STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

TECHNICAL REPORT DOCUMENTATION PAGE

TR0003 (REV. 10/98)

1. REPORT NUMBER	2. GOVERNMENT ASSOCIATION NUMBER	3. RECIPIENT'S CATALOG NUMBER
CA10-1131		

4. TITLE AND SUBTITLE	5. REPORT DATE
Creep And Drying Shrinkage Of High Performance Concrete For The Skyway Structures Of The New San Francisco – Oakland Bay Bridge And Cement Paste	April 30, 2011
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Akthem Al-Manaseer, Abdullah Fayyaz	SJSU ALM - 117

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. WORK UNIT NUMBER
Department of Civil and Environmental Engineering San Jose State University One Washington Square San José, California 95192-0083	11. CONTRACT OR GRANT NUMBER DRI Research Task No. 1131 Contract No. 59A0632

12. SPONSORING AGENCY AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
California Department of Transportation Engineering Service Center 1801 30th Street, MS 9-2/5i Sacramento, California 95816 California Department of Transportation Division of Research and Innovation, MS - 83 1227 O Street Sacramento, California 95814	Final Report 1/28/2008-2/28/2011 14. SPONSORING AGENCY CODE 913

15. SUPPLEMENTAL NOTES

Prepared in cooperation with the State of California Department of Transportation.

16. ABSTRACT

The objective of this study was to determine the influence of admixtures on long term drying shrinkage and creep of high strength concrete (HSC). Creep and shrinkage of the mix utilized in segments of the Skyway Structure of the San Francisco-Oakland Bay Bridge was also monitored.

Cement paste alone was investigated to remove the effect of aggregate on shrinkage as to the effect of individual admixtures on drying shrinkage of HSC.

This study reveals that the type and amount of admixture are key factors that can affect the drying shrinkage, creep and compressive strength. The mixtures used showed that most of the drying shrinkage occurs during the first 100 days after mixing.

17. KEY WORDS	18. DISTRIBUTION STATEMENT	
Admixture, Bay Bridge, Compressive Strength, Drying Shrinkage, San Francisco-Oakland	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161	
19. SECURITY CLASSIFICATION (of this report)	20. NUMBER OF PAGES	21. PRICE
Unclassified	231 pages	

San Jose State University
Department of Civil Engineering
One Washington Square
San Jose, CA 95192

CREEP AND DRYING SHRINKAGE OF HIGH PERFORMANCE CONCRETE FOR THE SKYWAY STRUCTURES OF THE NEW SAN FRANCISCO – OAKLAND BAY BRIDGE AND CEMENT PASTE

Final Report
Report No. CA 10-1131

Dr. Akthem Al-Manaseer, Professor
Mr. Abdullah Fayyaz, Graduate Student
Mr. Ric Maggenti, Technical Advisor, Caltrans
Mr. Peter Lee, Project Manager, Caltrans

March 2011
Final Report Submitted to the
California Department of Transportation (Caltrans)
under Contract No. 59A0632

DISCLAIMER STATEMENT

This document is disseminated in the interest of information exchange. The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This publication does not constitute a standard, specification or regulation. This report does not constitute an endorsement by the Department of any product described herein.

For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette, or compact disk. To obtain a copy of this document in one of these alternate formats, please contact: the Division of Research and Innovation, MS-83, California Department of Transportation, P.O. Box 942873, Sacramento, CA 94273-0001.

ACKNOWLEDGEMENT

The authors would like to thank many students of SJSU who participated in this project. Special thanks to Mr. Greg Thiebaut for preparing the mixes and taking the initial readings. Also, our appreciation to Ms. Faranak Mahdavi, who worked on this project and utilized part of the data for her MSc work.

ABSTRACT

The objective of this study was to determine the influence of admixtures on long term drying shrinkage and creep of high strength concrete (HSC). Creep and shrinkage of the mix utilized in segments of the Skyway Structure of the San Francisco-Oakland Bay Bridge was also monitored.

Cement paste alone was investigated to remove the effect of aggregate on shrinkage as to the effect of individual admixtures on drying shrinkage of HSC.

This study reveals that the type and amount of admixture are factors that can affect the drying shrinkage, creep and compressive strength. The mixtures used showed that most of the drying shrinkage occurs during the first 100 days after mixing.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

NOMENCLATURE

Organizations

ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
PCA	Portland Cement Association

Units

lb/cyd	Pounds per Cubic Yard
pcf	Pounds per Cubic Foot
psi	Pounds per Square Inch

Abbreviations

G	Grace
HRWR	High-Range Water Reducer
LRWR	Low-Range Water Reducer
MB	Master Builder
SRA	Shrinkage Reducing Admixture

Symbols

A/cm	Aggregate-to-Cementitious Materials Ratio by Weight
CA/FA	Coarse Aggregate-to-Fine Aggregate Ratio by Weight
E_c	Modulus Property of Concrete, psi
f_c’	Compressive Strength of Concrete at 28-day
w/cm	Water-to-Cementitious Materials Ratio by Weight

CHAPTER 1

Introduction

1.1 Influence of Admixtures on Drying on Cement Paste and High Strength Concrete

Concrete is used extensively in construction, because it can be formed in different shapes and sizes. Concrete tends to shrink when it is subjected to drying environment, which may cause cracking due to restraining, or as in the case of prestressed structural elements result in prestress losses as well as undesirable geometry changes. Several methods are utilized to control shrinkage cracking including utilizing expansive cement, fiber reinforced concrete, secondary reinforcement, or expansion joints.

The effect of different mineral and chemical admixtures, especially shrinkage reducing admixture (SRA) on the drying shrinkage of concrete, were studied in this investigation. Drying shrinkage was measured by ASTM C 157, “Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.” Creep of mixes with Shrinkage Reducing Admixture were also studied. Shrinkage was measured in cement paste and concrete samples up to 9 years. Creep for the mix used in the segments of the Skyway Structure of the new east spans of the San Francisco-Oakland Bay Bridge was also determined over 2500 days or 7 years.

1.2 Objectives

The main objective of this investigation was to study the effect of chemical and mineral admixtures on drying shrinkage and creep of HSC. The pastes were utilized to eliminate the effects of aggregate to better focus on the effect of admixtures on drying shrinkage of HSC.

1.3 Scope

Eighty-one different cementitious paste mixes were prepared to study the effect of admixtures on drying shrinkage. The effect of admixtures in concrete was studied using thirty-four concrete mixes. Six additional mixes, including the mix from the Skyway Structure of the new east spans of the San Francisco-Oakland Bay Bridge were studied for creep.

1.4 Report Outline

This report consists of five chapters. Chapter 1 describes objectives, scope and also the outline of the research. Chapter 2 contains a review of shrinkage of HSC. Chapter 3 describes the effect of chemical and mineral admixtures on drying shrinkage of cementitious paste. Chapter 4 contains the effect of chemical and mineral admixtures on drying shrinkage and compressive strength of HSC. Chapter 5 discusses the effects of Shrinkage reducing admixture on creep in concrete mixes.

CHAPTER 2

Review of Shrinkage of HSC

2.1 Introduction

Shrinkage, a volume reduction, is a characteristic of concrete. Drying Shrinkage is a shrinkage that takes place after hardening and is a result of moisture loss. Shrinkage Reducing Admixtures, SRA, were developed to reduce this type of shrinkage. There are several other types of shrinkage observed in concrete that include Plastic Shrinkage, Thermal Contraction due to decreased temperature, Autogenous Shrinkage, and Carbonation Shrinkage.[(1)] These other types were not included in the scope of laboratory testing in this project.

Plastic shrinkage is the rapid evaporation of water from the surface of the concrete while the underlying plastic concrete remains at the same volume. Drying Shrinkage is the moisture loss after concrete hardens. Thermal Contraction is the change of the volume of the concrete because of the change of the temperature. Autogenous Shrinkage is the chemical reactions that occur during cement hydration. Carbonation Shrinkage occurs when the calcium hydroxide in the hardened matrix reacts chemically with the carbon dioxide in the atmosphere after hardening.

Drying shrinkage is a result of loss of moisture from concrete; therefore, drying shrinkage is inevitable except for concrete in water or in an environment with 100% humidity. Chemical admixtures have been developed to reduce this volume change.

Several factors influence the drying shrinkage of concrete. The most significant being the total water content in a mix. Other factors include: water-to-cement ratio, composition and

fineness of cement, amount of cementitious materials, aggregate, and admixtures. The size and shape of specimen, temperature, and humidity change also affect the rate of drying shrinkage. Hard, rigid aggregate such as dolomite, limestone, quartz, granite, feldspar are difficult to compress and thus reduce drying shrinkage.

HSC is defined by the American Concrete Institute (ACI) as a concrete with a compressive strength greater than 6000 psi (42 MPa).[2] A structure with HSC requires less volume of concrete than a structure with normal-strength concrete.

It is made with relatively low w/cm ratio (usually less than 0.35). In order to produce a HSC chemical and mineral admixtures are incorporated into the mix.

2.2 Materials and Proportioning

HSC consists of the same main constituents as normal-strength concrete: coarse and fine aggregate, cement, water, and admixtures.[3] The strength of the concrete depends upon many factors. Water-to-cement ratio is the most important factors affecting the strength of the concrete. The size and shape of the aggregates are also key factors to increase the strength of the concrete. The addition of high range water reducing admixture allows achieving low w/cm ratios needed for HSC without increasing the cementitious contents beyond 800 lbs/cy.

2.2.1 Cement

The Cement utilized in this project was Portland Cement Type I/II. Three major constituents of cement are: Tricalcium silicate, Dicalcium silicate, and Tricalcium aluminate. Tetra calcium aluminoferrite is a fourth compound typical found except in white Portland cements used for architectural purposes. Hydration of cement is a chemical process: therefore the rate of hydration

depends on the fineness of cement particles. The finer the grind, the greater the tendency for drying shrinkage.

2.2.2 Cement Paste

Abrams law states that the quality of the cement paste controls the strength of the concrete; the paste quantity effects strength only as it effects the water to cement ratio and therefore the quality of the paste. A 0.33 w/cm ratio was used as a constant variable in concrete and paste samples for majority of study. The 0.33 w/cm ratio produced more than 10,000 psi concrete with only 631 lb/cy cementitious. A few samples were fabricated with higher cementitious contents of 675 and 702 lb/cy.

2.2.3 Aggregates

Most of the volume in concrete is occupied by aggregate, sometimes more than 75%. The strength of the aggregate and the bond between aggregate and cement affect the compressive strength of the concrete. Hard and strong coarse aggregates such as quartzite, feldspar, dolomite, limestone, granite, or fine-grained traprock are preferred for HSC because they do not break down. Research shows using coarse aggregate such as diabase and limestone can produce concrete with higher strength and elastic modulus than those using granite and river gravel.[5]

Fine aggregate has a larger surface area than coarse aggregate; therefore, it has more effect on the amount of water required and the properties of the paste. The bond of the paste to fine aggregate is less critical than the bond of the paste to coarse aggregate because of large surface area of fine aggregate. Coarse sand with a fineness modulus of about 3.0 will produce the best workability and highest compressive strength.

Coarse aggregate occupies the largest volume in a concrete mixture. The amount of the coarse aggregate in a concrete mixture depends on the amount of fine aggregate. Concrete should be proportioned so that paste can cover all the aggregates and the voids between the particles.

2.2.4 Mixing Water

The quality of water is important because impurities in the water may interfere with the setting of the cement, may adversely affect the strength of the concrete or cause staining of its surface, and may also lead to corrosion of the reinforcement.

2.2.5 Chemical Admixtures

Shrinkage reducing admixture was developed in Japan by Nihon Cement Co., Ltd, in1982. In 1985, Goto et al. were awarded a patent for this invention in U.S.[(6)] The main component of the SRA developed by Goto et al. is polyoxyalkylene alkyl ether, a lower alcohol alkyleneoxide adduct.

Shrinkage reducing admixture reduces capillary tension and tensile forces within concrete pores as concrete dries.

Shrinkage reducing admixture is compatible with all conventional air entraining agents, water reducers, superplasticizers, set retarders, accelerators, silica fume admixtures.

In general, SRA reduces drying shrinkage, drying shrinkage cracking, and improves aesthetics, water tightness, and durability.

2.2.6 Mineral Admixtures

Mineral admixtures or pozzolans are added to concrete to improve hardened properties of the concrete. Pozzolans are defined in ASTM Standard Definition C 219 as a siliceous or siliceous and aluminous materials, which have little or no cementitious value by themselves but become cementitious as they react with the calcium produced as a by product of Portland cement. As cement hydrates, calcium hydroxide reacts with water at ordinary temperature, and causes pozzolans to form compounds possessing cementitious properties.[7] Common types of pozzolans are fly ash, silica fume, calcine clay such as metakaolin, slag and natural pozzolans such as volcanic ash. Supplementary Cementitious Materials or SCMs are mineral admixtures.

Fly ash is a by-product of the combustion of pulverized coal in thermal power plants. Fly ash particles are spherical, so they decrease the water demand for the mix and increase the compressive strength. Fly ash with higher fineness and higher pozzolanic index produce higher compressive strength and modulus of elasticity.

Silica fume is composed of fine, solid, glassy spheres of silicon dioxide. Silica fume reduces permeability and improves durability. Silica fume and fly ash can be substituted for a percentage of Portland cement. Silica fume increase the strength of the concrete by increasing the strength of cement paste and possibly by strengthening the bond between cement paste and aggregate. Silica fume along with superplasticizers has been used to produce concrete with higher strength and durability.[8]

Metakaolin is calcine clay. Kaolin is a fine, white, clay mineral that has been used in the manufacture of porcelain. Metakaolin is a supplementary cementing material like fly ash and silica fume.

2.3 Mixing and Placing

2.3.1 Mixing

The procedure for mixing normal strength concrete is similar to that required for HSC and is described by ACI 211.1.

2.3.2 Placing

HSC may require more care in placing than normal concrete depending on the mix design.

2.3.3 Curing

Concrete must be properly cured for an adequate time to achieve proper strength and durability. The chemical reaction between cement and water or "hydration" is responsible for the strength-producing properties of cement paste. Time, temperature, and moisture condition affect hydration. In the beginning hydration occurs rapidly, but with time the rate becomes slower. HSC can be a concrete with w/cm ratio less than 0.30 required for hydration of cement.[9] However, a water-curing method during the first 24 hours provides additional water needed to help continue hydration afterward. Internal curing methods that use highly absorptive aggregate have also been used.

2.3.4 Testing

Standard ASTM procedures were used for sampling, molding, curing, and testing of cylinders.[10],[11],[12]

Cylinders provided for this study were 4 x 8-in. (100 x 200-mm) and 6 x 12-in. (150 x 300-mm). Malhotra in 1976 has done some research on the effect of specimen size on compressive strength Field sample comparison between 4x8-in.and 6x12-in. have been

performed by Caltrans. 4 x 8-in. (100 x 200-mm) cylinders are acceptable as substitute for 6 x 12-in. cylinders, as smaller cylinders appear to give slightly higher compressive strengths.

2.4 Properties

Tensile strength, modulus of rupture, and elastic modulus of the concrete are related to compressive strength of the concrete. Shrinkage and creep are time dependent properties of concrete.

2.4.1 Compressive Strength

HSC has been defined as a concrete having a compressive strength in the range from 6000 psi to 15000 psi (42-100 MPa). A minimum of two specimens was tested for each age according to ASTM C 157. Testing HSC for compressive strength puts into doubt a certain number of concrete testing practices. Most concrete laboratories are equipped with loading capacity machines inadequate for testing 6 x 12-in. (150 x 300-mm) cylinders, thus limiting HSC specimens to 4 x 8-in. (100 x 200-mm) size. HSC compressive strength values in 4 x 8-in. cylinders have been reported as greater by 5%.[13] and as low as 2% by Caltrans in recently published research.

CHAPTER 3

Effect of Admixtures on Cement Paste

3.1 Introduction

This chapter describes the effects of various types of admixtures on the drying shrinkage of cement paste, so that a better understanding of shrinkage of concrete can be obtained in the next chapter. The cement pastes included in this study contain cement, water, and mineral and chemical admixtures. Three mineral admixtures were used. These are fly ash class F, silica fume, and metakaolin. Four types of chemical admixtures produced by two separate manufacturers were utilized. These are shrinkage reducing admixture, high-range water-reducing admixture, low-range water reducing admixture, and a retarder or stabilizer. Tests were conducted to evaluate shrinkage, expansion of the cementitious paste with different admixtures according to ASTM C 157.

3.2 Properties of Cement Paste Constituents

3.2.1 Cement

ASTM type I/II Portland cement was used in this study. The cement meets ASTM C 150 specifications. Chemical compositions and physical properties of the cement are given in Table 3-1.

3.2.2 Admixtures

The admixtures used in this study were divided in two categories:

1) Mineral Admixtures

   A. Fly Ash class F- normally produced from burning anthracite bituminous coal and this class fly ash has pozzolanic properties. The chemical and physical compositions of the fly ash are given in Table 3-2 in accordance to ASTM C 618.

   B. Silica Fume- very fine non-crystalline silica (SiO2) produced by electric arc furnaces as a by-product of the production of metallic silicon or ferrosilicon alloys. The chemical composition and physical properties of the silica fume are given in Table 3-3.

   C. Metakaolin (calcine clay, class N)- is calcined kaolin clay with approximately 1.5% loss on ignition, and contains less than 1% quartz. The chemical and physical compositions of the metakaolin are given in Table 3-4.

2) Chemical admixtures

   W.R. Grace Products:

   A. SRA-G (Eclipse) is a shrinkage-reducing admixture

   B. HRWR-G (ADVA-100, superplasticizer) is high-range water-reducing admixture in accordance to ASTM C 494-90.

C. LRWR-G (WRAD-64) is a low-range water-reducing admixture. It is an admixture that reduces the quantity of mixing water required to produce concrete of a given consistency. It meets ASTM C 494-90.

Master Builder Products, which is now BASF:

A. SRA-MB (Tetraguard-AS20) is a shrinkage-reducing admixture, no ASTM specifications available at this time. It is an admixture that reduces the drying shrinkage.

B. HRWR-MB (Rheobuild-3000 FC) is high-range water-reducing admixture, meets the specification of ASTM C 494 Type A and F.

C. Retarder-MB (Delvo Stabilizer, hydration control admixture) is a retarding admixture, meets the specification of ASTM C 494 Type B and D. It is an admixture that retards the setting time of concrete.

3.3 Mix Design

A total of eighty-one cement paste mixes were made in this study to investigate the effect of different types of admixtures. The cement pastes were made with type I/II Portland cement and mostly have water-to-cementitious material ratio (w/cm) of 0.33. Table 3-5 and Table 3-6 describe the mix compositions and proportions.

3.4 Mixing Procedure

All cement pastes were mixed at room temperature using a three-speed kitchen mixer. The sequence of mixing began with adding mineral admixtures to the cement, next the chemical admixtures, and then the tap water. All mixtures were mixed for three minutes.

Two cement paste prisms with dimensions 1 x 1 x 11 ¼ -in. (25 x 25 x 285-mm) and one 2 x 4-in. (50 x 100-mm) cylinder were prepared for each mix in accordance to ASTM C157.

The cement paste prisms were left to cure for 24 hours at room temperature while they were covered with a plastic sheet. The specimens were then demolded and initial reading was taken by using the length changes measurement device (comparator) in accordance to ASTM C 490. The specimens were placed in water in a 100% humidity room for six days and a second reading was then taken. The second reading was used to calculate all volume changes in this study.

The specimens were then placed in a controlled room temperature of

73.4° ± 3°F (23° ± 1.7°C) with a relative humidity of 50% ± 4%. Shrinkage reading was taken at different time intervals up to 180 days. Shrinkage calculations were determined in accordance to ASTM C 157.

3.5 Test Results and Discussion

Shrinkage data versus age are plotted and tabulated in Appendix I and Appendix II. Shrinkage data versus age up to 2500 days for cement pastes with 0.33 w/cm ratios with the initial reading taken after seven days are plotted in Appendix I

The data and graphs described in this chapter are from the results of Appendix I. The effect of different admixtures on the shrinkage of cement paste is shown in Figures 3-1 through 3-13.

3.5.1 High Range Water Reducer

The effect of two different HRWR admixtures on drying shrinkage of cement paste mixes is shown in Figure 3-1 and Figure 3-2. HRWR-G caused a decrease in drying shrinkage while the addition of HRWR-MB resulted in an increase in drying shrinkage The drying shrinkage for cement paste specimens with 0.4% and 0.8% HRWR-G decreased by 10% and 16% respectively when compared to specimens with no HRWR-G. Mixes containing 0.2% to 1.0% HWRW-MB resulted in an increase in drying shrinkage of 6% when compared to similar mixes but with no HRWR-MB.

3.5.2 Low Range Water Reducer

Figure 3-3 shows the drying shrinkage versus age of cement pastes with varying LRWR-G percentages of 0.1%, 0.2% and 0.3%. The addition of LRWR-G showed no change in drying shrinkage when compared to the control mix containing no LRWR-G. The figure also shows that LRWR-G at dosages of 0.1%, 0.2% and 0.3% in combination with 0.4% HRWR-G has no effect on drying shrinkage

3.5.3 Shrinkage Reducing Admixture

The drying shrinkage versus age of cement paste with varying dosages of SRA-G is shown in Figure 3-4. The addition of SRA-G at 0.5%, 1.5% and 2.5% resulted in decrease of

drying shrinkage by 18%, 30% and 22%, respectively when compared to specimens containing no SRA-G. Figure 3-5 shows the drying shrinkage versus age of cement pastes with SRA-MB. The addition of SRA-MB at 0.5%, 1.5% and 2.5% reduced drying shrinkage by 29%, 38% and 42%, respectively when compared to specimens containing no SRA-MB. The use of SRA-MB was more effective in drying shrinkage reduction compared to SRA-G of similar dosages.

Figure 3-6 shows the drying shrinkage versus age of cement paste with varying dosages of SRA-G of 0.5%, 1.5% and 2.5% and 0.4% HRWR-G. The addition of 0.5% and 1.5% SRA-G, caused no significant change in drying shrinkage while addition of 2.5% SRA-G, reduced drying shrinkage by 32% when compared to specimen with no SRA-G. Figure 3-7 shows the drying shrinkage versus age of cement paste with different dosages of SRA-MB at 0.5%, 1.5% and 2.5% and 0.6% HRWR-MB. The addition of SRA-MB at percentages of 0.5%, 1.5% and 2.5%, resulted in drying shrinkage reduction of 30%, 33% and 42% respectively when compared to mixes with no SRA-MB.

The drying shrinkage versus age of cement paste specimen with varying SRA-G of 0.5%, 1.0% , 1.5% and 2.5% with 0.4% HRWR-G and 0.2% LRWR-G are shown in Figure 3-8. The addition of SRA-G at 0.5%, 1%, 1.5% and 2.5% reduced drying shrinkage by 17%, 13%, 33%, and 38%, respectively when compared to specimen containing no SRA-G.

3.5.4 Metakaolin

The drying shrinkage versus age of cement paste with MK replacements of 10%, 20% and 30% and 0.2% HRWR-G is shown in Figure 3-9. No change in drying shrinkage was observed between the specimens having different MK percentages.

3.5.5 Silica Fume

Figure 3-10, shows drying shrinkage versus age of cement paste with varying SF content and 0.2% HRWR-G. The addition of SF at dosages of 10%, 20% and 30%, increased drying shrinkage by 33%, 52% and 83% respectively when compared to similar specimen with no SF.

3.5.6 Fly Ash

The drying shrinkage versus age of cement paste with FA content of 20%, 25%, 30% and 35% in combination with 0.2% HRWR-G is shown in Figure 3-11. The specimens showed no change in drying shrinkage for the first 1000 days, when compared with specimen containing no FA. The cement paste specimens showed an unexplained significant increase in the rate of drying shrinkage after 1000 days with increasing amounts of FA. At 2500 days, the drying shrinkage increased by 6%, 9%, 16% and 24% at FA percentages of 20%, 25%, 30%, 35% respectively when compared to specimens with no FA. This trend was not reproduced in the concrete samples where FA portions were varied.

Figure 3-12 shows a comparison of drying shrinkage of specimens containing different FA content, SRA-G, MK and HRWR-G after 2500 days. It can be observed from the figure that the higher FA content consistently increased drying shrinkage in all mixes though not nearly as much as those samples shown in Figure 3-11. The addition of 5% SF to mixes containing 0.2% HRWR-G with varying FA content showed a slight increase in drying shrinkage when compared to mixes with no SF. The addition of 5% MK, 0.2% HRWR-G and 1% SRA-G with different FA content caused a significant decrease in drying shrinkage when compared to mixes with similar FA content combined with 5% SF and 0.2% HRWR-G.

Increasing the dosage of SRA-G from 1% to 2.5% in mixes containing MK caused an increase in drying shrinkage

3.5.7 Stabilizers

The effect of stabilizers was studied at different dosages of 0.1% and 0.2% as shown in Figure 3-13. The stabilizers have no effect on drying shrinkage when used in these two percentages.

3.6 Conclusions for Drying Shrinkage in Cement Paste

The results from the study on cement paste are summarized as follows:

1. The addition of HRWR-G in dosages varying from 0.4% to 0.8% reduced drying shrinkage by 10% to 16% respectively. The use of HRWR-MB with dosages varying from 0.2% to 1% had no effect on drying shrinkage

2. SRA-G in dosages varying from 0.5% to 2.5% reduced drying shrinkage by 18% to 30%. The maximum effect was observed at a dosage of 1.5%. The use of SRA-G at dosages varying between 0.5 to 2.5% with 0.6% HRWR-G reduced drying shrinkage by 30 to 42%, respectively. The addition of SRA-G at dosages varying from 0.5% to 2.5%, in combination with 0.4% HRWR-G and 0.2% LRWR-G reduced drying shrinkage by 38%.

3. SRA-MB utilized at dosages varying from 0.5% to 2.5% was found to reduce drying shrinkage by 29% to 42%. The addition of SRA-MB in dosages varying between 0.5% to 1.5% and 0.4% HRWR has no effect on drying shrinkage of the pastes. SRA-MB dosage of 2.5% with 0.4% HRWR reduces drying shrinkage by 32%.

4. The addition of LRWR-G at dosages varying between 0.1% to 0.3% had no effect on drying shrinkage LRWR-G, in dosages of 0.1% to 0.3% with 0.4% HRWR-G dosage has no effect on drying shrinkage

5. The replacement of cement by MK at percentages of 10%, 20% and 30%, with 0.2% HRWR-G, had no effect on drying shrinkage

6. The replacement of cement by SF at percentages of 10%, 20% and 30% increased drying shrinkage by 33%, 52% and 83% respectively.

7. The replacement of cement by FA at percentages of 20%, 25%, 30% and 35% increased drying shrinkage by 6%, 9%, 16% and 24%, respectively, but this increase is only after a sudden

increase in the rate of shrinkages after 3 years. An anomaly in testing procedure or storage can not be ruled out without further investigation.

8. The addition of 5% SF in mixes containing 0.2% HRWR-G with varying FA content resulted in small increase in drying shrinkage compared to specimens with no SF at similar FA content.

9. The addition 5% MK and 1% SRA-G in mixes containing 0.2% HRWR-G significantly decreased drying shrinkage when compared to mixes containing 0.2% HRWR-G at similar FA replacements.

10. The use of stabilizers is found to have no effect on drying shrinkage on cement paste at dosages of 0.1% and 0.2%.

Table 3-1 – Properties of Type II cement

Chemical Composition%	**Type II cement**	**ASTM C 150 Specification for Type I Cement**	**ASTM C 150 Specification for Type II Cement**
Silicon Dioxide (SiO_2)	21.73	-	20.0 min
Aluminum Oxide (Al_2O_3)	4.12	-	6.0 max
Ferric Oxide (Fe_2O_3)	3.48	-	6.0 max
Calcium Oxide (CaO)	63.75	-	-
Magnesium Oxide (MgO)	1.72	6.0 max	6.0 max
Sulfur Trioxide (SO_3)	2.59	3.0 max	3.0 max
Loss on Ignition	1.33	3.0 max	3.0 max
Sodium Oxide (Na_2O)	0.31	-	-
Potassium Oxide (K_2O)	0.44	-	-
Equivalent Alkalies (Na_2O + 0.658 K_2O)	0.6	0.6 max	0.6 max
Insoluble Residue	0.23	0.75 max	0.75 max
Compound Composition%			
Dicalcium Silicate (C_2S)	21.31	-	-
Tricalcium Silicate (C_3S)	54.34	-	-
Tricalcium Aluminate (C_3A)	5.01	-	8.0 max
Sum of Tricalcium Silicate and Tricalcium Aluminate	59.35	-	58.0 max
Tetracalcium Aluminoferrite (C_4AF)	10.6	-	-
Physical Properties			
Blaine fineness m^2/kg	3772	160 min	160 min
No 325 fineness	92.7	-	-
Autoclave expansion,%	0.053	0.8 max	0.8 max
Setting time, Gilmore needless (min.)			
Initial	133	60 min	60 min
Final	259	600 max	600 max
Setting time, Vicat (min.)			
Initial	61	45 min	45 min
Final	169	375 max	375 max
Air content of mortar, volume%	7.2	12 max	12 max
Compressive strength (psi) at:			
1 Day	1702	-	-
3 Days	2969	1740 min	1740 min
7 Days	3886	2760 min	2760 min
28 Days	5517	4060 min	4060 min

Table 3-2 – Properties of Fly Ash*

Chemical Composition%	Class F	ASTM C 618-97	
		Class F	Class C
Total Silica, Aluminum, Iron	81	70 min	50 min
Silicon Dioxide (SiO_2)	57.1	-	-
Aluminum Oxide (Al_2O_3)	18.7	-	-
Ferric Oxide (Fe_2O_3)	5.2	-	-
Sulfur Trioxide (SO_3)	0.7	5.0 max	5.0 max
Calcium Oxide (CaO)	8.3	-	-
Moisture Content	0.4	3.0 max	3.0 max
Loss on Ignition	0.4	6.0 max	6.0 max
Physical Properties			
No 325 fineness	26.5	34 max	34 max
Strength Activity with Portland Cement			
7 day,% of control	80.3	-	-
28 Day,% of control	94.2	75 min	75 min
Water Requirement,% of Control	92.1	105 max	105 max
Soundness, Autoclave Expansion (%)	0.01	0.8 max	0.8 max
Density	2.38	-	-

* Chemical composition and physical data provided by ISG Resources, INC. Western Region

Table 3-3 – Properties of Silica Fume

Chemical Composition%	Percentage by Dry Mass
Silicon Dioxide (SiO_2)	93.08
CL	0.19
Aluminum Oxide (Al_2O_3)	1.17
Ferric Oxide (Fe_2O_3)	0.19
Calcium Oxide (CaO)	0.43
Magnesium Oxide (MgO)	0.53
Sulfur Trioxide (SO_3)	0.22
Sodium Oxide (Na_2O)	0.42
Potassium Oxide (K_2O)	1.18
Available Alkalies	1.27
Carbon (C)	3.47
Loss on Ignition	4.47
Physical Properties	
No 325 Sieve Retained (%)	3.44
Specific Gravity	2.2
Density – Fluffy (pcf)	10.5
Moisture Content (%)	0.14

* Chemical composition and physical data provided by Norchem Concrete Products Inc., Fort Pierce, Florida

Table 3-4 – Properties of Metakaolin*

Chemical Composition%	**Class N**	**ASTM C 618 Limits Class N**	**ASTM Test Method**
Silicon Dioxide (SiO_2)	53.4	-	-
Aluminum Oxide (Al_2O_3)	41.1	-	-
Ferric Oxide (Fe_2O_3)	1.06	-	-
Sum of Constituents	95.58	70%	D4329
Sulfur Trioxide (SO_3)	0.09	4.0 max	D4329
Calcium Oxide (CaO)	0.09		D4329
Moisture Content	0.49	3.0 max	C311
Loss on Ignition (% of Carbon)	0.048	10.0 max	C311
Available Alkalies, as Na2O	0.011	1.5 max	C311
Physical Properties			
Fineness,% Retained on # 325 fineness	6.90	-	C311, C430
Strength Activity with Portland Cement			
7 day,% of control	106	75 min	C311, C109
28 Day,% of control	124	75 min	
Water Requirement,% of Control	115	115	-
Soundness, Autoclave Expansion (%)	- 0.05	0.8 max	C311, C151
True Particle Density	2.29	-	-

*** Chemical composition and physical data provided by ISG Resources, INC. Western Region**

Table 3-5 – Composition of grout mixes†

Grout No.	w/cm	Water Content (gram)	Portland Cement I/II (gram)	HRWR (Grace) (gram)	SRA (Grace) (gram)	LRWR (Grace) (gram)	HRWR (MB) (gram)	SRA (MB) (gram)	Retarder (MB) (gram)	Fly Ash (gram)	Slag (gram)	Silica Fume (gram)	Metakolin (gram)	Total (gram)
1	0.33	330	1000	0										1330
2	0.33	328	1000	2										1330
3	0.33	326	1000	4										1330
4	0.33	324	1000	6										1330
5	0.33	322	1000	8										1330
6	0.33	325	1000		5									1330
7	0.33	315	1000		15									1330
8	0.33	305	1000		25									1330
9	0.33	321	1000	4	5									1330
10	0.33	311	1000	4	15									1330
11	0.33	301	1000	4	25									1330
12	0.33	330	1000			0								1330
13	0.33	329	1000			1								1330
14	0.33	328	1000			2								1330
15	0.33	327	1000			3								1330
16	0.33	326	1000	4		0								1330
17	0.33	325	1000	4		1								1330
18	0.33	324	1000	4		2								1330
19	0.33	323	1000	4		3								1330
20	0.33	319	1000	4	5	2								1330
21	0.33	314	1000	4	10	2								1330
22	0.33	309	1000	4	15	2								1330
23	0.33	304	1000	4	20	2								1330
24	0.33	299	1000	4	25	2								1330
25	0.33	328	950	2						0			50	1330
26	0.33	328	750	2						200			50	1330

Grout No.	w/cm	Water Content (gram)	Portland Cement I/II (gram)	HRWR (Grace) (gram)	SRA (Grace) (gram)	LRWR (Grace) (gram)	HRWR (MB) (gram)	SRA (MB) (gram)	Retarder (MB) (gram)	Fly Ash (gram)	Slag (gram)	Silica Fume (gram)	Metakolin (gram)	Total (gram)
27	0.33	328	700	2						250			50	1330
28	0.33	328	650	2						300			50	1330
29	0.33	328	600	2						350			50	1330
30	0.33	328	950	2						0		50		1330
31	0.33	328	750	2						200		50		1330
32	0.33	328	700	2						250		50		1330
33	0.33	328	650	2						300		50		1330
34	0.33	328	600	2						350		50		1330
35	0.33	328	900	2									100	1330
36	0.33	328	800	2									200	1330
37	0.33	328	700	2									300	1330
38	0.33	328	900	2								100		1330
39	0.33	328	800	2								200		1330
40	0.33	328	700	2								300		1330
41	0.33	328	1000	2						0				1330
42	0.33	328	800	2						200				1330
43	0.33	328	750	2						250				1330
44	0.33	328	700	2						300				1330
45	0.33	328	650	2						350				1330
46	0.33	318	950	2	10					0			50	1330
47	0.33	318	750	2	10					200			50	1330
48	0.33	318	700	2	10					250			50	1330
49	0.33	318	650	2	10					300			50	1330
50	0.33	318	600	2	10					350			50	1330
51	0.33	303	950	2	25					0		50		1330
52	0.33	303	750	2	25					200		50		1330
53	0.33	303	700	2	25					250		50		1330
54	0.33	303	650	2	25					300		50		1330
55	0.33	303	600	2	25					350		50		1330
56	0.33	330	1000				0							1330
57	0.33	328	1000				2							1330

Grout No.	w/cm	Water Content (gram)	Portland Cement I/II (gram)	HRWR (Grace) (gram)	SRA (Grace) (gram)	LRWR (Grace) (gram)	HRWR (MB) (gram)	SRA (MB) (gram)	Retarder (MB) (gram)	Fly Ash (gram)	Slag (gram)	Silica Fume (gram)	Metakolin (gram)	Total (gram)
58	0.33	326	1000				4							1330
59	0.33	324	1000				6							1330
60	0.33	320	1000				10							1330
61	0.33	325	1000					5						1330
62	0.33	315	1000					15						1330
63	0.33	305	1000					25						1330
64	0.33	319	1000				6	5						1330
65	0.33	309	1000				6	15						1330
66	0.33	299	1000				6	25						1330
67	0.4	400	750							200			50	1400
68	0.45	450	750							200			50	1450
69	0.5	500	750							200			50	1500
70	0.55	550	750							200			50	1550
71	0.6	600	750							200			50	1600
72	0.4	400	750							200		50		1400
73	0.45	450	750							200		50		1450
74	0.5	500	750							200		50		1500
75	0.55	550	750							200		50		1550
76	0.6	600	750							200		50		1600
77	0.33	330	1000						0					1330
78	0.33	329	1000						1					1330
79	0.33	328	1000						2					1330
80	0.65	650	1000		0									1650
81	0.65	635	1000		15									1650

† All admixture quantities are expressed as grams

Table 3-6 – Proportion of grout mixes†

Grout No.	w/cm	Water Content (%)	Portland Cement I/II (%)	HRWR (Grace) (%)	SRA (Grace) (%)	LRWR (Grace) (%)	HRWR (MB) (%)	SRA (MB) (%)	Retarder (MB) (%)	Fly Ash (%)	Silica Fume (%)	Metakolin (%)
1	0.33	33	100	0								
2	0.33	32.8	100	0.2								
3	0.33	32.6	100	0.4								
4	0.33	32.4	100	0.6								
5	0.33	32.2	100	0.8								
6	0.33	32.5	100		0.5							
7	0.33	31.5	100		1.5							
8	0.33	30.5	100		2.5							
9	0.33	32.1	100	0.4	0.5							
10	0.33	31.1	100	0.4	1.5							
11	0.33	30.1	100	0.4	2.5							
12	0.33	33	100			0						
13	0.33	32.9	100			0.1						
14	0.33	32.8	100			0.2						
15	0.33	32.7	100			0.3						
16	0.33	32.6	100	0.4		0						
17	0.33	32.5	100	0.4		0.1						
18	0.33	32.4	100	0.4		0.2						
19	0.33	32.3	100	0.4		0.3						
20	0.33	31.9	100	0.4	0.5	0.2						
21	0.33	31.4	100	0.4	1	0.2						
22	0.33	30.9	100	0.4	1.5	0.2						
23	0.33	30.4	100	0.4	2	0.2						
24	0.33	29.9	100	0.4	2.5	0.2						
25	0.33	32.8	95	0.2						0		5
26	0.33	32.8	75	0.2						20		5
27	0.33	32.8	70	0.2						25		5

Grout No.	w/cm	Water Content (%)	Portland Cement I/II (%)	HRWR (Grace) (%)	SRA (Grace) (%)	LRWR (Grace) (%)	HRWR (MB) (%)	SRA (MB) (%)	Retarder (MB) (%)	Fly Ash (%)	Silica Fume (%)	Metakolin (%)
28	0.33	32.8	65	0.2						30		5
29	0.33	32.8	60	0.2						35		5
30	0.33	32.8	95	0.2						0	5	
31	0.33	32.8	75	0.2						20	5	
32	0.33	32.8	70	0.2						25	5	
33	0.33	32.8	65	0.2						30	5	
34	0.33	32.8	60	0.2						35	5	
35	0.33	32.8	90	0.2								10
36	0.33	32.8	80	0.2								20
37	0.33	32.8	70	0.2								30
38	0.33	32.8	90	0.2							10	
39	0.33	32.8	80	0.2							20	
40	0.33	32.8	70	0.2							30	
41	0.33	32.8	100	0.2						0		
42	0.33	32.8	80	0.2						20		
43	0.33	32.8	75	0.2						25		
44	0.33	32.8	70	0.2						30		
45	0.33	32.8	65	0.2						35		
46	0.33	31.8	95	0.2	1					0		5
47	0.33	31.8	75	0.2	1					20		5
48	0.33	31.8	70	0.2	1					25		5
49	0.33	31.8	65	0.2	1					30		5
50	0.33	31.8	60	0.2	1					35		5
51	0.33	30.3	95	0.2	2.5					0	5	
52	0.33	30.3	75	0.2	2.5					20	5	
53	0.33	30.3	70	0.2	2.5					25	5	
54	0.33	30.3	65	0.2	2.5					30	5	
55	0.33	30.3	60	0.2	2.5					35	5	
56	0.33	33	100				0					
57	0.33	32.8	100				0.2					
58	0.33	32.6	100				0.4					

Grout No.	w/cm	Water Content (%)	Portland Cement I/II (%)	HRWR (Grace) (%)	SRA (Grace) (%)	LRWR (Grace) (%)	HRWR (MB) (%)	SRA (MB) (%)	Retarder (MB) (%)	Fly Ash (%)	Silica Fume (%)	Metakolin (%)
59	0.33	32.4	100				0.6					
60	0.33	32	100				1					
61	0.33	32.5	100					0.5				
62	0.33	31.5	100					1.5				
63	0.33	30.5	100					2.5				
64	0.33	31.9	100				0.6	0.5				
65	0.33	30.9	100				0.6	1.5				
66	0.33	29.9	100				0.6	2.5				
67	0.4	40	75							20		5
68	0.45	45	75							20		5
69	0.5	50	75							20		5
70	0.55	55	75							20		5
71	0.6	60	75							20		5
72	0.4	40	75							20	5	
73	0.45	45	75							20	5	
74	0.5	50	75							20	5	
75	0.55	55	75							20	5	
76	0.6	60	75							20	5	
77	0.33	33	100						0			
78	0.33	32.9	100						0.1			
79	0.33	32.8	100						0.2			
80	0.65	65	100		0							
81	0.65	63.5	100		1.5							

† All Water and chemical admixture quantities are expressed as percentages of cementitious mass
Cementitious materials are reported as percentages of total cementitious mass

Figure 3-1 – Drying shrinkage versus Age for Cement Paste with Varying Dosages of HRWR-G

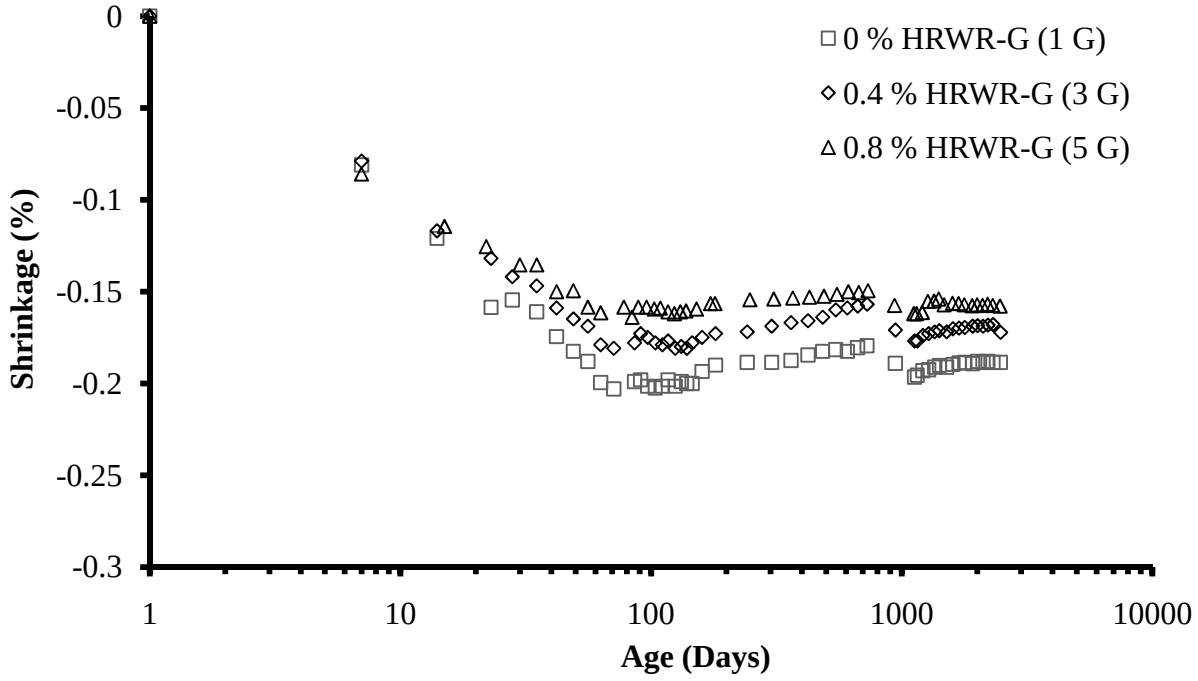


Figure 3-2 – Drying Shrinkage versus Age for Cement Paste with Varying HRWR-MB

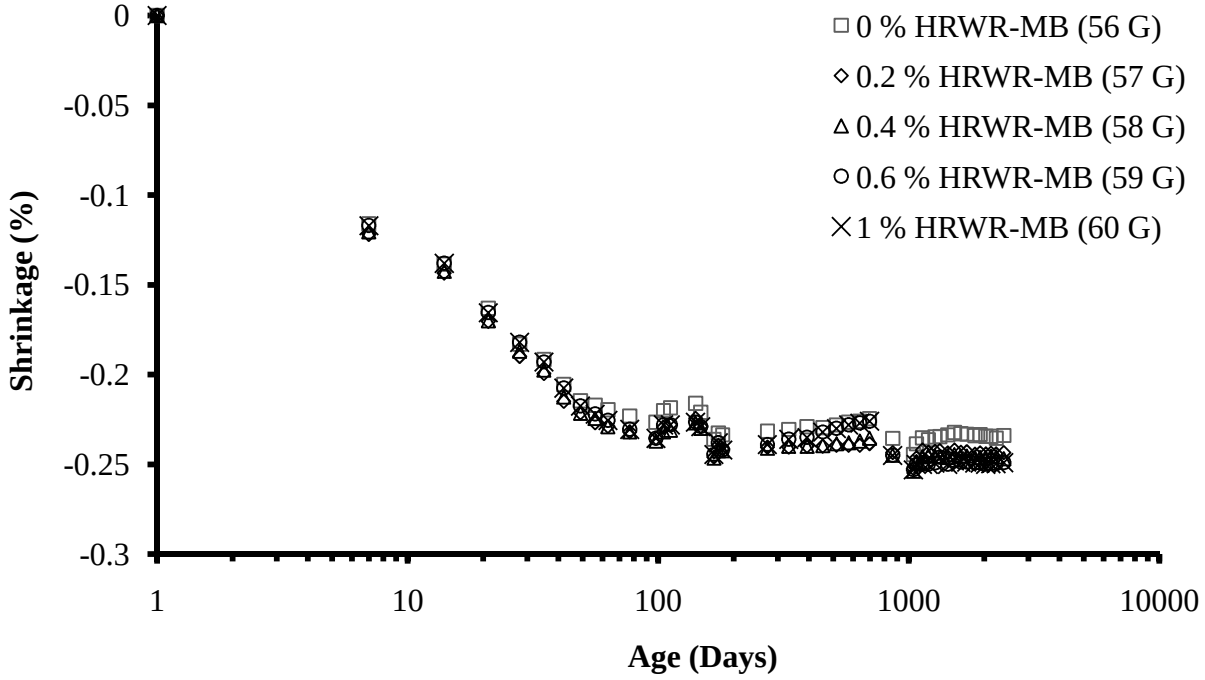


Figure 3-3 – Drying Shrinkage versus Age for Cement Paste with Varying LRWR and HRWR Dosage

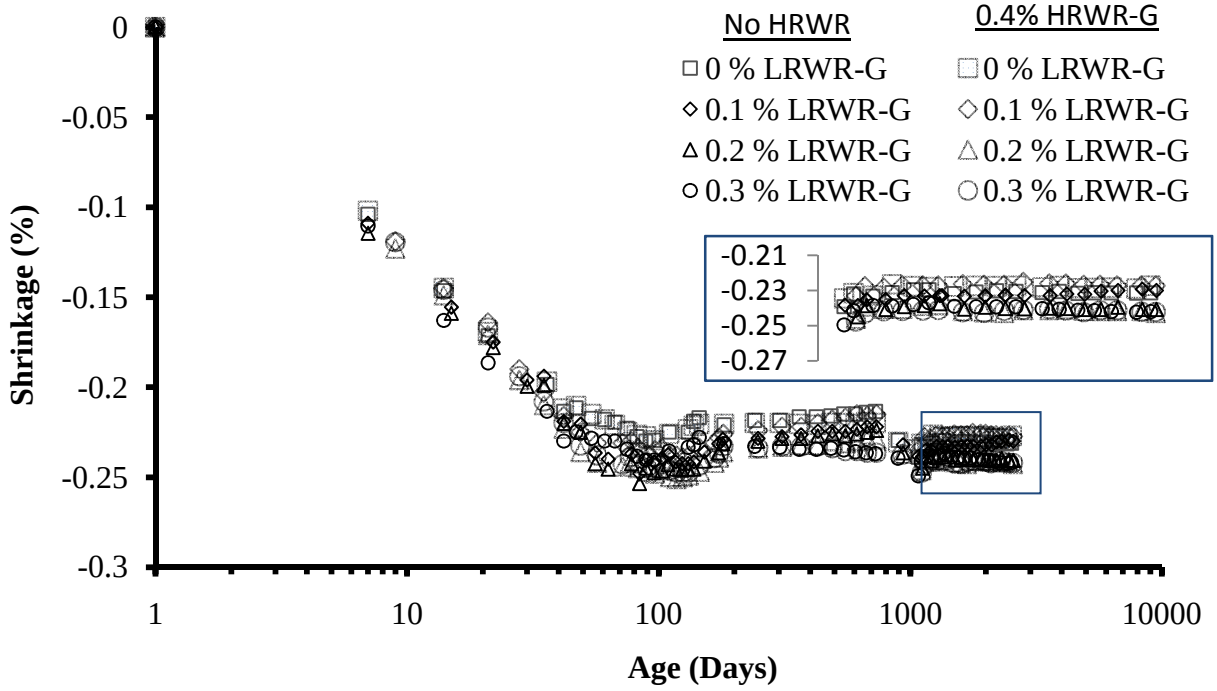


Figure 3-4 – Drying Shrinkage versus Age for Cement Paste with Varying SRA-G Dosage

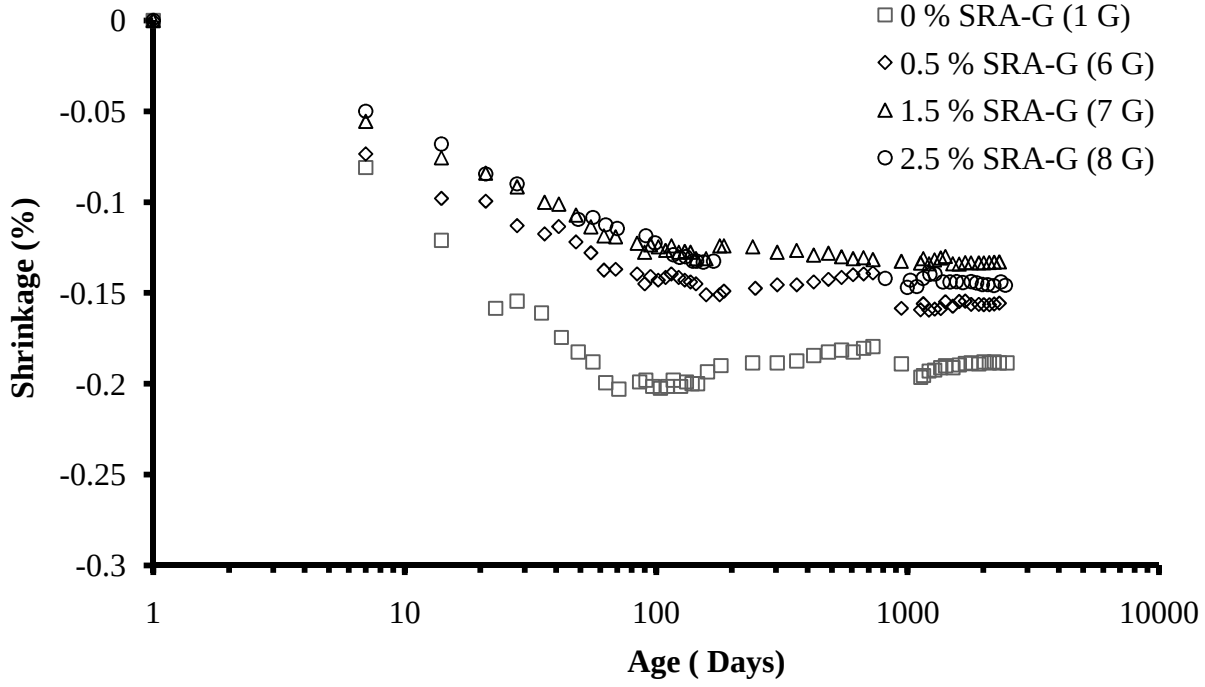


Figure 3-5 – Drying Shrinkage versus Age for Cement Paste with Varying SRA-MB Dosage

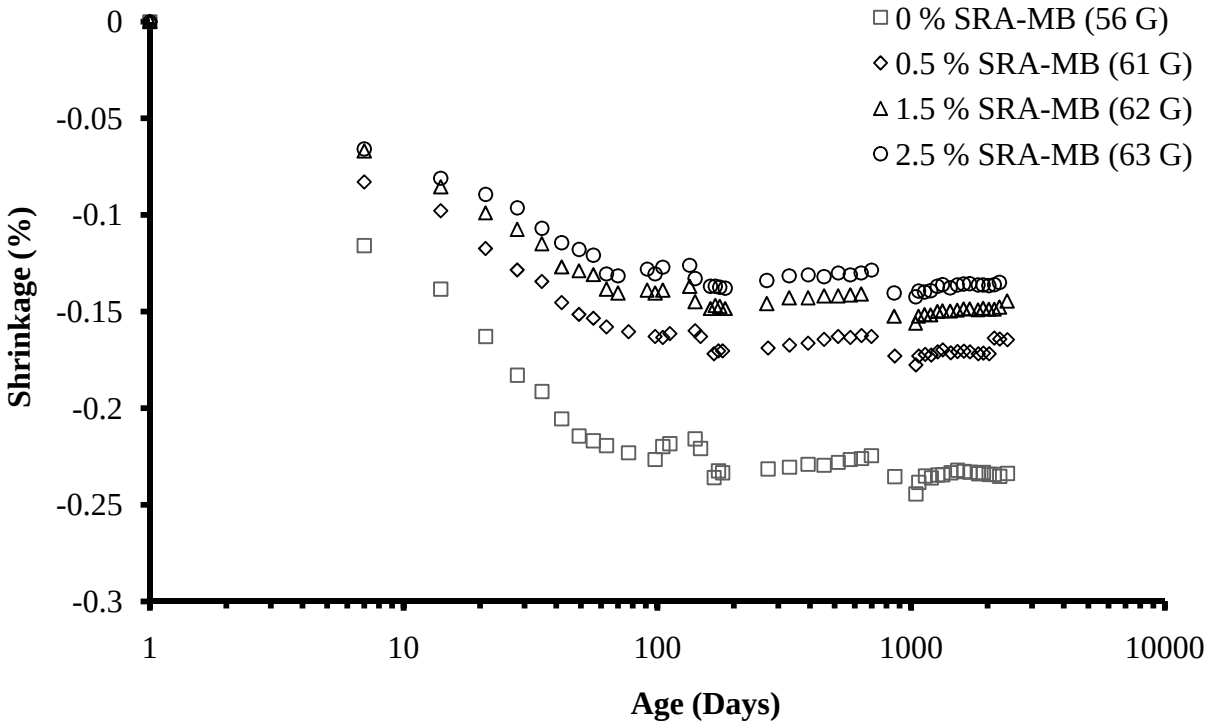


Figure 3-6 – Drying Shrinkage versus Age for Cement Paste with Varying SRA-G Dosage and 0.4% HRWR-G

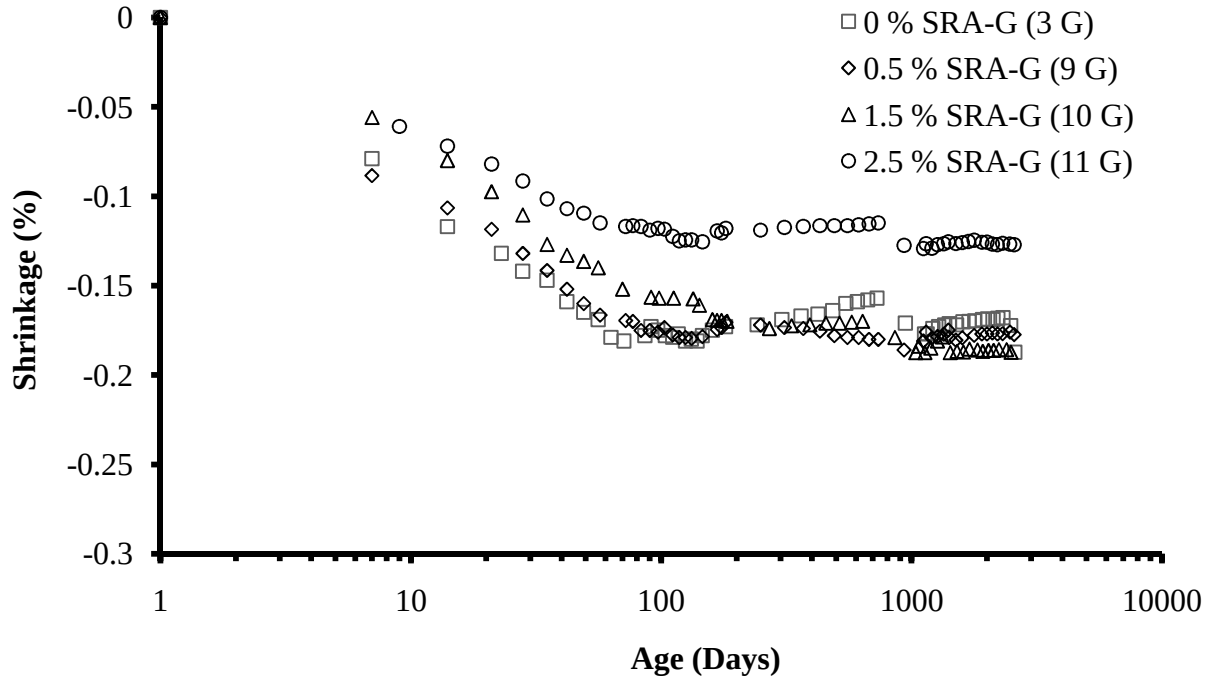


Figure 3-7 – Drying Shrinkage versus Age for Cement Paste with Varying SRA-MB Dosage and 0.6% HRWR

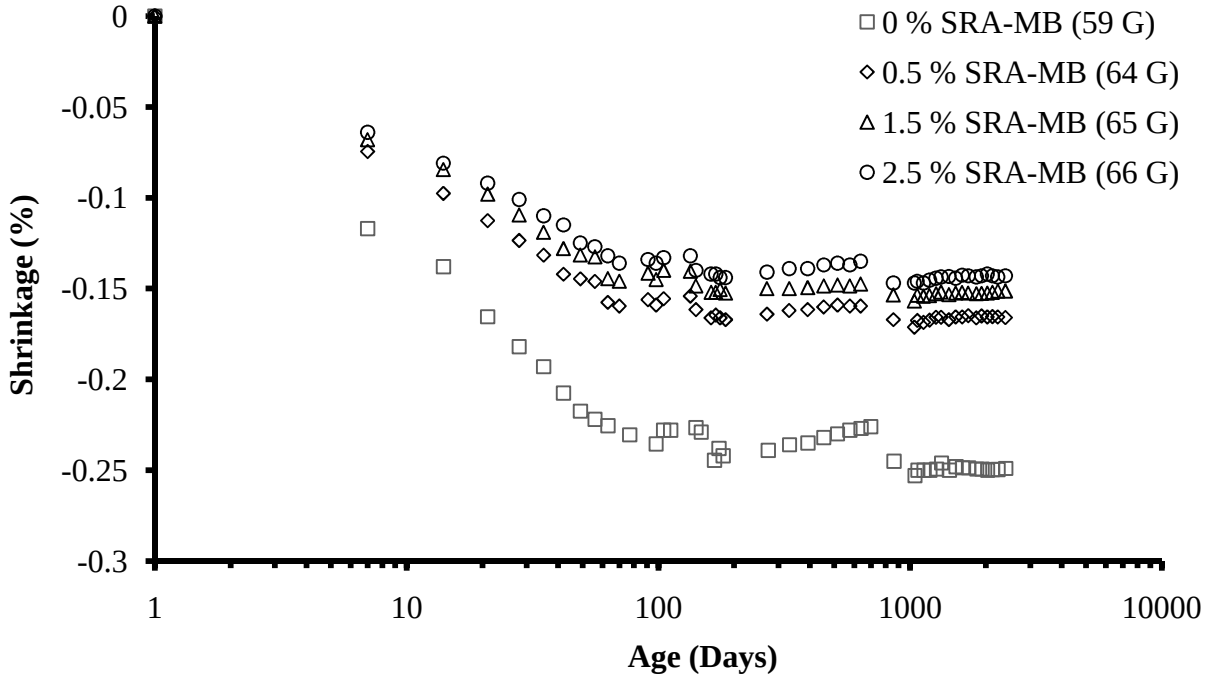


Figure 3-8 – Drying Shrinkage versus Age for Cement Paste with Varying SRA-G Dosage and HRWR 0.4% & LRWR 0.2%

