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**Final Report** **September 2009**

# DURABILITY AND MECHANICAL PROPERTIES OF TERNARY BLEND CONCRETES

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**Sponsor:**
Florida Department of Transportation (FDOT)
Michael Bergin, P.E – Project Manager

**Contract:**
UF Project No. 00050495
FDOT Contract No. BD545-35

UF

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Technical Report Documentation Page

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| 4. Title and Subtitle<br>Durability and Mechanical Properties of Ternary Blend Concretes | | 5. Report Date<br>September 2009<br>6. Performing Organization Code |
| 7. Author(s)<br>Van Etten, N., Vivas, E., Nash, T, and Hamilton, H. R. | | 8. Performing Organization Report No.<br>00050495 |
| 9. Performing Organization Name and Address<br>University of Florida<br>Department of Civil & Coastal Engineering<br>P.O. Box 116580<br>Gainesville, FL 32611-6580 | | 10. Work Unit No. (TRAIS)<br>11. Contract or Grant No.<br>BD545-35 |
| 12. Sponsoring Agency Name and Address<br>Florida Department of Transportation<br>Research Management Center<br>605 Suwannee Street, MS 30<br>Tallahassee, FL 32301-8064 | | 13. Type of Report and Period Covered<br>Final Report<br>10/26/04-9/30/09<br>14. Sponsoring Agency Code |
| 15. Supplementary Notes | | |

16. Abstract

The FDOT Structures Design Guidelines required that concrete piles placed in a marine environment must contain ordinary portland cement (PC), fly ash (FA), and silica fume (SF). This blend of PC and supplementary cementitious materials (SCM) is primarily intended to produce a durable concrete that is highly resistant to the penetration of chlorides.

This research project evaluated the durability of concrete made with a ternary blend of cementitious materials that included ordinary portland cement (PC), fly ash (FA), and blast furnace slag (S) in comparison to the current practice of using silica fume. Thirty-two ternary and binary mixtures (not including duplicate mixtures) containing varying quantities of FA, blast furnace slag (S), and SF were prepared to evaluate their effect on the mechanical and durability attributes. The ternary mixtures included PC+FA+S with FA being varied from 10% to 40% and S from 20% to 60% by weight of total cementitious materials. In addition, control mixtures of 80%PC+20%FA and 73%PC+20%FA+7%SF were prepared as control mixtures. Half of the mixtures were Class IV and half were Class V mixtures. In addition, this research also compared mixtures prepared with PC that met the ASTM C150 standard and to those with PC that met the AASHTO M85 standard prior to harmonization.

Mechanical tests were conducted that included compressive strength, modulus of elasticity, compressive creep, split tensile strength, and modulus of rupture. The durability tests conducted were rapid migration test, corrosion of embedded steel, surface resistivity, and bulk diffusion. Finally, X-ray Diffraction (XRD) was used to examine the microstructure of the hydration process of these materials.

Mixtures with higher FA (30 to 40% by replacement weight) content had delayed gains in compressive strength. Increasing quantities of S (and associated decrease of PC) produced a slight decrease (<10%) in average seven-day compressive strength. Specified 28-day concrete strength requirements of Class IV (5,500 psi) and Class V (6,500 psi), however, were exceeded by all of the mixtures. The resistance to chloride penetration of all of the concrete mixtures containing both FA and S was improved compared to that of the control mixture (FA only).

| 17. Key Word | 18. Distribution Statement | | |
|---|---|---|---|
| Supplementary cementitious materials, concrete durability, ternary blend, slag cement, silica fume | No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA, 22161 | | |
| 19. Security Classif. (of this report)<br>Unclassified | 20. Security Classif. (of this page)<br>Unclassified | 21. No. of Pages<br>220 | 22. Price |

**Form DOT F 1700.7** (8-72) Reproduction of completed page authorized

# ACKNOWLEDGMENTS

The authors would like to acknowledge and thank the Florida Department of Transportation for providing the funding for this research project. This project was a collaborative effort between the University of Florida and the FDOT State Materials Office Research Laboratory (Gainesville). Special thanks to Mike Bergin, Charles Ishee, and Mario Paredes, FDOT State Materials Office, for their guidance and technical support during the course of the project. Moreover, the authors would like to thank the FDOT State Materials Office Research Laboratory personnel for constructing the specimens and conducting materials testing, especially Charlotte Kasper, Phillip Armand and Sandra Bober, whose help was critical to the completion of this project. The assistance of Elizabeth (Beth) Tuller, Robert (Mitch) Langley and Richard DeLorenzo is gratefully acknowledged. The authors would also like to thank Dr. Valentin Craciun for his guidance and expertise in the XRD analysis and to the Major Analytical Instrumentation Center of the University of Florida Department of Materials Science and Engineering for the use of the XRD instrumentation.

# EXECUTIVE SUMMARY

This research project evaluated the use of a ternary blend of cementitious materials that included ordinary portland cement (PC), fly ash (FA), and blast furnace slag (S). The focus of this research was on the durability of concrete produced with varying relative quantities of these materials. Thirty-two ternary and binary mixtures (not including duplicate mixtures) containing varying quantities of FA, S, and SF were prepared to evaluate their effect on the mechanical and durability attributes. The ternary mixtures included PC+FA+S with FA being varied from 10% to 40% and S from 20% to 60% by weight of total cementitious materials. In addition, control mixtures of 80%PC+20%FA and 73%PC+20%FA+7%SF were prepared as control mixtures. Half of the mixtures were Class IV and half were Class V mixtures. In addition, this research also compared mixtures prepared with PC that met the ASTM C150 standard and to those with PC that met the AASHTO M85 standard prior to harmonization.

Mechanical tests were conducted that included compressive strength, modulus of elasticity, compressive creep, split tensile strength, and modulus of rupture. The durability tests conducted were rapid migration test, corrosion of embedded steel, surface resistivity, and bulk diffusion. Finally, X-ray Diffraction (XRD) was used to examine the microstructure of the hydration process of these materials.

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# 1 INTRODUCTION

Until recently, the FDOT Structures Design Guide required that concretes placed in a marine environment must contain ordinary portland cement (PC), fly ash (FA), and silica fume (SF). Current provisions allow substitution of metakaolin or ultrafine FA for SF. This blend of PC and supplementary cementitious materials (SCM) is primarily intended to produce a durable concrete that is highly resistant to the penetration of chlorides. Silica fume's availability, cost, and the potential adverse affect on workability have led to the search for other blends to achieve the chloride resistance necessary to ensure that concrete placed in a marine environment will protect the steel for the service life of the structure. Furthermore, in the interest of sustainable construction practice, other forms of SCM that are more energy efficient to produce than PC should be considered.

Ternary mixes composed of PC, FA, and blast furnace slag (S) have been shown to provide similar mechanical properties to those seen in concrete produced with SF (Li and Zhao 2002). The following report details a study in which concrete mixtures were prepared with varying amounts of S and FA to evaluate the effect on the mechanical and durability attributes comparable to that of PC, FA, and SF. In addition, this research also compared mixtures prepared with PC that met the ASTM C150 standard with mixtures made with PC that meets the AASHTO M85 standard prior to harmonization. Finally, this research also examined the microstructure of the hydration process of these materials.

The report is organized as follows. Chapter two presents the research objectives. Chapter three includes a literature review that focuses on the effect of each SCM in concrete as well as the work involving the use of SCM to formulate ternary blends of cementitious materials. The use of X-Ray Diffraction is also reviewed. Chapter four describes the concrete mixture design and proportions. Chapter five details the test procedures and chapter six provides results and discussion. Chapter seven compiles and compares the results of the tests for mechanical properties and durability.

## 2 RESEARCH OBJECTIVES

The primary objective of this research was to evaluate the mechanical and durability properties of PC-FA-S mixtures in relation to those of PC-FA-SF mixtures. The primary interest is in the resistance to chloride penetration in a harsh marine environment. In addition, mixtures made with PC conforming to the differing specifications of ASTM C150 and AASHTO M85 will be evaluated. Finally, the development of the microstructure during curing will be examined using X-ray diffraction.

# 3 LITERATURE REVIEW

This literature review focuses on the current knowledge available related to the use of Portland cement (PC) and the addition or substitution of two supplementary cementitious materials (SCM), which are typically used to enhance the mechanical performance or durability of the concrete. This literature review provides a brief description of Fly Ash (FA), Blast Furnace Slag (S) and Silica Fume (SF) along with their typical effect on concrete material properties. Next, literature that covers the use of ternary blend concretes is reviewed. Finally, the ASTM C150 and AASHTO M85 PC specifications are compared.

## 3.1 *FLY ASH*

Fly ash (FA) is created by the precipitation of exhaust gases of coal burning power stations. FA particles are generally spherical in shape, and glassy in texture. The components of FA particles are oxides of silicon, aluminum, iron and calcium. When compared to PC only concretes, the addition of FA has been found to reduce the compressive strength capacity of concrete mixtures at early testing ages, < 28 days (Neville 1995). However, as the age of the concrete increases past 91 days, the compressive strength of concretes containing FA surpasses the compressive strengths of PC only mixtures (Neville 1995). The increases in the concrete compressive strength are created as reacted FA begins to fill the voids within the concrete. The increased density created from reacted FA provides concrete with higher compressive strengths, flexural capacities, and resistance to creep and shrinkage effects. The denser concrete also decreases the rate at which chlorides can enter the interior concrete which provides increased durability for the concrete when placed in marine environments.

The modulus of elasticity of a FA concrete is slightly lower at early ages than PC only concretes. The ultimate modulus of elasticity of FA concrete has been found to be slightly higher than PC only concrete (Land and Best 1982). Land and Best 1982 also state the effects of FA on the overall elastic modulus of a concrete mixture are negligible compared to the effects seen by the type of PC and aggregate used. It is thought that any increases in elastic modulus are due to increases in compressive strength and not chemical changes created by the addition of FA.

When constant load is applied to concrete, typical for creep analysis, FA concretes generally exhibit smaller long term deflections due to the late strength gain created by FA (Cook 1983).

### 3.2 *Blast Furnace Slag*

Blast furnace slag (S) is a byproduct created from the production or refinement of iron or both. Blast furnace slag is removed from the molten iron, rapidly cooled and then ground to a specific fineness so that it can be used as a cementitious material. Typically, silica, calcium, aluminum, magnesium and oxygen constitute over 95% of the chemical composition of S (ACI 233R-03). S reacts slowly in water and needs activation by alkaline compounds, such as $Ca(OH)_2$ provided by portland cement. The principal hydration product formed from mixtures of S and PC and water is essentially the same as that of PC hydration, which is calcium-silicate hydrate (CSH) (ACI 233R-03). Similar to FA, compressive strength gains created from the addition of S are initially very slow due to coatings of silica and alumina on each S particle. When compared to PC only concrete, the use of Grade 120 S reduces the compressive strength at early ages ( < 7 days), and increases compressive strength after 7 days (Hogan and Muesel 1981).

The denser concrete matrix created from the reaction of S and water improves the bond at the aggregate-paste interface. The increased aggregated-paste interface has been found to increase the tensile strength and modulus of rupture within concrete mixtures (Hogan and Muesel 1981). However, Neville (1995) has stated that the addition of S does not significantly alter the tensile strength of a concrete beyond the relationship between improved compressive strength and tensile strength.

S causes a reduction in the modulus of elasticity for air cured concrete mixes. Mindess et al. (2003) reports that the reduction in elastic modulus is caused by inadequate curing of the interior concrete, which results in high porosity. However, Brooks et al. (1992) has suggested that water cured S concrete does not exhibit any improvements in elastic modulus compared to PC only concretes at early ages. Larger modulus of elasticity values have been found for S concretes moisture cured for periods beyond 28 days.

The increase in interior porosity described by Mindess et al. (2003) will also result in larger creep and shrinkage effects in S and PC concrete mixtures. As S increases the interior porosity, water found within the concrete specimen can escape to the surface at a higher rate which will cause increased creep and dry shrinkage effects at early ages. However, at later ages, shrinkage and creep are not adversely affected by the addition of S into a concrete mixture (Neville 1995).

As previously discussed the addition of S into a concrete will eventually produce a denser microstructure of hydrated cement paste. Furthermore, as the S content increases, the permeability of the concrete mixture decreases (Hooton and Emery 1990). Therefore, the concrete's ability to resist sulfate attack is increased as S content is increased. The increased concrete matrix density created by S in well hydrated concrete mixtures reduces the penetrability of chloride ions and depth of carbonation (Bakker 1980). Resisting both of these mechanisms helps reduce the amount of corrosion experienced by internal reinforcing steel (Hogan and Meusel 1981).

### 3.3 *Silica Fume*

Silica fume (SF) is a by-product created during the production of silicon metals or ferrosilicone alloys. SF is a highly reactive pozzolanic material that is typically used to replace PC in concrete mixtures. While the addition of SF has been found to be advantageous for both the mechanical and the durability properties in concrete mixtures, its popularity is not widespread due to its high cost and limited production.

Concretes mixed with SF have been found to exhibit higher compressive strengths before 28 days, while providing negligible increases in compressive strength after 28 days (Khatri 1995). However, the moisture conditions present at curing have been found to produce varying long term effects on SF concretes. Wet cured SF concrete gained little compressive strength capacity for up to3 years of age after the initial gain in strength seen at 28 days. Dry cured concrete shows decreasing compressive strengths after the peak value was reached at 3 months (Neville 1995). According to these findings, it is speculated that binary mixtures containing SF and PC have a tendency to dry out.

SF does produce significant changes on flexural and splitting tensile behavior of a concrete beyond the standard proportionality between compressive strength and tensile strength (Luther and Hansen 1989). Concrete that replaces 20% of PC with SF have a typical compressive strength to flexural strength ratios ranging from 0.13 to 0.15. The splitting tensile strength at various ages was found to range from 5.8 to 8.2% of the compressive strength (Hooton 1993). The creep and shrinkage characteristics of concrete are improved by a 5% replacement of PC with SF (Houde et al 1989).

The addition of SF affects the hardened properties of concrete by producing a more homogenous pore structure, decreasing the size of capillary pores and producing a more disconnected pore structure (Neville 1995). As permeability within the concrete microstructure is reduced, the concrete has a greater resistance to chloride penetration. An 8% substitution of PC in a 0.40 water to cement ratio concrete caused the diffusion coefficient to decrease by a factor of 7 (Whiting and Detwiler 1998). The reduction in permeability created by SF has also been found to increases the resistance to sulfate attack in concrete mixtures (Khatri et al 1997). However, an additional increase in sulfate resistance occurs from the pozzolanic reactions with SF as there is a large consumption of calcium hydroxide, the major component in sulfoaluminate corrosion (Mindess et al 2003).

## 3.4 *EFFECTS OF TERNARY BLENDS ON CONCRETE PERFORMANCE*

There are two main reasons to blend SCM (Nehdi 2001). The first is to take advantage of particle packing. The use of a SCM to ensure particle sizes are well distributed produces an improved density and reduced pore structure. This increases the compressive strength and resistance to chloride penetration. The second advantage is the synergistic effect of the chemical reactions that are created when using pozzolanic materials.

Prior research into the use of ternary blends composed of PC, FA, and S is limited. The majority of research into the use of ternary blends has involved some combination with SF (PC-SF-FA or PC-SF-S) (Bleszynski et al 2002, Nehdi and Sumner 2002, Popovics 1993, Long et al 2002, Shehata and Thomas 2002, Kahn and Lynsdale 2002, Kahn et al 2002, Thomas et al 1999, Lane and Ozyildirim 1999, Bágel 1998, Jones et al 1997, Menendez et al 2003, Isaia et al 2003, Domone and Soutsos 1995). Other work includes quaternary blends containing all three of the primary SCM (SF-FA-S) (Nehdi and Sumner 2002). SCMs not commonly used in Florida such as limestone fillers (Menendez et al 2003) or rice husk ash (Isaia et al 2003) have also been considered.

The use of ternary blends in high performance concretes is a relatively unexplored field compared to vast research already conducted on binary blends. Currently, there are no code requirements that specify the optimum mixing proportions of ternary blends. Therefore, finding the optimum proportions of ternary blend concretes is often obtained after the testing of numerous trial mixtures (Erdem and Kirca 2007). However, it is reported that after an optimal ternary mixture has been found, the use of ternary blends can provide mechanical and durability properties similar to SF, and PC binary blends. In addition to consideration of mixing proportions, it is recommended that ternary blends should be a combination of low and high surface area supplementary cementitious materials, such as FA and SF (Mehta and Gjoerv 1982).

### 3.4.1 FLY ASH AND SILICA FUME TERNARY BLENDS

While the addition of FA in concrete mixes is becoming common place in modern engineering, the lack of early strength in FA and PC concretes is still a concern for engineers. Meanwhile, SF has been shown to provide a source of early development strength. However, the use of SF in modern concrete blends is limited due to the high costs of SF itself and the high quantities of super-plasticizer needed to provide adequate workability. Fortunately, research has shown that the combinations of certain additions may provide more benefits for concrete when compared to the use of a single admixture.

Compressive strengths of concretes containing a combination of PC, FA, and SF produce higher compressive strengths at 28 days and later than mixtures containing only PC. However, at 3 and 7 days, ternary mixtures containing both FA and SF produce compressive strengths lower than PC only concretes (Khatri et al 1995). The pozzolanic activity of SF - FA ternary blends, and PC only concrete mixtures were measured through the analysis of the free lime content in each mixture. It was discovered that mixtures containing SF and FA indicated signs of higher pozzolanic activity at 7 and 28 days than PC only concretes (Mehta and Gjoerv 1982).

The flexural strength and elastic modulus of ternary blends increase due to the addition of FA and SF ternary blends. However, all gains in flexural strength and elastic modulus were found to be proportional with the gains found in compressive strength (Khatri et al 1995). The inclusion of FA on mixtures containing SF and PC show superior creep characteristics than those of PC only concrete (Khatri et al 1995). The addition of FA on SF and PC concrete mixtures produces decreased specific creep values than PC only mixtures due to the increases in compressive strength and modulus of elasticity. The calculated specific creep values for SF, FA, and PC ternary blends still produce values higher than SF and PC binary blends. Despite the decrease in specific creep created by the addition of SF and FA in PC concrete mixtures, it has been found that the percentage of FA added to SF and PC concrete mixtures does not affect the specific creep values of a mixture (Khatri et al 1995).

The combination of FA, SF and PC in ternary blends is an effective means to reduce the 2 year pore expansion of a concrete mix below the 0.04% benchmark specified in the Standard Concrete Prism Test (CSA A23.2-14A), which is similar to ASTM C1293 (Shehata and Thomas 2002). The decrease in pore expansion seen by the addition of FA into SF and PC concretes has been found to retard the Alkali Silica Reaction that increases the porosity of concrete with time. The combined use of SF with PC in concrete has been found to produce lower alkalinity levels at early ages, however, SF and PC binary mixtures release an alkali solution back into the concrete due to secondary reactions (Berube et al 1998). Increased alkali concentrations in concrete could potentially cause swelling and expansion in the interior concrete, resulting in cracking. The cracking caused by high alkalinity in the concrete would provide less resistance to corrosion (Neville 1995).

### 3.4.2 Fly Ash and Slag Ternary Blends

Ternary blends containing Fly Ash (FA) and Slag (S) have become increasingly popular as a substitute for Silica Fume (SF) in producing high performance concrete (Li and Zhao 2003). While both S and FA are slower reactive supplementary cementitious materials than SF, S typically reacts faster than FA resulting in higher earlier strengths than FA and PC binary concretes. Unfortunately, there is a dearth of published research papers that present results of the mechanical and durability properties of FA and S ternary blends.

The compressive strength gains seen in FA and S ternary blends at early ages (<28 days) has been found to be similar to PC only concrete. At later testing ages, FA and S ternary blends have been found to out perform PC only concretes. Unfortunately, FA and S ternary blends do not reach the compressive strengths of FA and PC concretes (Li and Zhao 2003). Li and Zhao also report that FA, S, and PC ternary blends have higher modulus of elasticity compared to FA and PC concretes.

The concretes ability to protect against sulfate attack has been found to depend on the permeability performance of the concrete mixture. Ternary blends containing FA, S and PC have been found to outperform PC only and FA and PC concrete mixtures. The increase in durability performance is caused by the ternary blend's ability to pore refinement, and the generation of discontinuities in the pore structure caused by strong pozzolanic reaction (Li and Zhao 2003).

Haque and Chulilung (1990) investigated the use of 'slagment' (65% PC, 35% S) to manufacture structural grade concrete, to characterize ternary blends by replacing a portion of the slagment with FA, to provide performance data of the slagment and slagment with FA under inadequate and non-standard curing conditions, and to explore the effect of specimen size on strength under standard and non-standard curing conditions. Four curing conditions were considered: control; fog curing; 7 days fog curing; and sealed fog curing. The results reported focused on effects on compressive strength, effects of curing, effects of specimen size, and water penetration. It was found that samples cast with slagment increased in strength faster than with PC concrete and that replacement of slagment with FA decreased strength. Maximum water penetration was observed in mixtures of 65% slagment and 35% FA.

Douglas and Pouskouleli 1991 attempted to find empirical equations and ternary diagrams from which the compressive strength may be predicted for any combination of PC, S, and FA. Mixtures with 50% PC and 50% S mixtures produced higher compressive strengths than 50% PC and 50% FA. Mixtures with 50% S and 50% FA performed better at 28 days and beyond. It was observed from predicted and experimental results that a 66% PC, 17% S, 17% FA performed better than 100% PC after 28 days. It was also observed that a 17% PC, 66% S, 17% FA mixture performed better than a 17% PC, 17% S, 66% FA mix, especially at 28 and 91 days.

Domone and Soutsos (1995) objective was to study the effects of FA and S on the workability, heat of hydration, and long-term strength of high-strength concretes. Since the high strength necessitates a lower binder-water ratio, FA+S+PC and FA+S+PC+SF mixes were tested at water-binder ratios from 0.20 to 0.38. They found that high-slump mixes can be made with a water-binder ratio down to 0.2. High slump, however, is insufficient for description of workability of high-strength concretes in practice. Heat of hydration thermal effects were reduced through the use of FA and S. Long-term strengths of FA and S mixtures may not reach that of 100% PC mixtures when the water-binder ratio is reduced to 0.26 and below. The addition of SF increased the strength of all mixes.

Dehuai and Zhaoyuan (1997) Using seven design points and three cubic polynomial models, the authors established strength predicting equations of mortars with ternary blends by the simplex-centroid design. The simplex-centroid design, introduced by Scheffe in 1958 and later studied for strength effects by Douglas and Stanish, was used with upper and lower bounds of PC, S, and FA proportion. Five experimental checkpoints were used to verify the precision of the strength-predicting equations. At seven days the compressive strength of mortars with a water-cement ratio of 0.44 was almost proportional to the proportion of PC present. S contributed the most to strength gain at both 7 to 28 days and at 28 to 56 days. FA and PC contributed the least, respectively.

### *3.5 ASTM and AASHTO Specifications for Portland Cement*

In general, five common classes of cements are available to meet different physical and chemical requirements (Table 1).

Table 1 Portland cement classification

| Cement Type | Uses |
|---|---|
| I | General purpose |
| II | Moderate resistance to sulfate attack and heat of hydration |
| III | High-early strength |
| IV | Low heat of hydration |
| V | High sulfate resistance |

AASHTO and ASTM both have specifications for the physical and chemical attributes of PC. In 2007, the AASHTO M85 and ASTM C150 cement standards were harmonized. Prior to that, however, AASHTO M85 provided the following criteria that were not in ASTM C150:

- A maximum blaine fineness limit (400 $m^3$/gm) for all cement classes
- A maximum tricalcium silicate limit of 58% for Type II cement
- A minimum silicon dioxide limit of 20% for Type II cement
- A processing additions limit of 1% for all cement classes
- No additional amount limestone may be added (ASTM C150 standard allows the addition of up to 5% of high-quality limestone fines in the production process)

By designating a maximum fineness limit for all PC classes, AASHTO M85 ensures coarser PC particles are used in concrete mixtures. The fineness of PC particles has been found to hydrate more rapidly, resulting in higher early strengths. However, the hydration products formed will, in effect, make it more difficult for hydration to proceed at later ages, leading to an ultimate strength lower than desired in some cases (Gebhart 1995). Due to this fact, concretes mixed with AASHTO cements are expected to produce weaker compressive strengths at earlier ages, but have higher ultimate compressive strengths.

This research project used cements that were produced under the old specifications to determine if there were effects on the mechanical and durability properties of the concretes produced using these cements.

## *3.6 MICROSTRUCTURE*

Microstructural examination of ordinary Portland cement mixes (PC) and blended mixes with a single replacement material have been carried out by a number of researchers (Hill 2002, Saeki and Monteiro 2005, Ramlochan et al 2004, Turanli and Bektas 2005, Pattanaik et al 2004, Temiz and Karakeci 2002, Mindess et al 2003). Little research, however, has been conducted on ternary blends at the microstructural level.

In general, early pozzolanic reactions from highly reactive SCM such as SF consumes CH produced by PC (Saeki and Monteiro 2005, Turanli and Bektas 2005, Pattanaik et al 2004, Temiz and Karakeci 2002, Mindess 2001, Diamond 2001, Lea 1970, Taylor 2003). This reaction typically yields the more desirable C-S-H. Overall, however, Saeki (2005) indicates that a "healthy balance must be reached whereby a concrete mix has an appropriate level of admixtures but not at levels that compromise the beneficial effects of calcium hydroxide."

The goal of the microscopy work is examine the microstructural effect and CH consumption/production within a ternary blend mix using varying relative proportions of Class F FA and S. Data from x-ray diffraction (XRD) will be used to evaluate the possible benefits and/or detriments of ternary blends based on the amount of CH in each mix.

## 3.7 Powder X-ray Diffraction

About 95% of all solid material can be defined as crystalline and concrete is one such material. As the water interacts with the cement, chemical reactions take place that form crystalline and amorphous structures, which ultimately comprise the hardened paste. Which crystals and how they form brings us one step closer to understanding the underlying properties of concrete microstructures.

One way to analyze such microstructures and their formation is through powder x-ray diffraction (XRD). XRD is in instrumental technique that uses a collimated beam of x-rays to uniquely identify the crystalline phases in materials. Overall, it is a fast and reliable method of mineral and crystal identification, accompanied with the capabilities of determining mineral proportions, degree of crystallinity and structural information. However, with all its capabilities, XRD does not provide the quantitative information such that energy dispersive x-ray spectroscopy (EDS) compositional analysis would, nor the qualitative information that can be obtained from the scanning electron microscope.

### 3.7.1 Theory and Methodology

Three-dimensional crystal structures are defined by their regular, repeating planes of atoms that form a lattice. When a beam of x-rays interact with the planes of the lattice, part of the wave is scattered constructively and creates a unique response from the x-rays, which is dependent on the lattice structure.

The x-rays themselves are generated within a sealed tube that is under vacuum as shown on the left side of Figure 1. Inside this tube, a current is applied to a filament. Electrons accelerated by the applied voltage are driven toward a metal target, commonly made of copper. The x-rays, which have a wavelength that is characteristic of the target is then collimated into a beam and directed onto the surface of the sample. After interacting with the samples, the x-ray signal is detected by a gas-proportional counter.

Figure 2 shows the schematic of a counter filled with a gas, like Xenon, with a wire down the center, which is under 1.5 – 2.0 kV. The gas is ionized by the incident photons and the electrons are accelerated toward the wire affecting its resistance. This signal is then converted into an amplified voltage and count rate. The gas is ionized by the incident x-ray photons. This accelerates the electrons toward the wire effecting its resistance, which is read and converted into a count rate.

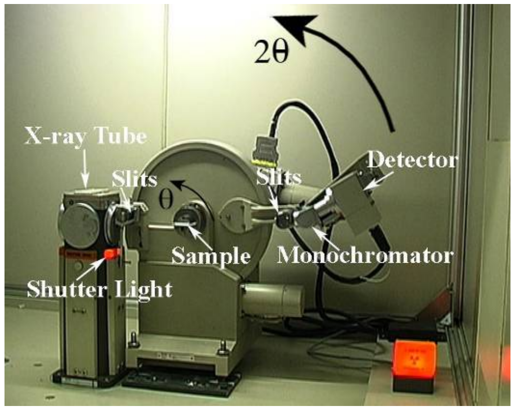



Figure 1 General schematic of a powder x-ray diffraction instrument

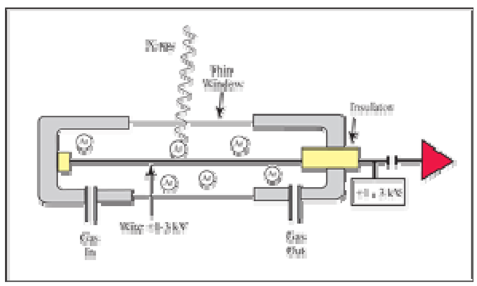



Figure 2 Gas-proportional counter filled with a gas and a charged wire

The angle between the x-ray source, the sample and the detector changes as the detector moves around the sample to pre-set limits. Changing the angle creates different interactions of the x-rays and the crystal lattice of the sample. This information creates a typical x-ray diffraction scan like the one shown in Figure 3.

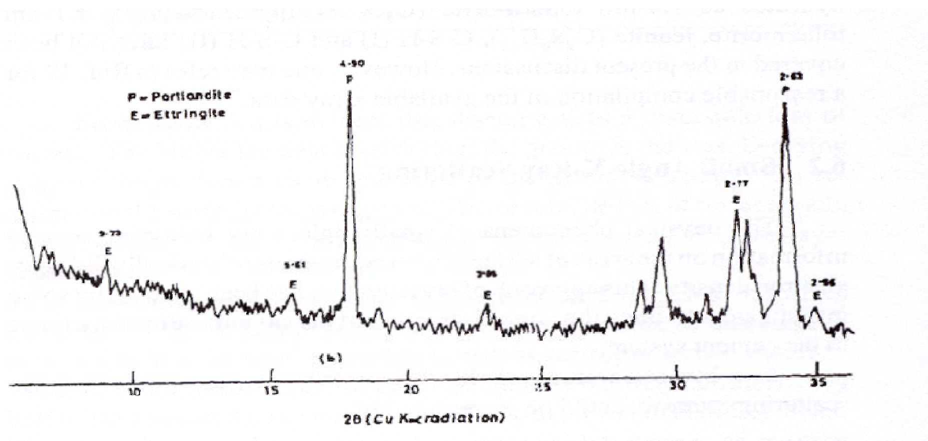



Figure 3 Typical x-ray diffraction pattern of hydrated OPC paste for 1-day

Bragg's Law describes the relationship for the scattering angles and the spacing between the planes of the atom scan with the following equation:

$$n\lambda = 2d \sin\theta \qquad \text{Equation 1}$$

where n is an integer for the order of the diffracted beam, λ is the wavelength of the incident x-ray beam, d is the distance between adjacent planes of atoms (referred to a d-spacings), and Θ is the angle of incidence of the x-ray beam. Figure 4 shows the general relationship of Bragg's Law as it interacts with planes of a lattice. The position, shape, intensities, and d-spacings of peaks like the ones shown in Figure 3 each have a unique "fingerprint" that can be compared to a reference material; with such information, the identification of a material can be made with confidence.

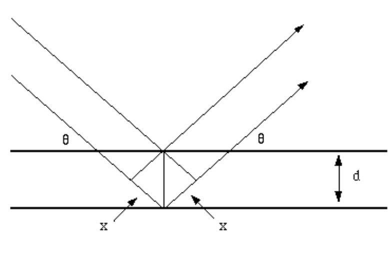



Figure 4 General schematic of Bragg's Law relationship; showing the incident beam entering at angle Θ and then being reflected off of a lattice plane with spacing d.

### 3.7.2 Sources of Error

There are several sources of error that can occur starting with the sample preparation and continuing on to the actual scanning of the sample. The following are some sources of error that one should be aware of prior to scanning a sample and while interpreting XRD results.

- Grinding
  - Too coarse results in sharp and intense reflections
  - Too fine results in peak broadening on some or all the peaks
  - Differential grinding
    - Non-flat surface
    - Different grain sizes
  - Sieve to ensure grain size and separate the multi-component materials
- Sample Packing
  - Diffraction is from a volume, not just the surface
  - Loose samples can have transparency effects
- Surface
  - Roughness
  - Curvature
  - Both can effect the peak positions and breadths of the reflections
- Sample Mounting
  - Sample area
    - Reflection positions and intensities
  - Position
    - Give false reflections as a result of the sample holder
- Sample thickness
  - Must be thick enough so the x-rays do not pass through it
  - Be aware of the minimum thickness needed
    - Path length of x-rays
    - Linear absorption coefficient
    - Packing density
    - X-ray radiation source
- Sample Height Displacement
  - Systematic errors in line positions

    - Largest systematic error effecting peak positions
    - Be sure to include internal standard
    - Analytical processing of data through a large 2Θ range
- Sample Displacement from Center
    - User set-up error
    - Affects measured angular positions of the peak
- Peak Broadening
    - Low angle grain boundaries
    - Very small particles
    - Plastic deformation
    - Compositional non-homogeneity
    - Large scale lattice strain variation
- Instrumental Errors
    - Peak intensity
        - Beam not perfectly collimated
            - Scattering occurs over a range of angles and can be different from one step to another
    - Peak Broadening
        - Detector resolution
        - Allowable sample size
        - Slit Width

As one can see from the list above, there are many things to consider when scanning a sample using XRD. Most instruments are regularly calibrated, which lowers the chances of having an instrumental error occur. There are usually guidelines for each instrument. This will help determine the sample size and placement. The user should take extra care when preparing and mounting the sample to limit all the other types of errors.

# 4 CONCRETE MIXTURE DESIGNS AND SAMPLING

Concrete mixtures that met the FDOT requirements for class IV and class V mixtures were prepared. The specified compressive strength of Class IV and Class V concretes are 5500 psi and 6500 psi, respectively. AASHTO M85 Type II (Rinker-Miami) and ASTM C150 Type I (Rinker-Columbia) cements were used to create two sets of replicate mixtures for each class. The chemical analysis of the two cements are given in Table 2 shows the complete list of mixtures that contained varying quantities of fly ash (FA), slag (S), and silica fume (SF). Table 4 details the material sources. All concrete batches were mixed with a w/c ratio of 0.35 to ensure that the requirements of FDOT class IV and V mixtures were met. The total cementitious materials for the class IV and V mixtures were 658 and 752 pcy, respectively.

Table 2 Proportions of ASTM C150 portland cement and SCM mixing proportions

| Mixture Name | Mixing Date | PC [pcy] | SCM 1 [pcy] | SCM 2 [pcy] | Pozzolan Name |
|---|---|---|---|---|---|
| TB1A4 | 11/1/05 | 526.4 | - | FA (20%) 131.6 | 2F (control) |
| TB1A4-2 | 3/1/07 | 526.4 | - | FA (20%) 131.6 | 2F (control) |
| TB2A4 | 11/3/05 | 480.3 | SF(7%) 46.06 | FA (20%) 131.6 | 2F7SF |
| TB2A4-2 | 3/1/07 | 480.3 | SF(7%) 46.06 | FA (20%) 131.6 | 2F7SF |
| TB3A4 | 3/1/05 | 394.8 | S(20%) 131.6 | FA (20%) 131.6 | 2F2S |
| TB3A4-2 | 3/1/07 | 394.8 | S(20%) 131.6 | FA (20%) 131.6 | 2F2S |
| TB4A4 | 11/10/05 | 329 | S(40%) 263.2 | FA (10%) 65.8 | 1F4S |
| TB4A4-2 | 3/1/07 | 329 | S(40%) 263.2 | FA (10%) 65.8 | 1F4S |
| TB5A4 | 11/15/05 | 329 | S(20%) 131.6 | FA (30%) 197.4 | 3F2S |
| TB5A4-2 | 3/1/07 | 329 | S(20%) 131.6 | FA (30%) 197.4 | 3F2S |
| TB6A4 | 2/21/06 | 263.2 | S(40%) 263.2 | FA (20%) 131.6 | 2F4S |
| TB6A4-2 | 3/6/07 | 263.2 | S(40%) 263.2 | FA (20%) 131.6 | 2F4S |
| TB7A4 | 2/21/06 | 263.2 | S(20%) 131.6 | FA (40%) 263.2 | 4F2S |
| TB7A4-2 | 3/6/07 | 263.2 | S(20%) 131.6 | FA (40%) 263.2 | 4F2S |
| TB8A4 | 3/30/06 | 197.4 | S(60%) 394.8 | FA (10%) 65.8 | 1F6S |
| TB8A4-2 | 3/6/07 | 197.4 | S(60%) 394.8 | FA (10%) 65.8 | 1F6S |
| TB1A5 | 3/30/06 | 601.6 | - | FA (20%) 150.4 | 2F (control) |
| TB1A5-2 | 3/6/07 | 601.6 | - | FA (20%) 150.4 | 2F (control) |
| TB2A5 | 5/2/06 | 548.96 | SF(7%) 52.64 | FA (20%) 150.4 | 2F7SF |
| TB3A5 | 5/2/06 | 451.2 | S(20%) 150.4 | FA (20%) 150.4 | 2F2S |
| TB4A5 | 5/4/06 | 376 | S(40%) 300.8 | FA (10%) 75.2 | 1F4S |
| TB5A5 | 5/4/06 | 376 | S(20%) 150.4 | FA (30%) 225.6 | 3F2S |
| TB6A5 | 5/9/06 | 300.8 | S(40%) 300.8 | FA (20%) 150.4 | 2F4S |
| TB7A5 | 5/9/06 | 300.8 | S(20%) 150.4 | FA (40%) 300.8 | 4F2S |
| TB8A5 | 5/11/06 | 225.6 | S(60%) 451.2 | FA (10%) 75.2 | 1F6S |

Table 3 Proportions of AASHTO M85 portland cement and SCM mixture proportions

| Mixture Name | Mixing Date | PC [pcy] | SCM 1 [pcy] | SCM 2 [pcy] | Pozzolan Name |
|---|---|---|---|---|---|
| TB1H4 | 5/11/06 | 526.4 | - | FA (20%) 131.6 | 2F (control) |
| TB1H4-2 | 3/8/07 | 526.4 | - | FA (20%) 131.6 | 2F (control) |
| TB2H4 | 5/16/06 | 480.3 | SF(7%) 46.06 | FA (20%) 131.6 | 2F7SF |
| TB3H4 | 5/16/06 | 394.8 | S(20%) 131.6 | FA (20%) 131.6 | 2F2S |
| TB3H4-2 | 3/8/07 | 394.8 | S(20%) 131.6 | FA (20%) 131.6 | 2F2S |
| TB4H4 | 5/18/06 | 329.0 | S(40%) 263.2 | FA (10%) 65.8 | 1F4S |
| TB5H4 | 5/18/06 | 329.0 | S(20%) 131.6 | FA (30%) 197.4 | 3F2S |
| TB5H4-2 | 3/8/07 | 329.0 | S(20%) 131.6 | FA (30%) 197.4 | 3F2S |
| TB6H4 | 5/23/06 | 263.2 | S(40%) 263.2 | FA (20%) 131.6 | 2F4S |
| TB7H4 | 5/23/06 | 263.2 | S(20%) 131.6 | FA (40%) 263.2 | 4F2S |
| TB8H4 | 5/25/07 | 197.4 | S(60%) 394.8 | FA (10%) 65.8 | 1F6S |
| TB8H4-2 | 3/8/07 | 197.4 | S(60%) 394.8 | FA (10%) 65.8 | 1F6S |
| TB1H5 | 2/1/07 | 601.6 | - | FA (20%) 150.4 | 2F (control) |
| TB1H5-2 | 3/8/07 | 601.6 | - | FA (20%) 150.4 | 2F (control) |
| TB2H5 | 2/1/07 | 548.9 | SF(7%) 52.64 | FA (20%) 150.4 | 2F7SF |
| TB3H5 | 2/6/07 | 451.2 | S(20%) 150.4 | FA (20%) 150.4 | 2F2S |
| TB4H5 | 2/8/07 | 376.0 | S(40%) 300.8 | FA (10%) 75.2 | 1F4S |
| TB5H5 | 2/8/07 | 376.0 | S(20%) 150.4 | FA (30%) 225.6 | 3F2S |
| TB6H5 | 2/8/07 | 300.8 | S(40%) 300.8 | FA (20%) 150.4 | 2F4S |
| TB7H5 | 2/15/07 | 300.8 | S(20%) 150.4 | FA (40%) 300.8 | 4F2S |
| TB8H5 | 2/15/07 | 225.6 | S(60%) 451.2 | FA (10%) 75.2 | 1F6S |

Table 4 Laboratory materials for all tested mixtures

| Materials | Source |
|---|---|
| ASTM C150 PC | ASTM C150 Type I (Rinker-Columbia) |
| AASHTO M85 PC | AASHTO M85 Type II (Rinker-Miami) |
| Fly Ash | Boral Materials Technologies Inc.<br>Fly Ash Class F |
| Silica Fume | W.R. Grace<br>Force 10,000D |
| Slag | Lafarge<br>NewCem-Grade 120 |
| Water | Gainesville, FL |
| Fine Aggregate | Silica Sand |
| Coarse Aggregate | Crushed Limestone |
| Air Entrainer | W.R. Grace<br>Daravair 1000 |
| Water Reducer | W.R. Grace<br>WRDA 60 |
| Super Plasticizer | W.R. GRACE<br>ADVA 140 |

The relative content of the FA and S were varied to determine the combination that provided the best performance relative to the mixtures with 7% SF. FA was varied from 10% to 40% and S was varied from 20% to 60%.

A total of 2518 samples were cast from 46 separate mixtures at the FDOT State Materials Office (SMO) in Gainesville, Florida. The concrete mixtures were divided into four groups based on the specified compressive strength (FDOT Class IV and V) and PC type (AASHTO M85 and ASTM C150).

The mixtures were prepared in controlled laboratory conditions with a constant air temperature of approximately 78F for each mixture. The size of the concrete batch for each mixture was six cubic feet (0.17 cubic meters). This volume of concrete included the specimens, concrete for quality control testing, and several extra samples. The quality control procedures executed during mixing and casting of the test samples were:

- Standard Test Method for Slump of Hydraulic Cement Concrete (ASTM C143).
- Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method (ASTM C173).
- Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete (ASTM C1064).
- Standard Test Method for Density (Unit Weight) of Freshly Mixed Concrete (ASTM C138).

AASHTO T23 procedures were followed for casting concrete cylinders with the exception that a vibrating table was used to compact the fresh concrete. The cylinders were cast and vibrated in two lifts. Rectangular beam specimens were also placed on the vibrating table to ensure complete compaction. The vibration period for each mixture was determined by visual inspection of the first set of samples vibrated. The samples were vibrated until the larger air bubbles ceased breaking through the top surface but before visible segregation occurred, which typically occurred between 15 to 30 seconds. After the samples were cast in their respective molds and the exposed surface finished with a trowel, they were left approximately 24-hours for atmospheric curing. During this period, the exposed surfaces of samples were covered with plastic to minimize evaporation of the water from the surface of the concrete. Finally, the samples were demolded and placed in their particular curing environment until their testing date.

Flexural and G109 rectangular test specimens were also cast in two lifts. After each lift was placed, the vibrating table was used to compact the lift. Before placement of the second concrete lift in the G109 specimens, a metal wire used to measure corrosion was placed on the layer of fresh concrete. The second and final lift was gently placed to avoid disturbing the wire.

Table 5 Standard method for casting and vibrating rectangular beam and g109 specimens

| Beam Dimensions [in] | Number of Layers | Number of Vibrator Insertions per Layer | Approximate Depth of Layer |
|---|---|---|---|
| 4x4x12 | 2 | 1 | ½ depth of specimen |
| 4.5x6x11 | 2 | 1 | ½ depth of specimen |

Figure 5 Initial curing of cast concrete specimens

# 5 TEST PROCEDURES

## 5.1 *Fresh Properties*

Fresh property tests were conducted to determine the effect of varying the SCM quantities. The fresh properties measured for this investigation were density, entrapped air, slump, temperature, and bleed water. This section describes the testing standards and procedures followed during or immediately after concrete mixing.

### 5.1.1 Density (ASTM C138)

The unit weight fresh property test is often conducted due to its simplicity. Typically, the unit weight is measured during the air content procedure. Unit weight measurements are used to calculate yield estimates. The addition of FA, S, and SF will have little effect on density as entrapped air and aggregate type provide larger changes in unit weight.

### 5.1.2 Air Content (ASTM C173)

The air content testing procedure measures the air contained in the mortar fraction of the concrete without being influenced by the air contained within the aggregate pores. One drawback of this procedure is that it can only measure the total air content within the concrete and can not distinguish between entrapped and entrained air. Regardless, it provides a method of evaluating the effects of an air entraining admixture when all entrapped air has been removed.

### 5.1.3 Bleeding of Concrete (ASTM C232)

ASTM C232 measures the percentage of water that is pushed towards the surface during consolidation (known as bleeding). The excess water found on the surface of the concrete is measured by filling a metal test beaker with concrete and then vibrating the beaker until the concrete is consolidated. After adequate consolidation has occurred, the concrete surface is carefully troweled and the bleed water is collected and measured.

Bleeding is generally reduced by the use of mineral admixtures. SF and FA have small particles that pack between PC grains, thus reducing the porosity and bleeding (Neville 1995). Some research has shown, however, that S may increase bleeding (Wainwright and Rey 2000).

### 5.1.4 Slump (ASTM C143)

The slump test is a relatively simple field procedure that gives an estimate of concrete workability. This test is typically used as a field measurement for the workability of a concrete mixture and is sometimes used to determine if sufficient superplasticizer has been added to a mixture. While an idealized target slump was not used for this investigation, it is important to note that a concrete mixture with poor workability has no practical use. All slump readings were taken immediately after the concrete was mixed.

The addition of pozzolans such as FA, S and SF can influence the slump of a concrete mixture due to their particle sizes and shapes. FA, due to its spherical shape, reduces interparticle friction, which results in larger slump measurements. SF and ultrafine FA particles, however, because of their small volume, have high surface areas and tend to increase the cohesiveness of the mixture. This results in a decrease in slump and a need for greater high range water reducer dosages to maintain the target slump. S also decreases the slump because of its angular and plate like particles, which have been found to increase interparticle friction.

## 5.2 MECHANICAL PROPERTIES

Standard test methods were conducted to determine the mechanical characteristics of the concrete. These characteristics are frequently used in structural design to estimate a variety of other concrete properties. Physical behavior also can be predicted based on the results of these mechanical tests, such as deflection, and prestressing losses.

### 5.2.1 STATIC MODULUS OF ELASTICITY (ASTM C49)

Modulus of elasticity was tested using ASTM C49 test method. The method calls for each specimen to be loaded to 40% of its ultimate strength. Tests were terminated immediately after reaching the 40% mark, however, to ensure that bond cracking would not occur in the concrete. Figure 6 shows the modulus of elasticity instrumentation and testing apparatus.


Figure 6 Modulus of elasticity testing apparatus

Because of the low stress levels used to test for modulus of elasticity (MOE), the same 4-in. diameter x 8-in. long cylinders that were used for MOE could be used for compressive strength tests. An initial test of compressive strength was conducted on the first cylinder from each set of three. Each of the two remaining cylinders was loaded three times to measure the MOE. The initial test, which was primarily for seating, was ignored. The two subsequent tests were then used to calculate an average MOE for that cylinder. An average was then taken of the results from the two cylinders. Testing was conducted at 7, 28, 56, 182 and 365 day ages.

### 5.2.2 Compressive Strength (ASTM C39)

As previously mentioned all compressive strength specimens were used to obtain the MOE data and thus, were tested on the same schedule. The cylinders were ground smooth using a DIAM-end grinder manufactured by M&L Testing Equipment as shown in Figure 7. However, on some occasions caused by grinder malfunction or lack of time, high strength neoprene (8,000 – 12,000psi) was used as a substitute.

Figure 7 DIAM-end grinder

All cylinders were cured in a moist condition at a temperature of 73.4 ± 3.0$^{o}$F, so that free water was maintained on the surface at all times. Each test was completed within an hour of removal from the curing room on a Test Mark load frame. Cylinders were loaded continuously and without shock at 20 to 50 pounds per square inch per second.

### 5.2.3 Creep (ASTM C512)

To ensure that a constant load was applied to each specimen a series spring-loaded creep loading frames were fabricated. All creep specimens were cast into 6-in. diameter x 12-in. high concrete cylinders and were covered with plastic until removed from the molds. The specimens were wet cured by placing them in a controlled environment at a constant temperature of 73 ± 3 °F and a constant humidity of 50± 4 °F. After adequate curing the cylinders were ground so that they could be stacked in the load frames and loaded. Three concrete cylinders were stacked and loaded to 30% of their maximum load in order to avoid any unexpected compressive failures. ASTM C512 calls for a loading of 40% of maximum load, but a lower load was used to avoid premature failures. Additionally, three unloaded specimens were placed on top of each loading frame in order to provide a control for each mixture. Comparator readings were taken on all specimens at an age of 28, 35, 42, 49, 56, 63, 91, 119, 147, 175, 203 and 251 days.

#### 5.2.4 FLEXURAL STRENGTH (ASTM C78)

Specimens were cast into 4-in. x 4-in. x 14-in. long beams and tested at ages of 28, 56 or 91, and 365 days. Beams were cured in a moist condition at a temperature of 73.4 ± 3.0$^{o}$F, so that free water was maintained on the surface at all times. Each test was completed within an hour of removal from the curing room. Beams were loaded continuously and without shock at a deflection controlled rate of 0.01 inches per minute on an Instron load frame as shown in Figure 8 and Figure 9.

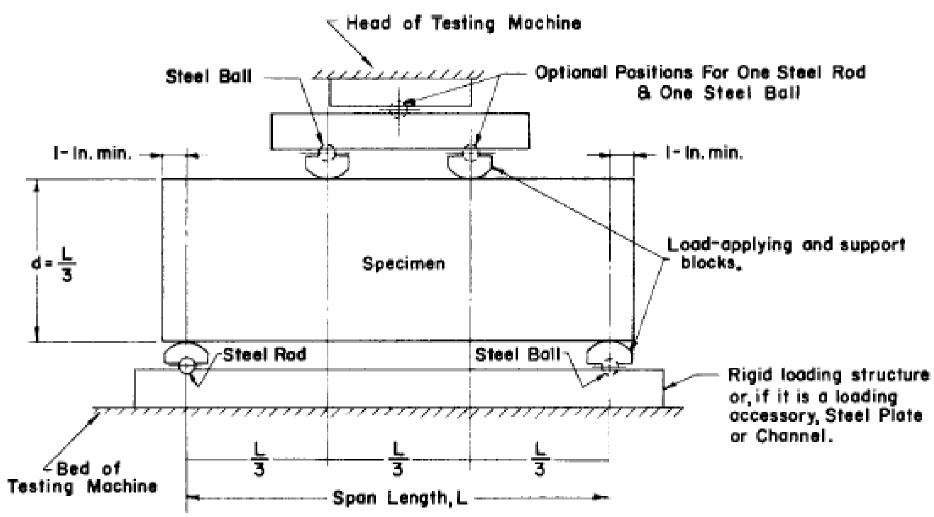



Figure 8 Diagram of the third-point loading flexure testing apparatus

Figure 9 Instron load frame testing flexural strength

### 5.2.5 Splitting Tensile Strength (ASTM C496)

ASTM C496 test method was used to estimate tensile strength through indirect tension. Specimens cast into 4-in. diameter x 8-in. long cylinders were tested at 3, 7, 28, 91, and 365 days of age. All cylinders were cured in a moist condition at a temperature of 73.4 ± 3.0$^{o}$F, so that free water was maintained on the surface at all times. Each test was completed within an hour of removal from the curing room on a Forney Load frame as shown in Figure 10.


Figure 10 Splitting tensile strength test.

## 5.3 DURABILITY TESTS

Three methods were chosen to measure the resistance of the various concrete mixtures to the penetration of chloride ions. They were rapid migration (RMT), surface resistivity (SR), and bulk diffusion (BD). In addition, specimens were constructed to test the relative corrosion resistance of reinforcement embedded in the various concrete mixtures (ASTM G109).

### 5.3.1 RAPID MIGRATION TEST

In the rapid migration test (RMT) an electrical potential is applied to the concrete specimen to force chloride movement through the concrete pore structure. A "migration coefficient" is calculated then using a measured depth of chloride penetration. Consequently, the most important single parameter to calculate RMT diffusion coefficient is the depth of chloride penetration. The RMT was conducted in accordance with NordTest NTBuild 492, including the modifications proposed by Hooton, Thomas and Stanish (2001). Table 6 shows the changes to the standardized procedure included using a different voltage than specified and adjusting the test duration based on the current measured at the start of the test. For each mixture, six 4-in. diameter by 8-in. long concrete cylinders were tested. The cylinders were kept in a moist room with a sustained 100% humidity until the testing day. The procedure was conducted at 56 and 91 days using three specimens per age. The test required a day of preparation. Specimens were removed from the moist room and cut on a water-cooled diamond saw. They were cut first into two halves with a 2-inch thick sample being cut from each of the two halves (see Figure 12). The side of the sample that was nearest to the first cut (middle surface) was the face to be exposed to the chloride solution (catholyte).

After the samples had been adequately prepared, each sample was placed in a desiccation chamber connected to a vacuum pump capable of reducing the pressure to less than 1 mm Hg (133 Pa). The vacuum was maintained for three hours to remove the pore solution from the samples (Figure 11). The container was then filled with boiled de-aerated water until the samples were totally submerged and the pump was left running for an additional hour. The desiccation chamber was return to atmospheric pressure and the samples were left submerged for 18 hours, plus or minus 2 hours.

After the samples were removed from the desiccation chamber, they were fitted into a rubber sleeve and secured with two stainless steel clamps to prevent possible leaks (Figure 13). The rubber sleeve containing the sample was positioned on a plastic support and the cathode and anode stainless steel plates were positioned (Figure 14 and Figure 15). The upper part of the sleeve was filled with a 0.3 N NaOH (1.2% NaOH) anode solution and the complete set-up was immersed into a plastic container filled with the catholyte solution of 10 percent NaCl. The cathode plate connector was connected to the negative terminal and the anode to the positive terminal of the power supply.

