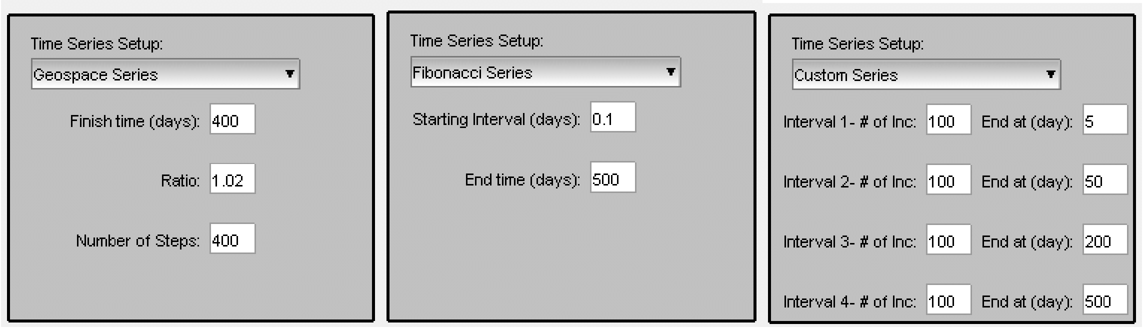
Elastic Modulus:
AASHTO (Ch5.4.2.4)

Shrinkage:
AASHTO 2005 (Ch5.4.2.3.3)

Creep:
AASHTO 2005 (Ch5.4.2.3.2)

Prestress Losses:
AASHTO Refined Method

Figure 3.2 Camber Prediction Program Method Selection



Time Series Setup:
Geospace Series
Finish time (days): 400
Ratio: 1.02
Number of Steps: 400

Time Series Setup:
Fibonacci Series
Starting Interval (days): 0.1
End time (days): 500

Time Series Setup:
Custom Series
Interval 1- # of Inc: 100 End at (day): 5
Interval 2- # of Inc: 100 End at (day): 50
Interval 3- # of Inc: 100 End at (day): 200
Interval 4- # of Inc: 100 End at (day): 500

Figure 3.3 Camber Prediction Program Time Mesh Selections

The second time series uses time steps the lengths of which form a Fibonacci Series. By selecting the starting time step and specifying the approximate ending time, the program will construct the time series and end on the first full time step beyond the ending time specified. This time series creates a mesh that is very fine at the beginning, and becomes coarser as time increases. In that sense it is similar, but not identical, to the Geospace series.

The third time series is defined by the user. The history is divided into four intervals, in each of which the user defines the length of the interval and the number of increments in each.

3.3 Calculation Methods

3.3.1 Concrete Compressive Strength

The concrete compressive strengths at release and at 28-days are defined by the user. The program can use either the design strength or the actual measured strength of the concrete, and it calculates the time history of the compressive strength by using Equation 2.1. The constants are found by using the two points to create a concrete compressive strength curve. See Figure 3.4 for an example of a concrete compressive strength plot from the camber program. The curve passes through the release and 28-day cylinder strengths.

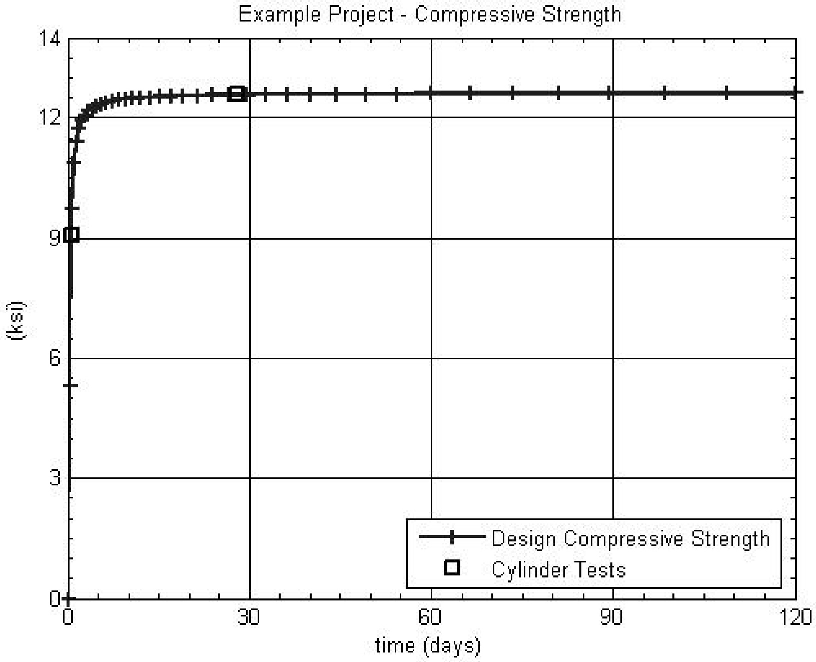


Figure 3.4 Camber Prediction Program Compressive Strength Plot

3.3.2 Elastic Modulus

Several methods are available for establishing the curve that relates the elastic modulus to time. They are discussed in Section 2.3. At each time interval, an elastic modulus is calculated from the instantaneous concrete compressive strength, using the methods described in Section 3.3.1. The time-dependence of the elastic modulus curve is therefore directly related to the time-dependence of the concrete compressive strength curve.

The WSDOT Model in the program uses this method to calculate an elastic modulus curve. However, WSDOT does not use a time history of the elastic modulus. Instead, the E_{ci} and E_c are calculated from the release and 28-day concrete compressive strengths, respectively. For the purpose of this analysis, all loads applied after release (i.e., temporary strand removal and dead load) are not applied until ultimate concrete strength is reached. Therefore, the E_c used by WSDOT and the E_c calculated from the concrete compressive strength curve will be equivalent values. See Figure 3.5 for an example of an elastic modulus plot from the camber program.

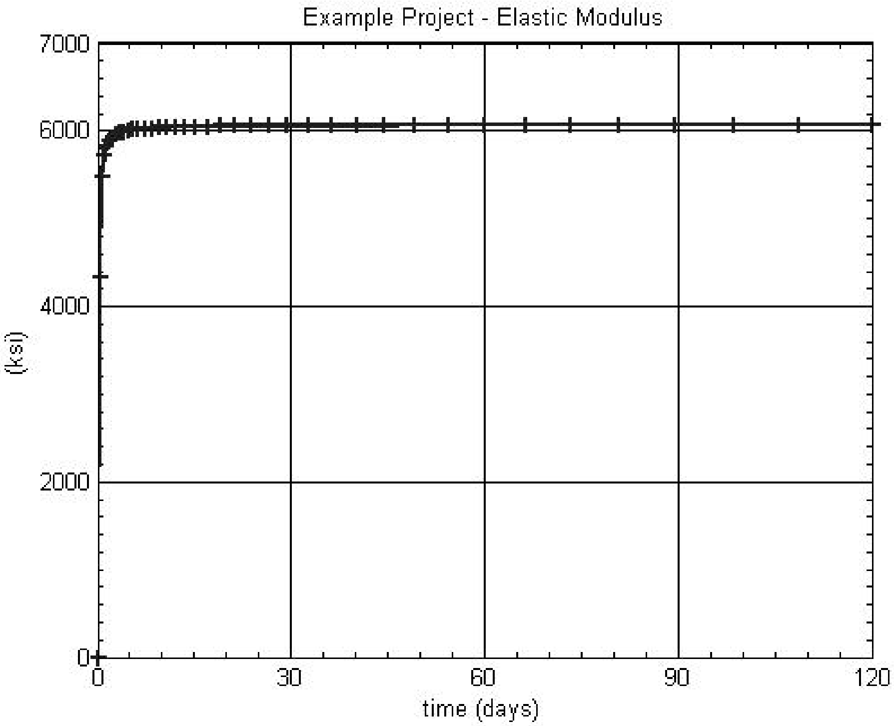


Figure 3.5 Camber Prediction Program Elastic Modulus Plot

3.3.3 Prestress Losses/Force

Prestress losses are calculated according to the equations discussed in Section 2.6. However, the equations are applied to the permanent and temporary strands separately. At the harping point and at the end of the girder, an effective eccentricity of the permanent strands is calculated by using a combination of the straight and harped strands. The strands are treated as an effective load by using the profile of the tendon and the total force in it.

The elastic prestress loss is calculated by determining the prestress force after release by using equilibrium and strain compatibility. With the total prestress force (permanent and temporary strands) applied at an effective eccentricity, the changes in concrete stress at the locations of the permanent and temporary strands are estimated separately. Then the elastic shortening of the prestress can be calculated from those stress changes.

Prestress losses due to creep, shrinkage, and relaxation are determined for the permanent and temporary strands separately, and the prestress forces for them are obtained. See Figure 3.6 for an example prestress force plot from the camber program. The plot shows the prestress force that the girder sees after release.

The changes in girder curvature due to loads applied after release (e.g., temporary strand removal and dead load) were initially included as “secondary” effects on the prestress force of the permanent strands. The change in bending and or axial stresses would cause a change in prestress. However, this change was considered to be minimal in comparison to the total stress in the strands and was therefore removed from the camber program.

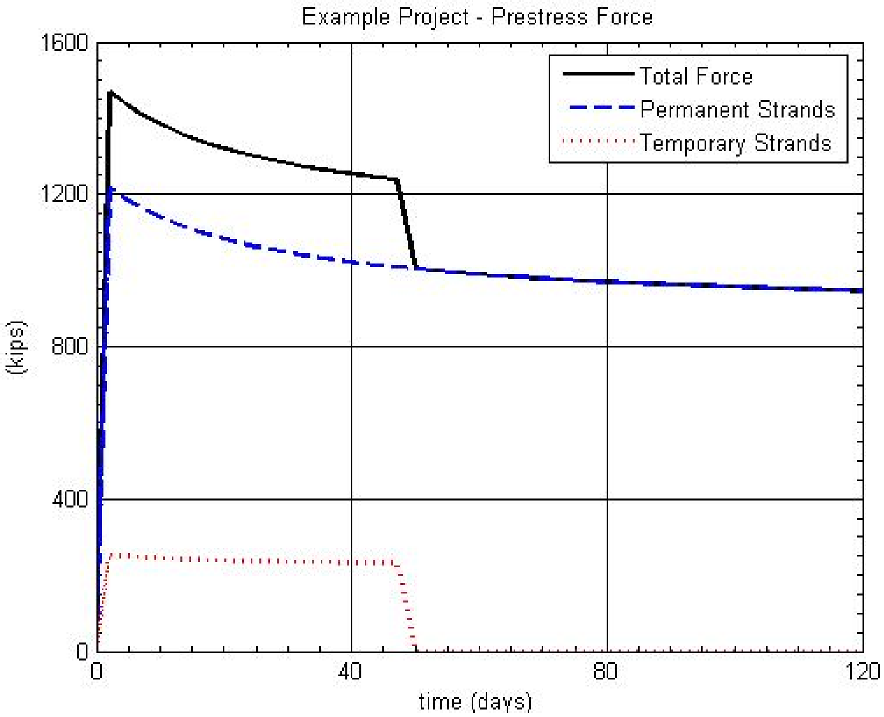


Figure 3.6 Camber Prediction Program Prestress Force Plot

3.3.4 Deflections

The camber program calculates deflections due to the individual components of loading. The components are superimposed to create the total camber history of the girder. See Figure 3.7 for an example plot of the deflection history predicted by the camber program.

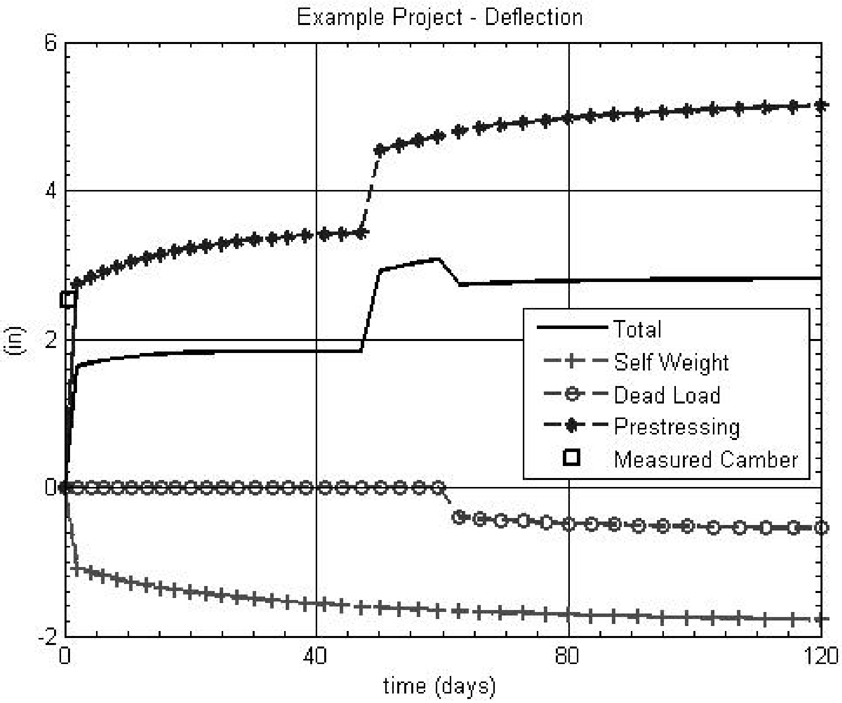


Figure 3.7 Camber Prediction Program Deflection Plot

3.3.4.1 Self-Weight Deflection

The self-weight component of the total deflection is calculated from the elastic deflection multiplied by the creep coefficient at the time of evaluation. The program offers the ability to change the support conditions of the girder in four stages. Therefore, the self-weight deflection curve may not be smooth but may have jumps due to changes in the support locations. The support conditions considered are the following:

- Release / Lifting Loops
- Storage Yard
- Shipping
- Final Bearing

The program models the change in support conditions by adding the change in elastic deflection and creates a creep curve associated with the new load.

3.3.4.2 ***<u>Prestress Deflection</u>***

Deflections caused by prestress are modeled similarly to those of the self-weight. The effects of the permanent and temporary strands are calculated separately and added together to find the total prestress deflection. However, the program offers two methods to calculate the deflection.

The method WSDOT uses multiplies the elastic prestress deflection by the creep coefficient to find the deflection due to creep at any time. However, this method does not account for the reduction in prestress force due to prestress losses.

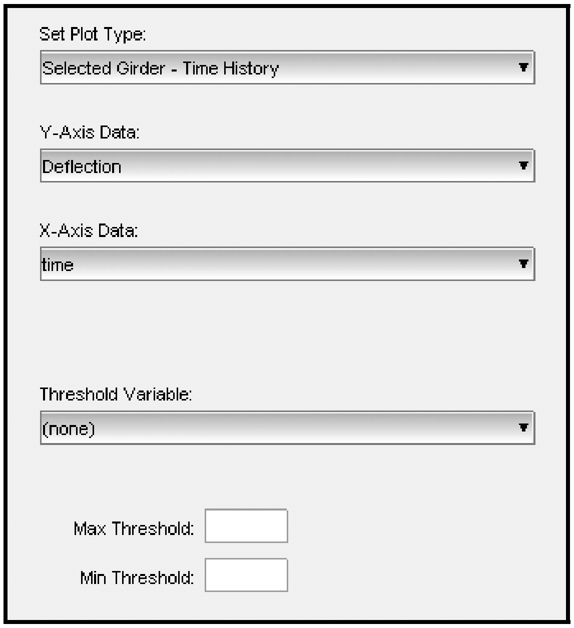
Because the prestress load is not a constant force on the girder, but rather changes with time as a result of prestress losses, the Modified WSDOT Method was created. To model the prestress losses, the program uses incremental changes in the prestress force to calculate incremental elastic changes in prestress deflection over time. Each elastic change in deflection is considered a new load and has its own creep deflection.

3.3.4.3 ***<u>Dead Load Deflection</u>***

The Dead Load deflection allows users to enter a distributed load at a specified time. This loading could represent the casting of the diaphragms, casting of the deck, or construction loading. The dead load of the diaphragms must be converted to an equivalent distributed load. The load is considered to be constant for the life of the girder.

3.4 Program Output

The camber program offers multiple plots to evaluate the time history of a single girder or to compare the measured and calculated results for a set of girders. The program interfaces with a MatLab Command Window when the analysis is complete, and the user can choose which plot is needed and export the data to the MatLab plotter. Figure 3.8 shows the interface where the user selects the type of plot to export.



Set Plot Type: Selected Girder - Time History

Y-Axis Data: Deflection

X-Axis Data: time

Threshold Variable: (none)

Max Threshold:

Min Threshold:

Figure 3.8 Camber Program Plotter

The time history plot type allows the following options to be plotted against time:

- Deflection (total, self-weight, prestress, dead load)
- Prestress Force (permanent strands, temporary strands)
- Prestress Losses (permanent strands, temporary strands)
- Concrete Compressive Strength
- Concrete Elastic Modulus.

The girder set comparison plot allows the user to select the x and y axis data from the following choices:

- X Data
  - Maturity at Release
  - Age at the Release Camber Measurement
  - Age at the Second Camber Measurement
  - Measured Concrete Compressive Strength at Release
  - Measured Concrete Compressive Strength at Release / f’ci Design
  - Measured Concrete Compressive Strength at 28 Days / f’c Design

  - Prestress Force at Release / Cross-Sectional Area
  - Length
  - Length / Depth
  - Month of Casting
- Y Data
  - Absolute Deflection Error at Release Camber
  - Absolute Deflection Error at Second Measured Camber
  - Relative Deflection Error at Release Camber
  - Relative Deflection Error at Second Measured Camber

A threshold variable can also be selected for plotting the deflection error in the girder set. For example, it could be used to identify the girders with a concrete compressive strength at release of less than 6000 psi. Figure 3.9 indicates by triangles those girders that have an age at release of greater than or equal to two days. Not surprisingly, those girders have some of the highest strengths of the whole set.

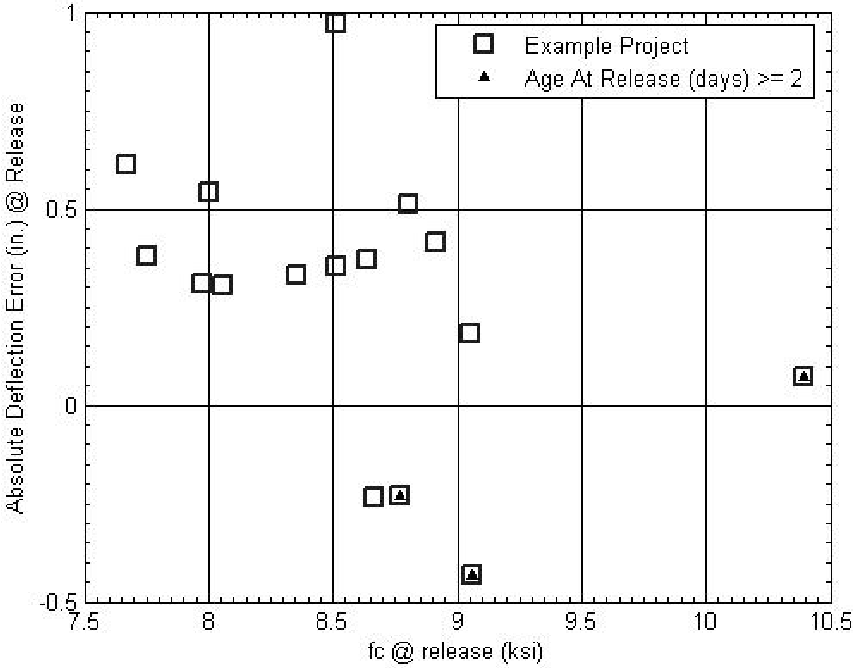


Figure 3.9 Example Girder Set Plot using Camber Program

CHAPTER 4

DETAILED CAMBER MONITORING – SNAKE LAKE GIRDERS

4.1 Purpose

In general, the data collected for each girder included camber measurements at release and a second time before shipping. This information was useful for calibrating a model for predicting elastic and creep behavior. However, a detailed camber study was desired to closely study the camber history of a girder set. Eight girders were monitored at Concrete Technology Co. (CTC) from August 29, 2005, until October 28, 2005. Section 4.2 discusses the girder properties that were monitored, Section 4.3 discusses the procedure used to measure the camber, and Section 4.4 provides the observed results.

4.2 Girder Properties

A detailed camber history study was conducted on the Snake Lake Bridge project at CTC's fabrication yard in Tacoma. All of the girders had W74G sections and were 135 feet long.

Table 4.1 shows the number of prestressing strands and girder age at release for each of the girders monitored. The numbers of straight and temporary strands were the same for all the girders: 26 and 6, respectively. However, the number of harped stands varied from 11 to 17. This variation was a result of the placement location of each girder. In the Snake Lake Bridge project, a two-span bridge was widened. The temporary strands were used to match the camber of the new girders to the profile of the existing bridge.

The "A" and "D" in the mark number indicate the span, while the G1 and G4 girders were exterior, and the G2 and G3 girders were interior, adjacent to the existing superstructure.

Table 4.1 Snake Lake Bridge Girder Properties

Cast Date	Mark No.	Number of Straight Strands	Number of Harped Strands	Number of Temporary Top Strands	Release Age (days)
8/29/2005	G4A	26	17	6	0.9
8/31/2005	G3A	26	15	6	0.6
9/1/2005	G2A	26	11	6	0.6
9/2/2005	G1A	26	11	6	3.5
9/6/2005	G4D	26	18	6	1.5
9/8/2005	G3D	26	15	6	0.5
9/9/2005	G2D	26	11	6	2.6
9/12/2005	G1D	26	12	6	0.6

Girders G1A and G2D were cast on Fridays and considered “weekend” girders. However, G1A matured over the Labor Day weekend, resulting in 3.5 days of curing before release. The remaining girders were cast and released in less than one day except for G4D. For this girder, the required release strength was not reached after one day of accelerated curing, so the prestress release was delayed until the second day.

4.3 Data Collection Procedure

After the prestress had been released, the girder was moved to the finishing yard and placed on timber supports. A camber reading was then taken by the University of Washington (UW) researchers on both faces of the girder. After girder camber had been measured on both sides of the girder, gross errors in measurement could be detected by comparing the readings from the two sides.

A self-leveling laser level was used to measure the girder elevation and the support locations and midspan. The level was set up near one end of the girder to obtain a single line of sight down the side of the girder and minimize the rotation of the level between readings. A wooden template cut to fit the section of a W74G between the web and bottom flange had a scale fixed on the side (see Figure 4.1). The template was placed vertically against the web and lowered to the bottom flange. The template was then in contact with both the web and flange. The template worked under the assumption that the bottom flange thickness was constant over the length of the girder. Measurements were taken at the support locations and midspan. The camber was then calculated by averaging the end elevations and subtracting them from the midspan elevation.

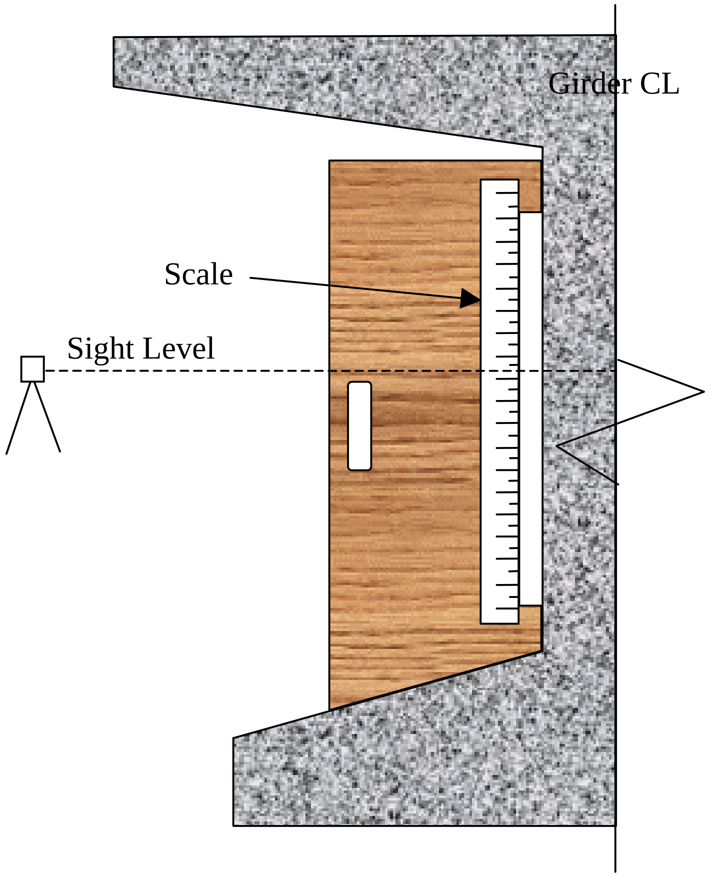


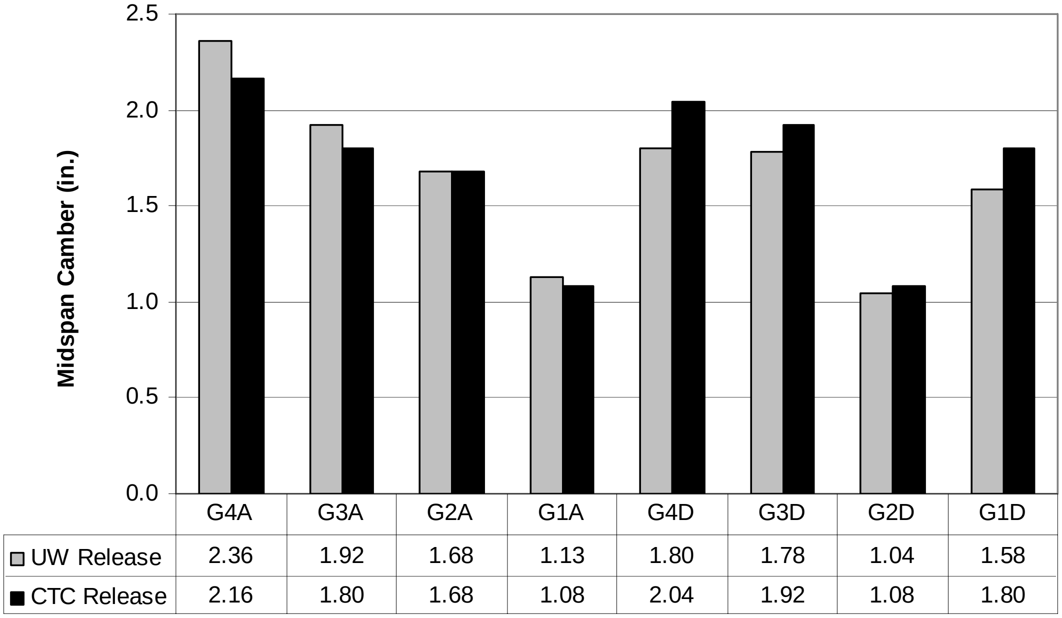
Figure 4.1 Camber Measuring Template

Camber measurements were taken only in the morning to minimize the effects of temperature differentials over the height of the girder caused by the sun. Measurements were taken between 6:00 AM and 10:00 AM.

Camber readings were taken daily after release to monitor the early effects of creep. The measurements were then taken at longer intervals as the rate of camber change decreased.

4.4 Observed Behavior

The release camber measurement recorded by the UW researchers was compared with the release measurements taken by CTC immediately after release, as shown in Figure 4.2.



	G4A	G3A	G2A	G1A	G4D	G3D	G2D	G1D
□ UW Release	2.36	1.92	1.68	1.13	1.80	1.78	1.04	1.58
■ CTC Release	2.16	1.80	1.68	1.08	2.04	1.92	1.08	1.80

Figure 4.2 CTC and UW Release Camber Measurements

The UW measurements were all within ¼ inch of CTC’s measurements. This discrepancy is probably attributable to errors in measurement. CTC measures camber with a tape measure as the girder is hanging by the lifting loops above the casting bed. Measurements are taken at the ends and midspan. The accuracy of this measurement is expected to be within ¼ inch.

All of the girders showed an increase in camber during the duration monitored. Figure 4.3 shows the average camber measurement between the two faces for all eight girders.

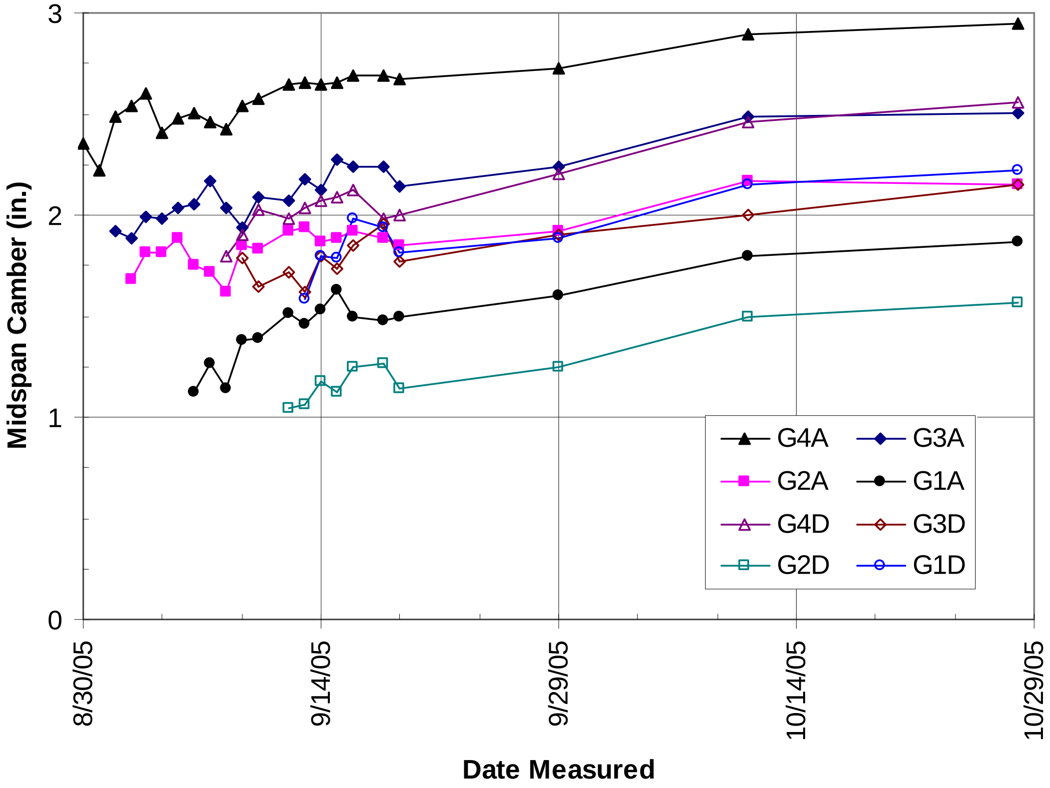


Figure 4.3 Snake Lake Bridge Girders Measured Camber Data

The camber history did not produce as smooth a curve as would be expected by the creep equations discussed in Section 2.5. Variations in the curve might be partially attributed to measurement inaccuracies. Temperature variations might also have contributed to the camber variations. In particular, heating the tops of the girders creates a temperature gradient over the height. To minimize this effect, camber measurements were taken only in the morning, before the ambient air temperature changed.

Figure 4.4 shows the observed "effective" creep coefficient plotted against the release age of the girders. This does not represent the value of the creep coefficient but rather the change in camber 45 to 60 days after release divided by the initial camber. However, it would still be expected that the "effective" creep coefficient would decrease as the age of loading increased.

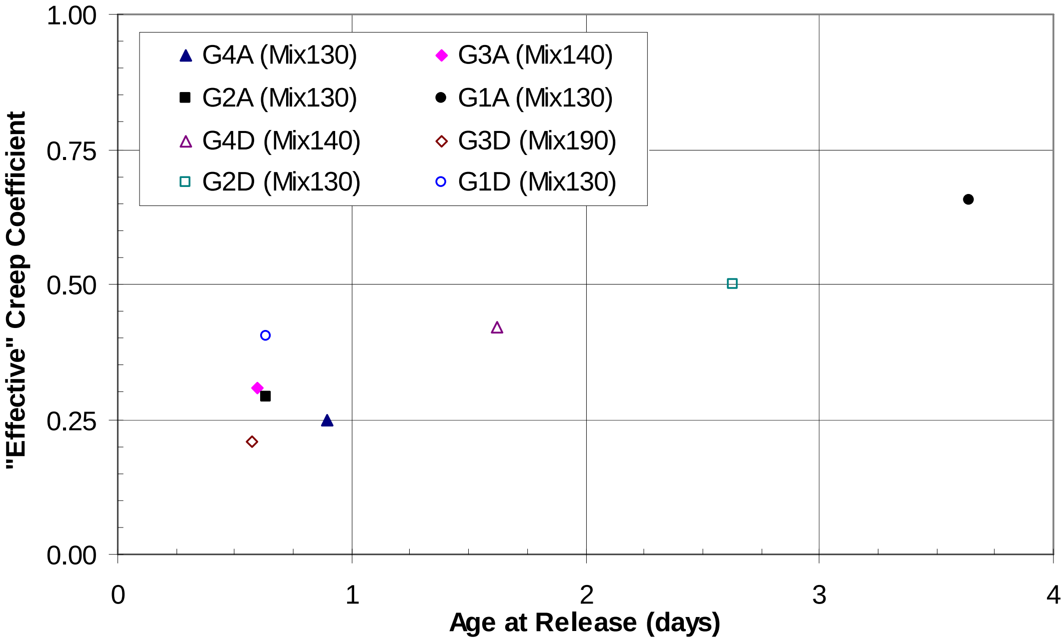


Figure 4.4 Snake Lake Girders Creep vs. Age at Release

The apparent trend may be misleading because of the small sample of girders and measurement errors of up to 1/8 inch. According to the AASHTO LRFD method, the factors that influence the creep coefficient are the age at loading, the age after loading, relative humidity, volume-to-surface ratio, and the concrete strength at loading.

CHAPTER 5

MATERIALS TESTING

5.1 Purpose

Material tests were performed on concrete for six of the eight girders cast at Concrete Technology Corporation (CTC) for the Snake Lake Bridge project. The materials tests were conducted to evaluate the compressive strength, elastic modulus, shrinkage, and creep properties of the concrete and to compare them with the cambers observed for the girders. The detailed camber history study that was conducted on these girders is discussed in Chapter 4.

Section 5.2 discusses the procedure followed to transport the cylinders from CTC's fabrication plant in Tacoma, Washington, to the materials lab at the University of Washington (UW) in Seattle, Washington. Sections 5.3 and 5.4 describe the concrete compressive strength and elastic modulus tests. Creep and shrinkage tests were also performed one on the girders and are discussed in Section 5.5. Testing was limited by the number of accelerated-cured and moist-cured cylinders that CTC was able to provide. All cylinders were 4 in. by 8 in. Both moist-cured and accelerated-cured cylinders were tested to compare the differences in curing methods and the influences on the material properties.

5.2 Cylinder Transportation and Curing Procedures

Two procedures were followed for transporting and curing the cylinders received from CTC. One method was used for girders on which only concrete compressive strength tests and elastic modulus tests were performed. A second method was used for the girders on which creep and shrinkage tests had been performed, in addition to the compressive strength and elastic modulus tests.

The accelerated-cured cylinders collected from CTC girders G4A, G2A, G4D, and G3D were used for compressive strength and elastic modulus testing only. These cylinders were cured by CTC at the same temperature as the girders by using matched cure molds. After the concrete compressive strength was high enough to allow prestress release, the UW researchers removed the cylinders from the cure molds and immediately covered them in plastic bags to prevent moisture loss before testing. The cylinders were then insulated by wrapping them in newspaper and placing them in an insulated box (a food cooler) for transportation to approximate the temperature history of the girder. The ambient air temperature during the week that the cylinders were transported from Tacoma to Seattle (first week of September, 2004) ranged from 55 to 60°F.

After the required concrete compressive strength had been reached, CTC released the strands. The time taken for release was approximately the same as the time it took to transport the cylinders from CTC to the UW materials lab. The drive time was between 45 and 75 minutes, depending on the traffic congestion. After arrival at the UW, two cylinders were removed from the cooler and unwrapped. Concrete compressive strength and elastic modulus tests were conducted at approximately the same time as the girder prestress was being released. After the release testing, the cylinders were kept in the insulated box for 24 hours and then placed in a fog room for storage at approximately 70°F.

The second procedure was intended for girders G2D and G1D. However, CTC did not supply moist-cured cylinders for girder G2D, so accelerated-cured cylinders were used to test the procedure for creating the creep and shrinkage stacks discussed in Section 5.5.1. Accelerated-cured and moist-cured cylinders from girder G1D were collected from CTC. These cylinders were used for creep and shrinkage tests in addition to compressive strength and elastic modulus tests. Once CTC obtained the required strength for prestress release, the cylinders were covered in plastic bags to prevent additional moisture loss before testing. However, to reduce the effects of temperature changes on the creep and shrinkage results, these cylinders were not insulated in newspaper or placed in a cooler. Instead they were secured in a bin that was open to the air during transportation. The intent was to bring the cylinder temperature down to the ambient temperature before testing. When the cylinders arrived at the UW lab, all the cylinders were removed from the plastic bags and prepared for the creep and shrinkage testing. The cylinders used for the compressive strength and elastic modulus tests were stored unwrapped in the same area as the creep and shrinkage tests to cure at the same temperature and relative humidity.

5.3 Concrete Compressive Strength

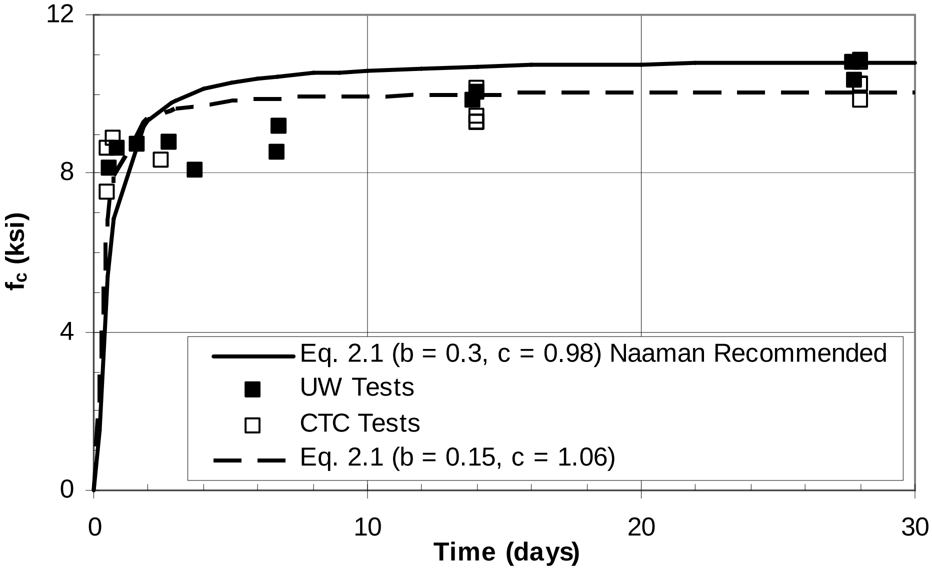
Concrete compressive strength tests were performed on all the girders at release and at multiple subsequent times, depending on the quantity of cylinders available. These tests were performed to observe the strength curve with maturity of the concrete. Accelerated-cured cylinders were taken of mix #130 from girder G4A, G2A, G2D and G1D. Girder G4D used mix #140, and G3D used mix #190.

Figure 5.1 shows the results of the UW and CTC concrete compressive strength tests for the accelerated-cured cylinders for mix #130. Figure 5.2 shows the UW concrete compressive strength tests for the moist-cured cylinders collected from girder G1D. CTC did not test any moist-cured cylinders. Equation 2.1 was used to model the concrete compressive strength over time and calibrated to fit the test data. Table 5.1 shows the coefficients that are recommended by Naaman (Naaman 2004).

Table 5.1 Concrete Compressive Strength Modeling Coefficients

		Recommended (Naaman, 2004)	Best Fit
Accelerated-Cured	b =	0.3	0.15
	c =	0.98	1.06
Moist-Cured	b =	2.3	0.8
	c =	0.99	0.99

However, to better model the behavior of the specific mix, the "best fit" coefficients were found by minimizing the error between the predicted and measured values. Still, the model did not predict well the concrete compressive strength of the accelerated-cured cylinders for the tests that were performed between two and ten days. The difficulty in fitting the data throughout the 28-day period may have been a consequence of the fact that the cylinders were subjected to two curing environments (before and after release). Two equations may have been necessary to model this behavior. The AASHTO LRFD method suggests that one day of moist-cure is equivalent to seven days of accelerated-cure. Figure 5.1a shows an average concrete compressive strength of 8500 ksi at one day for the accelerated-cured cylinders, and Figure 5.1b shows a concrete compressive strength of 10,375 ksi at seven days for the moist-cured cylinders.


a) Snake Lake Bridge - Mix 130, Accelerated-Cured

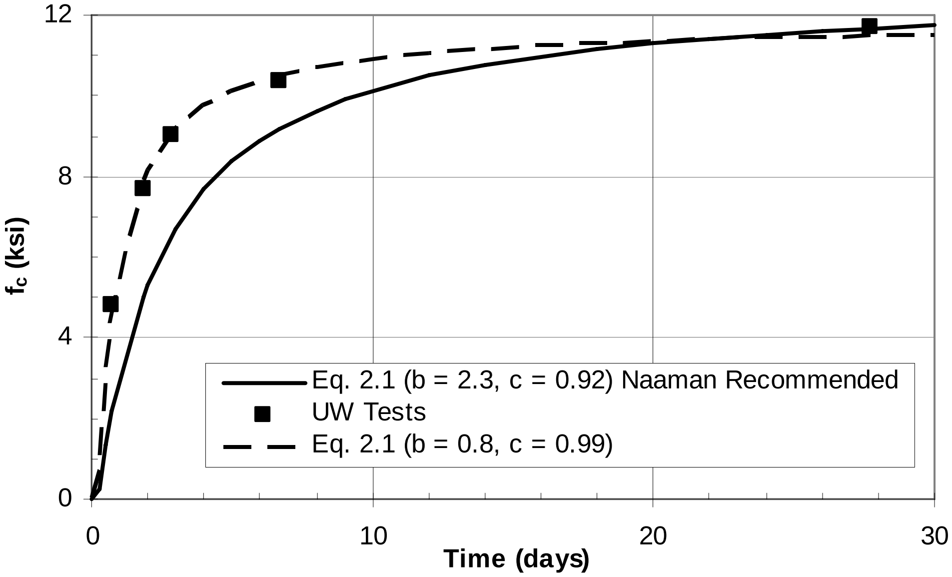

b) Snake Lake Bridge - Mix 130, Moist-Cured

Figure 5.1 Snake Lake Bridge Project Concrete Compressive Strengths a) Accelerated-Cured b) Moist-Cured

5.4 Elastic Modulus

Elastic modulus tests were performed on all girders at release and at multiple subsequent times, depending on the quantity of cylinders provided by CTC. Each cylinder used for a concrete compressive strength test had a corresponding elastic modulus test. To obtain additional points along the elastic modulus curve, elastic modulus tests were performed between scheduled breaks on a separate cylinder. This cylinder was then used for the 28-day compressive strength test. All elastic modulus tests were conducted on accelerated-cured cylinders except for several tests on the cylinders from G1D.

The only available elastic modulus testing apparatus was designed for 6-in. by 12-in. cylinders. However, it was adapted for use with 4-in. by 8-in. cylinders. Several of the elastic modulus tests provided nonlinear stress-strain data and were removed from the evaluation. The nonlinearity was attributed to shortcomings of the test rig. Mixes #130, #140, and #190 were all included in the comparison.

Figure 5.2 plots the elastic modulus test values against the age of the concrete cylinders. During the first few days, the elastic modulus tended to increase with increasing age. The moist-cured (MC) cylinders for Girder G1D of mix #130 had a smaller elastic modulus value at release, as would be expected because of a lower concrete compressive strength at release. However, as the moist-cured cylinders matured, the elastic modulus of these cylinders approached the magnitude of the accelerated-cured cylinders. After four days, there was considerable scatter in the data (see Figure 5.2). For all the cylinders, the changes with time were masked by the scatter. More data are needed to determine a reliable trend.

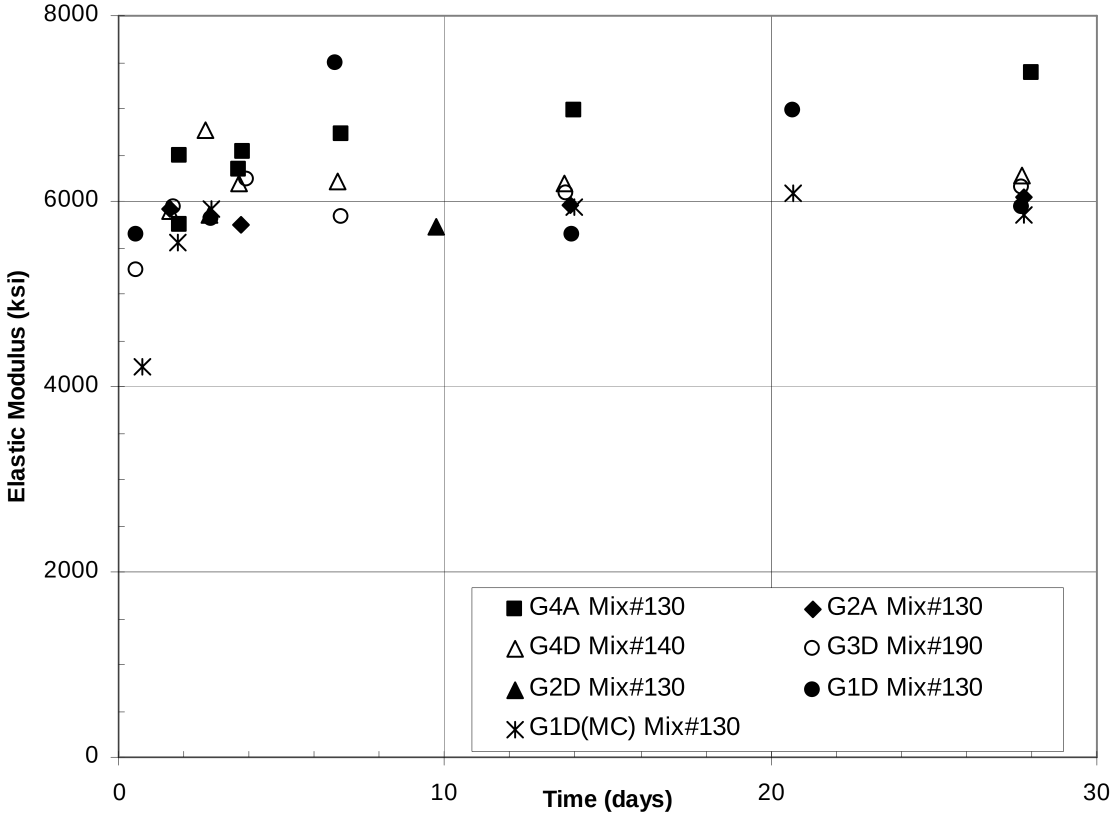


Figure 5.2 Snake Lake Bridge Elastic Modulus Test Results

All methods for predicting the elastic modulus are functions of the concrete compressive strength, as discussed in Section 2.3. Figure 5.3 compares the measured and predicted elastic modulus as functions of the concrete compressive strength. The CEB-FIP equation was the best predictor of the elastic modulus. The equation proposed by Tadros et al., with K2 = 1.0, was slightly higher than the mean of the measured data. The equations recommended by the AASHTO LRFD and ACI underestimated nearly all the measured data. This was consistent with the predicted camber data collected at release, as discussed in Chapter 4. On average, the measured elastic modulus was 8 percent higher than the value predicted by the AASHTO LRFD method.

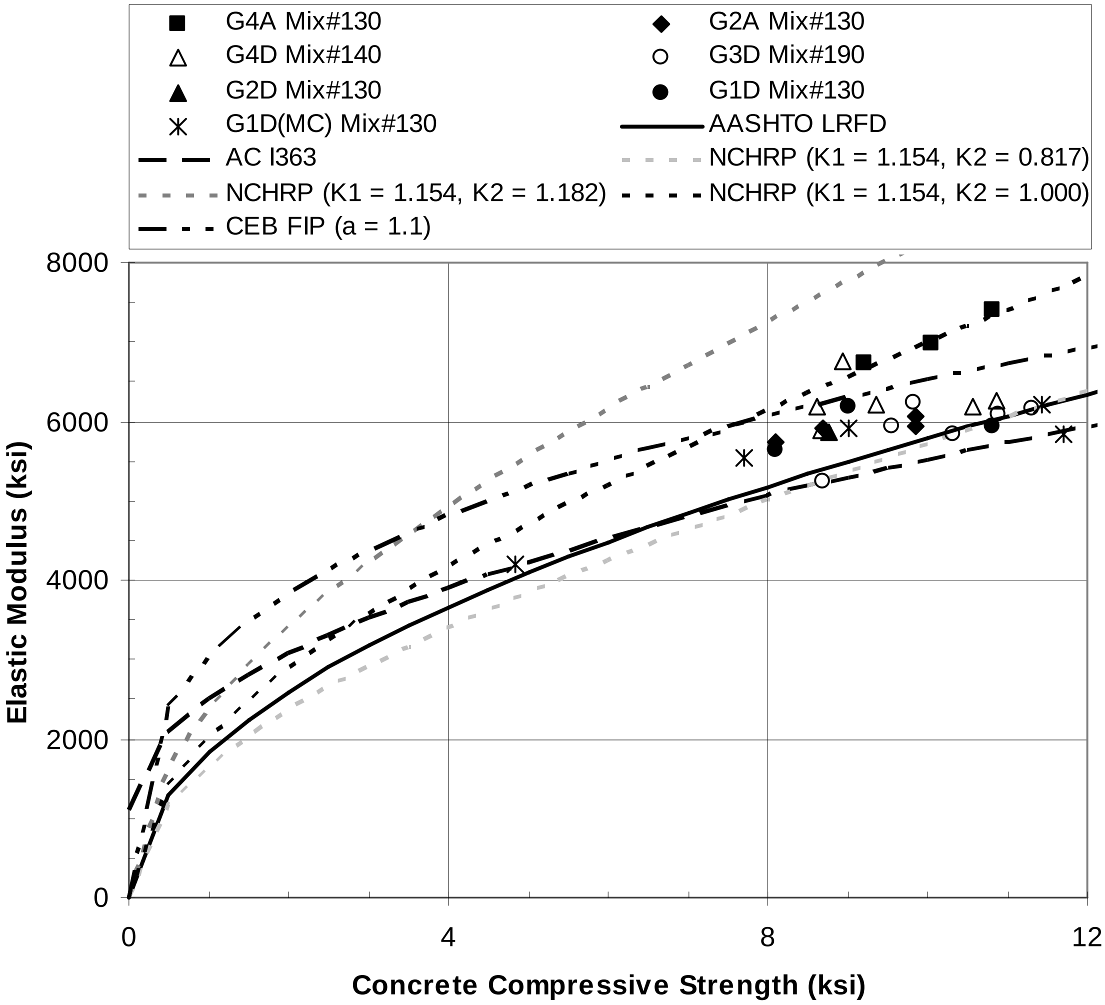


Figure 5.3 Snake Lake Bridge Elastic Modulus vs. Concrete Compressive Strength

For girder G1D, the elastic modulus was also calculated from the creep tests. Cylinders were loaded in the creep rigs at ages of one, three, and seven days. For each cylinder, the shortening due to the initial loading was measured and the elastic modulus was calculated as the change in strain divided by the change in stress. These tests are discussed further in Section 5.5. Table 5.2 shows the elastic modulus calculated for the sealed and unsealed cylinders in the same stack for both the moist-cured and accelerated-cured cylinders.

Table 5.2 Creep Test Elastic Modulus at Initial Loading – G1D

Nominal Loading Age	**1-Day**	**3-Day**	**7-Day**
Accelerated-Cured			
Age (days)	0.68	2.93	6.90
Compressive Stress (psi)	3855	3868	3868
E. Mod – Sealed (ksi)	4715	5643	5311
E. Mod – Unsealed (ksi)	4695	5825	4333
Moist-Cured			
Age (days)	0.97	2.88	6.87
Compressive Stress (psi)	2437	2365	2365
E. Mod – Sealed (ksi)	3547	4266	4623
E. Mod – Unsealed (ksi)	3493	4528	4133

The elastic modulus calculated from the creep cylinders at the time of loading was smaller than the values obtained from the elastic modulus test specimens. This could have been caused to slight errors in the calibration of the ram used to load the creep rig.

5.5 Shrinkage and Creep

Shrinkage and creep tests were performed on accelerated and moist-cured cylinders. These tests were performed on the concrete mix that was used for the Snake Lake Bridge project girder G1D, mix #130. Eight stacks consisting of two cylinders each were prepared. Moist-cured cylinders were used for four of the stacks, and accelerated cured-cylinders were used for the remaining four. One stack of each cure type was loaded after one day of curing (same time as release of prestress), three days of curing, and seven days of curing. The remaining stacks (one of each cure type) were not loaded but were monitored to determine the effects of shrinkage.

5.5.1 Shrinkage and Creep Preparation Protocol

After all of the accelerated and moist-cured cylinders arrived at the UW materials lab, four accelerated-cured cylinders were removed immediately. Two of these were prepared for a shrinkage specimen, and two were prepared for a long-term creep specimen. All specimens were prepared by the same method described here.

Each of the two cylinders in a cylinder stack was capped with sulfur on one end. One cylinder was then wrapped in furnace tape to minimize changes in strain due to drying. A 6-inch steel spacer was used to create a stack by using quick-set epoxy between the steel and uncapped ends of the concrete cylinders, because the cylinders were 8 inches long but the available Whittemore (mechanical) strain gauge had a gauge length of 10 inches. The stack was then marked with N, S, E and W faces and identified by the cure type and loading designation. Targets were fastened at three locations along the length of the specimen on each quarter. The locations included the center of the steel spacer and 1 inch from each end of the stack on the concrete cylinders. This allowed for 10-inch spacing between the targets along the length to accommodate the 10-inch length of the Whitemore gauge used to monitor the changes in strain. Figure 5.4 shows a completed stack.

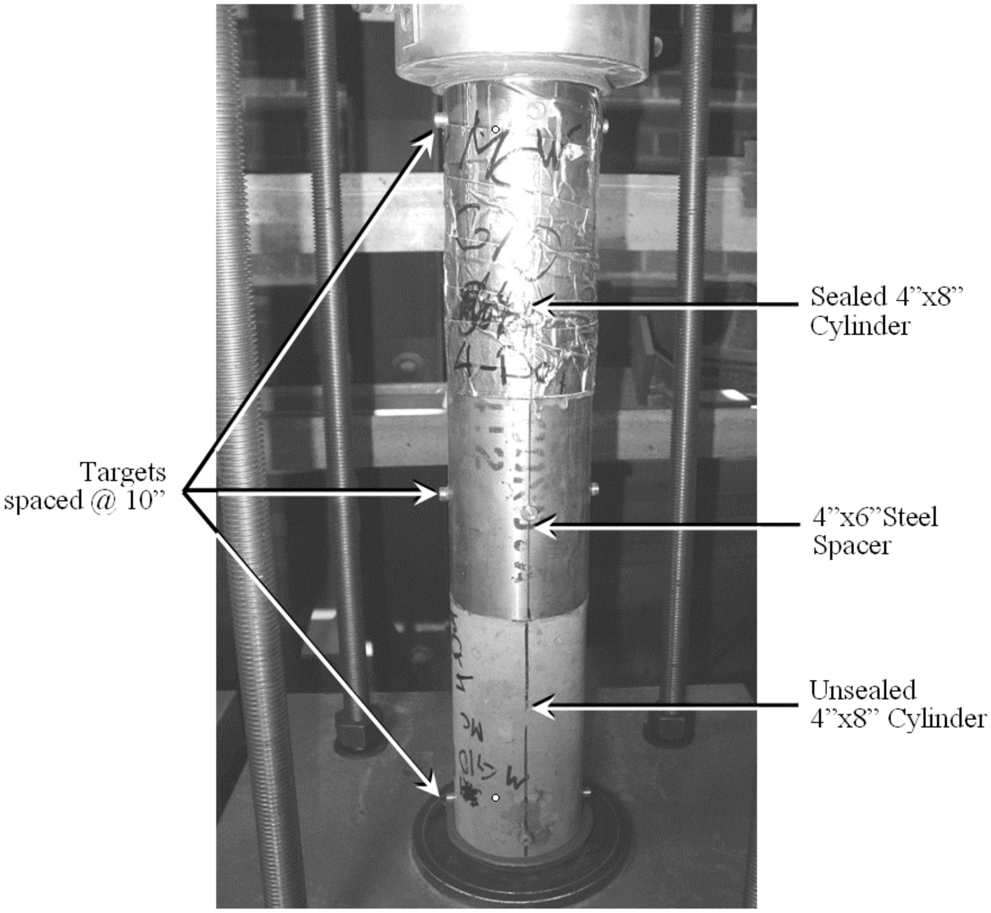


Figure 5.4 Creep and Shrinkage Stack Configuration

5.5.2 Creep Loading Procedure

One accelerated-cured stack and one moist-cured stack were loaded at one, three and seven days. The loading procedure was the same for all six specimens. A Whitemore demountable mechanical strain gauge was used to measure the change in distance between the targets mounted in the middle of the steel spacer and the target mounted on the concrete cylinders. Initial gauge readings were measured around the specimen before it was loaded. These values were treated as the base values and were subtracted from all subsequent measurements to find the change in strain at any time.

A lower plate was mounted under the table and coupled to the four threaded rods. A hydraulic ram was placed on the lower plate so it could push on the bottom of the table and pull the rods through the table. As the rods pulled down on the top plate above the specimen, they squeezed the specimen between the top plate and the plate supported by the springs. Therefore, when the rods were secured by bolts on the bottom of the table and the ram was removed, the springs carried all of the force applied to the stack. The nuts on the rod above the plate supported by the springs were left loose. They were threaded to within ¼ inch of the plate to prevent the top plate from falling if the specimen broke. See Figure 5.5 for a detail of the creep rig. Figure 5.6 shows the creep rig with a loaded specimen.

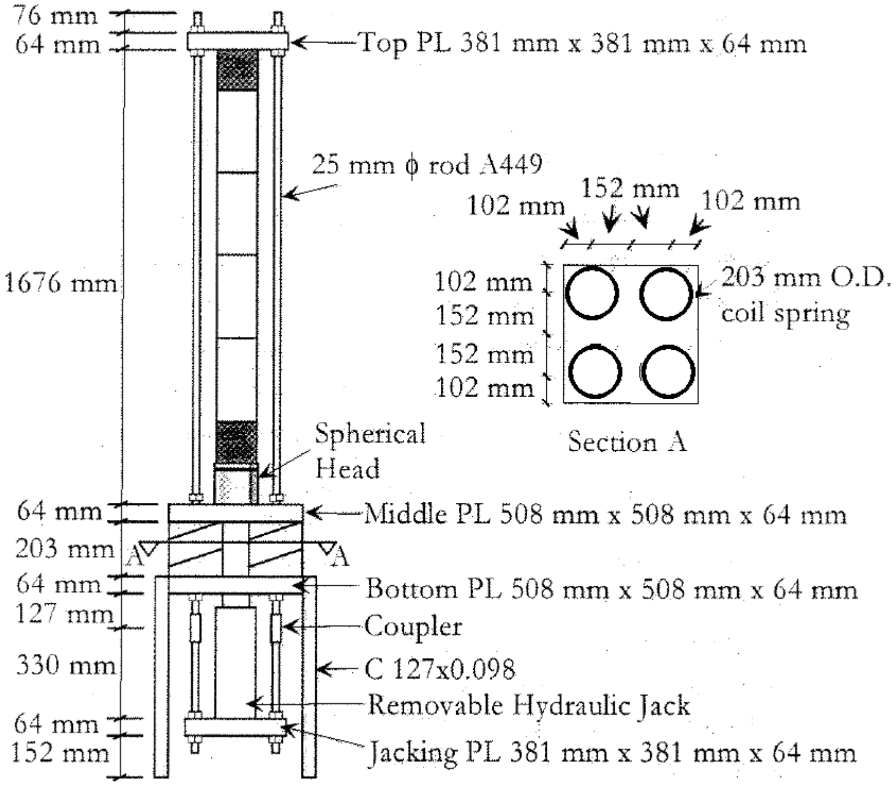


Figure 5.5 Creep Rig Detail (Barr et al. 2000)

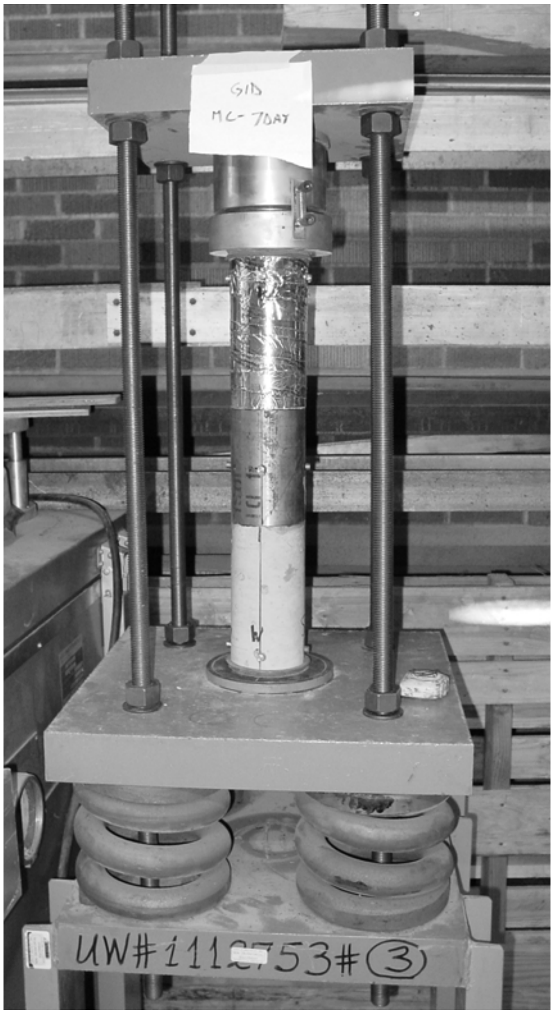


Figure 5.6 Creep Rig Assembly

The original creep rig design was configured with ten springs to accommodate a stack of five 6-in. by 12-in. cylinders. Five smaller springs were placed within five larger springs to provide stiffer force capacity. For these creep tests (on 4-in. by 8-in. cylinders), only four of the larger springs were used to reduce the stiffness of the rig. By reducing the stiffness, small deflections in the springs due to creep of the specimen would result in small changes in spring force.

The maximum concrete stress allowed for prestressed concrete at release is $0.60f'_{ci}$ (AASHTO 2006). Because the concrete strength was different for the accelerated-cured and moist-cured cylinders at initial loading, different loads were applied to each and determined from the release concrete compressive strength tests. The accelerated-cured cylinders were loaded to 3868 psi, and the moist-cured cylinders were loaded to 2365 psi.

Gauge readings were taken daily during the early stages of the test to closely monitor changes. Later, the readings were taken at longer intervals.

5.5.3 Observed Shrinkage Behavior

The observed behaviors of the accelerated-cured and moist-cured shrinkage specimens are shown in figures 5.7 and 5.8, respectively. Surprisingly, only the unsealed, moist-cured cylinder consistently shortened with cylinder age (i.e., negative strain). The other cylinders elongated or changed little in length. This elongation was not expected and introduced a complication that had not been anticipated.

The quality of the data collected could have been influenced by any of the following. Small changes in the gauge readings were noticed during the early stages of the monitoring as a result of slight bumps to the gauge that shifted the dial. The standard rod was used between each measured cylinder to detect these shifts and adjust the gauge reading. Because the assembly of the stacks was time sensitive, the targets may have been hastily applied. Not all of the targets were perfectly aligned vertically and may have shifted or sagged while the epoxy was setting.

Further material testing is necessary to better understand the behavior of the concrete’s shrinkage behavior. Therefore, the shrinkage strain was not subtracted from the total to determine the strain due to creep alone.

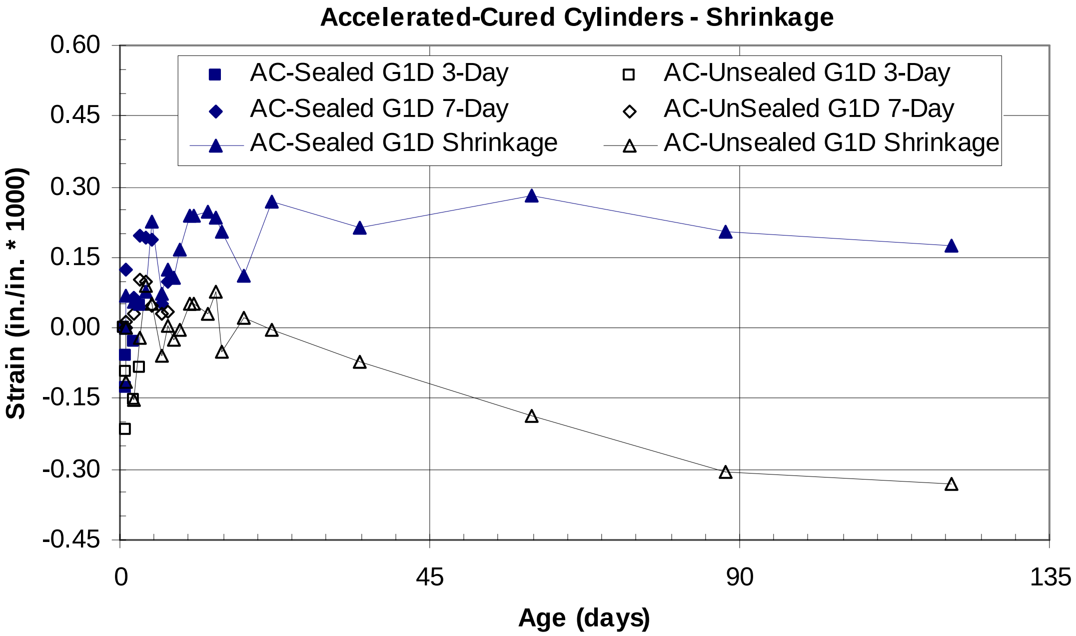


Figure 5.7 Snake Lake Bridge Accelerated-Cured Shrinkage History

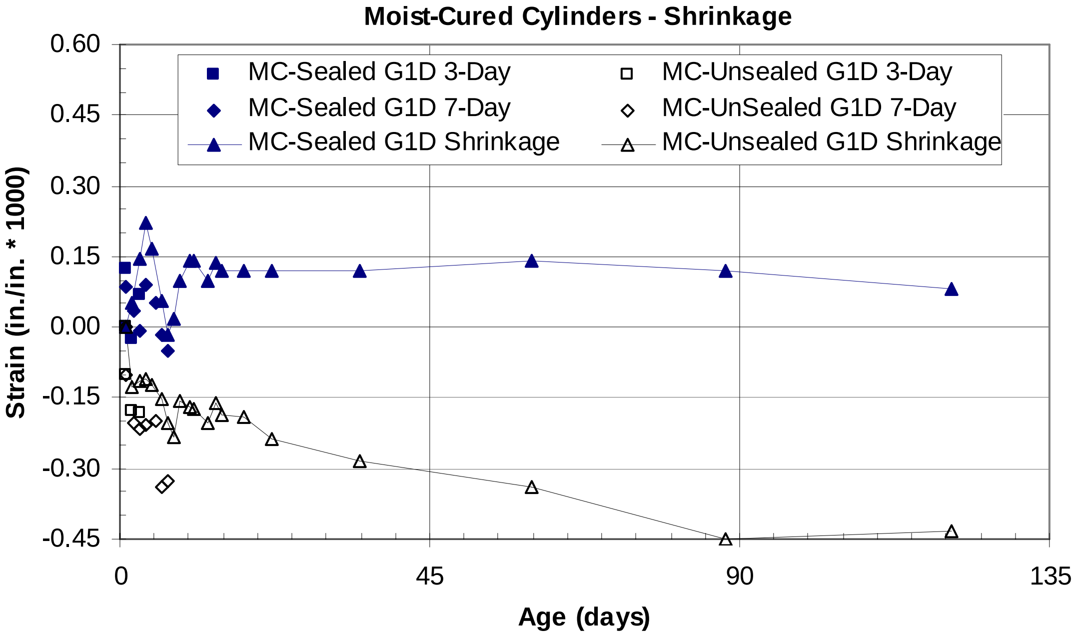


Figure 5.8 Snake Lake Bridge Moist-Cured Shrinkage History

5.5.4 Observed Creep Behavior

Creep tests monitored the cylinder strain over time after the initial load had been applied. Note that, because of difficulties in interpreting the shrinkage data, the strain results shown include strain changes due to shrinkage and are considered the total strain. Figure 5.9 shows the total change in concrete strain for the accelerated-cured cylinders, and Figure 5.10 shows results for the moist-cured cylinders. Each cylinder is designated by the age of the cylinder at loading and whether it was sealed on unsealed.

The sealed and unsealed cylinders were intended to simulate large (sealed) and small (unsealed) volume-to-surface ratios. For both the accelerated-cured and moist-cured cylinders, the sealed cylinders crept more than the cylinders that were not sealed. This might have been the result of drying shrinkage occurring in the unsealed cylinder while the sealed cylinders retained their moisture. Another explanation could be the result of free moisture being squeezed out of the unsealed cylinder, causing additional strain.

The moist-cured cylinders showed a wider range in strain with respect to the age of loading and sealed conditions. However, the sealed moist-cured cylinders had less concrete strain than the sealed accelerated-cured cylinders because of less load applied. If the sealed cylinders were assumed to be completely devoid of shrinkage strain due to loss of free water, then differences between the two might be attributed to different quantities of creep strain or different quantities of shrinkage strain due to chemical hydration.

The data showed that the concrete strain increased and the rate of deformation decreased as time increased.

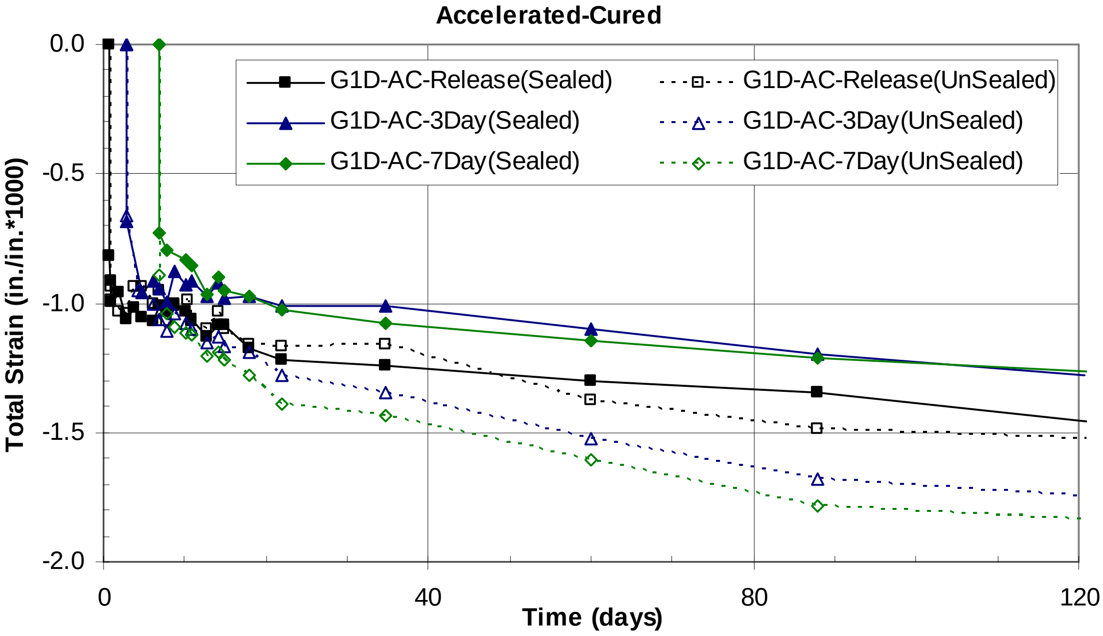


Figure 5.9 Snake Lake Bridge Accelerated-Cured Strain History

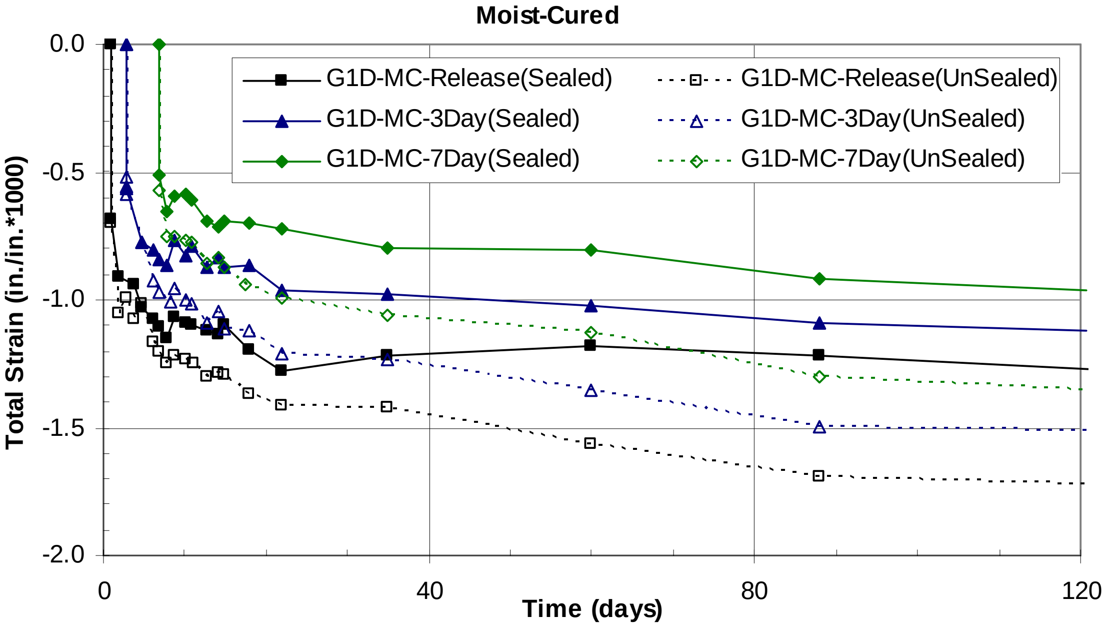


Figure 5.10 Snake Lake Bridge Moist-Cured Strain History

Table 5.3 shows a sample calculation of the total, basic and drying creep. These calculations were based on the accelerated-cured and moist-cured stacks that were loaded at one day and measured at 121 days after casting. The strain values in Table 5.3 come from the creep and shrinkage strain plots. The calculated drying creep was positive. This behavior corresponds to a negative drying component of the creep coefficient and must be considered improbable.

Table 5.3 Creep Calculation G1D Stack Loaded at Release

(με)		**AC**	**MC**	***AC/MC**
	Concrete Age (days)	121	121	
	Compressive Stress (psi)	3868	2364	1.636
	Total Shrinkage	-330	-430	
	Autogenous Shrinkage	180	90	
	Drying Shrinkage	-510	-510	
Unsealed	Total	-1530	-1720	
	Elastic	-820	-700	
	Shrinkage	-330	-430	
	Total Creep	-370	-590	-965
Sealed	Total	-1460	-1270	
	Elastic	-810	-690	
	Shrinkage	180	80	
	Basic Creep	-830	-660	-1080
	Drying Creep	460	70	115

*Multiplies the ratio of the stresses and the MC creep values to compare with the AC creep values.

Figures 5.11 and 5.12 show the calculated creep coefficient of each cylinder stack based on the total strain observed, including the shrinkage strain. The creep coefficient shown here is the total observed time-dependent strain divided by the initial elastic strain. This value is extremely sensitive to the value of the measured elastic strain.

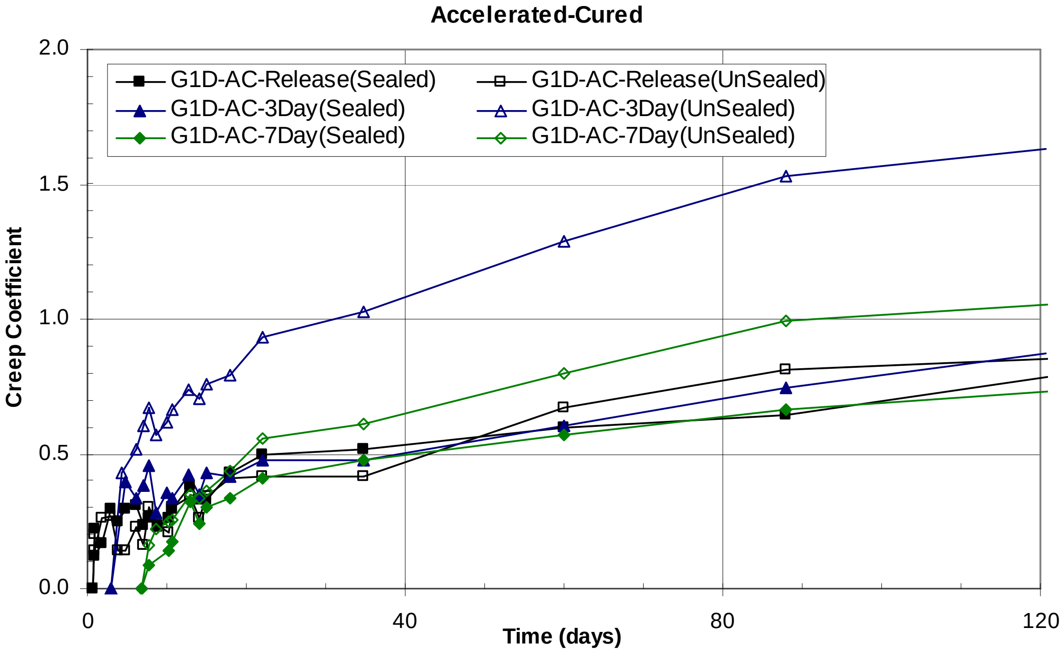


Figure 5.11 Snake Lake Bridge Accelerated-Cured Creep Coefficient

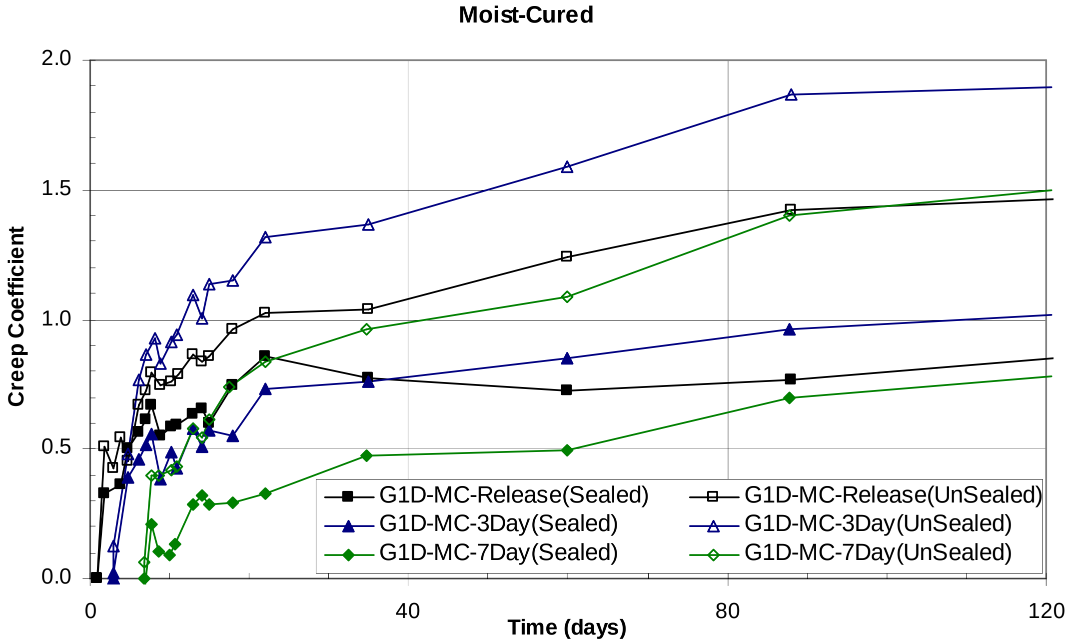


Figure 5.12 Snake Lake Bridge Moist-Cured Creep Coefficient

Most of the accelerated-cured cylinders had creep coefficients that lay between 0.7 and 1.1 at the end of the measuring period. However, cylinder G1D-AC-3Day had a creep coefficient of 1.6. For the moist-cured cylinders, the final creep coefficients were more evenly distributed over a larger range of 0.9 to 1.7. For both cure types, the cylinders that were unsealed showed higher creep coefficients than those that were sealed.

CHAPTER 6

FIELD CAMBER MONITORING – KEYS ROAD GIRDERS

6.1 Purpose

The camber monitoring data for the Snake Lake girders described in Chapter 4 did not show the expected effects of the release of temporary strands and deck placement. To evaluate the effects of these operations further, a detailed camber study was conducted on 91 girders for the Keys Road Bridge project in Yakima, Washington. Cambers were measured before and after the release of the temporary strands; before and after the cast-in-place deck pour; and at monthly intervals after these events. As many as nine and as few as four sets of camber measurements were taken on each of seven spans from November 30, 2005, to November 13, 2006. Section 6.2 summarizes the properties of the girders that were monitored. Section 6.3 discusses the measurement procedure. Section 6.4 discusses possible errors in the collected data and the data processing procedure, and Section 6.5 presents the measured results.

6.2 Girder Properties

The effects of the release of temporary strands and deck placement were measured on the Keys Road Bridge. All of the girders measured had W83G sections and were approximately 178 ft long.

The bridge had nine spans of 13 girders each. Spans 1 and 2 were inaccessible and not monitored. In this chapter, the middle seven girders (D-J) will be referred to as the interior girders, whereas the three on each side (A-C and K-M) will be referred to as the exterior girders (Figure 6.1). The girder schedule in the contract plans shows that the amounts of prestressing steel and the concrete strengths differed slightly between these two types of girders.

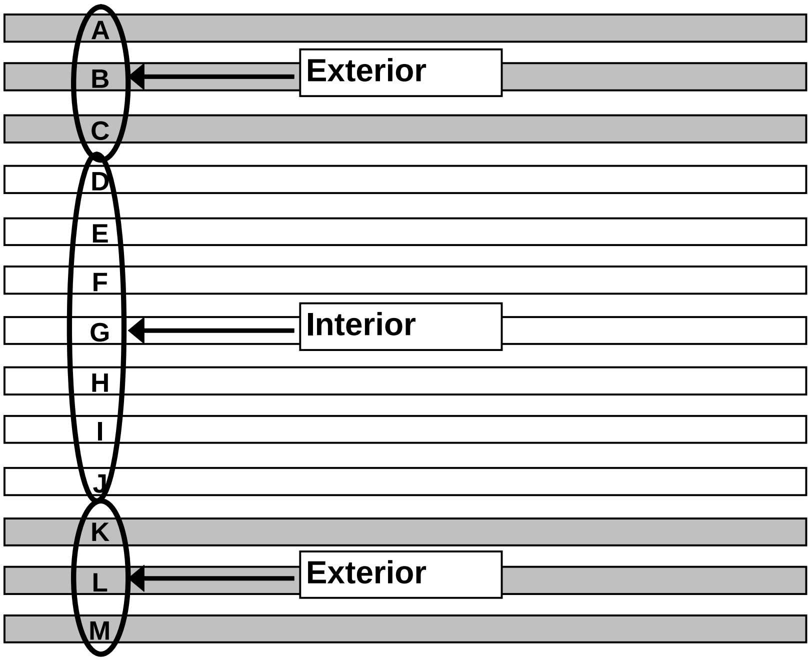


Figure 6.1 Typical Girder Layout

The end conditions varied among the spans. In spans 4, 5, 6, and 8 the construction procedure caused the piers to provide some restraint to the girder end rotation. Therefore, those spans behaved as partially restrained at both ends. Specifically, the girders in them were placed on oak blocks, braced laterally, and the temporary strands were released. The bottom flange was then embedded 7 in. into the pier, with an 18-in.-deep concrete step covering the bottom flange, as shown in Figure 6.2. The diaphragms were cast, the deck was placed, and the pier closure pour was cast. In each of the remaining spans (3, 7, and 9), one end of the girder was cast continuously, as described above, and the other end was placed on an elastomeric bearing pad to allow some rotation and displacement. The support conditions for all spans are shown in Figure 6.3. Table 6.1 summarizes the differences between the interior and exterior girders for each span and identifies the spans in which one end was placed on an elastomeric bearing pad.

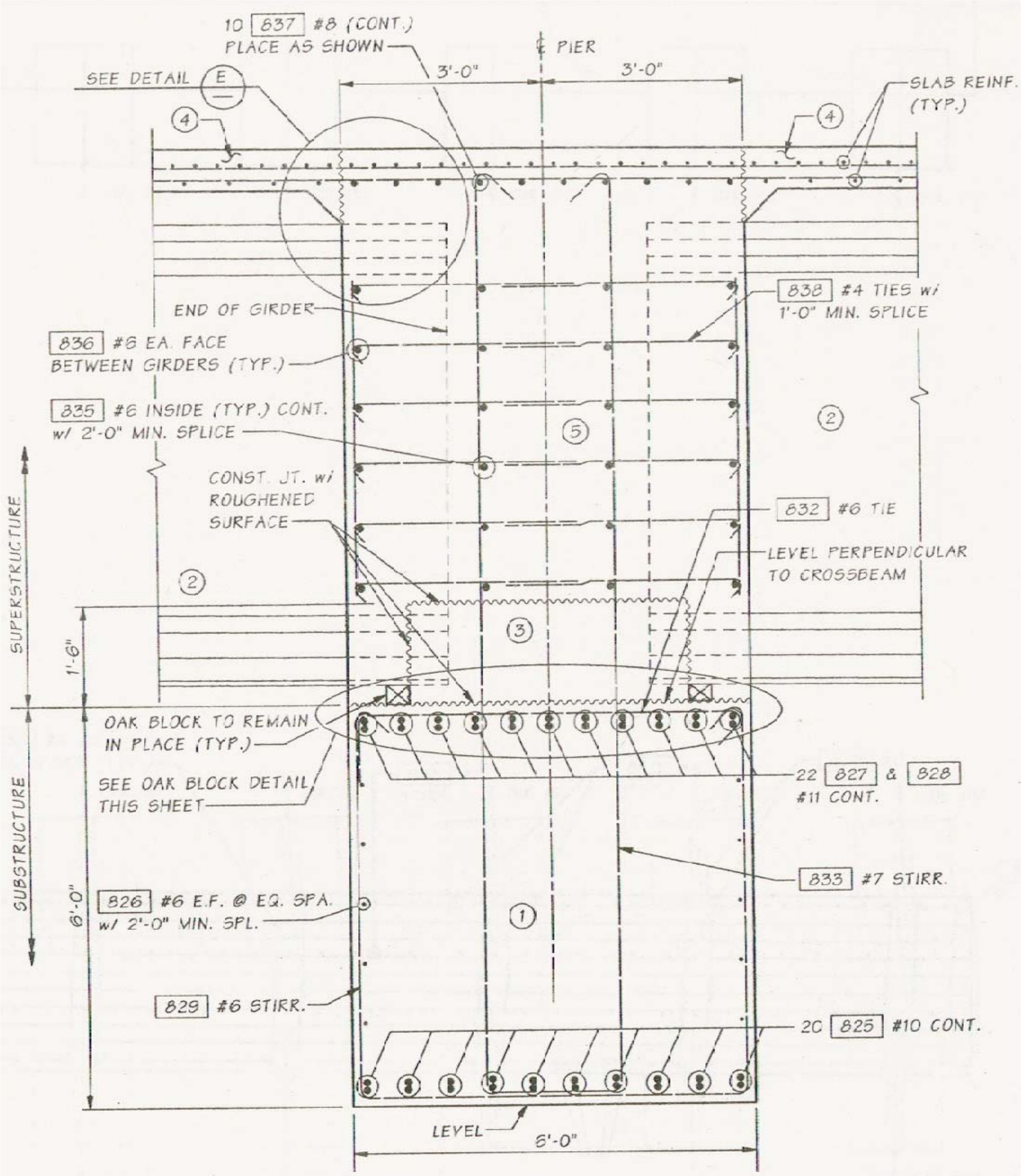


Figure 6.2 Embedment of Girder End in Partial-Height Diaphragm.

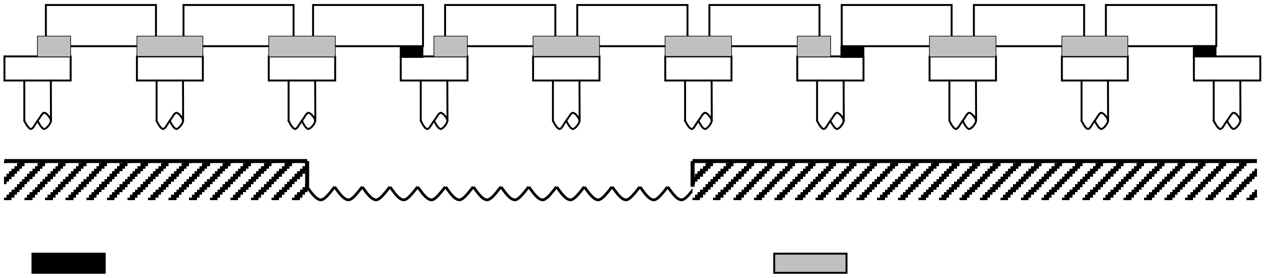


Figure 6.3 Keys Road Bridge: Support Conditions for All Spans

Table 6.1 Keys Road Bridge Girder Properties

Span	Plan Length (ft)	Interior/ Exterior	Number of Straight Strands	Number of Harped Strands	Number of Temporary Strands	Design f'_c at Release	Design f'_c at 28-Days
3*	178.50	Ext.	46	23	6	7.7	9.0
3*	178.50	Int.	46	22	6	7.5	9.0
4	178.00	Ext.	46	22	6	7.6	9.0
4	178.00	Int.	44	23	6	7.4	9.0
5	178.00	Ext.	46	22	6	7.6	9.0
5	178.00	Int.	44	23	6	7.4	9.0
6	178.00	Ext.	46	22	6	7.6	9.0
6	178.00	Int.	44	23	6	7.4	9.0
7*	178.50	Ext.	46	24	6	7.9	9.0
7*	178.50	Int.	44	24	6	7.5	9.0
8	177.95	Ext.	46	24	6	7.9	9.0
8	177.95	Int.	46	22	6	7.5	9.0
9*	176.09	Ext.	46	24	6	7.5	9.0
9*	176.09	Int.	44	24	6	7.2	9.0

* One end of the span was placed on an elastomeric bearing.

6.3 Data Collection Procedure

The girders were cast in Pasco, Washington, by the Central Premix Prestress Co. (CPM) and shipped to the project site in Yakima, Washington. All camber measurements were recorded by the WSDOT project office survey crew.

For all the girders in spans 3 through 8, camber measurements were recorded before and after the temporary strands were released. After the bottom flange had been cast into the pier cap, camber measurements were recorded monthly until the deck was cast. Measurements were then taken before, and one day after, deck placement. The girders in spans 3, 4, and 5 were not monitored after deck placement because these girders spanned over water, so the surveyors could not easily measure the elevation of the bottom flange of the girders. Monthly readings were recorded after deck placement for spans 6 through 9. Table 6.2 shows the camber measurement schedule for each span.

Table 6.2 Camber Measurement Schedule

Span	Before and After Temporary Strand Release	Additional Monthly Measurements	Before and After Deck Placement	Additional Monthly Measurements
3	Yes	5	No	0
4	Yes	6	No	0
5	Yes	6	No	0
6	Yes	2	Yes	2
7	Yes	3	Yes	1
8	Yes	1	Yes	2
9	No	1	Yes	1

The monitoring positions were marked on the top and bottom flanges at mid-width of the girders at both the ends and midspan before the girders were erected. (Details are shown in figures 6.5 and 6.6.) Before the deck placement, camber measurements were taken at the top of the girder. After the deck placement, the top of the girder was no longer accessible, so the measurements were taken on the underside of the bottom flange.

The top girder targets were marked approximately 1 ft from the end of the girder, near the centerline of the bearing. The targets on the bottoms of the girders were marked at the face of the pier cap or abutment wall, about 1 ft inside the bearing centerline. Figure 6.4 shows a typical set of camber measurements for interior and exterior, with one and two ends of continuity. The target locations are shown in figures 6.5 and 6.6.

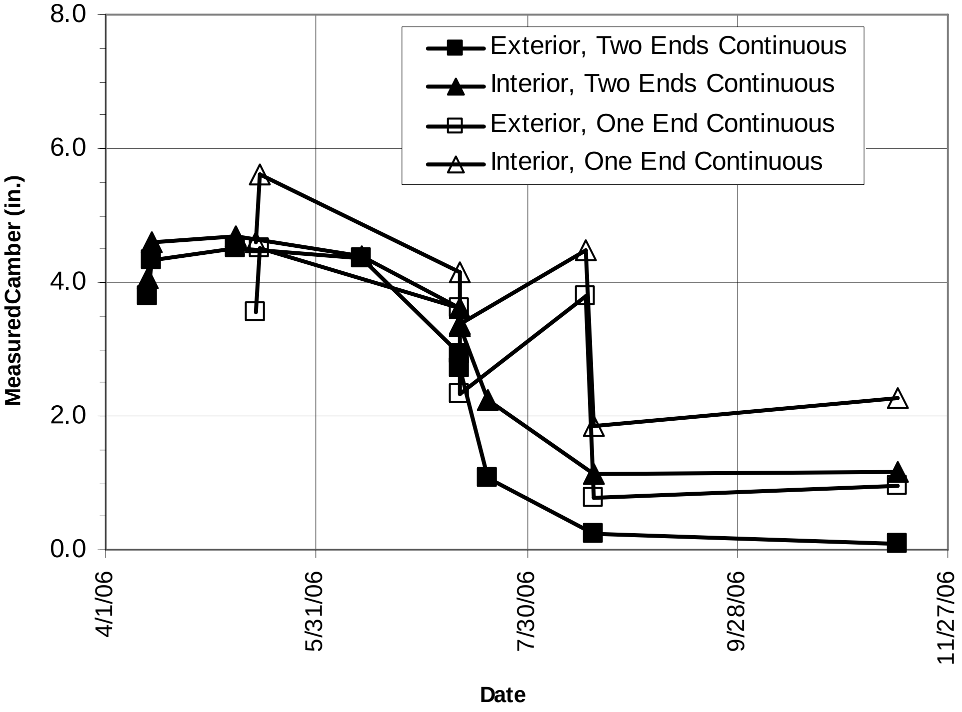


Figure 6.4 Typical Set of Camber Measurements

Measurements were recorded with a Leica Automatic Level and rod. Benchmarks were established at both ends of the bridge and back-sighted at a distance of approximately 150 feet with a reported accuracy of 1:20,000. Intermediate set-ups were established at bearing locations at a maximum distance of 300 feet apart. On the tops of the girders, the points of measurement were located between the stirrups, where the amplitude of the irregularities due to the roughened surface was reported to be up to ¾ in. On the bottoms of the girders, measurements were taken by extending the rod as much as 30 feet to the target location. This could only be done over land. The surveyor's accuracy on each closure was reported to be within 1:5,000.

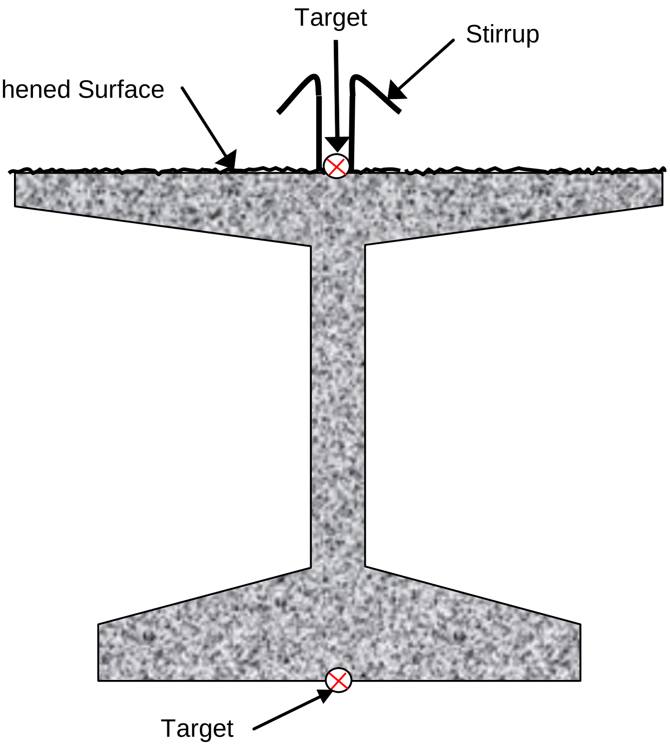


Figure 6.5 Girder Target Locations per Section

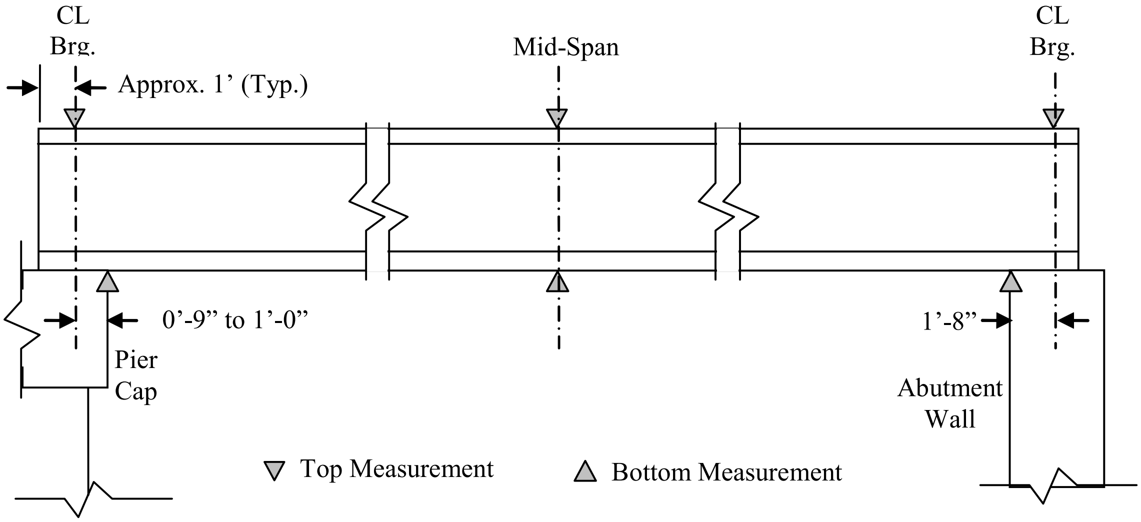


Figure 6.6 Girder Target Locations over Span Length

Central Premix Prestress Co. provided the concrete compressive strengths at release and at 28 days for all of the monitored girders except for those in Span 9.

Therefore, the average increase in concrete compressive strength from the design value in spans 3 through 8 was applied to Span 9 to estimate the actual strength (see Table 6.3). The measured strengths all exceeded the design values. On average, the measured concrete strength at release exceeded the design strength by 11 percent. The measured strength at 28 days exceeded the design strength by an average of 17 percent.

Table 6.3 Design and Measured Concrete Compressive Strengths (ksi)

		Release		28-Day	
Span	**Group**	**Design**	**Actual**	**Design**	**Actual**
3	Ext.	7.7	8.5	9.0	10.8
3	Int.	7.5	8.4	9.0	10.8
4	Ext.	7.6	8.1	9.0	10.0
4	Int.	7.4	8.3	9.0	10.5
5	Ext.	7.6	8.5	9.0	10.9
5	Int.	7.4	8.5	9.0	10.3
6	Ext.	7.6	8.4	9.0	11.6
6	Int.	7.4	8.4	9.0	11.2
7	Ext.	7.9	8.5	9.0	10.4
7	Int.	7.5	8.2	9.0	10.0
8	Ext.	7.9	8.4	9.0	10.0
8	Int.	7.5	8.3	9.0	9.5
9	Ext.	7.5	8.3*	9.0	10.5*
9	Int.	7.2	8.0*	9.0	10.5*
All	All	7.6	8.4	9.0	10.5
Actual/Design		1.11		1.17	

*Estimate of the actual concrete compressive strength from increasing the design value by the average ratio of actual/design.

6.4 Errors and Data Processing

Several factors may have contributed to errors in the camber measurements. The first factor was the accuracy of the measuring instrument. With a reported instrument accuracy of 1:20,000, the resultant error for a 180-foot length would be $^{1}/_{10}$ in. The accuracy of the measurements in the interior spans was reported to be less than that achieved at the benchmarks. The closure error was reported to be better than 1:5,000. This could have resulted in an average error of $^{7}/_{16}$ in. over 180 feet.

The girder elevations for spans 6, 7, and 8 were measured on both the top and bottom of the girders before deck placement. The goal was to minimize errors caused by the change in the target used before and after deck casting. It would be reasonable to assume that these two sets of measurements would produce the same cambers, but the data showed that the camber measured on the top of the girder was over ½ in. larger on average, and that the trend was consistent over all three spans and for both interior and exterior girders. Table 6.4 shows the difference between the cambers obtained from the top and bottom measurements for the three spans, and for interior and exterior girders separately. The interior and exterior girders showed nearly equal trends, so the effect appears unrelated to girder location.

Table 6.4 Difference Between Camber Measured on Top and Bottom of Girder

Span	Ave. Top Camber (in.)	Ave. Bottom Camber (in.)	(Top – Bottom) (in.)
6 Ext.	3.87	3.43	0.44
6 Int.	3.71	3.63	0.08
7 Ext.	4.09	3.42	0.67
7 Int.	4.40	3.54	0.86
8 Ext.	5.08	4.39	0.70
8 Int.	4.53	3.90	0.62
All Exterior	4.35	3.75	0.60
All Interior	4.21	3.69	0.52
All Girders	4.28	3.72	0.56

Measurement errors would be expected to be random, so they are unlikely to explain the phenomenon. For example, readings on the bottom of the girder were taken with the rod extended up to 30 feet. Longer rod lengths can decrease the accuracy of the reading by not achieving a plumb status with the target and through slip in the extension joints of the rod. If the bottom of a 30-ft. rod were 18 in. out of plumb with the top, the camber measurement error would be 0.45 in. This is the same order of magnitude as the observed discrepancies, but the measurement error would have had to be made consistently on all girders, which appears improbable.

As explained in Section 6.3, the upper and lower targets were located at different distances from the end of the girder. This placement leads to an error in camber that can be approximated by the product of the end slope of the girder and the difference in end distances of the targets. If the cambered shape due to both prestressing and self-weight is taken to be the same as that due to a uniform load, the camber error is

$$\Delta_{error} = 3.2\left(\frac{\Delta x_{end}}{L}\right)\Delta\left(\frac{L}{2}\right) \tag{6.1}$$

where

Δ_{error} = difference in camber obtained from the two targets

Δx_{end} = difference in horizontal locations of the two targets

$\Delta\left(\frac{L}{2}\right)$ = camber at mid-span

L = span, measured to target nearest the girder end

For a mid-span camber of 4 in. and a span of 197 ft., the expected camber error caused by moving the end target by 1 ft would be 0.068 in. This is much smaller than the observed error shown in Table 6.4 and so cannot be the cause.

Other, less probable, causes for the error must therefore be sought. One is that the girders were slightly deeper at mid-span than at the ends. This could have been the result of the roughened surface on top of the girder. With the surface having an irregular texture, the bottom of the rod could have rested on a higher surface than the mean top elevation. However, it is improbable that this would have been consistently true for all girders. It is also possible that the form was not prismatic. (The contractor confirmed that all of the girders were made for a single form) But again, this appears improbable because the forms are made of steel to precise tolerances.

The reason for the difference remains unknown. To account approximately for the discrepancy, the average difference (0.58 in.) was subtracted from the top-of-girder camber measurements in the calculation of short-term deflections due to deck placement. The cambers used in the subsequent calculations were thus less than the measured values.