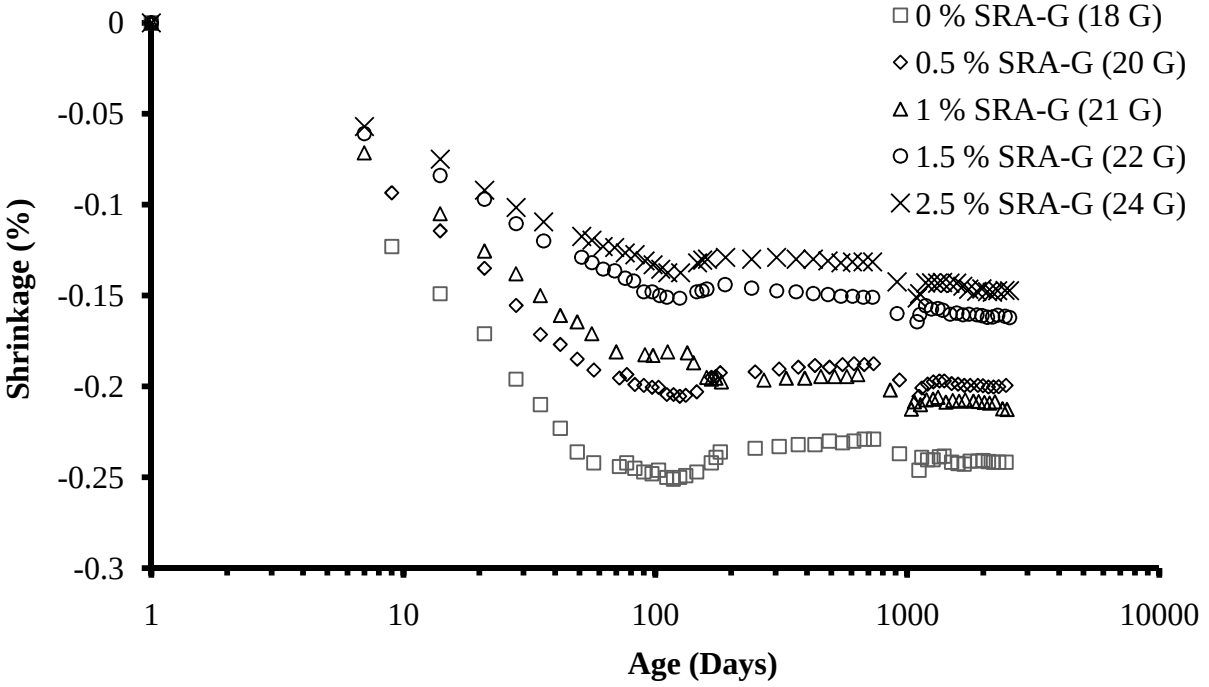


Figure 3-9 – Drying Shrinkage versus Age for Cement Paste with Varying MK and 0.2% HRWR

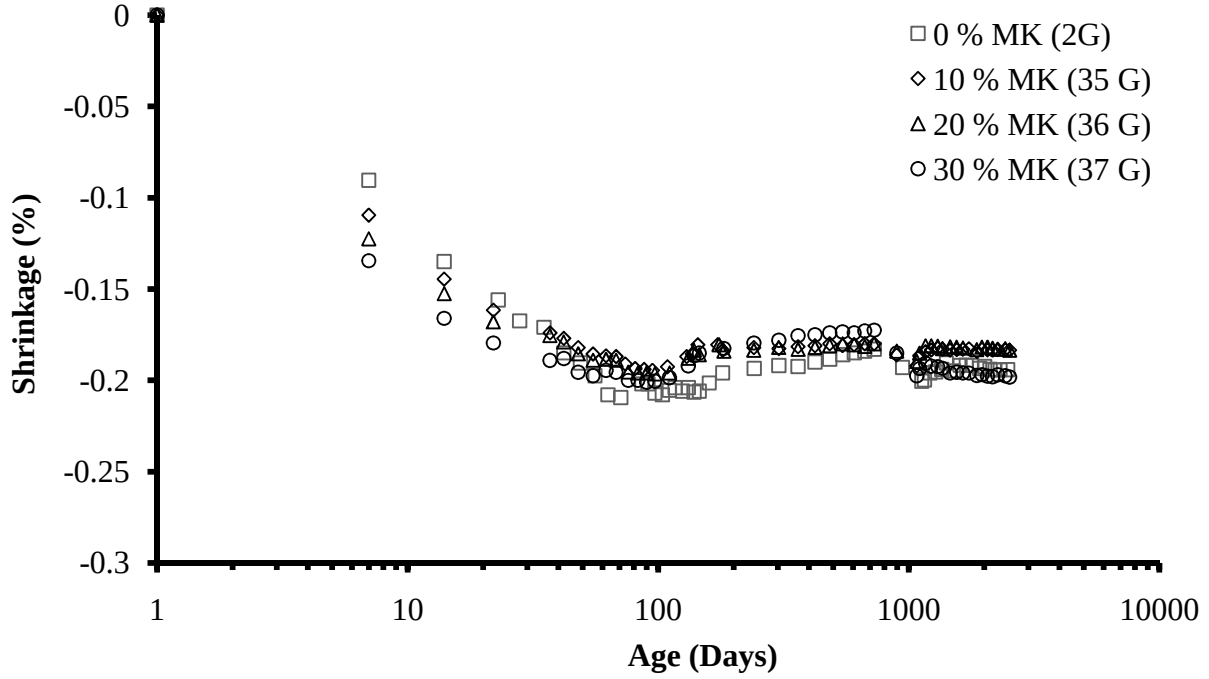


Figure 3-10 – Drying Shrinkage versus Age for Cement Paste with Varying SF and 0.2% HRWR-G

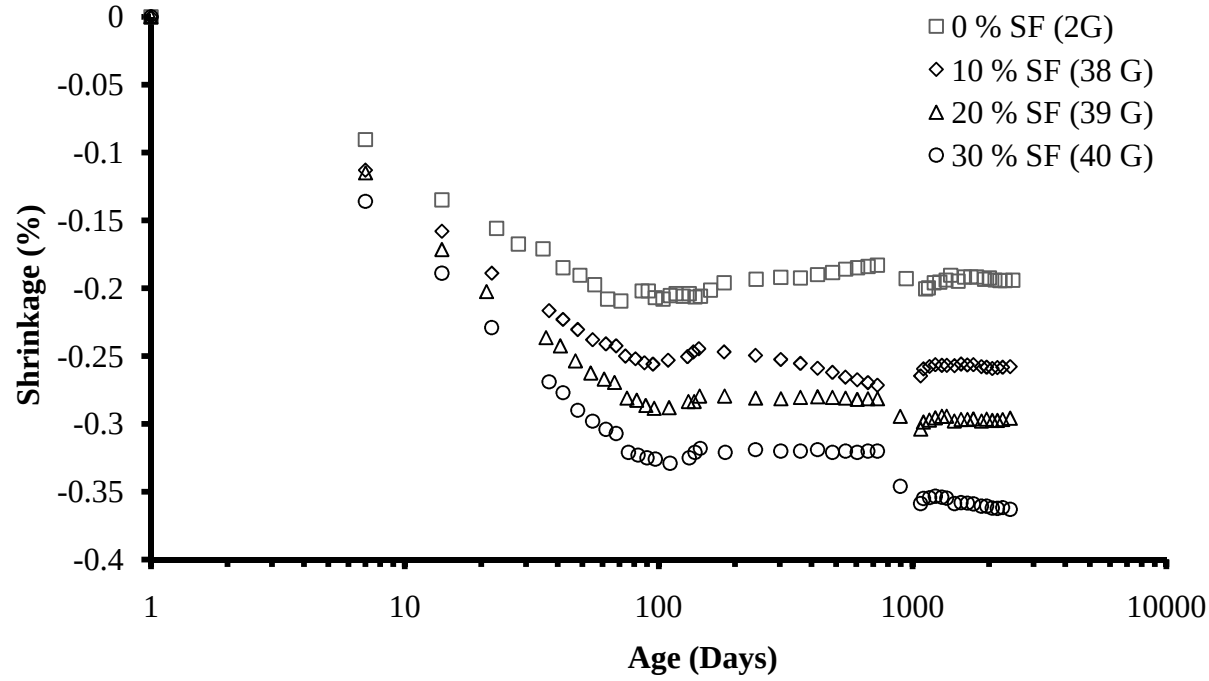


Figure 3-11 – Drying Shrinkage versus Age for Cement Paste with Varying FA and 0.2% HRWR-G

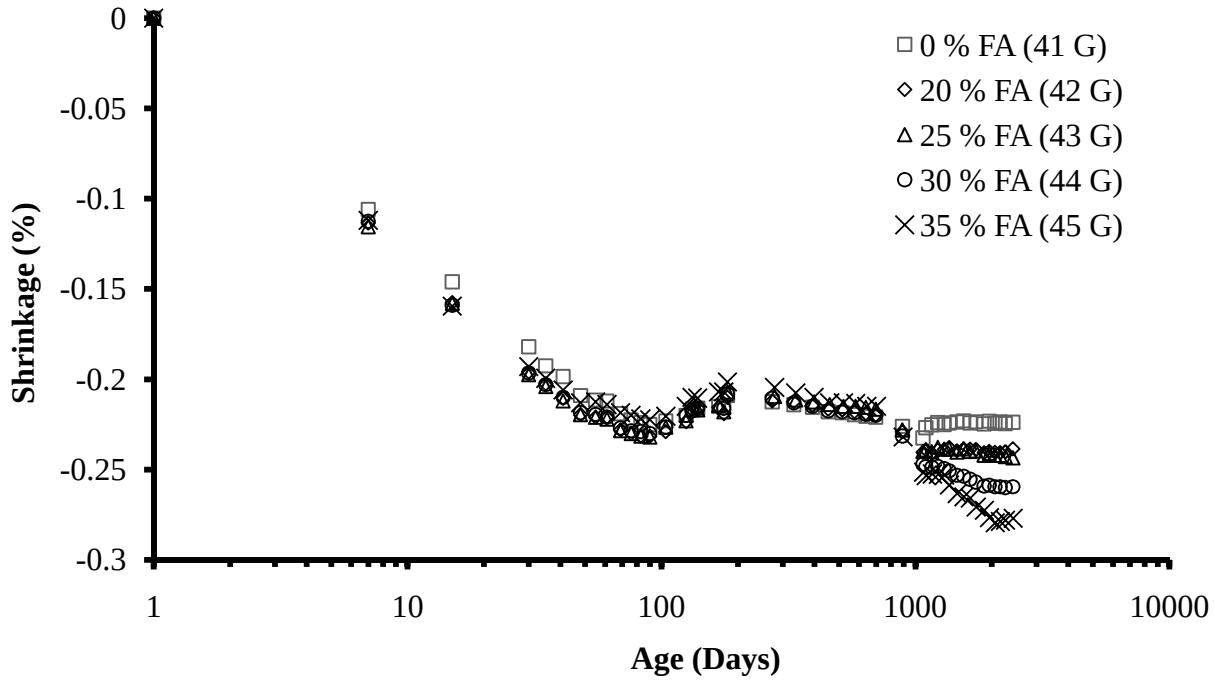


Figure 3-12 – Shrinkage of Cement Paste with Varying FA and other admixtures

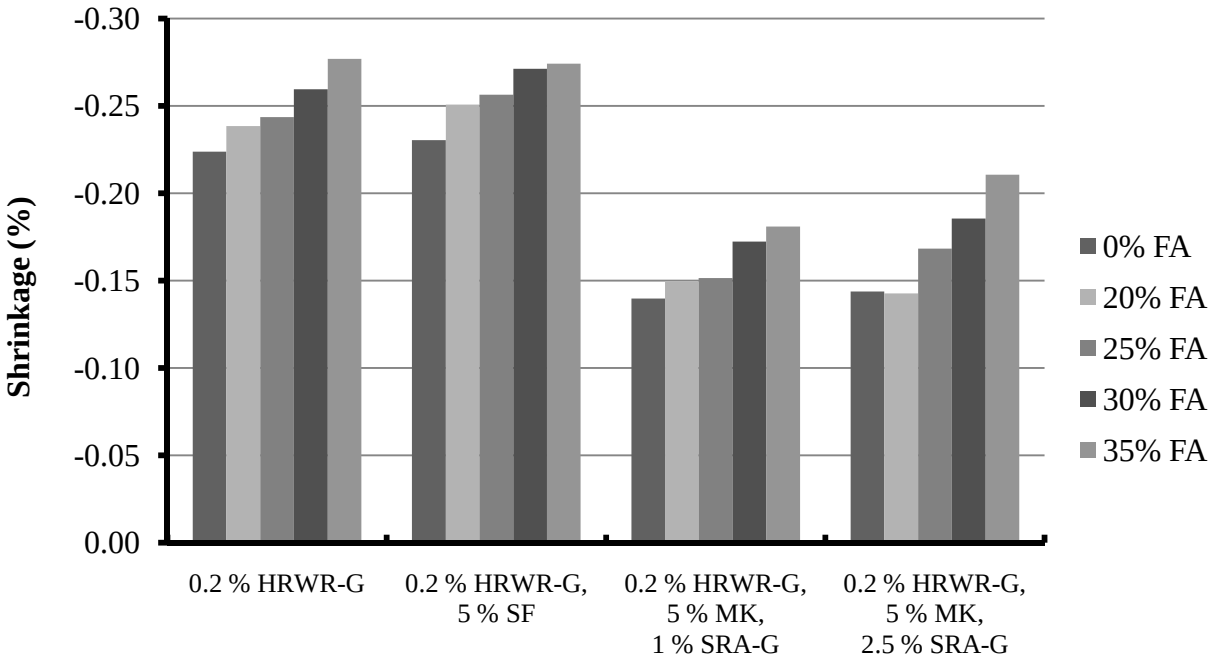
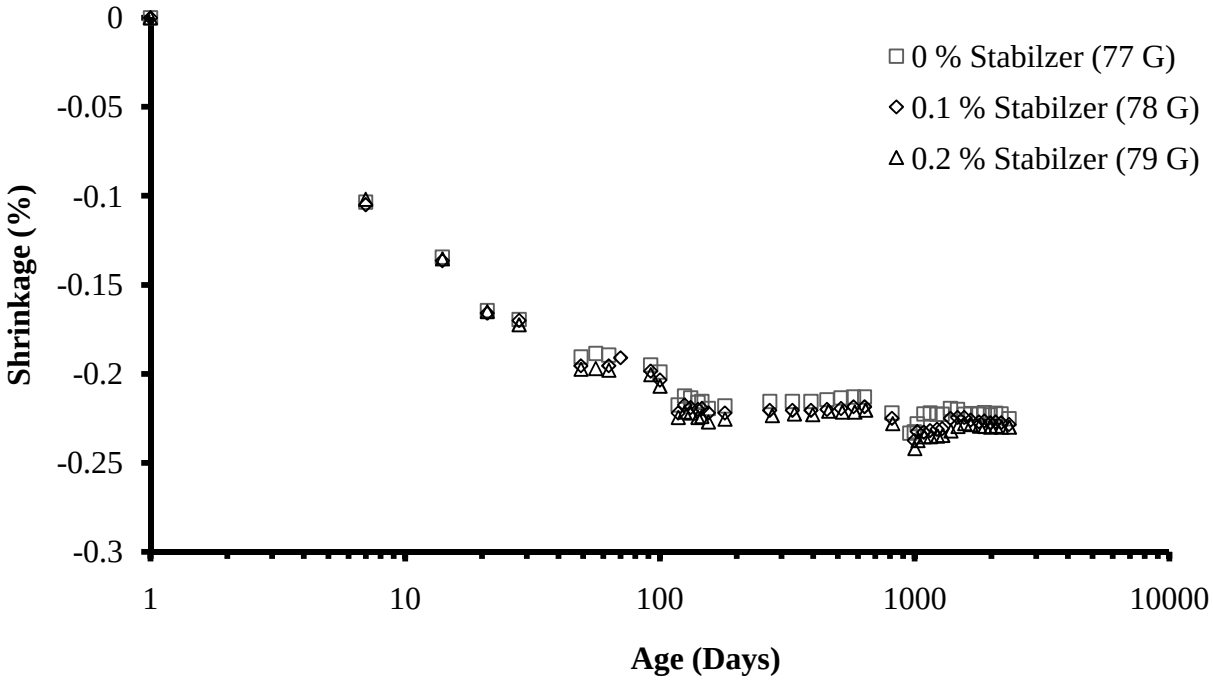


Figure 3-13 – Drying Shrinkage versus Age for Cement Paste with Varying Stabilizer



CHAPTER 4

Effect of Admixtures on High Strength Concrete

4.1 Introduction

This chapter describes the effects of various types of admixtures on the drying shrinkage and compressive strength of concrete. The concretes included in this study contain cement, water, coarse and fine aggregate, and mineral and chemical admixtures. Three types of mineral admixtures were used. These are fly ash class F, silica fume, and metakaolin (calcine clay, class N). Also three types of chemical admixtures produced by either Master Builder or W.R. Grace were utilized. These are shrinkage reducing admixture, high-range water reducing admixture, and low-range water reducing admixture. Tests were conducted to evaluate shrinkage, expansion, and compressive strength of the concrete with different admixtures according to ASTM C 157.

4.2 Properties of Concrete Constituents

4.2.1 Cement

ASTM type II Portland cement was used in this study. The cement meets ASTM C 150 specifications. Chemical compositions and physical properties of the cement are given in Table 3 - 1.

4.2.2 Admixtures

The admixtures used in this study were divided in two categories:

1) Mineral Admixtures

   A. Fly Ash class F- normally produced from burning anthracite bituminous coal and this class fly ash has pozzolanic properties. The chemical and physical compositions of the fly ash are given in Table 3-2 in accordance to ASTM C 618.

   B. Silica Fume- very fine non-crystalline silica (SiO2) produced by electric arc furnaces as a by-product of the production of metallic silicon or ferrosilicon alloys. The chemical composition and physical properties of the silica fume are given in Table 3 -3.

   C. Metakaolin (calcine clay, class N)- is calcined kaolin clay with approximately 1.5% loss on ignition, and contains less than 1% quartz. The chemical and physical compositions of the metakaolin are given in Table 3-4.

2) Chemical admixtures

   W.R. Grace Products:

   A. SRA-G (Eclipse) is a shrinkage-reducing admixture no ASTM specifications available at this time.

   B. HRWR-G (ADVA-100, superplasticizer) is high-range water-reducing admixture. It is an admixture that reduces the quantity of mixing water required.

C. LRWR-G (WRAD-64) is a low-range water-reducing admixture. It is an admixture that reduces the quantity of mixing water required to produce concrete of a given consistency. It meets ASTM C 494-90 specifications.

Master Builder Products:

D. SRA-MB (Tetraguard-AS20) is a shrinkage-reducing admixture. It is an admixture that reduces the drying shrinkage. No ASTM specifications available at this time.

E. HRWR-MB (Rheobuild-3000 FC) is high-range water-reducing admixture, ASTM No. ASTM C 494 Type A and F.

F. LRWR-MB (Pozzolith 200N) is a low-range water-reducing admixture. It is an admixture that reduces the quantity of mixing water required to produce concrete of a given consistency.

4.2.3 Aggregate

The coarse aggregate used in this study was limestone and crushed granite. The maximum size of the aggregate was ½-in. The aggregate was produced at the Sechelt, B.C. plant, and was distributed at Hanson's Bay area facilities. The sieve analysis of aggregates was performed in accordance to ASTM C 33.

Physical properties of coarse and fine aggregates are summarized in Table 4-1 The sieve analysis is also given in the table.

4.3 Mix Design

A total of thirty-four concrete mixes were made in this study to investigate the effect of different types of admixtures. The concrete mixes were made with type II Portland cement and have w/cm of 0.33 by weight of cementitious material except last three mixes with 0.34 w/cm ratio. Table 4-2 and 4-3 describe the mix compositions and proportions.

4.4 Mixing Procedure

The following mixing procedure was used in this study:

1. Wet the drum mixer and drain the water.
2. Add coarse aggregate followed with ¼ water.
3. Add silica fume to bond coarse aggregate.
4. Add fine aggregate with another ¼ water.
5. Add cement and fly ash at the same time.
6. Keep adding water after each solid.
7. Add superplasticizer by itself or mix by water at the end.
8. Mix for two – five minutes after all components are added, let stand for two minutes, then mix for additional three minutes.

Three concrete prisms with dimensions 3 x 3 x 11 ¼-in. (75 x 75 x 285-mm) and twelve 4 x 8-in. (100 x 200-mm) cylinders were prepared for each mix.

The concrete prisms were left to cure for 24 hours in a moist room (100% humidity) while they were covered with a plastic sheet. The specimens were then demolded and initial

reading was taken by using comparator in accordance to ASTM C 490. The specimens were placed in a bathtub in a moist room for six days, and second reading was taken.

The specimens were then placed in a controlled room temperature at 73.4°±3°F (23°± 1.7°C) with a relative humidity of 50% ± 4%. Shrinkage readings were taken at different time intervals up to 2500 days. Shrinkage was determined in accordance to ASTM C 157.

The 4 x 8-in. (100 x 200-mm) and 6 x 12-in. (150 x 300-mm) concrete cylinders were left to cure in a moist room for hundred and eighty days. The specimens were tested for compressive strength at 28, 56, 90, and 180 days. Also the modulus of elasticity was determined at 28, 56, 90, and 180 days.

4.5 Test Results and Discussion

4.5.1 Shrinkage

Shrinkage data versus age are plotted and tabulated up to 2500 days in Appendix III and Appendix IV. Shrinkage Data versus age up to 2500 days for concrete mixes with 0.33 w/cm ratio with initial reading taken after seven days are plotted in Appendix III (one day in mold and six days in water). Shrinkage data and expansion versus age up to 2500 days for concrete mixes with 0.33 w/cm ratio with the initial reading taken after one day are plotted in Appendix IV. The effect of different admixtures on the shrinkage of concrete is showed in Figures 4-1 through 4-16.

Figure 4-1 shows the effect of fly ash replaced by total weight of cement at different percentage 20%, 25%, and 30% with 5% silica fume, 0.6% HRWR-G, and 0.33 w/cm ratio. It can be observed that fly ash dosages of 20%, 25% and 30% showed a trend of slight increase in drying shrinkage.

Figure 4-2 shows the effect of fly ash replaced by total weight of cement at different percentage 20%, 25%, and 30% with 5% metakaolin, 0.6% HRWR-G, and 0.33 w/cm ratio. It can be observed that increasing dosage of fly ash from 20% to 30% reduced drying shrinkage.

Figure 4-3 shows the effect of fly ash replaced by total weight of cement at different percentage 20%, 25%, and 30% with 5% silica fume, 0.6% HRWR-G, 0.5% SRA-G, and 0.33 w/cm ratio. It can be observed that increasing fly ash from 20% to 30% reduced drying shrinkage. When comparing Figure 4-3 to Figure 4-1 it can be observed that addition a dosage of 0.5% SRA-G reduces the drying shrinkage by 36% at 2500 days.

Figure 4-4 shows the effect of fly ash replaced by total weight of cement at different percentage 20%, 25%, and 30% with 5% metakaolin, 0.6% HRWR-G, 0.5% SRA-G, and 0.33 w/cm ratio. It can be observed that increasing fly ash from 20% to 25% does not affect drying shrinkage, while 30% Fly Ash substitution reduced drying shrinkage. When comparing Figure 4-4 to 4-2 it can be observed that the addition a dosage of 0.5% SRA-G reduces the drying shrinkage by 10% at 2500 days.

The effects of metakaolin and silica fume for concrete with and without SRA-G are plotted in Figures 4-5 through 4-10.

Figure 4-5 shows the effect of different dosages of SRA-G with 25% fly ash, 5% silica fume, 0.6% HRWR-G, and 0.33 w/cm ratio. The graph indicates that addition of SRA-G at dosage of 0.5% reduces the drying shrinkage by 43% at 2500 days.

Figure 4-6 shows the effect of different dosages of SRA-G with 30% fly ash, 5% silica fume, 0.6% HRWR-G, and 0.33 w/cm ratio. The graph indicates that addition of SRA-G at dosage of 0.5% reduces the drying shrinkage by 29% at 2500 days.

Figure 4-7 shows the effect of different dosages of SRA-G with 20% fly ash, 5% metakaolin, 0.6% HRWR-G, and 0.33 w/cm ratio. It can be observed that addition of SRA-G at dosage of 0.5% reduces the drying shrinkage by 19%.

Figure 4-8 shows the effect of different dosages of SRA-G with 25% fly ash, 5% metakaolin, 0.6% HRWR-G, and 0.33 w/cm ratio. The graph shows the addition of SRA-G at dosage of 0.5% reduces the drying shrinkage by 20% at 2500 days.

Figure 4-9 shows the effect of different dosages of SRA-G with 30% fly ash, 5% metakaolin, 0.6% HRWR-G, and 0.33 w/cm ratio. The graph indicates that addition of SRA-G at dosage of 0.5% has minor increase in drying shrinkage.

Figure 4-10 shows the effect of different dosages of SRA-MB with 25% fly ash, 5% silica fume, 0.6% HRWR-MB, and 0.33 w/cm ratio. It can be observed that dosage of SRA-MB at 0.5% reduces the drying shrinkage by 43% at 2500 days.

Figure 4-11 shows the effect of different dosages of HRWR-MB and LRWR-MB. It can be observed that 0.6% HRWR-MB has the same effect on drying shrinkage as 0.4% HRWR-MB and 0.2% LRWR-MB.

Figure 4-12 shows the effect of different dosages of SRA-G with 25% fly ash, 5% silica fume, 0.6% HRWR-G and 0.33 w/cm ratio. It can be observed that dosage of SRA-G at 0.5% to 2.5% reduces the drying shrinkage by up to 57% at 2500 days.

Figure 4-13 shows the effect of different dosages of SRA-G with 25% fly ash, 5% silica fume, 0.4% HRWR-G, 0.2% LRWR-G, and 0.33 w/cm ratio. The figure indicates that dosage of SRA-G at 2.5% reduces the drying shrinkage by 56% at 2500 days. In addition, a dosage of SRA-G from 1.5% to 2.5% has similar effect on drying shrinkage.

Figure 4-14 shows the effect of different dosages of SRA-MB with 25% fly ash, 5% silica fume, 0.4% HRWR-MB, 0.2% LRWR-MB, and 0.33 w/cm ratio. It can be observed from the figure that dosage of SRA-MB at 1.5% to 2.5% reduces the drying shrinkage by 45% at 2500 days. And also, it can be observed that the effect of different dosages of SRA-MB with 0.4% HRWR-MB and 0.2% LRWR-MB is the same as the effect of different dosages of SRA-G with 0.4% HRWR-G and 0.2% LRWR-G, comparing Figures 4-13 and Figure 4-14.

Figure 4-15 shows the effect of different cement content (sack) with different aggregate-to-cementitious (A/cm) materials ratio. It can be observed that increasing A/cm ratio from 4.76 to 4.80 with the same cement content reduces the drying shrinkage by 12% at 2500 days.

4.5.2 Compressive Strength

The compressive strength versus age for concrete mixes containing different mineral and chemical admixtures is shown in Figures 4-16 through 4-26. The compressive strength data were obtained at different ages of 28, 56, 90 and 180 days. The compressive strength data were obtained from testing 4 x 8-in. (100 x 200-mm) cylinders for all mixes. In addition, 6 x 12-in. (150 x 300-mm) concrete cylinders were made for mix 31 through 34 for comparison.

Figure 4-16 shows the compressive strength versus age for different dosages of fly ash and SRA-G with 5% silica fume, 0.6% HRWR-G. It can be observed that increasing the dosage of fly ash from 20% to 30% and dosage of SRA-G from 0% to 0.5% decrease the compressive strength by 9%.

Figure 4-17 shows the compressive strength versus age of different dosages of fly ash and SRA-G with 5% metakaolin, 0.6% HRWR-G. It can be observed that increasing dosage of

fly ash from 20% to 30% and dosage of SRA-G from 0% to 0.5% decrease the compressive strength by 5%.

Figure 4-18 shows the compressive strength versus age of different dosages of SRA-G with 20% fly ash, 5% silica fume, 5% metakaolin, and 0.6% HRWR-G. It can be observed that addition dosage of SRA-G from 0% to 0.5% with 5% silica fume decrease the compressive strength by 5% higher than 5% metakaolin.

Figure 4-19 shows the compressive strength versus age of different dosages of SRA-G with 25% fly ash, 5% silica fume, 5% metakaolin, and 0.6% HRWR-G. It can be observed that addition dosage of SRA-G from 0% to 0.5% SRA-G with 5% silica fume decrease the compressive strength by 19% higher than 5% metakaolin.

Figure 4-20 shows the compressive strength versus age of different dosages of SRA-G with 30% fly ash, 5% silica fume, 5% metakaolin, and 0.6% HRWR-G. It can be observed that addition dosage of SRA-G from 0% to 0.5% with 5% silica fume decrease the compressive strength by 14% higher than 5% metakaolin.

Figure 4-21 shows the compressive strength versus age of different dosages of HRWR-MB and LRWR-MB with 25% fly ash, and 5% silica fume. It can be observed that decreasing dosage of HRWR-MB from 0.6% to 0.4% reduces the compressive strength by 13%.

Figure 4-22 shows the compressive strength versus age of different dosages of SRA-G with 25% fly ash, 5% silica fume, and 0.6% HRWR-G. It can be observed that addition different dosage of SRA-G from 0% to 2.5% reduces the compressive strength by 10%.

Figure 4-23 shows the compressive strength versus age of different dosages of SRA-G with 0.4% HRWR-G, 0.2% LRWR-G, 25% fly ash and 5% silica fume. It can be observed that increasing dosage of SRA-G from 0% to 2.5% reduces the compressive strength by 4%.

Furthermore, comparison of Figure 4-22 with 4-23 shows that decreasing dosage of HRWR-G from 0.6% to 0.4% decreases the compressive strength by 5%.

Figure 4-24 shows the compressive strength versus age of different dosages of SRA-MB with 0.4% HRWR-MB, 0.2% LRWR-MB, 25% fly ash and 5% silica fume. It can be observed that increasing dosages of SRA-MB from 0% to 2.5% reduce the compressive strength by 3%.

Figure 4-25 shows the compressive strength versus age of different dosage of cement content (sack) and A/cm ratio (4 x 8-in. cylinders). It can be observed that increasing A/cm ratio from 4.76 to 4.80 with the same cement content increases the compressive strength by 15%.

Figure 4-26 shows the compressive strength versus age of different dosage of cement content (sack) and A/cm ratios (6 x 12-in. cylinders). It can be observed that increasing A/cm ratio from 4.76 to 4.80 with the same cement content increases the compressive strength by 9% but this is considered statistically insignificant as would less than 2 standard deviations for a very good coefficient of variation of 5%. However, with the data shown in Figure 4-25 it is reasonable that these differences in A/cm ratio can affect compressive strength. This also indicates 4x8s do break slightly higher than 6 x12 of the same mix.

4.6 Conclusions on Drying Shrinkage and Compressive Strength in Concrete Mixes

The purpose of this study was to investigate the effect of chemical and mineral admixtures on drying shrinkage and compressive strength of concrete mixes.

4.6.1 Drying shrinkage of HSC

The effect of chemical and mineral admixtures on drying shrinkage of HSC is summarized as follows:

1. Fly ash replaced by total weight of cement at different percentage 20%, 25% and 30% with 5% silica fume and 0.6% HRWR-G increases drying shrinkage.
2. Fly ash replaced by total weight of cement at different percentage 20%, 25% and 30% with 5% metakaolin and 0.6% HRWR-G decreases drying shrinkage.
3. Fly ash replaced by total weight of cement at different percentage 20%, 25% and 30% with 5% silica fume, 0.6% HRWR-G, and 0.5% SRA-G reduced drying shrinkage by 36%. Furthermore, addition dosage of 0.5% SRA-G reduces the drying shrinkage by 36%.
4. Fly ash replaced by total weight of cement at percentages of 20% and 25% with 5% metakaolin, 0.6% HRWR-G, and 0.5% SRA-G have no effect on drying shrinkage. Furthermore, addition dosage of 0.5% SRA-G reduces the drying shrinkage by 10% at 2500 days.
5. Different dosage of SRA-G from 0% to 0.5% with 25% fly ash, 5% silica fume, and 0.6% HRWR-G reduces drying shrinkage by 43%.
6. Different dosage of SRA-G from 0% to 0.5% with 30% fly ash, 5% silica fume, and 0.6% HRWR-G reduces drying shrinkage by 29%.
7. Different dosage of SRA-G from 0% to 0.5% with 20% fly ash, 5% metakaolin, and 0.6% HRWR-G reduces drying shrinkage by 19%.
8. Different dosage of SRA-G from 0% to 0.5% with 25% fly ash, 5% metakaolin, and 0.6% HRWR-G reduces drying shrinkage by 20%.

9. Different dosage of SRA-G from 0% to 0.5% with 30% fly ash, 5% metakaolin, and 0.6% HRWR-G has negligible effect on drying shrinkage.
10. Different dosage of SRA-MB from 0% to 0.5 % with 25% fly ash, 5% silica fume, 0.6% HRWR-MB reduced drying shrinkage by 43%.
11. Addition of 0.6% HRWR-MB has the same effect as 0.4% HRWR-MB with 0.2% LRWR-MB on the drying shrinkage.
12. Different dosages of SRA-G of 0%, 0.5%, 1%, 1.5%, 2% and 2.5% with 25% fly ash, 5% silica fume, and 0.6% HRWR-G reduces the drying shrinkage by up to 57%. Furthermore, SRA-G above 1.5% to 2.5% has no additional effect on drying shrinkage.
13. Different dosages of SRA-G of 0%, 0.5%, 1%, 1.5%, 2% and 2.5% with 25% fly ash, 5% silica fume, 0.4% HRWR-G, and 0.2% LRWR-G reduces the drying shrinkage by up to 56%.
14. Different dosages of SRA-MB of 0%, 1%, 1.5%, 2% and 2.5% with 25% fly ash, 5% silica fume, 0.4% HRWR-MB, and 0.2% LRWR-MB reduces the drying shrinkage by 45% at 180 days. Furthermore, SRA-MB above 1.5% has no significant effect on drying shrinkage.
15. Increasing A/cm ratio from 4.76 to 4.80 decreases the drying shrinkage by 12% at 2500 days. Furthermore, dosage of A/cm from 4.80 to 5.28 has no significant effect on drying shrinkage.

4.6.2 Compressive strength of HSC

The effect of chemical and mineral admixtures on compressive strength of HSC is summarized as follows:

16. Fly ash replaced by total weight of cement at different percentage 20%, 25% and 30% and SRA-G from 0% to 0.5% with 5% silica fume decrease the compressive strength by 9%.
17. Fly ash replaced by total weight of cement at different percentage 20%, 25% and 30% and SRA-G from 0% to 0.5% with 5% metakaolin decrease the compressive strength by 5%.
18. Different dosages of SRA-G from 0% to 0.5% with 20% fly ash, and 5% silica fume reduce the compressive strength by 5% higher than 5% metakaolin.
19. Different dosages of SRA-G from 0% to 0.5% with 25% fly ash, and 5% silica fume reduce the compressive strength by 19% higher than 5% metakaolin.
20. Different dosages of SRA-G from 0% to 0.5% with 30% fly ash, and 5% silica fume reduce the compressive strength by 14% higher than 5% metakaolin.
21. Different dosages of HRWR-MB and LRWR-MB reduce the compressive strength by 13%.
22. Different dosages of SRA-G 0%, 0.5%, 1%, 1.5%, 2% and 2.5% with 25% fly ash, 5% silica fume, 0.6% HRWR-G, reduce the compressive strength by 10%.
23. Different dosages of SRA-G 0%, 0.5%, 1%, 1.5%, 2% and 2.5% with 25% fly ash, 5% silica fume, 0.4% HRWR-G, and 0.2% LRWR-G reduce the compressive strength by 4%.
24. Different dosages of SRA-MB 0%, 1%, 1.5%, 2% and 2.5% with 25% fly ash, 5% silica fume, 0.4% HRWR-MB, and 0.2% LRWR-MB reduce the compressive strength by 5%.

25. Increasing A/cm ratio from 4.76 to 4.80 (4 x 8-in.) cylinders increases the compressive strength by 15%. Furthermore, the compressive strength of 6 x 12-in. cylinders is lower than 4 x 8-in. cylinders.

Table 4-1 – Properties of Aggregates

½ in Coarse Aggregate				Fine Aggregate			
ASTM C33 Sieve Analysis	**Percentage Passing**		**ASTM C33 Spec. Size**	**ASTM C33 Sieve Analysis**	**Percentage Passing**		**ASTM C33 Spec. Size**
	Sechell ½" × #4	**Caltrans ½" × #4**			**Sechell ½" × #4**	**Caltrans ½" × #4**	
3/4"	100	100	100	3/8"	100	100	100
1/2"	95	82-100	90-100	No. 4	99	95-100	95-100
3/8"	63	40-78	40-70	No. 8	89	65-95	90-100
No. 4	2	0-15	0-15	No. 16	70	55-75	50-85
No. 8	1	0-6	0-5	No. 30	47	34-46	25-60
				No. 50	19	15-29	10-30
				No. 100	5	2-12	2-10
				No. 200	1	0-8	0-3
Bulk Specific Gravity (SSD)			2.69	Bulk Specific Gravity (SSD)			2.65
Absorption%			0.8	Absorption%			0.9
				Fineness Modulus			2.77

Table 4-2 – Concrete mix composition

Mix No.	Water	Cement	HRWR (Grace) ADVA-100	SRA (Grace) Eclipse	LRWR (Grace) WRAD-64	HRWR (MB) Rheobuild	SRA (MB) Tetraguard	LRWR (MB) Pozzolith	Fly Ash Class F	Silica Fume	Meta-kaolin Class N	Coarse Agg. (1/2 in.)	Fine Agg.
	(lb/cyd)	(lb/cyd)	(oz/cyd)	(oz/cyd)	(oz/cyd)	(oz/cyd)	(oz/cyd)	(oz/cyd)	(lb/cyd)	(lb/cyd)	(lb/cyd)	(lb/cyd)	(lb/cyd)
1	208	473	57.6	50.4	----				126	32	----	1752	1564
2	208	473	57.6	----	----				126	32	----	1752	1564
3	208	473	57.6	----	----				126	----	32	1752	1564
4	208	473	57.6	50.4	----				126	----	32	1752	1564
5	208	441	57.6	----	----				158	32	----	1752	1564
6	208	441	57.6	----	----				158	----	32	1752	1564
7	208	441	57.6	50.4	----				158	32	----	1752	1564
8	208	441	57.6	50.4	----				158	-----	32	1752	1564
9	208	410	57.6	----	----				189	32	----	1752	1564
10	208	410	57.6	----	----				189	----	32	1752	1564
11	208	410	57.6	50.4	----				189	----	32	1752	1564
12	208	410	57.6	50.4	----				189	32	----	1752	1564
13	208	441	57.6	100.8	----				158	32	----	1752	1564
14	208	441	57.6	151.3	----				158	32	----	1752	1564
15	208	441	57.6	201.7	----				158	32	----	1752	1564
16	208	441	57.6	252.1	----				158	32	----	1752	1564
17	208	441	38.4	----	19.2				158	32	----	1752	1564
18	208	441	38.4	50.4	19.2				158	32	----	1752	1564
19	208	441	38.4	100.8	19.2				158	32	----	1752	1564
20	208	441	38.4	151.3	19.2				158	32	----	1752	1564
21	208	441	38.4	201.7	19.2				158	32	----	1752	1564
22	208	441	38.4	252.1	19.2				158	32	----	1752	1564
23	208	441				57.6	----	----	158	32	----	1752	1564
24	208	441				57.6	50.4	----	158	32	----	1752	1564
25	208	441				38.4	----	19.2	158	32	----	1752	1564
26	208	441				38.4	50.4	19.2	158	32	----	1752	1564
27	208	441				38.4	100.8	19.2	158	32	----	1752	1564

Mix No.	Water	Cement	HRWR (Grace) ADVA-100	SRA (Grace) Eclipse	LRWR (Grace) WRAD-64	HRWR (MB) Rheobuild	SRA (MB) Tetraguard	LRWR (MB) Pozzolith	Fly Ash Class F	Silica Fume	Meta-kaolin Class N	Coarse Agg. (1/2 in.)	Fine Agg.
28	208	441				38.4	151.3	19.2	158	32	----	1752	1564
29	208	441				38.4	201.7	19.2	158	32	----	1752	1564
30	208	441	----	----	----	38.4	252.1	19.2	158	32	----	1752	1564
31	223	474	41.2	----	20.6				169	----	32	1752	1485
32	230	474	41.2	----	20.6				169	----	32	1752	1460
33	213	439	38.2	----	19.1				157	----	32	1752	1564
34	240	494	43	-----	21.5				176	----	32	1752	1413

Table 4-3 – Concrete mix proportions

Mix No.	*w/cm	HRWR (Grace) ADVA-100	SRA (Grace) Eclipse	LRWR (Grace) WRAD-64	HRWR (MB) Rheobuild 3000FC	SRA (MB) Tetraguard AS20	LRWR (MB) Pozzolith 200N	Fly Ash Class F	Silica Fume	Meta-kaolin Class N	**A/*cm*	***CA/FA	Fineness Fine Aggregate	CA vol. Per unit wt.
1	0.33	0.6	0.5					20	5		5.25	1.12	2.77	0.64
2	0.33	0.6	0.0					20	5		5.25	1.12	2.77	0.64
3	0.33	0.6	0.0					20		5	5.25	1.12	2.77	0.64
4	0.33	0.6	0.5					20		5	5.25	1.12	2.77	0.64
5	0.33	0.6	0.0					25	5		5.25	1.12	2.77	0.64
6	0.33	0.6	0.0					25		5	5.25	1.12	2.77	0.64
7	0.33	0.6	0.5					25	5		5.25	1.12	2.77	0.64
8	0.33	0.6	0.5					25		5	5.25	1.12	2.77	0.64
9	0.33	0.6	0.0					30	5		5.25	1.12	2.77	0.64
10	0.33	0.6	0.0					30		5	5.25	1.12	2.77	0.64
11	0.33	0.6	0.5					30		5	5.25	1.12	2.77	0.64
12	0.33	0.6	0.5					30	5		5.25	1.12	2.77	0.64
13	0.33	0.6	1.0					25	5		5.25	1.12	2.77	0.64
14	0.33	0.6	1.5					25	5		5.25	1.12	2.77	0.64
15	0.33	0.6	2.0					25	5		5.25	1.12	2.77	0.64
16	0.33	0.6	2.5					25	5		5.25	1.12	2.77	0.64
17	0.33	0.4	0.0	0.2				25	5		5.25	1.12	2.77	0.64
18	0.33	0.4	0.5	0.2				25	5		5.25	1.12	2.77	0.64
19	0.33	0.4	1.0	0.2				25	5		5.25	1.12	2.77	0.64
20	0.33	0.4	1.5	0.2				25	5		5.25	1.12	2.77	0.64
21	0.33	0.4	2.0	0.2				25	5		5.25	1.12	2.77	0.64
22	0.33	0.4	2.5	0.2				25	5		5.25	1.12	2.77	0.64
23	0.33				0.6	0		25	5		5.25	1.12	2.77	0.64
24	0.33				0.6	0.5		25	5		5.25	1.12	2.77	0.64
25	0.33				0.4	0	0.2	25	5		5.25	1.12	2.77	0.64
26	0.33				0.4	0.5	0.2	25	5		5.25	1.12	2.77	0.64
27	0.33				0.4	1	0.2	25	5		5.25	1.12	2.77	0.64

Mix No.	*w/cm	HRWR (Grace) ADVA-100	SRA (Grace) Eclipse	LRWR (Grace) WRAD-64	HRWR (MB) Rheobuild 3000FC	SRA (MB) Tetraguard AS20	LRWR (MB) Pozzolith 200N	Fly Ash Class F	Silica Fume	Meta-kaolin Class N	**A/*cm*	***CA/FA	Fineness Fine Aggregate	CA vol. Per unit wt.
28	0.33				0.4	1.5	0.2	25	5		5.25	1.12	2.77	0.64
29	0.33				0.4	2.0	0.2	25	5		5.25	1.12	2.77	0.64
30	0.33				0.4	2.5	0.2	25	5		5.25	1.12	2.77	0.64
31	0.33	0.4	0.0	0.2				25		5	4.80	1.18	2.77	0.64
32	0.34	0.4	0.0	0.2				25		5	4.76	1.20	2.77	0.64
33	0.34	0.4	0.0	0.2				25		5	5.28	1.12	2.77	0.64
34	0.34	0.4	0.0	0.2				25		5	4.51	1.24	2.77	0.64

* *w/cm* = Water-to-cementitious materials ratio by weight

** A/*cm* = Aggregate-to-cementitious materials ratio by weight

*** CA/FA = Coarse aggregate-to-fine aggregate ratio by weight

Mixes containing ASTM Type II cement.

Note:				
	Mixes 1 through 30	Cement Content=	631 lb/cy	(6.70 Sacks)
	Mixes 31 and 32	Cement Content=	675 lb/cy	(7.18 Sacks)
	Mix 33	Cement Content=	628 lb/cy	(6.68 Sacks)
	Mix 34	Cement Content=	702 lb/cy	(7.47 Sacks)

Figure 4-1 Shrinkage versus age of concrete mix with varying FA content and 5% SF, 0.6% HRWR-G

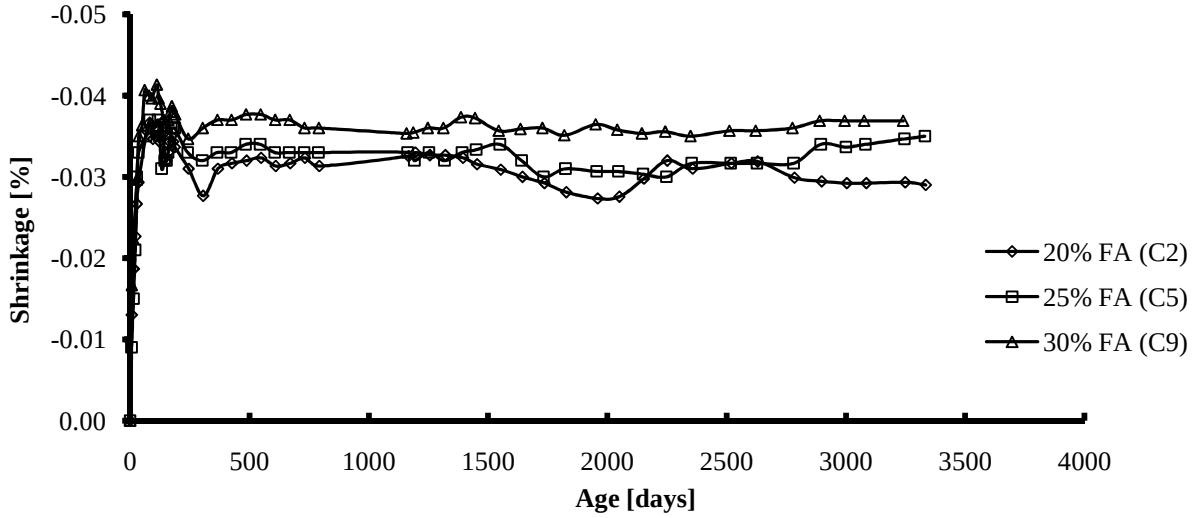


Figure 4-2 Shrinkage versus age of concrete mix with varying FA content and 5% MK, 0.6% HRWR-G

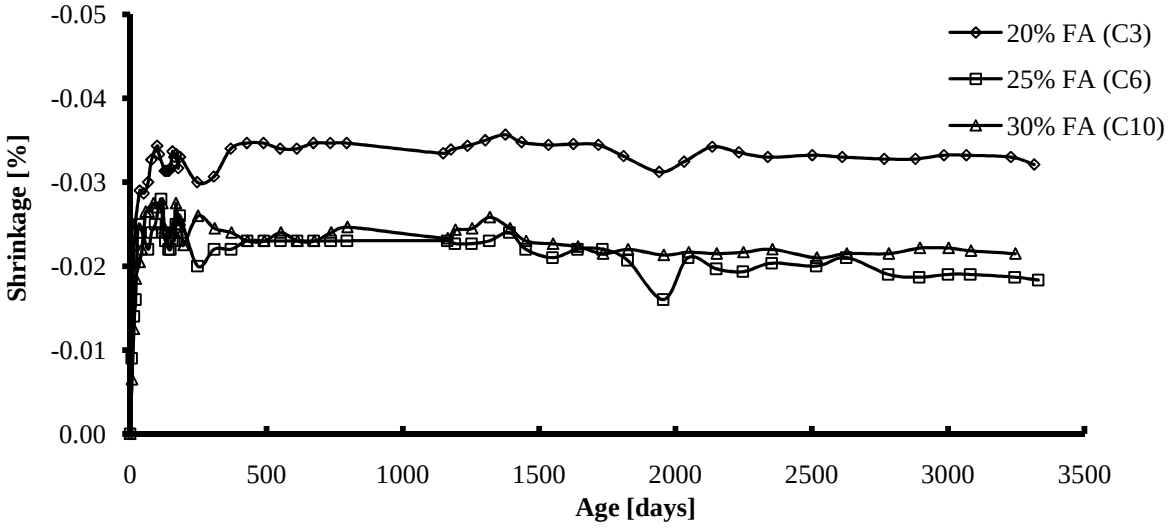


Figure 4-3 Shrinkage versus age of concrete mix with varying FA content and 5% SF, 0.6% HRWR-G, 0.5% SRA-G

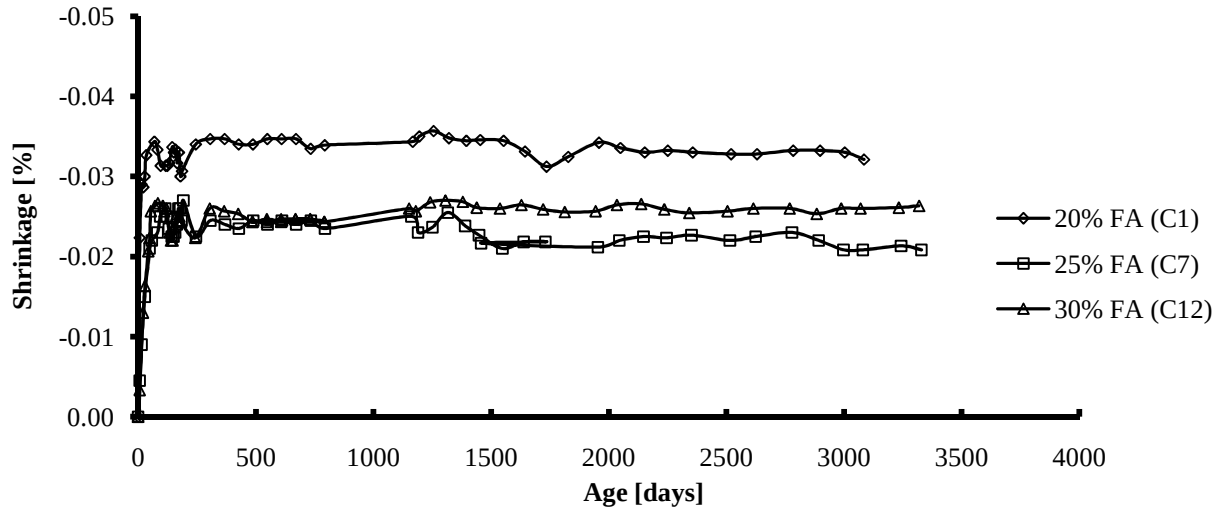


Figure 4-4 Shrinkage versus age of concrete mix with varying FA content and 5% MK, 0.6% HRWR-G, 0.5% SRA-G

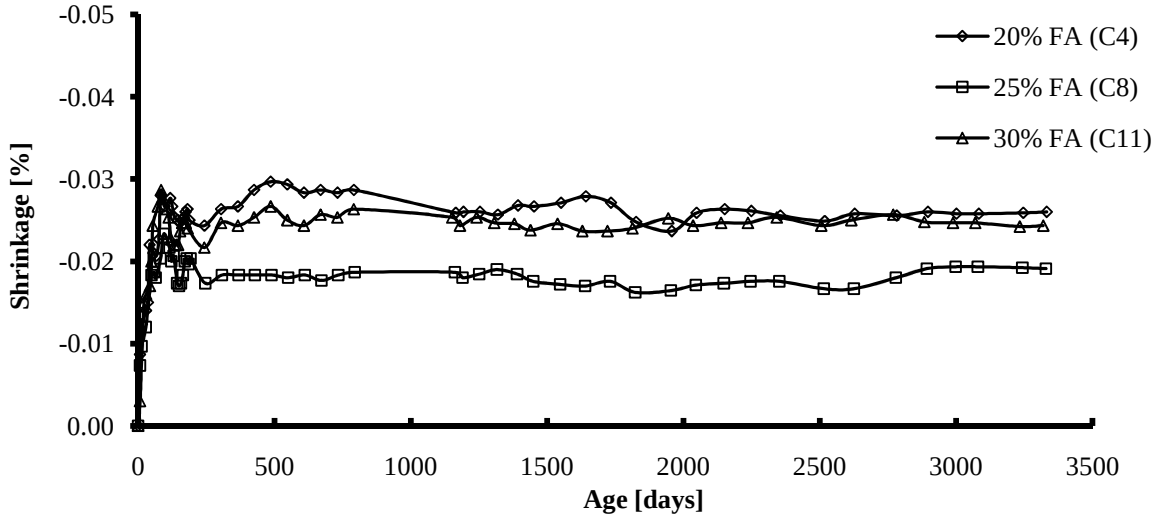


Figure 4-5 Shrinkage versus age of concrete mix with varying SRA-G and 5% SF, 25% FA, 0.6% HRWR-G

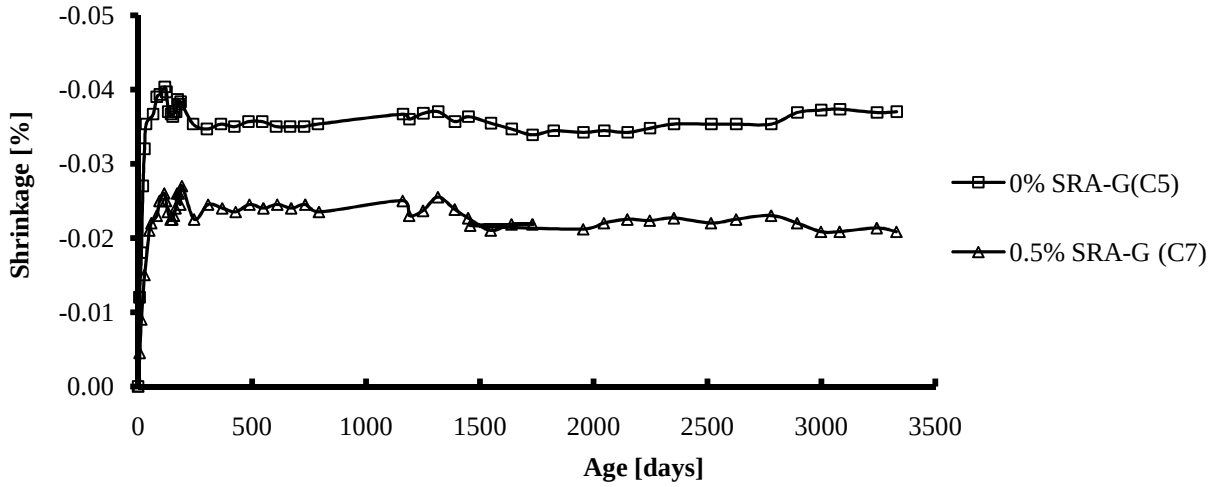


Figure 4-6 Shrinkage versus age of concrete mix with varying SRA-G and 5% SF, 30% FA, 0.6% HRWR-G

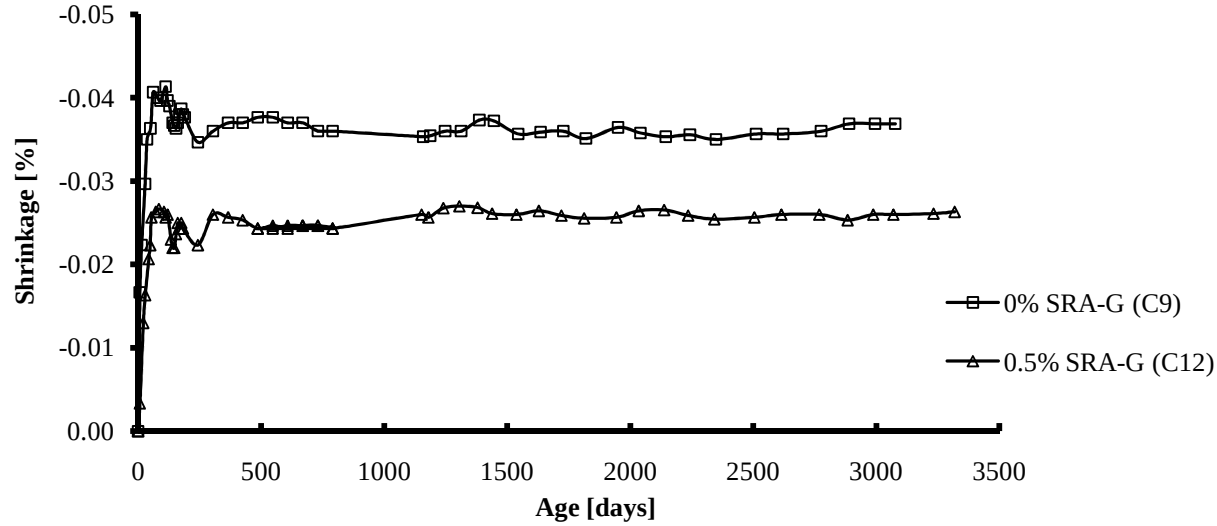


Figure 4-7 Shrinkage versus age of concrete mix with varying SRA-G and 5% MK, 20% FA, 0.6% HRWR-G

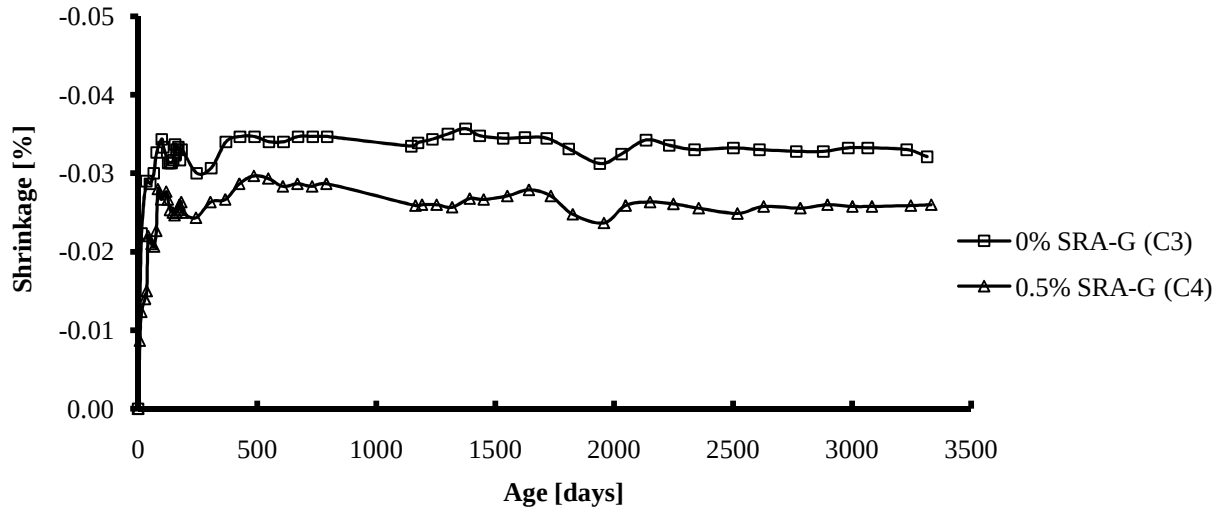


Figure 4-8 Shrinkage versus age of concrete mix with varying SRA-G and 5% MK, 25% FA, 0.6% HRWR-G

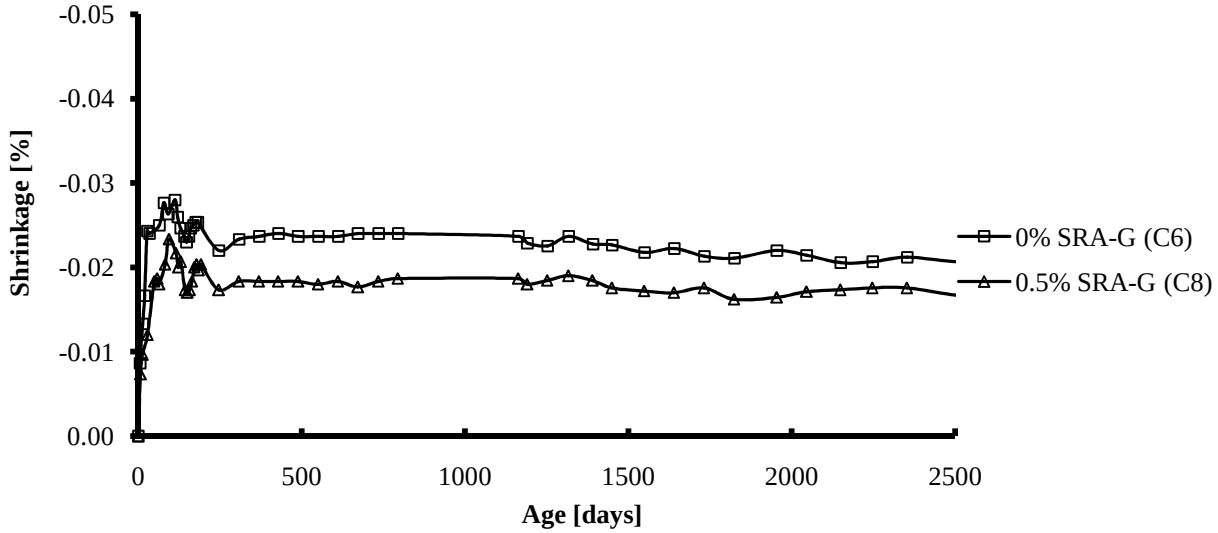


Figure 4-9 Shrinkage versus age of concrete mix with varying SRA-G and 5% MK, 30% FA, 0.6% HRWR-G