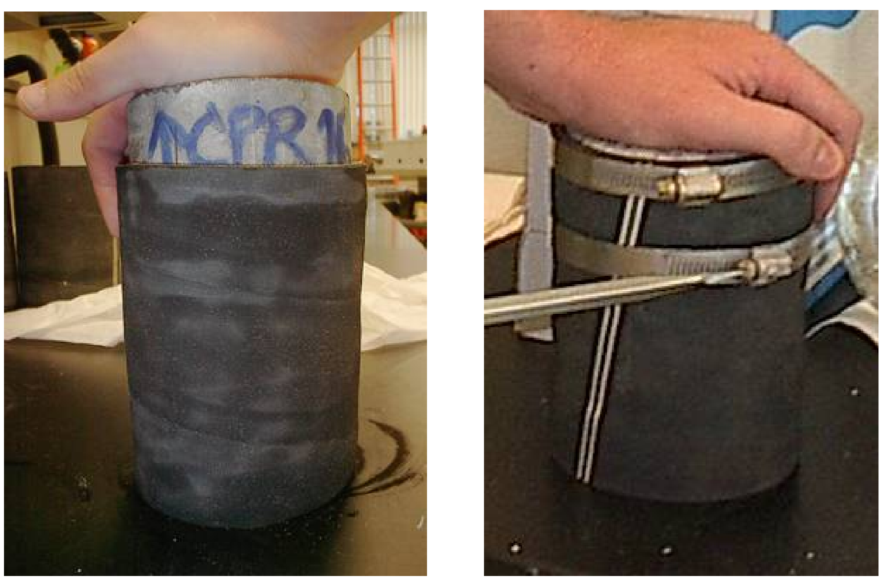
Table 6 Test voltage and duration proposed by Hooton, Thomas and Stanish 2001

| **Initial Current @ 60V [mA]** | **Applied Voltage [Volts]** | **Test Duration [hr]** | **Expected Penetration [mm]** | **V*t [V-hr]** |
|---|---|---|---|---|
| < 10<br>10-20<br>20-30<br>30-40<br>40-60<br>60-80<br>80-120 | 60 | 18 | < 40 | 1,080 |
| 120-180<br>180-240 | 30 | 18 | 20-40 | 540 |
| 240-480<br>480-800 | 10 | 18 | 13-40 | 180 |
| 800-1,200<br>> 1,200 | No Test | No Test | No Test | No Test |

Figure 11 RMT reduction of absolute pressure for sample desiccation

(a) (b)

Figure 12 Cutting RMT samples: a) RMT sample cut into two halves, b) Cutting of the 2-inch RMT sample



(a) (b)

Figure 13 RMT sample preparation. a) Sample being placed in the rubber sleeve, b) Securing the sample with stainless steel clamps

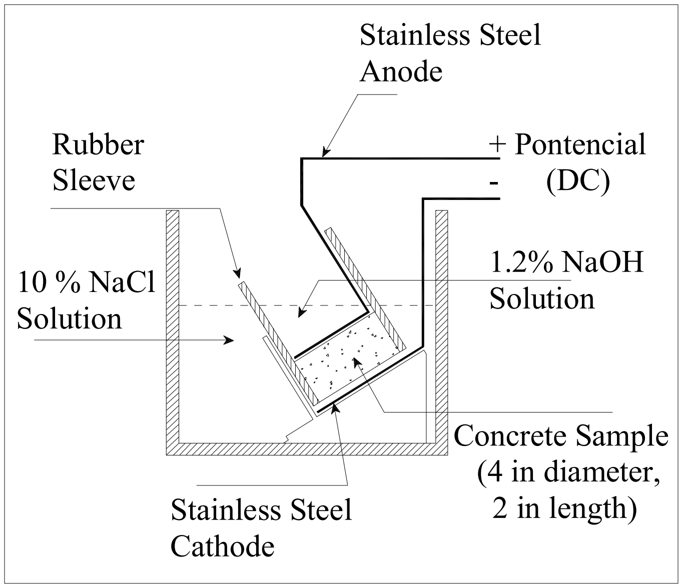



Figure 14 Rapid migration test setup (NordTest NTBuild 492)

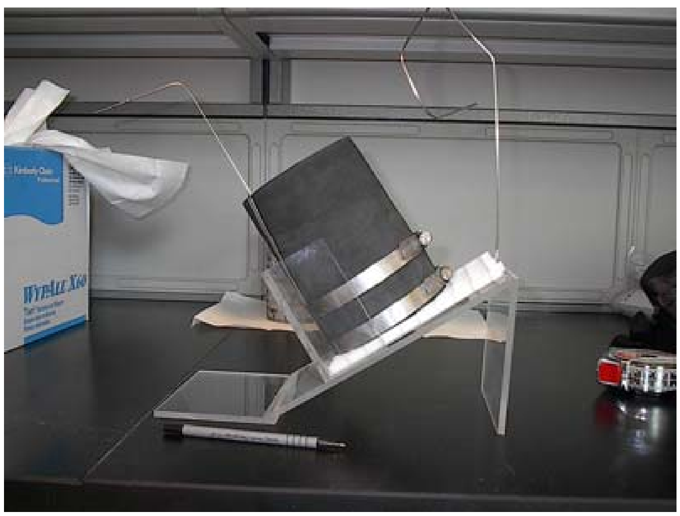


Figure 15 RMT test set-up shown prior to being immersed in the catholyte solution

The power supply was preset to 60-volts and the initial current through each specimen was recorded. The test voltage was then adjusted based on the initial current reading (Table 6) and left running for 18 hours. A data logger system read the temperature of the anolyte solution, charge passed, and current every 5 minutes.

After the monitoring process of 18 hours was completed, the RMT set-up was disassembled and the concrete samples were removed. The specimens were rinsed with tap water and the excess solution was wiped off the surfaces. The standardized method recommends a colorimetric procedure for measuring the depth of chloride infiltration. Therefore, the degree of chloride penetration in each RMT sample was evaluated by applying two methods to the each sample. The samples were split as shown in Figure 16. Chloride content was measured on one half with FM 5-516 and the silver nitrate solution spray was used on the other half (Figure 19).

For the silver nitrate method, the split section more nearly perpendicular to the end surfaces was selected for the depth of penetration analysis. The freshly split section was sprayed with a 0.1M silver nitrate solution creating a chemical reaction where the chlorides present in the concrete reacted and produced a visible white silver precipitation on the surface (Figure 17). A brownish color was created on the surface where the silver nitrate solution, in the absence of chlorides, reacted instead with the hydroxides present in the concrete (Figure 17).

Calipers were used to measure the location of the line between the two colors. Eight evenly spaced penetration depth readings were taken starting 0.4 inch (10 mm) away from the edges of the specimen to avoid the possible effect due to a non-homogeneous degree of saturation or a possible leakage during the exposure procedure (Figure 18). The readings were averaged to obtain the relative depth of chloride penetration for each specimen.

(a) (b)

Figure 16 Silver nitrate solution spray method sample preparation. a) Specimen axially being split, (b) Faces of split sample


Figure 17 Split surface of the specimen sprayed with the silver nitrate solution

Figure 18 Chloride penetration measurement using the silver nitrate solution method

Figure 19 Slicing samples for comparison between FM 5-516 and silver nitrate solution spray chloride methods

### 5.3.2 SURFACE RESISTIVITY TEST

The surface resistivity tests were conducted conforming to Florida Method of Test designation FM 5-578. The surface resistivity was measured on 4-in. diameter by 8-in. long concrete cylinders. Due to its nondestructive nature, the test was performed more frequently than the other electrical tests. For this project, the samples were tested at 1, 3, 7, 14, 28, 56, 91, 182, and 365 days. Commercially available four-probe Wenner array equipment was utilized for resistivity measurements. The model used had wooden plugs in the end of the probes that were pre-wetted with a contact medium to improve the electrical transfer with the concrete surface (Figure 20). The inter-probe spacing was set to 1.5-inch (38-mm) for all measurements.

On the day of testing the samples were removed from their curing environment and the readings were taken under surface wet conditions. Readings were then taken with the instrument placed such that the probes were aligned with the cylinder axis. Four separate readings were taken around the circumference of the cylinder at 90-degrees increments ($0^o$, $90^o$, $180^o$ and $270^o$). This process was repeated once again, to obtain a total of eight readings that were then averaged. This minimized possible interference due to the presence of a single aggregate particle obstructing the readings (Chini, Muszynski and Hicks 2003).

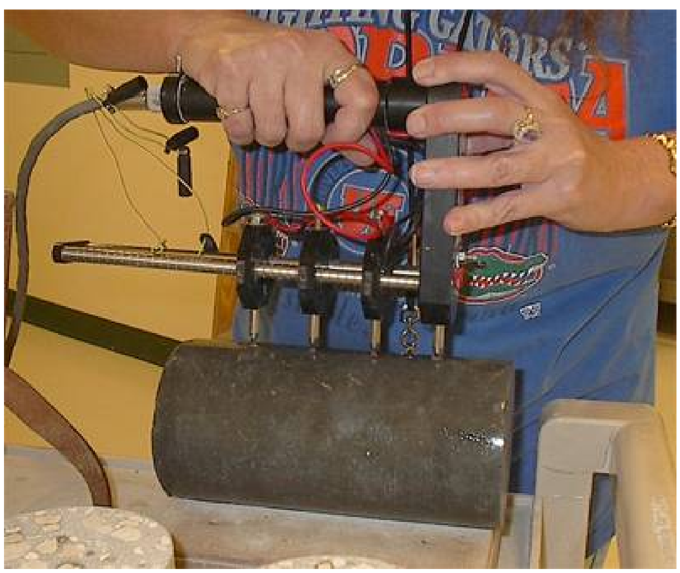


Figure 20 Surface resistivity measurements

Research conducted by Whiting and Mohammed (2003) indicate that the electrical conductivity of a concrete is related to its permeability and diffusivity of ions through the concrete. Consequently, the electrical resistance can be used as an estimation of chloride ion penetrability (Hooton et al. 2001). Additional research conducted by Chini et al. (2003) relating the surface resistivity measurements to Rapid Chloride Penetration tests produced a reference table to aid the interpretation of the surface resistivity results, which was later adopted by FM 5-578. The table categorizes the chloride ion penetrability of a concrete from surface resistivity measurements (Table 7).

Table 7 Summary table of penetrability category, penetration depth, coulombs passed and surface resistivity (for 4-in. x 8-in. cylinders tested with Wenner probe spacing set to 1.5 in.)

| Penetrability Category | Penetration Depth (mm) | Coulombs Passed (Coulombs) | Surface Resistivity (kΩ-cm) |
|---|---|---|---|
| High | > 1.3 | > 4,000 | < 12 |
| Moderate | 0.8 – 1.3 | 2,000 - 4,000 | 12 - 21 |
| Low | 0.55 – 0.8 | 1,000 - 2,000 | 21 - 37 |
| Very Low | 0.35 – 0.55 | 100 - 1,000 | 37 - 254 |
| Negligible | < 0.35 | < 100 | > 254 |

### 5.3.3 BULK DIFFUSION TEST

The bulk diffusion test was conducted using the NT BUILD 443 (1995) test procedure. Samples were 4-in. (102-mm) diameter by 8-in. (204-mm) long, with three samples cast for each mixture. The samples were kept in a moist room with a sustained 100% humidity for 28 days, removed from the moist conditions, and sliced on a water-cooled diamond saw into two halves (Figure 12a). The cut specimens were immersed in a saturated $Ca(OH)_2$ solution in an environment with an average temperature of $73^oF$ ($23^oC$). The samples were weighed daily in a surface-dry condition until their mass did not change by more than 0.1 percent. The specimens were then sealed with Sikadur 32 Hi-Mod epoxy on all surfaces except the saw-cut face and left to cure for 24-hours. The sealed samples were then returned to the $Ca(OH)_2$ tanks to repeat the above saturation process by weight control. The samples were then immersed under surface-dry conditions in salt solution (16.5 percent of sodium chloride solution mixed with deionized water) in tanks with tight closing lids (Figure 21). The tanks were shaken once a week and the NaCl solution was changed every 5 weeks. The original procedure called for at least 35 days of exposure before the chloride penetration analysis was to be conducted. Moreover, it suggests to sample between 0.04-inch to 0.08-inch (1-mm to 2-mm) increments by powder grinding the profiles for this exposure time and type of high quality concrete. With the equipment available for the use on the project, an exposure of 35 days is insufficient to achieve a measurable chloride profile. Exposure period was fixed at 365 days and a sampling increment of 0.25-inch (6.5-mm) was used.

Figure 21 Bulk diffusion saline solution exposure

### 5.3.4 Corrosion of Embedded Reinforcing Steel

ASTM G109 test method assesses the ability of the concrete to inhibit the corrosion of embedded steel reinforcement. Each specimen was fabricated using a mold containing three #4 deformed steel reinforcing bars and a titanium reference electrode as shown in Figure 22. At an age of 24 hours, each specimen was demolded and allowed to cure in a moist condition at a temperature of 73.4 ± 3.0$^{o}$F, so that free water was maintained on the surface at all times until they were 28-days of age. At this time, each specimen was placed in an environmental chamber maintained at 50% relative humidity for a period of two weeks. Following this conditioning, a 6 in. long x 3-in. wide x 3-in. deep acrylic dam was adhered to the top of each specimen. The surface of the concrete was then sealed, with the exception of the bottom and the inside of the dammed area, using Sikadur 32 High Mod epoxy (Figure 23)

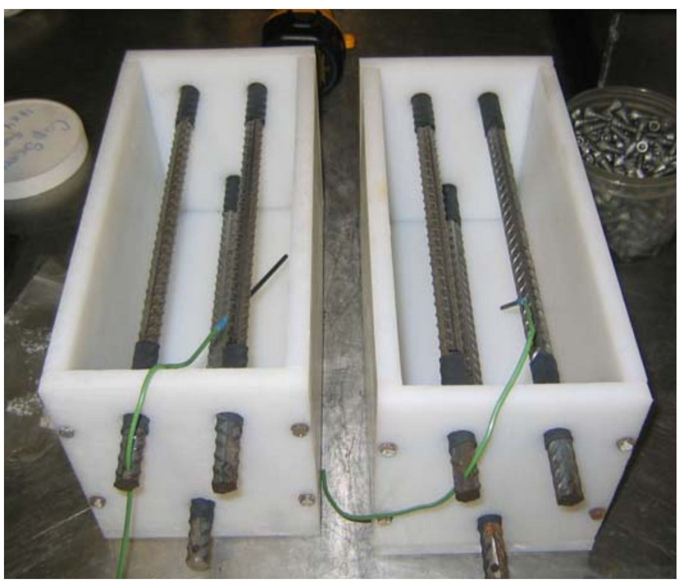


Figure 22 ASTM G109 specimen molds containing the reinforcing bars and reference electrode

Figure 23 ASTM G109 specimen after epoxy has been applied

Samples were then placed back into the environmental chamber for 56 days of age. After 56 days had passed an altered method of the testing procedure was followed. ASTM G 109 states that samples should be ponded with a 3% NaCl, and stored at 73 ± 5.0$^{o}$F and a relative humidity of 50 ± 5%. To accelerate corrosion, a 15% NaCl solution was used with the specimens exposed to 90 ± 5$^{o}$F. The specimens were connected to automated monitoring system that measured current and potential once daily (Figure 24). Each specimen was subjected to a cycled regime of the 15% NaCl solution; the cycles were maintained at two weeks of sealed continuous ponding, followed by two weeks of drying. An electrical diagram of the test setup is presented in Figure 25.

Figure 24 Environmental room containing the automated monitoring device and corrosion specimens

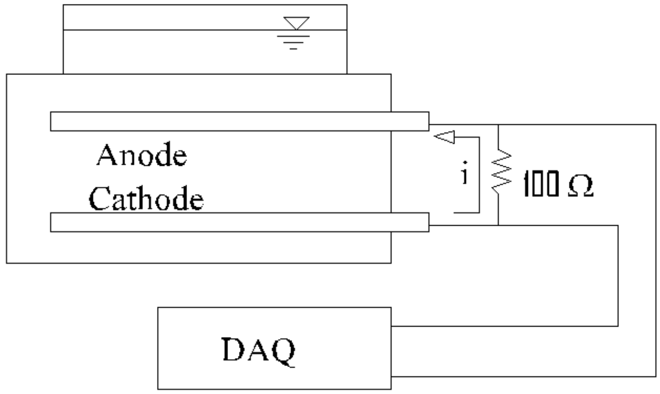



Figure 25 Electrical diagram of corrosion specimens

## 5.4 XRD

### 5.4.1 Sample Preparation

Prior to testing samples from the mechanical and durability tests, a pilot study was performed on neat PC pastes shown in Table 8. Batches of 990 grams were prepared with distilled water, Rinker Columbian PC and the admixture(s) using a high speed mixer for approximately one minute and maintaining a w/c of 0.5. Custom-made Teflon molds were used to create 4-in. x 1.5-in. x 1-in. prisms for each mix.

Table 8 Feasibility study mix proportions (% wt)

| Mixture | PC | FA | S |
|---|---|---|---|
| 1 | 100 | 0 | 0 |
| 2 | 70 | 0 | 30 |
| 3 | 50 | 0 | 50 |
| 4 | 80 | 20 | 0 |
| 5 | 50 | 20 | 30 |
| 6 | 30 | 20 | 50 |

Once the pilot study was complete, five ASTM Class V Type I PC and AASHTO Class V Type II PC mixtures were chosen from the concrete mixtures discussed previously as noted in Table 9. The mixes were chosen to represent both extremes for ratios of FA and S content, each maintaining a w/c of 0.35. Hardened cement pastes were created for each of the five mixes in small 2-in. x 1-in. disks and used for references for the paste in the concrete samples. The concrete samples were either received as 4-in. x 8-in. cylinders or 4 in. x 4 in. cut samples from the bulk diffusion test.

The decision to use the concrete samples was done after the first 28 days of curing had past for the ASTM mixes. Therefore, the unused halves of the bulk diffusion samples were used for all 28 day samples.

Table 9 Concrete mixtures in which X-Ray Diffraction was performed (% wt)

| Mixture | PC type | PC | FA | S |
|---|---|---|---|---|
| TB1A5 | ASTM | 80 | 20 | 0 |
| TB1H5 | AASHTO | 80 | 20 | 0 |
| TB3A5 | ASTM | 60 | 20 | 20 |
| TB3H5 | AASHTO | 60 | 20 | 20 |
| TB6A5 | ASTM | 40 | 20 | 40 |
| TB6H5 | AASHTO | 40 | 20 | 40 |
| TB7A5 | ASTM | 40 | 40 | 20 |
| TB7H5 | AASHTO | 40 | 40 | 20 |
| TB8A5 | ASTM | 30 | 10 | 60 |
| TB8H5 | AASHTO | 30 | 10 | 60 |

### 5.4.2 Curing

After mixing and placing in molds the pilot study samples and reference samples were placed in a curing room at 23° C and 97% relative humidity for 24 hours. All samples were then de-molded and transferred to a container of saturated lime water to continue curing. One sample of each mix was left aside on the day of de-molding, labeled as 1 day sample and then fully submerged in ethanol to halt the hydration process. The samples remained in ethanol for a minimum of 24 hours to ensure complete saturation. The other samples were removed from the lime water at the appropriate hydration date (3, 7, 14, 28, 56, 91, 128, and 365 days), labeled accordingly and placed in ethanol. The concrete cylinders were de-molded after 24 hours and then kept in lime water tanks until the appropriate hydration date.

### 5.4.3 Sample Preparation

Figure 26 shows the pattern used to cut the prisms from the feasibility study. Three cross-sectional cuts were made from each prism with an Allied Tech-Cut 4 low-speed saw. The cuts resulted in a 25.5 mm x 38 mm x 3.8 mm sample, the approximate size of a petrographic slide to allow the samples to be examined unmounted. The samples were then manually ground flat with 320 grit and 600 grit sand paper at 250 rpm for 3 minutes each and then polished, using 6μm and 1μm oil-based diamond suspensions at 350 rpm for approximately 5 minutes.

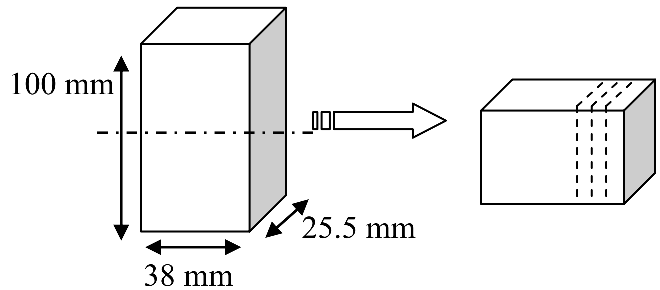



Figure 26 Cutting pattern for prisms

Figure 27 shows the progression of cuts needed for the hardened paste pucks and the concrete cylinders to render a sample size appropriate for XRD examination. The paste pucks were initially cut off-center to maximize the area for two 3.8-mm cuts. The concrete cylinders had an approximately ¼ in. slice taken from the center, which was then cut into at least 9 sections – one for each hydration date.

Figure 28 shows a sample removed from a concrete cylinder. Figure 28a shows the irregular surface left by the trim saw. The wafer saw was then used to cut a thin section (Figure 28b and Figure 28c), which exposed the most cement paste. The slice was then polished for examination. As shown in Figure 28, the concrete sections were examined as each cut was made to ensure that the final sample surface exposed as much cement paste as possible.

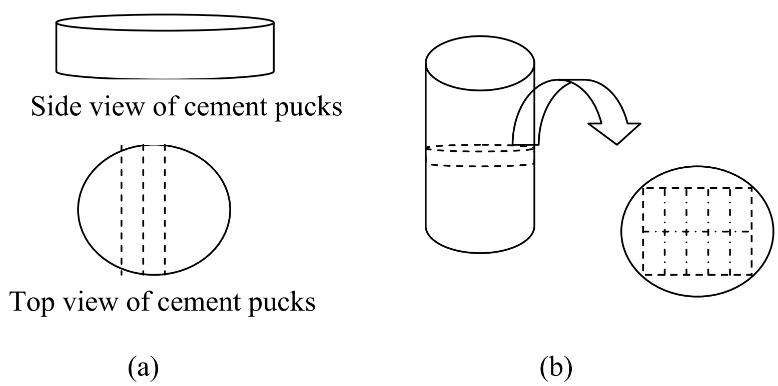
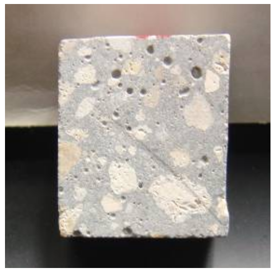
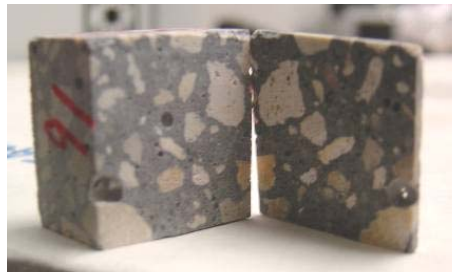



Figure 27 Cutting pattern for (a) cement paste pucks and (b) concrete cylinders





(a) (b)

Figure 28 Sample from a concrete cylinder (a) after initial cut
(b) after thin sectioning with wafer saw

Once the oil from the cutting saw had evaporated and/or the epoxy from mounting was dry, the sample was ready to be polished. Each sample was ground flat using a 320, 600, and 800 grit sand paper at 275 rpm for 3 minutes. The samples were then polished at 350 rpm using a 6, 1 and 0.25 micron oil-based diamond suspension for 5 minutes each. Grit, oil, or diamond dust left on the samples were removed using an ultrasonic cleaner for 3 minutes and then allowed to dry fully. If the final sample was too small, it was mounted to a glass petrographic slide with epoxy and then polished to a flat surface.

Since two slices were cut from each sample, one was analyzed as a hardened paste and the other was crushed into a powder. Mortar and pestle (Figure 29a) were used to crush the hardened cement paste samples. The powder was passed through a 200 mesh sieve to ensure uniformity in grain size (Figure 29b). The powders were placed in glass vials with a nylon cap (Figure 29c) and then stored in a dessicator until scanned (Figure 29d).

Figure 30 shows the final configuration for each type of cement or concrete sample. Figure 30a shows both cement paste sample that required mounting and a cement sample that was used without a slide. Figure 30b shows a concrete sample used in place of a slide to isolate and examine area of majority paste (avoiding the aggregate). Figure 30c shows a crushed sample pressed to a powdered layer on the slide.

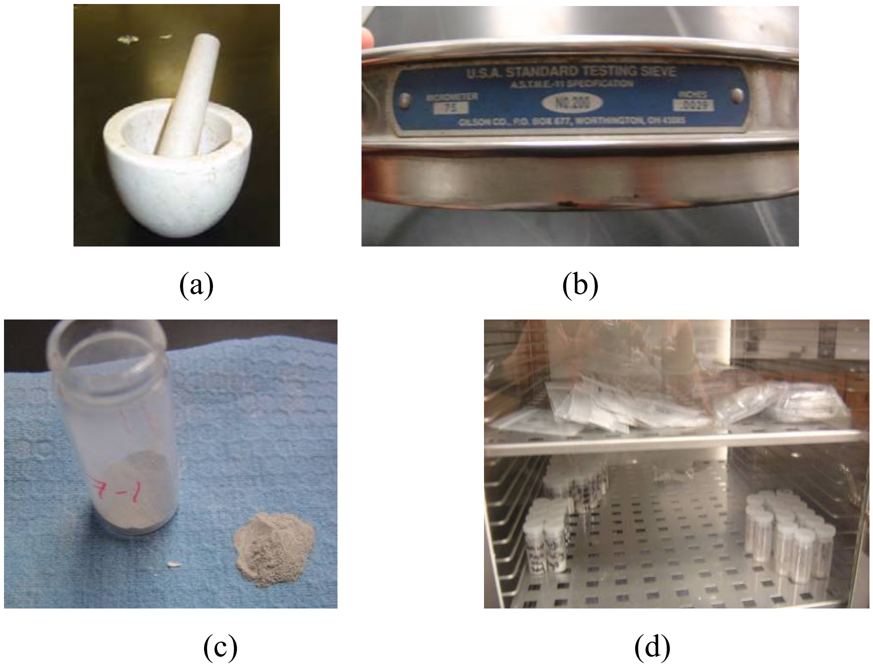



Figure 29 Preparation of powder samples (a) mortar and pestle (b) No. 200 Sieve, (c) sample storage (d) dessicator.


Figure 30 Final configuration for XRD examination (a) cement paste,
(b) concrete, and (c) powder

To ensure the correct spacing of the smaller pieces of hardened cement and the approximation of the area to scan on the concrete sample shown above, reference was made to a standard template for the powder diffractometer used in this study (Figure 31). The area in which the slide was held by had to be the same height as the actual sample, otherwise sample height errors will distort the data. Therefore, the small cement pieces were epoxied to the slide prior to polishing.

The area scanned on the concrete samples was estimated by using a 10mm x 10mm measurement, trying to ensure the most paste as possible in the scan. The center of the outlined area as well as the insertion line (the point at which the sample will be held) was marked. These marks help correctly line up the sample in the diffractometer to help ensure that the proper area was scanned. All marks were done with a carbon pen for later examination with the scanning electron microscope (SEM).

When the powders needed to be mounted, a glass slide was marked with a marker or carbon pen to match the template shown below. A piece of double-sided scotch tape was placed over the scan area. Some of the powdered cement paste was then poured over the top of the double-sided tape. Using a micro-spatula, the powder was firmly pressed to the tape and made level, which resulted in a slide such as the one shown above in Figure 30.

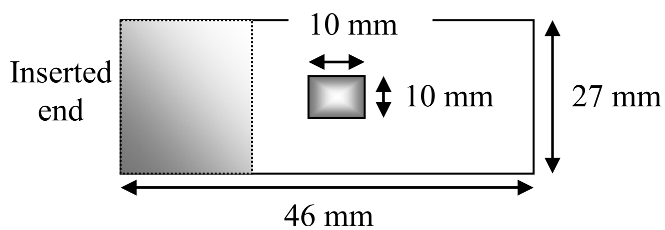



Figure 31 Dimensions and layout of sample examined by XRD

The powder diffraction instrument used in this study was the Phillips APD 3720 (Figure 32) provided by MAIC at the University of Florida. The specifics of the testing were as follows:

- X-ray Source: Cu kα radiation
- Operating Voltage: 40kV and 20mA
- Time per Step: 1 – 2.5 sec/step
- Step Size: 0.02 ° 2Θ
- Range: 17-35 °2Θ

Figure 32 Phillips APD 3720 powder XRD instrument at MAIC, University of Florida

# 6 RESULTS AND DISCUSSION

## 6.1 *MECHANICAL TESTS*

### 6.1.1 COMPRESSIVE STRENGTH

The compressive strength of each mixture was evaluated in accordance with ASTM C39. Though compressive strength is not commonly used as a means to investigate the durability of a concrete mixture, it is a helpful tool for determining the overall strength of a mixture and the level of stresses that can be applied during prestressing.

Figure 33 and Figure 34 shows the seven-day compressive strength for the class IV and V mixtures, respectively. The variation of supplementary cementitious materials (SCM) in each concrete mixture appears to have had little effect with the exception of 4F2S, which is markedly lower than the other mixtures. This mixture contains 40% FA, which tends to slow the early reaction rate of the concrete.

Interestingly, the mixture containing SF 7% and FA 20% did not outperform all of other mixes with regards to 7 day compressive strength. Mehta and Gjoerv (1982) showed that concretes made with SF and FA exhibit higher compressive strengths gains similar to PC only concretes until 28 days. Therefore, the average strength gain seen by all 2FA7SF mixtures is expected. The findings of this study shows a trend that at early development (< 7 days) SF seems to provide little advantage to S based ternary blends with regards to compressive strength, and thus, the addition of SF is not advantageous with regards to providing a high early strength for prestressed concrete production. Indeed, most all of the mixtures in both classes were near or exceeded 6,000 psi at seven days. It is important to note that seven day ages were the lowest age tested in this program.

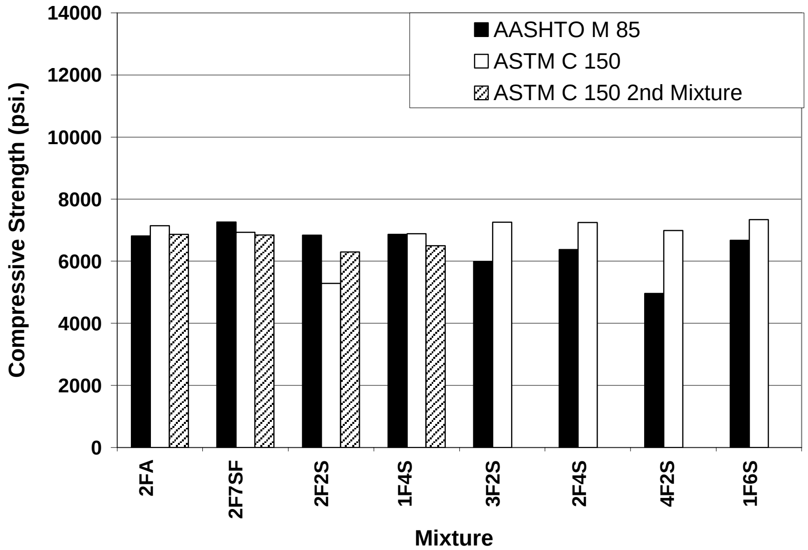



Figure 33 Compressive strength (7-day) class IV mixtures

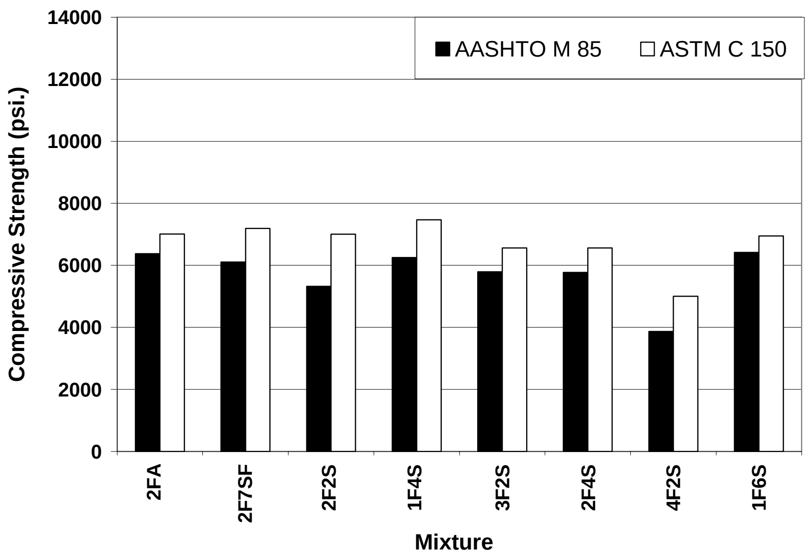



Figure 34 Compressive strength (7-day) for class V mixtures

As expected, Figure 33 and Figure 34 show that after 7 days of curing, ASTM PC frequently produce higher compressive strengths than AASHTO PC. The larger short-term strength gain seen in the ASTM PC is attributed to the smaller PC particles sizes found in the ASTM PC. The use of smaller particles allows the PC to react faster with water resulting in larger short-term strength gains.

Figure 36 and Figure 38 shows the results of the 28-day strength tests. One chart shows the actual 28-day strengths while the other chart gives the compressive strength normalized by the strength of the control mixture (2FA). As expected, S and SF provided higher compressive strengths than high quantities of FA. Mixtures containing more than 20% FA along with low percentages of S (20%) had lower strengths than that of the control. In all cases, however, the tested compressive strength exceeded that required by the FDOT Specifications for Class IV (5500 psi) and Class V (6500 psi).

S appears to have improved the 28-day compressive strength in ternary mixtures containing FA. Mixtures containing 40 or 60% S performed as well or better than the control and even the SF mixture. This agrees with ACI (233R-03), which found that when compared with a PC only concrete, the use of Grade 120 S typically increases concrete strength 7 days after curing. Li and Zhao (2003) also reported that ternary mixtures composed of 60%PC, 25%F and 15%S produce higher 28-day compressive strengths than PC only concretes and FA/PC binary mixtures. The use of higher quantities of S does not appear to proportionally increase strength as illustrated by the slight decrease in compressive strength as the percentage of S was increased from 40% to 60%.

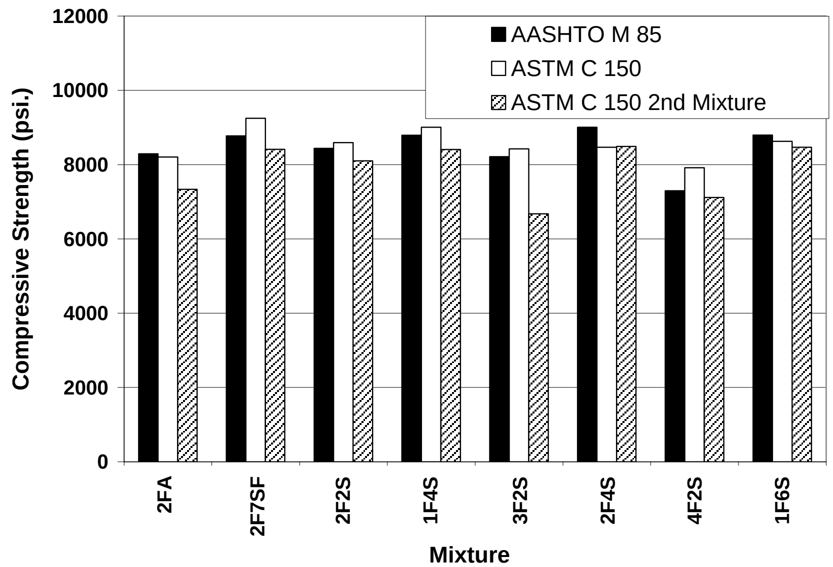



Figure 35 Compressive strength (28-day) for class IV mixtures

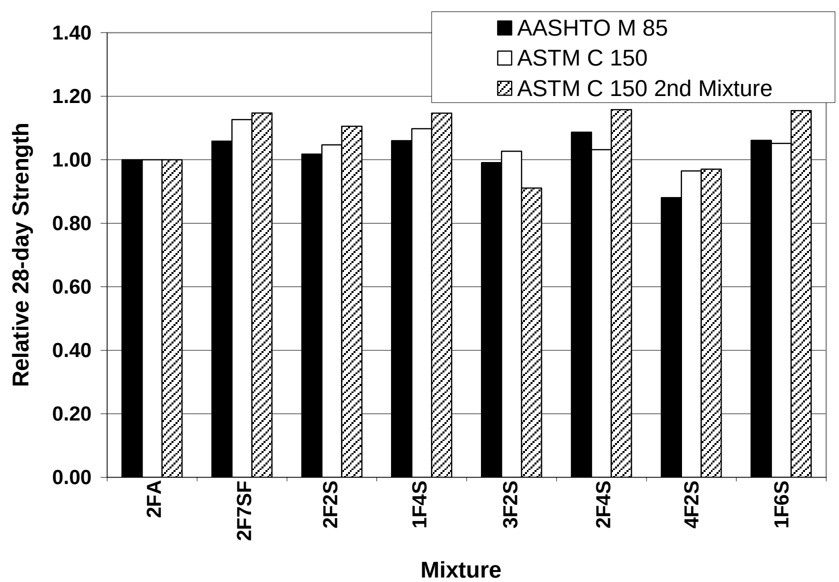



Figure 36 Relative compressive strength (28-day) for class IV mixtures

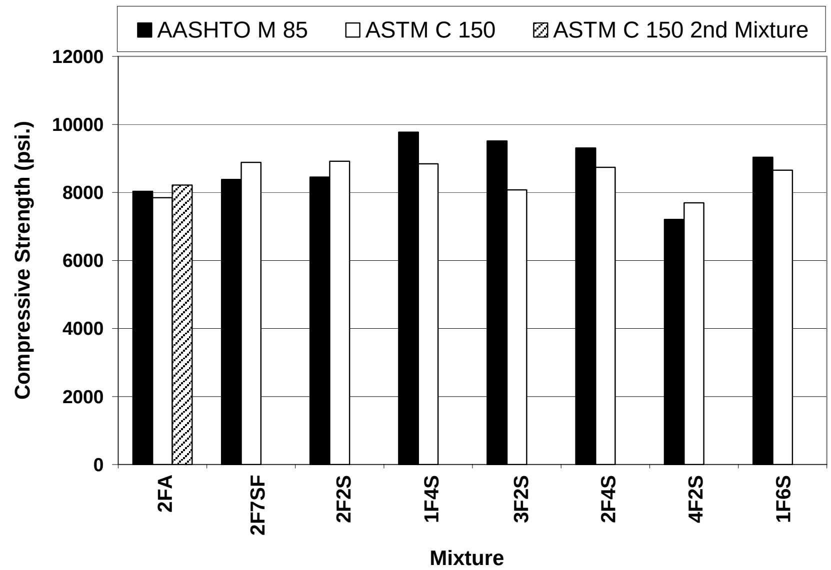



Figure 37 Compressive strength (28-day) for class V mixtures

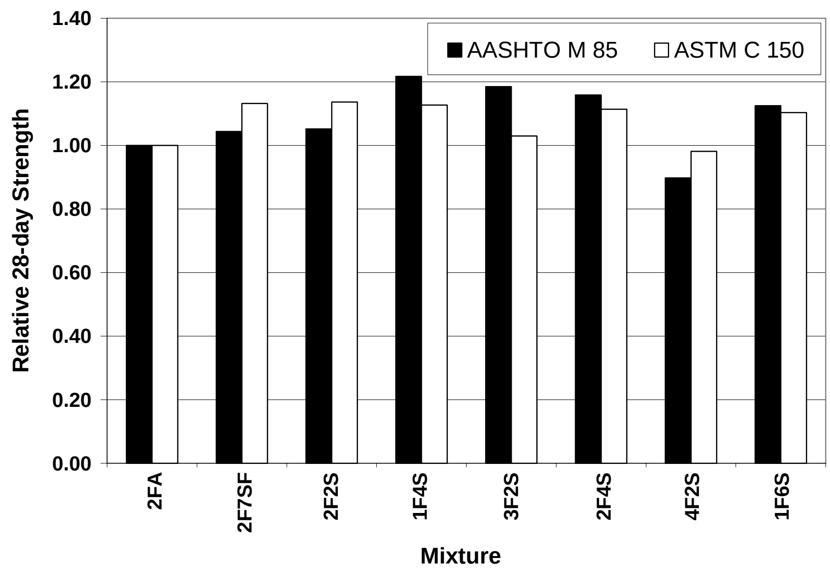



Figure 38 Relative compressive strength (28-day) for class V mixtures

After 28 days of curing, Figure 36 and Figure 38 show that ternary mixtures containing AASHTO PC have started to produce similar if not greater compressive strengths than concretes using ASTM PC. The relative increase between 7 and 28 days between the two PC types shows that the effect of the early delay in reaction of the larger PC particles has begun to fade. Consequently, due to the fact that neither ASTM nor AASHTO PC noticeably outperforms the other provides evidence that at 28 days, the use of either ASTM or AASHTO is equally advantageous.

Figure 40 and Figure 42 show the compressive strength 365 days after casting. Before discussing the results it should be noted that the compressive strength for a few of the mixtures appeared to decrease from 28-day to 365-day tests. The suspect tests from the Class IV mixtures are 1F4S and 3F2S using ASTM PC. The suspect tests from the Class V mixtures are 3F2S 2F4S, and 1F6S using AASHTO PC. The cause of this apparent decrease is not known and is attributed to test procedure problems.

When accounting for the outliers, the compressive strength at 1-year of age is relatively consistent with the exception of 4F2S, which underperformed the majority of mixtures for each class designation. This is thought to be due to the excessive quantity of FA.

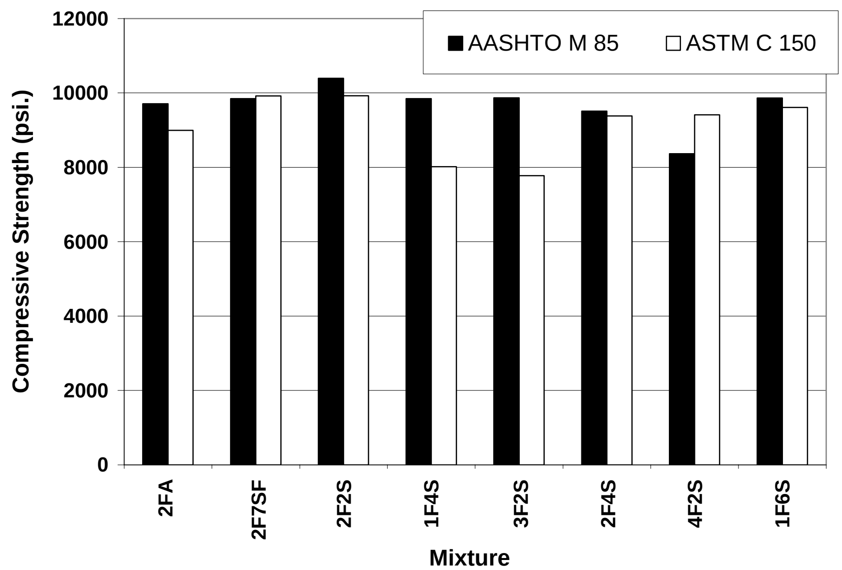



Figure 39 Compressive strength (365-day) for class IV mixtures

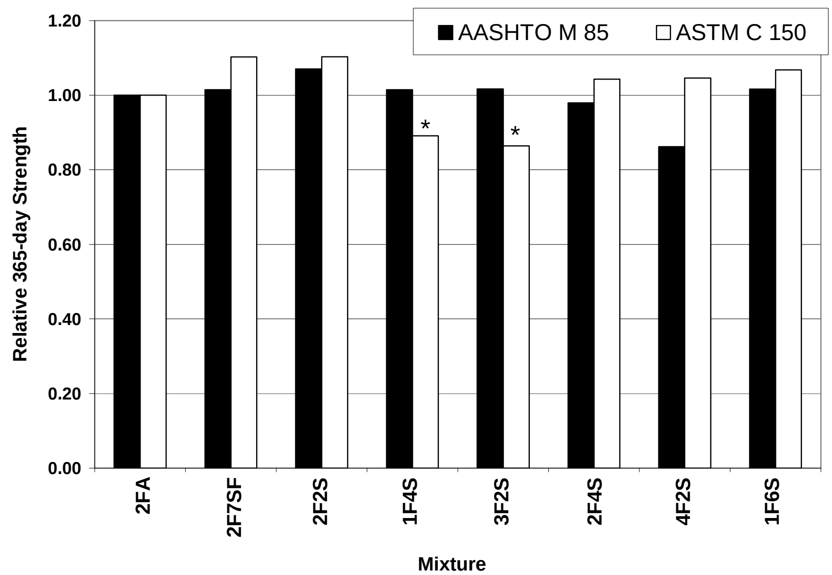



Figure 40 Relative compressive strength (365-day) for class IV mixtures
(* low values likely due to test procedures)

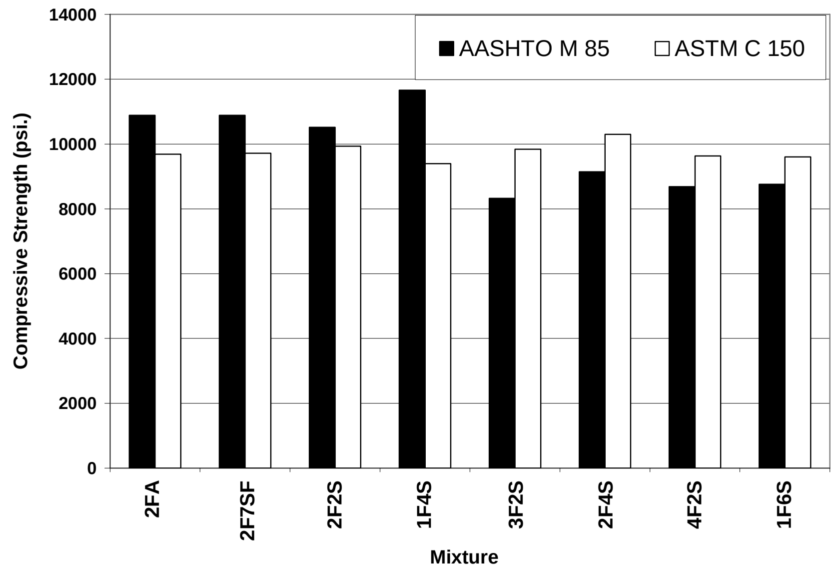



Figure 41 Compressive strength (365-day) for class V mixtures

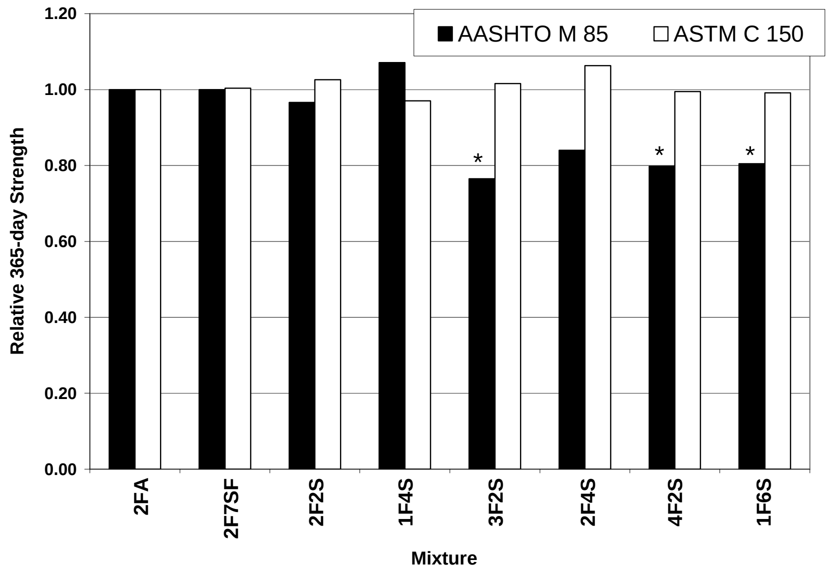



Figure 42 Relative compressive strength (365-day) for class V mixtures
(* low values likely due to test procedures)

In general, at 1-year the ternary mixtures containing AASHTO PC have a slightly greater compressive strength than that of the ASTM PC. Although this difference is thought to be relatively insignificant, one explanation is that AASHTO does not permit additional minerals to be added to the PC, while ASTM PC allows a 5% replacement of PC with limestone. This difference might explain the slight difference in performance.

### 6.1.2 MODULUS OF ELASTICITY

Figure 43 shows that the early MOE for class IV mixtures containing ASTM PC is dependant on the proportions of SCM added to the concrete mixture. Generally, binary and ternary mixtures containing high quantities of slow reacting FA provide the lowest MOE values until 365 days of curing. After curing of 365 days, the various SCM components appear to have fully reacted and produce MOE values similar to the mixtures containing S and SF. This result reflects the late strength gains noted in the compressive strength results. High quantities of S combined with FA appear to produce faster gains in MOE on ASTM class IV concrete mixtures.

Figure 44 shows that for the class V mixtures containing ASTM PC the addition of varying SCM proportions and materials has little notable effect. The majority of MOE values recorded for ASTM class V concrete report similar values at all testing dates and shows similar gains in MOE with time. The relatively unchanging MOE performance with regards to the different SCM proportions can be traced back to compressive strength performance. As recently shown, class V ASTM concretes show little variance among the different mixtures for all testing dates. Due to this occurrence, the similar MOE values appear acceptable. However, the SCM mixtures composed of 2F, and 3F2S, show significantly higher MOE values than the other mixtures at 7 and 14 day testing. These results are suspect, because both mixtures were formulated with high quantities of FA, and past research has shown that the slow reactive nature of FA will contribute to lower MOE values at early testing ages (Lane and Best 1982). Furthermore, there is no evidence in the compressive strength data to support the high MOE values shown by mixtures 2F and 3S2F at 7 and 14 days.

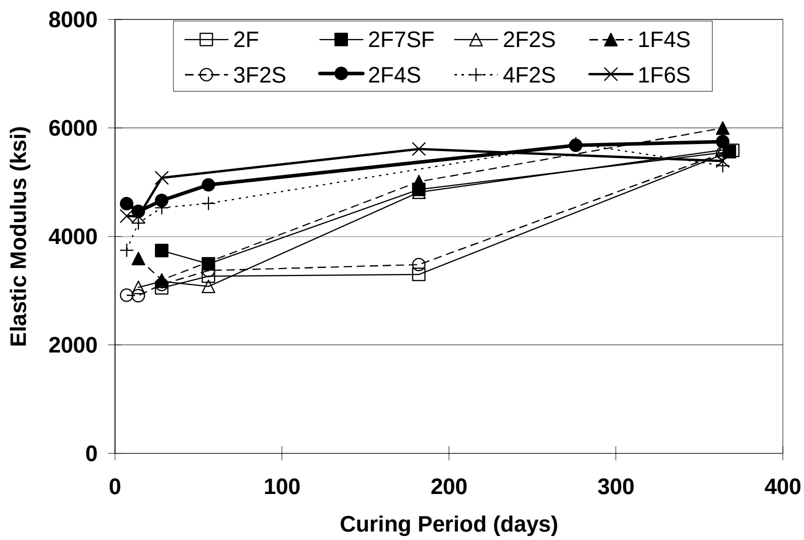



Figure 43 Modulus of elasticity for class IV mixtures with ASTM PC

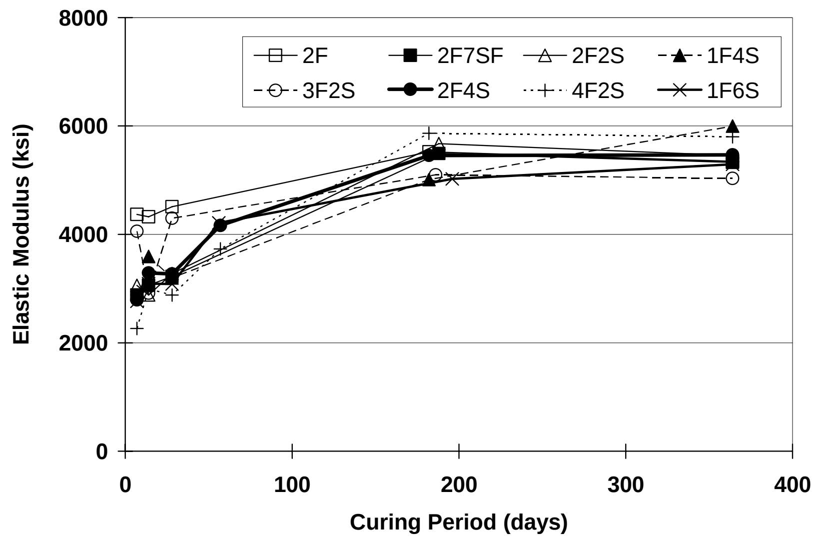



Figure 44 Modulus of elasticity for class V mixtures with ASTM PC

Similar to the pattern noticed for the mixtures with ASTM PC, Figure 45 shows that the SCM proportions used for each mixture generally do not produce any significant changes in MOE performance at later testing ages. At 14 days, however, the figure shows that mixtures containing high quantities of S (> 40%) produce higher MOE values than the other SCM mixtures. The higher MOE values reported for 1F4S and 1F6S was unexpected because the compressive strength for both mixtures does not greatly outperform the other mixtures. The class IV mixtures with AASHTO PC show that the addition of SF produces higher MOE values than the majority of the SCM mixtures. The high MOE values reported for 2F2SF at 56 days, however, appear reasonable based on highly reactive nature of SF.

Unlike the previous ASTM and AASHTO mixtures Figure 46 shows that AASHTO class V concrete produces relatively unchanging MOE values from 28 days to 365 days. However, the results previously presented for 7 and 28 day compressive strengths are similar to the results seen in Figure 46. Due to this fact, and the similarities noticed between compressive strength and MOE in the previous plots, the uniform results present in Figure 46 appear reasonable.