6.5 Observed Behavior

The measured cambers were compared to calculated values to identify trends in field measurements and to verify the design assumptions. For each span, the girders were grouped into interior and exterior girders, as described in Section 6.2, and the average of each group was compared with the calculated value for that group. For each set of girders, the cast dates were averaged to compute the time-dependent creep deflection after deck placement. Table 6.5 provides the average measured and calculated camber changes. Deflections were calculated by using equations defined in Section 2.7 assuming that each girder was simply supported. The elastic modulus was calculated by using the AASHTO LRFD method (Equation 2.2) with the average measured concrete strength for that group and included the 15 percent increase in elastic modulus, as recommended in Chapter 9.

Table 6.5 Measured and Calculated Cambers

Span	Number of Camber Measurements	Group	$\Delta_{temp.strands.release}$		$\Delta_{deck.placement}$		$\Delta_{deck.creep}$	
			Meas. (in.)	Calc.*	Meas.	Calc.*	Meas.	Calc.*
3**	7	Ext.	0.75	0.86	N/A	-2.19	N/A	N/A
		Int.	0.86	0.86	N/A	-2.19	N/A	N/A
4	8	Ext.	0.68	0.89	N/A	-2.24	N/A	N/A
		Int.	0.65	0.87	N/A	-2.19	N/A	N/A
5	8	Ext.	0.96	0.85	N/A	-2.15	N/A	N/A
		Int.	0.88	0.88	N/A	-2.21	N/A	N/A
6	9	Ext.	0.64	0.83	-1.64	-2.09	-1.07	-0.68
		Int.	0.67	0.84	-1.21	-2.12	-0.98	-0.71
7**	8	Ext.	1.19	0.88	-1.98	-2.23	-0.58	-0.81
		Int.	1.24	0.90	-2.31	-2.27	-0.32	-0.83
8	7	Ext.	0.76	0.89	-2.03	-2.25	0.16	-0.86
		Int.	0.73	0.91	-1.61	-2.30	0.18	-0.93
9**	4	Ext.	N/A	0.85	-2.77	-2.10	-0.35	-0.81
		Int.	N/A	0.85	-2.77	-2.10	-0.31	-0.81

*Uses the actual 28-day concrete compressive strength.
** One end cast continuous with one end on elastomeric bearing.

Table 6.6 provides statistics on the accuracy of the calculated cambers. The table separates the interior and exterior girders and considers the calculated values by using both the design and measured concrete compressive strengths. The calculated deflections for actual concrete compressive strength also included the 15 percent increase in elastic modulus, as recommended in Chapter 9. The mean and standard deviations were calculated by using all of the girders in the defined set of measured deflections. All deflections were calculated by assuming the girders to be simply supported.

Table 6.6 Measured and Calculated Changes in Camber

($\mu \pm \sigma$)		2 Ends Continuous		1 End Continuous	
		Exterior	**Interior**	**Exterior**	**Interior**
Temporary Strands Rel.	Δ_m (in.)	0.76 ± 0.16	0.73 ± 0.19	1.05 ± 0.28	1.05 ± 0.27
	Δ_m/Δ_c(Design f'_c)	0.70 ± 0.15	0.68 ± 0.18	0.98 ± 0.26	0.98 ± 0.25
	Δ_m/Δ_c(Actual f'_c)	0.88 ± 0.19	0.84 ± 0.22	1.22 ± 0.31	1.21 ± 0.29
Deck Placement	Δ_m ($\mu \pm \sigma$) (in.)	-1.54 ± 0.41	-1.13 ± 0.47	-1.79 ± 0.81	-1.96 ± 0.64
	Δ_m/Δ_c(Design f'_c)	0.57 ± 0.15	0.41 ± 0.17	0.66 ± 0.32	0.72 ± 0.25
	Δ_m/Δ_c(Actual f'_c)	0.71 ± 0.20	0.51 ± 0.21	0.82 ± 0.39	0.90 ± 0.56
Deck Creep*	Δ_m ($\mu \pm \sigma$) (in.)	-0.46 ± 0.70	-0.40 ± 0.70	-0.46 ± 0.49	-0.32 ± 0.56
	Δ_m/Δ_c(Design f'_c)	0.40 ± 0.63	0.35 ± 0.62	0.42 ± 0.44	0.29 ± 0.51
	Δ_m/Δ_c(Actual f'_c)	0.53 ± 0.86	0.45 ± 0.81	0.54 ± 0.56	0.36 ± 0.56
Deck Creep**	Δ_m ($\mu \pm \sigma$) (in.)	-0.46 ± 0.70	-0.40 ± 0.70	-0.46 ± 0.49	-0.32 ± 0.56
	Δ_m/Δ_c(Design f'_c)	0.72 ± 1.11	0.62 ± 1.11	0.74 ± 0.78	0.51 ± 0.90
	Δ_m/Δ_c(Actual f'_c)	0.94 ± 1.52	0.79 ± 1.43	0.95 ± 0.99	0.64 ± 1.16

m = measured, c = calculated

* Using girder section properties only.

** Using composite section properties ($1.6 {*} I_g$).

6.5.1 Effect of Actual Concrete Strength

According to Table 6.6, the measured cambers (on average) were smaller than the calculated ones when the design concrete strength was used. This was true for exterior and interior girders, for one-end and two-end continuous spans, and for all three loading conditions (strand release, deck placement and deck creep). The accuracy increased and the calculated cambers decreased significantly when the actual (rather than the design) concrete strength was used. This trend was expected because the actual stiffness of the concrete was greater than the value assumed in design. This resulted in smaller values of estimated deflection. The use of the actual concrete strength thus improves the prediction accuracy.

6.5.2 Camber Changes at Release of Temporary Strands

The release of temporary strands provides an opportunity to evaluate the effects of some of the parameters that might influence the response, such as interior versus exterior girder and the end restraint provided by the support conditions.

The response of the exterior and interior girders to strand release was nearly identical. Both types of girder had the same number of temporary strands and, at the time of monitoring, the deck had not yet been cast, so they were expected to behave similarly. The accuracy of the camber predictions for both types was therefore also similar.

By contrast, the end restraint had a significant effect on the measured cambers. The camber change in the spans with two ends continuous was only 71 percent of that in the spans with one end continuous. This finding suggests that the oak blocks produced significant end restraint, rendering the span 41 percent stiffer than a truly simply supported one. (This value is obtained by comparing the Δ_m values in Table 6.6 for 1 and 2 ends continuous). The issue is analyzed further in the discussion of modeling presented below.

In the spans with one end continuous, the measured cambers were significantly (21 percent) larger than the values calculated with the actual concrete strength and unrestrained supports. This behavior was unexpected. It is shown below that a girder with an elastomeric bearing at one end would undergo a camber change that differs from that of a girder on perfect rollers by an amount that is negligible. It was also argued above that the use of the actual, rather than the design, concrete strength in general leads to better prediction accuracy. Furthermore, when the temporary strands are released the structure consists of the bare girder, so the dimensions of the effective cross-section are not in doubt. For all these reasons, the camber changes due to release of temporary strands were expected to be well predicted. But that was not the case.

The measured results were particularly surprising because they were larger, and not smaller, than the predicted ones. Any additional effects that are not accounted for in the calculations are likely to provide restraint, rather than adding flexibility, and would therefore stiffen the system and reduce the camber change. The only exception is cracking. However, the load on the girders prior to release of temporary strands is so small that cracking is most improbable. Therefore, the results are regarded as anomalous, and the reasons for them remain unknown.

6.5.3 Camber Changes Due to Casting of the Deck

After the temporary strands had been cut, the bottom flanges were embedded into the pier cap at the plan locations as described in Section 6.2. The deck was then cast, leaving the pier closure pour open. The midspan deflection caused by deck casting was calculated by assuming a uniform load over a simply supported span. Table 6.6 shows that the observed deflections were consistently less than the calculated deflections for all the spans, particularly for the spans with restraint at both ends, which suggests that the pier cap embedment provided some restraint.

On average, the spans with two ends restrained were 46 percent stiffer than those with only one end restrained. (The interior and exterior girder showed rather different deflection ratios of 1.155 and 1.764 respectively, but the average was 1.46). This may be compared with the 41 percent additional stiffness observed for the temporary strand release. At strand release, only oak blocks restrained girder end movement, whereas at deck casting the pier cap embedment was also in place. The similarity in stiffness increase suggests that both systems prevented relative displacement between the girder and pier cap almost completely, and that almost all of the flexibility present was provided by deformations of the piers, which are assumed to have been the same on both occasions.

Some inconsistencies are apparent in the measured data, but they may have been caused by the relatively large scatter in the cambers for different girders. (The average coefficient of variation was 36 percent). For example, in the spans with two ends continuous, the exterior girders deflected more than the interior ones, but the opposite was true for the spans with only one end continuous. The differences are partially attributed to effects that were not included in the calculations. For example, the deck concrete starts to set up during the day. In the later stages of the pour, some of the concrete cast at the start may have set up sufficiently to provide some composite action with the girder, thereby stiffening the system.

6.5.4 Camber Changes after Deck Placement

The deflection measurements after the deck placement had significant amounts of scatter, with an average coefficient of variation of 152 percent. Approximately 0.4 in. of additional deflection (downward) was observed on average over the monitored time period for all the girders, while the standard deviation was as high as 0.70 in. This relatively large scatter is attributed to the fact that the creep deflections were quite small (relative to the initial camber) and that the deflections due to other loadings, such as thermal effects, differential shrinkage and changes in construction loading, were not considered but were undoubtedly present.

Span 8 girders consistently deflected upwards, whereas spans 6, 7, and 9 all deflected downwards. The reason for the difference remains unknown. Deflections after the deck pour were not available for spans 3, 4, and 5.

The calculated creep deflection was initially based on the elastic deck placement deflection, which was computed with the properties of the bare girder. To include the influence of the deck properly would require a time history of the compressive strength, elastic modulus, shrinkage and creep of the deck concrete, but these data were not available. Therefore, differential shrinkage was ignored and an upper bound on the time-dependent deflection was obtained by multiplying the elastic deflection by the creep coefficient. On average, the measured time-dependent camber change was only half of that computed with the actual concrete strength and the bare girder section. Note that the composite moment of inertia was about 1.77 times that of the bare girder, assuming the deck concrete had a compressive strength of 4 ksi and that the girder spacing was 6.875-ft, as specified in the contract plans. Thus, use of the composite inertia led to a better estimate of the time-dependent camber change (see Table 6.6).

Calculation of the creep deflection is clearly affected by many potential sources of error. Fortunately, the creep deflection is small relative to other components of the total camber (an average of 0.4 in. in this case), and it also occurs at a time that makes errors in its prediction relatively unimportant. Camber errors that occur before the deck has been cast may cause problems with placing the formwork and reinforcement, which in turn may lead to delays and contractual disputes. Those that occur after deck placement primarily affect the grade, and the consequences of an error in grade on the order of ¼ in. are unlikely to prove serious

6.5.5 Structural Model for Calculating Camber Changes

The calculated camber changes due to release of temporary strands and deck placement were influenced most strongly by the selection of the E_c value and the effects of end restraint. The E_c value has already been discussed. Use of the value corresponding to the actual, or expected, f'_c rather than the design one is recommended.

Section 5.14.1.4 of AASHTO LRFD is based on the assumption that transient and/or permanent loads are applied to a fully continuous girder (AASHTO 2006). .This implies that the cast-in-place closure joint at the pier has been completed. However, the deflections measured for this research were recorded before the closure pour was made and, therefore, the structure was modeled using simply supported.

Some end restraint did exist before the closure joint pour had been completed, generated by shear forces in the bearings that restrained the movement of the bottom flange of the girder. It affected the cambers, so finding some way of accounting for it in the model would be beneficial. The data from this bridge alone do not constitute a sufficiently rich set to allow reliable identification of a good method; nonetheless, two possible approaches are described here.

The simplest approach is to define a "continuity index", ω_c, which varies from 0 to 1.0 and indicates the level of end restraint available. A uniform load applied to a simple span would then cause a mid-span deflection of

$$\Delta = \left(\frac{5 - 4\omega_c}{384} \right) \frac{wL^4}{EI} \qquad 6.2$$

For a simple span, $\omega_c = 0$, and the deflection coefficient is 5/384. For full continuity, $\omega_c = 1.0$, and the deflection coefficient is 1/384. In this case the deflections due to deck placement were, on average, 1/1.45 or 0.69, times the simple span deflections. Therefore

$$\omega_c = \frac{1 - 0.69}{0.8} = 0.39 \qquad 6.3$$

so the spans were, according to this definition, 39 percent continuous.

This definition of continuity has the appeal of simplicity, but it breaks down when applied to the end moments caused by releasing the temporary strands because an end moment applied to a fixed-ended beam produces no deflection at all.

An alternative is to model the end restraint explicitly as a spring at the bottom of the girder end, as shown in Figure 6.7. When an elastomeric bearing supports the girder, the spring constant can be derived from its properties. When an oak block supplies the support, it may be quite rigid in shear, and the majority of the flexibility may come from deflection of the piers. Analysis using the model of Figure 6.7 shows that the end rotation of the girder, and the mid-span deflection, due to release of the temporary strands are reduced by a factor of $(1+\alpha)$, where

$$\alpha = \frac{c_1{}^2 K_{end} L}{EI} \qquad 6.4$$

Here:

c_1 = the distance from (composite) cgc to the bottom of the girder

K_{end} = stiffness of the end restraint (e.g., the bearing)

L = span length

EI = flexural rigidity of the girder

An infinitely stiff end restraint then leads to zero deflection, as it should. (In the model, the girder is treated as having an infinite axial stiffness, and only bending deformations are considered). In the case of an elastomeric bearing typical of the sort used for W83G prestressed girders, $K_{end} \approx 32$ kips/in. and $\alpha = 0.02$. The camber change due to release of the strands is thus reduced by a factor 1.02. This change is smaller than the probable errors in measurement and is therefore considered negligible

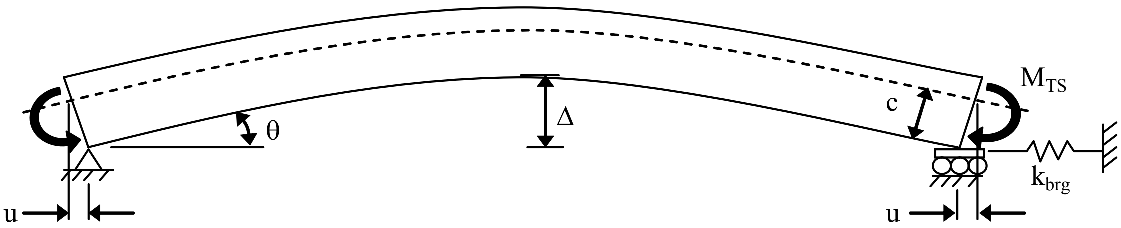


Figure 6.7 Elastomeric Support Restraint Model

For a uniform load, the model shows that the simple span deflection is reduced by a factor of $(1+\alpha)/(1+0.2\alpha)$. In that case an infinitely stiff restraint does not lead to zero displacement because the downward deflection due to the load is only partly offset by the upward deflection due to the induced end moment.

The measured deflections in the spans with continuity at both ends were smaller than the spans with continuity at one end by factors of 1.41 for strand release and 1.45 for deck casting. These observations lead to computed α values of 0.41 and 0.63, respectively, for which the implied restraint stiffnesses are 618 and 950 kips/inch per girder. It is logical that the stiffness at strand release should be less than that at deck placement because of the additional restraint supplied by the pier cap embedment in the latter case. However, the absolute values of the stiffnesses appear high, if indeed they represent the stiffness of the piers against longitudinal displacement.

Note that the spans were connected longitudinally in groups of three. The central span in each group (e.g. spans 5 and 8) therefore experienced resistance to longitudinal displacement not only from the piers that supported them directly but also from those supporting the adjacent spans. According to the model presented, they might be expected to deflect less under load than the girders in the end spans of the group (spans 4 and 6, 7 and 9). In practice, if that trend was present, it was masked by scatter in the results. Therefore, while the model provides a plausible basis for estimating the effects of end restraint, further development and verification are clearly necessary before it can be used with confidence.

CHAPTER 7

END RESTRAINT/ROLLER TESTING

7.1 Purpose

The camber of a girder may be restrained by the build-up of axial force when the support restrains shrinkage and creep. The horizontal force acts at the bottom flange level, which induces an end moment that leads to downward deflection. Release of those forces by lifting the girder might be expected to cause the restrained camber to rebound.

Tests were conducted to observe the magnitude of the camber rebound in a girder when one end was lifted off its support and placed on a roller. The tests were conducted on five W83G girders from the Keys Road Bridge project at the Central Pre-Mix Prestress plant in Pasco, Washington, on December 21, 2005.

7.2 Girder Properties

All five of the girders tested were W83G sections and were 178 ft long. They were placed on timber bunks located between 20 and 30 inches from the girder end. The bunks were approximately 12-in. by 12-in. in cross-section and lay directly on the ground. The soil was a loosely compacted mixture of gravel and sand, which might allow for rotation in the support if the girder were to shrink. Table 7.1 shows the number of prestressing strands and age of the girders. While all girders were identical with respect to prestress force, section, and length, the girders cast on November 12th and November 18th were released after approximately two days' curing, whereas the others were released after approximately one day.

Table7.1 Age and Prestressing of Girders Used in Roller Test

Cast Date	Age at Release (days)	Age at Test (days)	Number of Temporary Top Strands	Number of Straight Strands	Number of Harped Strands
11/8/05	0.9	43	6	44	24
11/10/05	0.9	41	6	44	24
11/12/05	1.9	39	6	44	24
11/15/05	1.0	36	6	44	24
11/18/05	2.9	33	6	44	24

The same concrete mix was used on all of the Keys Road Bridge girders. Table 7.2 shows the release and 28-day compressive strength results for all the girders tested. The average release strength of the 1-day cure girders was 8,014 psi, while the average release strength of the 2-day cure girders was 9,463 psi.

The 28-day compressive strength result was not available for the girder cast on November 12th, so it was taken as the average of the strengths of the other girders. The average 28-day compressive strength was 11,681 psi.

Table 7.2 Release and 28-Day Compressive Strengths

Cast Date	f'_{ci} (psi)	f'_{c28} (psi)
11/8/05	8205	11730
11/10/05	7900	11510
11/12/05	8585	N/A
11/15/05	7938	11148
11/18/05	10340	12334

7.3 Roller Test Procedure

Before lifting, the camber of each girder was measured on both sides. One end of the girder was then lifted at the lifting loop by the traveling crane and was set down again on the roller. Lifting was conducted gently, to avoid any potential for cracking.

Figure 7.1 shows the roller. It consisted of a 2.5-in.-diameter steel bar between two 0.5-in.-thick steel plates. The plates provided a smooth, clean surface to allow longitudinal movement when the weight of the girder was set on the roller. To keep the top plate from rolling or sliding off the bar while the girder was being lowered, a timber 2-by-4 was placed on each side, and wedges were used to balance the top plate. After the girder had been placed on top of the roller, the wedges were knocked out, and the 2-by-4s were removed. The system was then free to roll.

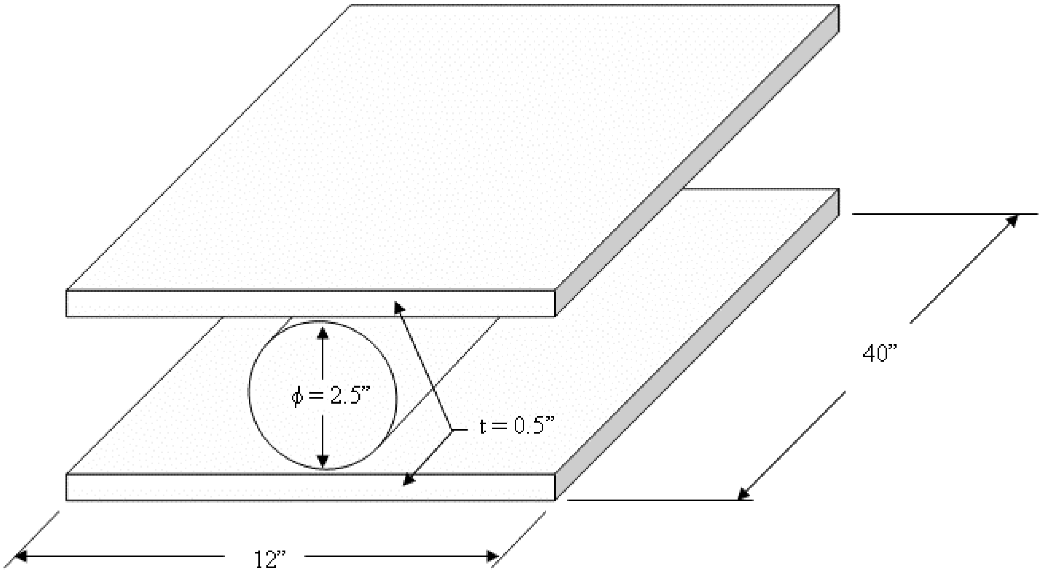


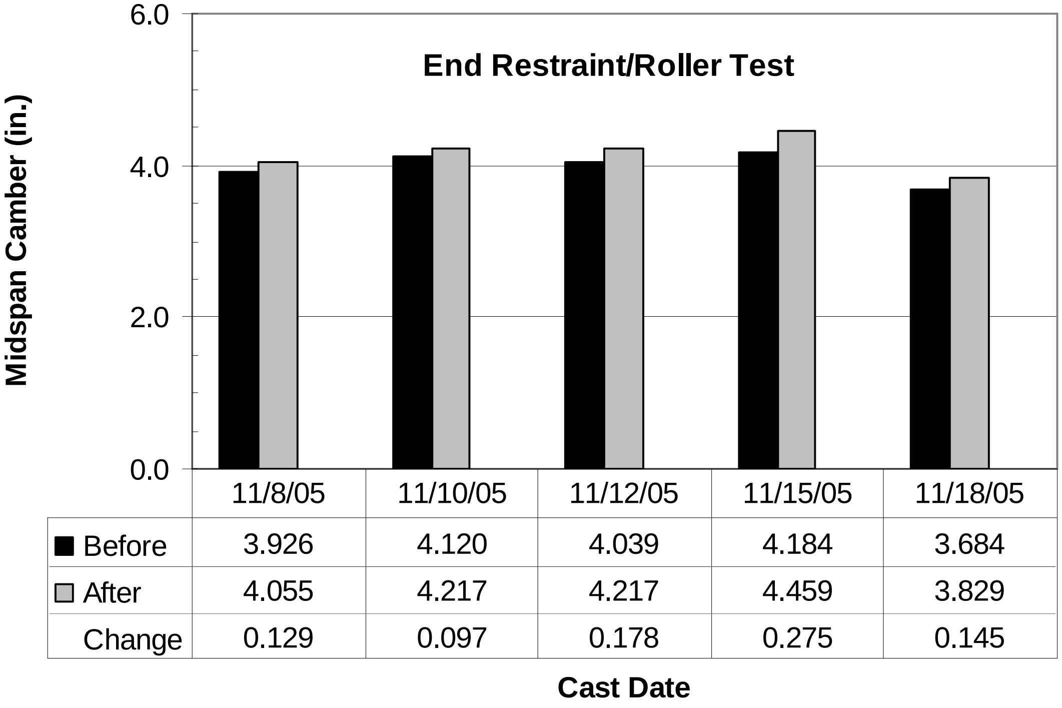
Figure 7.1 Roller Diagram

The camber was measured on each side of the girder and compared to the values obtained before lifting. The girder was then lifted, the steel bar and plates were removed, and the girder was placed back on the timber supports.

7.4 Observed Behavior

All five girders showed an increase in midspan camber after they had been placed on the rollers. Figure 7.2 shows the camber changes. The average increase was

0.165 inches. The consistent increase in camber suggests that the supports had been preventing some girder shortening due to creep and shrinkage.



	11/8/05	11/10/05	11/12/05	11/15/05	11/18/05
■ Before	3.926	4.120	4.039	4.184	3.684
▨ After	4.055	4.217	4.217	4.459	3.829
Change	0.129	0.097	0.178	0.275	0.145

Figure 7.2 Roller Test Camber Results

When girders are shipped, any stresses caused by shrinkage restraint are released. The camber after shipping and erection should therefore be expected to be larger than that in storage. The final camber is of interest. Any method for predicting final camber that is calibrated with data that do not account for the effects of shrinkage restraint in the storage area is therefore likely to contain this modest error.

CHAPTER 8

EVALUATION OF FABRICATOR DATA

8.1 Introduction

This chapter describes the broad-based data that were collected to complement the detailed data on girder camber and materials testing described in chapters 4 and 5. The discussion is organized in three sections. Section 8.2 discusses the procedures for collecting the data, Section 8.3 describes the data set, and Section 8.4 shows the trends that were observed in the data. The data collected from each girder were used to calibrate the camber prediction model, which is discussed in Chapter 8.

8.2 Data Collection Procedure

The two largest fabricators of prestressed concrete girders in the state of Washington are Concrete Technology Corporation, located in Tacoma, and Central Pre-Mix Prestress, based in Spokane with an additional prestressing plant in Pasco. To obtain data on a broad range of girders used in WSDOT bridges, site visits were made to those two companies, and data were collected from a total of 146 girders. Because of the range in size and length of the girders used in WSDOT bridges, an effort was made to collect data that varied in cross-section, length, and the amount of prestressing used. The information gathered included camber at release and at one subsequent time, girder geometry, material data, level of prestressing, and curing information. The data collected differed from the data described in Chapter 4 in that they were less detailed (with fewer camber readings per girder), but they described a larger number of girders.

Most of the information obtained from the fabricator was related to the girder cross-section, length, and prestressing strand size and quantity. Those properties were taken from the fabrication drawing plans. Quality control records were also reviewed. These records documented the fabrication history, including the time and date of casting, time and date of the release of prestress, concrete cylinder strengths at release and 28 days after casting, and all camber measurements.

8.3 Description of Dataset

The data set included girders fabricated by two fabricators under a number of conditions. This section describes the distribution of girders with respect to a number of properties.

8.3.1 Data Collection from Concrete Technology Corporation

The data set from Concrete Technology Corporation contained 103 girders from four projects and included the eight girders monitored for a detailed time history of camber and materials testing (see chapters 4 and 5).

The set of girders from the Black Lake Bridge project was the largest collected. This project included 66 W74G girders that ranged in length from 65 feet to 131 feet. The bridge had five spans, for each of which the span length and number of prestressing strands differed.

The 277th St Bridge project consisted of 16 girders with a W50G section that were all 96 feet long and had the same prestressing force. The girders in this data set varied only in the age of the concrete at the time of release.

The Snake Lake Bridge project was used for the detailed camber study and materials testing discussed in chapters 4 and 5. This girder set consisted of eight girders with a W74G section. All these girders were 135 feet long. However, different amounts of prestressing were used, and three slightly different concrete mixes were used to meet the required strengths at release.

The Cedar River Bridge project included 13 girders with a WF74G section, with five girders each spanning 95, 120, and 128 feet.

8.3.2 Data Collection from Central Pre-Mix Prestressing Corporation

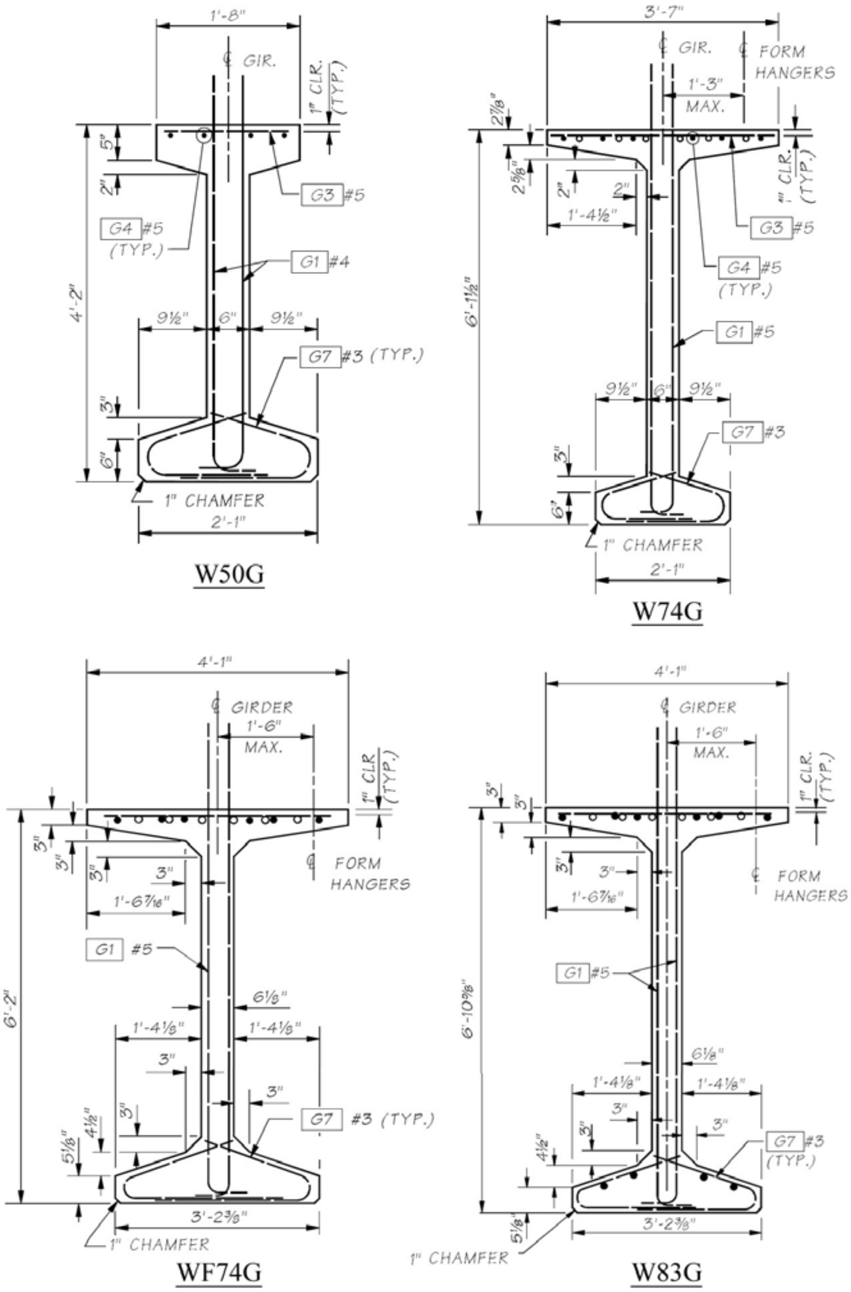
One trip was made to the Spokane prestressing plant, where 41 girders from four projects were collected from Central Pre-Mix's quality control records. However, many of the girders did not have a camber near the time of release and were not used in the evaluation. Additional trips were made to the Pasco plant to field measure and collect the quality control records for 31 addition girders. Three of those girders were removed from the evaluation because release cambers and/or concrete compressive strength results were not available. A total of 43 girders from Central Pre-Mix's records were used in the evaluation.

The Yakima River Bridge project included eight W83G girders, all 171 feet long.

The Keys Road Bridge project included 28 W83G girders, all 178 feet long and prestressed with various amounts of prestressing force. The roller test that was performed on five girders to determine the effects of restraint by temporary bunks is discussed in Chapter 6. Eight of these girders were measured in the field by UW researchers to obtain a second camber measurement with the same method that was used to measure the Snake Lake Bridge girders at Concrete Technology Corporation (see Chapter 4).

8.3.3 Sections

The girder cross-sectional properties varied over only a limited range because the state uses only its own standard girder sizes. Data were gathered from girders with a range of cross-sections, including the four most common sections (W50G, W74G, WF74G and W83G). Their cross-sections are shown in Figure 8.1, and Figure 8.2 shows the population distribution for girder length and section type.



W50G

W74G

WF74G

W83G

Figure 8.1 WSDOT Girder Section Dimensions

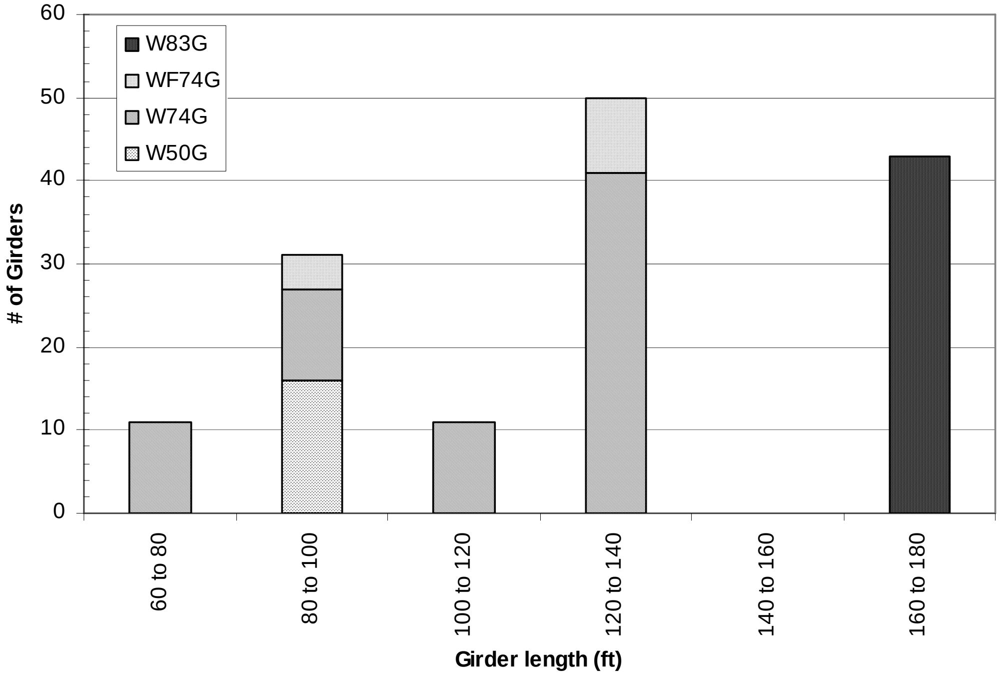


Figure 8.2 Number of Girders for Each Section

8.3.4 Age at Release

The age of the concrete at release influences the girder stiffness because the elastic modulus changes over time and with maturity. To optimize productivity, fabricators often strive to produce one girder in a 24-hour cycle, thereby maintaining consistent working schedules for the various specialist crews. Prestressing fabricators typically do not work on weekends and holidays, and as a result, girders that are cast on a Friday or before a holiday will continue to cure, and the concrete will gain strength and maturity. Therefore, while most girders will be released between 12 and 24 hours of casting, some girders will cure for between 48 and 96 hours prior to release.

Figure 8.3 shows the number of girders released on each day after the casting. Note that the increase in maturity for “Friday girders” may be less than first expected because the fabricator may choose to use a less aggressive heating program during the cure time, knowing that the cure time will be longer than usual.

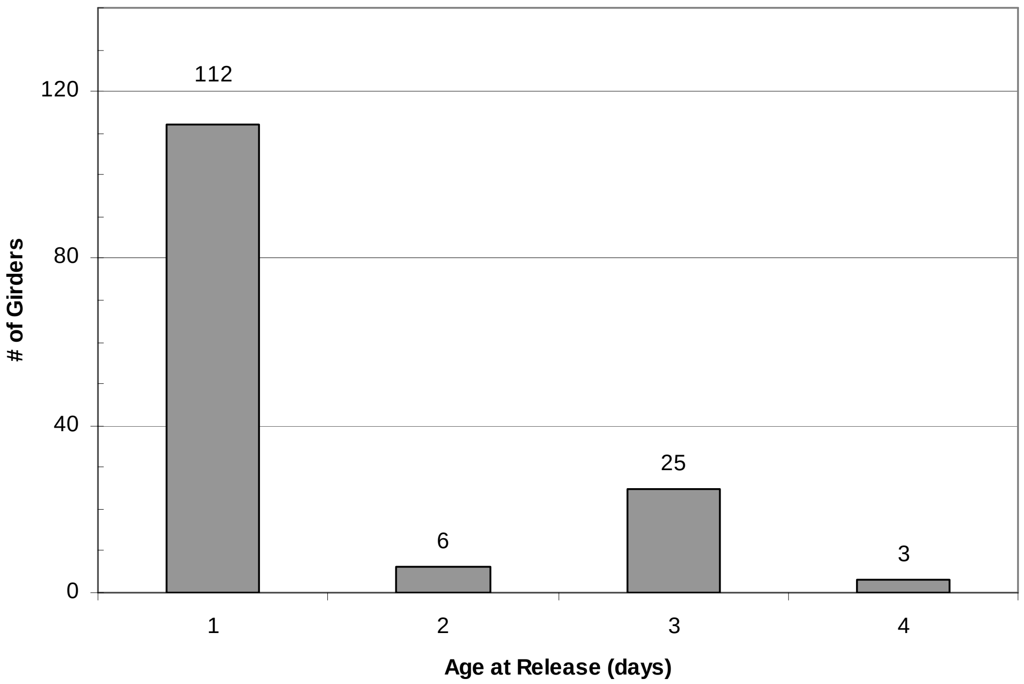


Figure 8.3 Number of Girders Released Each Day After Casting

8.3.5 Seasonal Variations

Temperature during casting and curing is known to influence material properties and may affect prestress loss. The two girder fabricators are located in areas that exhibit very different annual temperature and humidity cycles. Central Pre-Mix uses outdoor casting beds. It covers the girders with thermal blankets and, if necessary, raises the concrete’s temperature by releasing steam adjacent to the form, under the blanket. In the winter months, the temperature in Eastern Washington frequently drops below freezing, so special measures are needed to achieve proper concrete curing. In the summer months, the climate is typified by high temperatures and low humidity, both of which might be expected to promote shrinkage and creep.

Concrete Technology in Tacoma has a covered casting bed and heats the girders with electric elements inside insulated forms, even though the climate in Western Washington is much milder. Girders made at both plants are susceptible to some thermal effects during casting and curing, but the seasonal differences suggest that the effects might be larger in girders cast by Central Pre-Mix Prestress.

To illustrate the potential for seasonal effects on the data set, Figure 8.4 shows the number of girders that were cast in each month of the year.

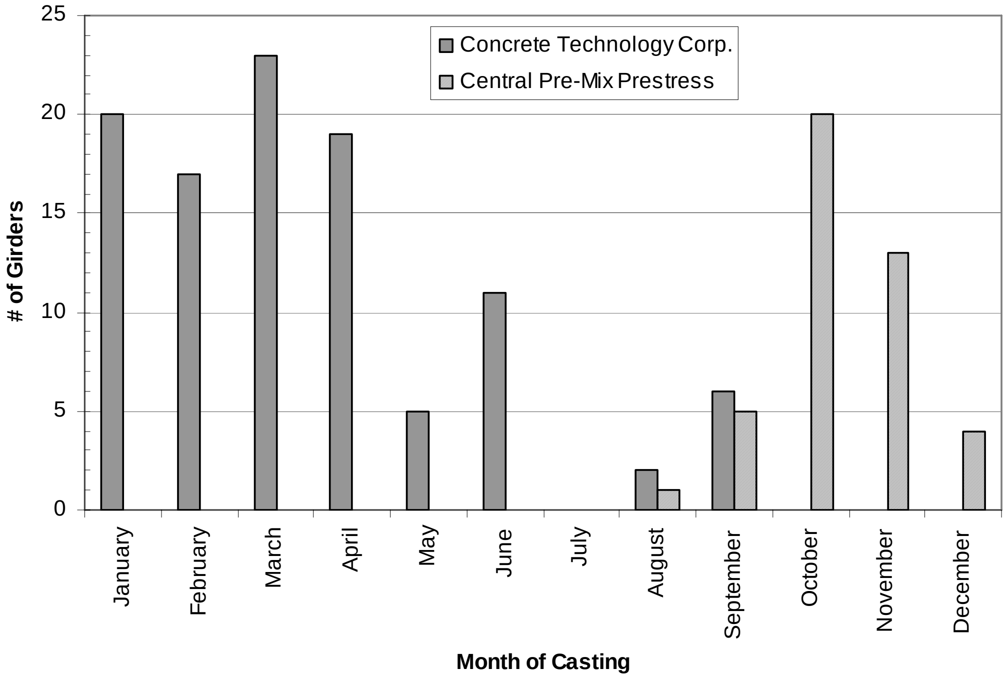


Figure 8.4 Number of Girders Cast in Each Month

8.4 Observed Trends

The trends observed in the behavior of the girders are discussed in this section. The measured cambers, compressive strengths, and maturities helped to identify key variables that influence the observed camber.

8.4.1 Effects of Concrete Maturity at Release

Uncertainty in predicting release camber is affected most strongly by the elastic modulus of the concrete, since other quantities used in the camber estimate, such as the moment of inertia of the section, can be estimated reliably. Unfortunately, elastic modulus at release is not routinely measured, so it usually has to be inferred from strength data by using relationships such as those proposed by ACI 318, AASHTO, ACI 363, and others. (See Section 2.3.) If detailed records of strength versus time are not available, approximate relationships between strength and maturity may be used to estimate strength gain with time.

Figure 8.5 shows measured strengths and maturities from the 277th St Bridge and Cedar River projects. It shows that the concrete gained strength as it matured by curing over a weekend or holiday. Because the heat of hydration raised the temperature above ambient for an extended time, it was possible for the fabricator to reduce energy consumption by turning off the external heat earlier than usual while still maintaining the maturity required to achieve the desired strength. Despite the early cut-off of external heat, the maturities were much higher and the strengths were slightly higher (on average 15 percent) than those of the girders released after one day.

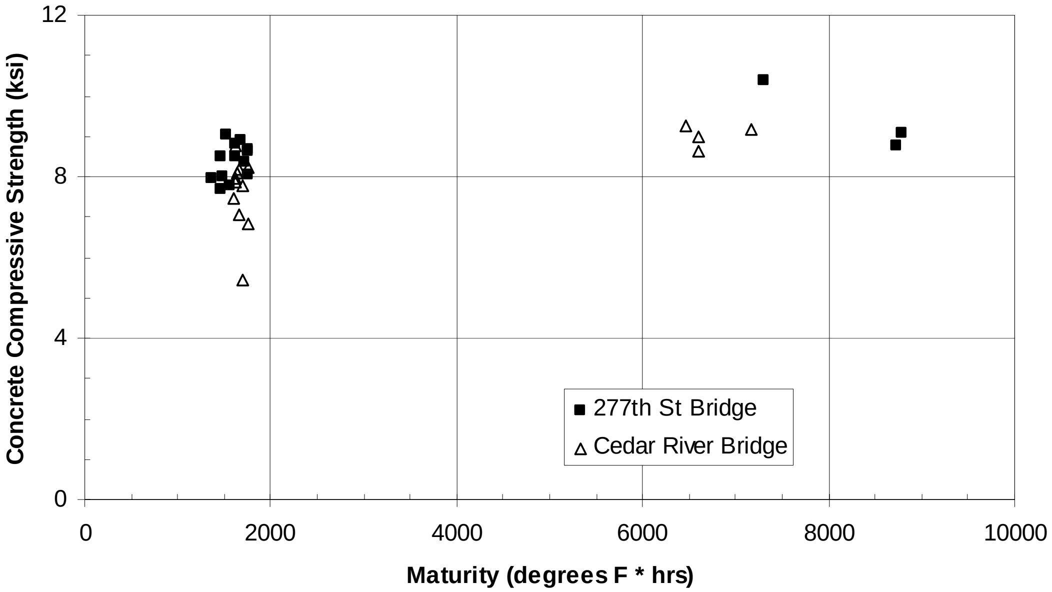


Figure 8.5 Influence of Maturity on Concrete Compressive Strength

Figure 8.6 shows the effect of maturity on camber at release. As the maturity increased, the concrete strength increased, the girder became stiffer and the release camber dropped. The effect is perceptible, but not great. This is explained by the data in Figure 8.5, which show that a large increase in maturity beyond that achieved in the first sixteen hours of curing led to only a small increase in strength.

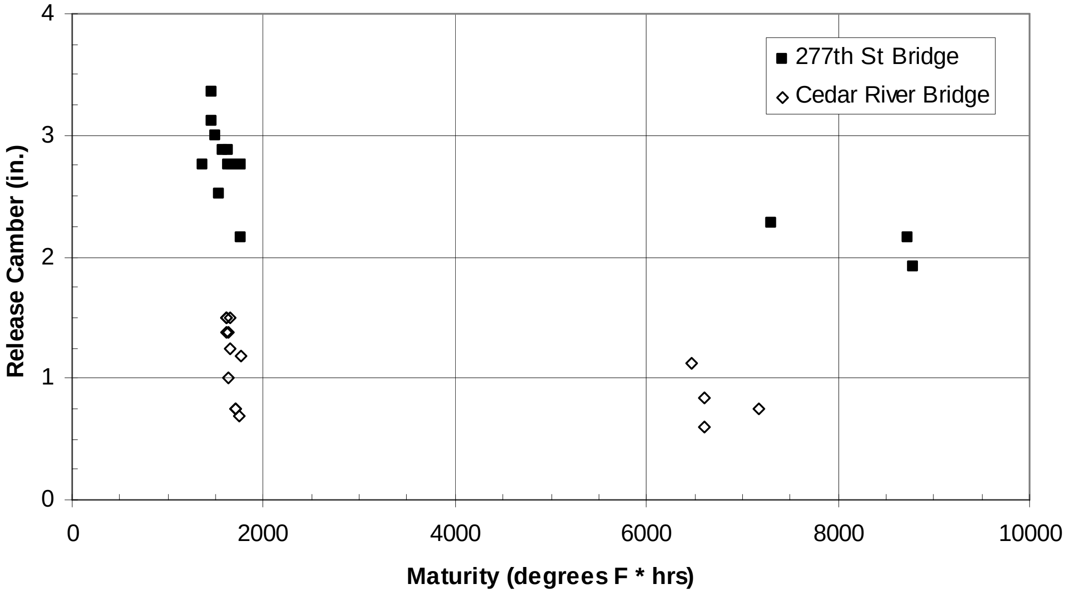


Figure 8.6 Effect of Maturity on Release Camber

8.4.2 *Influence of Compressive Strength on Release Camber*

The compressive strength at release can influence the release camber by changing the stiffness of the girder. Figure 8.7 illustrates this trend for the Black Lake Bridge project. This project had five spans and prestressing quantities, but all were W74G sections. As the compressive strength of the concrete increased at the time of release, the initial camber decreased. However, this trend was not observed in the girders with low cambers. This may be attributable to error in measurement. If the tolerance of measurement by the fabricator in the field is to the nearest ¼ in., then this will increase the percentage of error in camber measurements as they get smaller. The Black Lake

Bridge project spans that were 126 ft and 132 ft showed this trend best because they had larger initial cambers.

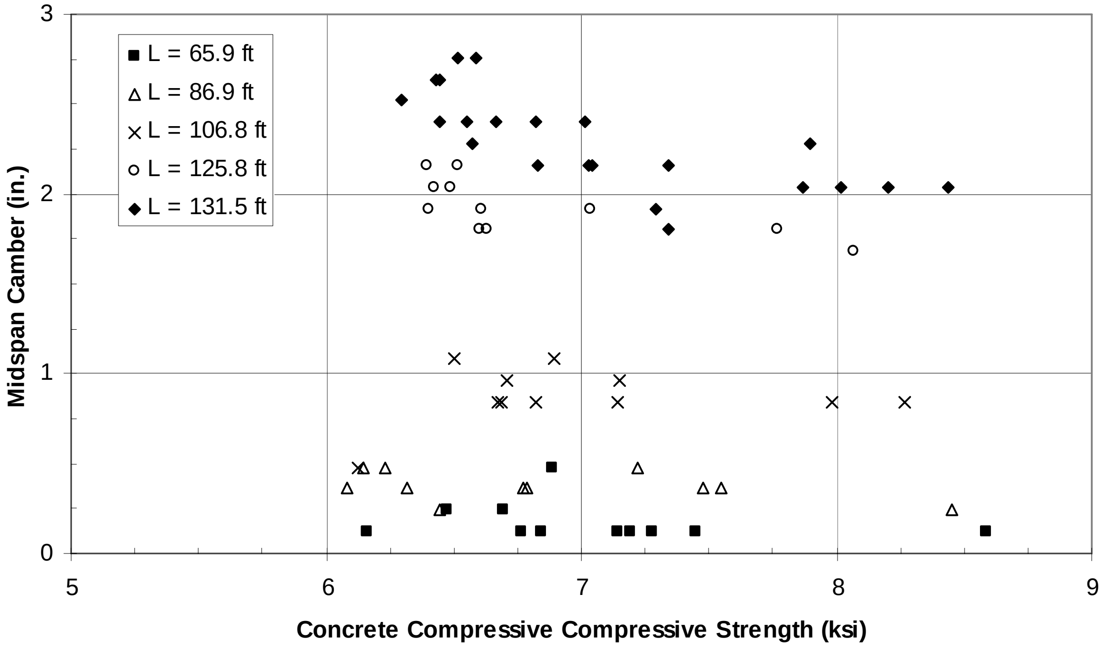


Figure 8.7 Black Lake Bridge Project Release Camber vs. Compressive Strength

8.4.3 Long-Term Camber

The long-term trends were more difficult to distinguish. The quantities that fabricators measure after the release measurements are 28-day compressive strengths and an additional camber measurement. This additional camber measurement was not taken at a consistent time after casting because WSDOT requires only that one additional measurement be taken prior to shipping. Shipping dates vary, and often change, in accordance with the contractor's schedule. This leads to a significant scatter in the age of the girder at the second camber measurement. The effects of creep and shrinkage will also vary with time, material properties, environmental conditions, and even girder support conditions in the yard, so larger scatter must be expected in this second camber measurement.

Figure 8.8 illustrates the camber measurements taken for the Black Lake Bridge project. These camber measurements were taken between 100 and 300 days after casting and were most representative of long-term camber. Overall, there is little correlation between long-term camber and 28-day strength. However, the longer spans of 126 ft and 132 ft showed a weak trend of lower long-term cambers with higher strength. This tendency is rational, in that the higher strength implies higher elastic modulus and lower creep coefficient. The long-span data also showed that the girders released after more than one day exhibited less long-term camber than girders released at less than one day. The shorter spans did not show this trend, probably as a result of measuring errors, since the total camber is of the same order of magnitude as the accuracy of the measurement.

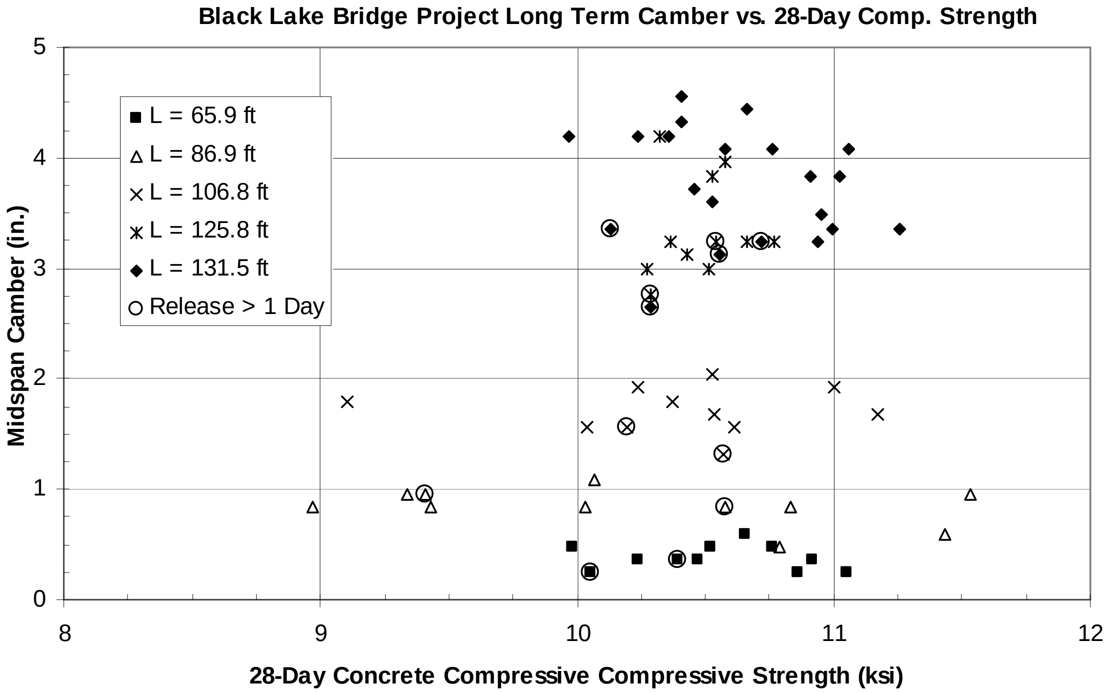


Figure 8.8 Black Lake Bridge Project – Long-Term Midspan Cambers vs. 28-Day Compressive Strength

CHAPTER 9

CALIBRATION OF CAMBER MODEL

9.1 Introduction

This chapter discusses calibration of the camber model with field data. Those data consisted of readings from girders that were fabricated by the two major manufacturers in the state of Washington and placed in six different bridges. In all cases, one reading was taken at release and another at some later time. The data therefore reflected largely the performance of the bare girders and excluded the effects of the end restraint caused by attachment to the bridge piers.

Section 9.2 evaluates the accuracy of the current camber prediction methodology. Section 9.3 shows the effect of using the measured concrete compressive strength instead of the design strength. Section 9.4 demonstrates the effect on predicted camber when the model accounts for the change in prestress force over time due to prestress losses. Section 9.5 calibrates the model by applying factors, with optimal values, to the elastic modulus, creep coefficient, and prestress loss due to creep.

9.2 Evaluation of Current Procedure

In the first phase of this project, the WSDOT prediction method was evaluated for prestress losses according to the AASHTO LRFD 2004 provisions because that was the method WSDOT used at the time. For the 146-girder set, the average errors in the prediction of camber at release and the second measurement are given in Table 9.1. Both the average error and the average absolute error are provided. Here the camber is treated as upwards positive, and the error is defined as the measured value minus the predicted one. Thus a negative error indicates that the predicted upward camber is larger than the measured, and that the real girder is flatter than the calculations suggest. This was the outcome in most cases when the standard WSDOT method of calculation was used.

Table 9.1 Average Errors in Camber Prediction (in.)

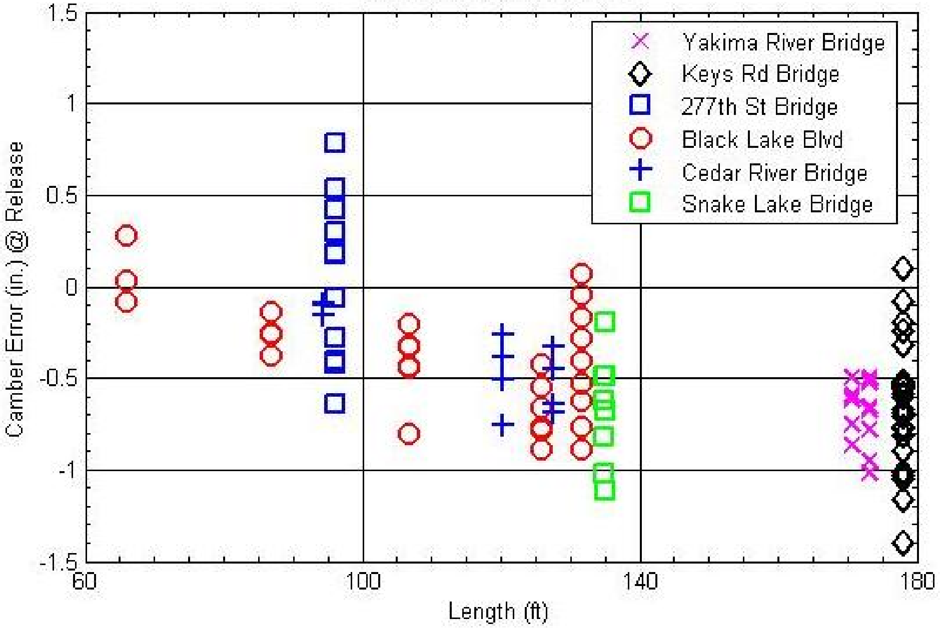
	Release	Second
Average	-0.42	-0.73
Average abs.	0.47	0.75

The current WSDOT practice for camber prediction was implemented in the camber prediction program discussed in Section 2.8. The program used the AASHTO LRFD 2006 equations for predicting the elastic modulus, shrinkage, creep, and prestress loss. This method also used the design concrete compressive strengths at release and 28 days. Figure 9.1 shows the camber error of the calculated values compared with the measured cambers at release and at a later time.

The errors in the cambers at release tended to become more negative with increasing girder length. The WSDOT method over-predicted the camber in almost all girders shown that were over 100 feet long. The range of error also varied for each project and length. The girder properties and spans for each project are shown in Table 9.2. In general, the girders with the largest span/radius of gyration ratios exhibited the greatest relative camber (i.e., camber/span), as shown in Figure 9.2.

The second measurements were taken at various times ranging from eight to 427 days after casting. For nearly all girders longer than 70 feet, the predicted cambers were larger than the measured ones, but for the 70- to 140-ft range the error was significantly larger for the second reading than at release. However, for the Keys Road (178 ft) and Yakima River (171 ft) projects, the errors at the two times were nearly the same. Those two girder sets differed in two ways from all the others. They were the only ones built by Central Premix Prestress Co. (CPM) with materials from Eastern Washington, and they were the only W83G sections on very long spans. Table 9.3 shows the errors at release and the second measurement that resulted from use of the current WSDOT method.

a) Release Measurements



b) Second Measurement

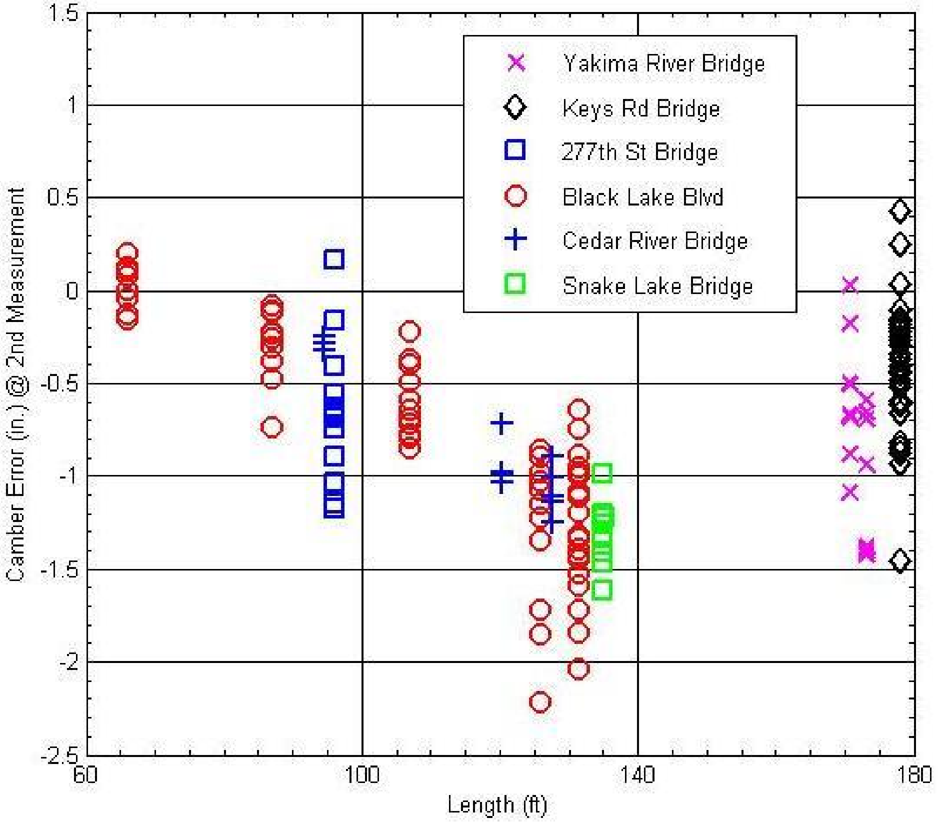


Figure 9.1 Camber Prediction Error Resulting from Use of the WSDOT Method
a) At release b) At second measurement

Table 9.2 Girder Properties

Project	Section	L_{ave} (ft)	L_{ave}/r
Black Lake	W74G	66	29.29
Black Lake	W74G	87	38.61
Black Lake	W74G	107	47.49
Black Lake	W74G	126	55.92
Black Lake	W74G	131	58.14
277th Street	W50G	96	65.01
Snake Lake	W74G	135	59.91
Cedar River	WF74G	95	41.02
Cedar River	WF74G	124	53.54
Yakima River	W83G	171	65.43
Keys Road	W83G	178	68.11

r = radius of gyration = $\sqrt{(I/A)}$

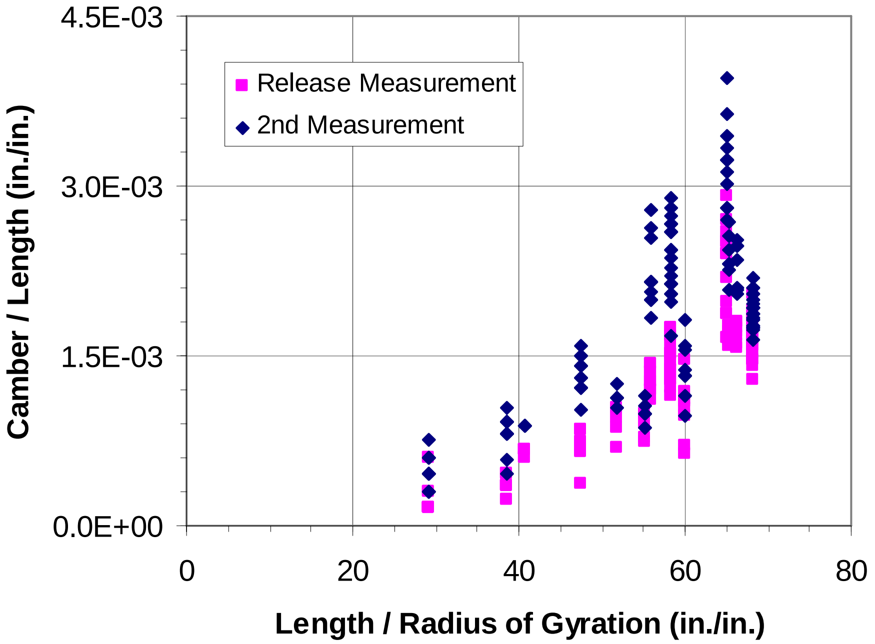


Figure 9.2 Measured Camber vs. Length/Radius of Gyration Ratio

Table 9.3 Summary of Errors for Various Predictive Methods

Variations on Predictive Method	Factors			Release Measurement (in.)			2nd Measurement (in.)		
	E_c	C_c	Δf_{pCR}	Average Error	Average Absolute Error	Standard Deviation	Average Error	Average Absolute Error	Standard Deviation
Design Concrete Compressive Strength									
WSDOT Method (Section 9.2)									
All	1.00	1.0	1.0	-0.42	0.47	0.37	-0.73	0.75	0.52
CTC	1.00	1.0	1.0	-0.31	0.39	0.34	-0.81	0.89	0.53
CPM	1.00	1.0	1.0	-0.68	0.69	0.29	-0.55	0.58	0.45
WSDOT Method w/ Prestress Loss									
All	1.00	1.0	1.0	-0.42	0.47	0.37	-0.18	0.39	0.48
CTC	1.00	1.0	1.0	-0.31	0.39	0.34	0.36	0.41	0.39
CPM	1.00	1.0	1.0	-0.68	0.69	0.29	0.26	0.35	0.37
Mod. WSDOT Method w/ Factors									
All	1.15	1.4	1.0	-0.14	0.29	0.33	-0.22	0.44	0.50
CTC	1.15	1.3	1.0	-0.10	0.27	0.33	-0.34	0.40	0.38
CPM	1.15	1.7	1.0	-0.25	0.31	0.29	0.04	0.29	0.38
Actual Concrete Compressive Strength									
WSDOT Method (Section 9.3)									
All	1.00	1.0	1.0	-0.29	0.38	0.36	-0.41	0.46	0.39
CTC	1.00	1.0	1.0	-0.18	0.30	0.32	-0.41	0.45	0.38
CPM	1.00	1.0	1.0	-0.56	0.57	0.30	-0.42	0.48	0.43
WSDOT Method WSDOT Method w/ Prestress Loss (Section 9.4)									
All	1.00	1.0	1.0	-0.29	0.38	0.36	0.02	0.30	0.39
CTC	1.00	1.0	1.0	-0.18	0.30	0.32	-0.10	0.27	0.34
CPM	1.00	1.0	1.0	-0.56	0.57	0.30	0.30	0.36	0.35
Mod. WSDOT Method w/ Factors (Section 9.5)									
All	1.15	1.4	1.0	-0.03	0.24	0.33	-0.01	0.30	0.39
CTC	1.15	1.3	1.0	0.02	0.02	0.33	-0.07	0.26	0.33
CPM	1.15	1.7	1.0	-0.14	0.25	0.30	0.07	0.29	0.37
Increased Design Concrete Compressive Strengths (110% at release, 125% at 28-Days)									
Mod. WSDOT Method w/ Factors (Section 9.5)									
All	1.15	1.4	1.0	-0.06	0.25	0.33	-0.08	0.36	0.46

9.3 Effect of Using Measured Concrete Compressive Strength

The design plans for a prestressed concrete girders specify concrete compressive strength requirements at two times: at release and at 28 days. The concrete design compressive strengths at release (f'_{ci}) and at 28 days (f'_c) are typically selected on the basis of the maximum compressive stresses expected in the girder at various stages of its life.

In general, the highest concrete stress occurs at release, so those conditions control the concrete mix design, and the specified 28-day compressive strength is often exceeded. Consequently, the girder tends to be stiffer and deflect less than would be the case if the actual strength had been based on the long-term requirements.

Table 9.4 shows the average ratio of the measured concrete compressive strength to the design concrete compressive strength for all the girders and the two fabricators. As expected, the average ratio was higher at 28 days than at release.

Table 9.4 Average Ratio of Measured to Design Concrete Compressive Strength

Measured / Design	Release	28 Day
All Girders	1.11	1.24
CTC Girders	1.06	1.12
CPM Girders	1.14	1.30

Figure 9.3 shows how concrete strength affects the predicted camber for a W74G girder. A 10 percent increase in concrete strength results in decreases in the predicted camber of approximately 0.10-in. at release and 0.25 in. after 200 days.

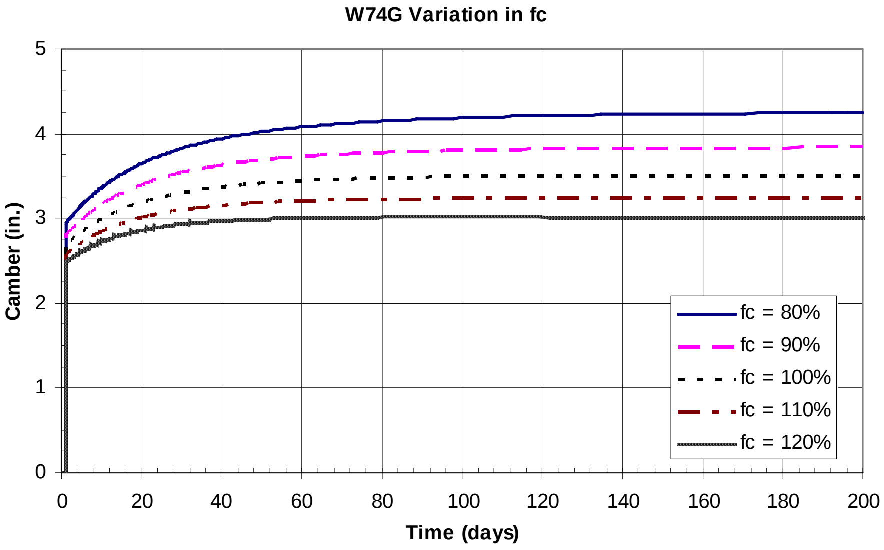
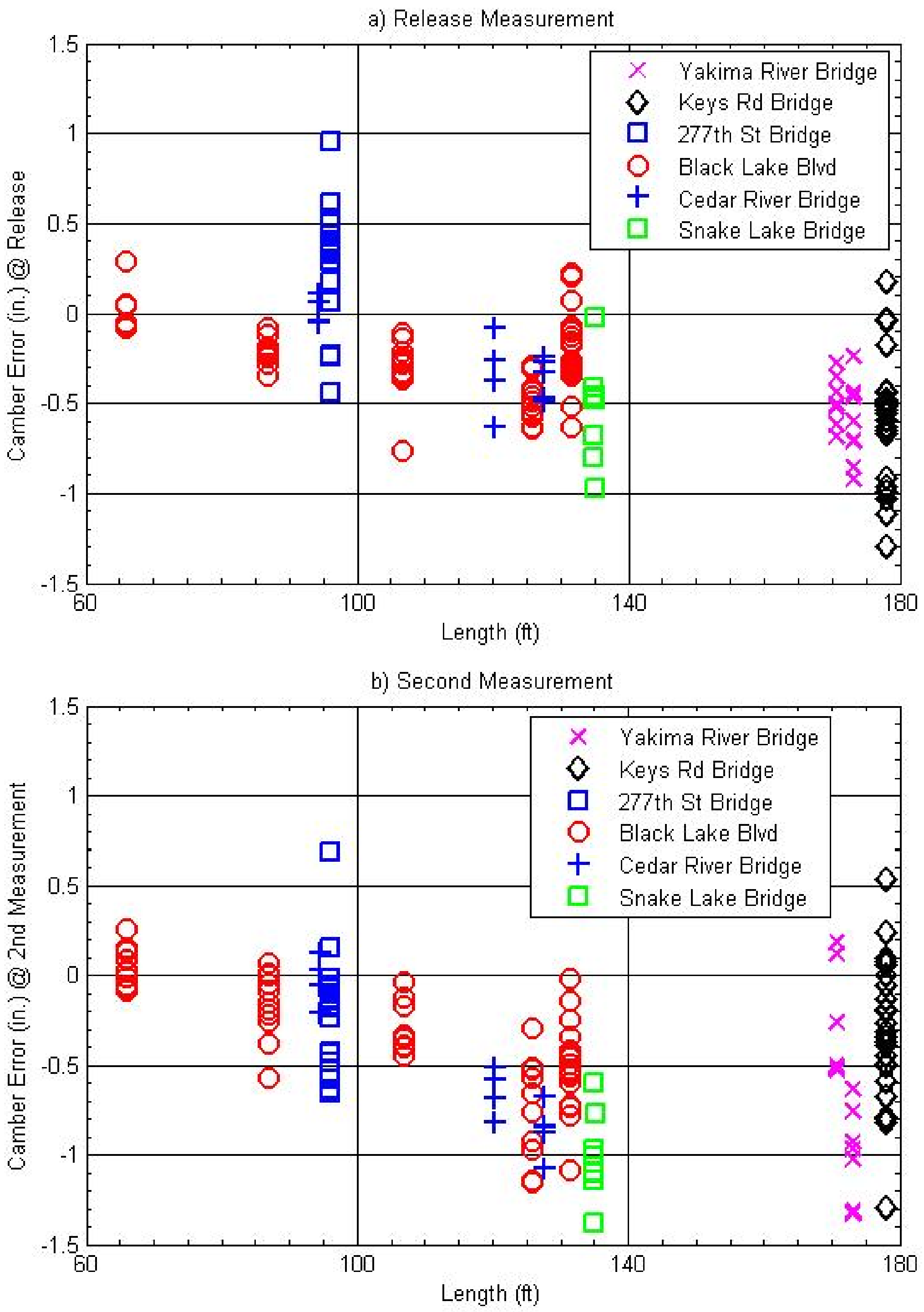


Figure 9.3 Effect of Changes in Concrete Compressive Strength (Example W74G)

Figure 9.4 shows the camber errors for all the girders when cambers were calculated with the measured concrete compressive strengths. The improvement in camber prediction can be seen by comparing the results shown in Figure 9.1 with those of Figure 9.4. The prediction errors decreased, as implied by the lower average values shown in Table 9.3.

Because actual values of concrete strength are not known at the time of design, camber must be calculated by using an estimate of the actual strengths. This can be achieved by increasing the design strengths by 10 percent at release and 25 percent at 28 days, which is the average ratio of actual to measured concrete compressive strengths from Table 9.4. The errors are shown in Table 9.3.


a) Release Measurement

b) Second Measurement

Figure 9.4 Camber Prediction Error Using Measured Concrete Compressive Strength a) At release b) At second measurement

9.4 Prestress Loss Deflection Adjustment

Creep in the concrete affects the magnitude of the prestressing force over time, and thus the camber due to prestressing, in two ways. First, if the prestressing force were to remain constant, creep of the concrete would increase the camber because the effective modulus of the concrete would decrease. This effect is taken into account as the "creep deflection" in the WSDOT method (Section 9.2). However, creep also causes a gradual reduction in prestress force over time. This, in turn, causes a reduction in camber due to prestressing, including both the elastic and creep components. The second effect represents an interaction between the prestressing and creep effects and is not accounted for in the WSDOT method.

According to the AASHTO LRFD method, the time-dependent components are losses due to shrinkage and creep of the concrete and relaxation of the prestressing strands (Section 2.6). In the WSDOT method, the creep deflection due to the prestressing is calculated on the basis of the initial elastic prestress deflection alone. This approach over-estimates the camber due to prestressing. The most accurate method would be to conduct a time-dependent evaluation in which the forces and deformations changed at every time-step, but this would be complex and time-consuming. The modified method uses the prestress losses as calculated by the AASHTO LRFD method to determine the deflection due to prestressing. This is discussed further in Section 3.3.4.2. Figure 9.5 shows the variation in predicted prestress deflection between the WSDOT and the modified method for an example W74G girder. The reduction in prestress force in the modified method reduces the predicted deflection after release.

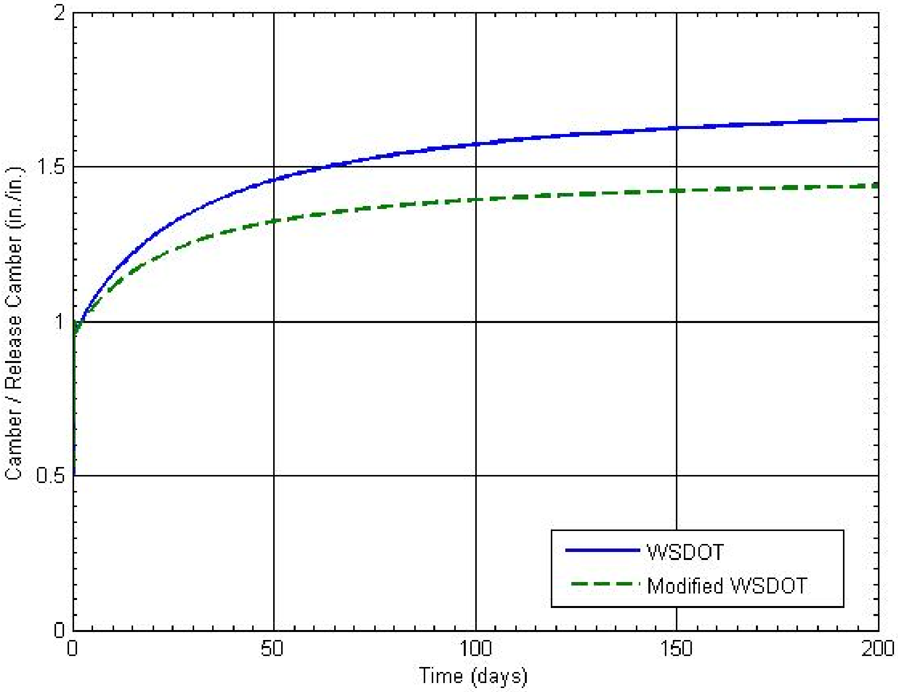


Figure 9.5 WSDOT vs. Modified WSDOT Prestress Deflection (Example W74G)

There are no time-dependent losses at release of the prestress. Therefore, use of the modified procedure does not change the elastic deflection at release.

Figure 9.6 shows the error in prediction for the second camber measurement when the modified prediction method was used. This modification reduced the mean error of all the data, as shown in the figure. For the longer span girders, over 140 ft, the change was enough to cause the camber error to just become positive.

By using the actual concrete compressive strength and including the effects of prestress loss on deflection, the error in the prediction was reduced as shown in Table 9.3.

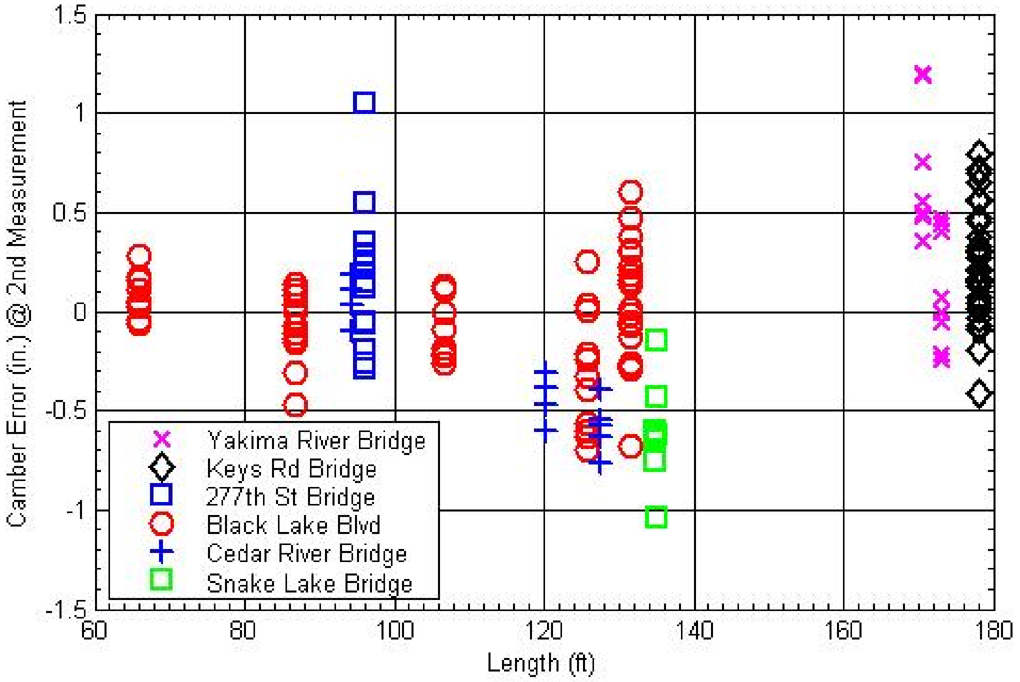


Figure 9.6 Camber Prediction Error Resulting from Inclusion of the Prestress Loss in Camber Calculations

9.5 Calibration of the Camber Prediction Model

Further improvements in camber prediction, beyond those available from incorporating the two foregoing effects, were sought. They were achieved by applying factors to three of the components of the camber and optimizing their values to minimize the camber error. Modification factors were applied to the elastic deflection caused by the self-weight and the release of the prestressing strands, the additional deflection due to creep, and the amount of prestress loss that is included in the long-term camber calculations.

Creep deflection is affected by the elastic modulus, but the converse is not true. Therefore the calibration was conducted in steps, the first of which was to determine the elastic modulus from the (elastic) release cambers (see Section 9.5.1). Then the elastic modulus was held constant while the creep coefficient was adjusted to achieve the best fit between predicted and measured camber at the second camber measurement (see Section

9.5.2). This process ignored the time dependent prestress losses. Finally, the time dependent prestress losses were included and the creep coefficient, and the prestress loss due to creep was modified simultaneously to minimize the predicted error at the second camber measurement.

The optimal values of the model parameters were obtained by minimizing the sum of the squares of camber errors, as shown in Equation 9.1.

$$\left|error_{ave}\right| = \sqrt{\frac{\sum_{i=1}^{N} error_i^{\,2}}{N}} \qquad 9.1$$

where:

$error_i$ = difference between the measured and calculated cambers

N = number of girders

This definition of error uses absolute, rather than relative, errors. It is therefore most strongly influenced by girders with large cambers, which are typically longer girders.

9.5.1 Elastic Modulus Calibration

Figure 9.7 shows separate calibrations of the elastic modulus for all the girders, girders fabricated at CTC, and girders fabricated at CPM. The basic elastic modulus was computed with the AASHTO LRFD 2006 method because that is the one WSDOT now uses.

The procedure involved selecting a value for the modification factor and computing the predicted release camber for all the girders. In this process, the prestress losses due to relaxation before transfer and elastic shortening were computed according to the AASHTO LRFD 2006 method.

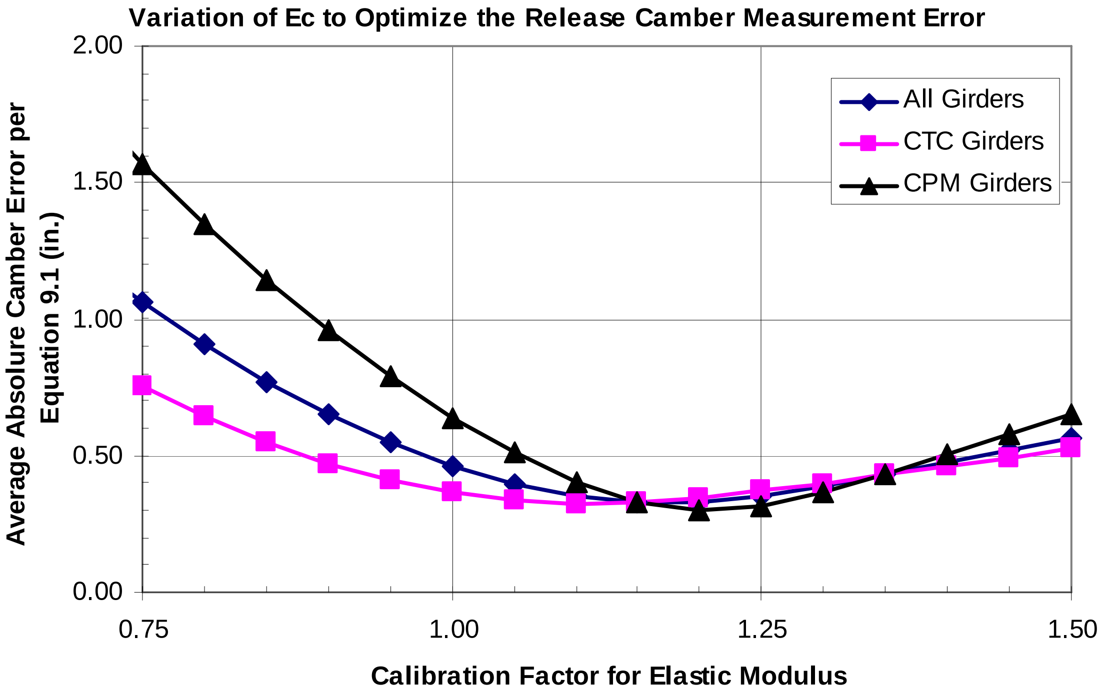


Figure 9.7 Calibration of Elastic Modulus at Release

The factors that minimized the average elastic deflection error at release were 1.15 for all girders, 1.10 for CTC girders, and 1.20 for CPM girders.

Figure 9.8 shows the predicted camber error at release when the calculated elastic modulus was multiplied by the calibration factor of 1.15 for all the girders. With the exception of the W50G girders from the 227th St Bridge project, most of the predicted cambers were within +/- 0.5 inches of the measured values. The average absolute error was 0.24 in.

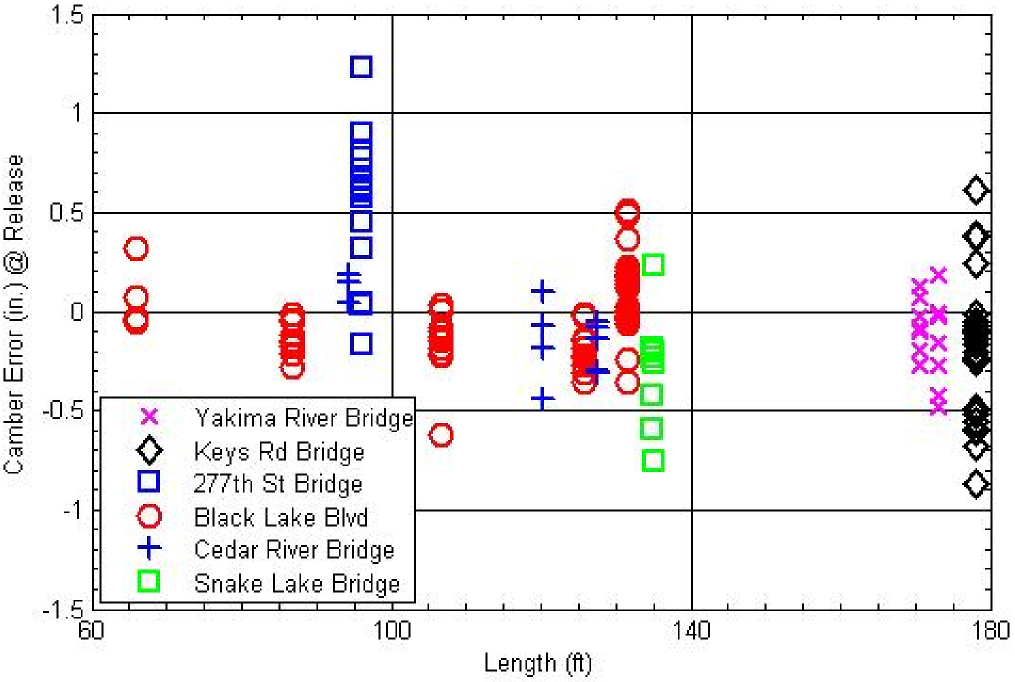


Figure 9.8 Error in Prediction of Camber at Release Resulting from Use of the Modified Elastic Modulus (E_c Factor = 1.15)

9.5.2 Creep Calibration

Using the calibrated elastic modulus from Section 9.5.1, the creep coefficient was calibrated to minimize the average absolute camber error for the second camber measurement. The 2004 AASHTO LRFD method did not link changes in the creep coefficient to changes in prestress due to creep. However, as pointed out by the NCHRP Report 496 Committee, prestress losses are directly influenced by the creep coefficient. Figures 9.9 and 9.10 show the variation in the elastic modulus and the creep coefficient that minimized the average absolute error for both the CTC and CPM girders, respectively, while using the actual concrete compressive strength.

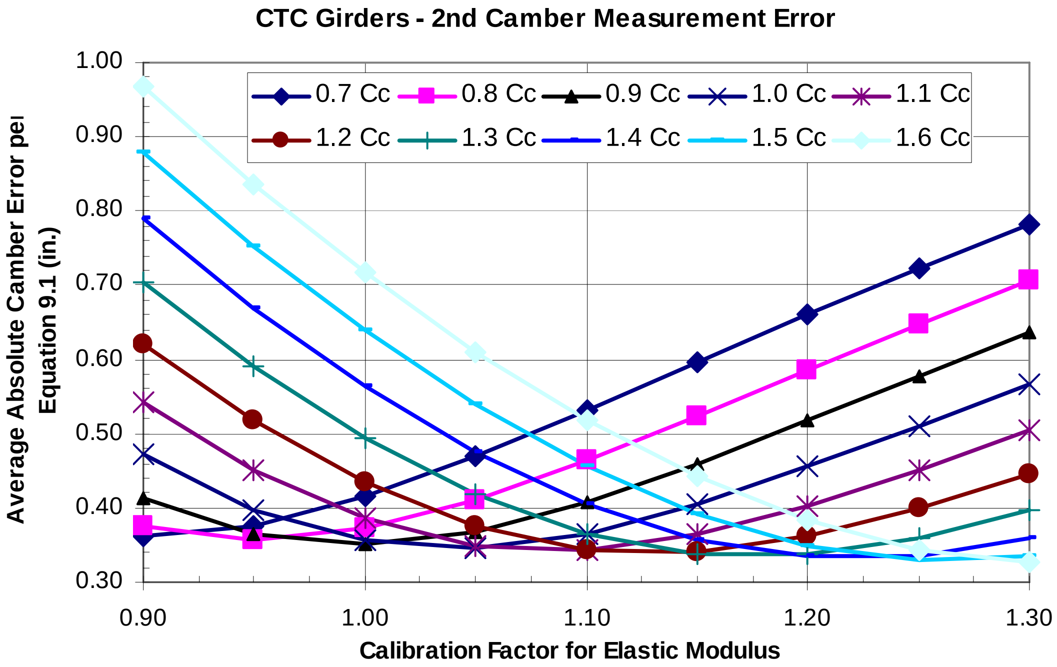


Figure 9.9 Effect of Variations in Elastic Modulus Factor and Creep Coefficient Factor for CTC Girders

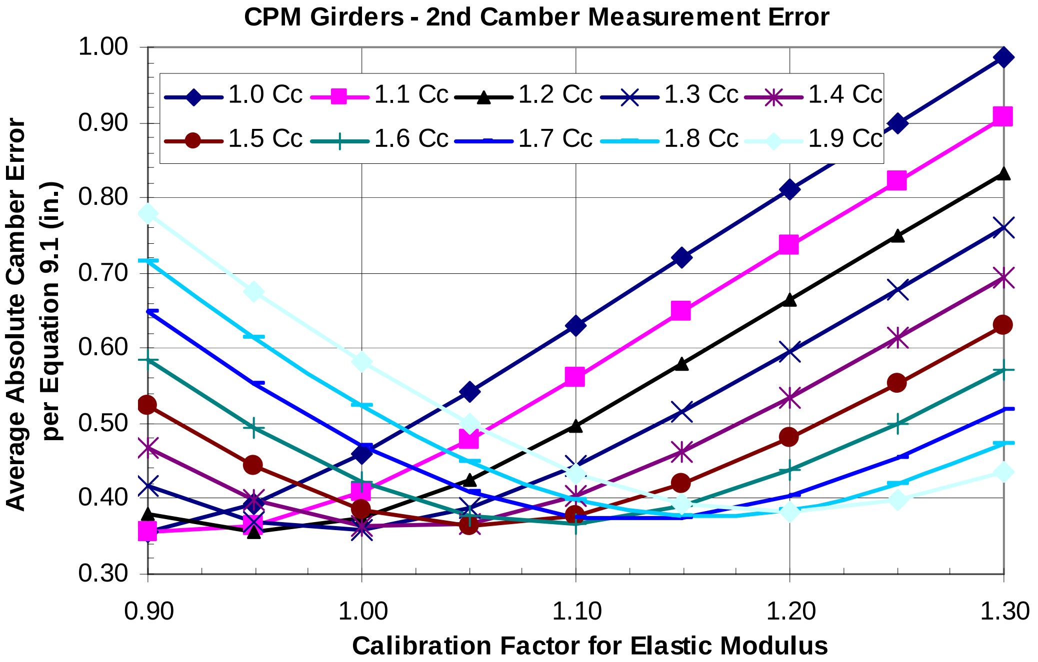


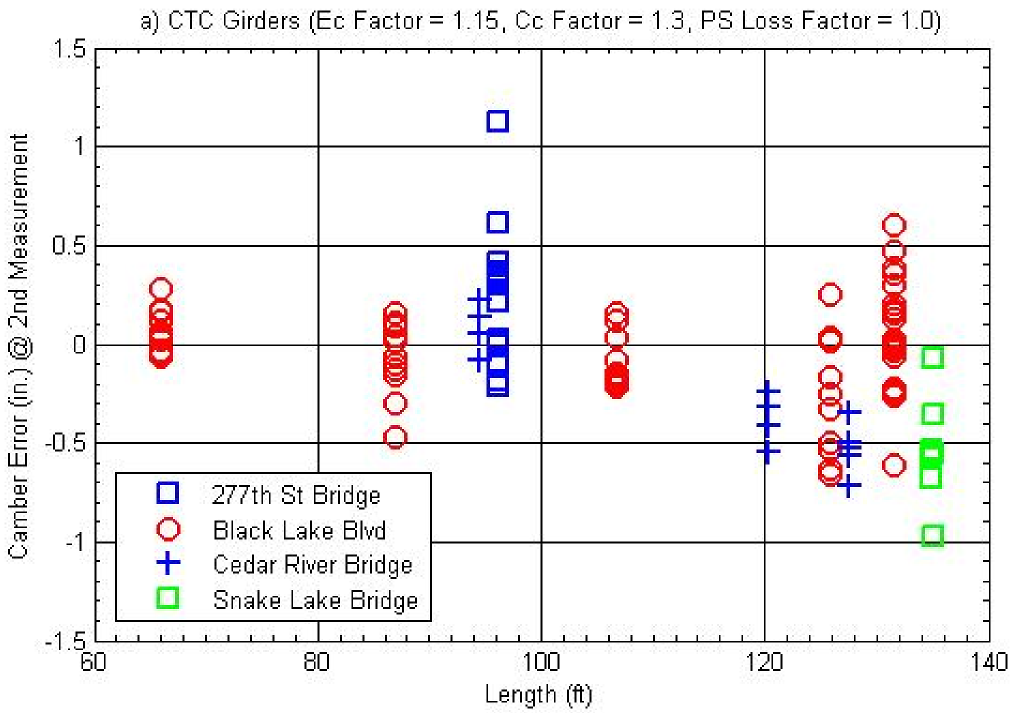
Figure 9.10 Effect of Variations in Elastic Modulus Factor and Creep Coefficient Factor for CPM Girders

Figures 9.9 and 9.10 show that numerous combinations of factors for the elastic modulus and creep coefficient were used to minimize the average error. Each combination was about as good as the next. This observation allows the factors for elastic modulus and creep to be established independently. Therefore, the elastic modulus factor selected in Section 9.5.1 was accepted, and the creep coefficient factor was chosen to minimize the average absolute camber error. Table 9.5 shows the creep coefficient factors and the average absolute camber errors for the calibration of all the girders, as well as girders fabricated at CTC and CPM. Because the factors for the calibrated creep coefficient that minimized the predicted error differed between the two fabricators, the camber errors were calculated separately for each fabricator. Figure 9.11 shows the camber error for the girders cast at CTC and CPM.

Table 9.5 Summary of Errors for Various Coefficients on Elastic Modulus, Creep, and Prestress Loss Due to Creep

Variations in E_c, C_c, and Δf_{ps}*	Factors			Release Measurement (in.)			2nd Measurement (in.)		
	E_c	C_c	Δf_{pCR}	Average Error	Average Absolute Error	Standard Deviation	Average Error	Average Absolute Error	Standard Deviation
None (Section 9.4)									
All	1.00	1.0	1.0	-0.29	0.38	0.36	0.02	0.30	0.39
CTC	1.00	1.0	1.0	-0.18	0.30	0.32	-0.10	0.27	0.34
CPM	1.00	1.0	1.0	-0.56	0.57	0.30	0.30	0.36	0.35
E_c (Section 9.5.1)									
All	1.15	1.0	1.0	-0.03	0.24	0.33	0.30	0.41	0.42
CTC	1.10	1.0	1.0	-0.04	0.25	0.32	0.08	0.28	0.36
CPM	1.20	1.0	1.0	-0.02	0.22	0.30	0.74	0.74	0.34
E_c, C_c (Section 9.5.2)									
All	1.15	1.4	1.0	-0.03	0.24	0.33	-0.01	0.30	0.39
CTC	1.15	1.3	1.0	0.02	0.24	0.33	-0.07	0.26	0.33
CPM	1.15	1.7	1.0	-0.14	0.25	0.30	0.07	0.29	0.37
E_c, C_c, Δf_{ps} (Section 9.5.3)									
All	1.15	1.5	1.0	-0.03	0.24	0.33	-0.09	0.32	0.39
CTC	1.15	1.3	1.2	0.02	0.24	0.33	-0.03	0.26	0.33
CPM	1.15	1.7	1.0	-0.14	0.25	0.30	0.07	0.29	0.37

* using actual concrete strengths



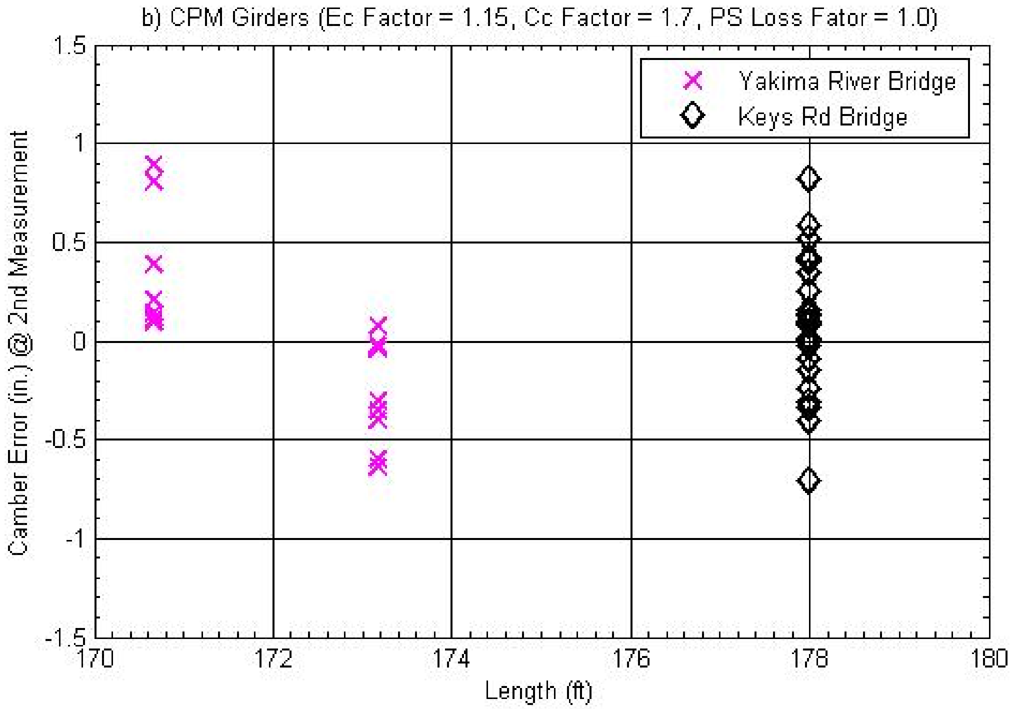


Figure 9.11 Camber Prediction Error Resulting from Use of the Calibrated Elastic Modulus and Creep Coefficient for a) CTC girders b) CPM girders

If two criteria, such as matching release and long-term camber, are to be satisfied, two adjustable variables are generally needed. In this case they are the factors on elastic modulus and creep coefficient. Figures 9.9 and 9.10 show that setting both factors to 1.0 (i.e., not modifying either quantity) led to a nearly optimal solution for the camber error at the second reading. However, the camber error at release was then not optimal. Values different from 1.0 were needed for both factors to give an overall optimal solution.

Because the elastic modulus factors were all greater than 1.0, they caused all the cambers to decrease. Consequently, the creep coefficient factors also had to be greater than 1.0 to increase the predicted long-term camber again to match the measured values. The CPM girders required the largest factor.

9.5.3 Calibration of Prestress Losses Due to Creep

The Washington State girders listed in the NCHRP Report 496 showed the W83G girders total prestress loss to be approximately 40 ksi (Tadros et al. 2003). However, according to the AASHTO 2004 equations, the prestress loss for creep alone in the W83G girders of the Yakima River and Keys Road girders was near 60 ksi. This indicates that the AASHTO LRFD 2004 prestress loss equation significantly over-predicted the real prestress losses for creep. Because the time-dependent losses due to concrete shrinkage and strand relaxation are relatively small, a third factor to calibrate the camber prediction model was used to adjust the amount of prestress loss due to creep. After the initial optimization had been completed in this project with the AASHTO LRFD 2004 equation, AASHTO adopted the recommendation in NCHRP Report 496, which generally predicts lower losses. WSDOT has since adopted the AASHTO 2006 “Refined Methods of Time-Dependant Losses”. The optimization was therefore re-done with the AASHTO LRFD 2006 equations for creep, shrinkage and prestress loss. The new optimization affects only the conditions at the second camber reading because the elastic modulus factor was left unchanged.

The modification factor was applied to the prestress loss calculated with Equation 2.18 from the AASHTO LRFD equation for predicting the amount of prestress loss due to creep. Because no superimposed dead load was used in the analysis, the change in concrete stress due to the dead load was zero.

Figures 9.12 and 9.13 show the average absolute camber error caused by variations in the modification factors for the creep coefficient and the prestress loss due to creep. For any prestress loss factor, the camber can be minimized by adjusting the creep factor appropriately, but the value of the predicted camber is almost the same for all optimal combinations. The optimal values are given in the last three rows of Table 9.3.

Figure 9.14 shows the predicted camber error for the CTC and CPM girders with their modification factors for creep, shrinkage, and prestress loss due to creep.

Table 9.5 shows the errors in predicted camber generated by progressing through the different stages of the optimization, in each of which an additional factor was introduced. Errors are shown at both the release measurement and second camber measurement, and for each fabricator and the total set of girders. This table summarizes the modification of the model discussed in Section 9.5.

Modification of the prestress loss due to creep did not significantly reduce the calculated error. Therefore, the researchers decided to use the least possible change to the prestress loss because that behavior had been subjected to extensive recent study (Tadros et al. 2003) and should be regarded as reliable (i.e., Δf_{pCR} Factor = 1.0).