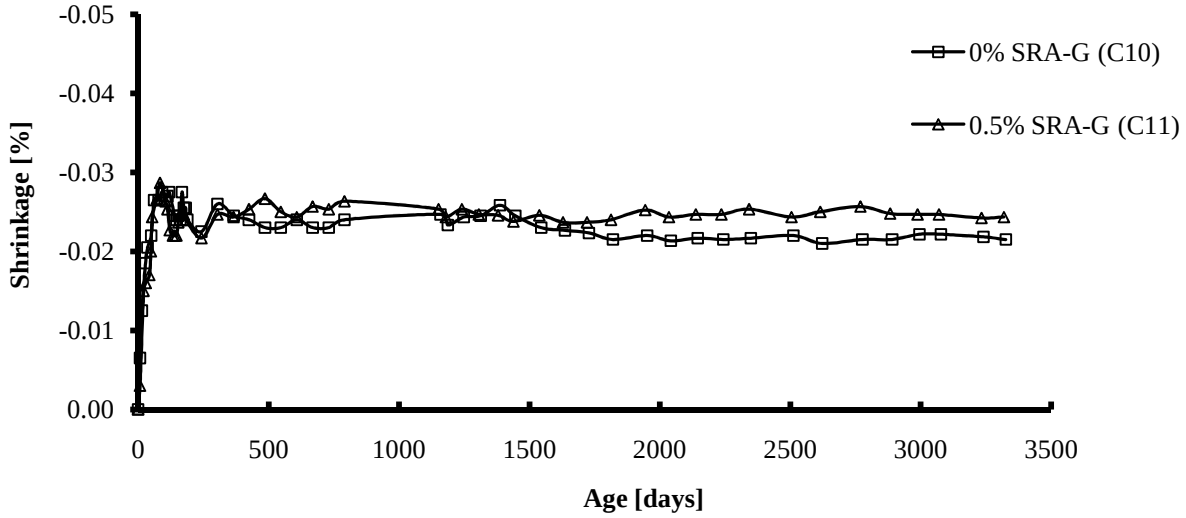


Figure 4-10 Shrinkage versus age of concrete mix with varying SRA-MB and 25% FA, 5% SF, 0.6% HRWR-MB

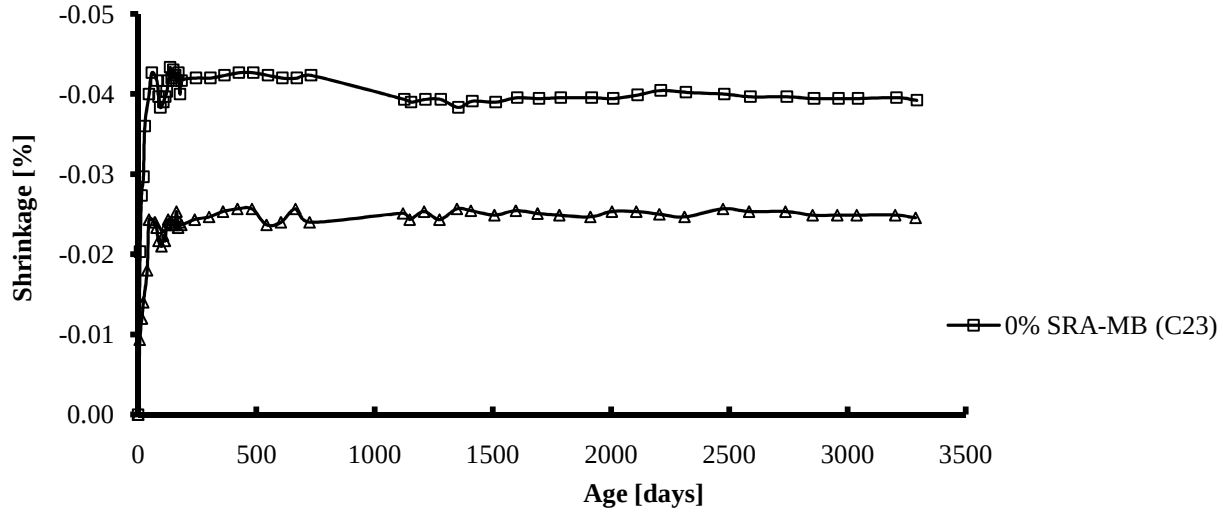


Figure 4-11 Shrinkage versus age of concrete mix with varying HRWR-MB and LRWR-MB; and 25% FA, 5% SF

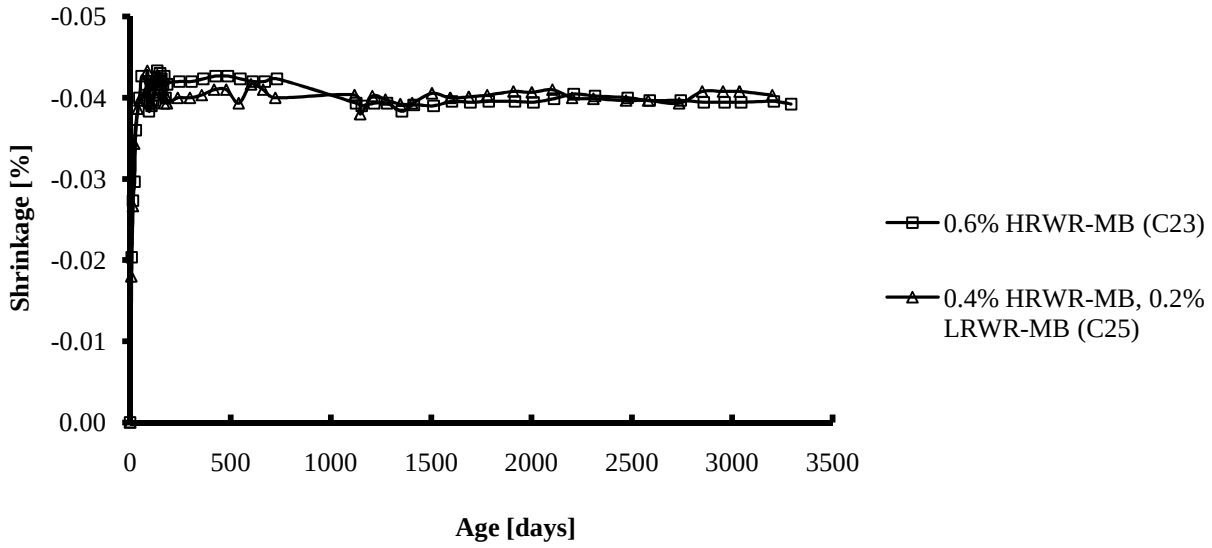


Figure 4-12 Shrinkage versus age of concrete mix with varying SRA-G and 5% SF, 25% FA, 0.6% HRWR-G

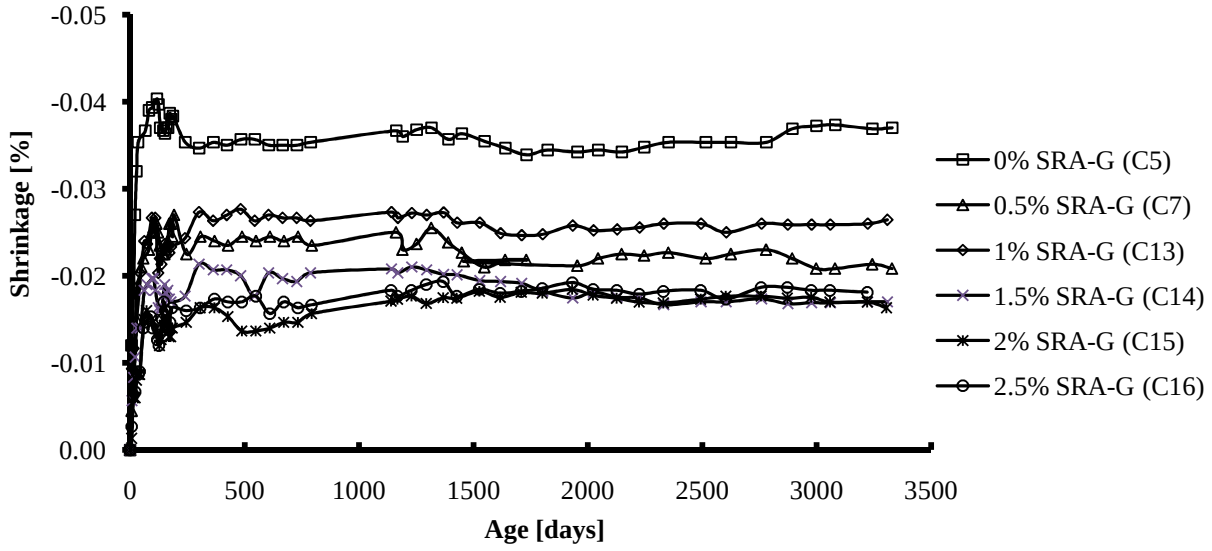


Figure 4-13 Shrinkage versus age of concrete mix with varying SRA-G content and 5% SF, 25% FA, 0.4% HRWR-G, 0.2% LRWR-G

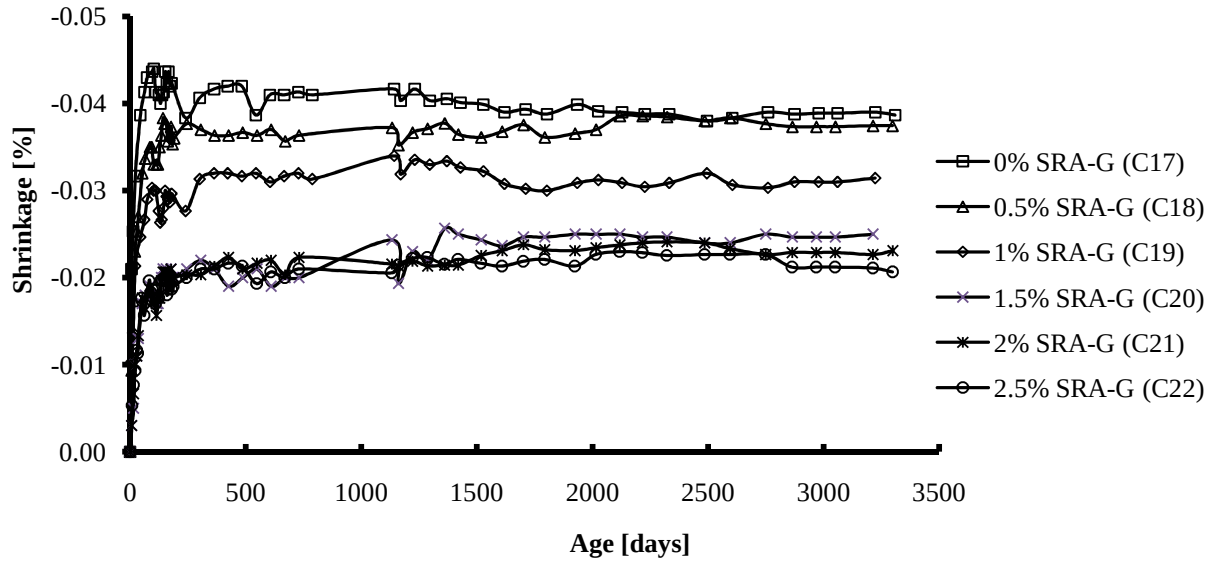


Figure 4-14 Shrinkage versus age of concrete mix with varying SRA-MB content and 5% SF, 25% FA, 0.4% HRWR-MB, 0.2% LRWR-MB

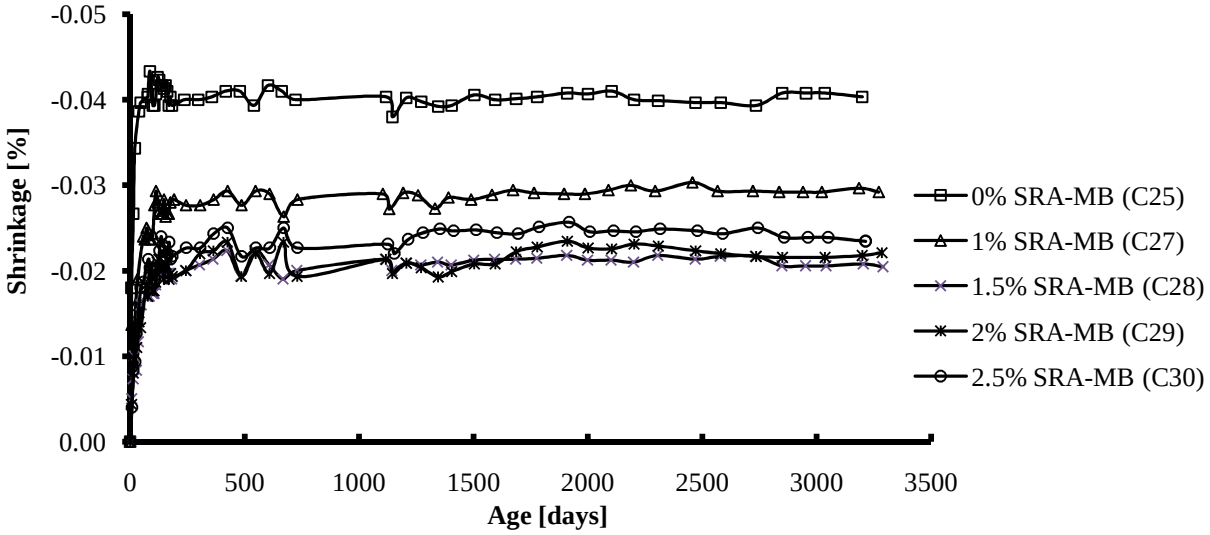


Figure 4-15 Shrinkage versus age of concrete mix with varying Cement content and 5% MK, 25% FA, 0.4% HRWR-G, 0.2% LRWR-G

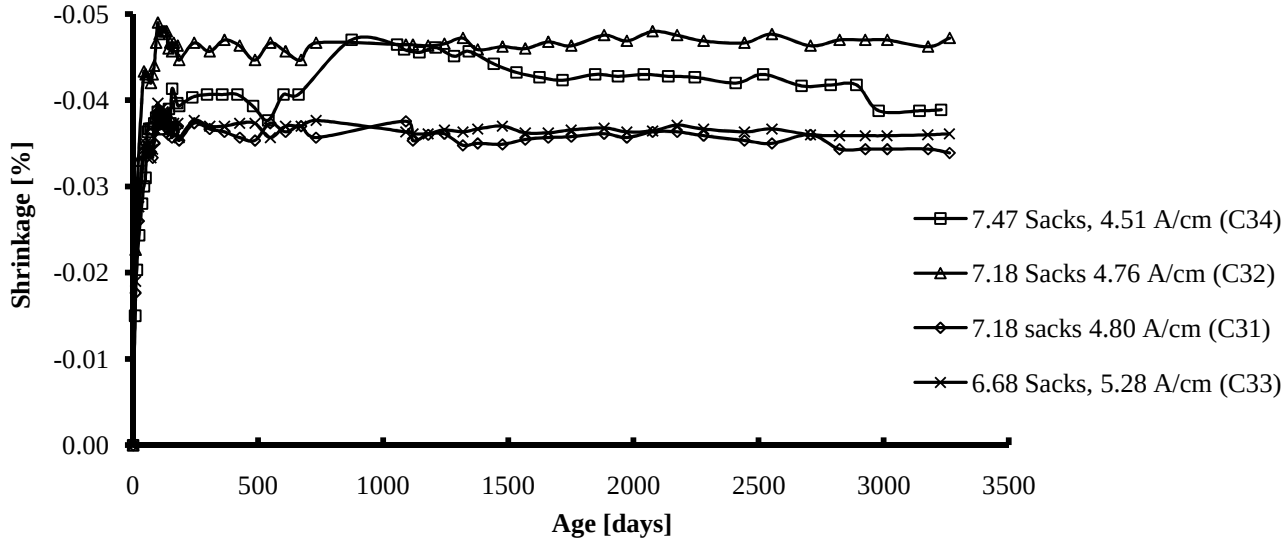


Figure 4-16: Compressive Strength versus Age for Concrete with Different Dosages of Fly Ash and SRA-G
(5% SF, 0.6% HRWR-G)

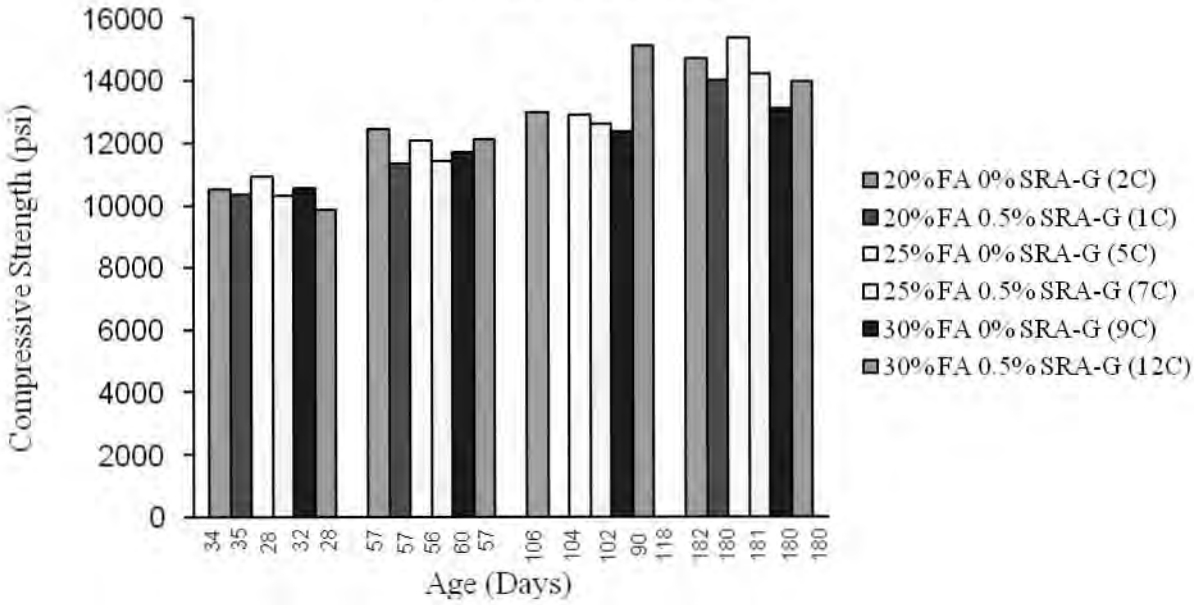


Figure 4-17: Compressive Strength versus Age for Concrete with Different Dosages of Fly Ash and SRA-G
(5% Metak, 0.6% HRWR-G)

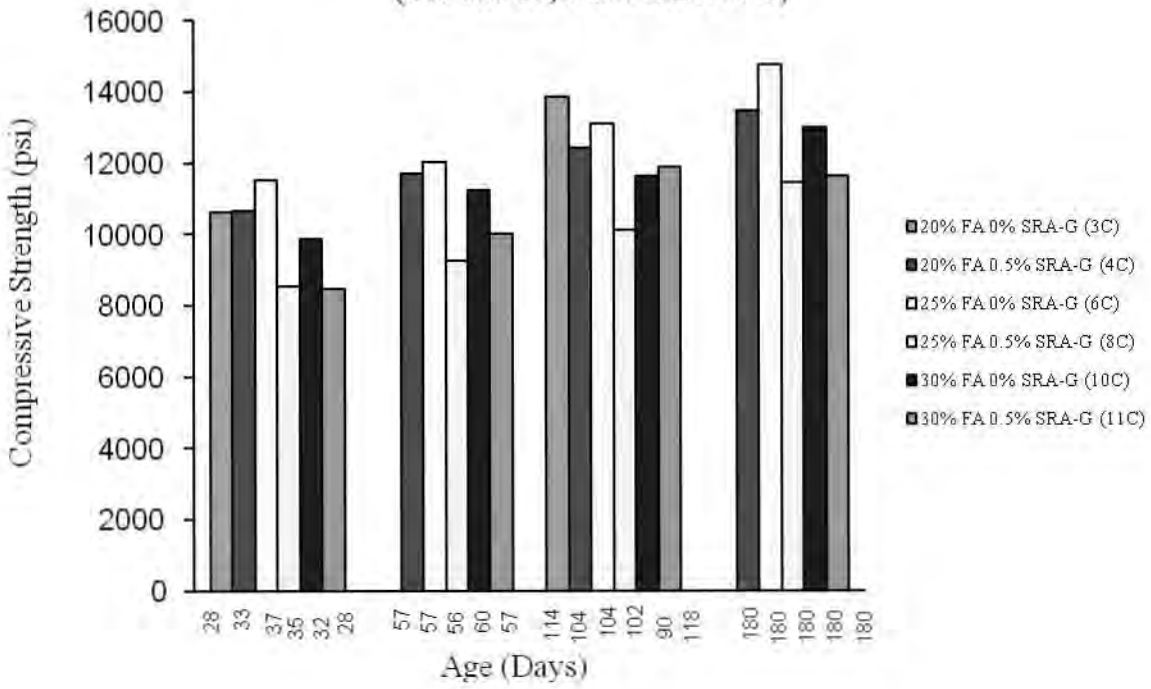


Figure 4-18: Compressive Strength versus Age for Concrete with 20% Fly Ash **(0.6% HRWR-G)**

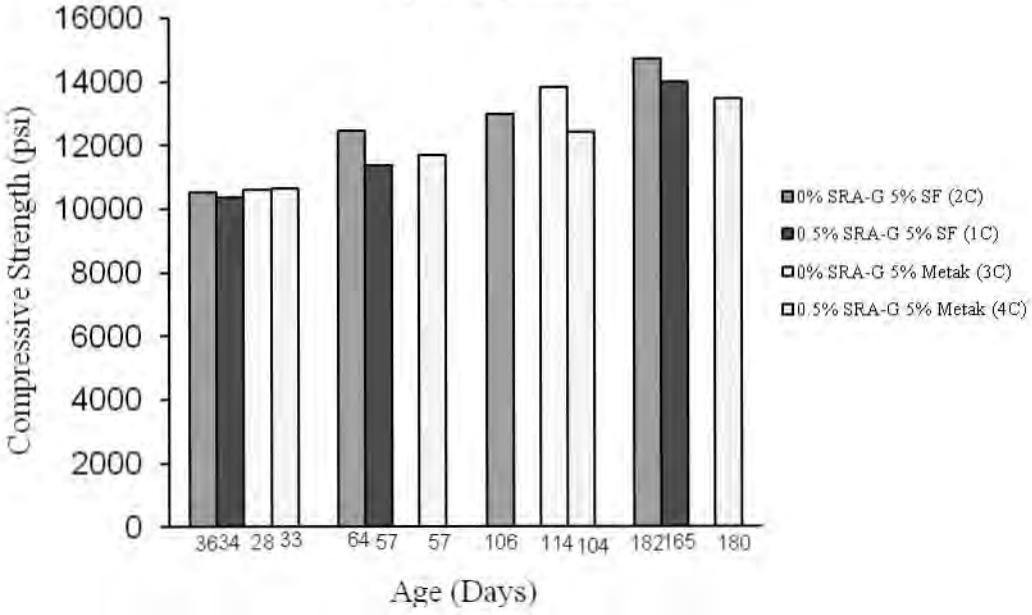


Figure 4-19: Compressive Strength versus Age for Concrete with 25% Fly Ash
(0.6% HRWR-G)

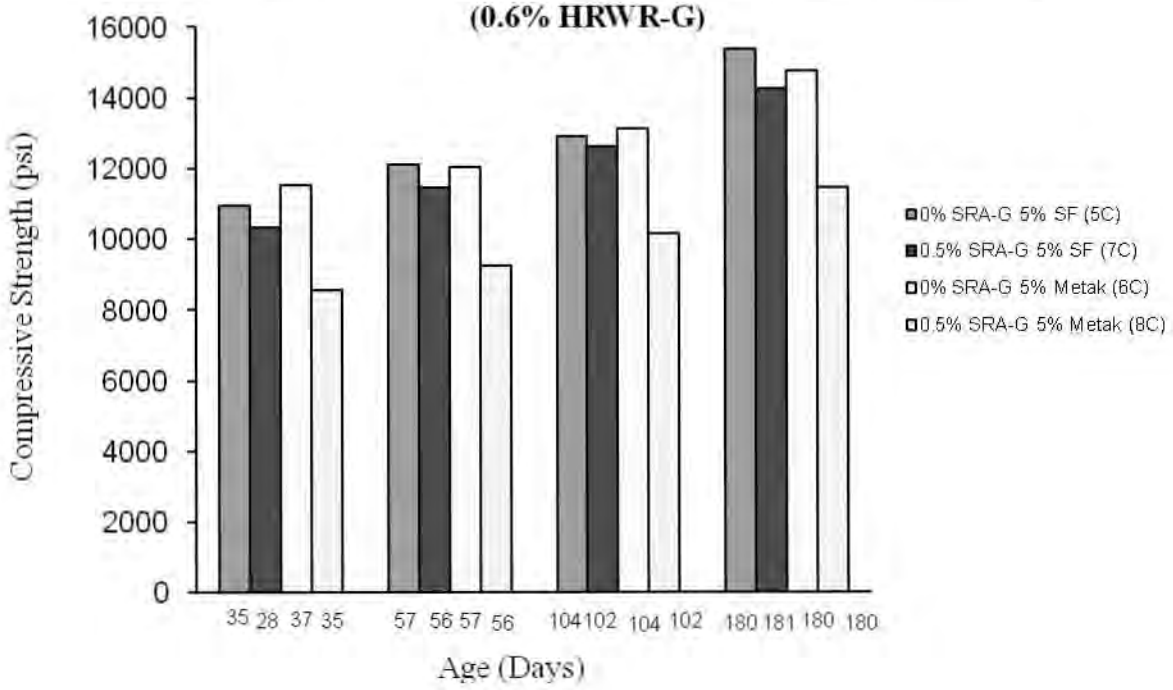


Figure 4-20: Compressive Strength versus Age for Concrete with 30% Fly Ash
(0.6% HRWR-G)

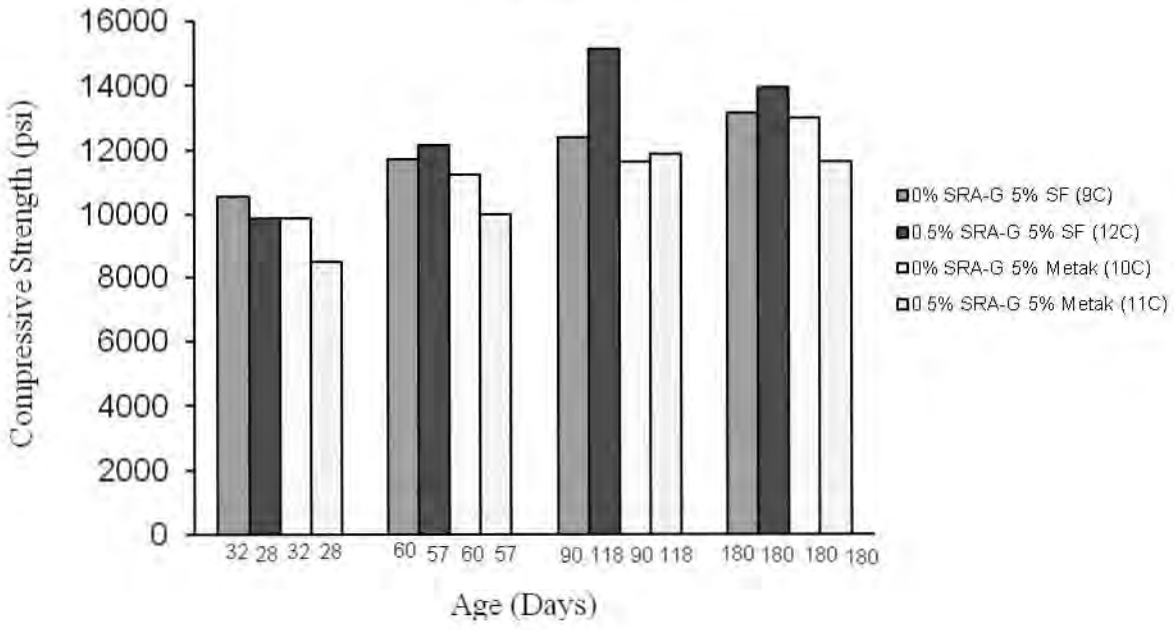


Figure 4-21: Compressive Strength versus Age for Concrete with Different Dosages of HRWR-MB and LRWR-MB
(25% FA, 5% SF)

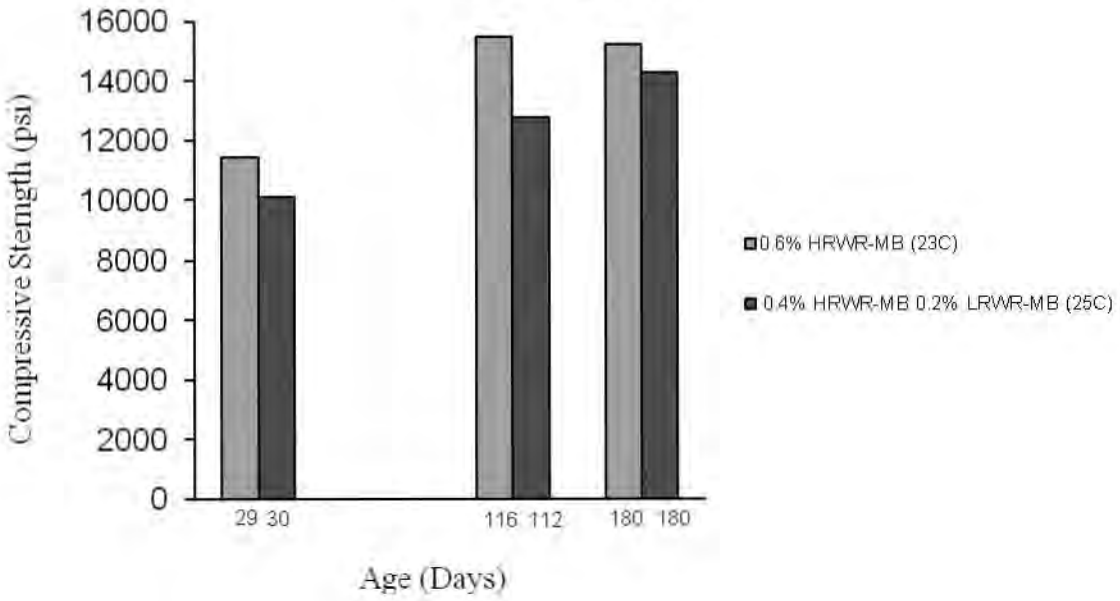


Figure 4-22: Compressive Strength versus Age for Concrete with Different Dosages of SRA-G
(5% SF, 25% FA, 0.6% HRWR-G)

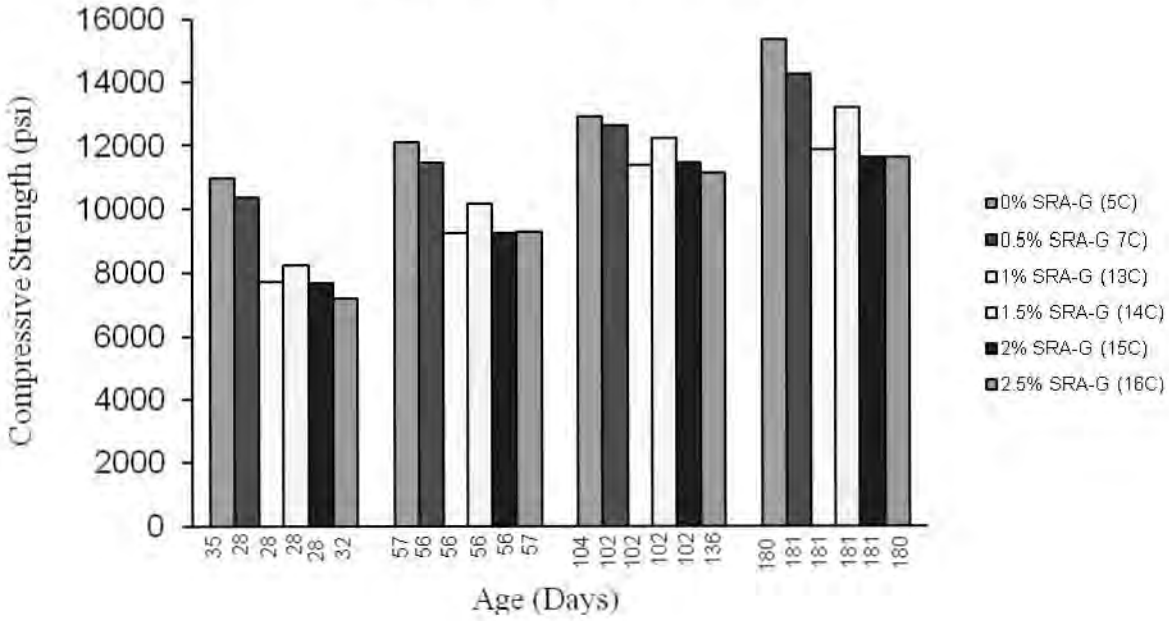


Figure 4-23: Compressive Strength versus Age for Concrete with Different Dosages of SRA-G

(5% SF, 25% FA, 0.4% HRWR-G, 0.2% LRWR-G)

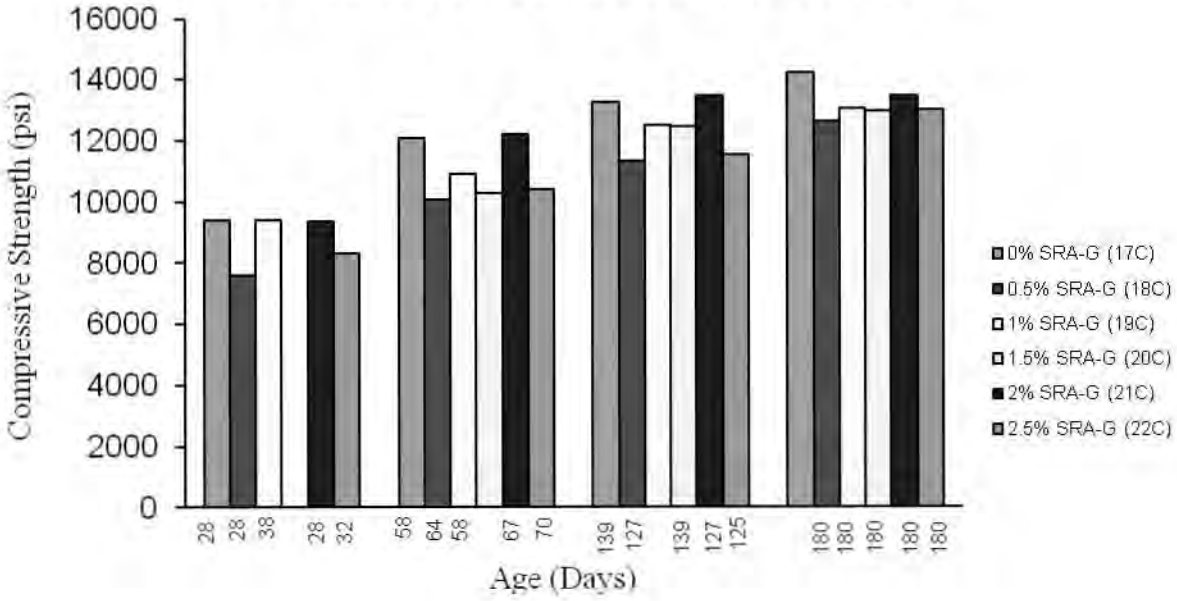


Figure 4-24: Compressive Strength versus Age for Concrete with Different Dosages of SRA-MB

(5% SF, 25% FA, 0.4% HRWR-MB, 0.2% LRWR-MB)

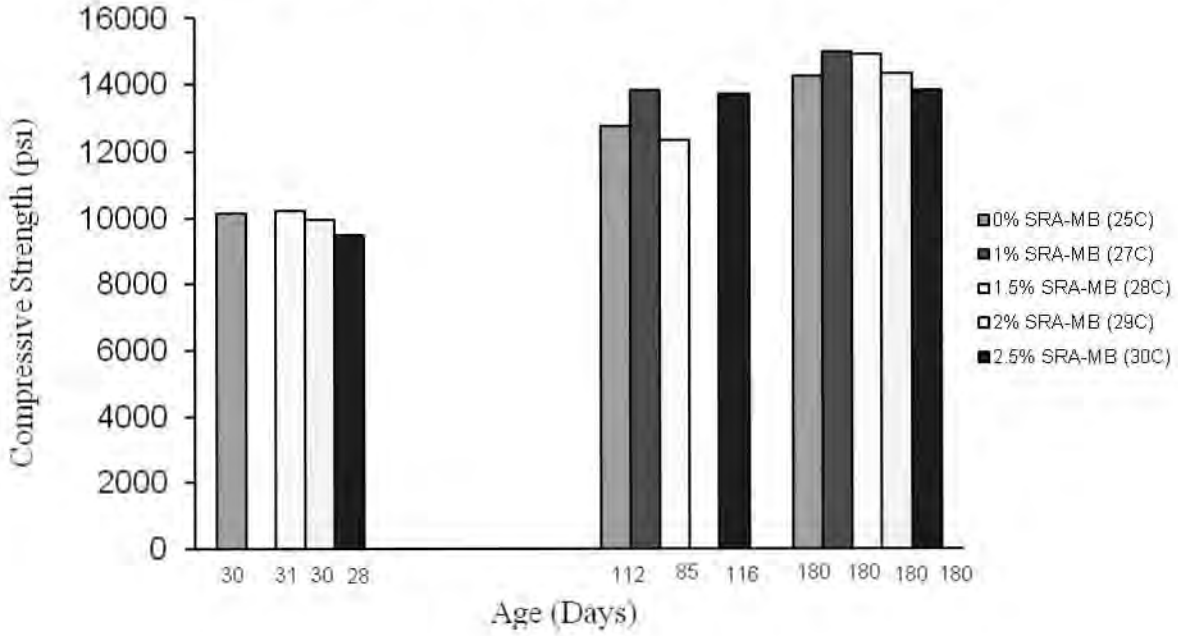


Figure 4-25: Compressive Strength versus Age for Concrete with Different Cement Content and A/cm Ratio
(4 x 8-in. Cylinders)

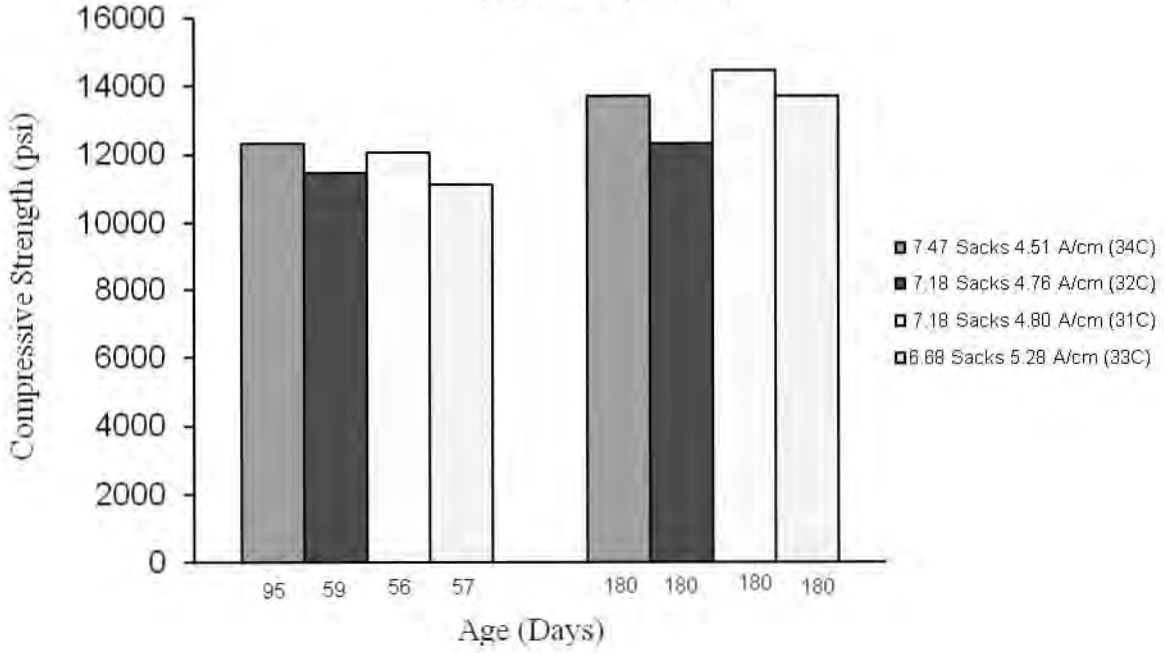
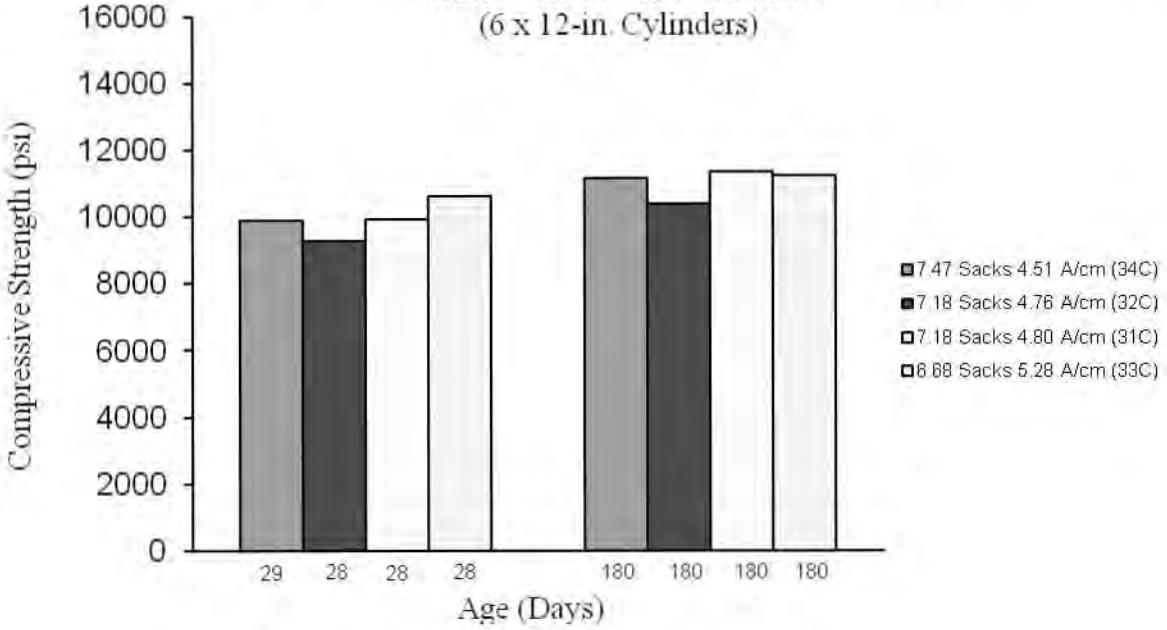


Figure 4-26: Compressive Strength versus Age for Concrete with Different Cement Content and A/cm Ratio (6 x 12-in. Cylinders)



CHAPTER 5 CREEP IN CONCRETE MIXES WITH ADMIXTURES

Creep in Concrete Mixes with admixtures

5.1 Introduction

This chapter describes the effects of admixtures on the creep of concrete mixes. The concrete mixes were prepared using SRA-G, HRWR-G, LRWR-G, slag, fly ash and metakaolin. The same materials and admixtures were utilized as described in Chapter 3 and 4.

5.2 Mix Design

A total of six concrete mixes were prepared to study the effect of SRAs and slag. Mixes with SRA were prepared with a w/cm ratio of 0.35. The detailed composition and proportions of the mixes are provided in Table 5-1.

5.3 Test Results and Discussion

The data from the creep specimens is provided is plotted and tabulated in Appendix VI. Creep specimens were studied for an age of up to 2500 days.

The data described in this chapter are from the results of Appendix VI. The effect of different mixes on creep of concrete mixes is shown in Figures 5-1 through 5-5. The figures provide creep along with shrinkage and elastic strain. Elastic strain was taken as the initial change in length, when the specimens were loaded for creep measurement.

Figure 5-6 shows the effect of adding SRA-G at dosages varying from 0% to 2.5% with 0.4% HRWR-G, 5% Fly Ash and a w/cm ratio of 0.35. The graph indicates that increasing

dosages of SRA-G reduces drying shrinkage. At age of 2500 days, the addition of 1.5% and 2.5% decreases drying shrinkage by 38% and 28%, compared to specimens with no SRA.

Figure 5-7 shows the effect of addition of 50% slag compared to a mix with no slag. The figure shows that the addition of slag resulted in a higher combined creep and shrinkage, however, the creep in the specimens was same. The comparison was performed for a period of 220 days.

Creep Coefficient for Skyway Structure of San Francisco-Oakland Bay Bridge

Creep coefficient was estimated using computational methods for mix 48, which was utilized in the Skyway Structure of San Francisco-Oakland Bay Bridge. The CEB 90-99 model was utilized and showed an over estimation of the creep coefficient when compared to the experimental data of the same mix. Figure 5-8 shows a comparison of experimental and computed creep coefficient for mix 48. Data for all the mixes is provided in Appendix VI.

5.4 Conclusion

The summary of the findings of this study are as follows

1. Addition of SRA-G in concrete mixes containing 0.4% HRWR-G, 5% Fly ash, 1% Metakaolin reduced long term creep and drying shrinkage.
2. The addition of slag resulted in higher shrinkage, while creep of concrete containing slag exhibited similar values as those with no slag.
3. The CEB 90-99 provided an over estimation of the creep coefficient when compared to the experimental data from the Skyway Structure of San Francisco-Oakland Bay Bridge.

Table 5-1 – Composition of Creep Mixes

Mix #	Mix Date	w/c	CA/FA	Cement Content (sacs)	Fly Ash %	Silica Fume %	Meta-kaolin %	Slag	HRWR %	LRWR %	SRA %
44	9/15/2003	0.35	1.24	7.5	5		1		0.40	0.00	1.00
45	1/7/2004	0.45	1	7				50			
46	9/15/2003	0.35	1.24	7.5	5		1		0.40	0.00	0.00
47	9/15/2003	0.35	1.24	7.5	5		1		0.40	0.00	2.50
48	8/24/2005	0.29	1.9	6.51	25				1.00	1.00	2.00

Figure 5- 1: Creep, Shrinkage and Elastic Strain in Mix 44 containing 1.0% SRA-G, 0.4% HRWR-G, 5% Fly ash, 1% Metakaolin

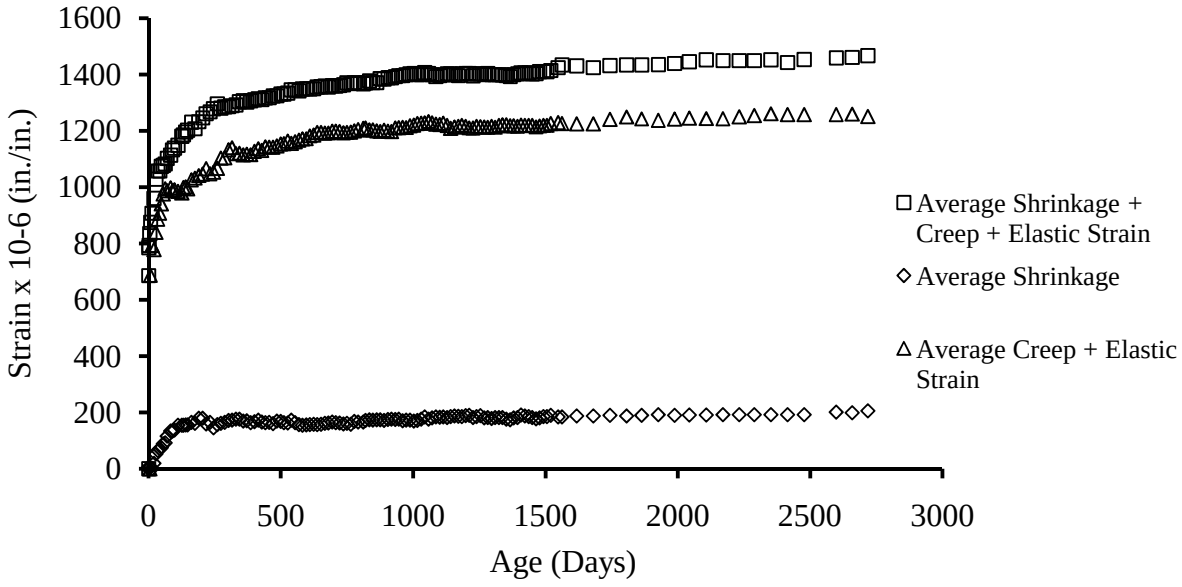


Figure 5-2: Creep, Shrinkage and Elastic Strain in Mix 45 containing 50% Slag

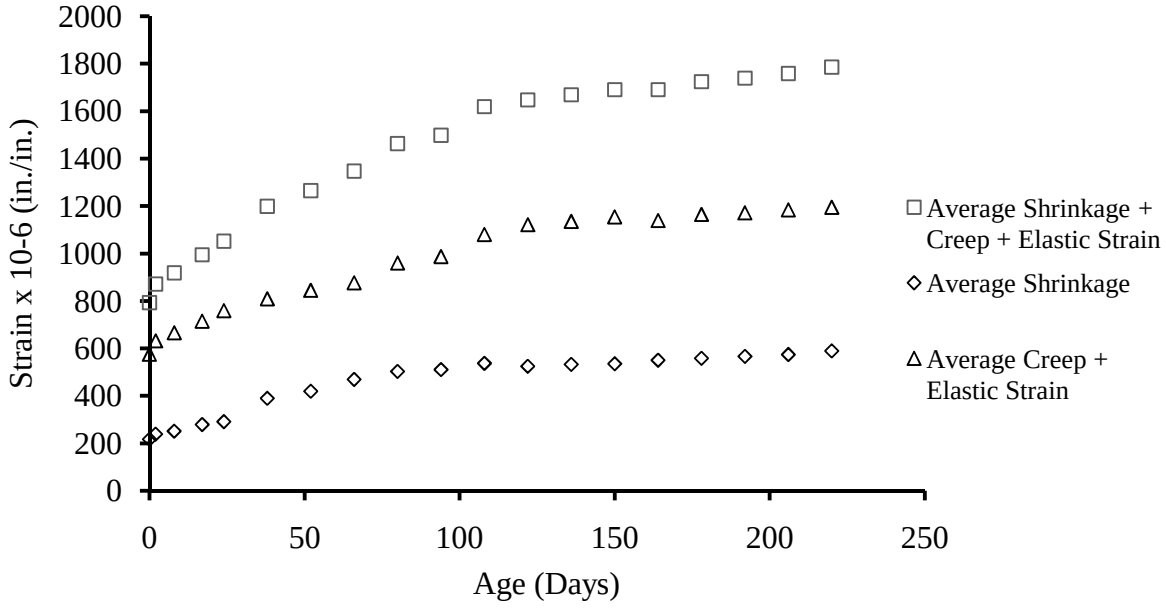


Figure 5-3: Creep, Shrinkage and Elastic Strain in Mix 46 containing 0.0% SRA-G, 0.4% HRWR-G 5% Fly ash, 1% Metakaolin

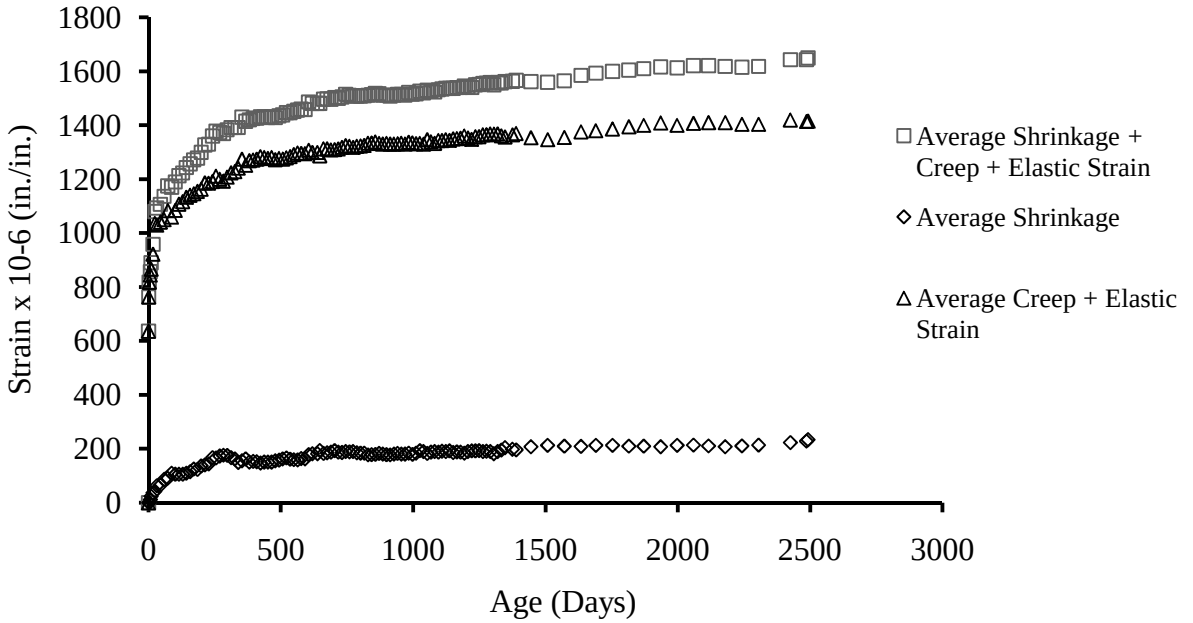


Figure 5-4: Creep, Shrinkage and Elastic Strain in Mix 47 containing 2.5% SRA-G, 0.4% HRWR-G 5% Fly ash, 1% Metakaolin

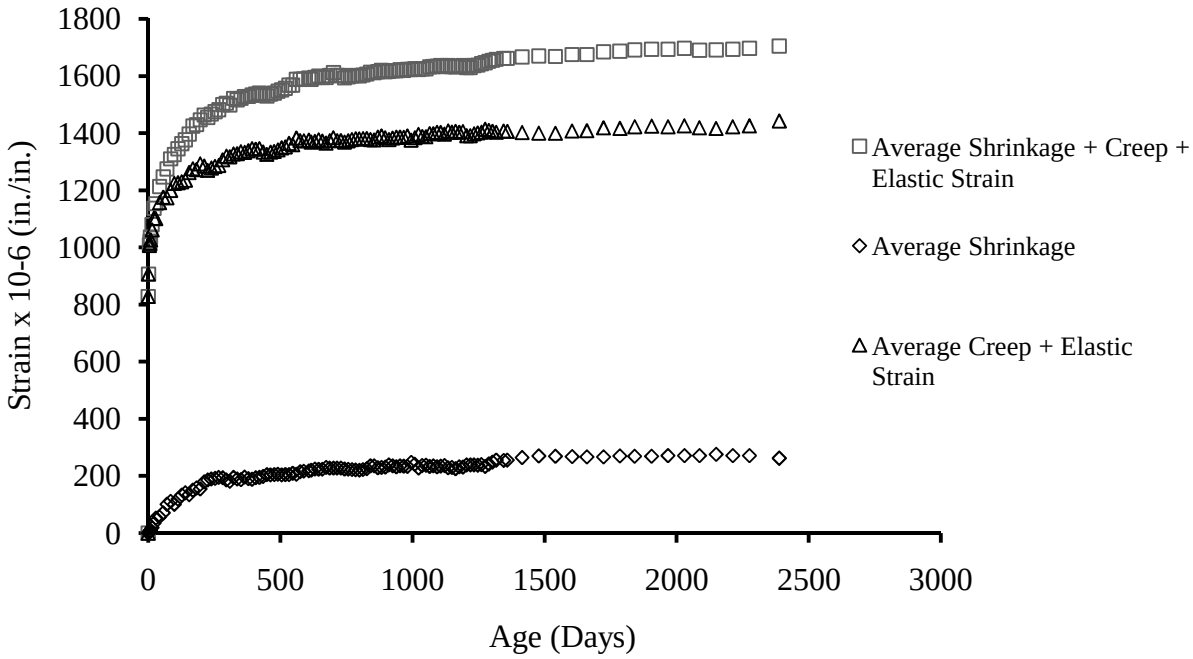


Figure 5-5: Creep, Shrinkage and Elastic Strain in Mix 48 (Skyway Structure of San Francisco-Oakland Bay Bridge)

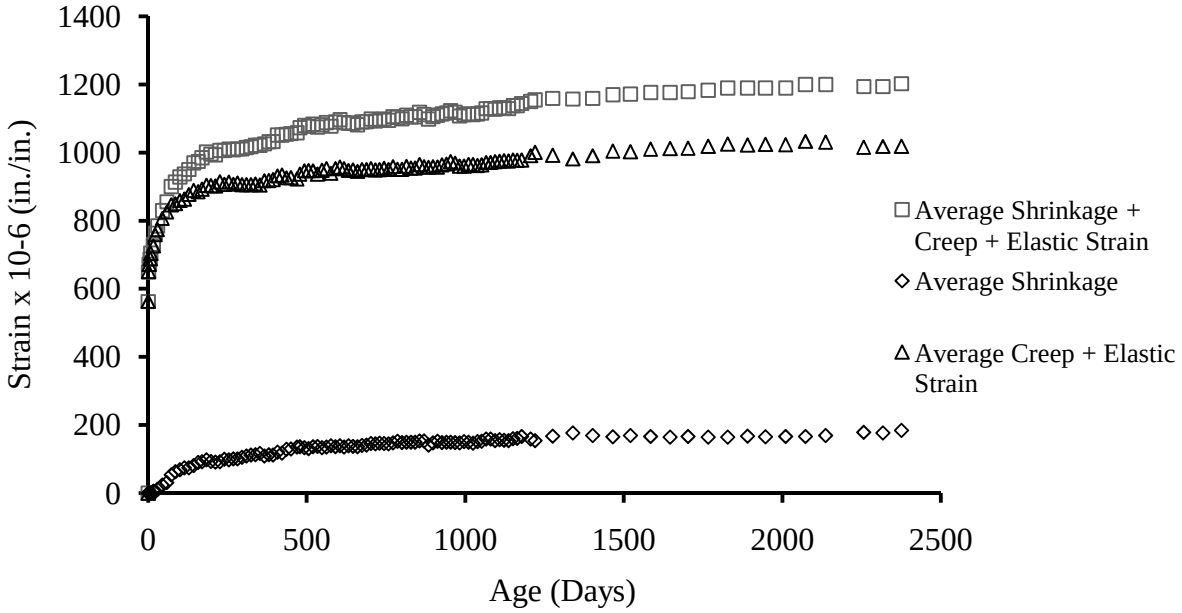


Figure 5-6: Creep strain versus age of concrete mixes containing different values of SRA-G (0.4% HRWR-G, 5% Fly Ash and a w/cm = 0.35)

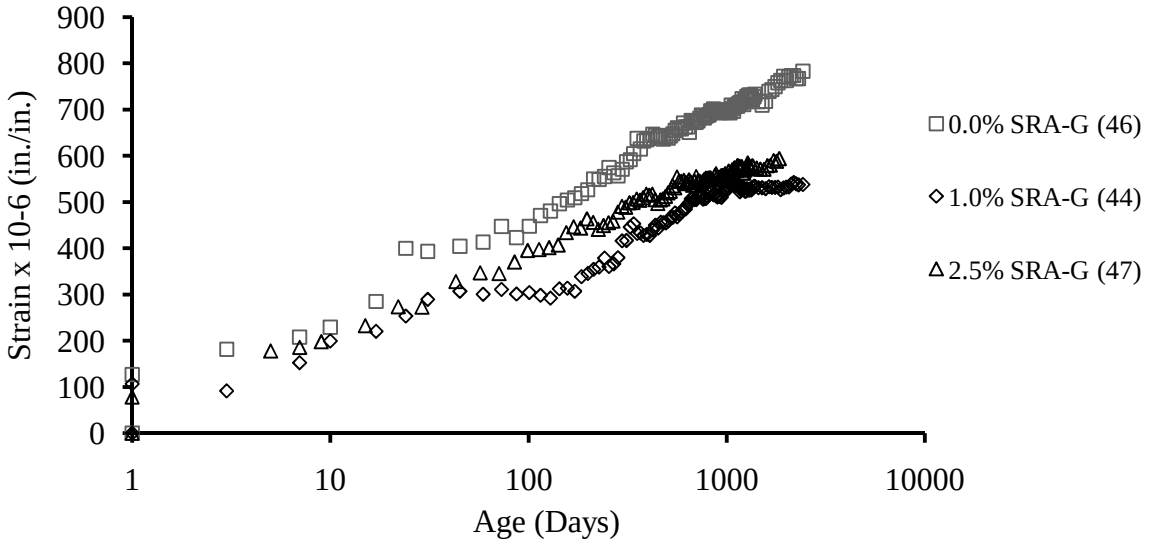


Figure 5-7: A comparison of Creep and Shrinkage at 250 days with specimen with or without 50% Slag

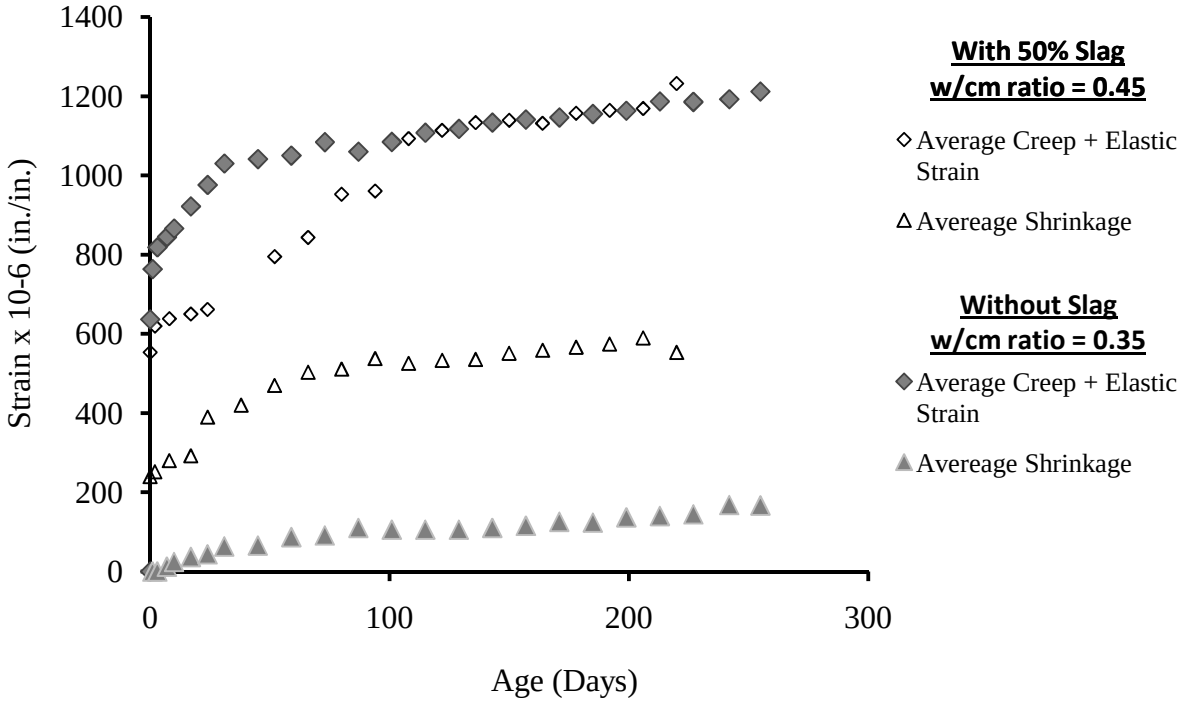
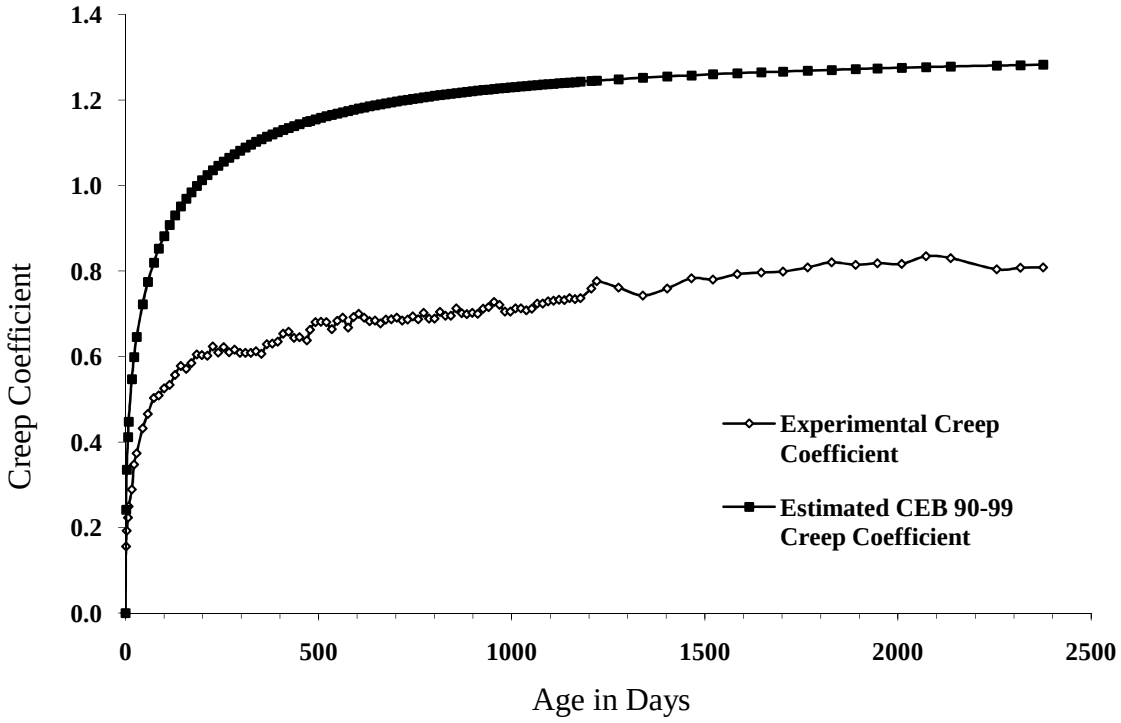


Table 5-8-Comparision of Experimental and Computed Creep Coefficient



REFERENCES

1. Nmai, C. K., Tomita, R., Hondo, F., and Buffenbarger, J., "Shrinkage-Reducing Admixtures for Concrete," ACI Concrete International, V. 20, No. 4, April 1998, pp. 31-37.
2. Carrasquillo, Ramon L., Nilson, Arthur H., and O. Slate, Floyd, "Properties of High Strength Concrete Subject in Short-term Load," *Journal of The American Concrete Institute*, May 1981, pp. 171-177.
3. Farny, J. A., and Panareses, W. C., *High-Strength Concrete*, Portland Cement Association, Skokie, Illinois, 1994.
4. Popvis, Sando, "Analysis of Concrete Strength Versus Water-Cement Ratio Relationship, *Journal of The American Concrete Institute*, V. 87, October 1990, pp. 517-529.
5. Aitcin, P. C., and Mehta, P. K., "Effect of Coarse Aggregate Characteristics on Mechanical Properties of High-Strength Concrete," *Journal of The American Concrete Institute*, V. 87, 1990, pp. 103-107.
6. Nmai, Charles, Mullen, Brendan, and Fletcher, Ken, "Comparative Evaluation of Shrinkage Reducing Admixtures for Concrete," Master Builder, Chapter 11, pp. 84-90.
7. Berry, E. E., Malhotra, V. M., "Fly Ash for Use in Concrete- A Critical Review," *Journal of The American Concrete Institute*, V. 77, March 1980, pp. 59-73.
8. Cong, Xiaofeng, Gong, Shanglong, Darwin, David, and Mccabe, David, "Role of Silica Fume in Compressive Strength of Cement Paste, Mortar, and

Concrete," *Journal of The American Concrete Institute*, V. 89, July 1992, pp. 375-387.