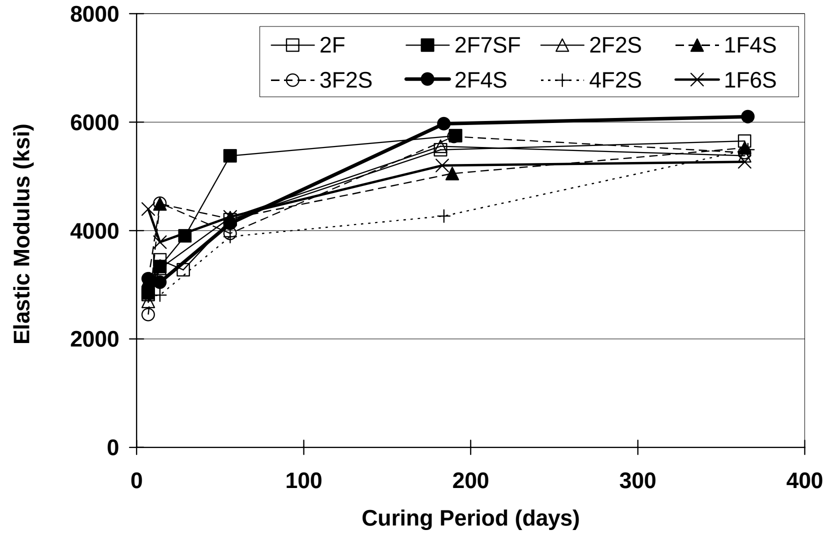



Figure 45 Modulus of elasticity for class IV mixtures with AASHTO PC

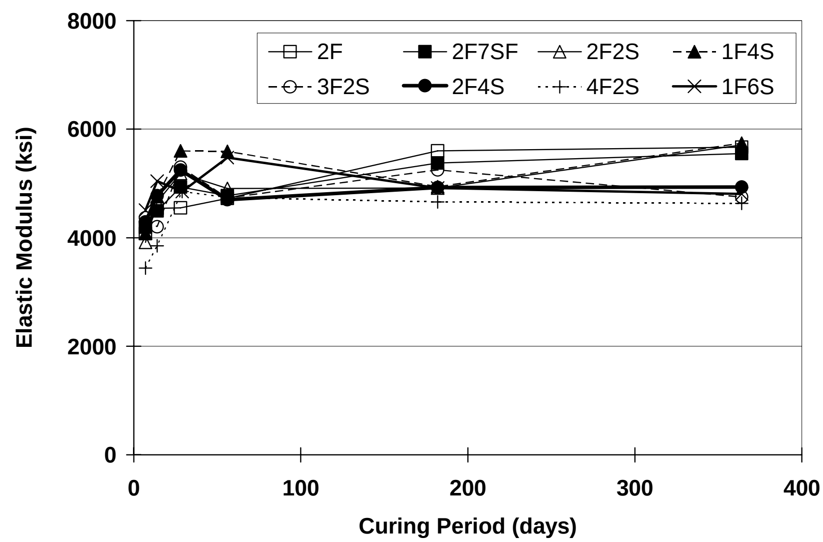



Figure 46 Modulus of elasticity for class V mixtures with AASHTO PC

Figure 47 and Figure 48 compare the 1-year MOE results. The similar performance noted between the PC types is due to the fact that the larger PC particles found in AASHTO PC have fully reacted at this curing period. Furthermore, the data presented in Figure 47 and Figure 48 show that 63% of the SCM mixtures containing AASHTO PC outperform the ASTM cements. This same proportion was valid for the compressive strength data as well.

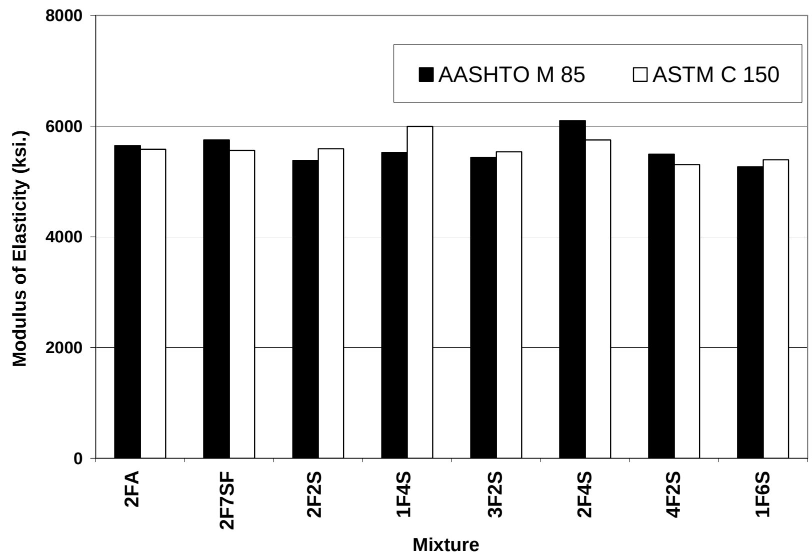



Figure 47 Modulus of elasticity (365-day) for class IV mixtures

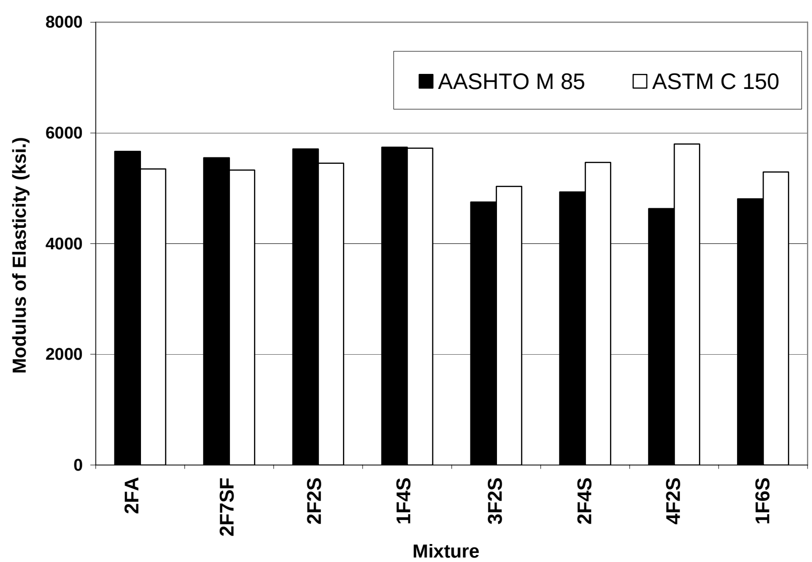



Figure 48 Modulus of elasticity (365-day) for class V mixtures

### 6.1.3 Split Tensile Strength

The results for the split cylinder test are presented in Figure 49 though Figure 52. The data for the split tensile strength have high variability for all testing ages. During testing, it was noted that all test specimens were found to fail by the splitting of the aggregate. Consequently, the variation in data is largely attributed to the variability of the coarse aggregate. Another cause of variance in the ultimate split tensile strength was caused by the shape of each specimen. It was found through caliper measurements that many specimens were not cylindrical through their entire length. Due to deformations in cylinder molds, the finished surface was oval shaped in many cylinders. This would allow a non-uniform load to be applied during the test, thus affecting the apparent tensile strength of the specimen.

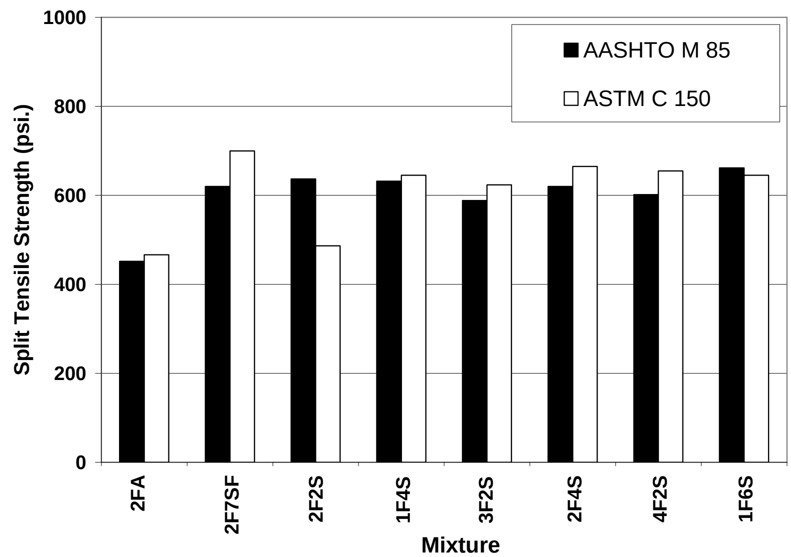



Figure 49 Split tensile strength (28-day) for class IV mixtures

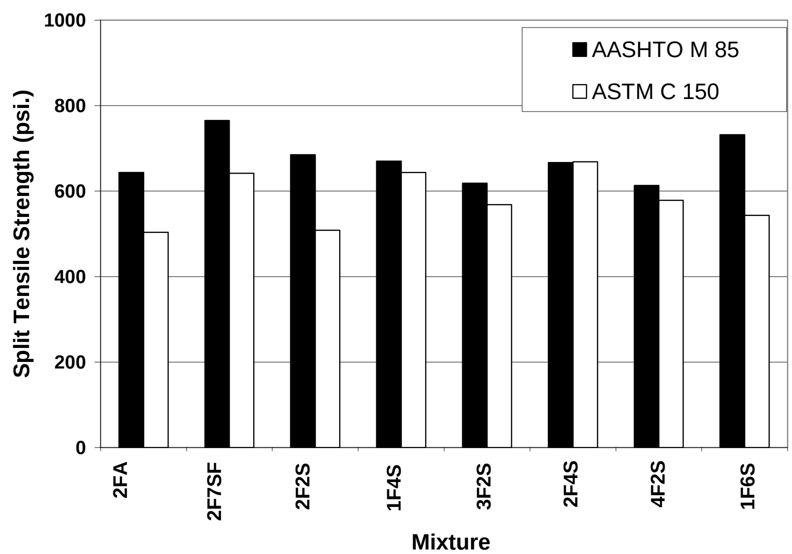



Figure 50 Split tensile strength (28-day) for class V mixtures

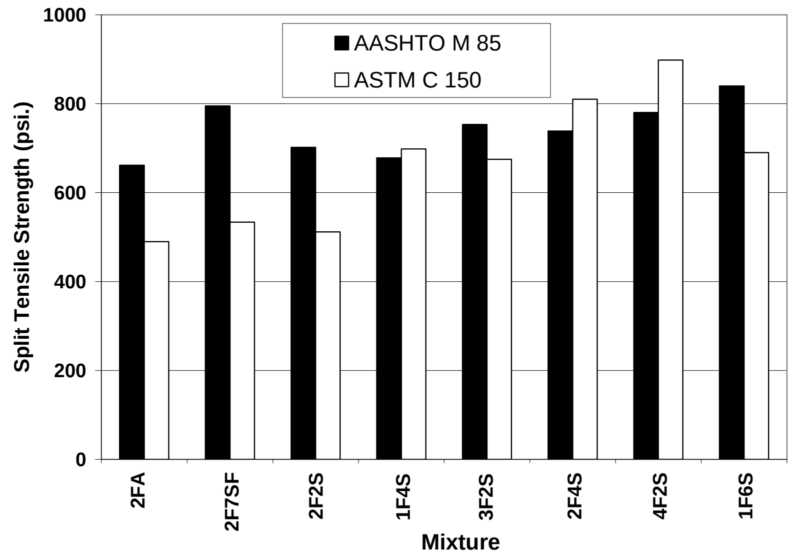



Figure 51 Split tensile strength (365-day) for class IV mixtures

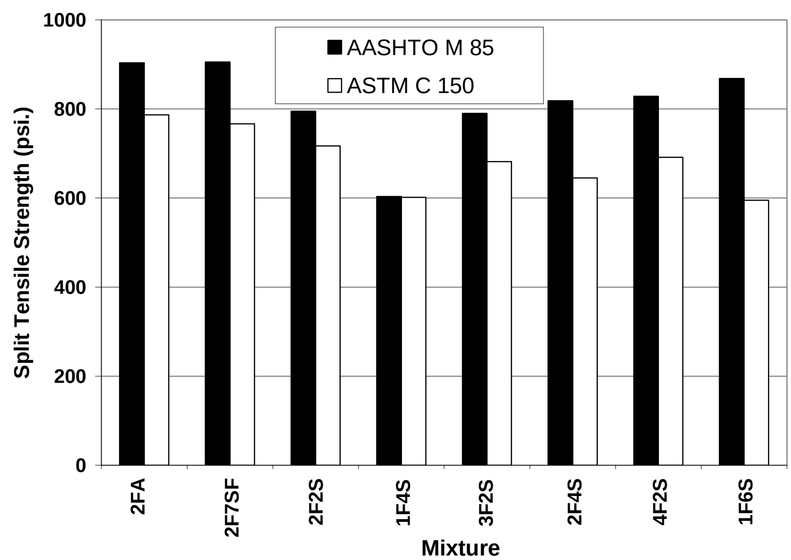



Figure 52 Split tensile strength (365-day) for class V mixtures

### 6.1.4 FLEXURAL STRENGTH

Figure 53 and Figure 54 show the 28-day Modulus of Rupture (MOR) results for class IV and V concrete. Note that some data are not available. The results appear to be relatively consistent among the various mixtures, but vary with PC type. In particular, the class V AASHTO PC mixtures have a consistently higher MOR than that of the ASTM mixtures. It is not clear why there is a significant effect for MOR but not for compressive strength.  This is likely due to the smaller PC particle size resulting in higher early strengths for the AASHTO PC relative to that of the ASTM PC.  Tensile strength appears to benefit from this phenomenon as well as compressive strength.

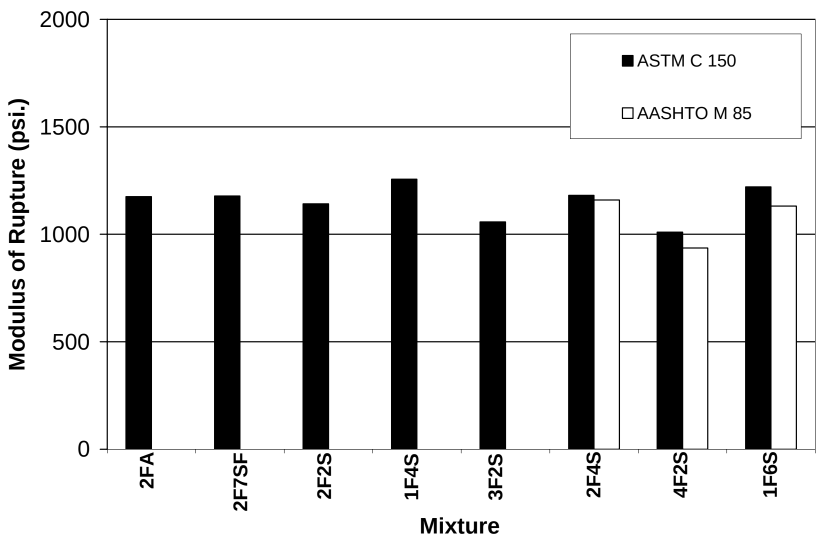



Figure 53 Modulus of rupture (28-day) for class IV mixtures

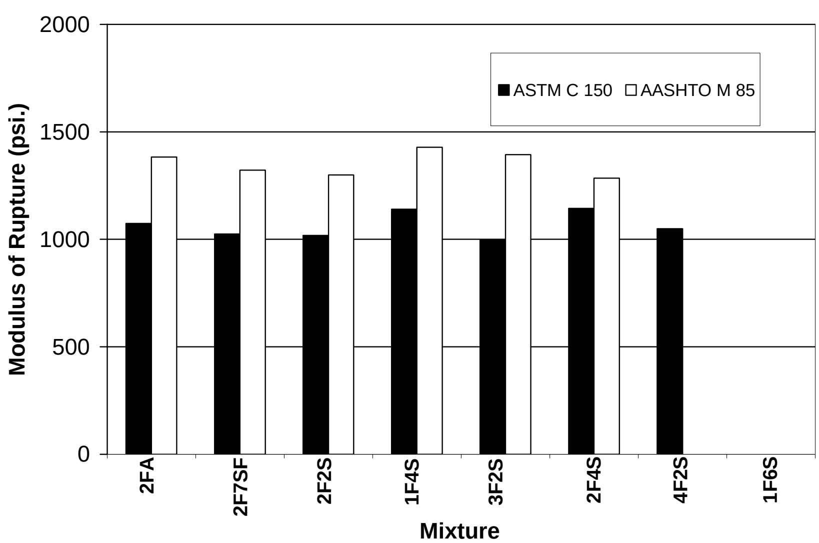



Figure 54 Modulus of rupture (28-day) for class IV mixtures

The majority of MOR strengths for each specimen exhibit a modest increase as the test age was increased from 28 days to 365 days (Figure 51 and Figure 52).  These results confirm those found by others. Neville 1995, for instance, suggests that the addition of SCMs into concrete mixtures does not directly influence the flexural tensile capacity beyond any typical gains normally experienced by altering the compressive capacity. Khatri provides evidence that for ternary blends containing different proportions of FA and SF, the MOR is not affected beyond the typical proportionality between MOR and compressive strength.

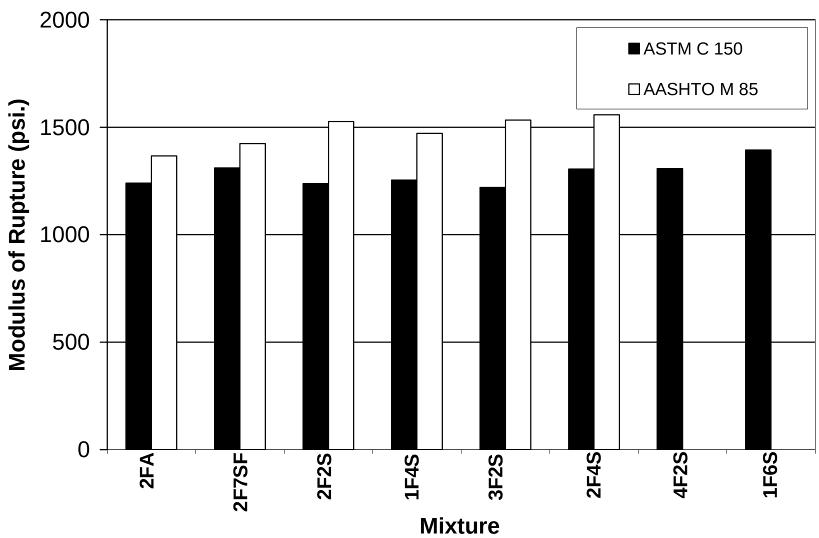



Figure 55 Modulus of rupture (365-day) for class IV mixtures

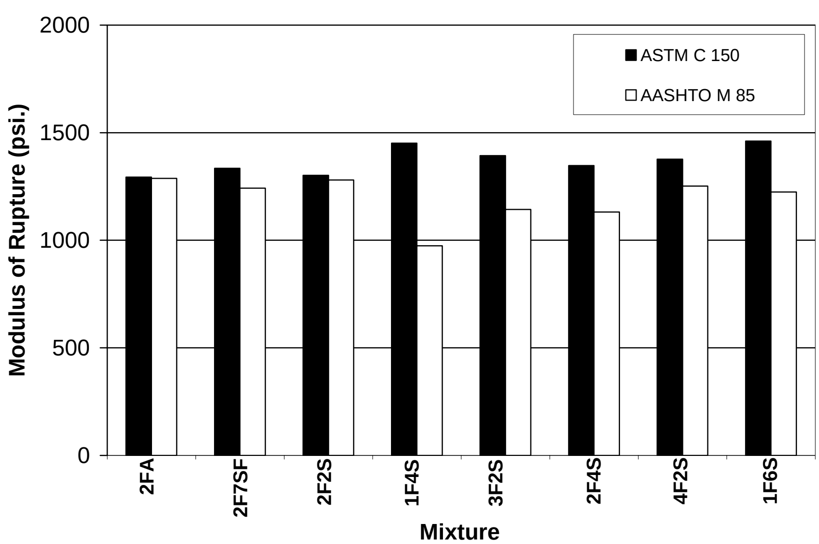



Figure 56 Modulus of rupture (365-day) for class V mixtures

### 6.1.5 CREEP COEFFICIENT

Figure 57 and Figure 58 present the creep coefficients calculated from the data gathered during the creep testing. Unfortunately, the combination of low sustained creep stresses and the use of dial gauges, resulted in data that produce creep coefficients that do not appear valid. Both of these figures show multiple specimens with creep coefficients significantly lower that 1.0. Furthermore, a number of specimens were calculated to have negative creep coefficients.

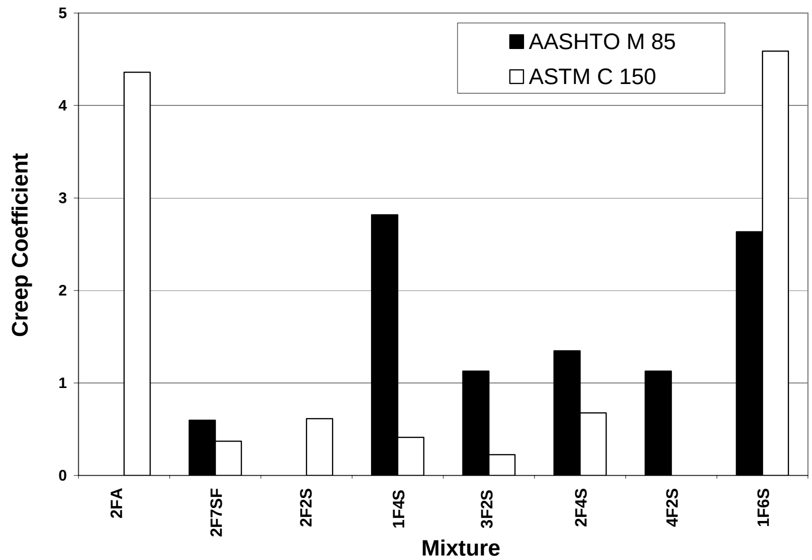



Figure 57 Creep coefficient for class IV mixtures

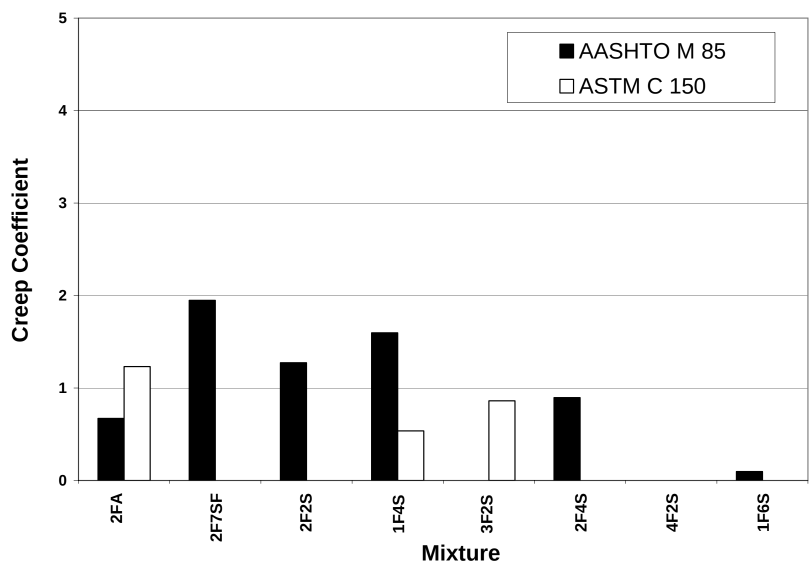



Figure 58 Creep coefficient for class V mixtures

## 6.2 DURABILITY TESTS

### 6.2.1 BULK DIFFUSION TEST

Selected bulk diffusion specimens were tested for chloride penetration after a 365-day exposure period. After their exposure period, each of the samples were profiled and tested using the FDOT standard test method FM5-516 to obtain their acid-soluble chloride ion content. The profiling was done by cutting 0.25-in. slices up to 1.5 in. depth for the ASTM C150 cement specimens and 2.0 in. for the AASHTO M85 cement specimens. Sample slices were saw-cut from the bulk diffusion cylinder specimens pulverized and divided into three separate samples for testing. The results are giving in Appendix G. Background chloride content was determined using uncontaminated samples. These values are also given in Appendix G.

The diffusion coefficients were determined by fitting the data obtained in the chloride profile analysis to Fick's Diffusion Second Law equation. The measured chloride contents at varying depths are fitted to Fick's diffusion equation by means of a non-linear regression analysis in accordance with the method of least squares fit. The equation used to fit the data was:

$$C(x,t) = C_s - (C_s - C_i) erf\left(\frac{x}{\sqrt{4Dt}}\right) \qquad \text{Equation 2}$$

where:

C(x,t) - chloride concentration, measured at depth x and exposure time t (% mass)

$C_s$ - projected chloride concentration at the interface between the exposure liquid and test specimen that is determined by the regression analysis (% mass)

$C_i$ - initial chloride-ion concentration of the cementitious mixture prior to the submersion in the exposure solution (% mass)

x - depth below the exposed surface (to the middle of a layer) (m)

D - chloride diffusion coefficient ($m^2$/sec)

t - exposure time (sec)

erf - error function (tables with values of the error function are given in standard mathematical reference books).

In some cases, the outermost data point may be ignored because the chloride transport mechanisms near the surface include absorption, capillary action, and wetting/drying. The bulk diffusion test, however, provides a saturated environment where nearly pure diffusion can occur. Consequently, all chloride values were considered when conducting the curve fit.

Profile data and curve fitting results for each concrete mixture are included in Appendix G. The background levels for samples TB4A4 through TB8A4 and TB5H5 through TB8H5 were higher than the chloride contents measured on interior slices of the respective exposed samples, indicating that the background samples were likely contaminated during processing. Consequently, the background values used to fit the equation were the lowest value measured in the interior slices of the exposed samples.

The one year diffusion coefficients are summarized in Figure 59 and Figure 60. The values range from around 3E-12 $m^2$/sec to less than 1.5E-12 $m^2$/sec. Vivas et al. (2007) conducted similar bulk diffusion tests using one year of exposure. They found that for a mixture with 8% SF the average one year diffusion coefficient was 2.06E-12 $m^2$/sec, for a mixture with 10% metakaolin it was 1.26E-12 $m^2$/sec, and for a mixture with 50% S it was 2.68E-12 $m^2$/sec for Florida concretes. These values are in reasonable agreement with the data shown in the chart.

The ASTM PC mixtures have higher diffusion coefficients with an average of 2.27 and 2.21E-12 $m^2$/sec for Class IV and Class V concrete mixtures while the AASHTO PC mixtures have an average of 2.02 and 1.53E-12 $m^2$/sec for Class IV and Class V concrete mixtures. The lower diffusion coefficients for the AASHTO PC may be the result of the continued hydration of the larger PC particles.

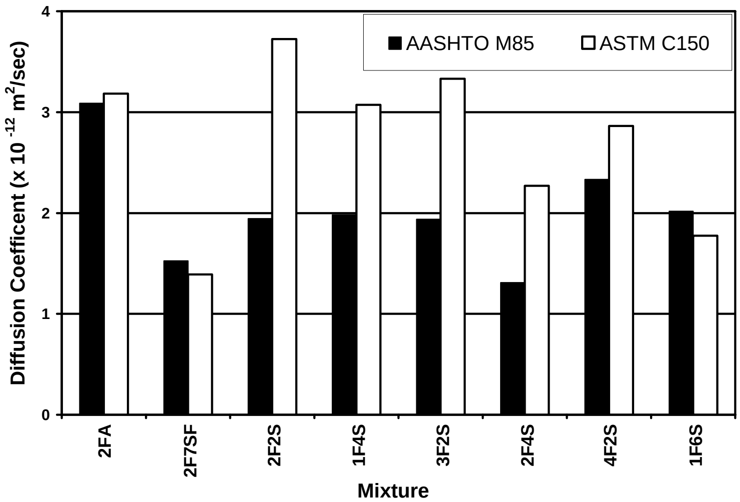



Figure 59 Bulk diffusion (365 day) for class IV mixtures

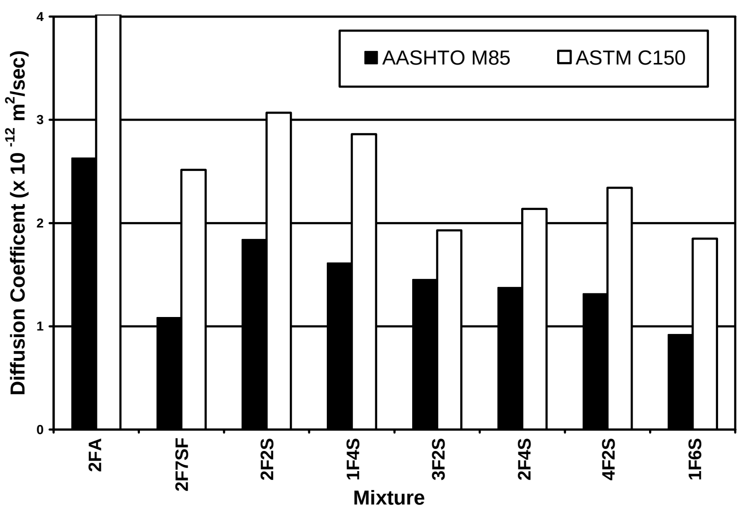



Figure 60 Bulk diffusion (365 day) for class V mixtures

### 6.2.2 Rapid Migration Test

Data collected from the rapid migration test (RMT) procedure was used to calculate the diffusion coefficient ($D_{RMT}$) based on the following equations:

$$D_{RMT} = \frac{R \cdot T \cdot L}{zF(U - 2)} \cdot \frac{x_d - \alpha\sqrt{x_d}}{t}$$ Equation 3

$$\alpha = 2\sqrt{\frac{R \cdot T \cdot L}{zF(U - 2)}} \cdot \mathrm{erf}^{-1}\left(1 - \frac{2C_d}{C_o}\right)$$ Equation 4

where:

$D_{RMT}$ - non-steady-state chloride migration coefficient, $m^2$/sec

z - absolute value of ion valence, for chlorides z = 1

F - Faraday constant, F = 9.648x104 J/(V*mol)

U - absolute value of the applied voltage, V

R - universal gas constant, R = 8.314 J/(K*mol)

T - average value of the initial and final temperature in the anolyte solution, K

L - thickness of the specimen, m

$x_d$ - average value of the penetration depths, m

t - test duration, sec

erf - error function

$C_d$ - chloride concentration at which the color changes, $C_d$ = 0.07 N for PC concrete

$C_o$ - chloride concentration in the catholyte solution, $C_o$ = 2 N.

Figure 61 and Figure 62 show the 56-day RMT results and Figure 63 and Figure 64 show the 91-day RMT results. Generally, the diffusion coefficients are lower for the class V mixture likely due to the lower w/cm ratio. With the exception of the 2FA mixture, the diffusion coefficients are less than 6E-12 $m^2$/sec. This agrees with results from Vivas et al. (2007). They found that RMT diffusion coefficient for a mixture with 20% FA and w/cm = 0.35 was 6.1E-12 $m^2$/sec. Although this is lower than that determined in this testing, it is in the general range of values obtained. For mixtures containing 20%FA and 8%SF their values were from 1.3 to 5.2 E-12 $m^2$/sec, which generally agrees with the results from this testing. Finally, they found that a mixture with 50% S had a 56 day RMT of 4.6E-12 $m^2$/sec, which agrees well with the results from this testing. To provide a reference point for these mixtures with SCM, Vivas et al. found that a mixture containing no SCM and a w/cm = 0.45 had a 91-day RMT diffusion coefficient of 20E-12 $m^2$/sec. This indicates that perhaps the variation in diffusion coefficients among the ternary mixtures should not be compared with too fine a point. All of the mixtures displayed low diffusion coefficients. It is interesting to note, however, that the diffusion coefficient for S mixtures decreased with the increase in S proportions. Furthermore, when the S replacement proportion was between 40-60%, then the diffusion coefficient approached that of the SF mixture.

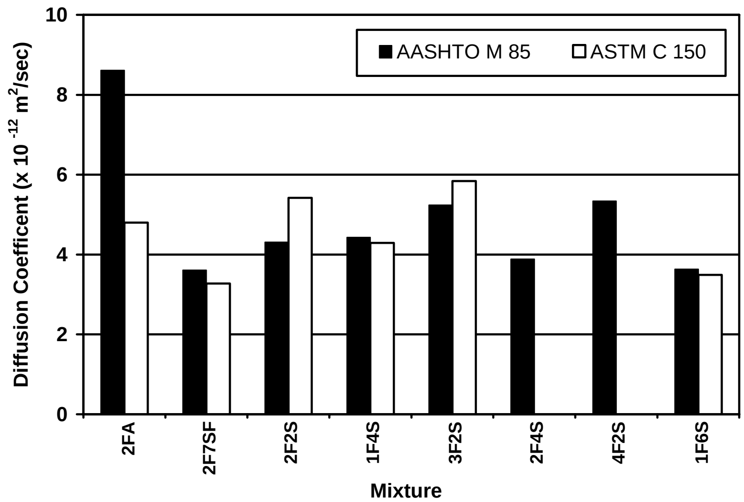



Figure 61 RMT (56-day) for class IV mixtures

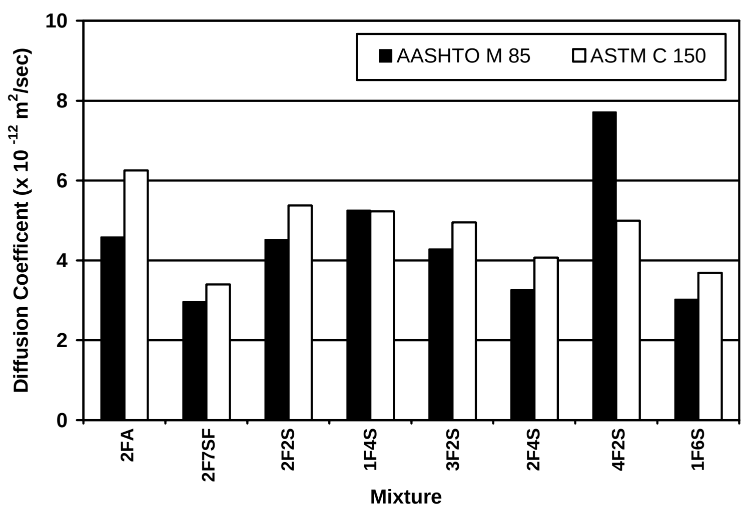



Figure 62 RMT (56-day) for class V mixtures

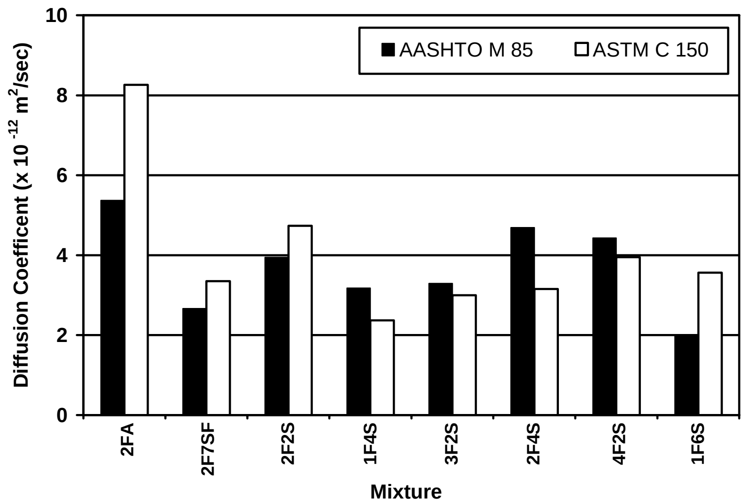



Figure 63 RMT (91-day) for class IV mixtures

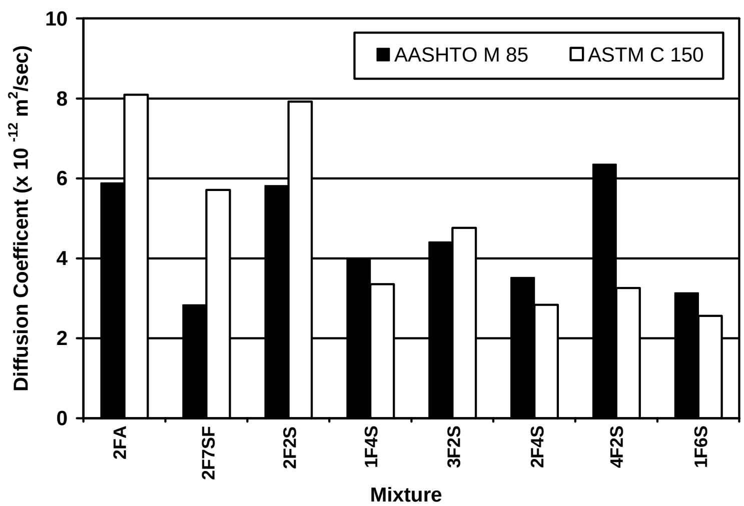



Figure 64 RMT (91-day) for class V mixtures

### 6.2.3 Surface Resistivity Test

Surface resistivity readings were taken at varying ages to determine the relative reduction in concrete permeability over time based on its conductivity. Results for concrete made with ASTM PC are shown in Figure 65 and Figure 66. The results are divided into two plots that contain the results for the Class IV and Class V concretes, respectively. Results for the concrete made with the AASHTO PC are shown in Figure 67 and Figure 68 and are likewise divided into two plots. In general, the increasing trend in resistivity is exhibited by nearly all of the mixtures as the age increases.

Figure 65 through Figure 68 show that the ternary blend admixtures and proportions used during mixing appear to have a direct effect on the SR readings. However, with regards to the concrete type there appears to be little change between ASTM class IV, ASTM class V, and AASHTO class IV concretes. At early curing ages, AASHTO Class V ternary mixtures produce similar values to the other ternary mixtures. Figure 68, however, shows that AASHTO class V ternary mixtures produce a decrease in SR between ages of 91 and 182 days. These data are likely the result of erroneous readings since the next age shows the SR back to the original trend. Furthermore, Figure 68 shows that at 91 day testing, AASHTO class V mixtures have very similar values to the other mixtures used for this investigation. Due to all of durability results collected during this investigation the data suggest that the decrease in surface resistivity readings was caused by a malfunctioning testing apparatus and/or poor casting technique directly after mixing.

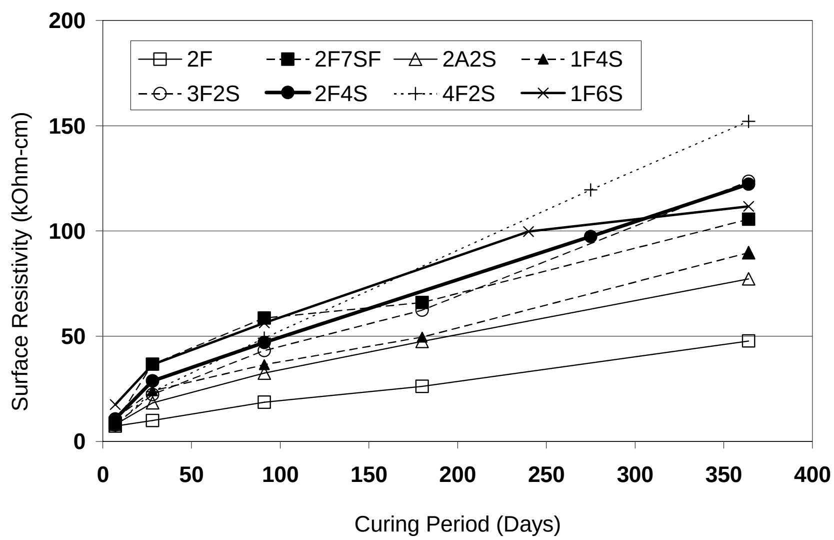



Figure 65 SR for class IV mixtures with ASTM PC

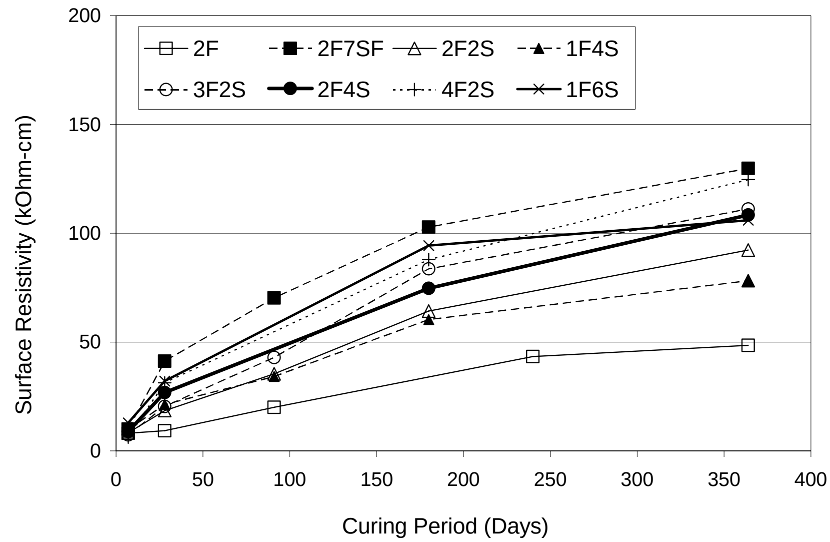



Figure 66 SR for class V mixtures with ASTM PC

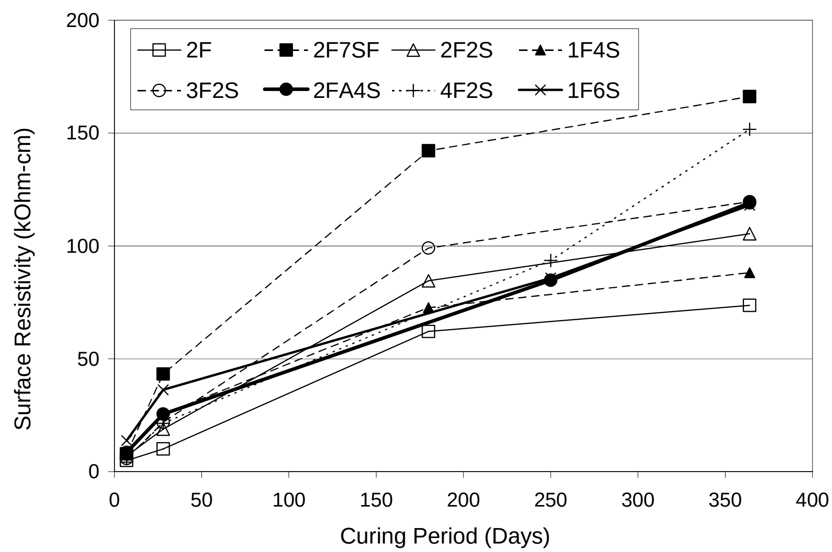



Figure 67 SR for class IV mixtures with AASHTO PC

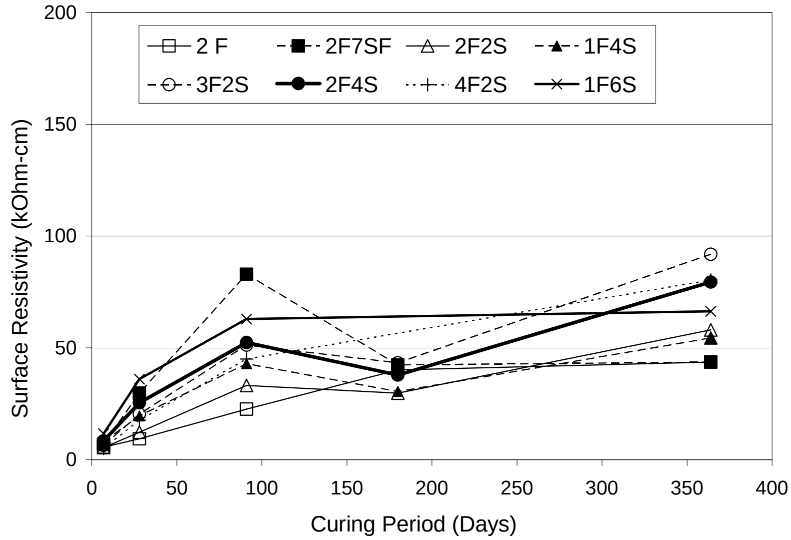



Figure 68 SR for class V mixtures with AASHTO PC

Figure 65 through Figure 68 show increases in surface resistivity for each concrete class and mixture with time. At early curing ages < 7 days all of the figures show little variance in the SR values for all of the mixtures. The lack of SR variance caused by the addition of ternary admixtures shows signs that at early curing ages the ternary blend admixtures have not begun to react. The lack of activity seen during these tests appears reasonable as a similar lack of reactivity was seen during compressive strength testing conducted at the early curing periods. While the low SR values seen at 7 day testing can be attributed to low reactivity, when compared to the values shown in Table 7, no mixtures produced SR values that performed better than High for the penetrability category created by Chini et al. (2003).

After a curing period of 28 days, however, ternary mixtures containing 20%FA+7%SF typically outperform the other mixtures. These results appear reasonable as the early reactive properties of SF are known to produce a dense, less permeable concrete (ACI 234R-06). After curing for 91 days the highly reactive SF has slowed leaving the slower reacting FA to produce denser, less permeable concrete. This explains why the rate of SR growth decreased to rates similar to the other ternary mixtures. The S mixtures, however, are unable to make up the large increase in SR values seen during the first 91 days.

Figure 69 and Figure 70 show that the addition of S to ternary blends produces higher short term SR values than mixtures containing solely FA. Additionally, the volume of S used as admixture has an effect on the 28 day surface resistivity of concrete. Ternary mixtures containing 60%S outperform mixtures containing 40%S and 20%S with comparable levels of FA. Moreover, mixtures containing 40%S consistently produce higher 28 day SR values than mixtures containing 20%S with similar quantities of FA. While the addition of large quantities of S to ternary mixtures causes SR values to increase for the first 28 days of curing, the ultimate SR values is not proportional to the quantity of S added during mixing.

Regardless of the concrete specification or class used for mixing, the test results show that the addition of S improves the surface resistivity within ternary blend concretes, especially at early ages. As the curing time increases (> 181 days), the increase in surface resistivity found in the ternary mixtures is similar to binary mixtures containing only 20%FA. This occurrence is once again supported by the slow reactive nature of FA. Analysis of the SR vs. curing period plots shown in Figure 65 - Figure 68 show that short term strength gain is comparable to other S containing ternary mixtures. However, after curing for a period of 182 days there is a large increase in surface resistivity for the 40%FA-20%S ternary mixture, relative to the other ternary mixtures. It is believed that the large percentages of FA added for these mixtures are reacting at late curing ages, producing denser and less permeable concretes. This occurrence is supported by the fact that the ternary mixtures containing 30%FA-20%S produce similar gains to 40%FA-20%S concretes in SR readings at late curing ages.

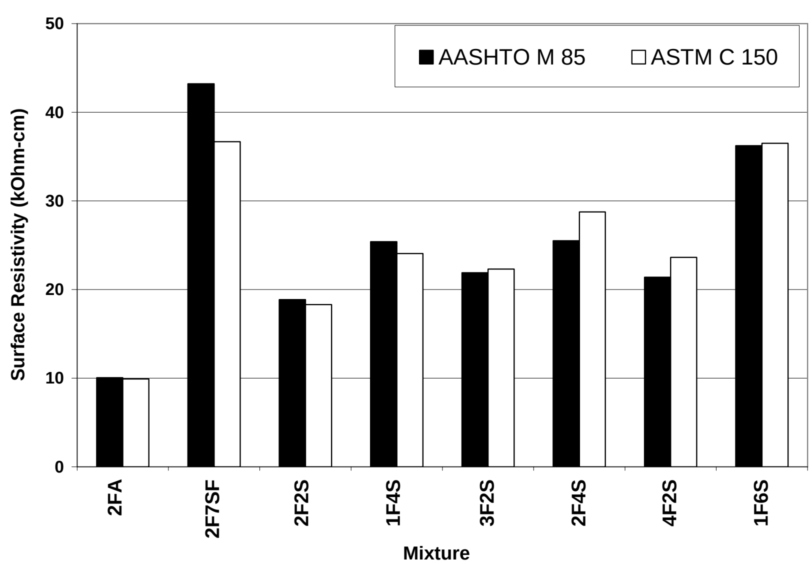



Figure 69 SR (28-day) for class IV mixtures

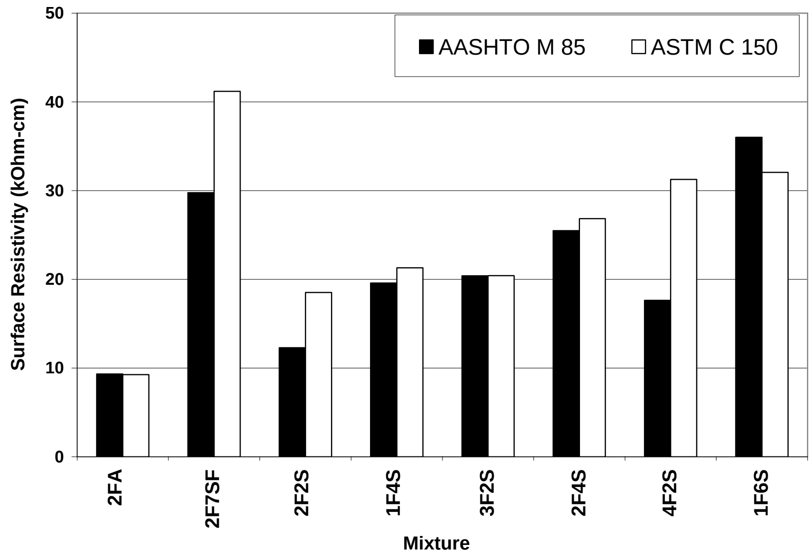



Figure 70 SR (28-day) for class V mixtures

#### 6.2.4 Corrosion of Embedded Reinforcing Steel

Based on the bulk diffusion test results, chloride penetration into the mixtures has been relatively small. This will be even more pronounced in the ASTM G109 test where salt water is ponded periodically on one surface of the specimen rather than continuously. Consequently, corrosion current and potential data indicate that there is very little activity in any of the specimens.

### *6.3 XRD*

JCPDS file 44-1481 reports a d-spacing of 2.62700 Å (approximately 34° 2Θ) as the dominant diffraction peak Portlandite, or CH; this peak was used as reference peak for comparison between mixes. All the data for peak intensity was re-calculated for the equivalent scan time of 1 sec/step.

#### 6.3.1 Feasibility study

The following pilot study results were able to show sufficient differences in the CH peaks to support the continued analysis of the ternary blends.

Figure 71 displays a summary of the prominent CH peaks through 91 days of hydration for the six pilot mixes. Mix 1 (control) consistently produced the largest volume of CH as reflected in the relatively high peak intensities measured with the maximum occurring at 14 days. This was because Mix 1 had the largest relative volume of PC, the primary source of CH. The other mixes contained lower volumes of CH at nearly all ages. Mixes 2 and 4 showed the same general trend as Mix 1. Mix 2 initially produced CH at a similar rate as the control mix between 1 and 7 days, although with lower total volume. After 7 days, however, an apparent decrease in production occurs, which is likely due to the CH consumption caused by the pozzolanic reaction of the S combined with the lower volume of CH available for reaction. Mix 4 (80% Portland) does not show the same initial production rate as Mix 2, but does appear to have the same volume and trend as that of Mix 2. This may be indicative of the lack relative difference in reaction kinetics of the FA compared to S, which allows early production of the CH in Mix 2, but not Mix 4. For mixes 3, 5, and 6, the low volume of PC may result in low volumes of CH with some slight variations caused by the SCM. For example, Mix 6 has the highest SCM replacement of any of the mixes, which may account for the low overall net production of CH throughout the 91 days.

The high replacement ratio in ternary blends may result in an inadequate volume of PC hydration products to allow reaction of the entire volume of SCM. The late drop in intensity around 56 days could be the FA reacting with the remaining CH. Lacking hydration products for reaction, the excess FA will remain unreacted within the matrix, which in large volume may cause mechanical or durability problems within the microstructure.

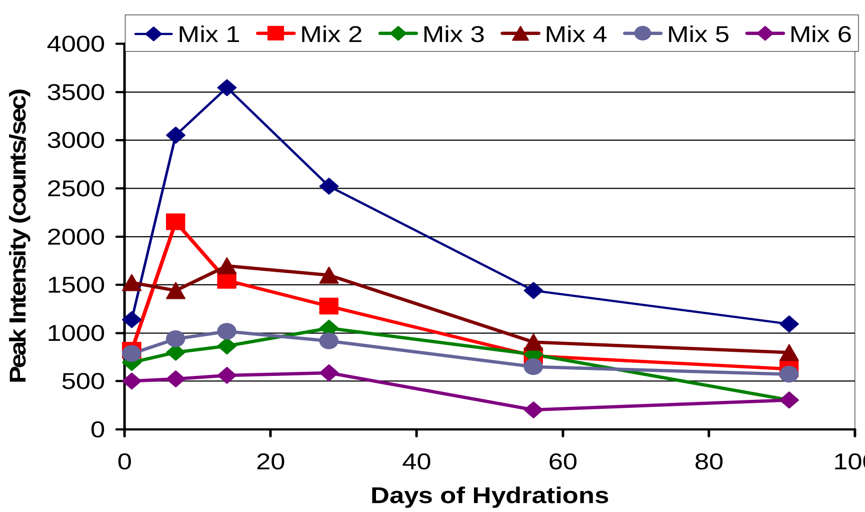



Figure 71 Comparison of peak intensities at d-value = 2.62700 Å for the pilot study mixes through 91 days.

Figure 72 through Figure 74 show SEM imaging of Mixes 1, 3, 5, and 6 at ages of 1 day, 28 days and 56 days, respectively. The images of each mix are placed in the same arrangement in each figure to allow visualization of the hydration process. Mix 1, which contains no SCM, shows the typical hydration stages of PC. The PC grains are apparent at the early ages with very little to no cementation present. At 56 days the matrix has become less grainy yet porous. In contrast, the hydration of Mix 3 (50% S) starts with a more coarse microstructure than that of the pure PC mix, which includes large S grains that are visible at 1 day. These grains diminish as they hydrate and appear to be nearly entirely consumed by an age of 56 days. By 56 days the mix 3 appears to have a less porous microstructure than that of mix 1.

Figure 71 shows that mix 3 and 5 appear to have similar CH production and consumption rates. In contrast, the SEM images for mix 5 (50% PC, 20% FA, and 30% S) differ from that of mix 3 (50% PC and 50% S). At day one, unhydrated S particles occupy a large volume of the mix 3 paste relative to that of mix 5. FA can also be seen in mix 5 and overall the structure appears to be less porous due to the particle packing provided by the smaller FA particles. At 28-days (Figure 73) most of the S particles in mix 3 and 5 have hydrated, while partially hydrated FA particles are still present in mix 5, confirming that S is more reactive than FA. Furthermore, S hydration will likely use the available CH products, possibly delaying or even stalling the FA reaction.