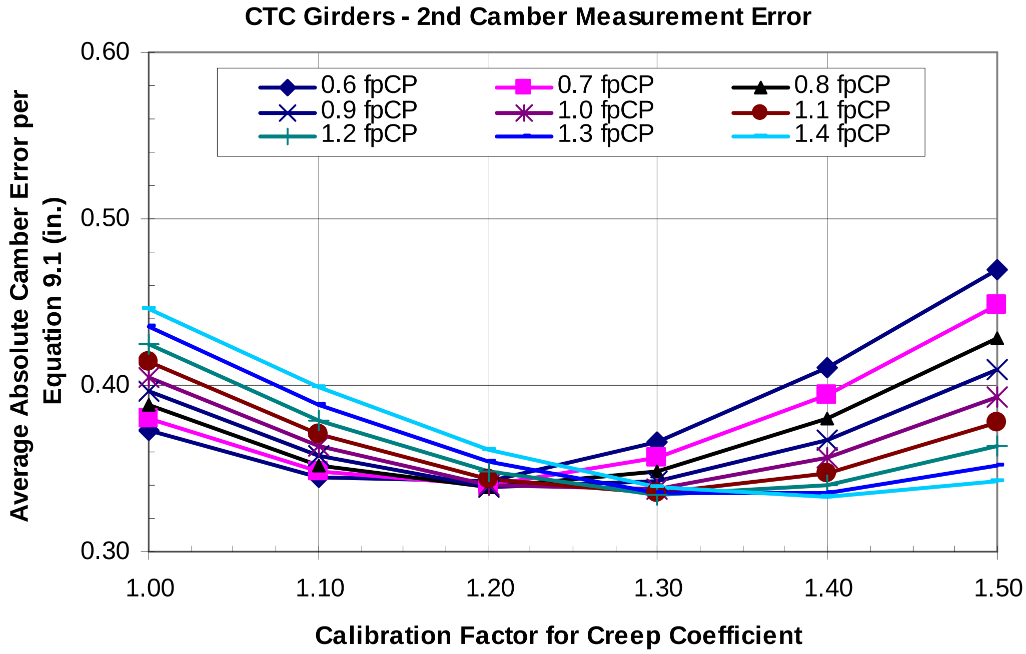


Figure 9.12 Effect of Variations in Creep Coefficient Factor and Prestress Losses Due to Creep for CTC Girders

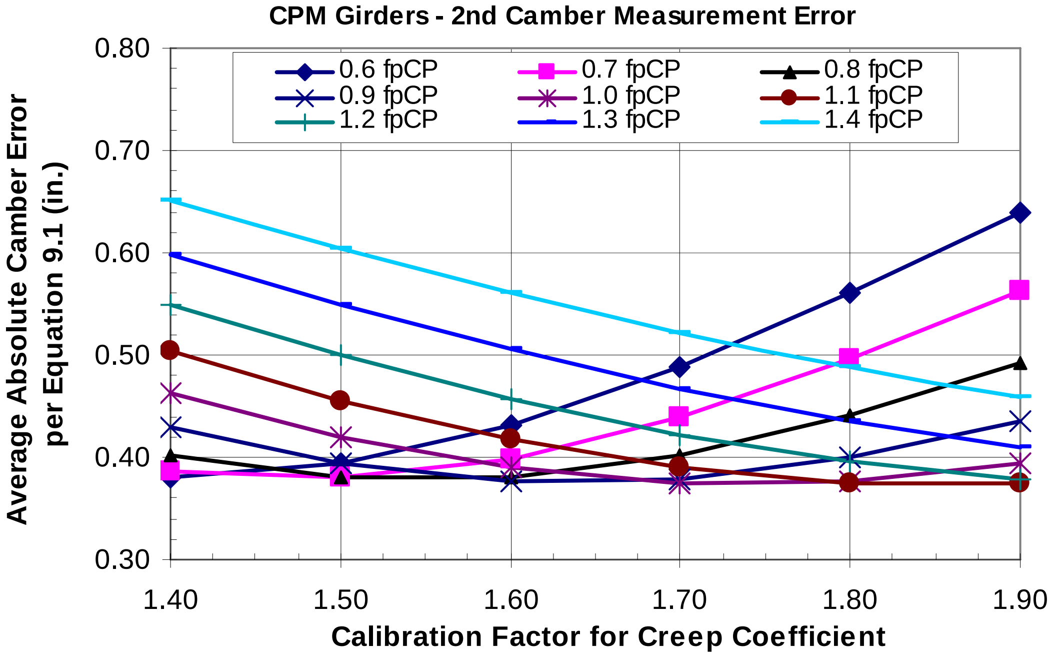
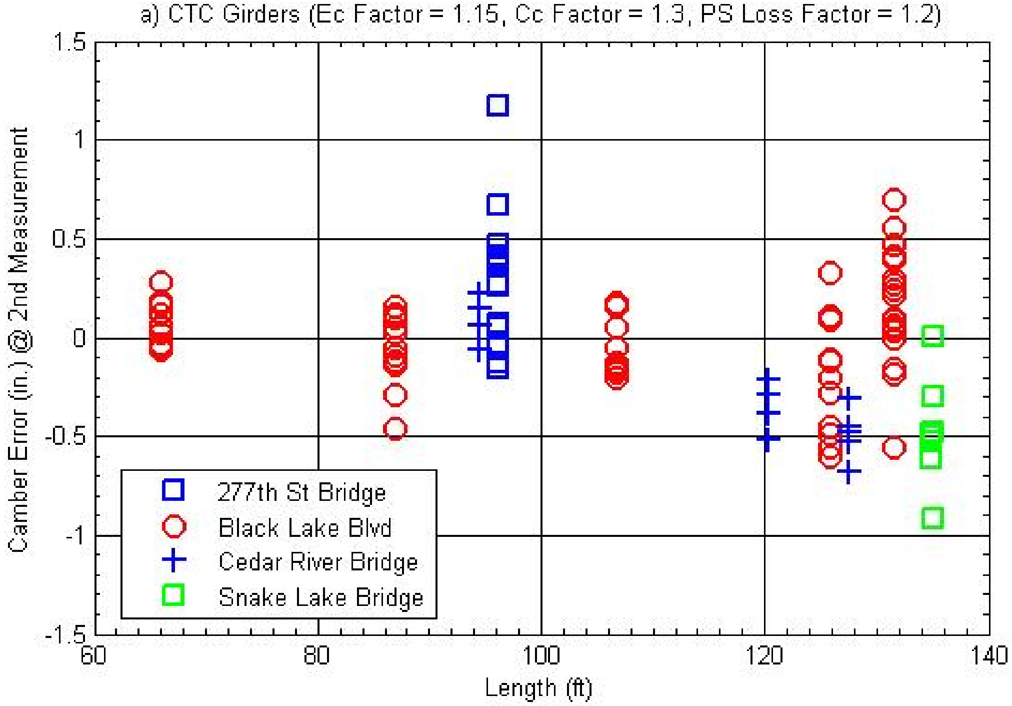


Figure 9.13 Effect of Variations in Creep Coefficient Factor and Prestress Losses Due to Creep for CPM Girders



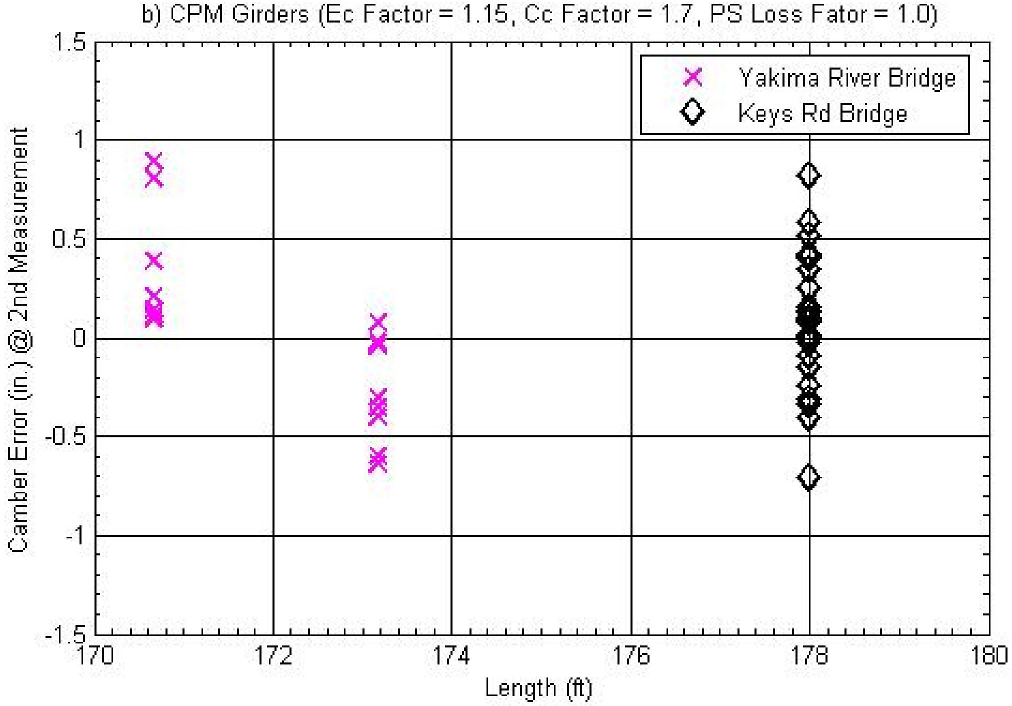


Figure 9.14 Camber Prediction Error Resulting from Use of the Calibrated Elastic Modulus, Creep Coefficient, and Prestress Loss Due to Creep for a) CTC girders b) CPM girders

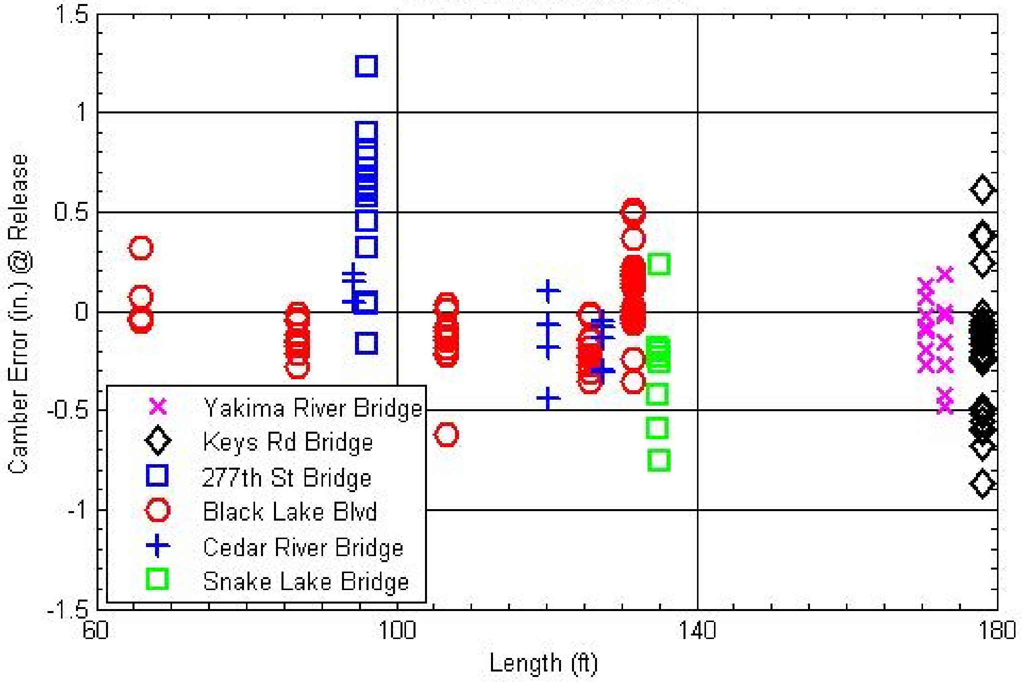
9.6 Summary

The reduction of error when the optimized factor was used on prestress loss due to creep was not significant. Therefore, the recommended combination uses factors of 1.0 on prestress losses and 1.4 on the creep coefficient (Section 9.5.2). Figure 9.15 shows the camber error for all the girders for the recommended modification factors listed in Table 9.3.

Table 9.6 shows the change in error resulting from the introduction of each modification procedure. The largest reduction in error occurred when all the modification procedures were used together. In addition, the basic WSDOT method using the design concrete compressive strength was replaced by the modified method with all the modification factors and the actual concrete compressive strength.

The table shows that the average error measures diminished significantly when the various corrections were used, but the standard deviations changed much less. Further improvement in the predictions can only be achieved if this scatter can be reduced. Such a reduction is likely to require better monitoring or control of phenomena that are not accounted for fully in the present methods, such as relative humidity, girder shape (including volume/surface ratio), and more detailed material properties. Accounting for these phenomena would require much more detailed reporting of materials properties than is done in present practice, in which measurements are seldom taken of elastic modulus and creep coefficient, much less of more advanced properties. Furthermore, production plants would have to record temperature and relative humidity, and sophisticated algorithms would need to be developed to account for parameters such as the volume /surface ratio. The need for camber predictions more accurate than those described here would therefore have to be evaluated carefully before such an effort were to be undertaken.

a) Release Measurement



b) Second Measurement

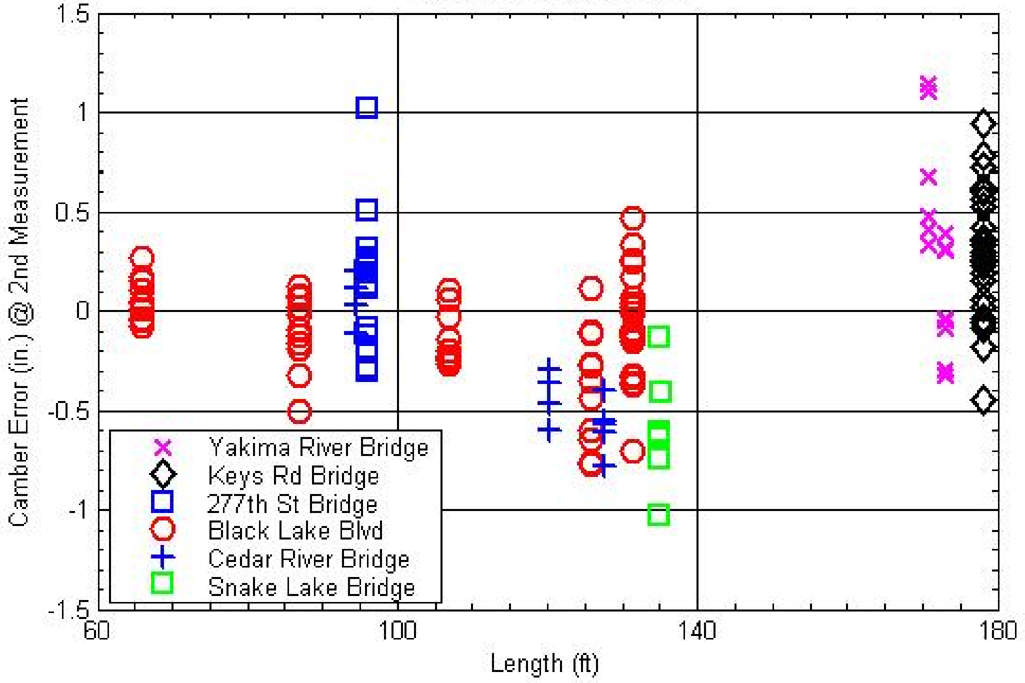


Figure 9.15 Camber Prediction Error Resulting from Use of the E_c Factor = 1.15, C_c Factor = 1.4, Δf_{CR} Factor = 1.0 for All Girders a) At release b) At second measurement

Table 9.6 Reductions in Errors Resulting from Use of the Various Predictive Methods

Percent Error Reduction for Method Comparisons	Release Measurement (in.)			2nd Measurement (in.)		
	Average Error	Average Absolute Error	Standard Deviation	Average Error	Average Absolute Error	Standard Deviation
WSDOT (DCS) *to* WSDOT (ACS)						
All	-30%	-19%	-2%	-43%	-39%	-25%
CTC	-43%	-22%	-6%	-49%	-45%	-29%
CPM	-17%	-16%	6%	-24%	-17%	-5%
WSDOT (ACS) to Modified WSDOT (ACS)						
All	0%	0%	0%	-104%	-35%	-1%
CTC	0%	0%	0%	-75%	-39%	-10%
CPM	0%	0%	0%	-172%	-25%	-18%
Modified WSDOT (ACS) to Mod. WSDOT w/ Factors (ACS)						
All	-90%	-37%	-8%	-180%	2%	1%
CTC	-110%	-92%	4%	-36%	-6%	-3%
CPM	-76%	-57%	-1%	-78%	-19%	6%
WSDOT (DCS) *to* Mod. WSDOT w/ Factors (ACS)						
All	-93%	-49%	-10%	-98%	-60%	-25%
CTC	-106%	-94%	-2%	-92%	-69%	-38%
CPM	-80%	-64%	5%	-112%	-50%	-17%

DCS = Design Concrete Strength

ACS = Actual Concrete Strength

CHAPTER 10

SUMMARY AND CONCLUSIONS

10.1 Summary

The goal of the research described in this report was to improve the methods of predicting camber in precast, prestressed concrete girders. To achieve this goal, a numerical model of a girder was developed that allowed various constitutive models to be used to estimate the major aspects of material behavior. These included elastic modulus, creep, shrinkage and prestress loss. The individual constitutive models were drawn from the AASHTO LRFD Specifications (AASHTO 2006), NCHRP report no. 496 (Tadros et al. 2003), ACI Committee 363 (ACI 1992), and CEB-FIB (CEB-FIP 1993). Three sets of measured data from isolated girders in the casting yard were then gathered and were used to calibrate the constants in the numerical model. A fourth set of measured data from girders erected in the field was used to verify the model's predictions for long term behavior.

The first set of measured data consisted of a detailed set of measurements on eight W74G girders for the Snake Lake Bridge project, fabricated by Concrete Technology Corporation (CTC) in Tacoma, Washington. Frequent camber measurements were taken, starting at release and continuing for two months. Nine or more measurements were taken on each girder. Preliminary materials measurements for that concrete, consisting of strength, elastic modulus, shrinkage, and creep properties, were also made at the University of Washington. Some of the results (e.g., negative shrinkage) were unexpected, so a confirmatory series of tests was conducted later, as described by Huphauf (2006).

The second set of measured data, which was less detailed, consisted of camber measurements taken on W83G girders fabricated at Central Premix Prestress Co. (CPM), in Pasco, Washington. Cambers were recorded for 28 girders in the yard on two occasions. Only strength data were available for the materials. For five of these girders, the effect of end restraint on camber was measured by replacing the supports with low-resistance roller assemblies.

The third set of data consisted of camber readings made by CPM and CTC on 110 girders from various projects fabricated during the last 11 years. These data were gathered from the companies' files. The camber readings were taken at release (or shortly thereafter) and at one subsequent time, as required by the state. Concrete strength at release and at 28 days constituted the only materials data available for these girders.

The values of the constants in the model were then calibrated by adjusting them to minimize the error between the predicted and measured cambers for all three sets, comprising 146 girders.

An additional 91 girders from the Keys Road Project in Yakima, Washington, were measured *in situ* to observe the change in camber due to the release of temporary prestressing strands, deck placement, and time-dependent deflection after deck placement. The observed changes in camber were compared with the calculated values to establish trends in the behavior of the material.

10.2 Conclusions

A number of factors influence the camber of a prestressed concrete girder. The findings associated with the broad study of 146 girders from six bridges, based on camber measurements taken at the production facilities, are as follows:

1) *Use of 2004 AASHTO LRFD*. When the project started, the WSDOT camber prediction method used prestress losses calculated according to the AASHTO LRFD 2004 provisions. For the 146-girder set, that procedure led to the camber prediction errors shown in Table 10.1

Table 10.1 Camber Errors (in.) Resulting from Use of Original WSDOT Method.

	Release	2nd measurement
Average	-0.42	0.73
Average abs.	0.47	0.75
Min/max	-2.20/+0.80	

2) *Use of 2006 AASHTO LRFD*. The current WSDOT procedure uses the AASHTO LRFD 2006 provisions. However, because WSDOT does not include prestress losses in the time-dependant camber calculations, the magnitude of the time-dependent losses does not affect the predicted camber, and the average error and average absolute error remain the same as in Table 10.1. This is true regardless of the prestress loss prediction method used.

3) *Calibration of model coefficients.* The numerical model was calibrated by minimizing the error between the predicted and measured cambers for the set of 146 girders. The coefficients for concrete strength, Young's modulus, creep coefficient and prestress loss due to creep were adjusted to achieve the best fit. The primary findings with respect to those factors are

   a) *Concrete strength.* On average, the measured concrete compressive strength exceeded the specified strength by 10 percent at release and 25 percent at 28 days. The excess strength at release was particularly large when the girder was cured for more than one day, as often happens over weekends.

   b) *Elastic Modulus*. For a given concrete strength at release, the value of the elastic modulus, E_{ci}, derived from the release camber measurements was, on average, higher than that predicted by the AASHTO LRFD code equations by approximately 15 percent. The value of E_{ci} obtained from the Snake Lake camber measurements at release was in close agreement with the values obtained from the materials tests on companion cylinders.

c) *Creep coefficient.* The second camber measurements, which included the effects of long-term camber changes, depended on E_c, C_c, and the time-dependent prestress losses. For a given method of predicting prestress loss (e.g., AASHTO LRFD 2006) the measured camber values could be matched almost equally well by using any one of many different pairs of factors for E_c and C. Selecting the factor for E_c from the release measurements led to a unique pair and, therefore, to a single value of C_c. The optimization resulted in a modification factor of 1.4 for C_c.

By adopting the optimum values described above for the factors, it was possible to decrease the camber prediction errors to those shown in Table 10.2.

Table 10.2 Camber Errors (in.) Resulting from Use of the Optimized Model

	Release	2nd measurement
Average	-0.03	-0.09
Average abs.	0.24	0.32
Min/max	-1.0/+1.3	

4) Additional factors that were not included in the modeling, but that contribute to the inaccuracy of prediction, are as follows:

   a) *Girder support locations.* The girder is supported at different locations at different times, such as at release, during storage and on the bridge piers. These support locations affect the camber, but are typically not accounted for during design.

b) *Restraint by support*. Placement of a girder on a fixed support creates some restraint to the longitudinal shortening of the bottom flange. Lifting and reseating a girder in the storage yard released that restraint and caused an increase in camber that averaged 0.15 in.

c) *Measurement errors*. Camber measurements after release were taken by CTC (with a tape measure in the casting bed) and by the UW researchers (with a laser level shortly after in the finishing yard). A comparison of the results suggests that measurement errors of less than 0.25 in. are achievable consistently.

d) *Environmental conditions*. Ambient air temperature, relative humidity, and temperature gradient in the girder could affect measured cambers but were not included in this research.

At the Keys Road Bridge site, girder cambers were measured at several times during construction. Seven spans, with 13 girders per span, or 91 girders in all, were monitored. Cambers were predicted using the numerical model and the optimum factors described above. The following observations were made from the site measurements.

1) *Effect of support conditions*. Some girder ends were supported on oak blocks and then built in to partial-height diaphragms, while others were seated on elastomeric bearings. Girders supported on oak blocks at both ends deflected less than those that were supported on an elastomeric bearing at one end. This was true both when the temporary strands were released (prior to the girder's embedment in the partial diaphragm) and when the deck was cast (after embedment). The lower deflections were attributed to fact that the bottom flange of the girder was partially restrained against longitudinal movement. The restrained girders behaved as if they were 41 percent to 46 percent stiffer than those seated on elastomeric bearings.

2) *Changes in camber due to changes in loading.* A simple analytical model showed that the girders with one end on an elastomeric bearing would behave almost like a simple span, with essentially no end restraint. Therefore a simple span model was used to predict camber change for the spans with one end on an elastomeric bearing. However, when the temporary strands were released the measured camber change was 21 percent larger than predicted, but when the deck was cast the change was 14 percent less than predicted. The former result suggests an end restraint with a negative stiffness and is anomalous. By contrast, the spans that were restrained at both ends in all cases suffered camber changes that were less than those predicted by using a simple span model. This is consistent with the existence of partial end restraint. Attempts to model the end restraint rationally showed that improbably large pier stiffnesses were needed to match the measured camber changes. More detailed site data and more sophisticated analytical modeling than was possible here are needed to resolve the discrepancies.
3) The time-dependent deflection after deck placement was approximately 0.4 in., on average. However, a large amount of scatter was observed in the data, with a coefficient of variation of 150 percent. Some results were unexpected. For example, of the interior girders, those with two ends restrained deflected more than those with only one end restrained. Choosing a simple but rational model to compute the deflection is not easy because the elastic deflection is controlled by the bare girder properties, but the girder is composite by the time that the creep occurs. The best prediction was obtained by using the composite section to compute a (fictitious) elastic deflection and multiplying that by the creep coefficient to give the creep deflection.

4) *Interior versus exterior girders.* In a given span, the girders labeled as exterior and interior deflected by almost identical mounts when the temporary strands were cut. The same was true when the deck was cast.

10.3 Recommendations

10.3.1 Recommendations for Practice

The following recommendations are made for practice:

1) Concrete strength

   For deflection calculations, increase the specified concrete strengths by 10 percent at release and 25 percent at 28 days.

2) Elastic modulus

   Use 1.15 times the AASHTO LRFD 2006 equation for predicting the concrete elastic modulus (E_c) for a given concrete strength. An alternative would be to adopt the methods recommended by NCHRP or CEB-FIP.

3) Time-dependent effects

   - Account for the changes in long-term camber due to prestress losses from the effects of creep, shrinkage, and relaxation.
   - Continue to use the AASHTO LRFD 2006 provisions for shrinkage and prestress loss.
   - Use 1.4 times the value given by the AASHTO LRFD 2006 equation for predicting the creep coefficient (C_c).

4) Effects of end restraint.

   - For temporary strand removal, use 1.2 times the elastic deflection of a simply supported girder when one end is placed on an elastomeric bearing pad, and multiply this amount by 0.7 when both ends are placed on oak blocks.

  - For deck casting, use 0.9 times the elastic deflection of a simply supported girder when one end is placed on an elastomeric bearing pad, and multiply this amount by 0.7 when both ends are placed on oak blocks.

By following these recommendations, maximum errors were -0.9/+1.3 at release and -1.0/+1.1 for subsequent measurements. Comparison with the values in Table 10.1 illustrates the improvement provided by the calibrated model.

10.3.2 Recommendations for Future Research

The following recommendations are made for further research.

- A model should be developed in which the time-dependent concrete behavior can be defined in terms of a potential function that can be differentiated with respect to time and stress. The use of such a model would avoid the need to track separately the response to each load component at each time step.
- Additional field camber measurements should be made on simply supported spans to compare the prediction model of a simply supported beam and the effects of the bearing pad resistance to lateral deformation.

NOTATION

a = distance from the end of the girder to the harping point

A_g = gross-cross sectional area of girder

A_c = cross sectional area of concrete

A_{ps} = total are of prestress strands

b = constant that changes the rate of increase

c = constant that changes the ultimate value

C_{cu} = ultimate creep coefficient

E_c = modulus of elasticity of concrete

E_{ci} = modulus of elasticity of the concrete at release

e_{end} = eccentricity of the prestressing at midspan of the girder

e_{mid} = eccentricity of the prestressing at the end of the girder

e_p = eccentricity of center of gravity of prestressing steel

E_p = modulus of elasticity of the prestressing strand

f'_c = concrete compressive strength (ksi)

f_{cgp} = concrete stress at the center of gravity of prestressing strands due to the prestressing force and self weight of the member directly after transfer

f'_{ci} = compressive strength at the time of prestressing (ksi)

f_{pj} = initial stress in the tendon directly after stressing (ksi)

f_{pu} = ultimate strength of prestress strands

f_{py} = yield strength of the prestressing strands (ksi)

H = relative humidity (%)

I_g = gross section moment of inertia of girder

K_{CA} = age at loading factor

K_{CH} = humidity factor

K_{CS} = shape and size factor

k_f = factor for the effect of concrete strength

k_{hc} = humidity factor for creep

k_{hs} = humidity factor for shrinkage

k_{td} = time development factor

k_{vs} = factor for the effect of the volume-to-surface ratio

L = girder length

L_c = length of overhang

L_n = distance between supports

M_g = self-weight moment of girder

n = modular ratio

P_i = initial prestress force directly after transfer

P_j = prestress force just before release.

t = maturity of concrete (days), defined as the age of the concrete between time of loading for creep calculations, or end of curing for shrinkage calculations, and the time being considered for analysis for creep or shrinkage effect.

t_a = age of concrete when load is initially applied (day)

t_p = time from strand stressing to release (days)

t_{str} = time after concrete starts to gain strength (day)

V/S = volume-to-surface ratio (in.)

β_1 = coefficient controlling creep rate

β_2 = coefficient controlling the effect of the age of loading

Δf_{cdp} = change in concrete stress at the center of gravity of prestressing steel due to permanent loads, with exception of the load acting at the time the prestressing force is applied

Δf_{pCR} = prestress loss due to creep of concrete

Δf_{pES} = prestress loss due to elastic shortening

Δf_{pR1} = prestress loss due to relaxation of steel before transfer

Δf_{pR2} = prestress loss due to relaxation of steel after transfer

Δf_{pSR} = prestress loss due to shrinkage

Δf_{pT} = total prestress loss

$\Delta_{MISDPAN}$ = the deflection at midspan relative to the support

$\Delta_{OVERHANG}$ = the deflection of the overhang relative to the support

Δ_{DL} = midspan deflection due to dead load

Δ_{PS} = midspan deflection due to prestressing strands

Δ_{SW} = midspan deflection due to self-weight

ε_{sr} = axial strain due to shrinkage

γ = unit weight of concrete (kcf)

ρ = reinforcement ratio

ω_{DL} = dead load linearly distributed over the length of the girder

ω_{SW} = self weight linearly distributed

ψ = creep coefficient

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APPENDIX A

FABRICATOR DATA COLLECTION

				Geometry			
	Group	Mk#	CastDate	Section	Length (ft)	Ag (in^2)	Ig (in^4)
1	277th_St_Bridge	G3	05/24/2004	W50G	96.10	526	165461
2	277th_St_Bridge	G3	05/25/2004	W50G	96.10	526	165461
3	277th_St_Bridge	G3	05/26/2004	W50G	96.10	526	165461
4	277th_St_Bridge	G3	05/27/2004	W50G	96.10	526	165461
5	277th_St_Bridge	G3	05/28/2004	W50G	96.10	526	165461
6	277th_St_Bridge	G3	06/01/2004	W50G	96.10	526	165461
7	277th_St_Bridge	G4	06/03/2004	W50G	96.10	526	165461
8	277th_St_Bridge	G4	06/04/2004	W50G	96.10	526	165461
9	277th_St_Bridge	G4	06/07/2004	W50G	96.10	526	165461
10	277th_St_Bridge	G4	06/08/2004	W50G	96.10	526	165461
11	277th_St_Bridge	G4	06/09/2004	W50G	96.10	526	165461
12	277th_St_Bridge	G4	06/10/2004	W50G	96.10	526	165461
13	277th_St_Bridge	G2	06/11/2004	W50G	96.10	526	165461
14	277th_St_Bridge	G2	06/14/2004	W50G	96.10	526	165461
15	277th_St_Bridge	G1	06/15/2004	W50G	96.10	526	165461
16	277th_St_Bridge	G1	06/16/2004	W50G	96.10	526	165461
17	Black_Lake_Blvd	G12	01/18/1994	W74G	65.94	747	547533
18	Black_Lake_Blvd	G12	01/19/1994	W74G	65.94	747	547533
19	Black_Lake_Blvd	G12	01/20/1994	W74G	65.94	747	547533
20	Black_Lake_Blvd	G11	01/21/1994	W74G	65.94	747	547533
21	Black_Lake_Blvd	G13	01/24/1994	W74G	65.94	747	547533
22	Black_Lake_Blvd	G12	04/01/1994	W74G	65.94	747	547533
23	Black_Lake_Blvd	G12	04/04/1994	W74G	65.94	747	547533
24	Black_Lake_Blvd	G12	04/05/1994	W74G	65.94	747	547533
25	Black_Lake_Blvd	G12	04/06/1994	W74G	65.94	747	547533
26	Black_Lake_Blvd	G14	04/07/1994	W74G	65.94	747	547533
27	Black_Lake_Blvd	G15	04/08/1994	W74G	65.94	747	547533
28	Black_Lake_Blvd	G22	01/25/1994	W74G	86.90	747	547533
29	Black_Lake_Blvd	G22	01/26/1994	W74G	86.90	747	547533
30	Black_Lake_Blvd	G22	01/27/1994	W74G	86.90	747	547533
31	Black_Lake_Blvd	G21	01/28/1994	W74G	86.90	747	547533
32	Black_Lake_Blvd	G23	01/31/1994	W74G	86.90	747	547533
33	Black_Lake_Blvd	G22	02/01/1994	W74G	86.90	747	547533
34	Black_Lake_Blvd	G22	02/02/1994	W74G	86.90	747	547533
35	Black_Lake_Blvd	G22	02/03/1994	W74G	86.90	747	547533
36	Black_Lake_Blvd	G22	02/04/1994	W74G	86.90	747	547533
37	Black_Lake_Blvd	G24	02/07/1994	W74G	86.90	747	547533
38	Black_Lake_Blvd	G25	02/08/1994	W74G	86.90	747	547533
39	Black_Lake_Blvd	G2	02/11/1994	W74G	106.75	747	547533
40	Black_Lake_Blvd	G2	02/14/1994	W74G	106.75	747	547533
41	Black_Lake_Blvd	G2	02/15/1994	W74G	106.75	747	547533
42	Black_Lake_Blvd	G2	02/16/1994	W74G	106.75	747	547533
43	Black_Lake_Blvd	G2	02/17/1994	W74G	106.75	747	547533
44	Black_Lake_Blvd	G2	02/18/1994	W74G	106.75	747	547533
45	Black_Lake_Blvd	G2	02/21/1994	W74G	106.75	747	547533
46	Black_Lake_Blvd	G4	02/22/1994	W74G	106.75	747	547533
47	Black_Lake_Blvd	G3	02/23/1994	W74G	106.75	747	547533
48	Black_Lake_Blvd	G1	02/24/1994	W74G	106.75	747	547533
49	Black_Lake_Blvd	G5	02/25/1994	W74G	106.75	747	547533
50	Black_Lake_Blvd	G20	03/01/1994	W74G	125.75	747	547533
51	Black_Lake_Blvd	G16	03/02/1994	W74G	125.75	747	547533
52	Black_Lake_Blvd	G18	03/03/1994	W74G	125.75	747	547533
53	Black_Lake_Blvd	G19	03/04/1994	W74G	125.75	747	547533
54	Black_Lake_Blvd	G17	03/07/1994	W74G	125.75	747	547533
55	Black_Lake_Blvd	G17	03/08/1994	W74G	125.75	747	547533
56	Black_Lake_Blvd	G17	03/09/1994	W74G	125.75	747	547533
57	Black_Lake_Blvd	G17	03/10/1994	W74G	125.75	747	547533
58	Black_Lake_Blvd	G17	03/11/1994	W74G	125.75	747	547533
59	Black_Lake_Blvd	G17	03/14/1994	W74G	125.75	747	547533
60	Black_Lake_Blvd	G17	03/15/1994	W74G	125.75	747	547533
61	Black_Lake_Blvd	G7	01/04/1994	W74G	131.49	747	547533
62	Black_Lake_Blvd	G7	01/05/1994	W74G	131.49	747	547533

				Geometry			
	Group	**Mk#**	**CastDate**	**Section**	**Length (ft)**	**Ag (in^2)**	**Ig (in^4)**
63	Black_Lake_Blvd	G7	01/06/1994	W74G	131.49	747	547533
64	Black_Lake_Blvd	G7	01/07/1994	W74G	131.49	747	547533
65	Black_Lake_Blvd	G7	01/10/1994	W74G	131.49	747	547533
66	Black_Lake_Blvd	G7	01/11/1994	W74G	131.49	747	547533
67	Black_Lake_Blvd	G8	01/12/1994	W74G	131.49	747	547533
68	Black_Lake_Blvd	G9	01/13/1994	W74G	131.49	747	547533
69	Black_Lake_Blvd	G6	01/14/1994	W74G	131.49	747	547533
70	Black_Lake_Blvd	G10	01/17/1994	W74G	131.49	747	547533
71	Black_Lake_Blvd	G7	03/16/1994	W74G	131.49	747	547533
72	Black_Lake_Blvd	G7	03/17/1994	W74G	131.49	747	547533
73	Black_Lake_Blvd	G7	03/18/1994	W74G	131.49	747	547533
74	Black_Lake_Blvd	G7	03/21/1994	W74G	131.49	747	547533
75	Black_Lake_Blvd	G7	03/22/1994	W74G	131.49	747	547533
76	Black_Lake_Blvd	G7	03/23/1994	W74G	131.49	747	547533
77	Black_Lake_Blvd	G7	03/24/1994	W74G	131.49	747	547533
78	Black_Lake_Blvd	G7	03/25/1994	W74G	131.49	747	547533
79	Black_Lake_Blvd	G8	03/28/1994	W74G	131.49	747	547533
80	Black_Lake_Blvd	G9	03/29/1994	W74G	131.49	747	547533
81	Black_Lake_Blvd	G10	03/30/1994	W74G	131.49	747	547533
82	Black_Lake_Blvd	G6	03/31/1994	W74G	131.49	747	547533
83	Cedar_River_Bridge	G17	04/20/2005	WF74G	94.42	918	709491
84	Cedar_River_Bridge	G17	04/21/2005	WF74G	94.42	918	709491
85	Cedar_River_Bridge	G17	04/22/2005	WF74G	94.42	918	709491
86	Cedar_River_Bridge	G16	04/27/2005	WF74G	94.42	918	709491
87	Cedar_River_Bridge	G14	04/04/2005	WF74G	120.25	918	709491
88	Cedar_River_Bridge	G14	04/05/2005	WF74G	120.25	918	709491
89	Cedar_River_Bridge	G14	04/06/2005	WF74G	120.25	918	709491
90	Cedar_River_Bridge	G15	04/07/2005	WF74G	120.25	918	709491
91	Cedar_River_Bridge	G12	04/12/2005	WF74G	127.58	918	709491
92	Cedar_River_Bridge	G10	04/13/2005	WF74G	127.58	918	709491
93	Cedar_River_Bridge	G11	04/14/2005	WF74G	127.58	918	709491
94	Cedar_River_Bridge	G11	04/15/2005	WF74G	127.58	918	709491
95	Cedar_River_Bridge	G11	04/18/2005	WF74G	127.58	918	709491
96	Keys_Rd_Bridge	MK6	09/24/2005	W83G	178.00	972	956639
97	Keys_Rd_Bridge	MK6	09/27/2005	W83G	178.00	972	956639
98	Keys_Rd_Bridge	MK6	09/29/2005	W83G	178.00	972	956639
99	Keys_Rd_Bridge	MK7C	10/04/2005	W83G	178.00	972	956639
100	Keys_Rd_Bridge	MK7C	10/07/2005	W83G	178.00	972	956639
101	Keys_Rd_Bridge	MK7C	10/11/2005	W83G	178.00	972	956639
102	Keys_Rd_Bridge	MK7C	10/13/2005	W83G	178.00	972	956639
103	Keys_Rd_Bridge	MK7D	10/15/2005	W83G	178.00	972	956639
104	Keys_Rd_Bridge	MK7E	10/19/2005	W83G	178.00	972	956639
105	Keys_Rd_Bridge	MK7F	12/02/2005	W83G	178.00	972	956639
106	Keys_Rd_Bridge	MK7F	12/06/2005	W83G	178.00	972	956639
107	Keys_Rd_Bridge	MK7F	12/08/2005	W83G	178.00	972	956639
108	Keys_Rd_Bridge	MK7F	12/13/2005	W83G	178.00	972	956639
109	Keys_Rd_Bridge	MK8A	10/21/2005	W83G	178.00	972	956639
110	Keys_Rd_Bridge	MK8A	10/23/2005	W83G	178.00	972	956639
111	Keys_Rd_Bridge	MK8A	10/25/2005	W83G	178.00	972	956639
112	Keys_Rd_Bridge	MK8A	10/27/2005	W83G	178.00	972	956639
113	Keys_Rd_Bridge	MK8A	10/29/2005	W83G	178.00	972	956639
114	Keys_Rd_Bridge	MK8B	11/04/2005	W83G	178.00	972	956639
115	Keys_Rd_Bridge	MK8B	11/08/2005	W83G	178.00	972	956639
116	Keys_Rd_Bridge	MK8B	11/10/2005	W83G	178.00	972	956639
117	Keys_Rd_Bridge	MK8B	11/15/2005	W83G	178.00	972	956639
118	Keys_Rd_Bridge	MK8B	11/18/2005	W83G	178.00	972	956639
119	Keys_Rd_Bridge	MK8B	11/22/2005	W83G	178.00	972	956639
120	Keys_Rd_Bridge	MK8B	11/29/2005	W83G	178.00	972	956639
121	Keys_Rd_Bridge	MK5	08/30/2005	W83G	178.00	972	956639
122	Keys_Rd_Bridge	MK5	09/01/2005	W83G	178.00	972	956639
123	Keys_Rd_Bridge	MK5A	09/06/2005	W83G	178.00	972	956639
124	Snake_Lake_Bridge	G1A	09/02/2005	W74G	134.94	747	547533

				Geometry			
	Group	**Mk#**	**CastDate**	**Section**	**Length (ft)**	**Ag (in^2)**	**Ig (in^4)**
125	Snake_Lake_Bridge	G2A	09/01/2005	W74G	134.96	747	547533
126	Snake_Lake_Bridge	G2D	09/09/2005	W74G	135.02	747	547533
127	Snake_Lake_Bridge	G1D	09/12/2005	W74G	135.04	747	547533
128	Snake_Lake_Bridge	G3D	09/08/2005	W74G	134.96	747	547533
129	Snake_Lake_Bridge	G3A	08/31/2005	W74G	135.00	747	547533
130	Snake_Lake_Bridge	G4A	08/29/2005	W74G	135.02	747	547533
131	Snake_Lake_Bridge	G4D	09/06/2005	W74G	134.96	747	547533
132	Yakima_River_Bridge	MK2	10/07/2003	W83G	170.67	972	956639
133	Yakima_River_Bridge	MK2	10/09/2003	W83G	170.67	972	956639
134	Yakima_River_Bridge	MK2	10/13/2003	W83G	170.67	972	956639
135	Yakima_River_Bridge	MK2	10/17/2003	W83G	170.67	972	956639
136	Yakima_River_Bridge	MK2	10/21/2003	W83G	170.67	972	956639
137	Yakima_River_Bridge	MK2B	10/23/2003	W83G	170.67	972	956639
138	Yakima_River_Bridge	MK2A	10/27/2003	W83G	170.67	972	956639
139	Yakima_River_Bridge	MK1A	10/29/2003	W83G	173.17	972	956639
140	Yakima_River_Bridge	MK1B	10/31/2003	W83G	173.17	972	956639
141	Yakima_River_Bridge	MK1	11/04/2003	W83G	173.17	972	956639
142	Yakima_River_Bridge	MK1	11/06/2003	W83G	173.17	972	956639
143	Yakima_River_Bridge	MK1	11/10/2003	W83G	173.17	972	956639
144	Yakima_River_Bridge	MK1	11/12/2003	W83G	173.17	972	956639
145	Yakima_River_Bridge	MK1	11/14/2003	W83G	173.17	972	956639
146	Yakima_River_Bridge	MK1	11/18/2003	W83G	173.17	972	956639

	Depth (in)	V/S (in)	c_1 (in.)	c_2 (in.)	Release L_n (ft)	2nd L_n (ft)	3rd L_n (ft)
1	50.00	3.13	22.77	27.23	92.60	92.10	90.10
2	50.00	3.13	22.77	27.23	92.60	92.10	90.10
3	50.00	3.13	22.77	27.23	92.60	92.10	90.10
4	50.00	3.13	22.77	27.23	92.60	92.10	90.10
5	50.00	3.13	22.77	27.23	92.60	92.10	90.10
6	50.00	3.13	22.77	27.23	92.60	92.10	90.10
7	50.00	3.13	22.77	27.23	92.60	92.10	90.10
8	50.00	3.13	22.77	27.23	92.60	92.10	90.10
9	50.00	3.13	22.77	27.23	92.60	92.10	90.10
10	50.00	3.13	22.77	27.23	92.60	92.10	90.10
11	50.00	3.13	22.77	27.23	92.60	92.10	90.10
12	50.00	3.13	22.77	27.23	92.60	92.10	90.10
13	50.00	3.13	22.77	27.23	92.60	92.10	90.10
14	50.00	3.13	22.77	27.23	92.60	92.10	90.10
15	50.00	3.13	22.77	27.23	92.60	92.10	90.10
16	50.00	3.13	22.77	27.23	92.60	92.10	90.10
17	73.50	2.90	38.03	35.47	62.94	62.94	55.94
18	73.50	2.90	38.03	35.47	62.94	62.94	55.94
19	73.50	2.90	38.03	35.47	62.94	62.94	55.94
20	73.50	2.90	38.03	35.47	62.94	62.94	55.94
21	73.50	2.90	38.03	35.47	62.94	62.94	55.94
22	73.50	2.90	38.03	35.47	62.94	62.94	55.94
23	73.50	2.90	38.03	35.47	62.94	62.94	55.94
24	73.50	2.90	38.03	35.47	62.94	62.94	55.94
25	73.50	2.90	38.03	35.47	62.94	62.94	55.94
26	73.50	2.90	38.03	35.47	62.94	62.94	55.94
27	73.50	2.90	38.03	35.47	62.94	62.94	55.94
28	73.50	2.90	38.03	35.47	83.90	83.98	76.98
29	73.50	2.90	38.03	35.47	83.90	83.98	76.98
30	73.50	2.90	38.03	35.47	83.90	83.98	76.98
31	73.50	2.90	38.03	35.47	83.90	83.98	76.98
32	73.50	2.90	38.03	35.47	83.90	83.98	76.98
33	73.50	2.90	38.03	35.47	83.90	83.98	76.98
34	73.50	2.90	38.03	35.47	83.90	83.98	76.98
35	73.50	2.90	38.03	35.47	83.90	83.98	76.98
36	73.50	2.90	38.03	35.47	83.90	83.98	76.98
37	73.50	2.90	38.03	35.47	83.90	83.98	76.98
38	73.50	2.90	38.03	35.47	83.90	83.98	76.98
39	73.50	2.90	38.03	35.47	103.75	103.88	96.88
40	73.50	2.90	38.03	35.47	103.75	103.88	96.88
41	73.50	2.90	38.03	35.47	103.75	103.88	96.88
42	73.50	2.90	38.03	35.47	103.75	103.88	96.88
43	73.50	2.90	38.03	35.47	103.75	103.88	96.88
44	73.50	2.90	38.03	35.47	103.75	103.88	96.88
45	73.50	2.90	38.03	35.47	103.75	103.88	96.88
46	73.50	2.90	38.03	35.47	103.75	103.88	96.88
47	73.50	2.90	38.03	35.47	103.75	103.88	96.88
48	73.50	2.90	38.03	35.47	103.75	103.88	96.88
49	73.50	2.90	38.03	35.47	103.75	103.88	96.88
50	73.50	2.90	38.03	35.47	122.75	122.94	115.94
51	73.50	2.90	38.03	35.47	122.75	122.94	115.94
52	73.50	2.90	38.03	35.47	122.75	122.94	115.94
53	73.50	2.90	38.03	35.47	122.75	122.94	115.94
54	73.50	2.90	38.03	35.47	122.75	122.94	115.94
55	73.50	2.90	38.03	35.47	122.75	122.94	115.94
56	73.50	2.90	38.03	35.47	122.75	122.94	115.94
57	73.50	2.90	38.03	35.47	122.75	122.94	115.94
58	73.50	2.90	38.03	35.47	122.75	122.94	115.94
59	73.50	2.90	38.03	35.47	122.75	122.94	115.94
60	73.50	2.90	38.03	35.47	122.75	122.94	115.94
61	73.50	2.90	38.03	35.47	127.49	128.71	121.71
62	73.50	2.90	38.03	35.47	127.49	128.71	121.71

	Depth (in)	V/S (in)	c_1 (in.)	c_2 (in.)	Release L_n (ft)	2nd L_n (ft)	3rd L_n (ft)
63	73.50	2.90	38.03	35.47	127.49	128.71	121.71
64	73.50	2.90	38.03	35.47	127.49	128.71	121.71
65	73.50	2.90	38.03	35.47	127.49	128.71	121.71
66	73.50	2.90	38.03	35.47	127.49	128.71	121.71
67	73.50	2.90	38.03	35.47	127.49	128.71	121.71
68	73.50	2.90	38.03	35.47	127.49	128.71	121.71
69	73.50	2.90	38.03	35.47	127.49	128.71	121.71
70	73.50	2.90	38.03	35.47	127.49	128.71	121.71
71	73.50	2.90	38.03	35.47	127.49	128.71	121.71
72	73.50	2.90	38.03	35.47	127.49	128.71	121.71
73	73.50	2.90	38.03	35.47	127.49	128.71	121.71
74	73.50	2.90	38.03	35.47	127.49	128.71	121.71
75	73.50	2.90	38.03	35.47	127.49	128.71	121.71
76	73.50	2.90	38.03	35.47	127.49	128.71	121.71
77	73.50	2.90	38.03	35.47	127.49	128.71	121.71
78	73.50	2.90	38.03	35.47	127.49	128.71	121.71
79	73.50	2.90	38.03	35.47	127.49	128.71	121.71
80	73.50	2.90	38.03	35.47	127.49	128.71	121.71
81	73.50	2.90	38.03	35.47	127.49	128.71	121.71
82	73.50	2.90	38.03	35.47	127.49	128.71	121.71
83	72.88	3.20	35.08	37.80	86.42	90.42	84.42
84	72.88	3.20	35.08	37.80	86.42	90.42	84.42
85	72.88	3.20	35.08	37.80	86.42	90.42	84.42
86	72.88	3.20	35.08	37.80	86.42	90.42	84.42
87	72.88	3.20	35.08	37.80	112.25	116.25	110.25
88	72.88	3.20	35.08	37.80	112.25	116.25	110.25
89	72.88	3.20	35.08	37.80	112.25	116.25	110.25
90	72.88	3.20	35.08	37.80	112.25	116.25	110.25
91	72.88	3.20	35.08	37.80	119.58	123.58	117.58
92	72.88	3.20	35.08	37.80	119.58	123.58	117.58
93	72.88	3.20	35.08	37.80	119.58	123.58	117.58
94	72.88	3.20	35.08	37.80	119.58	123.58	117.58
95	72.88	3.20	35.08	37.80	119.58	123.58	117.58
96	82.68	3.17	39.66	43.02	158.00	174.00	158.00
97	82.68	3.17	39.66	43.02	158.00	174.00	158.00
98	82.68	3.17	39.66	43.02	158.00	174.00	158.00
99	82.68	3.17	39.66	43.02	158.00	174.00	158.00
100	82.68	3.17	39.66	43.02	158.00	174.00	158.00
101	82.68	3.17	39.66	43.02	158.00	174.00	158.00
102	82.68	3.17	39.66	43.02	158.00	174.00	158.00
103	82.68	3.17	39.66	43.02	158.00	174.00	158.00
104	82.68	3.17	39.66	43.02	158.00	174.00	158.00
105	82.68	3.17	39.66	43.02	158.00	174.00	158.00
106	82.68	3.17	39.66	43.02	158.00	174.00	158.00
107	82.68	3.17	39.66	43.02	158.00	174.00	158.00
108	82.68	3.17	39.66	43.02	158.00	174.00	158.00
109	82.68	3.17	39.66	43.02	158.00	174.00	158.00
110	82.68	3.17	39.66	43.02	158.00	174.00	158.00
111	82.68	3.17	39.66	43.02	158.00	174.00	158.00
112	82.68	3.17	39.66	43.02	158.00	174.00	158.00
113	82.68	3.17	39.66	43.02	158.00	174.00	158.00
114	82.68	3.17	39.66	43.02	158.00	174.00	158.00
115	82.68	3.17	39.66	43.02	158.00	174.00	158.00
116	82.68	3.17	39.66	43.02	158.00	174.00	158.00
117	82.68	3.17	39.66	43.02	158.00	174.00	158.00
118	82.68	3.17	39.66	43.02	158.00	174.00	158.00
119	82.68	3.17	39.66	43.02	158.00	174.00	158.00
120	82.68	3.17	39.66	43.02	158.00	174.00	158.00
121	82.68	3.17	39.66	43.02	158.00	174.00	158.00
122	82.68	3.17	39.66	43.02	158.00	174.00	158.00
123	82.68	3.17	39.66	43.02	158.00	174.00	158.00
124	73.50	2.90	38.03	35.47	129.00	129.50	129.50

	Depth (in)	V/S (in)	c_1 (in.)	c_2 (in.)	Release L_n (ft)	2nd L_n (ft)	3rd L_n (ft)
125	73.50	2.90	38.03	35.47	129.00	129.50	129.50
126	73.50	2.90	38.03	35.47	129.00	129.50	129.50
127	73.50	2.90	38.03	35.47	129.00	129.50	129.50
128	73.50	2.90	38.03	35.47	129.00	129.50	129.50
129	73.50	2.90	38.03	35.47	129.00	129.50	129.50
130	73.50	2.90	38.03	35.47	129.00	129.50	129.50
131	73.50	2.90	38.03	35.47	129.00	129.50	129.50
132	82.68	3.17	39.66	43.02	150.67	166.67	150.67
133	82.68	3.17	39.66	43.02	150.67	166.67	150.67
134	82.68	3.17	39.66	43.02	150.67	166.67	150.67
135	82.68	3.17	39.66	43.02	150.67	166.67	150.67
136	82.68	3.17	39.66	43.02	150.67	166.67	150.67
137	82.68	3.17	39.66	43.02	150.67	166.67	150.67
138	82.68	3.17	39.66	43.02	150.67	166.67	150.67
139	82.68	3.17	39.66	43.02	153.17	166.67	150.67
140	82.68	3.17	39.66	43.02	153.17	166.67	150.67
141	82.68	3.17	39.66	43.02	153.17	166.67	150.67
142	82.68	3.17	39.66	43.02	153.17	166.67	150.67
143	82.68	3.17	39.66	43.02	153.17	166.67	150.67
144	82.68	3.17	39.66	43.02	153.17	166.67	150.67
145	82.68	3.17	39.66	43.02	153.17	166.67	150.67
146	82.68	3.17	39.66	43.02	153.17	166.67	150.67

	4th L_n (ft)	H (%)	Prestress Straight	$e_{straight}$	Harped	$e_{mid,harped}$	$e_{end,harped}$	a (in.)
1	94.81	80	24	19.29	7	13.75	-20.64	414.40
2	94.81	80	24	19.29	7	13.75	-20.64	414.40
3	94.81	80	24	19.29	7	13.75	-20.64	414.40
4	94.81	80	24	19.29	7	13.75	-20.64	414.40
5	94.81	80	24	19.29	7	13.75	-20.64	414.40
6	94.81	80	24	19.29	7	13.75	-20.64	414.40
7	94.81	80	24	19.29	7	13.75	-20.64	414.40
8	94.81	80	24	19.29	7	13.75	-20.64	414.40
9	94.81	80	24	19.29	7	13.75	-20.64	414.40
10	94.81	80	24	19.29	7	13.75	-20.64	414.40
11	94.81	80	24	19.29	7	13.75	-20.64	414.40
12	94.81	80	24	19.29	7	13.75	-20.64	414.40
13	94.81	80	24	19.29	7	13.75	-20.64	414.40
14	94.81	80	24	19.29	7	13.75	-20.64	414.40
15	94.81	80	24	19.29	7	13.75	-20.64	414.40
16	94.81	80	24	19.29	7	13.75	-20.64	414.40
17	64.78	80	6	36.16	6	35.03	-9.47	317.64
18	64.78	80	6	36.16	6	35.03	-9.47	317.64
19	64.78	80	6	36.16	6	35.03	-9.47	317.64
20	64.78	80	6	36.16	6	35.03	-9.47	317.64
21	64.78	80	6	36.16	6	35.03	-9.47	317.64
22	64.78	80	6	36.16	6	35.03	-9.47	317.64
23	64.78	80	6	36.16	6	35.03	-9.47	317.64
24	64.78	80	6	36.16	6	35.03	-9.47	317.64
25	64.78	80	6	36.16	6	35.03	-9.47	317.64
26	64.78	80	6	36.16	6	35.03	-9.47	317.64
27	64.78	80	6	36.16	6	35.03	-9.47	317.64
28	85.39	80	12	38.82	9	35.03	-24.40	418.88
29	85.39	80	12	38.82	9	35.03	-24.40	418.88
30	85.39	80	12	38.82	9	35.03	-24.40	418.88
31	85.39	80	12	38.82	9	35.03	-24.40	418.88
32	85.39	80	12	38.82	9	35.03	-24.40	418.88
33	85.39	80	12	38.82	9	35.03	-24.40	418.88
34	85.39	80	12	38.82	9	35.03	-24.40	418.88
35	85.39	80	12	38.82	9	35.03	-24.40	418.88
36	85.39	80	12	38.82	9	35.03	-24.40	418.88
37	85.39	80	12	38.82	9	35.03	-24.40	418.88
38	85.39	80	12	38.82	9	35.03	-24.40	418.88
39	105.22	80	22	34.70	10	35.03	-29.47	514.25
40	105.22	80	22	34.70	10	35.03	-29.47	514.25
41	105.22	80	22	34.70	10	35.03	-29.47	514.25
42	105.22	80	22	34.70	10	35.03	-29.47	514.25
43	105.22	80	22	34.70	10	35.03	-29.47	514.25
44	105.22	80	22	34.70	10	35.03	-29.47	514.25
45	105.22	80	22	34.70	10	35.03	-29.47	514.25
46	105.22	80	22	34.70	10	35.03	-29.47	514.25
47	105.22	80	22	34.70	10	35.03	-29.47	514.25
48	105.22	80	22	34.70	10	35.03	-29.47	514.25
49	105.22	80	22	34.70	10	35.03	-29.47	514.25
50	124.87	80	26	34.46	17	34.15	-17.32	317.64
51	124.87	80	26	34.46	17	34.15	-17.32	317.64
52	124.87	80	26	34.46	17	34.15	-17.32	317.64
53	124.87	80	26	34.46	17	34.15	-17.32	317.64
54	124.87	80	26	34.46	17	34.15	-17.32	317.64
55	124.87	80	26	34.46	17	34.15	-17.32	317.64
56	124.87	80	26	34.46	17	34.15	-17.32	317.64
57	124.87	80	26	34.46	17	34.15	-17.32	317.64
58	124.87	80	26	34.46	17	34.15	-17.32	317.64
59	124.87	80	26	34.46	17	34.15	-17.32	317.64
60	124.87	80	26	34.46	17	34.15	-17.32	317.64
61	131.71	80	26	34.46	22	33.67	-8.35	632.26
62	131.71	80	26	34.46	22	33.67	-8.35	632.26

	4th		Prestress					
	L_n (ft)	H (%)	Straight	$e_{straight}$	Harped	$e_{mid,harped}$	$e_{end,harped}$	a (in.)
63	131.71	80	26	34.46	22	33.67	-8.35	632.26
64	131.71	80	26	34.46	22	33.67	-8.35	632.26
65	131.71	80	26	34.46	22	33.67	-8.35	632.26
66	131.71	80	26	34.46	22	33.67	-8.35	632.26
67	131.71	80	26	34.46	22	33.67	-8.35	632.26
68	131.71	80	26	34.46	22	33.67	-8.35	632.26
69	131.71	80	26	34.46	22	33.67	-8.35	632.26
70	131.71	80	26	34.46	22	33.67	-8.35	632.26
71	131.71	80	26	34.46	22	33.67	-8.35	632.26
72	131.71	80	26	34.46	22	33.67	-8.35	632.26
73	131.71	80	26	34.46	22	33.67	-8.35	632.26
74	131.71	80	26	34.46	22	33.67	-8.35	632.26
75	131.71	80	26	34.46	22	33.67	-8.35	632.26
76	131.71	80	26	34.46	22	33.67	-8.35	632.26
77	131.71	80	26	34.46	22	33.67	-8.35	632.26
78	131.71	80	26	34.46	22	33.67	-8.35	632.26
79	131.71	80	26	34.46	22	33.67	-8.35	632.26
80	131.71	80	26	34.46	22	33.67	-8.35	632.26
81	131.71	80	26	34.46	22	33.67	-8.35	632.26
82	131.71	80	26	34.46	22	33.67	-8.35	632.26
83	92.42	80	16	33.08	9	32.08	-24.24	446.52
84	92.42	80	16	33.08	9	32.08	-24.24	446.52
85	92.42	80	16	33.08	9	32.08	-24.24	446.52
86	92.42	80	16	33.08	9	32.08	-24.24	446.52
87	118.25	80	26	32.31	14	31.66	-27.80	577.50
88	118.25	80	26	32.31	14	31.66	-27.80	577.50
89	118.25	80	26	32.31	14	31.66	-27.80	577.50
90	118.25	80	26	32.31	14	31.66	-27.80	577.50
91	125.58	80	30	32.15	16	31.31	-26.80	609.48
92	125.58	80	30	32.15	16	31.31	-26.80	609.48
93	125.58	80	30	32.15	16	31.31	-26.80	609.48
94	125.58	80	30	32.15	16	31.31	-26.80	609.48
95	125.58	80	30	32.15	16	31.31	-26.80	609.48
96	176.00	70	46	35.54	22	35.29	-29.08	852.00
97	176.00	70	46	35.54	22	35.29	-29.08	852.00
98	176.00	70	46	35.54	22	35.29	-29.08	852.00
99	176.00	70	46	35.54	22	35.29	-29.08	852.00
100	176.00	70	46	35.54	22	35.29	-29.08	852.00
101	176.00	70	46	35.54	22	35.29	-29.08	852.00
102	176.00	70	46	35.54	22	35.29	-29.08	852.00
103	176.00	70	46	35.54	22	35.29	-29.08	852.00
104	176.00	70	46	35.54	22	35.29	-29.08	852.00
105	176.00	70	46	35.54	22	35.29	-29.08	852.00
106	176.00	70	46	35.54	22	35.29	-29.08	852.00
107	176.00	70	46	35.54	22	35.29	-29.08	852.00
108	176.00	70	46	35.54	22	35.29	-29.08	852.00
109	176.00	70	44	36.35	24	35.16	-28.02	852.00
110	176.00	70	44	36.35	24	35.16	-28.02	852.00
111	176.00	70	44	36.35	24	35.16	-28.02	852.00
112	176.00	70	44	36.35	24	35.16	-28.02	852.00
113	176.00	70	44	36.35	24	35.16	-28.02	852.00
114	176.00	70	44	36.35	24	35.16	-28.02	852.00
115	176.00	70	44	36.35	24	35.16	-28.02	852.00
116	176.00	70	44	36.35	24	35.16	-28.02	852.00
117	176.00	70	44	36.35	24	35.16	-28.02	852.00
118	176.00	70	44	36.35	24	35.16	-28.02	852.00
119	176.00	70	44	36.35	24	35.16	-28.02	852.00
120	176.00	70	44	36.35	24	35.16	-28.02	852.00
121	176.00	70	46	35.54	24	35.16	-28.02	852.00
122	176.00	70	46	35.54	24	35.16	-28.02	852.00
123	176.00	70	46	35.54	24	35.16	-28.02	852.00
124	129.50	80	26	34.33	11	35.08	-26.97	647.70

	4th		Prestress					
	L_n (ft)	H (%)	Straight	$e_{straight}$	Harped	$e_{mid,harped}$	$e_{end,harped}$	a (in.)
125	129.50	80	26	34.33	11	35.08	-26.97	647.80
126	129.50	80	26	34.33	11	35.08	-26.97	648.10
127	129.50	80	26	34.33	12	35.08	-26.47	648.20
128	129.50	80	26	34.33	15	34.46	-24.97	647.80
129	129.50	80	26	34.33	15	34.46	-24.97	648.00
130	129.50	80	26	34.33	17	34.20	-23.97	648.10
131	129.50	80	26	34.33	18	34.08	-23.47	647.80
132	168.67	70	46	35.54	22	35.29	-29.02	819.22
133	168.67	70	46	35.54	22	35.29	-29.02	819.22
134	168.67	70	46	35.54	22	35.29	-29.02	819.22
135	168.67	70	46	35.54	22	35.29	-29.02	819.22
136	168.67	70	46	35.54	22	35.29	-29.02	819.22
137	168.67	70	46	35.54	22	35.29	-29.02	819.22
138	168.67	70	46	35.54	22	35.29	-29.02	819.22
139	168.67	70	46	35.54	24	35.22	-27.97	831.22
140	168.67	70	46	35.54	24	35.22	-27.97	831.22
141	168.67	70	46	35.54	24	35.22	-27.97	831.22
142	168.67	70	46	35.54	24	35.22	-27.97	831.22
143	168.67	70	46	35.54	24	35.22	-27.97	831.22
144	168.67	70	46	35.54	24	35.22	-27.97	831.22
145	168.67	70	46	35.54	24	35.22	-27.97	831.22
146	168.67	70	46	35.54	24	35.22	-27.97	831.22

	Temporary	$e_{mid,tempt}$	$e_{end,tempt}$	Strand Dia. (in)	Strand A_p (in^2)	E_p (ksi)	f_{pu} (ksi)	f_{py} (ksi)
1	0	0.00	0.00	0.60	0.217	28500	270	243
2	0	0.00	0.00	0.60	0.217	28500	270	243
3	0	0.00	0.00	0.60	0.217	28500	270	243
4	0	0.00	0.00	0.60	0.217	28500	270	243
5	0	0.00	0.00	0.60	0.217	28500	270	243
6	0	0.00	0.00	0.60	0.217	28500	270	243
7	0	0.00	0.00	0.60	0.217	28500	270	243
8	0	0.00	0.00	0.60	0.217	28500	270	243
9	0	0.00	0.00	0.60	0.217	28500	270	243
10	0	0.00	0.00	0.60	0.217	28500	270	243
11	0	0.00	0.00	0.60	0.217	28500	270	243
12	0	0.00	0.00	0.60	0.217	28500	270	243
13	0	0.00	0.00	0.60	0.217	28500	270	243
14	0	0.00	0.00	0.60	0.217	28500	270	243
15	0	0.00	0.00	0.60	0.217	28500	270	243
16	0	0.00	0.00	0.60	0.217	28500	270	243
17	0	0.00	0.00	0.50	0.153	28500	270	243
18	0	0.00	0.00	0.50	0.153	28500	270	243
19	0	0.00	0.00	0.50	0.153	28500	270	243
20	0	0.00	0.00	0.50	0.153	28500	270	243
21	0	0.00	0.00	0.50	0.153	28500	270	243
22	0	0.00	0.00	0.50	0.153	28500	270	243
23	0	0.00	0.00	0.50	0.153	28500	270	243
24	0	0.00	0.00	0.50	0.153	28500	270	243
25	0	0.00	0.00	0.50	0.153	28500	270	243
26	0	0.00	0.00	0.50	0.153	28500	270	243
27	0	0.00	0.00	0.50	0.153	28500	270	243
28	0	0.00	0.00	0.50	0.153	28500	270	243
29	0	0.00	0.00	0.50	0.153	28500	270	243
30	0	0.00	0.00	0.50	0.153	28500	270	243
31	0	0.00	0.00	0.50	0.153	28500	270	243
32	0	0.00	0.00	0.50	0.153	28500	270	243
33	0	0.00	0.00	0.50	0.153	28500	270	243
34	0	0.00	0.00	0.50	0.153	28500	270	243
35	0	0.00	0.00	0.50	0.153	28500	270	243
36	0	0.00	0.00	0.50	0.153	28500	270	243
37	0	0.00	0.00	0.50	0.153	28500	270	243
38	0	0.00	0.00	0.50	0.153	28500	270	243
39	0	0.00	0.00	0.50	0.153	28500	270	243
40	0	0.00	0.00	0.50	0.153	28500	270	243
41	0	0.00	0.00	0.50	0.153	28500	270	243
42	0	0.00	0.00	0.50	0.153	28500	270	243
43	0	0.00	0.00	0.50	0.153	28500	270	243
44	0	0.00	0.00	0.50	0.153	28500	270	243
45	0	0.00	0.00	0.50	0.153	28500	270	243
46	0	0.00	0.00	0.50	0.153	28500	270	243
47	0	0.00	0.00	0.50	0.153	28500	270	243
48	0	0.00	0.00	0.50	0.153	28500	270	243
49	0	0.00	0.00	0.50	0.153	28500	270	243
50	0	0.00	0.00	0.50	0.153	28500	270	243
51	0	0.00	0.00	0.50	0.153	28500	270	243
52	0	0.00	0.00	0.50	0.153	28500	270	243
53	0	0.00	0.00	0.50	0.153	28500	270	243
54	0	0.00	0.00	0.50	0.153	28500	270	243
55	0	0.00	0.00	0.50	0.153	28500	270	243
56	0	0.00	0.00	0.50	0.153	28500	270	243
57	0	0.00	0.00	0.50	0.153	28500	270	243
58	0	0.00	0.00	0.50	0.153	28500	270	243
59	0	0.00	0.00	0.50	0.153	28500	270	243
60	0	0.00	0.00	0.50	0.153	28500	270	243
61	0	0.00	0.00	0.50	0.153	28500	270	243
62	0	0.00	0.00	0.50	0.153	28500	270	243

	Temporary	$e_{mid,tempt}$	$e_{end,tempt}$	Strand Dia. (in)	Strand A_p (in^2)	E_p (ksi)	f_{pu} (ksi)	f_{py} (ksi)
63	0	0.00	0.00	0.50	0.153	28500	270	243
64	0	0.00	0.00	0.50	0.153	28500	270	243
65	0	0.00	0.00	0.50	0.153	28500	270	243
66	0	0.00	0.00	0.50	0.153	28500	270	243
67	0	0.00	0.00	0.50	0.153	28500	270	243
68	0	0.00	0.00	0.50	0.153	28500	270	243
69	0	0.00	0.00	0.50	0.153	28500	270	243
70	0	0.00	0.00	0.50	0.153	28500	270	243
71	0	0.00	0.00	0.50	0.153	28500	270	243
72	0	0.00	0.00	0.50	0.153	28500	270	243
73	0	0.00	0.00	0.50	0.153	28500	270	243
74	0	0.00	0.00	0.50	0.153	28500	270	243
75	0	0.00	0.00	0.50	0.153	28500	270	243
76	0	0.00	0.00	0.50	0.153	28500	270	243
77	0	0.00	0.00	0.50	0.153	28500	270	243
78	0	0.00	0.00	0.50	0.153	28500	270	243
79	0	0.00	0.00	0.50	0.153	28500	270	243
80	0	0.00	0.00	0.50	0.153	28500	270	243
81	0	0.00	0.00	0.50	0.153	28500	270	243
82	0	0.00	0.00	0.50	0.153	28500	270	243
83	2	-35.80	-35.80	0.60	0.217	28500	270	243
84	2	-35.80	-35.80	0.60	0.217	28500	270	243
85	2	-35.80	-35.80	0.60	0.217	28500	270	243
86	2	-35.80	-35.80	0.60	0.217	28500	270	243
87	2	-35.80	-35.80	0.60	0.217	28500	270	243
88	2	-35.80	-35.80	0.60	0.217	28500	270	243
89	2	-35.80	-35.80	0.60	0.217	28500	270	243
90	2	-35.80	-35.80	0.60	0.217	28500	270	243
91	6	-35.80	-35.80	0.60	0.217	28500	270	243
92	6	-35.80	-35.80	0.60	0.217	28500	270	243
93	6	-35.80	-35.80	0.60	0.217	28500	270	243
94	6	-35.80	-35.80	0.60	0.217	28500	270	243
95	6	-35.80	-35.80	0.60	0.217	28500	270	243
96	6	-41.02	-41.02	0.60	0.217	28500	270	243
97	6	-41.02	-41.02	0.60	0.217	28500	270	243
98	6	-41.02	-41.02	0.60	0.217	28500	270	243
99	6	-41.02	-41.02	0.60	0.217	28500	270	243
100	6	-41.02	-41.02	0.60	0.217	28500	270	243
101	6	-41.02	-41.02	0.60	0.217	28500	270	243
102	6	-41.02	-41.02	0.60	0.217	28500	270	243
103	6	-41.02	-41.02	0.60	0.217	28500	270	243
104	6	-41.02	-41.02	0.60	0.217	28500	270	243
105	6	-41.02	-41.02	0.60	0.217	28500	270	243
106	6	-41.02	-41.02	0.60	0.217	28500	270	243
107	6	-41.02	-41.02	0.60	0.217	28500	270	243
108	6	-41.02	-41.02	0.60	0.217	28500	270	243
109	6	-41.02	-41.02	0.60	0.217	28500	270	243
110	6	-41.02	-41.02	0.60	0.217	28500	270	243
111	6	-41.02	-41.02	0.60	0.217	28500	270	243
112	6	-41.02	-41.02	0.60	0.217	28500	270	243
113	6	-41.02	-41.02	0.60	0.217	28500	270	243
114	6	-41.02	-41.02	0.60	0.217	28500	270	243
115	6	-41.02	-41.02	0.60	0.217	28500	270	243
116	6	-41.02	-41.02	0.60	0.217	28500	270	243
117	6	-41.02	-41.02	0.60	0.217	28500	270	243
118	6	-41.02	-41.02	0.60	0.217	28500	270	243
119	6	-41.02	-41.02	0.60	0.217	28500	270	243
120	6	-41.02	-41.02	0.60	0.217	28500	270	243
121	6	-41.02	-41.02	0.60	0.217	28500	270	243
122	6	-41.02	-41.02	0.60	0.217	28500	270	243
123	6	-41.02	-41.02	0.60	0.217	28500	270	243
124	6	-32.47	-32.47	0.60	0.217	28500	270	243

	Temporary	$e_{mid,tempt}$	$e_{end,tempt}$	Strand Dia. (in)	Strand A_p (in^2)	E_p (ksi)	f_{pu} (ksi)	f_{py} (ksi)
125	6	-32.47	-32.47	0.60	0.217	28500	270	243
126	6	-32.47	-32.47	0.60	0.217	28500	270	243
127	6	-32.47	-32.47	0.60	0.217	28500	270	243
128	6	-32.47	-32.47	0.60	0.217	28500	270	243
129	6	-32.47	-32.47	0.60	0.217	28500	270	243
130	6	-32.47	-32.47	0.60	0.217	28500	270	243
131	6	-32.47	-32.47	0.60	0.217	28500	270	243
132	6	-41.02	-41.02	0.60	0.217	28500	270	243
133	6	-41.02	-41.02	0.60	0.217	28500	270	243
134	6	-41.02	-41.02	0.60	0.217	28500	270	243
135	6	-41.02	-41.02	0.60	0.217	28500	270	243
136	6	-41.02	-41.02	0.60	0.217	28500	270	243
137	6	-41.02	-41.02	0.60	0.217	28500	270	243
138	6	-41.02	-41.02	0.60	0.217	28500	270	243
139	6	-41.02	-41.02	0.60	0.217	28500	270	243
140	6	-41.02	-41.02	0.60	0.217	28500	270	243
141	6	-41.02	-41.02	0.60	0.217	28500	270	243
142	6	-41.02	-41.02	0.60	0.217	28500	270	243
143	6	-41.02	-41.02	0.60	0.217	28500	270	243
144	6	-41.02	-41.02	0.60	0.217	28500	270	243
145	6	-41.02	-41.02	0.60	0.217	28500	270	243
146	6	-41.02	-41.02	0.60	0.217	28500	270	243

				Concrete Cylinders			Design	Design	
	t_p (days)	f_{pj} (ksi)	t_i (days)	Mix	γ_c(kcf)	γ_G(kcf)	f'_{ci} (ksi	f'_c (ksi)	t_i (days)
1	0.7	203	0.6	57	0.155	0.160	7.500	8.500	0.5
2	0.7	203	0.6	57	0.155	0.160	7.500	8.500	0.5
3	0.8	203	0.6	57	0.155	0.160	7.500	8.500	0.6
4	0.8	203	0.6	57	0.155	0.160	7.500	8.500	0.6
5	3.7	203	3.5	57	0.155	0.160	7.500	8.500	3.5
6	0.9	203	0.7	57	0.155	0.160	7.500	8.500	0.7
7	0.7	203	0.6	57	0.155	0.160	7.500	8.500	0.5
8	2.7	203	2.5	57	0.155	0.160	7.500	8.500	2.5
9	0.8	203	0.6	57	0.155	0.160	7.500	8.500	0.6
10	0.7	203	0.5	57	0.155	0.160	7.500	8.500	0.5
11	0.7	203	0.6	57	0.155	0.160	7.500	8.500	0.5
12	0.8	203	0.6	57	0.155	0.160	7.500	8.500	0.6
13	2.6	203	2.5	61	0.155	0.160	7.500	8.500	2.4
14	0.8	203	0.6	57	0.155	0.160	7.500	8.500	0.6
15	0.7	203	0.6	57	0.155	0.160	7.500	8.500	0.5
16	0.8	203	0.6	57	0.155	0.160	7.500	8.500	0.6
17	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
18	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
19	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
20	2.8	203	2.6	11	0.155	0.160	6.000	7.000	2.5
21	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
22	2.8	203	2.6	11	0.155	0.160	6.000	7.000	2.5
23	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
24	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
25	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
26	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
27	2.8	203	2.7	11	0.155	0.160	6.000	7.000	2.6
28	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
29	0.8	203	0.8	10	0.155	0.160	6.000	7.000	0.7
30	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
31	2.8	203	2.5	10	0.155	0.160	6.000	7.000	2.5
32	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.7
33	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
34	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
35	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
36	2.8	203	2.5	10	0.155	0.160	6.000	7.000	2.5
37	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
38	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
39	2.8	203	2.6	10	0.155	0.160	6.000	7.000	2.5
40	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
41	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
42	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
43	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
44	2.8	203	2.6	10	0.155	0.160	6.000	7.000	2.6
45	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
46	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
47	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
48	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
49	2.8	203	2.6	11	0.155	0.160	6.000	7.000	2.6
50	0.8	203	0.7	10	0.155	0.160	6.000	7.000	0.6
51	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
52	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
53	2.8	203	2.6	10	0.155	0.160	6.000	7.000	2.5
54	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
55	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
56	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
57	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
58	2.8	203	2.6	10	0.155	0.160	6.000	7.000	2.5
59	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
60	0.8	203	0.6	10	0.155	0.160	6.000	7.000	0.6
61	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
62	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6

				Concrete Cylinders			Design	Design	
	t_p (days)	f_{pj} (ksi)	t_i (days)	Mix	γ_c(kcf)	γ_G(kcf)	f'_{ci} (ksi	f'_c (ksi)	t_i (days)
63	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
64	2.8	203	2.5	11	0.155	0.160	6.020	7.000	2.5
65	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
66	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
67	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
68	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
69	2.8	203	2.6	11	0.155	0.160	6.020	7.000	2.5
70	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
71	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.5
72	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
73	2.8	203	2.6	10	0.155	0.160	6.020	7.000	2.5
74	0.8	203	0.7	10	0.155	0.160	6.020	7.000	0.7
75	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
76	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
77	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
78	2.8	203	2.5	10	0.155	0.160	6.020	7.000	2.5
79	0.8	203	0.7	10	0.155	0.160	6.020	7.000	0.6
80	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
81	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
82	0.8	203	0.6	10	0.155	0.160	6.020	7.000	0.6
83	1.0	203	0.6	110	0.155	0.160	5.000	8.000	0.6
84	1.0	203	0.6	110	0.155	0.160	5.000	8.000	0.6
85	3.0	203	2.6	110	0.155	0.160	5.000	8.000	2.6
86	1.0	203	0.6	110	0.155	0.160	5.000	8.000	0.6
87	0.9	203	0.5	130	0.155	0.160	7.000	8.000	0.5
88	0.9	203	0.6	130	0.155	0.160	7.000	8.000	0.6
89	0.9	203	0.6	130	0.155	0.160	7.000	8.000	0.5
90	0.9	203	0.6	130	0.155	0.160	7.000	8.000	0.5
91	1.0	203	0.6	130	0.155	0.160	6.800	8.000	0.6
92	1.0	203	0.7	130	0.155	0.160	6.800	8.000	0.6
93	0.9	203	0.6	130	0.155	0.160	6.800	8.000	0.6
94	3.0	203	2.7	130	0.155	0.160	6.800	8.000	2.6
95	0.9	203	0.6	130	0.155	0.160	6.800	8.000	0.6
96	2.3	203	1.9	860	0.155	0.160	7.950	10.000	1.9
97	1.3	203	1.0	860	0.155	0.160	7.950	10.000	1.0
98	4.1	203	3.8	860	0.155	0.160	7.950	10.000	3.8
99	2.1	203	1.7	860	0.155	0.160	7.950	10.000	1.7
100	3.2	203	2.8	860	0.155	0.160	7.950	10.000	2.8
101	1.4	203	1.1	860	0.155	0.160	7.950	10.000	1.0
102	1.4	203	1.1	860	0.155	0.160	7.950	10.000	1.1
103	2.4	203	2.1	860	0.155	0.160	7.950	10.000	2.0
104	0.9	203	0.6	860	0.155	0.160	7.950	10.000	0.5
105	3.3	203	3.0	860	0.155	0.160	7.950	10.000	2.9
106	1.3	203	1.0	860	0.155	0.160	7.950	10.000	1.0
107	1.3	203	0.9	860	0.155	0.160	7.950	10.000	0.9
108	1.3	203	1.0	860	0.155	0.160	7.950	10.000	0.9
109	1.3	203	1.0	860	0.155	0.160	8.000	10.000	1.0
110	1.3	203	1.0	860	0.155	0.160	8.000	10.000	1.0
111	1.3	203	1.0	860	0.155	0.160	8.000	10.000	0.9
112	1.3	203	1.0	860	0.155	0.160	8.000	10.000	0.9
113	2.3	203	1.9	860	0.155	0.160	8.000	10.000	1.9
114	3.0	203	2.7	860	0.155	0.160	8.000	10.000	2.7
115	1.2	203	0.9	860	0.155	0.160	8.000	10.000	0.9
116	1.3	203	0.9	860	0.155	0.160	8.000	10.000	0.9
117	1.4	203	1.0	860	0.155	0.160	8.000	10.000	1.0
118	3.2	203	2.9	860	0.155	0.160	8.000	10.000	2.9
119	1.3	203	1.0	860	0.155	0.160	8.000	10.000	1.0
120	1.4	203	1.0	860	0.155	0.160	8.000	10.000	1.0
121	1.3	203	0.9	860	0.155	0.160	8.050	10.000	0.9
122	4.4	203	4.1	860	0.155	0.160	8.050	10.000	4.0
123	1.3	203	0.9	860	0.155	0.160	8.050	10.000	0.9
124	4.0	203	3.5	130	0.155	0.160	7.000	8.000	3.5

				Concrete Cylinders			Design	Design	
	t_p (days)	f_{pj} (ksi)	t_i (days)	Mix	γ_c(kcf)	γ_G(kcf)	f'_{ci} (ksi	f'_c (ksi)	t_i (days)
125	1.0	203	0.6	130	0.155	0.160	7.000	8.000	0.6
126	2.9	203	2.6	130	0.155	0.160	7.000	8.000	2.6
127	0.9	203	0.6	130	0.155	0.160	7.000	8.000	0.6
128	1.3	203	0.5	190	0.155	0.160	7.500	8.500	0.5
129	1.0	203	0.6	140	0.155	0.160	7.500	8.500	0.6
130	1.5	203	0.9	130	0.155	0.160	7.500	8.500	0.9
131	1.8	203	1.5	140	0.155	0.160	7.500	8.500	1.5
132	1.3	203	1.0	345860	0.155	0.160	7.700	9.000	0.9
133	1.2	203	0.8	345860	0.155	0.160	7.700	9.000	0.8
134	1.1	203	0.8	345860	0.155	0.160	7.700	9.000	0.7
135	3.1	203	2.7	345860	0.155	0.160	7.700	9.000	2.7
136	1.2	203	0.9	345860	0.155	0.160	7.700	9.000	0.8
137	1.2	203	0.9	345860	0.155	0.160	7.700	9.000	0.9
138	1.1	203	0.8	345860	0.155	0.160	7.700	9.000	0.8
139	1.2	203	0.8	345860	0.155	0.160	7.800	9.000	0.8
140	3.5	203	3.1	345860	0.155	0.160	7.800	9.000	3.1
141	1.2	203	0.9	345860	0.155	0.160	7.800	9.000	0.9
142	1.1	203	0.8	345860	0.155	0.160	7.800	9.000	0.8
143	1.2	203	0.9	345860	0.155	0.160	7.800	9.000	0.9
144	1.1	203	0.8	345860	0.155	0.160	7.800	9.000	0.7
145	3.0	203	2.6	345860	0.155	0.160	7.800	9.000	2.6
146	1.3	203	0.9	345860	0.155	0.160	7.800	9.000	0.9

							Measured Camber			
	Maturity(%)	f_{ci} (ksi)	t_2 (days)	f_{c2} (ksi)	t_3 (days)	f_{c3} (ksi)	t_i (days)	Δ_i (in)	t_2 (days)	Δ_2 (in)
1	1529.1	9.050	7	11.270	28	12.580	0.6	2.52	156	3.72
2	1462.3	8.515	7	10.835	28	12.310	0.6	3.36	155	4.56
3	1679.1	8.915	7	10.640	28	12.405	0.7	2.76	154	3.72
4	1628.2	8.800	7	10.355	28	11.920	0.7	2.88	153	3.84
5	7302.0	10.395	7	10.855	28	12.930	3.5	2.28	152	3.24
6	1759.2	8.665	0	0.000	28	11.650	0.8	2.16	148	3.24
7	1567.5	7.755	7	9.420	28	10.995	0.6	2.88	146	3.72
8	8779.4	9.060	7	9.085	28	10.935	2.5	1.92	145	3.12
9	1628.9	8.515	7	9.930	28	11.720	0.7	2.76	142	3.48
10	1367.2	7.975	7	9.800	28	11.380	0.6	2.76	141	4.20
11	1492.5	8.000	7	9.565	28	11.430	0.6	3.00	140	3.96
12	1757.5	8.635	7	9.630	28	11.220	0.7	2.76	139	3.72
13	8728.6	8.765	7	8.820	28	9.945	2.5	2.16	138	3.24
14	1719.5	8.355	7	10.280	28	11.185	0.7	2.76	135	3.72
15	1469.4	7.670	7	10.015	28	11.325	0.6	3.12	134	3.96
16	1759.2	8.055	7	9.720	28	11.380	0.7	2.76	133	3.60
17	1928.0	7.445	0	0.000	28	10.860	0.7	0.12	115	0.24
18	1806.0	7.145	0	0.000	28	11.050	0.7	0.12	114	0.24
19	1792.0	6.765	0	0.000	28	10.760	0.7	0.12	113	0.48
20	7221.0	8.590	0	0.000	28	10.390	2.6	0.12	112	0.36
21	1659.0	6.475	0	0.000	28	10.470	0.7	0.24	109	0.36
22	7364.0	7.195	0	0.000	28	10.050	2.6	0.12	367	0.24
23	2057.0	6.840	0	0.000	28	10.656	0.7	0.12	364	0.60
24	2055.0	6.885	0	0.000	28	10.520	0.7	0.48	363	0.48
25	2022.0	6.160	0	0.000	28	10.235	0.7	0.12	362	0.36
26	2025.0	6.695	0	0.000	28	10.915	0.7	0.24	361	0.36
27	7528.0	7.275	0	0.000	28	9.985	2.7	0.12	360	0.48
28	1808.0	6.770	0	0.000	28	11.435	0.7	0.36	108	0.60
29	2041.0	6.085	0	0.000	28	9.430	0.8	0.36	107	0.84
30	1604.0	6.145	0	0.000	28	9.340	0.7	0.48	106	0.96
31	7144.0	7.550	0	0.000	28	9.410	2.6	0.36	105	0.96
32	2055.0	6.230	0	0.000	28	8.970	0.8	0.48	102	0.84
33	1816.0	6.785	0	0.000	28	10.790	0.7	0.36	427	0.48
34	1985.0	7.480	0	0.000	28	11.530	0.7	0.36	426	0.96
35	1884.0	6.445	0	0.000	28	10.070	0.7	0.24	425	1.08
36	7142.0	8.455	0	0.000	28	10.575	2.6	0.24	424	0.84
37	1938.0	7.220	0	0.000	28	10.830	0.7	0.48	421	0.84
38	1639.0	6.320	0	0.000	28	10.035	0.7	0.36	420	0.84
39	7292.0	7.980	0	0.000	28	10.195	2.6	0.84	417	1.56
40	1959.0	6.675	0	0.000	28	10.535	0.7	0.84	414	1.68
41	1964.0	6.685	0	0.000	28	10.525	0.7	0.84	413	2.04
42	1810.0	6.890	0	0.000	28	10.040	0.6	1.08	86	1.56
43	1927.0	6.820	0	0.000	28	11.005	0.7	0.84	85	1.92
44	7431.0	8.265	0	0.000	28	10.570	2.7	0.84	84	1.32
45	2018.0	7.145	0	0.000	28	11.175	0.7	0.84	407	1.68
46	1785.0	6.125	0	0.000	28	10.235	0.6	0.48	406	1.92
47	1939.0	6.710	0	0.000	28	10.610	0.7	0.96	79	1.56
48	1930.0	6.500	0	0.000	28	10.370	0.7	1.08	78	1.80
49	7367.0	7.150	0	0.000	28	9.105	2.6	0.96	403	1.80
50	1848.0	6.610	0	0.000	28	10.765	0.7	1.92	399	3.24
51	1978.0	6.425	0	0.000	28	10.365	0.7	2.04	72	3.24
52	1965.0	6.405	0	0.000	28	10.275	0.7	1.92	71	3.00
53	7324.0	8.065	0	0.000	28	10.290	2.6	1.68	396	2.76
54	2006.0	6.515	0	0.000	28	10.510	0.7	2.16	67	3.00
55	1989.0	7.035	0	0.000	28	10.425	0.7	1.92	66	3.12
56	1906.0	6.395	0	0.000	28	10.580	0.7	2.16	390	3.96
57	1982.0	6.485	0	0.000	28	10.320	0.7	2.04	389	4.20
58	7269.0	7.770	0	0.000	28	10.540	2.6	1.80	388	3.24
59	1980.0	6.600	0	0.000	28	10.525	0.7	1.80	385	3.84
60	2021.0	6.630	0	0.000	28	10.660	0.7	1.80	59	3.24
61	1862.0	6.570	0	0.000	28	10.455	0.6	2.28	129	3.72
62	2003.0	6.665	0	0.000	28	10.530	0.7	2.40	128	3.60

							Measured Camber			
	Maturity(%)	f_{ci} (ksi)	t_2 (days)	f_{c2} (ksi)	t_3 (days)	f_{c3} (ksi)	t_i (days)	Δ_i (in)	t_2 (days)	Δ_2 (in)
63	1930.0	7.900	0	0.000	28	11.260	0.7	2.28	127	3.36
64	7256.0	8.435	0	0.000	28	10.555	2.6	2.04	126	3.12
65	1969.0	7.045	0	0.000	28	11.260	0.7	2.16	123	3.36
66	1878.0	7.345	0	0.000	28	10.955	0.7	2.16	122	3.48
67	1979.0	7.345	0	0.000	28	10.910	0.7	1.80	121	3.84
68	2010.0	7.295	0	0.000	28	10.935	0.7	1.92	120	3.24
69	7353.0	8.200	0	0.000	28	10.290	2.6	2.04	119	2.64
70	2028.0	7.025	0	0.000	28	10.995	0.7	2.16	116	3.36
71	1733.0	6.590	0	0.000	28	10.240	0.6	2.76	384	4.20
72	1856.0	6.515	0	0.000	28	10.405	0.7	2.76	383	4.56
73	7344.0	7.865	0	0.000	28	10.130	2.6	2.04	382	3.36
74	1928.0	6.445	0	0.000	28	10.360	0.8	2.40	379	4.20
75	1982.0	6.295	0	0.000	28	10.405	0.7	2.52	378	4.32
76	1959.0	6.555	0	0.000	28	9.965	0.7	2.40	377	4.20
77	1963.0	6.430	0	0.000	28	10.665	0.7	2.64	376	4.44
78	7285.0	8.020	0	0.000	28	10.720	2.6	2.04	375	3.24
79	2031.0	7.015	0	0.000	28	11.025	0.7	2.40	372	3.84
80	1984.0	6.830	0	0.000	28	10.580	0.7	2.16	371	4.08
81	1899.0	6.820	0	0.000	28	11.060	0.7	2.40	370	4.08
82	1978.0	6.445	0	0.000	28	10.760	0.7	2.64	369	4.08
83	1706.7	5.440	14	7.510	28	8.325	0.7	0.75	58	1.00
84	1754.3	6.835	14	8.185	28	9.415	0.7	0.69	57	1.00
85	7165.7	9.190	14	9.385	28	9.725	2.7	0.75	56	1.00
86	1708.6	7.765	14	9.950	28	10.220	0.7	0.75	58	1.00
87	1617.8	8.755	14	10.540	28	10.980	0.6	1.50	60	1.63
88	1658.3	8.170	14	10.090	28	11.180	0.7	1.25	59	1.63
89	1631.9	8.070	14	9.860	28	10.760	0.6	1.00	58	1.50
90	1628.0	7.975	14	10.105	28	11.015	0.6	1.38	57	1.81
91	1608.2	7.445	14	9.410	28	10.475	0.7	1.50	60	1.63
92	1759.2	8.225	14	9.555	28	10.470	0.7	1.19	56	1.50
93	1659.7	7.070	0	0.000	28	10.185	0.6	1.50	59	1.50
94	6469.3	9.275	14	9.705	28	9.660	2.7	1.13	57	1.31
95	1613.4	7.885	14	10.000	28	10.775	0.6	1.38	60	1.75
96	0.0	8.422	0	0.000	28	10.666	2.0	3.12	32	4.00
97	0.0	8.233	0	0.000	28	10.433	1.0	3.44	29	4.12
98	0.0	8.233	0	0.000	28	10.854	3.8	3.88	83	4.67
99	0.0	9.498	0	0.000	28	11.797	1.8	3.82	38	4.37
100	0.0	8.680	0	0.000	28	10.535	2.9	3.31	25	3.87
101	0.0	8.010	0	0.000	28	11.806	1.1	3.12	23	4.00
102	0.0	8.015	0	0.000	28	10.113	1.2	4.07	21	4.50
103	0.0	8.726	0	0.000	28	11.135	2.1	3.94	27	4.25
104	0.0	8.097	0	0.000	28	11.313	0.6	3.63	23	4.12
105	0.0	8.596	0	0.000	28	10.999	3.0	3.44	19	3.93
106	0.0	8.423	0	0.000	28	11.209	1.0	3.38	15	3.78
107	0.0	8.350	0	0.000	28	10.830	1.0	3.38	13	3.72
108	0.0	8.357	0	0.000	28	11.100	1.0	2.75	8	3.51
109	0.0	8.458	0	0.000	28	10.759	1.0	3.50	28	4.12
110	0.0	8.158	0	0.000	28	11.096	1.0	3.00	23	3.75
111	0.0	7.998	0	0.000	28	10.181	1.0	3.12	22	3.87
112	0.0	8.725	0	0.000	28	10.308	1.0	3.50	20	4.12
113	0.0	9.380	0	0.000	28	10.162	2.0	3.38	18	4.00
114	0.0	8.784	0	0.000	28	10.240	2.8	3.56	12	4.25
115	0.0	8.205	0	0.000	28	11.730	0.9	3.62	43	3.93
116	0.0	7.900	0	0.000	28	11.510	1.0	3.65	41	4.12
117	0.0	7.938	0	0.000	28	11.148	1.1	3.56	36	4.18
118	0.0	10.340	0	0.000	28	12.334	2.9	3.25	33	3.68
119	0.0	7.965	0	0.000	28	10.445	1.0	3.12	29	3.76
120	0.0	8.192	0	0.000	28	10.133	1.1	3.63	22	4.36
121	0.0	8.275	0	0.000	28	10.505	1.0	3.25	57	3.75
122	0.0	8.120	0	0.000	28	11.271	4.1	3.69	55	4.12
123	0.0	8.322	0	0.000	28	10.549	1.0	4.38	50	4.50
124	7156.7	9.090	14	10.370	28	10.650	3.6	1.13	56	1.87

							Measured Camber			
	Maturity(%)	f_{ci} (ksi)	t_2 (days)	f_{c2} (ksi)	t_3 (days)	f_{c3} (ksi)	t_i (days)	Δ_i (in)	t_2 (days)	Δ_2 (in)
125	1780.6	7.520	14	9.450	28	9.849	0.7	1.68	57	2.15
126	7063.2	8.295	14	9.295	28	9.825	2.7	1.04	49	1.57
127	1625.5	8.645	14	10.110	28	10.810	0.7	1.58	46	2.22
128	1531.5	8.540	14	10.605	28	11.310	0.6	1.78	50	2.15
129	1795.4	7.610	14	9.025	28	9.795	0.7	1.92	58	2.51
130	2628.8	8.855	14	9.260	28	10.250	1.0	2.36	60	2.95
131	2470.3	8.615	14	8.350	28	9.875	1.6	1.80	52	2.56
132	0.0	8.328	0	0.000	28	11.170	1.0	3.62	147	5.00
133	0.0	8.049	0	0.000	28	10.654	0.9	3.50	145	5.50
134	0.0	8.496	0	0.000	28	11.045	0.8	3.50	141	4.62
135	0.0	9.425	0	0.000	28	11.102	2.8	3.50	137	4.25
136	0.0	8.235	0	0.000	28	10.365	0.9	3.37	133	4.75
137	0.0	8.551	0	0.000	28	10.617	0.9	3.25	131	5.25
138	0.0	8.120	0	0.000	28	11.167	0.9	3.50	127	4.75
139	0.0	7.912	0	0.000	28	11.538	0.9	3.75	125	5.25
140	0.0	8.962	0	0.000	28	11.684	3.2	3.57	123	4.32
141	0.0	7.961	0	0.000	28	9.880	0.9	3.62	119	5.12
142	0.0	8.168	0	0.000	28	10.178	0.9	3.32	117	4.37
143	0.0	8.145	0	0.000	28	10.644	0.9	3.26	113	4.37
144	0.0	7.930	0	0.000	28	11.661	0.8	3.50	111	4.87
145	0.0	9.167	0	0.000	28	10.054	2.7	3.75	109	4.25
146	0.0	8.101	0	0.000	28	9.886	1.0	3.75	105	5.12

	t_{Conc} (days)	t_{Shr} (days)	t_2 (days)	t_3 (days)	t_4 (days)	t_5 (days)	t_6 (days)	DL (klf)
1	0.208	0.208	0.7	163.0	164.0	0.0	600.0	0.000
2	0.208	0.208	0.7	162.0	163.0	0.0	600.0	0.000
3	0.208	0.208	0.7	161.0	162.0	0.0	600.0	0.000
4	0.208	0.208	0.7	160.0	161.0	0.0	600.0	0.000
5	0.208	0.208	3.6	159.0	160.0	0.0	600.0	0.000
6	0.208	0.208	0.8	155.0	156.0	0.0	600.0	0.000
7	0.208	0.208	0.7	153.0	154.0	0.0	600.0	0.000
8	0.208	0.208	2.6	152.0	153.0	0.0	600.0	0.000
9	0.208	0.208	0.7	149.0	150.0	0.0	600.0	0.000
10	0.208	0.208	0.6	148.0	149.0	0.0	600.0	0.000
11	0.208	0.208	0.6	147.0	148.0	0.0	600.0	0.000
12	0.208	0.208	0.7	146.0	147.0	0.0	600.0	0.000
13	0.208	0.208	2.5	145.0	146.0	0.0	600.0	0.000
14	0.208	0.208	0.7	142.0	143.0	0.0	600.0	0.000
15	0.208	0.208	0.6	141.0	142.0	0.0	600.0	0.000
16	0.208	0.208	0.7	140.0	141.0	0.0	600.0	0.000
17	0.208	0.208	0.7	122.0	123.0	0.0	600.0	0.000
18	0.208	0.208	0.7	121.0	122.0	0.0	600.0	0.000
19	0.208	0.208	0.7	120.0	121.0	0.0	600.0	0.000
20	0.208	0.208	2.6	119.0	120.0	0.0	600.0	0.000
21	0.208	0.208	0.7	116.0	117.0	0.0	600.0	0.000
22	0.208	0.208	2.6	374.0	375.0	0.0	600.0	0.000
23	0.208	0.208	0.7	371.0	372.0	0.0	600.0	0.000
24	0.208	0.208	0.7	370.0	371.0	0.0	600.0	0.000
25	0.208	0.208	0.7	369.0	370.0	0.0	600.0	0.000
26	0.208	0.208	0.7	368.0	369.0	0.0	600.0	0.000
27	0.208	0.208	2.7	367.0	368.0	0.0	600.0	0.000
28	0.208	0.208	0.7	115.0	116.0	0.0	600.0	0.000
29	0.208	0.208	0.8	114.0	115.0	0.0	600.0	0.000
30	0.208	0.208	0.8	113.0	114.0	0.0	600.0	0.000
31	0.208	0.208	2.6	112.0	113.0	0.0	600.0	0.000
32	0.208	0.208	0.8	109.0	110.0	0.0	600.0	0.000
33	0.208	0.208	0.7	434.0	435.0	0.0	600.0	0.000
34	0.208	0.208	0.7	433.0	434.0	0.0	600.0	0.000
35	0.208	0.208	0.7	432.0	433.0	0.0	600.0	0.000
36	0.208	0.208	2.6	431.0	432.0	0.0	600.0	0.000
37	0.208	0.208	0.7	428.0	429.0	0.0	600.0	0.000
38	0.208	0.208	0.7	427.0	428.0	0.0	600.0	0.000
39	0.208	0.208	2.6	424.0	425.0	0.0	600.0	0.000
40	0.208	0.208	0.7	421.0	422.0	0.0	600.0	0.000
41	0.208	0.208	0.7	420.0	421.0	0.0	600.0	0.000
42	0.208	0.208	0.7	93.0	94.0	0.0	600.0	0.000
43	0.208	0.208	0.7	92.0	93.0	0.0	600.0	0.000
44	0.208	0.208	2.7	91.0	92.0	0.0	600.0	0.000
45	0.208	0.208	0.7	414.0	415.0	0.0	600.0	0.000
46	0.208	0.208	0.7	413.0	414.0	0.0	600.0	0.000
47	0.208	0.208	0.7	86.0	87.0	0.0	600.0	0.000
48	0.208	0.208	0.7	85.0	86.0	0.0	600.0	0.000
49	0.208	0.208	2.7	410.0	411.0	0.0	600.0	0.000
50	0.208	0.208	0.7	406.0	407.0	0.0	600.0	0.000
51	0.208	0.208	0.7	79.0	80.0	0.0	600.0	0.000
52	0.208	0.208	0.7	78.0	79.0	0.0	600.0	0.000
53	0.208	0.208	2.7	403.0	404.0	0.0	600.0	0.000
54	0.208	0.208	0.7	74.0	75.0	0.0	600.0	0.000
55	0.208	0.208	0.7	73.0	74.0	0.0	600.0	0.000
56	0.208	0.208	0.7	397.0	398.0	0.0	600.0	0.000
57	0.208	0.208	0.7	396.0	397.0	0.0	600.0	0.000
58	0.208	0.208	2.6	395.0	396.0	0.0	600.0	0.000
59	0.208	0.208	0.7	392.0	393.0	0.0	600.0	0.000
60	0.208	0.208	0.7	66.0	67.0	0.0	600.0	0.000
61	0.208	0.208	0.7	136.0	137.0	0.0	600.0	0.000
62	0.208	0.208	0.7	135.0	136.0	0.0	600.0	0.000

	t_{Conc} (days)	t_{Shr} (days)	t_2 (days)	t_3 (days)	t_4 (days)	t_5 (days)	t_6 (days)	DL (klf)
63	0.208	0.208	0.7	134.0	135.0	0.0	600.0	0.000
64	0.208	0.208	2.6	133.0	134.0	0.0	600.0	0.000
65	0.208	0.208	0.7	130.0	131.0	0.0	600.0	0.000
66	0.208	0.208	0.7	129.0	130.0	0.0	600.0	0.000
67	0.208	0.208	0.7	128.0	129.0	0.0	600.0	0.000
68	0.208	0.208	0.7	127.0	128.0	0.0	600.0	0.000
69	0.208	0.208	2.6	126.0	127.0	0.0	600.0	0.000
70	0.208	0.208	0.7	123.0	124.0	0.0	600.0	0.000
71	0.208	0.208	0.7	391.0	392.0	0.0	600.0	0.000
72	0.208	0.208	0.7	390.0	391.0	0.0	600.0	0.000
73	0.208	0.208	2.7	389.0	390.0	0.0	600.0	0.000
74	0.208	0.208	0.8	386.0	387.0	0.0	600.0	0.000
75	0.208	0.208	0.7	385.0	386.0	0.0	600.0	0.000
76	0.208	0.208	0.7	384.0	385.0	0.0	600.0	0.000
77	0.208	0.208	0.7	383.0	384.0	0.0	600.0	0.000
78	0.208	0.208	2.6	382.0	383.0	0.0	600.0	0.000
79	0.208	0.208	0.7	379.0	380.0	0.0	600.0	0.000
80	0.208	0.208	0.7	378.0	379.0	0.0	600.0	0.000
81	0.208	0.208	0.7	377.0	378.0	0.0	600.0	0.000
82	0.208	0.208	0.7	376.0	377.0	0.0	600.0	0.000
83	0.208	0.208	0.7	65.0	66.0	67.0	600.0	0.000
84	0.208	0.208	0.7	64.0	65.0	66.0	600.0	0.000
85	0.208	0.208	2.7	63.0	64.0	65.0	600.0	0.000
86	0.208	0.208	0.7	65.0	66.0	67.0	600.0	0.000
87	0.208	0.208	0.6	67.0	68.0	69.0	600.0	0.000
88	0.208	0.208	0.7	66.0	67.0	68.0	600.0	0.000
89	0.208	0.208	0.7	65.0	66.0	67.0	600.0	0.000
90	0.208	0.208	0.7	64.0	65.0	66.0	600.0	0.000
91	0.208	0.208	0.7	67.0	68.0	69.0	600.0	0.000
92	0.208	0.208	0.7	63.0	64.0	65.0	600.0	0.000
93	0.208	0.208	0.7	66.0	67.0	68.0	600.0	0.000
94	0.208	0.208	2.7	64.0	65.0	66.0	600.0	0.000
95	0.208	0.208	0.7	67.0	68.0	69.0	600.0	0.000
96	0.208	0.208	2.0	40.0	41.0	42.0	600.0	0.000
97	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
98	0.208	0.208	3.9	90.2	91.2	92.2	600.0	0.000
99	0.208	0.208	1.8	40.0	41.0	42.0	600.0	0.000
100	0.208	0.208	2.9	40.0	41.0	42.0	600.0	0.000
101	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
102	0.208	0.208	1.2	40.0	41.0	42.0	600.0	0.000
103	0.208	0.208	2.2	40.0	41.0	42.0	600.0	0.000
104	0.208	0.208	0.6	40.0	41.0	42.0	600.0	0.000
105	0.208	0.208	3.0	40.0	41.0	42.0	600.0	0.000
106	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
107	0.208	0.208	1.0	40.0	41.0	42.0	600.0	0.000
108	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
109	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
110	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
111	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
112	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
113	0.208	0.208	2.0	40.0	41.0	42.0	600.0	0.000
114	0.208	0.208	2.8	40.0	41.0	42.0	600.0	0.000
115	0.208	0.208	1.0	50.0	51.0	52.0	600.0	0.000
116	0.208	0.208	1.0	48.0	49.0	50.0	600.0	0.000
117	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
118	0.208	0.208	3.0	40.0	41.0	42.0	600.0	0.000
119	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
120	0.208	0.208	1.1	40.0	41.0	42.0	600.0	0.000
121	0.208	0.208	1.0	64.0	65.0	66.0	600.0	0.000
122	0.208	0.208	4.2	62.0	63.0	64.0	600.0	0.000
123	0.208	0.208	1.0	57.0	58.0	59.0	600.0	0.000
124	0.208	0.208	3.6	62.8	63.8	64.8	600.0	0.000

	t_{Conc} (days)	t_{Shr} (days)	t_2 (days)	t_3 (days)	t_4 (days)	t_5 (days)	t_6 (days)	DL (klf)
125	0.208	0.208	0.7	63.8	64.8	65.8	600.0	0.000
126	0.208	0.208	2.7	55.9	56.9	57.9	600.0	0.000
127	0.208	0.208	0.7	52.8	53.8	54.8	600.0	0.000
128	0.208	0.208	0.6	56.8	57.8	58.8	600.0	0.000
129	0.208	0.208	0.7	64.8	65.8	66.8	600.0	0.000
130	0.208	0.208	1.0	66.8	67.8	68.8	600.0	0.000
131	0.208	0.208	1.6	58.8	59.8	60.8	600.0	0.000
132	0.208	0.208	1.0	154.0	155.0	156.0	600.0	0.000
133	0.208	0.208	0.9	152.0	153.0	154.0	600.0	0.000
134	0.208	0.208	0.9	148.0	149.0	150.0	600.0	0.000
135	0.208	0.208	2.8	144.0	145.0	146.0	600.0	0.000
136	0.208	0.208	1.0	140.0	141.0	142.0	600.0	0.000
137	0.208	0.208	1.0	138.0	139.0	140.0	600.0	0.000
138	0.208	0.208	0.9	134.0	135.0	136.0	600.0	0.000
139	0.208	0.208	0.9	132.0	133.0	134.0	600.0	0.000
140	0.208	0.208	3.2	130.0	131.0	132.0	600.0	0.000
141	0.208	0.208	1.0	126.0	127.0	128.0	600.0	0.000
142	0.208	0.208	0.9	124.0	125.0	126.0	600.0	0.000
143	0.208	0.208	1.0	120.0	121.0	122.0	600.0	0.000
144	0.208	0.208	0.9	118.0	119.0	120.0	600.0	0.000
145	0.208	0.208	2.7	116.0	117.0	118.0	600.0	0.000
146	0.208	0.208	1.0	112.0	113.0	114.0	600.0	0.000

	Comments
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100	0
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103	0
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106	0
107	0
108	0
109	0
110	Shipping Cylinder strengths only provided. Do not know when shipping was. Assumed 28 days
111	Shipping Cylinder strengths only provided. Do not know when shipping was. Assumed 28 days
112	Shipping Cylinder strengths only provided. Do not know when shipping was. Assumed 28 days
113	Shipping Cylinder strengths only provided. Do not know when shipping was. Assumed 28 days
114	0
115	0
116	0
117	0
118	0
119	0
120	0
121	0
122	0
123	0
124	0

	Comments
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126	0
127	0
128	0
129	0
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132	0
133	0
134	0
135	0
136	0
137	0
138	0
139	0
140	0
141	0
142	0
143	0
144	0
145	0
146	0

APPENDIX B

SNAKE LAKE CAMBER MEASUREMENTS

Cast Date = 8/29/05 2:30 PM
Release Date = 8/30/05 11:00 AM

G4A

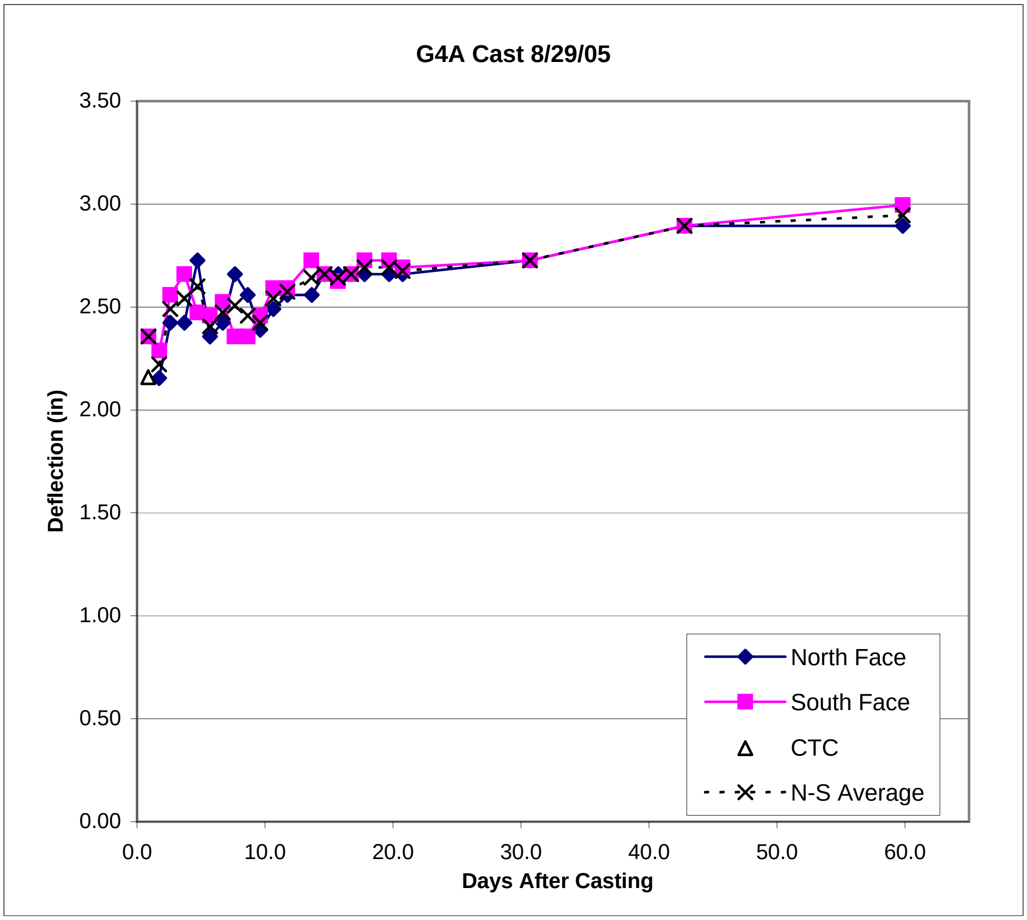
North Face Date	Time	(in.) East Elev	(in.) West Elev	(in.) Midspan	(days) Age	(in.) E-W Ave	(in.) Camber	1.077 *Camber
8/30/05	▨	▨	▨	▨	#N/A	0.000	#N/A	#N/A
8/31/05	8:00 AM	35 1/4	33 3/4	32 1/2	1.7	34.500	2.000	2.154
9/1/05	5:11 AM	30 3/4	29 1/4	27 3/4	2.6	30.000	2.250	2.423
9/2/05	7:10 AM	34 3/16	32 7/16	31 1/16	3.7	33.313	2.250	2.423
9/3/05	8:00 AM	28 9/16	27 1/8	25 5/16	4.7	27.844	2.531	2.726
9/4/05	7:20 AM	29 1/8	27 1/2	26 1/8	5.7	28.313	2.188	2.356
9/5/05	7:05 AM	30 7/8	29 1/4	27 13/16	6.7	30.063	2.250	2.423
9/6/05	6:00 AM	21 13/16	19 7/8	18 3/8	7.6	20.844	2.469	2.659
9/7/05	6:05 AM	32	30 5/8	28 15/16	8.6	31.313	2.375	2.558
9/8/05	5:35 AM	34 3/8	32 11/16	31 5/16	9.6	33.531	2.219	2.390
9/9/05	6:15 AM	34 5/16	32 9/16	31 1/8	10.7	33.438	2.313	2.491
9/10/05	8:30 AM	24 29/32	23 15/32	21 13/16	11.8	24.188	2.375	2.558
9/12/05	6:15 AM	34 13/16	33 5/16	31 11/16	13.7	34.063	2.375	2.558
9/13/05	6:00 AM	30 11/16	29 1/4	27 1/2	14.6	29.969	2.469	2.659
9/14/05	7:40 AM	24 13/16	23 1/8	22 1/16	15.7	23.969	2.469	2.659
9/15/05	8:00 AM	27	25 5/16	23 11/16	16.7	26.156	2.469	2.659
9/16/05	9:21 AM	22 3/16	20 3/8	18 13/16	17.8	21.281	2.469	2.659
9/18/05	7:12 AM	27 15/16	26 1/2	24 3/4	19.7	27.219	2.469	2.659
9/19/05	8:31 AM	24 1/8	22 7/16	20 13/16	20.8	23.281	2.469	2.659
9/29/05	7:10 AM	34 3/8	32 7/16	30 7/8	30.7	33.406	2.531	2.726
10/11/05	9:15 AM	19 9/16	17 13/16	16	42.8	18.688	2.688	2.894
10/28/05	10:17 AM	29 7/16	27 11/16	25 7/8	59.8	28.563	2.688	2.894

South Face Date	Time	(in.) East Elev	(in.) West Elev	(in.) Midspan	(days) Age	(in.) E-W Ave	(in.) Camber	*Camber
8/30/05	12:00 PM	26 5/16	25 1/16	23 1/2	0.9	25.688	2.188	2.356
8/31/05	8:15 AM	31 3/4	30 1/2	29	1.7	31.125	2.125	2.289
9/1/05	5:11 AM	30 3/8	29 1/8	27 3/8	2.6	29.750	2.375	2.558
9/2/05	7:05 AM	33 3/4	31 15/16	30 3/8	3.7	32.844	2.469	2.659
9/3/05	8:00 AM	20 9/32	19 1/16	17 3/8	4.7	19.672	2.297	2.474
9/4/05	7:10 AM	30 11/16	29 3/8	27 3/4	5.7	30.031	2.281	2.457
9/5/05	7:00 AM	31 11/16	30 1/4	28 5/8	6.7	30.969	2.344	2.524
9/6/05	5:38 AM	20 7/8	19 1/4	17 7/8	7.6	20.063	2.188	2.356
9/7/05	6:00 AM	32 1/2	31	29 9/16	8.6	31.750	2.188	2.356
9/8/05	5:27 AM	34 3/16	32 3/4	31 3/16	9.6	33.469	2.281	2.457
9/9/05	6:10 AM	35 5/16	33 7/8	32 3/16	10.7	34.594	2.406	2.592
9/10/05	8:30 AM	24 11/16	23 1/2	21 11/16	11.8	24.094	2.406	2.592
9/12/05	5:15 AM	29 5/8	28 5/16	26 7/16	13.6	28.969	2.531	2.726
9/13/05	5:50 AM	32 1/16	30 3/4	28 15/16	14.6	31.406	2.469	2.659
9/14/05	7:30 AM	24 1/8	23	21 1/8	15.7	23.563	2.438	2.625
9/15/05	8:00 AM	28 9/16	27	25 5/16	16.7	27.781	2.469	2.659
9/16/05	9:11 AM	23	21 9/16	19 3/4	17.8	22.281	2.531	2.726
9/18/05	7:08 AM	27 1/2	26 3/16	24 5/16	19.7	26.844	2.531	2.726
9/19/05	8:26 AM	22 13/16	21 5/16	19 9/16	20.7	22.063	2.500	2.693
9/29/05	7:07 AM	34 1/8	32 13/16	30 15/16	30.7	33.469	2.531	2.726
10/11/05	9:18 AM	18 1/2	16 7/8	15	42.8	17.688	2.688	2.894
10/28/05	10:13 AM	29 11/16	28 1/8	26 1/8	59.8	28.906	2.781	2.995

CTC Camber Measurements

Date	Time	(ft) Camber	(in.) Camber	(days) Age
8/30/05	11:13 AM	0.18	2.16	0.9

Initial Camber (in.) = 2.356
Age at Release (days) = 0.9
Ultimate Camber (in.) = 2.945
Creep Camber (in.) = 0.588
Creep Coef. = 0.25



Adjusted 9/13 South Face from 31 3/4 to 30 3/4.