9. Perenchio, W. F., An Evaluation of Some Factors Involved in Producing Very High-Strength Concrete, Research and Development Bulletin RD014T, Portland Cement Association, Skokie, Illinois, 1973.
10. *1997 Annual Book of ASTM Standards*, "Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory," American Society for Testing and Materials, Philadelphia, V. 04.04 (ASTM C 192) pp. 113-120.
11. *1997 Annual Book of ASTM Standards*, "Standard Practice for Compressive Strength of Cylindrical Concrete Specimens," American Society for Testing and Materials, Philadelphia, V. 04.04 (ASTM C 39), pp. 18-22.
12. *1997 Annual Book of ASTM Standards*, "Standard Practice for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression," American Society for Testing and Materials, Philadelphia, V. 04.04 (ASTM C 469), pp. 242-245.
13. Lessard, Micheal, Chaallal, Omar, Aitcin, Pierre, Journal of American Concrete Institute, V. 90, July 1993, pp. 303-308.
14. Oluokon, Francis, Burdette, Edwin G., Deatherage, J. Harold, "Elastic Modulus, Poisson's Ratio and Compressive Strength Relationships at early ages," *Journal of The American Concrete Institute*, V. 88, January 1991 pp. 3-10.

APPENDICES

Appendix I Shrinkage Data for Cement paste mixes

G1

Day	Shrinkage (%)
0	0.00000
7	-0.02350
14	-0.06350
23	-0.10100
28	-0.09700
35	-0.10350
42	-0.11700
49	-0.12500
56	-0.13050
63	-0.14200
71	-0.14550
86	-0.14150
91	-0.14050
97	-0.14400
104	-0.14500
111	-0.14400
117	-0.14050
125	-0.14400
132	-0.14150
139	-0.14250
146	-0.14250
160	-0.13600
181	-0.13250
242	-0.13100
303	-0.13100
362	-0.13000
423	-0.12700
484	-0.12500
546	-0.12400
607	-0.12500
668	-0.12300
728	-0.12200
945	-0.13150
1127	-0.13900
1155	-0.13800
1217	-0.13550
1281	-0.13500
1355	-0.13367
1414	-0.13267

G2

Day	Shrinkage (%)
0	0.00000
7	-0.10350
14	-0.14800
23	-0.16900
28	-0.18050
35	-0.18400
42	-0.19800
49	-0.20350
56	-0.21050
63	-0.22100
71	-0.22250
86	-0.21500
91	-0.21500
97	-0.22000
104	-0.22100
111	-0.21850
117	-0.21700
125	-0.21900
132	-0.21700
139	-0.21950
146	-0.21900
160	-0.21450
181	-0.20900
242	-0.20650
303	-0.20500
362	-0.20550
423	-0.20300
484	-0.20150
546	-0.19900
607	-0.19800
668	-0.19700
728	-0.19600
945	-0.20600
1127	-0.21350
1155	-0.21283
1217	-0.20900
1281	-0.20850
1355	-0.20700
1414	-0.20350

G3

Day	Shrinkage (%)
0	0.00000
7	-0.10700
14	-0.14500
23	-0.16000
28	-0.17000
35	-0.17500
42	-0.18700
49	-0.19300
56	-0.19700
63	-0.20700
71	-0.20900
86	-0.20600
91	-0.20100
97	-0.20300
104	-0.20600
111	-0.20700
117	-0.20500
125	-0.20900
132	-0.20800
139	-0.20900
146	-0.20600
160	-0.20300
181	-0.20100
242	-0.20000
303	-0.19700
362	-0.19500
423	-0.19400
484	-0.19200
546	-0.18800
607	-0.18700
668	-0.18600
728	-0.18500
945	-0.19900
1127	-0.20500
1155	-0.20500
1217	-0.20200
1281	-0.20100
1355	-0.20000
1414	-0.19933

G4

Day	Shrinkage (%)
0	0.00000
7	-0.09450
14	-0.12450
21	-0.14650
29	-0.16550
34	-0.17600
44	-0.18350
49	-0.18650
55	-0.18950
62	-0.19700
69	-0.19800
75	-0.19800
83	-0.20050
90	-0.20550
97	-0.20650
104	-0.20900
118	-0.20750
139	-0.20300
146	-0.20200
153	-0.19900
182	-0.19900
242	-0.19850
304	-0.19900
363	-0.20000
424	-0.20000
485	-0.20100
546	-0.20050
607	-0.20100
669	-0.20200
729	-0.20200
903	-0.20900
1085	-0.21450
1113	-0.20817
1175	-0.20800
1239	-0.20883
1313	-0.20833
1372	-0.20567
1471	-0.21083
1562	-0.20833

1513	-0.13367
1604	-0.13217
1696	-0.13133
1788	-0.13100
1920	-0.13167
2010	-0.13050
2113	-0.13100
2211	-0.13050
2317	-0.13100
2479	-0.13050
2589	-0.13000
2743	-0.13100
2869	-0.13117
2964	-0.13117
3051	-0.13033
3214	-0.13083
3298	-0.13133

1513	-0.20783
1604	-0.20483
1696	-0.20467
1788	-0.20483
1920	-0.20650
2010	-0.20550
2113	-0.20700
2211	-0.20733
2317	-0.20733
2479	-0.20550
2589	-0.20750
2743	-0.20700
2869	-0.20700
2964	-0.20733
3051	-0.20750
3214	-0.20783
3298	-0.20917

1513	-0.20000
1604	-0.19833
1696	-0.19800
1788	-0.19767
1920	-0.19700
2010	-0.19667
2113	-0.19700
2211	-0.19633
2317	-0.19600
2478	-0.19800
2589	-0.19600
2743	-0.19800
2869	-0.19500
2964	-0.19500
3051	-0.19567
3214	-0.19633
3298	-0.19700

1654	-0.20872
1746	-0.21000
1878	-0.20867
1968	-0.20850
2071	-0.20900
2169	-0.20883
2275	-0.20783
2436	-0.20850
2547	-0.20850
2701	-0.20800
2827	-0.20617
2922	-0.20617
3009	-0.20617
3172	-0.20700
3256	-0.20807

G5

Day	Shrinkage (%)
0	0.00000
7	-0.08600
15	-0.11450
22	-0.12550
30	-0.13550
35	-0.13550
42	-0.15000
49	-0.14950
56	-0.15850
63	-0.16150
78	-0.15850
84	-0.16400
89	-0.15850
96	-0.15850
103	-0.15950
109	-0.15900
117	-0.16100
124	-0.16200
131	-0.16100
138	-0.16050
152	-0.15950
173	-0.15650
180	-0.15650
248	-0.15450
309	-0.15400
368	-0.15350
429	-0.15300
490	-0.15250
552	-0.15150
613	-0.15000
674	-0.15050
734	-0.14950
937	-0.15750
1119	-0.16200
1147	-0.16200
1209	-0.16133
1273	-0.15533
1347	-0.15517
1406	-0.15400

G6

Day	Shrinkage (%)
0	0.00000
7	-0.07350
14	-0.09800
21	-0.09950
28	-0.11300
36	-0.11750
41	-0.11350
48	-0.12200
55	-0.12800
62	-0.13750
69	-0.13700
84	-0.13950
90	-0.14500
95	-0.14100
102	-0.14300
109	-0.14150
115	-0.13950
123	-0.14150
130	-0.14300
137	-0.14400
144	-0.14500
158	-0.15100
179	-0.15100
186	-0.14900
248	-0.14750
303	-0.14550
362	-0.14550
423	-0.14400
484	-0.14250
546	-0.14150
607	-0.14000
668	-0.13950
728	-0.13900
944	-0.15850
1126	-0.15933
1154	-0.15600
1216	-0.15950
1280	-0.15900
1354	-0.15867

G7

Day	Shrinkage (%)
0	0.00000
7	-0.05550
14	-0.07550
21	-0.08400
28	-0.09150
36	-0.10000
41	-0.10100
48	-0.10700
55	-0.11350
62	-0.11850
69	-0.11900
84	-0.12250
90	-0.12750
95	-0.12350
102	-0.12450
109	-0.12650
115	-0.12400
123	-0.12750
130	-0.12700
137	-0.12750
144	-0.13100
158	-0.13100
179	-0.12400
186	-0.12400
242	-0.12450
303	-0.12750
362	-0.12650
423	-0.12900
484	-0.12800
546	-0.13000
607	-0.13100
668	-0.13050
728	-0.13150
944	-0.13250
1126	-0.13350
1154	-0.13100
1216	-0.13383
1280	-0.13167
1354	-0.13067

G8

Day	Shrinkage (%)
0	0.00000
7	-0.05000
14	-0.06800
21	-0.08450
28	-0.09000
49	-0.10950
56	-0.10850
63	-0.11250
70	-0.11450
91	-0.11850
99	-0.12250
117	-0.12900
124	-0.13050
131	-0.13000
140	-0.13250
145	-0.13250
154	-0.13300
169	-0.13250
814	-0.14200
996	-0.14700
1024	-0.14300
1086	-0.14650
1150	-0.14200
1224	-0.13983
1283	-0.13958
1382	-0.14400
1473	-0.14400
1565	-0.14383
1657	-0.14433
1789	-0.14383
1879	-0.14450
1982	-0.14533
2080	-0.14550
2202	-0.14600
2347	-0.14550
2458	-0.14600
2612	-0.14400
2738	-0.14350
2833	-0.14317

G5

Day	Shrinkage (%)
1478	-0.15717
1596	-0.15633
1688	-0.15650
1780	-0.15717
1912	-0.15767
2002	-0.15717
2105	-0.15750
2203	-0.15683
2309	-0.15750
2470	-0.15600
2581	-0.15750
2735	-0.15650
2861	-0.15600
2956	-0.15567
3043	-0.15550
3206	-0.15617
3290	-0.15617

G6

Day	Shrinkage (%)
1413	-0.15483
1512	-0.15733
1603	-0.15467
1695	-0.15450
1787	-0.15633
1919	-0.15633
2009	-0.15650
2112	-0.15650
2210	-0.15617
2316	-0.15567
2477	-0.15600
2588	-0.15800
2742	-0.15650
2868	-0.15433
2963	-0.15467
3050	-0.15500
3213	-0.15450
3297	-0.15683

G7

Day	Shrinkage (%)
1413	-0.12983
1512	-0.13383
1603	-0.13400
1695	-0.13317
1787	-0.13333
1919	-0.13333
2009	-0.13333
2112	-0.13317
2210	-0.13300
2316	-0.13283
2477	-0.13250
2588	-0.13300
2742	-0.13250
2868	-0.13333
2963	-0.13383
3050	-0.13433
3213	-0.13350
3297	-0.13422

G8

Day	Shrinkage (%)
2920	-0.14383
3083	-0.14317
3167	-0.14358

G9

Day	Shrinkage (%)
0	0.00000
7	-0.08850
14	-0.10650
21	-0.11850
28	-0.13200
35	-0.14150
42	-0.15200
49	-0.16000
57	-0.16650
72	-0.16950
77	-0.17000
83	-0.17500
90	-0.17500
97	-0.17600
103	-0.17350
111	-0.17750
118	-0.17900
125	-0.17900
132	-0.17950
146	-0.17850
167	-0.17450
174	-0.17350
181	-0.17050
249	-0.17200
310	-0.17350
369	-0.17400
430	-0.17550
491	-0.17800
553	-0.17900
614	-0.17900
675	-0.18000
735	-0.18000
931	-0.18600
1113	-0.18100
1141	-0.17600
1203	-0.17933
1267	-0.17850
1341	-0.17717
1400	-0.17483

G10

Day	Shrinkage (%)
0	0.00000
7	-0.05600
14	-0.08000
21	-0.09750
28	-0.11050
35	-0.12700
42	-0.13300
49	-0.13650
56	-0.14000
70	-0.15200
91	-0.15650
98	-0.15700
112	-0.15700
134	-0.15750
142	-0.16100
160	-0.16900
167	-0.16950
174	-0.16950
183	-0.17000
270	-0.17400
331	-0.17250
392	-0.17200
454	-0.17100
515	-0.17100
576	-0.17050
636	-0.17000
856	-0.17900
1038	-0.18750
1066	-0.18400
1128	-0.18750
1192	-0.18500
1266	-0.18100
1325	-0.17875
1424	-0.18750
1515	-0.18683
1607	-0.18717
1699	-0.18550
1831	-0.18600
1921	-0.18683

G11

Day	Shrinkage (%)
0	0.00000
9	-0.06100
14	-0.07200
21	-0.08200
28	-0.09150
35	-0.10150
42	-0.10700
49	-0.10950
57	-0.11500
72	-0.11700
77	-0.11650
83	-0.11700
90	-0.11900
97	-0.11800
103	-0.11850
111	-0.12250
118	-0.12500
125	-0.12450
132	-0.12450
146	-0.12550
167	-0.11950
174	-0.12050
181	-0.11800
249	-0.11900
310	-0.11750
369	-0.11700
430	-0.11650
491	-0.11650
553	-0.11650
614	-0.11600
675	-0.11550
735	-0.11500
931	-0.12750
1113	-0.12933
1141	-0.12667
1203	-0.12917
1267	-0.12717
1341	-0.12667
1400	-0.12550

G12

Day	Shrinkage (%)
0	0.00000
7	-0.10400
14	-0.14650
21	-0.17150
36	-0.19850
42	-0.21350
47	-0.21150
54	-0.21750
61	-0.21800
67	-0.21950
75	-0.22300
82	-0.22750
89	-0.23000
96	-0.22950
110	-0.22500
131	-0.22500
138	-0.21900
145	-0.21700
182	-0.22100
241	-0.21850
303	-0.21850
362	-0.21650
423	-0.21650
484	-0.21600
545	-0.21500
606	-0.21500
668	-0.21400
728	-0.21350
895	-0.22950
1077	-0.23900
1105	-0.23200
1167	-0.23300
1231	-0.23100
1305	-0.22967
1364	-0.22967
1463	-0.23183
1554	-0.23067
1646	-0.23017
1738	-0.23050

G9

Day	Shrinkage (%)
1499	-0.18050
1590	-0.17917
1409	-0.17900
1774	-0.17783
1906	-0.17700
1996	-0.17700
2099	-0.17650
2197	-0.17700
2303	-0.17683
2464	-0.17750
2575	-0.17700
2729	-0.17700
2855	-0.17717
2950	-0.17717
3037	-0.17733
3200	-0.17750
3284	-0.17765

G10

Day	Shrinkage (%)
2024	-0.18633
2122	-0.18633
2228	-0.18583
2389	-0.18550
2500	-0.18500
2654	-0.18650
2780	-0.18683
2875	-0.18700
2962	-0.18667
3125	-0.18733
3209	-0.18625

G11

Day	Shrinkage (%)
1499	-0.12650
1590	-0.12600
1682	-0.12533
1774	-0.12467
1906	-0.12583
1996	-0.12567
2099	-0.12683
2197	-0.12717
2303	-0.12633
2464	-0.12600
2575	-0.12700
2729	-0.12600
2855	-0.12550
2950	-0.12600
3037	-0.12600
3200	-0.12567
3284	-0.12565

G12

Day	Shrinkage (%)
1870	-0.23100
1960	-0.23050
2063	-0.23167
2161	-0.23133
2267	-0.23117
2428	-0.23100
2539	-0.23100
2693	-0.23100
2819	-0.23100
2914	-0.23100
3001	-0.23100
3164	-0.23148
3248	-0.22895

G13

Day	Shrinkage (%)
0	0.00000
7	-0.10900
15	-0.15550
22	-0.17500
30	-0.19600
35	-0.19400
42	-0.21900
49	-0.22050
56	-0.23650
63	-0.24000
78	-0.23700
84	-0.24800
89	-0.24050
96	-0.24150
103	-0.23950
109	-0.23750
117	-0.24150
124	-0.24250
131	-0.24250
138	-0.24150
152	-0.23600
173	-0.23150
180	-0.22900
248	-0.22850
309	-0.22750
368	-0.22650
429	-0.22450
490	-0.22450
552	-0.22450
613	-0.22350
674	-0.22200
734	-0.22200
937	-0.23200
1080	-0.23833
1119	-0.23850
1147	-0.23517
1209	-0.23500
1273	-0.23283
1347	-0.23300

G14

Day	Shrinkage (%)
0	0.00000
7	-0.11450
15	-0.15900
22	-0.17800
30	-0.19950
35	-0.19900
42	-0.22000
49	-0.22500
56	-0.24250
63	-0.24550
78	-0.24250
84	-0.25350
89	-0.24500
96	-0.24750
103	-0.24650
109	-0.24300
117	-0.24550
124	-0.24600
131	-0.24550
138	-0.24550
152	-0.24100
173	-0.23650
180	-0.23150
248	-0.23000
309	-0.22850
368	-0.22850
429	-0.22700
490	-0.22600
552	-0.22700
613	-0.22600
674	-0.22500
734	-0.22400
937	-0.23650
1119	-0.24500
1147	-0.23850
1209	-0.24083
1273	-0.23917
1347	-0.23850
1406	-0.23750

G15

Day	Shrinkage (%)
0	0.00000
7	-0.11050
14	-0.16300
21	-0.18650
36	-0.21350
42	-0.23000
47	-0.22500
54	-0.22850
61	-0.23000
67	-0.23000
75	-0.23450
82	-0.23850
89	-0.24050
96	-0.24050
110	-0.23550
131	-0.23350
138	-0.23200
145	-0.22800
182	-0.23150
241	-0.23300
303	-0.23350
362	-0.23450
423	-0.23450
484	-0.23400
545	-0.23500
606	-0.23600
668	-0.23650
728	-0.23700
895	-0.23950
1077	-0.24933
1105	-0.24150
1167	-0.23850
1231	-0.23867
1305	-0.23800
1364	-0.23683
1463	-0.23883
1554	-0.23900
1646	-0.23933
1738	-0.23933

G16

Day	Shrinkage (%)
0	0.00000
7	-0.10200
14	-0.14500
21	-0.16950
36	-0.19700
42	-0.21200
47	-0.21050
54	-0.21500
61	-0.21800
67	-0.22100
75	-0.22500
82	-0.22650
89	-0.22750
96	-0.22950
110	-0.22600
131	-0.22350
138	-0.22150
145	-0.22050
182	-0.22050
241	-0.22000
303	-0.22000
362	-0.22050
423	-0.22100
484	-0.22000
545	-0.22000
606	-0.22050
668	-0.21950
728	-0.22000
895	-0.23050
1077	-0.23450
1105	-0.23150
1167	-0.23283
1231	-0.22650
1305	-0.22750
1364	-0.22800
1463	-0.22767
1554	-0.22733
1646	-0.22750
1738	-0.22733

G13

Day	Shrinkage (%)
1406	-0.23283
1505	-0.23333
1596	-0.23300
1688	-0.23267
1415	-0.23283
1596	-0.23300
1688	-0.23267
1780	-0.23283
1912	-0.23283
2002	-0.23200
2105	-0.23217
2203	-0.23033
2309	-0.23000
2470	-0.23200
2581	-0.23150
2735	-0.23150
2861	-0.23200
2956	-0.23200
3043	-0.23217
3206	-0.23150
3290	-0.23123

G14

Day	Shrinkage (%)
1505	-0.24050
1596	-0.23950
1688	-0.24017
1780	-0.24037
1912	-0.24000
2002	-0.24017
2105	-0.24067
2203	-0.24067
2309	-0.23950
2470	-0.23950
2581	-0.23900
2735	-0.24000
2861	-0.23900
2956	-0.23867
3043	-0.23867
3206	-0.23867
3290	-0.23788

G15

Day	Shrinkage (%)
1870	-0.24033
1960	-0.24067
2063	-0.24100
2161	-0.24117
2267	-0.24200
2428	-0.24100
2539	-0.24100
2693	-0.24050
2819	-0.24083
2914	-0.24050
3001	-0.24100
3164	-0.24083
3248	-0.24175

G16

Day	Shrinkage (%)
1870	-0.22817
1960	-0.22750
2063	-0.22867
2161	-0.22850
2267	-0.22833
2428	-0.22750
2539	-0.22750
2693	-0.22800
2819	-0.22683
2914	-0.22683
3001	-0.22717
3164	-0.22750
3248	-0.22555

G17

Day	Shrinkage (%)
0	0.00000
9	-0.11900
14	-0.14500
21	-0.16400
28	-0.19000
35	-0.20300
42	-0.21600
49	-0.22500
57	-0.23100
72	-0.23100
78	-0.23000
83	-0.23400
90	-0.23700
97	-0.23500
103	-0.23400
111	-0.23800
118	-0.23800
125	-0.23900
132	-0.23800
146	-0.23400
167	-0.23100
174	-0.22800
181	-0.22600
249	-0.22400
310	-0.22200
369	-0.22200
430	-0.22000
491	-0.21800
553	-0.21700
614	-0.21500
675	-0.21600
735	-0.21500
1113	-0.23300
1141	-0.22767
1203	-0.22833
1267	-0.22700
1341	-0.22733
1400	-0.22733
1499	-0.22633

G18

Day	Shrinkage (%)
0	0.00000
9	-0.12300
14	-0.14900
21	-0.17100
28	-0.19600
35	-0.21000
42	-0.22300
49	-0.23600
57	-0.24200
72	-0.24400
77	-0.24200
83	-0.24500
90	-0.24700
97	-0.24800
103	-0.24600
111	-0.25000
118	-0.25100
125	-0.25000
132	-0.24900
146	-0.24700
167	-0.24200
174	-0.23900
181	-0.23600
249	-0.23400
310	-0.23300
369	-0.23200
430	-0.23200
491	-0.23000
553	-0.23100
614	-0.23000
675	-0.22900
735	-0.22900
931	-0.23700
1113	-0.24600
1141	-0.23900
1203	-0.24033
1267	-0.24033
1341	-0.23867
1400	-0.23833

G19

Day	Shrinkage (%)
0	0.00000
9	-0.11950
14	-0.14600
21	-0.16700
28	-0.19400
35	-0.20800
42	-0.22000
49	-0.23250
57	-0.23800
72	-0.24300
77	-0.23900
83	-0.24250
90	-0.24500
97	-0.24500
103	-0.24300
111	-0.24650
118	-0.24750
125	-0.24750
132	-0.24750
146	-0.24350
167	-0.23950
174	-0.23700
181	-0.23300
249	-0.23400
310	-0.23300
369	-0.23300
430	-0.23300
491	-0.23400
553	-0.23550
614	-0.23550
675	-0.23650
735	-0.23650
931	-0.23750
1113	-0.24750
1141	-0.24300
1203	-0.24167
1267	-0.24150
1341	-0.24133
1400	-0.24100

G20

Day	Shrinkage (%)
0	0.00000
9	-0.09350
14	-0.11450
21	-0.13500
28	-0.15550
35	-0.17150
42	-0.17700
49	-0.18500
57	-0.19100
72	-0.19550
77	-0.19350
83	-0.19900
90	-0.19950
97	-0.20050
103	-0.20050
111	-0.20450
118	-0.20450
125	-0.20550
132	-0.20500
146	-0.20300
167	-0.19500
174	-0.19450
181	-0.19250
249	-0.19200
310	-0.19050
369	-0.18950
430	-0.18850
491	-0.18950
553	-0.18800
614	-0.18750
675	-0.18800
735	-0.18750
931	-0.19650
1113	-0.20550
1141	-0.20083
1203	-0.19883
1267	-0.19750
1341	-0.19700
1400	-0.19700

G17

Day	Shrinkage (%)
1590	-0.22667
1682	-0.22667
1774	-0.22533
1906	-0.22600
1996	-0.22600
2099	-0.22667
2197	-0.22667
2303	-0.22700
2464	-0.22600
2575	-0.22700
2729	-0.22500
2855	-0.22700
2950	-0.22667
3037	-0.22700
3200	-0.22700
3284	-0.22593

G18

Day	Shrinkage (%)
1499	-0.24167
1590	-0.24233
1682	-0.24267
1774	-0.24100
1906	-0.24100
1996	-0.24067
2099	-0.24133
2197	-0.24167
2303	-0.24167
2464	-0.24200
2575	-0.24200
2729	-0.24233
2855	-0.24233
2950	-0.24167
3037	-0.24100
3200	-0.24133
3284	-0.24169

G19

Day	Shrinkage (%)
1499	-0.24233
1590	-0.24267
1682	-0.24150
1774	-0.24100
1906	-0.24050
1996	-0.24133
2099	-0.24233
2197	-0.24117
2303	-0.24117
2464	-0.24117
2579	-0.24117
2729	-0.24200
2855	-0.24200
2950	-0.24183
3037	-0.24133
3200	-0.24133
3284	-0.23998

G20

Day	Shrinkage (%)
1499	-0.19850
1590	-0.19883
1682	-0.19950
1774	-0.19950
1906	-0.19950
1996	-0.19967
2099	-0.20033
2197	-0.20033
2303	-0.20017
2464	-0.20017
2575	-0.20017
2729	-0.20083
2855	-0.20083
2950	-0.20050
3037	-0.20050
3200	-0.20133
3284	-0.20203

G21

Day	Shrinkage (%)
0	0.00000
7	-0.07150
14	-0.10500
21	-0.12550
28	-0.13800
35	-0.15000
42	-0.16100
49	-0.16450
56	-0.17100
70	-0.18100
91	-0.18250
98	-0.18300
112	-0.18100
134	-0.18150
142	-0.18700
160	-0.19500
167	-0.19600
174	-0.19550
183	-0.19750
270	-0.19650
331	-0.19550
392	-0.19550
454	-0.19450
515	-0.19450
576	-0.19450
636	-0.19350
856	-0.20200
1038	-0.21250
1066	-0.20850
1128	-0.21000
1192	-0.20733
1266	-0.20700
1325	-0.20600
1424	-0.20867
1515	-0.20767
1607	-0.20817
1699	-0.20733
1831	-0.20817
1921	-0.20833

G22

Day	Shrinkage (%)
0	0.00000
7	-0.06100
14	-0.08400
21	-0.09700
28	-0.11050
36	-0.12000
51	-0.12900
56	-0.13200
62	-0.13550
69	-0.13650
76	-0.14050
82	-0.14200
90	-0.14800
97	-0.14800
104	-0.15000
111	-0.15100
125	-0.15150
146	-0.14800
153	-0.14750
160	-0.14650
189	-0.14400
241	-0.14600
303	-0.14750
362	-0.14800
423	-0.14900
484	-0.14950
545	-0.15050
606	-0.15050
668	-0.15100
728	-0.15100
910	-0.16000
1092	-0.16450
1120	-0.16050
1182	-0.15567
1246	-0.15750
1320	-0.15717
1379	-0.15817
1478	-0.16033
1569	-0.15967

G23

Day	Shrinkage (%)
0	0.00000
7	-0.05100
14	-0.07700
21	-0.09200
36	-0.11150
42	-0.12200
48	-0.12000
55	-0.12350
62	-0.12600
68	-0.12950
75	-0.13350
82	-0.13650
89	-0.13800
96	-0.13950
110	-0.13950
131	-0.13800
138	-0.13750
145	-0.13650
174	-0.13550
182	-0.13800
241	-0.13700
303	-0.13800
362	-0.13800
423	-0.13800
484	-0.13900
545	-0.13800
606	-0.13900
668	-0.13950
728	-0.13950
895	-0.14950
1077	-0.15617
1105	-0.15300
1167	-0.15133
1231	-0.15183
1305	-0.15067
1364	-0.15050
1463	-0.15233
1554	-0.15267
1646	-0.15283

G24

Day	Shrinkage (%)
0	0.00000
7	-0.05700
14	-0.07500
21	-0.09200
28	-0.10150
36	-0.10950
51	-0.11750
56	-0.11950
62	-0.12300
69	-0.12350
76	-0.12650
83	-0.12750
91	-0.13100
98	-0.13300
105	-0.13550
112	-0.13750
126	-0.13750
147	-0.13200
154	-0.13050
161	-0.13000
190	-0.12900
241	-0.13000
303	-0.12900
362	-0.13000
423	-0.13000
484	-0.13100
545	-0.13200
606	-0.13150
668	-0.13150
728	-0.13150
910	-0.14250
1092	-0.15133
1120	-0.14900
1182	-0.14300
1246	-0.14300
1320	-0.14317
1379	-0.14283
1478	-0.14317
1569	-0.14317

G21

Day	Shrinkage (%)
2024	-0.20883
2122	-0.20917
2228	-0.20850
2389	-0.20850
2500	-0.20850
2654	-0.20917
2780	-0.20900
2875	-0.20933
2962	-0.20933
3125	-0.21017
3209	-0.20825

G22

Day	Shrinkage (%)
1661	-0.16067
1753	-0.16033
1885	-0.16067
1975	-0.16117
2078	-0.16200
2176	-0.16183
2282	-0.16083
2443	-0.16150
2554	-0.16150
2708	-0.16100
2834	-0.16133
2929	-0.16150
3016	-0.16200
3179	-0.16183
3263	-0.16225

G23

Day	Shrinkage (%)
1738	-0.15200
1870	-0.15367
1960	-0.15267
2063	-0.15333
2161	-0.15267
2267	-0.15250
2428	-0.15250
2539	-0.15200
2693	-0.15200
2819	-0.15233
2914	-0.15283
3001	-0.15250
3164	-0.15317
3248	-0.15262

G24

Day	Shrinkage (%)
1661	-0.14483
1753	-0.14650
1885	-0.14767
1975	-0.14633
2078	-0.14783
2176	-0.14817
2282	-0.14733
2443	-0.14700
2554	-0.14800
2708	-0.14750
2834	-0.14767
2929	-0.14700
3016	-0.14717
3179	-0.14650
3263	-0.14702

G25

Day	Shrinkage (%)
0	0.00000
7	-0.10300
14	-0.13350
21	-0.14800
28	-0.16250
36	-0.17300
51	-0.17850
56	-0.17950
62	-0.18400
69	-0.18650
76	-0.18750
82	-0.18650
90	-0.19100
97	-0.19300
104	-0.19350
111	-0.19450
125	-0.19350
146	-0.18800
153	-0.18400
160	-0.18200
189	-0.18100
241	-0.18750
303	-0.18650
362	-0.18650
423	-0.18750
484	-0.18850
545	-0.18800
606	-0.18950
668	-0.18950
728	-0.18950
910	-0.19300
1092	-0.19350
1120	-0.18750
1182	-0.18667
1246	-0.18633
1320	-0.18550
1379	-0.18567
1478	-0.18533
1569	-0.18683

G26

Day	Shrinkage (%)
0	0.00000
7	-0.12600
14	-0.15650
21	-0.17650
28	-0.19300
36	-0.20450
51	-0.20700
56	-0.20650
62	-0.21000
69	-0.21350
76	-0.21150
82	-0.20900
90	-0.21200
97	-0.21000
104	-0.21150
111	-0.21100
125	-0.20450
146	-0.19950
153	-0.19500
160	-0.19450
189	-0.19100
241	-0.18950
303	-0.19000
362	-0.18900
423	-0.18800
484	-0.18700
545	-0.18700
606	-0.18800
668	-0.18700
728	-0.18700
910	-0.19750
1092	-0.20800
1120	-0.20300
1182	-0.20233
1246	-0.20150
1320	-0.20300
1379	-0.20283
1478	-0.20417
1569	-0.20383

G27

Day	Shrinkage (%)
0	0.00000
7	-0.12900
14	-0.15600
21	-0.18300
28	-0.19400
36	-0.20500
51	-0.20400
56	-0.20000
62	-0.20800
69	-0.21100
76	-0.20600
82	-0.20500
90	-0.20900
97	-0.20600
104	-0.20700
111	-0.20600
125	-0.20200
146	-0.19700
153	-0.19400
160	-0.19100
189	-0.18800
241	-0.18500
303	-0.18600
362	-0.18300
423	-0.18200
484	-0.18100
545	-0.18000
606	-0.18000
668	-0.17900
728	-0.17900
910	-0.19100
1092	-0.20400
1120	-0.20200
1182	-0.20200
1246	-0.20033
1320	-0.20133
1379	-0.20200
1478	-0.20333
1569	-0.20400

G28

Day	Shrinkage (%)
0	0.00000
7	-0.12400
14	-0.15900
21	-0.17750
28	-0.18750
38	-0.19450
42	-0.18950
48	-0.20050
55	-0.20250
62	-0.20250
68	-0.20050
76	-0.20350
83	-0.20200
90	-0.20300
97	-0.20350
111	-0.19600
132	-0.19500
139	-0.18750
146	-0.18800
184	-0.18900
241	-0.18750
303	-0.18700
363	-0.18700
423	-0.18650
484	-0.18600
545	-0.18500
606	-0.18500
668	-0.18450
728	-0.18450
897	-0.19550
1079	-0.20983
1107	-0.20900
1169	-0.21017
1233	-0.20633
1307	-0.20733
1366	-0.20750
1465	-0.21017
1556	-0.21017
1648	-0.21133

G25

Day	Shrinkage (%)
1569	-0.18733
1753	-0.18783
1885	-0.18750
1975	-0.18650
2078	-0.18667
2176	-0.18650
2282	-0.18633
2443	-0.18750
2554	-0.18700
2708	-0.18750
2834	-0.18717
2929	-0.18717
3016	-0.18700
3179	-0.18733
3263	-0.18732

G26

Day	Shrinkage (%)
1661	-0.20383
1753	-0.20417
1885	-0.20450
1975	-0.20433
2078	-0.20533
2176	-0.20550
2282	-0.20483
2443	-0.20400
2554	-0.20500
2708	-0.20500
2834	-0.20550
2929	-0.20583
3016	-0.20533
3179	-0.20617
3263	-0.20585

G27

Day	Shrinkage (%)
1296	-0.20400
1753	-0.20367
1885	-0.20467
1975	-0.20433
2078	-0.20400
2176	-0.20400
2282	-0.20533
2443	-0.20400
2554	-0.20400
2708	-0.20500
2834	-0.20500
2929	-0.20467
3016	-0.20500
3179	-0.20500
3263	-0.20400

G28

Day	Shrinkage (%)
1740	-0.21167
1872	-0.21383
1962	-0.21367
2065	-0.21400
2163	-0.21383
2269	-0.21400
2430	-0.21450
2541	-0.21450
2695	-0.21550
2821	-0.21600
2916	-0.21617
3003	-0.21583
3166	-0.21533
3250	-0.21405

G29	
Day	Shrinkage (%)
0	0.00000
7	-0.12500
14	-0.16700
22	-0.18500
28	-0.18700
37	-0.19550
42	-0.19400
48	-0.20000
55	-0.20250
62	-0.20250
68	-0.20050
76	-0.20250
83	-0.20200
90	-0.20300
97	-0.20300
111	-0.19600
132	-0.19200
139	-0.18600
146	-0.18350
175	-0.18500
183	-0.18700
241	-0.18750
303	-0.18700
362	-0.18650
423	-0.18650
484	-0.18650
545	-0.18650
606	-0.18650
668	-0.18650
728	-0.18600
896	-0.19900
1078	-0.21517
1106	-0.21550
1168	-0.21317
1232	-0.21183
1306	-0.21267
1365	-0.21317
1464	-0.21733
1555	-0.21850

G30	
Day	Shrinkage (%)
0	0.00000
7	-0.10600
14	-0.14100
21	-0.16850
28	-0.18850
38	-0.19850
42	-0.20150
49	-0.21150
56	-0.21550
63	-0.21800
69	-0.21850
77	-0.22350
84	-0.22450
91	-0.22700
98	-0.22700
112	-0.22800
133	-0.22450
140	-0.22200
147	-0.22200
184	-0.22300
241	-0.22300
303	-0.22250
362	-0.22250
423	-0.22200
484	-0.22250
545	-0.22150
606	-0.22200
668	-0.22300
728	-0.22250
897	-0.22700
1079	-0.23783
1107	-0.23250
1169	-0.22950
1233	-0.22817
1307	-0.22800
1366	-0.22967
1465	-0.22917
1556	-0.22850
1648	-0.22900

G31	
Day	Shrinkage (%)
0	0.00000
7	-0.12400
14	-0.16200
21	-0.18800
28	-0.20750
38	-0.21600
42	-0.22100
49	-0.23000
56	-0.23450
63	-0.23450
69	-0.23450
77	-0.23900
84	-0.24050
91	-0.24300
98	-0.24300
112	-0.23900
133	-0.23400
140	-0.22750
147	-0.22650
176	-0.22550
184	-0.22900
241	-0.22800
303	-0.22800
362	-0.22850
423	-0.22850
484	-0.22900
545	-0.22800
606	-0.22800
668	-0.22850
728	-0.22850
897	-0.24050
1079	-0.25050
1107	-0.24800
1169	-0.24950
1233	-0.24550
1307	-0.24533
1366	-0.24600
1465	-0.24867
1556	-0.24800

G32	
Day	Shrinkage (%)
0	0.00000
7	-0.12600
14	-0.16400
21	-0.18900
28	-0.21115
38	-0.21850
42	-0.21850
49	-0.22900
56	-0.23450
63	-0.23300
69	-0.23450
77	-0.23950
84	-0.24000
91	-0.24200
98	-0.24200
112	-0.23850
133	-0.23500
140	-0.22900
147	-0.22800
184	-0.22850
241	-0.22800
303	-0.22750
362	-0.22750
423	-0.22800
484	-0.22800
545	-0.22700
606	-0.22800
668	-0.22800
728	-0.22800
897	-0.24100
1079	-0.25417
1107	-0.25250
1169	-0.25383
1233	-0.25050
1307	-0.25017
1366	-0.25050
1465	-0.25150
1556	-0.25050
1648	-0.25350

G29

Day	Shrinkage (%)
1647	-0.22117
1739	-0.22183
1871	-0.22500
1961	-0.22433
2064	-0.22517
2162	-0.22483
2268	-0.22450
2429	-0.22400
2540	-0.22400
2694	-0.22400
2820	-0.22533
2915	-0.22500
2996	-0.22483
3159	-0.22450
3243	-0.22377

G30

Day	Shrinkage (%)
1740	-0.22883
1872	-0.23050
1962	-0.22933
2065	-0.22950
2163	-0.22883
2269	-0.22933
2430	-0.22850
2541	-0.22900
2695	-0.22950
2821	-0.22900
2916	-0.22900
3003	-0.22900
3166	-0.22883
3250	-0.22983

G31

Day	Shrinkage (%)
1648	-0.24933
1740	-0.24917
1872	-0.25067
1962	-0.25017
2065	-0.25117
2163	-0.25083
2269	-0.25033
2430	-0.25050
2541	-0.25000
2695	-0.25050
2821	-0.25167
2916	-0.25167
2997	-0.25100
3160	-0.25167
3244	-0.25198

G32

Day	Shrinkage (%)
1740	-0.25400
1872	-0.25567
1962	-0.25550
2065	-0.25650
2163	-0.25683
2269	-0.25650
2430	-0.25800
2541	-0.25650
2695	-0.25700
2821	-0.25800
2916	-0.25767
2997	-0.25767
3160	-0.25750
3244	-0.25852

G33

Day	Shrinkage (%)
0	0.00000
7	-0.12950
14	-0.16600
21	-0.19300
28	-0.21450
38	-0.22200
42	-0.21900
49	-0.23150
56	-0.23700
63	-0.23550
69	-0.23500
77	-0.24050
84	-0.24100
91	-0.24150
98	-0.24250
112	-0.23700
133	-0.23250
140	-0.22850
147	-0.22750
184	-0.22700
241	-0.22800
303	-0.22750
362	-0.22700
423	-0.22650
484	-0.22750
545	-0.22750
606	-0.22750
668	-0.22700
728	-0.22650
897	-0.24250
1079	-0.25900
1107	-0.25850
1169	-0.25967
1233	-0.25750
1307	-0.25767
1366	-0.25883
1465	-0.26217
1556	-0.26250
1648	-0.26650

G34

Day	Shrinkage (%)
0	0.00000
7	-0.13150
14	-0.16550
21	-0.19150
28	-0.21100
38	-0.21800
42	-0.21550
49	-0.22350
56	-0.22700
63	-0.22950
69	-0.23000
77	-0.23200
84	-0.23300
91	-0.23400
98	-0.23400
112	-0.23050
133	-0.22550
140	-0.22200
147	-0.21850
176	-0.21750
184	-0.21800
241	-0.22150
303	-0.22500
362	-0.22900
423	-0.23050
484	-0.23050
545	-0.23450
606	-0.23800
668	-0.24200
728	-0.24500
1079	-0.25750
1107	-0.25883
1169	-0.26000
1233	-0.25900
1307	-0.26083
1366	-0.26183
1465	-0.26500
1556	-0.26633
1648	-0.27283

G35

Day	Shrinkage (%)
0	0.00000
7	-0.10950
14	-0.14450
22	-0.16150
37	-0.17400
42	-0.17700
48	-0.18200
55	-0.18550
62	-0.18650
68	-0.18700
74	-0.19100
81	-0.19350
88	-0.19400
95	-0.19450
109	-0.19250
130	-0.18700
137	-0.18550
144	-0.18050
173	-0.18050
181	-0.18350
241	-0.18200
303	-0.18250
362	-0.18150
423	-0.18100
484	-0.18000
545	-0.18100
606	-0.18050
668	-0.18000
728	-0.18000
896	-0.18600
1078	-0.19200
1106	-0.18650
1168	-0.18433
1232	-0.18333
1306	-0.18233
1365	-0.18283
1464	-0.18350
1555	-0.18317
1647	-0.18300

G36

Day	Shrinkage (%)
0	0.00000
7	-0.12250
14	-0.15250
22	-0.16800
37	-0.17550
42	-0.17900
48	-0.18550
55	-0.18900
62	-0.18850
68	-0.18900
76	-0.19550
83	-0.19600
90	-0.19600
97	-0.19650
111	-0.19600
132	-0.18800
139	-0.18350
146	-0.18600
175	-0.18050
183	-0.18400
241	-0.18350
303	-0.18200
362	-0.18300
423	-0.18200
484	-0.18100
545	-0.18000
606	-0.18050
668	-0.18150
728	-0.18000
896	-0.18400
1078	-0.18967
1106	-0.18517
1168	-0.18117
1232	-0.18117
1306	-0.18133
1365	-0.18267
1464	-0.18167
1555	-0.18183
1647	-0.18233

G33

Day	Shrinkage (%)
1872	-0.27050
1962	-0.26950
2431	-0.27050
2163	-0.27067
2269	-0.27067
2269	-0.27067
2430	-0.27100
2541	-0.27100
2695	-0.27150
2821	-0.27467
2916	-0.27517
2997	-0.27433
3160	-0.27417
3244	-0.27353

G34

Day	Shrinkage (%)
1740	-0.27350
1872	-0.27567
1962	-0.27517
2065	-0.27617
2163	-0.27650
2269	-0.27483
2430	-0.27550
2541	-0.27500
2695	-0.27600
2821	-0.27867
2916	-0.27833
2997	-0.27867
3160	-0.27817
3244	-0.27815

G35

Day	Shrinkage (%)
1739	-0.18267
1871	-0.18417
1961	-0.18300
2064	-0.18333
2162	-0.18350
2268	-0.18317
2429	-0.18400
2540	-0.18400
2694	-0.18350
2820	-0.18250
2915	-0.18283
3002	-0.18267
3165	-0.18333
3249	-0.18343

G36

Day	Shrinkage (%)
1871	-0.18317
1961	-0.18183
2064	-0.18183
2162	-0.18250
2268	-0.18300
2429	-0.18250
2540	-0.18300
2694	-0.18200
2820	-0.18117
2915	-0.18167
2996	-0.18167
3159	-0.18167
3243	-0.18137

G37	
Day	Shrinkage (%)
0	0.00000
7	-0.13450
14	-0.16600
22	-0.17950
37	-0.18900
42	-0.18800
48	-0.19550
55	-0.19750
62	-0.19450
68	-0.19550
76	-0.20000
83	-0.20000
90	-0.20100
97	-0.20050
111	-0.19850
132	-0.19200
139	-0.18650
146	-0.18500
183	-0.18250
241	-0.17950
303	-0.17800
362	-0.17550
423	-0.17500
484	-0.17400
545	-0.17350
606	-0.17400
668	-0.17300
728	-0.17250
896	-0.18500
1078	-0.19750
1106	-0.19350
1168	-0.19067
1232	-0.19217
1306	-0.19250
1365	-0.19333
1464	-0.19600
1555	-0.19550
1647	-0.19583
1739	-0.19600

G38	
Day	Shrinkage (%)
0	0.00000
7	-0.11300
14	-0.15800
22	-0.18900
37	-0.21650
42	-0.22300
48	-0.23050
55	-0.23800
62	-0.24100
68	-0.24250
74	-0.25000
81	-0.25200
88	-0.25500
95	-0.25600
109	-0.25300
130	-0.25050
137	-0.24700
144	-0.24450
181	-0.24700
241	-0.24950
303	-0.25250
362	-0.25550
423	-0.25900
484	-0.26200
545	-0.26550
606	-0.26750
668	-0.26950
728	-0.27150
1078	-0.26467
1106	-0.25950
1168	-0.25767
1232	-0.25633
1306	-0.25683
1365	-0.25683
1464	-0.25717
1555	-0.25583
1647	-0.25650
1739	-0.25633
1871	-0.25783

G39	
Day	Shrinkage (%)
0	0.00000
7	-0.11500
14	-0.17150
21	-0.20250
36	-0.23650
41	-0.24250
47	-0.25350
54	-0.26250
61	-0.26700
67	-0.26950
75	-0.28100
82	-0.28250
89	-0.28650
96	-0.28850
110	-0.28800
131	-0.28350
138	-0.28350
145	-0.27950
182	-0.27950
241	-0.28100
303	-0.28150
362	-0.28050
423	-0.28000
484	-0.28050
545	-0.28100
606	-0.28200
668	-0.28150
728	-0.28150
895	-0.29450
1077	-0.30383
1105	-0.29867
1167	-0.29717
1231	-0.29550
1305	-0.29433
1364	-0.29433
1463	-0.29783
1554	-0.29667
1646	-0.29667
1738	-0.29633

G40	
Day	Shrinkage (%)
0	0.00000
7	-0.13600
14	-0.18900
22	-0.22900
37	-0.26900
42	-0.27700
48	-0.29000
55	-0.29800
62	-0.30400
68	-0.30700
76	-0.32100
83	-0.32300
90	-0.32500
97	-0.32600
111	-0.32900
132	-0.32500
139	-0.32100
146	-0.31800
183	-0.32100
241	-0.31900
303	-0.32000
362	-0.32000
423	-0.31900
484	-0.32100
545	-0.32000
606	-0.32100
668	-0.32000
728	-0.32000
896	-0.34600
1078	-0.35867
1106	-0.35500
1168	-0.35433
1232	-0.35333
1306	-0.35400
1365	-0.35467
1464	-0.35867
1555	-0.35800
1647	-0.35833
1739	-0.35900

G37

Day	Shrinkage (%)
1871	-0.19733
1961	-0.19683
2064	-0.19767
2162	-0.19800
2268	-0.19700
2429	-0.19650
2540	-0.19800
2694	-0.19750
2820	-0.19883
2915	-0.19917
2996	-0.19917
3159	-0.19983
3243	-0.19937

G38

Day	Shrinkage (%)
1961	-0.25817
2064	-0.25917
2162	-0.25850
2268	-0.25833
2429	-0.25800
2540	-0.25750
2694	-0.25800
2820	-0.25917
2915	-0.25883
2996	-0.25917
3159	-0.25883
3243	-0.25883

G39

Day	Shrinkage (%)
1870	-0.29783
1960	-0.29650
2063	-0.29750
2161	-0.29750
2267	-0.29683
2428	-0.29700
2539	-0.29700
2693	-0.29650
2819	-0.29767
2914	-0.29733
2995	-0.29767
3158	-0.29733
3242	-0.29700

G40

Day	Shrinkage (%)
1871	-0.36067
1961	-0.36067
2064	-0.36200
2162	-0.36233
2268	-0.36167
2429	-0.36100
2540	-0.36200
2694	-0.36300
2820	-0.36500
2915	-0.36467
2996	-0.36500
3159	-0.36400
3243	-0.36633

G41

Day	Shrinkage (%)
0	0.00000
7	-0.10600
15	-0.14600
30	-0.18200
35	-0.19250
41	-0.19850
48	-0.20900
55	-0.21150
61	-0.21200
69	-0.21900
76	-0.22250
83	-0.22400
90	-0.22500
104	-0.22300
125	-0.22000
132	-0.21650
139	-0.21600
168	-0.21500
176	-0.21550
182	-0.20900
273	-0.21250
332	-0.21400
393	-0.21550
454	-0.21800
515	-0.21850
576	-0.21950
638	-0.22050
698	-0.22100
889	-0.22600
1071	-0.23250
1099	-0.22683
1161	-0.22517
1225	-0.22400
1299	-0.22500
1358	-0.22417
1457	-0.22367
1548	-0.22300
1640	-0.22417
1732	-0.22350

G42

Day	Shrinkage (%)
0	0.00000
7	-0.11350
15	-0.15750
30	-0.19600
35	-0.20250
41	-0.21050
48	-0.21950
55	-0.22100
61	-0.22100
69	-0.22800
76	-0.23000
83	-0.23150
90	-0.23150
104	-0.22900
125	-0.22350
132	-0.21700
139	-0.21600
168	-0.21550
176	-0.21900
182	-0.21000
273	-0.21200
332	-0.21250
393	-0.21450
454	-0.21650
515	-0.21700
576	-0.21800
638	-0.21900
698	-0.22000
889	-0.22900
1071	-0.24050
1099	-0.23900
1161	-0.24100
1225	-0.23917
1299	-0.23883
1358	-0.23783
1457	-0.23950
1548	-0.23850
1640	-0.23867
1732	-0.23883

G43

Day	Shrinkage (%)
0	0.00000
7	-0.11550
15	-0.15800
30	-0.19750
35	-0.20400
41	-0.21200
48	-0.21950
55	-0.22100
61	-0.22200
69	-0.22850
76	-0.23000
83	-0.23150
90	-0.23200
104	-0.22650
125	-0.22300
132	-0.21700
139	-0.21700
168	-0.21450
176	-0.21800
182	-0.20700
279	-0.20950
338	-0.21150
399	-0.21250
460	-0.21400
521	-0.21500
582	-0.21500
638	-0.21550
698	-0.21650
889	-0.22800
1071	-0.24000
1099	-0.23900
1161	-0.24000
1225	-0.23767
1299	-0.23867
1358	-0.23850
1457	-0.24033
1548	-0.23850
1640	-0.24000
1732	-0.23967

G44

Day	Shrinkage (%)
0	0.00000
7	-0.11250
15	-0.15900
30	-0.19650
35	-0.20300
41	-0.21000
48	-0.21850
55	-0.21950
61	-0.22100
69	-0.22700
76	-0.22850
83	-0.22900
90	-0.23000
104	-0.22650
125	-0.22000
132	-0.21750
139	-0.21600
176	-0.21600
182	-0.20800
273	-0.21050
332	-0.21300
393	-0.21500
454	-0.21750
515	-0.21800
576	-0.21850
638	-0.21950
698	-0.22000
889	-0.23150
1071	-0.24700
1099	-0.24850
1161	-0.24883
1225	-0.24817
1299	-0.24950
1358	-0.25067
1457	-0.25317
1548	-0.25367
1640	-0.25533
1732	-0.25700
1864	-0.25917

G41

Day	Shrinkage (%)
1864	-0.22467
1954	-0.22317
2057	-0.22433
2155	-0.22367
2261	-0.22450
2422	-0.22450
2533	-0.22450
2687	-0.22450
2813	-0.22433
2908	-0.22400
2989	-0.22417
3152	-0.22333
3236	-0.22283

G42

Day	Shrinkage (%)
1864	-0.24067
1954	-0.23983
2057	-0.24050
2155	-0.24067
2261	-0.24017
2422	-0.24100
2533	-0.24000
2687	-0.24100
2813	-0.24233
2908	-0.24283
2989	-0.24300
3152	-0.24183
3236	-0.24200

G43

Day	Shrinkage (%)
1864	-0.24200
1954	-0.24100
2057	-0.24200
2155	-0.24217
2261	-0.24283
2422	-0.24200
2533	-0.24200
2687	-0.24300
2813	-0.24517
2908	-0.24550
2989	-0.24583
3152	-0.24633
3236	-0.24567

G44

Day	Shrinkage (%)
1954	-0.25867
2057	-0.25950
2155	-0.25950
2261	-0.26000
2422	-0.26050
2533	-0.25950
2687	-0.25950
2813	-0.26350
2908	-0.26300
2989	-0.26267
3152	-0.26317
3236	-0.26250

G45

Day	Shrinkage (%)
0	0.00000
7	-0.11200
15	-0.15950
30	-0.19300
35	-0.19950
41	-0.20600
48	-0.21300
55	-0.21250
61	-0.21400
69	-0.21850
76	-0.22000
83	-0.22200
90	-0.22250
104	-0.22050
125	-0.21500
132	-0.21000
139	-0.21050
168	-0.20700
176	-0.20700
182	-0.20150
279	-0.20450
338	-0.20750
399	-0.21000
460	-0.21300
521	-0.21300
582	-0.21350
644	-0.21500
704	-0.21500
895	-0.23200
1077	-0.25150
1105	-0.25350
1167	-0.25250
1231	-0.25267
1305	-0.25300
1364	-0.25867
1463	-0.26333
1554	-0.26517
1646	-0.26583
1738	-0.27083

G46

Day	Shrinkage (%)
0	0.00000
7	-0.06250
15	-0.08550
30	-0.11000
35	-0.11400
41	-0.11400
48	-0.11850
55	-0.12000
61	-0.12050
69	-0.12900
76	-0.13050
83	-0.13200
90	-0.13650
104	-0.13900
125	-0.13550
132	-0.13600
139	-0.13550
168	-0.13450
176	-0.13350
182	-0.13200
273	-0.13450
332	-0.13400
393	-0.13600
454	-0.13550
515	-0.13650
576	-0.13800
638	-0.13800
698	-0.13950
889	-0.14600
1071	-0.14833
1099	-0.14450
1161	-0.14533
1225	-0.14433
1299	-0.14350
1358	-0.14367
1457	-0.14367
1548	-0.14333
1640	-0.14233
1732	-0.14067

G47

Day	Shrinkage (%)
0	0.00000
7	-0.06750
15	-0.10100
30	-0.12250
35	-0.12800
41	-0.12900
48	-0.13000
55	-0.13250
61	-0.13450
69	-0.13900
76	-0.14000
83	-0.14200
90	-0.14450
104	-0.14300
125	-0.14000
132	-0.13750
139	-0.13600
168	-0.13400
176	-0.13600
182	-0.13250
273	-0.13350
332	-0.13400
393	-0.13450
454	-0.13400
515	-0.13400
576	-0.13500
638	-0.13500
698	-0.13500
889	-0.14900
1071	-0.15600
1099	-0.15450
1161	-0.15467
1225	-0.15400
1299	-0.15217
1358	-0.15167
1457	-0.15200
1548	-0.15067
1640	-0.15067
1732	-0.15067

G48

Day	Shrinkage (%)
0	0.00000
7	-0.07350
17	-0.10600
21	-0.11350
28	-0.12200
35	-0.12650
42	-0.12700
48	-0.13250
56	-0.13400
63	-0.13850
70	-0.13950
77	-0.14200
91	-0.14350
112	-0.14000
119	-0.14100
126	-0.14150
155	-0.13900
162	-0.14000
180	-0.14500
187	-0.14700
279	-0.14450
338	-0.14300
399	-0.14250
460	-0.14200
521	-0.14000
582	-0.13900
644	-0.13800
704	-0.13650
1064	-0.15950
1092	-0.15767
1154	-0.15917
1218	-0.15667
1292	-0.15383
1351	-0.15383
1450	-0.15267
1541	-0.15250
1633	-0.15250
1725	-0.15250
1857	-0.15383