The primary difference between mix 5 and mix 6 at 56 days is that all the S has reacted in mix 5 and the presence in mix 6 is evident in Figure 74d. Even after 56 days of hydration both show the presence of unhydrated FA left in the matrix. After 56 days, FA particles are still seen (sparsely) throughout the matrix in both mixes. The unhydrated particles could be due to the lack of CH caused by lower PC volumes and use of CH to react with S. Reduced CH availability is also evident when comparing the 56 day images of Mix 3 (50% PC and 50% S) and Mix 6 (30% PC, 20% FA, and 50% S). FA particles are visible in the matrix.

In summary, this limited scope XRD analysis and SEM imaging have shown that as SCM volumes are increased, the net volume of CH available for pozzolanic reaction decreases, resulting in unreacted SCM. This work has also indicated that the early reaction of S may consume available CH, which then may starve the FA reaction at later ages.

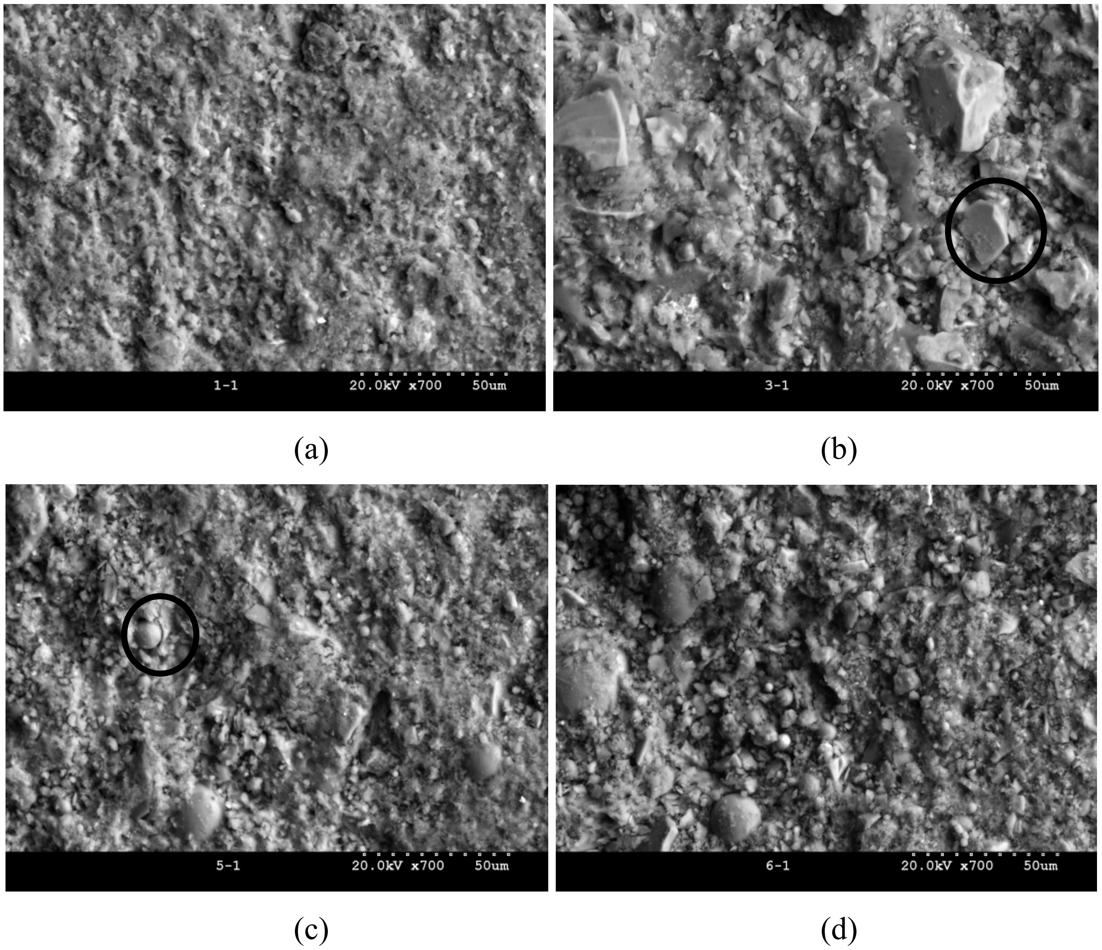



Figure 72 SEM micrographs at 1 day (a) mix 1 (100% PC), (b) mix 3 (50/50 PC/S), (c) mix 5 (50/20/30 PC/FA/S) (d) mix 6 (30/20/50 PC/FA/S).

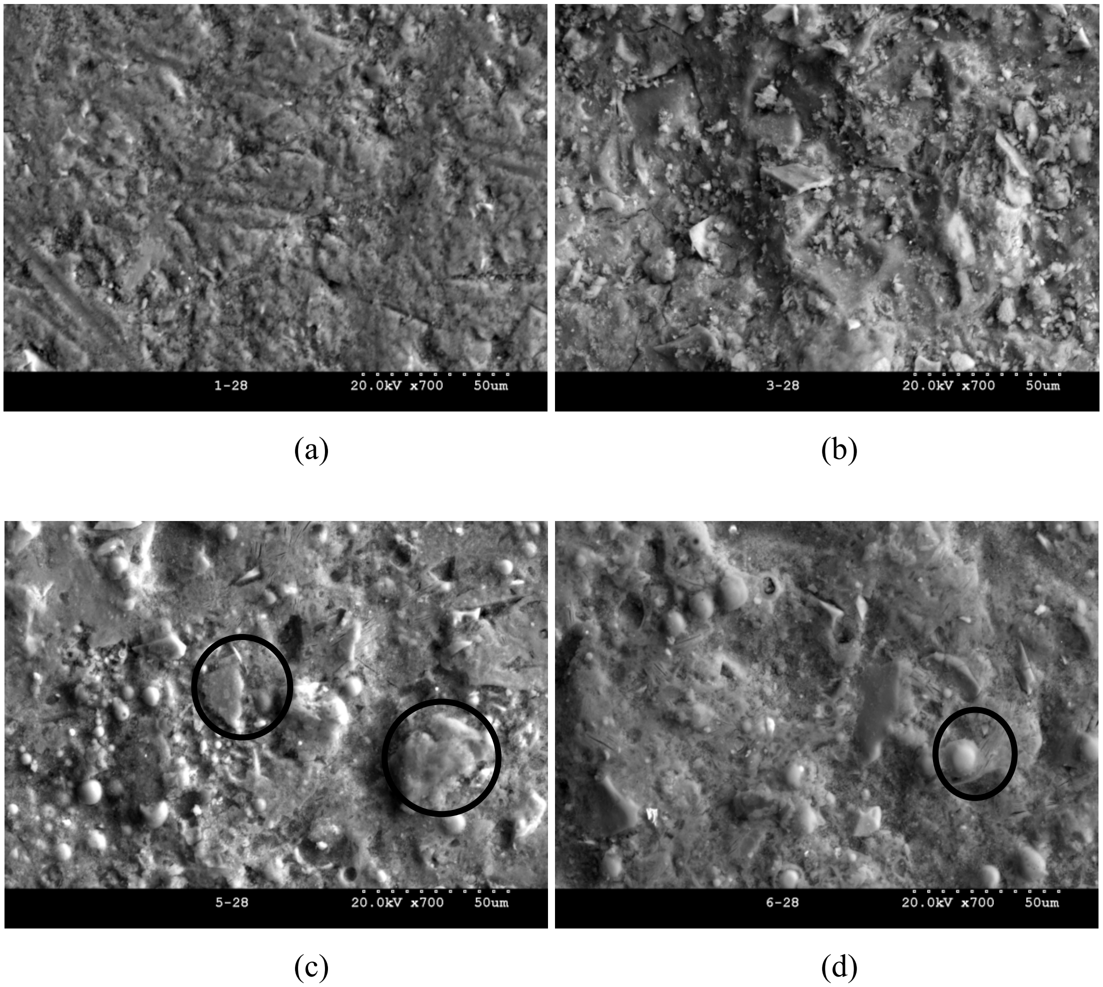



Figure 73 SEM micrographs at 28 days (a) mix 1 (100% PC), (b) mix 3 (50/50 PC/S), (c) mix 5 (50/20/30 PC/FA/S) (d) mix 6 (30/20/50 PC/FA/S).

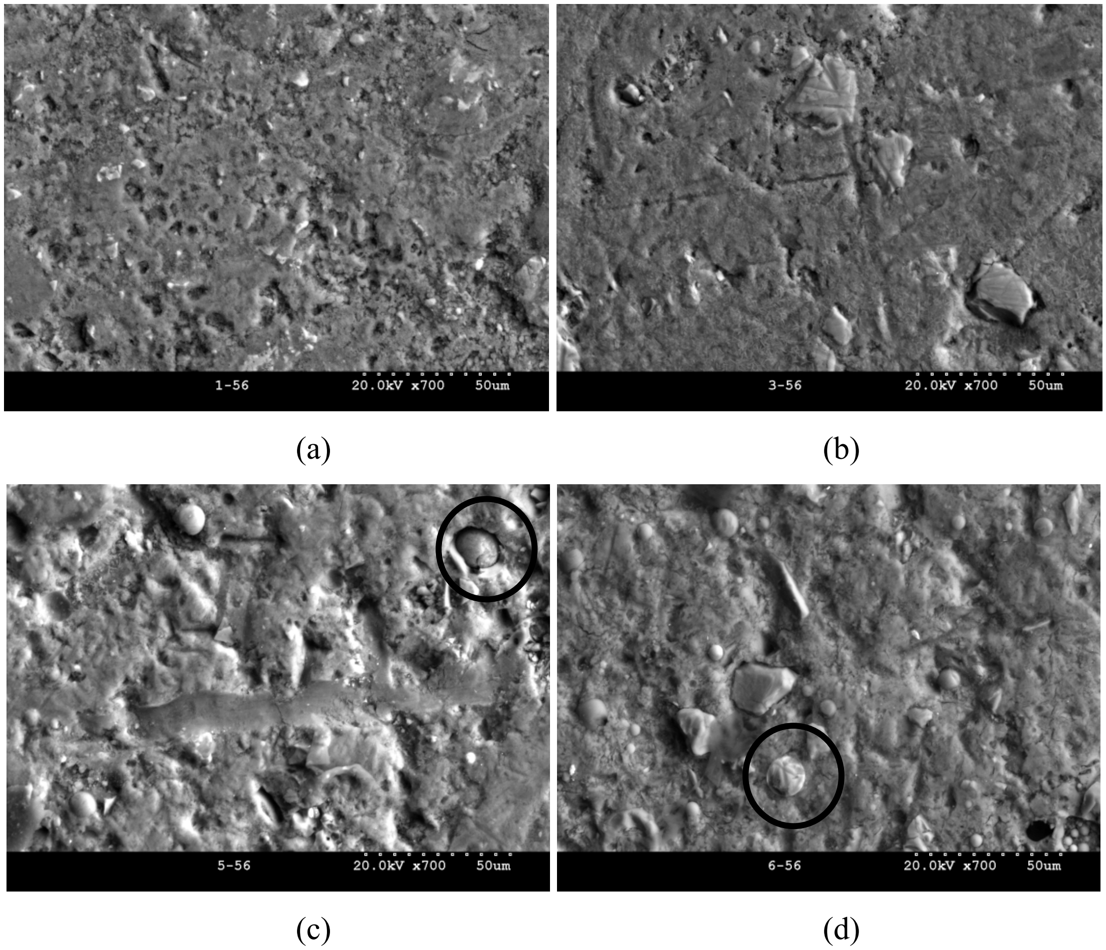



Figure 74 SEM micrographs at 56 days (a) mix 1 (100% PC), (b) mix 3 (50/50 PC/S), (c) mix 5 (50/20/30 PC/FA/S) (d) mix 6 (30/20/50 PC/FA/S).

### 6.3.2 Cement Pastes

Examining the XRD spectrums (Appendix B) supports the findings of the feasibility study the volume of PC has a direct effect on the production of CH and its reaction with SCM.

According to the JCPD of CH, the two of peaks at 18° and 28° 2Θ are CH peaks that are the 2nd and 3rd most prominent respectively for this mineral. Throughout the hydration it appears that the 28° peak does not change or have much relevance on the rate of hydration. The fluctuation of the 18° and the 34° peaks could indicate the production and dissolution of the CH in the corresponding crystal states. Based on the mineralogy of the structure at these 2 peaks, it is predicted that the 18° structure is more stable and forms a smaller crystal than the one at 34°. Assuming this can be shown, the benefit of optimizing the peak ratios between these two crystals will affect properties such as density of paste and the presence of an interstitial zone, which in turn will affect the durability of the concrete. This effect has been shown using nano-silicates in PC because of the greater surface area of the particles (Ji 2005, Jo, *et al*. 2007). It is possible that a similar effect occurs with the increased presence of the smaller CH crystal formation.

### 6.3.3 Hardened Paste vs. Concrete

Limited scans were done using powder diffraction on hardened concrete samples. The surface of the sample was evaluated and marked to try and encompass as much paste area as possible during the scan, as shown in Figure 75. The resulting scans clearly showed the quartz peaks indicating the aggregate and fines. Due to the intensity of the quartz peaks, the CH peaks were hard to separate. Figure 75 shows a comparison for ASTM TB6A5 between the hardened paste and the comparable concrete sample. Each was scanned under the same conditions. Improved scans might be obtained by using a longer scan rate and more isolated peak range, i.e. 32°-36° 2-theta. Even though the peak intensities of the quartz if very high, the CH peak appears to be comparable to the paste samples. Based on this trend it appears as though the hardened paste scans can be a comparable estimate to the paste within a concrete system.

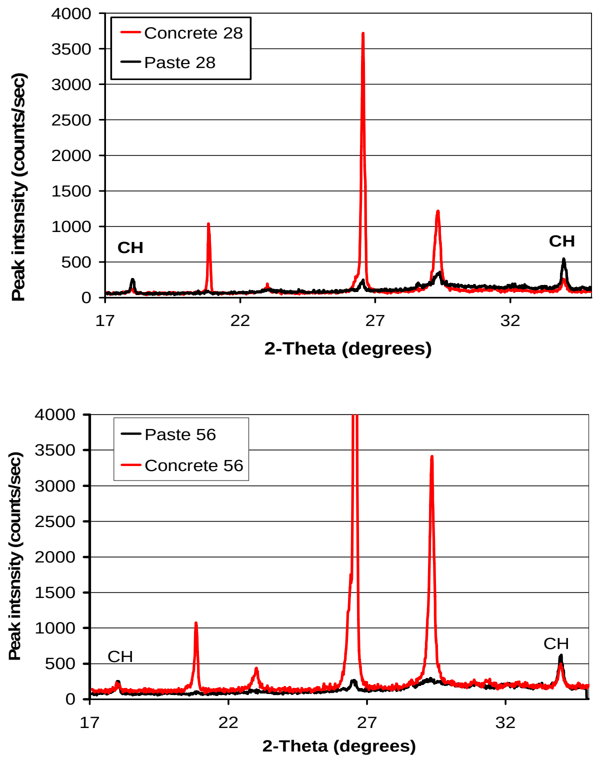



Figure 75 XRD spectrums comparing ASTM TB6A5 hardened paste to the same concrete mix at 28 and 56 days.

### 6.3.4 Hardened Paste vs Powder

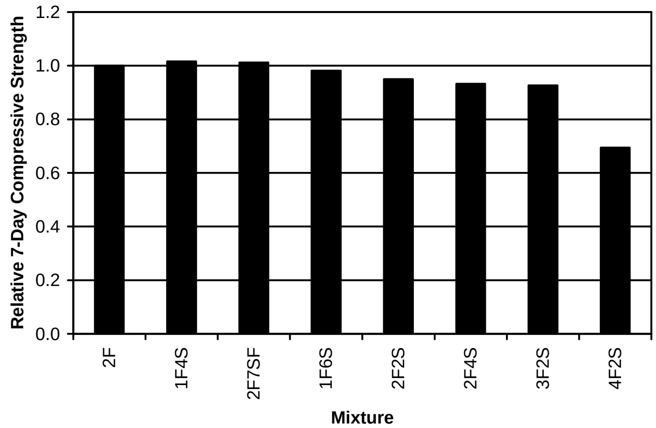
The general trend at each of the major peaks for CH was consistent throughout all the mixes. Both the 28° and 34° peak was lower in intensity for the powder than the hardened paste. The 18° peak for the powder was always higher than the hardened paste. The difference in these peaks may be attributed to the idea that CH crystallizes with a preferred orientation. When analyzing the powder samples, the orientation is negated and the results indicate quantitative comparison rather than a qualitative one for the hardened paste. More investigation would have to be done for confidence of the preferred orientation issue. It appears that as long as the samples compared are in the same form, hardened paste or power, a good qualitative analysis can be made.

# 7 SCM PROPORTIONING FOR STRENGTH AND DURABILITY

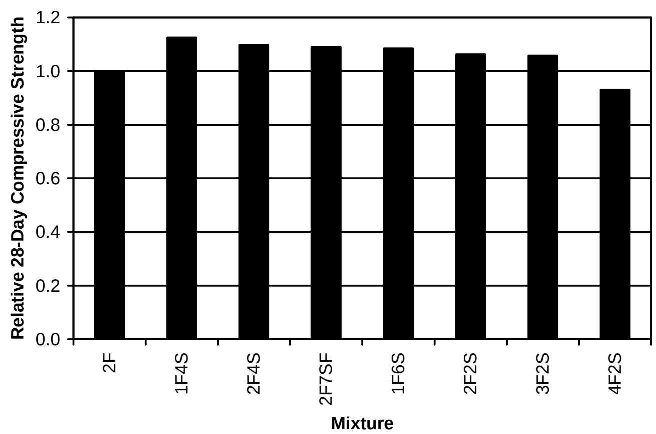
Because the mechanical properties and durability of concrete are both important factors for structures placed in aggressive environments, these parameters are further analyzed in the following sections.

## 7.1 *Compressive Strength Comparison*

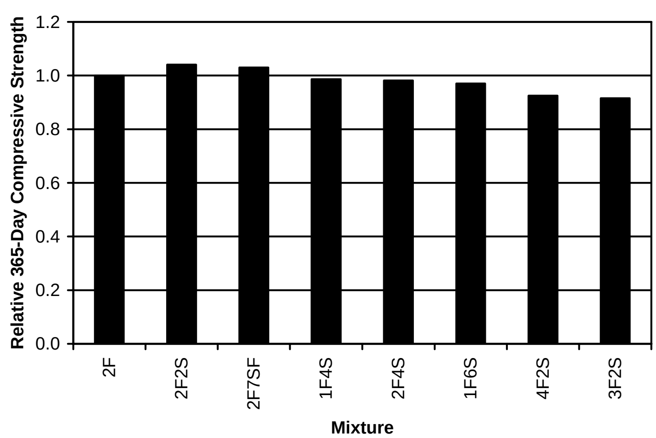
Figure 76 shows a summary of the 7, 28, and 365 day compressive strength normalized to the control mixture 2F. The final value for each mixture and age is an average of the results from both PC types and both concrete classes. Each chart shows the ternary results ranked from highest to lowest (left to right). Early strength development in concrete mixtures is important to consider due to the high compressive stresses generated during prestressing. Because a large number of the structures exposed to extremely corrosive environments are prestressed bridge piles, sufficient early strength is necessary to allow timely prestress transfer. This allows the piles to be produced more quickly resulting in economic savings. Figure 76 indicates that the variation in early strength among the ternary mixtures was no more than 10% with the exception of 4F2S. The results correlate well with the FA content. As the FA content increases, the early strength development is inhibited. This is particularly true for 4F2S, which contains 40% FA. This reflects the longer hydration period typically required by FA over that of other more reactive SCM. In addition, S appears to delay the early strength in mixtures with comparable quantities of FA (2F, 2F2S, 2F4S). As S content increases the seven-day compressive strength decreases. At 28-days and 365-days, however, the compressive strength results vary by no more than about 10% from the control values, indicating a stabilization of the reaction of the PC and SCM.




(a)




(b)



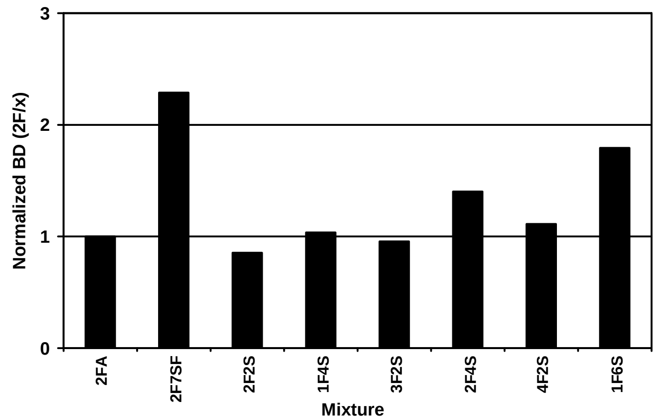

(c)

Figure 76 Relative compressive strength of concrete at
(a) 7 days, (b) 28 days, and (c) 365 days

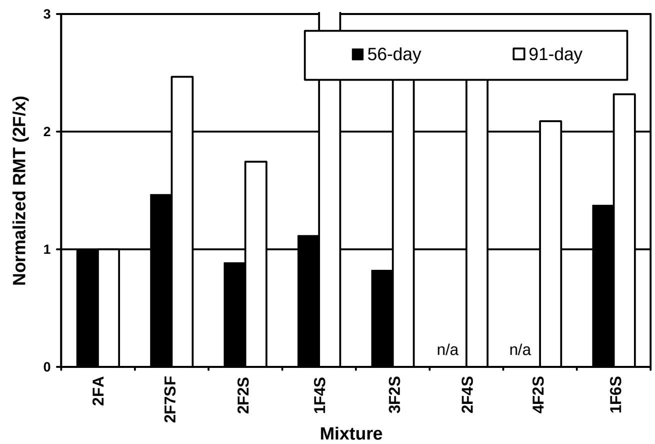
## 7.2 CHLORIDE RESISTANCE COMPARISON

The relative durability performance of the ternary mixtures is compared to the control mixture in Figure 77 through Figure 80. Each figure contains three plots which show the relative performance of the mixtures as measured by bulk diffusion (BD) at 365-days, rapid chloride migration (RMT), and surface resistivity (SR). Each plot shows the results of the tests normalized to those of the control mixture (2FA), which is a binary mixture incorporating 20% FA by PC replacement weight. The data are normalized such that when the result is greater than one, the mixture performed better than the control and when the value is less that one, the mixture performed worse than the control. For example, the ASTM Class IV 2F7SF mixture had a bulk diffusion value that was less than half that of the control.

The BD, RMT, and SR all appear to exhibit similar trends with respect to the control for both classes of concrete and both cements




(a)

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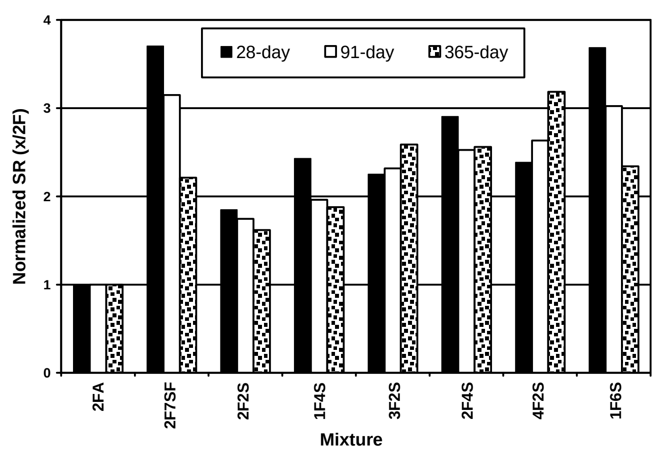
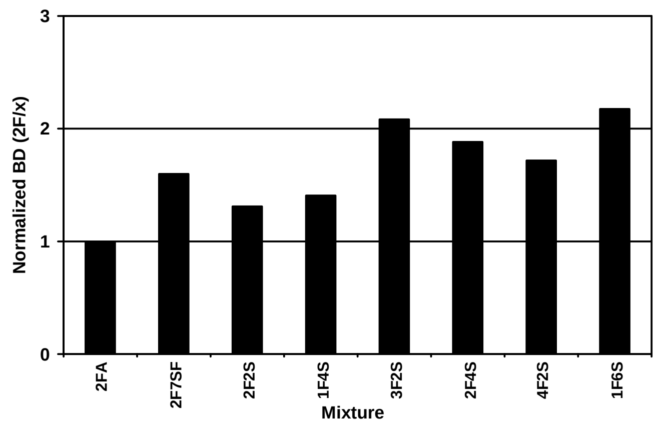
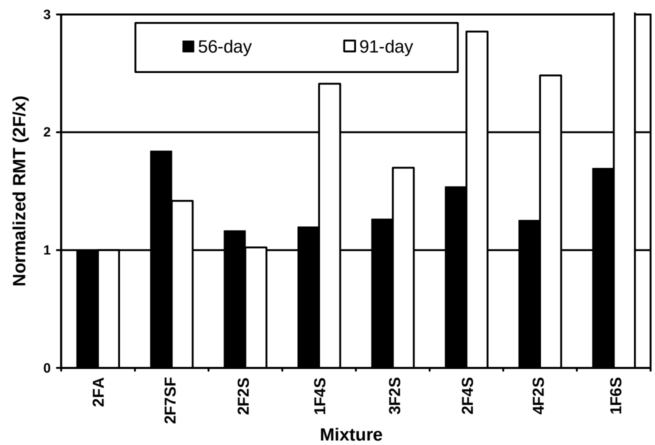



(c)

Figure 77 Durability comparison for class IV with ASTM PC




(a)

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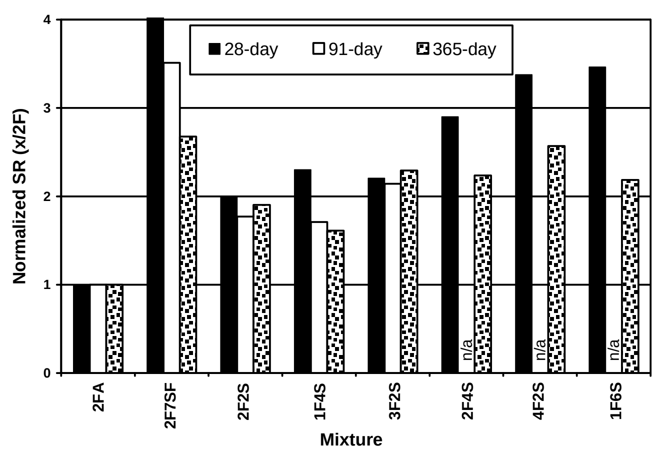
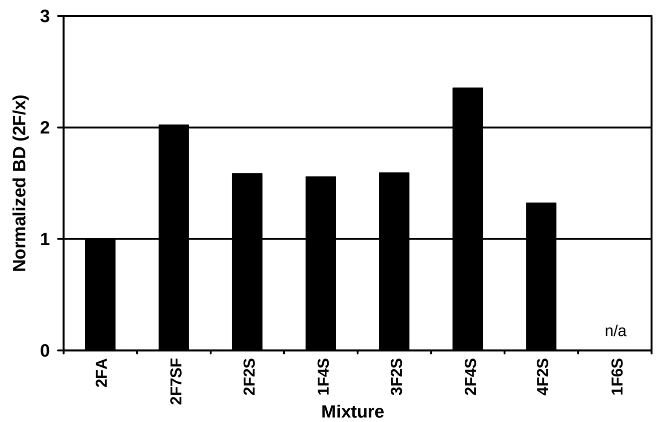
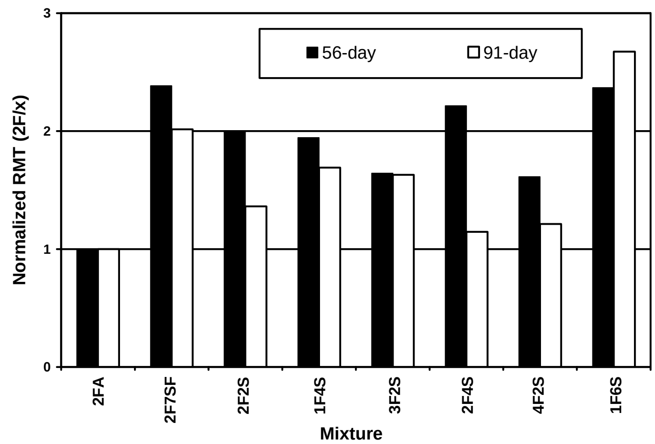



(c)

Figure 78 Durability comparison for class V with ASTM PC




(a)

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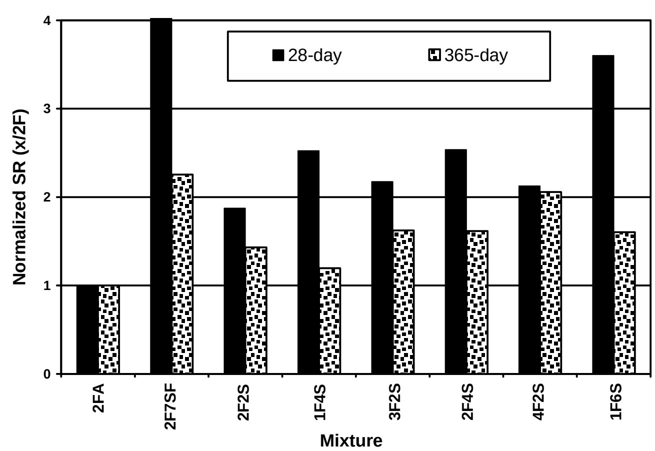
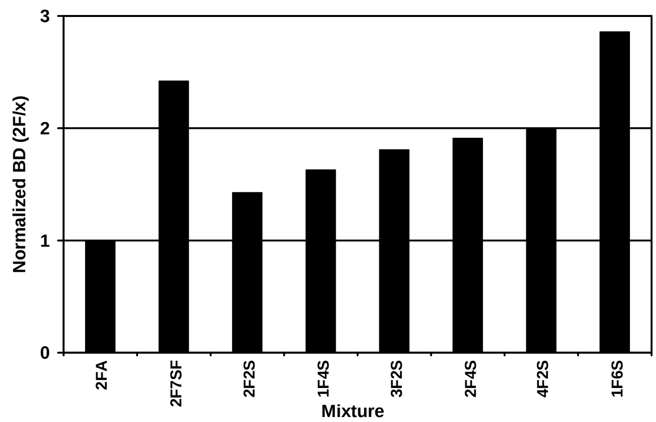
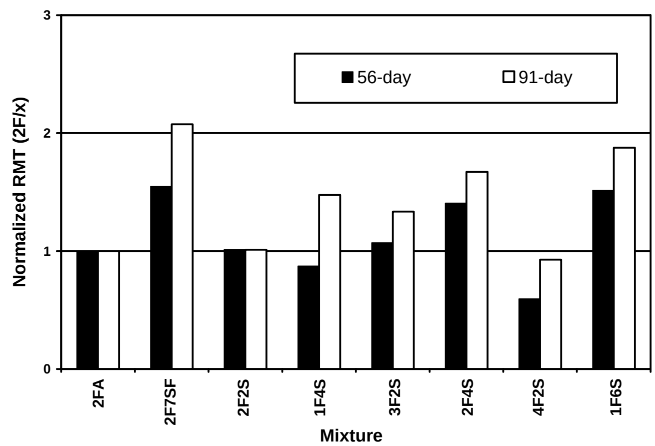



(c)

Figure 79 Durability comparison for class IV with AASHTO PC




(a)

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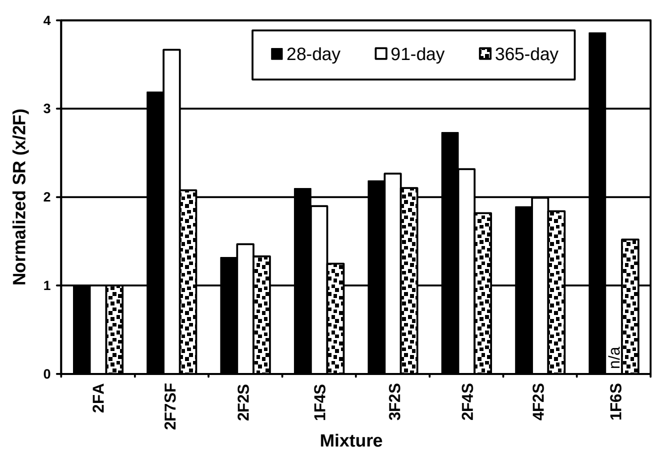


(c)

Figure 80 Durability comparison for class V with AASHTO PC

The durability performance of the two PC is compared by looking at the average results across concrete class for each measure of durability. Table 10 shows the average diffusion coefficients and resistivity on the indicated ages. In general, the only significant difference is seen in BD (51%) and 91-day RMT (8%), while the other measures are comparable. The average BD result for ASTM cement is 51% greater than that of the AASHTO cement and the average RMT result for the ASTM cement is 8% greater than that of the AASHTO cement. It is not clear why the two cement types give such different results for the BD test and yet the electrical methods of determining chloride penetration give comparable results. One possibility is that the slower hydration of the more coarsely ground AASHTO PC contributed to a more tortuous pore structure compared to that of the more finely ground ASTM PC. The ASTM PC may have hydrated very quickly during the early ages creating a pore structures that contributed to a higher permeability. In contrast, the electrical methods give comparable results because the total mass of cementitious materials was comparable between the two sets of mixtures resulting in similar electrical properties. This may also be an indication that when the diffusion coefficients are very low as they are for all of the mixtures tested, then the electrical methods are not as sensitive to changes in the pore structures because the density is so great. It is not clear the implication of the findings on the long term behavior of the concrete, if any.

Using Table 10 to compare the concrete classes, the higher strength mixtures generally exhibited a higher resistance to chloride penetration. Recall that for both BD and RMT, the resistance to chloride penetration improves as the permeability is reduced. Conversely, for SR the chloride resistance improves when the resistance increases. For ASTM mixtures, with the exception of the 91-day RMT, there is less than 5% difference in the class IV and class V results.

Table 10 Comparison of durability test results.

| PC Type | Class | BD (*$10^{-12}$ $m^2$/sec) | RMT (*$10^{-12}$ $m^2$/sec) | | SR (kΩ-cm) | | |
|---|---|---|---|---|---|---|---|
| | | 365-day | 56-day | 91-day | 28-day | 91-day | 365-day |
| ASTM | IV | 2.70 | 4.52 | 4.05 | 25 | 42.7 | 104 |
| | V | 2.59 | 4.75 | 4.81 | 25.1 | 40.6 | 100 |
| | Avg. | 2.64 | 4.65 | 4.43 | 25.1 | 41.6 | 102 |
| AASHTO | IV | 2.02 | 4.88 | 3.7 | 25.3 | n/a | 118 |
| | V | 1.53 | 4.45 | 4.5 | 21.3 | 49.1 | 70.6 |
| | Avg. | 1.75 | 4.67 | 4.10 | 23.3 | n/a | 94.2 |

The 91-day RMT results indicate a nearly 20% greater average diffusion coefficient in class V mixture, when the coefficient is expected to be smaller. For AASHTO mixtures, BD and 28-day SR show an improvement (24% and 16%) in chloride resistance while 56 and 91 day RMT and 365 day SR show a reduction (9%, 21%, and 40%) in chloride resistance for the class V mixture. It is not known if this is due to systematic or natural variability in the materials and test methods or to a behavioral difference among the mixtures.

Figure 81 shows a summary of the normalized chloride resistance results presented in Figure 77 through Figure 80. The final value for each mixture is an average of the results from both PC types and both concrete classes. Furthermore, the value includes the normalized 365-day BD, 56- and 91-day RMT; and 28- and 365-day SR results. Note that the 91-day data were not included due to missing values. These normalized results are averaged into a single value to enable ranking of the ternary mixture chloride resistance as measured by the durability test methods performed in this research. The results indicate that the SF mixture provides the best choice. Beyond that, the mixtures with moderate volumes of FA and larger volumes of S appear to out perform those mixtures containing larger volumes of FA and smaller volumes of S. Overall, the chloride resistance of all of the ternary mixtures were improved over that of the binary control, with some having only marginal improvement.

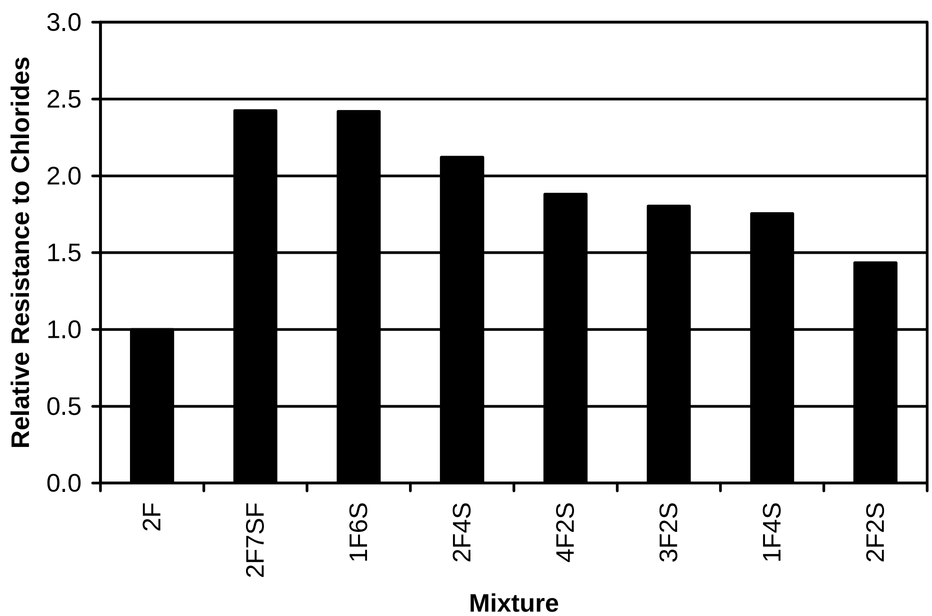


Figure 81 Relative resistance to chloride penetration.

Mixture design in which the relative proportions of the components are varied, but the total quantity is not, can be studied using a simplex-lattice design matrix or more simply a simplex-centroid matrix (Wadsworth 1998). These approaches, however, require a specific array of mixture proportions that were not used in this testing. Nevertheless, there were a sufficient number of variables to fit equations to the bulk diffusion data. A multivariate regression was conducted on the bulk diffusion data to obtain a second order polynomial equation for each of the four categories of mixtures designs.

$$BD(x,y) = (\beta_1 x^2 + \beta_2 y^2 + \beta_3 x + \beta_4 y + \beta_5 xy + \beta_6) * 10^{-12}\ m^2/\text{sec} \qquad \text{Equation 5}$$

$$x + y + z = 1 \qquad \text{Equation 6}$$

where BD (x,y), is the predicted diffusion coefficient from the bulk diffusion test ($m^2$/sec), x represents the fractional proportion of fly ash, y represents the fractional proportion of slag, z represents the fractional proportion of portland cement, and $\beta_i$ are the regression coefficients. The equation coefficients for each category along with the coefficient of determination for each of the equations is shown in

Table 11 – Equation coefficients for bulk diffusion regression.

| Mixture Category | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| ASTM IV | 0.00276 | 0.001897 | 0.2620 | 0.1850 | -0.00659 | -0.92 | 0.975 |
| ASTM V | 0.00508 | 0.000691 | -0.4360 | -0.1780 | 0.00516 | 10.75 | 0.977 |
| AASHTO IV | 0.00147 | 0.000350 | -0.1625 | -0.0929 | 0.00238 | 5.29 | 0.999 |
| AASHTO V | 0.00201 | 0.000635 | -0.0750 | -0.0436 | -0.00131 | 3.78 | 1.000 |

The equations are particularly useful when viewed in a ternary plot. These types of plots are used when there are three variables that sum to a constant for each point so that the third point is always dependent on the sum of the other two points. In Figure 82 through Figure 85 the variables for the four main categories are plotted as single points. The six ternary blends are plotted along with the control mixture containing only FA and PC. The SF mixture is not included in the plots. Each axis gives the percentage of that component in terms of weight, out of the total weight of cementitious materials.

Equation 5 and Equation 6 were used to formulate diffusion coefficient contours. The dashed line delineates the area of the plot representative of the mixtures used in the test program. The contours are not plotted outside these lines to avoid extrapolation of the regression. In general the contours form a saddle shape, which is a result of the second order function used to model the bulk diffusion data. The AASHTO Class IV, however, does not follow this trend, which is likely due to the missing data point for the 60% S mixture.

In general, the ternary plots confirm the combined results presented in Figure 81. FA quantities in the 10 to 20% range in combination with 40 to 60% S provide the best performance in the lowest diffusion coefficients.

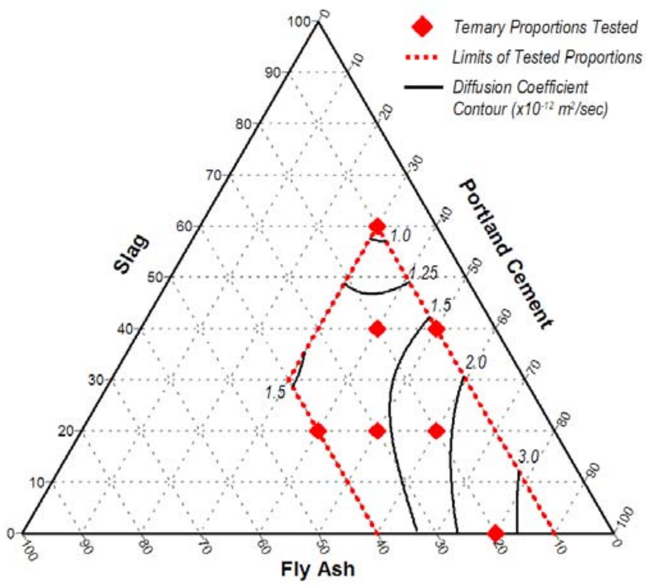


Figure 82 – AASHTO Class IV

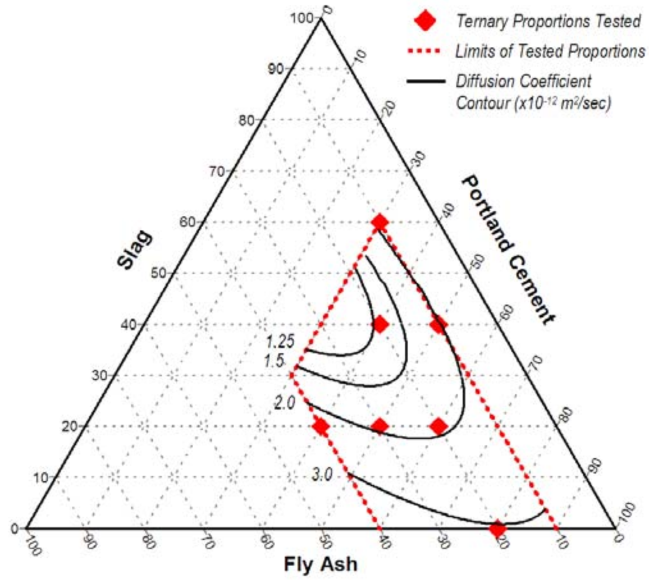


Figure 83 – AASHTO Class V

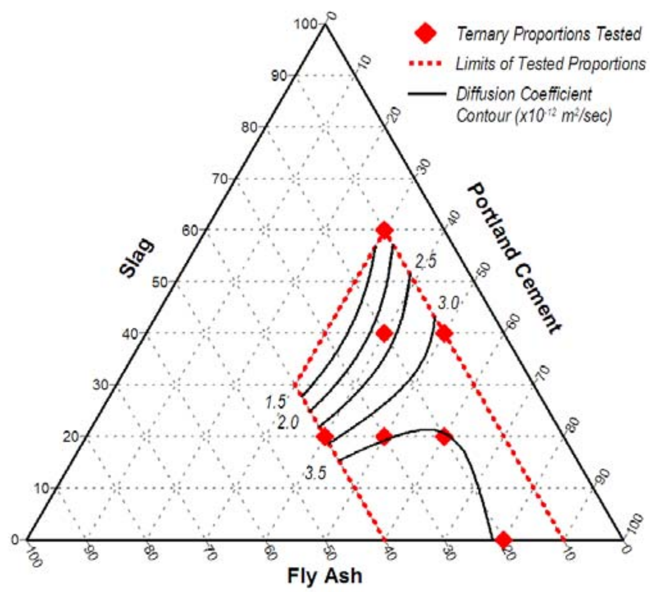


Figure 84 – ASTM Class IV

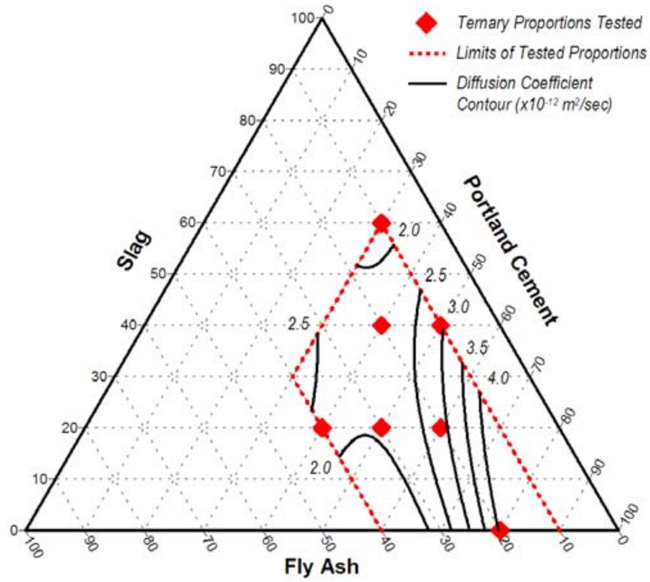


Figure 85 – ASTM Class V

# 8 DECISION MATRIX

The mechanical properties and durability of a concrete are both important factors for structures placed in extremely corrosive environment. Consequently, both mechanical and durability factors were considered in an effort to determine the group of ternary mixtures with the best suited attributes. A decision matrix was created to determine the best all-around performing mixtures. This chapter describes the method and rationale for the decision matrix used to order ternary concrete mixtures with regards to mechanical properties and durability. While the primary focus of this investigation is to determine the suitability of ternary mixtures in marine environments, this decision matrix will highlight other SCM proportions of FA and S that will assist the FDOT in future projects.

## *8.1 Criteria for Mechanical Properties*

### 8.1.1 Compressive Strength

Early strength development in concrete mixtures is important to consider due to the high compressive stresses generated during prestressing. Because a large number of the structures exposed to extremely corrosive environments are prestressed bridge piles sufficient early strength is necessary to allow timely prestress transfer. This allows the piles to be produced more quickly resulting in economic savings. To account for this advantage, points were assigned based on a sliding scale that gave benefit to the mixtures that reached higher 7-day compressive strengths. The mixtures that were ranked in the highest 20% of the 7-day compressive strengths were assigned 5 points each. The mixtures that ranked in the next highest 20% of 7-day compressive strengths were assigned 4 points each. This formula was continued until the lowest ranked 20% were assigned 1 point each.

FDOT requires the 28 day ultimate compressive stresses of 5500ksi and 6500 ksi for Class IV and Class V concretes, respectively. Due to this requirement concretes that exceed the specified compressive limits are assigned 5 points. Specimens that do not meet the ACI compressive stress requirements receive 0 points. For this study, none of the mixtures tested below the required compressive strengths.

### 8.1.2 Modulus of Elasticity

Similar to compressive strength, the early modulus of elasticity is highly important to ensure the serviceability of a concrete structure. Low modulus of elasticity values could potentially produce long term deflection problems and poor stiffness of the structure during construction. 1, 3 or 5 points were assigned to ternary mixtures at 7, 28 and 56 day testing dates. 5 points were assigned at each testing date where the modulus of elasticity exceeded 4000 ksi. 3 points were assigned at each testing date where the modulus of elasticity ranged between 3000-4000 ksi. 1 point was assigned at each testing date where the modulus of elasticity was found to be less than 3000ksi. Ternary mixtures performing around the scoring threshold values were assigned points on a case by case basis. The total number of points awarded for each mixture at each testing date was averaged, and the averaged score was used to represent the modulus of elasticity value in the decision matrix.

### 8.1.3 Split Tensile

Tensile strength of concrete has a direct effect on the ultimate capacity and the degree of cracking experienced in a concrete structure. High degrees of cracking result in increased corrosion rates due to increased permeability. Split tensile tests have been a long standing method to assess the ultimate tensile strength for concrete mixtures. Due to the high variability seen in the split tensile data a pass/fail system was used to assign points for the decision matrix. Specimens that exceed the suggested ACI estimated 28 day split tensile values of $7.5*\sqrt{f'c}$ were awarded 5 points and mixtures not meeting this requirement were assigned 0 points. It is important to note that the *f'c* values used for this analysis were the ACI 28 day specified values of 5500ksi and 6500ksi for Class IV and V concretes.

### 8.1.4 Modulus of Rupture

Because split cylinder tests can give variable results, modulus of rupture tests were also conducted to ensure a complete tensile strength analysis. Each SCM mixture tested at 364 days for MOR that exceeds the ASTM C 78 estimated value of 10*f'c (psi) received 5 points. Three points were assigned for values exceeding 90% of the previous requirement. Zero points were assigned to SCM mixtures that do meet either of the two requirements.

## 8.2 CRITERIA FOR DURABILITY

### 8.2.1 SURFACE RESISTIVITY

Points were assigned on a sliding scale for both early age and late age surface resistivity (SR) readings. To address short term performance, a total of 2-10 points were assigned for specimens tested at 28 days. The average SR readings for each ternary blend mixture were compared against the levels shown in Table 7. Mean surface resistivity results for each SCM mixture that are classified in Table 7 as negligible were assigned 10 points. Average SR readings classified as very low were assigned 8 points. Average SR readings classified as low were assigned 6 points. Average SR readings classified as Moderate were assigned 4 points, and SR readings classified as High were assigned 2 points.

Late age SR performance was measured using a similar approach. A total of 2-10 points were assigned for the 365 day testing age. The average SR reading for each ternary blend mixture was compared against the mean of all of SR readings found at each testing date. Average ternary mixture SR results performing 1 standard deviation above the mean of the entire testing population received 10 points for each test date. Two (2) points were subtracted for each half standard deviation below the 10 point value. The total points assigned by the long term analysis were averaged to create a scoring range of 2-10 points.

### 8.2.2 RAPID MIGRATION TEST

For the RMT results 2-10 points were assigned for the 91 day testing results on a sliding scale. RMT results for each ternary blend mixture with results below 1 standard deviation of the mean RMT value for the entire specimen population were assigned 10 points. Two (1) point were removed for each half standard deviation above the 10 point value. The scoring range is shown Table 12.

Table 12 – Scoring range for 91 RMT results

| RMT Diffusion ($10^{-12}$ $m^2$/sec) | Assigned Point Total |
|---|---|
| 2.63 or below | 10 |
| 2.63 – 3.44 | 8 |
| 3.44 – 4.26 | 6 |
| 4.26 – 5.08 | 4 |
| 5.08 or above | 2 |

### 8.2.3 Bulk Diffusion Test

Because of the approaching deadline for pile construction, final mixture designs were needed before later age testing could be completed. Consequently, ninety-one day data for the first series of specimens and 28 day data for the second series were available for use in selecting the mixture designs.

Table 13 – Scoring range for 364-day BD results

| BD ($10^{-12}$ $m^2$/sec) | Assigned Point Total |
|---|---|
| 1.46 or below | 10 |
| 1.46 – 1.84 | 8 |
| 1.84 – 2.22 | 6 |
| 2.22 – 2.59 | 4 |
| 2.59 or above | 2 |

## *8.3 Decision Matrix Results*

Table 14 summarizes the scoring used to rank the mixtures in the decision matrix. Forty percent of the score is devoted to mechanical properties and the remaining 60% covers the durability properties. The maximum possible score is 50. Figure 86 and Figure 87 present the results for ASTM PC and AASHTO PC, respectively. The y-axis is set to the maximum score of 50 and the control mixture is plotted in the leftmost position within each chart. The mixtures are then plotted left to right from the highest to lowest scores. The 1F6S mixture is not included in Figure 87a because the data set was not complete for that mixture, which would result in an artificially low score. This is due to the lack of bulk diffusion test results for this mixture. To provide a complete comparison for this category, the decision matrix was recomputed without the bulk diffusion test results. The plot for this is shown in Figure 88. Note that the maximum possible score for this combination is 40.

In general, the comparative performance of the mixtures improved when the quantities of S were increased. To provide significant improvement in overall performance more that 20% S was needed (40 – 60 %). In addition, larger quantities of FA (40%) consistently ranked near the lowest in terms of performance. Consequently, the best combination appears to be moderate quantities of FA (10-20%) in combination with larger quantities of S (40-60%) to provide improved durability and mechanical properties.

Table 14 – Summary of assigned points for decision matrix

| Test Method | Assigned Points |
|---|---|
| Compressive Strength (7-day) | 5 |
| Compressive Strength (28-day) | 5 |
| Modulus of Elasticity (average of ratings for 7, 14, and 56 days) | 5 |
| Split Tensile (28-day) | 5 |
| Surface Resistivity (average of ratings for 7, 14, and 364 days) | 10 |
| Rapid Migration (91-day) | 10 |
| Bulk Diffusions (364-day) | 10 |
| Total | 50 |

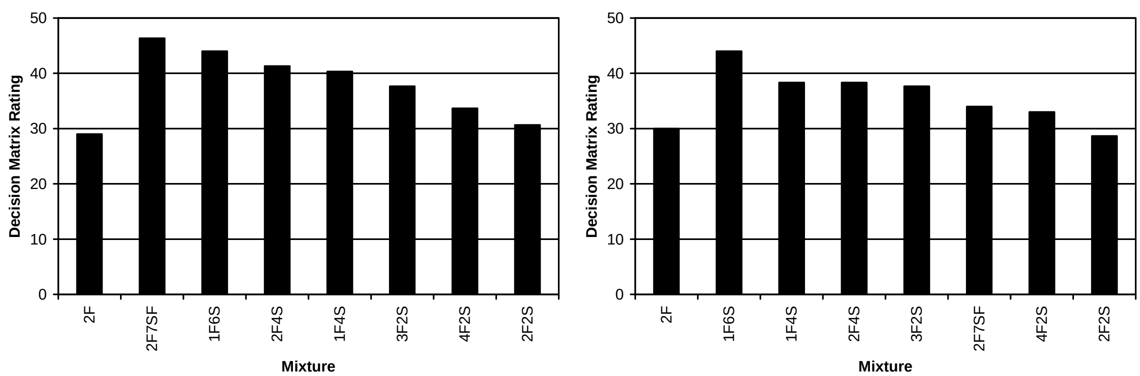


Figure 86 – Decision Matrix results for (a) ASTM Class IV and (b) ASTM Class V.