For the camber on 9/14 north face, took the average of the previous and next day due to a measuring error.

Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

G3A

Cast Date =	8/31/05	4:20 PM
Release Date =	9/1/05	6:00 AM

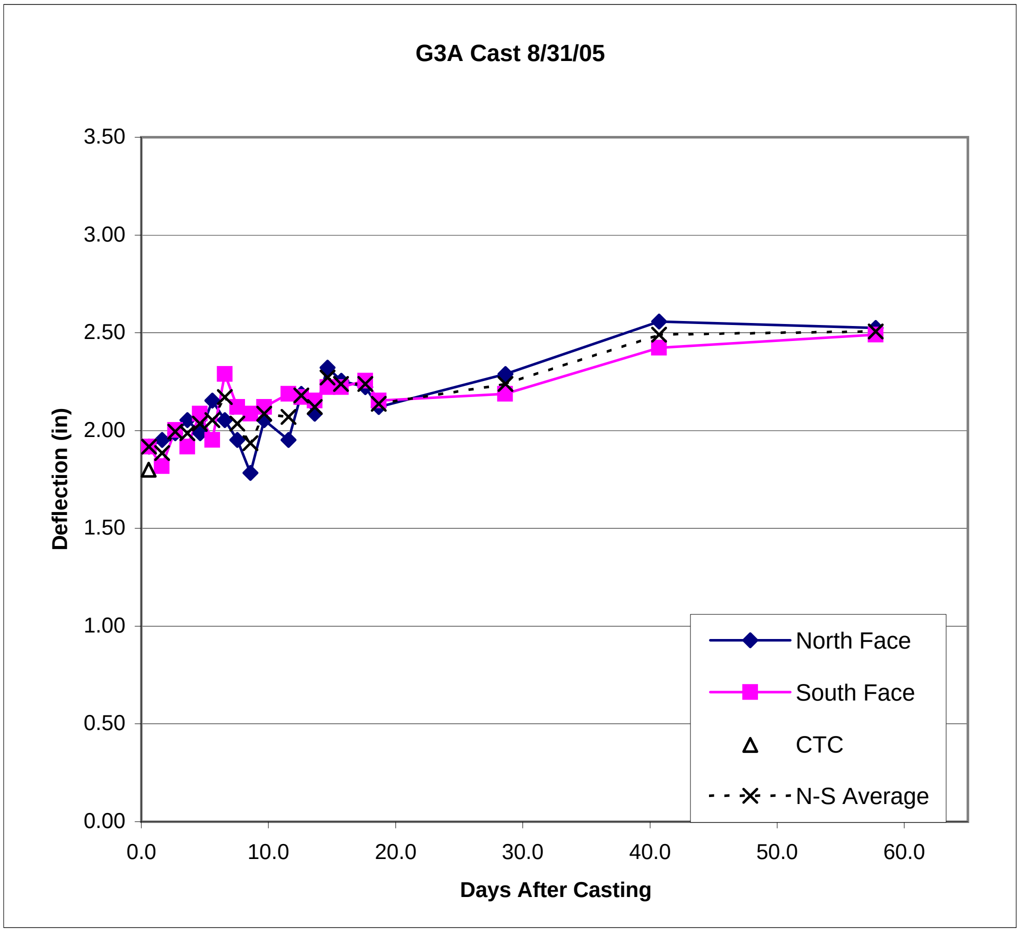
North Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	1.077
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/1/05	6:44 AM	27 7/16	26 5/8	25 1/4	0.6	27.031	1.781	1.918
9/2/05	7:20 AM	32 1/2	29 7/8	29 3/8	1.6	31.188	1.813	1.952
9/3/05	8:30 AM	27 1/8	24 3/4	24 3/32	2.7	25.938	1.844	1.986
9/4/05	7:30 AM	28 11/16	26 1/8	25 1/2	3.6	27.406	1.906	2.053
9/5/05	7:10 AM	31 1/8	28 1/16	27 3/4	4.6	29.594	1.844	1.986
9/6/05	6:35 AM	22 7/8	20 1/8	19 1/2	5.6	21.500	2.000	2.154
9/7/05	6:15 AM	30 9/16	27 3/4	27 1/4	6.6	29.156	1.906	2.053
9/8/05	5:45 AM	35 5/8	32 3/4	32 3/8	7.6	34.188	1.813	1.952
9/9/05	6:25 AM	34 3/16	31 7/8	31 3/8	8.6	33.031	1.656	1.784
9/10/05	8:10 AM	26 31/32	24 9/32	23 23/32	9.7	25.625	1.906	2.053
9/12/05	6:25 AM	34 1/4	31 3/8	31	11.6	32.813	1.813	1.952
9/13/05	6:07 AM	32 15/16	30 1/4	29 9/16	12.6	31.594	2.031	2.188
9/14/05	7:40 AM	25 3/8	22 1/2	22	13.6	23.938	1.938	2.087
9/15/05	8:00 AM	25 11/16	23	22 3/16	14.7	24.344	2.156	2.322
9/16/05	9:33 AM	23 1/4	20 5/16	19 11/16	15.7	21.781	2.094	2.255
9/18/05	7:23 AM	28 1/2	25 7/8	25 1/8	17.6	27.188	2.063	2.221
9/19/05	8:39 AM	24 13/16	22	21 7/16	18.7	23.406	1.969	2.120
9/29/05	7:28 AM	31 3/4	28 3/4	28 1/8	28.6	30.250	2.125	2.289
10/11/05	9:35 AM	20 3/16	17 3/16	16 5/16	40.7	18.688	2.375	2.558
10/28/05	10:25 AM	30 1/8	27 1/16	26 1/4	57.8	28.594	2.344	2.524
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

South Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/1/05	6:44 AM	27 7/16	26 1/4	25 1/16	0.6	26.844	1.781	1.918
9/2/05	7:15 AM	34 7/16	31 11/16	31 3/8	1.6	33.063	1.688	1.817
9/3/05	8:30 AM	25 23/32	23 5/16	22 21/32	2.7	24.516	1.859	2.003
9/4/05	7:20 AM	29 1/2	26 15/16	26 7/16	3.6	28.219	1.781	1.918
9/5/05	7:05 AM	31 1/8	28 1/2	27 7/8	4.6	29.813	1.938	2.087
9/6/05	6:24 AM	22 1/8	19 1/8	18 13/16	5.6	20.625	1.813	1.952
9/7/05	6:10 AM	32 7/8	29 3/4	29 3/16	6.6	31.313	2.125	2.289
9/8/05	5:40 AM	34 11/16	32	31 3/8	7.6	33.344	1.969	2.120
9/9/05	6:20 AM	34 5/8	31 7/8	31 5/16	8.6	33.250	1.938	2.087
9/10/05	8:10 AM	22 9/32	19 21/32	19	9.7	20.969	1.969	2.120
9/12/05	6:20 AM	35 1/8	32 11/16	31 7/8	11.6	33.906	2.031	2.188
9/13/05	6:05 AM	31 1/16	28 9/16	27 1/8	12.6	29.813	2.016	2.171
9/14/05	7:40 AM	25 1/16	22 7/16	21 3/4	13.6	23.750	2.000	2.154
9/15/05	8:00 AM	27 7/16	24 13/16	24 1/16	14.7	26.125	2.063	2.221
9/16/05	9:25 AM	22 1/2	19 3/4	19 1/16	15.7	21.125	2.063	2.221
9/18/05	7:12 AM	28 7/16	25 7/8	25 1/16	17.6	27.156	2.094	2.255
9/19/05	8:34 AM	24 7/16	21 9/16	21	18.7	23.000	2.000	2.154
9/29/05	7:14 AM	34 5/8	31 11/16	31 1/8	28.6	33.156	2.031	2.188
10/11/05	9:28 AM	19 7/8	17 1/8	16 1/4	40.7	18.500	2.250	2.423
10/28/05	10:20 AM	29 13/16	26 15/16	26 1/16	57.8	28.375	2.313	2.491
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

		(ft)	(in.)	(days)
Date	Time	Camber	Camber	Age
9/1/05	6:20 AM	0.15	1.80	0.6

Initial Camber (in.) =	1.918
Age at Release (days) =	0.6
Ultimate Camber (in.) =	2.507
Creep Camber (in.) =	0.589
Creep Coef. =	0.31



Measurements are taken at midspan and the supports. A factor of 1.07 is used to convert the camber relative to the end.

Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

G2A

Cast Date =	9/1/05	2:50 PM
Release Date =	9/2/05	4:50 AM

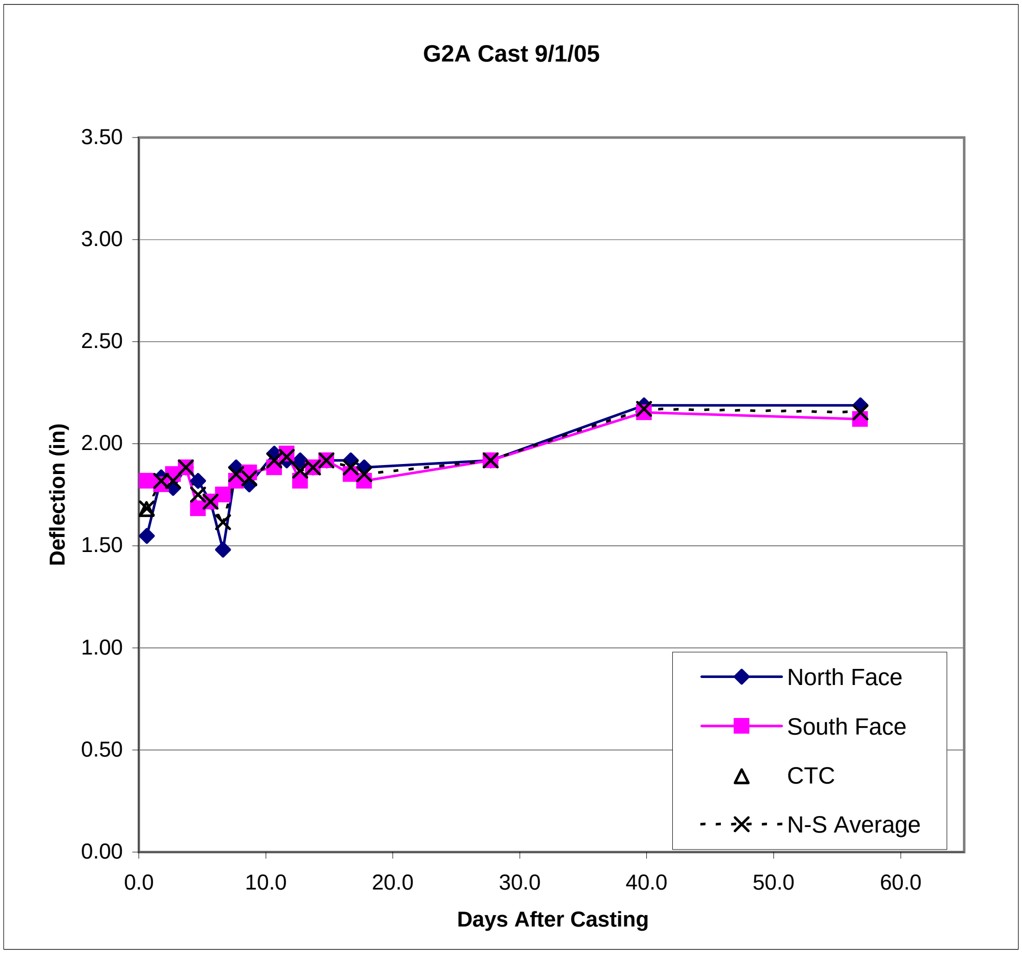
North Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	1.077
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/2/05	6:00 AM	26 1/8	27 1/4	25 1/4	0.6	26.688	1.438	1.548
9/3/05	9:00 AM	28 3/4	18 5/32	21 3/4	1.8	23.454	1.704	1.835
9/4/05	7:50 AM	31 3/8	20 7/16	24 1/4	2.7	25.906	1.656	1.784
9/5/05	7:30 AM	36	25	28 3/4	3.7	30.500	1.750	1.885
9/6/05	6:45 AM	22	18 3/8	18 1/2	4.7	20.188	1.688	1.817
9/7/05	6:25 AM	28 1/8	24 7/16	24 11/16	5.6	26.281	1.594	1.716
9/8/05	6:02 AM	35 1/2	32	32 3/8	6.6	33.750	1.375	1.481
9/9/05	6:35 AM	34 7/8	31 3/8	31 3/8	7.7	33.125	1.750	1.885
9/10/05	7:50 AM	24 15/32	21 3/32	21 7/64	8.7	22.781	1.672	1.801
9/12/05	6:35 AM	36 5/8	33	33	10.7	34.813	1.813	1.952
9/13/05	6:12 AM	31 5/16	28	27 7/8	11.6	29.656	1.781	1.918
9/14/05	7:53 AM	26	22 7/16	22 7/16	12.7	24.219	1.781	1.918
9/15/05	8:00 AM	26 5/8	23 1/8	23 1/8	13.7	24.875	1.750	1.885
9/16/05	9:49 AM	23 1/2	20 1/16	20	14.8	21.781	1.781	1.918
9/18/05	7:30 AM	29 1/2	26 1/16	26	16.7	27.781	1.781	1.918
9/19/05	8:48 AM	24 11/16	21 1/16	21 1/8	17.7	22.875	1.750	1.885
9/29/05	7:36 AM	31 7/16	27 3/4	27 13/16	27.7	29.594	1.781	1.918
10/11/05	9:46 AM	20 15/16	17 5/8	17 1/4	39.8	19.281	2.031	2.188
10/28/05	10:31 AM	31	27 5/16	27 1/8	56.8	29.156	2.031	2.188
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

South Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/2/05	6:15 AM	27 1/8	28 1/4	26	0.6	27.688	1.688	1.817
9/3/05	9:00 AM	25 1/2	15 1/32	18 19/32	1.8	20.266	1.672	1.801
9/4/05	7:40 AM	30 1/16	19 1/4	22 15/16	2.7	24.656	1.719	1.851
9/5/05	7:30 AM	32 13/16	22 3/16	25 3/4	3.7	27.500	1.750	1.885
9/6/05	6:40 AM	22 3/4	19 1/4	19 7/16	4.7	21.000	1.563	1.683
9/7/05	6:20 AM	30 3/8	27 1/16	27 1/8	5.6	28.719	1.594	1.716
9/8/05	5:59 AM	35 1/2	32 1/8	32 3/16	6.6	33.813	1.625	1.750
9/9/05	6:30 AM	34 9/16	31 3/16	31 3/16	7.7	32.875	1.688	1.817
9/10/05	7:50 AM	23 23/32	20 35/64	20 13/32	8.7	22.133	1.727	1.860
9/12/05	6:30 AM	34 1/8	30 7/8	30 3/4	10.7	32.500	1.750	1.885
9/13/05	6:10 AM	32 13/16	29 9/16	29 3/8	11.6	31.188	1.813	1.952
9/14/05	7:47 AM	25 1/8	21 3/4	21 3/4	12.7	23.438	1.688	1.817
9/15/05	8:00 AM	25 9/16	22 5/16	22 3/16	13.7	23.938	1.750	1.885
9/16/05	9:35 AM	22 15/16	19 5/8	19 1/2	14.8	21.281	1.781	1.918
9/18/05	7:32 AM	28 5/16	25 1/4	25 1/16	16.7	26.781	1.719	1.851
9/19/05	8:42 AM	24 3/4	21 3/8	21 3/8	17.7	23.063	1.688	1.817
9/29/05	7:34 AM	31 1/2	28 1/16	28	27.7	29.781	1.781	1.918
10/11/05	9:37 AM	20	16 5/8	16 5/16	39.8	18.313	2.000	2.154
10/28/05	10:27 AM	29 15/16	26 3/8	26 3/16	56.8	28.156	1.969	2.120
					#N/A	0.000	#N/A	#N/A
					#N/A	17.688	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

Date	Time	(ft) Camber	(in.) Camber	(days) Age
9/2/05	5:22 AM	0.14	1.68	0.6

Initial Camber (in.) =	1.683
Age at Release (days) =	0.6
Ultimate Camber (in.) =	2.171
Creep Camber (in.) =	0.488
Creep Coef. =	0.29



Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

Cast Date = 9/2/05 4:15 PM

Release Date = 9/6/05 4:45 AM

G1A

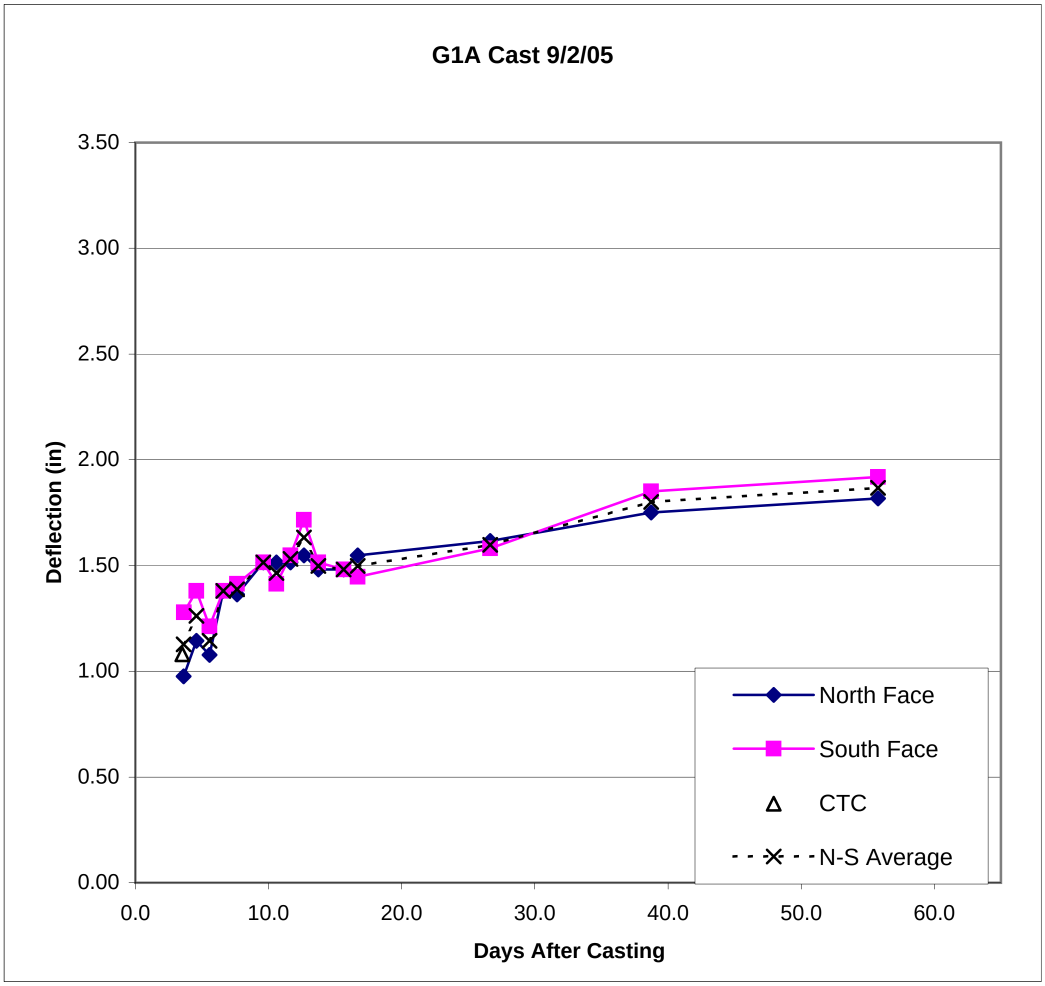
North Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	1.077
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/6/05	7:30 AM	14 1/16	17 3/4	15	3.6	15.906	0.906	0.976
9/7/05	6:30 AM	29 11/16	25 1/16	26 5/16	4.6	27.375	1.063	1.144
9/8/05	6:20 AM	35 7/8	31 5/8	32 3/4	5.6	33.750	1.000	1.077
9/9/05	6:45 AM	32 15/16	28 1/2	29 7/16	6.6	30.719	1.281	1.380
9/10/05	7:30 AM	20 13/16	16 21/32	17 15/32	7.6	18.734	1.266	1.363
9/12/05	6:45 AM	32 1/8	27 15/16	28 5/8	9.6	30.031	1.406	1.515
9/13/05	6:20 AM	30 15/16	26 7/8	27 1/2	10.6	28.906	1.406	1.515
9/14/05	8:00 AM	27	22 7/16	23 5/16	11.7	24.719	1.406	1.515
9/15/05	8:00 AM	28 3/8	24	24 3/4	12.7	26.188	1.438	1.548
9/16/05	10:02 AM	23 3/4	19 3/8	20 3/16	13.7	21.563	1.375	1.481
9/18/05	7:36 AM	29 9/16	25 1/16	25 15/16	15.6	27.313	1.375	1.481
9/19/05	8:58 AM	25 3/8	20 7/8	21 11/16	16.7	23.125	1.438	1.548
9/29/05	7:44 AM	31 1/8	26 5/8	27 3/8	26.6	28.875	1.500	1.616
10/11/05	9:55 AM	20 1/2	16 1/8	16 11/16	38.7	18.313	1.625	1.750
10/28/05	10:37 AM	30 1/16	25 11/16	26 3/16	55.8	27.875	1.688	1.817
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

South Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/6/05	7:40 AM	11 1/8	15 1/8	11 15/16	3.6	13.125	1.188	1.279
9/7/05	6:25 AM	27 1/2	23 1/16	24	4.6	25.281	1.281	1.380
9/8/05	6:06 AM	34 7/8	30 5/8	31 5/8	5.6	32.750	1.125	1.212
9/9/05	6:40 AM	34 5/16	29 7/8	30 13/16	6.6	32.094	1.281	1.380
9/10/05	7:30 AM	25 5/8	21 1/2	22 1/4	7.6	23.563	1.313	1.414
9/12/05	6:40 AM	36 1/16	31 3/4	32 1/2	9.6	33.906	1.406	1.515
9/13/05	6:20 AM	30 11/16	26 11/16	27 3/8	10.6	28.688	1.313	1.414
9/14/05	7:53 AM	25 1/2	21 1/8	21 7/8	11.7	23.313	1.438	1.548
9/15/05	8:00 AM	26 3/8	21 15/16	22 9/16	12.7	24.156	1.594	1.716
9/16/05	9:52 AM	22 15/16	18 5/8	19 3/8	13.7	20.781	1.406	1.515
9/18/05	7:30 AM	29	24 3/4	25 1/2	15.6	26.875	1.375	1.481
9/19/05	8:51 AM	24	19 11/16	20 1/2	16.7	21.844	1.344	1.447
9/29/05	7:40 AM	30 7/8	26 7/16	27 3/16	26.6	28.656	1.469	1.582
10/11/05	9:48 AM	20 3/8	16 1/16	16 1/2	38.7	18.219	1.719	1.851
10/28/05	10:35 AM	30 3/8	26 1/16	26 7/16	55.8	28.219	1.781	1.918
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	17.688	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

		(ft)	(in.)	(days)
Date	Time	Camber	Camber	Age
9/6/05	5:16 AM	0.09	1.08	3.5

Initial Camber (in.) =	1.127
Age at Release (days) =	3.5
Ultimate Camber (in.) =	1.868
Creep Camber (in.) =	0.740
Creep Coef. =	0.66



WE Release (4-Days, Labor Day Weekend)Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

Cast Date = 9/6/05 4:00 PM

Release Date = 9/8/05 5:00 AM

G4D

North Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	1.077
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/8/05	6:50 AM	23 5/8	28 1/8	24 3/16	1.6	25.875	1.688	1.817
9/9/05	7:05 AM	31 1/16	33	30 1/4	2.6	32.031	1.781	1.918
9/10/05	9:10 AM	30 5/8	32 23/32	29 3/4	3.7	31.672	1.922	2.070
9/12/05	6:55 AM	26 5/8	28 9/16	25 13/16	5.6	27.594	1.781	1.918
9/13/05	6:34 AM	26 1/16	28 1/16	25 3/16	6.6	27.063	1.875	2.019
9/14/05	8:10 AM	23 5/16	25 1/4	22 5/16	7.7	24.281	1.969	2.120
9/15/05	8:00 AM	29 1/16	31 3/16	28 3/16	8.7	30.125	1.938	2.087
9/16/05	10:49 AM	18	19 15/16	16 15/16	9.8	18.969	2.031	2.188
9/18/05	8:04 AM	22 15/16	24 1/2	22	11.7	23.719	1.719	1.851
9/19/05	9:12 AM	17 13/16	19 7/8	16 15/16	12.7	18.844	1.906	2.053
9/29/05	8:00 AM	29 3/8	31 3/16	28 1/4	22.7	30.281	2.031	2.188
10/11/05	10:15 AM	15	17	13 11/16	34.8	16.000	2.313	2.491
10/28/05	10:53 AM	25 3/8	27 7/16	24	51.8	26.406	2.406	2.592
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

South Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/8/05	7:02 AM	22 13/16	27 1/2	23 1/2	1.6	25.156	1.656	1.784
9/9/05	7:00 AM	32 5/16	34 5/16	31 9/16	2.6	33.313	1.750	1.885
9/10/05	9:10 AM	28 5/16	30 5/8	27 5/8	3.7	29.469	1.844	1.986
9/12/05	6:50 AM	24 1/16	26 1/4	23 1/4	5.6	25.156	1.906	2.053
9/13/05	6:30 AM	29 3/16	31 3/8	28 3/8	6.6	30.281	1.906	2.053
9/14/05	8:10 AM	26	28	25 1/8	7.7	27.000	1.875	2.019
9/15/05	8:00 AM	30 5/16	32 7/16	29 7/16	8.7	31.375	1.938	2.087
9/16/05	10:40 AM	17 3/8	19 5/16	16 7/16	9.8	18.344	1.906	2.053
9/18/05	8:19 AM	23 3/4	25 9/16	22 11/16	11.7	24.656	1.969	2.120
9/19/05	9:08 AM	18 5/8	20 1/2	17 3/4	12.7	19.563	1.813	1.952
9/29/05	7:57 AM	29 13/16	31 9/16	28 5/8	22.7	30.688	2.063	2.221
10/11/05	10:09 AM	16 1/16	18 1/16	14 13/16	34.8	17.063	2.250	2.423
10/28/05	10:49 AM	25 1/16	27 3/8	23 7/8	51.8	26.219	2.344	2.524
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	17.688	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

		(ft)	(in.)	(days)
Date	Time	Camber	Camber	Age
9/8/05	5:20 AM	0.17	2.04	1.6

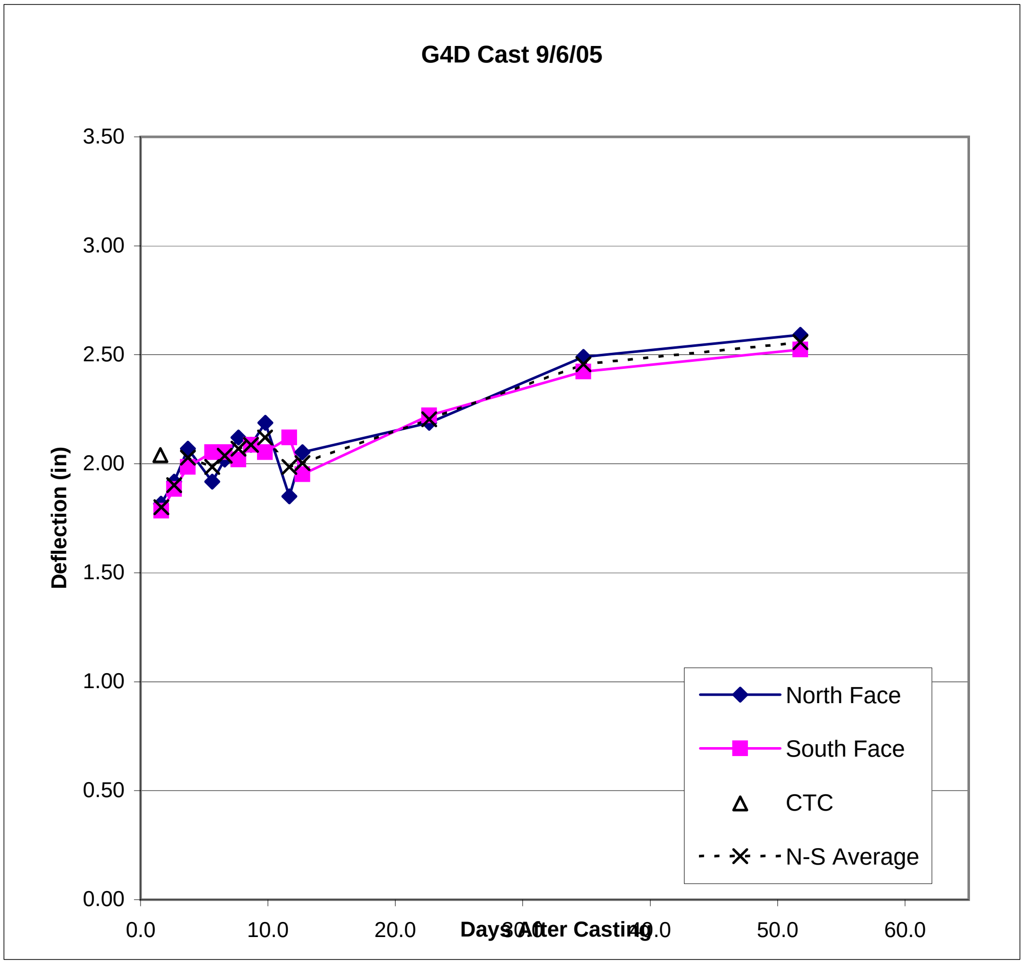
Initial Camber (in.) = 1.801

Age at Release (days) = 1.5

Ultimate Camber (in.) = 2.558

Creep Camber (in.) = 0.757

Creep Coef. = 0.42



2-Day Release, Did not get strength on the first day.

Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

G3D

Cast Date =	9/8/05	4:00 PM
Release Date =	9/9/05	5:00 AM

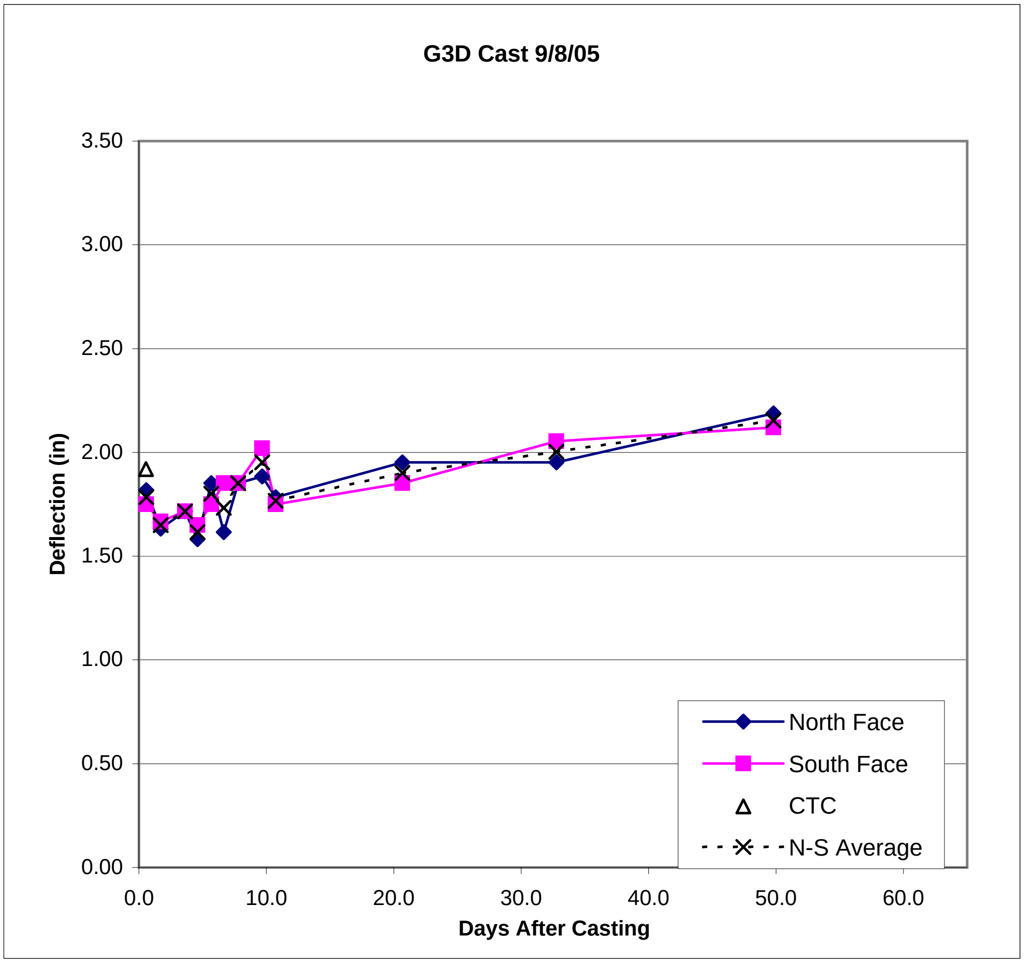
North Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	1.077
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/9/05	5:40 AM	22 3/4	27 5/8	23 1/2	0.6	25.188	1.688	1.817
9/10/05	9:00 AM	31 21/32	33 3/16	30 29/32	1.7	32.422	1.516	1.632
9/12/05	7:00 AM	25 15/16	27 3/8	25 1/16	3.6	26.656	1.594	1.716
9/13/05	6:39 AM	25 15/16	27 3/8	25 3/16	4.6	26.656	1.469	1.582
9/14/05	8:20 AM	25	26 9/16	24 1/16	5.7	25.781	1.719	1.851
9/15/05	8:00 AM	28 1/8	29 5/8	27 3/8	6.7	28.875	1.500	1.616
9/16/05	11:00 AM	18 1/4	19 7/16	17 1/8	7.8	18.844	1.719	1.851
9/18/05	7:56 AM	21 3/16	22 7/16	20 1/16	9.7	21.813	1.750	1.885
9/19/05	9:20 AM	18 3/8	19 11/16	17 3/8	10.7	19.031	1.656	1.784
9/29/05	8:06 AM	27 1/8	28 5/8	26 1/16	20.7	27.875	1.813	1.952
10/11/05	10:25 AM	15 11/16	17 5/16	14 11/16	32.8	16.500	1.813	1.952
10/28/05	11:05 AM	25 9/16	27 1/4	24 3/8	49.8	26.406	2.031	2.188
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

South Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/9/05	5:50 AM	20 11/16	25 15/16	21 11/16	0.6	23.313	1.625	1.750
9/10/05	9:00 AM	27 27/32	29 5/8	27 3/16	1.7	28.734	1.547	1.666
9/12/05	7:00 AM	26 15/16	28 1/2	26 1/8	3.6	27.719	1.594	1.716
9/13/05	6:35 AM	26 7/16	28 1/8	25 3/4	4.6	27.281	1.531	1.649
9/14/05	8:20 AM	23 5/8	25 1/8	22 3/4	5.7	24.375	1.625	1.750
9/15/05	8:00 AM	29 7/16	31 1/4	28 5/8	6.7	30.344	1.719	1.851
9/16/05	10:52 AM	18 3/8	19 11/16	17 5/16	7.8	19.031	1.719	1.851
9/18/05	8:04 AM	22 5/8	24 3/8	21 5/8	9.7	23.500	1.875	2.019
9/19/05	9:15 AM	18 3/16	19 11/16	17 5/16	10.7	18.938	1.625	1.750
9/29/05	8:03 AM	29 11/16	31 1/8	28 11/16	20.7	30.406	1.719	1.851
10/11/05	10:17 AM	15 7/16	17	14 5/16	32.8	16.219	1.906	2.053
10/28/05	10:56 AM	25 11/16	27 1/2	24 5/8	49.8	26.594	1.969	2.120
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	17.688	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

Date	Time	(ft) Camber	(in.) Camber	(days) Age
9/9/05	5:20 AM	0.16	1.92	0.6

Initial Camber (in.) = 1.784
Age at Release (days) = 0.5
Ultimate Camber (in.) = 2.154
Creep Camber (in.) = 0.370
Creep Coef. = 0.21



Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

G2D

Cast Date =	9/9/05	2:45 PM
Release Date =	9/12/05	5:00 AM

North Face

Date	Time	(in.) East Elev	(in.) West Elev	(in.) Midspan	(days) Age	(in.) E-W Ave	(in.) Camber	1.077 *Camber
9/12/05	5:50 AM	25 11/16	30 1/2	27 3/16	2.6	28.094	0.906	0.976
9/13/05	6:45 AM	27 11/16	28 3/4	27 1/4	3.7	28.219	0.969	1.043
9/14/05	8:30 AM	25 5/16	26 1/2	24 13/16	4.7	25.906	1.094	1.178
9/15/05	8:00 AM	26 7/8	28 1/8	26 1/2	5.7	27.500	1.000	1.077
9/16/05	11:16 AM	16 9/16	17 9/16	15 15/16	6.9	17.063	1.125	1.212
9/18/05	7:52 AM	22 5/16	23 1/2	21 3/4	8.7	22.906	1.156	1.245
9/19/05	9:28 AM	17	18	16 7/16	9.8	17.500	1.063	1.144
9/29/05	8:11 AM	28 7/8	29 11/16	28 1/8	19.7	29.281	1.156	1.245
10/11/05	10:33 AM	16 5/16	17 1/4	15 3/8	31.8	16.781	1.406	1.515
10/28/05	11:16 AM	24 1/4	25 9/16	23 7/16	48.9	24.906	1.469	1.582
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

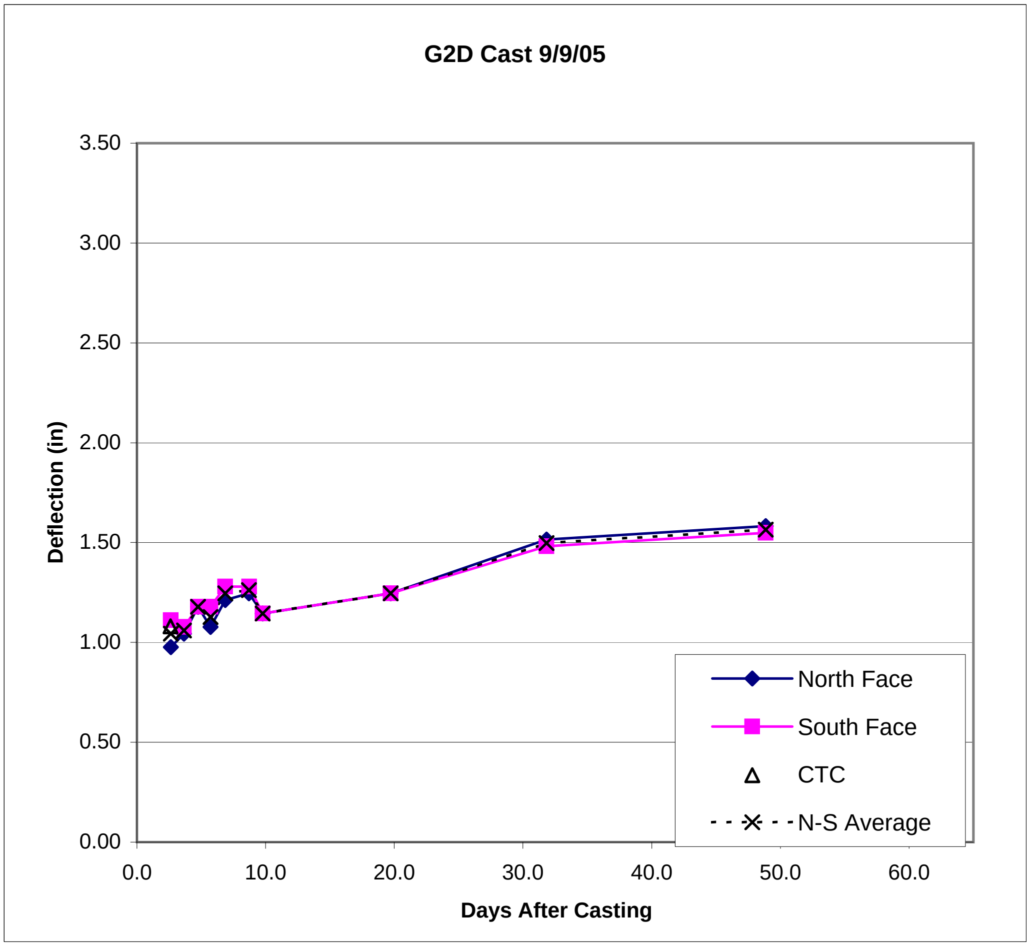
South Face

Date	Time	(in.) East Elev	(in.) West Elev	(in.) Midspan	(days) Age	(in.) E-W Ave	(in.) Camber	*Camber
9/12/05	5:50 AM	25 1/4	29 15/16	26 9/16	2.6	27.594	1.031	1.111
9/13/05	6:40 AM	26 1/8	27 1/2	25 13/16	3.7	26.813	1.000	1.077
9/14/05	8:30 AM	25	26 7/16	24 5/8	4.7	25.719	1.094	1.178
9/15/05	8:00 AM	28 3/16	29 5/8	27 13/16	5.7	28.906	1.094	1.178
9/16/05	11:11 AM	17 1/2	18 3/8	16 3/4	6.9	17.938	1.188	1.279
9/18/05	7:56 AM	21 1/8	22 1/4	20 1/2	8.7	21.688	1.188	1.279
9/19/05	9:23 AM	18 3/8	19 3/8	17 13/16	9.8	18.875	1.063	1.144
9/29/05	8:08 AM	27 3/16	28 1/8	26 1/2	19.7	27.656	1.156	1.245
10/11/05	10:27 AM	16 1/8	17 1/4	15 5/16	31.8	16.688	1.375	1.481
10/28/05	11:12 AM	25 3/4	27 1/8	25	48.9	26.438	1.438	1.548
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	17.688	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

Date	Time	(ft) Camber	(in.) Camber	(days) Age
9/12/05	5:20 AM	0.09	1.08	2.6

Initial Camber (in.) = 1.043
Age at Release (days) = 2.6
Ultimate Camber (in.) = 1.565
Creep Camber (in.) = 0.522
Creep Coef. = 0.50



WE Release (3-Days)

Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

Cast Date = 9/12/05 3:45 PM

Release Date = 9/13/05 5:00 AM

G1D

North Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	1.077
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/13/05	7:05 AM	28 1/16	32 9/16	28 7/8	0.6	30.313	1.438	1.548
9/14/05	8:50 AM	24 3/16	29	24 13/16	1.7	26.594	1.781	1.918
9/15/05	8:00 AM	22 3/8	27	23 1/8	2.7	24.688	1.563	1.683
9/16/05	11:30 AM	12 1/16	16 3/4	12 1/2	3.8	14.406	1.906	2.053
9/18/05	8:45 AM	23 5/8	28 1/16	24 1/16	5.7	25.844	1.781	1.918
9/19/05	9:35 AM	19 3/8	20 9/16	18 3/8	6.7	19.969	1.594	1.716
9/29/05	8:17 AM	30 7/16	31 3/16	29 1/16	16.7	30.813	1.750	1.885
10/11/05	10:40 AM	18 1/8	19 1/8	16 5/8	28.8	18.625	2.000	2.154
10/28/05	11:25 AM	24 7/16	25 9/16	22 15/16	45.8	25.000	2.063	2.221
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

South Face		(in.)	(in.)	(in.)	(days)	(in.)	(in.)	
Date	Time	East Elev	West Elev	Midspan	Age	E-W Ave	Camber	*Camber
9/13/05	7:00 AM	19 7/8	24 7/8	20 7/8	0.6	22.375	1.500	1.616
9/14/05	8:40 AM	25	29 3/4	25 13/16	1.7	27.375	1.563	1.683
9/15/05	8:00 AM	21 7/8	26 3/4	22 9/16	2.7	24.313	1.750	1.885
9/16/05	11:42 AM	12 15/16	17 3/4	13 9/16	3.8	15.344	1.781	1.918
9/18/05	8:45 AM	19 1/2	24 1/2	20 3/16	5.7	22.000	1.813	1.952
9/19/05	9:31 AM	18 3/4	19 13/16	17 1/2	6.7	19.281	1.781	1.918
9/29/05	8:14 AM	30 5/8	31 3/8	29 1/4	16.7	31.000	1.750	1.885
10/11/05	10:35 AM	18 1/8	19 1/8	16 5/8	28.8	18.625	2.000	2.154
10/28/05	11:20 AM	26 3/16	27 5/16	24 11/16	45.8	26.750	2.063	2.221
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A
					#N/A	17.688	#N/A	#N/A
					#N/A	0.000	#N/A	#N/A

CTC Camber Measurements

		(ft)	(in.)	(days)
Date	Time	Camber	Camber	Age
9/13/05	5:38 AM	0.15	1.80	0.6

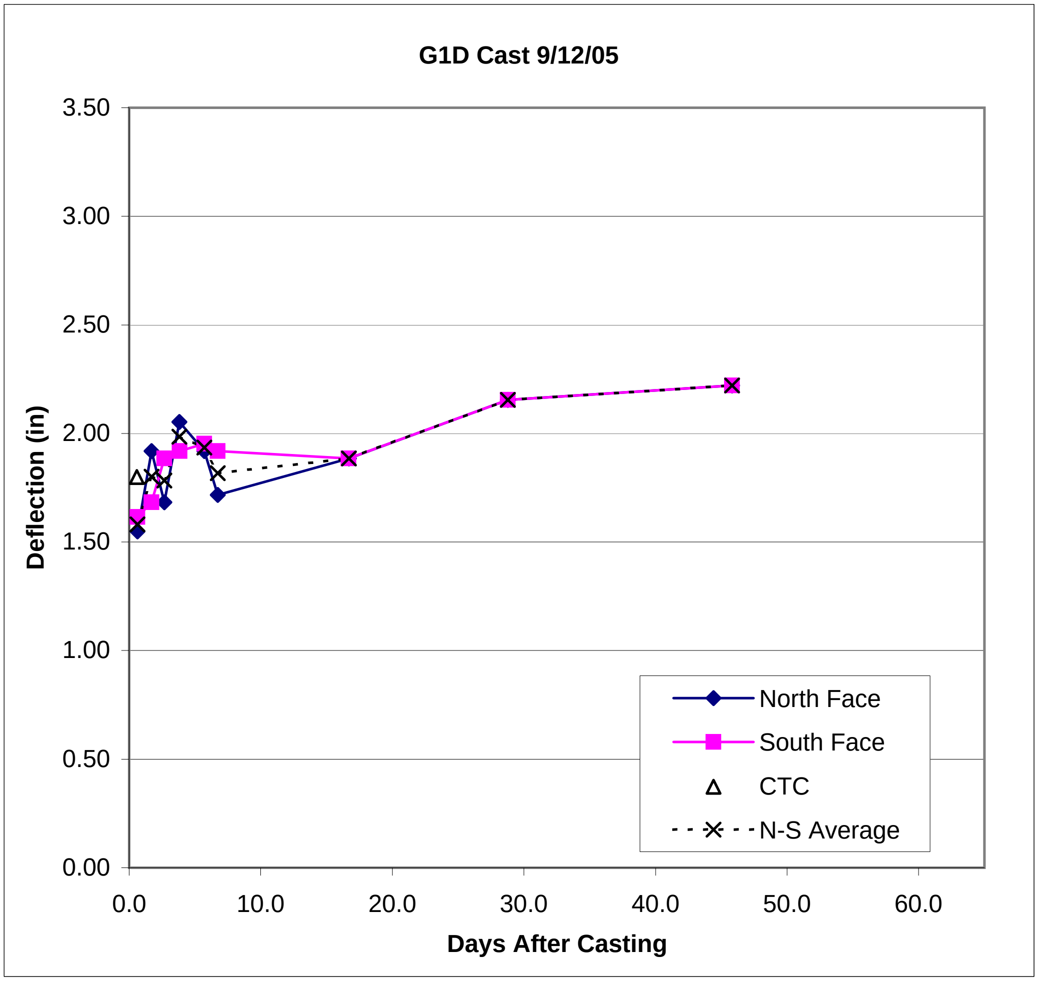
Initial Camber (in.) = 1.582

Age at Release (days) = 0.6

Ultimate Camber (in.) = 2.221

Creep Camber (in.) = 0.639

Creep Coef. = 0.40



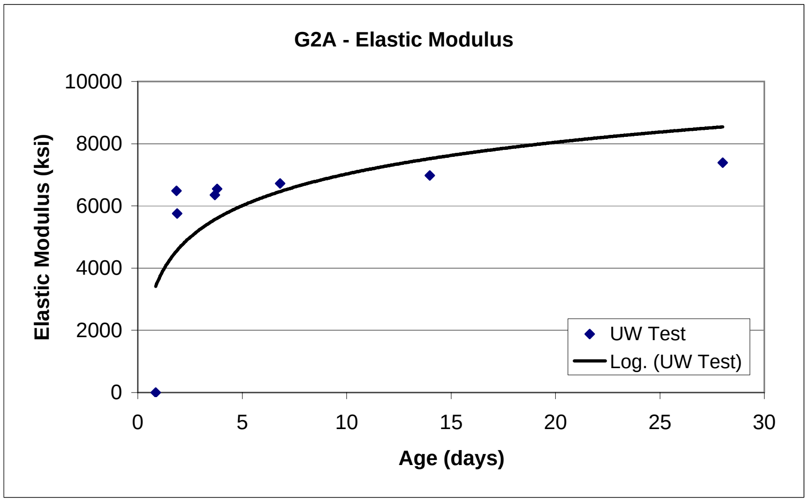
Adjusted 9/19 South Face from 20 13/16 to 19 13/16.

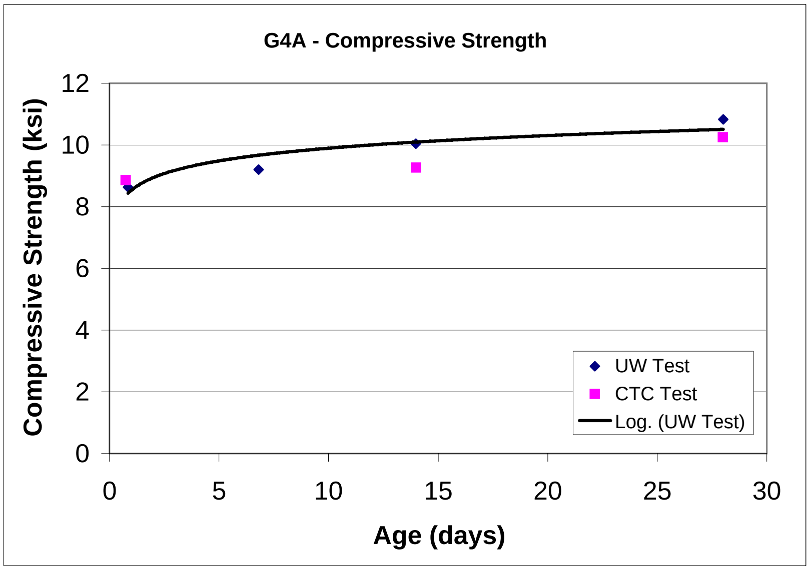
Camber mesurements were taken at the support locations. Multiplied camber by 1.077 to reflect total camber relative to ends of girder.

APPENDIX C

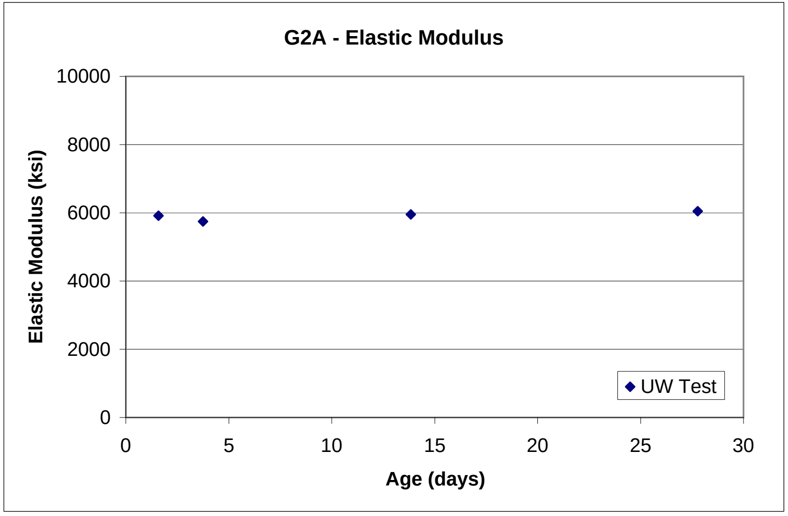
SNAKE LAKE MATERIALS TEST DATA

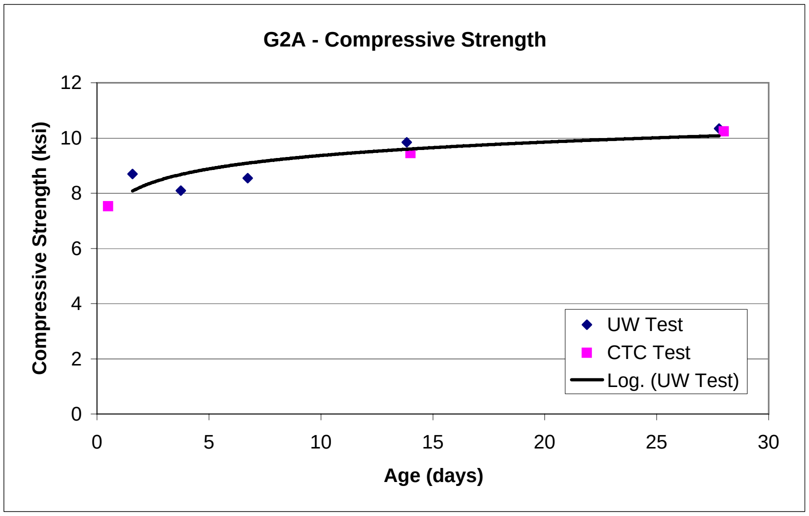
G4A	Mix #	130		Days to Release	1						
	Cast Date	8/29/05									
	Cast Time	2:30 PM		🟩	These cylinders were unwrapped at 7:00 am, 4 hrs before the actual release time.						
	Test Date	8/30/05	8/31/05	8/31/05	9/2/05	9/2/05	9/5/05	9/12/05	9/26/05		
	Test Time	11:00 AM	11:00 AM	11:45 AM	7:00 AM	9:30 AM	10:00 AM	2:00 PM	2:45 PM		
	Age (days)	0.85	1.85	1.89	3.69	3.79	6.81	13.98	28.01	#N/A	#N/A
E Mod	Gage Length (in)	5.281	5.281	5.281	5.281	5.281	5.287	5.511	5.241		
	E Mod (ksi) - a	▨	6537.26	5834.90	6345.50	6387.45	6842.00	6958.60	7330.70		
	b	▨	6424.45	5668.90	6348.75	6587.20	6643.25	6971.20	7409.15		
	c	▨	▨	▨	▨	6653.00	6689.20	6990.35	7436.35		
	E Mod Ave (ksi)	#DIV/0!	6480.86	5751.90	6347.13	6542.55	6724.82	6973.38	7392.07	#N/A	#N/A
UW - Fc	Load 1 (lb)	107490					118730	126180	130310		
	Load 2 (lb)	109550					112520	126190	141760		
	Average Load (lb)	108520	#N/A	#N/A	#N/A	#N/A	115625	126185	136035	#N/A	#N/A
	Comp Str (ksi)	8.636	#N/A	#N/A	#N/A	#N/A	9.201	10.041	10.825	#N/A	#N/A
CTC - Fc	Age (days)	0.75	0.75	14	28						
	Stress 1 (psi)	8840	8840	9160	10550						
	Stress 2 (psi)	8870	8870	9360	9950						
	Average Load (ksi)	8.855	8.855	9.260	10.250	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A





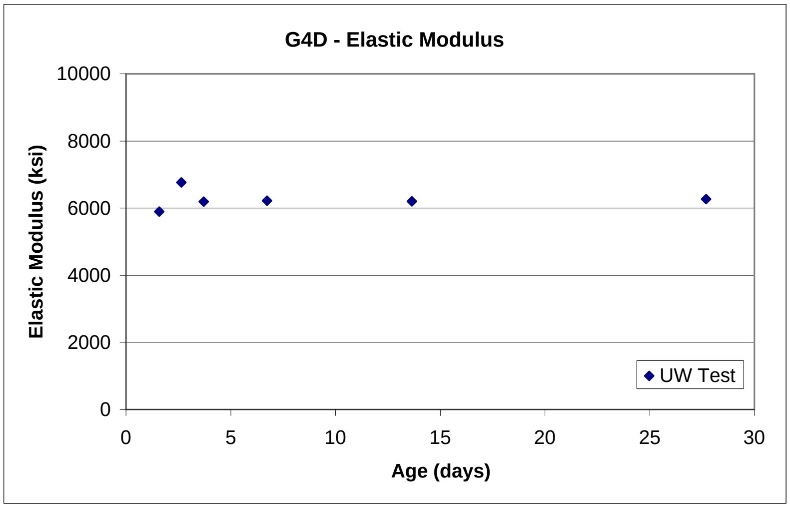
G2A	Mix #	130	Days to Release		1						
	Cast Date	9/1/05									
	Cast Time	2:50 PM									
	Test Date	9/3/05	9/5/05	9/8/05	9/15/05	9/29/05					
	Test Time	5:00 AM	8:45 AM	8:15 AM	11:00 AM	9:30 AM					
	Age (days)	1.59	3.75	6.73	13.84	27.78	#N/A	#N/A	#N/A	#N/A	#N/A
E Mod	Gage Length (in)	5.242	5.288	5.255	5.253	5.228					
	E Mod (ksi) - a	5858.90	5854.95	▨	▨	6018.30					
	b	5967.40	5694.00	▨	5943.55	6057.60					
	c	5926.90	5691.10	▨	5953.25	6076.90					
	E Mod Ave (ksi)	5917.73	5746.68	#N/A	5948.40	6050.93	#N/A	#N/A	#N/A	#N/A	#N/A
UW - Fc	Load 1 (lb)	110800	102750	103620	120590	130200					
	Load 2 (lb)	107850	100510	111030	126930	129680					
	Average Load (lb)	109325	101630	107325	123760	129940	#N/A	#N/A	#N/A	#N/A	#N/A
	Comp Str (ksi)	8.700	8.087	8.541	9.849	10.340	#N/A	#N/A	#N/A	#N/A	#N/A
CTC - Fc	Age (days)	0.5	14	28							
	Stress 1 (psi)	7340	9620	10020							
	Stress 2 (psi)	7700	9280	10450							
	Average Load (ksi)	7.520	9.450	10.235	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

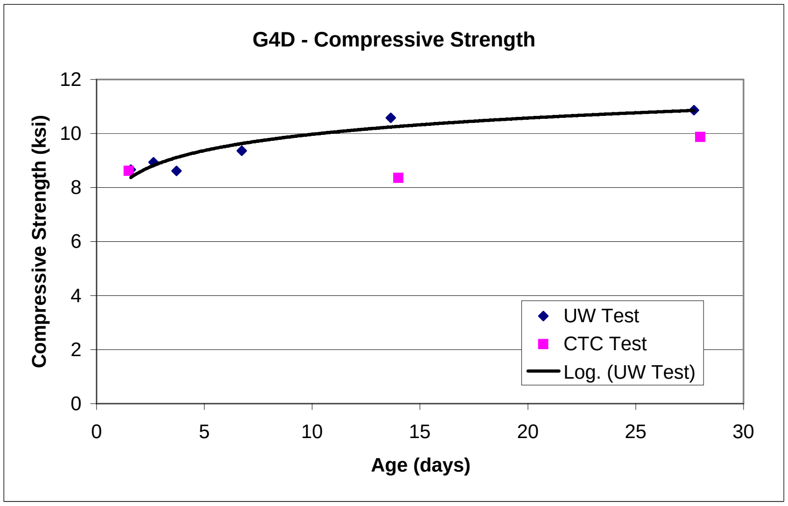




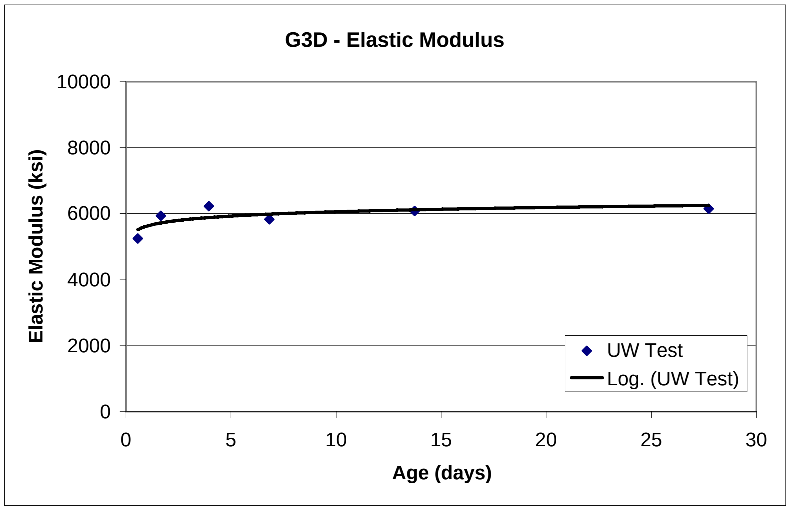
Days to Release 2

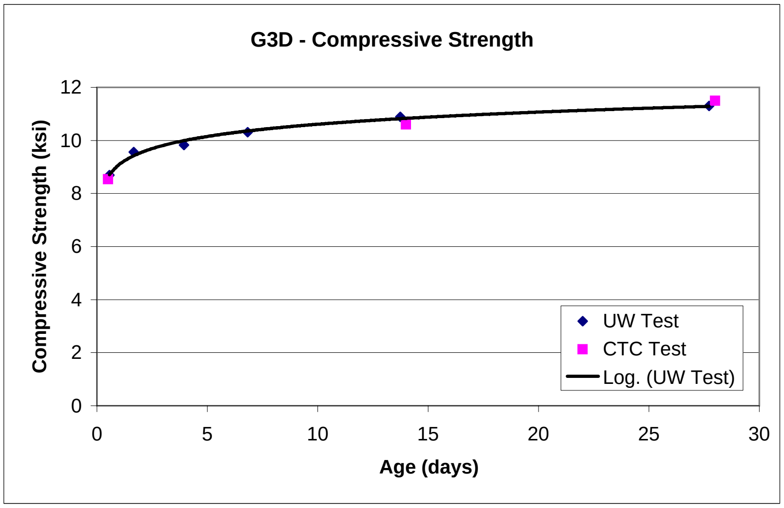
G4D	Mix #	140									
	Cast Date	9/6/05									
	Cast Time	4:00 PM									
	Test Date	9/8/05	9/9/05	9/10/05	9/13/05	9/20/05	10/4/05				
	Test Time	6:00 AM	7:15 AM	9:00 AM	9:30 AM	7:30 AM	8:45 AM				
	Age (days)	1.58	2.64	3.71	6.73	13.65	27.70	#N/A	#N/A	#N/A	#N/A
E Mod	Gage Length (in)	5.281	5.281	5.245	5.262	5.300	5.252				
	E Mod (ksi) - a	5812.50	6846.65	6326.10	6220.35	6263.55	6334.50				
	b	5887.50	6742.90	6070.65	6198.10	6163.55	6266.95				
	c	5992.70	6719.30	6173.35	6237.50	6166.15	6206.30				
	E Mod Ave (ksi)	5897.57	6769.62	6190.03	6218.65	6197.75	6269.25	#N/A	#N/A	#N/A	#N/A
UW - Fc	Load 1 (lb)	118350	111900	97769	117360	136820	136230				
	Load 2 (lb)	99371	112620	118830	118050	128990	136680				
	Average Load (lb)	108861	112260	108300	117705	132905	136455	#N/A	#N/A	#N/A	#N/A
	Comp Str (ksi)	8.663	8.933	8.618	9.367	10.576	10.859	#N/A	#N/A	#N/A	#N/A
CTC - Fc	Age (days)	1.5	14	28							
	Stress 1 (psi)	8640	8460	9960							
	Stress 2 (psi)	8590	8240	9790							
	Average Load (ksi)	8.615	8.350	9.875	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A



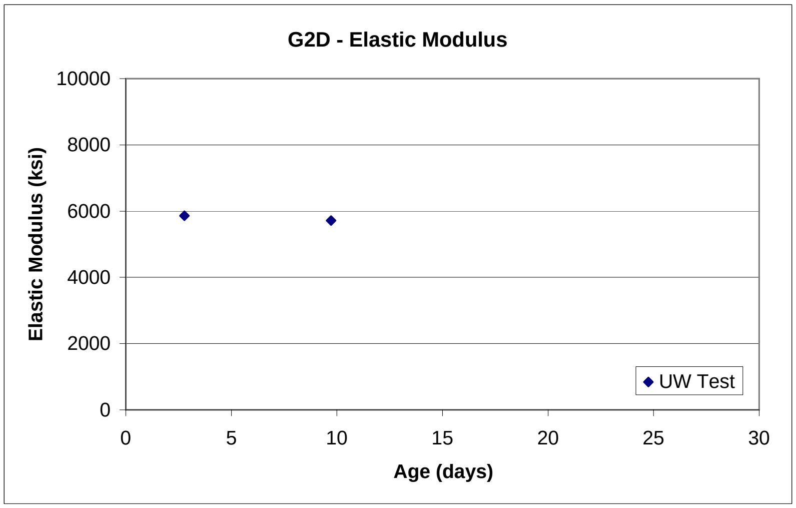


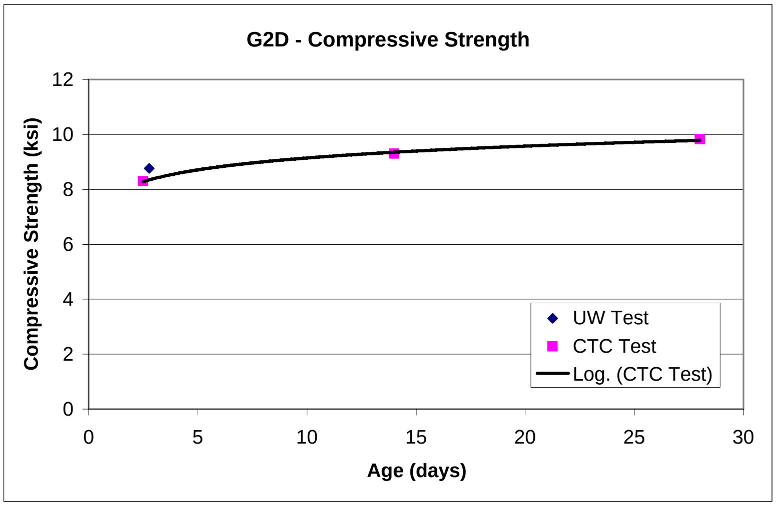
G3D	Mix #	190		Days to Release	1						
	Cast Date	9/8/05									
	Cast Time	4:00 PM									
	Test Date	9/9/05	9/10/05	9/12/05	9/15/05	9/22/05	10/6/05				
	Test Time	5:30 AM	8:00 AM	2:45 PM	11:45 AM	9:45 AM	9:30 AM				
	Age (days)	0.56	1.67	3.95	6.82	13.74	27.73	#N/A	#N/A	#N/A	#N/A
E Mod	Gage Length (in)	5.242	5.256	5.261	5.278	5.278	5.437				
	E Mod (ksi) - a	5303.55	5942.50	6224.15	5899.45	6105.40	6165.40				
	b	5253.90	5915.00	6243.80	5787.20	5996.55	6154.95				
	c	5197.10	5944.75	6216.20	5799.70	6136.25	6129.25				
	E Mod Ave (ksi)	5251.52	5934.08	6228.05	5828.78	6079.40	6149.87	#N/A	#N/A	#N/A	#N/A
UW - Fc	Load 1 (lb)	105500	115560	123570	131030	136820	142060				
	Load 2 (lb)	113000	124660	123270	128200	▨	▨				
	Average Load (lb)	109250	120110	123420	129615	136820	142060	#N/A	#N/A	#N/A	#N/A
	Comp Str (ksi)	8.694	9.558	9.821	10.314	10.888	11.305	#N/A	#N/A	#N/A	#N/A
CTC - Fc	Age (days)	0.5	14	28							
	Stress 1 (psi)	8980	10800	11610							
	Stress 2 (psi)	8100	10410	11380							
	Average Load (ksi)	8.540	10.605	11.495	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A



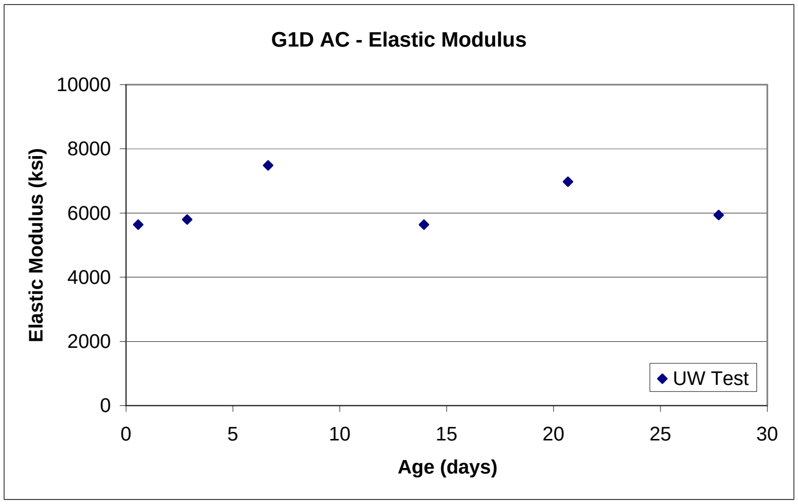


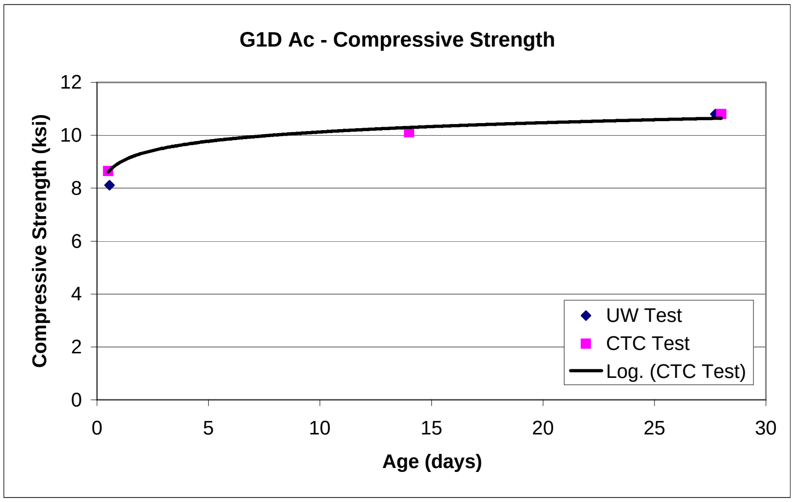
G2D	Mix #	130		Days to Release	3						
	Cast Date	9/9/05									
	Cast Time	2:45 PM									
	Test Date	9/12/05	9/15/05	9/19/05							
	Test Time	9:15 AM	12:30 PM	8:00 AM							
	Age (days)	2.77	5.91	9.72	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
E Mod	Gage Length (in)	4.818	5.286	5.268							
	E Mod (ksi) - a	5904.10		5635.40							
	b	5822.10		5787.60							
	c	5848.15		5729.10							
	E Mod Ave (ksi)	5858.12	#N/A	5717.37	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
UW - Fc	Load 1 (lb)	110200									
	Load 2 (lb)										
	Average Load (lb)	110200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Comp Str (ksi)	8.769	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
CTC - Fc	Age (days)	2.5	14	28							
	Stress 1 (psi)	8310	9460	9780							
	Stress 2 (psi)	8280	9130	9870							
	Average Load (ksi)	8.295	9.295	9.825	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A



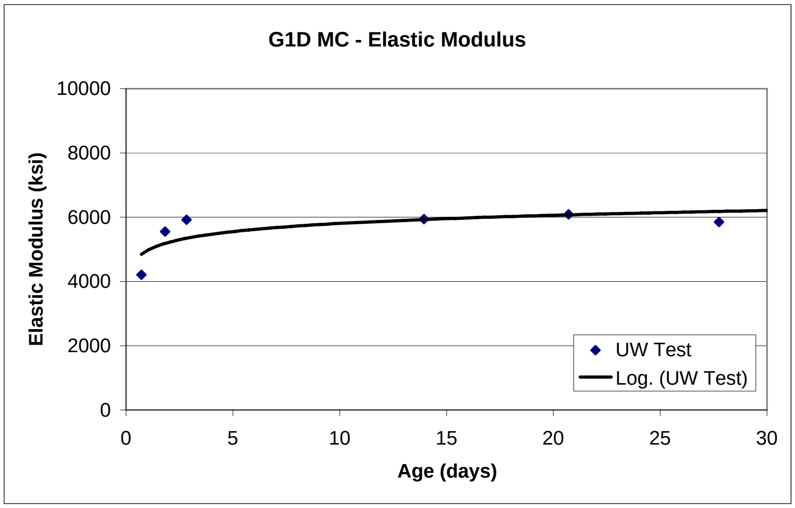


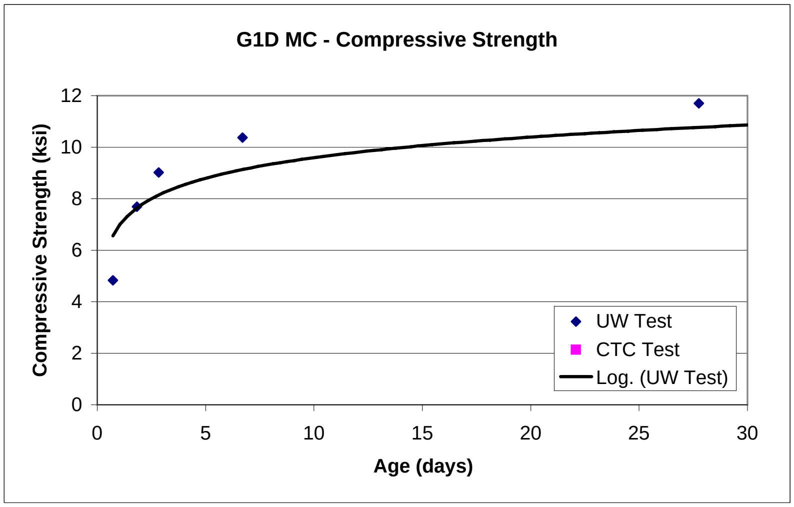
G1D - AC	Mix #	130		Days to Release	1						
	Cast Date	9/12/05									
	Cast Time	5:00 PM									
	Test Date	9/13/05	9/15/05	9/19/05	9/26/05	10/3/05	10/10/05	2/21/06			
	Test Time	6:30 AM	1:30 PM	8:30 AM	3:30 PM	9:15 AM	10:30 AM	12:00 PM			
	Age (days)	0.56	2.85	6.65	13.94	20.68	27.73	161.79	#N/A	#N/A	#N/A
E Mod	Gage Length (in)	5.255	5.253	5.257	5.248	5.263	5.239				
	E Mod (ksi) - a	5641.80	▨	7449.00	▨	6864.00	5976.45				
	b	5676.00	5776.40	7451.55	5631.90	7059.00	5938.15				
	c	5608.30	5820.00	7556.55	5651.25	7017.65	5906.80				
	E Mod Ave (ksi)	5642.03	5798.20	7485.70	5641.58	6980.22	5940.47	#N/A	#N/A	#N/A	#N/A
UW - Fc	Load 1 (lb)	102120	▨	▨	▨	▨	139000	113390			
	Load 2 (lb)	101720	▨	▨	▨	▨	132590				
	Average Load (lb)	101920	#N/A	#N/A	#N/A	#N/A	135795	113390	#N/A	#N/A	#N/A
	Comp Str (ksi)	8.111	#N/A	#N/A	#N/A	#N/A	10.806	9.023	#N/A	#N/A	#N/A
CTC - Fc	Age (days)	0.5	14	28							
	Stress 1 (psi)	8580	10120	11020							
	Stress 2 (psi)	8710	10100	10580							
	Average Load (ksi)	8.645	10.110	10.800	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A





G1D - MC	Mix #	130		Days to Release	1						
	Cast Date	9/12/05									
	Cast Time	5:00 PM									
	Test Date	9/13/05	9/14/05	9/15/05	9/19/05	9/26/05	10/3/05	10/10/05	2/21/06		
	Test Time	10:15 AM	1:00 PM	1:00 PM	9:45 AM	3:45 PM	10:00 AM	11:00 AM	12:00 PM		
	Age (days)	0.72	1.83	2.83	6.70	13.95	20.71	27.75	161.79	#N/A	#N/A
E Mod	Gage Length (in)	5.211	5.151	5.287	5.283	5.244	5.257	5.248			
	E Mod (ksi) - a	4212.65	5561.45			5968.40		5878.80			
	b	4238.96	5565.40	5865.15		5914.60	6074.60	5825.75			
	c	4167.30	5517.75	5980.95		5932.30	6098.05	5841.95			
	E Mod Ave (ksi)	4206.30	5548.20	5923.05	#N/A	5938.43	6086.33	5848.83	#N/A	#N/A	#N/A
UW - Fc	Load 1 (lb)	59187	95099	113310	130370			146470	143660		
	Load 2 (lb)	62193	98283					147500			
	Average Load (lb)	60690	96691	113310	130370	#N/A	#N/A	146985	143660	#N/A	#N/A
	Comp Str (ksi)	4.830	7.694	9.017	10.375	#N/A	#N/A	11.697	11.432	#N/A	#N/A
CTC - Fc	Age (days)										
	Stress 1 (psi)										
	Stress 2 (psi)										
	Average Load (ksi)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A





APPENDIX D

SNAKE LAKE CREEP TEST DATA

G2D-AC-Release

Girder Name:	G2D
Cast Date:	09/09/05
Cast Time:	5:00 PM
Release date:	09/12/05
Cylinder Loading:	Release
Cylinder Cure:	AC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	73	73
Unwrap Time	8:15 AM	8:15 AM
Cyl. Surf. Temp(°F)	65	65
Humidity (%)		

Loading:

Ave E Mod = 5143 ksi

Sustained Pressure = 3.656 ksi

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/12/05	09/12/05	09/12/05	09/12/05
Time	12:16 PM	12:20 PM	12:30 PM	12:40 PM
Ambient Temp (°F)	64			
Cyl. Surf. Temp(°F)	68			
Gauge Load (psi)	0	7300	0	7300
Stress (ksi)	0	3.656	0	3.656
(10,000 in) N	160	63	152	69
S	274	252	276	252
E	310	272	310	255
W	300	244	301	238
Age (days)	2.80	2.81	2.81	2.82
Gauge Correction	7	7	7	7
Rod Temp (°F)	68	68	68	68
ADJ - N	167	70	159	76
ADJ - S	281	259	283	259
ADJ - E	317	279	317	262
ADJ - W	307	251	308	245
Δ Average N-S		-60		-54
Δ Average E-W		-47		-59
Δ Ave-Ave (in)		-53		-56
Concrete Strain		-0.000784		-0.000827
E_c (ksi)		4663		4421

Comments:

Loading proceedure:
Pump to gauge pressure of 7300 psi.
Maintain pressure with jack while taking readings. Hand tighten nuts until snug.