G45

Day	Shrinkage (%)
1870	-0.27267
1960	-0.27667
2063	-0.27950
2161	-0.27883
2267	-0.27817
2428	-0.28000
2539	-0.27900
2693	-0.28050
2819	-0.28167
2914	-0.28133
2995	-0.28017
3158	-0.28050
3242	-0.28083

G46

Day	Shrinkage (%)
1864	-0.14183
1954	-0.14117
2057	-0.14183
2155	-0.14167
2261	-0.14167
2533	-0.14267
2687	-0.14367
2813	-0.14417
2908	-0.14333
2989	-0.14333
3152	-0.14283
3236	-0.14283

G47

Day	Shrinkage (%)
1864	-0.15150
1954	-0.15100
2057	-0.15167
2155	-0.15117
2261	-0.15133
2422	-0.15050
2533	-0.15050
2687	-0.15150
2813	-0.15367
2908	-0.15367
2989	-0.15400
3152	-0.15467
3236	-0.15067

G48

Day	Shrinkage (%)
1947	-0.15317
2050	-0.15283
2148	-0.15250
2254	-0.15317
2415	-0.15350
2526	-0.15150
2680	-0.15350
2806	-0.15450
2901	-0.15433
2982	-0.15417
3145	-0.15550
3229	-0.15483

G49

Day	Shrinkage (%)
0	0.00000
7	-0.07700
17	-0.11350
21	-0.12200
28	-0.13100
35	-0.13900
42	-0.14050
48	-0.14400
56	-0.14950
63	-0.15050
70	-0.15150
77	-0.15600
91	-0.15250
112	-0.15000
119	-0.14900
126	-0.14750
155	-0.14500
162	-0.14650
180	-0.15350
187	-0.15450
273	-0.15250
332	-0.15100
393	-0.15100
454	-0.15050
515	-0.14850
576	-0.14700
638	-0.14700
698	-0.14550
876	-0.16150
1058	-0.17250
1086	-0.17183
1148	-0.17167
1212	-0.17050
1286	-0.16933
1345	-0.16900
1444	-0.17100
1535	-0.17033
1627	-0.17083
1719	-0.17100

G50

Day	Shrinkage (%)
0	0.00000
7	-0.08500
17	-0.11900
21	-0.12750
28	-0.13750
35	-0.14150
42	-0.14650
48	-0.15000
56	-0.15400
63	-0.15500
70	-0.15650
77	-0.16150
91	-0.15550
112	-0.15150
119	-0.15250
126	-0.14900
155	-0.14800
162	-0.14800
180	-0.15750
187	-0.15700
273	-0.15550
332	-0.15550
393	-0.15450
454	-0.15500
515	-0.15350
576	-0.15250
638	-0.15250
698	-0.15150
876	-0.16600
1058	-0.18000
1086	-0.18017
1148	-0.18033
1212	-0.17883
1286	-0.17850
1345	-0.17850
1444	-0.17867
1535	-0.17850
1627	-0.17983
1719	-0.17967

G51

Day	Shrinkage (%)
0	0.00000
7	-0.05450
17	-0.07800
21	-0.08600
28	-0.09400
35	-0.10050
42	-0.10650
48	-0.10950
56	-0.11750
63	-0.12100
70	-0.12100
77	-0.12700
91	-0.12700
112	-0.12900
119	-0.12950
126	-0.13050
155	-0.13050
162	-0.13350
180	-0.13800
187	-0.13950
273	-0.13850
332	-0.13700
393	-0.13800
454	-0.13700
515	-0.13650
576	-0.13550
638	-0.13450
698	-0.13450
876	-0.14450
1058	-0.14683
1086	-0.14500
1148	-0.14817
1212	-0.14483
1286	-0.14467
1345	-0.14367
1444	-0.14400
1535	-0.14350
1627	-0.14317
1719	-0.14300

G52

Day	Shrinkage (%)
0	0.00000
7	-0.05450
17	-0.08500
21	-0.09500
28	-0.10050
35	-0.10750
42	-0.11250
48	-0.11550
56	-0.12450
63	-0.12850
70	-0.13050
77	-0.13500
91	-0.13750
112	-0.13650
119	-0.13700
126	-0.13600
155	-0.13600
162	-0.13700
180	-0.14300
187	-0.14350
273	-0.14350
332	-0.14250
393	-0.14300
454	-0.14300
515	-0.14250
576	-0.14200
638	-0.14250
698	-0.14250
876	-0.15050
1058	-0.16300
1086	-0.16250
1148	-0.16233
1212	-0.15967
1286	-0.15833
1345	-0.15900
1444	-0.15833
1535	-0.15900
1627	-0.15850
1719	-0.15883

G49

Day	Shrinkage (%)
1851	-0.17217
1941	-0.17183
2044	-0.17183
2142	-0.17133
2248	-0.17183
2409	-0.17050
2520	-0.16900
2674	-0.17000
2800	-0.17333
2895	-0.17333
2976	-0.17233
3139	-0.17267
3223	-0.17163

G50

Day	Shrinkage (%)
1851	-0.18133
1941	-0.18100
2044	-0.18267
2142	-0.18117
2248	-0.18100
2409	-0.18050
2520	-0.18100
2674	-0.18200
2800	-0.18733
2895	-0.18717
2976	-0.18750
3139	-0.18767
3223	-0.18737

G51

Day	Shrinkage (%)
1851	-0.14417
1941	-0.14317
2044	-0.14283
2142	-0.14283
2248	-0.14383
2409	-0.14350
2520	-0.14250
2674	-0.14250
2800	-0.14133
2895	-0.14083
2976	-0.14050
3139	-0.14033
3223	-0.13982

G52

Day	Shrinkage (%)
1851	-0.16067
1941	-0.16000
2044	-0.16083
2142	-0.16133
2248	-0.16083
2409	-0.16150
2520	-0.16100
2674	-0.16050
2800	-0.16267
2895	-0.16267
2976	-0.16333
3139	-0.16333
3223	-0.16350

G53

Day	Shrinkage (%)
0	0.00000
7	-0.05650
17	-0.08600
21	-0.09550
28	-0.10100
35	-0.10650
42	-0.11250
48	-0.11700
56	-0.12500
63	-0.13000
70	-0.13400
77	-0.13850
91	-0.14150
112	-0.14000
119	-0.14050
126	-0.14100
155	-0.13700
162	-0.13900
180	-0.14650
187	-0.14600
273	-0.14650
332	-0.14700
393	-0.14650
454	-0.14650
515	-0.14700
576	-0.14650
638	-0.14750
698	-0.14750
876	-0.15500
1058	-0.17050
1086	-0.17000
1148	-0.17083
1212	-0.16883
1286	-0.16750
1345	-0.16733
1444	-0.16750
1535	-0.16633
1627	-0.16667
1719	-0.16700

G54

Day	Shrinkage (%)
0	0.00000
7	-0.06000
17	-0.08950
21	-0.09800
28	-0.10350
35	-0.10900
42	-0.11500
48	-0.12000
56	-0.13150
63	-0.13450
70	-0.13600
77	-0.14100
91	-0.14250
112	-0.14100
119	-0.14100
126	-0.14200
155	-0.13500
162	-0.13950
180	-0.14550
187	-0.14600
273	-0.14600
332	-0.14600
393	-0.14500
454	-0.14600
515	-0.14550
576	-0.14500
638	-0.14450
698	-0.14450
876	-0.16000
1058	-0.17900
1086	-0.17950
1148	-0.18117
1212	-0.17967
1286	-0.17917
1345	-0.17933
1444	-0.18150
1535	-0.18117
1627	-0.18367
1719	-0.18400

G55

Day	Shrinkage (%)
0	0.00000
7	-0.07150
14	-0.08850
21	-0.10000
28	-0.10750
35	-0.11500
42	-0.12650
49	-0.13150
56	-0.13350
63	-0.13750
70	-0.14350
77	-0.14400
98	-0.14700
105	-0.14550
112	-0.14400
119	-0.14400
141	-0.13900
148	-0.14150
167	-0.14700
174	-0.14750
181	-0.14900
273	-0.14900
332	-0.15000
393	-0.15000
454	-0.14900
515	-0.15000
576	-0.15050
638	-0.15100
698	-0.15100
863	-0.16850
1045	-0.18800
1073	-0.18950
1135	-0.18867
1199	-0.18783
1273	-0.18967
1332	-0.19100
1431	-0.19333
1522	-0.19683
1614	-0.20300

G56

Day	Shrinkage (%)
0	0.00000
7	-0.11600
14	-0.13850
21	-0.16300
28	-0.18300
35	-0.19150
42	-0.20550
49	-0.21450
56	-0.21700
63	-0.21950
77	-0.22300
98	-0.22650
105	-0.22000
112	-0.21850
141	-0.21600
148	-0.22100
167	-0.23600
174	-0.23250
181	-0.23350
273	-0.23150
332	-0.23050
393	-0.22900
454	-0.22950
515	-0.22800
576	-0.22650
638	-0.22600
698	-0.22450
863	-0.23550
1045	-0.24450
1073	-0.23850
1135	-0.23517
1199	-0.23617
1273	-0.23467
1332	-0.23450
1431	-0.23350
1522	-0.23217
1614	-0.23283
1706	-0.23317
1838	-0.23400

G53

Day	Shrinkage (%)
1851	-0.16833
1941	-0.16817
2044	-0.16900
2142	-0.16883
2248	-0.16850
2409	-0.16850
2520	-0.16800
2674	-0.16800
2800	-0.17233
2895	-0.17367
2976	-0.17300
3139	-0.17300
3223	-0.17300

G54

Day	Shrinkage (%)
1851	-0.18567
1941	-0.18583
2044	-0.18683
2142	-0.18567
2248	-0.18500
2409	-0.18550
2520	-0.18500
2674	-0.18550
2800	-0.19183
2895	-0.19183
2976	-0.19150
3139	-0.19167
3223	-0.19083

G55

Day	Shrinkage (%)
1706	-0.20250
1838	-0.20933
1928	-0.21167
2031	-0.21200
2129	-0.20967
2235	-0.21033
2396	-0.21400
2507	-0.22000
2661	-0.22800
2787	-0.23433
2882	-0.23500
2963	-0.23567
3126	-0.23467
3210	-0.23467

G56

Day	Shrinkage (%)
1928	-0.23333
2031	-0.23433
2129	-0.23433
2235	-0.23487
2396	-0.23400
2507	-0.23350
2661	-0.23450
2787	-0.23067
2882	-0.23067
2963	-0.23017
3126	-0.23100
3210	-0.22917

G57	
Day	Shrinkage (%)
0	0.00000
7	-0.12200
14	-0.14350
21	-0.17050
28	-0.19000
35	-0.19950
42	-0.21500
49	-0.22150
56	-0.22700
63	-0.22900
77	-0.23200
98	-0.23550
105	-0.22950
112	-0.22800
141	-0.22450
148	-0.22900
167	-0.24600
174	-0.23950
181	-0.24150
273	-0.24050
332	-0.24050
393	-0.24000
454	-0.24000
515	-0.23950
576	-0.23950
638	-0.23950
698	-0.23850
863	-0.24350
1045	-0.25250
1073	-0.24650
1135	-0.24217
1199	-0.24333
1273	-0.24283
1332	-0.24250
1431	-0.24367
1522	-0.24217
1614	-0.24333
1706	-0.24300
1838	-0.24450

G58	
Day	Shrinkage (%)
0	0.00000
7	-0.12050
14	-0.14250
21	-0.17000
28	-0.18700
35	-0.19750
42	-0.21250
49	-0.22150
56	-0.22450
63	-0.22900
77	-0.23200
98	-0.23700
105	-0.23200
112	-0.23100
141	-0.22700
148	-0.23000
167	-0.24650
174	-0.24250
181	-0.24250
273	-0.24100
332	-0.24000
393	-0.24000
454	-0.23950
515	-0.23850
576	-0.23800
638	-0.23700
698	-0.23550
863	-0.24500
1045	-0.25383
1073	-0.24850
1135	-0.24583
1199	-0.24500
1273	-0.24550
1332	-0.24567
1431	-0.24617
1522	-0.24450
1614	-0.24550
1706	-0.24533
1838	-0.24633

G59	
Day	Shrinkage (%)
0	0.00000
7	-0.11700
14	-0.13800
21	-0.16550
28	-0.18200
35	-0.19300
42	-0.20750
49	-0.21750
56	-0.22200
63	-0.22550
77	-0.23050
98	-0.23550
105	-0.22800
112	-0.22800
141	-0.22650
148	-0.22900
167	-0.24450
174	-0.23800
181	-0.24200
273	-0.23900
332	-0.23600
393	-0.23500
454	-0.23200
515	-0.23000
576	-0.22800
638	-0.22700
698	-0.22600
863	-0.24500
1045	-0.25300
1073	-0.25000
1135	-0.25000
1199	-0.25000
1273	-0.24933
1332	-0.24600
1431	-0.25000
1522	-0.24800
1614	-0.24867
1706	-0.24867
1838	-0.24933

G60	
Day	Shrinkage (%)
0	0.00000
7	-0.12700
14	-0.14850
21	-0.17100
28	-0.18600
35	-0.19500
42	-0.20900
49	-0.21600
56	-0.21800
63	-0.22350
77	-0.22700
98	-0.23150
105	-0.22600
112	-0.22400
141	-0.22200
148	-0.22500
167	-0.24000
174	-0.23800
181	-0.23900
273	-0.24100
332	-0.24200
393	-0.24100
454	-0.24300
515	-0.24500
576	-0.24600
638	-0.24500
698	-0.24600
863	-0.23700
1045	-0.24533
1073	-0.24100
1135	-0.24033
1199	-0.23900
1273	-0.23967
1332	-0.24000
1431	-0.24033
1522	-0.23833
1614	-0.23833
1706	-0.23767
1838	-0.23967

G57

Day	Shrinkage (%)
1928	-0.24367
2031	-0.24433
2129	-0.24383
2235	-0.24433
2396	-0.24500
2507	-0.24350
2661	-0.24300
2787	-0.24417
2882	-0.24500
2963	-0.24517
3126	-0.24483
3210	-0.24467

G58

Day	Shrinkage (%)
1928	-0.24617
2031	-0.24633
2129	-0.24550
2235	-0.24583
2396	-0.24600
2507	-0.24550
2661	-0.24600
2787	-0.24533
2882	-0.24533
2963	-0.24500
3126	-0.24467
3210	-0.24417

G59

Day	Shrinkage (%)
1928	-0.24933
2031	-0.25000
2129	-0.24967
2235	-0.24967
2396	-0.24900
2507	-0.24800
2661	-0.25100
2787	-0.24900
2882	-0.24900
2963	-0.24900
3126	-0.24900
3210	-0.24900

G60

Day	Shrinkage (%)
1928	-0.23867
2031	-0.23867
2129	-0.23867
2235	-0.24000
2396	-0.23900
2507	-0.24000
2661	-0.23900
2787	-0.23667
2882	-0.23700
2963	-0.23667
3126	-0.23767
3210	-0.23733

G61

Day	Shrinkage (%)
0	0.00000
7	-0.08300
14	-0.09800
21	-0.11750
28	-0.12850
35	-0.13450
42	-0.14550
49	-0.15150
56	-0.15350
63	-0.15800
77	-0.16050
98	-0.16300
105	-0.16350
112	-0.16150
141	-0.16000
148	-0.16300
167	-0.17200
174	-0.17050
181	-0.17050
273	-0.16900
332	-0.16750
393	-0.16650
454	-0.16450
515	-0.16300
576	-0.16350
638	-0.16250
698	-0.16300
863	-0.17300
1045	-0.17767
1073	-0.17300
1135	-0.17233
1199	-0.17267
1273	-0.17100
1332	-0.17000
1431	-0.17150
1522	-0.17083
1614	-0.17067
1706	-0.17100
1838	-0.17200

G62

Day	Shrinkage (%)
0	0.00000
7	-0.06700
14	-0.08550
21	-0.09900
28	-0.10750
35	-0.11500
42	-0.12700
49	-0.12900
56	-0.13100
63	-0.13850
70	-0.14050
91	-0.13900
98	-0.14050
105	-0.13900
134	-0.13700
141	-0.14500
162	-0.14850
169	-0.14700
176	-0.14750
185	-0.14850
270	-0.14600
331	-0.14300
392	-0.14300
454	-0.14200
515	-0.14200
576	-0.14150
636	-0.14100
858	-0.15250
1040	-0.15617
1068	-0.15250
1130	-0.15167
1194	-0.15183
1268	-0.15000
1327	-0.14967
1426	-0.14983
1517	-0.14933
1609	-0.14867
1701	-0.14867
1833	-0.14917

G63

Day	Shrinkage (%)
0	0.00000
7	-0.06600
14	-0.08100
21	-0.08950
28	-0.09650
35	-0.10700
42	-0.11450
49	-0.11800
56	-0.12100
63	-0.13050
70	-0.13150
91	-0.12800
98	-0.13050
105	-0.12700
134	-0.12600
141	-0.13300
162	-0.13700
169	-0.13700
176	-0.13750
185	-0.13800
270	-0.13400
331	-0.13150
392	-0.13100
454	-0.13200
515	-0.13000
576	-0.13100
636	-0.13000
697	-0.12850
858	-0.14050
1040	-0.14250
1068	-0.13950
1130	-0.14000
1194	-0.13933
1268	-0.13700
1327	-0.13617
1426	-0.13783
1517	-0.13633
1609	-0.13583
1701	-0.13567

G64

Day	Shrinkage (%)
0	0.00000
7	-0.07450
14	-0.09750
21	-0.11250
28	-0.12350
35	-0.13150
42	-0.14200
49	-0.14450
56	-0.14600
63	-0.15750
70	-0.15950
91	-0.15600
98	-0.15900
105	-0.15550
134	-0.15400
141	-0.16150
162	-0.16600
169	-0.16450
176	-0.16600
185	-0.16700
270	-0.16400
331	-0.16200
392	-0.16150
454	-0.16000
515	-0.15900
576	-0.15950
636	-0.15950
858	-0.16700
1040	-0.17117
1068	-0.16750
1130	-0.16850
1194	-0.16733
1268	-0.16567
1327	-0.16567
1426	-0.16700
1517	-0.16550
1609	-0.16550
1701	-0.16483
1833	-0.16600

G61

Day	Shrinkage (%)
1928	-0.17167
2031	-0.17200
2129	-0.16383
2235	-0.16433
2396	-0.16500
2507	-0.17150
2661	-0.17150
2787	-0.17033
2882	-0.17083
2963	-0.17033
3126	-0.16983
3210	-0.16967

G62

Day	Shrinkage (%)
1923	-0.14833
2026	-0.14883
2124	-0.14883
2230	-0.14783
2391	-0.14800
2502	-0.14800
2656	-0.14800
2782	-0.14850
2877	-0.14850
2958	-0.14850
3121	-0.14850
3205	-0.14850

G63

Day	Shrinkage (%)
1833	-0.13633
1923	-0.13633
2026	-0.13667
2124	-0.13617
2230	-0.13500
2391	-0.13600
2502	-0.13650
2656	-0.13600
2782	-0.13783
2877	-0.13817
2958	-0.13883
3121	-0.13767
3205	-0.13767

G64

Day	Shrinkage (%)
1923	-0.16500
2026	-0.16550
2124	-0.16533
2230	-0.16550
2391	-0.16550
2502	-0.16600
2656	-0.16650
2782	-0.16417
2877	-0.16433
2958	-0.16417
3121	-0.16483
3205	-0.16433

G65

Day	Shrinkage (%)
0	0.00000
7	-0.06800
14	-0.08450
21	-0.09800
28	-0.10950
35	-0.11900
42	-0.12800
49	-0.13150
56	-0.13250
63	-0.14450
70	-0.14600
91	-0.14150
98	-0.14500
105	-0.14000
134	-0.14050
141	-0.14850
162	-0.15200
169	-0.15200
176	-0.15050
185	-0.15250
270	-0.15000
331	-0.15000
392	-0.14950
454	-0.14850
515	-0.14800
576	-0.14850
636	-0.14750
858	-0.15350
1040	-0.15683
1068	-0.15367
1130	-0.15417
1194	-0.15383
1268	-0.15283
1327	-0.15183
1426	-0.15333
1517	-0.15250
1609	-0.15217
1701	-0.15250
1833	-0.15283

G66

Day	Shrinkage (%)
0	0.00000
7	-0.06400
14	-0.08100
21	-0.09200
28	-0.10100
35	-0.11000
42	-0.11500
49	-0.12500
56	-0.12700
63	-0.13200
70	-0.13600
91	-0.13400
98	-0.13600
105	-0.13300
134	-0.13200
141	-0.14000
162	-0.14200
169	-0.14200
176	-0.14400
185	-0.14400
270	-0.14100
331	-0.13900
392	-0.13900
454	-0.13700
515	-0.13600
576	-0.13700
636	-0.13500
858	-0.14700
1040	-0.14700
1068	-0.14600
1130	-0.14700
1194	-0.14533
1268	-0.14433
1327	-0.14367
1426	-0.14333
1517	-0.14433
1609	-0.14267
1701	-0.14300
1833	-0.14367

G67

Day	Shrinkage (%)
0	0.00000
7	-0.14000
14	-0.17850
21	-0.20100
28	-0.20900
35	-0.22600
42	-0.23300
49	-0.23650
56	-0.23700
63	-0.24750
70	-0.25050
91	-0.22350
98	-0.23250
105	-0.21700
134	-0.20950
141	-0.22000
169	-0.22750
176	-0.22900
185	-0.23050
270	-0.22900
331	-0.22750
392	-0.22750
454	-0.22550
515	-0.22500
576	-0.22500
636	-0.22500
858	-0.24000
1040	-0.26217
1068	-0.26300
1130	-0.25767
1194	-0.26083
1268	-0.26533
1327	-0.26717
1426	-0.27300
1517	-0.27317
1609	-0.27600
1701	-0.28000
1833	-0.28217
1923	-0.28183

G68

Day	Shrinkage (%)
0	0.00000
7	-0.18300
14	-0.22300
21	-0.24600
28	-0.24900
35	-0.26500
42	-0.26700
49	-0.26800
56	-0.26800
63	-0.28100
70	-0.28200
91	-0.25200
98	-0.25700
105	-0.24400
134	-0.24300
141	-0.24700
162	-0.26100
169	-0.25500
176	-0.25900
185	-0.25900
270	-0.26500
331	-0.27100
392	-0.27800
454	-0.29200
515	-0.30000
576	-0.30800
636	-0.31300
697	-0.30400
858	-0.33300
1001	-0.37867
1040	-0.38000
1068	-0.38400
1130	-0.38400
1194	-0.38433
1268	-0.38467
1327	-0.39100
1426	-0.39167
1517	-0.39367
1609	-0.39900

G65

Day	Shrinkage (%)
1923	-0.15267
2026	-0.15250
2124	-0.15200
2230	-0.15133
2391	-0.15200
2502	-0.15200
2656	-0.15150
2782	-0.15283
2877	-0.15283
2958	-0.15267
3121	-0.15350
3205	-0.15283

G66

Day	Shrinkage (%)
1923	-0.14300
2026	-0.14200
2124	-0.14300
2230	-0.14367
2391	-0.14400
2502	-0.14200
2656	-0.14400
2782	-0.14333
2877	-0.14300
2958	-0.14333
3121	-0.14333
3205	-0.14300

G67

Day	Shrinkage (%)
2026	-0.28200
2124	-0.28283
2230	-0.28183
2391	-0.28250
2502	-0.28250
2656	-0.28300
2782	-0.28900
2877	-0.28900
2958	-0.28900
3121	-0.28983
3205	-0.29017

G68

Day	Shrinkage (%)
1701	-0.40167
1833	-0.40733
1923	-0.40700
2026	-0.41133
2124	-0.41133
2230	-0.40900
2391	-0.40900
2502	-0.41100
2656	-0.40700
2782	-0.41133
2877	-0.41167
2958	-0.41200
3121	-0.41233
3205	-0.41233

G69

Day	Shrinkage (%)
0	0.00000
7	-0.17750
14	-0.22800
21	-0.25050
28	-0.25850
35	-0.27450
42	-0.27550
49	-0.27700
56	-0.27550
70	-0.27200
91	-0.27300
98	-0.26300
105	-0.27200
134	-0.25900
141	-0.26350
161	-0.27650
168	-0.27350
175	-0.27700
184	-0.27750
276	-0.28400
337	-0.29100
398	-0.29750
460	-0.30850
521	-0.31450
582	-0.32050
642	-0.32450
703	-0.35300
863	-0.37400
1045	-0.40633
1073	-0.40850
1135	-0.40650
1199	-0.40900
1273	-0.41100
1332	-0.41317
1431	-0.41417
1522	-0.41583
1614	-0.42033
1706	-0.42183
1838	-0.42383

G70

Day	Shrinkage (%)
0	0.00000
7	-0.19600
14	-0.24350
21	-0.27150
28	-0.28350
35	-0.29900
42	-0.29800
49	-0.30250
56	-0.29750
70	-0.30050
91	-0.30250
98	-0.29250
112	-0.30050
134	-0.29300
141	-0.29850
161	-0.31200
168	-0.31250
175	-0.31650
184	-0.31900
270	-0.34600
331	-0.35500
392	-0.37350
454	-0.38900
515	-0.41000
576	-0.42450
636	-0.43450
697	-0.44150
857	-0.44550
1039	-0.45850
1067	-0.45800
1129	-0.45850
1193	-0.45667
1267	-0.45750
1326	-0.45767
1425	-0.45633
1516	-0.45833
1608	-0.46267
1700	-0.46350
1832	-0.46617

G71

Day	Shrinkage (%)
0	0.00000
7	-0.22050
14	-0.26950
21	-0.30000
28	-0.31450
35	-0.33150
42	-0.33450
49	-0.33750
56	-0.33800
70	-0.34800
91	-0.36050
98	-0.35550
112	-0.35700
134	-0.36700
141	-0.37400
161	-0.39300
168	-0.39450
175	-0.40200
184	-0.40500
270	-0.41750
331	-0.43350
392	-0.45350
454	-0.47350
515	-0.48500
576	-0.49500
636	-0.50550
697	-0.51950
1039	-0.52200
1067	-0.52100
1129	-0.52200
1193	-0.51983
1267	-0.51933
1326	-0.51900
1425	-0.51933
1516	-0.52000
1608	-0.52333
1700	-0.52383
1832	-0.52500
1922	-0.52400

G72

Day	Shrinkage (%)
0	0.00000
7	-0.14650
14	-0.20100
21	-0.24150
28	-0.25450
35	-0.27350
42	-0.27800
49	-0.28550
56	-0.28700
70	-0.28450
91	-0.28400
98	-0.27750
112	-0.26900
134	-0.27000
141	-0.27500
161	-0.28650
168	-0.28300
175	-0.28750
184	-0.29000
270	-0.28950
331	-0.29050
392	-0.29000
454	-0.28900
515	-0.28900
576	-0.29000
636	-0.28950
857	-0.32200
1039	-0.35350
1067	-0.36050
1129	-0.36150
1193	-0.36350
1267	-0.36433
1326	-0.37233
1425	-0.37433
1516	-0.38333
1608	-0.38733
1700	-0.39200
1832	-0.39883
1922	-0.39900

G69

Day	Shrinkage (%)
1928	-0.42267
2031	-0.42383
2129	-0.42317
2235	-0.42167
2396	-0.42250
2507	-0.42200
2661	-0.42200
2787	-0.42517
2882	-0.42517
2963	-0.42583
3126	-0.42450
3210	-0.42500

G70

Day	Shrinkage (%)
1922	-0.46417
2025	-0.46600
2123	-0.46617
2229	-0.46600
2390	-0.46600
2501	-0.46550
2655	-0.46600
2781	-0.46900
2876	-0.46867
2957	-0.46867
3120	-0.46800
3204	-0.46800

G71

Day	Shrinkage (%)
2025	-0.52633
2123	-0.52600
2229	-0.52567
2390	-0.52450
2501	-0.52550
2655	-0.52550
2781	-0.53000
2876	-0.53000
2957	-0.53067
3120	-0.52983

G72

Day	Shrinkage (%)
2025	-0.40233
2123	-0.40150
2229	-0.40233
2390	-0.40150
2501	-0.40000
2655	-0.40000
2781	-0.40508
2876	-0.40508
2957	-0.40475
3120	-0.40473

G73

Day	Shrinkage (%)
0	0.00000
7	-0.16050
14	-0.22500
21	-0.25750
28	-0.27050
35	-0.28850
42	-0.29150
49	-0.29400
56	-0.29700
70	-0.29650
91	-0.29950
98	-0.29600
112	-0.28450
134	-0.28750
141	-0.29250
161	-0.30600
168	-0.30150
175	-0.30600
184	-0.30700
270	-0.31750
331	-0.32700
392	-0.33950
454	-0.35150
515	-0.36050
576	-0.36700
636	-0.37350
697	-0.37050
857	-0.41000
1039	-0.43700
1067	-0.43900
1129	-0.44000
1193	-0.44050
1267	-0.44117
1326	-0.44317
1425	-0.44467
1516	-0.44667
1608	-0.45150
1700	-0.45317
1832	-0.45533

G74

Day	Shrinkage (%)
0	0.00000
7	-0.15950
14	-0.22700
21	-0.25900
28	-0.27400
35	-0.29250
42	-0.29900
49	-0.30050
56	-0.30150
70	-0.30150
91	-0.30800
98	-0.29700
112	-0.29050
134	-0.29600
141	-0.30000
161	-0.31450
168	-0.31150
175	-0.31500
184	-0.31650
276	-0.32400
337	-0.33650
398	-0.35000
460	-0.36200
521	-0.37800
582	-0.38500
642	-0.39150
703	-0.40750
857	-0.42450
1039	-0.44817
1067	-0.45000
1129	-0.45000
1193	-0.45050
1267	-0.45200
1326	-0.45367
1425	-0.45567
1516	-0.45617
1608	-0.45833
1700	-0.46133
1832	-0.46383

G75

Day	Shrinkage (%)
0	0.00000
7	-0.18750
14	-0.25550
21	-0.28900
28	-0.30650
35	-0.32700
42	-0.33150
49	-0.33850
56	-0.33950
70	-0.34600
91	-0.35550
98	-0.34700
112	-0.34550
134	-0.35100
141	-0.35650
161	-0.37450
168	-0.37300
175	-0.37800
184	-0.38150
270	-0.40000
331	-0.41200
392	-0.42800
454	-0.43700
515	-0.46000
576	-0.47550
636	-0.49250
697	-0.50800
857	-0.50900
1039	-0.52150
1067	-0.52100
1129	-0.52250
1193	-0.52100
1267	-0.52083
1326	-0.52167
1425	-0.52283
1516	-0.52417
1608	-0.52767
1700	-0.52817
1832	-0.52933

G76

Day	Shrinkage (%)
0	0.00000
7	-0.20050
14	-0.27400
21	-0.30550
28	-0.32300
35	-0.34950
42	-0.36800
49	-0.37150
56	-0.37600
70	-0.40300
91	-0.42600
98	-0.42450
112	-0.43100
134	-0.44950
142	-0.45550
160	-0.48100
167	-0.48250
174	-0.48900
183	-0.49350
276	-0.51200
337	-0.52700
398	-0.54200
460	-0.55500
521	-0.56750
582	-0.57700
642	-0.58400
703	-0.59600
856	-0.58950
1038	-0.59950
1066	-0.59900
1128	-0.59833
1192	-0.59733
1266	-0.59750
1325	-0.59650
1424	-0.59633
1515	-0.59817
1607	-0.59800
1699	-0.60100
1831	-0.60233

G73

Day	Shrinkage (%)
1922	-0.45417
2025	-0.45683
2123	-0.45550
2229	-0.45533
2390	-0.45350
2501	-0.45400
2655	-0.45450
2781	-0.45983
2876	-0.46000
2957	-0.45967
3120	-0.45933
3204	-0.46000

G74

Day	Shrinkage (%)
1922	-0.46300
2025	-0.46517
2123	-0.46250
2229	-0.46233
2390	-0.46250
2501	-0.46200
2655	-0.46250
2781	-0.46367
2876	-0.46367
2957	-0.46383
3120	-0.46350
3204	-0.46400

G75

Day	Shrinkage (%)
1922	-0.52883
2025	-0.53167
2123	-0.52867
2229	-0.52900
2390	-0.53100
2501	-0.53000
2655	-0.53000
2781	-0.53067
2876	-0.53017
2957	-0.52967
3120	-0.52967
3204	-0.53050

G76

Day	Shrinkage (%)
1921	-0.60133
2024	-0.60500
2122	-0.60267
2228	-0.60217
2389	-0.60350
2500	-0.60300
2654	-0.59995
2780	-0.60467
2875	-0.60433
2956	-0.60433
3119	-0.60533
3203	-0.60550

G77

Day	Shrinkage (%)
0	0.00000
7	-0.10350
14	-0.13450
21	-0.16450
28	-0.16950
49	-0.19050
56	-0.18850
63	-0.18950
92	-0.19500
100	-0.19900
118	-0.21750
125	-0.21250
132	-0.21350
141	-0.21600
146	-0.21550
155	-0.21950
180	-0.21800
270	-0.21550
331	-0.21550
392	-0.21550
453	-0.21450
514	-0.21350
576	-0.21300
636	-0.21300
814	-0.22200
957	-0.23333
996	-0.23250
1024	-0.22800
1086	-0.22250
1150	-0.22200
1224	-0.22267
1283	-0.22267
1382	-0.21950
1473	-0.22000
1565	-0.22267
1657	-0.22233
1789	-0.22267
1879	-0.22183
1982	-0.22300

G78

Day	Shrinkage (%)
0	0.00000
7	-0.10500
14	-0.13650
21	-0.16600
28	-0.17000
49	-0.19550
63	-0.19550
70	-0.19100
92	-0.19850
100	-0.20350
118	-0.22200
125	-0.21750
132	-0.21900
141	-0.22000
146	-0.21950
155	-0.22200
180	-0.22200
270	-0.22050
331	-0.22050
392	-0.22050
453	-0.22000
514	-0.21950
576	-0.21850
636	-0.21850
814	-0.22500
996	-0.23750
1024	-0.23250
1086	-0.23283
1150	-0.23183
1224	-0.23117
1283	-0.23083
1382	-0.22500
1473	-0.22450
1565	-0.22450
1657	-0.22600
1789	-0.22700
1879	-0.22650
1982	-0.22750
2080	-0.22700

G79

Day	Shrinkage (%)
0	0.00000
7	-0.10200
14	-0.13550
21	-0.16500
28	-0.17250
49	-0.19750
56	-0.19700
63	-0.19800
92	-0.20050
100	-0.20700
118	-0.22450
125	-0.22150
132	-0.22200
141	-0.22450
146	-0.22400
155	-0.22700
180	-0.22550
276	-0.22350
337	-0.22250
398	-0.22300
459	-0.22100
520	-0.22150
582	-0.22150
642	-0.22050
820	-0.22800
1002	-0.24200
1030	-0.23750
1092	-0.23533
1156	-0.23533
1230	-0.23500
1289	-0.23467
1388	-0.23217
1479	-0.22967
1571	-0.22800
1663	-0.22850
1795	-0.22933
1885	-0.22967
1988	-0.23000
2086	-0.22950

G80

Day	Shrinkage (%)
0	0.00000
7	-0.14950
14	-0.21850
28	-0.27350
56	-0.27750
63	-0.27650
70	-0.27550
92	-0.27600
100	-0.28050
118	-0.30400
125	-0.30000
132	-0.30400
141	-0.30550
146	-0.30800
155	-0.31400
180	-0.31800
270	-0.33550
331	-0.35550
392	-0.37750
453	-0.39550
514	-0.41500
576	-0.43350
636	-0.43800
814	-0.46300
996	-0.48200
1024	-0.48250
1086	-0.48367
1150	-0.48267
1224	-0.48400
1283	-0.48567
1382	-0.48567
1473	-0.48783
1565	-0.48883
1657	-0.49050
1789	-0.49350
1879	-0.49317
1982	-0.49367
2080	-0.49150
2186	-0.49150

G77

Day	Shrinkage (%)
2080	-0.22217
2186	-0.22250
2347	-0.22300
2458	-0.22300
2612	-0.22250
2738	-0.22367
2833	-0.22367
2914	-0.22433
3077	-0.22367
3161	-0.22400

G78

Day	Shrinkage (%)
2186	-0.22750
2347	-0.22600
2458	-0.22800
2612	-0.22750
2738	-0.22750
2833	-0.22750
2914	-0.22800
3077	-0.22717

G79

Day	Shrinkage (%)
2192	-0.23000
2353	-0.22950
2464	-0.22950
2618	-0.22800
2744	-0.22533
2839	-0.22600
2920	-0.22550
3083	-0.22617
3167	-0.22633

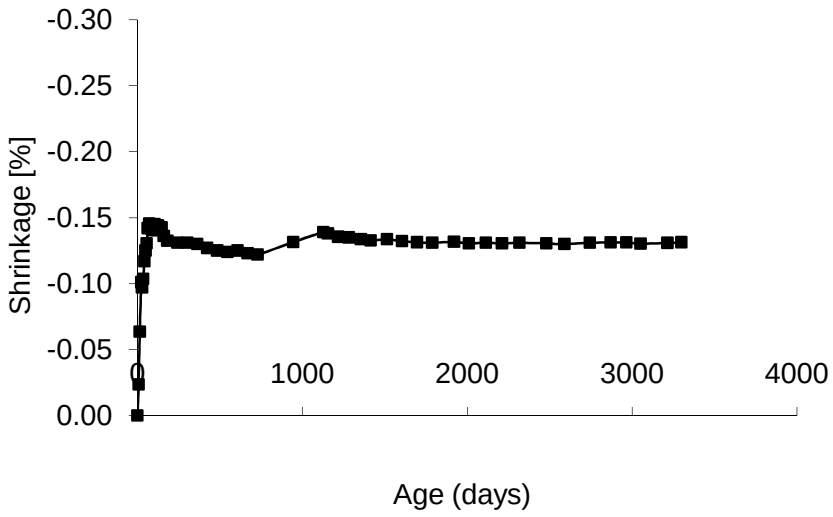
G80

Day	Shrinkage (%)
2347	-0.49100
2458	-0.49150
2612	-0.49300
2738	-0.49567
2833	-0.49533
2914	-0.49500
3077	-0.49583
3161	-0.49600

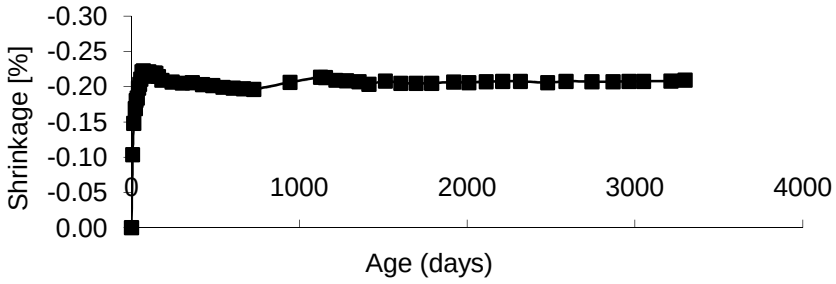
G81				
Days	Shrinkage (%)		Days	Shrinkage (%)
0	0.00000		2612	-0.44900
7	-0.12900		2738	-0.45067
14	-0.19200		2833	-0.45100
21	-0.24000		2914	-0.45167
28	-0.23400		3077	-0.45167
56	-0.24600		3161	-0.45200
63	-0.24500			
89	-0.24600			
118	-0.26400			
125	-0.25900			
132	-0.26300			
141	-0.26700			
146	-0.26200			
155	-0.27300			
180	-0.27300			
270	-0.28000			
331	-0.28700			
392	-0.29300			
453	-0.30000			
514	-0.30700			
576	-0.31100			
636	-0.31600			
814	-0.41600			
996	-0.43500			
1024	-0.44000			
1086	-0.43400			
1150	-0.43433			
1224	-0.43900			
1283	-0.43967			
1382	-0.44000			
1473	-0.44167			
1565	-0.44333			
1657	-0.44600			
1789	-0.44800			
1879	-0.44833			
1982	-0.45000			
2080	-0.44767			
2186	-0.44900			

Appendix II Graphs for Drying Shrinkage Data for cement pastes

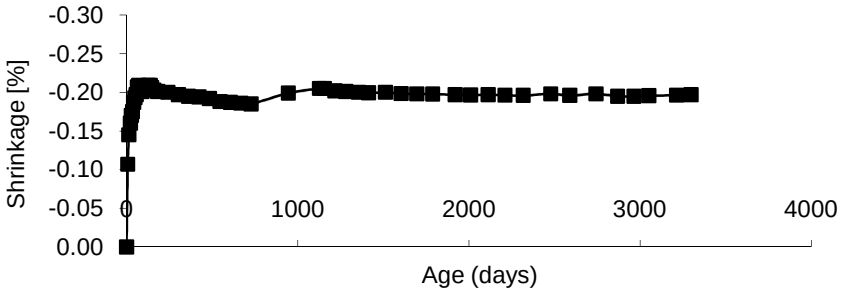
G # 1


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
1000
2000
3000
4000
Age (days)

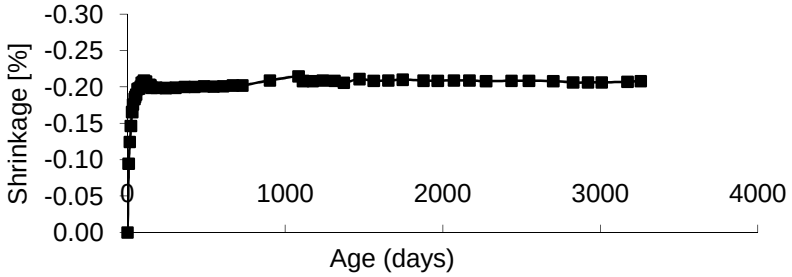
G # 2


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
1000
2000
3000
4000
Age (days)

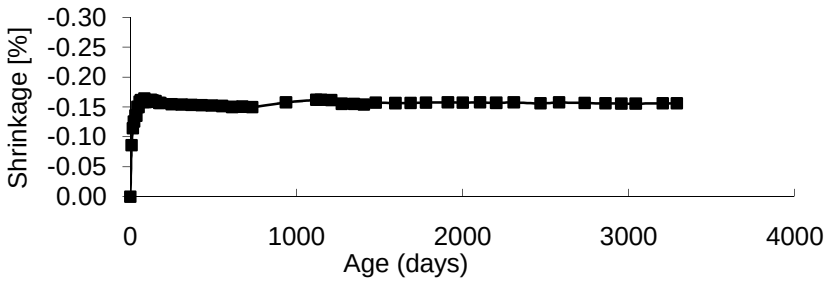
G # 3


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
1000
2000
3000
4000
Age (days)

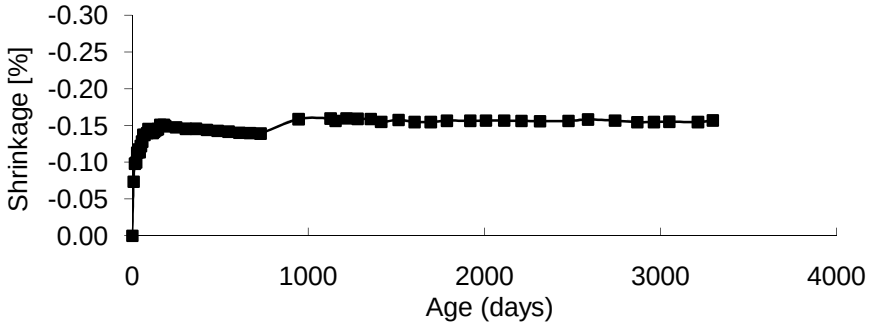
G # 4


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
1000
2000
3000
4000
Age (days)

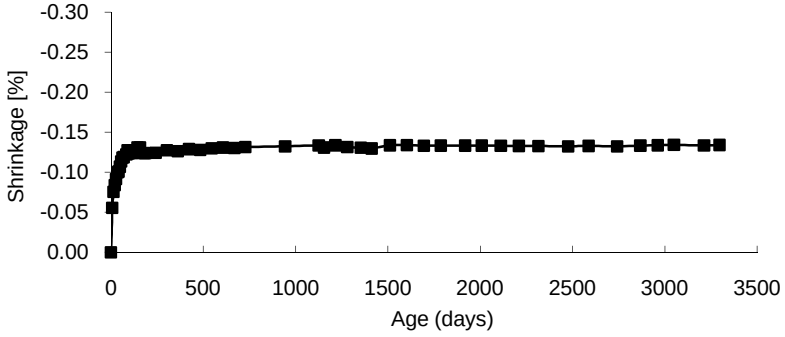
G # 5


Shrinkage [%]
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
1000
2000
3000
4000
Age (days)

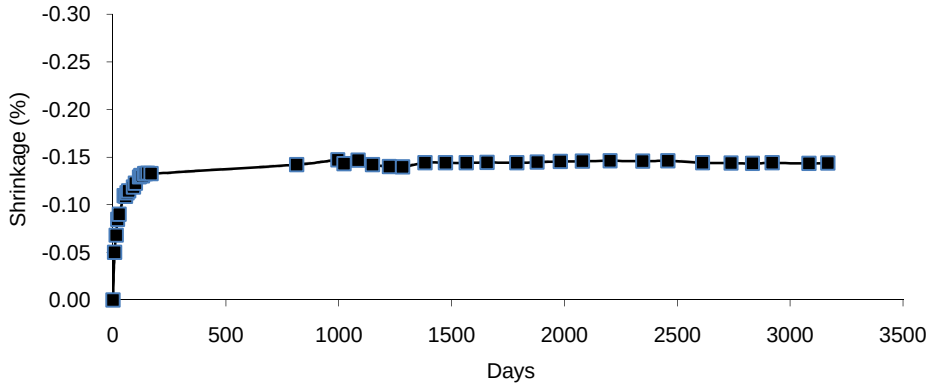
G # 6


Shrinkage [%]
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
1000
2000
3000
4000
Age (days)

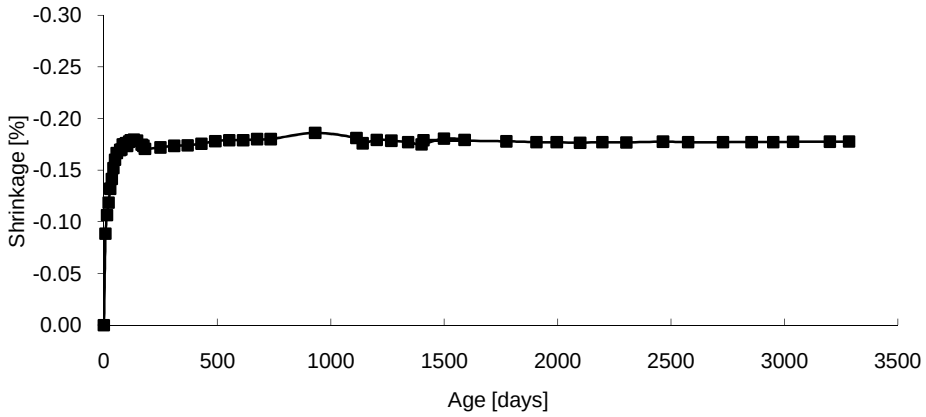
G # 7


Shrinkage [%]
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0
500
1000
1500
2000
2500
3000
3500
Age (days)

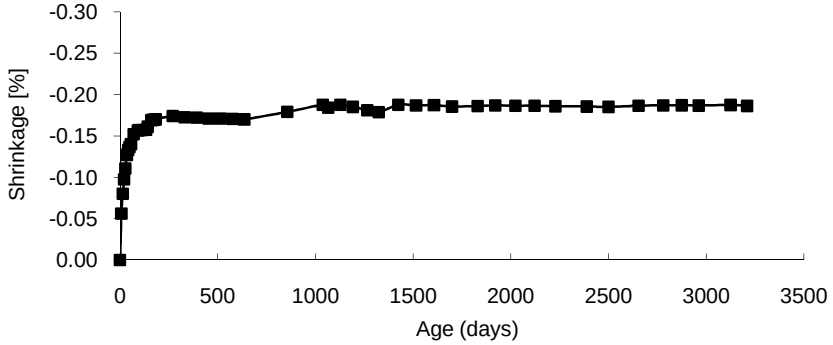
G # 8


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage (%)
0
500
1000
1500
2000
2500
3000
3500
Days

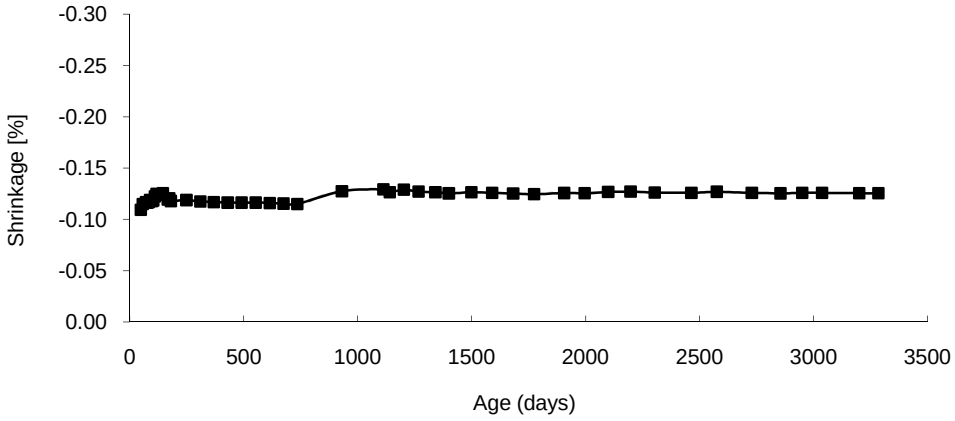
G # 9


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age [days]