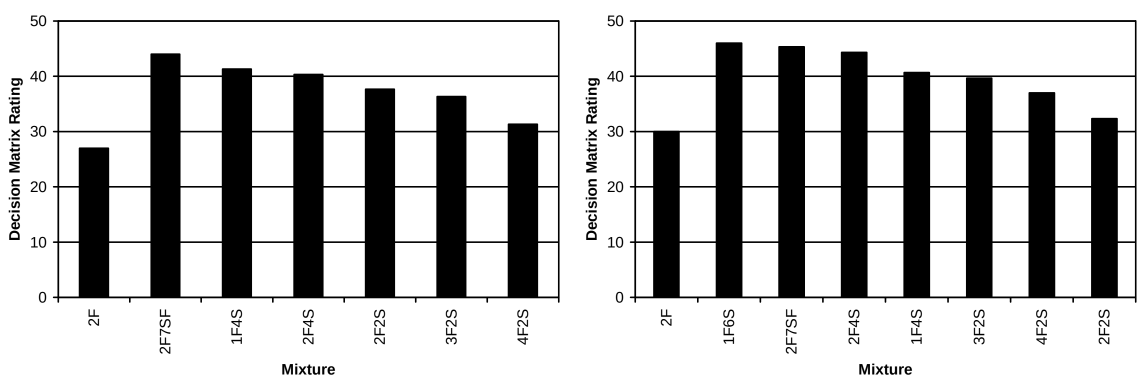


Figure 87 – Decision Matrix results for (a) AASHTO Class IV and (b) AASHTO Class V.

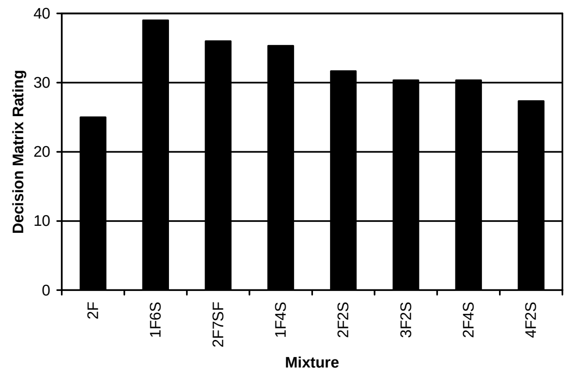


Figure 88 – Decision Matrix results for AASHTO Class IV without bulk diffusion test data.

# 9 SUMMARY AND CONCLUSIONS

This research had two primary objectives. The first was to evaluate the variation in durability and mechanical properties of two types of ordinary Portland cement (PC). One was AASHTO M85 type II and the other was ASTM C150 Type I. The cements were produced under the old specification system before the cement standards were harmonized. The second was to evaluate the durability and mechanical properties of various ternary cementitious materials systems.

Thirty-two ternary and binary mixtures (not including duplicate mixtures) containing varying quantities of fly ash (FA), blast furnace slag (S), and silica fume (SF) were batched. Mechanical and durability tests were conducted. The mechanical tests included compressive strength, modulus of elasticity, compressive creep, split tensile strength, and modulus of rupture. The durability tests conducted for this investigation were rapid migration test, corrosion of embedded steel, surface resistivity, and bulk diffusion. The following are the important results of the research:

- Early age (seven day) compressive strengths of mixtures with both PC types and concrete strengths were comparable, with the exception of the mixtures containing high quantities of FA (40%).
- In comparing mixtures with 20% FA and varying S, there appears to be an early age effect. As S quantities increase, the seven-day compressive strength decreases.
- For class V mixtures the early age strengths of ASTM PC was greater than that of the AASHTO PC in all cases. For class IV mixtures about half of the ASTM PC mixtures had greater early age compressive strengths than that of the AASHTO PC mixtures.
- Some of the mixtures with higher FA content had delayed gains in compressive strength. Specified 28-day concrete strength requirements of Class IV (5,500 psi) and Class V (6,500 psi), however, were exceeded by all of the mixtures.
- The age difference between the 7-day and 28-day tests appears to have minimized the effect of the PC fineness as the there is not a significant difference in 28-day compressive strength between ASTM and AASHTO PC.

- The ASTM PC mixtures have higher diffusion coefficients with an average of 2.70 and 2.59E-12 $m^2$/sec for Class IV and Class V concrete mixtures while the AASHTO PC mixtures have an average of 2.02 and 1.53E-12 $m^2$/sec for Class IV and Class V concrete mixtures.
- Comparison of durability data for ASTM PC and AASHTO PC indicated no clear trend relative to the cement type.
- All ternary blends had better resistance to chloride penetration relative to that of the control mixture.
- Early age durability as measured by SR indicated that all mixtures, including one containing 40% FA (with 20% S) showed improvement over FA alone.
- Combinations of moderate quantities of FA (10-20%) in with larger quantities of S (40-60%) provided the best improvement in chloride resistance and mechanical properties.

Powder x-ray diffraction was used to determine whether or not CH hydration was effected by different ternary blend ratios. The following summarizes the findings of the XRD work:

- The pilot study has shown that differences in hydration relative to CH can be seen and tracked over time as well as qualitatively compared to other mixes.
- The hardened pastes showed involved interaction with the reactants C3S and C2S.
- The availability of certain <u>reactants</u> or <u>reaction products</u> (which is related to the type of portland cement) can be affected by large relative proportions of supplementary cementitious materials.
- SEM imaging has shown that as SCM volumes are increased, the net volume of CH available for pozzolanic reaction decreases, resulting in unreacted SCM. This work has also indicated that the early reaction of S may consume available CH, which then may starve the FA reaction at later ages. The possibility of having unreacted material within the final system is evident but hard to conclude with the work done in the scope of this study. Specific recommendations for further study are made in the Recommendations.

# 10 RECOMMENDATIONS

The primary objective of this research was to evaluate the mechanical and durability properties of PC-FA-S mixtures in relation to those of PC-FA-SF mixtures. The primary interest is in the resistance to chloride penetration in a harsh marine environment. The following make up the recommendations for implementation of these results into FDOT Specifications.

## *10.1 Mechanical Properties*

The use of ternary combinations of fly ash, slag, and ordinary portland cement did not provide a clear advantage in the mechanical properties over that of the control mixture containing 20%FA. Furthermore, creep results were inconclusive. Consequently, no recommendations are made regarding mechanical properties. SF did not provide a significant strength advantage over the other mixes at 7 days and beyond. Tests for high-early strength prior to 7 days were not conducted. This and lack of information on creep may be a consideration if ternary mixtures are implemented in precast, prestressed concrete.

## *10.2 Slightly and Moderately Aggressive Environments*

Current FDOT specifications allow the replacement of cementitious materials with 58 to 62% slag in drilled shafts and up to 70% in precast concrete and other selected elements. Depending on the application, smaller proportions of fly ash may be used in combination with slag. Clearly, FDOT already allows the use of slag in a broad array of concrete elements in a variety of environments. The research presented in this report evaluated the mechanical and durability properties of mixtures with 10% to 40% fly ash and 20% to 60% slag and found that both early age (28-day) and late age (1-year) indicators of chloride resistance showed that all mixtures had improved performance over that of the 20% fly ash mixtures. Therefore, continued use of the slag in combination with fly ash is recommended.

## *10.3 Extremely Aggressive Environments (Due to Chlorides)*

The FDOT Structures Design Guidelines (from General Requirements January 2009) currently indicate that when the environmental classification is Extremely Aggressive due to the presence of chloride in the water of a marine environment. Silica fume (or metakaolin, or ultrafine fly ash) is to be used in all:

a.) Piles of pile bents.

b.) Columns or walls within the "splash zone."

c.) Sections of post-tensioned cylinder piles within the "splash zone" plus one section above and below the "splash zone" limits.

FDOT Specification 346 (12-22-08) indicates that silica fume use should fall between 7 to 9 percent by replacement weight of cementitious materials. Furthermore, the specifications indicate that precast concrete should contain no less than 18% fly ash. Based on the results of this research, in particular, the resistance to chloride penetration, the use of 10-20% fly ash + 50 to 60% slag gives chloride resistance similar to that obtained from 20% fly ash in combination with 7% silica fume, with 10% fly ash + 60% slag giving the best results. This is true for both Class IV and Class V mixtures and both portland cement specifications. The only slag mixture, however, to consistently meet the minimum 28-day surface resistivity requirements of 29 kOhm-cm (FDOT 346-3.1(d)) for test mixtures was that containing 10% fly ash and 60% slag. Consequently, if the use of slag cement in extremely harsh environments is desired, then the proportions should be in the range of 10% fly ash + 60% slag.

## 10.4 Further Research

Although the results of the testing in this program indicated that the performance of fly ash and slag ternary blends improved some durability aspects of the mixtures, the underlying behavior at the microstructure is not yet fully understood. Consequently, a full microstructural study on ternary blends is recommended to better understand the hydration process of the supplementary cementitious material blends and the effect of varying their relative proportions. This study may include:

- More detailed XRD analysis
  - Longer scan rates for each
  - More specific 2-theta range
  - Detailed look at the unit cell structure for each mix during hydration
  - Preferred orientation of CH during hydration (with and without aggregate)
  - Detailed look at concrete systems using Grazing Angle XRD

- Further investigation of the effect of dissolution/creation of CH on the microstructure and its components
- Petrographical study on the mineral formation of different ternary blends during hydration
- SEM analysis of the paste structure and the concrete system comparison to physical testing results.

Each of these steps can bring us closer to understating the true microstructure of ternary blends and its mechanisms. The relationship of microstructure and physical performance can be translated to more durable and better performing binders and concrete systems.

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Certificate of Analysis
for Sample ID:**0600015961**
Resolution Sample: **NO**

**State of Florida**
**State Materials Office**
5007 NE 39th Avenue
Gainesville FL 32609
352/955-6600
Lab ID: DSM001

Project No.: 1909701A101Contract ID: N/A
Pay Item: N/A Material:465 IV
Material ID on Spec.: 465 IV
Sample Number: C0002 QPL ID:
Design Mix Mix Type:
Plant: 000 Lot: Sublot:
Terminal:
Manufacturer or Producer: RINKER - COLUMBIA
Aggregate Sample Type: Process:
Sample Status: REPORTED
AC: Compares Favorably
Post Approval Disposition:

Date Sample Taken: 01/01/2006 By THOMAS
Logged: 03/01/2006 By RT822RD
Received: 03/01/2006 By RT822RD
Approved: 05/31/2006 By RT822AC

**Loggers Remarks:** RINKER TYPE I, FULL CHEM. & PHYS. - PROVIDE FINGERPRINT

**C114-INSOL** **ASTM C114 Cement Acid Insoluble** Test Status: VALIDATED
Tested :04/10/2006 By: T24516046-000 Comment:
Validated:04/11/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Insoluble residue** | **0.14** | %Insoluble | none specified | |
| | **1.0014** | SampWT | none specified | |
| | **11.4976** | CruxTare | none specified | |
| | **11.4990** | CruxAshWt | none specified | |

**C114-LOI** **ASTM C114 Cement (Portland) Loss on Ignition** Test Status: VALIDATED
Tested :04/10/2006 By: T24516046-000 Comment:
Validated:04/11/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Loss On Ignition** | **0.5** | %LOI | <= 3.0 | |
| | **11.4976** | CruxStartWT | none specified | |
| | **12.4990** | CruxSampWT | none specified | |
| | **12.4935** | FinalWT | none specified | |

**C114-I XRF** **ASTM C114 Cement Type I M85** Test Status: VALIDATED
Tested :03/06/2006 By: T24516046-000 Comment:
Validated:03/06/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Magnesium Oxide** | **0.8** | % | <= 6.0 | |
| **Sulfur Trioxide** | **2.3** | % | <= 3.0 | |
| **Total Alkali as Na2O** | **0.23** | % | <= 0.60 | |

**C151** **ASTM C151-Autoclave Expansion Portland Cement** Test Status: VALIDATED
Tested :05/02/2006 By: CAMPS Comment:
Validated:05/17/2006 By RT824TD
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Change and Percentage of Change** | **-0.05** | % | <= 0.80 | |
| | **-0.0404** | Initial | none specified | |

Sample_certificate_V3 bws 7/22/08

Page 1 of 2

| | | | |
|---|---|---|---|
| **Change and Percentage of Change** | **-0.0458** Final | none specified | |
| | **-0.0054** Change | none specified | |

**C266** **ASTM C266 Time of Setting / Gillmore Needle** Test Status: VALIDATED

Tested :05/01/2006 By: THOMAS Comment:
Validated:05/17/2006 By RT824TD
Technician Qualification Status:N/A

| Rep # **1** | Assay Results | Primary Limits | PASS |
|---|---|---|---|
| **Intial Set Time** | **140** min | >= 60 | |
| **Final Set Time** | **205** min | <= 600 | |

**C204** **ASTM C204 Fineness of Portland Cement by Air Perm. Apparatus** Test Status: VALIDATED

Tested :03/03/2006 By: ABDU Comment:
Validated:04/11/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # **1** | Assay Results | Primary Limits | PASS |
|---|---|---|---|
| **Specific surface** | **361.00** sqm/Kg | none specified | |

**C109-3DAY** **ASTM C109 3-Day Breaks for Compressive Strength of Cement** Test Status: VALIDATED

Tested :05/04/2006 By: HARVEY Comment:
Validated:05/24/2006 By RT820WH
Technician Qualification Status:N/A

| Rep # **1** | Assay Results | Primary Limits | PASS |
|---|---|---|---|
| **Compressive Strength Standard** | **3,450.0000** PSI | >=1740.00 | |

**C109-7DAY** **ASTM C109 7-Day Breaks for Compressive Strength of Cement** Test Status: VALIDATED

Tested :05/08/2006 By: HARVEY Comment:
Validated:05/30/2006 By RT824TD
Technician Qualification Status:N/A

| Rep # **1** | Assay Results | Primary Limits | PASS |
|---|---|---|---|
| **Compressive Strength Standard** | **4,380.0000** PSI | >=2760.00 | |

**Notepad:**

Certificate of Analysis
for Sample ID:**0600015959**
Resolution Sample: **NO**

**State of Florida**
**State Materials Office**
5007 NE 39th Avenue
Gainesville FL 32609
352/955-6600
Lab ID: DSM001

Project No.: 1909701A101 Contract ID: N/A
Pay Item: N/A Material:465 IV
Material ID on Spec.: 465 IV
Sample Number: C0001 QPL ID:
Design Mix Mix Type:
Plant: 000 Lot: Sublot:
Terminal:
Manufacturer or Producer: RINKER - MIAMI
Aggregate Sample Type: Process:
Sample Status: REPORTED
AC: Compares Favorably
Post Approval Disposition:

Date Sample Taken: 01/01/2006 By THOMAS
Logged: 03/01/2006 By RT822RD
Received: 03/01/2006 By RT822RD
Approved: 05/25/2006 By RT822AC

**Loggers Remarks:** RINKER TYPE II, FULL CHEM. & PHYS. - PROVIDE FINGERPRINT

**C114-II XRF** **ASTM C114 Cement Type II M85** Test Status: VALIDATED
Tested :01/01/1940 By: T24516046-000 Comment:
Validated:03/06/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Silicon Dioxide** | **20.5** | % | >= 20.0 | |
| **Aluminum Oxide** | **5.2** | % | <= 6.0 | |
| **Ferric Oxide** | **4.5** | % | <= 6.0 | |
| **Magnesium Oxide** | **1.1** | % | <= 6.0 | |
| **Sulfur Trioxide** | **2.6** | % | <= 3.0 | |
| **Tricalcium Aluminate** | **6** | % | <= 8 | |
| **Tricalcium Silicate** | **54** | % | <= 58 | |
| **Total Alkali as Na2O** | **0.24** | % | <= 0.60 | |

**C114-INSOL** **ASTM C114 Cement Acid Insoluble** Test Status: VALIDATED
Tested :04/11/2006 By: T24516046-000 Comment:
Validated:04/11/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Insoluble residue** | **0.35** | %Insoluble | none specified | |
| | **0.9790** | SampWT | none specified | |
| | **11.4975** | CruxTare | none specified | |
| | **11.5009** | CruxAshWt | none specified | |

**C114-LOI** **ASTM C114 Cement (Portland) Loss on Ignition** Test Status: VALIDATED
Tested :04/11/2006 By: T24516046-000 Comment:
Validated:04/11/2006 By RT825DT
Technician Qualification Status:N/A

| Rep # 1 | Assay Results | | Primary Limits | PASS |
|---|---|---|---|---|
| **Loss On Ignition** | **0.2** | %LOI | <= 3.0 | |
| | **12.3340** | CruxStartWT | none specified | |
| | **13.3220** | CruxSampWT | none specified | |
| | **13.3201** | FinalWT | none specified | |

**C151** **ASTM C151-Autoclave Expansion Portland Cement** Test Status: VALIDATED
Tested :04/26/2006 By: ABDU Comment:
Validated:05/15/2006 By RT820TJ
Technician Qualification Status:N/A

| | Rep # 1 | Assay Results | Primary Limits | PASS |
|---|---|---|---|---|
| **Change and Percentage of Change** | **-0.01** | % | <= 0.80 | |
| | **0.0111** | Initial | none specified | |
| | **0.0099** | Final | none specified | |
| | **-0.0012** | Change | none specified | |

**C266** **ASTM C266 Time of Setting / Gillmore Needle** Test Status: VALIDATED
Tested :04/25/2006 By: DILLOW Comment:
Validated:05/09/2006 By RT824TD
Technician Qualification Status:N/A

| | Rep # 1 | Assay Results | Primary Limits | PASS |
|---|---|---|---|---|
| **Intial Set Time** | **160** | min | >= 60 | |
| **Final Set Time** | **225** | min | <= 600 | |

**C204** **ASTM C204 Fineness of Portland Cement by Air Perm. Apparatus** Test Status: VALIDATED
Tested :03/03/2006 By: ABDU Comment:
Validated:04/11/2006 By RT825DT
Technician Qualification Status:N/A

| | Rep # 1 | Assay Results | Primary Limits | PASS |
|---|---|---|---|---|
| **Specific surface** | **375.00** | sqm/Kg | none specified | |

**C109-3DAY** **ASTM C109 3-Day Breaks for Compressive Strength of Cement** Test Status: VALIDATED
Tested :04/28/2006 By: HARVEY Comment:
Validated:05/17/2006 By RT824TD
Technician Qualification Status:N/A

| | Rep # 1 | Assay Results | Primary Limits | PASS |
|---|---|---|---|---|
| **Compressive Strength Standard** | **3,760.0000** | PSI | >=1450.00 | |

**C109-7DAY** **ASTM C109 7-Day Breaks for Compressive Strength of Cement** Test Status: VALIDATED
Tested :05/02/2006 By: ABDU Comment:
Validated:05/17/2006 By RT824TD
Technician Qualification Status:N/A

| | Rep # 1 | Assay Results | Primary Limits | PASS |
|---|---|---|---|---|
| **Compressive Strength Standard** | **5,120.0000** | PSI | >=2470.00 | |

**Notepad:**

**Durability and Mechanical Properties of Ternary Blend Concrete Research Sample Matrix**

| | | | | | Mechanical Tests | | | | Durability Tests | | | | | | Extras |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Test Method | | ASTM C39[1,11] | ASTM C496[2] | ASTM C512 | ASTM C78 | FM5-578[5] | NTBuild 492[4] | NTBuild 443[7] | ASTM C1585 | ASTM C642 | G109 | |
| | | | Common Test Name | | Comp. Strength | Split Tension | Comp. Creep | Flex. Beam | Surface Resistivity | RMT | Bulk Diffusion | Absorption | Voids Volume | G109 | Extra Samples |
| | | | Sample Size | | 4" x 8" Cylinders | 4" x 8" Cylinders | 6" x 12" Cylinders | 4"x4"x12" Beams | 4" x 8" Cylinders | 4" x 8" Cylinders | 4" x 8" Cylinders | 4" x 8" Cylinders[13] | | 11"x6"x4.5" | 4" x 8" Cylinders |
| | | | **Mix Name** | **SCMs Used** | Total Number of Samples per Test | | | | | | | | | | |
| Laboratory Mixes | ASTM Type I/II Cement | Class IV[0] | TB1A4 | 2F | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB1A4-2 | 2F | 9 | 0 | 0 | 9 | 0 | 0 | | 0 | | 2 | 3 |
| | | | TB2A4 | 2F7SF | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB2A4-2 | 2F7SF | 9 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | | | TB3A4 | 2F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB3A4-2 | 2F2S | 6 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | | | TB4A4 | 1F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB4A4-2 | 1F4S | 6 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | | | TB5A4 | 3F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB5A4-2 | 3F2S | 3 | 0 | 0 | 9 | 0 | 0 | | 0 | | 2 | 3 |
| | | | TB6A4 | 2F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB6A4-2 | 2F4S | 3 | 0 | 0 | 9 | 0 | 0 | | 0 | | 2 | 3 |
| | | | TB7A4 | 4F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB7A4-2 | 4F2S | 3 | 0 | 0 | 9 | 0 | 0 | | 0 | | 2 | 3 |
| | | | TB8A4 | 1F6S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB8A4-2 | 1F6S | 3 | 0 | 0 | 9 | 0 | 0 | | 0 | | 2 | 3 |
| | | Class V[0] | TB1A5 | 2F | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB1A5-2 | 2F | 3 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | | | TB2A5 | 2F7SF | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB3A5 | 2F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB4A5 | 1F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB5A5 | 3F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB6A5 | 2F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB7A5 | 4F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | | | TB8A5 | 1F6S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |

| Durability and Mechanical Properties of Ternary Blend Concrete Research Sample Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mechanical Tests | | | | Durability Tests | | | | | | Extras |
| | Test Method | | ASTM C39[1,11] | ASTM C496[2] | ASTM C512 | ASTM C78 | FM5-578[5] | NTBuild 492[4] | NTBuild 443[7] | ASTM C1585 | ASTM C642 | G109 | |
| | Common Test Name | | Comp. Strength | Split Tension | Comp. Creep | Flex. Beam | Surface Resistivity | RMT | Bulk Diffusion | Absorption | Voids Volume | G109 | Extra Samples |
| | Sample Size | | 4" x 8" Cylinders | 4" x 8" Cylinders | 6" x 12" Cylinders | 4"x4"x12" Beams | 4" x 8" Cylinders | 4" x 8" Cylinders | 4" x 8" Cylinders | 4" x 8" Cylinders[13] | | 11"x6"x4.5" | 4" x 8" Cylinders |
| Laboratory Mixes, AASHTO M-85 Type II Cement, Class IV[0] | TB1H4 | 2F | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB1H4-2 | 2F | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | TB2H4 | 2F7SF | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB3H4 | 2F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB3H4-2 | 2F2S | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | TB4H4 | 1F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB5H4 | 3F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB5H4-2 | 3F2S | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | TB6H4 | 2F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB7H4 | 4F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB8H4 | 1F6S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| Laboratory Mixes, AASHTO M-85 Type II Cement, Class V[0] | TB1H5 | 2F | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB1H5-2 | 2F | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | | 2 | 3 |
| | TB2H5 | 2F7SF | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB3H5 | 2F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB4H5 | 1F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB5H5 | 3F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB6H5 | 2F4S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB7H5 | 4F2S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |
| | TB8H5 | 1F6S | 18 | 6 | 9 | 10 | 3 | 6 | 9 | 3 | | 2 | 3 |

**Notes:**

**0. Class IV and V concrete** with ASTM type I/II and AASHTO M-85 type II. **Class IV and V** concrete with 0.35 w/c and #89 stone. **Class IV** 658 lbs cementitious content. **Class V** with 752 lbs cementitious content.
**1. C39** will be conducted at 7,14, 28, 56, 182 and 364 days.
**2. ASTM C496 and Boyd-01** will be conducted at 28 and 364 days.
**3.** For **BOYD-01,** 3 of the 4"x8" cylinders will be partially submerged on sulfates on cycles and tested at 364 days.
**4. NTBuild 492** will be conducted at 56 and 91 days.
**5. FM5-578** will be conducted at 1,3,7,14, 28, 56, 91, 182 and 364 days.
**7. NTBuild 443** will be conducted at 91,182 and 364 days.
**9. Macroscopy** will be performed at the end of the procedure.
**11. Modulus of Elasticity** will be measured from C39 samples.
**12. XRD** states for Xray Diffraction and **SEM** for Scanning Electron Microscopy.
**13. ASTM C1585 and ASTM C642** samples taken from different portions of the same 4"x8" cylinder.

**Note: ASTM C232 Concrete Bleeding** proposed on the original project matrix was eliminated due the results obtained on the first 4 mixes. No concrete bleeding was obtained on those mixes. The low w/c

# APPENDIX B – XRD SPECTRUMS

## *PILOT STUDY*

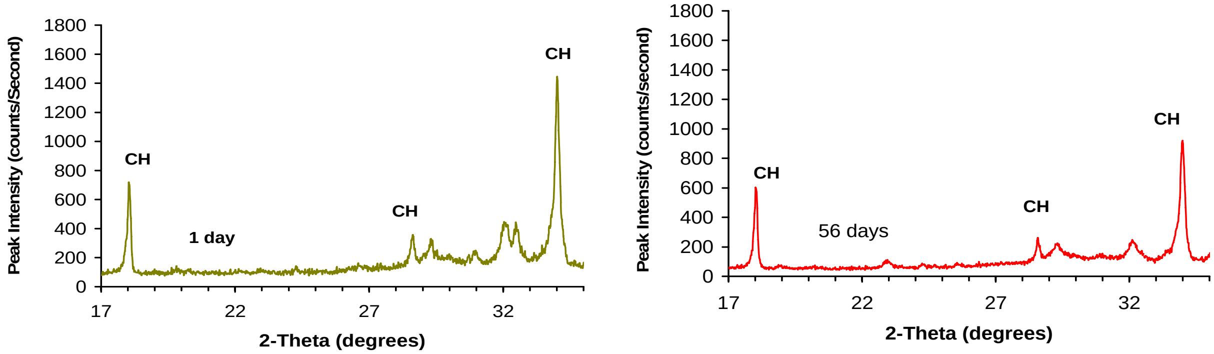



Figure 89 Mix 1 – 100% Cement (Control)

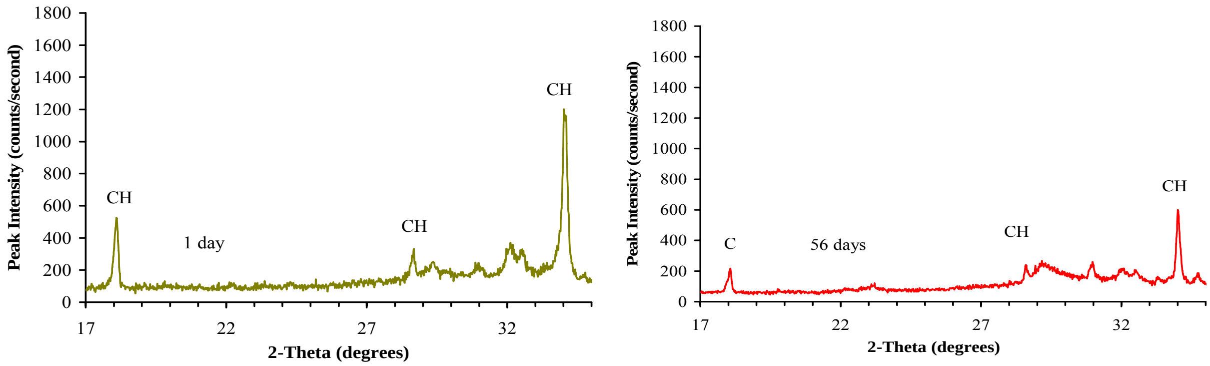



Figure 90 Mix 2 – 70/30 Cement/Slag

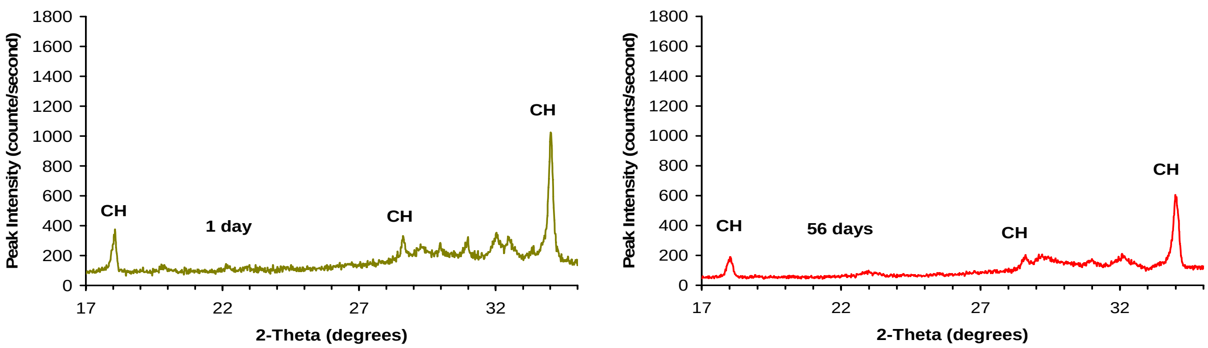



Figure 91 Mix 3 – 50/50 Cement/Slag

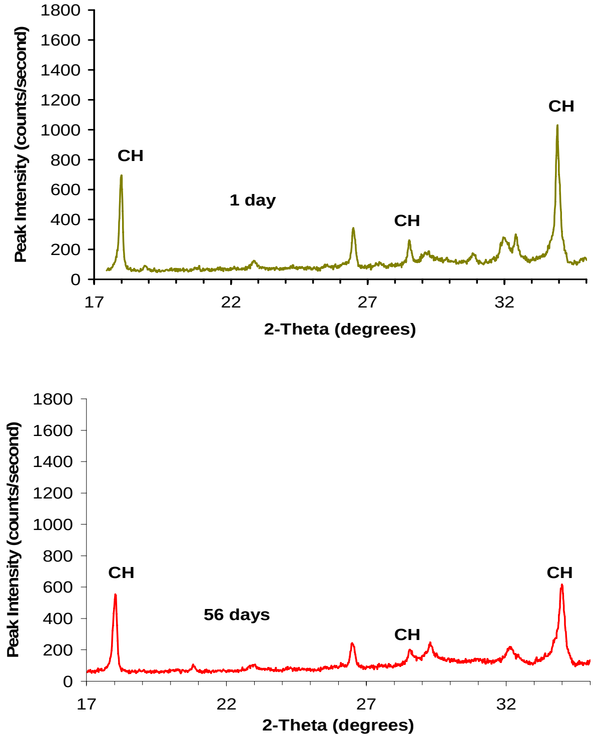



Figure 92 Mix 4 – 80/20 Cement/Fly As

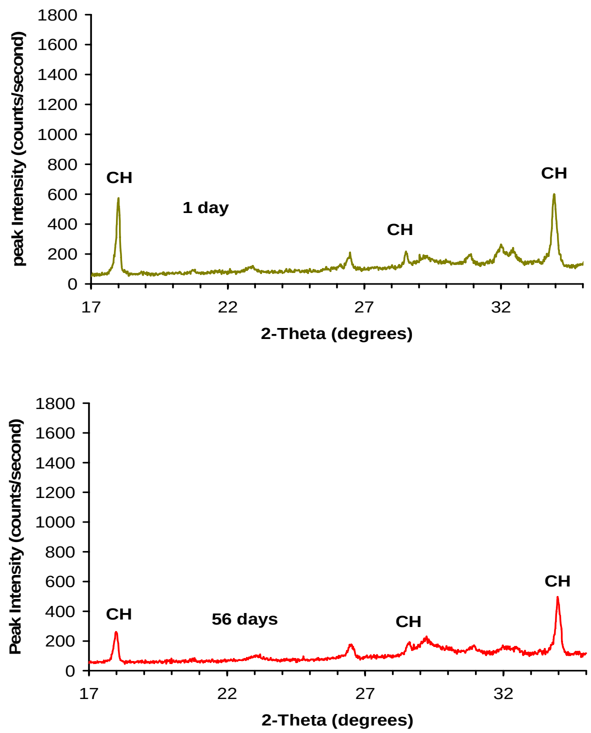



Figure 93 Mix 5 – 50/20/30 Cement / Fly Ash / Slag

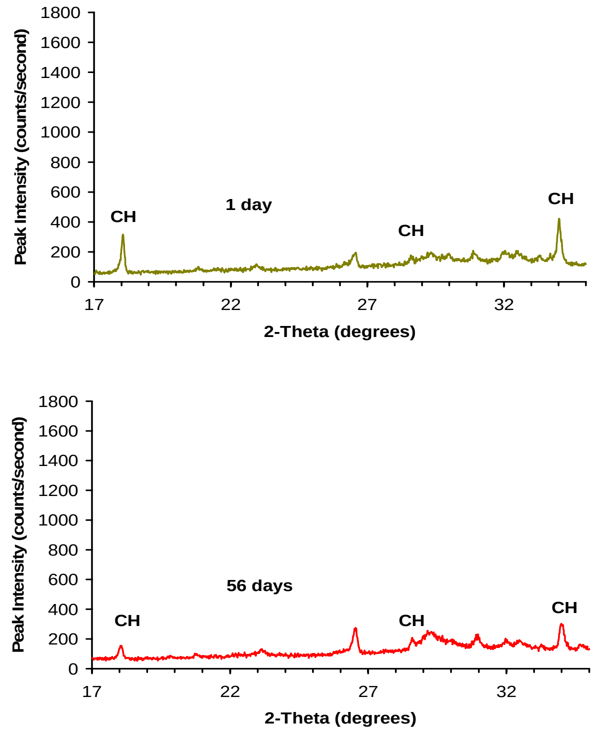



Figure 94 Mix 6 – 30/20/50 Cement / Fly Ash / Slag

## *HARDENED PASTE – ASTM XRD SPECTRUMS FOR 1 AND 91 DAYS OF HYDRATION*

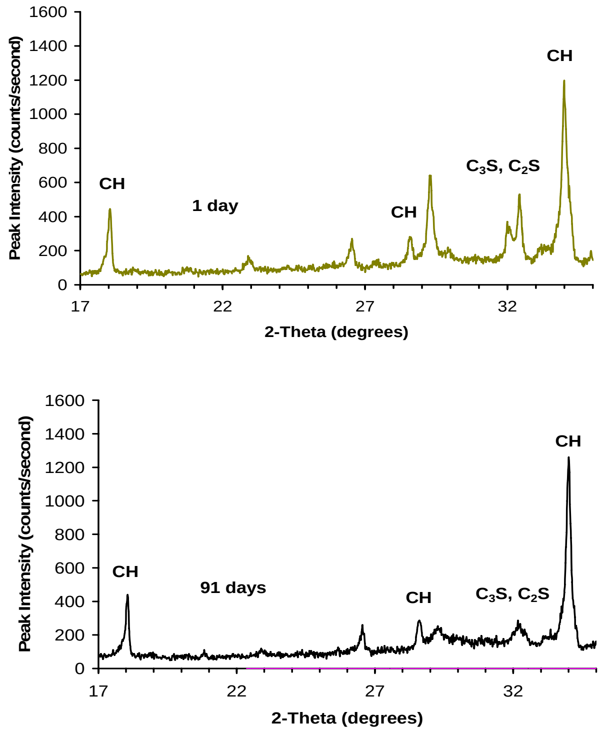



Figure 95 Mix 1 – 80/20 Cement / Fly Ash

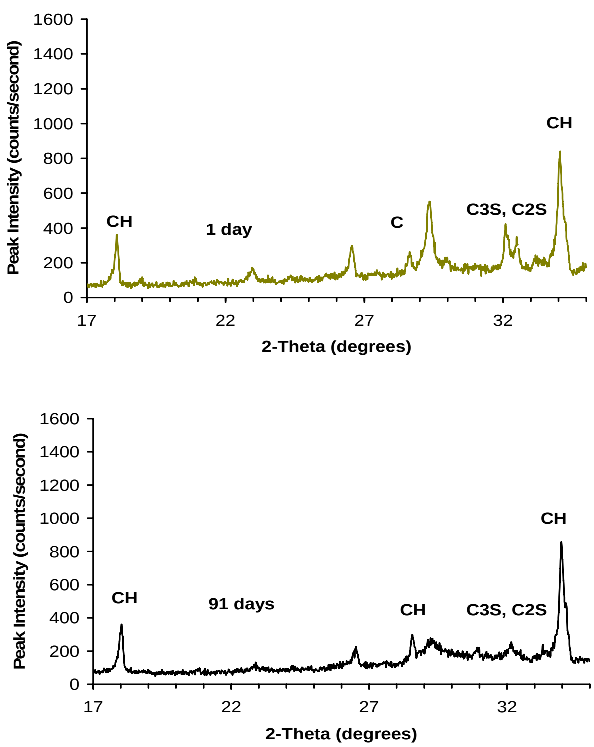



Figure 96 Mix 3 – 60/20/20 Cement / Fly Ash / Slag

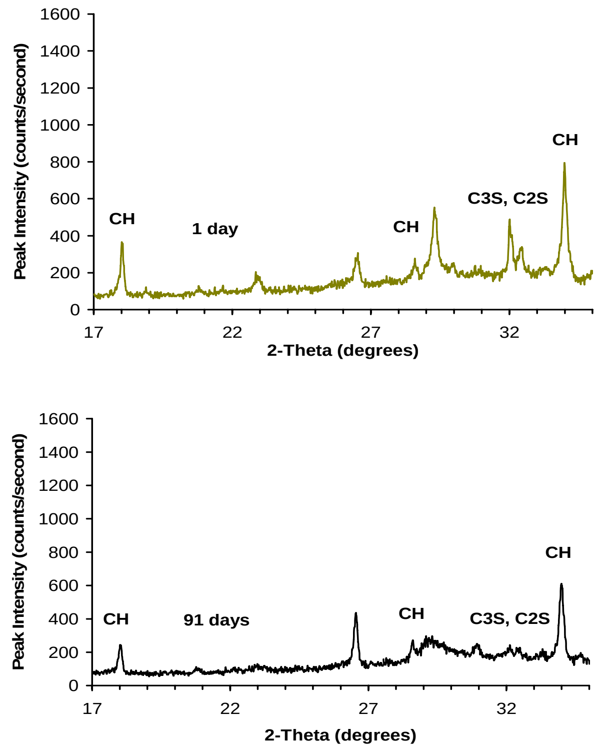



Figure 97 Mix 6 – 40/20/40 Cement / Fly Ash / Slag

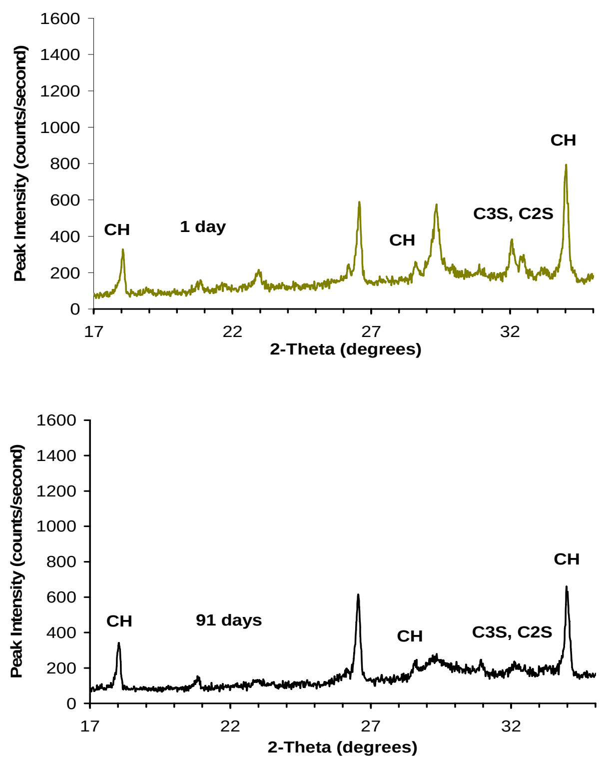



Figure 98 Mix 7 – 40/40/20 Cement / Fly Ash / Slag

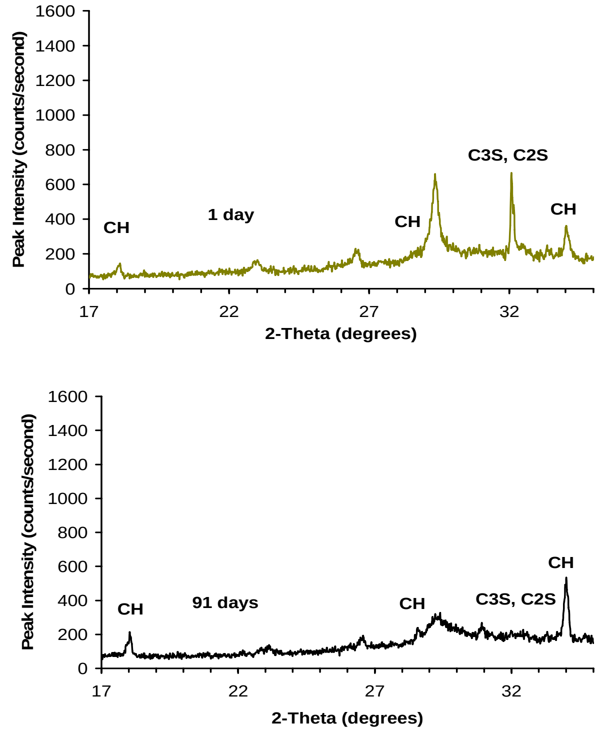



Figure 99 Mix 8 – 30/10/60 Cement / Fly Ash / Slag

*HARDENED PASTE – AASHTO XRD SPECTRUMS FOR 1 AND 91 DAYS OF HYDRATION*

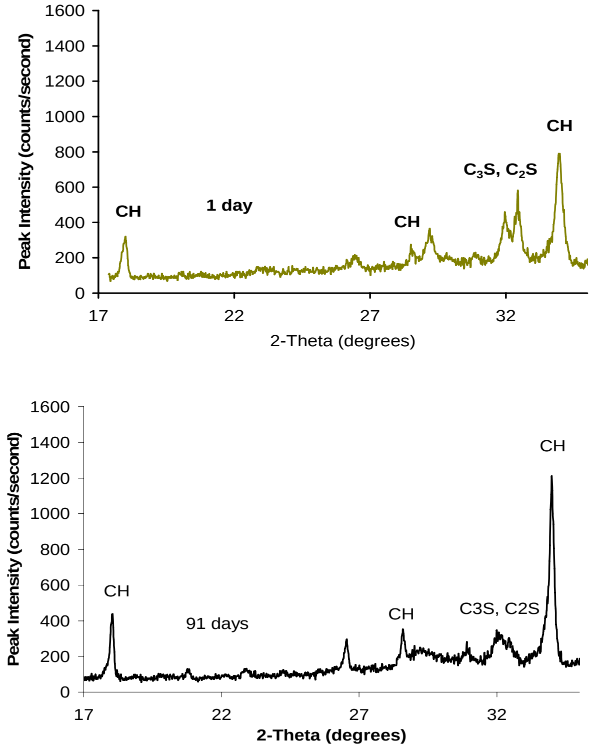



Figure 100 Mix 1 – 80/20 Cement / Fly Ash

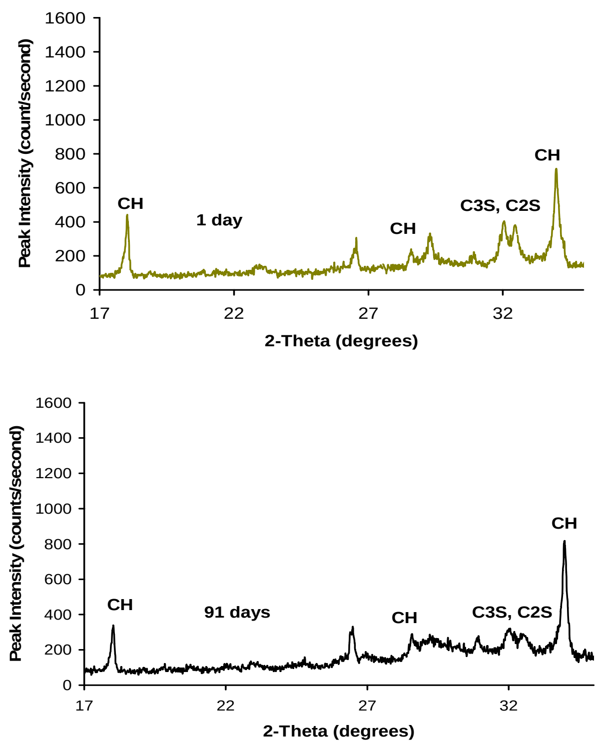



Figure 101 Mix 3 – 60/20/20 Cement / Fly Ash / Slag

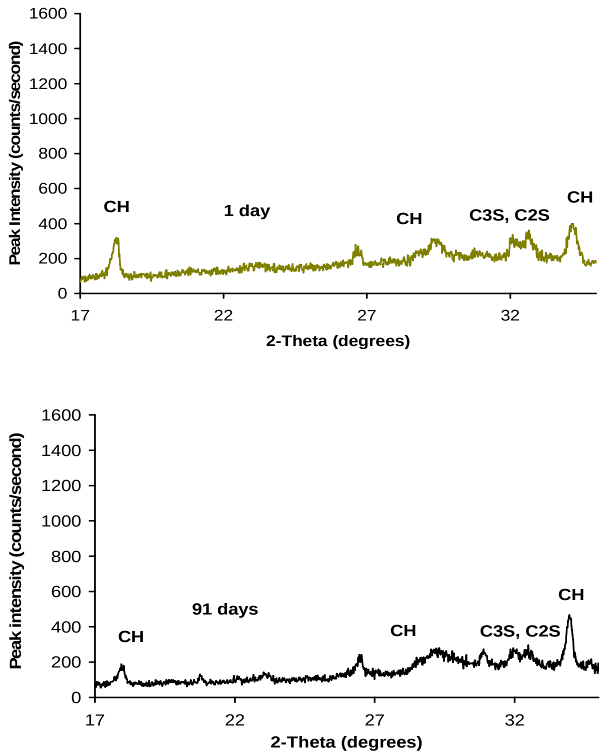



Figure 102 Mix 6 – 40/20/40 Cement / Fly Ash / Slag

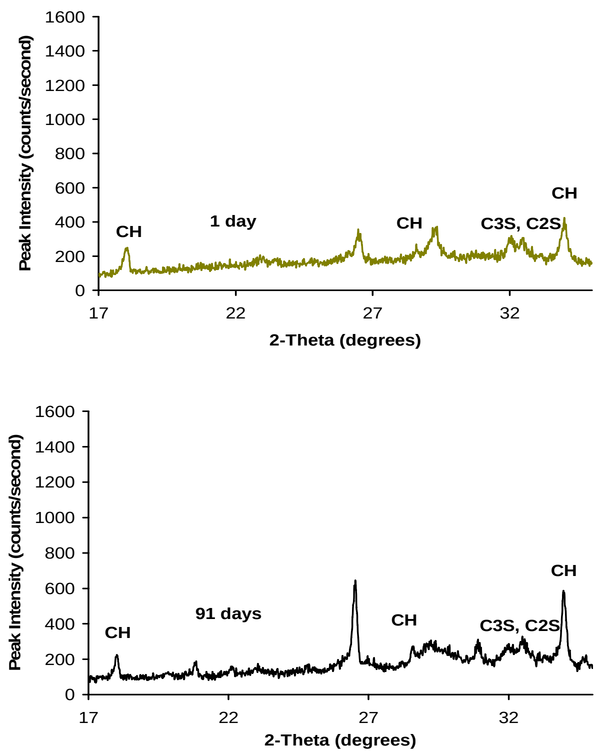



Figure 103 Mix 7 – 40/40/20 Cement / Fly Ash / Slag

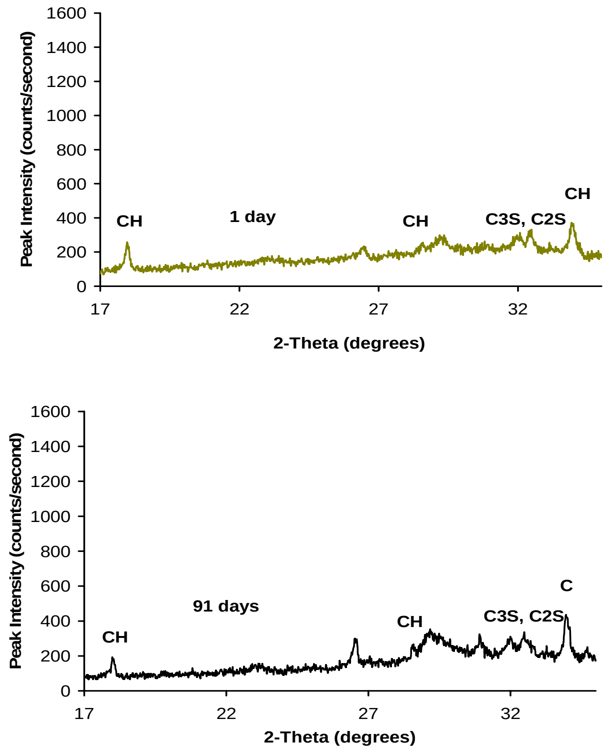
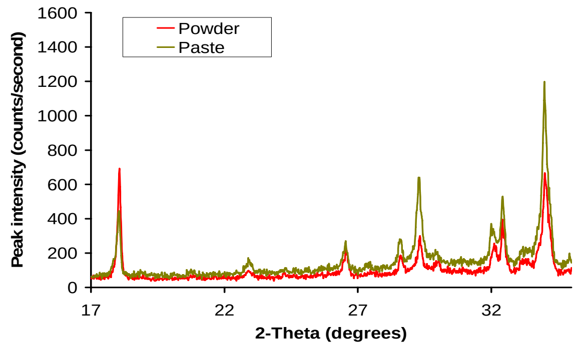



Figure 104 Mix 8 – 30/10/60 Cement / Fly Ash / Slag

*ASTM CEMENT POWDER VS. HARDENED CEMENT – XRD SPECTRUMS FOR 1 AND 91 DAYS OF HYDRATION*



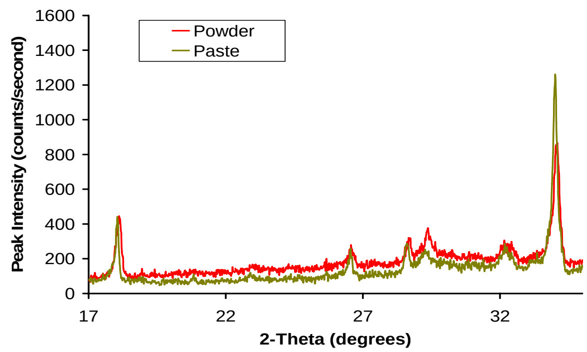
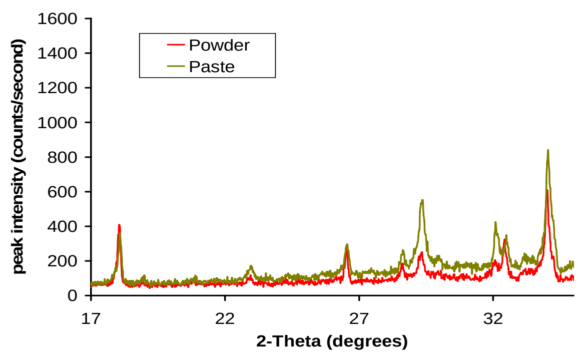