UnSealed				
Date	09/12/05	09/12/05	09/12/05	09/12/05
Time	12:16 PM	12:20 PM	12:30 PM	12:40 PM
Ambient Temp (°F)	64			
Cyl. Surf. Temp(°F)	68			
Gauge Load (psi)	0	7300	0	7300
Stress (ksi)	0	3.656	0	3.656
(10,000 in) N	422	362	415	371
S	357	307	349	310
E	428	385	423	389
W	356	300	352	301
Age (days)	2.80	2.81	2.81	2.82
Gauge Correction	7	7	7	7
Rod Temp (°F)	68	68	68	68
ADJ - N	429	369	422	378
ADJ - S	364	314	356	317
ADJ - E	435	392	430	396
ADJ - W	363	307	359	308
Δ Average N-S		-55		-42
Δ Average E-W		-50		-43
Δ Ave-Ave (in)		-52		-42
Concrete Strain		-0.000770		-0.000623
E_c (ksi)		4749		5864

Un-Loading:

Sealed	**100%**	**0%**
Date	01/11/06	01/11/06
Time	1:17 PM	1:58 PM
Ambient Temp (°F)	50	49
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7300	0
Stress (ksi)	3.656	0
(10,000 in) N	23	94
S	298	324
E	315	359
W	256	315
Age (days)	123.85	123.87
Gauge Correction	-67	-73
Rod Temp (°F)	54	54
ADJ - N	-44	21
ADJ - S	231	251
ADJ - E	248	286
ADJ - W	189	242
Δ Average N-S		43
Δ Average E-W		46
Δ Ave-Ave (in)		44
Concrete Strain		0.000605
E_c (ksi)		6041

Creep Monitoring:

Sealed	**0%**	**100%**	
Date	09/12/05	09/12/05	09/14/05
Time	12:30 PM	12:40 PM	1:33 PM
Ambient Temp (°F)			
Cyl. Surf. Temp(°F)			66
(10,000 in) N	152	69	145
S	276	252	405
E	310	255	415
W	301	238	479
Age (days)	2.81	2.82	4.86
Gauge Correction	7	7	-153
Rod Temp (°F)	68	68	68
ADJ - N	159	76	-8
ADJ - S	283	259	252
ADJ - E	317	262	262
ADJ - W	308	245	326
Δ Average N-S	0	-54	-99
Δ Average E-W	0	-59	-19
Δ Ave-Ave	0	-56	-59
Stress (ksi)	0	3.656	3.656
Concrete Strain	0	-0.000827	-0.000863
E_c Effective (ksi)	0	4421	4238
$C_c(t)$	0	0	0.0431862

UnSealed		
Date	01/11/06	01/11/06
Time	1:19 PM	2:00 PM
Ambient Temp (°F)	50	49
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7300	0
Stress (ksi)	3.656	0
(10,000 in) N	372	419
S	231	286
E	352	396
W	304	365
Age (days)	123.85	123.88
Gauge Correction	-67	-73
Rod Temp (°F)	54	54
ADJ - N	305	346
ADJ - S	164	213
ADJ - E	285	323
ADJ - W	237	292
Δ Average N-S		45
Δ Average E-W		47
Δ Ave-Ave (in)		46
Concrete Strain		0.000654
E_c (ksi)		5594

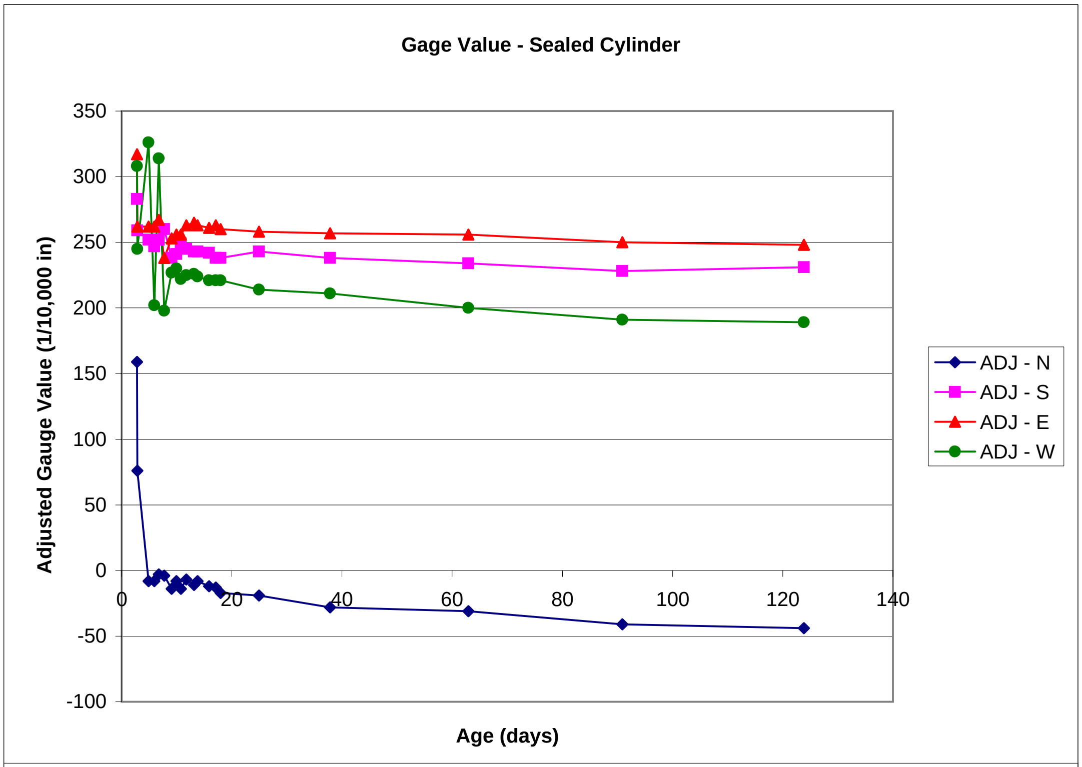
UnSealed			
Date	09/12/05	09/12/05	09/14/05
Time	12:30 PM	12:40 PM	1:39 PM
Ambient Temp (°F)			
Cyl. Surf. Temp(°F)			65
(10,000 in) N	415	371	490
S	349	310	466
E	423	389	474
W	352	301	434
Age (days)	2.81	2.82	4.86
Gauge Correction	7	7	-153
Rod Temp (°F)	68	68	68
ADJ - N	422	378	337
ADJ - S	356	317	313
ADJ - E	430	396	321
ADJ - W	359	308	281
Δ Average N-S	0	-42	-64
Δ Average E-W	0	-43	-94
Δ Ave-Ave	0	-42	-79
Stress (ksi)	0	3.656	3.656
Concrete Strain	0	-0.000623	-0.001148
E_c Effective (ksi)	0	5864	3184
$C_c(t)$	0	0	0.8421386

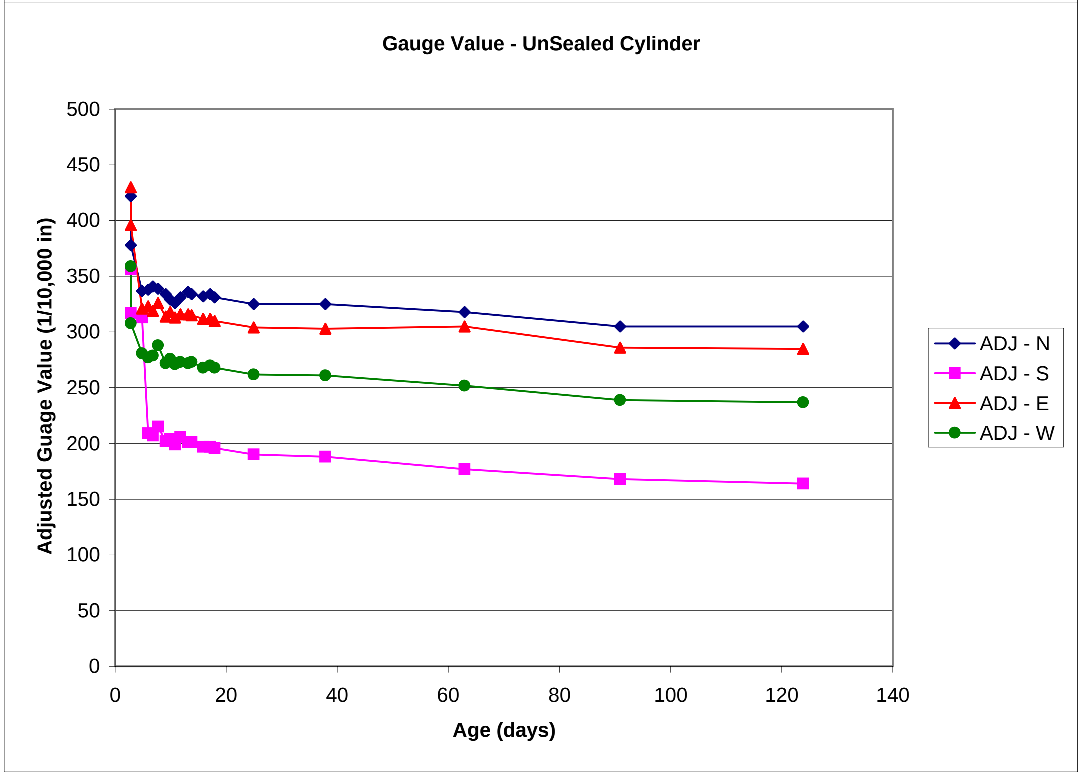
09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05
3:45 PM	11:27 AM	10:06 AM	7:02 PM	3:23 PM	11:02 AM	10:51 AM	7:40 PM	11:44 AM	1:08 PM
66	62	60	68	68	68	66	66	65	66
65	64	63	69	71	76	66	66	65	69
570	568	558	556	560	555	556	551	552	550
825	823	822	808	809	818	808	805	803	804
840	838	800	823	824	825	826	827	823	823
780	885	760	797	798	791	788	788	784	783
5.95	6.77	7.71	9.08	9.93	10.75	11.74	13.11	13.78	15.84
-578	-571	-562	-570	-568	-569	-563	-562	-560	-562
66	59	64	70	68	68	66	68	64	70
-8	-3	-4	-14	-8	-14	-7	-11	-8	-12
247	252	260	238	241	249	245	243	243	242
262	267	238	253	256	256	263	265	263	261
202	314	198	227	230	222	225	226	224	221
-102	-97	-93	-109	-105	-104	-102	-105	-104	-106
-81	-22	-95	-73	-70	-74	-69	-67	-69	-72
-91	-59	-94	-91	-87	-89	-85	-86	-86	-89
3.656	3.656	3.656	3.656	3.656	3.656	3.656	3.656	3.656	3.656
-0.001323	-0.000870	-0.001363	-0.001320	-0.001266	-0.001288	-0.001241	-0.001252	-0.001256	-0.001291
2763	4203	2683	2770	2887	2839	2945	2920	2912	2831
0.6002878	0.0518234	0.6477926	0.5959692	0.5311899	0.5571017	0.5009596	0.5139155	0.5182341	0.5614203

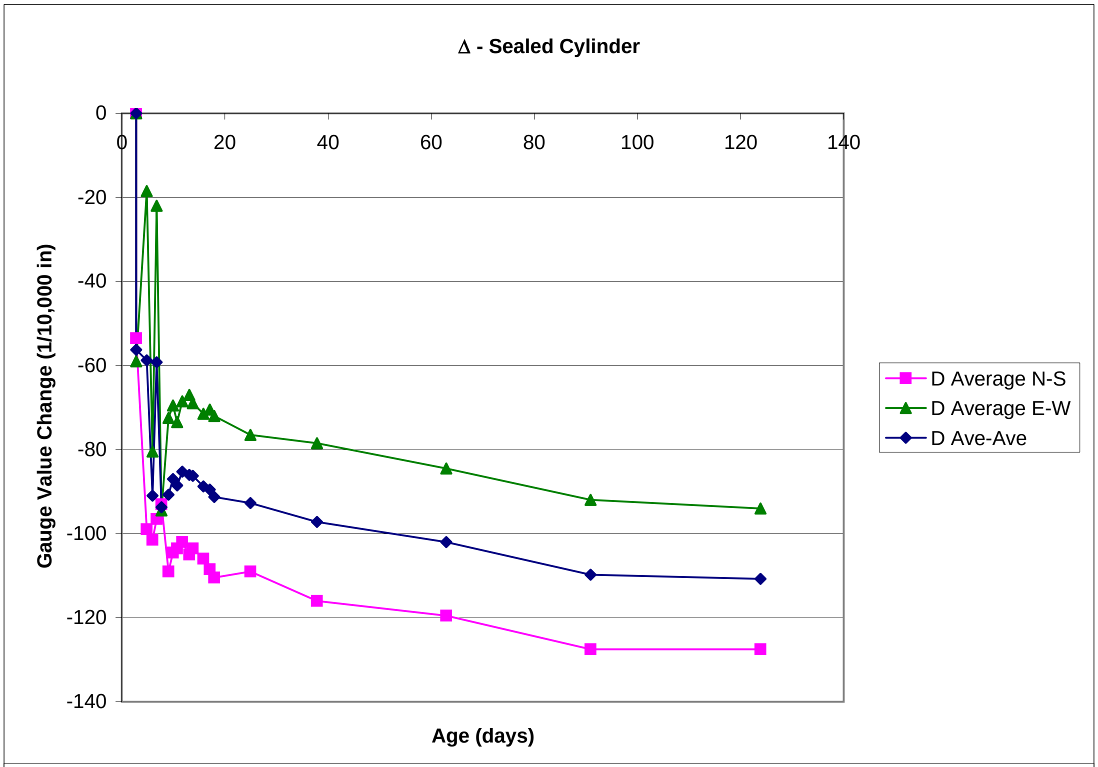
09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05
3:48 PM	11:31 AM	10:08 AM	7:04 PM	3:25 PM	11:04 AM	10:53 AM	7:43 PM	11:45 AM	1:10 PM
66	62	60	68	68	68	66	66	65	66
69	64	62	68	67	71	64	66	63	66
916	912	901	904	897	895	894	898	894	894
787	778	777	772	772	768	769	763	761	759
901	890	888	884	886	882	879	878	875	874
855	850	850	842	844	840	836	834	833	830
5.95	6.77	7.71	9.09	9.93	10.75	11.75	13.11	13.78	15.84
-578	-571	-562	-570	-568	-569	-563	-562	-560	-562
66	59	63	70	70	68	66	68	64	70
338	341	339	334	329	326	331	336	334	332
209	207	215	202	204	199	206	201	201	197
323	319	326	314	318	313	316	316	315	312
277	279	288	272	276	271	273	272	273	268
-116	-115	-112	-121	-123	-127	-121	-121	-122	-125
-95	-96	-88	-102	-98	-103	-100	-101	-101	-105
-105	-105	-100	-111	-110	-115	-110	-111	-111	-115
3.656	3.656	3.656	3.656	3.656	3.656	3.656	3.656	3.656	3.656
-0.001523	-0.001527	-0.001448	-0.001613	-0.001595	-0.001659	-0.001598	-0.001602	-0.001609	-0.001659
2400	2394	2524	2267	2292	2204	2287	2282	2272	2204
1.4436662	1.449395	1.3233607	1.5868871	1.5582429	1.6613619	1.5639717	1.5697006	1.5811582	1.6613619

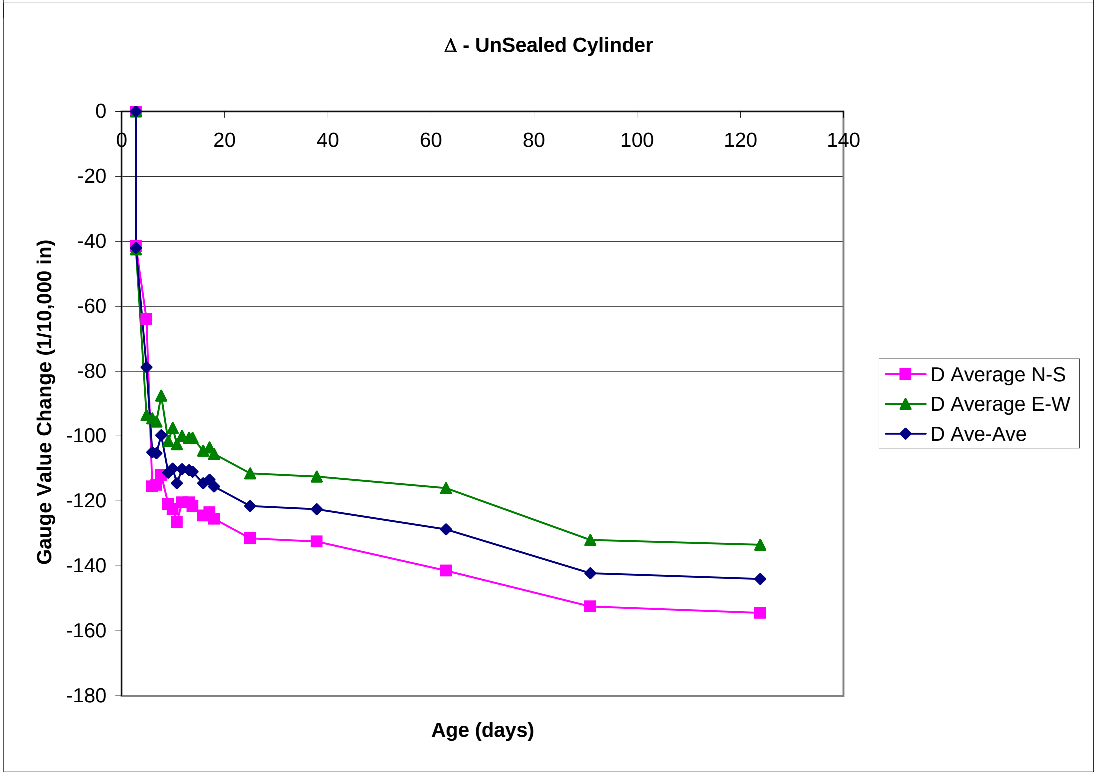
09/26/05	09/27/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06
7:10 PM	3:18 PM	3:37 PM	12:54 PM	2:54 PM	2:58 PM	1:17 PM
69	74	65	66	52	57	49
69	71	65	68	55		
550	561	555	547	539	108	23
801	816	817	813	804	377	298
826	838	832	832	826	399	315
784	799	788	786	770	340	256
17.09	17.93	24.94	37.83	62.91	90.92	123.85
-563	-578	-574	-575	-570	-149	-67
72	73	66	68	57	63	54
-13	-17	-19	-28	-31	-41	-44
238	238	243	238	234	228	231
263	260	258	257	256	250	248
221	221	214	211	200	191	189
-109	-111	-109	-116	-120	-128	-128
-71	-72	-77	-79	-85	-92	-94
-90	-91	-93	-97	-102	-110	-111
3.656	3.656	3.656	3.656	3.656	3.656	3.656
-0.001302	-0.001327	-0.001348	-0.001413	-0.001481	-0.001591	-0.001606
2808	2755	2711	2588	2469	2298	2277
0.5743761	0.6046064	0.6305182	0.7082533	0.790307	0.9241841	0.9414586

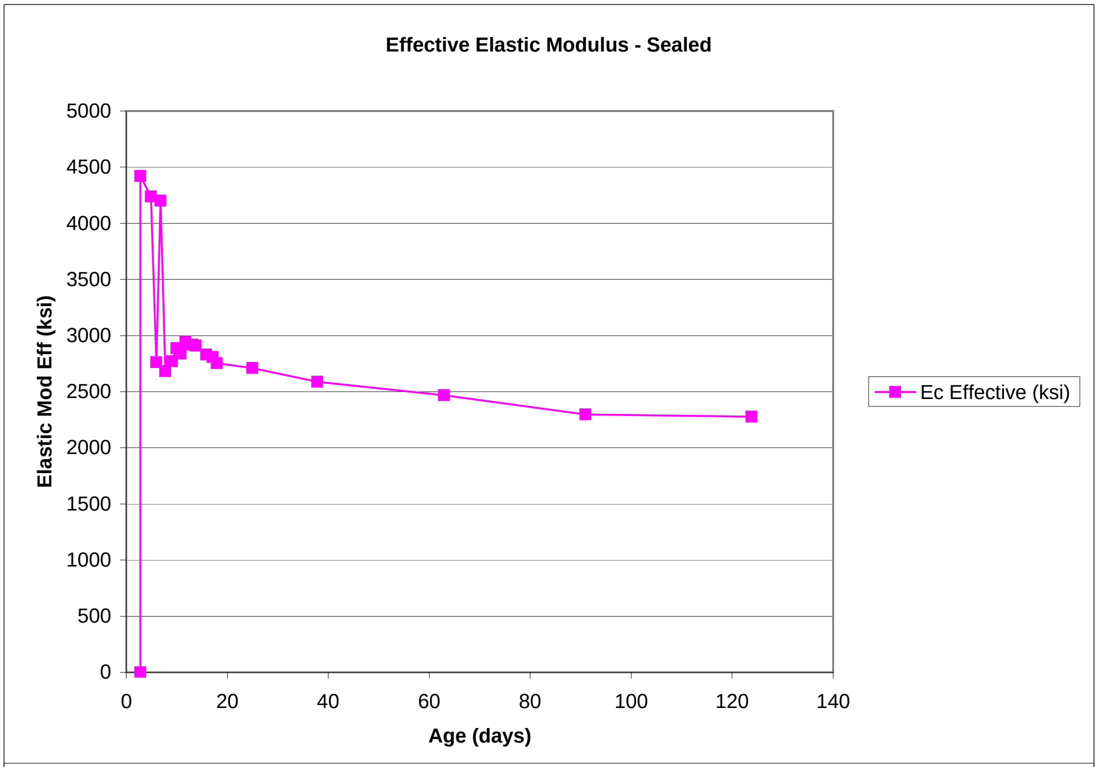
09/26/05	09/27/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06
7:11 PM	3:19 PM	3:58 PM	12:56 PM	2:55 PM	3:00 PM	1:19 PM
69	74	65	66	52	57	49
69	68	63	65	55		
897	909	902	900	888	454	372
760	774	767	763	747	317	231
875	888	881	878	875	435	352
833	846	839	836	822	388	304
17.09	17.93	24.96	37.83	62.91	90.92	123.85
-563	-578	-577	-575	-570	-149	-67
72	73	68	68	57	63	54
334	331	325	325	318	305	305
197	196	190	188	177	168	164
312	310	304	303	305	286	285
270	268	262	261	252	239	237
-124	-126	-132	-133	-142	-153	-155
-104	-106	-112	-113	-116	-132	-134
-114	-116	-122	-123	-129	-142	-144
3.656	3.656	3.656	3.656	3.656	3.656	3.656
-0.001645	-0.001673	-0.001759	-0.001773	-0.001863	-0.002056	-0.002081
2223	2185	2078	2062	1963	1779	1757
1.6384466	1.6842772	1.8217693	1.8446846	1.9879054	2.2972625	2.3373643

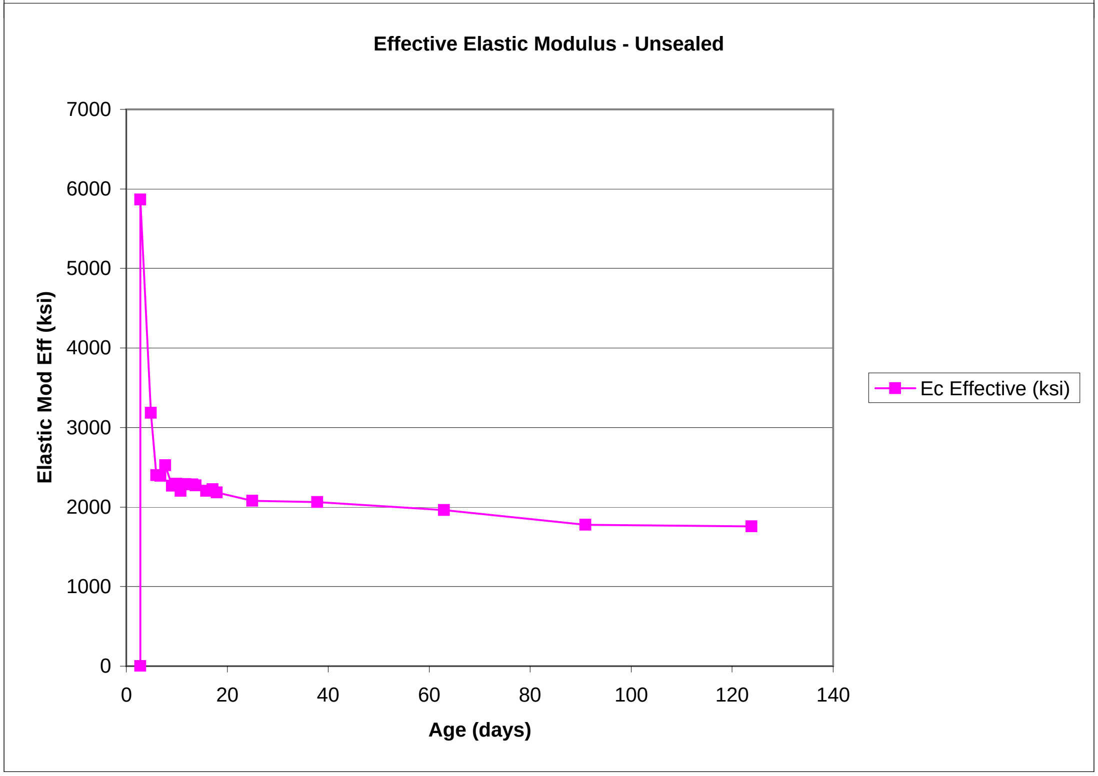

Gage Value - Sealed Cylinder
350
300
250
200
150
100
50
0
-50
-100
Adjusted Gauge Value (1/10,000 in)
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

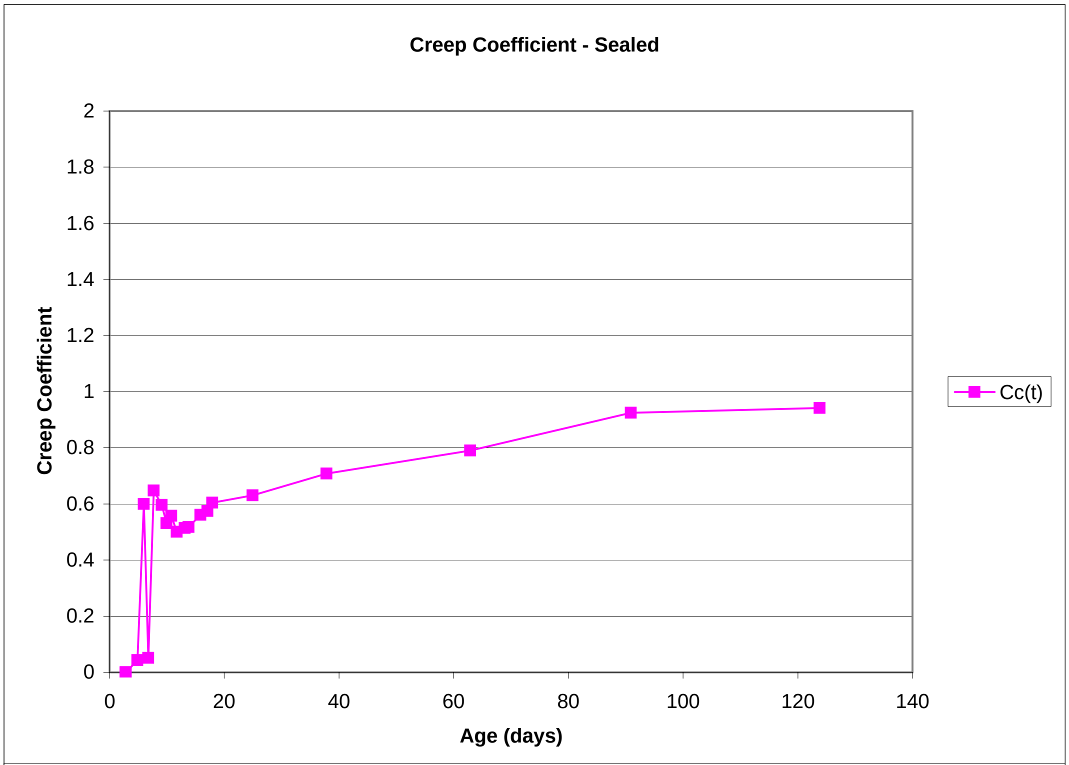

Gauge Value - UnSealed Cylinder
500
450
400
350
300
250
200
150
100
50
0
Adjusted Guage Value (1/10,000 in)
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Δ - Sealed Cylinder
Gauge Value Change (1/10,000 in)
0
-20
-40
-60
-80
-100
-120
-140
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave


Δ - UnSealed Cylinder
Gauge Value Change (1/10,000 in)
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave


Effective Elastic Modulus - Sealed
Elastic Mod Eff (ksi)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Effective Elastic Modulus - Unsealed
Elastic Mod Eff (ksi)
7000
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Creep Coefficient - Sealed
Creep Coefficient
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)


Creep Coefficient - Unsealed
Creep Coefficient
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)

G1D-AC-Release

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	Release
Cylinder Cure:	AC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	72	72
Unwrap Time	10:25 AM	10:25 AM
Cyl. Surf. Temp(°F)		
Humidity (%)		

Loading:

Ave E Mod = 4705 ksi

Sustained Pressure = 3.855 ksi

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/13/05	09/13/05	09/13/05	09/13/05
Time	8:36 AM	8:45 AM	9:00 AM	9:15 AM
Ambient Temp (°F)	72	72	72	72
Cyl. Surf. Temp(°F)	64			
Gauge Load (psi)	0	7300	0	7300
Stress (ksi)	0	3.855	0	3.855
(10,000 in) N	327	294	355	305
S	367	304	356	296
E	363	311	356	307
W	325	253	319	256
Age (days)	0.65	0.66	0.67	0.68
Gauge Correction	15	-14	-14	-14
Rod Temp (°F)	64	64	64	64
ADJ - N	342	280	341	291
ADJ - S	382	290	342	282
ADJ - E	378	297	342	293
ADJ - W	340	239	305	242
Δ Average N-S		-77		-55
Δ Average E-W		-91		-56
Δ Ave-Ave (in)		-84		-56
Concrete Strain		-0.001225		-0.000818
E_c (ksi)		3148		4715

Comments:

Loading Procedure:
Pump to gauge pressure of 7300 psi.
Hand tighten nuts to snug. Add additional 1/4 turn of nuts with wrench.
Take Reading.

UnSealed				
Date	09/13/05	09/13/05	09/13/05	09/13/05
Time	8:39 AM	8:45 AM	9:00 AM	9:15 AM
Ambient Temp (°F)	72	72	72	72
Cyl. Surf. Temp(°F)	76			
Gauge Load (psi)	0	7300	0	7300
Stress (ksi)	0	3.855	0	3.855
(10,000 in) N	362	294	360	304
S	392	331	387	323
E	345	293	336	283
W	389	326	381	331
Age (days)	0.65	0.66	0.67	0.68
Gauge Correction	15	-14	-14	-14
Rod Temp (°F)	64	64	64	64
ADJ - N	377	280	346	290
ADJ - S	407	317	373	309
ADJ - E	360	279	322	269
ADJ - W	404	312	367	317
Δ Average N-S		-94		-60
Δ Average E-W		-87		-52
Δ Ave-Ave (in)		-90		-56
Concrete Strain		-0.001310		-0.000821
E_c (ksi)		2942		4695

Un-Loading:

Sealed	**100%**	**0%**
Date	01/11/06	01/11/06
Time	1:28 PM	2:50 PM
Ambient Temp (°F)	49	49
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7300	0
Stress (ksi)	3.855	0
(10,000 in) N	308	361
S	310	361
E	324	367
W	278	329
Age (days)	120.85	120.91
Gauge Correction	-73	-73
Rod Temp (°F)	54	52
ADJ - N	235	288
ADJ - S	237	288
ADJ - E	251	294
ADJ - W	205	256
Δ Average N-S	▨	52
Δ Average E-W	▨	47
Δ Ave-Ave (in)	▨	50
Concrete Strain	▨	0.000682
E_c (ksi)	▨	5649

Creep Monitoring:

Sealed	**0%**	**100%**	
Date	09/13/05	09/13/05	09/13/05
Time	9:00 AM	9:15 AM	2:00 PM
Ambient Temp (°F)	72	72	
Cyl. Surf. Temp(°F)			77
(10,000 in) N	355	305	291
S	356	296	283
E	356	307	294
W	319	256	242
Age (days)	0.67	0.68	0.88
Gauge Correction	-14	-14	-13
Rod Temp (°F)	64	64	75
ADJ - N	341	291	278
ADJ - S	342	282	270
ADJ - E	342	293	281
ADJ - W	305	242	229
Δ Average N-S	0	-55	-68
Δ Average E-W	0	-56	-69
Δ Ave-Ave	0	-56	-68
Stress (ksi)	0	3.855	3.855
Concrete Strain	0	-0.000818	-0.000996
E_c Effective (ksi)	0	4715	3870
$C_c(t)$	0	0	0.2184242

UnSealed		
Date	01/11/06	01/11/06
Time	1:30 PM	2:52 PM
Ambient Temp (°F)	49	49
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7300	0
Stress (ksi)	3.855	0
(10,000 in) N	315	363
S	333	392
E	287	335
W	346	395
Age (days)	120.85	120.91
Gauge Correction	-73	-73
Rod Temp (°F)	54	52
ADJ - N	242	290
ADJ - S	260	319
ADJ - E	214	262
ADJ - W	273	322
Δ Average N-S	▨	54
Δ Average E-W	▨	49
Δ Ave-Ave (in)	▨	51
Concrete Strain	▨	0.000704
E_c (ksi)	▨	5477

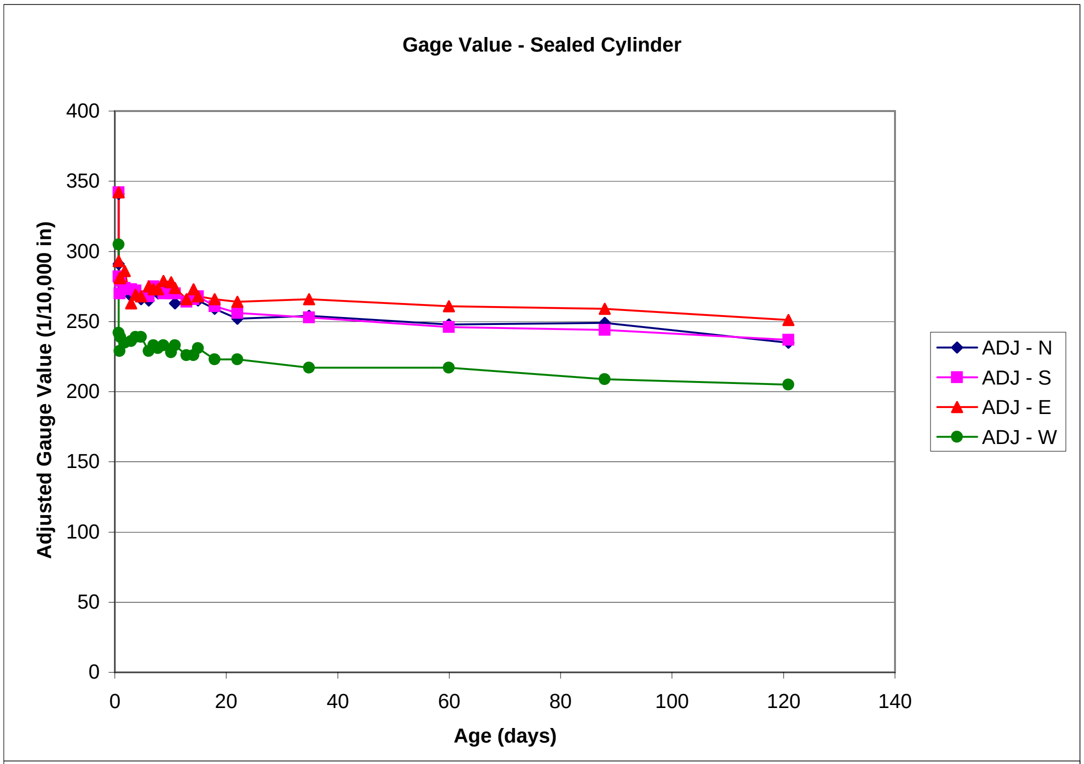
UnSealed			
Date	09/13/05	09/13/05	09/13/05
Time	9:00 AM	9:15 AM	2:00 PM
Ambient Temp (°F)	72	72	
Cyl. Surf. Temp(°F)			73
(10,000 in) N	360	304	293
S	387	323	309
E	336	283	277
W	381	331	311
Age (days)	0.67	0.68	0.88
Gauge Correction	-14	-14	-13
Rod Temp (°F)	64	64	75
ADJ - N	346	290	280
ADJ - S	373	309	296
ADJ - E	322	269	264
ADJ - W	367	317	298
Δ Average N-S	0	-60	-72
Δ Average E-W	0	-52	-64
Δ Ave-Ave	0	-56	-68
Stress (ksi)	0	3.855	3.855
Concrete Strain	0	-0.000821	-0.000989
E_c Effective (ksi)	0	4695	3898
$C_c(t)$	0	0	0.2044257

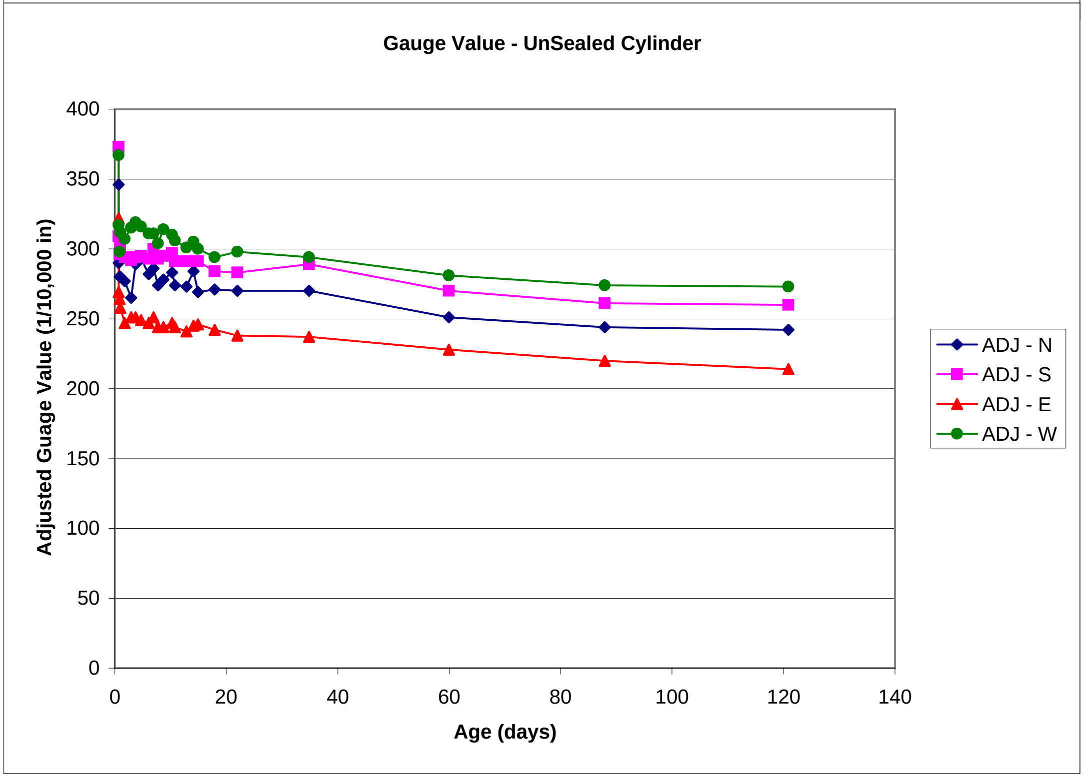
09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	09/20/05	09/21/05	09/22/05
4:21 PM	11:58 AM	3:30 PM	11:10 AM	9:53 AM	6:52 PM	3:30 PM	10:47 AM	11:02 AM	7:55 PM
		66	62	61	68	68	68	66	64
77	65	68	65	63		71	69	67	65
442	435	685	842	830	834	841	837	836	834
440	435	690	843	832	837	843	841	833	832
442	447	680	840	832	844	841	840	842	840
400	396	653	810	803	798	801	798	796	790
0.97	1.79	2.94	3.76	4.70	6.08	6.94	7.74	8.75	10.12
-161	-161	-417	-571	-564	-569	-568	-567	-563	-562
75	75	66	59	64	72	70	66	68	68
281	274	268	271	266	265	273	270	273	272
279	274	273	272	268	268	275	274	270	270
281	286	263	269	268	275	273	273	279	278
239	235	236	239	239	229	233	231	233	228
-62	-68	-71	-70	-75	-75	-68	-70	-70	-71
-64	-63	-74	-70	-70	-72	-71	-72	-68	-71
-63	-65	-73	-70	-72	-73	-69	-71	-69	-71
3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855
-0.000918	-0.000957	-0.001060	-0.001021	-0.001057	-0.001071	-0.001010	-0.001032	-0.001007	-0.001032
4201	4029	3635	3775	3648	3599	3815	3736	3829	3736
0.1223175	0.1703708	0.2970568	0.2490035	0.2926884	0.3101623	0.2358981	0.262109	0.2315296	0.262109

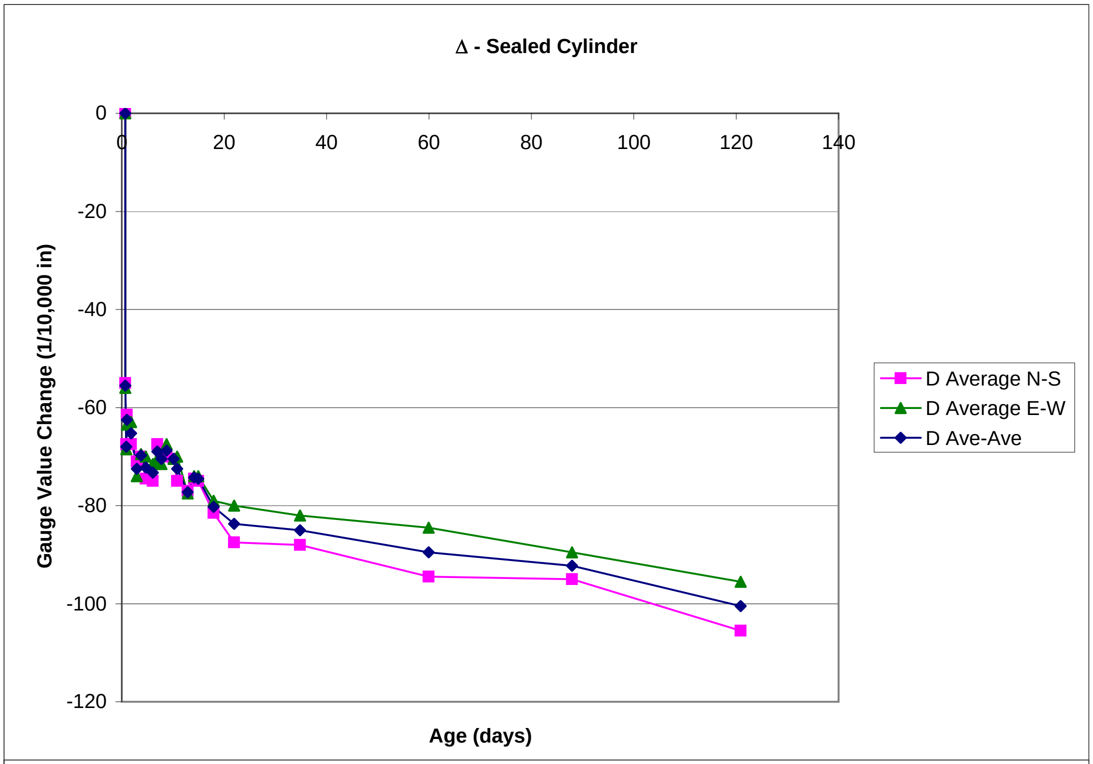
09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	09/20/05	09/21/05	09/22/05
4:21 PM	11:58 AM	3:32 PM	11:14 AM	9:30 AM	6:54 PM	3:33 PM	10:49 AM	11:04 AM	11:58 PM
		66	62	61	68	68	68	66	64
77	64	66	64	61		69	67	65	66
441	438	682	860	855	851	854	841	841	843
463	455	709	865	857	862	868	860	858	857
419	408	668	822	811	816	819	811	807	807
473	468	732	890	878	880	879	871	877	870
0.97	1.79	2.94	3.76	4.69	6.08	6.94	7.74	8.75	10.29
-161	-161	-417	-571	-562	-569	-568	-567	-563	-560
75	75	66	59	64	72	70	66	68	68
280	277	265	289	293	282	286	274	278	283
302	294	292	294	295	293	300	293	295	297
258	247	251	251	249	247	251	244	244	247
312	307	315	319	316	311	311	304	314	310
-69	-74	-81	-68	-66	-72	-67	-76	-73	-70
-60	-68	-62	-60	-62	-66	-64	-71	-66	-66
-64	-71	-71	-64	-64	-69	-65	-73	-69	-68
3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855
-0.000939	-0.001035	-0.001043	-0.000935	-0.000935	-0.001007	-0.000953	-0.001071	-0.001014	-0.000993
4106	3723	3698	4121	4121	3829	4044	3599	3802	3884
0.1435329	0.2609689	0.2696679	0.1391834	0.1391834	0.2261731	0.1609308	0.3044638	0.2348721	0.2087752

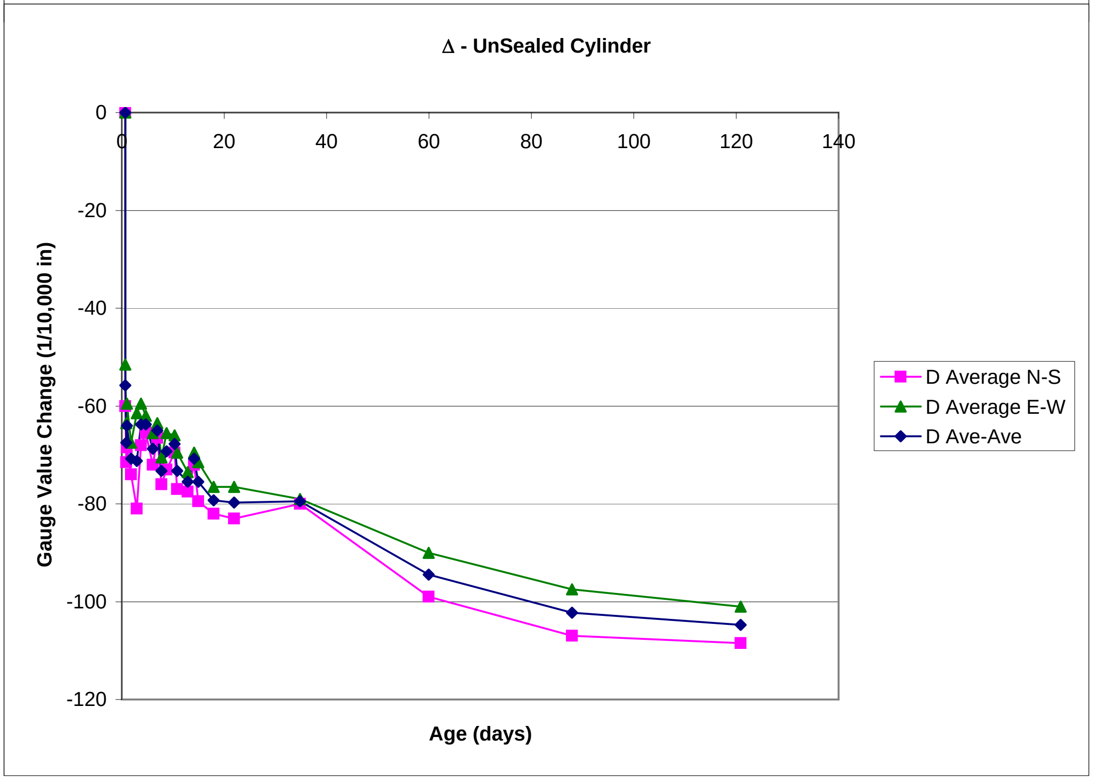
09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06
11:51 AM	1:23 PM	7:24 PM	3:30 PM	3:11 PM	4:12 PM	1:09 PM	3:09 PM	3:13 PM	1:28 PM
65	68	69	74	64	65	67	52	56	49
67	70	68	74	63	66	69	52		
823	829	830	842	834	829	829	818	398	308
830	828	828	845	836	833	828	816	393	310
834	830	835	845	841	841	841	831	408	324
793	790	788	808	798	800	792	787	358	278
10.79	12.85	14.10	14.94	17.92	21.97	34.84	59.92	87.93	120.85
-560	-564	-562	-577	-575	-577	-575	-570	-149	-73
66	72	70	73	66	68	68	57	63	54
263	265	268	265	259	252	254	248	249	235
270	264	266	268	261	256	253	246	244	237
274	266	273	268	266	264	266	261	259	251
233	226	226	231	223	223	217	217	209	205
-75	-77	-75	-75	-82	-88	-88	-95	-95	-106
-70	-78	-74	-74	-79	-80	-82	-85	-90	-96
-73	-77	-74	-75	-80	-84	-85	-90	-92	-101
3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855
-0.001060	-0.001128	-0.001085	-0.001089	-0.001171	-0.001221	-0.001239	-0.001303	-0.001343	-0.001460
3635	3417	3552	3540	3292	3157	3111	2958	2871	2640
0.2970568	0.380058	0.3276362	0.3320047	0.4324798	0.4936386	0.515481	0.5941137	0.642167	0.7863269

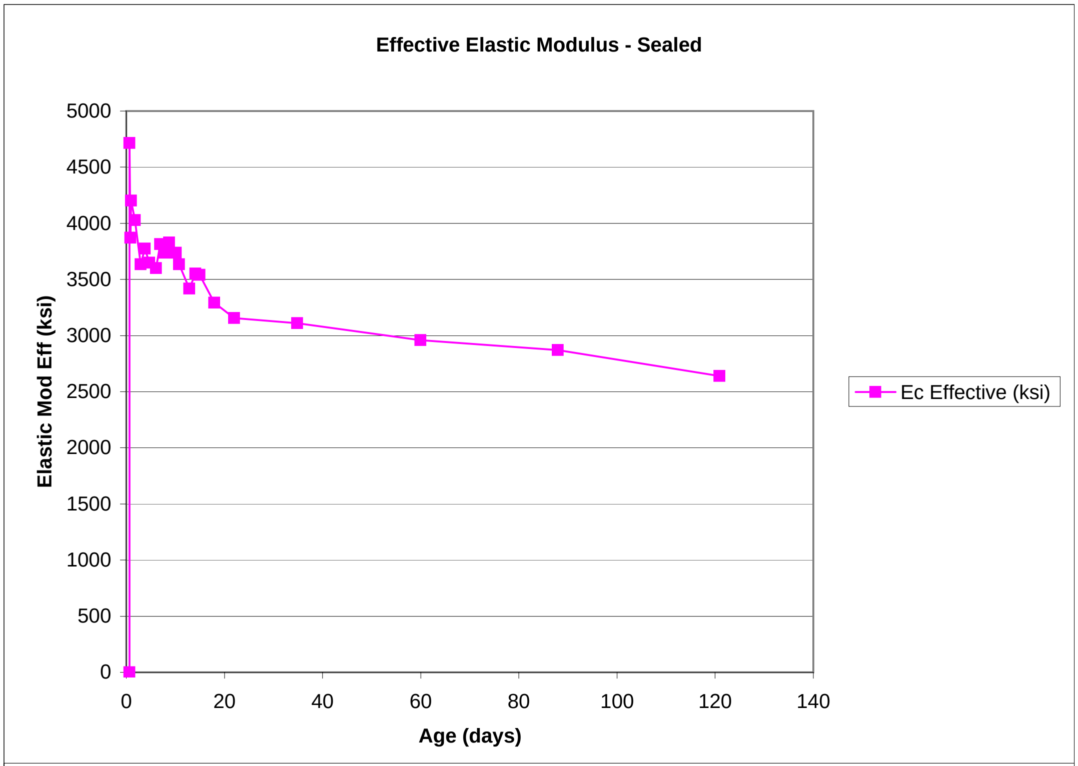
09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06
11:53 AM	1:25 PM	7:25 PM	3:31 PM	3:13 PM	4:13 PM	1:11 PM	3:10 PM	3:15 PM	1:30 PM
65	68	69	74	64	65	67	52	56	49
64	69	69	72	64	65	66	54		
834	837	846	846	846	847	845	821	393	315
851	855	853	868	859	860	864	840	410	333
804	805	807	823	817	815	812	798	369	287
866	865	867	877	869	875	869	851	423	346
10.79	12.85	14.10	14.94	17.93	21.97	34.84	59.92	87.93	120.85
-560	-564	-562	-577	-575	-577	-575	-570	-149	-73
66	72	70	73	66	68	68	57	63	54
274	273	284	269	271	270	270	251	244	242
291	291	291	291	284	283	289	270	261	260
244	241	245	246	242	238	237	228	220	214
306	301	305	300	294	298	294	281	274	273
-77	-78	-72	-80	-82	-83	-80	-99	-107	-109
-70	-74	-70	-72	-77	-77	-79	-90	-98	-101
-73	-76	-71	-76	-79	-80	-80	-95	-102	-105
3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855	3.855
-0.001071	-0.001103	-0.001035	-0.001103	-0.001157	-0.001164	-0.001160	-0.001375	-0.001485	-0.001521
3599	3494	3723	3494	3332	3312	3322	2804	2595	2534
0.3044638	0.3436091	0.2609689	0.3436091	0.4088513	0.4175503	0.4132008	0.6741698	0.8090037	0.8524986

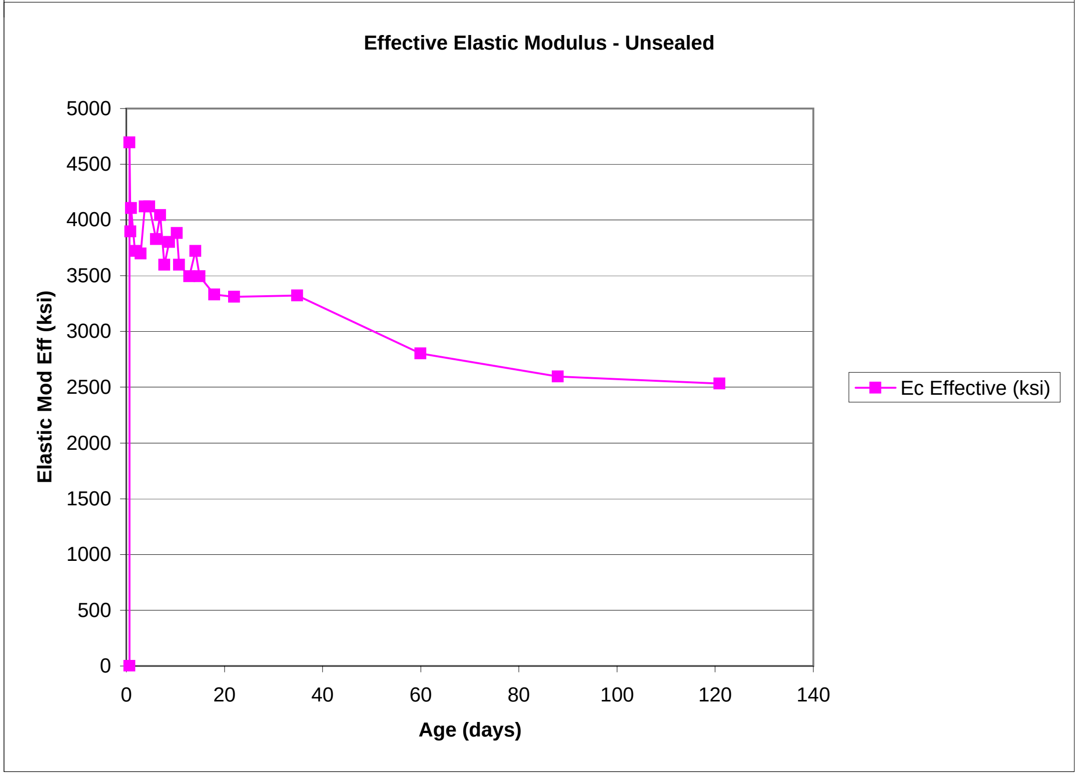

Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

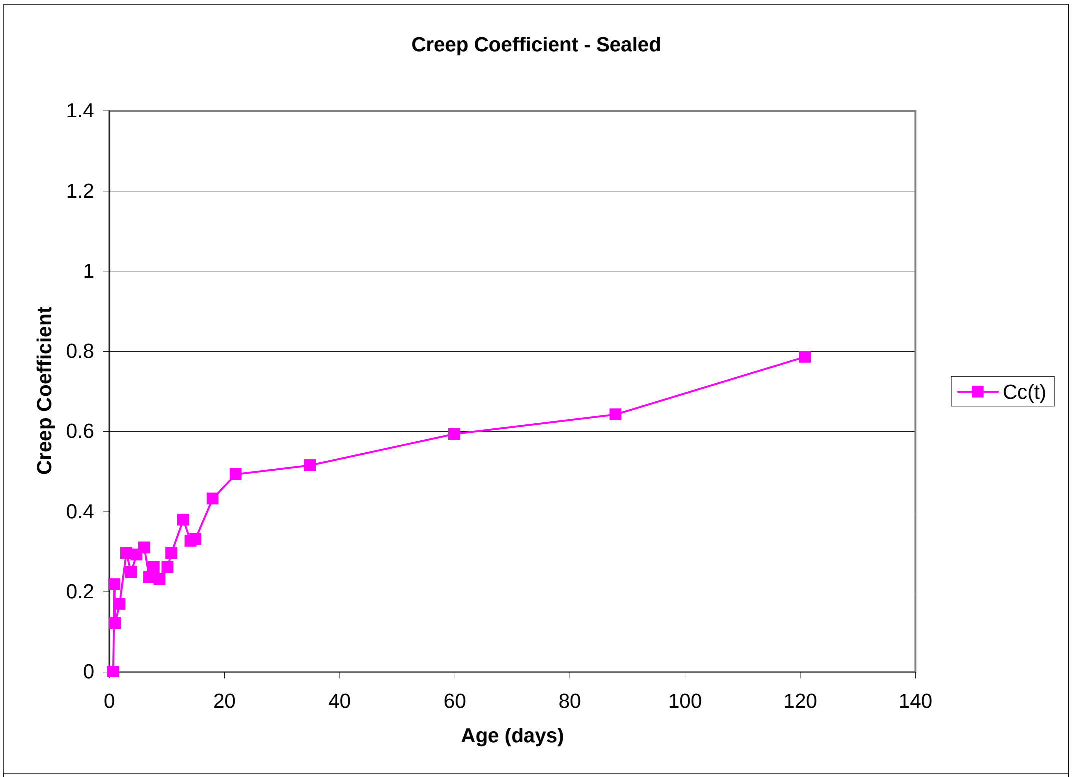

Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Δ - Sealed Cylinder
0
-20
-40
-60
-80
-100
-120
0
20
40
60
80
100
120
140
Gauge Value Change (1/10,000 in)
Age (days)
D Average N-S
D Average E-W
D Ave-Ave


Δ - UnSealed Cylinder
0
-20
-40
-60
-80
-100
-120
0
20
40
60
80
100
120
140
Gauge Value Change (1/10,000 in)
Age (days)
D Average N-S
D Average E-W
D Ave-Ave


Effective Elastic Modulus - Sealed


Effective Elastic Modulus - Unsealed


Creep Coefficient - Sealed
Creep Coefficient
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)


Creep Coefficient - Unsealed
Creep Coefficient
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)

G1D-MC-Release

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	Release
Cylinder Cure:	MC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	70	70
Unwrap Time	9:34 AM	9:34 AM
Cyl. Surf. Temp(°F)	77	77
Humidity (%)		

Loading:

Ave E Mod =	3520	ksi
Sustained Pressure =	2.437	ksi

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/13/05	09/13/05	09/13/05	09/13/05
Time	3:40 PM	3:48 PM	3:58 PM	4:00 PM
Ambient Temp (°F)	74	74	74	74
Cyl. Surf. Temp(°F)	73	73	73	73
Gauge Load (psi)	0	4380	0	4380
Stress (ksi)	0	2.437	0	2.437
(10,000 in) N	490	392	480	378
S	505	450	505	440
E	489	427	484	424
W	655	550	645	540
Age (days)	0.94	0.95	0.96	0.96
Gauge Correction	-148	-148	-151	-148
Rod Temp (°F)	75	75	75	75
ADJ - N	342	244	329	230
ADJ - S	357	302	354	292
ADJ - E	341	279	333	276
ADJ - W	507	402	494	392
∆ Average N-S		-77		-81
∆ Average E-W		-84		-80
∆ Ave-Ave (in)		-80		-80
Concrete Strain		-0.001158		-0.001158
E_c (ksi)		2104		2104

Comments:

Loading Procedure:
Pump to gauge pressure of 4380 psi.
Hand tighten nuts to snug.
Addadditional 1/4 turn of nuts with wrench. Take reading.

UnSealed				
Date	09/13/05	09/13/05	09/13/05	09/13/05
Time	3:45 PM	3:48 PM	3:59 PM	4:00 PM
Ambient Temp (°F)	74	74	74	74
Cyl. Surf. Temp(°F)	73	73	73	73
Gauge Load (psi)	0	4380	0	4380
Stress (ksi)	0	2.437	0	2.437
(10,000 in) N	512	424	495	413
S	397	308	392	298
E	473	399	468	389
W	375	285	360	285
Age (days)	0.95	0.95	0.96	0.96
Gauge Correction	-148	-148	-151	-148
Rod Temp (°F)	75	75	75	75
ADJ - N	364	276	344	265
ADJ - S	249	160	241	150
ADJ - E	325	251	317	241
ADJ - W	227	137	209	137
∆ Average N-S		-89		-85
∆ Average E-W		-82		-74
∆ Ave-Ave (in)		-85		-80
Concrete Strain		-0.001233		-0.001151
E_c (ksi)		1976		2117

Un-Loading:

0%	100%	**Sealed**	100%	0%
09/13/05	09/13/05	Date	01/11/06	01/11/06
4:10 PM	4:19 PM	Time	1:24 PM	2:32 PM
		Ambient Temp (°F)	50	49
		Cyl. Surf. Temp(°F)		
0	4380	Gauge Load (psi)	4380	0
0	2.437	Stress (ksi)	2.437	0
484	430	(10,000 in) N	293	318
518	479	S	349	376
496	465	E	338	361
645	585	W	451	481
0.97	0.97	Age (days)	120.85	120.90
-163	-164	Gauge Correction	-73	-73
75	75	Rod Temp (°F)	54	54
321	266	ADJ - N	220	245
355	315	ADJ - S	276	303
333	301	ADJ - E	265	288
482	421	ADJ - W	378	408
▨	-48	Δ Average N-S	▨	26
▨	-47	Δ Average E-W	▨	27
▨	-47	Δ Ave-Ave (in)	▨	26
▨	-0.000687	Concrete Strain	▨	0.000359
▨	3547	E_c (ksi)	▨	6781

		UnSealed		
09/13/05	09/13/05	Date	01/11/06	01/11/06
4:10 PM	4:10 PM	Time	1:26 PM	2:34 PM
		Ambient Temp (°F)	50	49
		Cyl. Surf. Temp(°F)		
0	4380	Gauge Load (psi)	4380	0
0	2.437	Stress (ksi)	2.437	0
500	456	(10,000 in) N	297	326
402	348	S	177	212
475	433	E	287	313
365	314	W	144	178
0.97	0.97	Age (days)	120.85	120.90
-163	-163	Gauge Correction	-73	-73
75	75	Rod Temp (°F)	54	52
337	293	ADJ - N	224	253
239	185	ADJ - S	104	139
312	270	ADJ - E	214	240
202	151	ADJ - W	71	105
▨	-49	Δ Average N-S	▨	32
▨	-47	Δ Average E-W	▨	30
▨	-48	Δ Ave-Ave (in)	▨	31
▨	-0.000698	Concrete Strain	▨	0.000427
▨	3493	E_c (ksi)	▨	5704

Creep Monitoring:

Sealed	**0%**	**100%**						
Date	09/13/05	09/13/05	09/14/05	03/15/05	09/16/05	09/17/05	09/18/05	09/19/05
Time	4:10 PM	4:19 PM	12:32 PM	3:37 PM	11:19 AM	10:02 AM	6:58 PM	3:36 PM
Ambient Temp (°F)				66	62	60	68	68
Cyl. Surf. Temp(°F)			69	69	64	64	69	71
(10,000 in) N	484	430	408	832	823	804	816	805
S	518	479	454	873	868	856	856	855
E	496	465	452	865	864	850	853	852
W	645	585	558	955	962	944	949	961
Age (days)	0.97	0.97	1.81	-181.06	3.76	4.71	6.08	6.94
Gauge Correction	-163	-164	-158	#N/A	-571	-562	-570	-572
Rod Temp (°F)	75	75	66	#N/A	59	64	70	70
ADJ - N	321	266	250	#N/A	252	242	246	233
ADJ - S	355	315	296	#N/A	297	294	286	283
ADJ - E	333	301	294	#N/A	293	288	283	280
ADJ - W	482	421	400	#N/A	391	382	379	389
∆ Average N-S	0	-48	-65	#N/A	-64	-70	-72	-80
∆ Average E-W	0	-47	-61	#N/A	-66	-73	-77	-73
∆ Ave-Ave	0	-47	-63	#N/A	-65	-71	-74	-77
Stress (ksi)	0	2.437	2.437	2.437	2.437	2.437	2.437	2.437
Concrete Strain	0	-0.000687	-0.000912	#N/A	-0.000937	-0.001033	-0.001076	-0.001108
E_c Effective (ksi)	0	3547	2672	#N/A	2601	2358	2264	2199
$C_c(t)$	0	0	0.3274942	#N/A	0.3638825	0.5042372	0.566617	0.6134019

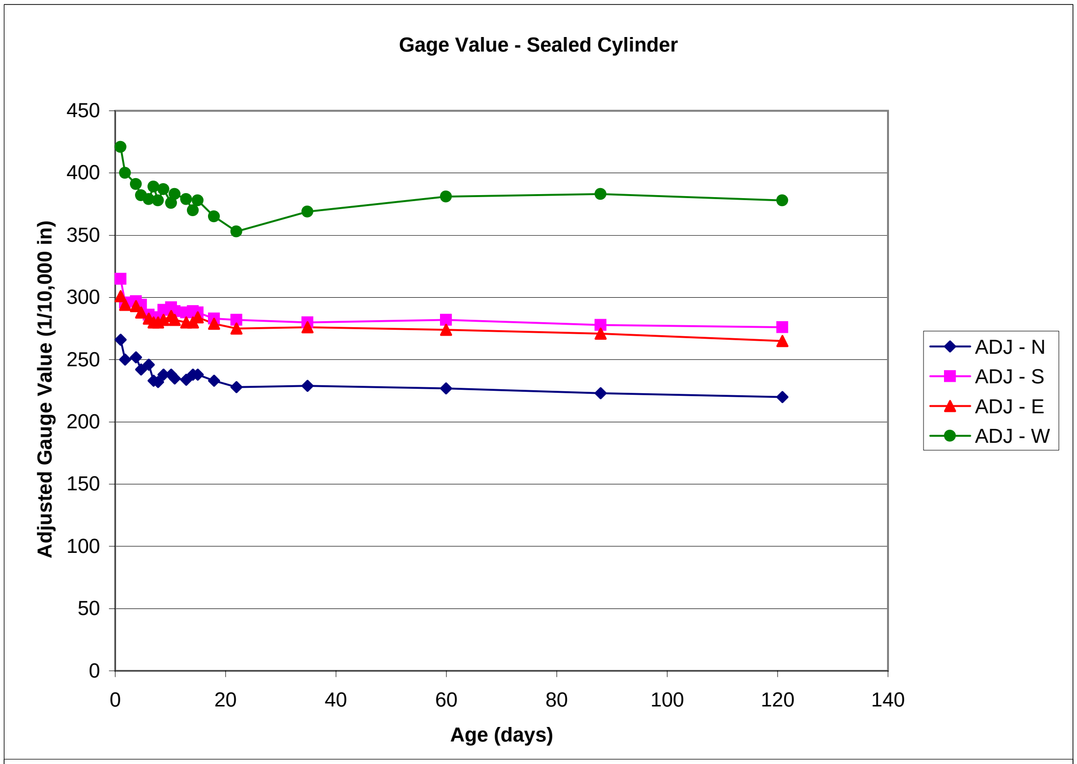
UnSealed								
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05
Time	4:10 PM	4:10 PM	12:35 PM	3:39 PM	11:22 AM	10:02 AM	6:59 PM	3:38 PM
Ambient Temp (°F)				66	62	60	68	68
Cyl. Surf. Temp(°F)			67	67	64	62	69	69
(10,000 in) N	500	456	425	850	837	825	834	829
S	402	348	316	740	730	739	719	721
E	475	433	416	832	819	814	814	814
W	365	314	274	702	691	681	681	681
Age (days)	0.97	0.97	1.82	2.94	3.77	4.71	6.08	6.94
Gauge Correction	-163	-163	-158	-577	-571	-562	-570	-572
Rod Temp (°F)	75	75	66	66	59	64	70	70
ADJ - N	337	293	267	273	266	263	264	257
ADJ - S	239	185	158	163	159	177	149	149
ADJ - E	312	270	258	255	248	252	244	242
ADJ - W	202	151	116	125	120	119	111	109
∆ Average N-S	0	-49	-76	-70	-76	-68	-82	-85
∆ Average E-W	0	-47	-70	-67	-73	-72	-80	-82
∆ Ave-Ave	0	-48	-73	-69	-74	-70	-81	-83
Stress (ksi)	0	2.437	2.437	2.437	2.437	2.437	2.437	2.437
Concrete Strain	0	-0.000698	-0.001055	-0.000994	-0.001076	-0.001012	-0.001166	-0.001205
E_c Effective (ksi)	0	3493	2310	2451	2264	2408	2091	2023
$C_c(t)$	0	0	0.5118499	0.4248354	0.5425608	0.4504279	0.6705233	0.7268268

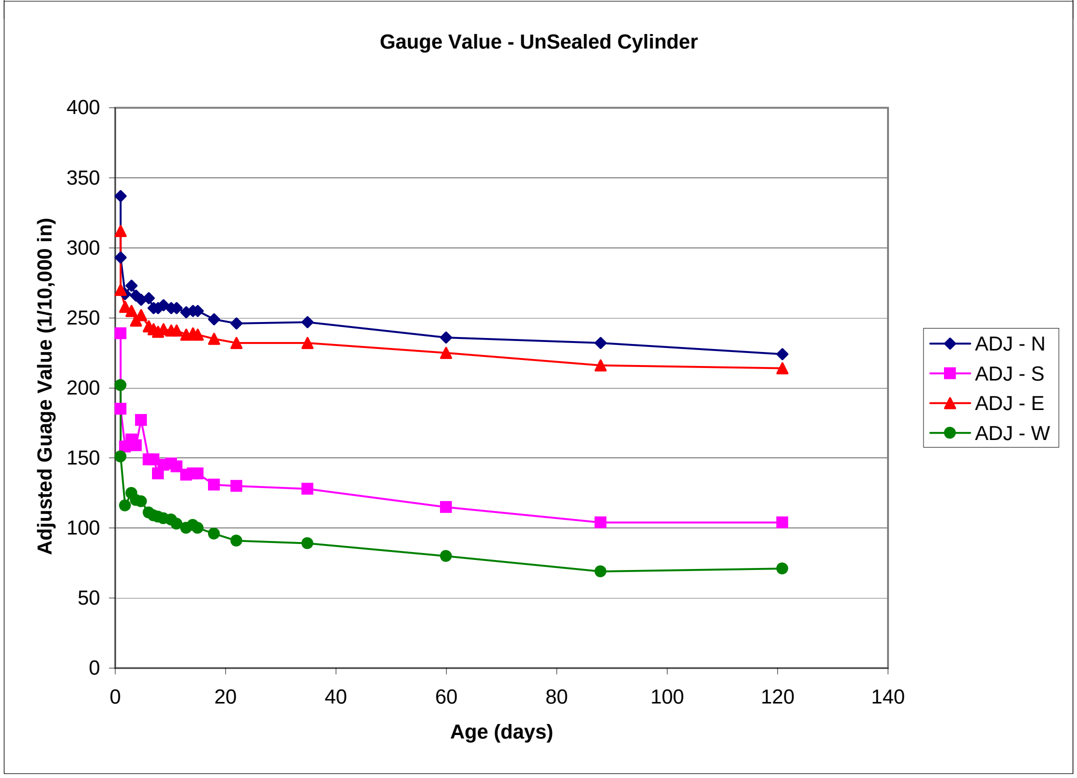
09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05
10:52 AM	11:06 AM	8:02 PM	11:55 AM	1:19 PM	7:20 PM	3:28 PM	3:07 PM	4:07 PM	1:05 PM
67	66	64	64	68	69	74	64	64	67
68	69	66	67	69	70	73	65	66	69
800	801	799	795	797	800	815	808	806	805
852	853	853	849	851	851	865	858	860	856
848	845	846	842	843	842	861	854	853	852
946	950	937	943	942	932	955	940	931	945
7.74	8.75	10.13	10.79	12.85	14.10	14.94	17.92	21.96	34.84
-568	-563	-561	-560	-563	-562	-577	-575	-578	-576
68	68	68	66	70	70	73	66	68	68
232	238	238	235	234	238	238	233	228	229
284	290	292	289	288	289	288	283	282	280
280	282	285	282	280	280	284	279	275	276
378	387	376	383	379	370	378	365	353	369
-80	-74	-73	-76	-77	-75	-75	-80	-83	-84
-79	-73	-77	-75	-78	-83	-77	-86	-94	-85
-79	-74	-75	-76	-78	-79	-76	-83	-88	-84
2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437
-0.001148	-0.001066	-0.001087	-0.001094	-0.001123	-0.001137	-0.001098	-0.001198	-0.001276	-0.001219
2123	2287	2242	2227	2171	2143	2220	2035	1909	1999
0.6705835	0.5510221	0.582212	0.5926086	0.6341952	0.6549885	0.597807	0.74336	0.857723	0.7745499

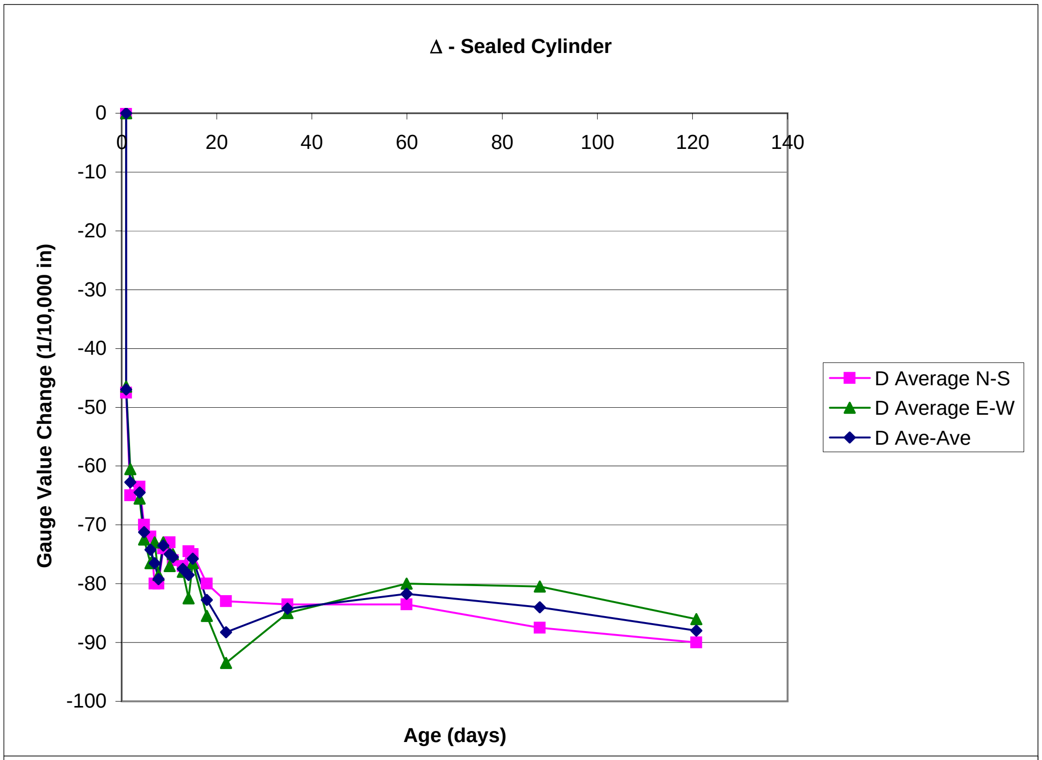
09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05
10:54 AM	11:08 AM	8:04 PM	8:16 PM	1:21 PM	7:21 PM	3:29 PM	3:10 PM	4:08 PM	1:07 PM
67	66	64	64	68	69	74	64	64	67
67	66	66	64	68	70	72	64	65	67
825	822	818	817	817	817	832	824	824	823
707	708	707	704	701	701	716	706	708	704
808	805	802	801	801	801	815	810	810	808
676	670	667	663	663	664	677	671	669	665
7.75	8.76	10.13	11.14	12.85	14.10	14.94	17.92	21.96	34.84
-568	-563	-561	-560	-563	-562	-577	-575	-578	-576
68	68	68	66	70	70	73	66	68	68
257	259	257	257	254	255	255	249	246	247
139	145	146	144	138	139	139	131	130	128
240	242	241	241	238	239	238	235	232	232
108	107	106	103	100	102	100	96	91	89
-90	-86	-87	-88	-92	-91	-91	-98	-100	-101
-83	-83	-84	-85	-88	-87	-88	-92	-96	-97
-87	-84	-85	-86	-90	-89	-90	-95	-98	-99
2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437
-0.001251	-0.001219	-0.001230	-0.001248	-0.001301	-0.001283	-0.001294	-0.001369	-0.001412	-0.001423
1948	1999	1981	1953	1873	1899	1883	1780	1726	1713
0.7933673	0.7473008	0.7626563	0.7882488	0.8650263	0.8394338	0.8547893	0.9622777	1.0236997	1.0390552

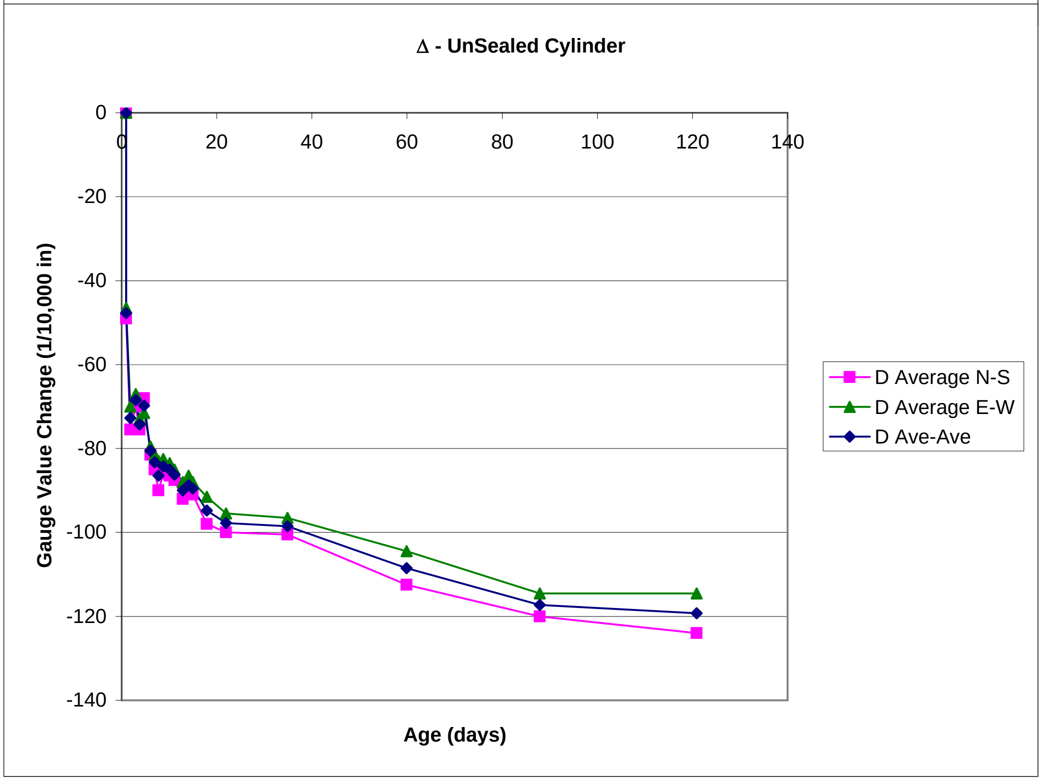
11/11/05	12/09/05	01/11/06
3:05 PM	3:09 PM	1:24 PM
52	56	50
55		
797	372	293
852	427	349
844	420	338
951	532	451
59.92	87.92	120.85
-570	-149	-73
57	63	54
227	223	220
282	278	276
274	271	265
381	383	378
-84	-88	-90
-80	-81	-86
-82	-84	-88
2.437	2.437	2.437
-0.001183	-0.001216	-0.001273
2059	2005	1915
0.7225667	0.7693516	0.8525247

11/11/05	12/09/05	01/11/06
3:06 PM	3:11 PM	1:26 PM
52	56	50
55		
806	381	297
685	253	177
795	365	287
650	218	144
59.92	87.92	120.85
-570	-149	-73
57	63	54
236	232	224
115	104	104
225	216	214
80	69	71
-113	-120	-124
-105	-115	-115
-109	-117	-119
2.437	2.437	2.437
-0.001566	-0.001691	-0.001719
1557	1441	1418
1.2437951	1.4229426	1.4638906

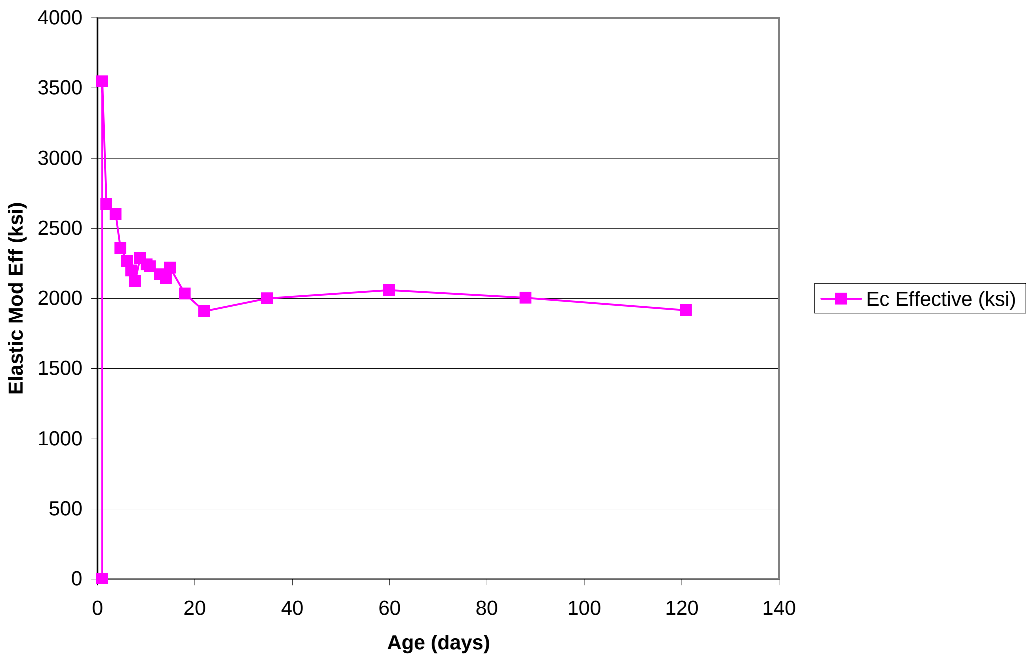

Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

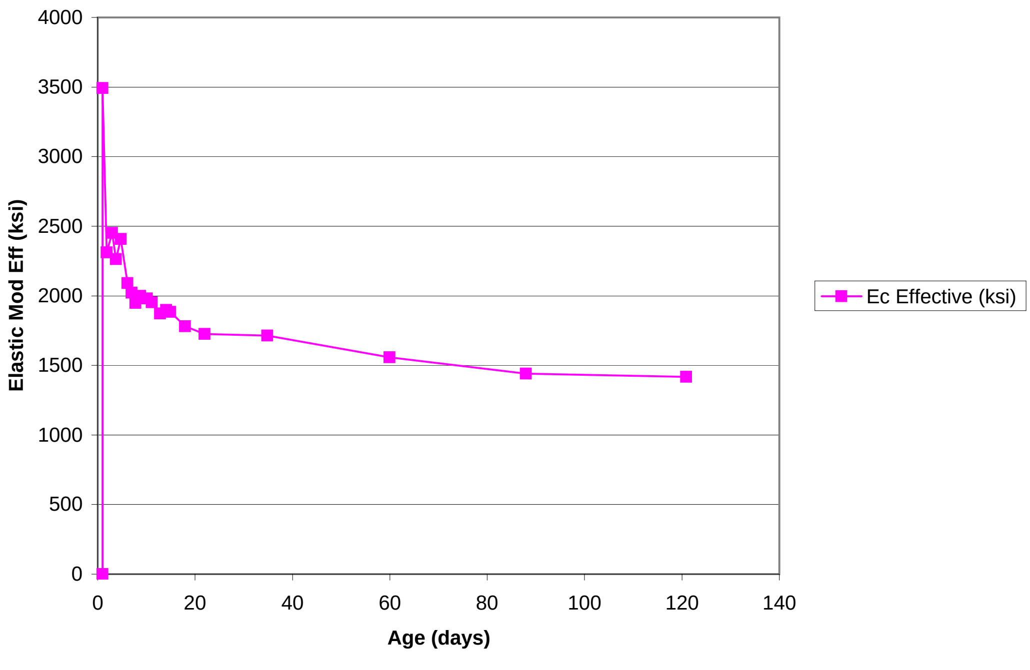

Δ - Sealed Cylinder
Gauge Value Change (1/10,000 in)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave

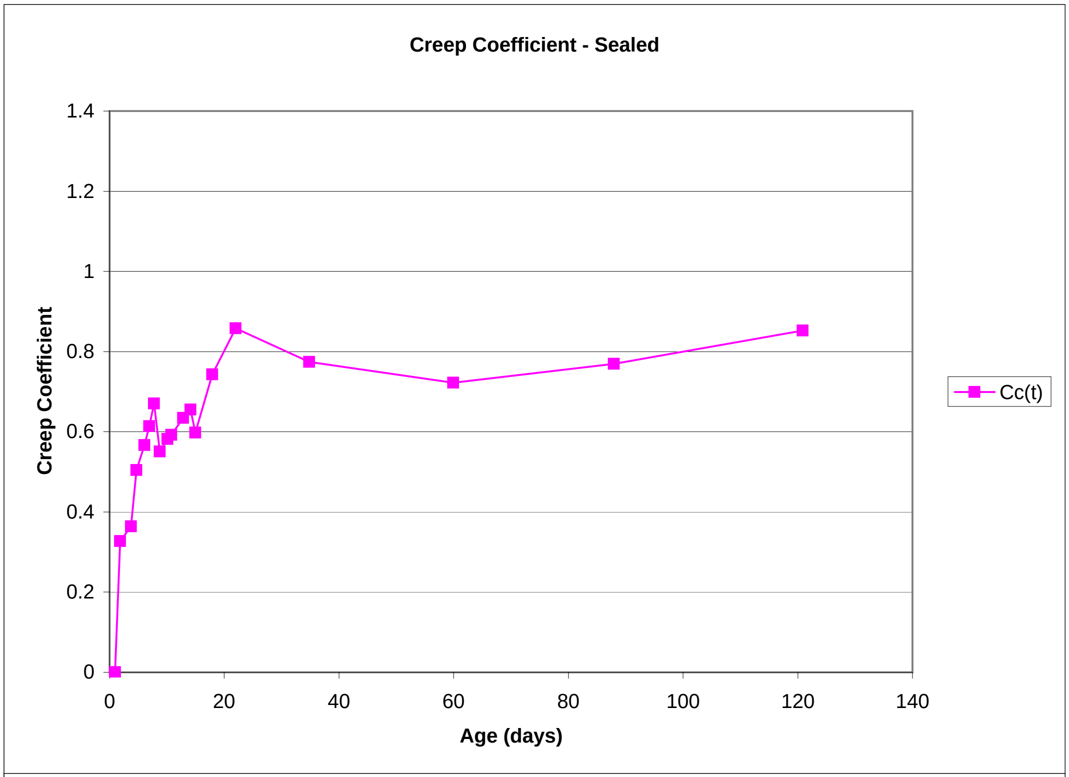

Δ - UnSealed Cylinder
Gauge Value Change (1/10,000 in)
0
-20
-40
-60
-80
-100
-120
-140
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave

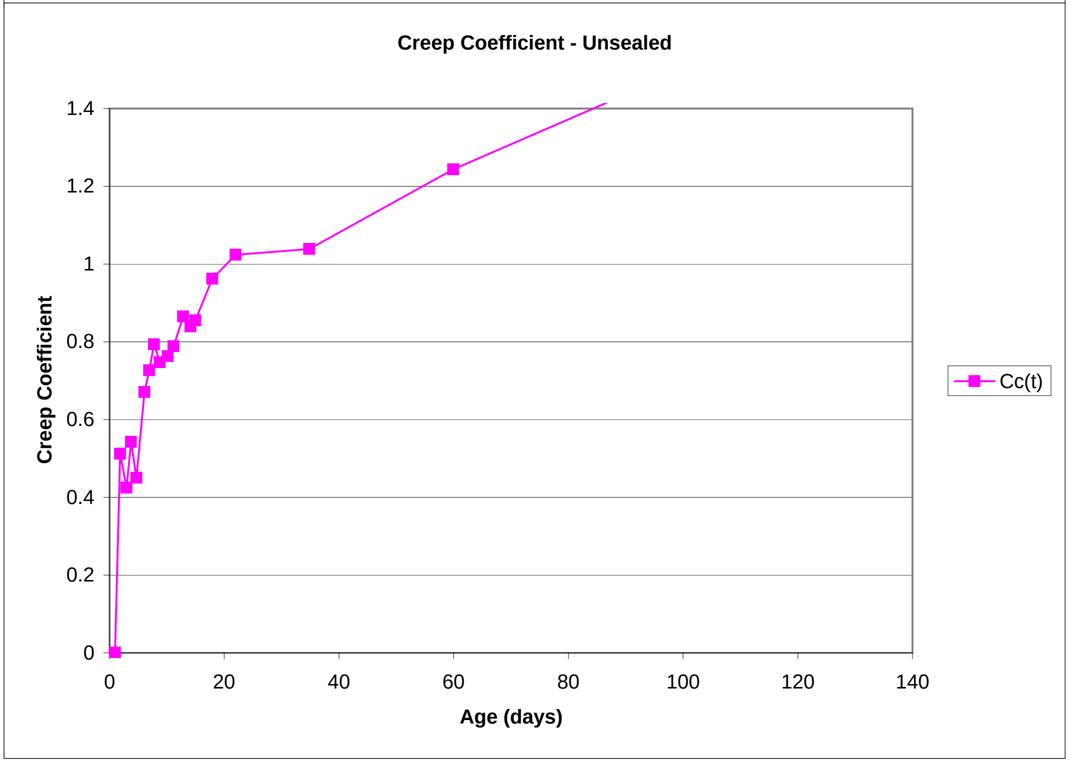
Effective Elastic Modulus - Sealed



Effective Elastic Modulus - Unsealed




Creep Coefficient - Sealed
Creep Coefficient
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)


Creep Coefficient - Unsealed
Creep Coefficient
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)

G1D-AC-3Day

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	3Day
Cylinder Cure:	AC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)		
Unwrap Time	6:40 AM	
Cyl. Surf. Temp(°F)		
Humidity (%)		

Loading:

Ave E Mod =	5734	ksi
Sustained Pressure =	3.868	ksi

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/15/05	09/15/05	09/15/05	09/15/05
Time	2:58 PM	3:04 PM	3:08 PM	3:16 PM
Ambient Temp (°F)	66	66	66	66
Cyl. Surf. Temp(°F)	67	67	67	67
Gauge Load (psi)	0	7700	0	7700
Stress (ksi)	0	3.868	0	3.868
(10,000 in) N	652	594	652	557
S	727	689	722	652
E	649	604	643	566
W	658	604	656	569
Age (days)	2.92	2.92	2.92	2.93
Gauge Correction	-306	-306	-305	-269
Rod Temp (°F)	66	66	66	66
ADJ - N	346	288	347	288
ADJ - S	421	383	417	383
ADJ - E	343	298	338	297
ADJ - W	352	298	351	300
Δ Average N-S	▨	-48	▨	-47
Δ Average E-W	▨	-50	▨	-46
Δ Ave-Ave (in)	▨	-49	▨	-46
Concrete Strain	▨	-0.000721	▨	-0.000685
E_c (ksi)	▨	5363	▨	5643

Comments:

Loading Procedure:
Pump to gauge pressure of 7700 psi.
Hand tighten nuts as snug as possible.
Take redings.

After a Load Cell calibration, it was noticed that the load cell was reading approximately 4kips lower that the pump reading of 50k. It was also concluded that 1/4 turn of the nut with the wrench would induce 2.5kips of force into the Load Cell. By hand tightening the nuts, the pressure applied to the cylinders after the pump was released was closer to the applied pressure. The settling of the nut was minor incomparison to the force applied. Therefore adjustments need to be made to the actual applied force in the release cylinders o the calculation represent what was applied.

UnSealed				
Date	09/15/05	09/15/05	09/15/05	09/15/05
Time	2:59 PM	3:05 PM	3:10 PM	3:17 PM
Ambient Temp (°F)	66	66	66	66
Cyl. Surf. Temp(°F)	67	67	67	67
Gauge Load (psi)	0	7700	0	7700
Stress (ksi)	0	3.868	0	3.868
(10,000 in) N	678	647	681	615
S	668	587	648	555
E	676	616	671	584
W	662	612	662	585
Age (days)	2.92	2.92	2.92	2.93
Gauge Correction	-306	-306	-305	-269
Rod Temp (°F)	66	66	66	66
ADJ - N	372	341	376	346
ADJ - S	362	281	343	286
ADJ - E	370	310	366	315
ADJ - W	356	306	357	316
Δ Average N-S	▨	-56	▨	-44
Δ Average E-W	▨	-55	▨	-46
Δ Ave-Ave (in)	▨	-56	▨	-45
Concrete Strain	▨	-0.000818	▨	-0.000664
E_c (ksi)	▨	4731	▨	5825

Un-Loading:

Sealed	**100%**	**0%**
Date	01/11/06	01/11/06
Time	11:35 AM	12:32 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7700	0
Stress (ksi)	3.868	0
(10,000 in) N	304	362
S	421	452
E	324	368
W	324	375
Age (days)	120.77	120.81
Gauge Correction	-68	-68
Rod Temp (°F)	55	55
ADJ - N	236	294
ADJ - S	353	384
ADJ - E	256	300
ADJ - W	256	307
Δ Average N-S		45
Δ Average E-W		48
Δ Ave-Ave (in)		46
Concrete Strain		0.000632
E_c (ksi)		6117

Creep Monitoring:

Sealed	**0%**	**100%**	
Date	09/15/05	09/15/05	09/17/05
Time	3:08 PM	3:16 PM	9:43 AM
Ambient Temp (°F)	66	66	
Cyl. Surf. Temp(°F)	67	67	64
(10,000 in) N	652	557	841
S	722	652	916
E	643	566	842
W	656	569	845
Age (days)	2.92	2.93	4.70
Gauge Correction	-305	-269	-563
Rod Temp (°F)	66	66	64
ADJ - N	347	288	278
ADJ - S	417	383	353
ADJ - E	338	297	279
ADJ - W	351	300	282
Δ Average N-S	0	-47	-67
Δ Average E-W	0	-46	-64
Δ Ave-Ave	0	-46	-65
Stress (ksi)	0	3.868	3.868
Concrete Strain	0	-0.000685	-0.000957
E_c Effective (ksi)	0	5643	4042
$C_c(t)$	0	0	0.3959659

UnSealed		
Date	01/11/06	01/11/06
Time	11:37 AM	12:32 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7700	0
Stress (ksi)	3.868	0
(10,000 in) N	355	388
S	262	324
E	300	352
W	315	359
Age (days)	120.78	120.81
Gauge Correction	-68	-68
Rod Temp (°F)	55	55
ADJ - N	287	320
ADJ - S	194	256
ADJ - E	232	284
ADJ - W	247	291
Δ Average N-S		48
Δ Average E-W		48
Δ Ave-Ave (in)		48
Concrete Strain		0.000657
E_c (ksi)		5884

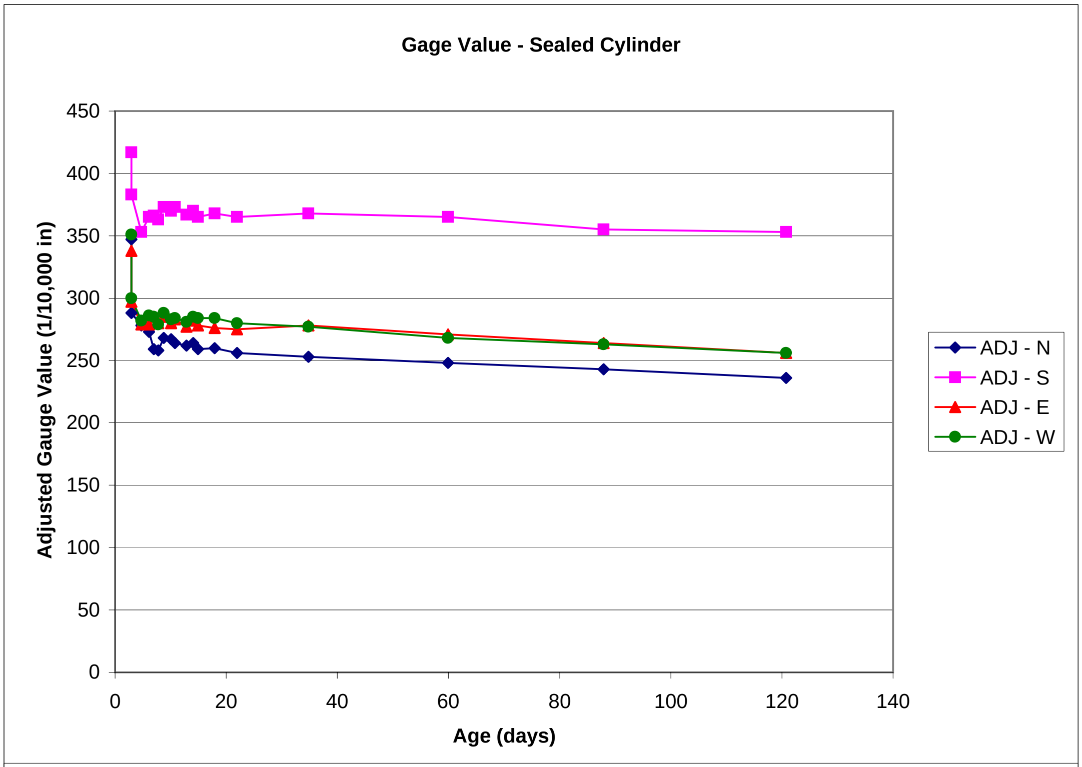
UnSealed			
Date	09/15/05	09/15/05	09/17/05
Time	3:10 PM	3:17 PM	
Ambient Temp (°F)	66	66	
Cyl. Surf. Temp(°F)	67	67	64
(10,000 in) N	681	615	893
S	648	555	834
E	671	584	858
W	662	585	862
Age (days)	2.92	2.93	4.29
Gauge Correction	-305	-269	-566
Rod Temp (°F)	66	66	59
ADJ - N	376	346	327
ADJ - S	343	286	268
ADJ - E	366	315	292
ADJ - W	357	316	296
Δ Average N-S	0	-44	-62
Δ Average E-W	0	-46	-68
Δ Ave-Ave	0	-45	-65
Stress (ksi)	0	3.868	3.868
Concrete Strain	0	-0.000664	-0.000950
E_c Effective (ksi)	0	5825	4073
$C_c(t)$	0	0	0.4302562

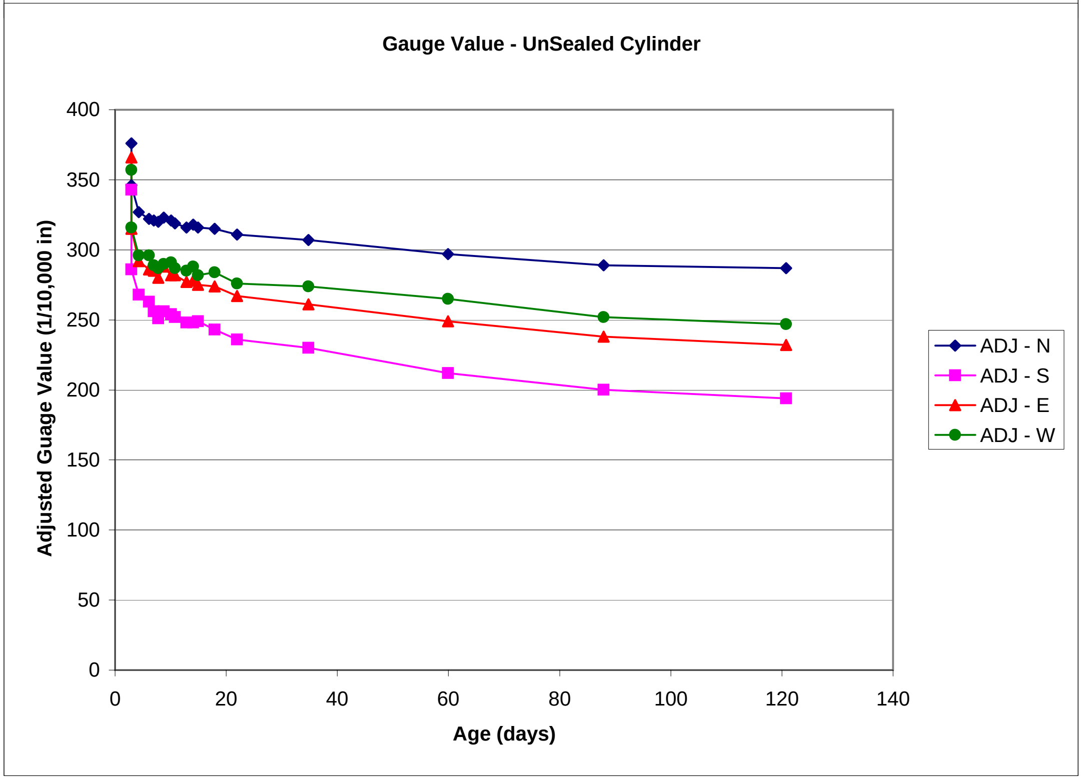
09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05
7:16 PM	3:44 PM	11:12 AM	10:37 AM	7:22 PM	11:38 AM	12:51 PM	6:56 PM	3:11 PM	2:51 PM
67	68	68	64	66	63	67	70	75	64
70	68	69	66	67	65	67	71	73	67
843	830	827	829	828	823	823	825	822	833
935	937	932	934	931	932	928	931	928	941
849	856	849	846	841	842	838	843	841	849
856	856	848	849	844	843	842	846	847	857
6.09	6.95	7.76	8.73	10.10	10.78	12.83	14.08	14.92	17.91
-570	-571	-569	-561	-561	-559	-561	-561	-563	-573
70	72	68	66	66	64	68	72	72	64
273	259	258	268	267	264	262	264	259	260
365	366	363	373	370	373	367	370	365	368
279	285	280	285	280	283	277	282	278	276
286	285	279	288	283	284	281	285	284	284
-63	-70	-72	-62	-64	-64	-68	-65	-70	-68
-62	-60	-65	-58	-63	-61	-66	-61	-64	-65
-63	-65	-68	-60	-63	-62	-67	-63	-67	-66
3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.000918	-0.000946	-0.001000	-0.000878	-0.000928	-0.000914	-0.000975	-0.000925	-0.000978	-0.000971
4215	4088	3869	4404	4167	4232	3968	4183	3954	3983
0.338655	0.3803357	0.4584868	0.2813442	0.3542853	0.333445	0.4220163	0.3490752	0.4272264	0.4168062

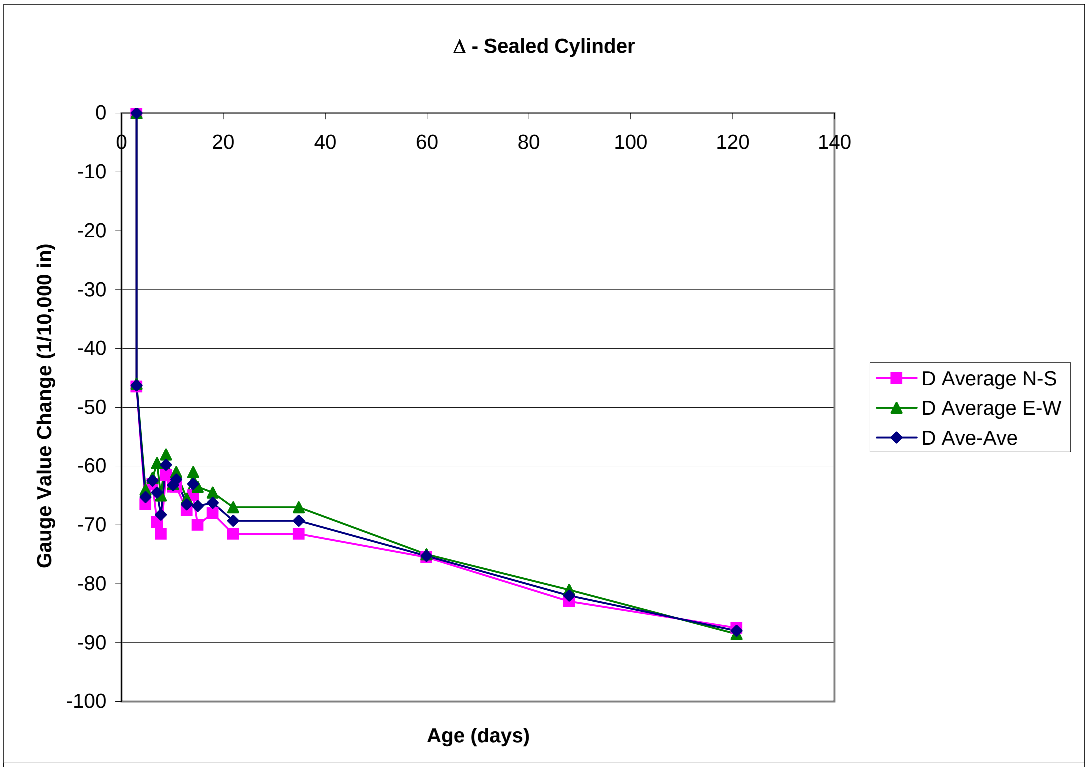
09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05
7:17 PM	3:46 PM	11:14 AM	10:40 AM	7:26 PM	11:39 AM	12:53 PM	6:57 PM	3:12 PM	2:52 PM
67	68	68	64	66	63	67	70	75	64
69	69	66	63	67	62	64	70	69	65
892	892	889	884	882	878	877	879	879	888
833	827	820	817	815	811	809	809	812	816
856	856	849	849	843	841	838	839	838	847
866	860	856	851	852	846	846	849	845	857
6.10	6.95	7.76	8.74	10.10	10.78	12.83	14.08	14.92	17.91
-570	-571	-569	-561	-561	-559	-561	-561	-563	-573
70	72	68	66	66	64	68	72	72	64
322	321	320	323	321	319	316	318	316	315
263	256	251	256	254	252	248	248	249	243
286	285	280	288	282	282	277	278	275	274
296	289	287	290	291	287	285	288	282	284
-67	-71	-74	-70	-72	-74	-78	-77	-77	-81
-71	-75	-78	-73	-75	-77	-81	-79	-83	-83
-69	-73	-76	-71	-74	-76	-79	-78	-80	-82
3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.001007	-0.001064	-0.001110	-0.001043	-0.001075	-0.001103	-0.001153	-0.001132	-0.001168	-0.001189
3841	3635	3483	3710	3599	3506	3354	3417	3313	3253
0.5163075	0.6023587	0.6722753	0.5700895	0.6184933	0.6615189	0.7368138	0.7045445	0.7583266	0.7905958

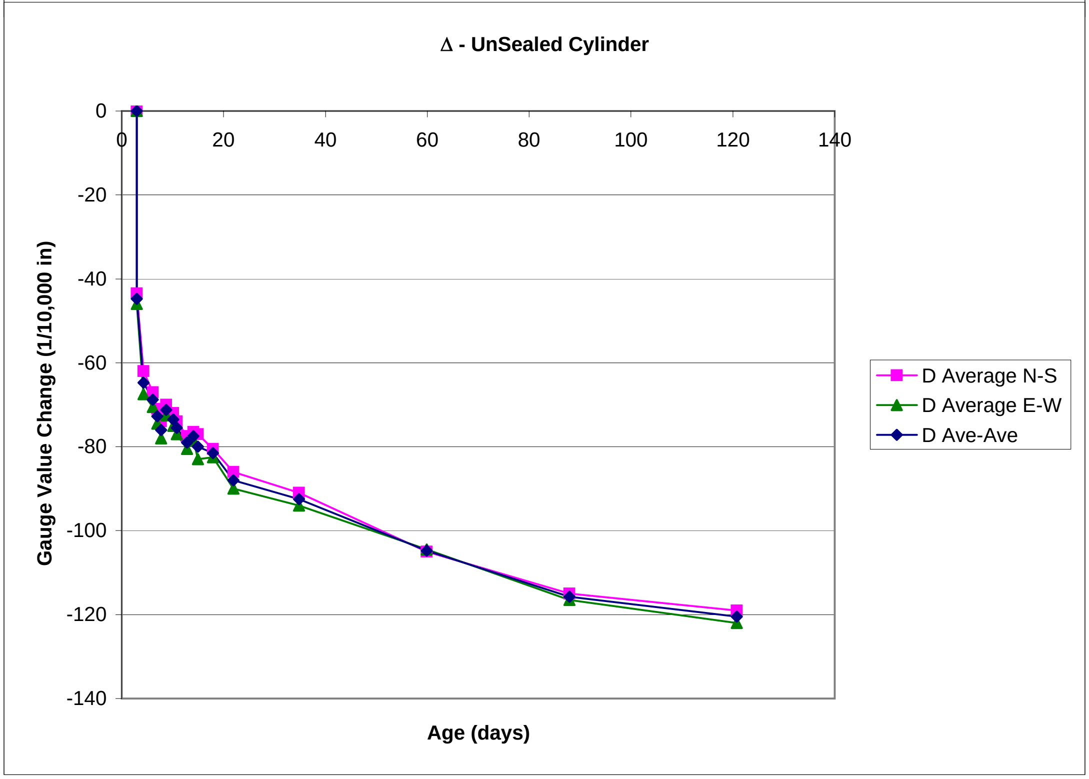
10/04/05	10/17/05	11/11/05	12/09/05	01/11/06		
3:46 PM	12:44 PM	2:44 PM	2:35 PM	11:35 AM		
65	65	54	59	54		
68	67	56				
832	828	819	392	304		
941	943	936	504	421		
851	853	842	413	324		
856	852	839	412	324		
21.95	34.82	59.91	87.90	120.77	#N/A	#N/A
-576	-575	-571	-149	-68	#N/A	#N/A
68	66	57	63	55	#N/A	#N/A
256	253	248	243	236	#N/A	#N/A
365	368	365	355	353	#N/A	#N/A
275	278	271	264	256	#N/A	#N/A
280	277	268	263	256	#N/A	#N/A
-72	-72	-76	-83	-88	#N/A	#N/A
-67	-67	-75	-81	-89	#N/A	#N/A
-69	-69	-75	-82	-88	#N/A	#N/A
3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.001014	-0.001014	-0.001100	-0.001196	-0.001282	#N/A	#N/A
3814	3814	3517	3234	3017	#N/A	#N/A
0.4793271	0.4793271	0.604369	0.7450411	0.8700829	#N/A	#N/A

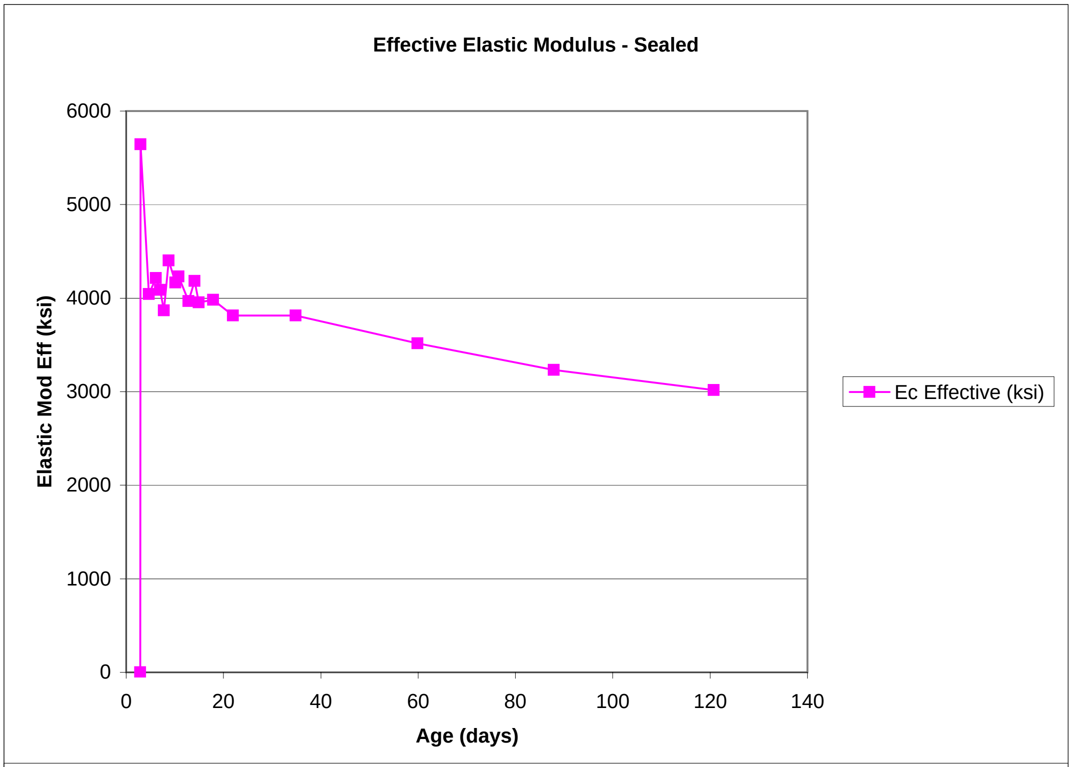
10/04/05	10/17/05	11/11/05	12/09/05	01/11/06		
3:47 PM	12:46 PM	2:45 PM	2:36 PM	11:37 AM		
65	65	54	59	54		
64	65	57				
887	882	868	438	355		
812	805	783	349	262		
843	836	820	387	300		
852	849	836	401	315		
21.95	34.82	59.91	87.90	120.78	#N/A	#N/A
-576	-575	-571	-149	-68	#N/A	#N/A
68	66	57	63	55	#N/A	#N/A
311	307	297	289	287	#N/A	#N/A
236	230	212	200	194	#N/A	#N/A
267	261	249	238	232	#N/A	#N/A
276	274	265	252	247	#N/A	#N/A
-86	-91	-105	-115	-119	#N/A	#N/A
-90	-94	-105	-117	-122	#N/A	#N/A
-88	-93	-105	-116	-121	#N/A	#N/A
3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.001282	-0.001346	-0.001521	-0.001678	-0.001746	#N/A	#N/A
3017	2873	2543	2305	2215	#N/A	#N/A
0.9304291	1.0272367	1.2907686	1.5274095	1.6295954	#N/A	#N/A

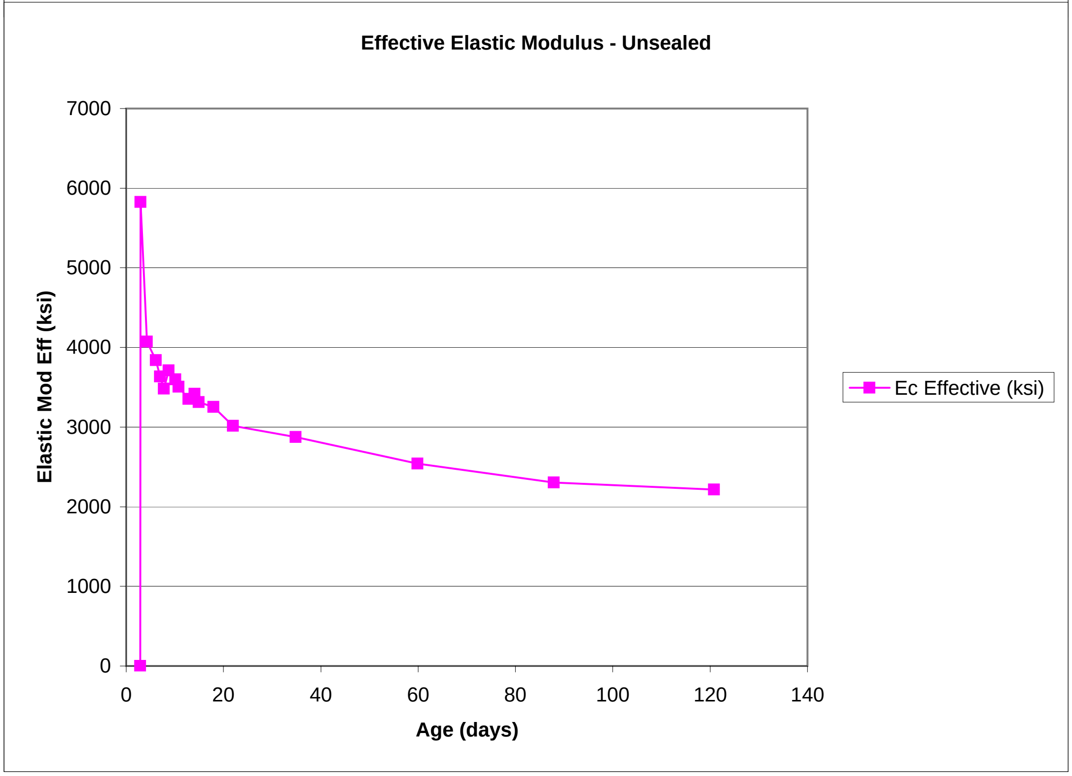

Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

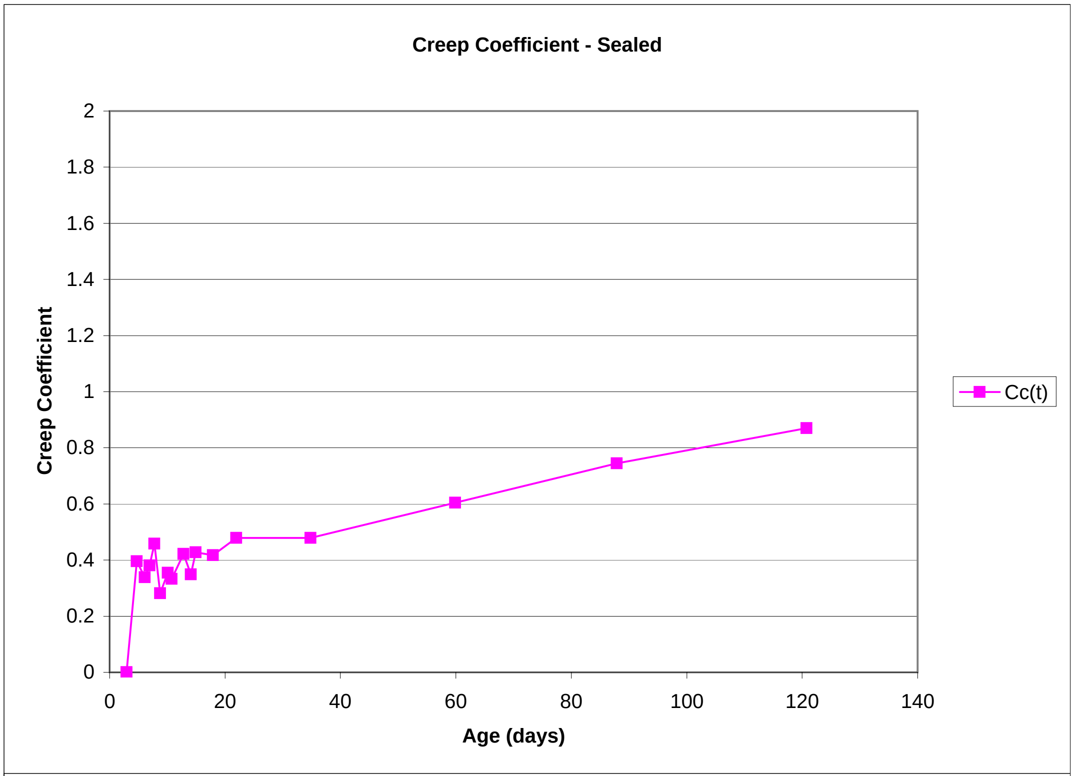

Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Δ - Sealed Cylinder
Gauge Value Change (1/10,000 in)
Age (days)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
20
40
60
80
100
120
140
D Average N-S
D Average E-W
D Ave-Ave


Δ - UnSealed Cylinder
Gauge Value Change (1/10,000 in)
Age (days)
0
-20
-40
-60
-80
-100
-120
-140
0
20
40
60
80
100
120
140
D Average N-S
D Average E-W
D Ave-Ave


Effective Elastic Modulus - Sealed
Elastic Mod Eff (ksi)
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Effective Elastic Modulus - Unsealed
Elastic Mod Eff (ksi)
7000
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Creep Coefficient - Sealed
Creep Coefficient
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)


Creep Coefficient - Unsealed
Creep Coefficient
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)

G1D-MC-3Day

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	3Day
Cylinder Cure:	MC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	70	70
Unwrap Time	9:34 AM	9:34 AM
Cyl. Surf. Temp(°F)	77	77
Humidity (%)		

Loading:

Ave E Mod = 4397 ksi

Sustained Pressure = 2.365 ksi

Comments:

Loading Procedure:
Pump to guge pressure of 7700 psi. Hand tighten nuts to snug. Take reading.