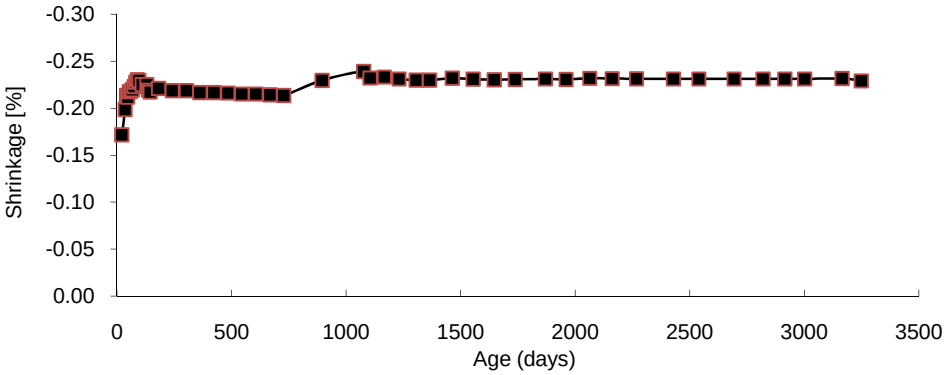
G # 10


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

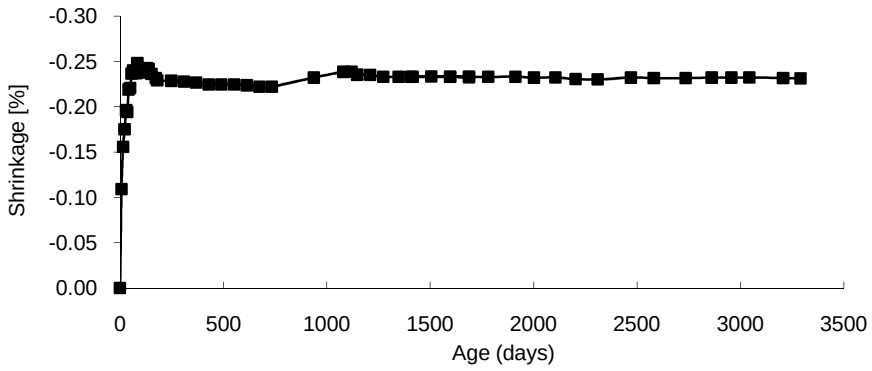
G # 11


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

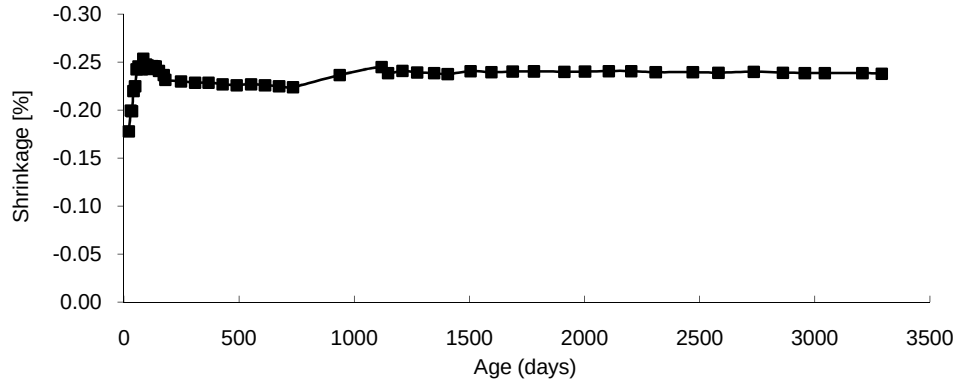
G # 12


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

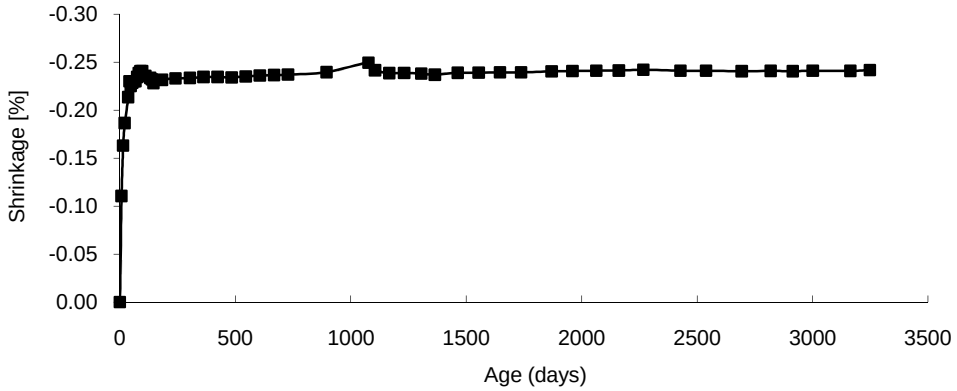
G # 13


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

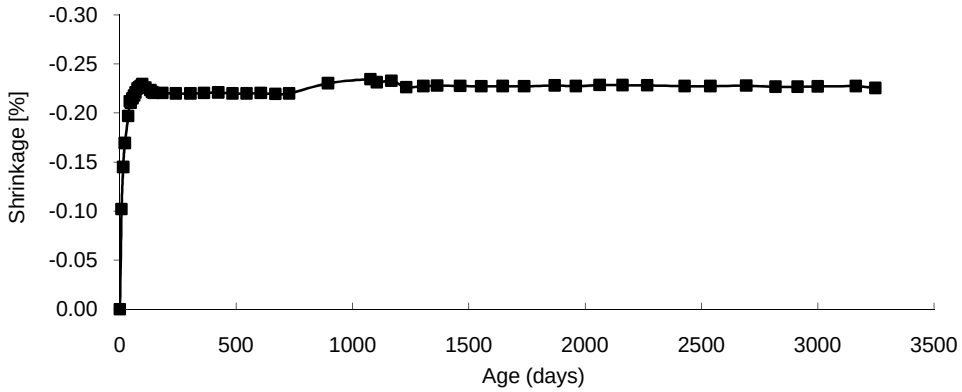
G # 14


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

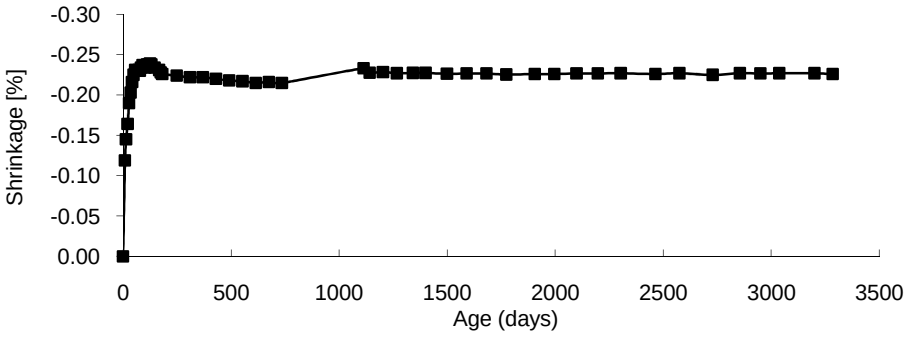
G # 15


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

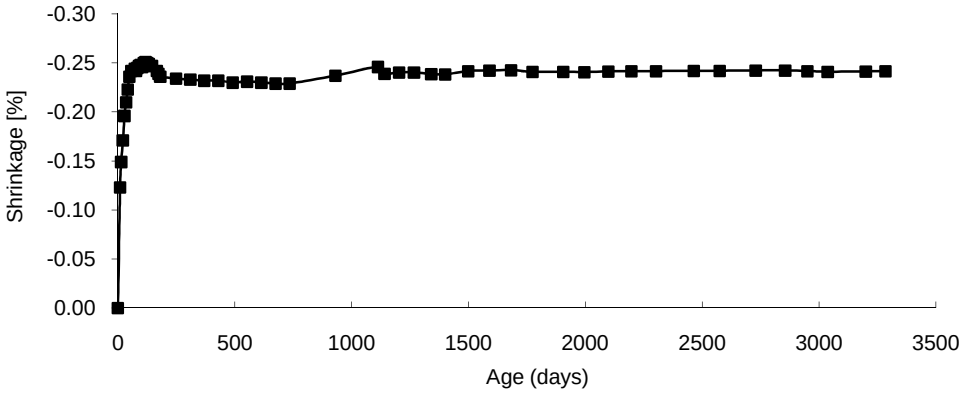
G # 16


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

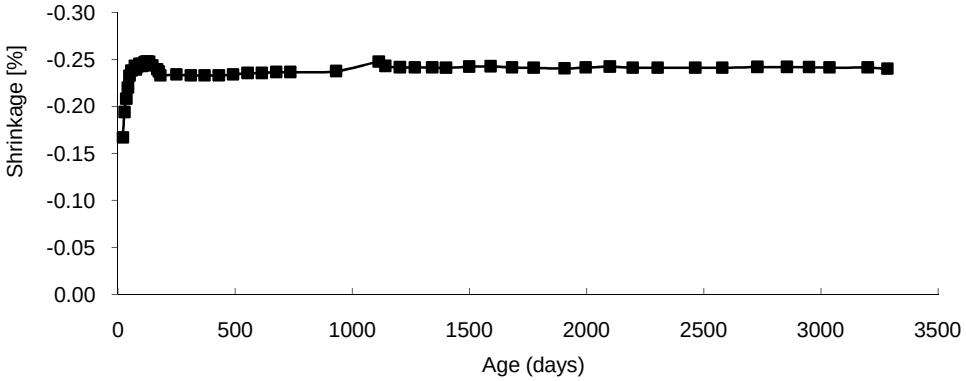
G # 17


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

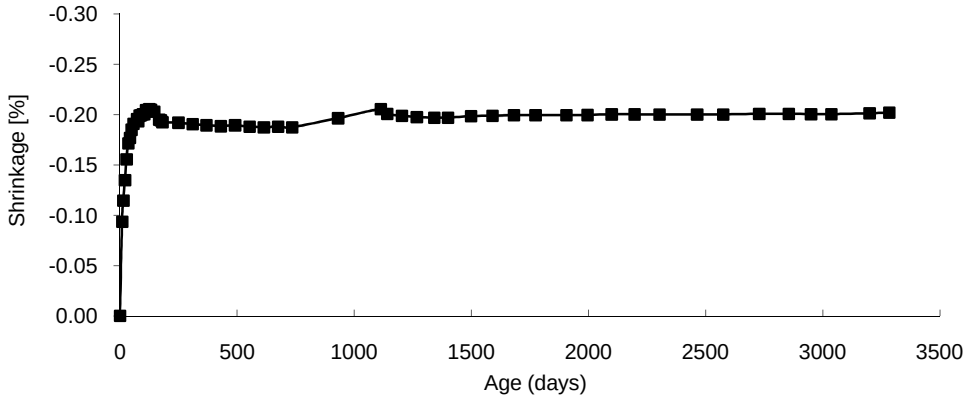
G # 18


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

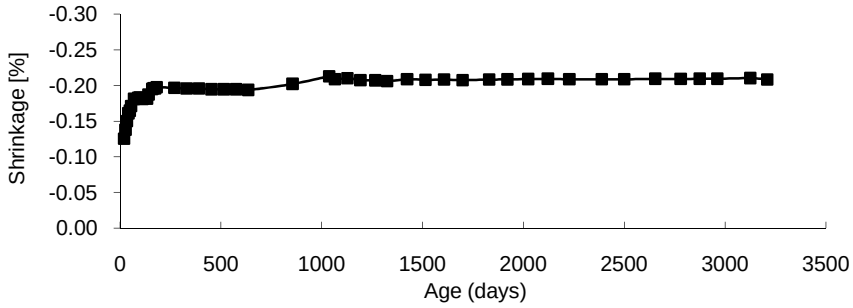
G # 19


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

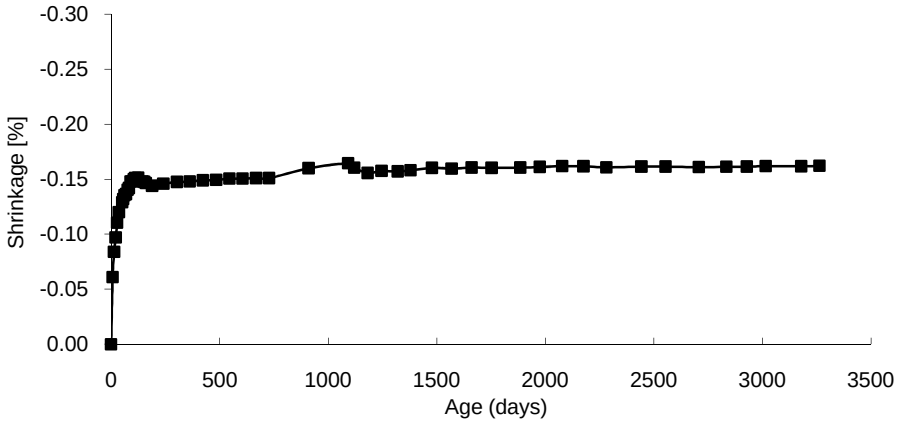
G # 20


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

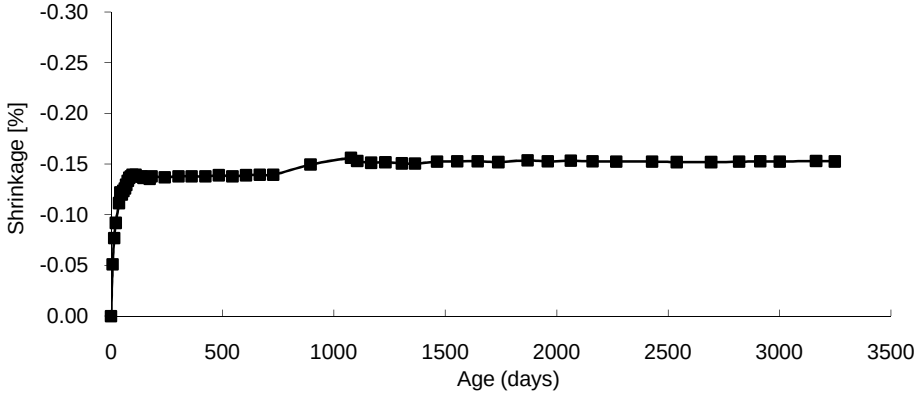
G # 21


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

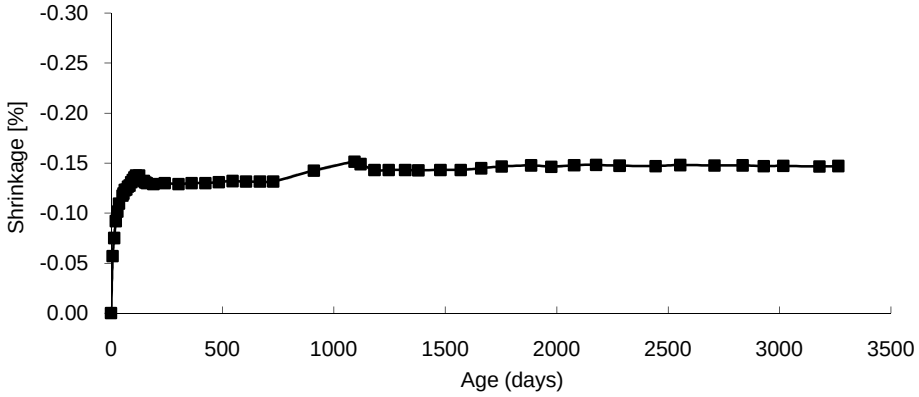
G # 22


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

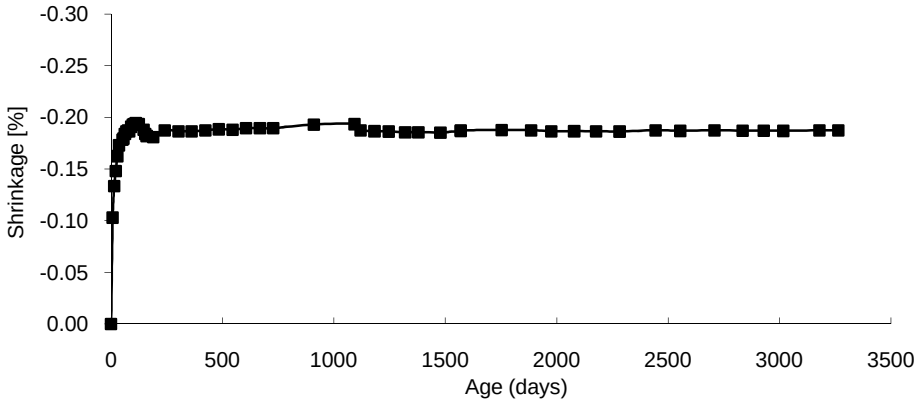
G # 23


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

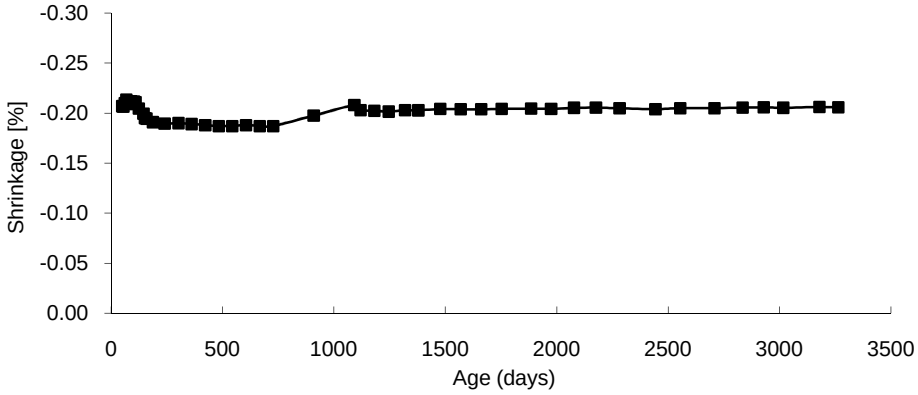
G # 24


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

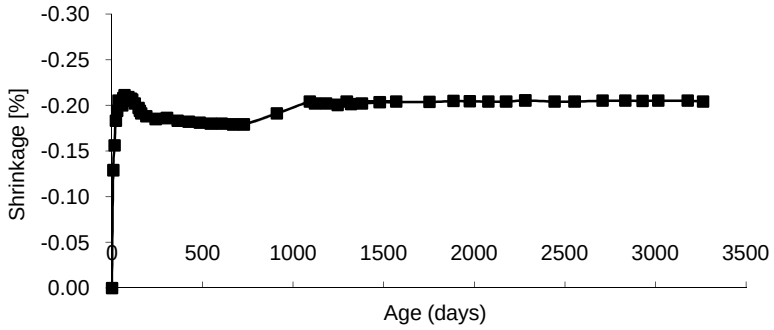
G # 25


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

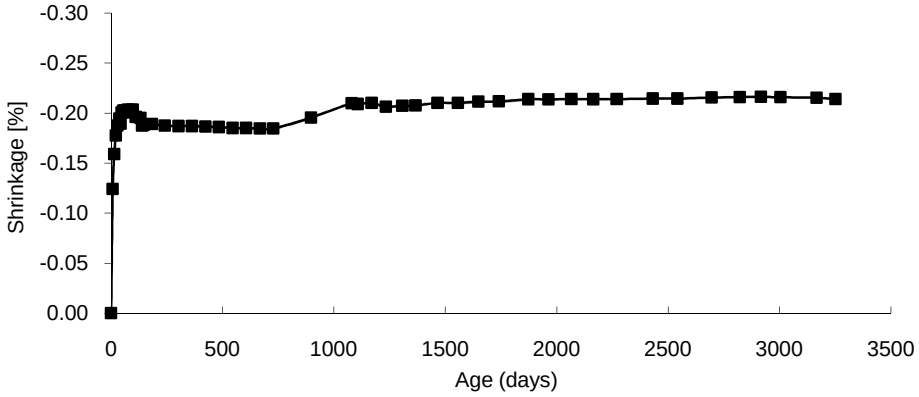
G # 26


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

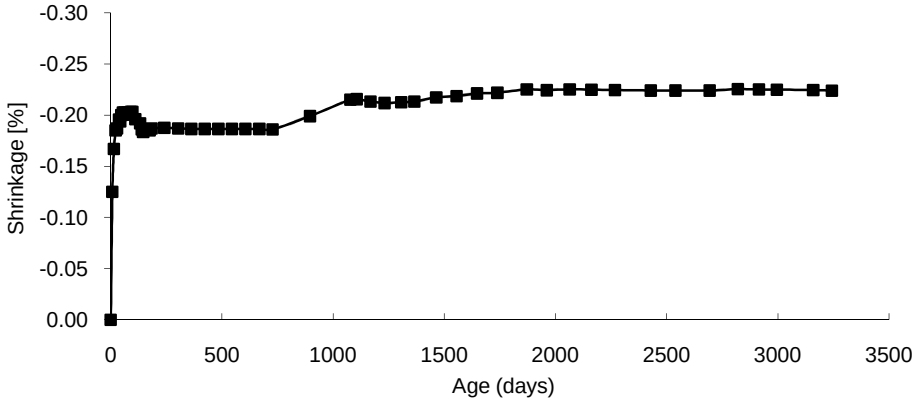
G # 27


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

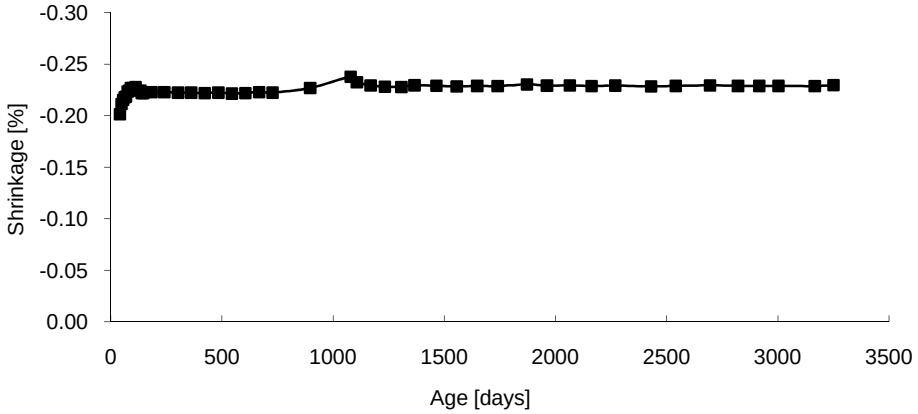
G # 28


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

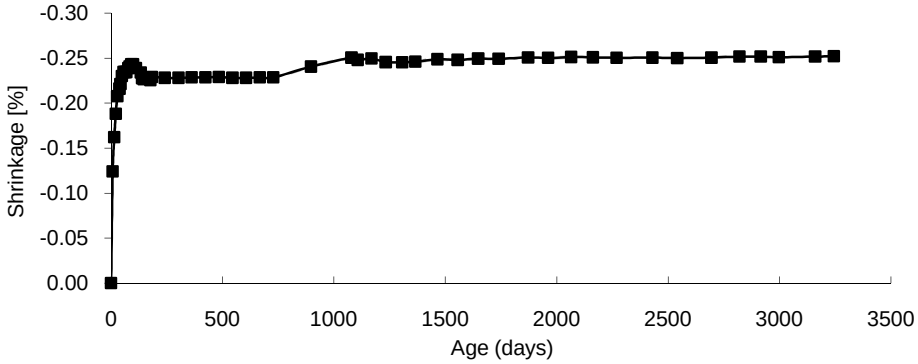
G # 29


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

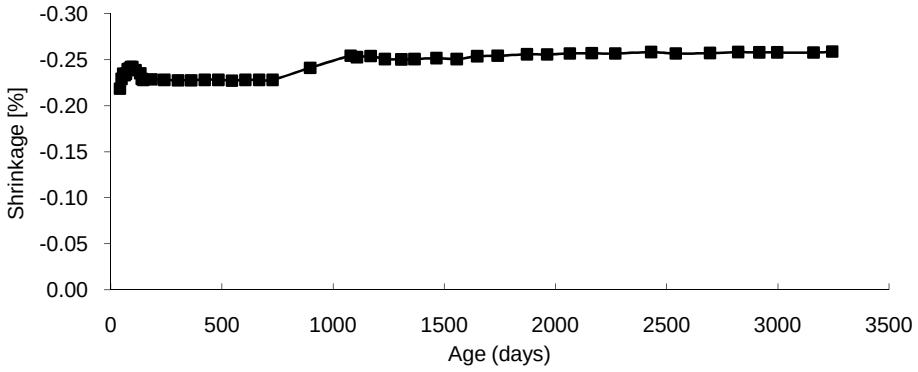
G # 30


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age [days]

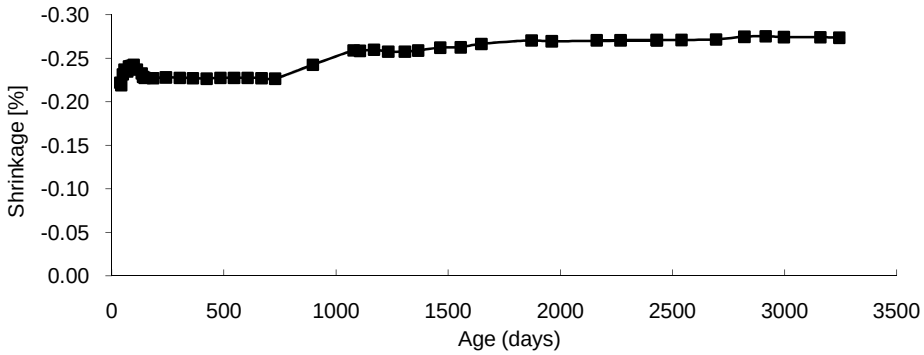
G # 31


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

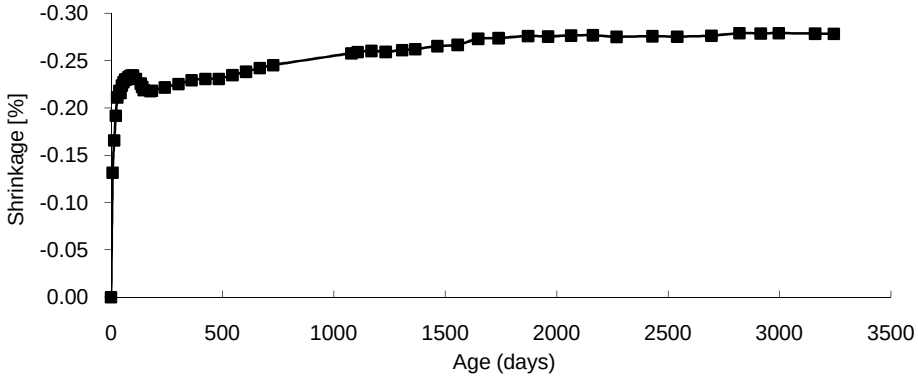
G # 32


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

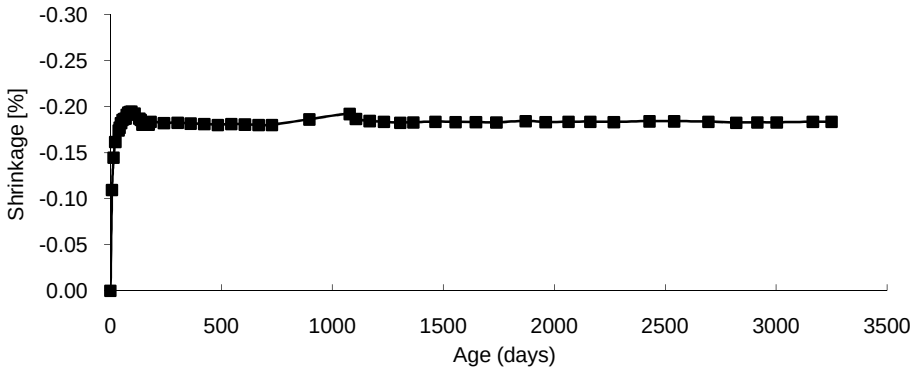
G # 33


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

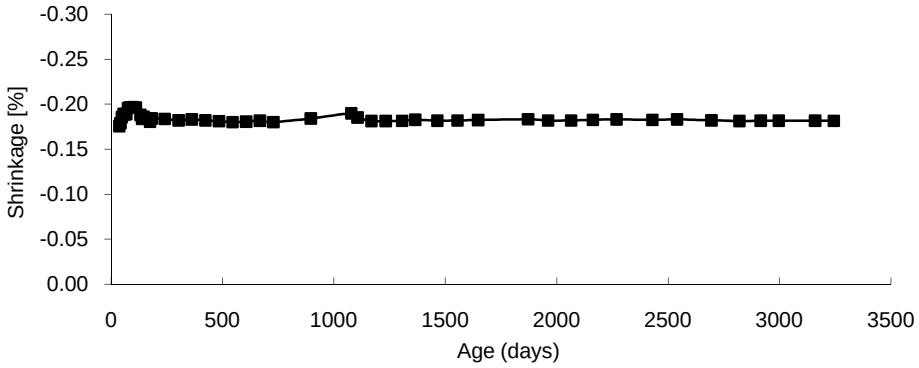
G # 34


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

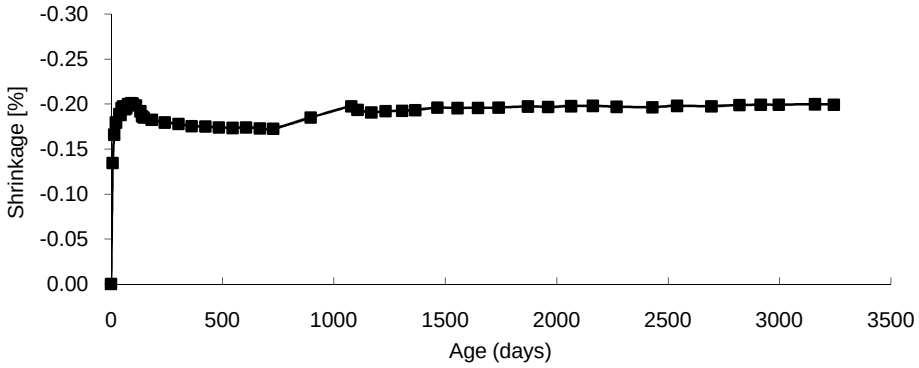
G # 35


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

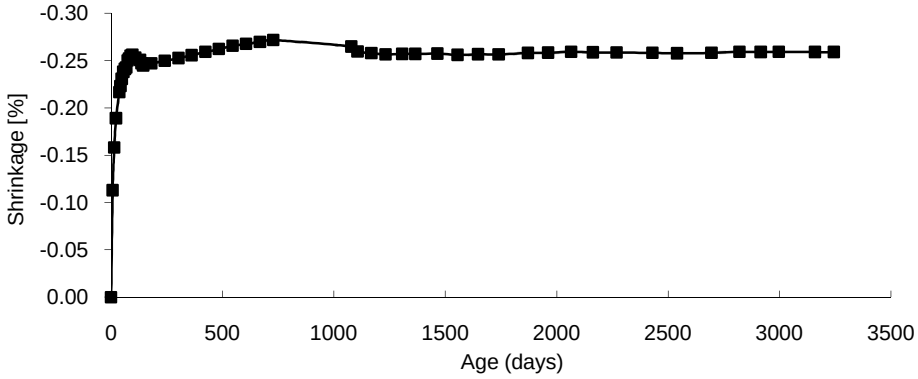
G # 36


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

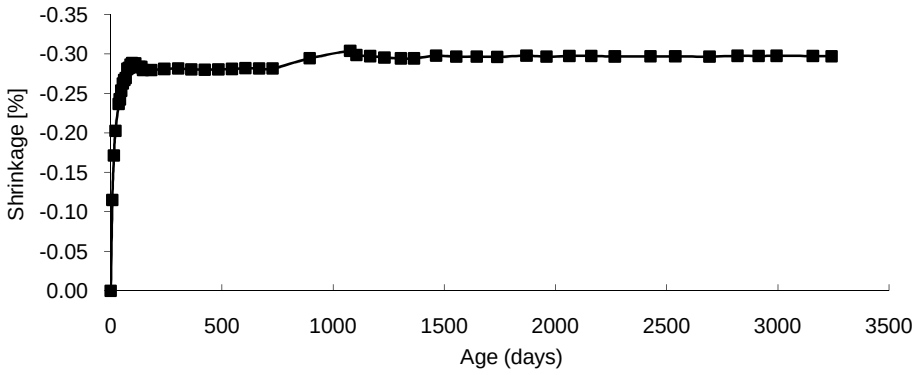
G # 37


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

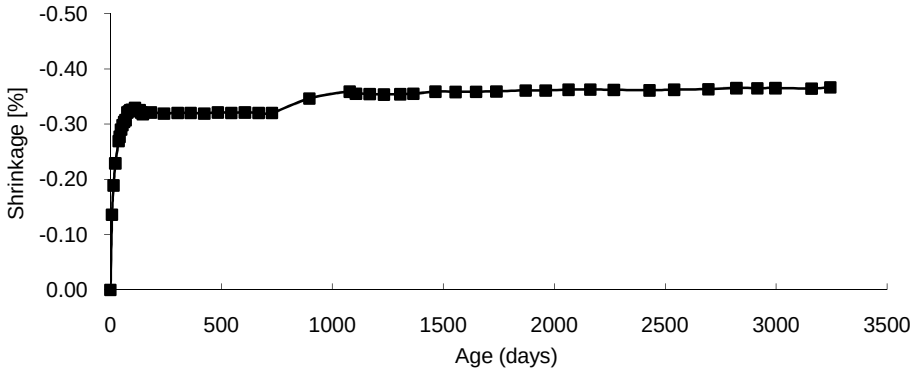
G # 38


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

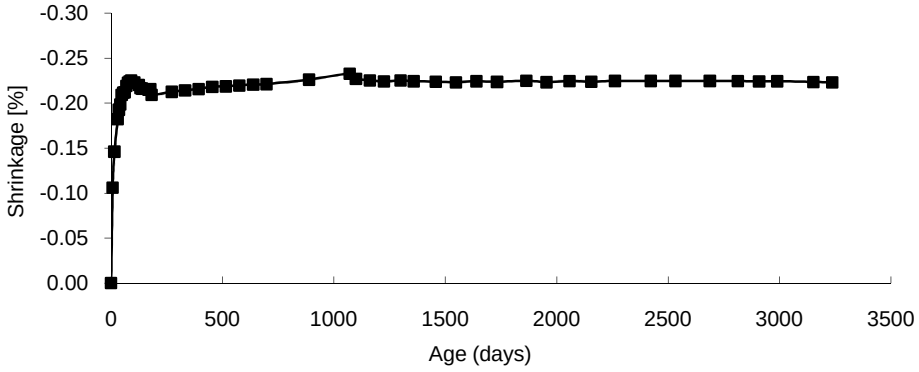
G # 39


-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

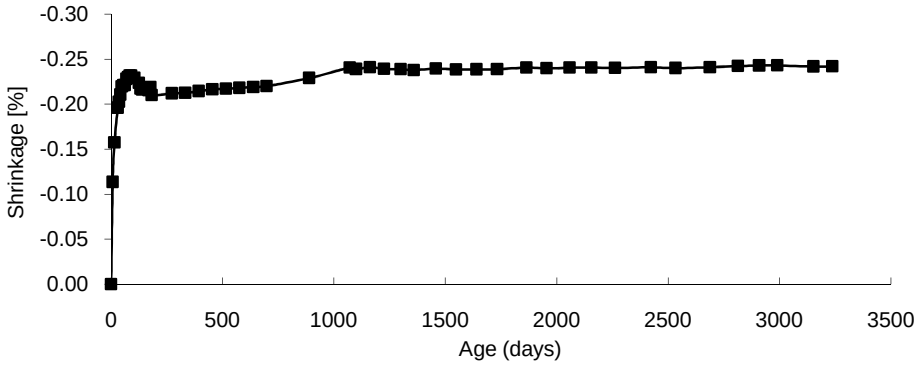
G # 40


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

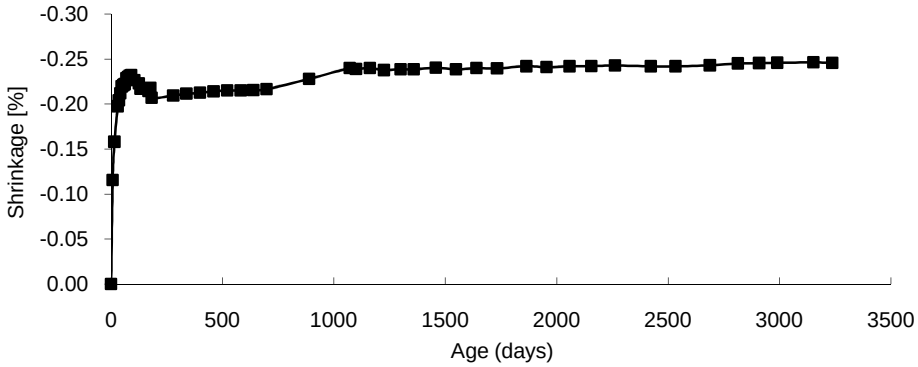
G # 41


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

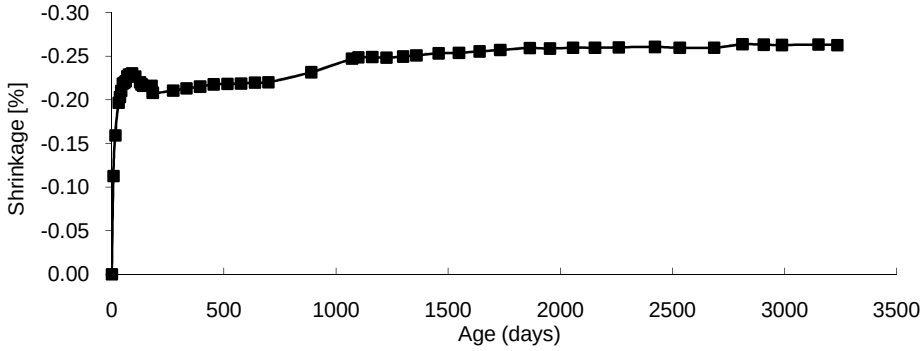
G # 42


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

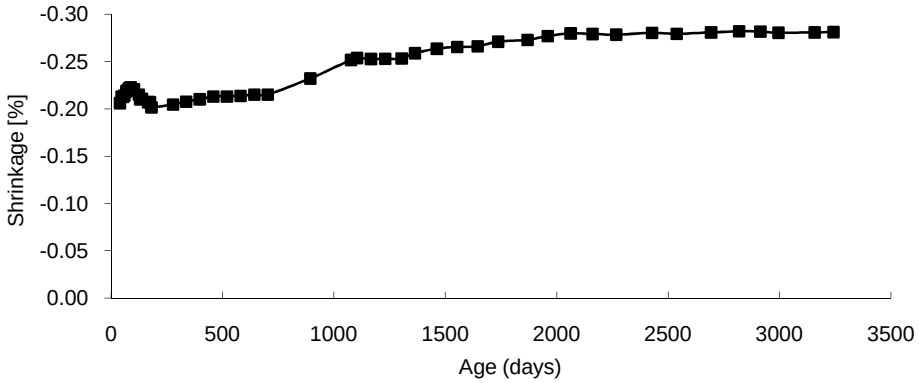
G # 43


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

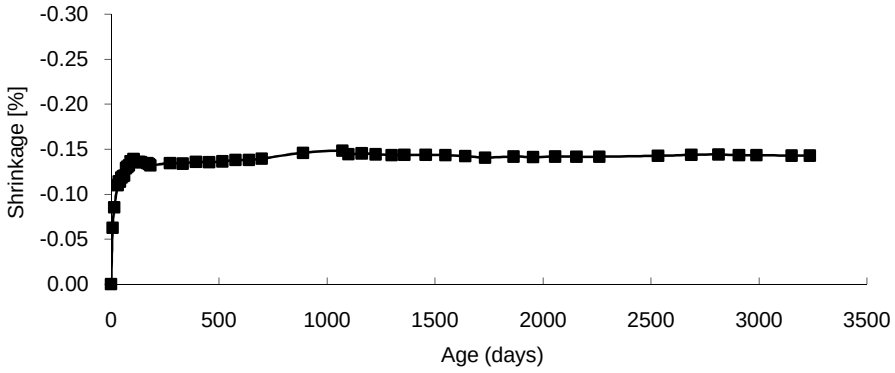
G # 44


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

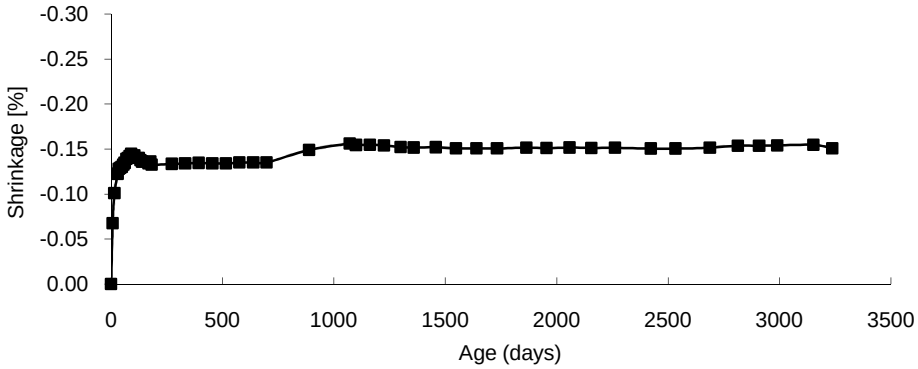
G # 45


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

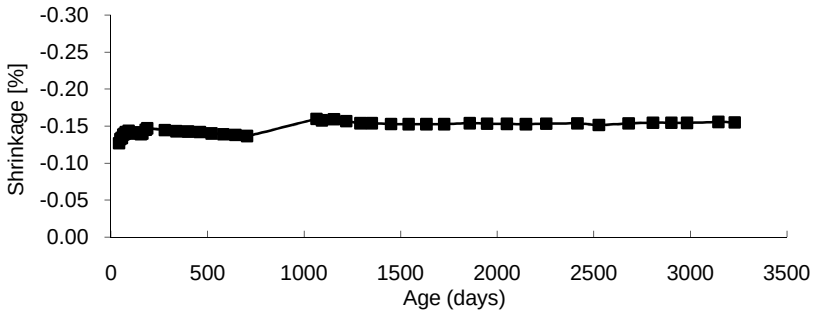
G # 46


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

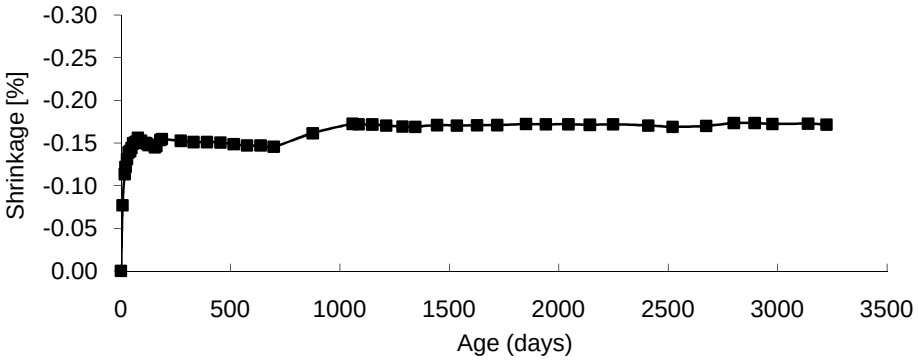
G # 47


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

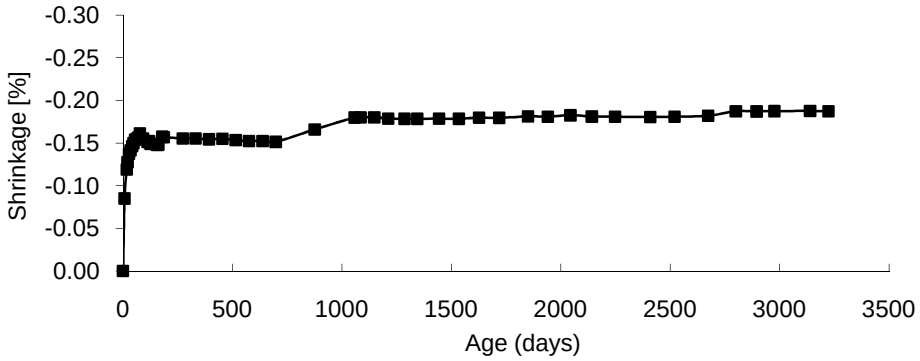
G # 48


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

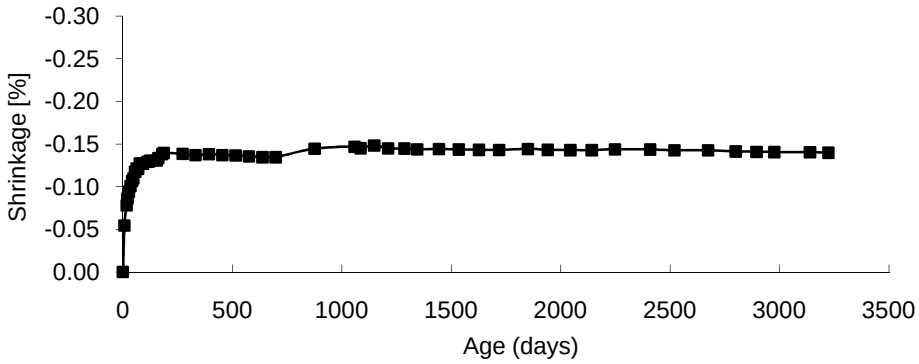
G # 49


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

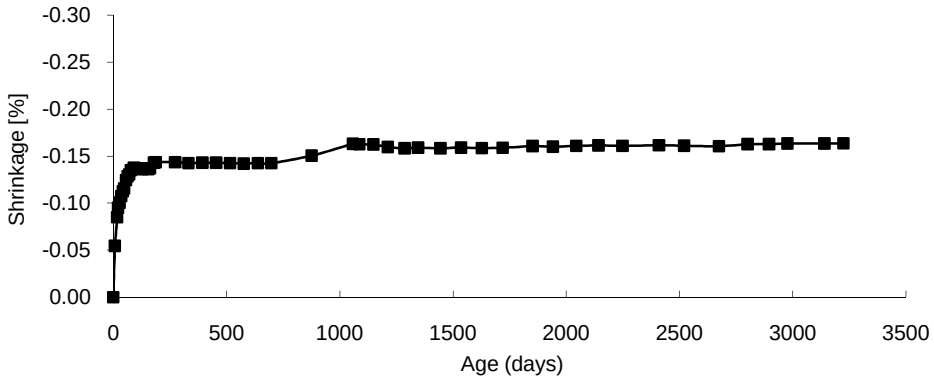
G # 50


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

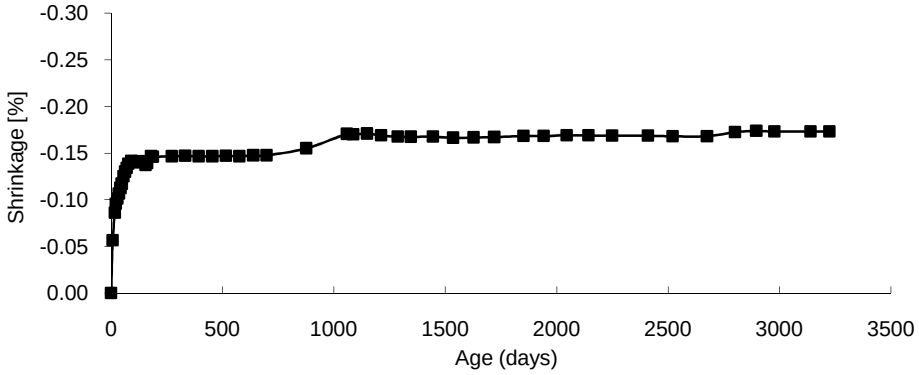
G # 51


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

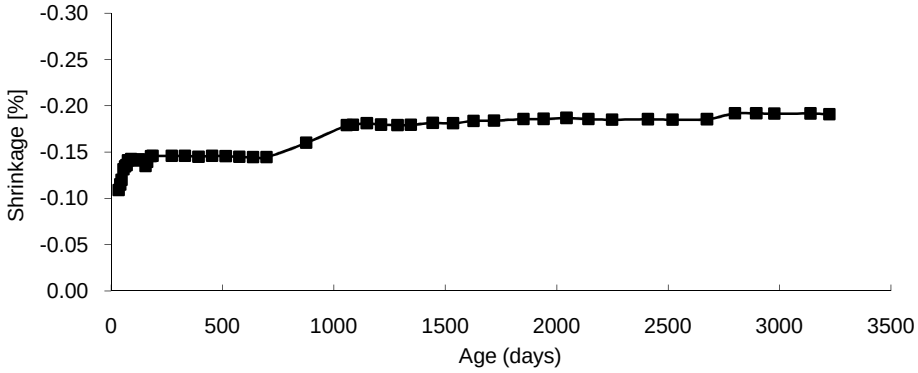
G # 52


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

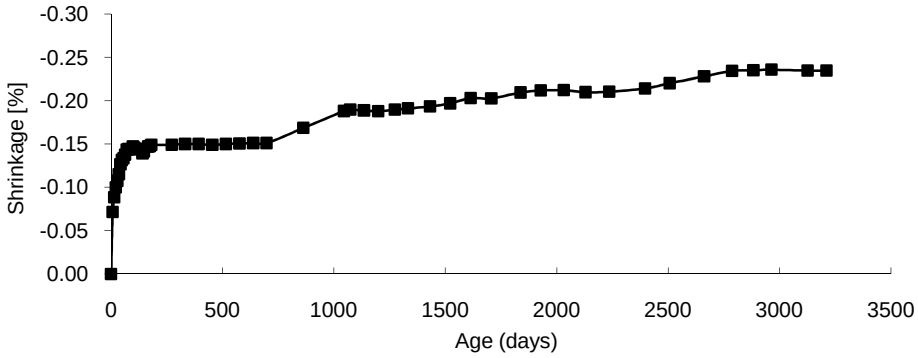
G # 53


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

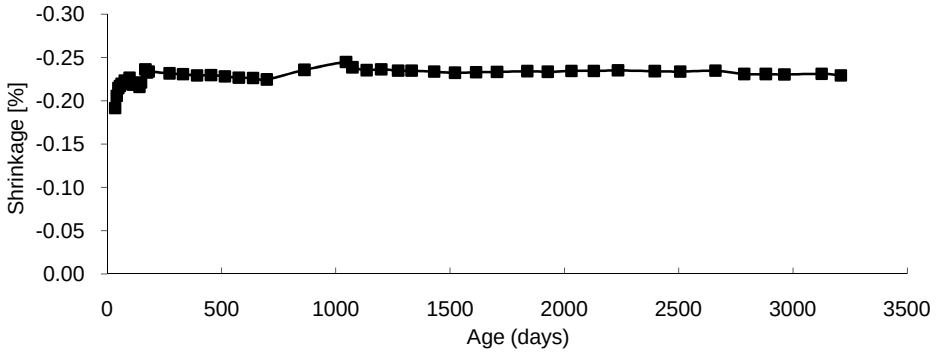
G # 54


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

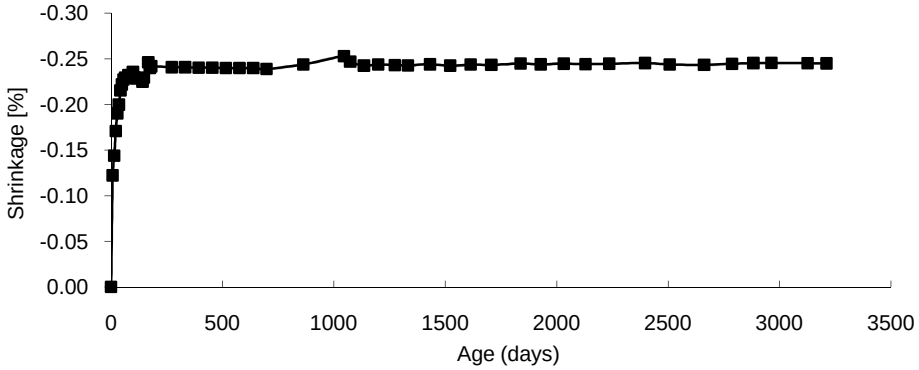
G # 55


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

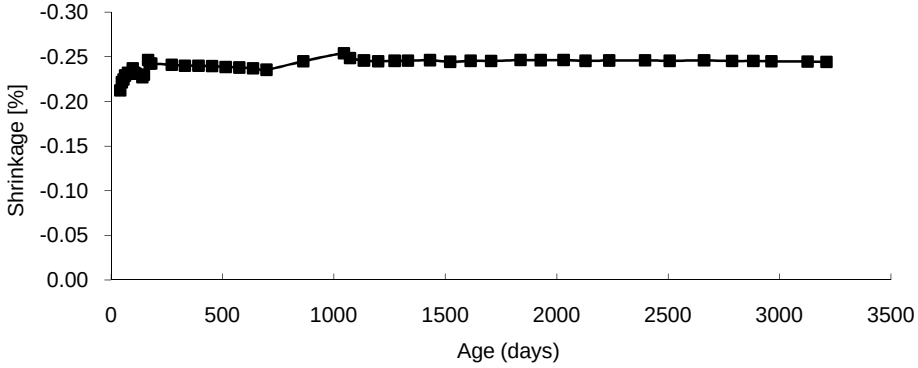
G # 56


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

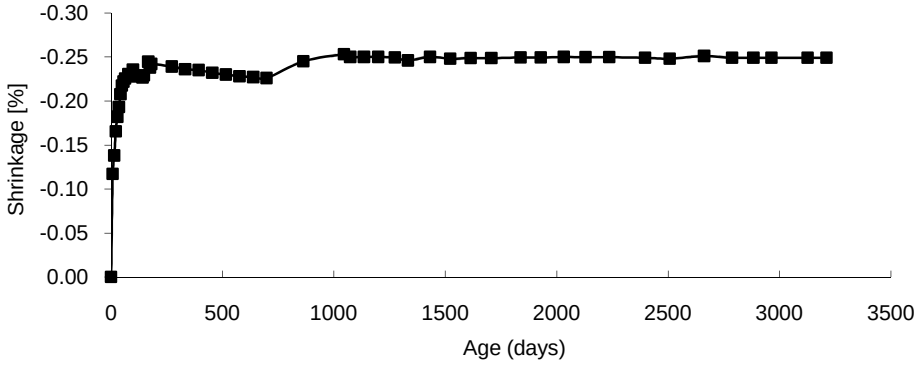
G # 57


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

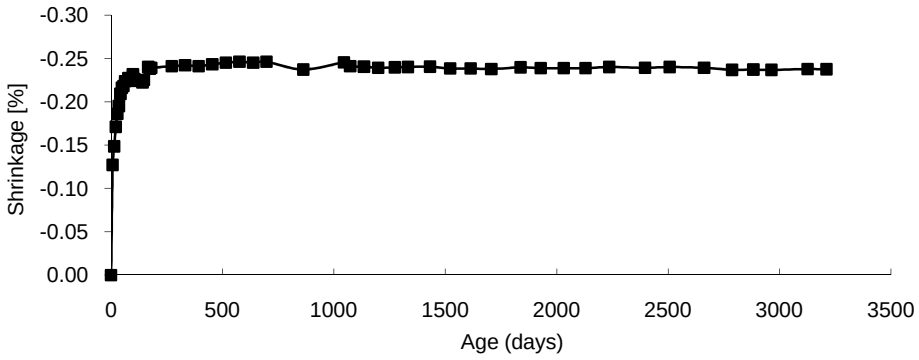
G # 58


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

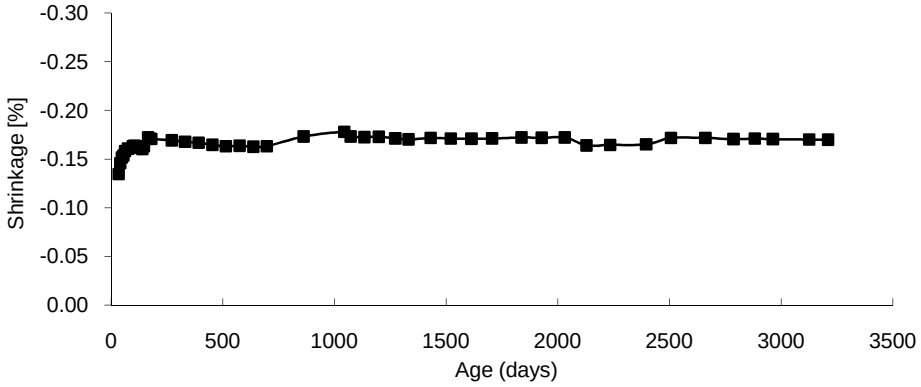
G # 59


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

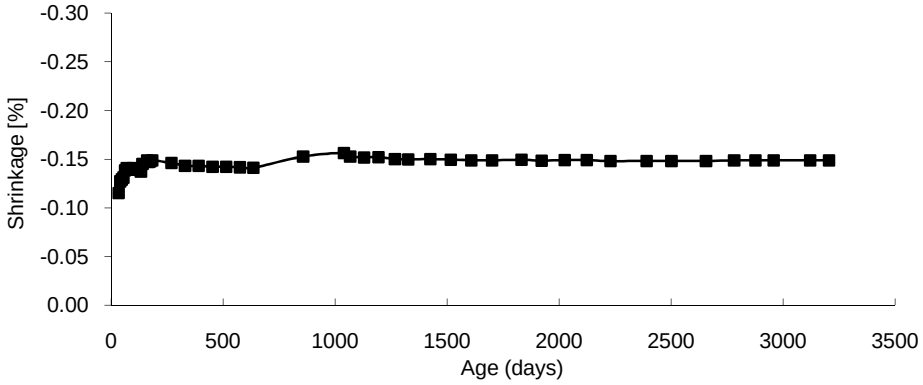
G # 60


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

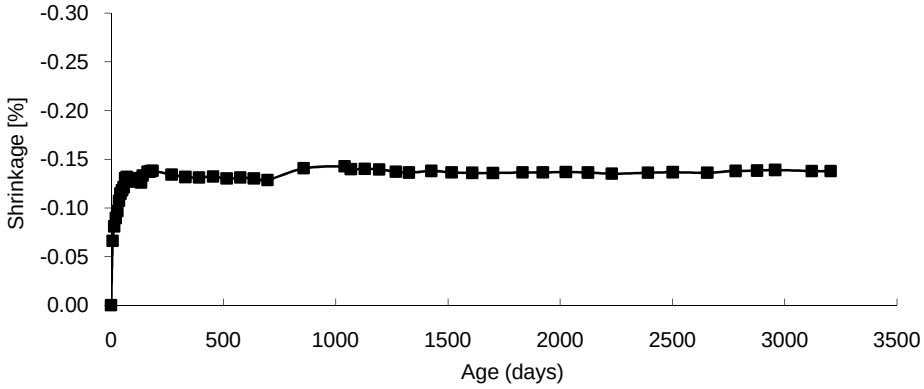
G # 61


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

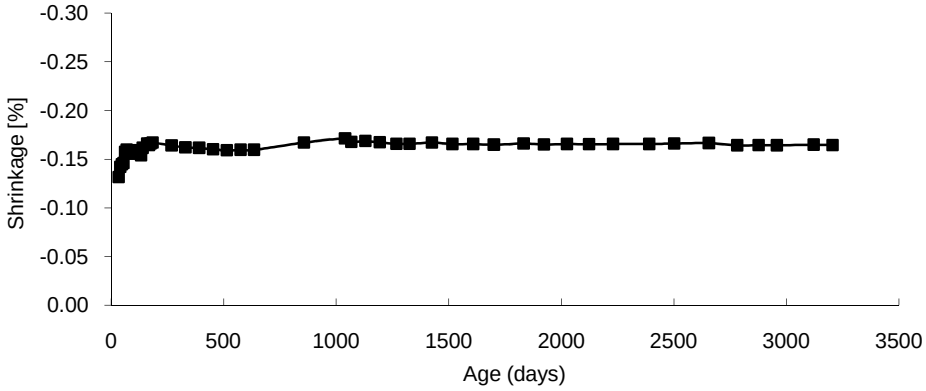
G # 62


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

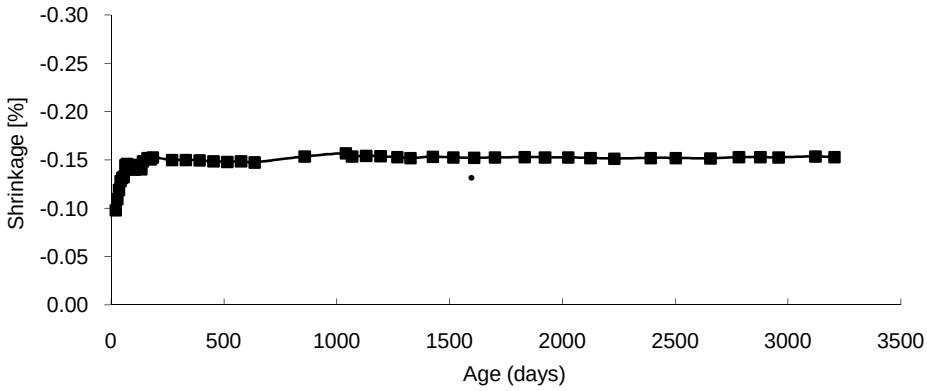
G # 63


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

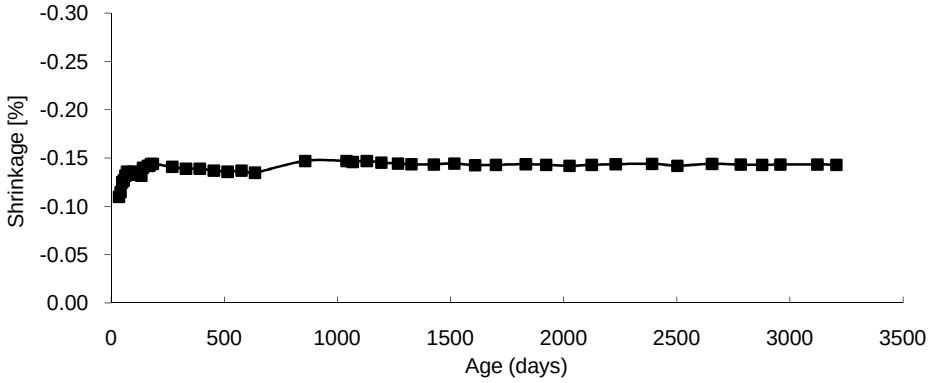
G # 64


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

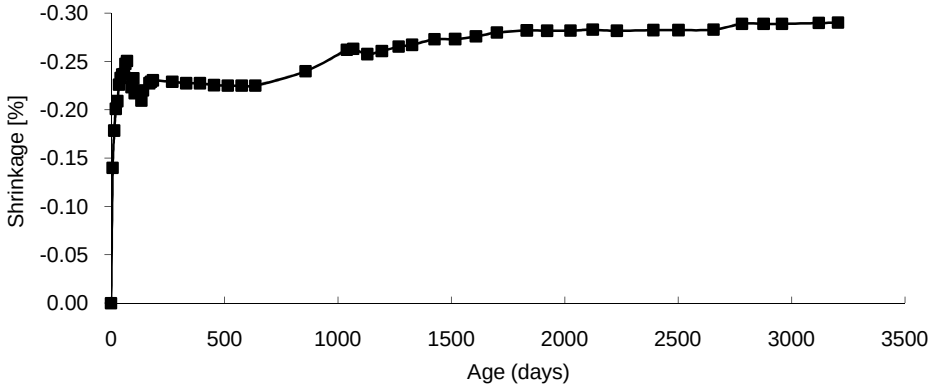
G # 65


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

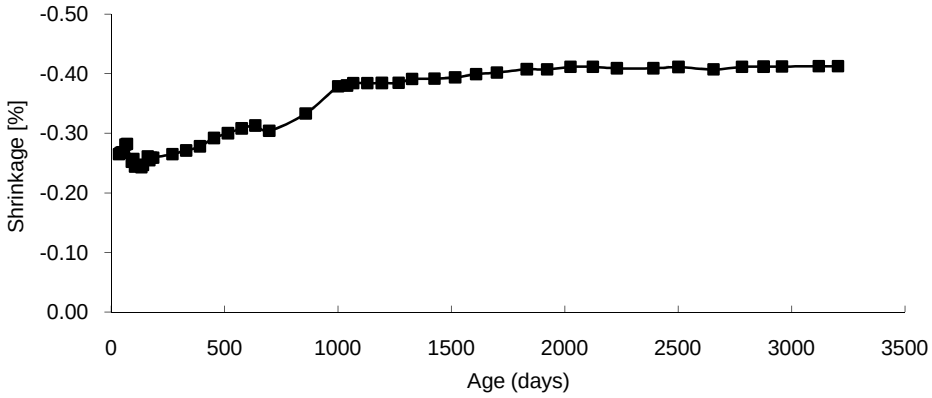
G # 66


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

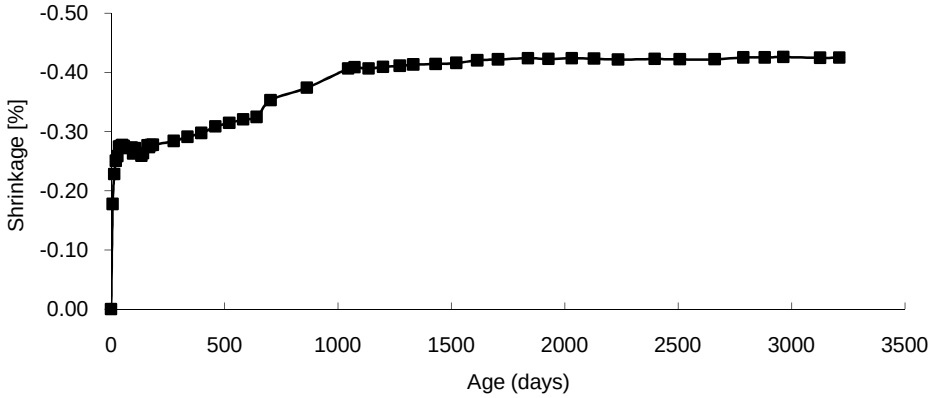
G # 67


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

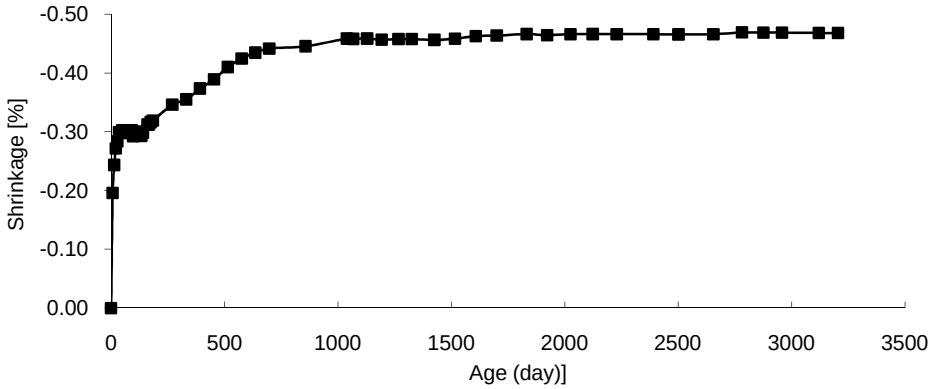
G # 68


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

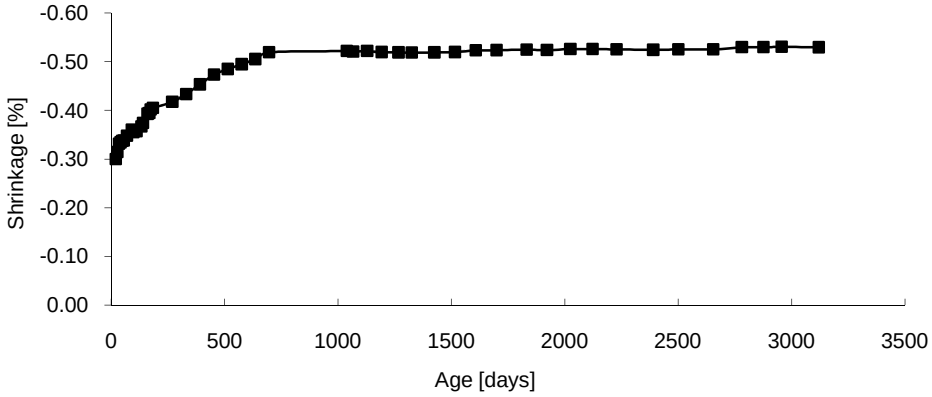
G # 69


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

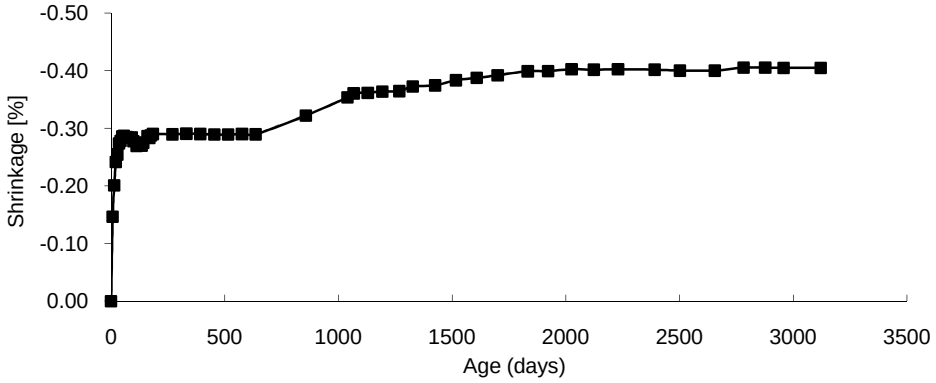
G # 70


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (day)]

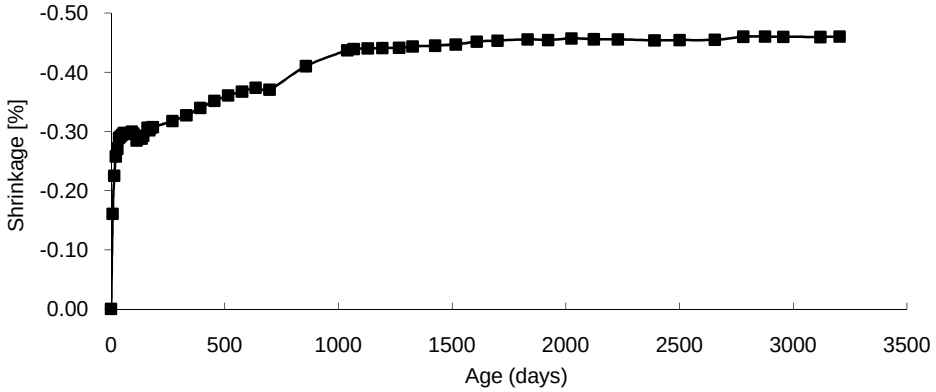
G # 71


-0.60
-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age [days]

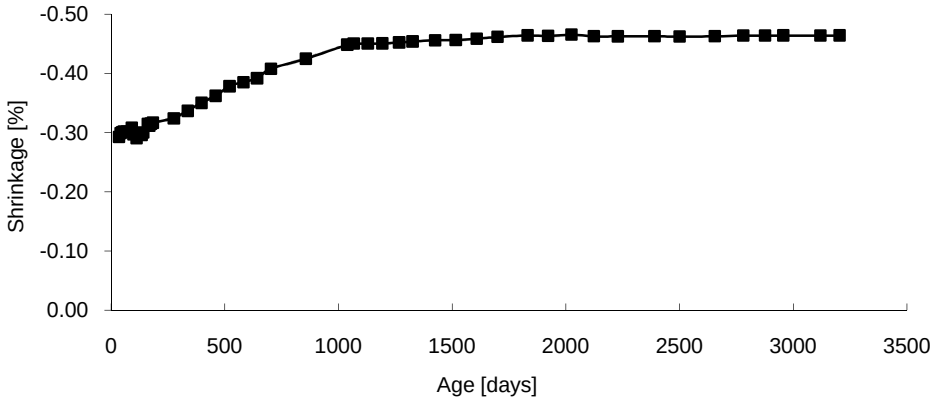
G # 72


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

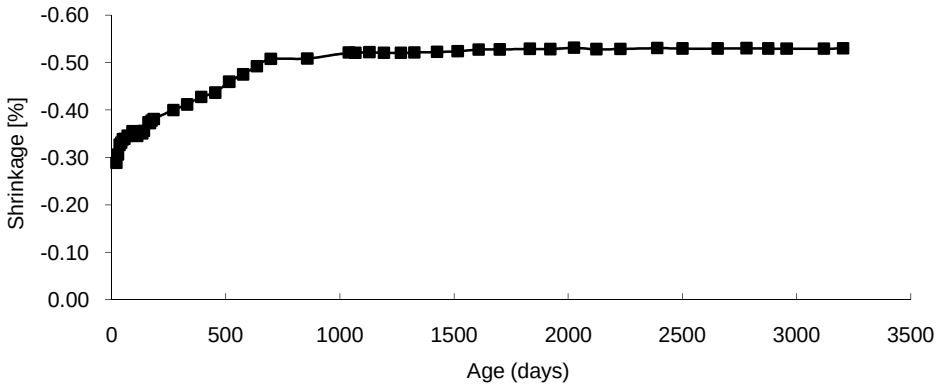
G # 73


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

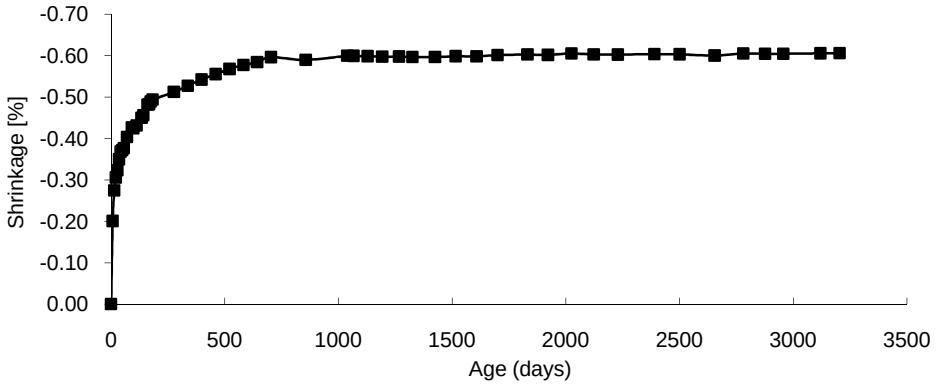
G # 74


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age [days]