Figure 105 Mix 1 – 80/20 Cement / Fly Ash



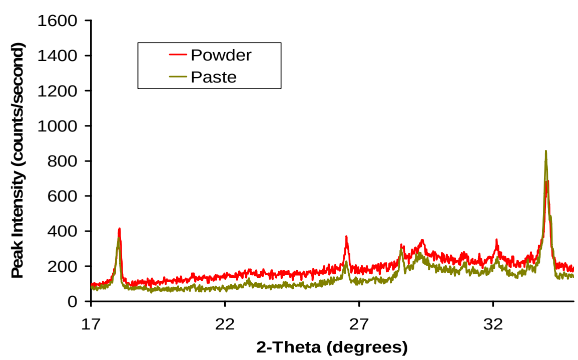




Figure 106 Mix 3 – 60/20/20 Cement / Fly Ash / Slag

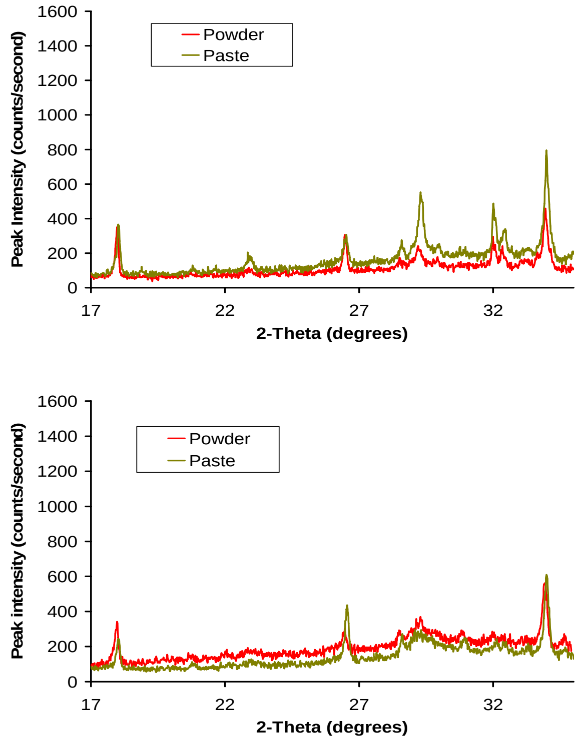



Figure 107 Mix 6 – 40/20/40 Cement / Fly Ash / Slag

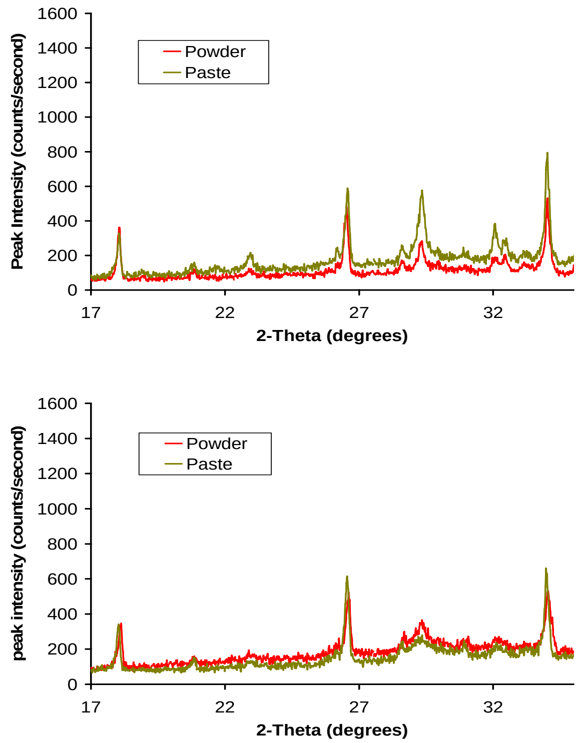



Figure 108 Mix 7 – 40/40/20 Cement / Fly Ash / Slag

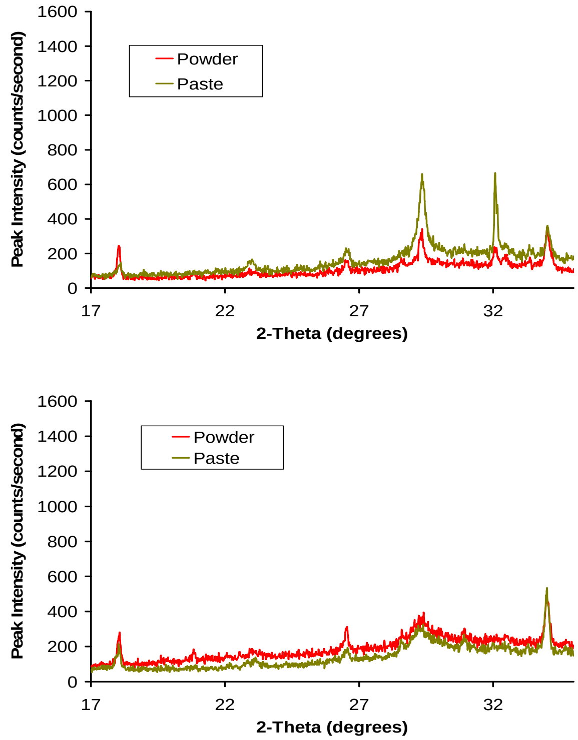



Figure 109 Mix 8 – 30/10/60 Cement / Fly Ash / Slag

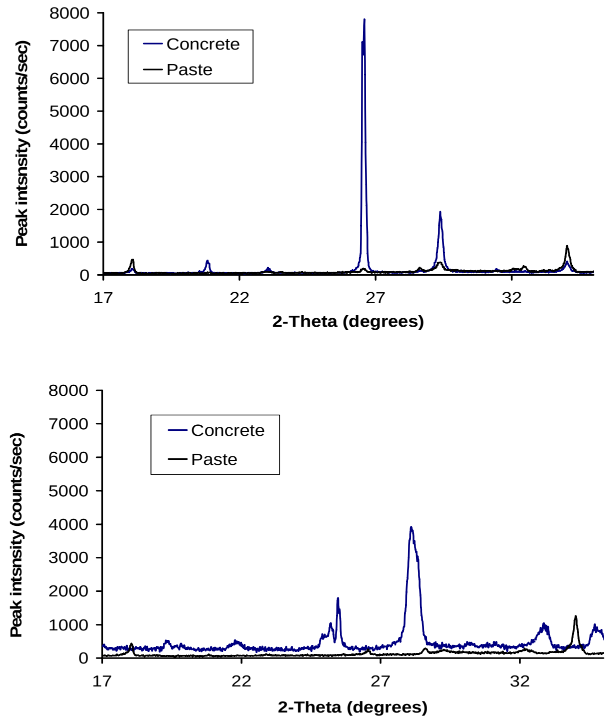



Figure 110 Mix 1 – 80/20 Cement / Fly Ash 28 and 91 days of hydration

CONCRETE SAMPLES – ASTM XRD SPECTRUMS FOR 28 AND 56 DAYS OF HYDRATION

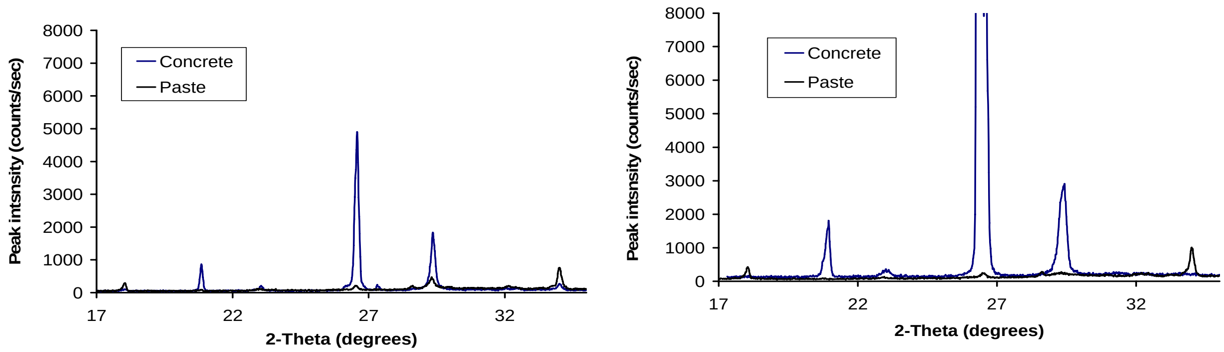



Figure 111 Mix 3 – 60/20/20 Cement / Fly Ash / Slag

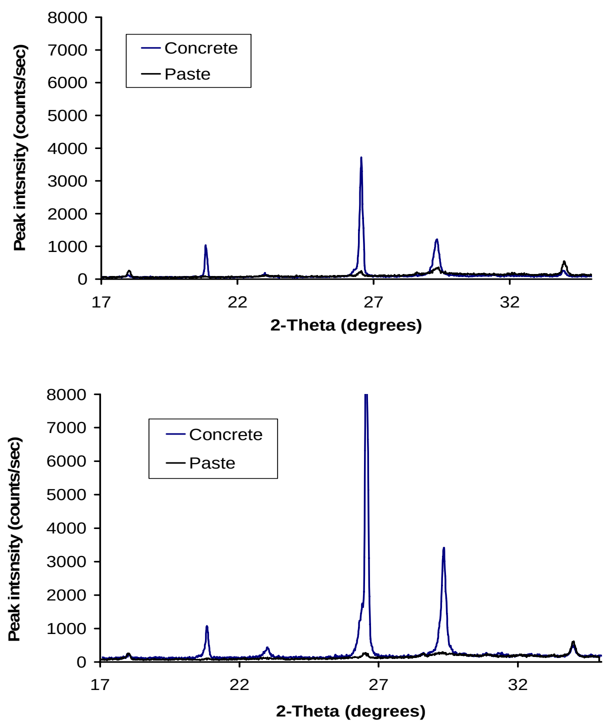



Figure 112 Mix 6 – 40/20/40 Cement / Fly Ash / Slag

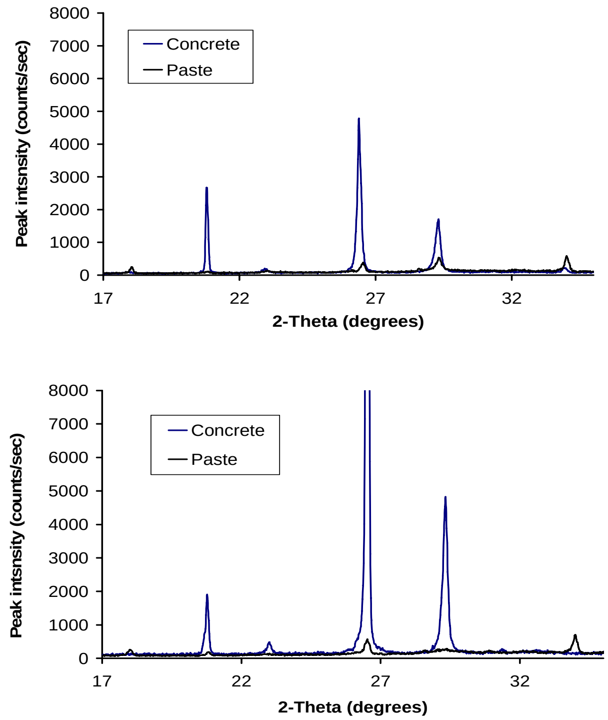



Figure 113 Mix 7 – 40/40/20 Cement / Fly Ash / Slag

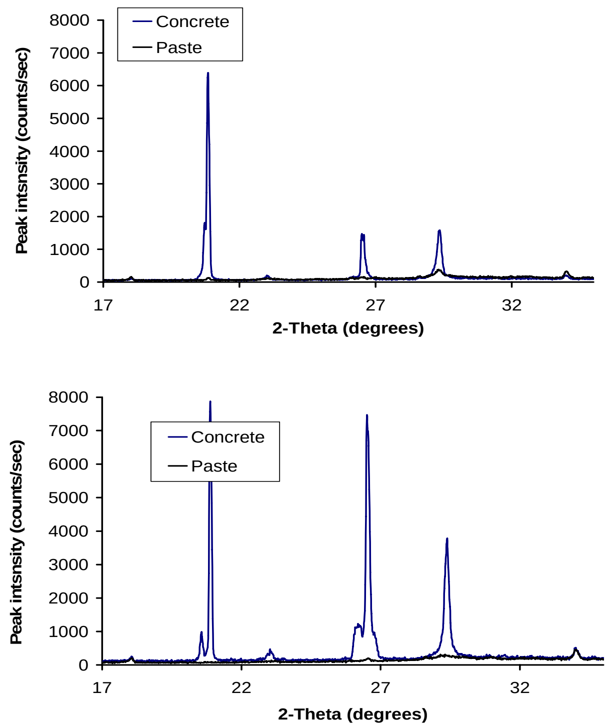



Figure 114 Mix 8 – 30/10/60 Cement / Fly Ash / Slag

# APPENDIX C – COMPRESSIVE STRENGTH DATA

**Mix** TB1A4
**Cast Date** 11/1/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB1A4 | 11/8/2005 | 7 | A | 89400 | 7114 | 91200 | 7257 |
| | | | B | 90400 | 7194 | | |
| | | | C | 93800 | 7464 | | |
| | 11/15/2005 | 14 | A | 96300 | 7663 | 96500 | 7679 |
| | | | B | 98600 | 7846 | | |
| | | | C | 94600 | 7528 | | |
| | 11/29/2005 | 28 | A | 100500 | 7998 | 103133 | 8207 |
| | | | B | 105700 | 8411 | | |
| | | | C | 103200 | 8212 | | |
| | 12/27/2005 | 56 | A | 110900 | 8825 | 112067 | 8918 |
| | | | B | 113000 | 8992 | | |
| | | | C | 112300 | 8937 | | |
| | 5/2/2006 | 182 | A | 121830 | 9695 | 117657 | 9363 |
| | | | B | 112800 | 8976 | | |
| | | | C | 118340 | 9417 | | |
| | 11/6/2006 | 370 | A | 109445 | 8709 | 113065 | 8997 |
| | | | B | 110990 | 8832 | | |
| | | | C | 118761 | 9451 | | |

**Mix** TB1A4-2
**Cast Date** 3/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB1A4-2 | 3/8/2007 | 7 | A | 84600 | 6732 | 86247 | 6863 |
| | | | B | 84933 | 6759 | | |
| | | | C | 89209 | 7099 | | |
| | 3/16/2007 | 15 | A | 92635 | 7372 | 90222 | 7180 |
| | | | B | 88124 | 7013 | | |
| | | | C | 89908 | 7155 | | |
| | 3/29/2007 | 28 | A | 93155 | 7413 | 92149 | 7333 |
| | | | B | 91512 | 7282 | | |
| | | | C | 91780 | 7304 | | |

**Mix** TB2A4
**Cast Date** 11/3/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB2A4 | 11/10/2005 | 7 | A | 91300 | 7265 | 91067 | 7247 |
| | | | B | 89900 | 7154 | | |
| | | | C | 92000 | 7321 | | |
| | 11/17/2005 | 14 | A | 105400 | 8387 | 102800 | 8180 |
| | | | B | 102000 | 8117 | | |
| | | | C | 101000 | 8037 | | |
| | 12/1/2005 | 28 | A | 117000 | 9311 | 116200 | 9247 |
| | | | B | 118300 | 9414 | | |
| | | | C | 113300 | 9016 | | |
| | 12/29/2005 | 56 | A | 130700 | 10401 | 128167 | 10199 |
| | | | B | 127600 | 10154 | | |
| | | | C | 126200 | 10043 | | |
| | 5/4/2006 | 182 | A | 120940 | 9624 | 118493 | 9429 |
| | | | B | 120180 | 9564 | | |
| | | | C | 114360 | 9100 | | |
| | 11/6/2006 | 368 | A | 133794 | 10647 | 124649 | 9919 |
| | | | B | 111431 | 8867 | | |
| | | | C | 128721 | 10243 | | |

**Mix** TB2A4-2
**Cast Date** 3/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB2A4-2 | 3/8/2007 | 7 | A | 87210 | 6940 | 86022 | 6845 |
| | | | B | 87876 | 6993 | | |
| | | | C | 82980 | 6603 | | |
| | 3/16/2007 | 15 | A | 92455 | 7357 | 97685 | 7773 |
| | | | B | 100577 | 8004 | | |
| | | | C | 100022 | 7959 | | |
| | 3/29/2007 | 28 | A | 107204 | 8531 | 105717 | 8413 |
| | | | B | 105976 | 8433 | | |
| | | | C | 103970 | 8274 | | |

**Mix** TB3A4
**Cast Date** 11/8/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB3A4 | 11/15/2005 | 7 | A | 87400 | 6955 | 87800 | 6987 |
| | | | B | 88800 | 7066 | | |
| | | | C | 87200 | 6939 | | |
| | 11/22/2005 | 14 | A | 106900 | 8507 | 107067 | 8520 |
| | | | B | 112100 | 8921 | | |
| | | | C | 102200 | 8133 | | |
| | 12/6/2005 | 28 | A | 109300 | 8698 | 107933 | 8589 |
| | | | B | 107400 | 8547 | | |
| | | | C | 107100 | 8523 | | |
| | 1/3/2006 | 56 | A | 118100 | 9398 | 113133 | 9003 |
| | | | B | 113300 | 9016 | | |
| | | | C | 108000 | 8594 | | |
| | 5/9/2006 | 182 | A | 123000 | 9788 | 123767 | 9849 |
| | | | B | 126300 | 10051 | | |
| | | | C | 122000 | 9708 | | |
| | 11/7/2006 | 364 | A | 125656 | 9999 | 124677 | 9921 |
| | | | B | 123697 | 9843 | | |
| | | | C | 111702 | 8889 | | |

**Mix** TB3A4-2
**Cast Date** 3/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB3A4-2 | 3/8/2007 | 7 | A | 80141 | 6377 | 79136 | 6297 |
| | | | B | 78502 | 6247 | | |
| | | | C | 78766 | 6268 | | |
| | 3/29/2007 | 28 | A | 100479 | 7996 | 101822 | 8103 |
| | | | B | 101145 | 8049 | | |
| | | | C | 103842 | 8263 | | |

**Mix** TB4A4
**Cast Date** 11/10/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB4A4 | 11/17/2005 | 7 | A | 91300 | 7265 | 92267 | 7342 |
| | | | B | 90900 | 7234 | | |
| | | | C | 94600 | 7528 | | |
| | 11/24/2005 | 14 | A | 113700 | 9048 | 112300 | 8937 |
| | | | B | 110800 | 8817 | | |
| | | | C | 112400 | 8945 | | |
| | 12/8/2005 | 28 | A | 108800 | 8658 | 113200 | 9008 |
| | | | B | 116500 | 9271 | | |
| | | | C | 114300 | 9096 | | |
| | 1/5/2006 | 56 | A | 113800 | 9056 | 114500 | 9112 |
| | | | B | 114800 | 9136 | | |
| | | | C | 114900 | 9143 | | |
| | 5/11/2006 | 182 | A | 127300 | 10130 | 126567 | 10072 |
| | | | B | 127100 | 10114 | | |
| | | | C | 125300 | 9971 | | |
| | 11/9/2006 | 364 | A | 106828 | 8501 | 100752 | 8018 |
| | | | B | 125736 | 10006 | | |
| | | | C | 69692 | 5546 | | |

**Mix** TB4A4-2
**Cast Date** 3/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB4A4-2 | 3/8/2007 | 7 | A | 85002 | 6764 | 81736 | 6504 |
| | | | B | 77836 | 6194 | | |
| | | | C | 82370 | 6555 | | |
| | 3/29/2007 | 28 | A | 105215 | 8370 | 105666 | 8408 |
| | | | B | 102362 | 8146 | | |
| | | | C | 109420 | 8707 | | |

**Mix** TB5A4
**Cast Date** 11/15/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB5A4 | 11/22/2005 | 7 | A | 88300 | 7027 | 89800 | 7146 |
| | | | B | 90500 | 7202 | | |
| | | | C | 90600 | 7210 | | |
| | 11/29/2005 | 14 | A | 98700 | 7854 | 95850 | 7628 |
| | | | B | 62700 | 4990 | | |
| | | | C | 93000 | 7401 | | |
| | 12/13/2005 | 28 | A | 104200 | 8292 | 105867 | 8424 |
| | | | B | 105400 | 8387 | | |
| | | | C | 108000 | 8594 | | |
| | 1/10/2006 | 56 | A | 116000 | 9231 | 114900 | 9143 |
| | | | B | 111500 | 8873 | | |
| | | | C | 117200 | 9326 | | |
| | 5/16/2006 | 182 | A | 127600 | 10154 | 121733 | 9687 |
| | | | B | 120000 | 9549 | | |
| | | | C | 117600 | 9358 | | |
| | 11/14/2006 | 364 | A | 62629 | 4984 | 68991 | 7776 |
| | | | B | 65584 | 9496 | | |
| | | | C | 72398 | 6056 | | |

**Mix** TB5A4-2
**Cast Date** 3/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB5A4-2 | 3/29/2007 | 28 | A | 83781 | 6667 | 83912 | 6677 |
| | | | B | 84162 | 6697 | | |
| | | | C | 83792 | 6668 | | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6A4 | 2/28/2006 | 7 | A | 85600 | 6812 | 87067 | 6929 |
| | | | B | 85800 | 6828 | | |
| | | | C | 89800 | 7146 | | |
| | 3/7/2006 | 14 | A | 101450 | 8073 | 102100 | 8125 |
| | | | B | 107500 | 8555 | | |
| | | | C | 97350 | 7747 | | |
| | 3/21/2006 | 28 | A | 103100 | 8204 | 106433 | 8470 |
| | | | B | 111800 | 8897 | | |
| | | | C | 104400 | 8308 | | |
| | 4/18/2006 | 56 | A | 119090 | 9477 | 116920 | 9304 |
| | | | B | 117160 | 9323 | | |
| | | | C | 114510 | 9112 | | |
| | 11/24/2006 | 276 | A | 106918 | 8508 | 118492 | 9429 |
| | | | B | 128568 | 10231 | | |
| | | | C | 119989 | 9548 | | |
| | 2/20/2007 | 364 | A | 112210 | 8929 | 117939 | 9385 |
| | | | B | 123932 | 9862 | | |
| | | | C | 117674 | 9364 | | |

* Test was not run

**Mix** TB6A4-2
**Cast Date** 3/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6A4-2 | 4/3/2007 | 28 | A | 110753 | 8813 | 106668 | 8488 |
| | | | B | 100484 | 7996 | | |
| | | | C | 108766 | 8655 | | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB7A4 | 2/28/2006 | 7 | A | 69000 | 5491 | 66467 | 5289 |
| | | | B | 70400 | 5602 | | |
| | | | C | 60000 | 4775 | | |
| | 3/7/2006 | 14 | A | 88380 | 7033 | 86980 | 6922 |
| | | | B | 87180 | 6938 | | |
| | | | C | 85380 | 6794 | | |
| | 3/21/2006 | 28 | A | 101800 | 8101 | 99500 | 7918 |
| | | | B | 102000 | 8117 | | |
| | | | C | 94700 | 7536 | | |
| | 4/18/2006 | 56 | A | 108450 | 8630 | 110203 | 8770 |
| | | | B | 115120 | 9161 | | |
| | | | C | 107040 | 8518 | | |
| | 11/24/2006 | 276 | A | 116594 | 9278 | 107563 | 8697 |
| | | | B | 96146 | 7651 | | |
| | | | C | 109949 | 9162 | | |
| | 2/20/2007 | 364 | A | 111734 | 8891 | 118266 | 9411 |
| | | | B | 122277 | 9730 | | |
| | | | C | 120788 | 9612 | | |

* Test was not run

**Mix** TB5A4-2
**Cast Date** 3/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB5A4-2 | 3/29/2007 | 28 | A | 83781 | 6667 | 83912 | 6677 |
| | | | B | 84162 | 6697 | | |
| | | | C | 83792 | 6668 | | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6A4 | 2/28/2006 | 7 | A | 85600 | 6812 | 87067 | 6929 |
| | | | B | 85800 | 6828 | | |
| | | | C | 89800 | 7146 | | |
| | 3/7/2006 | 14 | A | 101450 | 8073 | 102100 | 8125 |
| | | | B | 107500 | 8555 | | |
| | | | C | 97350 | 7747 | | |
| | 3/21/2006 | 28 | A | 103100 | 8204 | 106433 | 8470 |
| | | | B | 111800 | 8897 | | |
| | | | C | 104400 | 8308 | | |
| | 4/18/2006 | 56 | A | 119090 | 9477 | 116920 | 9304 |
| | | | B | 117160 | 9323 | | |
| | | | C | 114510 | 9112 | | |
| | 11/24/2006 | 276 | A | 106918 | 8508 | 118492 | 9429 |
| | | | B | 128568 | 10231 | | |
| | | | C | 119989 | 9548 | | |
| | 2/20/2007 | 364 | A | 112210 | 8929 | 117939 | 9385 |
| | | | B | 123932 | 9862 | | |
| | | | C | 117674 | 9364 | | |

* Test was not run

**Mix** TB6A4-2
**Cast Date** 3/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6A4-2 | 4/3/2007 | 28 | A | 110753 | 8813 | 106668 | 8488 |
| | | | B | 100484 | 7996 | | |
| | | | C | 108766 | 8655 | | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB7A4 | 2/28/2006 | 7 | A | 69000 | 5491 | 66467 | 5289 |
| | | | B | 70400 | 5602 | | |
| | | | C | 60000 | 4775 | | |
| | 3/7/2006 | 14 | A | 88380 | 7033 | 86980 | 6922 |
| | | | B | 87180 | 6938 | | |
| | | | C | 85380 | 6794 | | |
| | 3/21/2006 | 28 | A | 101800 | 8101 | 99500 | 7918 |
| | | | B | 102000 | 8117 | | |
| | | | C | 94700 | 7536 | | |
| | 4/18/2006 | 56 | A | 108450 | 8630 | 110203 | 8770 |
| | | | B | 115120 | 9161 | | |
| | | | C | 107040 | 8518 | | |
| | 11/24/2006 | 276 | A | 116594 | 9278 | 107563 | 8697 |
| | | | B | 96146 | 7651 | | |
| | | | C | 109949 | 9162 | | |
| | 2/20/2007 | 364 | A | 111734 | 8891 | 118266 | 9411 |
| | | | B | 122277 | 9730 | | |
| | | | C | 120788 | 9612 | | |

* Test was not run

**Mix** TB7A4-2
**Cast Date** 3/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB7A4-2 | 4/3/2007 | 28 | A | 86737 | 6902 | 89421 | 7116 |
| | | | B | 88887 | 7073 | | |
| | | | C | 92639 | 7372 | | |

**Mix** TB8A4
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB8A4 | 4/6/2006 | 7 | A | 87430 | 6957 | 86580 | 6890 |
| | | | B | 89660 | 7135 | | |
| | | | C | 82650 | 6577 | | |
| | 4/13/2006 | 14 | A | 98340 | 7826 | 102883 | 8187 |
| | | | B | 107530 | 8557 | | |
| | | | C | 102780 | 8179 | | |
| | 4/27/2006 | 28 | A | 108320 | 8620 | 108427 | 8628 |
| | | | B | 106980 | 8513 | | |
| | | | C | 109980 | 8752 | | |
| | 5/25/2006 | 56 | A | 105700 | 8411 | 114867 | 9141 |
| | | | B | 119500 | 9510 | | |
| | | | C | 119400 | 9502 | | |
| | 9/28/2006 | 182 | A | 113127 | 9002 | 118028 | 9392 |
| | | | B | 121839 | 9696 | | |
| | | | C | 119117 | 9479 | | |
| | 3/29/2007 | 364 | A | 120552 | 9593 | 120755 | 9609 |
| | | | B | 121847 | 9696 | | |
| | | | C | 119865 | 9539 | | |

**Mix** TB8A4-2
**Cast Date** 3/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB8A4-2 | 4/3/2007 | 28 | A | 108059 | 8599 | 106398 | 8467 |
| | | | B | 107946 | 8590 | | |
| | | | C | 103190 | 8212 | | |

**Mix** TB1A5
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB1A5 | 4/6/2006 | 7 | A | 85670 | 6817 | 88123 | 7013 |
| | | | B | 88160 | 7016 | | |
| | | | C | 90540 | 7205 | | |
| | 4/13/2006 | 14 | A | 95690 | 7615 | 91767 | 7303 |
| | | | B | 88820 | 7068 | | |
| | | | C | 90790 | 7225 | | |
| | 4/27/2006 | 28 | A | 93680 | 7455 | 98597 | 7846 |
| | | | B | 101940 | 8112 | | |
| | | | C | 100170 | 7971 | | |
| | 5/25/2006 | 56 | A | 102600 | 8165 | 109900 | 8746 |
| | | | B | 111400 | 8865 | | |
| | | | C | 115700 | 9207 | | |
| | 9/28/2006 | 182 | A | 130593 | 10392 | 126818 | 10092 |
| | | | B | 125344 | 9975 | | |
| | | | C | 124516 | 9909 | | |
| | 3/29/2007 | 364 | A | 118993 | 9469 | 122003 | 9708 |
| | | | B | 124903 | 9939 | | |
| | | | C | 122113 | 9717 | | |

**Mix** TB1A5-2
**Cast Date** 3/16/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB1A5-2 | 4/3/2007 | 28 | A | 105466 | 8393 | 103246 | 8216 |
| | | | B | 101003 | 8038 | | |
| | | | C | 103269 | 8218 | | |

**Mix** TB2A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB2A5 | 5/9/2006 | 7 | A | 87600 | 6971 | 90400 | 7194 |
| | | | B | 92900 | 7393 | | |
| | | | C | 90700 | 7218 | | |
| | 5/16/2006 | 14 | A | 100100 | 7966 | 103267 | 8218 |
| | | | B | 105500 | 8395 | | |
| | | | C | 104200 | 8292 | | |
| | 5/30/2006 | 28 | A | 113370 | 9022 | 111603 | 8881 |
| | | | B | 114390 | 9103 | | |
| | | | C | 107050 | 8519 | | |
| | 6/27/2006 | 56 | A | * | * | * | * |
| | | | B | * | * | | |
| | | | C | * | * | | |
| | 11/6/2006 | 188 | A | 110456 | 8790 | 108040 | 8598 |
| | | | B | 108376 | 8624 | | |
| | | | C | 105289 | 8379 | | |
| | 5/1/2007 | 364 | A | 119347 | 9497 | 123790 | 9851 |
| | | | B | 138497 | 11021 | | |
| | | | C | 113525 | 9034 | | |

* Test was not run

**Mix** TB3A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB3A5 | 5/9/2006 | 7 | A | 83500 | 6645 | 88033 | 7006 |
| | | | B | 90200 | 7178 | | |
| | | | C | 90400 | 7194 | | |
| | 5/16/2006 | 14 | A | 92000 | 7321 | 101300 | 8061 |
| | | | B | 106300 | 8459 | | |
| | | | C | 105600 | 8403 | | |
| | 5/30/2006 | 28 | A | 113970 | 9069 | 112067 | 8918 |
| | | | B | 114040 | 9075 | | |
| | | | C | 108190 | 8609 | | |
| | 6/27/2006 | 56 | A | * | * | * | * |
| | | | B | * | * | | |
| | | | C | * | * | | |
| | 11/6/2006 | 188 | A | 112432 | 8947 | 114430 | 9106 |
| | | | B | 110990 | 8832 | | |
| | | | C | 119867 | 9539 | | |
| | 5/1/2007 | 364 | A | 126170 | 10040 | 130549 | 10390 |
| | | | B | 131948 | 10500 | | |
| | | | C | 133528 | 10631 | | |

* Test was not run

**Mix** TB4A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB4A5 | 5/11/2006 | 7 | A | 92200 | 7337 | 94100 | 7468 |
| | | | B | 95100 | 7568 | | |
| | | | C | 95000 | 7500 | | |
| | 5/18/2006 | 14 | A | 108000 | 8594 | 109633 | 8724 |
| | | | B | 109100 | 8682 | | |
| | | | C | 111800 | 8897 | | |
| | 6/1/2006 | 28 | A | 111890 | 8904 | 111130 | 8844 |
| | | | B | 108040 | 8598 | | |
| | | | C | 113460 | 9029 | | |
| | 6/29/2006 | 56 | A | 115430 | 9186 | 112893 | 8984 |
| | | | B | 116140 | 9242 | | |
| | | | C | 107110 | 8523 | | |
| | 11/6/2006 | 186 | A | 91743 | 7301 | 110210 | 8771 |
| | | | B | 125461 | 9984 | | |
| | | | C | 94959 | 7557 | | |
| | 5/3/2007 | 364 | A | 117061 | 9315 | 123756 | 9848 |
| | | | B | 124497 | 9907 | | |
| | | | C | 129710 | 10322 | | |

**Mix** TB5A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB5A5 | 5/11/2006 | 7 | A | 83000 | 6605 | 82400 | 6557 |
| | | | B | 80900 | 6438 | | |
| | | | C | 83300 | 6629 | | |
| | 5/18/2006 | 14 | A | 92200 | 7337 | 95667 | 7613 |
| | | | B | 97500 | 7759 | | |
| | | | C | 97300 | 7743 | | |
| | 6/1/2006 | 28 | A | 105190 | 8371 | 101490 | 8076 |
| | | | B | 96010 | 7640 | | |
| | | | C | 103270 | 8217 | | |
| | 6/29/2006 | 56 | A | 108850 | 8662 | 106155 | 8447 |
| | | | B | 107086 | 8521 | | |
| | | | C | 102530 | 8159 | | |
| | 11/6/2006 | 186 | A | 84292 | 6708 | 108828 | 8660 |
| | | | B | 96276 | 7661 | | |
| | | | C | 121380 | 9659 | | |
| | 5/3/2007 | 364 | A | 123176 | 9802 | 124028 | 9870 |
| | | | B | 124426 | 9901 | | |
| | | | C | 124483 | 9906 | | |

**Mix** TB6A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6A5 | 5/16/2006 | 7 | A | 80900 | 6438 | 82400 | 6557 |
| | | | B | 81500 | 6486 | | |
| | | | C | 84800 | 6748 | | |
| | 5/23/2006 | 14 | A | 105200 | 8372 | 102433 | 8152 |
| | | | B | 99600 | 7926 | | |
| | | | C | 102500 | 8157 | | |
| | 6/6/2006 | 28 | A | 108460 | 8631 | 109800 | 8738 |
| | | | B | 116360 | 9260 | | |
| | | | C | 104580 | 8322 | | |
| | 7/5/2006 | 57 | A | 81030 | 6448 | 112560 | 8957 |
| | | | B | 113630 | 9042 | | |
| | | | C | 111490 | 8872 | | |
| | 11/7/2006 | 182 | A | 112094 | 8920 | 117680 | 9031 |
| | | | B | 119489 | 8509 | | |
| | | | C | 121457 | 9665 | | |
| | 5/8/2007 | 364 | A | 113305 | 9017 | 119511 | 9511 |
| | | | B | 124432 | 9902 | | |
| | | | C | 120795 | 9613 | | |

**Mix** TB7A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB7A5 | 5/16/2006 | 7 | A | 58800 | 4679 | 62900 | 5005 |
| | | | B | 68600 | 5459 | | |
| | | | C | 61300 | 4878 | | |
| | 5/23/2006 | 14 | A | 86200 | 6860 | 87400 | 6955 |
| | | | B | 87300 | 6947 | | |
| | | | C | 88700 | 7059 | | |
| | 6/6/2006 | 28 | A | 93570 | 7446 | 96732 | 7697 |
| | | | B | 97876 | 7788 | | |
| | | | C | 98750 | 7858 | | |
| | 7/5/2006 | 57 | A | 109430 | 8708 | 105413 | 8388 |
| | | | B | 102110 | 8126 | | |
| | | | C | 104700 | 8331 | | |
| | 11/7/2006 | 182 | A | 73828 | 5875 | 105183 | 8370 |
| | | | B | 103916 | 8269 | | |
| | | | C | 106450 | 8471 | | |
| | 5/8/2007 | 364 | A | 115360 | 9180 | 105141 | 8367 |
| | | | B | 92006 | 7322 | | |
| | | | C | 108058 | 8599 | | |

**Mix** TB8A5
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB8A5 | 5/18/2006 | 7 | A | 90700 | 7218 | 87333 | 6950 |
| | | | B | 85000 | 6764 | | |
| | | | C | 86300 | 6868 | | |
| | 5/25/2006 | 14 | A | 101700 | 8093 | 103300 | 8220 |
| | | | B | 105500 | 8395 | | |
| | | | C | 102700 | 8173 | | |
| | 6/8/2006 | 28 | A | 105470 | 8393 | 108753 | 8654 |
| | | | B | 112380 | 8943 | | |
| | | | C | 108410 | 8627 | | |
| | 7/6/2006 | 56 | A | 115390 | 9182 | 113099 | 9000 |
| | | | B | 108786 | 8656 | | |
| | | | C | 115120 | 9161 | | |
| | 11/23/2006 | 196 | A | 84564 | 6729 | 104723 | 8334 |
| | | | B | 107039 | 8518 | | |
| | | | C | 122567 | 9754 | | |
| | 5/10/2007 | 364 | A | 125510 | 9988 | 123971 | 9865 |
| | | | B | 122683 | 9763 | | |
| | | | C | 123720 | 9845 | | |

**Mix** TB1H4
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB1H4 | 5/18/2006 | 7 | A | 85300 | 6788 | 85633 | 6815 |
| | | | B | 85700 | 6820 | | |
| | | | C | 85900 | 6836 | | |
| | 5/25/2006 | 14 | A | 95100 | 7568 | 96667 | 7692 |
| | | | B | 95900 | 7631 | | |
| | | | C | 99000 | 7878 | | |
| | 6/8/2006 | 28 | A | 99066 | 7883 | 104862 | 8291 |
| | | | B | 109870 | 8743 | | |
| | | | C | 105650 | 8248 | | |
| | 7/6/2006 | 56 | A | 104320 | 8302 | 108361 | 8623 |
| | | | B | 112626 | 8962 | | |
| | | | C | 108136 | 8604 | | |
| | 11/9/2006 | 182 | A | 102417 | 8150 | 104046 | 8280 |
| | | | B | 105675 | 8409 | | |
| | | | C | 47081 | 3747 | | |
| | 5/10/2007 | 364 | A | 123892 | 9859 | 121703 | 9685 |
| | | | B | 130484 | 10384 | | |
| | | | C | 110733 | 8812 | | |

**Mix** TB2H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB2H4 | 5/23/2006 | 7 | A | 90200 | 7178 | 91300 | 7265 |
| | | | B | 91900 | 7313 | | |
| | | | C | 91800 | 7305 | | |
| | 5/30/2006 | 14 | A | 107320 | 8540 | 106627 | 8485 |
| | | | B | 106890 | 8506 | | |
| | | | C | 105670 | 8409 | | |
| | 6/14/2006 | 29 | A | 111390 | 8864 | 110263 | 8775 |
| | | | B | 111020 | 8835 | | |
| | | | C | 108380 | 8625 | | |
| | 7/11/2006 | 56 | A | 114660 | 9125 | 115860 | 9220 |
| | | | B | 116820 | 9296 | | |
| | | | C | 116100 | 9239 | | |
| | 11/23/2006 | 191 | A | 124920 | 9941 | 123264 | 9809 |
| | | | B | 121709 | 9685 | | |
| | | | C | 123162 | 9801 | | |
| | 5/15/2007 | 364 | A | 114263 | 9063 | 122228 | 9717 |
| | | | B | 127917 | 10179 | | |
| | | | C | 124505 | 9908 | | |

**Mix** TB3H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB3H4 | 5/23/2006 | 7 | A | 87900 | 6995 | 85967 | 6841 |
| | | | B | 87500 | 6963 | | |
| | | | C | 82500 | 6565 | | |
| | 5/30/2006 | 14 | A | 100600 | 8006 | 101937 | 8112 |
| | | | B | 101440 | 8072 | | |
| | | | C | 103770 | 8258 | | |
| | 6/14/2006 | 29 | A | 104460 | 8313 | 106023 | 8437 |
| | | | B | 104700 | 8332 | | |
| | | | C | 108910 | 8667 | | |
| | 7/11/2006 | 56 | A | 111100 | 8841 | 112710 | 8969 |
| | | | B | 111870 | 8902 | | |
| | | | C | 115160 | 9164 | | |
| | 11/14/2006 | 182 | A | 88726 | 7061 | 94720 | 7538 |
| | | | B | 119331 | 9496 | | |
| | | | C | 76102 | 6056 | | |
| | 5/15/2007 | 364 | A | 124470 | 9905 | 124841 | 9935 |
| | | | B | 122370 | 9738 | | |
| | | | C | 127684 | 10161 | | |

**Mix** TB4H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB4H4 | 5/25/2006 | 7 | A | 86900 | 6915 | 87833 | 6989 |
| | | | B | 87300 | 6947 | | |
| | | | C | 89300 | 7106 | | |
| | 6/1/2006 | 14 | A | 109950 | 8750 | 105170 | 8369 |
| | | | B | 103220 | 8214 | | |
| | | | C | 102340 | 8144 | | |
| | 6/15/2006 | 28 | A | 113346 | 9019 | 110455 | 8789 |
| | | | B | 107710 | 8571 | | |
| | | | C | 110310 | 8778 | | |
| | 7/13/2006 | 56 | A | 106230 | 8453 | 105490 | 8394 |
| | | | B | 111640 | 8884 | | |
| | | | C | 98600 | 7846 | | |
| | 11/23/2006 | 189 | A | 102046 | 8121 | 104721 | 8333 |
| | | | B | 114899 | 9143 | | |
| | | | C | 97219 | 7736 | | |
| | 5/17/2007 | 364 | A | 116294 | 9254 | 118074 | 9396 |
| | | | B | 124793 | 9931 | | |
| | | | C | 113136 | 9003 | | |

**Mix** TB5H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB5H4 | 5/25/2006 | 7 | A | 75300 | 5992 | 75233 | 5987 |
| | | | B | 75700 | 6024 | | |
| | | | C | 74700 | 5944 | | |
| | 6/1/2006 | 14 | A | 97110 | 7728 | 95093 | 7568 |
| | | | B | 92960 | 7398 | | |
| | | | C | 95210 | 7577 | | |
| | 6/15/2006 | 28 | A | 99060 | 7883 | 103241 | 8216 |
| | | | B | 105116 | 8365 | | |
| | | | C | 105546 | 8399 | | |
| | 7/13/2006 | 56 | A | 109930 | 8748 | 109437 | 8709 |
| | | | B | 111010 | 8834 | | |
| | | | C | 107370 | 8545 | | |
| | 11/24/2006 | 190 | A | 94138 | 7491 | 114716 | 9129 |
| | | | B | 126656 | 10079 | | |
| | | | C | 123354 | 9816 | | |
| | 5/17/2007 | 364 | A | 120599 | 9597 | 123642 | 9839 |
| | | | B | 125174 | 9961 | | |
| | | | C | 125154 | 9959 | | |

**Mix** TB6H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6H4 | 5/30/2006 | 7 | A | 77150 | 6139 | 80173 | 6380 |
| | | | B | 81090 | 6453 | | |
| | | | C | 82280 | 6548 | | |
| | 6/6/2006 | 14 | A | 96720 | 7697 | 89230 | 7101 |
| | | | B | 104710 | 8333 | | |
| | | | C | 66260 | 5273 | | |
| | 6/20/2006 | 28 | A | 112846 | 8979 | 113209 | 9009 |
| | | | B | 115260 | 9172 | | |
| | | | C | 111520 | 8875 | | |
| | 7/18/2006 | 56 | A | 113510 | 9032 | 113655 | 9044 |
| | | | B | 120456 | 9585 | | |
| | | | C | 107000 | 8515 | | |
| | 11/23/2006 | 184 | A | 126539 | 10070 | 121070 | 9634 |
| | | | B | 122664 | 9761 | | |
| | | | C | 114007 | 9072 | | |
| | 5/24/2007 | 366 | A | 126905 | 10099 | 129392 | 10297 |
| | | | B | 131878 | 10494 | | |
| | | | C | | | | |

**Mix** TB7H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB7H4 | 5/30/2006 | 7 | A | 62780 | 4996 | 62347 | 4962 |
| | | | B | 62450 | 4970 | | |
| | | | C | 61810 | 4919 | | |
| | 6/6/2006 | 14 | A | 73590 | 5856 | 75427 | 6002 |
| | | | B | 85640 | 6815 | | |
| | | | C | 67050 | 5336 | | |
| | 6/20/2006 | 28 | A | 95466 | 7597 | 91712 | 7298 |
| | | | B | 85610 | 6813 | | |
| | | | C | 94060 | 7485 | | |
| | 7/18/2006 | 56 | A | 102990 | 8196 | 100260 | 7979 |
| | | | B | 92090 | 7328 | | |
| | | | C | 105700 | 8412 | | |
| | 11/23/2006 | 184 | A | 108308 | 8619 | 107850 | 8582 |
| | | | B | 119822 | 9535 | | |
| | | | C | 95419 | 7593 | | |
| | 5/23/2006 | 366 | A | 123556 | 9832 | 121040 | 9632 |
| | | | B | 111556 | 8877 | | |
| | | | C | 128008 | 10187 | | |

**Mix** TB8H4
**Cast Date** 5/25/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB8H4 | 6/1/2006 | 7 | A | 86820 | 6909 | 83890 | 6676 |
| | | | B | 81220 | 6463 | | |
| | | | C | 83630 | 6655 | | |
| | 6/8/2006 | 14 | A | 100356 | 7986 | 98712 | 7855 |
| | | | B | 98730 | 7857 | | |
| | | | C | 97050 | 7723 | | |
| | 6/22/2006 | 28 | A | 110060 | 8759 | 110525 | 8795 |
| | | | B | 108926 | 8667 | | |
| | | | C | 112590 | 8960 | | |
| | 7/20/2006 | 56 | A | 117830 | 9377 | 115071 | 9157 |
| | | | B | 108242 | 8613 | | |
| | | | C | 119140 | 9481 | | |
| | 11/24/2006 | 183 | A | 115139 | 9162 | 107914 | 8581 |
| | | | B | 89473 | 7120 | | |
| | | | C | 119129 | 9460 | | |
| | 5/24/2007 | 364 | A | 116146 | 9243 | 120673 | 9603 |
| | | | B | 120768 | 9610 | | |
| | | | C | 125104 | 9955 | | |

**Mix** TB1H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB1H5 | 2/8/2007 | 7 | A | 79727 | 6344 | 80154 | 6378 |
| | | | B | 78129 | 6217 | | |
| | | | C | 82607 | 6574 | | |
| | 2/15/2007 | 14 | A | 94855 | 7548 | 95853 | 7628 |
| | | | B | 96813 | 7704 | | |
| | | | C | 95890 | 7631 | | |
| | 3/1/2007 | 28 | A | 99234 | 7897 | 100924 | 8031 |
| | | | B | 103259 | 8217 | | |
| | | | C | 100280 | 7980 | | |
| | 3/29/2007 | 56 | A | 108395 | 8626 | 107144 | 8526 |
| | | | B | 106074 | 8441 | | |
| | | | C | 106964 | 8512 | | |
| | 8/2/2007 | 182 | A | 94676 | 7534 | 104454 | 8312 |
| | | | B | 111915 | 8906 | | |
| | | | C | 106770 | 8496 | | |
| | 2/4/2008 | 368 | A | 131030 | 10427 | 136807 | 10887 |
| | | | B | 135670 | 10796 | | |
| | | | C | 143720 | 11437 | | |

**Mix** TB2H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB2H5 | 2/8/2007 | 7 | A | 76429 | 6082 | 76762 | 6108 |
| | | | B | 78181 | 6221 | | |
| | | | C | 75677 | 6022 | | |
| | 2/15/2007 | 14 | A | 99892 | 7949 | 98677 | 7852 |
| | | | B | 97451 | 7755 | | |
| | | | C | 98689 | 7853 | | |
| | 3/1/2007 | 28 | A | 103816 | 8261 | 105337 | 8382 |
| | | | B | 104341 | 8303 | | |
| | | | C | 107853 | 8583 | | |
| | 3/29/2007 | 56 | A | 109664 | 8727 | 108624 | 8644 |
| | | | B | 100829 | 8024 | | |
| | | | C | 115380 | 9182 | | |
| | 8/2/2007 | 182 | A | 83159 | 6618 | 87087 | 6930 |
| | | | B | 85363 | 6793 | | |
| | | | C | 92740 | 7380 | | |
| | 2/4/2008 | 368 | A | 146880 | 10427 | 140113 | 10887 |
| | | | B | 139600 | 10796 | | |
| | | | C | 133860 | 11437 | | |

**Mix** TB6H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB6H5 | 2/15/2007 | 7 | A | 71557 | 5694 | 72538 | 5772 |
| | | | B | 73273 | 5831 | | |
| | | | C | 72785 | 5792 | | |
| | 2/22/2007 | 14 | A | 91851 | 7309 | 92329 | 7347 |
| | | | B | 91544 | 7285 | | |
| | | | C | 93591 | 7448 | | |
| | 3/8/2007 | 28 | A | 113451 | 9028 | 116907 | 9303 |
| | | | B | 112905 | 8985 | | |
| | | | C | 124366 | 9897 | | |
| | 4/5/2007 | 56 | A | 117179 | 9325 | 118044 | 9394 |
| | | | B | 119707 | 9526 | | |
| | | | C | 117246 | 9330 | | |
| | 8/9/2007 | 182 | A | 97785 | 7781 | 90518 | 7205 |
| | | | B | 73895 | 5883 | | |
| | | | C | 99874 | 7952 | | |
| | 2/7/2008 | 364 | A | 114110 | 9081 | 114927 | 9146 |
| | | | B | 116850 | 9299 | | |
| | | | C | 113820 | 9057 | | |

**Mix** TB7H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB7H5 | 2/22/2007 | 7 | A | 47451 | 3776 | 48631 | 3870 |
| | | | B | 49651 | 3951 | | |
| | | | C | 48790 | 3883 | | |
| | 3/1/2007 | 14 | A | (*) | (*) | 74560 | 5933 |
| | | | B | 73029 | 5811 | | |
| | | | C | 76090 | 6055 | | |
| | 3/16/2007 | 29 | A | 86321 | 6869 | 90578 | 7208 |
| | | | B | 93915 | 7474 | | |
| | | | C | 91498 | 7281 | | |
| | 4/12/2007 | 56 | A | 104559 | 8321 | 102119 | 8127 |
| | | | B | 102856 | 8185 | | |
| | | | C | 98943 | 7874 | | |
| | 8/16/2007 | 182 | A | 106954 | 8511 | 105707 | 8412 |
| | | | B | 101241 | 8056 | | |
| | | | C | 108927 | 8668 | | |
| | 2/14/2008 | 364 | A | 110600 | 8803 | 109150 | 8686 |
| | | | B | 111240 | 8852 | | |
| | | | C | 105610 | 8404 | | |

(*) Compression computer crashed right after the test ended

**Mix** TB8H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) |
|---|---|---|---|---|---|---|---|
| TB8H5 | 2/22/2007 | 7 | A | 80306 | 6391 | 80651 | 6418 |
| | | | B | 80450 | 6402 | | |
| | | | C | 81198 | 6462 | | |
| | 3/1/2007 | 14 | A | 100845 | 8025 | 103704 | 8253 |
| | | | B | 102376 | 8147 | | |
| | | | C | 107891 | 8586 | | |
| | 3/16/2007 | 29 | A | 111063 | 8838 | 113502 | 9032 |
| | | | B | 110552 | 8797 | | |
| | | | C | 118891 | 9461 | | |
| | 4/12/2007 | 56 | A | 117015 | 9312 | 122340 | 9736 |
| | | | B | 122958 | 9785 | | |
| | | | C | 127047 | 10110 | | |
| | 8/16/2007 | 182 | A | 114019 | 9073 | 114214 | 9089 |
| | | | B | 113140 | 9003 | | |
| | | | C | 115482 | 9190 | | |
| | 2/14/2008 | 364 | A | 115120 | 9161 | 109180 | 8760 |
| | | | B | 101010 | 8038 | | |
| | | | C | 111410 | 9081 | | |

# APPENDIX D – TENSILE STRENGTH DATA

## *SPLIT CYLINDER TESTS*

**Mix** TB1A4
**Cast Date** 11/1/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB1A4 | 11/29/2005 | 28 | A | 25050 | 495 | 23543 | 467 |
| | | | B | 22790 | 450 | | |
| | | | C | 22790 | 455 | | |
| | 10/31/2006 | 364 | A | 23000 | 455 | 24770 | 490 |
| | | | B | 24130 | 475 | | |
| | | | C | 27180 | 540 | | |

**Mix** TB2A4
**Cast Date** 11/3/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB2A4 | 12/1/2005 | 28 | A | 35780 | 710 | 35393 | 700 |
| | | | B | 35250 | 695 | | |
| | | | C | 35150 | 695 | | |
| | 11/2/2006 | 364 | A | 22320 | 445 | 26843 | 533 |
| | | | B | 27320 | 540 | | |
| | | | C | 30890 | 615 | | |

**Mix** TB3A4
**Cast Date** 11/8/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB3A4 | 12/6/2005 | 28 | A | 25110 | 500 | 24490 | 487 |
| | | | B | 24510 | 490 | | |
| | | | C | 23850 | 470 | | |
| | 11/7/2006 | 364 | A | 26630 | 530 | 25823 | 512 |
| | | | B | 20970 | 415 | | |
| | | | C | 29870 | 590 | | |

**Mix** TB4A4
**Cast Date** 11/10/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB4A4 | 12/8/2005 | 28 | A | 32270 | 640 | 32550 | 645 |
| | | | B | 31520 | 625 | | |
| | | | C | 33860 | 670 | | |
| | 11/9/2006 | 364 | A | 35540 | 705 | 35300 | 698 |
| | | | B | 33720 | 665 | | |
| | | | C | 36640 | 725 | | |

**Mix** TB5A4
**Cast Date** 11/15/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB5A4 | 12/13/2005 | 28 | A | 28350 | 550 | 31800 | 623 |
| | | | B | 33600 | 660 | | |
| | | | C | 33450 | 660 | | |
| | 11/14/2006 | 364 | A | 34550 | 685 | 33983 | 675 |
| | | | B | 33480 | 665 | | |
| | | | C | 33920 | 675 | | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB6A4 | 3/21/2006 | 28 | A | 33560 | 665 | 33563 | 665 |
| | | | B | 34100 | 675 | | |
| | | | C | 33030 | 655 | | |
| | 2/20/2007 | 364 | A(*) | 28140 | 550 | 41220 | 810 |
| | | | B | 48260 | 955 | | |
| | | | C | 47260 | 925 | | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB7A4 | 3/21/2006 | 28 | A | 33240 | 655 | 33323 | 655 |
| | | | B | 34020 | 670 | | |
| | | | C | 32710 | 640 | | |
| | 2/20/2007 | 364 | A | 48510 | 955 | 46140 | 898 |
| | | | B | 44020 | 855 | | |
| | | | C | 45890 | 885 | | |

**Mix** TB8A4
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB8A4 | 4/28/2006 | 29 | A | 30480 | 605 | 32613 | 645 |
| | | | B | 34180 | 675 | | |
| | | | C | 33180 | 655 | | |
| | 3/29/2007 | 364 | A | 29440 | 580 | 34993 | 690 |
| | | | B | 37260 | 735 | | |
| | | | C | 38280 | 755 | | |

**Mix** TB1A5
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB1A5 | 4/28/2006 | 29 | A | 23610 | 465 | 22860 | 452 |
| | | | B | 22220 | 440 | | |
| | | | C | 22750 | 450 | | |
| | 3/29/2007 | 364 | A | 35860 | 710 | 40087 | 787 |
| | | | B | 45390 | 885 | | |
| | | | C | 39010 | 765 | | |

**Mix** TB2A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB2A5 | 5/30/2006 | 28 | A | 33680 | 665 | 31410 | 620 |
| | | | B | 32200 | 635 | | |
| | | | C | 28350 | 560 | | |
| | 5/1/2007 | 364 | A | 36530 | 720 | 38863 | 767 |
| | | | B | 43700 | 860 | | |
| | | | C | 36360 | 720 | | |

**Mix** TB3A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB3A5 | 5/30/2006 | 28 | A | 31420 | 625 | 32220 | 637 |
| | | | B | 32520 | 640 | | |
| | | | C | 32720 | 645 | | |
| | 5/1/2007 | 364 | A | 29960 | 595 | 36187 | 717 |
| | | | B | 38170 | 750 | | |
| | | | C | 40430 | 805 | | |

**Mix** TB4A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB4A5 | 6/1/2006 | 28 | A | 29053 | 575 | 32051 | 632 |
| | | | B | 31780 | 630 | | |
| | | | C | 35320 | 690 | | |
| | 5/3/2007 | 364 | A | 28500 | 575 | 33760 | 602 |
| | | | B | 32720 | 435 | | |
| | | | C | 40060 | 795 | | |

**Mix** TB5A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB5A5 | 6/1/2006 | 28 | A | 29100 | 580 | 29850 | 588 |
| | | | B | 28050 | 550 | | |
| | | | C | 32400 | 635 | | |
| | 5/3/2007 | 364 | A | 39120 | 780 | 34150 | 682 |
| | | | B | 27570 | 550 | | |
| | | | C | 35760 | 715 | | |

**Mix** TB6A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB6A5 | 6/6/2006 | 28 | A | 32000 | 635 | 31330 | 620 |
| | | | B | 28820 | 570 | | |
| | | | C | 33170 | 655 | | |
| | 5/8/2007 | 364 | A | 32850 | 650 | 32607 | 645 |
| | | | B | 32780 | 650 | | |
| | | | C | 32190 | 635 | | |

**Mix** TB7A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB7A5 | 6/6/2006 | 28 | A | 29010 | 570 | 30620 | 602 |
| | | | B | 28090 | 550 | | |
| | | | C | 34760 | 685 | | |
| | 5/8/2007 | 364 | A | 37620 | 745 | 34937 | 692 |
| | | | B | 35100 | 695 | | |
| | | | C | 32090 | 635 | | |

**Mix** TB8A5
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB8A5 | 6/8/2006 | 28 | A | 31250 | 625 | 33083 | 662 |
| | | | B | 34410 | 685 | | |
| | | | C | 33590 | 675 | | |
| | 5/10/2007 | 364 | A | 28130 | 560 | 29957 | 595 |
| | | | B | 29860 | 595 | | |
| | | | C | 31880 | 630 | | |

**Mix** TB1H4
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB1H4 | 6/8/2006 | 28 | A | 25750 | 510 | 25343 | 503 |
| | | | B | 26100 | 520 | | |
| | | | C | 24180 | 480 | | |
| | 5/10/2007 | 364 | A | 30750 | 605 | 33443 | 662 |
| | | | B | 35210 | 700 | | |
| | | | C | 34370 | 680 | | |

**Mix** TB2H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB2H4 | 6/14/2006 | 29 | A | 28600 | 565 | 32400 | 642 |
| | | | B | 37900 | 750 | | |
| | | | C | 30700 | 610 | | |
| | 5/15/2007 | 364 | A | 42560 | 845 | 40333 | 795 |
| | | | B | 41140 | 805 | | |
| | | | C | 37300 | 735 | | |

**Mix** TB3H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB3H4 | 6/14/2006 | 29 | A | 27160 | 540 | 25647 | 508 |
| | | | B | 23050 | 455 | | |
| | | | C | 26730 | 530 | | |
| | 5/15/2007 | 364 | A | 28600 | 565 | 35360 | 702 |
| | | | B | 37290 | 740 | | |
| | | | C | 40190 | 800 | | |

**Mix** TB4H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB4H4 | 6/15/2006 | 28 | A | 27000 | 535 | 32600 | 643 |
| | | | B | 34820 | 685 | | |
| | | | C | 35980 | 710 | | |
| | 5/17/2007 | 364 | A | 26060 | 520 | 34360 | 678 |
| | | | B | 37040 | 735 | | |
| | | | C | 39980 | 780 | | |

**Mix** TB5H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB5H4 | 6/15/2006 | 28 | A | 26510 | 525 | 28813 | 568 |
| | | | B | 31530 | 620 | | |
| | | | C | 28400 | 560 | | |
| | 5/17/2007 | 364 | A | 37600 | 740 | 37853 | 753 |
| | | | B | 39380 | 785 | | |
| | | | C | 36580 | 735 | | |

**Mix** TB6H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB6H4 | 6/20/2006 | 28 | A | 34160 | 675 | 34137 | 668 |
| | | | B | 36980 | 720 | | |
| | | | C | 31270 | 610 | | |
| | 5/22/2007 | 364 | A | 31210 | 620 | 36973 | 738 |
| | | | B | 35610 | 705 | | |
| | | | C | 44100 | 890 | | |

* Only 2 samples. One of the sample was missing.