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/15/05	09/15/05	09/15/05	09/15/05
Time	1:55 PM	1:59 PM	2:08 PM	2:13 PM
Ambient Temp (°F)	66	66	66	66
Cyl. Surf. Temp(°F)	66	66	66	66
Gauge Load (psi)	0	4620	0	4620
Stress (ksi)	0	2.365	0	2.365
(10,000 in) N	560	520	558	517
S	559	529	559	526
E	545	519	542	513
W	523	479	523	475
Age (days)	2.87	2.87	2.88	2.88
Gauge Correction	-150	-150	-150	-150
Rod Temp (°F)	68	68	66	66
ADJ - N	410	370	408	367
ADJ - S	409	379	409	376
ADJ - E	395	369	392	363
ADJ - W	373	329	373	325
Δ Average N-S		-35		-37
Δ Average E-W		-35		-39
Δ Ave-Ave (in)		-35		-38
Concrete Strain		-0.000515		-0.000554
E_c (ksi)		4591		4266

UnSealed				
Date	09/15/05	09/15/05	09/15/05	09/15/05
Time	1:57 PM	2:01 PM	2:09 PM	2:14 PM
Ambient Temp (°F)	66	66	66	66
Cyl. Surf. Temp(°F)	65	66	66	66
Gauge Load (psi)	0	4620	0	4620
Stress (ksi)	0	2.365	0	2.365
(10,000 in) N	557	526	557	526
S	558	512	561	524
E	514	471	512	468
W	503	470	505	475
Age (days)	2.87	2.88	2.88	2.88
Gauge Correction	-150	-150	-150	-150
Rod Temp (°F)	68	68	66	66
ADJ - N	407	376	407	376
ADJ - S	408	362	411	374
ADJ - E	364	321	362	318
ADJ - W	353	320	355	325
Δ Average N-S		-39		-34
Δ Average E-W		-38		-37
Δ Ave-Ave (in)		-38		-36
Concrete Strain		-0.000562		-0.000522
E_c (ksi)		4211		4528

Un-Loading:

Sealed	**100%**	**0%**
Date	01/11/06	01/11/06
Time	11:39 AM	11:59 AM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	4620	0
Stress (ksi)	2.365	0
(10,000 in) N	396	425
S	411	435
E	391	411
W	347	381
Age (days)	120.78	120.79
Gauge Correction	-68	-68
Rod Temp (°F)	55	55
ADJ - N	328	357
ADJ - S	343	367
ADJ - E	323	343
ADJ - W	279	313
Δ Average N-S	▨	27
Δ Average E-W	▨	27
Δ Ave-Ave (in)	▨	27
Concrete Strain	▨	0.000367
E_c (ksi)	▨	6444

Creep Monitoring:

Sealed	**0%**	**100%**	
Date	09/15/05	09/15/05	09/15/05
Time	2:08 PM	2:13 PM	2:53 PM
Ambient Temp (°F)	66	66	66
Cyl. Surf. Temp(°F)	66	66	67
(10,000 in) N	558	517	670
S	559	526	683
E	542	513	672
W	523	475	627
Age (days)	2.88	2.88	2.91
Gauge Correction	-150	-150	-306
Rod Temp (°F)	66	66	66
ADJ - N	408	367	364
ADJ - S	409	376	377
ADJ - E	392	363	366
ADJ - W	373	325	321
Δ Average N-S	0	-37	-38
Δ Average E-W	0	-39	-39
Δ Ave-Ave	0	-38	-39
Stress (ksi)	0	2.365	2.365
Concrete Strain	0	-0.000554	-0.000565
E_c Effective (ksi)	0	4266	4185
$C_c(t)$	0	0	0.0193248

UnSealed		
Date	01/11/06	01/11/06
Time	11:41 AM	12:01 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	4320	0
Stress (ksi)	2.365	0
(10,000 in) N	386	411
S	358	398
E	311	349
W	333	361
Age (days)	120.78	120.79
Gauge Correction	-68	-68
Rod Temp (°F)	55	55
ADJ - N	318	343
ADJ - S	290	330
ADJ - E	243	281
ADJ - W	265	293
Δ Average N-S	▨	33
Δ Average E-W	▨	33
Δ Ave-Ave (in)	▨	33
Concrete Strain	▨	0.000453
E_c (ksi)	▨	5224

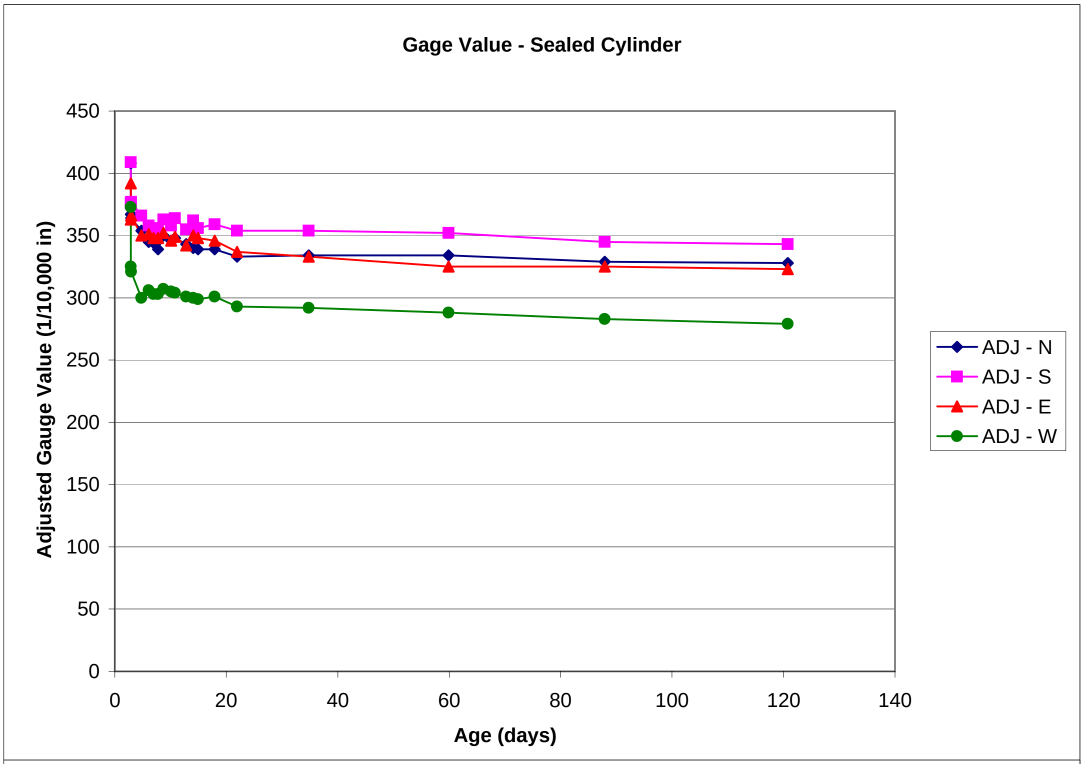
UnSealed			
Date	09/15/05	09/15/05	09/15/05
Time	2:09 PM	2:14 PM	2:54 PM
Ambient Temp (°F)	66	66	66
Cyl. Surf. Temp(°F)	66	66	67
(10,000 in) N	557	526	681
S	561	524	669
E	512	468	624
W	505	475	625
Age (days)	2.88	2.88	2.91
Gauge Correction	-150	-150	-306
Rod Temp (°F)	66	66	66
ADJ - N	407	376	375
ADJ - S	411	374	363
ADJ - E	362	318	318
ADJ - W	355	325	319
Δ Average N-S	0	-34	-40
Δ Average E-W	0	-37	-40
Δ Ave-Ave	0	-36	-40
Stress (ksi)	0	2.365	2.365
Concrete Strain	0	-0.000522	-0.000587
E_c Effective (ksi)	0	4528	4032
$C_c(t)$	0	0	0.1230848

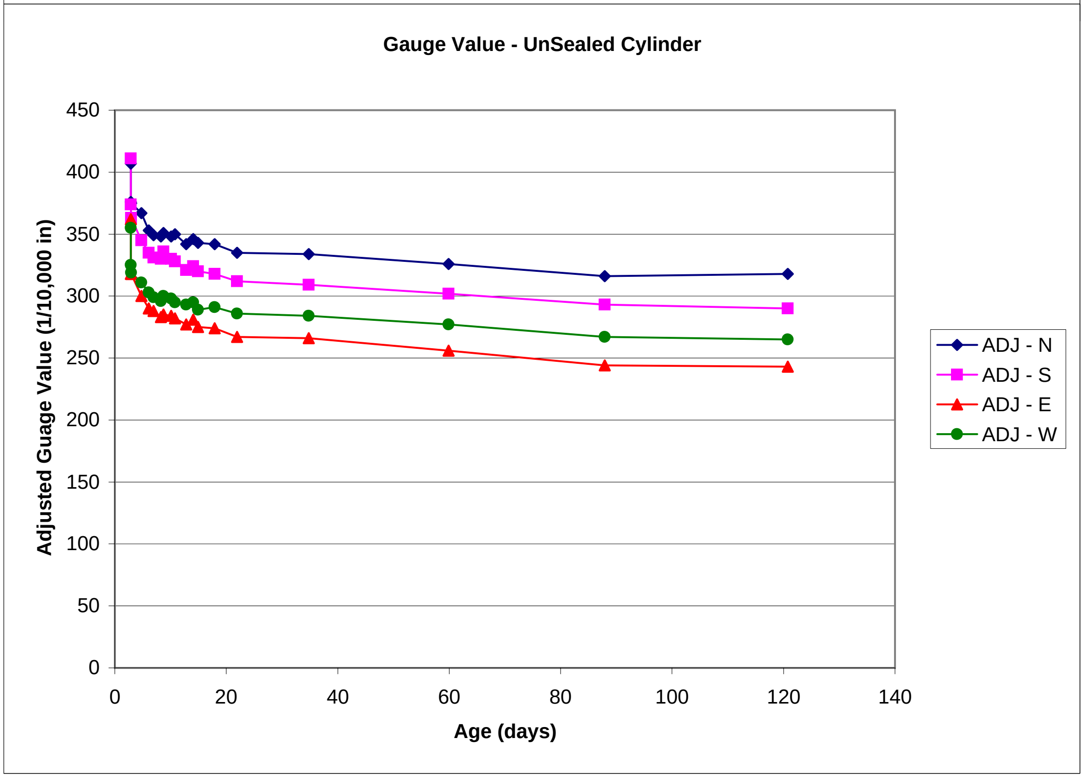
09/17/05	09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05
10:47 AM	7:10 PM	3:41 PM	11:08 AM	10:44 AM	7:29 PM	11:41 AM	12:56 PM	6:59 PM	3:14 PM
	67	68	70	64	66	63	67	70	75
64	69	71	71	65	67	65	67	70	7000
916	915	916	908	912	908	907	905	902	916
928	928	928	923	925	920	923	917	924	933
912	921	920	917	914	908	908	904	912	925
862	876	875	872	869	867	863	863	862	876
4.74	6.09	6.95	7.76	8.74	10.10	10.78	12.83	14.08	14.93
-562	-570	-572	-569	-562	-562	-559	-562	-562	-577
63	70	70	68	66	68	64	68	72	73
354	345	344	339	350	346	348	343	340	339
366	358	356	354	363	358	364	355	362	356
350	351	348	348	352	346	349	342	350	348
300	306	303	303	307	305	304	301	300	299
-49	-57	-59	-62	-52	-57	-53	-60	-58	-61
-58	-54	-57	-57	-53	-57	-56	-61	-58	-59
-53	-56	-58	-60	-53	-57	-54	-60	-58	-60
2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.000772	-0.000808	-0.000840	-0.000865	-0.000765	-0.000826	-0.000790	-0.000876	-0.000837	-0.000872
3062	2927	2815	2734	3091	2864	2993	2700	2827	2711
0.3929382	0.4573543	0.5153288	0.5604201	0.380055	0.4895624	0.4251463	0.5797449	0.5088872	0.5733033

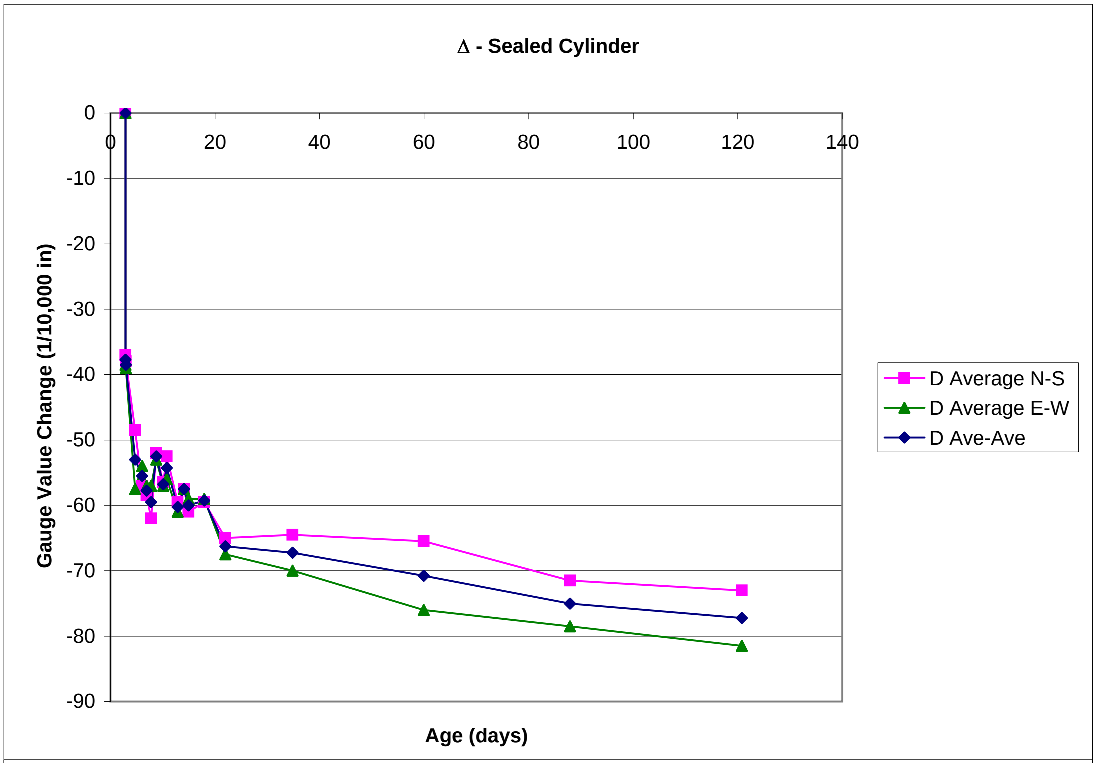
09/17/05	09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05
10:49 AM	7:12 PM	3:43 PM	11:09 PM	10:48 AM	7:31 PM	11:42 AM	12:58 PM	6:59 PM	3:15 PM
	67	68	70	64	66	63	67	70	75
63	69	68	67	63	67	63	65	70	69
929	923	921	917	913	910	909	904	908	920
907	905	903	899	898	892	887	883	886	897
862	860	860	852	847	846	841	839	843	852
873	873	871	865	862	860	854	855	857	866
4.74	6.09	6.95	8.26	8.74	10.10	10.78	12.83	14.08	14.93
-562	-570	-572	-569	-562	-562	-559	-562	-562	-577
63	70	70	70	66	68	64	68	72	73
367	353	349	348	351	348	350	342	346	343
345	335	331	330	336	330	328	321	324	320
300	290	288	283	285	284	282	277	281	275
311	303	299	296	300	298	295	293	295	289
-53	-65	-69	-70	-66	-70	-70	-78	-74	-78
-53	-62	-65	-69	-66	-68	-70	-74	-71	-77
-53	-64	-67	-70	-66	-69	-70	-76	-72	-77
2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.000772	-0.000922	-0.000972	-0.001008	-0.000954	-0.000997	-0.001015	-0.001094	-0.001047	-0.001115
3062	2564	2432	2346	2478	2371	2330	2162	2258	2121
0.478663	0.7658607	0.8615933	0.9299737	0.8274031	0.9094596	0.9436498	1.0940867	1.0051922	1.135115

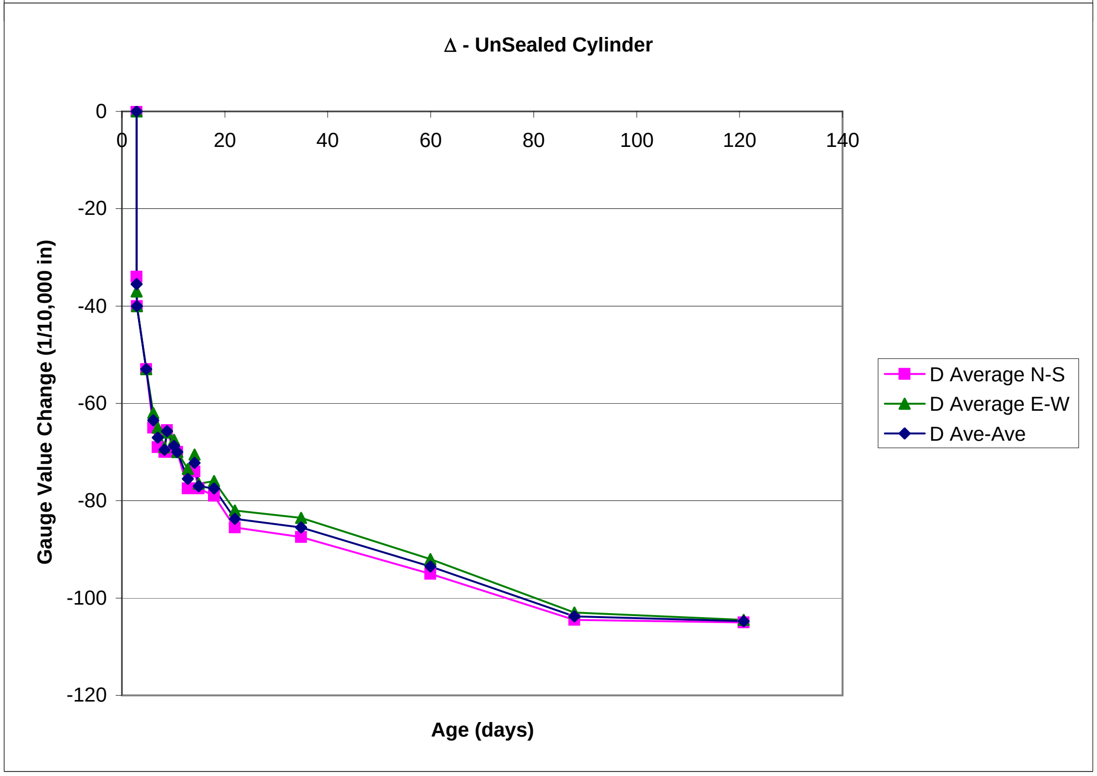
09/30/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06	
2:53 PM	3:50 PM	12:47 PM	2:47 PM	2:38 PM	11:39 AM	
64	65	65	54	59	54	
67	68	68	57			
912	910	909	904	478	396	
932	931	929	922	494	411	
919	914	908	895	474	391	
874	870	867	858	432	347	
17.91	21.95	34.82	59.91	87.90	120.78	#N/A
-573	-577	-575	-570	-149	-68	#N/A
64	68	68	57	63	55	#N/A
339	333	334	334	329	328	#N/A
359	354	354	352	345	343	#N/A
346	337	333	325	325	323	#N/A
301	293	292	288	283	279	#N/A
-60	-65	-65	-66	-72	-73	#N/A
-59	-68	-70	-76	-79	-82	#N/A
-59	-66	-67	-71	-75	-77	#N/A
2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.000862	-0.000962	-0.000976	-0.001026	-0.001087	-0.001119	#N/A
2745	2460	2424	2305	2177	2114	#N/A
0.5539785	0.7343436	0.76011	0.8502925	0.9597999	1.0177744	#N/A

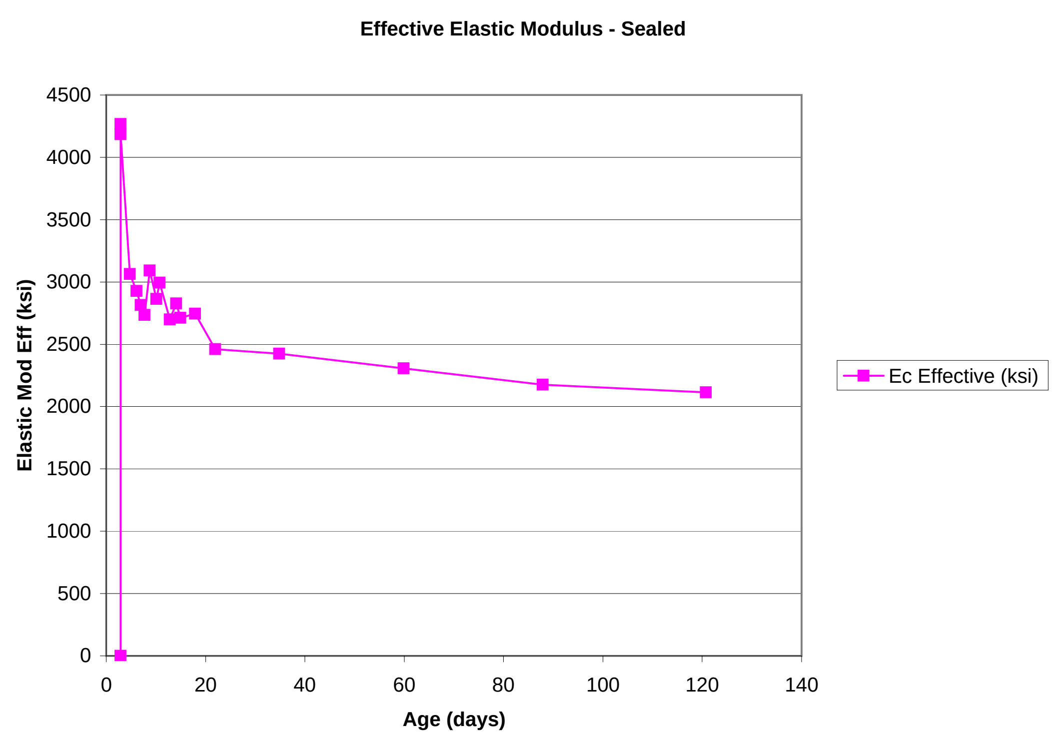
09/30/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06	
2:52 PM	3:52 PM	12:49 PM	2:48 PM	2:40 PM	11:41 AM	
64	65	65	54	60	54	
65	63	64	56			
915	912	909	896	465	386	
891	889	884	872	442	358	
847	844	841	826	393	311	
864	863	859	847	416	333	
17.91	21.95	34.83	59.91	87.90	120.78	#N/A
-573	-577	-575	-570	-149	-68	#N/A
64	68	68	57	63	55	#N/A
342	335	334	326	316	318	#N/A
318	312	309	302	293	290	#N/A
274	267	266	256	244	243	#N/A
291	286	284	277	267	265	#N/A
-79	-86	-88	-95	-105	-105	#N/A
-76	-82	-84	-92	-103	-105	#N/A
-78	-84	-86	-94	-104	-105	#N/A
2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.001122	-0.001212	-0.001237	-0.001351	-0.001497	-0.001512	#N/A
2107	1952	1913	1751	1580	1565	#N/A
1.1487911	1.3197421	1.3676084	1.5864258	1.8667855	1.8941377	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

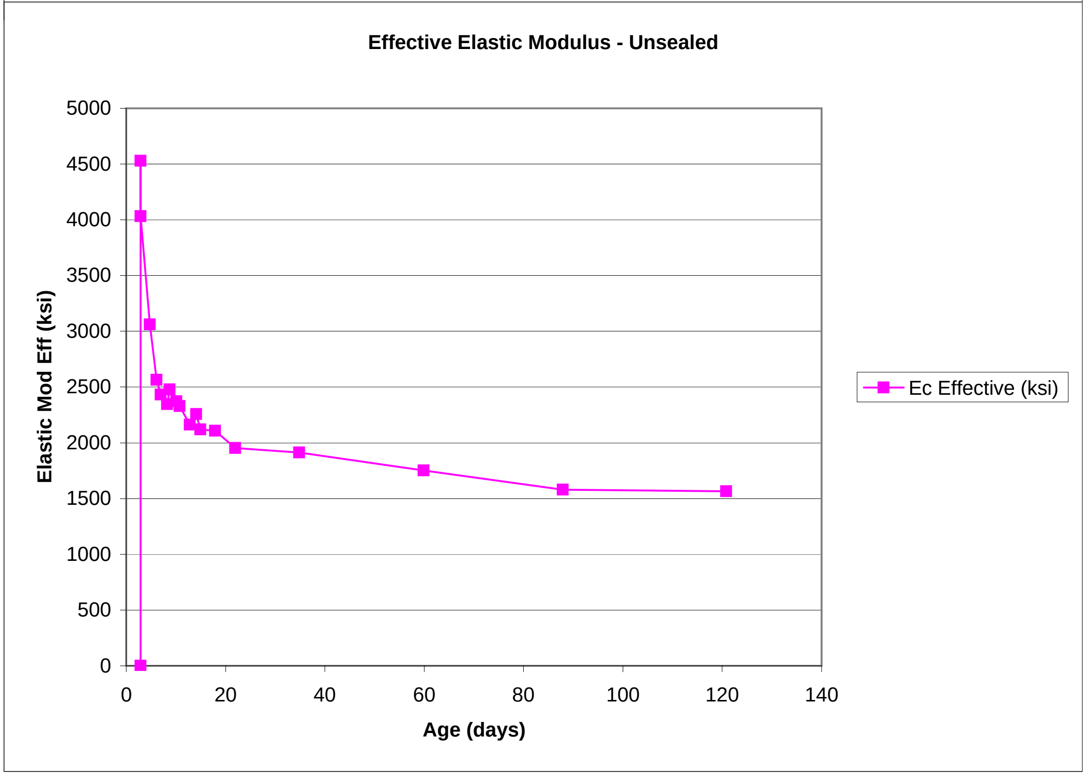

Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Δ - Sealed Cylinder
Gauge Value Change (1/10,000 in)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave

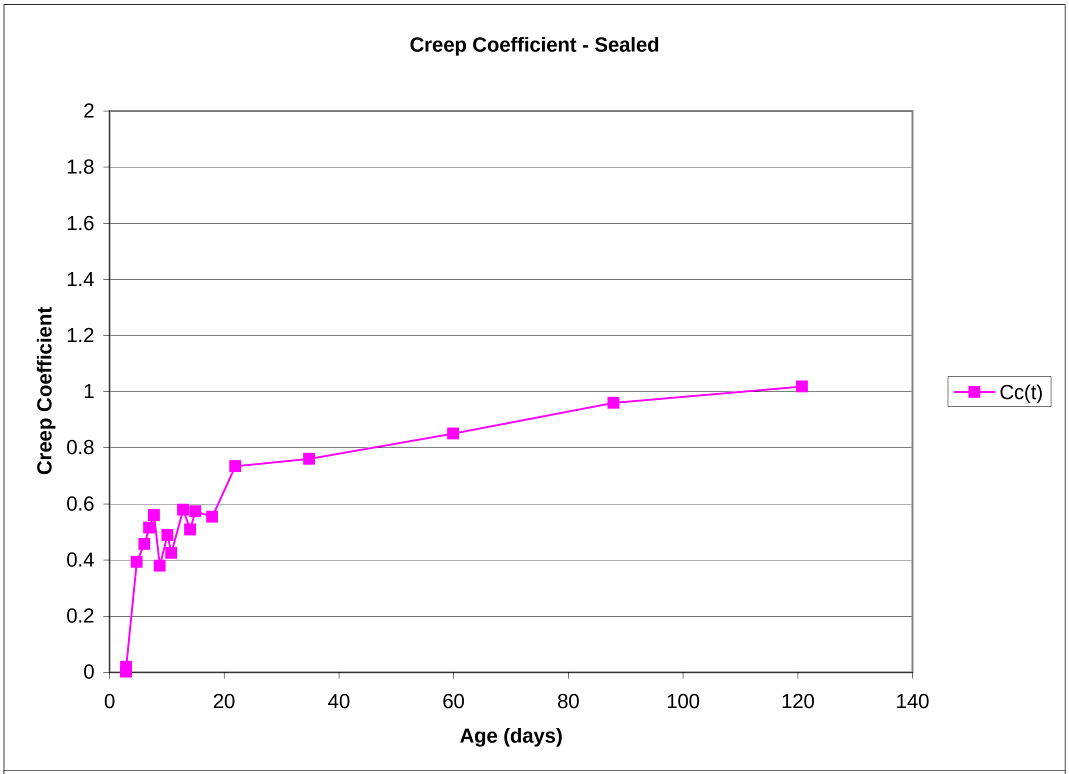

Δ - UnSealed Cylinder
Gauge Value Change (1/10,000 in)
0
-20
-40
-60
-80
-100
-120
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave



Effective Elastic Modulus - Sealed



Effective Elastic Modulus - Unsealed


Creep Coefficient - Sealed
Creep Coefficient
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)


Creep Coefficient - Unsealed
Creep Coefficient
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)

G1D-AC-7Day

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	7Day
Cylinder Cure:	AC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)		
Unwrap Time		
Cyl. Surf. Temp(°F)		
Humidity (%)		

Loading:

Ave E Mod = 4822 ksi

Sustained Pressure = 3.868 ksi

Comments:

Loading Procedure:
Pump to gauge pressure of 7700psi.
Hand tight nuts to snug. Take reading.

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/19/05	09/19/05	09/19/05	09/19/05
Time	2:16 PM	2:23 PM	2:28 PM	2:35 PM
Ambient Temp (°F)	68	68	68	68
Cyl. Surf. Temp(°F)	71	71	71	71
Gauge Load (psi)	0	7700	0	7700
Stress (ksi)	0	3.868	0	3.868
(10,000 in) N	961	922	959	926
S	996	928	992	923
E	1021	974	1018	975
W	915	859	910	858
Age (days)	6.89	6.89	6.89	6.90
Gauge Correction	-568	-569	-569	-569
Rod Temp (°F)	68	68	68	68
ADJ - N	393	353	390	357
ADJ - S	428	359	423	354
ADJ - E	453	405	449	406
ADJ - W	347	290	341	289
∆ Average N-S		-55		-51
∆ Average E-W		-53		-48
∆ Ave-Ave (in)		-54		-49
Concrete Strain		-0.000789		-0.000728
E_c (ksi)		4902		5311

UnSealed				
Date	09/19/05	09/19/05	09/19/05	09/19/05
Time	2:18 PM	2:25 PM	2:30 PM	2:37 PM
Ambient Temp (°F)	68	68	68	68
Cyl. Surf. Temp(°F)	67	67	67	67
Gauge Load (psi)	0	7700	0	7700
Stress (ksi)	0	3.868	0	3.868
(10,000 in) N	999	946	993	952
S	847	772	851	770
E	756	726	757	724
W	928	834	921	833
Age (days)	6.89	6.89	6.90	6.90
Gauge Correction	-568	-569	-569	-569
Rod Temp (°F)	68	68	68	68
ADJ - N	431	377	424	383
ADJ - S	279	203	282	201
ADJ - E	188	157	188	155
ADJ - W	360	265	352	264
∆ Average N-S		-65		-61
∆ Average E-W		-63		-61
∆ Ave-Ave (in)		-64		-61
Concrete Strain		-0.000939		-0.000893
E_c (ksi)		4119		4333

Un-Loading:

Sealed	**100%**	**0%**
Date	01/11/06	01/11/06
Time	1:13 PM	1:40 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7700	0
Stress (ksi)	3.868	0
(10,000 in) N	392	432
S	380	440
E	439	490
W	318	375
Age (days)	120.84	120.86
Gauge Correction	-68	-73
Rod Temp (°F)	55	54
ADJ - N	324	359
ADJ - S	312	367
ADJ - E	371	417
ADJ - W	250	302
Δ Average N-S	▨	45
Δ Average E-W	▨	49
Δ Ave-Ave (in)	▨	47
Concrete Strain	▨	0.000647
E_c (ksi)	▨	5982

Creep Monitoring:

Sealed	**0%**	**100%**	
Date	09/19/05	09/19/05	09/20/05
Time	2:28 PM	2:35 PM	10:56 AM
Ambient Temp (°F)	68	68	68
Cyl. Surf. Temp(°F)	71	71	82
(10,000 in) N	959	926	920
S	992	923	913
E	1018	975	977
W	910	858	846
Age (days)	6.89	6.90	7.75
Gauge Correction	-569	-569	-567
Rod Temp (°F)	68	68	68
ADJ - N	390	357	353
ADJ - S	423	354	346
ADJ - E	449	406	410
ADJ - W	341	289	279
Δ Average N-S	0	-51	-57
Δ Average E-W	0	-48	-51
Δ Ave-Ave	0	-49	-54
Stress (ksi)	0	3.868	3.868
Concrete Strain	0	-0.000728	-0.000793
E_c Effective (ksi)	0	5311	4880
$C_c(t)$	0	0	0.0882631

UnSealed		
Date	01/11/06	01/11/06
Time	1:15 PM	1:42 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	7700	0
Stress (ksi)	3.868	0
(10,000 in) N	391	441
S	201	262
E	171	210
W	248	323
Age (days)	120.84	120.86
Gauge Correction	-68	-73
Rod Temp (°F)	55	54
ADJ - N	323	368
ADJ - S	133	189
ADJ - E	103	137
ADJ - W	180	250
Δ Average N-S	▨	51
Δ Average E-W	▨	52
Δ Ave-Ave (in)	▨	51
Concrete Strain	▨	0.000707
E_c (ksi)	▨	5468

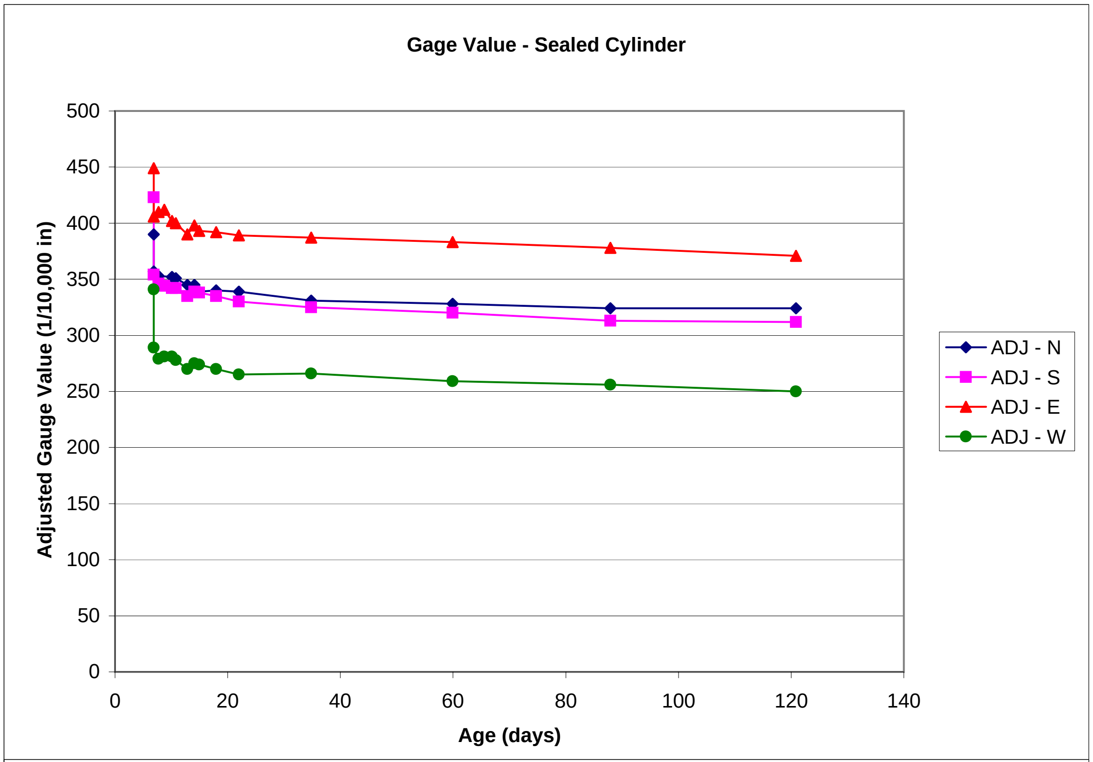
UnSealed			
Date	09/19/05	09/19/05	09/20/05
Time	2:30 PM	2:37 PM	10:59 AM
Ambient Temp (°F)	68	68	68
Cyl. Surf. Temp(°F)	67	67	78
(10,000 in) N	993	952	941
S	851	770	757
E	757	724	717
W	921	833	815
Age (days)	6.90	6.90	7.75
Gauge Correction	-569	-569	-567
Rod Temp (°F)	68	68	68
ADJ - N	424	383	374
ADJ - S	282	201	190
ADJ - E	188	155	150
ADJ - W	352	264	248
Δ Average N-S	0	-61	-71
Δ Average E-W	0	-61	-71
Δ Ave-Ave	0	-61	-71
Stress (ksi)	0	3.868	3.868
Concrete Strain	0	-0.000893	-0.001039
E_c Effective (ksi)	0	4333	3723
$C_c(t)$	0	0	0.1640422

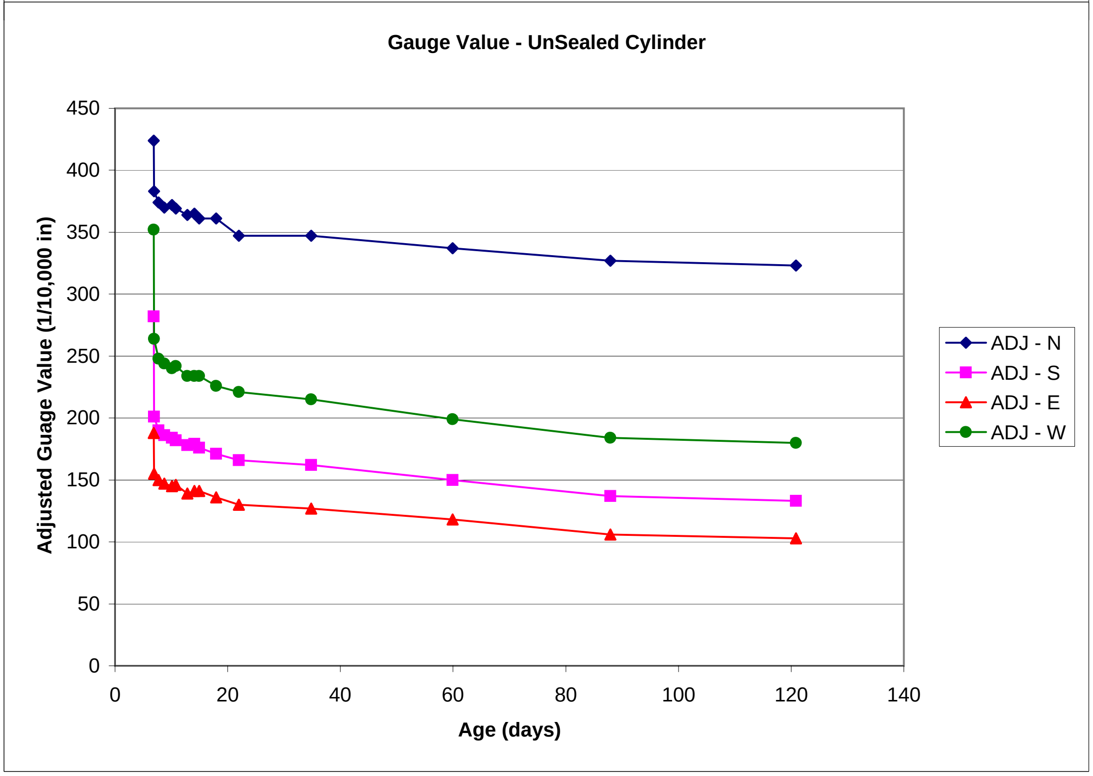
09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05	11/11/05
10:57 AM	7:47 PM	11:48 AM	1:14 PM	7:15 PM	3:22 PM	3:04 PM	4:02 PM	12:59 PM	3:01 PM
66	64	65	68	69	74	64	65	67	52
67	65	66	70	68	72	66	65	67	54
#N/A	914	911	908	907	916	915	916	907	898
908	904	902	898	901	915	910	907	901	890
976	964	960	953	960	970	967	966	963	953
845	843	838	833	837	851	845	842	842	829
8.75	10.12	10.78	12.84	14.09	14.93	17.92	21.96	34.83	59.92
-564	-562	-560	-563	-562	-577	-575	-577	-576	-570
66	68	64	70	70	73	66	68	68	57
#N/A	352	351	345	345	339	340	339	331	328
344	342	342	335	339	338	335	330	325	320
412	402	400	390	398	393	392	389	387	383
281	281	278	270	275	274	270	265	266	259
#N/A	-60	-60	-67	-65	-68	-69	-72	-79	-83
-49	-54	-56	-65	-59	-62	-64	-68	-69	-74
#N/A	-57	-58	-66	-62	-65	-67	-70	-74	-78
3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868
#N/A	-0.000832	-0.000853	-0.000964	-0.000903	-0.000950	-0.000975	-0.001025	-0.001075	-0.001143
#N/A	4650	4533	4012	4282	4073	3968	3775	3599	3385
#N/A	0.1422017	0.1716227	0.3236314	0.2402718	0.3040174	0.3383419	0.406991	0.4756401	0.5688067

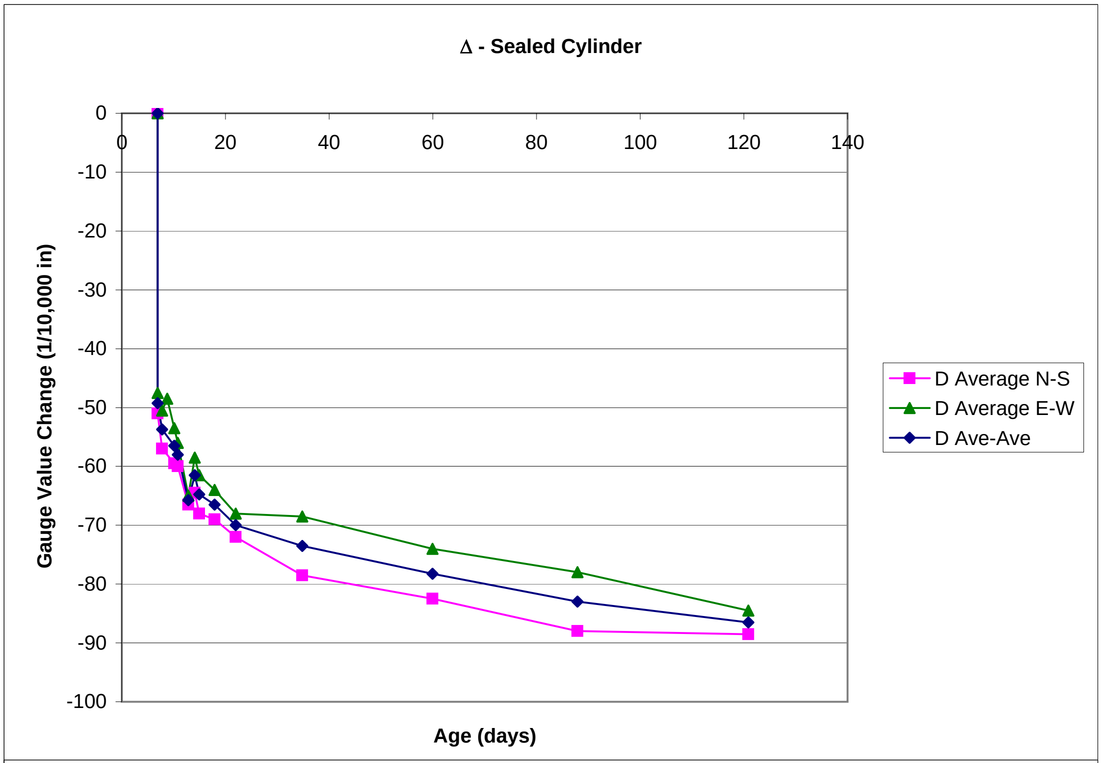
09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05	11/11/05
10:59 AM	7:50 PM	11:49 AM	1:17 PM	7:16 PM	3:23 PM	3:05 PM	4:03 PM	1:01 PM	3:02 PM
66	64	65	68	69	74	64	65	67	52
65	66	63	67	69	70	67	64	65	55
934	934	929	927	927	938	936	924	923	907
750	746	742	741	741	753	746	743	738	720
711	707	706	702	703	718	711	707	703	688
808	802	802	797	796	811	801	798	791	769
8.75	10.12	10.78	12.85	14.09	14.93	17.92	21.96	34.83	59.92
-564	-562	-560	-563	-562	-577	-575	-577	-576	-570
66	68	64	70	70	73	66	68	68	57
370	372	369	364	365	361	361	347	347	337
186	184	182	178	179	176	171	166	162	150
147	145	146	139	141	141	136	130	127	118
244	240	242	234	234	234	226	221	215	199
-75	-75	-78	-82	-81	-85	-87	-97	-99	-110
-75	-78	-76	-84	-83	-83	-89	-95	-99	-112
-75	-76	-77	-83	-82	-84	-88	-96	-99	-111
3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.001093	-0.001114	-0.001121	-0.001207	-0.001193	-0.001218	-0.001282	-0.001389	-0.001435	-0.001603
3540	3472	3450	3205	3243	3177	3017	2785	2695	2412
0.2240576	0.2480638	0.2560658	0.3520905	0.3360864	0.3640936	0.4361121	0.556143	0.6081564	0.7962047

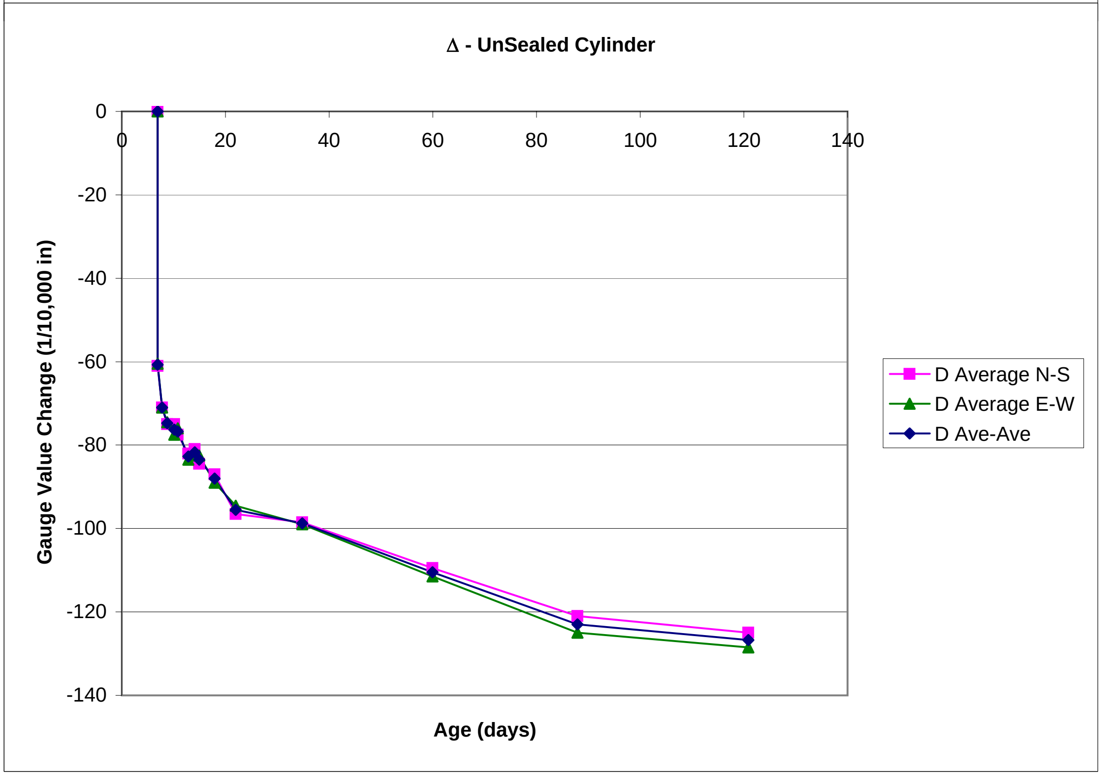
12/09/05	01/11/06					
3:05 PM	1:13 PM					
57	54					
473	392					
462	380					
527	439					
405	318					
87.92	120.84	#N/A	#N/A	#N/A	#N/A	#N/A
-149	-68	#N/A	#N/A	#N/A	#N/A	#N/A
63	55	#N/A	#N/A	#N/A	#N/A	#N/A
324	324	#N/A	#N/A	#N/A	#N/A	#N/A
313	312	#N/A	#N/A	#N/A	#N/A	#N/A
378	371	#N/A	#N/A	#N/A	#N/A	#N/A
256	250	#N/A	#N/A	#N/A	#N/A	#N/A
-88	-89	#N/A	#N/A	#N/A	#N/A	#N/A
-78	-85	#N/A	#N/A	#N/A	#N/A	#N/A
-83	-87	#N/A	#N/A	#N/A	#N/A	#N/A
3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.001210	-0.001260	#N/A	#N/A	#N/A	#N/A	#N/A
3195	3069	#N/A	#N/A	#N/A	#N/A	#N/A
0.6619733	0.7306224	#N/A	#N/A	#N/A	#N/A	#N/A

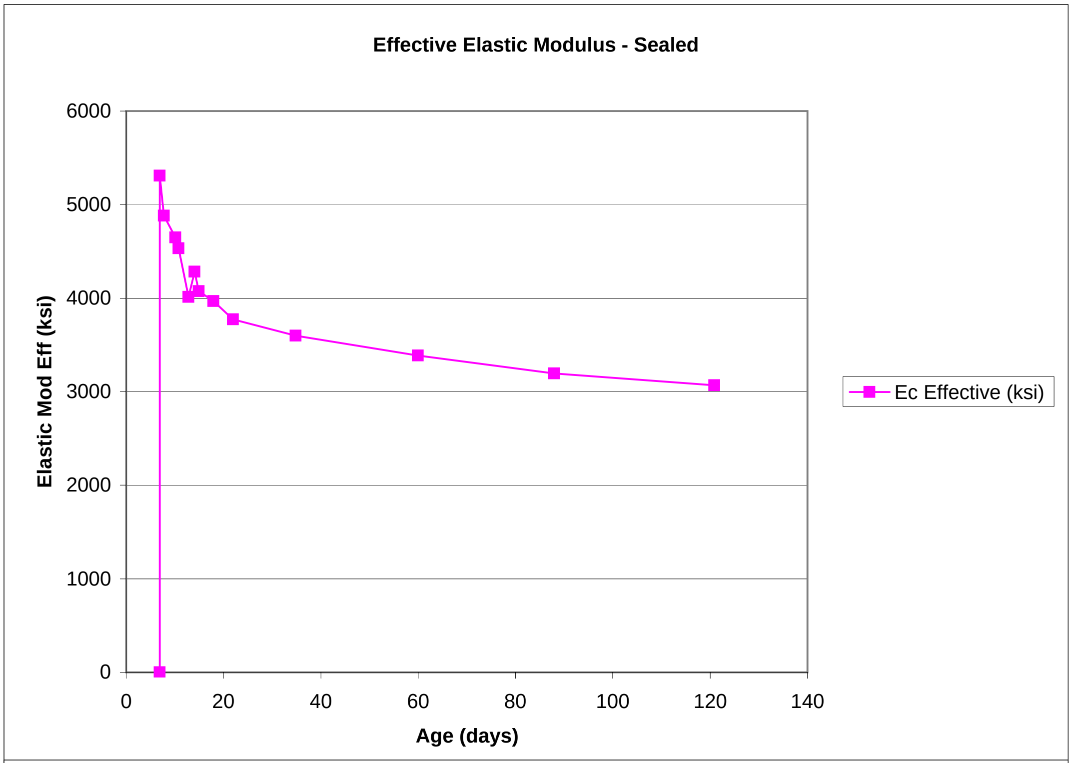
12/09/05	01/11/06					
3:07 PM	1:15 PM					
57	54					
476	391					
286	201					
255	171					
333	248					
87.92	120.84	#N/A	#N/A	#N/A	#N/A	#N/A
-149	-68	#N/A	#N/A	#N/A	#N/A	#N/A
63	55	#N/A	#N/A	#N/A	#N/A	#N/A
327	323	#N/A	#N/A	#N/A	#N/A	#N/A
137	133	#N/A	#N/A	#N/A	#N/A	#N/A
106	103	#N/A	#N/A	#N/A	#N/A	#N/A
184	180	#N/A	#N/A	#N/A	#N/A	#N/A
-121	-125	#N/A	#N/A	#N/A	#N/A	#N/A
-125	-129	#N/A	#N/A	#N/A	#N/A	#N/A
-123	-127	#N/A	#N/A	#N/A	#N/A	#N/A
3.868	3.868	3.868	3.868	3.868	3.868	3.868
-0.001782	-0.001835	#N/A	#N/A	#N/A	#N/A	#N/A
2171	2107	#N/A	#N/A	#N/A	#N/A	#N/A
0.9962561	1.0562716	#N/A	#N/A	#N/A	#N/A	#N/A

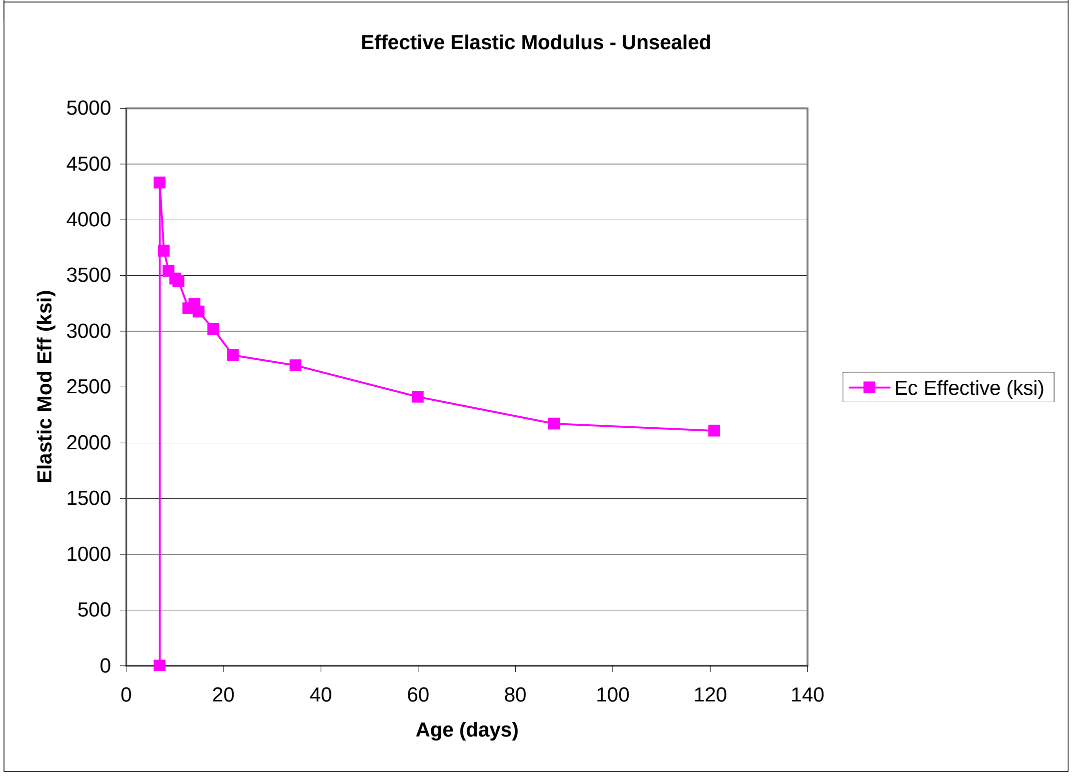

Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
500
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

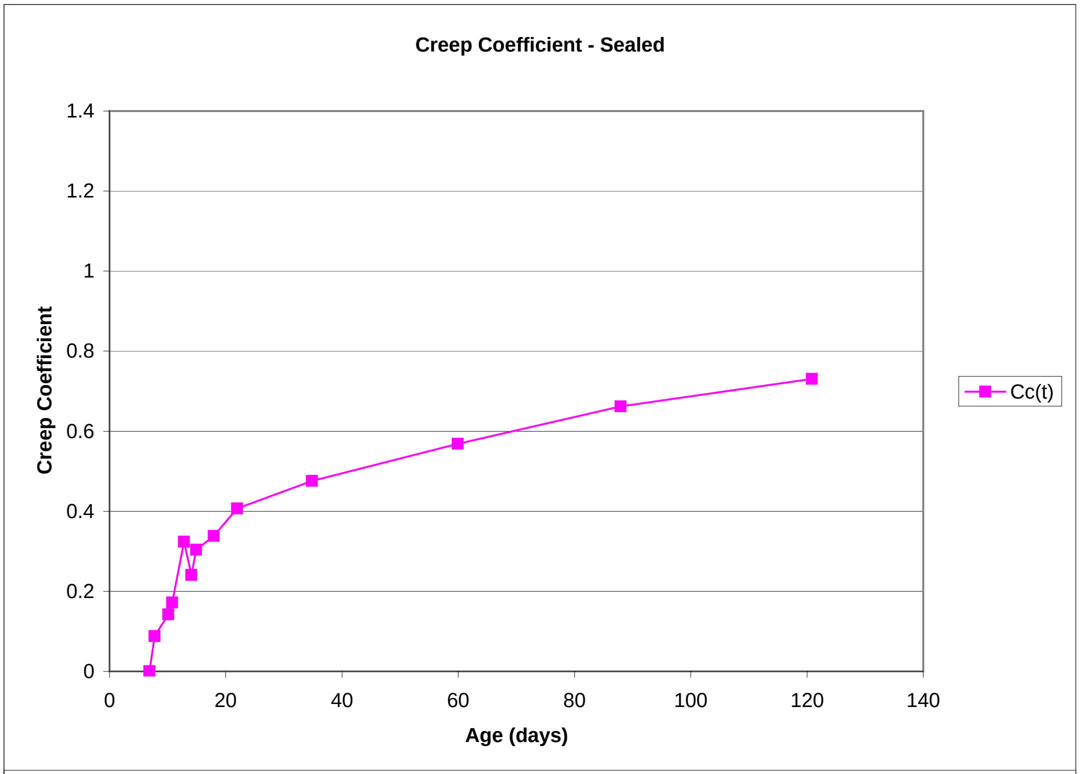

Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Δ - Sealed Cylinder


Δ - UnSealed Cylinder


Effective Elastic Modulus - Sealed
Elastic Mod Eff (ksi)
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Effective Elastic Modulus - Unsealed
Elastic Mod Eff (ksi)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Creep Coefficient - Sealed


Creep Coefficient - Unsealed

G1D-MC-7Day

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	7Day
Cylinder Cure:	MC

Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	76	76
Unwrap Time	11:20 AM	11:20 AM
Cyl. Surf. Temp(°F)	76	76
Humidity (%)		

Loading:

Ave E Mod = 4378 ksi

Sustained Pressure = 2.365 ksi

Comments:

Loading Procedure:
Pump to gauge pressure of 7700psi. Hand tight nuts to snug. Take reading.

Initial Loading:

Sealed	**0%**	**100%**	**0%**	**100%**
Date	09/19/05	09/19/05	09/19/05	09/19/05
Time	1:32 PM	1:39 PM	1:47 PM	1:52 PM
Ambient Temp (°F)	66	66	66	66
Cyl. Surf. Temp(°F)	68	68	68	69
Gauge Load (psi)	0	4620	0	4620
Stress (ksi)	0	2.365	0	2.365
(10,000 in) N	969	932	965	928
S	949	921	947	918
E	1010	970	1008	969
W	952	928	953	923
Age (days)	6.86	6.86	6.87	6.87
Gauge Correction	-568	-567	-567	-568
Rod Temp (°F)	66	66	66	68
ADJ - N	401	365	398	360
ADJ - S	381	354	380	350
ADJ - E	442	403	441	401
ADJ - W	384	361	386	355
Δ Average N-S		-32		-34
Δ Average E-W		-31		-36
Δ Ave-Ave (in)		-31		-35
Concrete Strain		-0.000462		-0.000512
E_c (ksi)		5124		4623

UnSealed				
Date	09/19/05	09/19/05	09/19/05	09/19/05
Time	1:35 PM	1:39 PM	1:48 PM	1:52 PM
Ambient Temp (°F)	66	66	66	66
Cyl. Surf. Temp(°F)	65	66	66	66
Gauge Load (psi)	0	4620	0	4620
Stress (ksi)	0	2.365	0	2.365
(10,000 in) N	884	848	883	851
S	822	776	821	775
E	842	797	838	795
W	811	781	812	781
Age (days)	6.86	6.86	6.87	6.87
Gauge Correction	-567	-567	-567	-568
Rod Temp (°F)	66	66	66	68
ADJ - N	317	281	316	283
ADJ - S	255	209	254	207
ADJ - E	275	230	271	227
ADJ - W	244	214	245	213
Δ Average N-S		-41		-40
Δ Average E-W		-38		-38
Δ Ave-Ave (in)		-39		-39
Concrete Strain		-0.000576		-0.000572
E_c (ksi)		4107		4133

Un-Loading:

Sealed	**100%**	**0%**
Date	01/11/06	01/11/06
Time	11:31 AM	12:52 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	4620	0
Stress (ksi)	2.365	0
(10,000 in) N	398	428
S	384	406
E	429	464
W	401	423
Age (days)	120.77	120.83
Gauge Correction	-68	-68
Rod Temp (°F)	55	55
ADJ - N	330	360
ADJ - S	316	338
ADJ - E	361	396
ADJ - W	333	355
Δ Average N-S	▨	26
Δ Average E-W	▨	29
Δ Ave-Ave (in)	▨	27
Concrete Strain	▨	0.000374
E_c (ksi)	▨	6321

Creep Monitoring:

Sealed	**0%**	**100%**	
Date	09/19/05	09/19/05	09/20/05
Time	1:47 PM	1:52 PM	11:16 AM
Ambient Temp (°F)	66	66	68
Cyl. Surf. Temp(°F)	68	69	69
(10,000 in) N	965	928	919
S	947	918	911
E	1008	969	956
W	953	923	920
Age (days)	6.87	6.87	7.76
Gauge Correction	-567	-568	-570
Rod Temp (°F)	66	68	70
ADJ - N	398	360	349
ADJ - S	380	350	341
ADJ - E	441	401	386
ADJ - W	386	355	350
Δ Average N-S	0	-34	-44
Δ Average E-W	0	-36	-46
Δ Ave-Ave	0	-35	-45
Stress (ksi)	0	2.365	2.365
Concrete Strain	0	-0.000512	-0.000654
E_c Effective (ksi)	0	4623	3614
$C_c(t)$	0	-0.052993	0.2114584

UnSealed		
Date	01/11/06	01/11/06
Time	11:32 AM	12:54 PM
Ambient Temp (°F)	54	54
Cyl. Surf. Temp(°F)		
Gauge Load (psi)	4620	0
Stress (ksi)	2.365	0
(10,000 in) N	310	333
S	209	256
E	243	279
W	222	254
Age (days)	120.77	120.83
Gauge Correction	-68	-68
Rod Temp (°F)	55	55
ADJ - N	242	265
ADJ - S	141	188
ADJ - E	175	211
ADJ - W	154	186
Δ Average N-S	▨	35
Δ Average E-W	▨	34
Δ Ave-Ave (in)	▨	35
Concrete Strain	▨	0.000478
E_c (ksi)	▨	4951

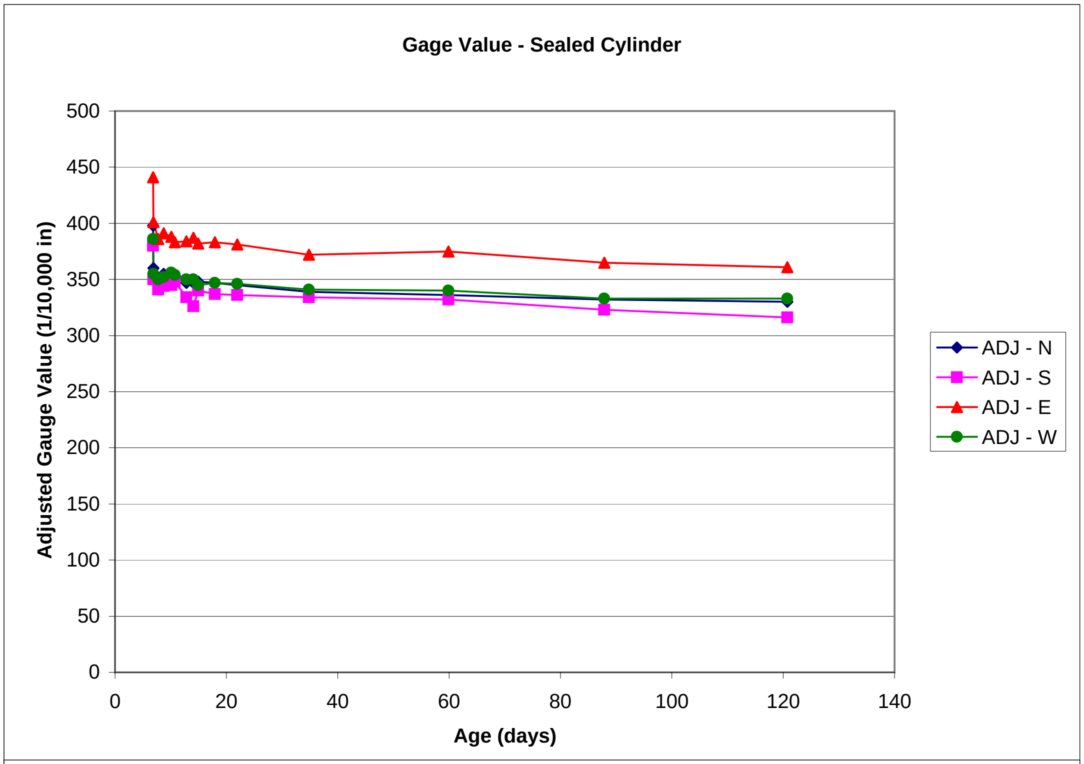
UnSealed			
Date	09/19/05	09/19/05	09/20/05
Time	1:48 PM	1:52 PM	11:18 AM
Ambient Temp (°F)	66	66	68
Cyl. Surf. Temp(°F)	66	66	66
(10,000 in) N	883	851	844
S	821	775	761
E	838	795	784
W	812	781	770
Age (days)	6.87	6.87	7.76
Gauge Correction	-567	-568	-570
Rod Temp (°F)	66	68	70
ADJ - N	316	283	274
ADJ - S	254	207	191
ADJ - E	271	227	214
ADJ - W	245	213	200
Δ Average N-S	0	-40	-53
Δ Average E-W	0	-38	-51
Δ Ave-Ave	0	-39	-52
Stress (ksi)	0	2.365	2.365
Concrete Strain	0	-0.000572	-0.000754
E_c Effective (ksi)	0	4133	3135
$C_c(t)$	0	0.0593986	0.3965747

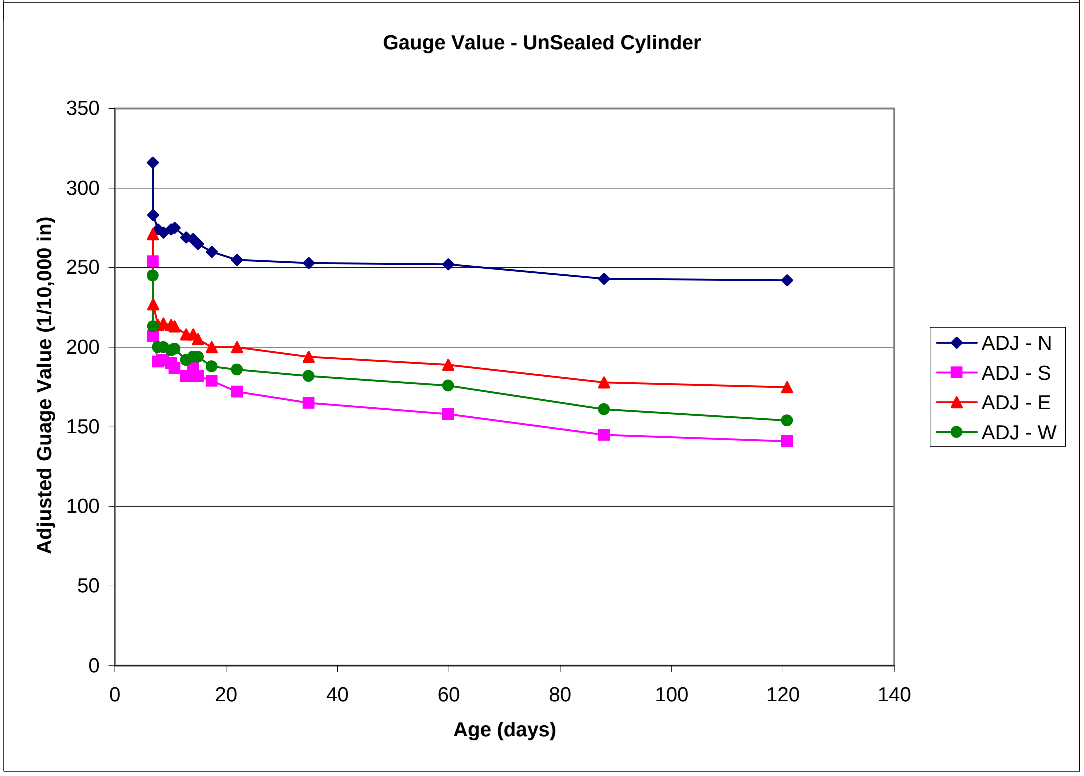
09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05	11/11/05
10:31 AM	7:16 PM	11:35 AM	12:45 PM	6:52 PM	3:08 PM	2:48 PM	3:40 PM	12:39 PM	2:39 PM
64	66	64	67	70	75	64	65	65	54
65	67	65	71	72	74	65	68	67	57
917	916	911	908	910	911	920	919	915	905
906	906	906	895	889	903	910	910	910	901
953	949	941	945	950	945	956	955	948	944
914	917	912	911	913	908	920	920	917	909
8.73	10.09	10.77	12.82	14.08	14.92	17.91	21.94	34.82	59.90
-562	-561	-558	-561	-563	-563	-573	-574	-576	-569
66	66	64	68	72	72	64	66	66	57
355	355	353	347	347	348	347	345	339	336
344	345	348	334	326	340	337	336	334	332
391	388	383	384	387	382	383	381	372	375
352	356	354	350	350	345	347	346	341	340
-40	-39	-39	-49	-53	-45	-47	-49	-53	-55
-42	-42	-45	-47	-45	-50	-49	-50	-57	-56
-41	-40	-42	-48	-49	-48	-48	-49	-55	-56
2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.000597	-0.000590	-0.000612	-0.000694	-0.000712	-0.000694	-0.000697	-0.000719	-0.000797	-0.000808
3960	4007	3867	3409	3324	3409	3392	3291	2966	2927
0.1056776	0.0924551	0.1321228	0.2841826	0.3172391	0.2841826	0.2907939	0.3304617	0.4759102	0.4957441

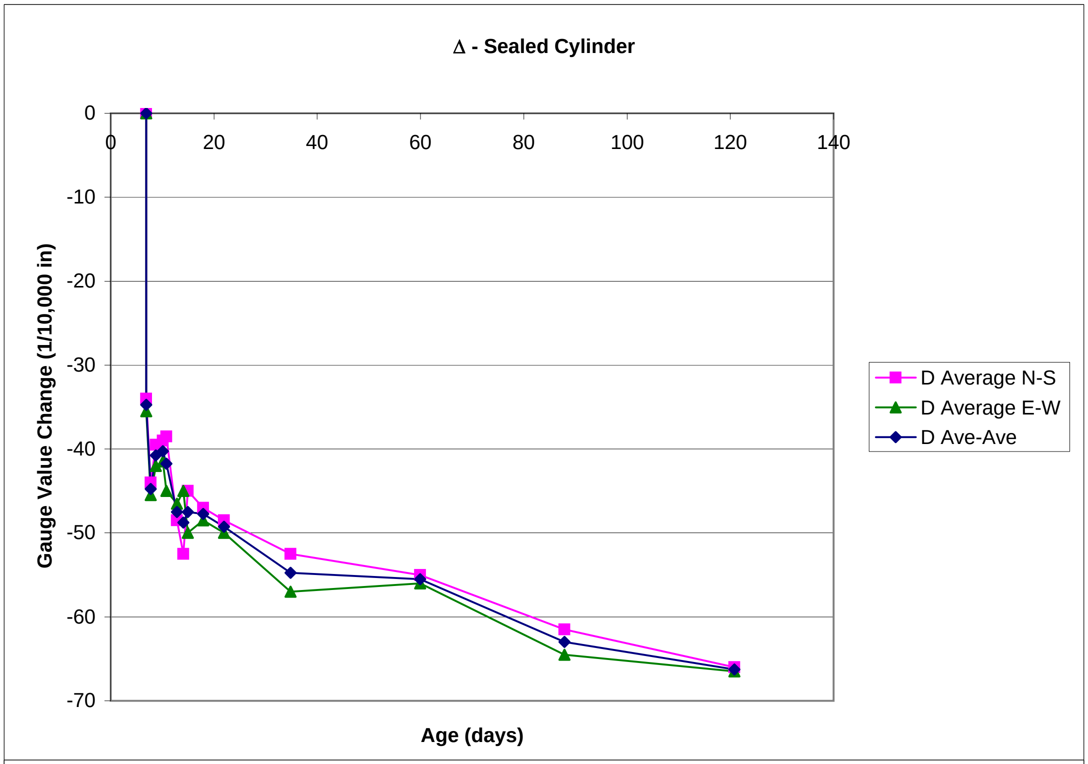
09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05	10/17/05	11/11/05
10:33 AM	7:19 PM	11:37 AM	12:48 PM	6:53 PM	3:09 PM	2:49 AM	3:42 PM	12:41 PM	2:40 PM
64	66	64	67	70	75	64	65	65	54
63	67	63	66	72	71	65	64	64	56
834	835	833	830	831	828	838	829	829	821
754	751	745	743	750	745	757	746	741	727
777	775	771	769	771	768	778	774	770	758
762	759	757	753	757	757	766	760	758	745
8.73	10.10	10.78	12.82	14.08	14.92	17.41	21.95	34.82	59.90
-562	-561	-558	-561	-563	-563	-578	-574	-576	-569
66	66	64	68	72	72	73	66	66	57
272	274	275	269	268	265	260	255	253	252
192	190	187	182	187	182	179	172	165	158
215	214	213	208	208	205	200	200	194	189
200	198	199	192	194	194	188	186	182	176
-53	-53	-54	-60	-58	-62	-66	-72	-76	-80
-51	-52	-52	-58	-57	-59	-64	-65	-70	-76
-52	-53	-53	-59	-57	-60	-65	-68	-73	-78
2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.000754	-0.000765	-0.000772	-0.000854	-0.000833	-0.000872	-0.000940	-0.000990	-0.001058	-0.001126
3135	3091	3062	2768	2839	2711	2516	2389	2235	2101
0.3965747	0.4164085	0.4296311	0.5816909	0.5420232	0.6147474	0.740362	0.8329202	0.9585348	1.0841494

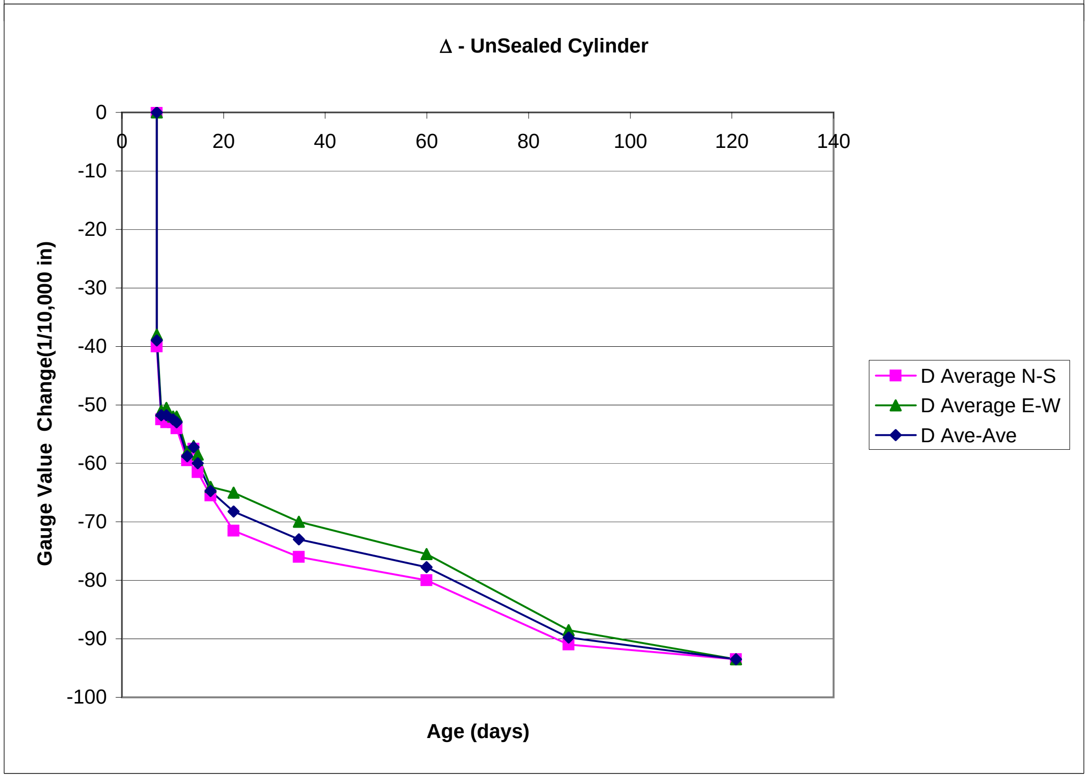
12/09/05	01/11/06					
2:30 PM	11:31 AM					
59	54					
481	398					
472	384					
514	429					
482	401					
87.90	120.77	#N/A	#N/A	#N/A	#N/A	#N/A
-149	-68	#N/A	#N/A	#N/A	#N/A	#N/A
63	55	#N/A	#N/A	#N/A	#N/A	#N/A
332	330	#N/A	#N/A	#N/A	#N/A	#N/A
323	316	#N/A	#N/A	#N/A	#N/A	#N/A
365	361	#N/A	#N/A	#N/A	#N/A	#N/A
333	333	#N/A	#N/A	#N/A	#N/A	#N/A
-62	-66	#N/A	#N/A	#N/A	#N/A	#N/A
-65	-67	#N/A	#N/A	#N/A	#N/A	#N/A
-63	-66	#N/A	#N/A	#N/A	#N/A	#N/A
2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.000915	-0.000962	#N/A	#N/A	#N/A	#N/A	#N/A
2584	2460	#N/A	#N/A	#N/A	#N/A	#N/A
0.694083	0.7800298	#N/A	#N/A	#N/A	#N/A	#N/A

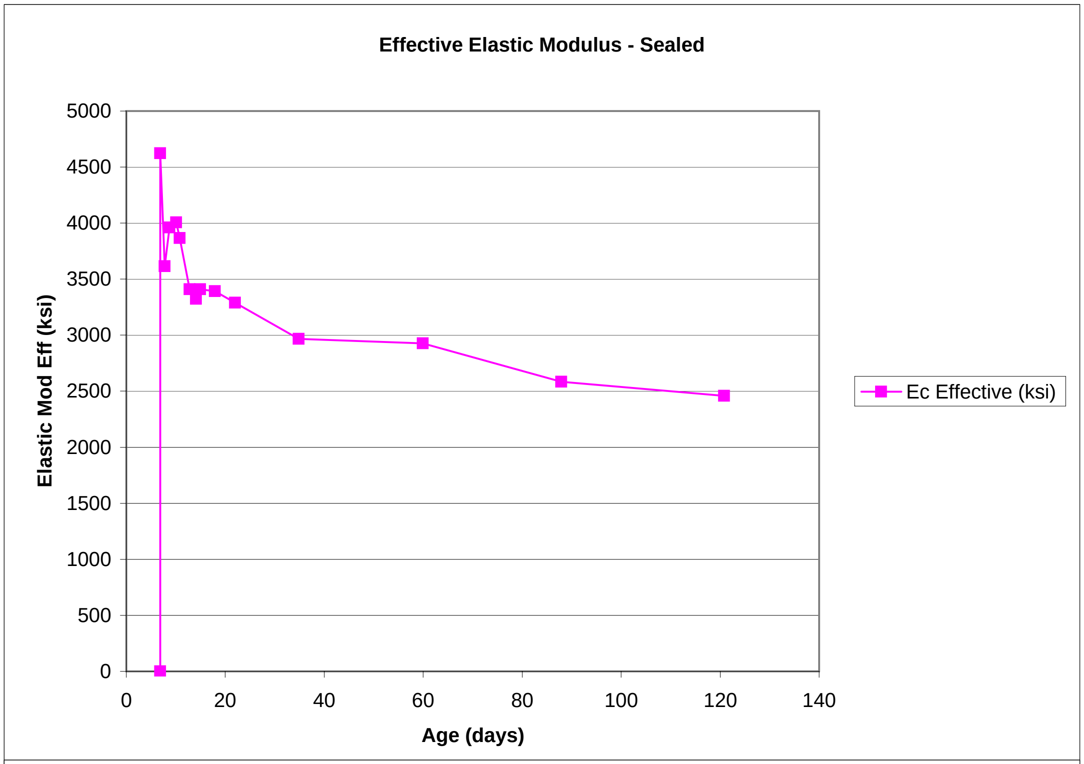
12/09/05	01/11/06					
2:31 PM	11:32 AM					
59	54					
392	310					
294	209					
327	243					
310	222					
87.90	120.77	#N/A	#N/A	#N/A	#N/A	#N/A
-149	-68	#N/A	#N/A	#N/A	#N/A	#N/A
63	55	#N/A	#N/A	#N/A	#N/A	#N/A
243	242	#N/A	#N/A	#N/A	#N/A	#N/A
145	141	#N/A	#N/A	#N/A	#N/A	#N/A
178	175	#N/A	#N/A	#N/A	#N/A	#N/A
161	154	#N/A	#N/A	#N/A	#N/A	#N/A
-91	-94	#N/A	#N/A	#N/A	#N/A	#N/A
-89	-94	#N/A	#N/A	#N/A	#N/A	#N/A
-90	-94	#N/A	#N/A	#N/A	#N/A	#N/A
2.365	2.365	2.365	2.365	2.365	2.365	2.365
-0.001297	-0.001351	#N/A	#N/A	#N/A	#N/A	#N/A
1823	1751	#N/A	#N/A	#N/A	#N/A	#N/A
1.4014916	1.500661	#N/A	#N/A	#N/A	#N/A	#N/A

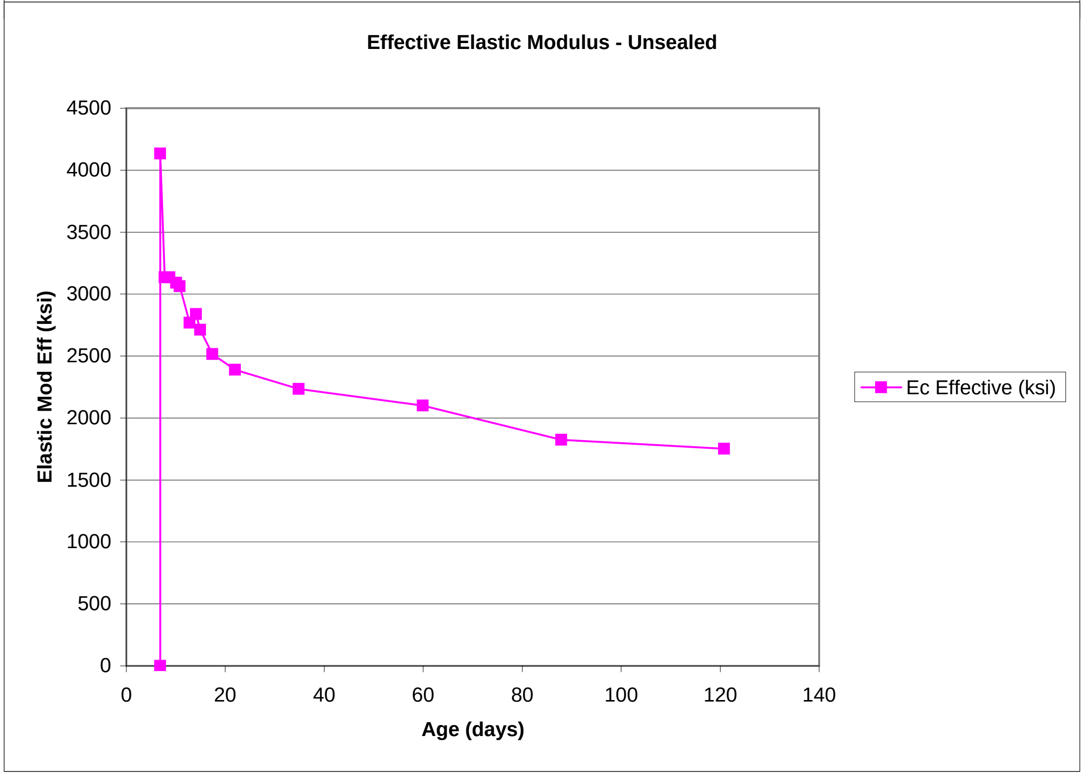

Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
500
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W

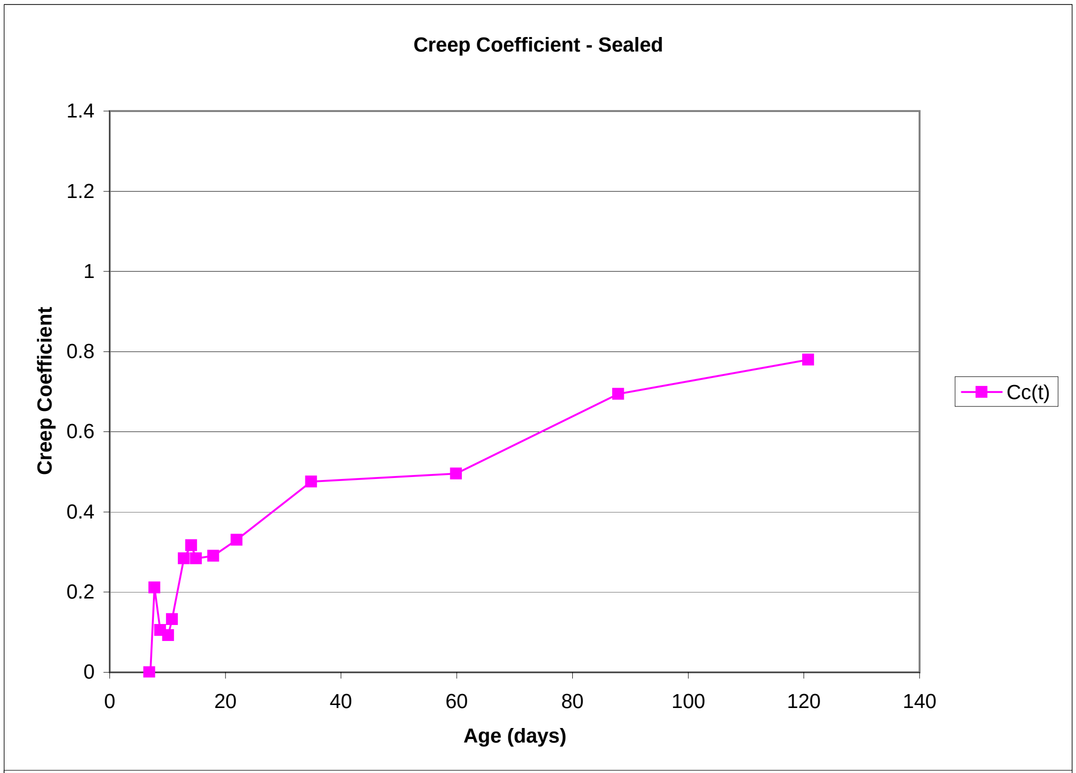

Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Δ - Sealed Cylinder
Gauge Value Change (1/10,000 in)
0
-10
-20
-30
-40
-50
-60
-70
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave


Δ - UnSealed Cylinder
Gauge Value Change(1/10,000 in)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
20
40
60
80
100
120
140
Age (days)
D Average N-S
D Average E-W
D Ave-Ave


Effective Elastic Modulus - Sealed
Elastic Mod Eff (ksi)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Effective Elastic Modulus - Unsealed
Elastic Mod Eff (ksi)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
Age (days)
Ec Effective (ksi)


Creep Coefficient - Sealed
Creep Coefficient
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)


Creep Coefficient - Unsealed
Creep Coefficient
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
Age (days)
Cc(t)

APPENDIX E

SNAKE LAKE SHRINKAGE TEST DATA

G2D-AC-Sh

Girder Name:	G2D
Cast Date:	09/09/05
Cast Time:	5:00 PM
Release date:	09/12/05
Cylinder Loading:	Sh
Cylinder Cure:	AC

Prep Work:	Sealed	UnSealed
Ambient Temp (°F)	74	74
Unwrap Time	8:22 AM	8:22 AM
Cyl. Surf. Temp(°F)	66	66
Humidity (%)		

Comments:

Cylinders arrived to UW Lab at 8:00am. Only 6 AC cylinders delivered (2 SH, 2 CR, 2 Materials). Placed Sulfer Caps 8:40-8:50am. Created stacks 8:55-9:25am. Placed Target 9:25-10:00am.