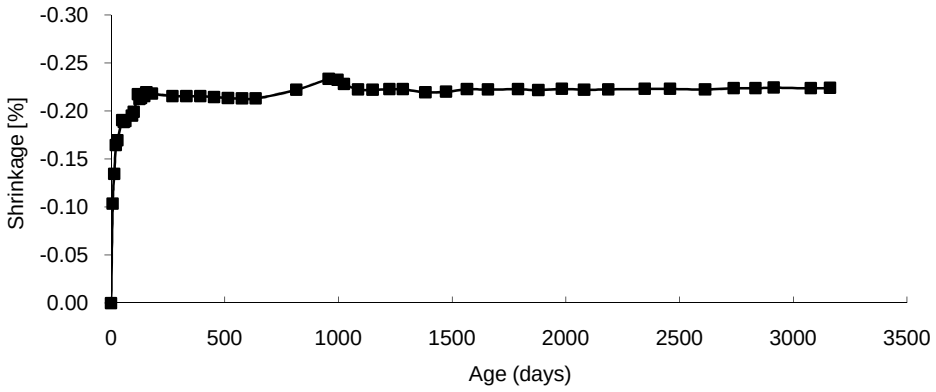
G # 75


-0.60
-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

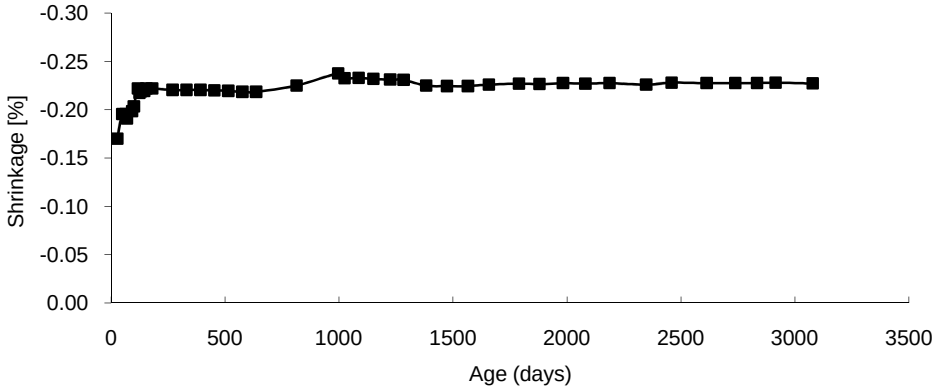
G # 76


-0.70
-0.60
-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

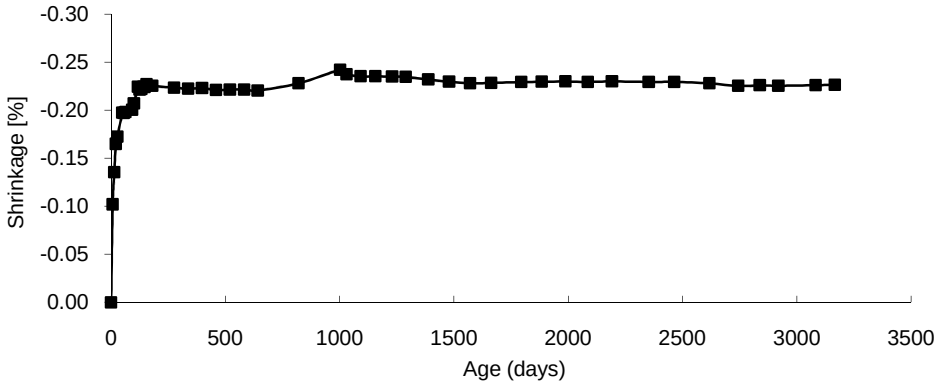
G # 77


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

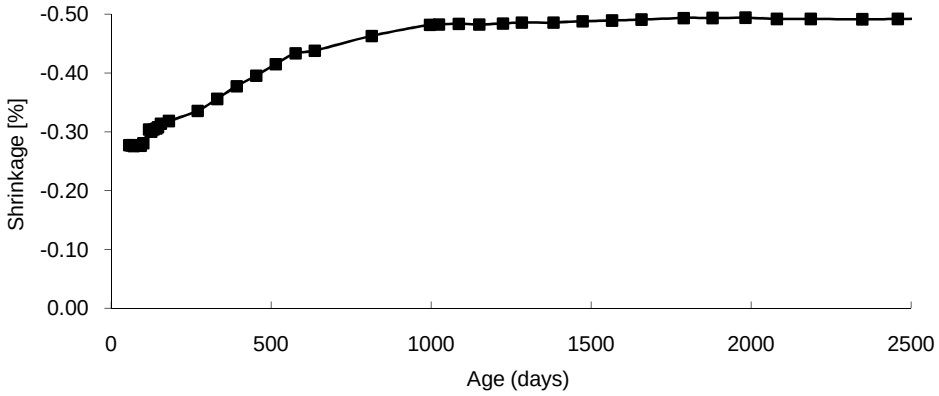
G # 78


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

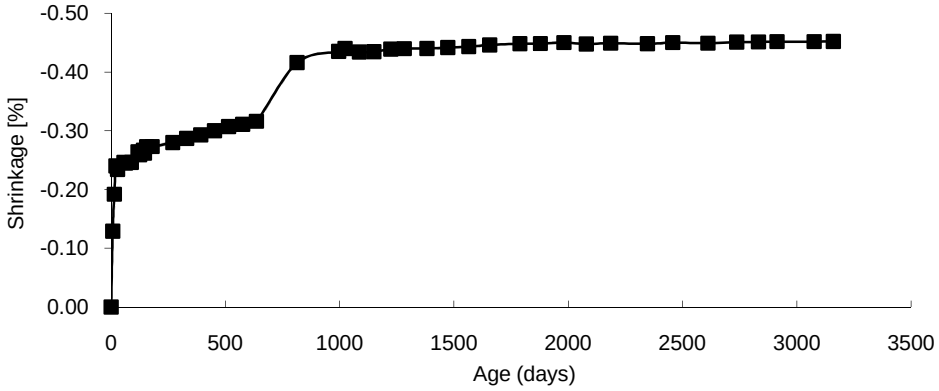
G # 79


-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

G # 80


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
Age (days)

G # 81


-0.50
-0.40
-0.30
-0.20
-0.10
0.00
Shrinkage [%]
0
500
1000
1500
2000
2500
3000
3500
Age (days)

Appendix III Shrinkage versus age data for concrete mixes

C2	
Day	Shrinkage (%)
0	0.00000
7	-0.01300
15	-0.01867
22	-0.02267
28	-0.02667
35	-0.02933
69	-0.03567
82	-0.03667
96	-0.03467
117	-0.03567
124	-0.03433
132	-0.03667
145	-0.03233
152	-0.03200
159	-0.03300
166	-0.03433
173	-0.03500
180	-0.03433
187	-0.03367
245	-0.03100
306	-0.02767
368	-0.03100
427	-0.03167
488	-0.03200
549	-0.03233
610	-0.03133
671	-0.03167
733	-0.03233
793	-0.03133
1167	-0.03256
1195	-0.03300
1256	-0.03267
1321	-0.03267
1395	-0.03233
1454	-0.03156
1553	-0.03089
1644	-0.03000
1736	-0.02922

C3	
Day	Shrinkage (%)
0	0.00000
14	-0.02233
35	-0.02900
50	-0.02867
66	-0.03000
78	-0.03267
99	-0.03433
106	-0.03333
127	-0.03133
134	-0.03133
141	-0.03133
148	-0.03167
155	-0.03367
162	-0.03300
169	-0.03333
176	-0.03167
183	-0.03300
246	-0.03000
307	-0.03067
369	-0.03400
428	-0.03467
489	-0.03467
550	-0.03400
611	-0.03400
672	-0.03467
734	-0.03467
794	-0.03467
1148	-0.03344
1176	-0.03389
1237	-0.03433
1302	-0.03500
1376	-0.03567
1435	-0.03478
1534	-0.03444
1625	-0.03456
1717	-0.03444
1809	-0.03311
1940	-0.03122

C4	
Day	Shrinkage (%)
0	0.00000
7	-0.00867
14	-0.01233
29	-0.01400
36	-0.01500
42	-0.02200
56	-0.02100
67	-0.02067
76	-0.02267
83	-0.02800
97	-0.02667
118	-0.02767
125	-0.02667
134	-0.02533
146	-0.02500
153	-0.02467
160	-0.02500
167	-0.02533
174	-0.02600
181	-0.02633
188	-0.02500
243	-0.02433
304	-0.02633
366	-0.02667
425	-0.02867
486	-0.02967
547	-0.02933
608	-0.02833
669	-0.02867
731	-0.02833
791	-0.02867
1165	-0.02589
1193	-0.02600
1254	-0.02600
1319	-0.02567
1393	-0.02678
1452	-0.02667
1551	-0.02711

C5	
Day	Shrinkage (%)
0	0.00000
6	-0.01200
14	-0.01800
21	-0.02700
28	-0.03200
35	-0.03533
66	-0.03667
82	-0.03900
96	-0.03933
117	-0.04033
124	-0.03967
132	-0.03700
145	-0.03667
152	-0.03633
159	-0.03700
166	-0.03700
173	-0.03867
180	-0.03800
187	-0.03833
241	-0.03533
302	-0.03467
364	-0.03533
423	-0.03500
484	-0.03567
545	-0.03567
606	-0.03500
667	-0.03500
729	-0.03500
789	-0.03533
1163	-0.03667
1191	-0.03600
1252	-0.03678
1317	-0.03700
1391	-0.03567
1450	-0.03633
1549	-0.03544
1640	-0.03467
1732	-0.03389

C2

Day	Shrinkage (%)
1828	-0.02811
1959	-0.02733
2050	-0.02756
2153	-0.02978
2251	-0.03200
2357	-0.03100
2520	-0.03167
2630	-0.03189
2784	-0.02989
2898	-0.02944
3003	-0.02922
3085	-0.02922
3248	-0.02933
3334	-0.02900

C3

Day	Shrinkage (%)
2031	-0.03244
2134	-0.03422
2232	-0.03356
2338	-0.03300
2501	-0.03322
2611	-0.03300
2765	-0.03278
2879	-0.03278
2984	-0.03322
3066	-0.03322
3229	-0.03300
3315	-0.03211

C4

Day	Shrinkage (%)
1642	-0.02789
1734	-0.02711
1826	-0.02478
1957	-0.02367
2048	-0.02589
2151	-0.02633
2249	-0.02611
2355	-0.02556
2518	-0.02489
2628	-0.02578
2782	-0.02556
2896	-0.02600
3001	-0.02578
3083	-0.02578
3246	-0.02589
3332	-0.02600

C5

Day	Shrinkage (%)
1824	-0.03444
1955	-0.03422
2046	-0.03444
2149	-0.03422
2247	-0.03478
2353	-0.03533
2516	-0.03533
2626	-0.03533
2780	-0.03533
2894	-0.03689
2999	-0.03722
3081	-0.03733
3244	-0.03689
3330	-0.03700

C6	
Day	Shrinkage (%)
0	0.00000
6	-0.00867
14	-0.01333
20	-0.01667
27	-0.02433
34	-0.02400
65	-0.02500
78	-0.02767
92	-0.02633
113	-0.02800
120	-0.02600
129	-0.02467
141	-0.02367
148	-0.02300
155	-0.02367
161	-0.02467
168	-0.02500
175	-0.02533
182	-0.02533
247	-0.02200
308	-0.02333
370	-0.02367
429	-0.02400
490	-0.02367
551	-0.02367
612	-0.02367
673	-0.02400
735	-0.02400
795	-0.02400
1163	-0.02367
1191	-0.02289
1252	-0.02256
1317	-0.02367
1391	-0.02278
1450	-0.02267
1549	-0.02178
1640	-0.02222
1732	-0.02133

C7	
Day	Shrinkage (%)
0	0.00000
7	-0.00450
14	-0.00900
28	-0.01500
49	-0.02100
58	-0.02200
82	-0.02300
94	-0.02500
115	-0.02600
122	-0.02500
130	-0.02350
143	-0.02250
150	-0.02250
157	-0.02300
164	-0.02400
171	-0.02600
178	-0.02600
185	-0.02450
192	-0.02700
246	-0.02250
307	-0.02450
369	-0.02400
428	-0.02350
489	-0.02450
550	-0.02400
611	-0.02450
672	-0.02400
734	-0.02450
794	-0.02350
1162	-0.02500
1190	-0.02300
1251	-0.02367
1316	-0.02550
1390	-0.02383
1449	-0.02267
1548	-0.02100
1639	-0.02183
1731	-0.02183

C8	
Day	Shrinkage (%)
0	0.00000
7	-0.00733
13	-0.00967
28	-0.01200
49	-0.01833
58	-0.01867
64	-0.01800
82	-0.02033
94	-0.02333
115	-0.02167
122	-0.02000
130	-0.02067
143	-0.01733
150	-0.01700
157	-0.01733
164	-0.01833
171	-0.02000
178	-0.02033
185	-0.01967
192	-0.02033
246	-0.01733
307	-0.01833
369	-0.01833
428	-0.01833
489	-0.01833
550	-0.01800
611	-0.01833
672	-0.01767
734	-0.01833
794	-0.01867
1162	-0.01867
1190	-0.01800
1251	-0.01844
1316	-0.01900
1390	-0.01844
1449	-0.01756
1548	-0.01719
1639	-0.01700

C9	
Day	Shrinkage (%)
0	0.00000
7	-0.01667
14	-0.02233
28	-0.02967
36	-0.03500
50	-0.03633
61	-0.04067
79	-0.04000
91	-0.03967
112	-0.04133
119	-0.03967
127	-0.03900
140	-0.03700
147	-0.03667
154	-0.03633
161	-0.03700
168	-0.03800
175	-0.03867
182	-0.03800
189	-0.03767
243	-0.03467
304	-0.03600
366	-0.03700
425	-0.03700
486	-0.03767
547	-0.03767
608	-0.03700
669	-0.03700
731	-0.03600
791	-0.03600
1159	-0.03533
1187	-0.03544
1248	-0.03600
1313	-0.03600
1387	-0.03733
1446	-0.03722
1545	-0.03567
1636	-0.03589

C6

Day	Shrinkage (%)
1824	-0.02111
1955	-0.02200
2046	-0.02144
2149	-0.02056
2247	-0.02067
2353	-0.02122
2516	-0.02067
2626	-0.02133
2780	-0.02033
2894	-0.02056
2999	-0.02067
3081	-0.02067
3244	-0.02067
3330	-0.02022

C7

Day	Shrinkage (%)
1458	-0.02167
1954	-0.02117
2045	-0.02200
2148	-0.02250
2246	-0.02233
2352	-0.02267
2515	-0.02200
2625	-0.02250
2779	-0.02300
2893	-0.02200
2998	-0.02083
3080	-0.02083
3243	-0.02133
3329	-0.02083

C8

Day	Shrinkage (%)
1731	-0.01756
1823	-0.01622
1954	-0.01644
2045	-0.01711
2148	-0.01733
2246	-0.01756
2352	-0.01756
2515	-0.01667
2625	-0.01667
2779	-0.01800
2893	-0.01911
2998	-0.01933
3080	-0.01933
3243	-0.01922
3329	-0.01911

C9

Day	Shrinkage (%)
1728	-0.03600
1820	-0.03511
1951	-0.03644
2042	-0.03578
2145	-0.03533
2243	-0.03556
2349	-0.03500
2512	-0.03567
2622	-0.03567
2776	-0.03600
2890	-0.03689
2995	-0.03689
3077	-0.03689
3240	-0.03689

C10	
Day	Shrinkage (%)
0	0.00000
7	-0.00650
14	-0.01250
28	-0.01850
36	-0.02050
50	-0.02200
61	-0.02650
79	-0.02650
91	-0.02750
112	-0.02700
119	-0.02750
140	-0.02450
147	-0.02400
154	-0.02450
161	-0.02400
168	-0.02750
175	-0.02550
182	-0.02550
189	-0.02400
243	-0.02250
304	-0.02600
366	-0.02450
425	-0.02400
486	-0.02300
547	-0.02300
608	-0.02400
669	-0.02300
731	-0.02300
791	-0.02400
1159	-0.02467
1187	-0.02333
1248	-0.02433
1313	-0.02450
1387	-0.02583
1446	-0.02450
1545	-0.02300
1636	-0.02267
1728	-0.02233

C11	
Day	Shrinkage (%)
0	0.00000
7	-0.00300
21	-0.01500
29	-0.01600
43	-0.01700
49	-0.02000
54	-0.02433
72	-0.02667
84	-0.02867
105	-0.02633
112	-0.02533
121	-0.02267
133	-0.02200
140	-0.02200
147	-0.02200
154	-0.02367
161	-0.02467
168	-0.02467
175	-0.02467
182	-0.02400
243	-0.02167
304	-0.02467
366	-0.02433
425	-0.02533
486	-0.02667
547	-0.02500
608	-0.02433
669	-0.02567
731	-0.02533
791	-0.02633
1152	-0.02533
1180	-0.02433
1241	-0.02533
1306	-0.02467
1380	-0.02456
1439	-0.02378
1538	-0.02456
1629	-0.02367

C12	
Day	Shrinkage (%)
0	0.00000
7	-0.00333
21	-0.01300
29	-0.01633
43	-0.02067
49	-0.02233
54	-0.02567
72	-0.02633
84	-0.02667
105	-0.02633
112	-0.02567
120	-0.02600
133	-0.02300
140	-0.02200
147	-0.02200
154	-0.02367
161	-0.02500
168	-0.02433
175	-0.02500
182	-0.02433
243	-0.02233
304	-0.02600
366	-0.02567
425	-0.02533
486	-0.02433
547	-0.02467
608	-0.02433
669	-0.02467
731	-0.02467
791	-0.02433
486	-0.02433
547	-0.02433
608	-0.02467
669	-0.02467
731	-0.02467
791	-0.02433
1152	-0.02600
1180	-0.02567

C13	
Day	Shrinkage (%)
0	0.00000
8	-0.00933
15	-0.01167
22	-0.01400
29	-0.01867
44	-0.02033
62	-0.02400
74	-0.02367
95	-0.02667
102	-0.02500
110	-0.02667
123	-0.02033
130	-0.02200
137	-0.02133
144	-0.02300
151	-0.02367
158	-0.02333
165	-0.02333
172	-0.02267
179	-0.02333
240	-0.02433
301	-0.02733
363	-0.02633
422	-0.02700
483	-0.02767
544	-0.02633
605	-0.02700
666	-0.02667
728	-0.02667
788	-0.02633
1142	-0.02733
1170	-0.02667
1231	-0.02722
1296	-0.02700
1370	-0.02728
1429	-0.02611
1528	-0.02611
1619	-0.02489

C10

Day	Shrinkage (%)
1820	-0.02150
1951	-0.02200
2042	-0.02133
2145	-0.02167
2243	-0.02150
2349	-0.02167
2512	-0.02200
2622	-0.02100
2776	-0.02150
2890	-0.02150
2995	-0.02217
3077	-0.02217
3240	-0.02183
3326	-0.02150

C11

Day	Shrinkage (%)
1721	-0.02367
1813	-0.02400
1944	-0.02522
2035	-0.02433
2138	-0.02467
2236	-0.02467
2342	-0.02533
2505	-0.02433
2615	-0.02500
2769	-0.02567
2883	-0.02478
2988	-0.02467
3070	-0.02467
3233	-0.02422
3319	-0.02433

C12

Day	Shrinkage (%)
1241	-0.02678
1306	-0.02700
1380	-0.02683
1439	-0.02611
1538	-0.02600
1629	-0.02644
1721	-0.02589
1813	-0.02556
1944	-0.02567
2035	-0.02644
2138	-0.02656
2236	-0.02589
2342	-0.02544
2505	-0.02567
2615	-0.02600
2769	-0.02600
2884	-0.02533
2988	-0.02600
3070	-0.02600
3233	-0.02611
3319	-0.02633

C13

Day	Shrinkage (%)
1711	-0.02467
1803	-0.02478
1934	-0.02578
2025	-0.02522
2128	-0.02533
2226	-0.02556
2332	-0.02600
2495	-0.02600
2605	-0.02500
2759	-0.02600
2874	-0.02589
2978	-0.02589
3060	-0.02589
3223	-0.02600
3309	-0.02644

C14	
Day	Shrinkage (%)
0	0.00000
8	-0.00567
15	-0.00833
22	-0.01067
29	-0.01400
44	-0.01400
62	-0.01833
74	-0.01900
95	-0.01967
102	-0.01967
110	-0.01833
123	-0.01633
130	-0.01600
137	-0.01633
144	-0.01767
151	-0.01900
158	-0.01800
165	-0.01833
172	-0.01733
179	-0.01700
240	-0.01767
301	-0.02133
363	-0.02067
422	-0.02067
483	-0.02000
544	-0.01767
605	-0.02033
666	-0.01967
728	-0.01933
788	-0.02033
1142	-0.02078
1170	-0.02033
1231	-0.02100
1296	-0.02067
1370	-0.02017
1429	-0.02011
1528	-0.01944
1619	-0.01933

C15	
Day	Shrinkage (%)
0	0.00000
7	-0.00133
14	-0.00600
22	-0.00600
28	-0.00800
36	-0.00867
42	-0.00867
60	-0.01500
72	-0.01600
93	-0.01500
100	-0.01467
121	-0.01333
128	-0.01200
135	-0.01267
142	-0.01500
149	-0.01433
156	-0.01500
163	-0.01400
170	-0.01300
177	-0.01300
184	-0.01400
245	-0.01467
306	-0.01633
368	-0.01633
427	-0.01533
488	-0.01367
549	-0.01367
610	-0.01400
671	-0.01467
733	-0.01467
793	-0.01567
1140	-0.01711
1168	-0.01733
1229	-0.01767
1294	-0.01683
1368	-0.01750
1427	-0.01744
1526	-0.01822

C16	
Day	Shrinkage (%)
0	0.00000
7	-0.00267
14	-0.00633
22	-0.00667
28	-0.00900
36	-0.00867
42	-0.00900
58	-0.01400
70	-0.01467
91	-0.01533
98	-0.01400
119	-0.01267
126	-0.01200
133	-0.01367
140	-0.01500
147	-0.01700
154	-0.01600
161	-0.01600
168	-0.01400
175	-0.01467
182	-0.01633
245	-0.01600
306	-0.01633
368	-0.01733
427	-0.01700
488	-0.01700
549	-0.01767
610	-0.01567
671	-0.01700
733	-0.01633
793	-0.01667
1140	-0.01833
1168	-0.01767
1229	-0.01833
1294	-0.01900
1368	-0.01933
1427	-0.01767
1526	-0.01844

C17	
Day	Shrinkage (%)
0	0.00000
6	-0.02100
13	-0.02533
22	-0.03167
44	-0.03867
62	-0.04133
74	-0.04300
95	-0.04367
102	-0.04400
111	-0.04133
124	-0.04100
131	-0.04000
138	-0.04100
145	-0.04133
152	-0.04367
159	-0.04233
166	-0.04367
173	-0.04200
180	-0.04233
240	-0.03833
301	-0.04067
363	-0.04167
422	-0.04200
483	-0.04200
544	-0.03867
605	-0.04100
666	-0.04100
728	-0.04133
788	-0.04100
1142	-0.04167
1170	-0.04033
1231	-0.04167
1296	-0.04033
1370	-0.04056
1429	-0.04011
1528	-0.03989
1619	-0.03900
1711	-0.03933

C14

Day	Shrinkage (%)
1711	-0.01911
1803	-0.01822
1934	-0.01744
2025	-0.01811
2128	-0.01756
2226	-0.01744
2332	-0.01667
2495	-0.01700
2605	-0.01700
2759	-0.01733
2874	-0.01678
2978	-0.01689
3060	-0.01689
3223	-0.01700
3309	-0.01700

C15

Day	Shrinkage (%)
1617	-0.01756
1709	-0.01811
1801	-0.01800
1932	-0.01844
2023	-0.01778
2126	-0.01744
2224	-0.01700
2330	-0.01689
2493	-0.01733
2603	-0.01767
2757	-0.01767
2872	-0.01744
2976	-0.01756
3058	-0.01700
3221	-0.01700
3305	-0.01633

C16

Day	Shrinkage (%)
1617	-0.01800
1709	-0.01822
1801	-0.01856
1932	-0.01922
2023	-0.01844
2126	-0.01833
2224	-0.01789
2330	-0.01822
2493	-0.01833
2603	-0.01733
2757	-0.01867
2872	-0.01867
2976	-0.01833
3058	-0.01833
3221	-0.01811

C17

Day	Shrinkage (%)
1803	-0.03878
1934	-0.03989
2025	-0.03911
2128	-0.03900
2226	-0.03878
2332	-0.03878
2495	-0.03800
2605	-0.03833
2759	-0.03900
2874	-0.03878
2978	-0.03889
3060	-0.03889
3223	-0.03900
3309	-0.03867

C18	
Day	Shrinkage (%)
0	0.00000
7	-0.00933
15	-0.01733
21	-0.02300
29	-0.02533
35	-0.02700
53	-0.03200
65	-0.03367
86	-0.03500
93	-0.03500
102	-0.03300
114	-0.03300
121	-0.03300
128	-0.03500
135	-0.03633
142	-0.03833
149	-0.03767
156	-0.03767
163	-0.03567
170	-0.03633
177	-0.03733
184	-0.03533
191	-0.03600
245	-0.03767
306	-0.03700
365	-0.03633
426	-0.03633
487	-0.03667
549	-0.03633
610	-0.03700
671	-0.03567
731	-0.03633
1133	-0.03722
1161	-0.03522
1222	-0.03667
1287	-0.03711
1361	-0.03772
1420	-0.03644

C19	
Day	Shrinkage (%)
0	0.00000
6	-0.01033
13	-0.01367
22	-0.02133
44	-0.02467
62	-0.02667
74	-0.02900
95	-0.03033
102	-0.03000
110	-0.03000
123	-0.02767
130	-0.02633
137	-0.02667
144	-0.02800
151	-0.03000
158	-0.02933
165	-0.02900
172	-0.02867
179	-0.02967
240	-0.02767
301	-0.03133
363	-0.03200
422	-0.03200
483	-0.03167
544	-0.03200
605	-0.03100
666	-0.03167
728	-0.03200
788	-0.03133
1142	-0.03400
1170	-0.03189
1231	-0.03356
1296	-0.03300
1370	-0.03339
1429	-0.03267
1528	-0.03222
1619	-0.03078
1711	-0.03022

C20	
Day	Shrinkage (%)
0	0.00000
7	-0.00433
15	-0.00700
21	-0.01267
29	-0.01333
35	-0.01567
53	-0.02067
65	-0.02067
86	-0.02233
93	-0.02033
102	-0.02100
114	-0.01967
121	-0.02000
128	-0.02067
135	-0.02300
142	-0.02433
149	-0.02367
156	-0.02367
163	-0.02267
170	-0.02267
177	-0.02433
184	-0.02267
191	-0.02233
245	-0.02367
306	-0.02433
365	-0.02433
426	-0.02433
487	-0.02400
549	-0.02400
610	-0.02167
671	-0.02367
731	-0.02333
1133	-0.02689
1161	-0.02444
1222	-0.02589
1287	-0.02533
1361	-0.02711
1420	-0.02656

C21	
Day	Shrinkage (%)
0	0.00000
7	-0.00300
15	-0.00667
21	-0.01000
29	-0.01100
35	-0.01333
53	-0.01767
65	-0.01733
86	-0.01867
93	-0.01700
102	-0.01733
114	-0.01567
121	-0.01767
128	-0.01767
135	-0.01967
142	-0.02067
149	-0.02067
156	-0.02067
163	-0.01967
170	-0.02000
177	-0.02100
184	-0.01967
191	-0.02000
245	-0.02033
306	-0.02033
365	-0.02133
426	-0.02233
487	-0.02100
549	-0.02167
610	-0.02200
671	-0.02033
731	-0.02233
1133	-0.02156
1161	-0.02133
1222	-0.02189
1287	-0.02133
1361	-0.02144
1420	-0.02144

C18

Day	Shrinkage (%)
1519	-0.03611
1610	-0.03678
1702	-0.03756
1794	-0.03611
1925	-0.03656
2016	-0.03700
2119	-0.03856
2217	-0.03856
2323	-0.03844
2486	-0.03800
2596	-0.03833
2750	-0.03767
2865	-0.03733
2969	-0.03733
3051	-0.03733
3214	-0.03744
3298	-0.03744

C19

Day	Shrinkage (%)
1803	-0.03000
1934	-0.03089
2025	-0.03122
2128	-0.03089
2226	-0.03044
2332	-0.03089
2495	-0.03200
2605	-0.03067
2759	-0.03033
2874	-0.03100
2978	-0.03100
3060	-0.03100
3223	-0.03144

C20

Day	Shrinkage (%)
1519	-0.02622
1610	-0.02567
1702	-0.02711
1794	-0.02678
1925	-0.02733
2016	-0.02711
2119	-0.02700
2217	-0.02678
2323	-0.02667
2486	-0.02567
2596	-0.02533
2750	-0.02633
2865	-0.02678
2969	-0.02678
3051	-0.02678
3214	-0.02678

C21

Day	Shrinkage (%)
1519	-0.02256
1610	-0.02311
1702	-0.02378
1794	-0.02322
1925	-0.02311
2016	-0.02344
2119	-0.02378
2217	-0.02400
2323	-0.02411
2486	-0.02400
2596	-0.02333
2750	-0.02267
2865	-0.02289
2969	-0.02289
3051	-0.02289
3214	-0.02267
3300	-0.02311

C22	
Day	Shrinkage (%)
0	0.00000
8	-0.00533
15	-0.00767
22	-0.00933
28	-0.01167
33	-0.01133
49	-0.01767
61	-0.01567
82	-0.01967
89	-0.01833
97	-0.01867
110	-0.01700
117	-0.01767
124	-0.01767
131	-0.01967
138	-0.01967
145	-0.02000
152	-0.01967
159	-0.01800
166	-0.01867
173	-0.02033
180	-0.01867
187	-0.01900
243	-0.02000
304	-0.02100
363	-0.02100
424	-0.02167
485	-0.02133
547	-0.01933
608	-0.02067
669	-0.02000
729	-0.02100
1131	-0.02056
1159	-0.02144
1220	-0.02222
1285	-0.02233
1359	-0.02156
1418	-0.02211

C23	
Day	Shrinkage (%)
0	0.00000
8	-0.02033
14	-0.02733
22	-0.02967
28	-0.03600
46	-0.04000
58	-0.04267
79	-0.04167
86	-0.03967
94	-0.03833
107	-0.03900
114	-0.03967
121	-0.04033
128	-0.04167
135	-0.04333
142	-0.04200
149	-0.04300
156	-0.04233
163	-0.04167
170	-0.04267
177	-0.04000
184	-0.04167
245	-0.04200
306	-0.04200
365	-0.04233
426	-0.04267
487	-0.04267
549	-0.04233
610	-0.04200
671	-0.04200
731	-0.04233
1126	-0.03933
1154	-0.03900
1215	-0.03933
1280	-0.03933
1354	-0.03833
1413	-0.03911
1512	-0.03900

C24	
Day	Shrinkage (%)
0	0.00000
7	-0.00933
16	-0.01200
22	-0.01400
38	-0.01800
46	-0.02433
71	-0.02400
78	-0.02333
86	-0.02167
99	-0.02100
106	-0.02233
113	-0.02167
120	-0.02367
127	-0.02433
134	-0.02400
141	-0.02400
148	-0.02367
155	-0.02367
162	-0.02533
169	-0.02333
176	-0.02400
183	-0.02367
239	-0.02433
300	-0.02467
359	-0.02533
420	-0.02567
481	-0.02567
543	-0.02367
604	-0.02400
665	-0.02567
725	-0.02400
1120	-0.02511
1148	-0.02433
1209	-0.02533
1274	-0.02433
1348	-0.02567
1407	-0.02544
1506	-0.02489

C25	
Day	Shrinkage (%)
0	0.00000
6	-0.01800
14	-0.02667
20	-0.03433
38	-0.03867
46	-0.03967
77	-0.04033
78	-0.04067
86	-0.04333
99	-0.03933
106	-0.03933
113	-0.04067
120	-0.04267
127	-0.04233
134	-0.04167
141	-0.04167
148	-0.04133
155	-0.04167
162	-0.04100
169	-0.03933
176	-0.04033
183	-0.03933
237	-0.04000
298	-0.04000
357	-0.04033
418	-0.04100
479	-0.04100
541	-0.03933
602	-0.04167
663	-0.04100
723	-0.04000
1118	-0.04033
1146	-0.03800
1207	-0.04022
1272	-0.03978
1346	-0.03922
1405	-0.03933
1504	-0.04056

C22

Day	Shrinkage (%)
1517	-0.02167
1608	-0.02133
1700	-0.02189
1792	-0.02211
1923	-0.02133
2014	-0.02267
2117	-0.02300
2215	-0.02289
2321	-0.02256
2484	-0.02267
2594	-0.02267
2748	-0.02267
2863	-0.02122
2967	-0.02122
3049	-0.02122
3212	-0.02111
3298	-0.02067

C23

Day	Shrinkage (%)
1603	-0.03956
1695	-0.03944
1787	-0.03956
1918	-0.03956
2009	-0.03944
2112	-0.03989
2210	-0.04044
2316	-0.04022
2479	-0.04000
2589	-0.03967
2743	-0.03967
2858	-0.03944
2962	-0.03944
3044	-0.03944
3207	-0.03956
3293	-0.03922

C24

Day	Shrinkage (%)
1597	-0.02544
1689	-0.02509
1781	-0.02489
1912	-0.02467
2003	-0.02533
2106	-0.02533
2204	-0.02500
2310	-0.02467
2473	-0.02567
2583	-0.02533
2737	-0.02533
2852	-0.02489
2956	-0.02489
3038	-0.02489
3201	-0.02489
3287	-0.02456

C25

Day	Shrinkage (%)
1595	-0.04000
1687	-0.04011
1779	-0.04033
1910	-0.04078
2001	-0.04067
2104	-0.04100
2202	-0.04000
2308	-0.03989
2471	-0.03967
2581	-0.03967
2735	-0.03933
2850	-0.04078
2954	-0.04078
3036	-0.04078
3199	-0.04033

C27	
Day	Shrinkage (%)
0	0.00000
6	-0.01367
15	-0.01267
24	-0.01600
32	-0.01900
57	-0.02400
64	-0.02367
72	-0.02500
85	-0.02367
92	-0.02367
99	-0.02433
106	-0.02767
113	-0.02933
120	-0.02800
127	-0.02700
134	-0.02667
141	-0.02667
148	-0.02833
155	-0.02633
162	-0.02667
169	-0.02667
176	-0.02800
192	-0.02833
244	-0.02767
306	-0.02767
365	-0.02833
426	-0.02933
487	-0.02767
548	-0.02933
609	-0.02900
671	-0.02633
731	-0.02833
1104	-0.02900
1132	-0.02722
1193	-0.02911
1258	-0.02883
1332	-0.02728
1391	-0.02857

C28	
Day	Shrinkage (%)
0	0.00000
7	-0.00500
13	-0.00733
18	-0.01000
27	-0.00833
36	-0.01167
48	-0.01600
69	-0.01700
76	-0.01700
84	-0.01700
97	-0.01733
104	-0.01733
111	-0.01833
118	-0.02033
125	-0.02033
132	-0.01933
139	-0.01933
146	-0.01967
153	-0.01933
160	-0.02067
167	-0.01967
174	-0.01967
181	-0.01900
242	-0.02000
303	-0.02067
362	-0.02133
423	-0.02233
484	-0.01933
546	-0.02233
607	-0.02067
668	-0.01900
728	-0.02000
1116	-0.02133
1144	-0.02000
1205	-0.02089
1270	-0.02067
1344	-0.02100
1403	-0.02067

C29	
Day	Shrinkage (%)
0	0.00000
6	-0.00433
14	-0.00800
20	-0.01300
29	-0.01100
38	-0.01400
46	-0.01333
71	-0.01833
77	-0.01700
85	-0.02033
98	-0.01767
105	-0.01767
112	-0.01867
119	-0.02100
126	-0.02133
133	-0.02033
140	-0.02033
147	-0.01900
154	-0.02067
163	-0.02133
170	-0.01900
177	-0.01967
184	-0.01933
244	-0.02000
305	-0.02200
364	-0.02233
425	-0.02333
486	-0.01933
548	-0.02200
609	-0.01967
670	-0.02333
730	-0.01933
1118	-0.02133
1146	-0.01967
1207	-0.02089
1272	-0.02033
1346	-0.01928
1405	-0.01989

C30	
Day	Shrinkage (%)
0	0.00000
8	-0.00400
14	-0.00833
22	-0.00933
28	-0.01267
46	-0.01800
58	-0.01867
79	-0.02133
86	-0.02033
107	-0.01900
114	-0.02033
121	-0.02033
128	-0.02233
135	-0.02400
142	-0.02300
149	-0.02267
156	-0.02167
163	-0.02200
170	-0.02333
177	-0.02133
184	-0.02167
245	-0.02267
306	-0.02267
365	-0.02433
426	-0.02500
487	-0.02167
549	-0.02267
610	-0.02267
671	-0.02500
731	-0.02267
1126	-0.02311
1154	-0.02200
1215	-0.02367
1280	-0.02444
1354	-0.02489
1413	-0.02467
1512	-0.02478
1603	-0.02444

C27

Day	Shrinkage (%)
1490	-0.02833
1581	-0.02889
1673	-0.02944
1765	-0.02911
1896	-0.02900
1987	-0.02900
2090	-0.02944
2188	-0.03000
2294	-0.02933
2457	-0.03033
2567	-0.02933
2721	-0.02933
2836	-0.02922
2940	-0.02922
3022	-0.02922
3185	-0.02967
3271	-0.02922

C28

Day	Shrinkage (%)
1502	-0.02122
1593	-0.02133
1685	-0.02133
1777	-0.02144
1908	-0.02178
1999	-0.02122
2102	-0.02122
2200	-0.02100
2306	-0.02178
2469	-0.02133
2579	-0.02167
2733	-0.02167
2848	-0.02056
2952	-0.02056
3041	-0.02056
3204	-0.02078
3290	-0.02044

C29

Day	Shrinkage (%)
1504	-0.02078
1595	-0.02078
1687	-0.02222
1779	-0.02278
1910	-0.02344
2001	-0.02267
2104	-0.02256
2202	-0.02311
2308	-0.02289
2471	-0.02233
2581	-0.02200
2735	-0.02167
2850	-0.02156
3036	-0.02156
3199	-0.02178
3285	-0.02211

C30

Day	Shrinkage (%)
1695	-0.02433
1787	-0.02511
1918	-0.02567
2009	-0.02456
2112	-0.02467
2210	-0.02456
2316	-0.02489
2479	-0.02467
2589	-0.02433
2743	-0.02500
2858	-0.02389
2962	-0.02389
3050	-0.02389
3213	-0.02344
3214	-0.02344

C31	
Day	Shrinkage (%)
0	0.00000
10	-0.01767
22	-0.02600
43	-0.03367
50	-0.03500
59	-0.03433
71	-0.03400
78	-0.03333
85	-0.03500
92	-0.03800
99	-0.03867
106	-0.03867
113	-0.03800
120	-0.03800
127	-0.03800
134	-0.03800
141	-0.03600
148	-0.03700
155	-0.03567
162	-0.03633
178	-0.03700
184	-0.03533
244	-0.03733
306	-0.03667
365	-0.03633
426	-0.03567
487	-0.03533
548	-0.03733
609	-0.03633
671	-0.03700
731	-0.03567
1090	-0.03756
1118	-0.03533
1179	-0.03600
1244	-0.03611
1318	-0.03478
1377	-0.03500
1476	-0.03489

C32	
Day	Shrinkage (%)
0	0.00000
10	-0.02267
22	-0.03300
43	-0.04333
50	-0.04300
59	-0.04267
71	-0.04200
78	-0.04300
85	-0.04400
92	-0.04667
99	-0.04900
106	-0.04767
113	-0.04800
120	-0.04800
127	-0.04800
134	-0.04800
141	-0.04600
148	-0.04667
155	-0.04567
162	-0.04667
178	-0.04633
184	-0.04467
244	-0.04667
306	-0.04567
365	-0.04700
426	-0.04633
487	-0.04467
548	-0.04667
609	-0.04567
671	-0.04467
731	-0.04667
1090	-0.04644
1118	-0.04644
1179	-0.04633
1244	-0.04656
1318	-0.04722
1377	-0.04589
1476	-0.04622

C33	
Day	Shrinkage (%)
0	0.00000
10	-0.01900
22	-0.02767
43	-0.03467
50	-0.03500
59	-0.03467
71	-0.03333
78	-0.03433
85	-0.03567
92	-0.03800
99	-0.03967
106	-0.03833
113	-0.03900
120	-0.03867
127	-0.03833
134	-0.03867
141	-0.03700
148	-0.03667
155	-0.03633
162	-0.03733
178	-0.03733
184	-0.03567
244	-0.03767
306	-0.03700
365	-0.03700
426	-0.03733
487	-0.03733
548	-0.03567
609	-0.03700
671	-0.03700
731	-0.03767
1090	-0.03633
1118	-0.03611
1179	-0.03611
1244	-0.03656
1318	-0.03633
1377	-0.03667
1476	-0.03700

C34	
Day	Shrinkage (%)
0	0.00000
8	-0.01500
15	-0.02033
24	-0.02433
36	-0.02800
43	-0.03000
50	-0.03100
57	-0.03633
64	-0.03667
71	-0.03667
78	-0.03667
85	-0.03733
92	-0.03800
99	-0.03867
106	-0.03667
113	-0.03733
120	-0.03667
127	-0.03767
143	-0.03900
149	-0.03733
156	-0.04133
176	-0.03967
184	-0.03933
236	-0.04033
295	-0.04067
356	-0.04067
417	-0.04067
479	-0.03933
540	-0.03767
601	-0.04067
661	-0.04067
873	-0.04700
1055	-0.04644
1083	-0.04589
1144	-0.04556
1209	-0.04611
1283	-0.04511
1342	-0.04567

C31

Day	Shrinkage (%)
1567	-0.03544
1659	-0.03567
1751	-0.03578
1882	-0.03611
1973	-0.03567
2076	-0.03633
2174	-0.03633
2280	-0.03589
2443	-0.03533
2553	-0.03500
2707	-0.03600
2823	-0.03433
2926	-0.03433
3014	-0.03433
3177	-0.03433
3263	-0.03389

C32

Day	Shrinkage (%)
1567	-0.04600
1659	-0.04678
1751	-0.04633
1882	-0.04756
1973	-0.04689
2076	-0.04800
2174	-0.04756
2280	-0.04689
2443	-0.04667
2553	-0.04767
2707	-0.04633
2823	-0.04700
2926	-0.04700
3014	-0.04700
3177	-0.04622
3263	-0.04722

C33

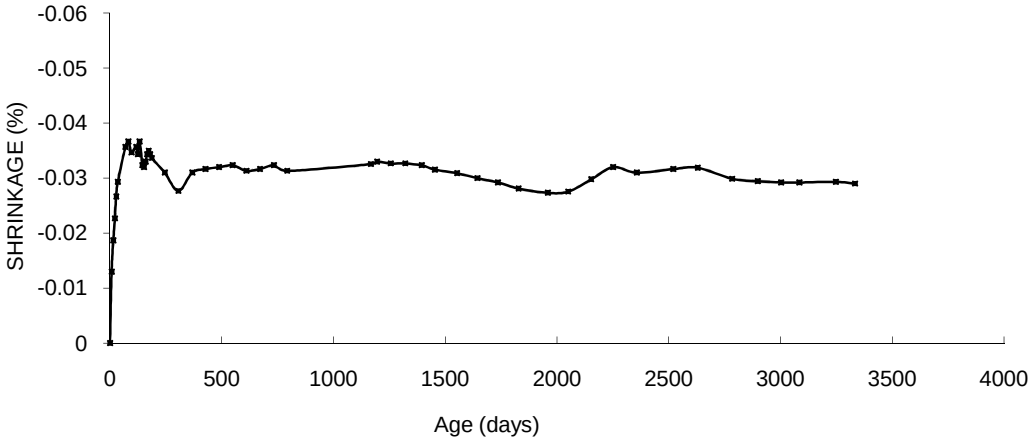
Day	Shrinkage (%)
1567	-0.03622
1659	-0.03622
1751	-0.03656
1882	-0.03678
1973	-0.03633
2076	-0.03644
2174	-0.03711
2280	-0.03667
2443	-0.03633
2553	-0.03667
2707	-0.03600
2823	-0.03589
2926	-0.03589
3013	-0.03589
3176	-0.03600
3262	-0.03611

C34

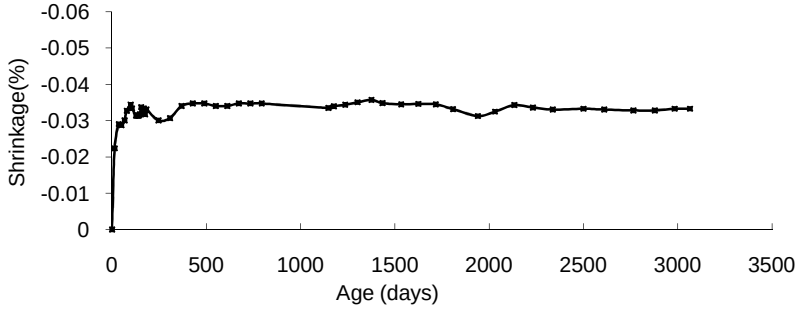
Day	Shrinkage (%)
1441	-0.04422
1532	-0.04322
1624	-0.04267
1716	-0.04233
1847	-0.04300
1938	-0.04278
2041	-0.04300
2139	-0.04278
2245	-0.04267
2408	-0.04200
2518	-0.04300
2672	-0.04167
2788	-0.04178
2891	-0.04178
2980	-0.03878
3143	-0.03878
3229	-0.03889