**Mix** TB7H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB7H4 | 6/20/2006 | 28 | A | 23470 | 470 | 29187 | 578 |
| | | | B | 32450 | 645 | | |
| | | | C | 31640 | 620 | | |
| | 5/22/2007 | 364 | A | 35620 | 710 | 39263 | 780 |
| | | | B | 43240 | 855 | | |
| | | | C | 38930 | 775 | | |

**Mix** TB8H4
**Cast Date** 5/25/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB8H4 | 6/22/2006 | 28 | A | 28640 | 565 | 27513 | 543 |
| | | | B | 29430 | 580 | | |
| | | | C | 24470 | 485 | | |
| | 5/24/2007 | 364 | A | 41740 | 830 | 42343 | 840 |
| | | | B | 44130 | 875 | | |
| | | | C | 41160 | 815 | | |

**Mix** TB1H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB1H5 | 3/1/2007 | 28 | A | 31480 | 615 | 32913 | 643 |
| | | | B | 34450 | 670 | | |
| | | | C | 32810 | 645 | | |
| | 1/31/2008 | 364 | A | 48760 | 960 | 45900 | 903 |
| | | | B | 44040 | 870 | | |
| | | | C | 44900 | 880 | | |

**Mix** TB2H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB2H5 | 3/1/2007 | 28 | A | 38540 | 760 | 38643 | 765 |
| | | | B | 38420 | 760 | | |
| | | | C | 38970 | 775 | | |
| | 1/31/2008 | 364 | A | 43480 | 855 | 45965 | 905 |
| | | | B | 29540 | 585 | | |
| | | | C | 48450 | 955 | | |

**Mix** TB3H5
**Cast Date** 2/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB3H5 | 3/6/2007 | 28 | A | 33580 | 660 | 34853 | 685 |
| | | | B | 36800 | 725 | | |
| | | | C | 34180 | 670 | | |
| | 2/5/2008 | 364 | A | 43920 | 860 | 40543 | 795 |
| | | | B | 44090 | 865 | | |
| | | | C | 33620 | 660 | | |

**Mix** TB4H5
**Cast Date** 2/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB4H5 | 3/6/2007 | 28 | A | 33990 | 665 | 33980 | 670 |
| | | | B | 32890 | 650 | | |
| | | | C | 35060 | 695 | | |
| | 2/5/2008 | 364 | A | 28110 | 550 | 30837 | 603 |
| | | | B | 33850 | 660 | | |
| | | | C | 30550 | 600 | | |

**Mix** TB5H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB5H5 | 3/8/2007 | 28 | A | 31220 | 615 | 31283 | 618 |
| | | | B | 35290 | 700 | | |
| | | | C | 27340 | 540 | | |
| | 2/7/2008 | 364 | A | 38460 | 755 | 40237 | 790 |
| | | | B | 42390 | 835 | | |
| | | | C | 39860 | 780 | | |

**Mix** TB6H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB6H5 | 3/8/2007 | 28 | A | 34570 | 680 | 33740 | 667 |
| | | | B | 33570 | 665 | | |
| | | | C | 33080 | 655 | | |
| | 2/7/2008 | 364 | A | 38400 | 760 | 41623 | 818 |
| | | | B | 44550 | 885 | | |
| | | | C | 41920 | 810 | | |

**Mix** TB7H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB7H5 | 3/15/2007 | 28 | A | 31660 | 620 | 31197 | 613 |
| | | | B | 33370 | 660 | | |
| | | | C | 28560 | 560 | | |
| | 2/14/2008 | 364 | A | 38150 | 750 | 42103 | 828 |
| | | | B | 46580 | 915 | | |
| | | | C | 41580 | 820 | | |

**Mix** TB8H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Tensile Strength (psi) | Ave. Load (lb) | Ave. Tens. Strength (psi) |
|---|---|---|---|---|---|---|---|
| TB8H5 | 3/15/2007 | 28 | A | 35280 | 690 | 37327 | 732 |
| | | | B | 40140 | 790 | | |
| | | | C | 36560 | 715 | | |
| | 2/14/2008 | 364 | A | 42810 | 840 | 43993 | 868 |
| | | | B | 46740 | 930 | | |
| | | | C | 42430 | 835 | | |

*MODULUS OF RUPTURE*

| MIX | Cast Date | Test Age | Test Date | Sample | Maximum Load (lbf) | MOR (psi) | Average MOR (psi) | Remarks |
|---|---|---|---|---|---|---|---|---|
| TB1A4-2 | 3/1/2007 | 29 | 3/30/2007 | A | 6318 | 1096 | 1175 | Fract. at 3.7in from supp. |
| | | | | B | 6279 | 1118 | | Fract. at 3.8in from supp. |
| | | | | C | 5989 | 1310 | | Fracture Middle Third |
| | | 91 | 5/31/2007 | A | 5795 | 1268 | 1213 | Fracture Middle Third |
| | | | | B | 5479 | 1199 | | Fracture Middle Third |
| | | | | C | 5366 | 1174 | | Fracture Middle Third |
| | | 364 | 2/28/2008 | A | 5559 | 1216 | 1240 | Fracture Middle Third |
| | | | | B | 5801 | 1269 | | Fracture Middle Third |
| | | | | C | 5640 | 1234 | | Fracture Middle Third |
| TB2A4-2 | 3/1/2007 | 29 | 3/30/2007 | A | 6407 | 1141 | 1178 | Fract. at 3.8in from supp. |
| | | | | B | 6277 | 1148 | | Fract. at 3.9in from supp. |
| | | | | C | 5695 | 1246 | | Fracture Middle Third |
| | | 91 | 5/31/2007 | A | 5529 | 1209 | 1230 | Fracture Middle Third |
| | | | | B | 5763 | 1261 | | Fracture Middle Third |
| | | | | C | 5574 | 1219 | | Fracture Middle Third |
| | | 364 | 2/28/2008 | A | 6254 | 1368 | 1311 | Fracture Middle Third |
| | | | | B | 6060 | 1326 | | Fracture Middle Third |
| | | | | C | 5661 | 1238 | | Fracture Middle Third |
| TB3A4-2 | 3/1/2007 | 29 | 3/30/2007 | A | 5467 | 1196 | 1142 | Fracture Middle Third |
| | | | | B | 5704 | 1043 | | Fract. at 3.9in from supp. |
| | | | | C | 5430 | 1188 | | Fracture Middle Third |
| | | 91 | 5/31/2007 | A | 5436 | 1189 | 1194 | Fracture Middle Third |
| | | | | B | 5243 | 1147 | | Fracture Middle Third |
| | | | | C | 5702 | 1247 | | Fracture Middle Third |
| | | 364 | 2/28/2008 | A | 5787 | 1266 | 1238 | Fracture Middle Third |
| | | | | B | 5649 | 1236 | | Fracture Middle Third |
| | | | | C | 5537 | 1211 | | Fracture Middle Third |
| TB4A4-2 | 3/1/2007 | 29 | 3/30/2007 | A | 6261 | 1115 | 1256 | Fract. at 3.8n from supp. |
| | | | | B | 5915 | 1294 | | Fracture Middle Third |
| | | | | C | 6214 | 1359 | | Fracture Middle Third |
| | | 91 | 5/31/2007 | A | 5693 | 1245 | 1230 | Fracture Middle Third |
| | | | | B | 5556 | 1215 | | Fracture Middle Third |
| | | | | C | - | - | | - |
| | | 364 | 2/28/2008 | A | 6071 | 1328 | 1254 | Fracture Middle Third |
| | | | | B | 5752 | 1258 | | Fracture Middle Third |
| | | | | C | 5379 | 1177 | | Fracture Middle Third |
| TB5A4-2 | 3/1/2007 | 29 | 3/30/2007 | A | 4905 | 1073 | 1058 | Fracture Middle Third |
| | | | | B | 4988 | 1091 | | Fracture Middle Third |
| | | | | C | 4613 | 1009 | | Fracture Middle Third |
| | | 91 | 5/31/2007 | A | 5015 | 1097 | 1069 | Fracture Middle Third |
| | | | | B | 4551 | 996 | | Fracture Middle Third |
| | | | | C | 5090 | 1113 | | Fracture Middle Third |
| | | 364 | 2/28/2008 | A | 5500 | 1203 | 1220 | Fracture Middle Third |
| | | | | B | 5674 | 1241 | | Fracture Middle Third |
| | | | | C | 5553 | 1215 | | Fracture Middle Third |
| TB6A4-2 | 3/6/2007 | 28 | 4/3/2007 | A | 5762 | 1260 | 1182 | Fracture Middle Third |
| | | | | B | 5887 | 1076 | | Fract. at 3.9in from supp. |
| | | | | C | 5522 | 1208 | | Fracture Middle Third |
| | | 91 | 6/5/2007 | A | 5755 | 1259 | 1222 | Fracture Middle Third |
| | | | | B | 5421 | 1186 | | Fracture Middle Third |
| | | | | C | - | - | | - |
| | | 364 | 3/4/2008 | A | 6261 | 1370 | 1306 | Fracture Middle Third |
| | | | | B | 6131 | 1341 | | Fracture Middle Third |
| | | | | C | 5514 | 1206 | | Fracture Middle Third |

| MIX | Cast Date | Test Age | Test Date | Sample | Maximum Load (lbf) | MOR (psi) | Average MOR (psi) | Remarks |
|---|---|---|---|---|---|---|---|---|
| TB7A4-2 | 3/6/2007 | 28 | 4/3/2007 | A | 4344 | 950 | 1009 | Fracture Middle Third |
| | | | | B | 4990 | 1092 | | Fracture Middle Third |
| | | | | C | 4508 | 986 | | Fracture Middle Third |
| | | 91 | 6/5/2007 | A | 5328 | 1166 | 1152 | Fracture Middle Third |
| | | | | B | 5627 | 1231 | | Fracture Middle Third |
| | | | | C | 5800 | 1060 | | Fract. at 3.9in from supp. |
| | | 364 | 3/4/2008 | A | 5977 | 1307 | 1308 | Fracture Middle Third |
| | | | | B | 5839 | 1277 | | Fracture Middle Third |
| | | | | C | 6123 | 1339 | | Fracture Middle Third |
| TB8A4-2 | 3/6/2007 | 28 | 4/3/2007 | A | 5604 | 1226 | 1221 | Fracture Middle Third |
| | | | | B | 5780 | 1264 | | Fracture Middle Third |
| | | | | C | 5356 | 1172 | | Fracture Middle Third |
| | | 91 | 6/5/2007 | A | 5502 | 1204 | 1229 | Fracture Middle Third |
| | | | | B | 5589 | 1223 | | Fracture Middle Third |
| | | | | C | 5761 | 1260 | | Fracture Middle Third |
| | | 364 | 3/4/2008 | A | 6169 | 1349 | 1394 | Fracture Middle Third |
| | | | | B | 6581 | 1440 | | Fracture Middle Third |
| | | | | C | 6374 | 1394 | | Fracture Middle Third |
| TB1A5-2 | 3/6/2007 | 28 | 4/3/2007 | A | 4901 | 1072 | 1074 | Fracture Middle Third |
| | | | | B | 5218 | 1141 | | Fracture Middle Third |
| | | | | C | 4607 | 1008 | | Fracture Middle Third |
| | | 91 | 6/5/2007 | A | 5944 | 1300 | 1245 | Fracture Middle Third |
| | | | | B | 5900 | 1291 | | Fracture Middle Third |
| | | | | C | 5233 | 1145 | | Fracture Middle Third |
| | | 364 | 3/4/2008 | A | 5629 | 1231 | 1294 | Fracture Middle Third |
| | | | | B | 6002 | 1313 | | Fracture Middle Third |
| | | | | C | 6113 | 1337 | | Fracture Middle Third |
| TB2A5 | 5/2/2006 | 28 | 5/30/2006 | A | 4938 | 1080 | 1025 | Fracture Middle Third |
| | | | | B | 4432 | 970 | | Fracture Middle Third |
| | | | | C | - | - | | - |
| | | 93 | 8/3/2006 | A | 5489 | 1201 | 1183 | Fracture Middle Third |
| | | | | B | 5568 | 1218 | | Fracture Middle Third |
| | | | | C | 5165 | 1130 | | Fracture Middle Third |
| | | 365 | 5/2/2007 | A | 6313 | 1381 | 1334 | Fracture Middle Third |
| | | | | B | 6182 | 1352 | | Fracture Middle Third |
| | | | | C | 5799 | 1269 | | Fracture Middle Third |
| TB3A5 | 5/2/2006 | 28 | 5/30/2006 | A | 4719 | 1032 | 1018 | Fracture Middle Third |
| | | | | B | 4731 | 1035 | | Fracture Middle Third |
| | | | | C | 4513 | 987 | | Fracture Middle Third |
| | | 93 | 8/3/2006 | A | 5511 | 1206 | 1172 | Fracture Middle Third |
| | | | | B | 5089 | 1113 | | Fracture Middle Third |
| | | | | C | 5478 | 1198 | | Fracture Middle Third |
| | | 365 | 5/2/2007 | A | 5721 | 1251 | 1302 | Fracture Middle Third |
| | | | | B | 5901 | 1291 | | Fracture Middle Third |
| | | | | C | 6231 | 1363 | | Fracture Middle Third |
| TB4A5 | 5/4/2006 | 28 | 6/1/2006 | A | 5250 | 1148 | 1140 | Fracture Middle Third |
| | | | | B | 5207 | 1139 | | Fracture Middle Third |
| | | | | C | 5183 | 1134 | | Fracture Middle Third |
| | | 91 | 8/3/2006 | A | 5149 | 1126 | 1140 | Fracture Middle Third |
| | | | | B | 5413 | 1184 | | Fracture Middle Third |
| | | | | C | 5070 | 1109 | | Fracture Middle Third |
| | | 365 | 5/4/2007 | A | 6247 | 1367 | 1451 | Fracture Middle Third |
| | | | | B | 7075 | 1548 | | Fracture Middle Third |
| | | | | C | 6582 | 1440 | | Fracture Middle Third |

| MIX | Cast Date | Test Age | Test Date | Sample | Maximum Load (lbf) | MOR (psi) | Average MOR (psi) | Remarks |
|---|---|---|---|---|---|---|---|---|
| **TB5A5** | 5/4/2006 | 28 | 6/1/2006 | A | 4567 | 999 | 996 | Fracture Middle Third |
| | | | | B | 4853 | 1062 | | Fracture Middle Third |
| | | | | C | 5074 | 928 | | Fract. at 3.9in from supp. |
| | | 91 | 8/3/2006 | A | 4736 | 1036 | 1043 | Fracture Middle Third |
| | | | | B | 4796 | 1049 | | Fracture Middle Third |
| | | | | C | - | - | | - |
| | | 365 | 5/4/2007 | A | 6342 | 1387 | 1393 | Fracture Middle Third |
| | | | | B | 6502 | 1422 | | Fracture Middle Third |
| | | | | C | 6265 | 1370 | | Fracture Middle Third |
| **TB6A5** | 5/9/2006 | 28 | 6/6/2006 | A | 5042 | 1103 | 1144 | Fracture Middle Third |
| | | | | B | 5280 | 1155 | | Fracture Middle Third |
| | | | | C | 5371 | 1175 | | Fracture Middle Third |
| | | 92 | 8/9/2006 | A | 5650 | 1236 | 1239 | Fracture Middle Third |
| | | | | B | 5411 | 1184 | | Fracture Middle Third |
| | | | | C | 5925 | 1296 | | Fracture Middle Third |
| | | 364 | 5/8/2007 | A | 6574 | 1438 | 1347 | Fracture Middle Third |
| | | | | B | 5849 | 1279 | | Fracture Middle Third |
| | | | | C | 6054 | 1324 | | Fracture Middle Third |
| **TB7A5** | 5/9/2006 | 28 | 6/6/2006 | A | 4864 | 1064 | 1050 | Fracture Middle Third |
| | | | | B | 4725 | 1034 | | Fracture Middle Third |
| | | | | C | 4808 | 1052 | | Fracture Middle Third |
| | | 92 | 8/9/2006 | A | 5112 | 1118 | 1101 | Fracture Middle Third |
| | | | | B | 4832 | 1057 | | Fracture Middle Third |
| | | | | C | 5150 | 1127 | | Fracture Middle Third |
| | | 364 | 5/8/2007 | A | 6335 | 1386 | 1377 | Fracture Middle Third |
| | | | | B | 6087 | 1332 | | Fracture Middle Third |
| | | | | C | 6467 | 1415 | | Fracture Middle Third |
| **TB8A5** | 5/11/2006 | 56 | 7/6/2006 | A | 5663 | 1239 | 1225 | Fracture Middle Third |
| | | | | B | 5614 | 1228 | | Fracture Middle Third |
| | | | | C | 5528 | 1209 | | Fracture Middle Third |
| | | 92 | 8/11/2006 | A | 5306 | 1161 | 1196 | Fracture Middle Third |
| | | | | B | 5429 | 1188 | | Fracture Middle Third |
| | | | | C | 5663 | 1239 | | Fracture Middle Third |
| | | 364 | 5/10/2007 | A | 6391 | 1398 | 1461 | Fracture Middle Third |
| | | | | B | 7330 | 1603 | | Fracture Middle Third |
| | | | | C | 6321 | 1383 | | Fracture Middle Third |
| **TB1H4** | 5/11/2006 | 56 | 7/6/2006 | A | 5097 | 1115 | 1128 | Fracture Middle Third |
| | | | | B | 5194 | 1136 | | Fracture Middle Third |
| | | | | C | 5178 | 1133 | | Fracture Middle Third |
| | | 92 | 8/11/2006 | A | 5512 | 1206 | 1161 | Fracture Middle Third |
| | | | | B | 5264 | 1152 | | Fracture Middle Third |
| | | | | C | 5143 | 1125 | | Fracture Middle Third |
| | | 364 | 5/10/2007 | A | 6619 | 1448 | 1366 | Fracture Middle Third |
| | | | | B | 6180 | 1352 | | Fracture Middle Third |
| | | | | C | 5939 | 1299 | | Fracture Middle Third |
| **TB2H4** | 5/16/2006 | 56 | 7/11/2006 | A | 5410 | 1183 | 1197 | Fracture Middle Third |
| | | | | B | 5495 | 1202 | | Fracture Middle Third |
| | | | | C | 5513 | 1206 | | Fracture Middle Third |
| | | 91 | 8/15/2006 | A | 5407 | 1183 | 1171 | Fracture Middle Third |
| | | | | B | 5320 | 1164 | | Fracture Middle Third |
| | | | | C | 5337 | 1167 | | Fracture Middle Third |
| | | 364 | 5/15/2007 | A | 5864 | 1283 | 1424 | Fracture Middle Third |
| | | | | B | 6659 | 1457 | | Fracture Middle Third |
| | | | | C | 7007 | 1533 | | Fracture Middle Third |

| MIX | Cast Date | Test Age | Test Date | Sample | Maximum Load (lbf) | MOR (psi) | Average MOR (psi) | Remarks |
|---|---|---|---|---|---|---|---|---|
| **TB3H4** | 5/16/2006 | 56 | 7/11/2006 | A | 5323 | 1164 | 1166 | Fracture Middle Third |
| | | | | B | 5706 | 1248 | | Fracture Middle Third |
| | | | | C | 4959 | 1085 | | Fracture Middle Third |
| | | 91 | 8/15/2006 | A | 5825 | 1274 | 1257 | Fracture Middle Third |
| | | | | B | 5430 | 1188 | | Fracture Middle Third |
| | | | | C | 5986 | 1309 | | Fracture Middle Third |
| | | 364 | 5/15/2007 | A | 6987 | 1528 | 1527 | Fracture Middle Third |
| | | | | B | 6957 | 1522 | | Fracture Middle Third |
| | | | | C | 6994 | 1530 | | Fracture Middle Third |
| **TB4H4** | 5/18/2006 | 57 | 7/14/2006 | A | 5485 | 1200 | 1198 | Fracture Middle Third |
| | | | | B | 5486 | 1200 | | Fracture Middle Third |
| | | | | C | 5453 | 1193 | | Fracture Middle Third |
| | | 91 | 8/17/2006 | A | 5981 | 1308 | 1274 | Fracture Middle Third |
| | | | | B | 5638 | 1233 | | Fracture Middle Third |
| | | | | C | 5847 | 1279 | | Fracture Middle Third |
| | | 364 | 5/17/2007 | A | 6617 | 1447 | 1471 | Fracture Middle Third |
| | | | | B | 6753 | 1477 | | Fracture Middle Third |
| | | | | C | 6807 | 1489 | | Fracture Middle Third |
| **TB5H4** | 5/18/2006 | 57 | 7/14/2006 | A | 5357 | 1172 | 1171 | Fracture Middle Third |
| | | | | B | 5264 | 1152 | | Fracture Middle Third |
| | | | | C | 5436 | 1189 | | Fracture Middle Third |
| | | 91 | 8/17/2006 | A | 5447 | 1192 | 1269 | Fracture Middle Third |
| | | | | B | 5870 | 1284 | | Fracture Middle Third |
| | | | | C | 6080 | 1330 | | Fracture Middle Third |
| | | 364 | 5/17/2007 | A | 7431 | 1626 | 1534 | Fracture Middle Third |
| | | | | B | 6750 | 1477 | | Fracture Middle Third |
| | | | | C | 6852 | 1499 | | Fracture Middle Third |
| **TB6H4** | 5/23/2006 | 28 | 6/20/2006 | A | 5350 | 1170 | 1160 | Fracture Middle Third |
| | | | | B | 5182 | 1134 | | Fracture Middle Third |
| | | | | C | 5375 | 1176 | | Fracture Middle Third |
| | | 91 | 8/22/2006 | A | 5491 | 1201 | 1125 | Fracture Middle Third |
| | | | | B | 4943 | 1081 | | Fracture Middle Third |
| | | | | C | 4988 | 1091 | | Fracture Middle Third |
| | | 364 | 5/22/2007 | A | 7060 | 1544 | 1557 | Fracture Middle Third |
| | | | | B | 7597 | 1662 | | Fracture Middle Third |
| | | | | C | 6702 | 1466 | | Fracture Middle Third |
| **TB7H4** | 5/23/2006 | 29 | 6/21/2006 | A | 4376 | 957 | 937 | Fracture Middle Third |
| | | | | B | 4922 | 900 | | Fract. at 3.9in from supp. |
| | | | | C | 4358 | 953 | | Fracture Middle Third |
| | | 57 | 7/19/2006 | A | 4123 | 902 | 946 | Fracture Middle Third |
| | | | | B | 4598 | 1006 | | Fracture Middle Third |
| | | | | C | 4246 | 929 | | Fracture Middle Third |
| | | 91 | 8/22/2006 | A | 5084 | 1112 | 1071 | Fracture Middle Third |
| | | | | B | 5276 | 1154 | | Fracture Middle Third |
| | | | | C | 4324 | 946 | | Fracture Middle Third |
| **TB8H4** | 5/25/2006 | 28 | 6/22/2006 | A | 5174 | 1132 | 1131 | Fracture Middle Third |
| | | | | B | 5159 | 1129 | | Fracture Middle Third |
| | | | | C | 5174 | 1132 | | Fracture Middle Third |
| | | 57 | 7/21/2006 | A | 4926 | 1078 | 1076 | Fracture Middle Third |
| | | | | B | 4773 | 1044 | | Fracture Middle Third |
| | | | | C | 5054 | 1106 | | Fracture Middle Third |
| | | 364 | 5/24/2007 | A | * | * | * | * |
| | | | | B | * | * | | * |
| | | | | C | * | * | | * |

| MIX | Cast Date | Test Age | Test Date | Sample | Maximum Load (lbf) | MOR (psi) | Average MOR (psi) | Remarks |
|---|---|---|---|---|---|---|---|---|
| **TB1H5** | 2/1/2007 | 29 | 3/2/2007 | A | 6862 | 1501 | 1383 | Fracture Middle Third |
| | | | | B | 6351 | 1389 | | Fracture Middle Third |
| | | | | C | 5753 | 1258 | | Fracture Middle Third |
| | | 92 | 5/4/2007 | A | 6304 | 1379 | 1448 | Fracture Middle Third |
| | | | | B | 6806 | 1489 | | Fracture Middle Third |
| | | | | C | 6750 | 1477 | | Fracture Middle Third |
| | | 364 | 1/31/2008 | A | 5979 | 1308 | 1288 | Fracture Middle Third |
| | | | | B | 6099 | 1334 | | Fracture Middle Third |
| | | | | C | 5580 | 1221 | | Fracture Middle Third |
| **TB2H5** | 2/1/2007 | 29 | 3/2/2007 | A | 5937 | 1299 | 1322 | Fracture Middle Third |
| | | | | B | 5959 | 1304 | | Fracture Middle Third |
| | | | | C | 6233 | 1363 | | Fracture Middle Third |
| | | 92 | 5/4/2007 | A | 6863 | 1501 | 1481 | Fracture Middle Third |
| | | | | B | 6673 | 1460 | | Fracture Middle Third |
| | | | | C | - | - | | - |
| | | 364 | 1/31/2008 | A | 5430 | 1188 | 1242 | Fracture Middle Third |
| | | | | B | 5922 | 1295 | | Fracture Middle Third |
| | | | | C | - | - | | Fracture Middle Third |
| **TB3H5** | 2/6/2007 | 28 | 3/6/2007 | A | 6291 | 1376 | 1300 | Fracture Middle Third |
| | | | | B | 5963 | 1304 | | Fracture Middle Third |
| | | | | C | 6846 | 1219 | | Fract. at 3.8in from supp. |
| | | 91 | 5/8/2007 | A | 6720 | 1470 | 1346 | Fracture Middle Third |
| | | | | B | 5496 | 1202 | | Fracture Middle Third |
| | | | | C | 6248 | 1367 | | Fracture Middle Third |
| | | 364 | 2/5/2008 | A | 6083 | 1331 | 1281 | Fracture Middle Third |
| | | | | B | - | - | | Fracture Middle Third |
| | | | | C | 5625 | 1230 | | Fracture Middle Third |
| **TB4H5** | 2/6/2007 | 28 | 3/6/2007 | A | 7117 | 1557 | 1428 | Fracture Middle Third |
| | | | | B | 6338 | 1386 | | Fracture Middle Third |
| | | | | C | 7328 | 1340 | | Fract. at 3.9in from supp. |
| | | 91 | 5/8/2007 | A | 6440 | 1409 | 1452 | Fracture Middle Third |
| | | | | B | 6907 | 1511 | | Fracture Middle Third |
| | | | | C | 6560 | 1435 | | Fracture Middle Third |
| | | 364 | 2/5/2008 | A | 5364 | 1173 | 975 | Fracture Middle Third |
| | | | | B | 4143 | 906 | | Fracture Middle Third |
| | | | | C | 3862 | 845 | | Fracture Middle Third |
| **TB5H5** | 2/8/2007 | 29 | 3/9/2007 | A | 6828 | 1494 | 1394 | Fracture Middle Third |
| | | | | B | 7035 | 1253 | | Fract. at 3.8in from supp. |
| | | | | C | 6563 | 1436 | | Fracture Middle Third |
| | | 91 | 5/10/2007 | A | 6858 | 1500 | 1411 | Fracture Middle Third |
| | | | | B | 6366 | 1393 | | Fracture Middle Third |
| | | | | C | 6133 | 1342 | | Fracture Middle Third |
| | | 364 | 2/7/2008 | A | 4929 | 1078 | 1143 | Fracture Middle Third |
| | | | | B | 5216 | 1141 | | Fracture Middle Third |
| | | | | C | 5533 | 1210 | | Fracture Middle Third |
| **TB6H5** | 2/8/2007 | 29 | 3/9/2007 | A | 5901 | 1291 | 1285 | Fracture Middle Third |
| | | | | B | 6105 | 1335 | | Fracture Middle Third |
| | | | | C | 5611 | 1227 | | Fracture Middle Third |
| | | 91 | 5/10/2007 | A | 6018 | 1316 | 1379 | Fracture Middle Third |
| | | | | B | 6497 | 1421 | | Fracture Middle Third |
| | | | | C | 6399 | 1400 | | Fracture Middle Third |
| | | 364 | 2/7/2008 | A | 5286 | 1156 | 1132 | Fracture Middle Third |
| | | | | B | 4664 | 1020 | | Fracture Middle Third |
| | | | | C | 5568 | 1218 | | Fracture Middle Third |

| MIX | Cast Date | Test Age | Test Date | Sample | Maximum Load (lbf) | MOR (psi) | Average MOR (psi) | Remarks |
|---|---|---|---|---|---|---|---|---|
| **TB7H5** | 2/15/2007 | 56 | 4/12/2007 | A | 3845 | 841 | 937 | Fracture Middle Third |
| | | | | B | 4678 | 1023 | | Fracture Middle Third |
| | | | | C | 4321 | 945 | | Fracture Middle Third |
| | | 91 | 5/17/2007 | A | 4431 | 969 | 1124 | Fracture Middle Third |
| | | | | B | 5583 | 1221 | | Fracture Middle Third |
| | | | | C | 5396 | 1180 | | Fracture Middle Third |
| | | 364 | 2/14/2008 | A | 5708 | 1249 | 1252 | Fracture Middle Third |
| | | | | B | 5706 | 1248 | | Fracture Middle Third |
| | | | | C | 5752 | 1258 | | Fracture Middle Third |
| **TB8H5** | 2/15/2007 | 56 | 4/12/2007 | A | 5279 | 1155 | 1186 | Fracture Middle Third |
| | | | | B | 6121 | 1090 | | Fract. at 3.8in from supp. |
| | | | | C | 6006 | 1314 | | Fracture Middle Third |
| | | 91 | 5/17/2007 | A | 4685 | 1025 | 1192 | Fracture Middle Third |
| | | | | B | 5960 | 1304 | | Fracture Middle Third |
| | | | | C | 5705 | 1248 | | Fracture Middle Third |
| | | 364 | 2/14/2008 | A | 5616 | 1229 | 1225 | Fracture Middle Third |
| | | | | B | 5696 | 1246 | | Fracture Middle Third |
| | | | | C | 5486 | 1200 | | Fracture Middle Third |

## APPENDIX E – MODULUS OF ELASTICITY DATA

**Mix** TB1A4
**Cast Date** 11/1/2005

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 11/29/2005 | 28 | A | 3000 | 3087 | 3075 | 3054 | 3050 |
| | | B | 3028 | 3055 | 3055 | 3046 | |
| | | | | | | | |
| 12/27/2005 | 56 | A | 3546 | 3617 | 3667 | 3610 | 3266 |
| | | B | 2900 | 2966 | 2900 | 2922 | |
| | | | | | | | |
| 5/2/2006 | 182 | A | 3600 | 3600 | 3600 | 3600 | 3300 |
| | | B | 3000 | 3000 | 3000 | 3000 | |
| | | | | | | | |
| 11/6/2006 | 370 | A | 5190 | 5334 | 5336 | 5287 | 5584 |
| | | B | 5846 | 5898 | 5901 | 5882 | |
| | | | | | | | |

**Mix** TB1A4-2
**Cast Date** 3/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 3/8/2007 | 7 | A | 5950 | 5100 | 5100 | 5383 | 5000 |
| | | B | 4150 | 4950 | 4750 | 4617 | |
| | | | | | | | |
| 3/16/2007 | 15 | A | 4900 | 4900 | 4950 | 4917 | 4758 |
| | | B | 4450 | 4650 | 4700 | 4600 | |
| | | | | | | | |
| 3/29/2007 | 28 | A | 6350 | 6300 | 6150 | 6267 | 5642 |
| | | B | 5100 | 4950 | 5000 | 5017 | |
| | | | | | | | |

**Mix** TB2A4
**Cast Date** 11/3/2005

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 12/1/2005 | 28 | A | 4031 | 4404 | 4541 | 4325 | 3739 |
| | | B | 3107 | 3174 | 3175 | 3152 | |
| | | | | | | | |
| 12/29/2005 | 56 | A | 3604 | 3659 | 3644 | 3636 | 3494 |
| | | B | 3200 | 3417 | 3438 | 3352 | |
| | | | | | | | |
| 5/4/2006 | 182 | A | 4992 | 5077 | 5039 | 5036 | 4864 |
| | | B | 4575 | 4676 | 4822 | 4691 | |
| | | | | | | | |
| 11/6/2006 | 368 | A | 5513 | 5830 | 5366 | 5570 | 5561 |
| | | B | 5537 | 5566 | 5552 | 5552 | |
| | | | | | | | |

**Mix** TB2A4-2
**Cast Date** 3/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 3/8/2007 | 7 | A | 4650 | 4800 | 4800 | 4750 | 4775 |
| | | B | 4700 | 4850 | 4850 | 4800 | |
| | | | | | | | |
| 3/16/2007 | 15 | A | 4250 | 4400 | 4400 | 4350 | 4833 |
| | | B | 5150 | 5400 | 5400 | 5317 | |
| | | | | | | | |
| 3/29/2007 | 28 | A | 4650 | 4700 | 4700 | 4683 | 5000 |
| | | B | 5250 | 5350 | 5350 | 5317 | |
| | | | | | | | |

**Mix** TB3A4
**Cast Date** 11/8/2005

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 11/22/2005 | 14 | A | 3000 | 3060 | 3119 | 3060 | 3059 |
| | | B | 3050 | 3052 | 3074 | 3059 | |
| | | | | | | | |
| 12/6/2005 | 28 | A | 3123 | 3160 | 3159 | 3147 | 3171 |
| | | B | 3234 | 3171 | 3180 | 3195 | |
| | | | | | | | |
| 1/3/2006 | 56 | A | 3010 | 3106 | 3140 | 3085 | 3079 |
| | | B | 3000 | 3109 | 3110 | 3073 | |
| | | | | | | | |
| 5/9/2006 | 182 | A | 4760 | 4875 | - | 4818 | 4815 |
| | | B | 4908 | 4828 | 4700 | 4812 | |
| | | | | | | | |
| 11/7/2006 | 364 | A | 5462 | 5490 | - | 5476 | 5593 |
| | | B | 5577 | 5750 | 5800 | 5709 | |
| | | | | | | | |

**Mix** TB3A4-2
**Cast Date** 3/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 3/8/2007 | 7 | A | 4550 | 4600 | 4600 | 4583 | 4525 |
| | | B | 4400 | 4500 | 4500 | 4467 | |
| | | | | | | | |
| 3/29/2007 | 28 | A | 4850 | 5000 | 5000 | 4950 | 5033 |
| | | B | 5050 | 5150 | 5150 | 5117 | |
| | | | | | | | |

**Mix** TB4A4
**Cast Date** 11/10/2005

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 11/24/2005 | 14 | A | 3300 | 3350 | 3350 | 3333 | 3592 |
| | | B | 3700 | 3900 | 3950 | 3850 | |
| | | C | | | | | |
| 12/8/2005 | 28 | A | 3151 | 3245 | 3249 | 3215 | 3197 |
| | | B | 3252 | 3232 | 3052 | 3179 | |
| | | | | | | | |
| 5/11/2006 | 182 | A | 4919 | 5044 | 5066 | 5010 | 5010 |
| | | B | - | - | - | | |
| | | | | | | | |
| 11/9/2006 | 364 | A | 5433 | 5823 | 5648 | 5635 | 5997 |
| | | B | 6712 | 6008 | - | 6360 | |
| | | | | | | | |

**Mix** TB4A4-2
**Cast Date** 3/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 3/29/2007 | 28 | A | 4600 | 4750 | 4750 | 4700 | 4708 |
| | | B | 4600 | 4750 | 4800 | 4717 | |
| | | | | | | | |

**Mix** TB5A4
**Cast Date** 11/15/2005

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 11/22/2005 | 7 | A | 2920 | 2917 | 2910 | 2916 | 2916 |
| | | B | - | - | - | | |
| | | | | | | | |
| 11/29/2005 | 14 | A | 3015 | 3069 | 3045 | 3043 | 2905 |
| | | B | 2901 | 2517 | 2882 | 2767 | |
| | | | | | | | |
| 12/13/2005 | 28 | A | 3012 | 3061 | 3085 | 3053 | 3113 |
| | | B | 3202 | 3195 | 3122 | 3173 | |
| | | | | | | | |
| 1/10/2006 | 56 | A | 3638 | 3611 | 3659 | 3636 | 3371 |
| | | B | 2994 | 3152 | 3172 | 3106 | |
| | | | | | | | |
| 5/16/2006 | 182 | A | 3419 | 3582 | 3645 | 3549 | 3481 |
| | | B | 3370 | 3444 | 3423 | 3412 | |
| | | | | | | | |
| 11/14/2006 | 364 | A | - | - | - | | 5535 |
| | | B | 5433 | 5523 | 5648 | 5535 | |
| | | | | | | | |

**Mix** TB5A4-2
**Cast Date** 3/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 3/29/2007 | 28 | A | 4850 | 4950 | 4950 | 4917 | 4950 |
| | | B | 5000 | 4950 | 5000 | 4983 | |
| | | | | | | | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/28/2006 | 7 | A | 4529 | 4634 | 4647 | 4603 | 4603 |
| | | B | - | - | - | | |
| | | | | | | | |
| 3/7/2006 | 14 | A | 4299 | 4362 | 4273 | 4311 | 4461 |
| | | B | 4710 | 4670 | 4452 | 4611 | |
| | | | | | | | |
| 3/21/2006 | 28 | A | 4545 | 4764 | 4830 | 4713 | 4662 |
| | | B | 4473 | 4681 | 4679 | 4611 | |
| | | | | | | | |
| 4/18/2006 | 56 | A | 5042 | 5020 | 4937 | 5000 | 4949 |
| | | B | 4794 | 4917 | 4983 | 4898 | |
| | | | | | | | |
| 11/24/2006 | 276 | A | 5703 | 5666 | 5664 | 5678 | 5678 |
| | | B | 5474 | 5782 | 5778 | 5678 | |
| | | | | | | | |
| 2/20/2007 | 364 | A | 5823 | 6113 | 6124 | 6020 | 5748 |
| | | B | 5465 | 5404 | 5558 | 5476 | |
| | | | | | | | |

**Mix** TB6A4-2
**Cast Date** 3/6/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 4/3/2007 | 28 | A | 5300 | 5300 | 5300 | 5300 | 5125 |
| | | B | 4850 | 5000 | 5000 | 4950 | |
| | | | | | | | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/28/2006 | 7 | A | 3730 | 3697 | 3780 | 3736 | 3745 |
| | | B | 3600 | 3823 | 3837 | 3753 | |
| | | | | | | | |
| 3/7/2006 | 14 | A | 4135 | 4044 | 4304 | 4161 | 4245 |
| | | B | 4261 | 4333 | 4390 | 4328 | |
| | | | | | | | |
| 3/21/2006 | 28 | A | 4504 | 4633 | 4639 | 4592 | 4527 |
| | | B | 4374 | 4510 | 4503 | 4462 | |
| | | | | | | | |
| 4/18/2006 | 56 | A | 4970 | 4965 | 4775 | 4903 | 4607 |
| | | B | 4144 | 4422 | 4363 | 4310 | |
| | | | | | | | |
| 11/24/2006 | 276 | A | 5377 | 5640 | 5610 | 5542 | 5708 |
| | | B | 5782 | 5916 | 5925 | 5874 | |
| | | | | | | | |
| 2/20/2007 | 364 | A | 5387 | 5587 | 5587 | 5520 | 5305 |
| | | B | 5172 | 5076 | 5020 | 5089 | |
| | | | | | | | |

**Mix** TB7A4-2
**Cast Date** 3/6/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 4/3/2007 | 28 | A | 4450 | 4550 | 4550 | 4517 | 4467 |
| | | B | 4350 | 4450 | 4450 | 4417 | |
| | | | | | | | |

**Mix** TB8A4
**Cast Date** 3/30/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 4/6/2006 | 7 | A | 4328 | 4405 | 4439 | 4391 | 4375 |
| | | B | 4435 | 4225 | 4419 | 4360 | |
| | | | | | | | |
| 4/13/2006 | 14 | A | 4252 | 4365 | 4450 | 4356 | 4370 |
| | | B | 4456 | 4223 | 4476 | 4385 | |
| | | | | | | | |
| 4/27/2006 | 28 | A | 5225 | 5088 | 5068 | 5127 | 5080 |
| | | B | 4919 | 5095 | 5084 | 5033 | |
| | | | | | | | |
| 9/28/2006 | 182 | A | 5404 | 5322 | - | 5363 | 5614 |
| | | B | 5819 | 5872 | 5904 | 5865 | |
| | | | | | | | |
| 3/29/2007 | 364 | A | 5100 | 5100 | 5100 | 5100 | 5392 |
| | | B | 5600 | 5700 | 5750 | 5683 | |
| | | | | | | | |

**Mix** TB8A4-2
**Cast Date** 3/6/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 4/3/2007 | 28 | A | 5150 | 5300 | 5300 | 5250 | 5225 |
| | | B | 5200 | 5200 | 5200 | 5200 | |
| | | | | | | | |

**Mix** TB1A5
**Cast Date** 3/30/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 4/6/2006 | 7 | A | 4242 | 4405 | 4379 | 4342 | 4370 |
| | | B | 4378 | 4403 | 4410 | 4397 | |
| | | | | | | | |
| 4/13/2006 | 14 | A | - | - | - | | 4326 |
| | | B | 4194 | 4378 | 4405 | 4326 | |
| | | | | | | | |
| 4/27/2006 | 28 | A | 4476 | 4684 | 4707 | 4622 | 4512 |
| | | B | 4242 | 4456 | 4507 | 4402 | |
| | | | | | | | |
| 5/25/2006 | 56 | A | - | - | - | - | 5518 |
| | | B | 5758 | 5278 | - | 5518 | |
| | | | | | | | |
| 9/28/2006 | 182 | A | 5474 | | | 5474 | 5521 |
| | | B | 5547 | 5579 | 5580 | 5569 | |
| | | | | | | | |
| 3/29/2007 | 364 | A | 5255 | 5252 | 5283 | 5263 | 5349 |
| | | B | 5451 | 5419 | - | 5435 | |
| | | | | | | | |

**Mix** TB1A5-2
**Cast Date** 3/16/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 4/3/2007 | 28 | A | 4750 | 4850 | 4850 | 4817 | 4933 |
| | | B | 4900 | 5100 | 5150 | 5050 | |
| | | | | | | | |

**Mix** TB2A5
**Cast Date** 5/2/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/9/2006 | 7 | A | 3000 | 3000 | 3000 | 3000 | 2883 |
| | | B | 2700 | 2800 | 2800 | 2767 | |
| | | | | | | | |
| 5/16/2006 | 14 | A | 3260 | 3011 | 3397 | 3223 | 3060 |
| | | B | 2771 | 2969 | 2953 | 2898 | |
| | | | | | | | |
| 5/30/2006 | 28 | A | 3251 | 3116 | 3198 | 3188 | 3225 |
| | | B | 3096 | 3322 | 3368 | 3262 | |
| | | | | | | | |
| 11/6/2006 | 188 | A | 5381 | 5850 | 5492 | 5574 | 5493 |
| | | B | 5272 | 5483 | 5481 | 5412 | |
| | | | | | | | |
| 5/1/2007 | 364 | A | 5150 | 5400 | 5437 | 5329 | 5327 |
| | | B | 5265 | 5276 | 5436 | 5326 | |
| | | | | | | | |

**Mix** TB3A5
**Cast Date** 5/2/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/9/2006 | 7 | A | 3000 | 3050 | 3050 | 3033 | 3058 |
| | | B | 3050 | 3100 | 3100 | 3083 | |
| | | | | | | | |
| 5/16/2006 | 14 | A | 2767 | 2868 | 2760 | 2798 | 2882 |
| | | B | 2940 | 2986 | 2969 | 2965 | |
| | | | | | | | |
| 5/30/2006 | 28 | A | 3419 | 3463 | 3252 | 3378 | 3276 |
| | | B | 3224 | 3214 | 3081 | 3173 | |
| | | | | | | | |
| 11/6/2006 | 188 | A | 5649 | 5725 | 5746 | 5707 | 5672 |
| | | B | 5609 | 5651 | 5654 | 5638 | |
| | | | | | | | |
| 5/1/2007 | 364 | A | 5608 | 5315 | - | 5462 | 5453 |
| | | B | 5563 | 5325 | - | 5444 | |
| | | | | | | | |

**Mix** TB4A5
**Cast Date** 5/4/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/11/2006 | 7 | A | 3050 | 3150 | 3150 | 3117 | 3150 |
| | | B | 3050 | 3200 | 3300 | 3183 | |
| | | | | | | | |
| 5/18/2006 | 14 | A | 3070 | 3180 | 3150 | 3133 | 3242 |
| | | B | 3250 | 3400 | 3400 | 3350 | |
| | | | | | | | |
| 6/1/2006 | 28 | A | 3550 | 3650 | 3650 | 3617 | 3567 |
| | | B | 3450 | 3550 | 3550 | 3517 | |
| | | | | | | | |
| 11/6/2006 | 186 | A | 5647 | 5748 | 5666 | 5687 | 5671 |
| | | B | 5702 | 5612 | 5652 | 5655 | |
| | | | | | | | |
| 5/3/2007 | 364 | A | 5850 | 5850 | 5700 | 5800 | 5725 |
| | | B | 5650 | 5650 | 5650 | 5650 | |
| | | | | | | | |

**Mix** TB5A5
**Cast Date** 5/4/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/11/2006 | 7 | A | 3912 | 4100 | 4114 | 4042 | 4057 |
| | | B | 3968 | 4123 | 4123 | 4071 | |
| | | | | | | | |
| 5/18/2006 | 14 | A | 2767 | 2917 | 3007 | 2897 | 2917 |
| | | B | 2798 | 3004 | 3006 | 2936 | |
| | | | | | | | |
| 6/1/2006 | 28 | A | 4243 | 4512 | 4481 | 4412 | 4299 |
| | | B | 4144 | 4185 | 4226 | 4185 | |
| | | | | | | | |
| 11/6/2006 | 186 | A | 4997 | 5192 | 5267 | 5152 | 5098 |
| | | B | 4971 | 5037 | 5126 | 5045 | |
| | | | | | | | |
| 5/3/2007 | 364 | A | 4950 | 5000 | 5050 | 5000 | 5033 |
| | | B | 5000 | 5100 | 5100 | 5067 | |
| | | | | | | | |

**Mix** TB6A5
**Cast Date** 5/9/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/16/2006 | 7 | A | 2688 | 2728 | 2824 | 2747 | 2793 |
| | | B | 2729 | 2865 | 2925 | 2840 | |
| | | | | | | | |
| 5/23/2006 | 14 | A | 3246 | 3334 | 3268 | 3283 | 3291 |
| | | B | 3237 | 3334 | 3325 | 3299 | |
| | | | | | | | |
| 6/6/2006 | 28 | A | 3125 | 3286 | 3326 | 3246 | 3270 |
| | | B | 3301 | 3292 | 3291 | 3295 | |
| | | | | | | | |
| 7/5/2006 | 57 | A | 4272 | 4421 | 4421 | 4371 | 4164 |
| | | B | 4031 | 3931 | 3906 | 3956 | |
| | | | | | | | |
| 11/7/2006 | 182 | A | 5147 | 5332 | 5373 | 5284 | 5455 |
| | | B | 5706 | 5581 | 5591 | 5626 | |
| | | | | | | | |
| 5/8/2007 | 364 | A | 5500 | 5550 | 5550 | 5533 | 5467 |
| | | B | 5450 | 5350 | 5400 | 5400 | |
| | | | | | | | |

**Mix** TB7A5
**Cast Date** 5/9/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/16/2006 | 7 | A | 2176 | 2287 | 2300 | 2254 | 2266 |
| | | B | 2201 | 2305 | 2327 | 2278 | |
| | | | | | | | |
| 5/23/2006 | 14 | A | 3190 | 3190 | 3126 | 3169 | 2996 |
| | | B | 2709 | 2899 | 2859 | 2822 | |
| | | | | | | | |
| 6/6/2006 | 28 | A | 2847 | 2999 | 2972 | 2939 | 2881 |
| | | B | 2709 | 2899 | 2859 | 2822 | |
| | | | | | | | |
| 7/5/2006 | 57 | A | 3686 | 3784 | 3816 | 3762 | 3731 |
| | | B | 3625 | 3714 | 3761 | 3700 | |
| | | | | | | | |
| 11/7/2006 | 182 | A | 5772 | 6008 | 5999 | 5926 | 5867 |
| | | B | 5859 | 5767 | 5795 | 5807 | |
| | | | | | | | |
| 5/8/2007 | 364 | A | - | - | - | - | 5800 |
| | | B | 5800 | 5800 | 5800 | 5800 | |
| | | | | | | | |

**Mix** TB8A5
**Cast Date** 5/11/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/18/2006 | 7 | A | 2863 | 2956 | 2965 | 2928 | 2765 |
| | | B | 2504 | 2521 | 2782 | 2602 | |
| | | | | | | | |
| 5/25/2006 | 14 | A | 2907 | 3078 | 3076 | 3020 | 3090 |
| | | B | 2979 | 3225 | 3277 | 3160 | |
| | | | | | | | |
| 6/8/2006 | 28 | A | 2963 | 3120 | 3169 | 3084 | 3084 |
| | | B | - | - | - | - | |
| | | | | | | | |
| 7/6/2006 | 56 | A | 4123 | 4156 | 4066 | 4115 | 4214 |
| | | B | 4345 | 4289 | 4303 | 4312 | |
| | | | | | | | |
| 11/23/2006 | 196 | A | 5235 | 5137 | 5232 | 5201 | 5024 |
| | | B | - | 5000 | 4693 | 4847 | |
| | | | | | | | |
| 5/10/2007 | 364 | A | 5450 | 5550 | 5550 | 5517 | 5292 |
| | | B | 5000 | 5100 | 5100 | 5067 | |
| | | | | | | | |

**Mix** TB1H4
**Cast Date** 5/11/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/18/2006 | 7 | A | 2783 | 2917 | 2919 | 2873 | 2817 |
| | | B | 2603 | 2821 | 2861 | 2762 | |
| | | | | | | | |
| 5/25/2006 | 14 | A | 3440 | 3448 | 3491 | 3460 | 3460 |
| | | B | - | - | - | - | |
| | | | | | | | |
| 6/8/2006 | 28 | A | 3406 | 3494 | 3511 | 3470 | 3276 |
| | | B | 2928 | 3130 | 3185 | 3081 | |
| | | | | | | | |
| 7/6/2006 | 56 | A | 3881 | 4095 | 4134 | 4037 | 4200 |
| | | B | 4584 | 4225 | 4282 | 4364 | |
| | | | | | | | |
| 11/9/2006 | 182 | A | 5906 | 5828 | 5838 | 5857 | 5489 |
| | | B | 5010 | 5232 | - | 5121 | |
| | | | | | | | |
| 5/10/2007 | 364 | A | 5700 | 5850 | 5800 | 5783 | 5650 |
| | | B | 5450 | 5550 | 5550 | 5517 | |
| | | | | | | | |