Area = 12.566 in2. Cylinder Strength = 110200 lb / Area = 8770 psi.
required strength on girder. 6500psi, 6800psi. -> 6500*0.6*A = 49k, 6800*0.6*A = 51k -> Use 50k. (7300psi or 50k on pump)

Shrinkage:

Sealed								
Date	09/12/05	09/12/05	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05
Time	11:00 AM	12:16 PM	1:55 PM	5:00 PM	2:16 PM	4:13 PM	10:41 AM	9:22 AM
Ambient Temp (°F)	64	64			66	66	66	
Cyl. Surf. Temp(°F)	68	68	74		69	69	64	65
(10,000 in) N	332	335	340	501	485	919	912	909
S	OS	OS	OS	OS	OS	OS	OS	OS
E	338	345	354	511	OS	OS	912	924
W	OS	OS	OS	OS	494	425	422	414
Age (days)	2.75	2.80	3.87	4.00	4.89	5.97	6.74	7.68
Gauge Correction	0	7	-13	-161	-154	-575	-572	-563
Rod Temp (°F)	75	68	75	75	68	66	59	64
ADJ - N	332	342	327	340	331	344	340	346
ADJ - S	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - E	338	352	341	350	#N/A	#N/A	340	361
ADJ - W	#N/A	#N/A	#N/A	#N/A	340	-150	-150	-149
Δ N	0	10	-5	8	-1	12	8	14
Δ S	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Δ E	0	14	3	12	#N/A	#N/A	2	23
Δ W	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

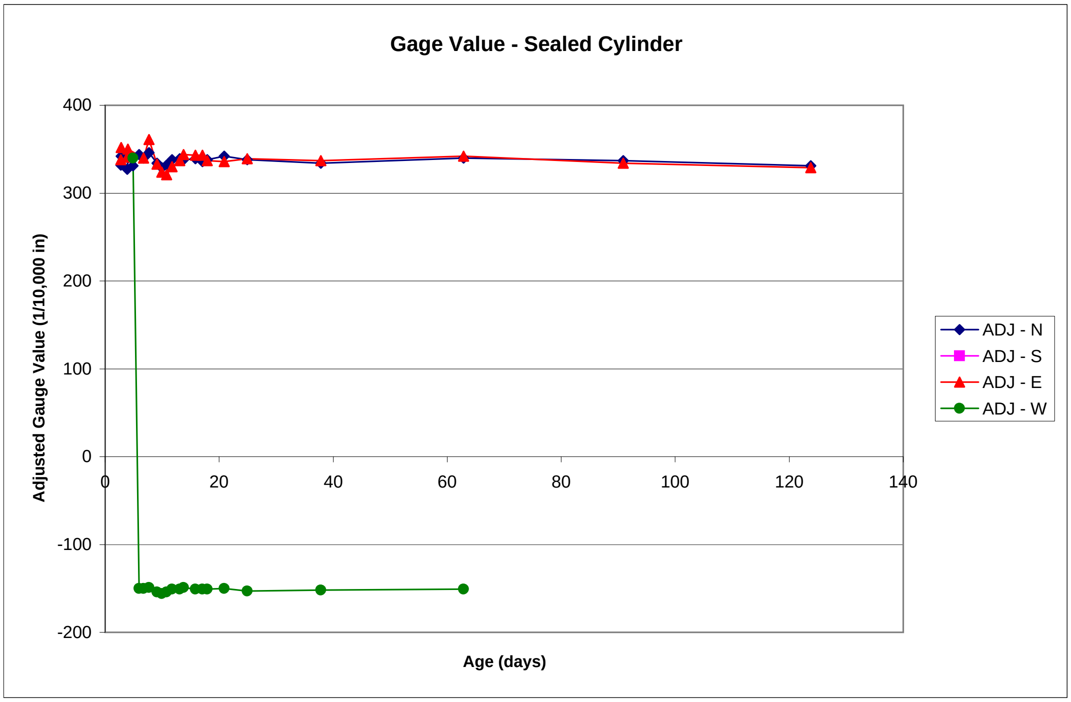
UnSealed								
Date	09/12/05	09/12/05	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05
Time	11:00 AM	12:16 PM	1:55 PM	5:00 PM	2:19 PM	4:15 PM	10:13 AM	9:24 AM
Ambient Temp (°F)	64	64			66	66	66	
Cyl. Surf. Temp(°F)	70	70	70	77	67	67	64	63
(10,000 in) N	OS	OS	OS	OS	OS	OS	OS	OS
S	380	377	391	543	538	963	960	953
E	387	390	393	547	542	968	967	960
W	353	355	375	537	529	956	955	948
Age (days)	2.75	2.80	3.87	4.00	4.89	5.97	6.72	7.68
Gauge Correction	0	7	-13	-161	-154	-575	-574	-563
Rod Temp (°F)	75	68	75	75	68	66	66	64
ADJ - N	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - S	380	384	378	382	384	388	386	390
ADJ - E	387	397	380	386	388	393	393	397
ADJ - W	353	362	362	376	375	381	381	385
Δ N	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Δ S	0	4	-2	2	4	8	6	10
Δ E	0	10	-7	-1	1	6	6	10
Δ W	0	9	9	23	22	28	28	32

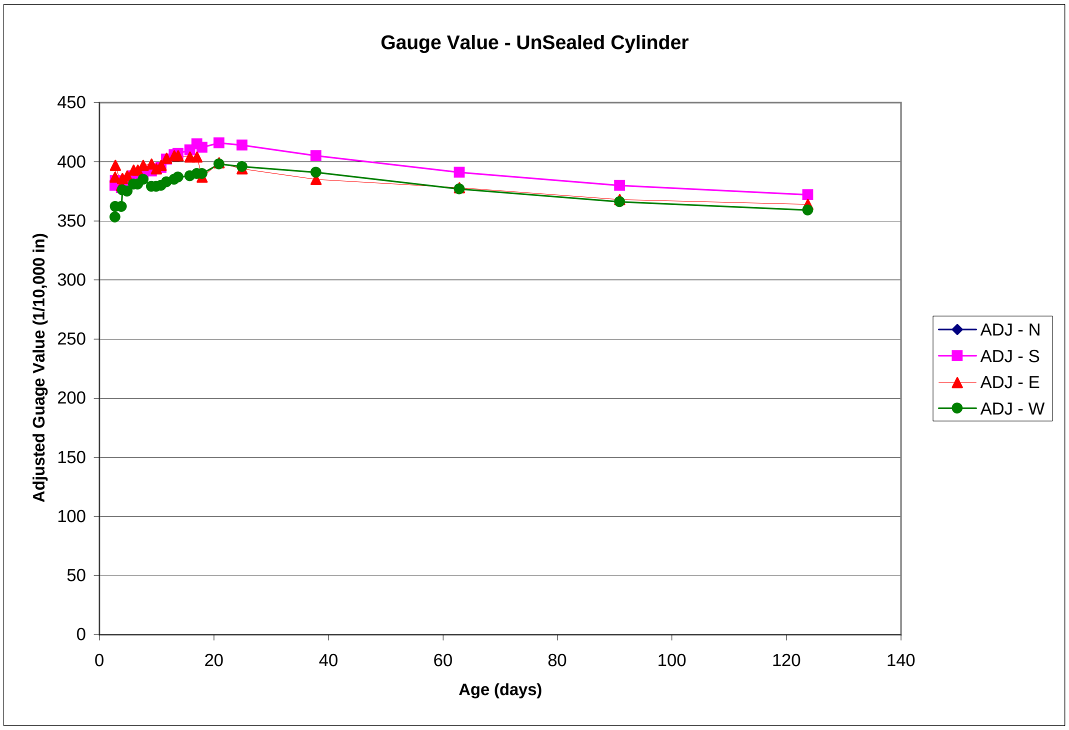
09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05
7:34 PM	3:50 PM	11:27 AM	10:12 AM	7:11 PM	11:26 AM	12:30 PM	6:42 PM	3:05 PM
68	70	67	62	66	64	67	70	74
69	71	70	64	67	64	68	72	75
903	901	901	898	900	894	898	898	901
OS	OS	OS	OS	OS	OS	OS	OS	OS
902	896	890	890	898	900	902	905	900
415	416	415	409	410	407	408	411	412
9.11	9.95	10.77	11.72	13.09	13.77	15.81	17.07	17.92
-569	-572	-569	-560	-561	-556	-559	-562	-563
70	72	70	63	66	63	66	72	72
334	329	332	338	339	338	339	336	338
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
333	324	321	330	337	344	343	343	337
-154	-156	-154	-151	-151	-149	-151	-151	-151
2	-3	0	6	7	6	7	4	6
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
-5	-14	-17	-8	-1	6	5	5	-1
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

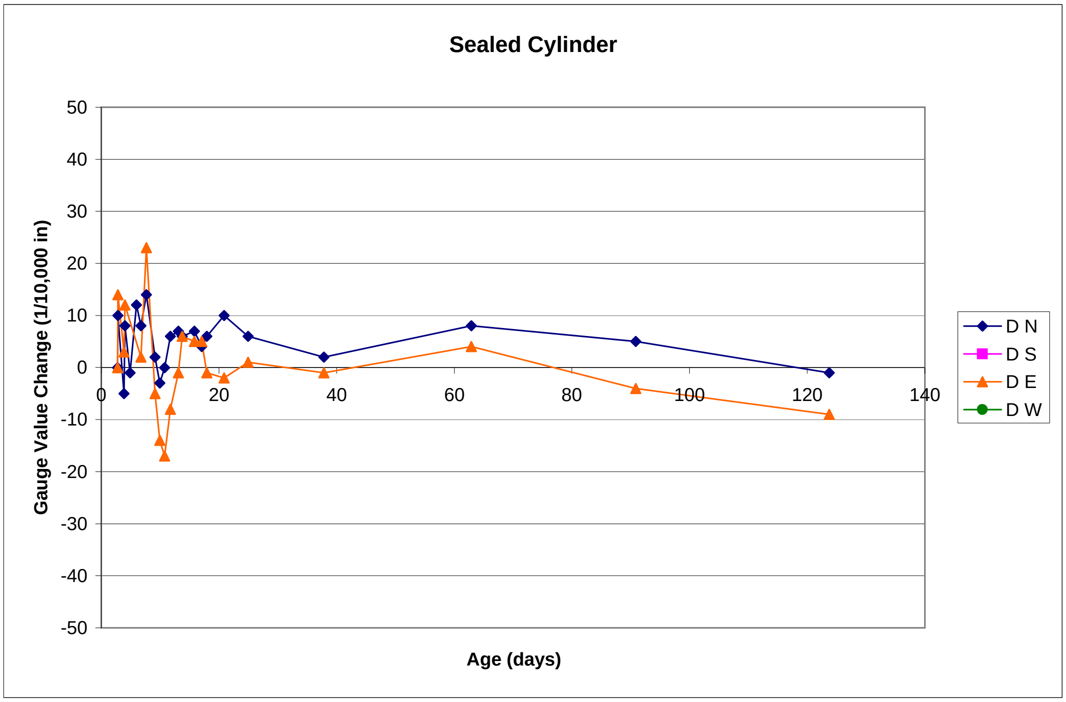
09/18/05	09/19/05	09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05
7:37 PM	3:53 PM	11:29 AM	10:15 AM	7:14 PM	11:27 AM	12:32 PM	6:44 PM	3:06 PM
68	70	67	62	66	64	67	70	74
70	71	67	62	68	63	66	72	72
OS	OS	OS	OS	OS	OS	OS	OS	OS
961	966	964	962	967	963	969	977	975
967	966	966	963	966	961	963	966	950
948	951	949	943	946	943	947	952	953
9.11	9.95	10.77	11.72	13.09	13.77	15.81	17.07	17.92
-569	-572	-569	-560	-561	-556	-559	-562	-563
70	72	70	63	66	63	66	72	72
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
392	394	395	402	406	407	410	415	412
398	394	397	403	405	405	404	404	387
379	379	380	383	385	387	388	390	390
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12	14	15	22	26	27	30	35	32
11	7	10	16	18	18	17	17	0
26	26	27	30	32	34	35	37	37

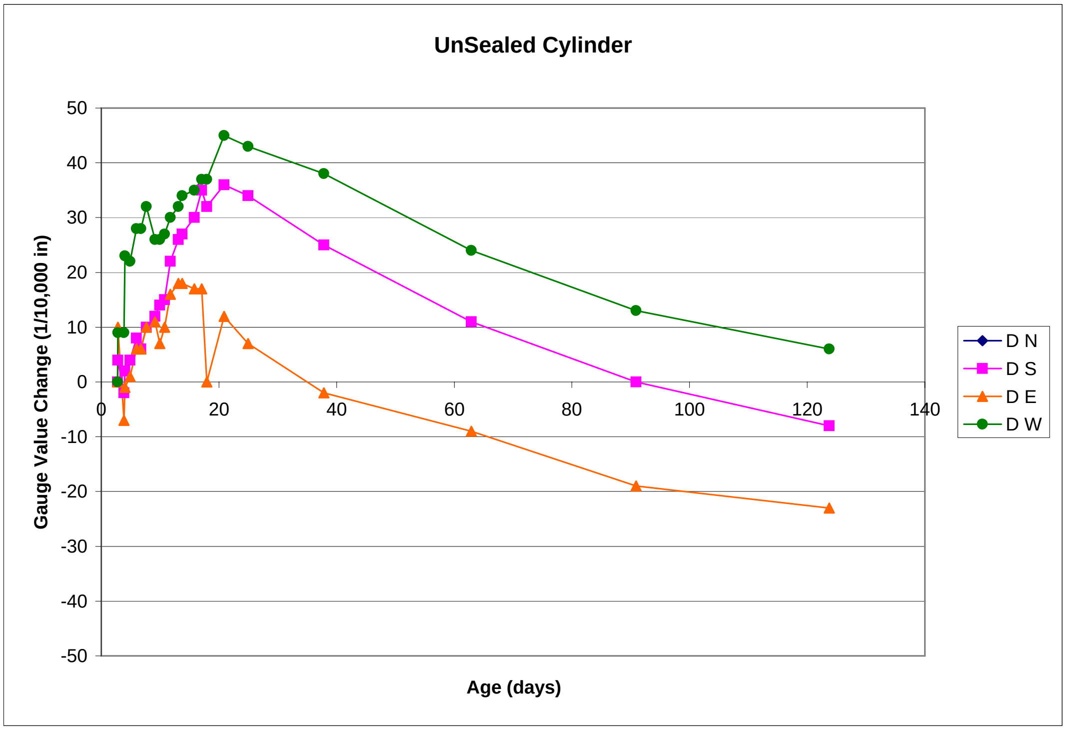
09/30/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06
2:41 PM	3:31 PM	12:33 PM	2:26 PM	2:02 PM	11:14 AM
63	67	65	54	60	53
65	70	67	57		
914	912	910	909	486	479
OS	OS	OS	OS	OS	OS
908	913	913	911	483	477
422	421	424	418	OS	OS
20.90	24.94	37.81	62.89	90.88	123.76
-572	-574	-576	-569	-149	-148
64	66	66	57	63	55
342	338	334	340	337	331
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
336	339	337	342	334	329
-150	-153	-152	-151	#N/A	#N/A
10	6	2	8	5	-1
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
-2	1	-1	4	-4	-9
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

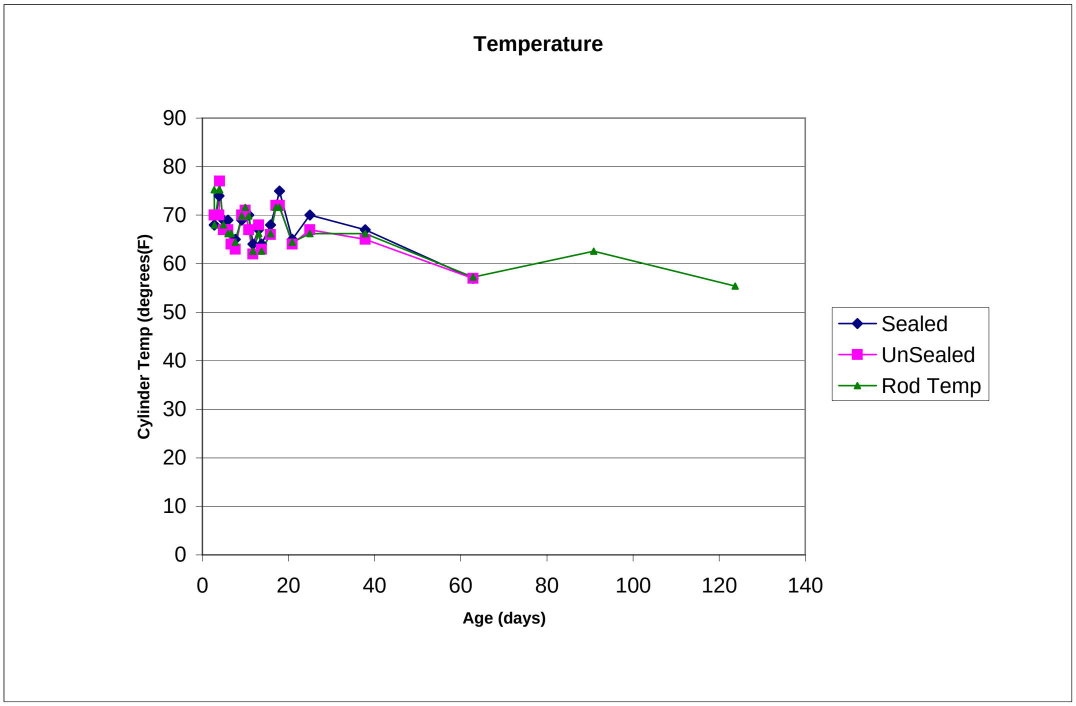
09/30/05	10/04/05	10/17/05	11/11/05	12/09/05	01/11/06
2:42 PM	3:32 PM	12:35 PM	2:27 PM	2:04 PM	11:16 AM
63	67	65	54	60	53
64	67	65	57		
OS	OS	OS	OS	OS	OS
988	988	981	960	529	520
971	968	961	947	517	512
970	970	967	946	515	507
20.90	24.94	37.82	62.89	90.88	123.76
-572	-574	-576	-569	-149	-148
64	66	66	57	63	55
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
416	414	405	391	380	372
399	394	385	378	368	364
398	396	391	377	366	359
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36	34	25	11	0	-8
12	7	-2	-9	-19	-23
45	43	38	24	13	6


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
400
300
200
100
0
-100
-200
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
Age (days)
D N
D S
D E
D W


Temperature
Cylinder Temp (degrees(F)
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
Age (days)
Sealed
UnSealed
Rod Temp

G1D-AC-Sh

Girder Name:	G1D	
Cast Date:	09/12/05	
Cast Time:	5:00 PM	
Release date:	09/13/05	
Cylinder Loading:	Sh	
Cylinder Cure:	AC	
Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	75	75
Unwrap Time	10:25 AM	10:25 AM
Cyl. Surf. Temp(°F)	78	78
Humidity (%)		

Comments:

Shrinkage:

Sealed								
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05
Time	1:10 PM	4:45 PM	2:37 PM	3:56 PM	10:55 AM	9:21 AM	7:25 PM	3:55 PM
Ambient Temp (°F)	72	71	67	66	62	62	68	70
Cyl. Surf. Temp(°F)	74		69	68	64	65	70	73
(10,000 in) N	357	506	502	920	920	915	905	902
S	430	584	574	982	1004	1004	990	996
E	462	612	603	1025	995	1015	1015	1023
W	403	557	553	980	983	977	982	986
Age (days)	0.84	0.99	1.90	2.96	3.75	4.68	6.10	6.95
Gauge Correction	-14	-161	-155	-574	-571	-563	-569	-569
Rod Temp (°F)	66	75	68	66	59	64	70	72
ADJ - N	343	345	347	346	349	352	336	333
ADJ - S	416	423	419	408	433	441	421	427
ADJ - E	448	451	448	451	424	452	446	454
ADJ - W	389	396	398	406	412	414	413	417
Δ N	0	2	4	3	6	9	-7	-10
Δ S	0	7	3	-8	17	25	5	11
Δ E	0	3	0	3	-24	4	-2	6
Δ W	0	7	9	17	23	25	24	28

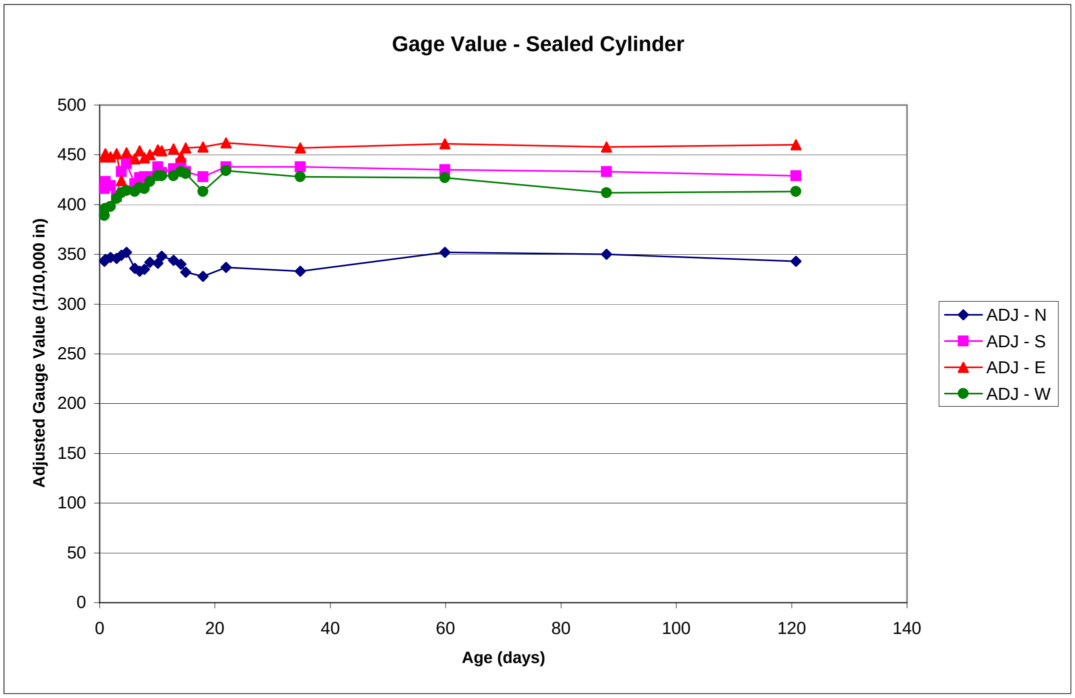
UnSealed								
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05
Time	1:10 PM	4:45 PM	2:39 PM	3:56 PM	10:58 AM	9:19 AM	7:27 PM	3:56 PM
Ambient Temp (°F)	72	71	67	66	62	62	68	70
Cyl. Surf. Temp(°F)	74	77	67	67	64	64	70	71
(10,000 in) N	295	450	438	863	882	855	856	857
S	308	432	450	878	877	870	871	878
E	360	495	472	904	908	905	897	904
W	280	422	404	832	829	823	823	825
Age (days)	0.84	0.99	1.90	2.96	3.75	4.68	6.10	6.96
Gauge Correction	-14	-161	-155	-574	-571	-563	-569	-569
Rod Temp (°F)	66	75	68	66	59	64	70	72
ADJ - N	281	289	283	289	311	292	287	288
ADJ - S	294	271	295	304	306	307	302	309
ADJ - E	346	334	317	330	337	342	328	335
ADJ - W	266	261	249	258	258	260	254	256
Δ N	0	8	2	8	30	11	6	7
Δ S	0	-23	1	10	12	13	8	15
Δ E	0	-12	-29	-16	-9	-4	-18	-11
Δ W	0	-5	-17	-8	-8	-6	-12	-10

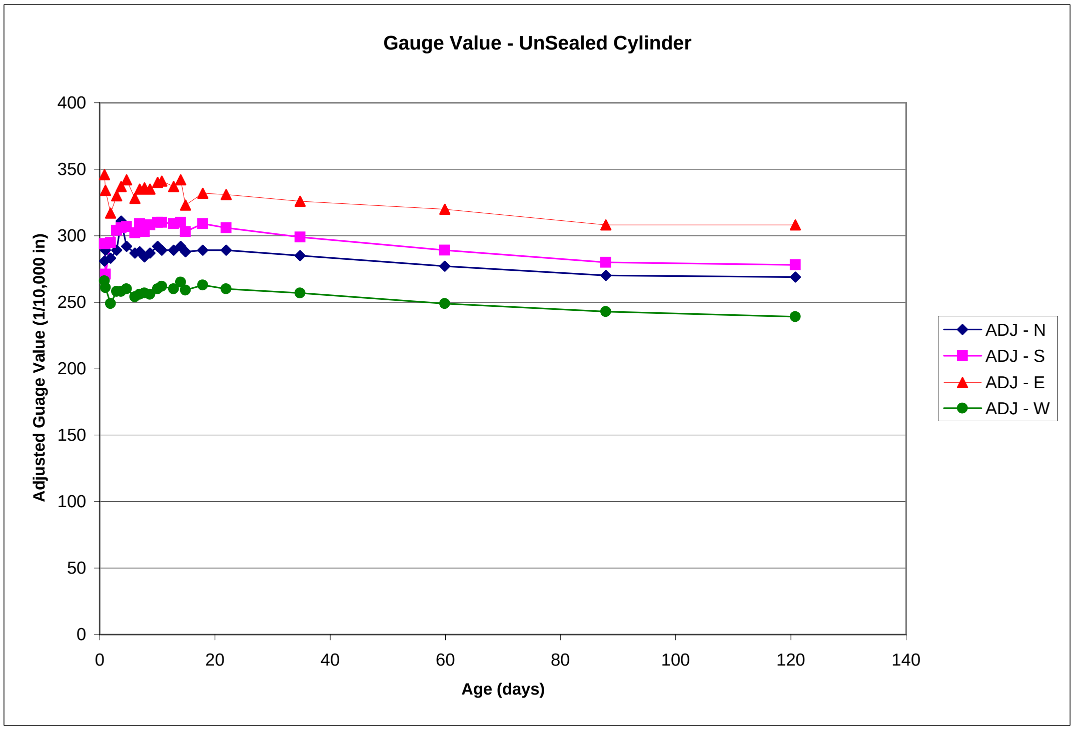
09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05
11:24 AM	10:25 AM	7:00 PM	11:22 AM	12:40 PM	6:38 PM	3:01 PM	2:43 PM	3:26 PM
67	64	66	64	67	70	74	63	67
70	66	67	66	71	71	75	66	69
905	904	902	908	905	902	894	900	910
998	990	999	992	997	1003	995	1000	1011
1017	1012	1016	1014	1017	1010	1019	1030	1035
986	985	990	989	990	995	993	985	1007
7.77	8.73	10.08	10.77	12.82	14.07	14.92	17.90	21.93
-570	-562	-561	-560	-561	-562	-562	-572	-573
70	66	66	68	68	70	72	64	64
335	342	341	348	344	340	332	328	337
428	428	438	432	436	441	433	428	438
447	450	455	454	456	448	457	458	462
416	423	429	429	429	433	431	413	434
-8	-1	-2	5	1	-3	-11	-15	-6
12	12	22	16	20	25	17	12	22
-1	2	7	6	8	0	9	10	14
27	34	40	40	40	44	42	24	45

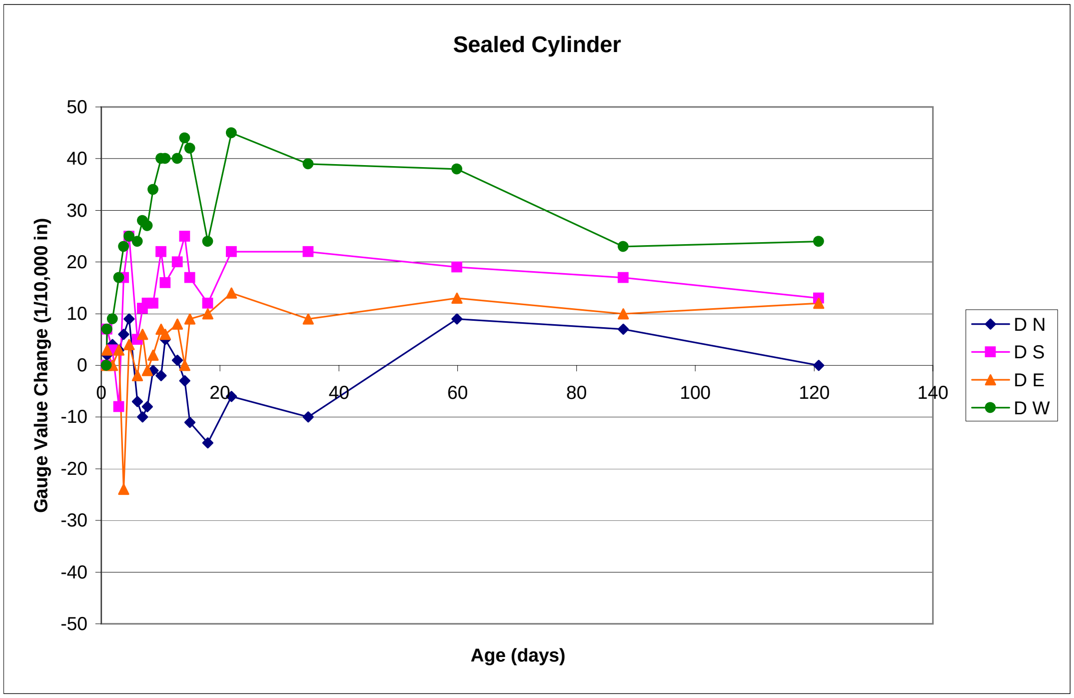
09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05
11:25 AM	10:27 AM	7:03 PM	11:33 AM	12:42 PM	6:39 PM	3:03 PM	2:45 PM	3:26 PM
67	64	66	64	67	70	74	63	67
67	64	68	63	67	72	72	65	67
854	849	853	847	850	854	850	861	862
873	870	871	868	870	872	865	881	879
906	897	901	899	898	904	885	904	904
827	818	821	820	821	827	821	835	833
7.77	8.73	10.09	10.77	12.82	14.07	14.92	17.91	21.93
-570	-562	-561	-558	-561	-562	-562	-572	-573
70	66	66	64	68	70	72	64	64
284	287	292	289	289	292	288	289	289
303	308	310	310	309	310	303	309	306
336	335	340	341	337	342	323	332	331
257	256	260	262	260	265	259	263	260
3	6	11	8	8	11	7	8	8
9	14	16	16	15	16	9	15	12
-10	-11	-6	-5	-9	-4	-23	-14	-15
-9	-10	-6	-4	-6	-1	-7	-3	-6

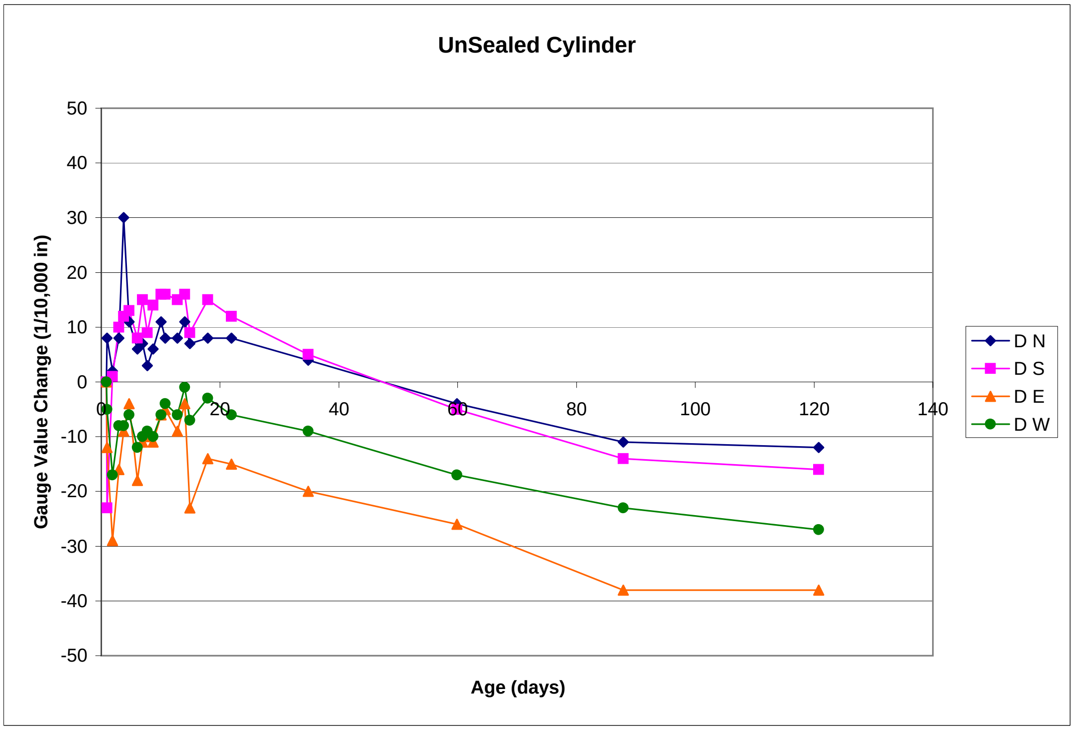
10/17/05	11/11/05	12/09/05	01/11/06	
12:29 PM	2:30 PM	2:12 PM	11:27 AM	
65	54	60	54	
67	55			
907	921	499	411	
1012	1004	582	497	
1031	1030	607	528	
1002	996	561	481	
34.81	59.90	87.88	120.77	#N/A
-574	-569	-149	-68	#N/A
66	57	63	55	#N/A
333	352	350	343	#N/A
438	435	433	429	#N/A
457	461	458	460	#N/A
428	427	412	413	#N/A
-10	9	7	0	#N/A
22	19	17	13	#N/A
9	13	10	12	#N/A
39	38	23	24	#N/A

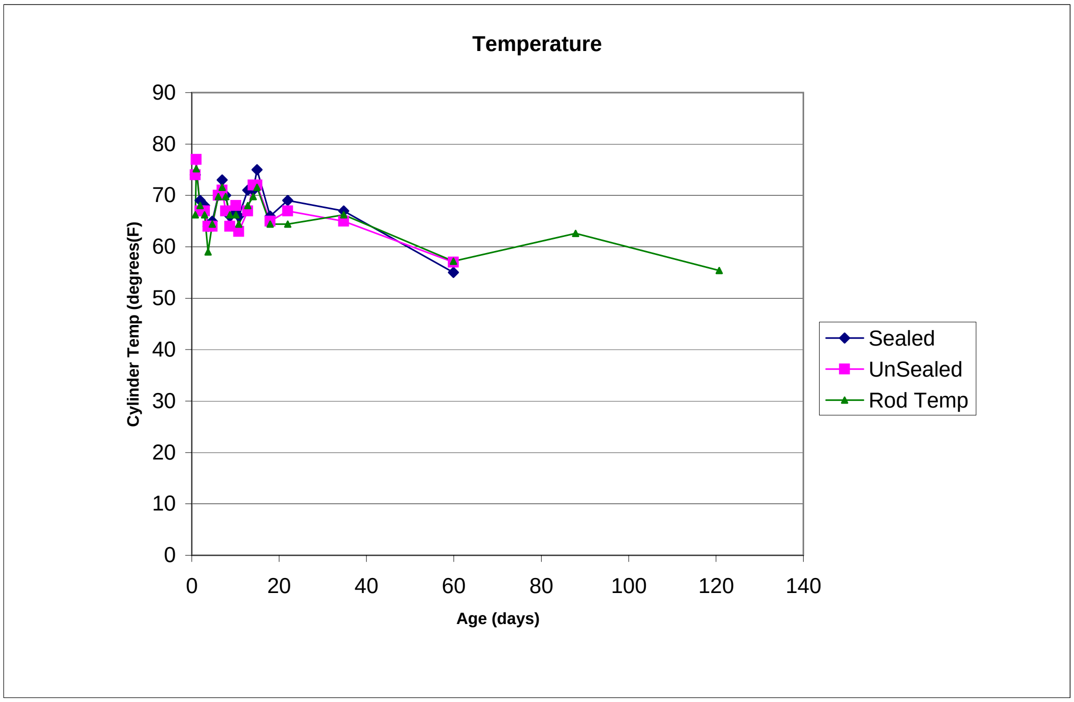
10/17/05	11/11/05	12/09/05	01/11/06	
12:31 PM	2:31 PM	2:14 PM	11:29 AM	
65	54	60	54	
65	57			
859	846	419	337	
873	858	429	346	
900	889	457	376	
831	818	392	307	
34.81	59.90	87.88	120.77	#N/A
-574	-569	-149	-68	#N/A
66	57	63	55	#N/A
285	277	270	269	#N/A
299	289	280	278	#N/A
326	320	308	308	#N/A
257	249	243	239	#N/A
4	-4	-11	-12	#N/A
5	-5	-14	-16	#N/A
-20	-26	-38	-38	#N/A
-9	-17	-23	-27	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
500
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
Age (days)
D N
D S
D E
D W


Temperature
90
80
70
60
50
40
30
20
10
0
Cylinder Temp (degrees(F)
0
20
40
60
80
100
120
140
Age (days)
Sealed
UnSealed
Rod Temp

G1D-MC-Sh

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	Sh
Cylinder Cure:	MC

Prep Work:	Sealed	UnSealed
Ambient Temp (°F)	75	75
Unwrap Time	10:25 AM	10:25 AM
Cyl. Surf. Temp(°F)	78	78
Humidity (%)		

Comments:

Shrinkage:

Sealed

Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05
Time	1:37 PM	4:55 PM	2:08 PM	4:18 PM	10:33 AM	9:31 AM	7:40 PM	3:58 PM
Ambient Temp (°F)	75	76	66	66	66	62	68	70
Cyl. Surf. Temp(°F)	77			68	64	66	70	73
(10,000 in) N	421	600	595	1028	1029	1018	1018	1015
S	397	562	556	985	990	970	969	965
E	bad	584	593	1015	1014	1003	1005	1003
W	485	640	625	1055	1055	1045	1042	1039
Age (days)	~~0.86~~	1.00	1.88	2.97	3.73	4.69	6.11	6.96
Gauge Correction	~~-14~~	-161	-153	-575	-571	-562	-569	-571
Rod Temp (°F)	~~66~~	75	66	66	59	64	70	72
ADJ - N	~~407~~	439	442	453	458	456	449	444
ADJ - S	~~383~~	401	403	410	419	408	400	394
ADJ - E	~~#N/A~~	423	440	440	443	441	436	432
ADJ - W	~~471~~	479	472	480	484	483	473	468
Δ N	~~0~~	0	3	14	19	17	10	5
Δ S	~~0~~	0	2	9	18	7	-1	-7
Δ E	~~#N/A~~	0	17	17	20	18	13	9
Δ W	~~0~~	0	-7	1	5	4	-6	-11

UnSealed

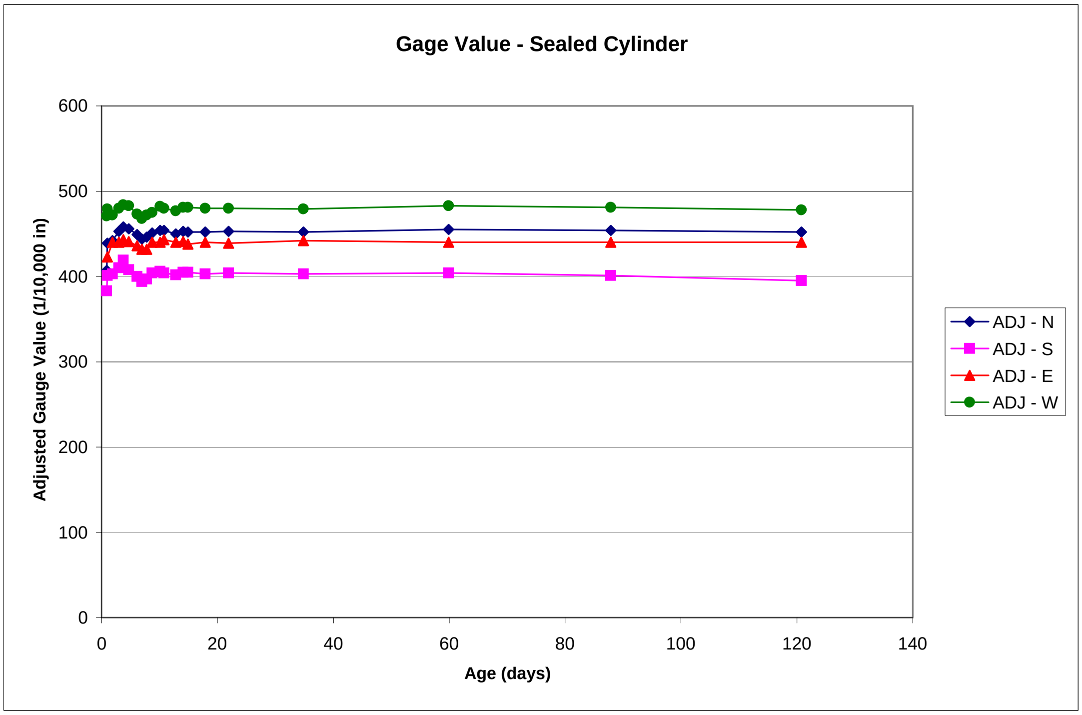
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05
Time	1:37 PM	4:55 PM	2:11 PM	4:19 PM	10:35 AM	9:30 AM	7:41 PM	4:00 PM
Ambient Temp (°F)	75	76	66	66	66	62	68	70
Cyl. Surf. Temp(°F)	77	77		67	64	64	70	71
(10,000 in) N	250	382	360	788	782	761	782	776
S	274	403	390	810	805	797	798	799
E	327	471	458	878	876	866	870	866
W	bad	518	499	922	920	920	913	916
Age (days)	~~0.86~~	1.00	1.88	2.97	3.73	4.69	6.11	6.96
Gauge Correction	~~-14~~	-161	-153	-575	-571	-562	-569	-571
Rod Temp (°F)	~~66~~	75	66	66	59	64	70	72
ADJ - N	~~236~~	221	207	213	211	199	213	205
ADJ - S	~~260~~	242	237	235	234	235	229	228
ADJ - E	~~313~~	310	305	303	305	304	301	295
ADJ - W	~~#N/A~~	357	346	347	349	358	344	345
Δ N	~~0~~	0	-14	-8	-10	-22	-8	-16
Δ S	~~0~~	0	-5	-7	-8	-7	-13	-14
Δ E	~~0~~	0	-5	-7	-5	-6	-9	-15
Δ W	~~#N/A~~	0	-11	-10	-8	1	-13	-12

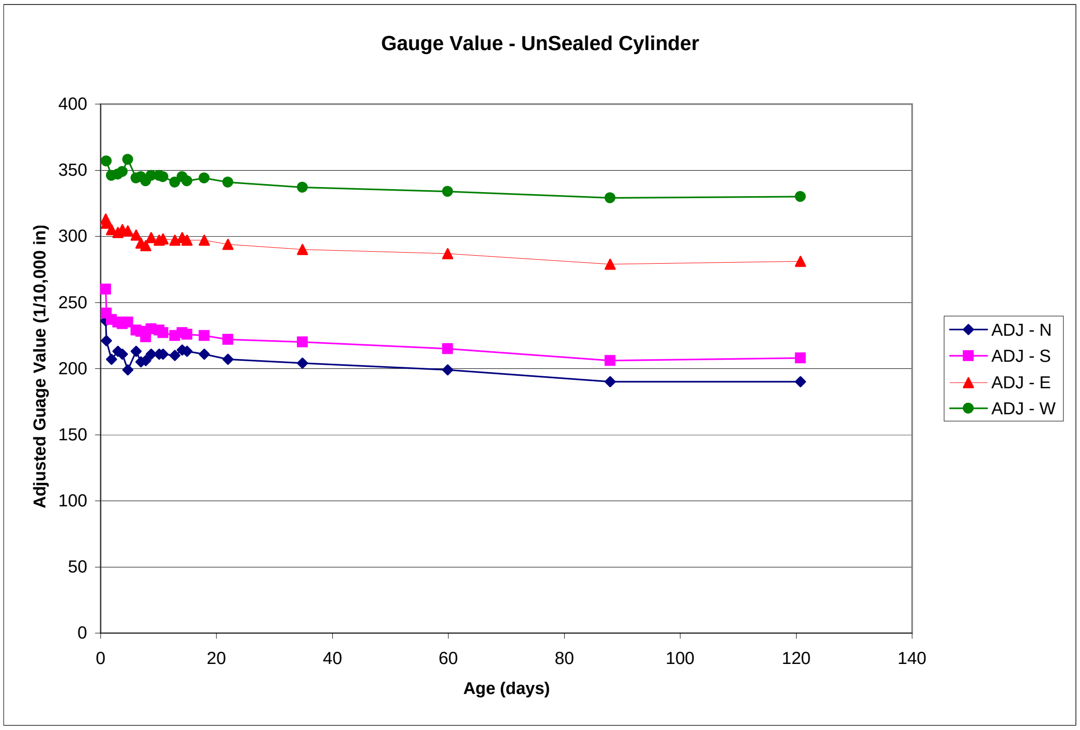
09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05
11:20 AM	10:19 AM	7:06 PM	11:29 AM	12:35 PM	6:47 PM	2:57 PM	2:38 PM	3:35 PM
68	63	66	64	67	70	75	64	66
69	64	68	65	68	72	74	63	70
1016	1011	1015	1012	1011	1015	1014	1024	1027
967	964	967	962	963	967	967	975	978
1002	1000	1001	1001	1001	1003	1000	1012	1013
1042	1035	1043	1038	1038	1043	1043	1052	1054
7.76	8.72	10.09	10.77	12.82	14.07	14.91	17.90	21.94
-570	-560	-561	-558	-561	-562	-562	-572	-574
68	64	66	64	66	72	70	64	66
446	451	454	454	450	453	452	452	453
397	404	406	404	402	405	405	403	404
432	440	440	443	440	441	438	440	439
472	475	482	480	477	481	481	480	480
7	12	15	15	11	14	13	13	14
-4	3	5	3	1	4	4	2	3
9	17	17	20	17	18	15	17	16
-7	-4	3	1	-2	2	2	1	1

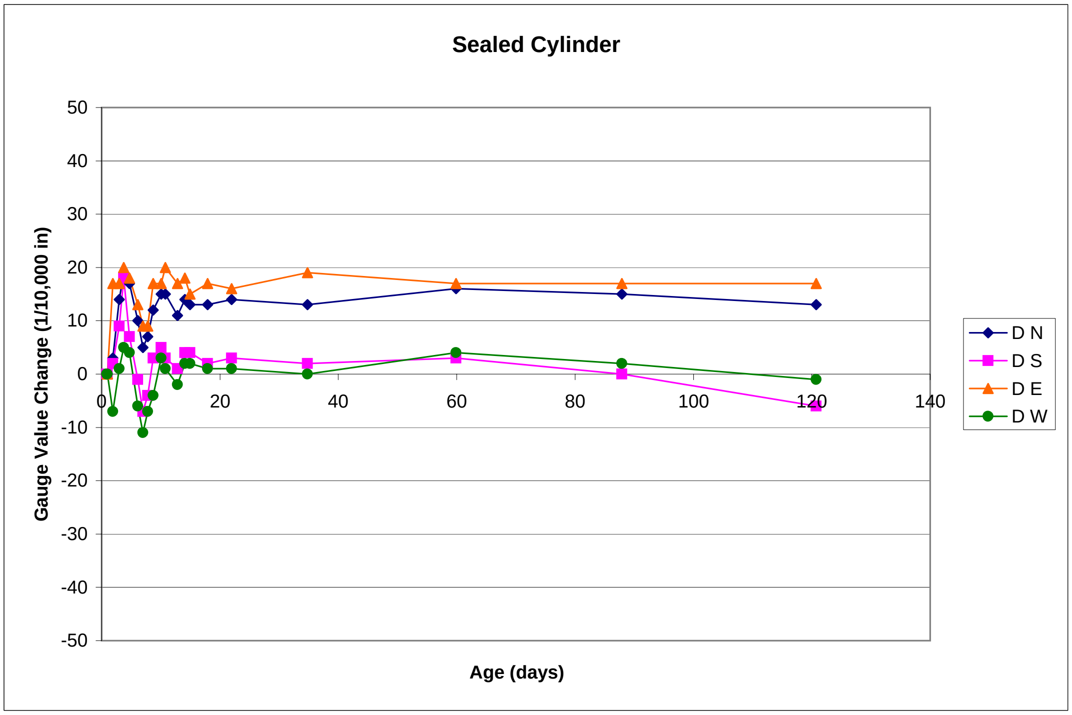
09/20/05	09/21/05	09/22/05	09/23/05	09/25/05	09/26/05	09/27/05	09/30/05	10/04/05
11:22 AM	10:21 AM	7:08 PM	11:31 AM	12:36 PM	6:48 PM	3:00 PM	2:39 PM	3:37 PM
68	63	66	64	67	70	75	63	66
67	63	68	63	66	73	73	65	66
776	771	772	769	771	776	775	783	781
794	790	790	785	786	789	788	797	796
863	859	858	856	858	861	859	869	868
912	906	907	903	902	907	904	916	915
7.77	8.72	10.09	10.77	12.82	14.07	14.92	17.90	21.94
-570	-560	-561	-558	-561	-562	-562	-572	-574
68	64	66	64	66	72	70	64	66
206	211	211	211	210	214	213	211	207
224	230	229	227	225	227	226	225	222
293	299	297	298	297	299	297	297	294
342	346	346	345	341	345	342	344	341
-15	-10	-10	-10	-11	-7	-8	-10	-14
-18	-12	-13	-15	-17	-15	-16	-17	-20
-17	-11	-13	-12	-13	-11	-13	-13	-16
-15	-11	-11	-12	-16	-12	-15	-13	-16

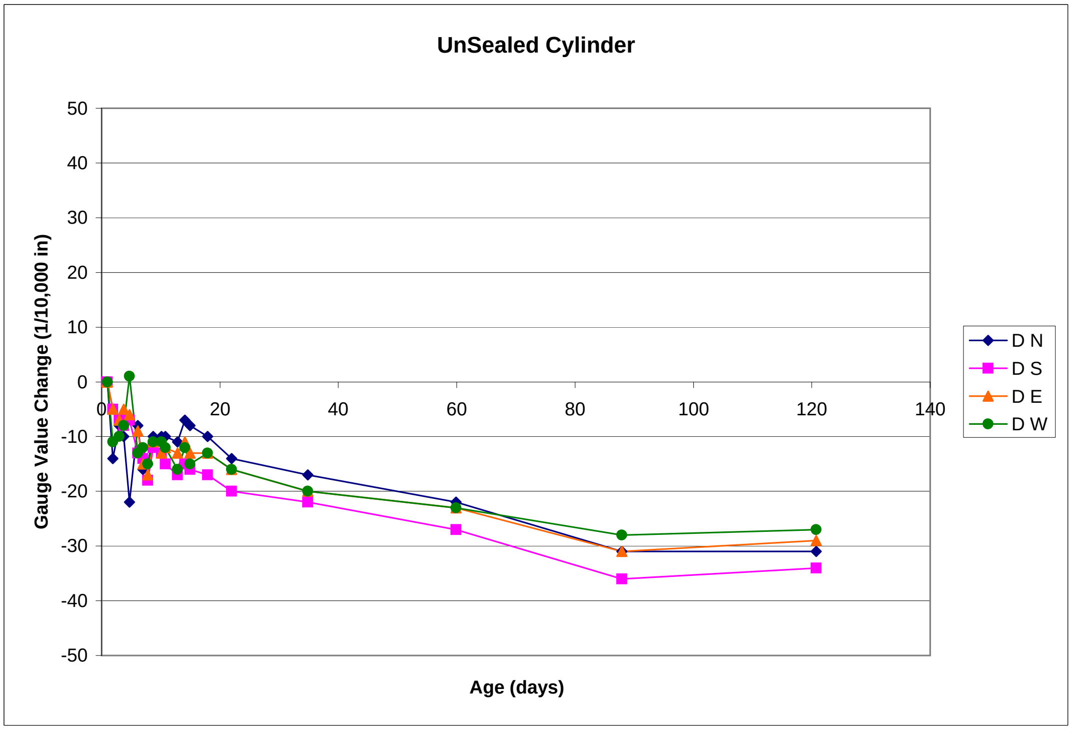
10/17/05	11/11/05	12/09/05	01/11/06	
12:25 PM	2:36 PM	2:19 PM	11:19 AM	
65	54	60	54	
66	56			
1026	1024	603	600	
977	973	550	543	
1016	1009	589	588	
1053	1052	630	626	
34.81	59.90	87.89	120.76	#N/A
-574	-569	-149	-148	#N/A
66	57	63	55	#N/A
452	455	454	452	#N/A
403	404	401	395	#N/A
442	440	440	440	#N/A
479	483	481	478	#N/A
13	16	15	13	#N/A
2	3	0	-6	#N/A
19	17	17	17	#N/A
0	4	2	-1	#N/A

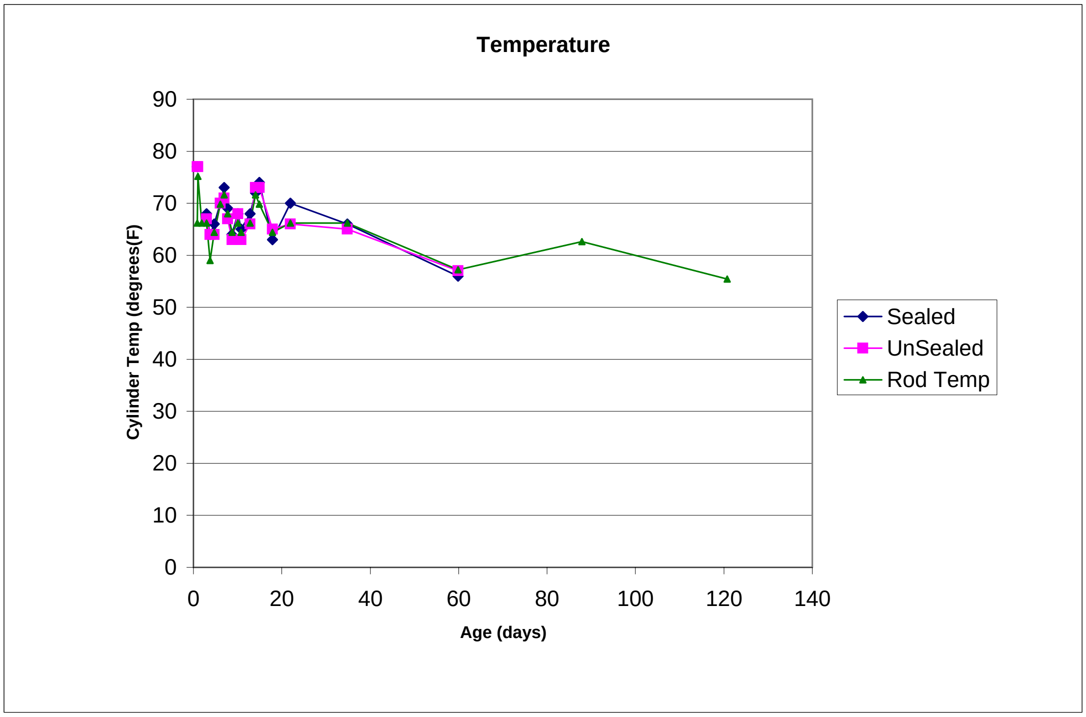
10/17/05	11/11/05	12/09/05	01/11/06	
12:37 PM	2:37 PM	2:21 PM	11:21 AM	
65	54	60	54	
65	57			
780	768	339	338	
796	784	355	356	
866	856	428	429	
913	903	478	478	
34.82	59.90	87.89	120.76	#N/A
-576	-569	-149	-148	#N/A
66	57	63	55	#N/A
204	199	190	190	#N/A
220	215	206	208	#N/A
290	287	279	281	#N/A
337	334	329	330	#N/A
-17	-22	-31	-31	#N/A
-22	-27	-36	-34	#N/A
-20	-23	-31	-29	#N/A
-20	-23	-28	-27	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
Age (days)
D N
D S
D E
D W


Temperature
Cylinder Temp (degrees(F)
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
Age (days)
Sealed
UnSealed
Rod Temp

G1D-AC-3Day

Comments:

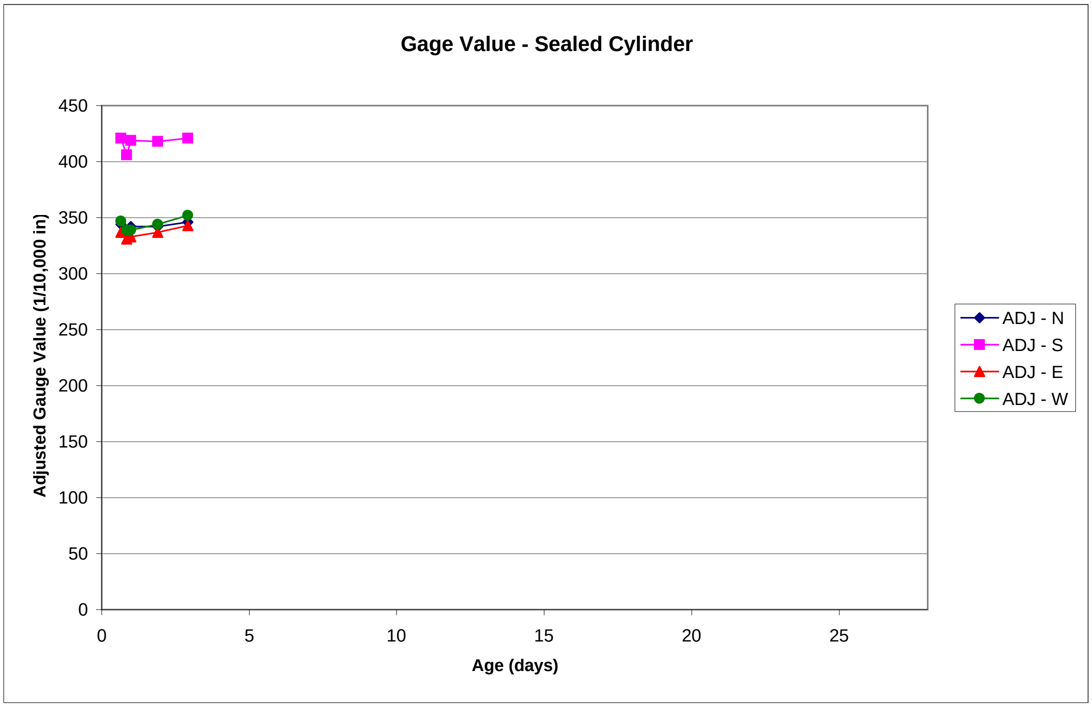
Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	3Day
Cylinder Cure:	AC

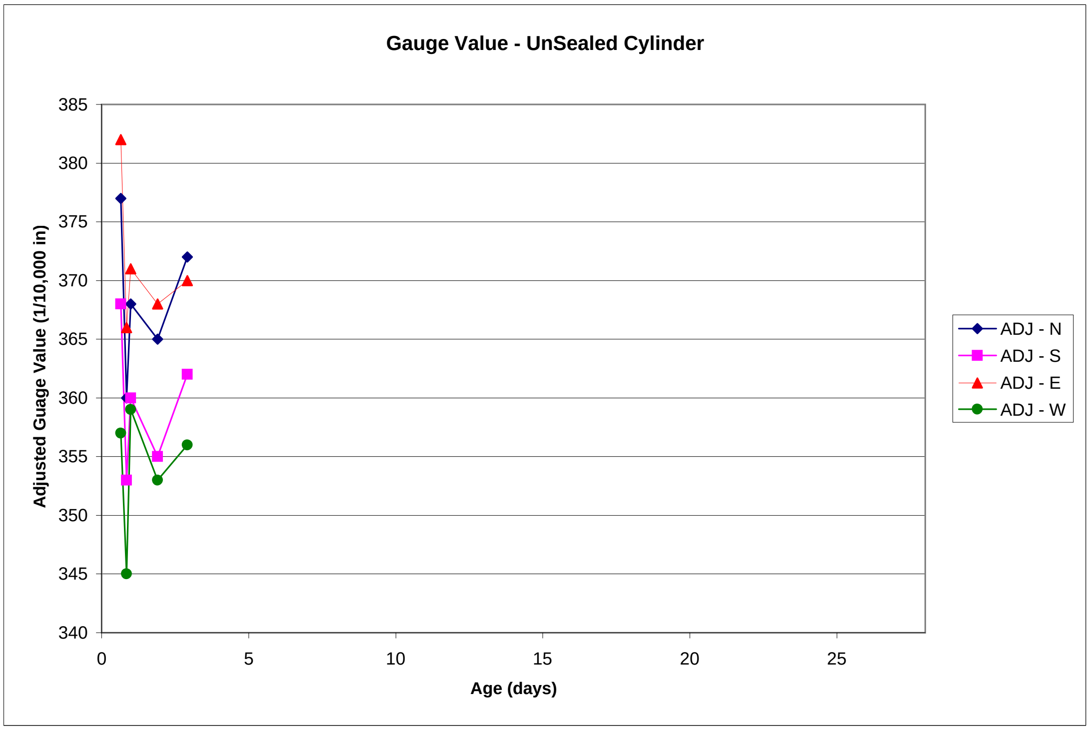
Prep Work:	Sealed	UnSealed
Ambient Temp (°F)		
Unwrap Time	6:40 AM	
Cyl. Surf. Temp(°F)		
Humidity (%)		

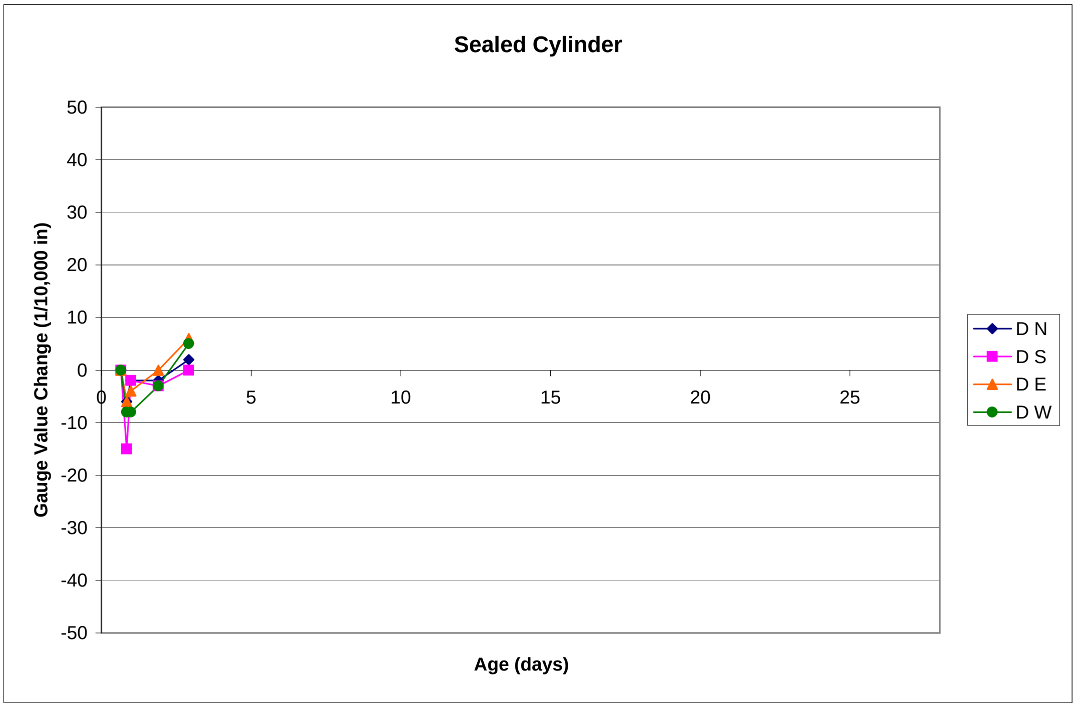
Shrinkage:

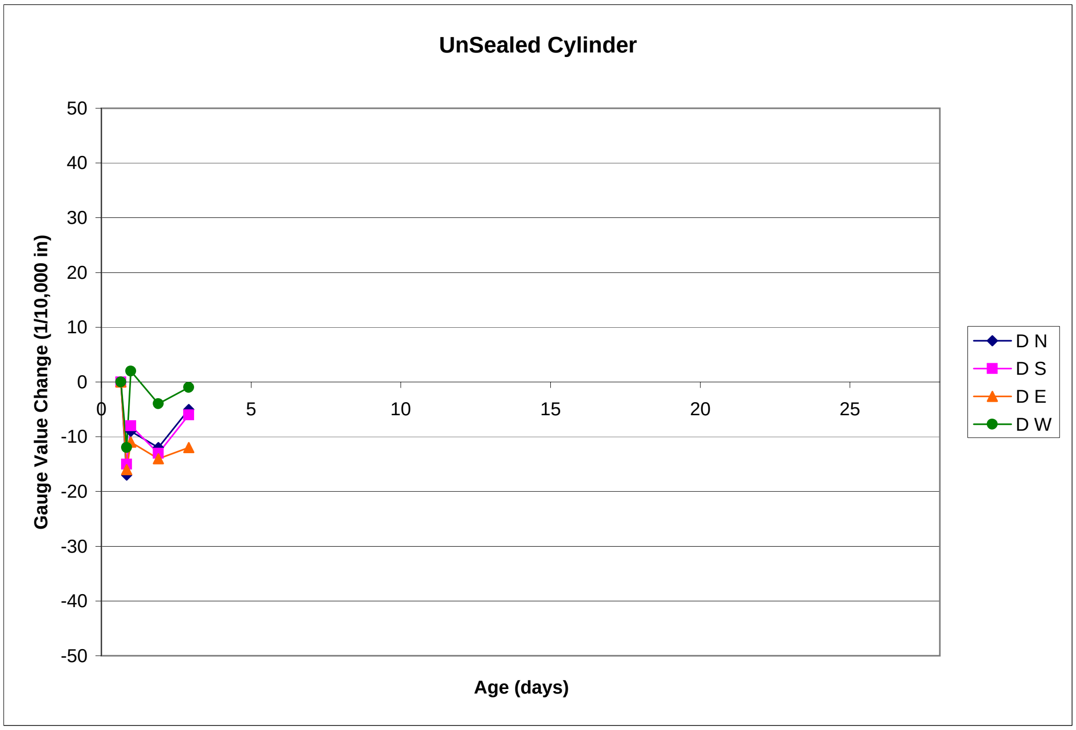
Sealed									
Date	09/13/05	09/13/05	09/13/05	09/14/05	09/15/05				
Time	8:41 AM	1:15 PM	4:40 PM	2:42 PM	2:58 PM				
Ambient Temp (°F)	60	73	71	66	66				
Cyl. Surf. Temp(°F)	63	75			67				
(10,000 in) N	358	352	503	497	652				
S	435	420	580	573	727				
E	351	345	494	492	649				
W	361	353	500	499	658				
Age (days)	0.65	0.84	0.99	1.90	2.92	#N/A	#N/A	#N/A	#N/A
Gauge Correction	-14	-14	-161	-155	-306	#N/A	#N/A	#N/A	#N/A
Rod Temp (°F)	64	66	75	68	66	#N/A	#N/A	#N/A	#N/A
ADJ - N	344	338	342	342	346	#N/A	#N/A	#N/A	#N/A
ADJ - S	421	406	419	418	421	#N/A	#N/A	#N/A	#N/A
ADJ - E	337	331	333	337	343	#N/A	#N/A	#N/A	#N/A
ADJ - W	347	339	339	344	352	#N/A	#N/A	#N/A	#N/A
∆ N	0	-6	-2	-2	2	#N/A	#N/A	#N/A	#N/A
∆ S	0	-15	-2	-3	0	#N/A	#N/A	#N/A	#N/A
∆ E	0	-6	-4	0	6	#N/A	#N/A	#N/A	#N/A
∆ W	0	-8	-8	-3	5	#N/A	#N/A	#N/A	#N/A

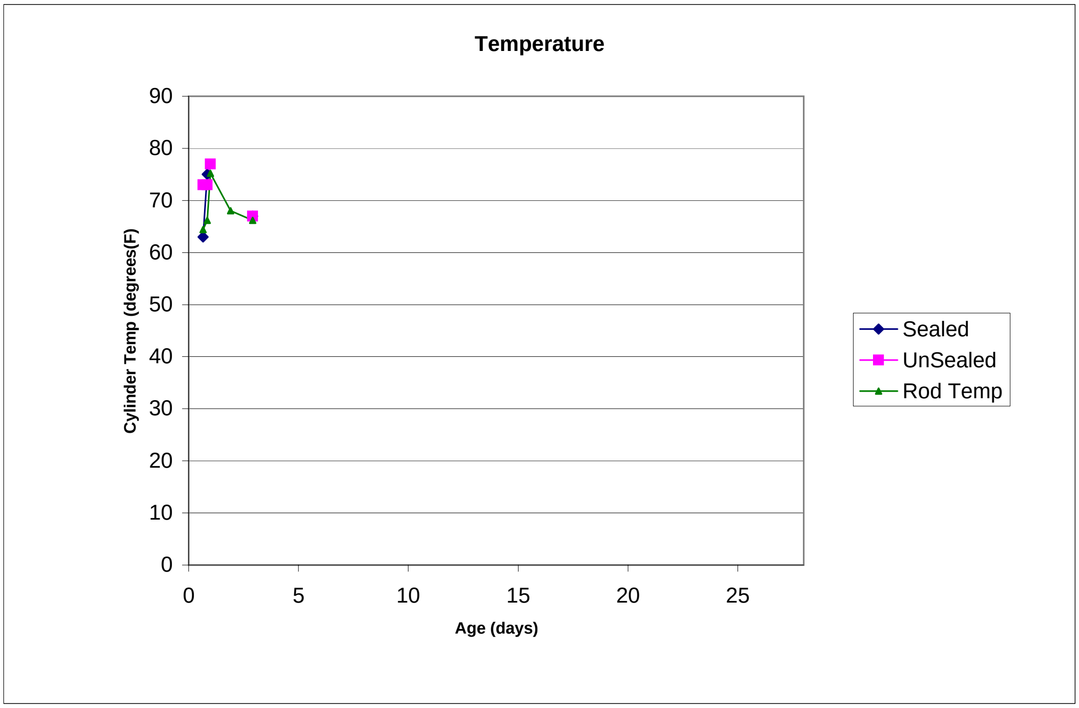
UnSealed									
Date	09/13/05	09/13/05	09/13/05	09/14/05	09/15/05				
Time	8:41 AM	1:16 PM	4:41 PM	2:44 PM	2:59 PM				
Ambient Temp (°F)	60	73	71	66	66				
Cyl. Surf. Temp(°F)	73	73	77		67				
(10,000 in) N	391	374	529	520	678				
S	382	367	521	510	668				
E	396	380	532	523	676				
W	371	359	520	508	662				
Age (days)	0.65	0.84	0.99	1.91	2.92	#N/A	#N/A	#N/A	#N/A
Gauge Correction	-14	-14	-161	-155	-306	#N/A	#N/A	#N/A	#N/A
Rod Temp (°F)	64	66	75	68	66	#N/A	#N/A	#N/A	#N/A
ADJ - N	377	360	368	365	372	#N/A	#N/A	#N/A	#N/A
ADJ - S	368	353	360	355	362	#N/A	#N/A	#N/A	#N/A
ADJ - E	382	366	371	368	370	#N/A	#N/A	#N/A	#N/A
ADJ - W	357	345	359	353	356	#N/A	#N/A	#N/A	#N/A
∆ N	0	-17	-9	-12	-5	#N/A	#N/A	#N/A	#N/A
∆ S	0	-15	-8	-13	-6	#N/A	#N/A	#N/A	#N/A
∆ E	0	-16	-11	-14	-12	#N/A	#N/A	#N/A	#N/A
∆ W	0	-12	2	-4	-1	#N/A	#N/A	#N/A	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
385
380
375
370
365
360
355
350
345
340
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


Temperature
Cylinder Temp (degrees(F)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Age (days)
Sealed
UnSealed
Rod Temp

G1D-MC-3Day

Comments:

Girder Name:	G1D	
Cast Date:	09/12/05	
Cast Time:	5:00 PM	
Release date:	09/13/05	
Cylinder Loading:	3Day	
Cylinder Cure:	MC	
Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	70	70
Unwrap Time	9:34 AM	9:34 AM
Cyl. Surf. Temp(°F)	77	77
Humidity (%)		

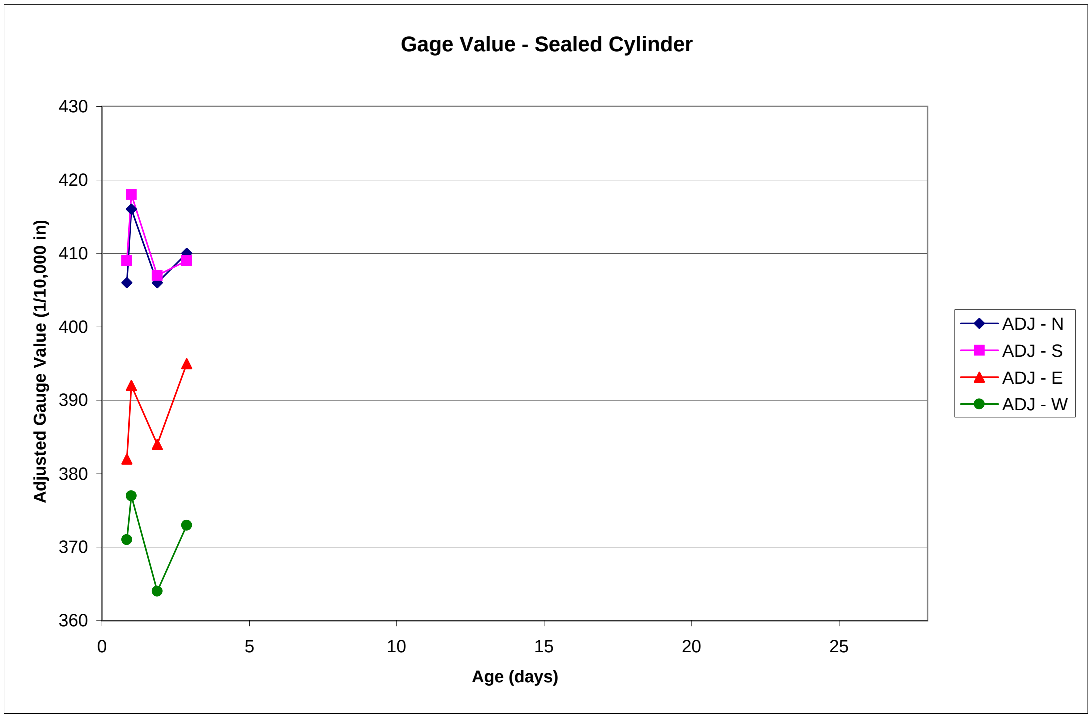
Shrinkage:

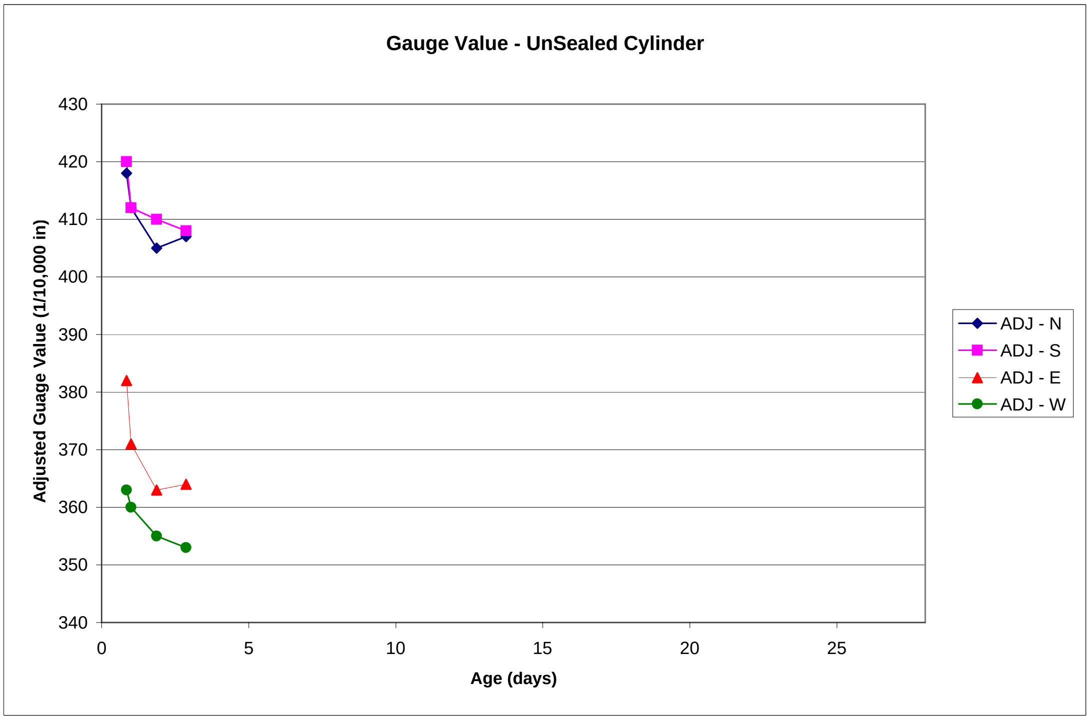
Sealed

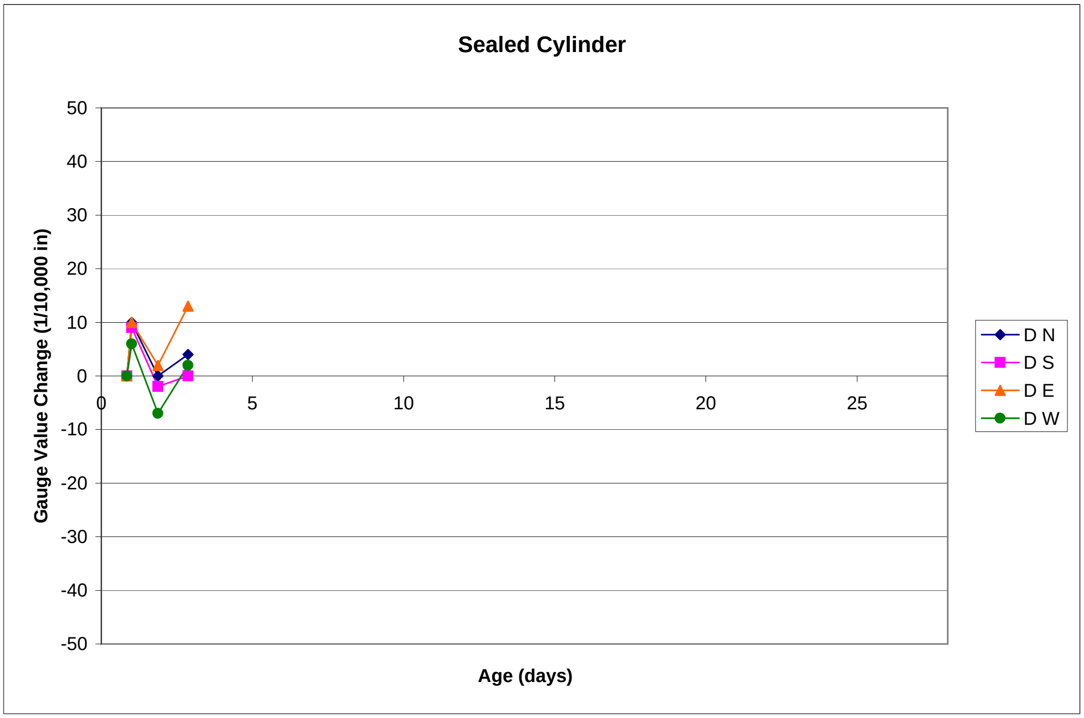
Date	09/13/05	09/13/05	09/14/05	09/15/05					
Time	1:25 PM	5:05 PM	1:58 PM	1:55 PM					
Ambient Temp (°F)	73		66	66					
Cyl. Surf. Temp(°F)	78		70	66					
(10,000 in) N	420	577	561	560					
S	423	579	562	559					
E	396	553	539	545					
W	385	538	519	523					
Age (days)	0.85	1.00	1.87	2.87	#N/A	#N/A	#N/A	#N/A	#N/A
Gauge Correction	-14	-161	-155	-150	#N/A	#N/A	#N/A	#N/A	#N/A
Rod Temp (°F)	66	75	66	68	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - N	406	416	406	410	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - S	409	418	407	409	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - E	382	392	384	395	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - W	371	377	364	373	#N/A	#N/A	#N/A	#N/A	#N/A
∆ N	0	10	0	4	#N/A	#N/A	#N/A	#N/A	#N/A
∆ S	0	9	-2	0	#N/A	#N/A	#N/A	#N/A	#N/A
∆ E	0	10	2	13	#N/A	#N/A	#N/A	#N/A	#N/A
∆ W	0	6	-7	2	#N/A	#N/A	#N/A	#N/A	#N/A

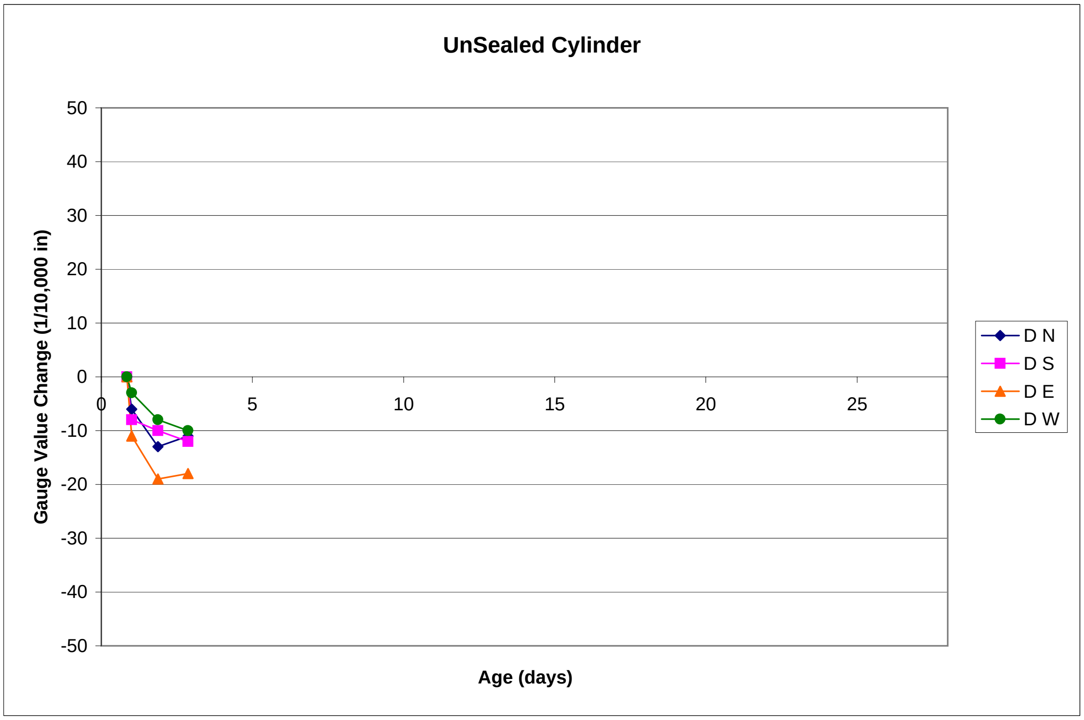
UnSealed

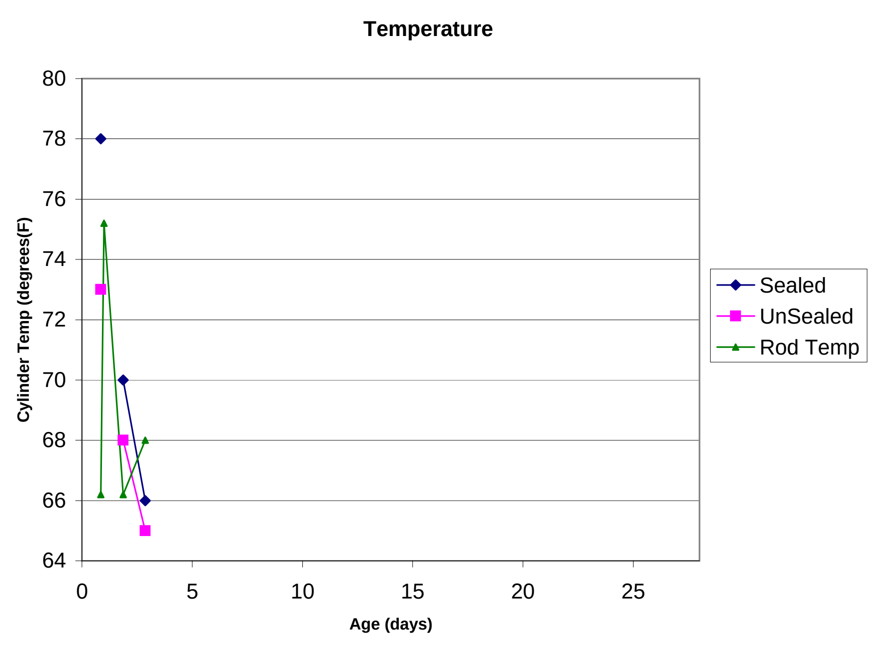
Date	09/13/05	09/13/05	09/14/05	09/15/05					
Time	1:25 PM	5:05 PM	1:58 PM	1:57 PM					
Ambient Temp (°F)	73		66	66					
Cyl. Surf. Temp(°F)	73		68	65					
(10,000 in) N	432	573	560	557					
S	434	573	565	558					
E	396	532	518	514					
W	377	521	510	503					
Age (days)	0.85	1.00	1.87	2.87	#N/A	#N/A	#N/A	#N/A	#N/A
Gauge Correction	-14	-161	-155	-150	#N/A	#N/A	#N/A	#N/A	#N/A
Rod Temp (°F)	66	75	66	68	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - N	418	412	405	407	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - S	420	412	410	408	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - E	382	371	363	364	#N/A	#N/A	#N/A	#N/A	#N/A
ADJ - W	363	360	355	353	#N/A	#N/A	#N/A	#N/A	#N/A
∆ N	0	-6	-13	-11	#N/A	#N/A	#N/A	#N/A	#N/A
∆ S	0	-8	-10	-12	#N/A	#N/A	#N/A	#N/A	#N/A
∆ E	0	-11	-19	-18	#N/A	#N/A	#N/A	#N/A	#N/A
∆ W	0	-3	-8	-10	#N/A	#N/A	#N/A	#N/A	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
430
420
410
400
390
380
370
360
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
430
420
410
400
390
380
370
360
350
340
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


Temperature
Cylinder Temp (degrees(F)
80
78
76
74
72
70
68
66
64
0
5
10
15
20
25
Age (days)
Sealed
UnSealed
Rod Temp

G1D-AC-7Day

Girder Name:	G1D
Cast Date:	09/12/05
Cast Time:	5:00 PM
Release date:	09/13/05
Cylinder Loading:	7Day
Cylinder Cure:	AC

Prep Work:	Sealed	UnSealed
Ambient Temp (°F)		
Unwrap Time		
Cyl. Surf. Temp(°F)		
Humidity (%)		

Comments:

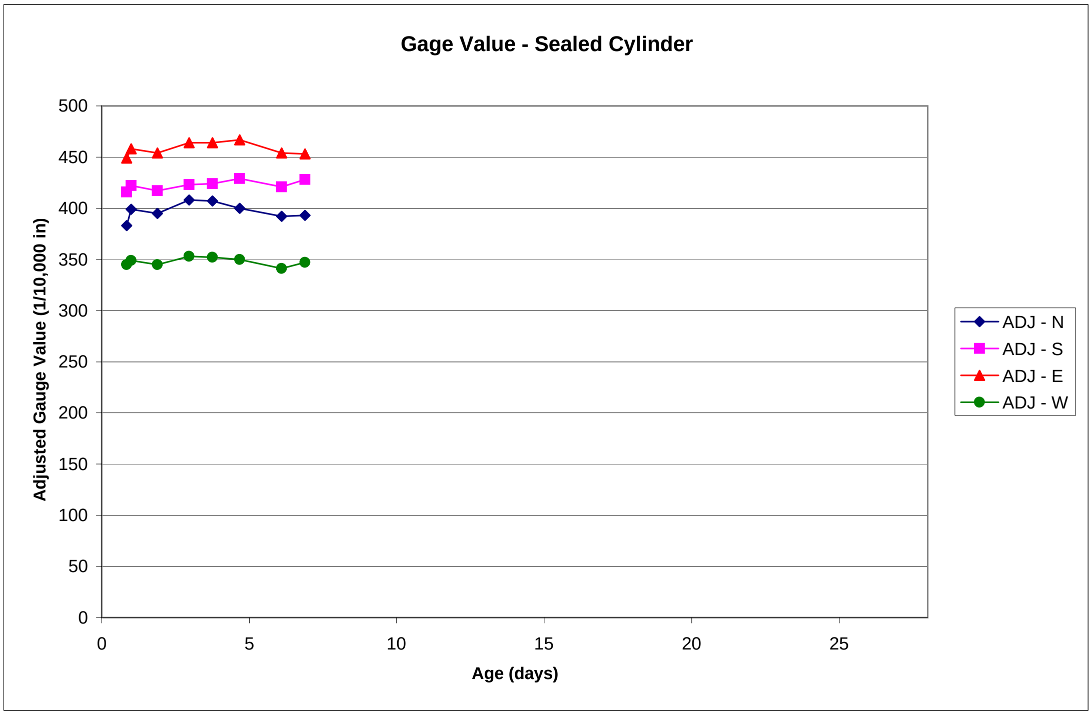
Shrinkage:

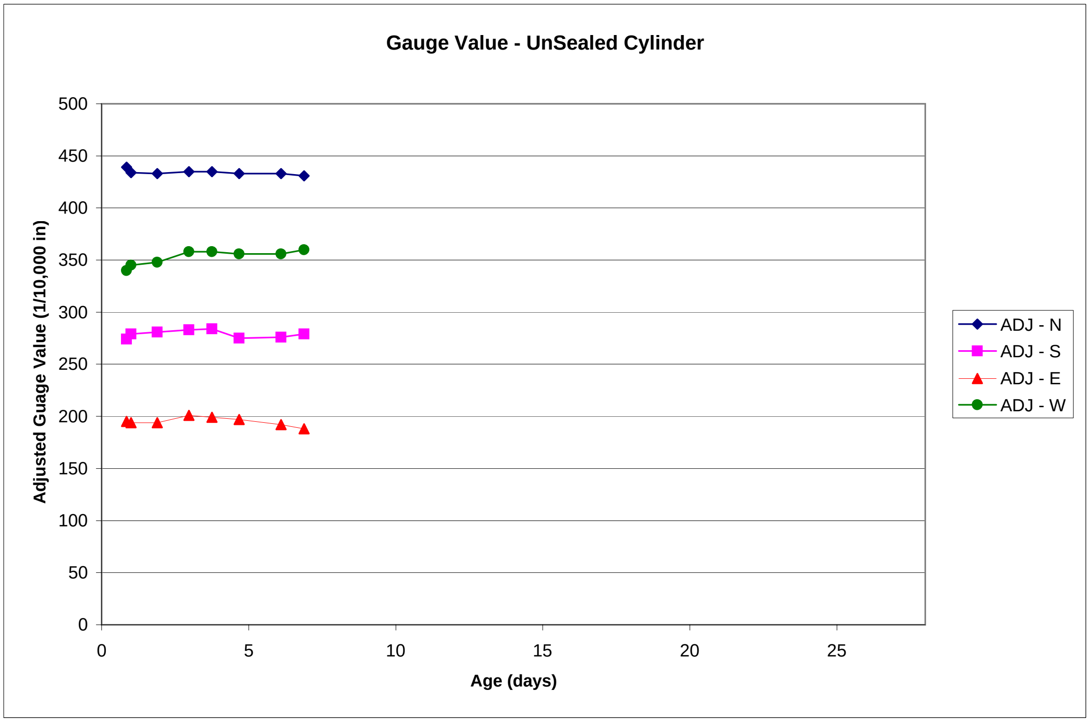
Sealed

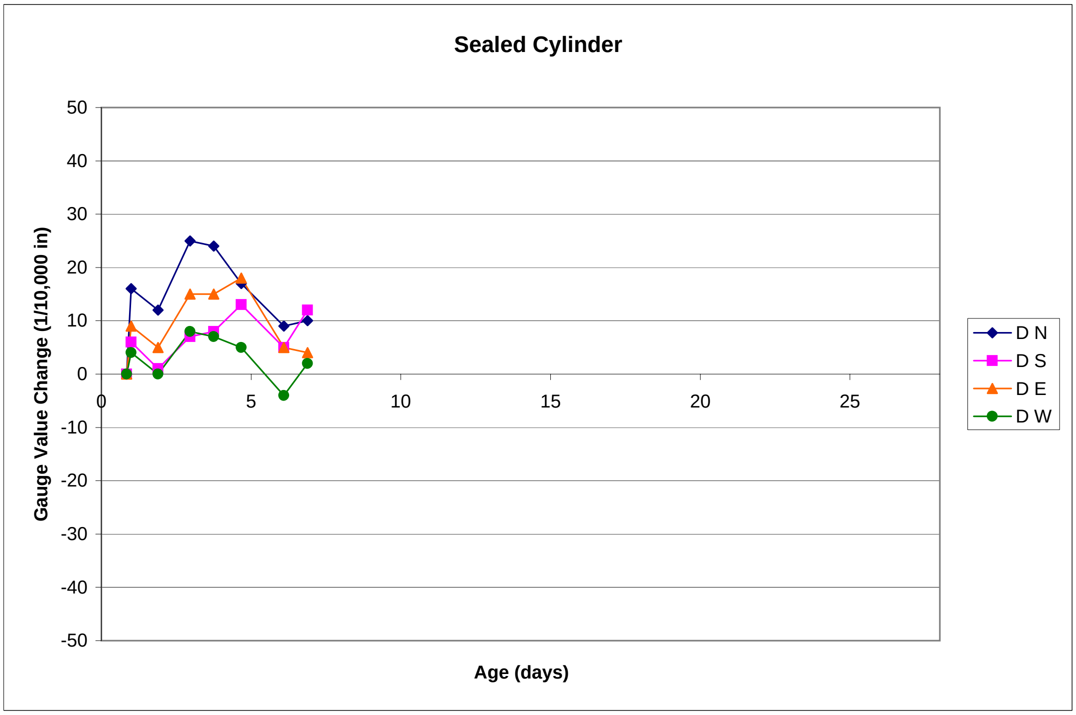
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	
Time	1:20 PM	4:50 PM	2:25 PM	4:09 PM	11:02 AM	9:14 AM	7:20 PM	2:16 PM	
Ambient Temp (°F)	74	72	66	66	62	63	68	68	
Cyl. Surf. Temp(°F)	76		66	69	64	64	70	71	
(10,000 in) N	397	560	549	983	978	963	962	961	
S	430	583	571	998	995	992	991	996	
E	463	619	608	1039	1035	1030	1024	1021	
W	359	510	499	928	923	913	911	915	
Age (days)	0.85	0.99	1.89	2.96	3.75	4.68	6.10	6.89	#N/A
Gauge Correction	-14	-161	-154	-575	-571	-563	-570	-568	#N/A
Rod Temp (°F)	66	75	68	66	59	64	70	68	#N/A
ADJ - N	383	399	395	408	407	400	392	393	#N/A
ADJ - S	416	422	417	423	424	429	421	428	#N/A
ADJ - E	449	458	454	464	464	467	454	453	#N/A
ADJ - W	345	349	345	353	352	350	341	347	#N/A
∆ N	0	16	12	25	24	17	9	10	#N/A
∆ S	0	6	1	7	8	13	5	12	#N/A
∆ E	0	9	5	15	15	18	5	4	#N/A
∆ W	0	4	0	8	7	5	-4	2	#N/A

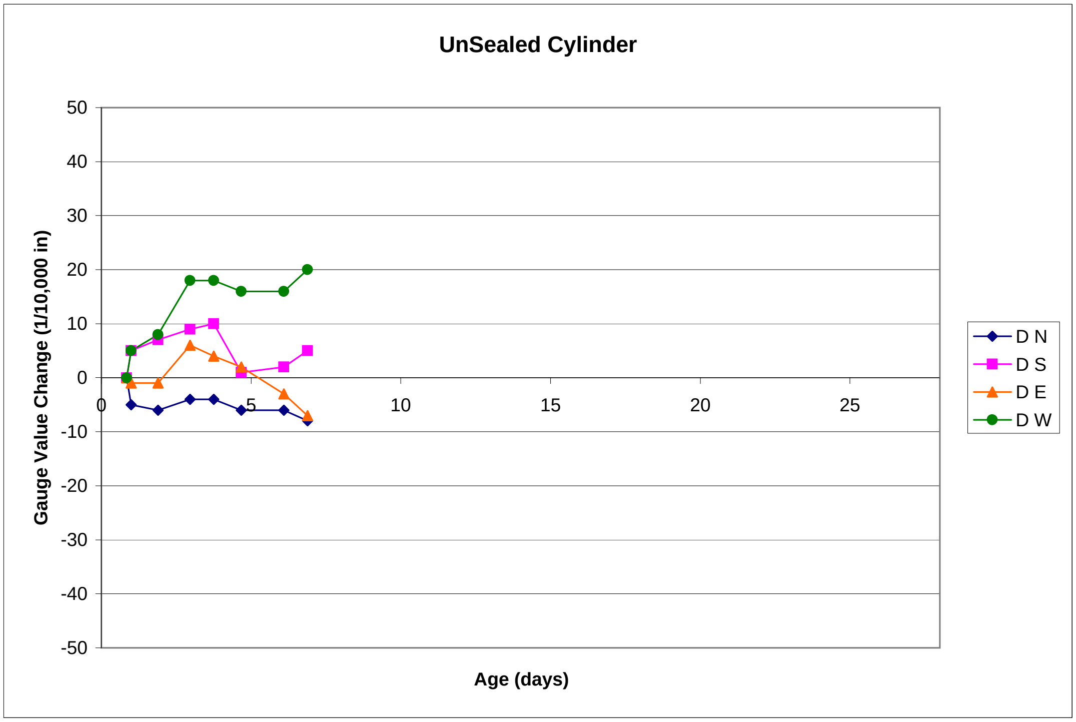
UnSealed

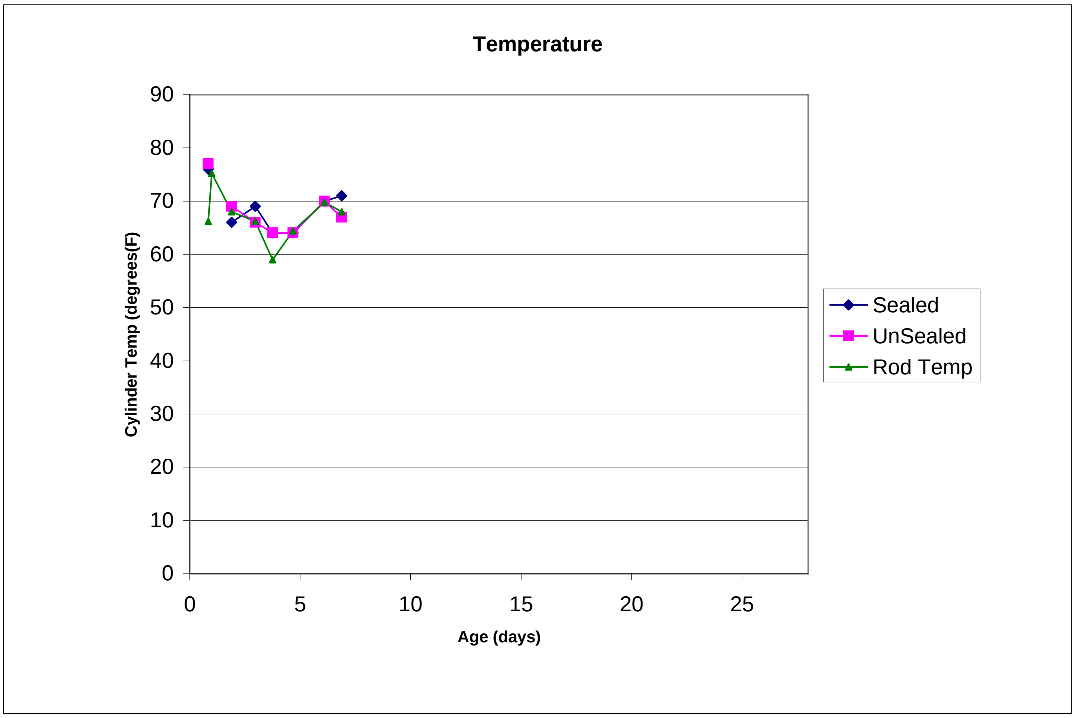
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	
Time	1:20 PM	4:55 PM	2:27 PM	4:11 PM	11:04 AM	9:14 AM	7:22 PM	2:18 PM	
Ambient Temp (°F)	74	72	66	66	62	63	68	68	
Cyl. Surf. Temp(°F)	77		69	66	64	64	70	67	
(10,000 in) N	453	595	587	1010	1006	996	1003	999	
S	288	440	435	858	855	838	846	847	
E	209	355	348	776	770	760	762	756	
W	354	506	502	933	929	919	926	928	
Age (days)	0.85	1.00	1.89	2.97	3.75	4.68	6.10	6.89	#N/A
Gauge Correction	-14	-161	-154	-575	-571	-563	-570	-568	#N/A
Rod Temp (°F)	66	75	68	66	59	64	70	68	#N/A
ADJ - N	439	434	433	435	435	433	433	431	#N/A
ADJ - S	274	279	281	283	284	275	276	279	#N/A
ADJ - E	195	194	194	201	199	197	192	188	#N/A
ADJ - W	340	345	348	358	358	356	356	360	#N/A
∆ N	0	-5	-6	-4	-4	-6	-6	-8	#N/A
∆ S	0	5	7	9	10	1	2	5	#N/A
∆ E	0	-1	-1	6	4	2	-3	-7	#N/A
∆ W	0	5	8	18	18	16	16	20	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


Temperature
Cylinder Temp (degrees(F)
Age (days)
0
10
20
30
40
50
60
70
80
90
0
5
10
15
20
25
Sealed
UnSealed
Rod Temp

G1D-MC-7Day

Girder Name:	G1D	
Cast Date:	09/12/05	
Cast Time:	5:00 PM	
Release date:	09/13/05	
Cylinder Loading:	7Day	
Cylinder Cure:	MC	
Prep Work:	**Sealed**	**UnSealed**
Ambient Temp (°F)	76	76
Unwrap Time	11:20 AM	11:20 AM
Cyl. Surf. Temp(°F)	76	76
Humidity (%)		

Comments:

The average shrinkage for G1D-MC-3Day was 7 for the first time interval , which is approximately tha same as this one. Therfore, this MC Unsealed stack shoould be adjusted by 35 to to average 7. This is reflected in the Summary 2.