Appendix IV Graphs for Shrinkage in Concrete

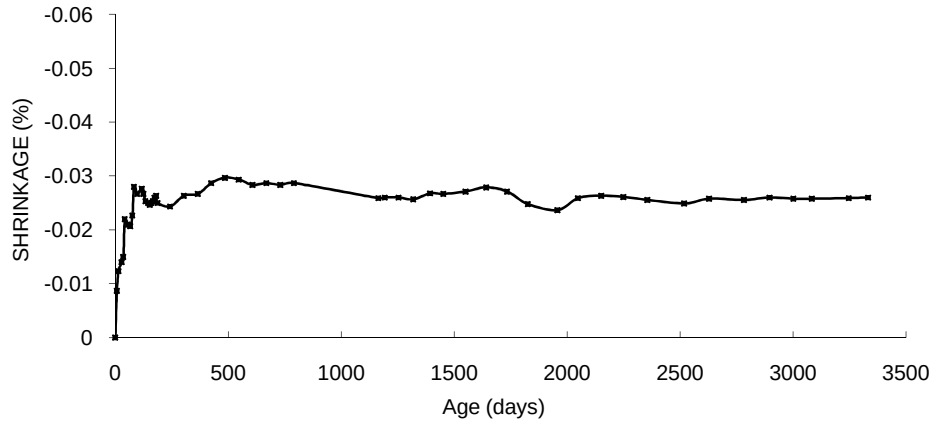
Mix No. 2



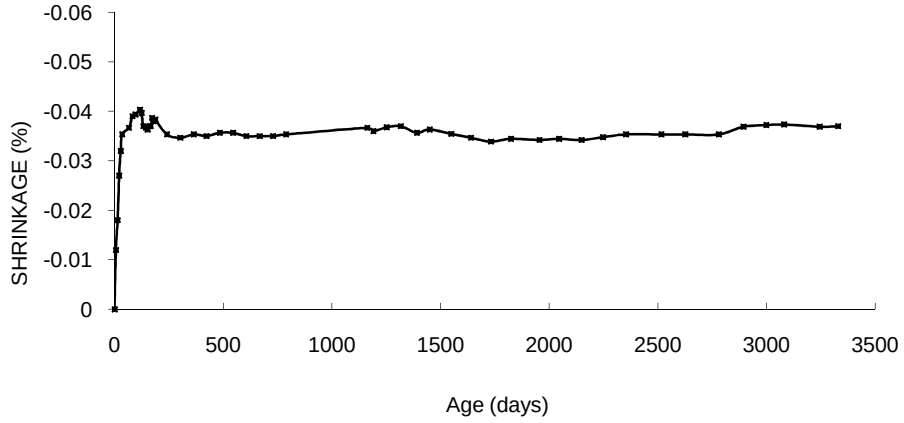
Mix No. 3



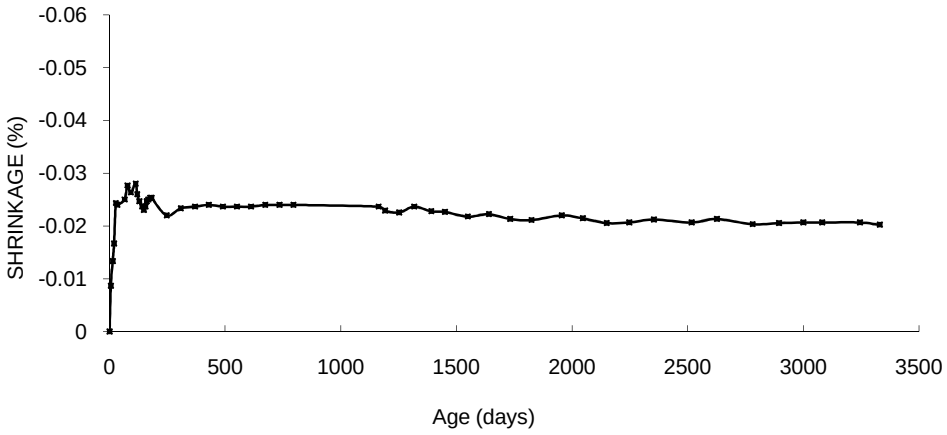
Mix No. 4



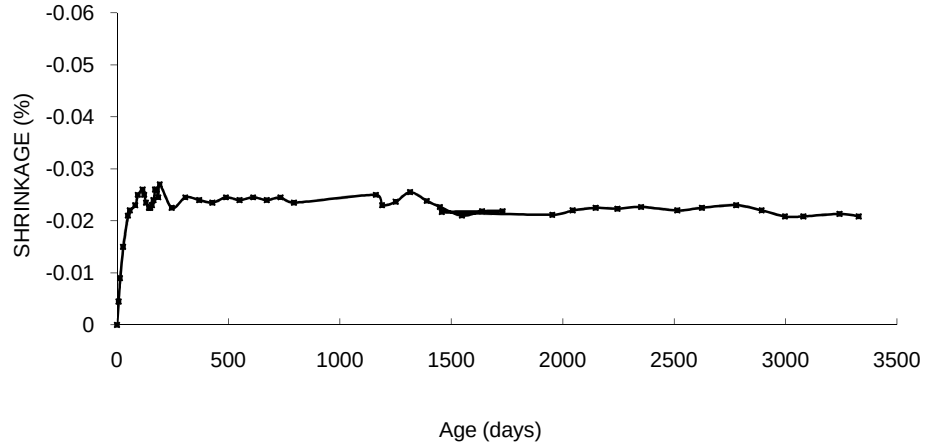
Mix No. 5



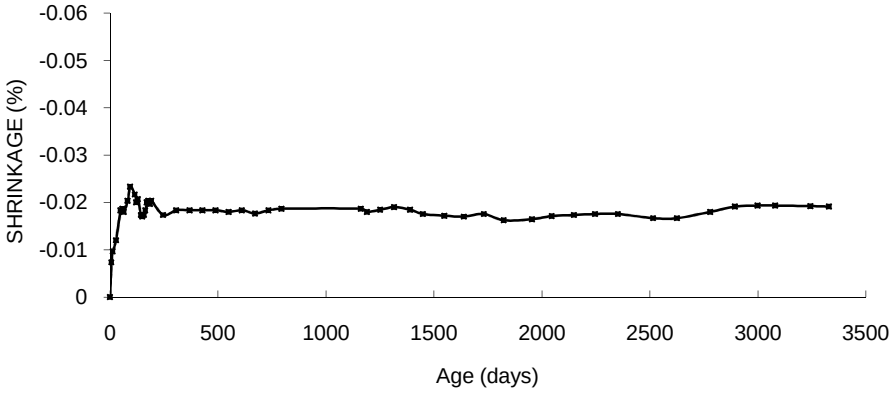
Mix No. 6



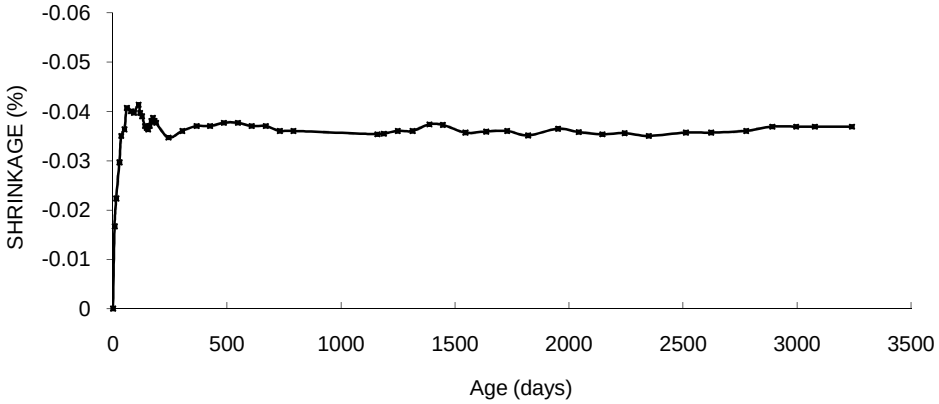
Mix No. 7



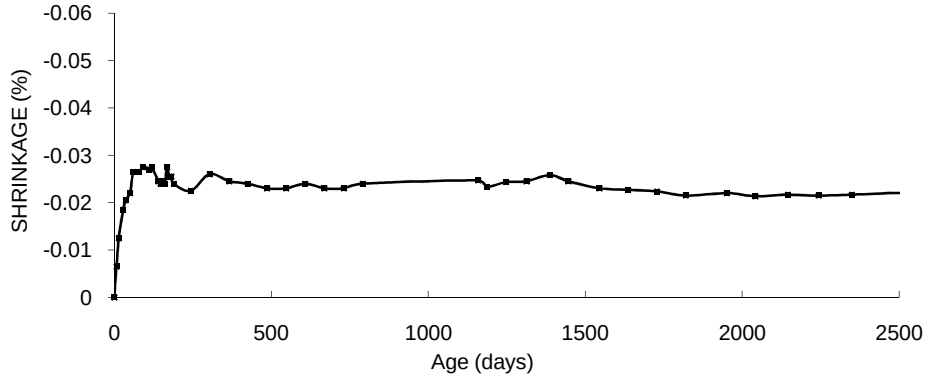
Mix No. 8



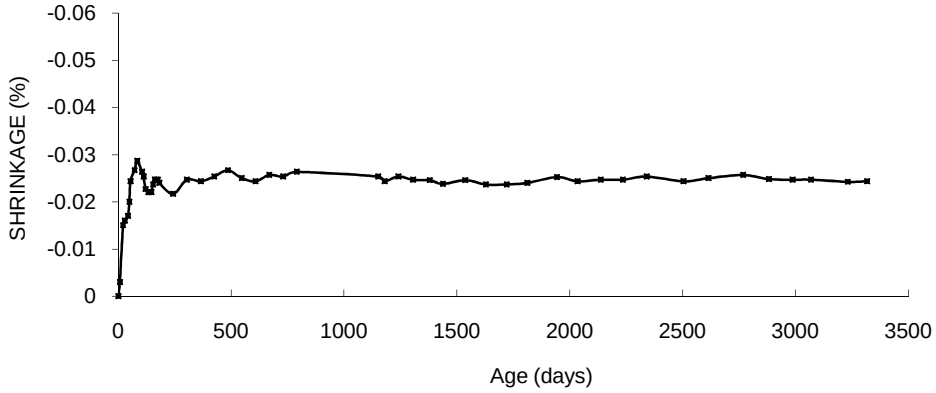
Mix No. 9



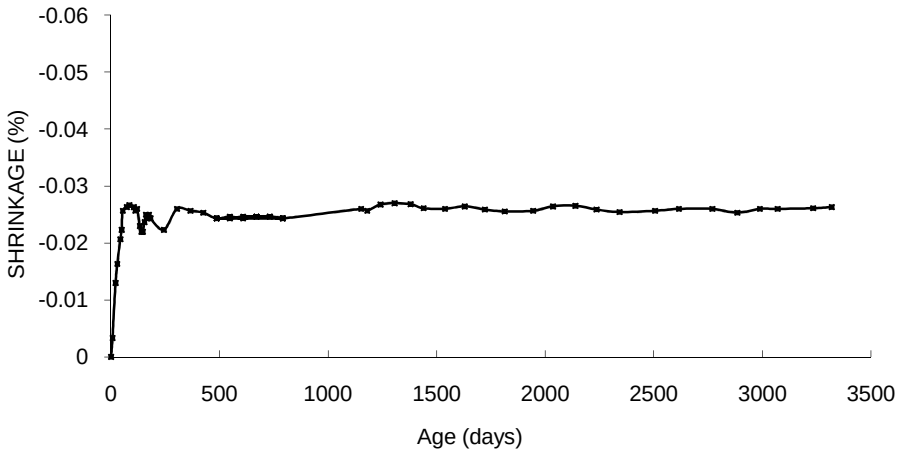
Mix No.10



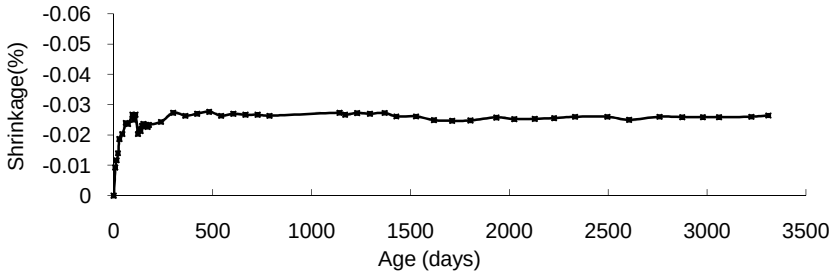
Mix No.11



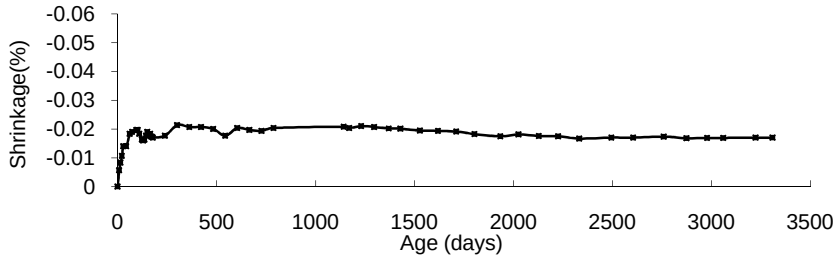
Mix No.12



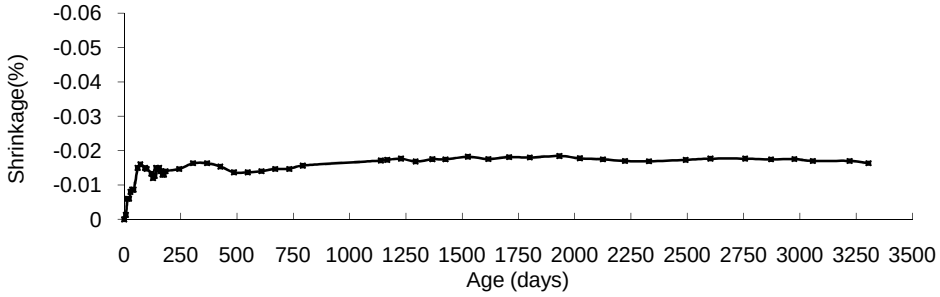
Mix No.13



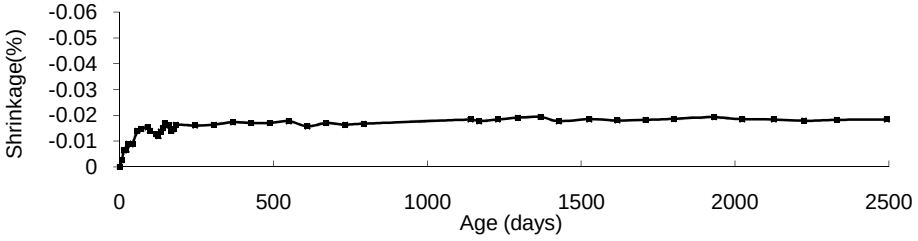
Mix No.14



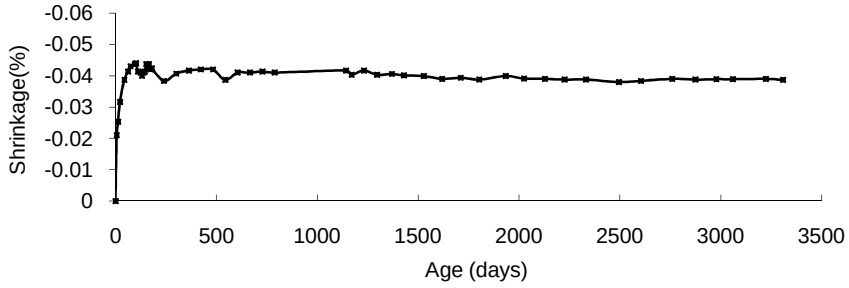
Mix No.15



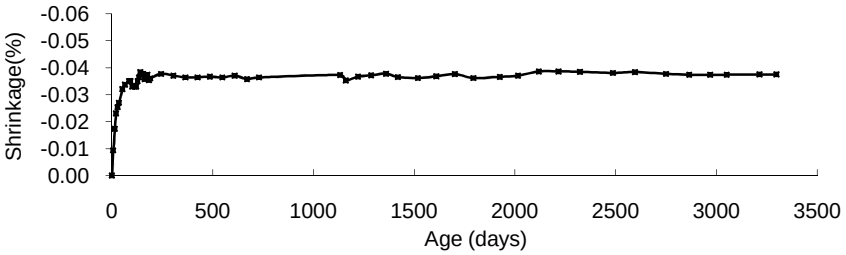
Mix No. 16



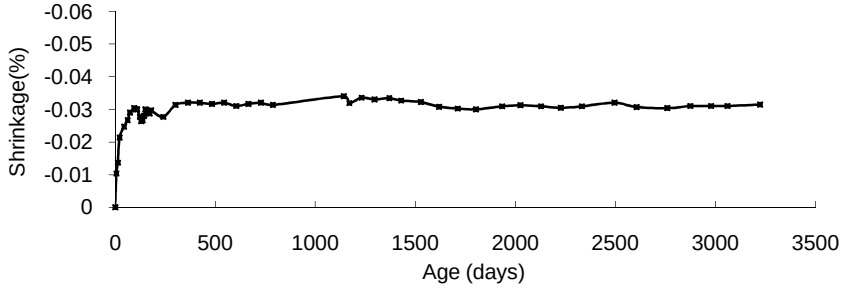
Mix No. 17



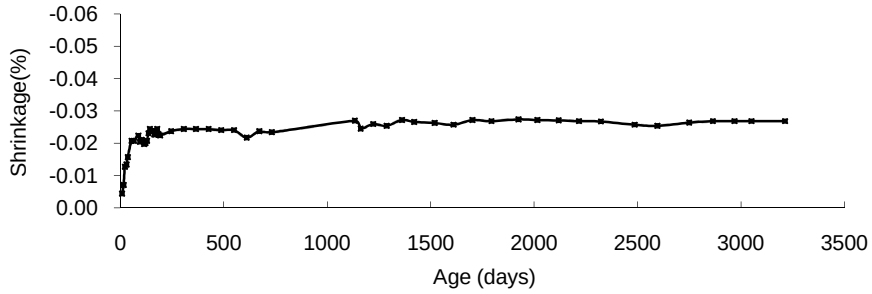
Mix No.18



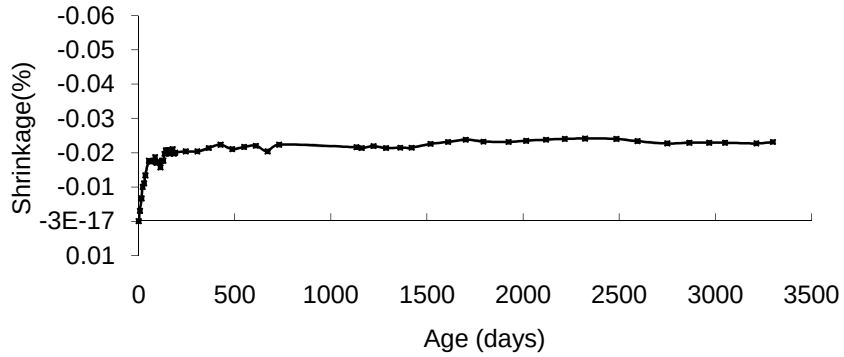
Mix No. 19



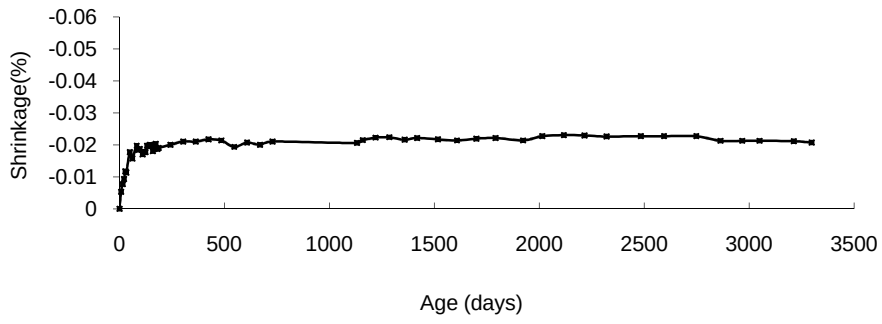
Mix No. 20



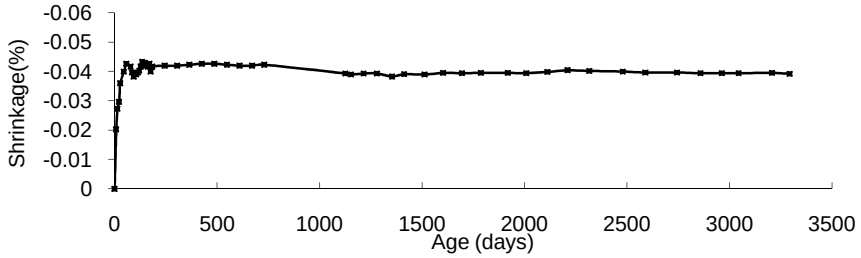
Mix No. 21



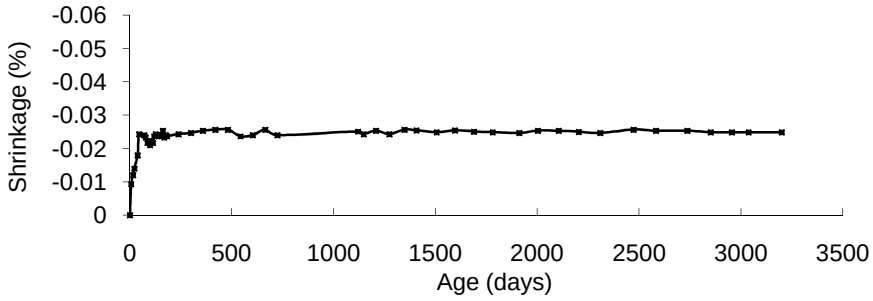
Mix No.22



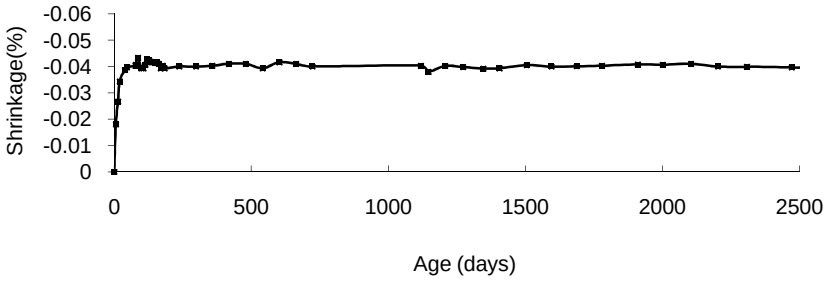
Mix No. 23



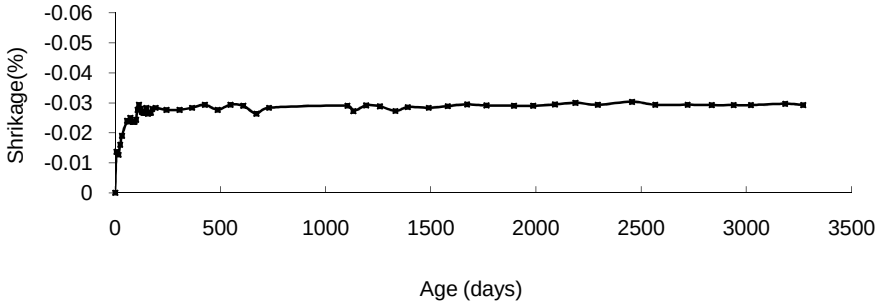
Mix No.24



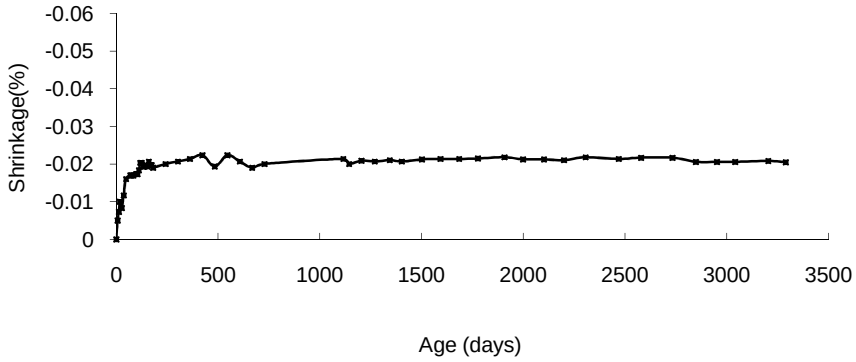
Mix No. 25



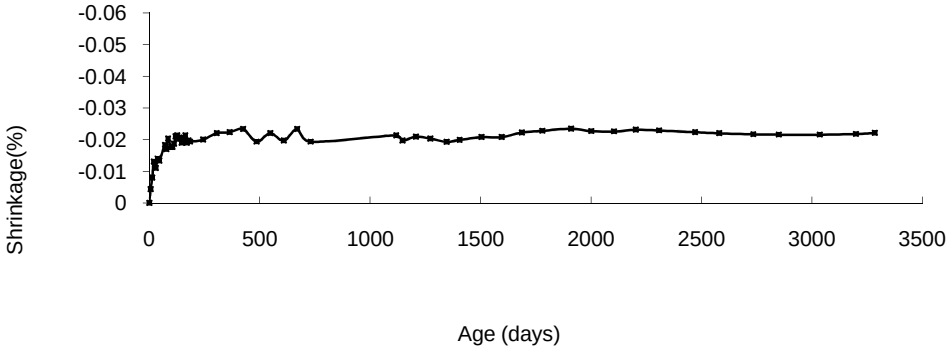
Mix No. 27



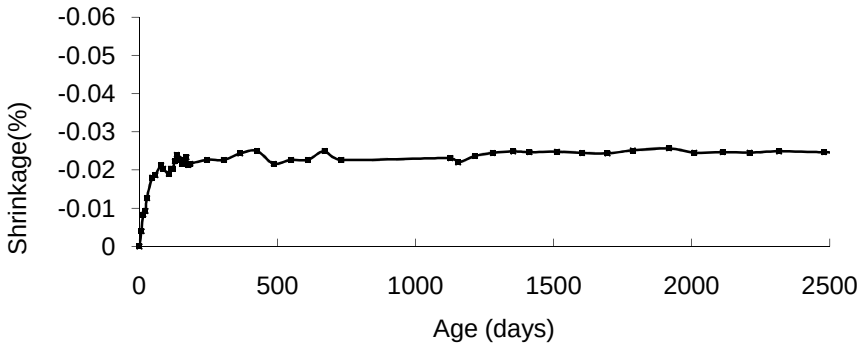
Mix No.28



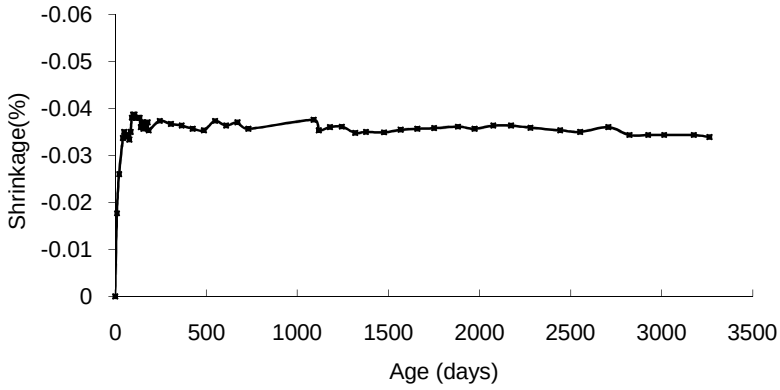
Mix No.29



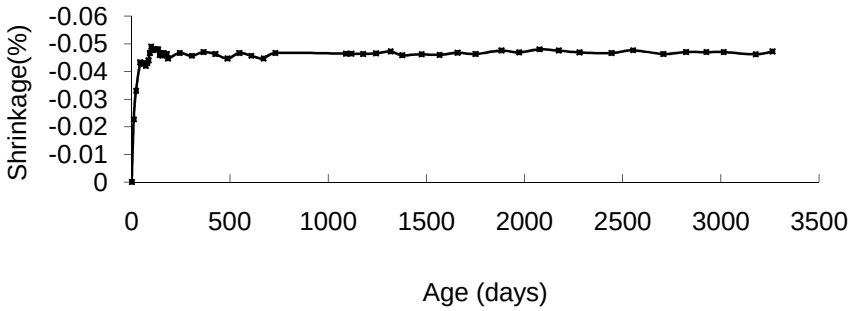
Mix No. 30



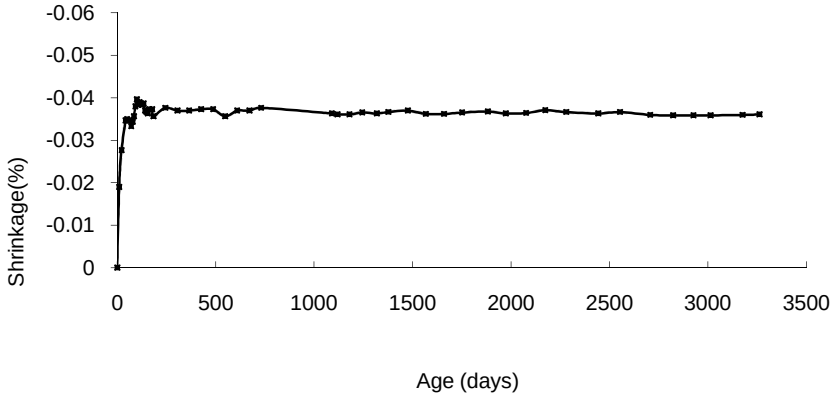
Mix No. 31



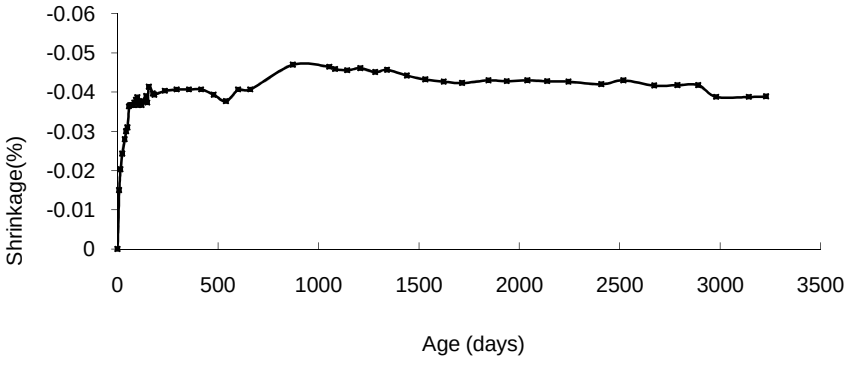
Mix No. 32



Mix No. 33



Mix No. 34



Appendix V Compressive Strength for HSC

Mix No.	w/cm	Cement Content (lb/cyd)	Age (days)	Cylinder Size (in.)	Compressive Strength (psi)		
					Spec.1	Spec.2	Average
1C	0.33	631	36	4 x 8	10565	10145	**10355**
			64		10838	11886	**11362**
			165		15034	12973	**14004**
			----		----	----	**----**
2C	0.33	631	34	4 x 8	10550	10343	**10518**
			57		12505	12426	**12466**
			106		12797	13173	**12980**
			182		15011	14406	**14709**
3C	0.33	631	28	4 x 8	10530	10721	**10625**
			114		14456	13223	**13840**
4C	0.33	631	33	4 x 8	11120	10175	**10648**
			57		11583	11807	**11695**
			104		12256	12605	**12419**
			180		13701	13227	**13464**
5C	0.33	631	35	4 x 8	11259	10634	**10947**
			57		12204	11975	**12088**
			104		13138	12682	**12903**
			180		14816	15855	**15356**
6C	0.33	631	37	4 x 8	11716	11315	**11515**
			57		12380	11667	**12023**
			104		12971	13283	**13102**
			180		14113	15406	**14759**
7C	0.33	631	28	4 x 8	10560	10122	**10341**
			56		11059	11834	**11445**
			102		12988	12232	**12610**
			181		13893	14572	**14232**
8C	0.33	631	35	4 x 8	8645	8642	**85554**
			56		9224	9280	**9252**
			102		10194	10101	**10139**
			180		11533	11341	**11437**
9C	0.33	631	32	4 x 8	10470	10644	**10557**
			60		11117	12289	**11703**
			90		12504	12269	**12383**
			180		13139	13107	**13123**

Mix No.	w/cm	Cement Content (lb/cyd)	Age (days)	Cylinder Size (in.)	Compressive Strength (psi)		
					Spec.1	Spec.2	Average
10C	0.33	631	32	4 x 8	10130	9645	**9888**
			60		10528	11951	**11236**
			90		11280	11968	**11624**
			180		12879	13125	**13002**
11C	0.33	631	28	4 x 8	8689	8234	**8462**
			57		10247	9773	**10006**
			118		11542	12208	**11875**
			180		11361	11869	**11615**
12C	0.33	631	28	4 x 8	9753	9979	**9866**
			57		12325	11934	**12129**
			118		15445	14812	**15128**
			180		14163	13744	**13953**
13C	0.33	631	31	4 x 8	7951	7485	**7718**
			56		9138	9335	**9226**
			137		11424	11318	**11371**
			180		12295	11381	**11838**
14C	0.33	631	31	4 x 8	8172	8353	**8238**
			56		9617	10722	**10169**
			137		12271	12187	**12229**
			180		13250	13177	**13214**
15C	0.33	631	30	4 x 8	7525	7847	**7686**
			57		8776	9664	**9220**
			136		11199	11714	**11457**
			180		11296	11894	**11595**
16C	0.33	631	32	4 x 8	7076	7282	**7179**
			57		9174	9384	**9279**
			136		11149	11080	**11112**
			180		12228	11023	**11625**
17C	0.33	631	28	4 x 8	9210	9584	**9397**
			58		11534	12636	**12071**
			139		13600	12908	**13254**
			180		14265	14139	**14202**
18C	0.33	631	28	4 x 8	7675	7526	**7601**
			64		10404	9741	**10073**
			127		11016	11612	**11314**
			180		12490	12732	**12611**

Mix No.	w/cm	Cement Content (lb/cyd)	Age (days)	Cylinder Size (in.)	Compressive Strength (psi)		
					Spec.1	Spec.2	Average
19C	0.33	631	38	4 x 8	8998	9818	**9408**
			58		11278	10576	**10927**
			139		12675	12303	**12489**
			180		13377	12720	**13048**
20C	0.33	631	----	4 x 8	----	----	**----**
			64		10210	10573	**10283**
			127		13088	11804	**12446**
			180		13338	12625	**12981**
21C	0.33	631	28	4 x 8	9599	9163	**9381**
			67		12150	12316	**12230**
			127		13046	13868	**13457**
			180		13538	13374	**13456**
22C	0.33	631	32	4 x 8	8267	5325	**8296**
			70		10420	10377	**10397**
			125		11134	11971	**11553**
			180		12846	13162	**13004**
23C	0.33	631	29	4 x 8	11488	11382	**11435**
			----		----	----	**----**
			116		15239	15689	**15464**
			180		14946	15516	**15231**
24C	0.33	631	30	4 x 8	11476	11559	**11317**
			----		----	----	**----**
			110		13822	13825	**13823**
			180		14539	15363	**14951**
25C	0.33	631	30	4 x 8	9647	10560	**10119**
			----		----	----	**----**
			112		13042	12505	**12773**
			180		13862	14651	**14256**
27C	0.33	631	----	4 x 8	----	-----	**----**
			----		----	----	**----**
			96		13982	13632	**13807**
			180		14911	14281	**14956**
28C	0.33	631	31	4 x 8	10419	10029	**10224**
			----		----	----	**----**
			85		11824	12884	**12354**
			180		15146	14644	**14895**

Mix No.	w/cm	Cement Content (lb/cyd)	Age (days)	Cylinder Size (in.)	Compressive Strength (psi)		
					Spec.1	Spec.2	Average
29C	0.33	631	30	4 x 8	10262	9654	**9958**
			----		----	----	**----**
			----		----	----	**----**
			180		15447	13215	**14331**
30C	0.33	631	28	4 x 8	9225	9738	**9482**
			----		----	----	**----**
			116		13962	13420	**13691**
			180		14320	13328	**13824**
31C	0.34	675	56	4 x 8	11590	12546	**12068**
			180		14258	14675	**14466**
			28	6 x 12	9981	9911	**9927**
			180		11340	----	**11340**
32C	0.34	675	59	4 x 8	11208	11706	**11457**
			180		12569	12108	**12339**
			28	6 x 12	9469	9118	**9294**
			180		10388	----	**10388**
33C	0.34	628	57	4 x 8	9524	12681	**11103**
			180		14577	12858	**13717**
			28	6 x 12	10678	10542	**10609**
			180		11221	----	**11221**
34C	0.34	702	95	4 x 8	11947	12688	**12317**
			180		12425	14988	**13712**
			29	6 x 12	9672	10108	**9890**
			180		11170	----	**11170**

Appendix VI Creep Data for Chapter 5 Specimens

Creep and Shrinkage Data for Specimen 44

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
0	686.67	10/15/2003	0.00	686.67	0	0.00	0.00
1	793.33	10/16/2003	0.00	793.33	107	0.16	0.28
2	778.33	10/17/2003	6.67	785.00	92	0.13	0.34
5	839.33	10/20/2003	-4.33	835.00	153	0.22	0.45
7	886.11	10/22/2003	-11.11	875.00	199	0.29	0.50
14	907.22	10/29/2003	1.11	908.33	221	0.32	0.61
21	940.00	11/5/2003	20.00	960.00	253	0.37	0.68
28	976.11	11/12/2003	52.22	1028.33	289	0.42	0.74
35	993.89	11/19/2003	64.44	1058.33	307	0.45	0.79
42	987.22	11/26/2003	71.11	1058.33	301	0.44	0.83
49	997.78	12/3/2003	75.56	1073.33	311	0.45	0.86
56	987.78	12/10/2003	88.89	1076.67	301	0.44	0.89
63	991.11	12/17/2003	92.22	1083.33	304	0.44	0.92
70	985.00	12/24/2003	116.67	1101.67	298	0.43	0.94
84	978.89	1/7/2004	134.44	1113.33	292	0.43	0.98
91	998.89	1/14/2004	134.44	1133.33	312	0.45	1.00
98	1000.56	1/21/2004	137.78	1138.33	314	0.46	1.02
112	993.89	2/4/2004	154.44	1148.33	307	0.45	1.05
126	1025.56	2/18/2004	154.44	1180.00	339	0.49	1.08
132	1032.22	2/24/2004	154.44	1186.67	346	0.50	1.09
141	1041.11	3/4/2004	155.56	1196.67	354	0.52	1.10
148	1046.11	3/11/2004	155.56	1201.67	359	0.52	1.11
162	1065.56	3/25/2004	164.44	1230.00	379	0.55	1.13
176	1047.22	4/8/2004	161.11	1208.33	361	0.53	1.15
190	1053.33	4/22/2004	180.00	1233.33	367	0.53	1.17
204	1066.67	5/6/2004	180.00	1246.67	380	0.55	1.18
218	1102.78	5/20/2004	158.89	1261.67	416	0.61	1.20
232	1103.89	6/3/2004	164.44	1268.33	417	0.61	1.21
246	1132.78	6/17/2004	145.56	1278.33	446	0.65	1.22
260	1140.00	7/1/2004	156.67	1296.67	453	0.66	1.23
274	1118.89	7/15/2004	161.11	1280.00	432	0.63	1.24
288	1120.56	7/29/2004	164.44	1285.00	434	0.63	1.25
302	1114.44	8/12/2004	172.22	1286.67	428	0.62	1.26
316	1116.67	8/26/2004	173.33	1290.00	430	0.63	1.27
330	1115.00	9/9/2004	176.67	1291.67	428	0.62	1.28
344	1126.67	9/23/2004	176.67	1303.33	440	0.64	1.29
358	1136.67	10/7/2004	170.00	1306.67	450	0.66	1.30
372	1130.56	10/21/2004	171.11	1301.67	444	0.65	1.30
386	1143.33	11/4/2004	163.33	1306.67	457	0.67	1.31

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
400	1142.22	11/18/2004	167.78	1310.00	456	0.66	1.31
415	1141.67	12/3/2004	173.33	1315.00	455	0.66	1.32
428	1146.11	12/16/2004	165.56	1311.67	459	0.67	1.33
442	1153.33	12/30/2004	163.33	1316.67	467	0.68	1.33
456	1153.89	1/13/2005	164.44	1318.33	467	0.68	1.34
470	1163.33	1/27/2005	160.00	1323.33	477	0.69	1.34
485	1155.00	2/11/2005	170.00	1325.00	468	0.68	1.35
499	1161.11	2/25/2005	168.89	1330.00	474	0.69	1.35
512	1166.67	3/10/2005	163.33	1330.00	480	0.70	1.35
526	1171.11	3/24/2005	162.22	1333.33	484	0.71	1.36
540	1171.67	4/7/2005	173.33	1345.00	485	0.71	1.36
554	1182.03	4/21/2005	163.33	1345.37	495	0.72	1.37
568	1185.00	5/5/2005	156.67	1341.67	498	0.73	1.37
582	1193.89	5/19/2005	154.44	1348.33	507	0.74	1.37
596	1194.44	6/2/2005	155.56	1350.00	508	0.74	1.38
610	1192.03	6/16/2005	156.67	1348.70	505	0.74	1.38
624	1192.22	6/30/2005	157.78	1350.00	506	0.74	1.38
638	1198.33	7/14/2005	156.67	1355.00	512	0.75	1.39
652	1198.89	7/28/2005	157.78	1356.67	512	0.75	1.39
666	1197.22	8/11/2005	161.11	1358.33	511	0.74	1.39
680	1192.78	8/25/2005	162.22	1355.00	506	0.74	1.39
694	1194.44	9/8/2005	165.56	1360.00	508	0.74	1.40
708	1195.00	9/22/2005	163.33	1358.33	508	0.74	1.40
722	1199.44	10/6/2005	162.22	1361.67	513	0.75	1.40
736	1204.44	10/20/2005	158.89	1363.33	518	0.75	1.40
750	1208.89	11/3/2005	161.11	1370.00	522	0.76	1.41
764	1210.56	11/17/2005	157.78	1368.33	524	0.76	1.41
778	1202.78	12/1/2005	168.89	1371.67	516	0.75	1.41
792	1203.33	12/15/2005	166.67	1370.00	517	0.75	1.41
811	1200.00	1/3/2006	166.67	1366.67	513	0.75	1.42
820	1197.78	1/12/2006	172.22	1370.00	511	0.74	1.42
834	1202.22	1/26/2006	174.44	1376.67	516	0.75	1.42
848	1198.33	2/9/2006	173.33	1371.67	512	0.75	1.42
862	1197.22	2/23/2006	174.44	1371.67	511	0.74	1.42
876	1210.56	3/9/2006	174.44	1385.00	524	0.76	1.42
890	1211.11	3/23/2006	172.22	1383.33	524	0.76	1.43
904	1212.78	4/6/2006	175.56	1388.33	526	0.77	1.43
918	1211.67	4/20/2006	176.67	1388.33	525	0.76	1.43
932	1217.78	5/4/2006	175.56	1393.33	531	0.77	1.43
946	1220.00	5/18/2006	176.67	1396.67	533	0.78	1.43
960	1225.56	6/1/2006	171.11	1396.67	539	0.78	1.43
974	1226.67	6/15/2006	173.33	1400.00	540	0.79	1.44

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
988	1228.33	6/29/2006	173.33	1401.67	542	0.79	1.44
1002	1233.33	7/13/2006	170.00	1403.33	547	0.80	1.44
1016	1227.78	7/27/2006	172.22	1400.00	541	0.79	1.44
1030	1223.33	8/10/2006	176.67	1400.00	537	0.78	1.44
1044	1222.22	8/24/2006	184.44	1406.67	536	0.78	1.44
1058	1226.67	9/7/2006	176.67	1403.33	540	0.79	1.44
1072	1218.89	9/21/2006	181.11	1400.00	532	0.78	1.45
1086	1208.89	10/5/2006	184.44	1393.33	522	0.76	1.45
1100	1213.33	10/19/2006	183.33	1396.67	527	0.77	1.45
1114	1215.56	11/2/2006	184.44	1400.00	529	0.77	1.45
1128	1219.44	11/16/2006	182.22	1401.67	533	0.78	1.45
1142	1216.11	11/30/2006	185.56	1401.67	529	0.77	1.45
1156	1210.56	12/14/2006	187.78	1398.33	524	0.76	1.45
1170	1210.00	12/28/2006	186.67	1396.67	523	0.76	1.45
1184	1216.11	1/11/2007	185.56	1401.67	529	0.77	1.45
1198	1214.44	1/25/2007	188.89	1403.33	528	0.77	1.46
1212	1213.33	2/8/2007	190.00	1403.33	527	0.77	1.46
1226	1212.78	2/22/2007	182.22	1395.00	526	0.77	1.46
1240	1216.11	3/8/2007	185.56	1401.67	529	0.77	1.46
1254	1212.78	3/22/2007	188.89	1401.67	526	0.77	1.46
1268	1218.89	4/5/2007	181.11	1400.00	532	0.78	1.46
1282	1221.11	4/19/2007	182.22	1403.33	534	0.78	1.46
1296	1221.11	5/3/2007	178.89	1400.00	534	0.78	1.46
1310	1217.78	5/17/2007	182.22	1400.00	531	0.77	1.46
1324	1217.78	5/31/2007	182.22	1400.00	531	0.77	1.46
1338	1216.11	6/14/2007	182.22	1398.33	529	0.77	1.47
1352	1220.00	6/28/2007	176.67	1396.67	533	0.78	1.47
1366	1218.89	7/12/2007	174.44	1393.33	532	0.78	1.47
1380	1218.89	7/26/2007	181.11	1400.00	532	0.78	1.47
1394	1219.44	8/9/2007	182.22	1401.67	533	0.78	1.47
1408	1213.89	8/23/2007	191.11	1405.00	527	0.77	1.47
1422	1217.22	9/6/2007	187.78	1405.00	531	0.77	1.47
1436	1219.44	9/20/2007	185.56	1405.00	533	0.78	1.47
1450	1219.44	10/4/2007	182.22	1401.67	533	0.78	1.47
1464	1225.56	10/18/2007	177.78	1403.33	539	0.78	1.47
1478	1228.89	11/1/2007	181.11	1410.00	542	0.79	1.47
1492	1226.11	11/15/2007	185.56	1411.67	539	0.79	1.47
1506	1224.44	11/29/2007	185.56	1410.00	538	0.78	1.47
1520	1225.00	12/13/2007	190.00	1415.00	538	0.78	1.48
1548	1240.56	1/10/2008	184.44	1425.00	554	0.81	1.48
1562	1248.89	1/24/2008	184.44	1433.33	562	0.82	1.48
1618	1242.22	3/20/2008	187.78	1430.00	556	0.81	1.48

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
1681	1237.22	5/22/2008	187.78	1425.00	551	0.80	1.48
1744	1241.67	7/24/2008	190.00	1431.67	555	0.81	1.49
1807	1245.22	9/25/2008	188.11	1433.33	559	0.81	1.49
1863	1243.33	11/20/2008	190.00	1433.33	557	0.81	1.49
1926	1242.78	1/22/2009	192.22	1435.00	556	0.81	1.49
1988	1250.00	3/25/2009	190.00	1440.00	563	0.82	1.49
2044	1254.00	5/20/2009	191.00	1445.00	567	0.83	1.49
2108	1260.56	7/23/2009	191.11	1451.67	574	0.84	1.50
2170	1257.78	9/23/2009	192.22	1450.00	571	0.83	1.50
2232	1257.78	11/24/2009	192.22	1450.00	571	0.83	1.50
2289	1257.78	1/20/2010	192.22	1450.00	571	0.83	1.50
2352	1259.44	3/24/2010	192.22	1451.67	573	0.83	1.50
2415	1251.11	5/26/2010	192.22	1443.33	564	0.82	1.50
2478	1261.11	7/28/2010	192.22	1453.33	574	0.84	1.51
2598	1257.22	11/25/2010	201.11	1458.33	571	0.83	1.51
2718	1262.78	3/25/2011	198.89	1461.67	576	0.84	1.51

Creep and Shrinkage Data for Specimen 45

Age	Average C +ES	Shrink bar dates	Shrinkage Only	Average SH+CR
0	553.33	2/16/2004	240.00	793.33
2	619.44	2/18/2004	252.22	871.67
8	638.33	2/24/2004	280.00	918.33
17	702.78	3/4/2004	292.22	995.00
24	661.67	3/11/2004	390.00	1051.67
38	911.67	3/25/2004	420.00	1331.67
52	795.00	4/8/2004	470.00	1265.00
66	843.33	4/22/2004	503.33	1346.67
80	952.22	5/6/2004	511.11	1463.33
94	960.56	5/20/2004	537.78	1498.33
108	1092.78	6/3/2004	525.56	1618.33
122	1113.33	6/17/2004	533.33	1646.67
136	1132.78	7/1/2004	535.56	1668.33
150	1138.89	7/15/2004	551.11	1690.00
164	1131.11	7/29/2004	558.89	1690.00
178	1156.67	8/12/2004	566.67	1723.33
192	1163.89	8/26/2004	574.44	1738.33
206	1168.33	9/9/2004	590.00	1758.33
220	1231.67	9/23/2004	553.33	1785.00

Creep and Shrinkage Data for Specimen 46

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
0	636.67	4/5/2004	0.00	636.67	0	0.00	0.00
1	763.33	4/6/2004	0.00	763.33	127	0.20	0.21
3	818.33	4/8/2004	0.00	818.33	182	0.29	0.29
7	844.67	4/12/2004	12.00	856.67	208	0.33	0.37
10	866.00	4/15/2004	24.00	890.00	229	0.36	0.41
17	921.67	4/22/2004	36.67	958.33	285	0.45	0.48
24	1036.67	4/29/2004	43.33	1080.00	400	0.63	0.53
31	1030.00	5/6/2004	63.33	1093.33	393	0.62	0.57
45	1041.11	5/20/2004	65.56	1106.67	404	0.64	0.64
59	1050.00	6/3/2004	86.67	1136.67	413	0.65	0.69
73	1083.89	6/17/2004	91.11	1175.00	447	0.70	0.73
87	1060.00	7/1/2004	110.00	1170.00	423	0.66	0.77
101	1084.44	7/15/2004	105.56	1190.00	448	0.70	0.80
115	1107.78	7/29/2004	105.56	1213.33	471	0.74	0.83
129	1117.44	8/12/2004	105.56	1223.00	481	0.76	0.86
143	1133.33	8/26/2004	110.00	1243.33	497	0.78	0.89
157	1141.11	9/9/2004	115.56	1256.67	504	0.79	0.91
171	1146.11	9/23/2004	125.56	1271.67	509	0.80	0.93
185	1155.00	10/7/2004	123.33	1278.33	518	0.81	0.95
199	1163.33	10/21/2004	136.67	1300.00	527	0.83	0.97
213	1186.67	11/4/2004	140.00	1326.67	550	0.86	0.98
227	1185.56	11/18/2004	144.44	1330.00	549	0.86	1.00
242	1192.22	12/3/2004	167.78	1360.00	556	0.87	1.01
255	1211.67	12/16/2004	166.67	1378.33	575	0.90	1.03
269	1200.00	12/30/2004	173.33	1373.33	563	0.88	1.04
283	1193.33	1/13/2005	176.67	1370.00	557	0.87	1.05
297	1207.78	1/27/2005	175.56	1383.33	571	0.90	1.07
312	1223.89	2/11/2005	167.78	1391.67	587	0.92	1.08
326	1228.33	2/25/2005	163.33	1391.67	592	0.93	1.09
339	1241.67	3/10/2005	150.00	1391.67	605	0.95	1.10
353	1274.44	3/24/2005	155.56	1430.00	638	1.00	1.11
367	1251.67	4/7/2005	163.33	1415.00	615	0.97	1.12
381	1268.89	4/21/2005	151.11	1420.00	632	0.99	1.13
395	1271.67	5/5/2005	153.33	1425.00	635	1.00	1.14
409	1274.44	5/19/2005	152.22	1426.67	638	1.00	1.15
423	1283.89	6/2/2005	147.78	1431.67	647	1.02	1.16
437	1280.56	6/16/2005	151.11	1431.67	644	1.01	1.17
451	1277.22	6/30/2005	151.11	1428.33	641	1.01	1.17
465	1280.56	7/14/2005	151.11	1431.67	644	1.01	1.18
479	1272.78	7/28/2005	155.56	1428.33	636	1.00	1.19
493	1277.22	8/11/2005	157.78	1435.00	641	1.01	1.20
507	1275.00	8/25/2005	163.33	1438.33	638	1.00	1.20

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
521	1280.00	9/8/2005	166.67	1446.67	643	1.01	1.21
535	1284.44	9/22/2005	162.22	1446.67	648	1.02	1.22
549	1291.67	10/6/2005	160.00	1451.67	655	1.03	1.23
563	1297.78	10/20/2005	158.89	1456.67	661	1.04	1.23
577	1295.56	11/3/2005	164.44	1460.00	659	1.03	1.24
591	1295.00	11/17/2005	163.33	1458.33	658	1.03	1.24
605	1307.78	12/1/2005	178.89	1486.67	671	1.05	1.25
619	1299.44	12/15/2005	182.22	1481.67	663	1.04	1.26
638	1299.44	1/3/2006	182.22	1481.67	663	1.04	1.26
647	1287.22	1/12/2006	194.44	1481.67	651	1.02	1.27
661	1313.33	1/26/2006	183.33	1496.67	677	1.06	1.27
675	1312.78	2/9/2006	185.56	1498.33	676	1.06	1.28
689	1308.89	2/23/2006	187.78	1496.67	672	1.06	1.28
703	1310.00	3/9/2006	193.33	1503.33	673	1.06	1.29
717	1312.22	3/23/2006	187.78	1500.00	676	1.06	1.29
731	1318.33	4/6/2006	186.67	1505.00	682	1.07	1.30
745	1325.00	4/20/2006	190.00	1515.00	688	1.08	1.30
759	1322.78	5/4/2006	188.89	1511.67	686	1.08	1.31
773	1318.33	5/18/2006	190.00	1508.33	682	1.07	1.31
787	1322.78	6/1/2006	185.56	1508.33	686	1.08	1.31
801	1323.89	6/15/2006	184.44	1508.33	687	1.08	1.32
815	1325.56	6/29/2006	184.44	1510.00	689	1.08	1.32
829	1333.89	7/13/2006	177.78	1511.67	697	1.10	1.33
843	1334.44	7/27/2006	178.89	1513.33	698	1.10	1.33
857	1338.33	8/10/2006	180.00	1518.33	702	1.10	1.33
871	1333.33	8/24/2006	183.33	1516.67	697	1.09	1.34
885	1330.56	9/7/2006	181.11	1511.67	694	1.09	1.34
899	1332.78	9/21/2006	178.89	1511.67	696	1.09	1.35
913	1330.56	10/5/2006	177.78	1508.33	694	1.09	1.35
927	1330.56	10/19/2006	181.11	1511.67	694	1.09	1.35
941	1331.67	11/2/2006	183.33	1515.00	695	1.09	1.36
955	1333.89	11/16/2006	181.11	1515.00	697	1.10	1.36
969	1330.56	11/30/2006	181.11	1511.67	694	1.09	1.36
983	1337.22	12/14/2006	184.44	1521.67	701	1.10	1.37
997	1335.00	12/28/2006	180.00	1515.00	698	1.10	1.37
1011	1332.22	1/11/2007	184.44	1516.67	696	1.09	1.37
1025	1333.33	1/25/2007	193.33	1526.67	697	1.09	1.38
1039	1330.00	2/8/2007	190.00	1520.00	693	1.09	1.38
1053	1346.67	2/22/2007	183.33	1530.00	710	1.12	1.38
1067	1338.89	3/8/2007	187.78	1526.67	702	1.10	1.38
1081	1333.33	3/22/2007	190.00	1523.33	697	1.09	1.39
1095	1343.89	4/5/2007	187.78	1531.67	707	1.11	1.39

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
1109	1343.89	4/19/2007	191.11	1535.00	707	1.11	1.39
1123	1346.67	5/3/2007	190.00	1536.67	710	1.12	1.40
1137	1344.44	5/17/2007	192.22	1536.67	708	1.11	1.40
1151	1350.00	5/31/2007	186.67	1536.67	713	1.12	1.40
1165	1351.11	6/14/2007	188.89	1540.00	714	1.12	1.40
1179	1352.22	6/28/2007	187.78	1540.00	716	1.12	1.41
1193	1360.56	7/12/2007	184.44	1545.00	724	1.14	1.41
1207	1353.33	7/26/2007	190.00	1543.33	717	1.13	1.41
1221	1347.78	8/9/2007	192.22	1540.00	711	1.12	1.41
1235	1357.78	8/23/2007	192.22	1550.00	721	1.13	1.42
1249	1358.33	9/6/2007	193.33	1551.67	722	1.13	1.42
1263	1365.00	9/20/2007	190.00	1555.00	728	1.14	1.42
1277	1365.56	10/4/2007	191.11	1556.67	729	1.14	1.42
1291	1368.33	10/18/2007	190.00	1558.33	732	1.15	1.43
1305	1367.78	11/1/2007	182.22	1550.00	731	1.15	1.43
1319	1368.33	11/15/2007	190.00	1558.33	732	1.15	1.43
1333	1361.11	11/29/2007	195.56	1556.67	724	1.14	1.43
1347	1357.22	12/13/2007	204.44	1561.67	721	1.13	1.43
1375	1364.44	1/10/2008	198.89	1563.33	728	1.14	1.44
1389	1370.00	1/24/2008	196.67	1566.67	733	1.15	1.44
1445	1353.89	3/20/2008	207.78	1561.67	717	1.13	1.45
1508	1346.67	5/22/2008	213.33	1560.00	710	1.12	1.46
1571	1355.00	7/24/2008	210.00	1565.00	718	1.13	1.46
1634	1376.11	9/25/2008	208.89	1585.00	739	1.16	1.47
1690	1380.00	11/20/2008	213.33	1593.33	743	1.17	1.48
1753	1386.67	1/22/2009	213.33	1600.00	750	1.18	1.48
1815	1395.00	3/25/2009	210.00	1605.00	758	1.19	1.49
1871	1400.00	5/20/2009	210.00	1610.00	763	1.20	1.50
1935	1408.89	7/23/2009	207.78	1616.67	772	1.21	1.50
1997	1400.00	9/23/2009	213.33	1613.33	763	1.20	1.51
2059	1407.22	11/24/2009	214.44	1621.67	771	1.21	1.51
2116	1410.56	1/20/2010	211.11	1621.67	774	1.22	1.52
2179	1410.56	3/24/2010	207.78	1618.33	774	1.22	1.52
2242	1403.89	5/26/2010	211.11	1615.00	767	1.21	1.53
2305	1403.89	7/28/2010	214.44	1618.33	767	1.21	1.53
2425	1420.00	11/25/2010	223.33	1643.33	783	1.23	1.54
2486	1414.44	1/25/2011	228.89	1643.33	778	1.22	1.54
2492	1415.56	1/31/2011	234.44	1650.00	779	1.22	1.54
2492	822.22	1/31/2011	234.44	1056.67	186	01.29	1.54
2493	812.78	2/1/2011	235.56	1048.33	176	01.28	1.54

Creep and Shrinkage Data for Specimen 47

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
0	828.33	5/5/2004	0.00	828.33	0	0.00	0.00
1	906.67	5/6/2004	0.00	906.67	78	0.09	0.21
5	1006.25	5/10/2004	4.50	1010.00	178	0.21	0.34
7	1014.17	5/12/2004	9.00	1021.67	186	0.22	0.38
9	1026.42	5/14/2004	13.50	1036.67	198	0.24	0.41
15	1061.11	5/20/2004	18.89	1080.00	233	0.28	0.47
22	1102.22	5/27/2004	34.44	1136.67	274	0.33	0.53
29	1101.11	6/3/2004	52.22	1153.33	273	0.33	0.58
43	1156.67	6/17/2004	56.67	1213.33	328	0.40	0.65
57	1175.56	7/1/2004	71.11	1246.67	347	0.42	0.70
71	1173.89	7/15/2004	101.11	1275.00	346	0.42	0.75
85	1198.89	7/29/2004	111.11	1310.00	371	0.45	0.78
99	1223.89	8/12/2004	101.11	1325.00	396	0.48	0.82
113	1226.11	8/26/2004	118.89	1345.00	398	0.48	0.85
127	1230.00	9/9/2004	133.33	1363.33	402	0.48	0.88
141	1235.56	9/23/2004	141.11	1376.67	407	0.49	0.90
155	1262.22	10/7/2004	134.44	1396.67	434	0.52	0.92
169	1275.00	10/21/2004	150.00	1425.00	447	0.54	0.95
183	1272.22	11/4/2004	157.78	1430.00	444	0.54	0.97
197	1292.22	11/18/2004	154.44	1446.67	464	0.56	0.98
212	1284.44	12/3/2004	178.89	1463.33	456	0.55	1.00
225	1269.44	12/16/2004	185.56	1455.00	441	0.53	1.02
239	1277.78	12/30/2004	188.89	1466.67	449	0.54	1.03
253	1283.89	1/13/2005	191.11	1475.00	456	0.55	1.05
267	1287.22	1/27/2005	194.44	1481.67	459	0.55	1.06
282	1306.67	2/11/2005	193.33	1500.00	478	0.58	1.08
296	1319.44	2/25/2005	185.56	1505.00	491	0.59	1.09
309	1317.22	3/10/2005	181.11	1498.33	489	0.59	1.10
323	1327.22	3/24/2005	194.44	1521.67	499	0.60	1.11
337	1327.78	4/7/2005	188.89	1516.67	499	0.60	1.12
351	1335.00	4/21/2005	186.67	1521.67	507	0.61	1.14
365	1332.78	5/5/2005	195.56	1528.33	504	0.61	1.15
379	1338.33	5/19/2005	190.00	1528.33	510	0.62	1.16
393	1345.56	6/2/2005	187.78	1533.33	517	0.62	1.17
407	1343.33	6/16/2005	193.33	1536.67	515	0.62	1.17
421	1345.56	6/30/2005	194.44	1540.00	517	0.62	1.18
435	1333.89	7/14/2005	197.78	1531.67	506	0.61	1.19
449	1325.56	7/28/2005	204.44	1530.00	497	0.60	1.20
463	1333.33	8/11/2005	203.33	1536.67	505	0.61	1.21
477	1335.56	8/25/2005	204.44	1540.00	507	0.61	1.22
491	1341.11	9/8/2005	205.56	1546.67	513	0.62	1.22

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
505	1348.33	9/22/2005	203.33	1551.67	520	0.63	1.23
519	1352.22	10/6/2005	204.44	1556.67	524	0.63	1.24
533	1363.89	10/20/2005	204.44	1568.33	536	0.65	1.25
547	1359.44	11/3/2005	208.89	1568.33	531	0.64	1.25
561	1382.78	11/17/2005	205.56	1588.33	554	0.67	1.26
575	1373.89	12/1/2005	214.44	1588.33	546	0.66	1.27
589	1373.33	12/15/2005	216.67	1590.00	545	0.66	1.27
608	1375.56	1/3/2006	217.78	1593.33	547	0.66	1.28
617	1368.33	1/12/2006	220.00	1588.33	540	0.65	1.28
631	1370.56	1/26/2006	224.44	1595.00	542	0.65	1.29
645	1376.67	2/9/2006	223.33	1600.00	548	0.66	1.29
659	1371.67	2/23/2006	223.33	1595.00	543	0.66	1.30
673	1365.00	3/9/2006	230.00	1595.00	537	0.65	1.31
687	1373.89	3/23/2006	227.78	1601.67	546	0.66	1.31
701	1383.89	4/6/2006	227.78	1611.67	556	0.67	1.32
715	1373.89	4/20/2006	227.78	1601.67	546	0.66	1.32
729	1373.89	5/4/2006	227.78	1601.67	546	0.66	1.33
743	1368.89	5/18/2006	224.44	1593.33	541	0.65	1.33
757	1373.33	6/1/2006	223.33	1596.67	545	0.66	1.34
771	1377.78	6/15/2006	222.22	1600.00	549	0.66	1.34
785	1380.56	6/29/2006	221.11	1601.67	552	0.67	1.34
799	1380.00	7/13/2006	220.00	1600.00	552	0.67	1.35
813	1381.11	7/27/2006	222.22	1603.33	553	0.67	1.35
827	1381.11	8/10/2006	225.56	1606.67	553	0.67	1.36
841	1377.78	8/24/2006	235.56	1613.33	549	0.66	1.36
855	1376.11	9/7/2006	235.56	1611.67	548	0.66	1.37
869	1386.11	9/21/2006	228.89	1615.00	558	0.67	1.37
883	1390.00	10/5/2006	230.00	1620.00	562	0.68	1.37
897	1383.89	10/19/2006	231.11	1615.00	556	0.67	1.38
911	1377.78	11/2/2006	238.89	1616.67	549	0.66	1.38
925	1382.78	11/16/2006	235.56	1618.33	554	0.67	1.38
939	1386.11	11/30/2006	232.22	1618.33	558	0.67	1.39
953	1386.11	12/14/2006	235.56	1621.67	558	0.67	1.39
967	1385.56	12/28/2006	234.44	1620.00	557	0.67	1.39
981	1390.00	1/11/2007	233.33	1623.33	562	0.68	1.40
995	1375.56	1/25/2007	247.78	1623.33	547	0.66	1.40
1009	1383.89	2/8/2007	241.11	1625.00	556	0.67	1.40
1023	1395.56	2/22/2007	227.78	1623.33	567	0.68	1.41
1037	1388.33	3/8/2007	236.67	1625.00	560	0.68	1.41
1051	1387.22	3/22/2007	237.78	1625.00	559	0.67	1.41
1065	1398.33	4/5/2007	233.33	1631.67	570	0.69	1.42
1079	1397.78	4/19/2007	235.56	1633.33	569	0.69	1.42

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
1093	1402.78	5/3/2007	232.22	1635.00	574	0.69	1.42
1107	1402.22	5/17/2007	234.44	1636.67	574	0.69	1.43
1121	1396.67	5/31/2007	236.67	1633.33	568	0.69	1.43
1135	1407.78	6/14/2007	228.89	1636.67	579	0.70	1.43
1149	1403.33	6/28/2007	230.00	1633.33	575	0.69	1.43
1163	1406.11	7/12/2007	225.56	1631.67	578	0.70	1.44
1177	1402.78	7/26/2007	232.22	1635.00	574	0.69	1.44
1191	1405.56	8/9/2007	231.11	1636.67	577	0.70	1.44
1205	1391.11	8/23/2007	238.89	1630.00	563	0.68	1.44
1219	1391.11	9/6/2007	238.89	1630.00	563	0.68	1.45
1233	1397.78	9/20/2007	238.89	1636.67	569	0.69	1.45
1247	1400.56	10/4/2007	237.78	1638.33	572	0.69	1.45
1261	1403.33	10/18/2007	240.00	1643.33	575	0.69	1.45
1275	1413.33	11/1/2007	233.33	1646.67	585	0.71	1.46
1289	1409.44	11/15/2007	242.22	1651.67	581	0.70	1.46
1303	1406.11	11/29/2007	248.89	1655.00	578	0.70	1.46
1317	1402.78	12/13/2007	255.56	1658.33	574	0.69	1.46
1345	1407.22	1/10/2008	254.44	1661.67	579	0.70	1.47
1359	1406.11	1/24/2008	255.56	1661.67	578	0.70	1.47
1415	1402.22	3/20/2008	264.44	1666.67	574	0.69	1.48
1478	1400.00	5/22/2008	270.00	1670.00	572	0.69	1.49
1541	1399.44	7/24/2008	268.89	1668.33	571	0.69	1.50
1604	1407.22	9/25/2008	267.78	1675.00	579	0.70	1.50
1660	1408.33	11/20/2008	266.67	1675.00	580	0.70	1.51
1723	1418.33	1/22/2009	266.67	1685.00	590	0.71	1.52
1785	1416.67	3/25/2009	270.00	1686.67	588	0.71	1.52
1841	1422.78	5/20/2009	268.89	1691.67	594	0.72	1.53
1905	1424.44	7/23/2009	268.89	1693.33	596	0.72	1.54
1967	1422.22	9/23/2009	271.11	1693.33	594	0.72	1.54
2029	1425.56	11/24/2009	271.11	1696.67	597	0.72	1.55
2086	1418.89	1/20/2010	271.11	1690.00	591	0.71	1.55
2149	1416.11	3/24/2010	275.56	1691.67	588	0.71	1.56
2212	1422.22	5/26/2010	271.11	1693.33	594	0.72	1.56
2275	1425.56	7/28/2010	271.11	1696.67	597	0.72	1.57
2388	1442.78	11/18/2010	262.22	1705.00	614	0.74	1.57

Creep and Shrinkage Data for Specimen 48

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
0	563.33	9/21/2004	0.00	563.33	0	0.00	0.00
1	651.11	9/22/2004	-1.11	650.00	88	0.16	0.24
3	671.67	9/24/2004	0.00	671.67	108	0.19	0.34
6	688.89	9/27/2004	-2.22	686.67	126	0.22	0.41
8	703.89	9/29/2004	1.11	705.00	141	0.25	0.45
16	726.11	10/7/2004	5.56	731.67	163	0.29	0.55
22	758.89	10/13/2004	4.44	763.33	196	0.35	0.60
29	773.89	10/20/2004	11.11	785.00	211	0.37	0.65
44	806.67	11/4/2004	23.33	830.00	243	0.43	0.72
58	825.56	11/18/2004	31.11	856.67	262	0.47	0.78
73	846.67	12/3/2004	53.33	900.00	283	0.50	0.82
86	850.00	12/16/2004	63.33	913.33	287	0.51	0.85
100	859.44	12/30/2004	68.89	928.33	296	0.53	0.88
114	863.89	1/13/2005	74.44	938.33	301	0.53	0.91
128	877.22	1/27/2005	74.44	951.67	314	0.56	0.93
143	888.89	2/11/2005	81.11	970.00	326	0.58	0.95
157	885.00	2/25/2005	90.00	975.00	322	0.57	0.97
170	892.78	3/10/2005	92.22	985.00	329	0.58	0.98
184	903.89	3/24/2005	97.78	1001.67	341	0.60	1.00
198	903.33	4/7/2005	93.33	996.67	340	0.60	1.01
212	902.22	4/21/2005	91.11	993.33	339	0.60	1.02
226	914.44	5/5/2005	92.22	1006.67	351	0.62	1.04
240	906.67	5/19/2005	100.00	1006.67	343	0.61	1.05
254	913.89	6/2/2005	97.78	1011.67	351	0.62	1.06
268	907.22	6/16/2005	101.11	1008.33	344	0.61	1.07
282	910.56	6/30/2005	101.11	1011.67	347	0.62	1.07
296	906.11	7/14/2005	105.56	1011.67	343	0.61	1.08
310	906.11	7/28/2005	108.89	1015.00	343	0.61	1.09
324	906.11	8/11/2005	112.22	1018.33	343	0.61	1.10
338	908.33	8/25/2005	113.33	1021.67	345	0.61	1.10
352	905.00	9/8/2005	116.67	1021.67	342	0.61	1.11
366	917.78	9/22/2005	108.89	1026.67	354	0.63	1.11
380	918.33	10/6/2005	113.33	1031.67	355	0.63	1.12
394	921.11	10/20/2005	112.22	1033.33	358	0.64	1.12
408	931.67	11/3/2005	120.00	1051.67	368	0.65	1.13
422	933.89	11/17/2005	117.78	1051.67	371	0.66	1.13
436	926.11	12/1/2005	128.89	1055.00	363	0.64	1.14
450	926.67	12/15/2005	130.00	1056.67	363	0.64	1.14
469	922.78	1/3/2006	135.56	1058.33	359	0.64	1.15
478	936.67	1/12/2006	136.67	1073.33	373	0.66	1.15
492	946.67	1/26/2006	133.33	1080.00	383	0.68	1.16

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
506	947.22	2/9/2006	131.11	1078.33	384	0.68	1.16
520	946.67	2/23/2006	136.67	1083.33	383	0.68	1.16
534	937.22	3/9/2006	137.78	1075.00	374	0.66	1.17
548	948.33	3/23/2006	133.33	1081.67	385	0.68	1.17
562	952.78	4/6/2006	135.56	1088.33	389	0.69	1.17
576	939.44	4/20/2006	138.89	1078.33	376	0.67	1.17
590	953.33	5/4/2006	136.67	1090.00	390	0.69	1.18
604	957.78	5/18/2006	138.89	1096.67	394	0.70	1.18
618	952.78	6/1/2006	135.56	1088.33	389	0.69	1.18
632	947.78	6/15/2006	138.89	1086.67	384	0.68	1.19
646	948.89	6/29/2006	137.78	1086.67	386	0.68	1.19
660	945.00	7/13/2006	136.67	1081.67	382	0.68	1.19
674	950.00	7/27/2006	140.00	1090.00	387	0.69	1.19
688	950.56	8/10/2006	141.11	1091.67	387	0.69	1.19
702	952.78	8/24/2006	145.56	1098.33	389	0.69	1.20
716	948.89	9/7/2006	144.44	1093.33	386	0.68	1.20
730	950.00	9/21/2006	146.67	1096.67	387	0.69	1.20
744	954.44	10/5/2006	145.56	1100.00	391	0.69	1.20
758	950.56	10/19/2006	144.44	1095.00	387	0.69	1.20
772	958.89	11/2/2006	147.78	1106.67	396	0.70	1.21
786	951.11	11/16/2006	152.22	1103.33	388	0.69	1.21
800	951.11	11/30/2006	148.89	1100.00	388	0.69	1.21
814	960.00	12/14/2006	150.00	1110.00	397	0.70	1.21
828	955.00	12/28/2006	150.00	1105.00	392	0.70	1.21
842	955.00	1/11/2007	150.00	1105.00	392	0.70	1.21
856	965.00	1/25/2007	153.33	1118.33	402	0.71	1.22
870	958.33	2/8/2007	153.33	1111.67	395	0.70	1.22
884	957.22	2/22/2007	141.11	1098.33	394	0.70	1.22
898	958.89	3/8/2007	147.78	1106.67	396	0.70	1.22
912	957.78	3/22/2007	152.22	1110.00	394	0.70	1.22
926	964.44	4/5/2007	148.89	1113.33	401	0.71	1.22
940	966.67	4/19/2007	150.00	1116.67	403	0.72	1.22
954	973.33	5/3/2007	150.00	1123.33	410	0.73	1.23
968	969.44	5/17/2007	148.89	1118.33	406	0.72	1.23
982	960.56	5/31/2007	147.78	1108.33	397	0.71	1.23
996	960.56	6/14/2007	151.11	1111.67	397	0.71	1.23
1010	965.00	6/28/2007	150.00	1115.00	402	0.71	1.23
1024	965.00	7/12/2007	146.67	1111.67	402	0.71	1.23
1038	962.22	7/26/2007	151.11	1113.33	399	0.71	1.23
1052	964.44	8/9/2007	152.22	1116.67	401	0.71	1.23
1066	971.11	8/23/2007	158.89	1130.00	408	0.72	1.24

Age	Creep PLUS Elastic Strain	Creep dates	Shrinkage Only	Average SH+CR	Creep Only	Experimental Creep Coefficient	Estimated CEB 90-99 Creep Coefficient
1080	971.11	9/6/2007	158.89	1130.00	408	0.72	1.24
1094	973.89	9/20/2007	154.44	1128.33	411	0.73	1.24
1108	975.00	10/4/2007	156.67	1131.67	412	0.73	1.24
1122	976.11	10/18/2007	155.56	1131.67	413	0.73	1.24
1136	975.56	11/1/2007	154.44	1130.00	412	0.73	1.24
1150	978.33	11/15/2007	160.00	1138.33	415	0.74	1.24
1164	977.22	11/29/2007	161.11	1138.33	414	0.73	1.24
1178	978.33	12/13/2007	166.67	1145.00	415	0.74	1.24
1206	991.11	1/10/2008	158.89	1150.00	428	0.76	1.24
1220	1000.56	1/24/2008	154.44	1155.00	437	0.78	1.25
1276	992.22	3/20/2008	167.78	1160.00	429	0.76	1.25
1339	981.67	5/22/2008	176.67	1158.33	418	0.74	1.25
1402	991.11	7/24/2008	168.89	1160.00	428	0.76	1.26
1465	1004.44	9/25/2008	165.56	1170.00	441	0.78	1.26
1521	1002.78	11/20/2008	168.89	1171.67	439	0.78	1.26
1584	1010.00	1/22/2009	166.67	1176.67	447	0.79	1.26
1646	1012.22	3/25/2009	164.44	1176.67	449	0.80	1.26
1702	1013.33	5/20/2009	166.67	1180.00	450	0.80	1.27
1766	1018.89	7/23/2009	164.44	1183.33	456	0.81	1.27
1828	1025.56	9/23/2009	164.44	1190.00	462	0.82	1.27
1890	1022.22	11/24/2009	167.78	1190.00	459	0.81	1.27
1947	1024.44	1/20/2010	165.56	1190.00	461	0.82	1.27
2010	1023.33	3/24/2010	166.67	1190.00	460	0.82	1.28
2073	1033.33	5/26/2010	166.67	1200.00	470	0.83	1.28
2136	1031.11	7/28/2010	168.89	1200.00	468	0.83	1.28
2256	1016.11	11/25/2010	178.89	1195.00	453	0.80	1.28
2317	1018.33	1/25/2011	176.67	1195.00	455	0.81	1.28
2376	1018.89	3/25/2011	184.44	1203.33	456	0.81	1.28