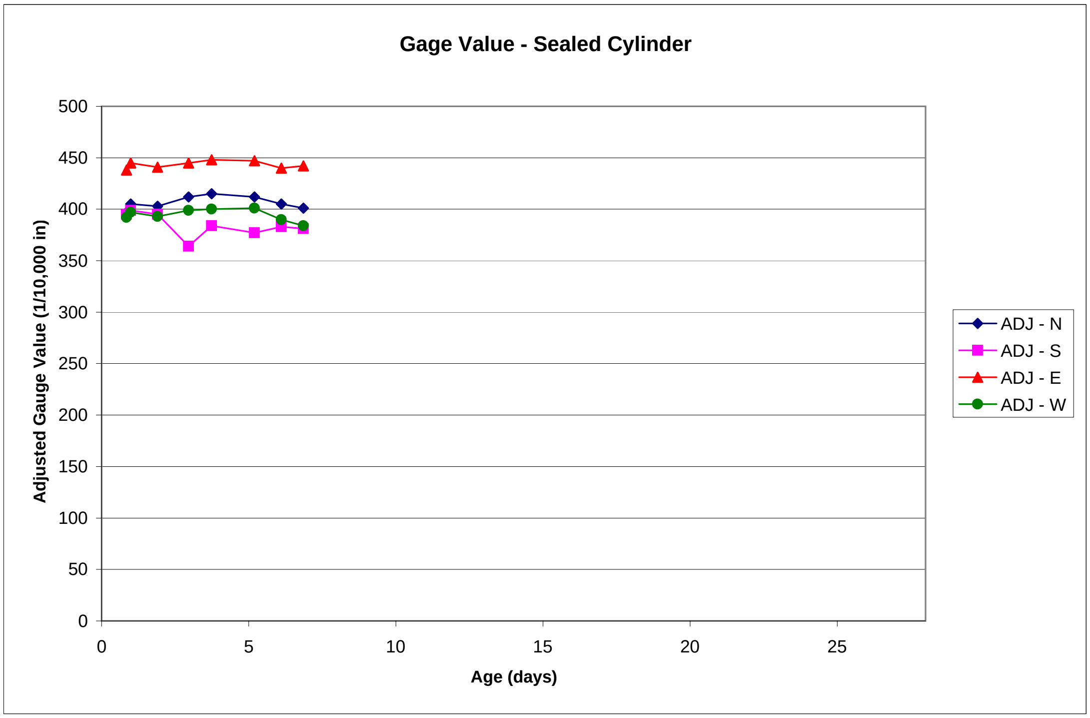
Shrinkage:

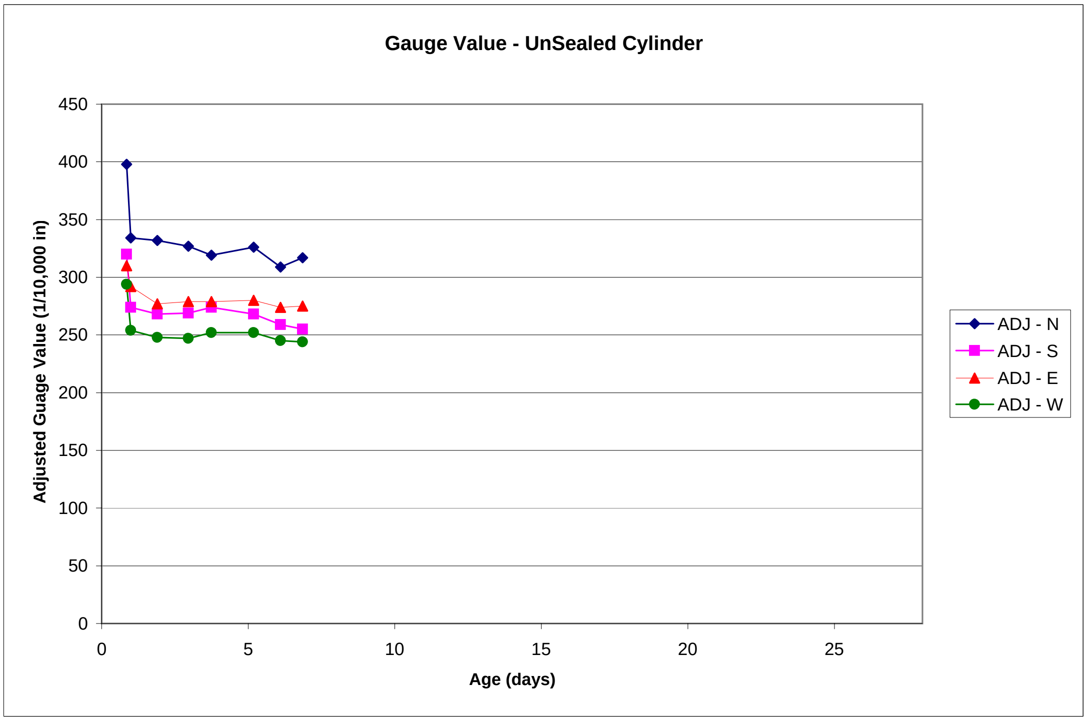
Sealed

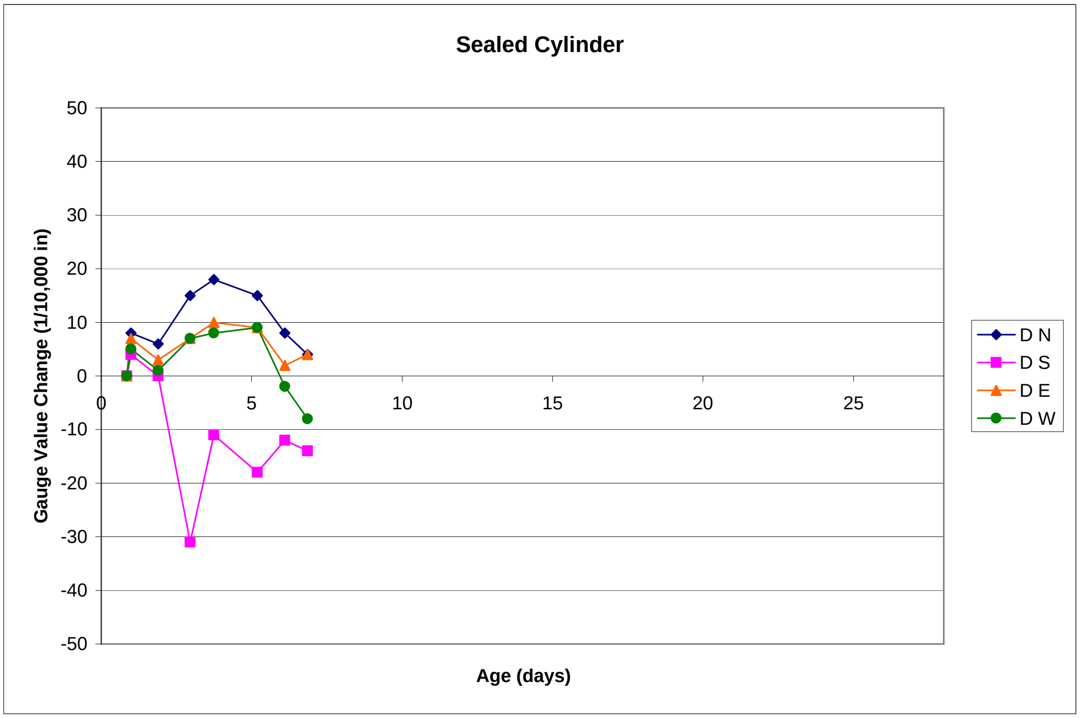
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	
Time	1:20 PM	4:45 PM	2:32 PM	4:02 PM	10:49 AM	9:34 PM	7:30 PM	1:32 PM	
Ambient Temp (°F)	74	71	67	66	62		68	66	
Cyl. Surf. Temp(°F)			69	69	64	65	70	68	
(10,000 in) N	411	566	558	988	986	974	974	969	
S	409	560	550	940	955	939	952	949	
E	452	606	596	1021	1019	1009	1009	1010	
W	406	558	548	975	971	963	959	952	
Age (days)	0.85	0.99	1.90	2.96	3.74	5.19	6.10	6.86	#N/A
Gauge Correction	-14	-161	-155	-576	-571	-562	-569	-568	#N/A
Rod Temp (°F)	66	75	68	66	59	63	70	66	#N/A
ADJ - N	397	405	403	412	415	412	405	401	#N/A
ADJ - S	395	399	395	364	384	377	383	381	#N/A
ADJ - E	438	445	441	445	448	447	440	442	#N/A
ADJ - W	392	397	393	399	400	401	390	384	#N/A
∆ N	0	8	6	15	18	15	8	4	#N/A
∆ S	0	4	0	-31	-11	-18	-12	-14	#N/A
∆ E	0	7	3	7	10	9	2	4	#N/A
∆ W	0	5	1	7	8	9	-2	-8	#N/A

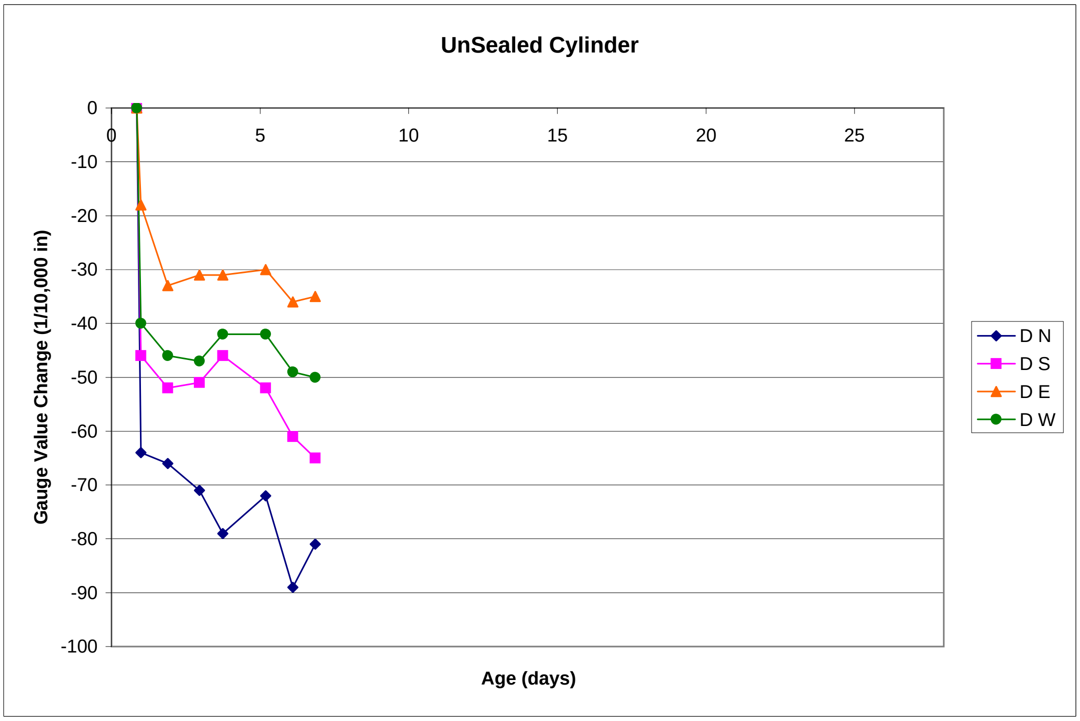
UnSealed

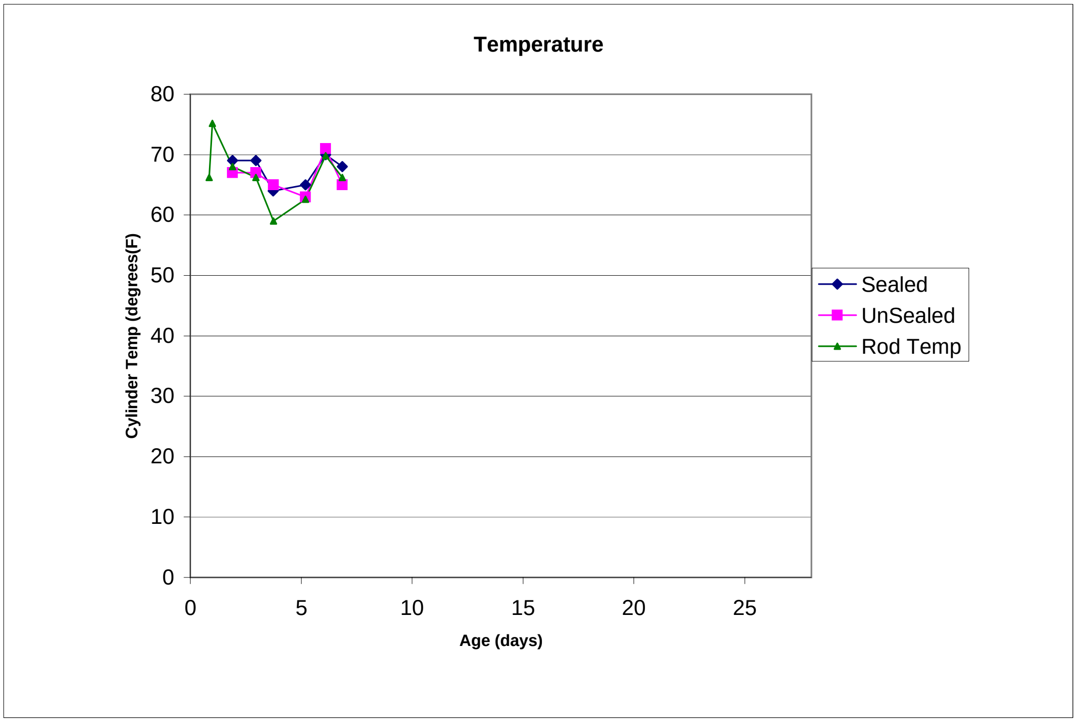
Date	09/13/05	09/13/05	09/14/05	09/15/05	09/16/05	09/17/05	09/18/05	09/19/05	
Time	1:30 PM	4:45 PM	2:33 PM	4:04 PM	10:56 AM	9:34 PM	7:32 PM	1:35 PM	
Ambient Temp (°F)	74	71	67	66	62		68	66	
Cyl. Surf. Temp(°F)			67	67	65	63	71	65	
(10,000 in) N	412	495	487	903	890	888	878	884	
S	334	435	423	845	845	830	828	822	
E	324	453	432	855	850	842	843	842	
W	308	415	403	823	823	814	814	811	
Age (days)	0.85	0.99	1.90	2.96	3.75	5.19	6.11	6.86	#N/A
Gauge Correction	-14	-161	-155	-576	-571	-562	-569	-567	#N/A
Rod Temp (°F)	66	75	68	66	59	63	70	66	#N/A
ADJ - N	398	334	332	327	319	326	309	317	#N/A
ADJ - S	320	274	268	269	274	268	259	255	#N/A
ADJ - E	310	292	277	279	279	280	274	275	#N/A
ADJ - W	294	254	248	247	252	252	245	244	#N/A
∆ N	0	-64	-66	-71	-79	-72	-89	-81	#N/A
∆ S	0	-46	-52	-51	-46	-52	-61	-65	#N/A
∆ E	0	-18	-33	-31	-31	-30	-36	-35	#N/A
∆ W	0	-40	-46	-47	-42	-42	-49	-50	#N/A


Gage Value - Sealed Cylinder
Adjusted Gauge Value (1/10,000 in)
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Gauge Value - UnSealed Cylinder
Adjusted Guage Value (1/10,000 in)
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
Age (days)
ADJ - N
ADJ - S
ADJ - E
ADJ - W


Sealed Cylinder
Gauge Value Change (1/10,000 in)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


UnSealed Cylinder
Gauge Value Change (1/10,000 in)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
5
10
15
20
25
Age (days)
D N
D S
D E
D W


Temperature
Cylinder Temp (degrees(F)
Age (days)
0
10
20
30
40
50
60
70
80
0
5
10
15
20
25
Sealed
UnSealed
Rod Temp

APPENDIX F

KEYS ROAD YARD MEASUREMENTS

Camber Measurements

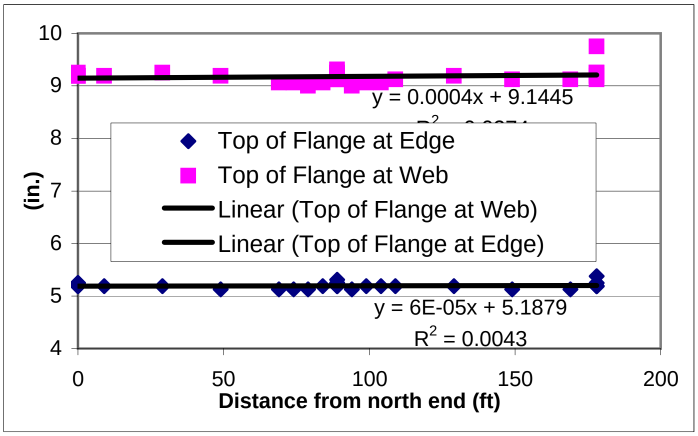
Girders			CPM - Release				UW Measurement	
Cast Date	Time	Mk #	Date	Time	days Age	in. Camber	Date	Time
9/29/05	9:55 AM	6	10/3/05	4:00 AM	3.8	3.88	12/21/05	2:05 PM
							12/21/05	2:10 PM
11/8/05	9:15 AM	8B	11/9/05	6:00 AM	0.9	3.62	12/21/05	8:35 AM
							12/21/05	8:40 AM
11/10/05	9:15 AM	8B(Q)	11/11/05	7:00 AM	0.9	3.65	12/21/05	8:26 AM
							12/21/05	8:30 AM
11/12/05	9:00 AM	8B	11/14/05	6:00 AM	1.9	3.5	12/21/05	8:20 AM
							12/21/05	8:23 AM
11/15/05	12:00 PM	8B	11/16/05	12:00 PM	1.0	3.56	12/21/05	8:10 AM
							12/21/05	8:15 AM
11/18/05	8:15 AM	8B	11/21/05	5:00 AM	2.9	3.25	12/21/05	7:55 AM
							12/21/05	8:05 AM
11/22/05	8:00 AM	8B	11/23/05	7:00 AM	1.0	3.12	12/21/05	11:45 AM
							12/21/05	11:50 AM
11/29/05	11:00 AM	8B	11/30/05	10:30 AM	1.0	3.63	12/21/05	11:33 AM
							12/21/05	11:35 AM
12/2/05	10:00 AM	7F	12/5/05	8:00 AM	2.9	3.44	12/21/05	11:25 AM
							12/21/05	11:28 AM
12/6/05	10:00 AM	7F	12/7/05	9:00 AM	1.0	3.38	12/21/05	11:20 AM
							12/21/05	11:22 AM
12/8/05	9:45 AM	7F	12/9/05	7:00 AM	0.9	3.38	12/21/05	11:10 AM
							12/21/05	11:15 AM
12/13/05	10:15 AM	7F	12/14/05	9:00 AM	0.9	2.75	12/21/05	10:50 AM
							12/21/05	10:55 AM
12/15/05	12:15 PM	7F	12/16/05	7:00 AM	0.8	2.87	12/21/05	11:00 AM
							12/21/05	11:05 AM

Girders							
Cast Date	**Face**	**North**	**Mid**	**South**	**Age**	**Camber**	***Camber**
9/29/05	E	13 9/16	10 11/16	16 11/16	83.2	4.438	4.588
	W	10 15/16	7 13/16	13 7/8		4.594	4.750
11/8/05	E	35 3/8	19 5/16	10 1/2	43.0	3.625	3.748
	W	34 7/16	18 1/16	9 5/8		3.969	4.104
11/10/05	E	33 13/16	17 1/4	8 3/8	41.0	3.844	3.974
	W	35 5/16	18 7/16	9 13/16		4.125	4.265
11/12/05	E	30	13 15/16	5 1/4	39.0	3.688	3.813
	W	33 3/16	16 11/16	8 7/16		4.125	4.265
11/15/05	E	35 9/16	19 15/16	11 15/16	35.8	3.813	3.942
	W	34 9/16	18 7/16	10 7/8		4.281	4.427
11/18/05	E	41	26 3/16	18 5/16	33.0	3.469	3.587
	W	35 7/16	20 5/16	12 1/2		3.656	3.781
11/22/05	E	35 15/16	17 1/2	5 7/8	29.2	3.406	3.522
	W	35 5/16	16 1/4	4 15/16		3.875	4.007
11/29/05	E	34 7/16	12 9/16	-1 1/8	22.0	4.094	4.233
	W	36	13 7/8	7/16		4.344	4.491
12/2/05	E	35 1/8	17 9/16	7 5/16	19.1	3.656	3.781
	W	33 1/4	15 5/16	5 1/4		3.938	4.071
12/6/05	E	32 5/8	15 7/8	6 1/4	15.1	3.563	3.684
	W	33 5/8	16 5/8	7 1/8		3.750	3.878
12/8/05	E	34 13/16	18 1/8	8 7/16	13.1	3.500	3.619
	W	31 11/16	14 13/16	5 5/16		3.688	3.813
12/13/05	E	30 9/16	17 7/16	10 13/16	8.0	3.250	3.361
	W	30 11/16	17 3/8	11 1/8		3.531	3.651
12/15/05	E	30 1/4	17 3/4	11 3/16	5.9	2.969	3.070
	W	29 1/2	16 9/16	10 1/4		3.313	3.425

Girders	1.034 = *Camber adjustment to end from bunk					Compareison	
Cast Date	**Average Camber**	**E-W**	**N-S**	**Diff N-S**	**Average N-S**	**Δ Camber**	**Δ Age**
9/29/05			-3.125				
	4.669	-0.156	-2.938	0.188	-3.031	0.789	79.4
11/8/05			24.875				
	3.926	-0.344	24.813	-0.063	24.844	0.306	42.1
11/10/05			25.438				
	4.120	-0.281	25.500	0.063	25.469	0.470	40.1
11/12/05			24.750				
	4.039	-0.438	24.750	0.000	24.750	0.539	37.1
11/15/05			23.625				
	4.184	-0.469	23.688	0.063	23.656	0.624	34.8
11/18/05			22.688				
	3.684	-0.188	22.938	0.250	22.813	0.434	30.1
11/22/05			30.063				
	3.764	-0.469	30.375	0.313	30.219	0.644	28.2
11/29/05			35.563				
	4.362	-0.250	35.563	0.000	35.563	0.732	21.0
12/2/05			27.813				
	3.926	-0.281	28.000	0.188	27.906	0.486	16.1
12/6/05			26.375				
	3.781	-0.188	26.500	0.125	26.438	0.401	14.1
12/8/05			26.375				
	3.716	-0.188	26.375	0.000	26.375	0.336	12.2
12/13/05			19.750				
	3.506	-0.281	19.563	-0.188	19.656	0.756	7.1
12/15/05			19.063				
	3.247	-0.344	19.250	0.188	19.156	0.377	5.2

Bottom Flange Measurements

Cast Date	Mk #	Face (E/W)	Dist from North End	BOF	TOF	TOF-W	Flange D @ End	Flenge D @ Web
11/15/05	8B	E	89	20	25 1/4	3 13/16	5 1/4	9 3/16
		E	84	20	25 3/16	3 15/16	5 3/16	9 1/16
		E	79	20	25 1/8	4	5 1/8	9
		E	74	20	25 1/8	3 15/16	5 1/8	9 1/16
		E	69	20	25 1/8	3 15/16	5 1/8	9 1/16
		E	49	20	25 1/8	3 13/16	5 1/8	9 3/16
		E	29	20	25 3/16	3 3/4	5 3/16	9 1/4
		E	9	20	25 3/16	3 13/16	5 3/16	9 3/16
		E	0	20	25 3/16	3 13/16	5 3/16	9 3/16
		E	94	20	25 1/8	4	5 1/8	9
		E	99	20	25 3/16	3 15/16	5 3/16	9 1/16
		E	104	20	25 3/16	3 15/16	5 3/16	9 1/16
		E	109	20	25 3/16	3 7/8	5 3/16	9 1/8
		E	129	20	25 3/16	3 13/16	5 3/16	9 3/16
		E	149	20	25 1/8	3 7/8	5 1/8	9 1/8
		E	169	20	25 1/8	3 7/8	5 1/8	9 1/8
		E	178	20	25 3/8	3 1/4	5 3/8	9 3/4
11/18/05	8B	E	178	20	25 1/4	3 7/8	5 1/4	9 1/8
		E	89	20	25 3/16	3 7/8	5 3/16	9 1/8
		E	0	20	25 3/16	3 3/4	5 3/16	9 1/4
		W	0	20	25 1/4	3 13/16	5 1/4	9 3/16
		W	89	20	25 3/16	3 3/4	5 3/16	9 1/4
		W	178	20	25 3/16	3 13/16	5 3/16	9 3/16
11/12/05	8B	E	178	20	25 3/16	3 3/4	5 3/16	9 1/4
		E	89	20	25 3/16	3 7/8	5 3/16	9 1/8
		E	0	20	25 3/16	3 13/16	5 3/16	9 3/16
		W	0	20	25 1/4	3 13/16	5 1/4	9 3/16
		W	89	20	25 1/4	3 11/16	5 1/4	9 5/16
		W	178	20	25 3/16	3 13/16	5 3/16	9 3/16
11/10/05	8B	E	178	20	25 3/16	3 3/4	5 3/16	9 1/4
		E	89	20	25 5/16	3 3/4	5 5/16	9 1/4
		E		20		3 11/16		9 5/16
						Average =	5.194	9.182



Notes:

BOF = Botom of Blange

TOF = Top of Flange at Edge

TOF-W = Top of Flange at Web

Roller Test Measurements

Girders			UW Measurement					
Cast Date	Initial Camber	Ave	Date	Time	Face	North	Mid	South
11/8/05	3.748		12/21/05	1:55 PM	E	34 7/16	16 9/16	6 1/4
	4.104	3.926	12/21/05		W	34 7/16	16 3/8	6 7/16
11/10/05	3.974		12/21/05	1:40 PM	E	30 3/8	11 15/16	1 7/16
	4.265	4.120	12/21/05		W	34 3/8	15 3/4	5 1/2
11/12/05	3.813		12/21/05	12:35 PM	E	36 7/16	18 1/4	8 1/16
	4.265	4.039	12/21/05		W	36 3/4	18 1/2	8 9/16
11/15/05	3.942		12/21/05	12:20 PM	E	35 1/16	17 3/8	8
	4.427	4.184	12/21/05		W	35 15/16	17 15/16	8 7/8
11/18/05	3.587		12/21/05	12:05 PM	E	34	17 1/4	7 11/16
	3.781	3.684	12/21/05		W	35	18	8 5/8

Cast Date	Adj to end Camber	*Camber	Ave Camber	E-W	Δ Camber	Average
11/8/05	3.781	3.910			0.162	
	4.063	4.201	4.055	-0.281	0.097	0.129
11/10/05	3.969	4.104			0.129	
	4.188	4.330	4.217	-0.219	0.065	0.097
11/12/05	4.000	4.136			0.323	
	4.156	4.298	4.217	-0.156	0.032	0.178
11/15/05	4.156	4.298			0.355	
	4.469	4.621	4.459	-0.313	0.194	0.275
11/18/05	3.594	3.716			0.129	
	3.813	3.942	3.829	-0.219	0.162	0.145

* Adjustment to end camber from bunk = 1.034

Average (in.) = 0.165

APPENDIX G

KEYS ROAD CAMBER MEASUREMENTS

Process

Prior to setting, the monitoring positions were marked on the girder (top and bottom). Initial camber was measured prior to temporary strand cutting. Measurement was performed using a Leica Autolevel and rod. Measurements were taken on a monthly basis on top of the girders. Prior to the deck pour, the girders were measured on both the top and bottom to correlate the camber measurements. The bottom measurements were performed on the viaduct portion of the bridge only(spans 6-9). Monitoring continued from 24 hours after deck pour until mid November 2006. The data was checked daily for closure. The loop closed better than 1/5000.

Date	Temp (°F)
11/30/2005	26
12/5/2005	26
1/5/2006	33
2/10/2006	30
3/7/2006	55
4/13/2006	50
4/14/2006	50
4/27/2006	60
5/8/2006	55
5/14/2006	70
5/15/2006	70
6/10/2006	70
6/13/2006	70
6/14/2006	70
7/11/2006	85
7/17/2006	85
7/19/2006	80
8/16/2006	85
8/18/2006	85
8/21/2006	85
8/30/2006	85
10/4/2006	70
11/13/2006	40

NOTES:

3-8, show before and after temp strand release.
9, starts after temp strand release.

6, before and after deck pour on bottom.
7-9, before deck pour top, after bottom.

several dates showing 1/5/2005 should be 1/5/2006.

potential errors in measurement.
  span 5, girder H, 1/5/2006 (1.91 in.)
  span 8, girder D, 8/16/2006 (6.58 in.)

Span 3

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
12/5/2005	26	A	1016.29	1017.22	1017.23	5.47	Pre Strand Release (Top of Girder)
12/5/2005	26	A	1016.29	1017.22	1017.23	5.52	After Temp Strands are Released (Top of Girder)
1/5/2006	33	A	1016.28	1017.23	1017.22	5.76	Monthly Monitoring (Top of Girder)
2/10/2006	30	A	1016.30	1017.23	1017.24	5.52	Monthly Monitoring (Top of Girder)
3/7/2006	55	A	1016.29	1017.24	1017.24	5.70	Monthly Monitoring (Top of Girder)
4/27/2006	60	A	1016.27	1017.23	1017.22	5.82	Monthly Monitoring (Top of Girder)
5/8/2006	55	A	1016.30	1017.21	1017.22	5.40	Monthly Monitoring (Top of Girder)
12/5/2005	26	B	1016.42	1017.24	1017.32	4.44	Pre Strand Release (Top of Girder)
12/5/2005	26	B	1016.42	1017.31	1017.32	5.28	After Temp Strands are Released (Top of Girder)
1/5/2006	33	B	1016.42	1017.32	1017.34	5.28	Monthly Monitoring (Top of Girder)
2/10/2006	30	B	1016.43	1017.31	1017.36	4.98	Monthly Monitoring (Top of Girder)
3/7/2006	55	B	1016.43	1017.33	1017.36	5.22	Monthly Monitoring (Top of Girder)
4/27/2006	60	B	1016.41	1017.32	1017.33	5.40	Monthly Monitoring (Top of Girder)
5/8/2006	55	B	1016.43	1017.29	1017.34	4.86	Monthly Monitoring (Top of Girder)
12/5/2005	26	C	1016.60	1017.35	1017.45	3.90	Pre Strand Release (Top of Girder)
12/5/2005	26	C	1016.60	1017.42	1017.45	4.74	After Temp Strands are Released (Top of Girder)
1/5/2006	50	C	1016.60	1017.42	1017.45	4.74	Monthly Monitoring (Top of Girder)
2/10/2006	30	C	1016.62	1017.42	1017.47	4.50	Monthly Monitoring (Top of Girder)
3/7/2006	55	C	1016.61	1017.43	1017.51	4.44	Monthly Monitoring (Top of Girder)
4/27/2006	60	C	1016.59	1017.44	1017.47	4.92	Monthly Monitoring (Top of Girder)
5/8/2006	55	C	1016.61	1017.40	1017.51	4.08	Monthly Monitoring (Top of Girder)

Span 3

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
12/5/2005	26	D	1016.72	1017.56	1017.62	4.68	Pre Strand Release (Top of Girder)
12/5/2005	26	D	1016.72	1017.63	1017.62	5.52	After Temp Strands are Released (Top of Girder)
1/5/2006	50	D	1016.72	1017.63	1017.61	5.58	Monthly Monitoring (Top of Girder)
2/10/2006	30	D	1016.72	1017.63	1017.62	5.52	Monthly Monitoring (Top of Girder)
3/7/2006	55	D	1016.77	1017.65	1017.63	5.40	Monthly Monitoring (Top of Girder)
4/27/2006	60	D	1016.72	1017.68	1017.61	6.18	Monthly Monitoring (Top of Girder)
5/8/2006	55	D	1016.72	1017.61	1017.61	5.34	Monthly Monitoring (Top of Girder)
12/5/2005	26	E	1016.88	1017.64	1017.78	3.72	Pre Strand Release (Top of Girder)
12/5/2005	26	E	1016.88	1017.72	1017.78	4.68	After Temp Strands are Released (Top of Girder)
1/5/2006	50	E	1016.88	1017.72	1017.78	4.68	Monthly Monitoring (Top of Girder)
2/10/2006	30	E	1016.88	1017.72	1017.80	4.56	Monthly Monitoring (Top of Girder)
3/7/2006	55	E	1016.89	1017.75	1017.84	4.62	Monthly Monitoring (Top of Girder)
4/27/2006	60	E	1016.86	1017.74	1017.78	5.04	Monthly Monitoring (Top of Girder)
5/8/2006	55	E	1016.88	1017.70	1017.78	4.44	Monthly Monitoring (Top of Girder)
12/5/2005	26	F	1016.96	1017.76	1017.86	4.20	Pre Strand Release (Top of Girder)
12/5/2005	26	F	1016.96	1017.83	1017.86	5.04	After Temp Strands are Released (Top of Girder)
1/5/2006	50	F	1016.95	1017.82	1017.86	4.98	Monthly Monitoring (Top of Girder)
2/10/2006	30	F	1016.96	1017.83	1017.87	4.98	Monthly Monitoring (Top of Girder)
3/7/2006	55	F	1016.96	1017.85	1017.88	5.16	Monthly Monitoring (Top of Girder)
4/27/2006	60	F	1016.94	1017.85	1017.87	5.34	Monthly Monitoring (Top of Girder)
5/8/2006	55	F	1016.98	1017.81	1017.87	4.62	Monthly Monitoring (Top of Girder)

Span 3

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
12/5/2005	26	G	1017.15	1017.89	1018.05	3.48	Pre Strand Release (Top of Girder)
12/5/2005	26	G	1017.15	1017.96	1018.05	4.32	After Temp Strands are Released (Top of Girder)
1/5/2006	50	G	1017.14	1017.95	1018.04	4.32	Monthly Monitoring (Top of Girder)
2/10/2006	30	G	1017.15	1017.95	1018.06	4.14	Monthly Monitoring (Top of Girder)
3/7/2006	55	G	1017.15	1017.97	1018.07	4.32	Monthly Monitoring (Top of Girder)
4/27/2006	60	G	1017.13	1017.97	1018.05	4.56	Monthly Monitoring (Top of Girder)
5/8/2006	55	G	1017.15	1017.93	1018.05	3.96	Monthly Monitoring (Top of Girder)
12/5/2005	26	H	1017.21	1017.95	1018.10	3.54	Pre Strand Release (Top of Girder)
12/5/2005	26	H	1017.21	1018.03	1018.10	4.50	After Temp Strands are Released (Top of Girder)
1/5/2006	33	H	1017.21	1018.01	1018.09	4.32	Monthly Monitoring (Top of Girder)
2/10/2006	30	H	1017.22	1018.02	1018.11	4.26	Monthly Monitoring (Top of Girder)
3/7/2006	55	H	1017.22	1018.04	1018.11	4.50	Monthly Monitoring (Top of Girder)
4/27/2006	60	H	1017.20	1018.05	1018.10	4.80	Monthly Monitoring (Top of Girder)
5/8/2006	55	H	1017.21	1018.01	1018.10	4.26	Monthly Monitoring (Top of Girder)
12/5/2005	26	I	1017.08	1017.90	1017.99	4.38	Pre Strand Release (Top of Girder)
12/5/2005	26	I	1017.08	1017.97	1017.99	5.22	After Temp Strands are Released (Top of Girder)
1/5/2006	33	I	1017.07	1017.96	1017.98	5.22	Monthly Monitoring (Top of Girder)
2/10/2006	30	I	1017.08	1017.97	1017.99	5.22	Monthly Monitoring (Top of Girder)
3/7/2006	55	I	1017.08	1017.99	1018.00	5.40	Monthly Monitoring (Top of Girder)
4/27/2006	60	I	1017.06	1018.00	1017.97	5.82	Monthly Monitoring (Top of Girder)
5/8/2006	55	I	1017.08	1017.95	1017.98	5.04	Monthly Monitoring (Top of Girder)

Span 3

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
12/5/2005	26	J	1016.93	1017.73	1017.85	4.08	Pre Strand Release (Top of Girder)
12/5/2005	26	J	1016.93	1017.79	1017.85	4.80	After Temp Strands are Released (Top of Girder)
1/5/2006	33	J	1016.93	1017.79	1017.84	4.86	Monthly Monitoring (Top of Girder)
2/10/2006	30	J	1016.94	1017.78	1017.86	4.56	Monthly Monitoring (Top of Girder)
3/7/2006	55	J	1016.94	1017.81	1017.86	4.92	Monthly Monitoring (Top of Girder)
4/27/2006	60	J	1016.92	1017.82	1017.84	5.28	Monthly Monitoring (Top of Girder)
5/8/2006	55	J	1016.94	1017.78	1017.85	4.62	Monthly Monitoring (Top of Girder)
12/5/2005	26	K	1016.87	1017.59	1017.72	3.54	Pre Strand Release (Top of Girder)
12/5/2005	26	K	1016.87	1017.68	1017.72	4.62	After Temp Strands are Released (Top of Girder)
1/5/2006	33	K	1016.85	1017.66	1017.71	4.56	Monthly Monitoring (Top of Girder)
2/10/2006	30	K	1016.87	1017.66	1017.73	4.32	Monthly Monitoring (Top of Girder)
3/7/2006	55	K	1016.87	1017.69	1017.74	4.62	Monthly Monitoring (Top of Girder)
4/27/2006	60	K	1016.85	1017.69	1017.72	4.86	Monthly Monitoring (Top of Girder)
5/8/2006	55	K	1016.86	1017.66	1017.72	4.44	Monthly Monitoring (Top of Girder)
12/5/2005	26	L	1016.66	1017.49	1017.59	4.38	Pre Strand Release (Top of Girder)
12/5/2005	26	L	1016.66	1017.56	1017.59	5.22	After Temp Strands are Released (Top of Girder)
1/5/2006	50	L	1016.66	1017.56	1017.58	5.28	Monthly Monitoring (Top of Girder)
2/10/2006	30	L	1016.67	1017.55	1017.59	5.04	Monthly Monitoring (Top of Girder)
3/7/2006	55	L	1016.67	1017.58	1017.60	5.34	Monthly Monitoring (Top of Girder)
4/27/2006	60	L	1016.65	1017.58	1017.58	5.58	Monthly Monitoring (Top of Girder)
5/8/2006	55	L	1016.67	1017.55	1017.59	5.04	Monthly Monitoring (Top of Girder)

Span 3

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
12/5/2005	26	M	1016.56	1017.30	1017.46	3.48	Pre Strand Release (Top of Girder)
12/5/2005	26	M	1016.56	1017.37	1017.46	4.32	After Temp Strands are Released (Top of Girder)
1/5/2006	50	M	1016.55	1017.37	1017.47	4.32	Monthly Monitoring (Top of Girder)
2/10/2006	30	M	1016.56	1017.36	1017.47	4.14	Monthly Monitoring (Top of Girder)
3/7/2006	55	M	1016.56	1017.38	1017.48	4.32	Monthly Monitoring (Top of Girder)
4/27/2006	60	M	1016.53	1017.37	1017.44	4.62	Monthly Monitoring (Top of Girder)
5/8/2006	55	M	1016.55	1017.34	1017.45	4.08	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	A	1017.28	1017.85	1017.74	4.02	Pre Strand Release (Top of Girder)
12/5/2005	26	A	1017.28	1017.91	1017.74	4.75	After Temp Strands are Released (Top of Girder)
1/5/2006	33	A	1017.30	1017.93	1017.73	4.96	Monthly Monitoring (Top of Girder)
2/10/2006	30	A	1017.30	1017.93	1017.75	4.86	Monthly Monitoring (Top of Girder)
3/7/2006	55	A	1017.30	1017.91	1017.74	4.62	Monthly Monitoring (Top of Girder)
4/27/2006	60	A	1017.29	1017.93	1017.73	4.98	Monthly Monitoring (Top of Girder)
5/8/2006	55	A	1017.27	1017.88	1017.72	4.56	Monthly Monitoring (Top of Girder)
6/13/2006	70	A	1017.27	1017.89	1017.73	4.62	Monthly Monitoring (Top of Girder)
11/30/2005	26	B	1017.41	1018.00	1017.83	4.52	Pre Strand Release (Top of Girder)
12/5/2005	26	B	1017.41	1018.05	1017.83	5.18	After Temp Strands are Released (Top of Girder)
1/5/2006	33	B	1017.42	1018.06	1017.83	5.27	Monthly Monitoring (Top of Girder)
2/10/2006	30	B	1017.42	1018.10	1017.84	5.64	Monthly Monitoring (Top of Girder)
3/7/2006	55	B	1017.43	1018.06	1017.83	5.09	Monthly Monitoring (Top of Girder)
4/27/2006	60	B	1017.44	1018.09	1017.83	5.52	Monthly Monitoring (Top of Girder)
5/8/2006	55	B	1017.43	1018.04	1017.82	4.95	Monthly Monitoring (Top of Girder)
6/13/2006	70	B	1017.42	1018.05	1017.82	5.19	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	C	1017.54	1018.19	1017.92	5.47	Pre Strand Release (Top of Girder)
12/5/2005	26	C	1017.54	1018.25	1017.92	6.25	After Temp Strands are Released (Top of Girder)
1/5/2006	50	C	1017.55	1018.26	1018.02	5.75	Monthly Monitoring (Top of Girder)
2/10/2006	30	C	1017.55	1018.27	1018.02	5.82	Monthly Monitoring (Top of Girder)
3/7/2006	55	C	1017.57	1018.25	1018.01	5.57	Monthly Monitoring (Top of Girder)
4/27/2006	60	C	1017.56	1018.29	1018.02	6.00	Monthly Monitoring (Top of Girder)
5/8/2006	55	C	1017.56	1018.23	1018.01	5.31	Monthly Monitoring (Top of Girder)
6/13/2006	70	C	1017.53	1018.27	1018.03	5.85	Monthly Monitoring (Top of Girder)
11/30/2005	26	D	1017.69	1018.18	1018.11	3.32	Pre Strand Release (Top of Girder)
12/5/2005	26	D	1017.69	1018.23	1018.11	3.98	After Temp Strands are Released (Top of Girder)
1/5/2006	50	D	1017.69	1018.24	1018.10	4.04	Monthly Monitoring (Top of Girder)
2/10/2006	30	D	1017.70	1018.26	1018.12	4.20	Monthly Monitoring (Top of Girder)
3/7/2006	55	D	1017.70	1018.24	1018.10	3.99	Monthly Monitoring (Top of Girder)
4/27/2006	60	D	1017.70	1018.27	1018.10	4.44	Monthly Monitoring (Top of Girder)
5/8/2006	55	D	1017.68	1018.21	1018.10	3.87	Monthly Monitoring (Top of Girder)
6/13/2006	70	D	1017.69	1018.23	1018.10	4.08	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	E	1017.81	1018.40	1018.28	4.23	Pre Strand Release (Top of Girder)
12/5/2005	26	E	1017.81	1018.44	1018.28	4.77	After Temp Strands are Released (Top of Girder)
1/5/2006	50	E	1017.81	1018.46	1018.27	5.03	Monthly Monitoring (Top of Girder)
2/10/2006	30	E	1017.82	1018.48	1018.29	5.10	Monthly Monitoring (Top of Girder)
3/7/2006	55	E	1017.82	1018.45	1018.27	4.88	Monthly Monitoring (Top of Girder)
4/27/2006	60	E	1017.82	1018.49	1018.27	5.34	Monthly Monitoring (Top of Girder)
5/8/2006	55	E	1017.80	1018.43	1018.27	4.80	Monthly Monitoring (Top of Girder)
6/13/2006	70	E	1017.80	1018.45	1018.27	4.98	Monthly Monitoring (Top of Girder)
11/30/2005	26	F	1017.98	1018.50	1018.42	3.54	Pre Strand Release (Top of Girder)
12/5/2005	26	F	1017.98	1018.56	1018.42	4.32	After Temp Strands are Released (Top of Girder)
1/5/2006	50	F	1017.99	1018.59	1018.42	4.67	Monthly Monitoring (Top of Girder)
2/10/2006	30	F	1018.00	1018.59	1018.42	4.56	Monthly Monitoring (Top of Girder)
3/7/2006	55	F	1018.01	1018.57	1018.41	4.28	Monthly Monitoring (Top of Girder)
4/27/2006	60	F	1018.01	1018.60	1018.43	4.62	Monthly Monitoring (Top of Girder)
5/8/2006	55	F	1017.98	1018.54	1018.42	4.14	Monthly Monitoring (Top of Girder)
6/13/2006	70	F	1017.97	1018.55	1018.41	4.32	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	G	1018.09	1018.65	1018.53	4.02	Pre Strand Release (Top of Girder)
12/5/2005	26	G	1018.09	1018.70	1018.53	4.68	After Temp Strands are Released (Top of Girder)
1/5/2006	50	G	1018.07	1018.71	1018.53	4.87	Monthly Monitoring (Top of Girder)
2/10/2006	30	G	1018.10	1018.72	1018.55	4.74	Monthly Monitoring (Top of Girder)
3/7/2006	55	G	1018.10	1018.71	1018.53	4.74	Monthly Monitoring (Top of Girder)
4/27/2006	60	G	1018.09	1018.75	1018.53	5.28	Monthly Monitoring (Top of Girder)
5/8/2006	55	G	1018.08	1018.69	1018.53	4.65	Monthly Monitoring (Top of Girder)
6/13/2006	70	G	1018.08	1018.70	1018.53	4.74	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	H	1018.21	1018.77	1018.67	3.93	Pre Strand Release (Top of Girder)
12/5/2005	26	H	1018.21	1018.82	1018.67	4.53	After Temp Strands are Released (Top of Girder)
1/5/2006	33	H	1018.21	1018.82	1018.67	4.54	Monthly Monitoring (Top of Girder)
2/10/2006	30	H	1018.22	1018.83	1018.71	4.38	Monthly Monitoring (Top of Girder)
3/7/2006	55	H	1018.23	1018.81	1018.67	4.33	Monthly Monitoring (Top of Girder)
4/27/2006	60	H	1018.22	1018.85	1018.71	4.65	Monthly Monitoring (Top of Girder)
5/8/2006	55	H	1018.20	1018.80	1018.70	4.17	Monthly Monitoring (Top of Girder)
6/13/2006	70	H	1018.21	1018.82	1018.70	4.38	Monthly Monitoring (Top of Girder)
11/30/2005	26	I	1018.03	1018.59	1018.49	3.93	Pre Strand Release (Top of Girder)
12/5/2005	26	I	1018.03	1018.63	1018.49	4.47	After Temp Strands are Released (Top of Girder)
1/5/2006	33	I	1018.04	1018.71	1018.49	5.36	Monthly Monitoring (Top of Girder)
2/10/2006	30	I	1018.05	1018.65	1018.50	4.50	Monthly Monitoring (Top of Girder)
3/7/2006	55	I	1018.05	1018.65	1018.49	4.57	Monthly Monitoring (Top of Girder)
4/27/2006	60	I	1018.05	1018.70	1018.49	5.13	Monthly Monitoring (Top of Girder)
5/8/2006	55	I	1018.03	1018.64	1018.48	4.65	Monthly Monitoring (Top of Girder)
6/13/2006	70	I	1018.03	1018.64	1018.49	4.56	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	J	1017.95	1018.48	1018.37	3.78	Pre Strand Release (Top of Girder)
12/5/2005	26	J	1017.95	1018.54	1018.37	4.56	After Temp Strands are Released (Top of Girder)
1/5/2006	33	J	1017.95	1018.55	1018.37	4.76	Monthly Monitoring (Top of Girder)
2/10/2006	30	J	1017.96	1018.56	1018.38	4.68	Monthly Monitoring (Top of Girder)
3/7/2006	55	J	1017.96	1018.55	1018.37	4.60	Monthly Monitoring (Top of Girder)
4/27/2006	60	J	1017.96	1018.60	1018.36	5.22	Monthly Monitoring (Top of Girder)
5/8/2006	55	J	1017.94	1018.54	1018.36	4.65	Monthly Monitoring (Top of Girder)
6/13/2006	70	J	1017.94	1018.55	1018.36	4.80	Monthly Monitoring (Top of Girder)
11/30/2005	26	K	1017.77	1018.37	1018.23	4.38	Pre Strand Release (Top of Girder)
12/5/2005	26	K	1017.77	1018.42	1018.23	4.98	After Temp Strands are Released (Top of Girder)
1/5/2006	33	K	1017.77	1018.43	1018.23	5.11	Monthly Monitoring (Top of Girder)
2/10/2006	30	K	1017.79	1018.45	1018.25	5.16	Monthly Monitoring (Top of Girder)
3/7/2006	55	K	1017.80	1018.43	1018.24	4.93	Monthly Monitoring (Top of Girder)
4/27/2006	60	K	1017.79	1018.47	1018.23	5.49	Monthly Monitoring (Top of Girder)
5/8/2006	55	K	1017.77	1018.43	1018.23	5.16	Monthly Monitoring (Top of Girder)
6/13/2006	70	K	1017.77	1018.44	1018.22	5.31	Monthly Monitoring (Top of Girder)

Span 4

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	L	1017.63	1018.15	1018.12	3.24	Pre Strand Release (Top of Girder)
12/5/2005	26	L	1017.63	1018.21	1018.12	4.02	After Temp Strands are Released (Top of Girder)
1/5/2006	50	L	1017.63	1018.23	1018.13	4.18	Monthly Monitoring (Top of Girder)
2/10/2006	30	L	1017.64	1018.21	1018.13	3.90	Monthly Monitoring (Top of Girder)
3/7/2006	55	L	1017.65	1018.21	1018.13	3.85	Monthly Monitoring (Top of Girder)
4/27/2006	60	L	1017.64	1018.25	1018.12	4.44	Monthly Monitoring (Top of Girder)
5/8/2006	55	L	1017.62	1018.21	1018.12	4.05	Monthly Monitoring (Top of Girder)
6/13/2006	70	L	1017.62	1018.21	1018.12	4.14	Monthly Monitoring (Top of Girder)
11/30/2005	26	M	1017.53	1018.13	1017.94	4.68	Pre Strand Release (Top of Girder)
12/5/2005	26	M	1017.53	1018.17	1017.94	5.22	After Temp Strands are Released (Top of Girder)
1/5/2006	50	M	1017.53	1018.18	1017.94	5.30	Monthly Monitoring (Top of Girder)
2/10/2006	30	M	1017.54	1018.18	1017.94	5.28	Monthly Monitoring (Top of Girder)
3/7/2006	55	M	1017.55	1018.19	1017.94	5.37	Monthly Monitoring (Top of Girder)
4/27/2006	60	M	1017.55	1018.19	1017.93	5.40	Monthly Monitoring (Top of Girder)
5/8/2006	55	M	1017.54	1018.15	1017.92	4.98	Monthly Monitoring (Top of Girder)
6/13/2006	70	M	1017.53	1018.16	1017.93	5.19	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	A	1017.75	1018.00	1017.66	3.52	Pre Strand Release (Top of Girder)
12/5/2005	26	A	1017.75	1018.09	1017.66	4.64	After Temp Strands are Released (Top of Girder)
1/5/2006	33	A	1017.75	1018.08	1017.66	4.52	Monthly Monitoring (Top of Girder)
2/10/2006	30	A	1017.74	1018.09	1017.68	4.56	Monthly Monitoring (Top of Girder)
3/7/2006	55	A	1017.73	1018.08	1017.68	4.46	Monthly Monitoring (Top of Girder)
4/27/2006	60	A	1017.74	1018.10	1017.65	4.89	Monthly Monitoring (Top of Girder)
5/8/2006	55	A	1017.74	1018.07	1017.66	4.50	Monthly Monitoring (Top of Girder)
6/13/2006	70	A	1017.72	1018.07	1017.65	4.62	Monthly Monitoring (Top of Girder)
11/30/2005	26	B	1017.86	1018.16	1017.82	3.81	Pre Strand Release (Top of Girder)
12/5/2005	26	B	1017.86	1018.23	1017.82	4.70	After Temp Strands are Released (Top of Girder)
1/5/2006	33	B	1017.86	1018.24	1017.82	4.79	Monthly Monitoring (Top of Girder)
2/10/2006	30	B	1017.85	1018.22	1017.82	4.62	Monthly Monitoring (Top of Girder)
3/7/2006	55	B	1017.86	1018.20	1017.82	4.36	Monthly Monitoring (Top of Girder)
4/27/2006	60	B	1017.86	1018.23	1017.80	4.77	Monthly Monitoring (Top of Girder)
5/8/2006	55	B	1017.86	1018.22	1017.80	4.65	Monthly Monitoring (Top of Girder)
6/13/2006	70	B	1017.86	1018.20	1017.80	4.50	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	C	1018.00	1018.31	1017.93	4.13	Pre Strand Release (Top of Girder)
12/5/2005	26	C	1018.00	1018.38	1017.93	5.05	After Temp Strands are Released (Top of Girder)
1/5/2006	33	C	1018.00	1018.39	1017.93	5.12	Monthly Monitoring (Top of Girder)
2/10/2006	30	C	1018.00	1018.37	1017.93	4.86	Monthly Monitoring (Top of Girder)
3/7/2006	55	C	1017.99	1018.36	1017.93	4.77	Monthly Monitoring (Top of Girder)
4/27/2006	60	C	1018.00	1018.39	1017.91	5.19	Monthly Monitoring (Top of Girder)
5/8/2006	55	C	1017.99	1018.37	1017.91	5.01	Monthly Monitoring (Top of Girder)
6/13/2006	70	C	1017.98	1018.36	1017.91	4.92	Monthly Monitoring (Top of Girder)
11/30/2005	26	D	1018.17	1018.46	1018.09	3.99	Pre Strand Release (Top of Girder)
12/5/2005	26	D	1018.17	1018.53	1018.09	4.88	After Temp Strands are Released (Top of Girder)
1/5/2006	33	D	1018.17	1018.54	1018.08	4.99	Monthly Monitoring (Top of Girder)
2/10/2006	30	D	1018.18	1018.52	1018.08	4.68	Monthly Monitoring (Top of Girder)
3/7/2006	55	D	1018.17	1018.51	1018.09	4.63	Monthly Monitoring (Top of Girder)
4/27/2006	60	D	1018.17	1018.53	1018.09	4.86	Monthly Monitoring (Top of Girder)
5/8/2006	55	D	1018.17	1018.52	1018.07	4.80	Monthly Monitoring (Top of Girder)
6/13/2006	70	D	1018.16	1018.50	1018.07	4.65	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	E	1018.31	1018.55	1018.22	3.37	Pre Strand Release (Top of Girder)
12/5/2005	26	E	1018.31	1018.62	1018.22	4.23	After Temp Strands are Released (Top of Girder)
1/5/2006	33	E	1018.31	1018.63	1018.22	4.43	Monthly Monitoring (Top of Girder)
2/10/2006	30	E	1018.32	1018.60	1018.22	3.96	Monthly Monitoring (Top of Girder)
3/7/2006	55	E	1018.31	1018.60	1018.22	3.99	Monthly Monitoring (Top of Girder)
4/27/2006	60	E	1018.32	1018.63	1018.20	4.44	Monthly Monitoring (Top of Girder)
5/8/2006	55	E	1018.31	1018.62	1018.20	4.32	Monthly Monitoring (Top of Girder)
6/13/2006	70	E	1018.31	1018.58	1018.20	3.93	Monthly Monitoring (Top of Girder)
11/30/2005	26	F	1018.45	1018.73	1018.35	3.95	Pre Strand Release (Top of Girder)
12/5/2005	26	F	1018.45	1018.80	1018.35	4.74	After Temp Strands are Released (Top of Girder)
1/5/2006	33	F	1018.44	1018.82	1018.35	5.06	Monthly Monitoring (Top of Girder)
2/10/2006	30	F	1018.45	1018.79	1018.35	4.68	Monthly Monitoring (Top of Girder)
3/7/2006	55	F	1018.44	1018.77	1018.35	4.46	Monthly Monitoring (Top of Girder)
4/27/2006	60	F	1018.44	1018.79	1018.36	4.71	Monthly Monitoring (Top of Girder)
5/8/2006	55	F	1018.44	1018.78	1018.34	4.65	Monthly Monitoring (Top of Girder)
6/13/2006	70	F	1018.41	1018.75	1018.35	4.44	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	G	1018.59	1018.85	1018.47	3.80	Pre Strand Release (Top of Girder)
12/5/2005	26	G	1018.59	1018.93	1018.47	4.76	After Temp Strands are Released (Top of Girder)
1/5/2006	33	G	1018.58	1018.93	1018.47	4.88	Monthly Monitoring (Top of Girder)
2/10/2006	30	G	1018.62	1018.91	1018.47	4.38	Monthly Monitoring (Top of Girder)
3/7/2006	55	G	1018.58	1018.89	1018.47	4.43	Monthly Monitoring (Top of Girder)
4/27/2006	60	G	1018.58	1018.92	1018.45	4.80	Monthly Monitoring (Top of Girder)
5/8/2006	55	G	1018.58	1018.90	1018.45	4.65	Monthly Monitoring (Top of Girder)
6/13/2006	70	G	1018.58	1018.89	1018.45	4.50	Monthly Monitoring (Top of Girder)
11/30/2005	26	H	1018.71	1018.91	1018.59	3.11	Pre Strand Release (Top of Girder)
12/5/2005	26	H	1018.71	1018.99	1018.59	4.08	After Temp Strands are Released (Top of Girder)
1/5/2006	33	H	1018.70	1018.99	1018.97	#N/A	Monthly Monitoring (Top of Girder)
2/10/2006	30	H	1018.69	1018.96	1018.59	3.84	Monthly Monitoring (Top of Girder)
3/7/2006	55	H	1018.70	1018.96	1018.60	3.72	Monthly Monitoring (Top of Girder)
4/27/2006	60	H	1018.70	1018.99	1018.57	4.20	Monthly Monitoring (Top of Girder)
5/8/2006	55	H	1018.71	1018.97	1018.57	3.93	Monthly Monitoring (Top of Girder)
6/13/2006	70	H	1018.68	1018.95	1018.57	3.90	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	I	1018.53	1018.77	1018.43	3.50	Pre Strand Release (Top of Girder)
12/5/2005	26	I	1018.53	1018.84	1018.43	4.32	After Temp Strands are Released (Top of Girder)
1/5/2006	33	I	1018.53	1018.86	1018.43	4.57	Monthly Monitoring (Top of Girder)
2/10/2006	30	I	1018.54	1018.84	1018.43	4.26	Monthly Monitoring (Top of Girder)
3/7/2006	55	I	1018.53	1018.83	1018.43	4.16	Monthly Monitoring (Top of Girder)
4/27/2006	60	I	1018.52	1018.86	1018.42	4.65	Monthly Monitoring (Top of Girder)
5/8/2006	55	I	1018.54	1018.85	1018.42	4.44	Monthly Monitoring (Top of Girder)
6/13/2006	70	I	1018.52	1018.82	1018.41	4.29	Monthly Monitoring (Top of Girder)
11/30/2005	26	J	1018.38	1018.62	1018.31	3.25	Pre Strand Release (Top of Girder)
12/5/2005	26	J	1018.38	1018.69	1018.31	4.14	After Temp Strands are Released (Top of Girder)
1/5/2006	33	J	1018.38	1018.70	1018.30	4.37	Monthly Monitoring (Top of Girder)
2/10/2006	30	J	1018.39	1018.69	1018.31	4.08	Monthly Monitoring (Top of Girder)
3/7/2006	55	J	1018.38	1018.68	1018.30	4.07	Monthly Monitoring (Top of Girder)
4/27/2006	60	J	1018.38	1018.71	1018.28	4.53	Monthly Monitoring (Top of Girder)
5/8/2006	55	J	1018.38	1018.70	1018.29	4.35	Monthly Monitoring (Top of Girder)
6/13/2006	70	J	1018.36	1018.68	1018.29	4.20	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	K	1018.21	1018.49	1018.16	3.69	Pre Strand Release (Top of Girder)
12/5/2005	26	K	1018.21	1018.58	1018.16	4.75	After Temp Strands are Released (Top of Girder)
1/5/2006	33	K	1018.22	1018.57	1018.17	4.55	Monthly Monitoring (Top of Girder)
2/10/2006	30	K	1018.24	1018.57	1018.16	4.44	Monthly Monitoring (Top of Girder)
3/7/2006	55	K	1018.23	1018.54	1018.16	4.15	Monthly Monitoring (Top of Girder)
4/27/2006	60	K	1018.22	1018.58	1018.15	4.74	Monthly Monitoring (Top of Girder)
5/8/2006	55	K	1018.24	1018.56	1018.15	4.44	Monthly Monitoring (Top of Girder)
6/13/2006	70	K	1018.22	1018.54	1018.14	4.35	Monthly Monitoring (Top of Girder)
11/30/2005	26	L	1018.08	1018.36	1018.04	3.62	Pre Strand Release (Top of Girder)
12/5/2005	26	L	1018.08	1018.44	1018.04	4.56	After Temp Strands are Released (Top of Girder)
1/5/2006	33	L	1018.08	1018.44	1018.04	4.61	Monthly Monitoring (Top of Girder)
2/10/2006	30	L	1018.09	1018.43	1018.06	4.26	Monthly Monitoring (Top of Girder)
3/7/2006	55	L	1018.08	1018.41	1018.04	4.27	Monthly Monitoring (Top of Girder)
4/27/2006	60	L	1018.08	1018.44	1018.04	4.56	Monthly Monitoring (Top of Girder)
5/8/2006	55	L	1018.08	1018.44	1018.04	4.56	Monthly Monitoring (Top of Girder)
6/13/2006	70	L	1018.06	1018.40	1018.04	4.20	Monthly Monitoring (Top of Girder)

Span 5

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
11/30/2005	26	M	1017.99	1018.33	1017.91	4.50	Pre Strand Release (Top of Girder)
12/5/2005	26	M	1017.99	1018.40	1017.91	5.36	After Temp Strands are Released (Top of Girder)
1/5/2006	33	M	1017.97	1018.42	1017.91	5.82	Monthly Monitoring (Top of Girder)
2/10/2006	30	M	1017.97	1018.39	1017.92	5.34	Monthly Monitoring (Top of Girder)
3/7/2006	55	M	1017.97	1018.38	1017.91	5.29	Monthly Monitoring (Top of Girder)
4/27/2006	60	M	1017.98	1018.39	1017.89	5.49	Monthly Monitoring (Top of Girder)
5/8/2006	55	M	1017.98	1018.38	1017.89	5.31	Monthly Monitoring (Top of Girder)
6/13/2006	70	M	1017.96	1018.35	1017.90	5.07	Monthly Monitoring (Top of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	A	1017.65	1017.69	1017.09	3.78	Pre Strand Release (Top of Girder)
4/14/2006	50	A	1017.65	1017.73	1017.09	4.32	After Temp Strands are Released (Top of Girder)
5/8/2006	50	A	1017.68	1017.78	1017.12	4.50	Monthly Monitoring (Top of Girder)
6/13/2006	70	A	1017.70	1017.78	1017.14	4.35	Monthly Monitoring (Top of Girder)
7/11/2006	85	A	1017.70	1017.68	1017.17	2.94	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	A	1010.77	1010.72	1010.21	2.73	Before Deck Pour (Bottom of Girder)
7/19/2006	80	A	1010.77	1010.59	1010.22	1.08	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	A	1010.76	1010.51	1010.21	0.24	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	A	1010.77	1010.49	1010.20	0.09	Monthly Monitoring (Bottom of Girder)
4/13/2006	50	B	1017.74	1017.87	1017.24	4.53	Pre Strand Release (Top of Girder)
4/14/2006	50	B	1017.74	1017.92	1017.24	5.19	After Temp Strands are Released (Top of Girder)
5/8/2006	50	B	1017.77	1017.96	1017.26	5.28	Monthly Monitoring (Top of Girder)
6/13/2006	70	B	1017.79	1017.96	1017.26	5.25	Monthly Monitoring (Top of Girder)
7/11/2006	85	B	1017.80	1017.88	1017.32	3.84	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	B	1010.89	1010.89	1010.36	3.18	Before Deck Pour (Bottom of Girder)
7/19/2006	80	B	1010.88	1010.77	1010.37	1.74	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	B	1010.87	1010.68	1010.35	0.84	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	B	1010.87	1010.68	1010.32	0.99	Monthly Monitoring (Bottom of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	C	1017.90	1018.07	1017.37	5.22	Pre Strand Release (Top of Girder)
4/14/2006	50	C	1017.90	1018.12	1017.37	5.82	After Temp Strands are Released (Top of Girder)
5/8/2006	50	C	1017.92	1018.16	1017.40	6.00	Monthly Monitoring (Top of Girder)
6/13/2006	70	C	1017.93	1018.16	1017.44	5.67	Monthly Monitoring (Top of Girder)
7/11/2006	85	C	1018.01	1018.09	1017.46	4.26	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	C	1011.03	1011.08	1010.52	3.72	Before Deck Pour (Bottom of Girder)
7/19/2006	80	C	1011.03	1010.98	1010.53	2.46	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	C	1011.02	1010.89	1010.51	1.50	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	C	1011.02	1010.89	1010.49	1.68	Monthly Monitoring (Bottom of Girder)
4/13/2006	50	D	1018.04	1018.11	1017.52	3.96	Pre Strand Release (Top of Girder)
4/14/2006	50	D	1018.04	1018.17	1017.52	4.68	After Temp Strands are Released (Top of Girder)
5/8/2006	50	D	1018.08	1018.22	1017.56	4.80	Monthly Monitoring (Top of Girder)
6/13/2006	70	D	1018.09	1018.21	1017.56	4.62	Monthly Monitoring (Top of Girder)
7/11/2006	85	D	1018.10	1018.13	1017.61	3.30	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	D	1011.16	1011.17	1010.65	3.15	Before Deck Pour (Bottom of Girder)
7/19/2006	80	D	1011.16	1011.06	1010.64	1.92	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	D	1011.16	1010.97	1010.63	0.93	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	D	1011.15	1010.97	1010.62	1.05	Monthly Monitoring (Bottom of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	E	1018.13	1018.29	1017.67	4.68	Pre Strand Release (Top of Girder)
4/14/2006	50	E	1018.13	1018.35	1017.67	5.34	After Temp Strands are Released (Top of Girder)
5/8/2006	50	E	1018.16	1018.38	1017.70	5.43	Monthly Monitoring (Top of Girder)
6/13/2006	70	E	1018.19	1018.37	1017.72	4.98	Monthly Monitoring (Top of Girder)
7/11/2006	85	E	1018.21	1018.32	1017.75	4.08	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	E	1011.29	1011.37	1010.80	3.90	Before Deck Pour (Bottom of Girder)
7/19/2006	80	E	1011.29	1011.27	1010.80	2.67	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	E	1011.28	1011.17	1010.78	1.68	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	E	1011.28	1011.17	1010.77	1.71	Monthly Monitoring (Bottom of Girder)
4/13/2006	50	F	1018.33	1018.39	1017.75	4.20	Pre Strand Release (Top of Girder)
4/14/2006	50	F	1018.33	1018.44	1017.75	4.86	After Temp Strands are Released (Top of Girder)
5/8/2006	50	F	1018.36	1018.48	1017.77	4.95	Monthly Monitoring (Top of Girder)
6/13/2006	70	F	1018.37	1018.45	1017.80	4.41	Monthly Monitoring (Top of Girder)
7/11/2006	85	F	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	F	1011.43	1011.44	1010.89	3.33	Before Deck Pour (Bottom of Girder)
7/19/2006	80	F	1011.43	1011.34	1010.89	2.19	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	F	1011.42	1011.25	1010.88	1.20	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	F	1011.42	1011.25	1010.88	1.26	Monthly Monitoring (Bottom of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	G	1018.48	1018.53	1017.90	4.05	Pre Strand Release (Top of Girder)
4/14/2006	50	G	1018.48	1018.57	1017.90	4.59	After Temp Strands are Released (Top of Girder)
5/8/2006	50	G	1018.51	1018.61	1017.93	4.68	Monthly Monitoring (Top of Girder)
6/13/2006	70	G	1018.52	1018.60	1017.95	4.38	Monthly Monitoring (Top of Girder)
7/11/2006	85	G	1018.52	1018.55	1017.98	3.60	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	G	1011.59	1011.60	1011.05	3.33	Before Deck Pour (Bottom of Girder)
7/19/2006	80	G	1011.59	1011.51	1011.06	2.25	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	G	1011.58	1011.41	1011.04	1.14	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	G	1011.59	1011.41	1011.03	1.17	Monthly Monitoring (Bottom of Girder)
4/13/2006	50	H	1018.53	1018.68	1018.08	4.50	Pre Strand Release (Top of Girder)
4/14/2006	50	H	1018.53	1018.73	1018.08	5.10	After Temp Strands are Released (Top of Girder)
5/8/2006	50	H	1018.56	1018.77	1018.11	5.22	Monthly Monitoring (Top of Girder)
6/13/2006	70	H	1018.59	1018.78	1018.13	5.04	Monthly Monitoring (Top of Girder)
7/11/2006	85	H	1018.60	1018.71	1018.16	3.96	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	H	1011.65	1011.76	1011.20	3.99	Before Deck Pour (Bottom of Girder)
7/19/2006	80	H	1011.65	1011.65	1011.20	2.70	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	H	1011.64	1011.56	1011.20	1.68	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	H	1011.65	1011.56	1011.17	1.80	Monthly Monitoring (Bottom of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	I	1018.41	1018.68	1018.28	3.99	Pre Strand Release (Top of Girder)
4/14/2006	50	I	1018.41	1018.74	1018.28	4.77	After Temp Strands are Released (Top of Girder)
5/8/2006	50	I	1018.44	1018.78	1018.30	4.92	Monthly Monitoring (Top of Girder)
6/13/2006	70	I	1018.45	1018.77	1018.33	4.56	Monthly Monitoring (Top of Girder)
7/11/2006	85	I	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	I	1011.52	1011.75	1011.33	3.90	Before Deck Pour (Bottom of Girder)
7/19/2006	80	I	1011.52	1011.65	1011.33	2.73	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	I	1011.51	1011.55	1011.32	1.62	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	I	1011.51	1011.55	1011.30	1.71	Monthly Monitoring (Bottom of Girder)
4/13/2006	50	J	1018.29	1018.67	1018.35	4.20	Pre Strand Release (Top of Girder)
4/14/2006	50	J	1018.29	1018.73	1018.35	4.92	After Temp Strands are Released (Top of Girder)
5/8/2006	50	J	1018.32	1018.78	1018.38	5.10	Monthly Monitoring (Top of Girder)
6/13/2006	70	J	1018.33	1018.78	1018.41	4.92	Monthly Monitoring (Top of Girder)
7/11/2006	85	J	1018.39	1018.71	1018.43	3.60	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	J	1011.40	1011.74	1011.46	3.78	Before Deck Pour (Bottom of Girder)
7/19/2006	80	J	1011.40	1011.63	1011.46	2.43	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	J	1011.39	1011.53	1011.45	1.32	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	J	1011.39	1011.51	1011.42	1.32	Monthly Monitoring (Bottom of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	K	1018.14	1018.66	1018.45	4.44	Pre Strand Release (Top of Girder)
4/14/2006	50	K	1018.14	1018.72	1018.45	5.16	After Temp Strands are Released (Top of Girder)
5/8/2006	50	K	1018.13	1018.78	1018.47	5.76	Monthly Monitoring (Top of Girder)
6/13/2006	70	K	1018.14	1018.76	1018.49	5.34	Monthly Monitoring (Top of Girder)
7/11/2006	85	K	1018.22	1018.74	1018.52	4.44	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	K	1011.25	1011.76	1011.58	4.11	Before Deck Pour (Bottom of Girder)
7/19/2006	80	K	1011.26	1011.64	1011.59	2.61	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	K	1011.25	1011.54	1011.58	1.50	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	K	1011.25	1011.52	1011.57	1.32	Monthly Monitoring (Bottom of Girder)
4/13/2006	50	L	1017.98	1018.66	1018.60	4.44	Pre Strand Release (Top of Girder)
4/14/2006	50	L	1017.98	1018.72	1018.60	5.16	After Temp Strands are Released (Top of Girder)
5/8/2006	50	L	1018.01	1018.76	1018.63	5.25	Monthly Monitoring (Top of Girder)
6/13/2006	70	L	1018.03	1018.77	1018.65	5.13	Monthly Monitoring (Top of Girder)
7/11/2006	85	L	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	L	1011.06	1011.74	1011.70	4.29	Before Deck Pour (Bottom of Girder)
7/19/2006	80	L	1011.13	1011.61	1011.71	2.28	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	L	1011.12	1011.51	1011.71	1.17	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	L	1011.12	1011.49	1011.69	1.02	Monthly Monitoring (Bottom of Girder)

Span 6

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
4/13/2006	50	M	1017.85	1018.59	1018.78	3.27	Pre Strand Release (Top of Girder)
4/14/2006	50	M	1017.85	1018.64	1018.78	3.87	After Temp Strands are Released (Top of Girder)
5/8/2006	50	M	1017.88	1018.69	1018.80	4.14	Monthly Monitoring (Top of Girder)
6/13/2006	70	M	1017.90	1018.70	1018.81	4.17	Monthly Monitoring (Top of Girder)
7/11/2006	85	M	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder) *and Before Deck Pour*
7/11/2006	85	M	1011.01	1011.70	1011.84	3.26	Before Deck Pour (Bottom of Girder)
7/19/2006	80	M	1011.01	1011.53	1011.85	1.26	1 Day After Deck Pour (Bottom of Girder)
8/18/2006	85	M	1011.01	1011.44	1011.84	0.18	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	M	1010.97	1011.40	1011.84	-0.10	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	A	1017.01	1016.20	1014.80	3.54	Pre Strand Release (Top of Girder)
5/15/2006	70	A	1017.01	1016.28	1014.80	4.50	After Temp Strands are Released (Top of Girder)
6/13/2006	70	A	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder)
7/11/2006	85	A	1017.08	1016.26	1014.84	3.60	Monthly Monitoring (Top of Girder)
7/11/2006	85	A	1010.10	1009.21	1007.94	2.34	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	A	1017.03	1016.26	1014.86	3.78	Before Deck Pour (Top of Girder)
8/18/2006	85	A	1010.10	1009.08	1007.93	0.78	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	A	1010.08	1009.07	1007.90	0.96	Monthly Monitoring (Bottom of Girder)
5/14/2006	70	B	1017.14	1016.35	1014.94	3.72	Pre Strand Release (Top of Girder)
5/15/2006	70	B	1017.14	1016.44	1014.94	4.80	After Temp Strands are Released (Top of Girder)
6/13/2006	70	B	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder)
7/11/2006	85	B	1017.18	1016.41	1014.98	3.96	Monthly Monitoring (Top of Girder)
7/11/2006	85	B	1010.24	1009.39	1008.07	2.82	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	B	1017.17	1016.40	1015.03	3.66	Before Deck Pour (Top of Girder)
8/18/2006	85	B	1010.24	1009.29	1008.06	1.65	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	B	1010.23	1009.27	1008.06	1.50	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	C	1017.28	1016.62	1015.26	4.23	Pre Strand Release (Top of Girder)
5/15/2006	70	C	1017.28	1016.69	1015.26	5.07	After Temp Strands are Released (Top of Girder)
6/13/2006	70	C	1017.33	1016.75	1015.29	5.25	Monthly Monitoring (Top of Girder)
7/11/2006	85	C	1017.36	1016.68	1015.30	4.20	Monthly Monitoring (Top of Girder)
7/11/2006	85	C	1010.37	1009.63	1008.40	2.91	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	C	1017.32	1016.68	1015.31	4.38	Before Deck Pour (Top of Girder)
8/18/2006	85	C	1010.37	1009.57	1008.39	2.28	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	C	1010.36	1009.53	1008.38	1.95	Monthly Monitoring (Bottom of Girder)
5/14/2006	70	D	1017.39	1016.90	1015.64	4.59	Pre Strand Release (Top of Girder)
5/15/2006	70	D	1017.39	1016.98	1015.64	5.61	After Temp Strands are Released (Top of Girder)
6/13/2006	70	D	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder)
7/11/2006	85	D	1017.47	1016.92	1015.68	4.14	Monthly Monitoring (Top of Girder)
7/11/2006	85	D	1010.51	1009.91	1008.76	3.36	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	D	1017.42	1016.94	1015.71	4.47	Before Deck Pour (Top of Girder)
8/18/2006	85	D	1010.56	1009.82	1008.76	1.86	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	D	1010.49	1009.81	1008.75	2.28	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	E	1017.55	1017.09	1015.92	4.26	Pre Strand Release (Top of Girder)
5/15/2006	70	E	1017.55	1017.17	1015.92	5.16	After Temp Strands are Released (Top of Girder)
6/13/2006	70	E	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder)
7/11/2006	85	E	1017.63	1017.18	1015.95	4.68	Monthly Monitoring (Top of Girder)
7/11/2006	85	E	1010.65	1010.07	1009.08	2.49	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	E	1017.58	1017.12	1016.03	3.81	Before Deck Pour (Top of Girder)
8/18/2006	85	E	1010.68	1009.98	1009.08	1.23	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	E	1010.64	1009.95	1009.17	0.57	Monthly Monitoring (Bottom of Girder)
5/14/2006	70	F	1017.79	1017.32	1016.32	3.15	Pre Strand Release (Top of Girder)
5/15/2006	70	F	1017.79	1017.41	1016.32	4.29	After Temp Strands are Released (Top of Girder)
6/13/2006	70	F	1017.72	1017.43	1016.34	4.80	Monthly Monitoring (Top of Girder)
7/11/2006	85	F	1017.79	1017.37	1016.35	3.60	Monthly Monitoring (Top of Girder)
7/11/2006	85	F	1010.80	1010.38	1009.43	3.15	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	F	1017.73	1017.35	1016.37	3.60	Before Deck Pour (Top of Girder)
8/18/2006	85	F	1010.88	1010.29	1009.43	1.62	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	F	1010.79	1010.23	1009.40	1.59	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	G	1017.82	1017.54	1016.62	3.87	Pre Strand Release (Top of Girder)
5/15/2006	70	G	1017.82	1017.65	1016.62	5.13	After Temp Strands are Released (Top of Girder)
6/13/2006	70	G	1017.86	1017.67	1016.65	4.92	Monthly Monitoring (Top of Girder)
7/11/2006	85	G	1017.88	1017.60	1016.66	3.96	Monthly Monitoring (Top of Girder)
7/11/2006	85	G	1010.63	1010.59	1009.77	4.74	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	G	1017.84	1017.59	1016.66	4.11	Before Deck Pour (Top of Girder)
8/18/2006	85	G	1010.94	1010.49	1009.75	1.74	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	G	1010.92	1010.43	1009.74	1.23	Monthly Monitoring (Bottom of Girder)
5/14/2006	70	H	1017.97	1017.82	1016.97	4.23	Pre Strand Release (Top of Girder)
5/15/2006	70	H	1017.97	1017.93	1016.97	5.55	After Temp Strands are Released (Top of Girder)
6/13/2006	70	H	1018.01	1017.96	1017.00	5.46	Monthly Monitoring (Top of Girder)
7/11/2006	85	H	1018.04	1017.90	1017.01	4.50	Monthly Monitoring (Top of Girder)
7/11/2006	85	H	1011.10	1010.90	1010.11	3.60	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	H	1017.99	1017.88	1017.03	4.44	Before Deck Pour (Top of Girder)
8/18/2006	85	H	1011.11	1010.74	1010.10	1.62	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	H	1011.08	1010.72	1010.08	1.68	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	I	1018.10	1018.12	1017.32	4.95	Pre Strand Release (Top of Girder)
5/15/2006	70	I	1018.10	1018.24	1017.32	6.39	After Temp Strands are Released (Top of Girder)
6/13/2006	70	I	1018.15	1018.27	1017.36	6.18	Monthly Monitoring (Top of Girder)
7/11/2006	85	I	1018.17	1018.20	1017.37	5.16	Monthly Monitoring (Top of Girder)
7/11/2006	85	I	1011.21	1011.13	1010.44	3.63	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	I	1018.13	1018.12	1017.36	4.44	Before Deck Pour (Top of Girder)
8/18/2006	85	I	1011.22	1011.02	1010.42	2.40	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	I	1011.20	1010.96	1010.42	1.83	Monthly Monitoring (Bottom of Girder)
5/14/2006	70	J	1018.22	1018.26	1017.58	4.29	Pre Strand Release (Top of Girder)
5/15/2006	70	J	1018.22	1018.39	1017.58	5.91	After Temp Strands are Released (Top of Girder)
6/13/2006	70	J	1018.26	1018.40	1017.60	5.64	Monthly Monitoring (Top of Girder)
7/11/2006	85	J	1018.31	1018.35	1017.60	4.74	Monthly Monitoring (Top of Girder)
7/11/2006	85	J	1011.34	1011.33	1010.69	3.78	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	J	1018.26	1018.33	1017.65	4.56	Before Deck Pour (Top of Girder)
8/18/2006	85	J	1011.35	1011.26	1010.70	2.82	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	J	1011.32	1011.16	1010.69	1.86	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	K	1018.39	1018.52	1017.98	4.08	Pre Strand Release (Top of Girder)
5/15/2006	70	K	1018.39	1018.67	1017.98	5.82	After Temp Strands are Released (Top of Girder)
6/13/2006	70	K	1018.43	1018.67	1018.02	5.37	Monthly Monitoring (Top of Girder)
7/11/2006	85	K	1018.46	1018.60	1018.02	4.32	Monthly Monitoring (Top of Girder)
7/11/2006	85	K	1011.51	1011.63	1011.11	3.84	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	K	1018.42	1018.59	1018.03	4.41	Before Deck Pour (Top of Girder)
8/18/2006	85	K	1011.51	1011.51	1011.10	2.46	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	K	1011.49	1011.44	1011.10	1.77	Monthly Monitoring (Bottom of Girder)
5/14/2006	70	L	1018.49	1018.72	1018.28	4.05	Pre Strand Release (Top of Girder)
5/15/2006	70	L	1018.49	1018.83	1018.28	5.31	After Temp Strands are Released (Top of Girder)
6/13/2006	70	L	1018.54	1018.86	1018.32	5.13	Monthly Monitoring (Top of Girder)
7/11/2006	85	L	1018.58	1018.78	1018.32	3.96	Monthly Monitoring (Top of Girder)
7/11/2006	85	L	1011.63	1011.84	1011.32	4.38	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	L	1018.55	1018.77	1018.36	3.78	Before Deck Pour (Top of Girder)
8/18/2006	85	L	1011.62	1011.75	1011.42	2.76	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	L	1011.61	1011.63	1011.41	1.44	Monthly Monitoring (Bottom of Girder)

Span 7

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
5/14/2006	70	M	1018.67	1019.03	1018.69	4.26	Pre Strand Release (Top of Girder)
5/15/2006	70	M	1018.67	1019.14	1018.69	5.52	After Temp Strands are Released (Top of Girder)
6/13/2006	70	M	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Top of Girder)
7/11/2006	85	M	1018.73	1019.10	1018.72	4.50	Monthly Monitoring (Top of Girder)
7/11/2006	85	M	1011.78	1012.13	1011.78	4.26	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	M	1018.70	1019.10	1018.76	4.47	Before Deck Pour (Top of Girder)
8/18/2006	85	M	1011.79	1012.01	1011.77	2.70	1 Day After Deck Pour (Bottom of Girder)
11/13/2006	40	M	1011.77	1011.90	1011.77	1.56	Monthly Monitoring (Bottom of Girder)

Span 8

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
6/10/2006	70	A	1014.83	1014.39	1013.43	3.09	Pre Strand Release (Top of Girder)
6/14/2006	70	A	1014.83	1014.43	1013.43	3.57	After Temp Strands are Released (Top of Girder)
7/11/2006	85	A	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	A	1014.81	1014.39	1013.22	4.56	Before Deck Pour (Top of Girder)
8/18/2006	85	A	1007.87	1007.26	1006.31	2.07	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	A	1007.88	1007.23	1006.32	1.59	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	A	1007.87	1007.29	1006.28	2.55	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	B	1014.97	1014.54	1013.39	4.32	Pre Strand Release (Top of Girder)
6/14/2006	70	B	1014.97	1014.60	1013.39	5.04	After Temp Strands are Released (Top of Girder)
7/11/2006	85	B	#N/A	#N/A	#N/A	#N/A	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	B	1014.97	1014.56	1013.39	4.62	Before Deck Pour (Top of Girder)
8/18/2006	85	B	1008.02	1007.47	1006.49	2.61	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	B	1008.02	1007.42	1006.49	1.95	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	B	1008.00	1007.50	1006.48	3.06	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	C	1015.29	1014.91	1013.75	4.68	Pre Strand Release (Top of Girder)
6/14/2006	70	C	1015.29	1014.99	1013.75	5.58	After Temp Strands are Released (Top of Girder)
7/11/2006	85	C	1008.33	1007.94	1006.85	4.26	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	C	1015.34	1014.93	1013.78	4.41	Before Deck Pour (Top of Girder)
8/18/2006	85	C	1008.32	1007.87	1006.88	3.24	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	C	1008.32	1007.78	1006.84	2.40	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	C	1008.31	1007.85	1006.84	3.27	Monthly Monitoring (Bottom of Girder)

Span 8

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
6/10/2006	70	D	1015.77	1015.28	1014.05	4.41	Pre Strand Release (Top of Girder)
6/14/2006	70	D	1015.77	1015.32	1014.05	4.89	After Temp Strands are Released (Top of Girder)
7/11/2006	85	D	1008.83	1008.30	1007.14	3.78	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	D	1015.47	1015.32	1014.03	#N/A	Before Deck Pour (Top of Girder)
8/18/2006	85	D	1008.89	1008.22	1007.16	2.34	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	D	1008.82	1008.14	1007.13	1.92	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	D	1008.81	1008.22	1007.12	3.12	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	E	1015.91	1015.49	1014.39	4.08	Pre Strand Release (Top of Girder)
6/14/2006	70	E	1015.91	1015.55	1014.39	4.86	After Temp Strands are Released (Top of Girder)
7/11/2006	85	E	1009.02	1008.56	1007.50	3.57	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	E	1015.91	1015.50	1014.39	4.17	Before Deck Pour (Top of Girder)
8/18/2006	85	E	1009.09	1008.49	1007.49	2.40	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	E	1009.01	1008.39	1007.49	1.68	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	E	1009.00	1008.47	1007.48	2.73	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	F	1016.28	1015.87	1014.71	4.47	Pre Strand Release (Top of Girder)
6/14/2006	70	F	1016.28	1015.92	1014.71	5.07	After Temp Strands are Released (Top of Girder)
7/11/2006	85	F	1009.36	1008.87	1007.83	3.33	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	F	1016.27	1015.85	1014.74	4.20	Before Deck Pour (Top of Girder)
8/18/2006	85	F	1009.40	1008.81	1007.83	2.34	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	F	1009.34	1008.70	1007.81	1.50	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	F	1009.33	1008.78	1007.80	2.52	Monthly Monitoring (Bottom of Girder)

Span 8

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
6/10/2006	70	G	1016.59	1016.23	1015.11	4.53	Pre Strand Release (Top of Girder)
6/14/2006	70	G	1016.59	1016.31	1015.11	5.49	After Temp Strands are Released (Top of Girder)
7/11/2006	85	G	1009.71	1009.28	1008.21	3.87	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	G	1016.63	1016.25	1015.12	4.53	Before Deck Pour (Top of Girder)
8/18/2006	85	G	1009.70	1009.26	1008.20	3.72	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	G	1009.70	1009.11	1008.20	1.92	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	G	1009.70	1009.18	1008.19	2.82	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	H	1016.98	1016.56	1015.44	4.20	Pre Strand Release (Top of Girder)
6/14/2006	70	H	1016.98	1016.63	1015.44	5.04	After Temp Strands are Released (Top of Girder)
7/11/2006	85	H	1010.05	1009.65	1008.53	4.29	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	H	1016.97	1016.59	1015.44	4.65	Before Deck Pour (Top of Girder)
8/18/2006	85	H	1010.05	1009.59	1008.53	3.60	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	H	1010.03	1009.47	1008.52	2.37	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	H	1010.03	1009.55	1008.50	3.42	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	I	1017.32	1016.95	1015.80	4.68	Pre Strand Release (Top of Girder)
6/14/2006	70	I	1017.32	1017.01	1015.80	5.40	After Temp Strands are Released (Top of Girder)
7/11/2006	85	I	1010.38	1010.00	1008.90	4.29	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	I	1017.27	1016.97	1015.82	5.10	Before Deck Pour (Top of Girder)
8/18/2006	85	I	1010.48	1009.92	1008.87	2.91	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	I	1010.37	1009.82	1008.87	2.34	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	I	1010.36	1009.89	1008.83	3.54	Monthly Monitoring (Bottom of Girder)

Span 8

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
6/10/2006	70	J	1017.62	1017.21	1016.11	4.11	Pre Strand Release (Top of Girder)
6/14/2006	70	J	1017.62	1017.27	1016.11	4.83	After Temp Strands are Released (Top of Girder)
7/11/2006	85	J	1010.70	1010.30	1009.22	4.05	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	J	1017.62	1017.23	1016.10	4.50	Before Deck Pour (Top of Girder)
8/18/2006	85	J	1010.76	1010.20	1009.22	2.52	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	J	1010.69	1010.12	1009.20	2.04	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	J	1010.68	1010.18	1009.19	2.97	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	K	1017.99	1017.63	1016.46	4.92	Pre Strand Release (Top of Girder)
6/14/2006	70	K	1017.99	1017.70	1016.46	5.70	After Temp Strands are Released (Top of Girder)
7/11/2006	85	K	1011.07	1010.68	1009.59	4.17	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	K	1017.99	1017.67	1016.46	5.31	Before Deck Pour (Top of Girder)
8/18/2006	85	K	1011.07	1010.62	1009.57	3.57	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	K	1011.06	1010.50	1009.57	2.16	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	K	1011.05	1010.57	1009.56	3.18	Monthly Monitoring (Bottom of Girder)
6/10/2006	70	L	1018.33	1017.97	1016.82	4.77	Pre Strand Release (Top of Girder)
6/14/2006	70	L	1018.33	1018.05	1016.82	5.67	After Temp Strands are Released (Top of Girder)
7/11/2006	85	L	1011.41	1011.02	1009.94	4.17	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	L	1018.35	1018.03	1016.82	5.34	Before Deck Pour (Top of Girder)
8/18/2006	85	L	1011.40	1010.91	1009.93	2.97	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	L	1011.39	1010.84	1009.92	2.22	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	L	1011.39	1010.91	1009.91	3.09	Monthly Monitoring (Bottom of Girder)

Span 8

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
6/10/2006	70	M	1018.70	1018.37	1017.15	5.31	Pre Strand Release (Top of Girder)
6/14/2006	70	M	1018.70	1018.43	1017.15	6.09	After Temp Strands are Released (Top of Girder)
7/11/2006	85	M	1011.77	1011.45	1010.30	4.95	Monthly Monitoring (Bottom of Girder)
8/16/2006	85	M	1018.71	1018.39	1017.19	5.28	Before Deck Pour (Top of Girder)
8/18/2006	85	M	1011.75	1011.28	1010.32	2.91	One Day After Deck Pour (Bottom of Girder)
10/4/2006	70	M	1011.76	1011.21	1010.28	2.28	Monthly Monitoring (Bottom of Girder)
11/13/2006	40	M	1011.76	1011.28	1010.27	3.18	Monthly Monitoring (Bottom of Girder)

Span 9

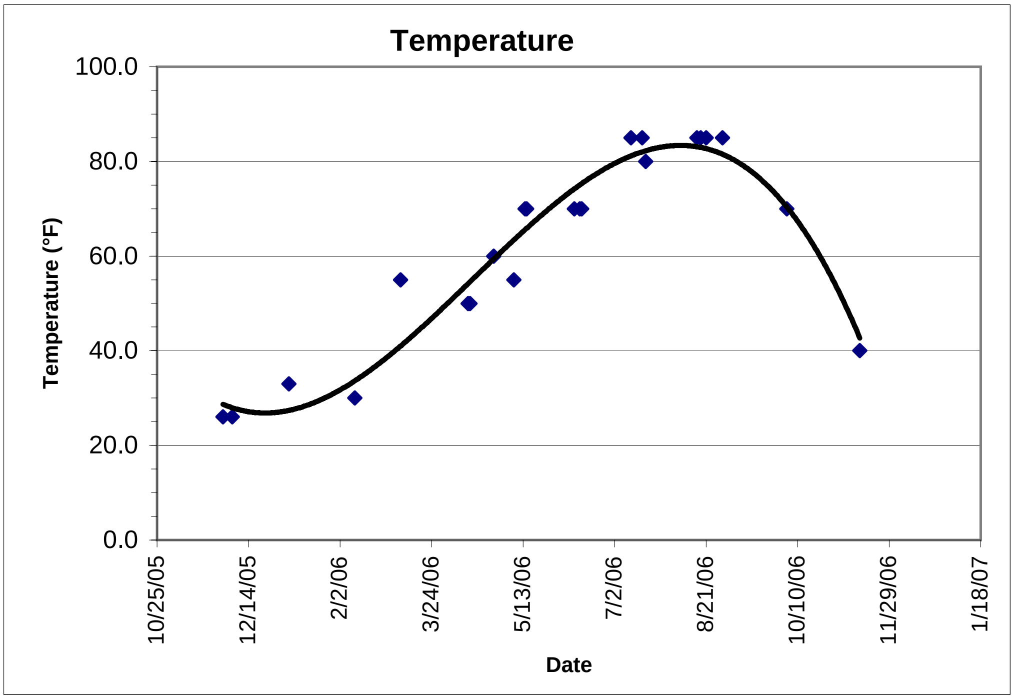
Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
7/17/2006	85	A	1013.32	1012.80	1011.39	5.40	After Temp Strands are Released (Top of Girder)
8/21/2006	85	A	1013.27	1012.70	1011.36	4.62	Before Deck Pour (Top of Girder)
8/30/2006	85	A	1006.30	1005.57	1004.48	2.16	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	A	1006.29	1005.58	1004.47	2.37	Monthly Monitoring (bottom of Girder)
7/17/2006	85	B	1013.41	1012.96	1011.73	4.73	After Temp Strands are Released (Top of Girder)
8/21/2006	85	B	1013.36	1012.88	1011.70	4.20	Before Deck Pour (Top of Girder)
8/30/2006	85	B	1006.43	1005.79	1004.80	2.07	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	B	1006.42	1005.78	1004.79	2.07	Monthly Monitoring (bottom of Girder)
7/17/2006	85	C	1013.73	1013.32	1011.95	5.81	After Temp Strands are Released (Top of Girder)
8/21/2006	85	C	1013.68	1013.22	1011.70	6.36	Before Deck Pour (Top of Girder)
8/30/2006	85	C	1006.72	1006.06	1005.02	2.25	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	C	1006.71	1006.03	1005.02	1.98	Monthly Monitoring (bottom of Girder)
7/17/2006	85	D	1014.09	1013.52	1012.22	4.41	After Temp Strands are Released (Top of Girder)
8/21/2006	85	D	1014.06	1013.44	1011.90	5.52	Before Deck Pour (Top of Girder)
8/30/2006	85	D	1007.10	1006.32	1005.32	1.29	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	D	1007.08	1006.33	1005.31	1.62	Monthly Monitoring (bottom of Girder)
7/17/2006	85	E	1014.41	1013.90	1012.57	4.98	After Temp Strands are Released (Top of Girder)
8/21/2006	85	E	1014.36	1013.78	1012.53	3.99	Before Deck Pour (Top of Girder)
8/30/2006	85	E	1007.43	1006.68	1005.65	1.68	One Day After Deck Pour (Bottom of Girder)
11/13/2006		E	1007.42	1006.68	1005.63	1.83	Monthly Monitoring (bottom of Girder)

Span 9

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
7/17/2006	85	F	1014.74	1014.26	1012.87	5.46	After Temp Strands are Released (Top of Girder)
8/21/2006	85	F	1014.69	1014.16	1012.83	4.77	Before Deck Pour (Top of Girder)
8/30/2006	85	F	1007.86	1007.06	1005.98	1.68	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	F	1007.74	1007.03	1005.97	2.07	Monthly Monitoring (bottom of Girder)
7/17/2006	85	G	1015.15	1014.55	1013.30	3.90	After Temp Strands are Released (Top of Girder)
8/21/2006	85	G	1015.11	1014.50	1013.26	3.84	Before Deck Pour (Top of Girder)
8/30/2006	85	G	1008.16	1007.43	1006.35	2.10	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	G	1008.12	1007.33	1006.34	1.23	Monthly Monitoring (bottom of Girder)
7/17/2006	85	H	1015.52	1014.92	1013.61	4.26	After Temp Strands are Released (Top of Girder)
8/21/2006	85	H	1015.46	1014.84	1013.57	3.87	Before Deck Pour (Top of Girder)
8/30/2006	85	H	1008.50	1007.68	1006.70	0.96	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	H	1008.48	1007.66	1006.68	0.90	Monthly Monitoring (bottom of Girder)
7/17/2006	85	I	1015.82	1015.30	1014.01	4.62	After Temp Strands are Released (Top of Girder)
8/21/2006	85	I	1015.78	1015.22	1013.95	4.26	Before Deck Pour (Top of Girder)
8/30/2006	85	I	1008.82	1008.10	1007.09	1.74	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	I	1008.80	1008.03	1007.17	0.54	Monthly Monitoring (bottom of Girder)
7/17/2006	85	J	1016.14	1015.65	1014.32	5.04	After Temp Strands are Released (Top of Girder)
8/21/2006	85	J	1016.11	1015.57	1014.29	4.44	Before Deck Pour (Top of Girder)
8/30/2006	85	J	1009.19	1008.44	1007.38	1.83	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	J	1009.18	1008.35	1007.37	0.90	Monthly Monitoring (bottom of Girder)

Span 9

Date Surveyed	Temp (F)	Girder	West Pier Elev	Midspan Elev	East Pier Elev	Camber (in)	Comment
7/17/2006	85	K	1016.58	1015.95	1014.63	4.14	After Temp Strands are Released (Top of Girder)
8/21/2006	85	K	1016.54	1015.88	1014.59	3.84	Before Deck Pour (Top of Girder)
8/30/2006	85	K	1009.54	1008.78	1007.73	1.74	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	K	1009.52	1008.72	1007.71	1.23	Monthly Monitoring (bottom of Girder)
7/17/2006	85	L	1016.89	1016.29	1015.00	4.14	After Temp Strands are Released (Top of Girder)
8/21/2006	85	L	1016.85	1016.21	1014.94	3.78	Before Deck Pour (Top of Girder)
8/30/2006	85	L	1009.88	1009.09	1008.06	1.44	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	L	1009.87	1009.01	1008.05	0.60	Monthly Monitoring (bottom of Girder)
7/17/2006	85	M	1017.26	1016.74	1015.34	5.28	After Temp Strands are Released (Top of Girder)
8/21/2006	85	M	1017.22	1016.68	1015.29	5.13	Before Deck Pour (Top of Girder)
8/30/2006	85	M	1010.25	1009.48	1008.43	1.68	One Day After Deck Pour (Bottom of Girder)
11/13/2006	40	M	1010.24	1009.40	1008.40	0.99	Monthly Monitoring (bottom of Girder)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3/24/06
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7/2/06
8/21/06
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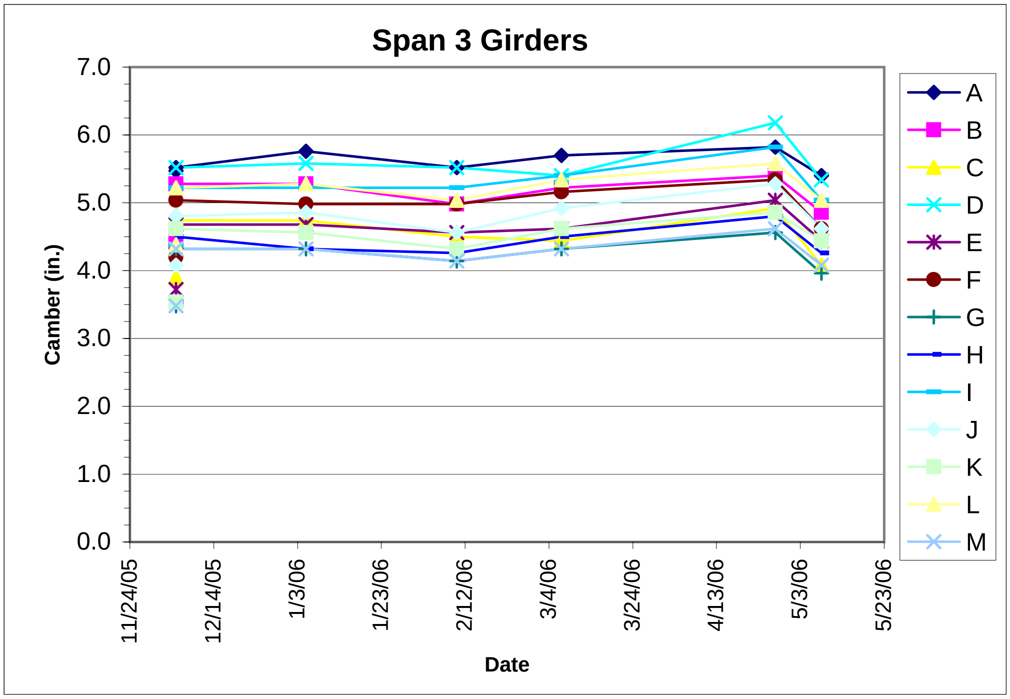
11/29/06
1/18/07
Date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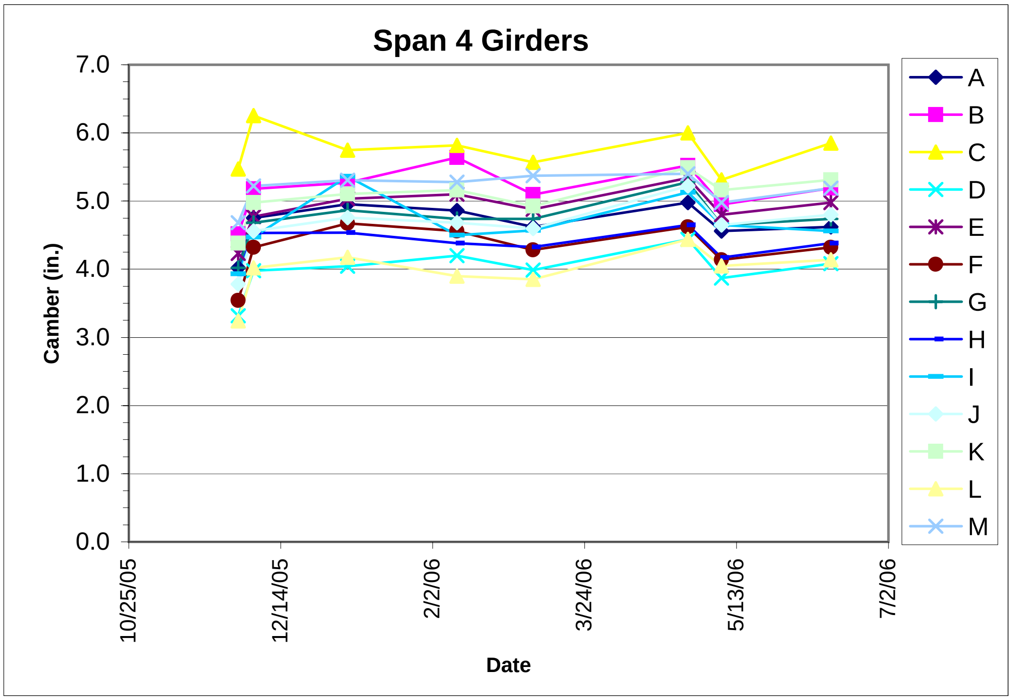
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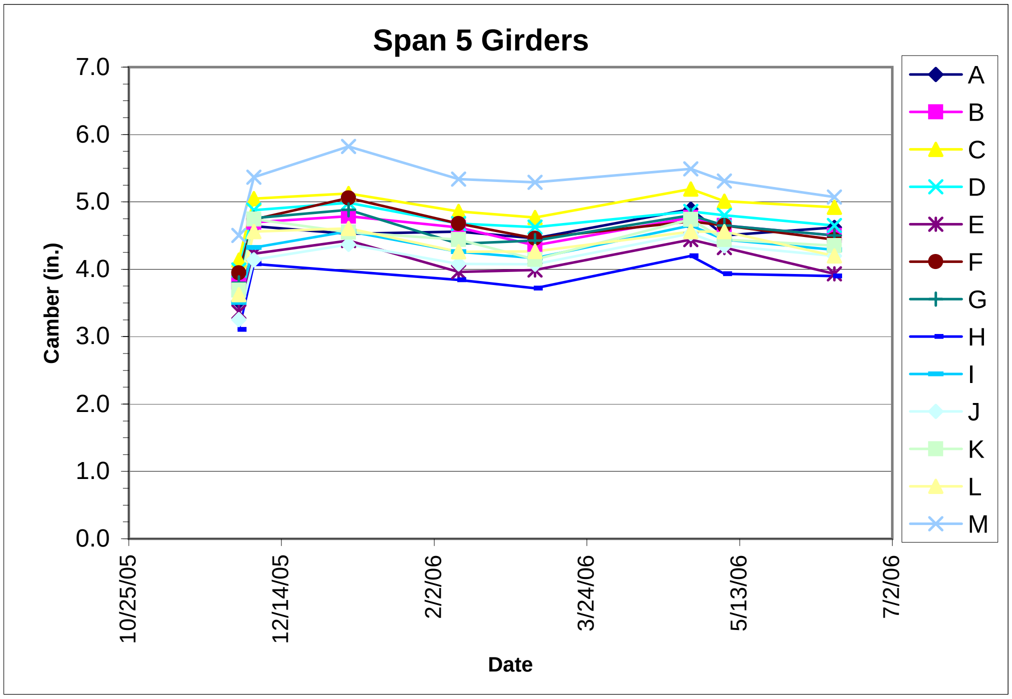
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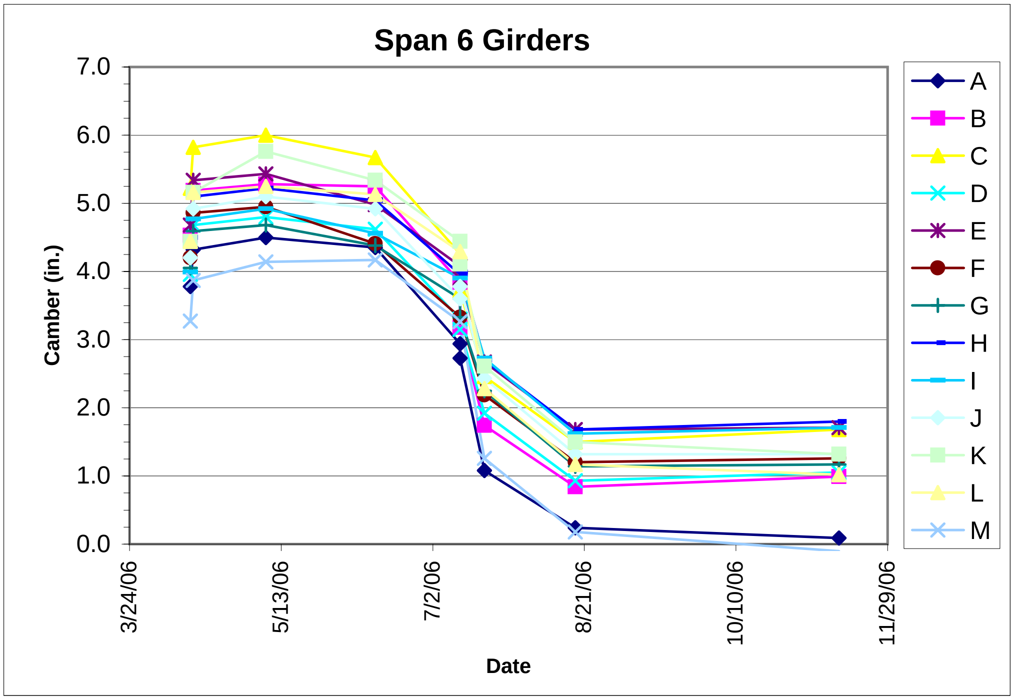
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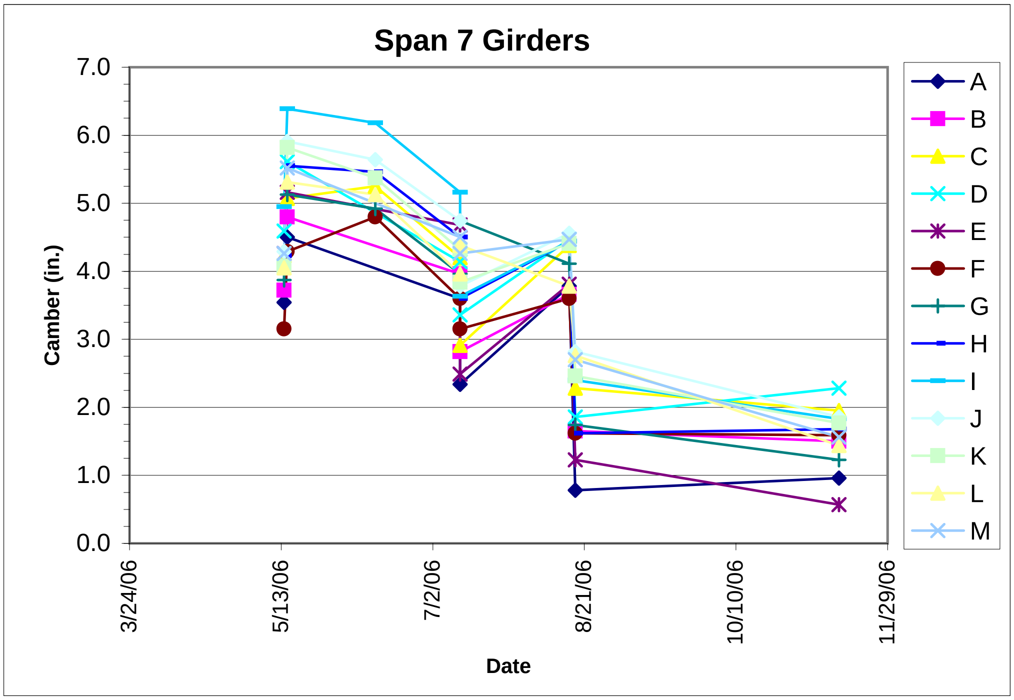
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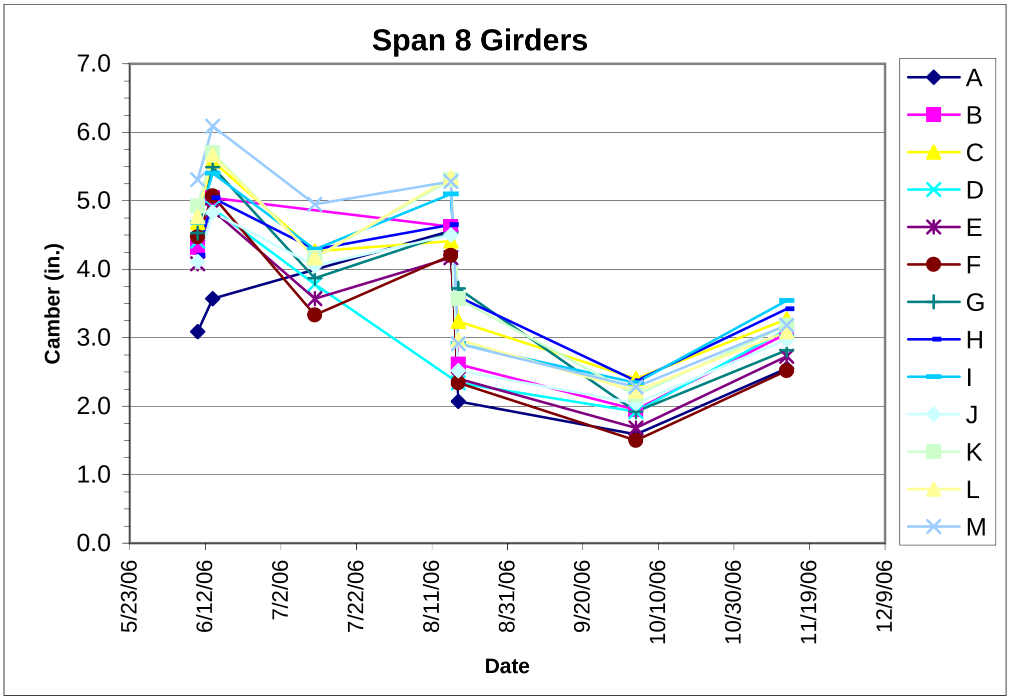
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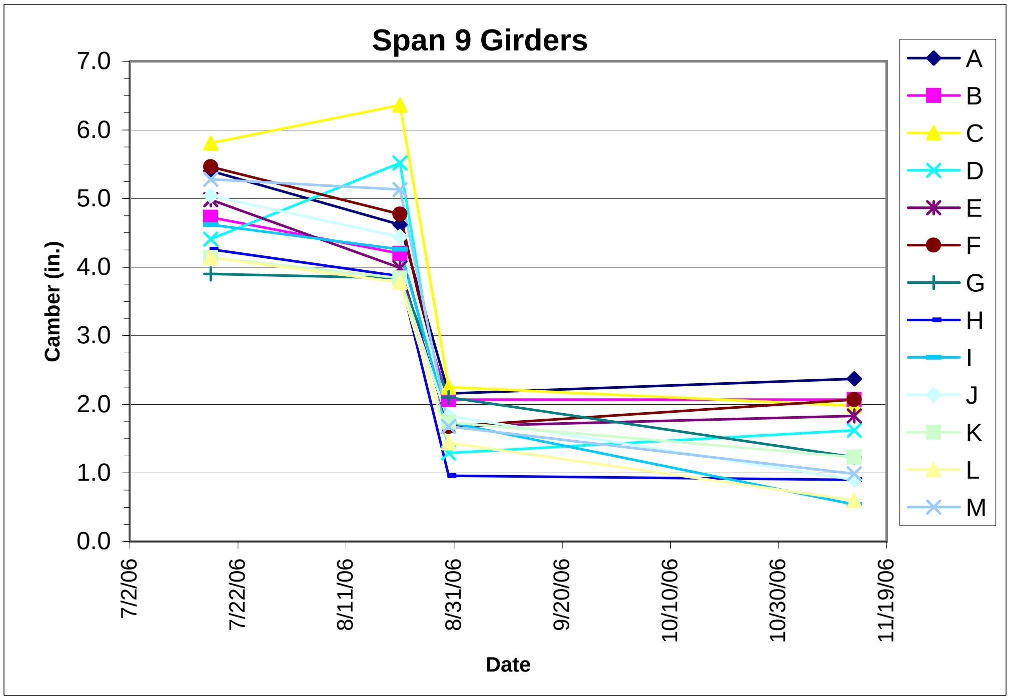
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4.0
3.0
2.0
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7/22/06
8/11/06
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