**Mix** TB2H4
**Cast Date** 5/16/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/23/2006 | 7 | A | 2656 | 2817 | 3068 | 2847 | 2847 |
| | | B | * | * | * | | |
| | | | | | | | |
| 5/30/2006 | 14 | A | 3297 | 3381 | 3386 | 3355 | 3337 |
| | | B | 3206 | 3370 | 3381 | 3319 | |
| | | | | | | | |
| 6/14/2006 | 29 | A | * | * | * | | * |
| | | B | * | * | * | | |
| | | | | | | | |
| 7/11/2006 | 56 | A | 3955 | 3983 | 4032 | 3990 | 3901 |
| | | B | 3626 | 3704 | 4106 | 3812 | |
| | | | | | | | |
| 11/23/2006 | 191 | A | 5254 | 5376 | 5429 | 5353 | 5378 |
| | | B | 5381 | 5396 | 5432 | 5403 | |
| | | | | | | | |
| 5/15/2007 | 364 | A | 6050 | 6050 | 6000 | 6033 | 5750 |
| | | B | 5400 | 5500 | 5500 | 5467 | |
| | | | | | | | |

**Mix** TB3H4
**Cast Date** 5/16/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/23/2006 | 7 | A | 2984 | 3010 | 3067 | 3020 | 2694 |
| | | B | 2308 | 2380 | 2412 | 2367 | |
| | | | | | | | |
| 5/30/2006 | 14 | A | 3137 | 3245 | 3296 | 3226 | 3300 |
| | | B | 3343 | 3413 | 3365 | 3374 | |
| | | | | | | | |
| 7/11/2006 | 56 | A | 3777 | 3861 | 3982 | 3873 | 4238 |
| | | B | 4650 | 4561 | 4598 | 4603 | |
| | | | | | | | |
| 11/14/2006 | 182 | A | 5029 | 5469 | 5518 | 5339 | 5554 |
| | | B | 5973 | 5723 | 5611 | 5769 | |
| | | | | | | | |
| 5/15/2007 | 364 | A | 5343 | 5486 | 5454 | 5428 | 5381 |
| | | B | * | 5321 | 5347 | 5334 | |
| | | | | | | | |

**Cast Date** 5/18/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/25/2006 | 7 | A | 2976 | 2999 | 3283 | 3086 | 3086 |
| | | B | * | * | * | | |
| 6/1/2006 | 14 | A | 4351 | 4522 | 4555 | 4476 | 4493 |
| | | B | 4366 | 4550 | 4612 | 4509 | |
| 7/13/2006 | 56 | A | 3965 | 4225 | 4312 | 4167 | 4215 |
| | | B | 3853 | 4473 | 4459 | 4262 | |
| 11/23/2006 | 189 | A | 5104 | 5050 | 5000 | 5051 | 5051 |
| | | B | | | | | |
| 5/17/2007 | 364 | A | 5633 | 5658 | 5738 | 5676 | 5524 |
| | | B | 5200 | 5460 | 5455 | 5372 | |

**Mix** TB5H4
**Cast Date** 5/18/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/25/2006 | 7 | A | 2976 | 2999 | 3283 | 3086 | 2448 |
| | | B | - | 1866 | 1752 | 1809 | |
| 6/1/2006 | 14 | A | 4375 | 4419 | 4419 | 4404 | 4503 |
| | | B | 4486 | 4653 | 4666 | 4602 | |
| 7/13/2006 | 56 | A | 3949 | 4180 | 4235 | 4121 | 3946 |
| | | B | 3243 | 4018 | 4053 | 3771 | |
| 11/24/2006 | 190 | A | 5919 | 5924 | 5923 | 5922 | 5736 |
| | | B | 5420 | 5606 | 5622 | 5549 | |
| 5/17/2007 | 364 | A | 5229 | 5483 | 5467 | 5393 | 5437 |
| | | B | 5276 | 5592 | 5575 | 5481 | |

**Mix** TB6H4
**Cast Date** 5/23/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/30/2006 | 7 | A | 3162 | 3158 | 3135 | 3152 | 3112 |
| | | B | 3061 | 3061 | 3097 | 3073 | |
| 6/6/2006 | 14 | A | 2919 | 3259 | 3293 | 3157 | 3045 |
| | | B | 2884 | 2960 | 2957 | 2934 | |
| 7/18/2006 | 56 | A | 4072 | 3893 | 3931 | 3965 | 4130 |
| | | B | 4260 | 4317 | 4307 | 4295 | |
| 11/23/2006 | 184 | A | 5984 | 5984 | 5896 | 5955 | 5969 |
| | | B | 5984 | 5984 | 5984 | 5984 | |
| 5/24/2007 | 366 | A | 6000 | 6100 | 6100 | 6067 | 6100 |
| | | B | 6100 | 6150 | 6150 | 6133 | |

**Mix** TB7H4
**Cast Date** 5/23/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 5/30/2006 | 7 | A | 2714 | 2761 | 2783 | 2753 | 2789 |
| | | B | 2908 | 2722 | 2845 | 2825 | |
| 6/6/2006 | 14 | A | 2652 | 2784 | 2793 | 2743 | 2810 |
| | | B | 2984 | 2684 | 2961 | 2876 | |
| 7/18/2006 | 56 | A | 3855 | 4104 | 4104 | 4021 | 3887 |
| | | B | 3455 | 3945 | 3859 | 3753 | |
| 11/23/2006 | 184 | A | 4300 | 4250 | 4250 | 4267 | 4267 |
| | | B | - | - | - | | |
| 5/24/2007 | 366 | A | 4900 | 5150 | 5150 | 5067 | 5492 |
| | | B | 5850 | 5950 | 5950 | 5917 | |

**Mix** TB8H4
**Cast Date** 5/25/2006

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 6/1/2006 | 7 | A | 4480 | 4427 | 4753 | 4553 | 4396 |
| | | B | 4166 | 4228 | 4322 | 4239 | |
| | | | | | | | |
| 6/8/2006 | 14 | A | 3958 | 4228 | 4322 | 4169 | 3786 |
| | | B | 3374 | 3456 | 3376 | 3402 | |
| | | | | | | | |
| 7/20/2006 | 56 | A | 4045 | 4045 | 4113 | 4068 | 4253 |
| | | B | 4330 | 4493 | 4493 | 4439 | |
| | | | | | | | |
| 11/24/2006 | 183 | A | 5270 | 5270 | 5100 | 5213 | 5199 |
| | | B | 5185 | 5185 | 5185 | 5185 | |
| | | | | | | | |
| 5/24/2007 | 364 | A | 4900 | 5000 | 5050 | 4983 | 5267 |
| | | B | 5550 | 5550 | 5550 | 5550 | |
| | | | | | | | |

**Mix** TB1H5
**Cast Date** 2/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/8/2007 | 7 | A | 4050 | 4200 | 4250 | 4167 | 4075 |
| | | B | 3900 | 4050 | 4000 | 3983 | |
| | | | | | | | |
| 2/15/2007 | 14 | A | 4600 | 4800 | 4850 | 4750 | 4542 |
| | | B | 4250 | 4350 | 4400 | 4333 | |
| | | | | | | | |
| 3/1/2007 | 28 | A | 4450 | 4550 | 4600 | 4533 | 4550 |
| | | B | 4500 | 4600 | 4600 | 4567 | |
| | | | | | | | |
| 3/29/2007 | 56 | A | 4700 | 4750 | 4750 | 4733 | 4725 |
| | | B | 4650 | 4750 | 4750 | 4717 | |
| | | | | | | | |
| 8/2/2007 | 182 | A | 5750 | 5700 | 5700 | 5717 | 5600 |
| | | B | 5450 | 5500 | 5500 | 5483 | |
| | | | | | | | |
| 1/31/2008 | 364 | A | 5750 | 5800 | 5900 | 5817 | 5667 |
| | | B | 5450 | 5600 | 5500 | 5517 | |
| | | | | | | | |

**Mix** TB2H5
**Cast Date** 2/1/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/8/2007 | 7 | A | 4400 | 4500 | 4500 | 4467 | 4192 |
| | | B | 3850 | 3950 | 3950 | 3917 | |
| | | | | | | | |
| 2/15/2007 | 14 | A | 4100 | 4250 | 4300 | 4217 | 4492 |
| | | B | 4650 | 4800 | 4850 | 4767 | |
| | | | | | | | |
| 3/1/2007 | 28 | A | 4700 | 4750 | 4800 | 4750 | 4933 |
| | | B | 5050 | 5150 | 5150 | 5117 | |
| | | | | | | | |
| 3/29/2007 | 56 | A | 4100 | 4100 | 4100 | 4100 | 4775 |
| | | B | 5450 | 5450 | 5450 | 5450 | |
| | | | | | | | |
| 8/2/2007 | 182 | A | 5350 | 5400 | 5150 | 5300 | 5375 |
| | | B | 5350 | 5500 | 5500 | 5450 | |
| | | | | | | | |
| 1/31/2008 | 364 | A | 5500 | 5700 | 5700 | 5633 | 5550 |
| | | B | 5450 | 5450 | 5500 | 5467 | |
| | | | | | | | |

**Mix** TB3H5
**Cast Date** 2/6/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/13/2007 | 7 | A | 3650 | 3750 | 3750 | 3717 | 3917 |
| | | B | 4050 | 4150 | 4150 | 4117 | |
| | | | | | | | |
| 2/20/2007 | 14 | A | 4500 | 4650 | 4650 | 4600 | 4658 |
| | | B | 4600 | 4800 | 4750 | 4717 | |
| | | | | | | | |
| 3/6/2007 | 28 | A | 5200 | 5250 | 5100 | 5183 | 5183 |
| | | B | 5250 | 5150 | 5150 | 5183 | |
| | | | | | | | |
| 4/3/2007 | 56 | A | 5050 | 5200 | 5200 | 5150 | 4908 |
| | | B | 4550 | 4700 | 4750 | 4667 | |
| | | | | | | | |
| 8/7/2007 | 182 | A | 4850 | 5050 | 4900 | 4933 | 4917 |
| | | B | 4850 | 4950 | 4900 | 4900 | |
| | | | | | | | |
| 2/5/2008 | 364 | A | 5500 | 5650 | 5650 | 5600 | 5708 |
| | | B | 5750 | 5850 | 5850 | 5817 | |
| | | | | | | | |

**Mix** TB4H5
**Cast Date** 2/6/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/13/2007 | 7 | A | 4200 | 4300 | 4300 | 4267 | 4083 |
| | | B | 3750 | 3950 | 4000 | 3900 | |
| | | | | | | | |
| 2/20/2007 | 14 | A | 4700 | 4800 | 4800 | 4767 | 4758 |
| | | B | 4750 | 4750 | 4750 | 4750 | |
| | | | | | | | |
| 3/6/2007 | 28 | A | 5600 | 5500 | 5350 | 5483 | 5600 |
| | | B | 5650 | 5750 | 5750 | 5717 | |
| | | | | | | | |
| 4/3/2007 | 56 | A | 5400 | 5650 | 5600 | 5550 | 5592 |
| | | B | 5500 | 5700 | 5700 | 5633 | |
| | | | | | | | |
| 8/7/2007 | 182 | A | 4950 | 5050 | 5000 | 5000 | 4942 |
| | | B | 4750 | 4950 | 4950 | 4883 | |
| | | | | | | | |
| 2/5/2008 | 364 | A | 5500 | 5500 | 5650 | 5550 | 5742 |
| | | B | 5900 | 5950 | 5950 | 5933 | |
| | | | | | | | |

**Mix** TB5H5
**Cast Date** 2/8/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/15/2007 | 7 | A | 4500 | 4600 | 4550 | 4550 | 4367 |
| | | B | 4150 | 4200 | 4200 | 4183 | |
| | | | | | | | |
| 2/22/2007 | 14 | A | 3950 | 4100 | 4150 | 4067 | 4200 |
| | | B | 4200 | 4400 | 4400 | 4333 | |
| | | | | | | | |
| 3/8/2007 | 28 | A | 5250 | 5700 | 5750 | 5567 | 5300 |
| | | B | 5100 | 4950 | 5050 | 5033 | |
| | | | | | | | |
| 4/5/2007 | 56 | A | 4600 | 4750 | 4750 | 4700 | 4733 |
| | | B | 4700 | 4800 | 4800 | 4767 | |
| | | | | | | | |
| 8/9/2007 | 182 | A | 5000 | 4650 | 4450 | 4700 | 5250 |
| | | B | 5850 | 5750 | 5800 | 5800 | |
| | | | | | | | |
| 2/7/2008 | 364 | A | 4750 | 4850 | 4850 | 4817 | 4750 |
| | | B | 4700 | 4650 | 4700 | 4683 | |
| | | | | | | | |

**Mix** TB6H5
**Cast Date** 2/8/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/15/2007 | 7 | A | 4250 | 4350 | 4350 | 4317 | 4292 |
| | | B | 4200 | 4300 | 4300 | 4267 | |
| 2/22/2007 | 14 | A | 4700 | 4750 | 4750 | 4733 | 4775 |
| | | B | 4650 | 4850 | 4950 | 4817 | |
| 3/8/2007 | 28 | A | 5200 | 5300 | 5300 | 5267 | 5246 |
| | | B | 5100 | 5350 | * | 5225 | |
| 4/5/2007 | 56 | A | 4550 | 4700 | 4700 | 4650 | 4700 |
| | | B | 4650 | 4800 | 4800 | 4750 | |
| 8/9/2007 | 182 | A | 5000 | 4900 | 4950 | 4950 | 4925 |
| | | B | 4950 | 4900 | 4850 | 4900 | |
| 2/7/2008 | 364 | A | 4900 | 4950 | 5000 | 4950 | 4933 |
| | | B | 4850 | 4950 | 4950 | 4917 | |

**Mix** TB7H5
**Cast Date** 2/15/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/22/2007 | 7 | A | 3250 | 3300 | 3300 | 3283 | 3442 |
| | | B | 3550 | 3650 | 3600 | 3600 | |
| 3/1/2007 | 14 | A | 3600 | 3850 | 3850 | 3767 | 3850 |
| | | B | 3850 | 4000 | 3950 | 3933 | |
| 3/16/2007 | 29 | A | 4600 | 4750 | 4750 | 4700 | 4850 |
| | | B | 4900 | 5050 | 5050 | 5000 | |
| 4/12/2007 | 56 | A | 4600 | 4700 | 4750 | 4683 | 4742 |
| | | B | 4750 | 4800 | 4850 | 4800 | |
| 8/16/2007 | 182 | A | 4800 | 4650 | 4650 | 4700 | 4658 |
| | | B | 4600 | 4600 | 4650 | 4617 | |
| 2/14/2008 | 364 | A | 4500 | 4600 | 4600 | 4567 | 4633 |
| | | B | 4600 | 4750 | 4750 | 4700 | |

**Mix** TB8H5
**Cast Date** 2/15/2007

| Date | Age (days) | Sample | Run 1 | Run 2 | Run 3 | E-Mod (ksi) | Ave. E-Mod (ksi) |
|---|---|---|---|---|---|---|---|
| 2/22/2007 | 7 | A | 4200 | 4250 | 4300 | 4250 | 4508 |
| | | B | 4700 | 4800 | 4800 | 4767 | |
| 3/1/2007 | 14 | A | 4700 | 4800 | 4750 | 4750 | 5042 |
| | | B | 5350 | 5300 | 5350 | 5333 | |
| 3/16/2007 | 29 | A | 4600 | 4750 | 4750 | 4700 | 4850 |
| | | B | 4900 | 5050 | 5050 | 5000 | |
| 4/12/2007 | 56 | A | 5350 | 5350 | 5450 | 5383 | 5475 |
| | | B | 5500 | 5600 | 5600 | 5567 | |
| 8/16/2007 | 182 | A | 4750 | 4850 | 4850 | 4817 | 4917 |
| | | B | 4900 | 5050 | 5100 | 5017 | |
| 2/14/2008 | 364 | A | 4750 | 4800 | 4800 | 4783 | 4808 |
| | | B | 4800 | 4850 | 4850 | 4833 | |

# APPENDIX F – CREEP DATA

**Mix** TB1A4
**Cast Date** 11/1/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB1A4 | 11/29/2005 | 28 | A | 238500 | 8435 | 236933 | 8380 | 30 | 71080 | 4.359 |
| | | | B | 236600 | 8368 | | | | | |
| | | | C | 235700 | 8336 | | | | | |

**Mix** TB2A4
**Cast Date** 11/3/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB2A4 | 12/1/2005 | 28 | A | 246900 | 8732 | 249200 | 8814 | 30 | 74760 | 0.370 |
| | | | B | 255700 | 9044 | | | | | |
| | | | C | 245000 | 8665 | | | | | |

**Mix** TB3A4
**Cast Date** 11/8/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB3A4 | 12/7/2005 | 29 | A | 255600 | 9040 | 255100 | 9022 | 30 | 76530 | 0.613 |
| | | | B | 260300 | 9206 | | | | | |
| | | | C | 249400 | 8821 | | | | | |

**Mix** TB4A4
**Cast Date** 11/10/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB4A4 | 12/8/2005 | 28 | A | 279400 | 9882 | 278133 | 9837 | 30 | 83440 | 0.412 |
| | | | B | 284600 | 10066 | | | | | |
| | | | C | 270400 | 9563 | | | | | |

**Mix** TB5A4
**Cast Date** 11/15/2005

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB5A4 | 12/15/2005 | 30 | A | 247000 | 8736 | 248400 | 8785 | 30 | 74520 | 0.225 |
| | | | B | 254000 | 8983 | | | | | |
| | | | C | 244200 | 8637 | | | | | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB6A4 | 3/21/2006 | 28 | A | 241700 | 8548 | 242593 | 8593 | 40 | 97037 | 0.676 |
| | | | B | 245000 | 8665 | | | | | |
| | | | C | 241080 | 8565 | | | | | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB7A4 | 3/21/2006 | 28 | A | 219000 | 7746 | 215933 | 7637 | 40 | 86373 | 0.997 |
| | | | B | 220000 | 7781 | | | | | |
| | | | C | 208800 | 7385 | | | | | |

**Mix** TB8A4
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB8A4 | 4/27/2006 | 28 | A | 257730 | 9115 | 252400 | 8927 | 40 | 100960 | 4.587 |
| | | | B | 245740 | 8691 | | | | | |
| | | | C | 253730 | 8974 | | | | | |

**Mix** TB1A5
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB1A5 | 4/27/2006 | 28 | A | 233160 | 8246 | 234193 | 8283 | 40 | 93677 | 1.232 |
| | | | B | 222840 | 7881 | | | | | |
| | | | C | 246580 | 8721 | | | | | |

**Mix** TB2A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB2A5 | 5/30/2006 | 28 | A | 245730 | 8691 | 247547 | 8755 | 40 | 99019 | - |
| | | | B | 247010 | 8736 | | | | | |
| | | | C | 249900 | 8838 | | | | | |

**Mix** TB3A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB3A5 | 5/30/2006 | 28 | A | 260580 | 9216 | 260423 | 9211 | 40 | 104169 | - |
| | | | B | 264860 | 9368 | | | | | |
| | | | C | 255830 | 9048 | | | | | |

**Mix** TB4A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB4A5 | 6/1/2006 | 28 | A | 280650 | 9926 | 281003 | 9938 | 40 | 112401 | 0.537 |
| | | | B | 285950 | 10113 | | | | | |
| | | | C | 276410 | 9776 | | | | | |

**Mix** TB5A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB5A5 | 6/1/2006 | 28 | A | 252900 | 8945 | 244487 | 8647 | 40 | 97795 | 0.862 |
| | | | B | 241800 | 8552 | | | | | |
| | | | C | 238760 | 8444 | | | | | |

**Mix** TB6A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB6A5 | 6/6/2006 | 28 | A | 234010 | 8276 | 245593 | 8686 | 40 | 98237 | - |
| | | | B | 251170 | 8883 | | | | | |
| | | | C | 251600 | 8899 | | | | | |

**Mix** TB7A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB7A5 | 6/6/2006 | 28 | A | 213130 | 7538 | 223230 | 7895 | 40 | 89292 | - |
| | | | B | 229370 | 8112 | | | | | |
| | | | C | 227190 | 8035 | | | | | |

**Mix** TB8A5
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB8A5 | 6/8/2006 | 28 | A | 226440 | 8009 | 238037 | 8419 | 40 | 95215 | - |
| | | | B | 233220 | 8248 | | | | | |
| | | | C | 254450 | 8999 | | | | | |

**Mix** TB1H4-2
**Cast Date** 3/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB1H4-2 | 4/5/2007 | 28 | A | 232040 | 8207 | 231333 | 8182 | 40 | 92533 | - |
| | | | B | 238190 | 8424 | | | | | |
| | | | C | 223770 | 7914 | | | | | |

**Mix** TB2H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB2H4 | 6/14/2006 | 29 | A | 253710 | 8973 | 247940 | 8769 | 40 | 99176 | 0.596 |
| | | | B | 247860 | 8766 | | | | | |
| | | | C | 242250 | 8568 | | | | | |

**Mix** TB3H4-2
**Cast Date** 3/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB3H4-2 | 4/5/2007 | 28 | A | 255540 | 9038 | 237690 | 8407 | 40 | 95076 | - |
| | | | B | 198100 | 7006 | | | | | |
| | | | C | 259430 | 9176 | | | | | |

**Mix** TB4H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB4H4 | 6/18/2006 | 31 | A | 256720 | 9080 | 256227 | 9062 | 40 | 102491 | 2.817 |
| | | | B | 259770 | 9187 | | | | | |
| | | | C | 252190 | 8919 | | | | | |

**Mix** TB5H4-2
**Cast Date** 3/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB5H4-2 | 4/5/2007 | 28 | A | 245340 | 8677 | 244550 | 8649 | 40 | 97820 | 1.128 |
| | | | B | 241270 | 8533 | | | | | |
| | | | C | 247040 | 8737 | | | | | |

**Mix** TB6H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB6H4 | 6/23/2006 | 31 | A | 259240 | 9190 | 255727 | 9051 | 30 | 76718 | 1.347 |
| | | | B | 251080 | 8880 | | | | | |
| | | | C | 256860 | 9084 | | | | | |

**Mix** TB7H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB7H4 | 6/23/2006 | 31 | A | 214740 | 7595 | 220523 | 7799 | 30 | 66157 | 1.128 |
| | | | B | 216070 | 7642 | | | | | |
| | | | C | 230760 | 8161 | | | | | |

**Mix** TB8H4
**Cast Date** 5/25/2006

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB8H4 | 6/25/2006 | 31 | A | 238280 | 8428 | 246743 | 8727 | 30 | 74023 | 2.634 |
| | | | B | 250450 | 8858 | | | | | |
| | | | C | 251500 | 8895 | | | | | |

**Mix** TB1H5-2
**Cast Date** 3/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB1H5-2 | 4/5/2007 | 28 | A | 234390 | 8144 | 233200 | 8199 | 40 | 93280 | 0.671 |
| | | | B | 239670 | 8477 | | | | | |
| | | | C | 225540 | 7977 | | | | | |

**Mix** TB2H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB2H5 | 3/1/2007 | 28 | A | 247780 | 8608 | 252960 | 8895 | 30 | 75888 | 1.947 |
| | | | B | 265460 | 9389 | | | | | |
| | | | C | 245640 | 8688 | | | | | |

**Mix** TB3H5
**Cast Date** 2/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB3H5 | 3/6/2007 | 28 | A | 248430 | 8787 | 245830 | 8695 | 40 | 98332 | 1.273 |
| | | | B | 249150 | 8812 | | | | | |
| | | | C | 239910 | 8485 | | | | | |

**Mix** TB4H5
**Cast Date** 2/6/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB4H5 | 3/6/2007 | 28 | A | 273700 | 9680 | 270587 | 9570 | 40 | 108235 | 1.596 |
| | | | B | 270830 | 9579 | | | | | |
| | | | C | 267230 | 9451 | | | | | |

**Mix** TB5H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB5H5 | 3/8/2007 | 28 | A | 262180 | 9273 | 262053 | 9268 | 40 | 104821 | - |
| | | | B | 260750 | 9222 | | | | | |
| | | | C | 263230 | 9310 | | | | | |

**Mix** TB6H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB6H5 | 3/8/2007 | 28 | A | 267490 | 9461 | 266677 | 9432 | 40 | 106671 | 0.896 |
| | | | B | 267180 | 9450 | | | | | |
| | | | C | 265360 | 9385 | | | | | |

**Mix** TB7H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB7H5 | 3/15/2007 | 28 | A | 211550 | 7482 | 214250 | 7460 | 30 | 64275 | - |
| | | | B | 210750 | 7100 | | | | | |
| | | | C | 220450 | 7797 | | | | | |

**Mix** TB8H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Max. Load (lb) | Max. Stress (psi) | Ave. Load (lb) | Ave. Stress (psi) | % of Ave Load | Frame Load (lb) | Creep Coefficent |
|---|---|---|---|---|---|---|---|---|---|---|
| TB8H5 | 3/15/2007 | 28 | A | 238400 | 8432 | 238860 | 8448 | 30 | 71658 | 0.096 |
| | | | B | 233650 | 8264 | | | | | |
| | | | C | 244530 | 8649 | | | | | |

# APPENDIX G – CHLORIDE SAMPLE DATA AND ANALYSIS

## BACKGROUND CHLORIDE CONTENT

| Mix Name | NaCl ($lb/yd^3$) | | | RANGE | PPM | AVE ($lb/yd^3$) |
|---|---|---|---|---|---|---|
| | A | B | C | | | |
| TB1H4 | 0.268 | 0.271 | 0.269 | 0.003 | 70.9 | 0.269 |
| TB2H4 | 0.404 | 0.424 | 0.413 | 0.020 | 110.1 | 0.414 |
| TB3H4 | 0.203 | 0.222 | 0.207 | 0.019 | 55.3 | 0.211 |
| TB4H4 | 0.221 | 0.222 | 0.214 | 0.008 | 58.4 | 0.219 |
| TB5H4 | 0.265 | 0.251 | 0.263 | 0.014 | 69.5 | 0.260 |
| TB6H4 | 0.215 | 0.231 | 0.234 | 0.019 | 60.6 | 0.227 |
| TB7H4 | 0.239 | 0.249 | 0.252 | 0.013 | 66.2 | 0.247 |
| TB8H4 | 0.185 | 0.198 | 0.228 | 0.043 | 54.0 | 0.204 |
| 80 ppm standard | | | | | 77.8 | 0.210 |

| Mix Name | NaCl ($lb/yd^3$) | | | RANGE | PPM | AVE ($lb/yd^3$) |
|---|---|---|---|---|---|---|
| | A | B | C | | | |
| TB1A4 | 0.191 | 0.184 | 0.201 | 0.017 | 50.2 | 0.192 |
| TB2A4 | 0.323 | 0.308 | 0.352 | 0.044 | 86.9 | 0.328 |
| TB3A4 | 0.318 | 0.345 | 0.360 | 0.042 | 87.5 | 0.341 |
| TB4A4 | 4.096 | 4.237 | 4.113 | 0.141 | 1088.9 | 4.149 |
| TB5A4 | 2.096 | 2.132 | 2.142 | 0.046 | 554.7 | 2.123 |
| TB6A4 | 1.262 | 1.272 | 1.256 | 0.016 | 329.5 | 1.263 |
| TB7A4 | 0.548 | 0.528 | 0.55 | 0.022 | 141.3 | 0.542 |
| TB8A4 | 1.422 | 1.478 | 1.426 | 0.056 | 381.8 | 1.442 |
| 30 ppm standard | | | | | 27.2 | 0.103 |

| Mix Name | NaCl ($lb/yd^3$) | | | RANGE | PPM | AVE ($lb/yd^3$) |
|---|---|---|---|---|---|---|
| | A | B | C | | | |
| TB1H5 | 0.261 | 0.253 | 0.279 | 0.026 | 70.2 | 0.264 |
| TB2H5 | 0.313 | 0.302 | 0.310 | 0.011 | 82.6 | 0.308 |
| TB3H5 | 0.229 | 0.252 | 0.246 | 0.023 | 64.5 | 0.242 |
| TB4H5 | 0.221 | 0.248 | 0.227 | 0.027 | 61.7 | 0.232 |
| TB5H5 | 0.761 | 0.747 | 0.742 | 0.019 | 200.4 | 0.750 |
| TB6H5 | 0.624 | 0.606 | 0.671 | 0.065 | 168.4 | 0.634 |
| TB7H5 | 0.498 | 0.546 | 0.481 | 0.065 | 136.4 | 0.508 |
| TB8H5 | 0.523 | 0.511 | 0.535 | 0.024 | 139.5 | 0.523 |
| 200 ppm standard | | | | | 202.5 | 0.765 |

| Mix Name | NaCl ($lb/yd^3$) | | | RANGE | PPM | AVE ($lb/yd^3$) |
|---|---|---|---|---|---|---|
| | A | B | C | | | |
| TB1A5 | 0.183 | 0.190 | 0.181 | 0.009 | 49.2 | 0.185 |
| TB2A5 | 0.222 | 0.214 | 0.231 | 0.017 | 59.7 | 0.222 |
| TB3A5 | 0.169 | 0.181 | 0.172 | 0.012 | 45.7 | 0.174 |
| TB4A5 | 0.163 | 0.157 | 0.154 | 0.009 | 41.6 | 0.158 |
| TB5A5 | 0.161 | 0.173 | 0.175 | 0.014 | 44.9 | 0.170 |
| TB6A5 | 0.166 | 0.149 | 0.176 | 0.027 | 43.7 | 0.164 |
| TB7A5 | 0.143 | 0.158 | 0.162 | 0.019 | 41.4 | 0.154 |
| TB8A5 | 0.152 | 0.175 | 0.16 | 0.023 | 43.2 | 0.162 |
| 90 ppm standard | | | | | 89.8 | 0.335 |

## *AASHTO Cement - Class IV Concrete (364 days)*

**Sample TB1H4-A**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 38.722 | 39.058 | 38.310 | 38.697 |
| 0.500 | 29.651 | 29.840 | 30.426 | 29.972 |
| 0.750 | 13.894 | 14.235 | 14.156 | 14.095 |
| 1.000 | 2.745 | 2.897 | 2.894 | 2.845 |
| 1.250 | 0.424 | 0.428 | 0.423 | 0.425 |
| 1.500 | 0.294 | 0.281 | 0.298 | 0.291 |
| 1.750 | 0.292 | 0.293 | 0.283 | 0.289 |
| 2.000 | 0.299 | 0.281 | 0.288 | 0.289 |

**Sample TB1H4-B**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 43.559 | 43.858 | 44.263 | 43.893 |
| 0.500 | 33.634 | 34.023 | 34.412 | 34.023 |
| 0.750 | 15.517 | 15.491 | 15.753 | 15.587 |
| 1.000 | 3.082 | 3.013 | 2.992 | 3.029 |
| 1.250 | 0.526 | 0.487 | 0.471 | 0.495 |
| 1.500 | 0.337 | 0.341 | 0.337 | 0.338 |
| 1.750 | 0.324 | 0.327 | 0.311 | 0.321 |
| 2.000 | 0.326 | 0.321 | 0.310 | 0.319 |

**Sample TB1H4-C**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 37.745 | 37.791 | 37.663 | 37.733 |
| 0.500 | 26.310 | 26.709 | 26.905 | 26.641 |
| 0.750 | 11.253 | 11.408 | 11.336 | 11.332 |
| 1.000 | 1.738 | 1.735 | 1.743 | 1.739 |
| 1.250 | 0.367 | 0.365 | 0.381 | 0.371 |
| 1.500 | 0.313 | 0.337 | 0.300 | 0.317 |
| 1.750 | 0.298 | 0.292 | 0.302 | 0.297 |
| 2.000 | 0.270 | 0.291 | 0.280 | 0.280 |

**Sample TB2H4-A**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 37.787 | 38.271 | 37.684 | 37.914 |
| 0.500 | 22.355 | 21.945 | 21.797 | 22.032 |
| 0.750 | 3.412 | 3.496 | 3.838 | 3.582 |
| 1.000 | 0.425 | 0.411 | 0.398 | 0.411 |
| 1.250 | 0.343 | 0.364 | 0.362 | 0.356 |
| 1.500 | 0.344 | 0.360 | 0.351 | 0.352 |
| 1.750 | 0.360 | 0.358 | 0.356 | 0.358 |
| 2.000 | 0.307 | 0.314 | 0.311 | 0.311 |

**Sample TB2H4-B**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 35.553 | 36.119 | 35.914 | 35.862 |
| 0.500 | 20.239 | 20.315 | 20.399 | 20.318 |
| 0.750 | 2.658 | 2.560 | 2.665 | 2.628 |
| 1.000 | 0.610 | 0.618 | 0.600 | 0.609 |
| 1.250 | 0.374 | 0.389 | 0.372 | 0.378 |
| 1.500 | 0.319 | 0.322 | 0.355 | 0.332 |
| 1.750 | 0.355 | 0.323 | 0.325 | 0.334 |
| 2.000 | 0.340 | 0.343 | 0.348 | 0.344 |

**Sample TB2H4-C**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 34.108 | 34.489 | 34.333 | 34.310 |
| 0.500 | 15.764 | 15.902 | 15.741 | 15.802 |
| 0.750 | 2.293 | 2.310 | 2.405 | 2.336 |
| 1.000 | 0.355 | 0.355 | 0.352 | 0.354 |
| 1.250 | 0.336 | 0.332 | 0.330 | 0.333 |
| 1.500 | 0.331 | 0.315 | 0.366 | 0.337 |
| 1.750 | 0.272 | 0.273 | 0.290 | 0.278 |
| 2.000 | 0.270 | 0.279 | 0.230 | 0.260 |

**Sample TB3H4-A**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 42.459 | 42.705 | 42.156 | 42.440 |
| 0.500 | 29.933 | 29.869 | 29.219 | 29.674 |
| 0.750 | 9.130 | 9.130 | 8.595 | 8.952 |
| 1.000 | 0.588 | 0.588 | 0.565 | 0.580 |
| 1.250 | 0.238 | 0.230 | 0.246 | 0.238 |
| 1.500 | 0.217 | 0.217 | 0.231 | 0.222 |
| 1.750 | 0.231 | 0.234 | 0.220 | 0.228 |
| 2.000 | 0.212 | 0.197 | 0.200 | 0.203 |

**Sample TB3H4-B**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 41.129 | 41.348 | 41.759 | 41.412 |
| 0.500 | 20.781 | 20.742 | 20.781 | 20.768 |
| 0.750 | 3.438 | 3.534 | 3.429 | 3.467 |
| 1.000 | 0.222 | 0.241 | 0.287 | 0.250 |
| 1.250 | 0.210 | 0.194 | 0.215 | 0.206 |
| 1.500 | 0.202 | 0.199 | 0.182 | 0.194 |
| 1.750 | 0.189 | 0.187 | 0.173 | 0.183 |
| 2.000 | 0.530 | 0.537 | 0.549 | 0.539 |

**Sample TB3H4-C**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 41.022 | 41.455 | 41.058 | 41.178 |
| 0.500 | 25.909 | 25.529 | 25.612 | 25.683 |
| 0.750 | 6.606 | 6.556 | 6.465 | 6.542 |
| 1.000 | 0.292 | 0.291 | 0.317 | 0.300 |
| 1.250 | 0.199 | 0.212 | 0.208 | 0.206 |
| 1.500 | 0.181 | 0.186 | 0.188 | 0.185 |
| 1.750 | 0.183 | 0.191 | 0.200 | 0.191 |
| 2.000 | 0.229 | 0.207 | 0.185 | 0.207 |

**Sample TB4H4-A**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 32.270 | 31.812 | 31.928 | 32.003 |
| 0.500 | 20.739 | 20.699 | 21.490 | 20.976 |
| 0.750 | 5.111 | 5.386 | 5.781 | 5.426 |
| 1.000 | 0.243 | 0.243 | 0.239 | 0.242 |
| 1.250 | 0.151 | 0.181 | 0.170 | 0.167 |
| 1.500 | 0.142 | 0.116 | 0.118 | 0.125 |
| 1.750 | 0.145 | 0.162 | 0.189 | 0.165 |
| 2.000 | 0.144 | 0.136 | 0.186 | 0.155 |

**Sample TB4H4-B**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 33.960 | 33.671 | 33.616 | 33.749 |
| 0.500 | 22.090 | 22.515 | 22.121 | 22.242 |
| 0.750 | 5.864 | 6.034 | 5.886 | 5.928 |
| 1.000 | 1.397 | 1.403 | 1.388 | 1.396 |
| 1.250 | 0.379 | 0.400 | 0.383 | 0.387 |
| 1.500 | 0.160 | 0.158 | 0.159 | 0.159 |
| 1.750 | 0.176 | 0.161 | 0.135 | 0.157 |
| 2.000 | 0.160 | 0.169 | 0.166 | 0.165 |

**Sample TB4H4-C**

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 33.233 | 32.735 | 32.947 | 32.972 |
| 0.500 | 17.539 | 17.779 | 17.539 | 17.619 |
| 0.750 | 3.536 | 3.545 | 3.614 | 3.565 |
| 1.000 | 0.820 | 0.840 | 0.822 | 0.827 |
| 1.250 | 0.267 | 0.241 | 0.251 | 0.253 |
| 1.500 | 0.213 | 0.221 | 0.223 | 0.219 |
| 1.750 | 0.217 | 0.204 | 0.236 | 0.219 |
| 2.000 | 0.214 | 0.246 | 0.235 | 0.232 |

**Sample TB5H4-A**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 34.203 | 33.985 | 33.686 | 33.958 |
| 0.500 | 17.549 | 17.575 | 18.051 | 17.725 |
| 0.750 | 3.604 | 3.788 | 3.715 | 3.702 |
| 1.000 | 0.650 | 0.609 | 0.674 | 0.644 |
| 1.250 | 0.314 | 0.326 | 0.311 | 0.317 |
| 1.500 | 0.182 | 0.170 | 0.189 | 0.180 |
| 1.750 | 0.190 | 0.201 | 0.178 | 0.190 |
| 2.000 | 0.196 | 0.200 | 0.195 | 0.197 |

**Sample TB5H4-B**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 32.621 | 32.848 | 32.413 | 32.627 |
| 0.500 | 24.365 | 24.390 | 24.535 | 24.430 |
| 0.750 | 5.459 | 5.491 | 5.549 | 5.500 |
| 1.000 | 0.463 | 0.478 | 0.456 | 0.466 |
| 1.250 | 0.230 | 0.219 | 0.246 | 0.232 |
| 1.500 | 0.255 | 0.253 | 0.248 | 0.252 |
| 1.750 | 0.233 | 0.253 | 0.221 | 0.236 |
| 2.000 | 0.231 | 0.241 | 0.234 | 0.235 |

**Sample TB5H4-C**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 34.025 | 34.598 | 34.651 | 34.425 |
| 0.500 | 20.321 | 20.075 | 19.569 | 19.988 |
| 0.750 | 5.337 | 5.572 | 5.318 | 5.409 |
| 1.000 | 0.540 | 0.552 | 0.560 | 0.551 |
| 1.250 | 0.248 | 0.247 | 0.260 | 0.252 |
| 1.500 | 0.237 | 0.231 | 0.232 | 0.233 |
| 1.750 | 0.240 | 0.242 | 0.232 | 0.238 |
| 2.000 | 0.306 | 0.236 | 0.232 | 0.258 |

**Sample TB6H4-A**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 33.967 | 33.720 | 34.320 | 34.002 |
| 0.500 | 15.510 | 15.030 | 15.511 | 15.350 |
| 0.750 | 0.738 | 0.741 | 0.726 | 0.735 |
| 1.000 | 0.195 | 0.242 | 0.223 | 0.220 |
| 1.250 | 0.207 | 0.178 | 0.194 | 0.193 |
| 1.500 | 0.194 | 0.198 | 0.187 | 0.193 |
| 1.750 | 0.183 | 0.198 | 0.201 | 0.194 |
| 2.000 | 0.184 | 0.190 | 0.186 | 0.187 |

**Sample TB6H4-B**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 35.383 | 34.975 | 35.526 | 35.295 |
| 0.500 | 18.399 | 18.333 | 18.580 | 18.437 |
| 0.750 | 3.717 | 3.817 | 3.800 | 3.778 |
| 1.000 | 0.317 | 0.338 | 0.307 | 0.321 |
| 1.250 | 0.256 | 0.203 | 0.209 | 0.223 |
| 1.500 | 0.243 | 0.192 | 0.191 | 0.209 |
| 1.750 | 0.189 | 0.192 | 0.233 | 0.205 |
| 2.000 | 0.198 | 0.206 | 0.188 | 0.197 |

**Sample TB6H4-C**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 33.483 | 33.830 | 34.076 | 33.796 |
| 0.500 | 13.180 | 12.985 | 13.198 | 13.121 |
| 0.750 | 2.269 | 2.401 | 2.552 | 2.407 |
| 1.000 | 0.435 | 0.418 | 0.424 | 0.426 |
| 1.250 | 0.253 | 0.215 | 0.234 | 0.234 |
| 1.500 | 0.202 | 0.222 | 0.209 | 0.211 |
| 1.750 | 0.195 | 0.199 | 0.189 | 0.194 |
| 2.000 | 0.189 | 0.198 | 0.206 | 0.198 |

**Sample TB7H4-A**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 28.661 | 29.319 | 29.081 | 29.020 |
| 0.500 | 25.407 | 25.033 | 25.654 | 25.365 |
| 0.750 | 5.314 | 5.314 | 5.356 | 5.328 |
| 1.000 | 0.451 | 0.420 | 0.407 | 0.426 |
| 1.250 | 0.362 | 0.328 | 0.310 | 0.333 |
| 1.500 | 0.244 | 0.261 | 0.238 | 0.248 |
| 1.750 | 0.255 | 0.239 | 0.282 | 0.259 |
| 2.000 | 0.273 | 0.299 | 0.286 | 0.286 |

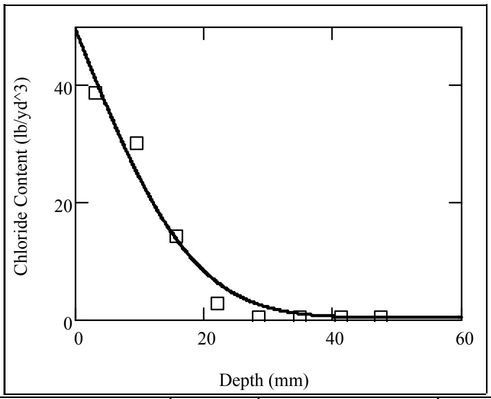
**Sample TB7H4-B**

| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 32.099 | 31.497 | 31.802 | 31.799 |
| 0.500 | 21.982 | 22.390 | 21.614 | 21.995 |
| 0.750 | 4.167 | 4.233 | 4.167 | 4.189 |
| 1.000 | 0.432 | 0.428 | 0.456 | 0.439 |
| 1.250 | 0.293 | 0.328 | 0.344 | 0.322 |
| 1.500 | 0.278 | 0.284 | 0.290 | 0.284 |
| 1.750 | 0.249 | 0.246 | 0.262 | 0.252 |
| 2.000 | 0.206 | 0.271 | 0.271 | 0.249 |

**Sample TB7H4-C**

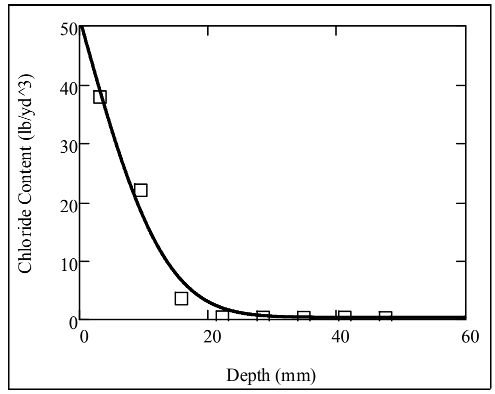
| Depth (in) | NaCl (lb/yd$^3$) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 30.276 | 30.706 | 30.275 | 30.419 |
| 0.500 | 22.668 | 22.881 | 23.309 | 22.953 |
| 0.750 | 4.550 | 4.891 | 4.835 | 4.759 |
| 1.000 | 0.528 | 0.487 | 0.511 | 0.509 |
| 1.250 | 0.247 | 0.250 | 0.246 | 0.248 |
| 1.500 | 0.216 | 0.207 | 0.214 | 0.212 |
| 1.750 | 0.236 | 0.251 | 0.262 | 0.250 |
| 2.000 | 0.203 | 0.200 | 0.202 | 0.202 |

**Sample:TB1H4-A Blend:20%FA**
**Cement:AASHTO Concrete:Class IV 365 days**



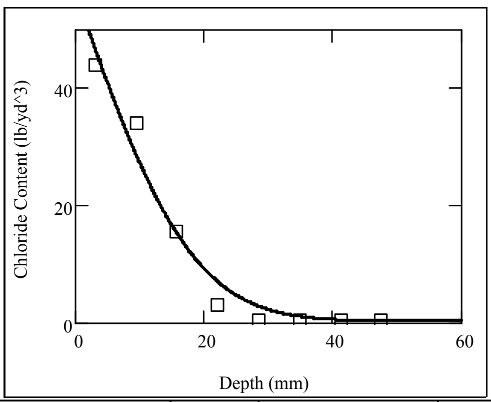

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.262E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 49.753 | **R^2 Value** | 0.9874 |

**Sample:TB2H4-A Blend:20%FA7%SF**
**Cement:AASHTO Concrete:Class IV 365 days**



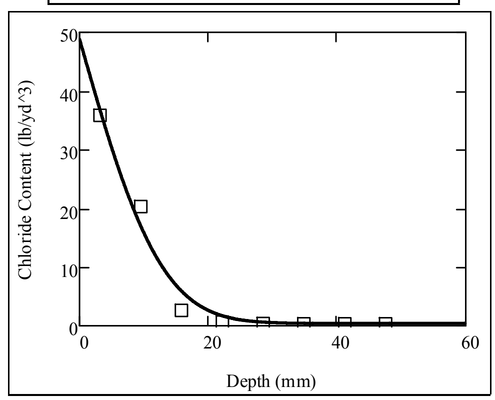

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.682E-12 | **Background(lb/yd^3)** | 0.414 |
| **Surface(lb/yd^3)** | 51.324 | **R^2 Value** | 0.9912 |

**Sample:TB1H4-B Blend:20%FA**
**Cement:AASHTO Concrete:Class IV 365 days**



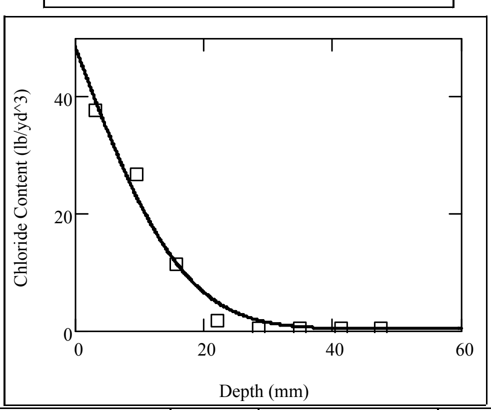

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.220E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 56.538 | **R^2 Value** | 0.9871 |

**Sample:TB2H4-B Blend:20%FA7%SF**
**Cement:AASHTO Concrete:Class IV 365 days**



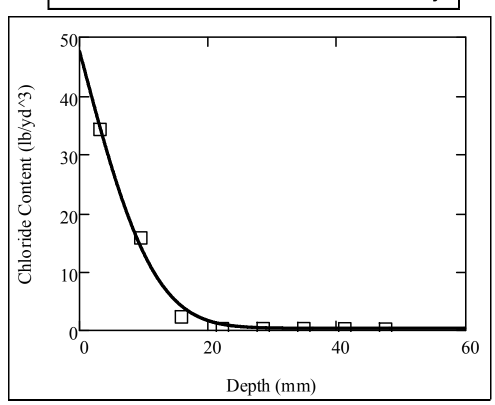

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.596E-12 | **Background(lb/yd^3)** | 0.414 |
| **Surface(lb/yd^3)** | 48.866 | **R^2 Value** | 0.9908 |

**Sample:TB1H4-C Blend:20%FA**
**Cement:AASHTO Concrete:Class IV 365 days**



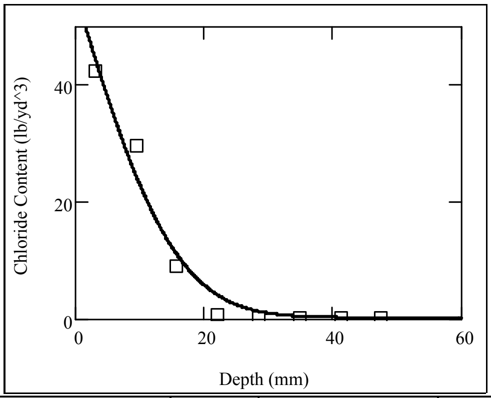

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.779E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 48.548 | **R^2 Value** | 0.9915 |

**Sample:TB2H4-C Blend:20%FA7%SF**
**Cement:AASHTO Concrete:Class IV 365 days**



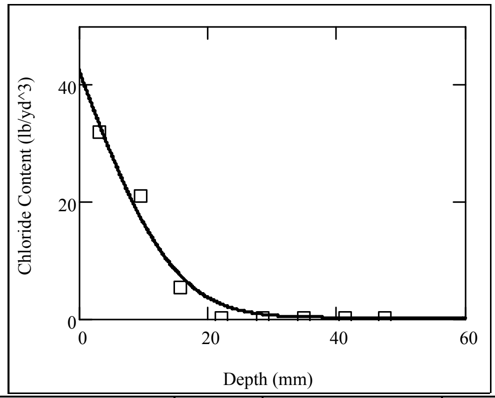

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.303E-12 | **Background(lb/yd^3)** | 0.414 |
| **Surface(lb/yd^3)** | 47.639 | **R^2 Value** | 0.9972 |

Sample:TB3H4-A Blend:20%FA20%S
Cement:AASHTO Concrete:Class IV 365 days



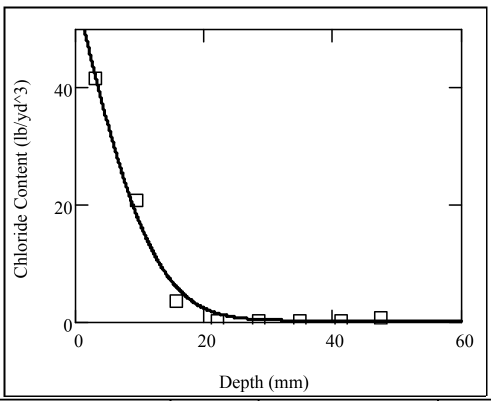

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.361E-12 | **Background(lb/yd^3)** | 0.211 |
| **Surface(lb/yd^3)** | 55.922 | **R^2 Value** | 0.9878 |

Sample:TB4H4-A Blend:10%FA40%S
Cement:AASHTO Concrete:Class IV 365 days



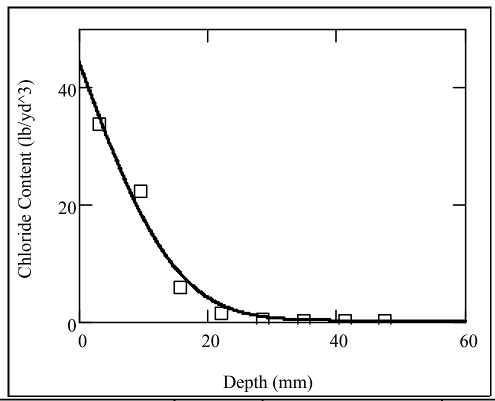

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.098E-12 | **Background(lb/yd^3)** | 0.219 |
| **Surface(lb/yd^3)** | 42.469 | **R^2 Value** | 0.9897 |

Sample:TB3H4-B Blend:20%FA20%S
Cement:AASHTO Concrete:Class IV 365 days



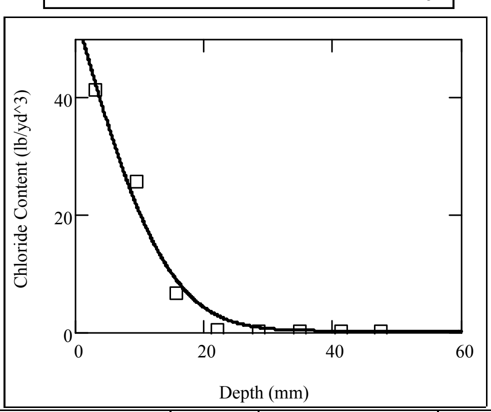

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.475E-12 | **Background(lb/yd^3)** | 0.211 |
| **Surface(lb/yd^3)** | 56.625 | **R^2 Value** | 0.9961 |

Sample:TB4H4-B Blend:10%FA40%S
Cement:AASHTO Concrete:Class IV 365 days



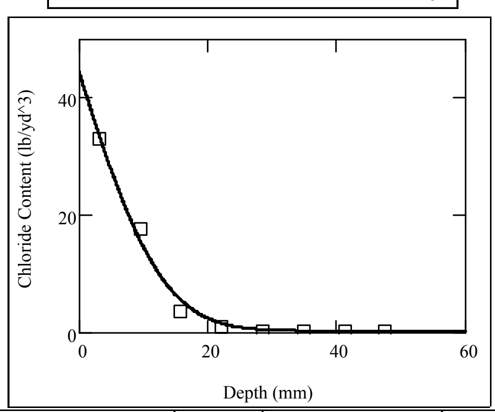

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.206E-12 | **Background(lb/yd^3)** | 0.219 |
| **Surface(lb/yd^3)** | 44.372 | **R^2 Value** | 0.9913 |

Sample:TB3H4-C Blend:20%FA20%S
Cement:AASHTO Concrete:Class IV 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.999E-12 | **Background(lb/yd^3)** | 0.211 |
| **Surface(lb/yd^3)** | 54.668 | **R^2 Value** | 0.9920 |

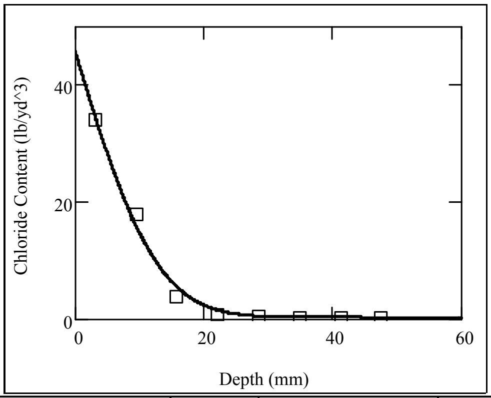
Sample:TB4H4-C Blend:10%FA40%S
Cement:AASHTO Concrete:Class IV 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.641E-12 | **Background(lb/yd^3)** | 0.219 |
| **Surface(lb/yd^3)** | 44.384 | **R^2 Value** | 0.9961 |

Sample:TB5H4-A Blend:30%FA20%S

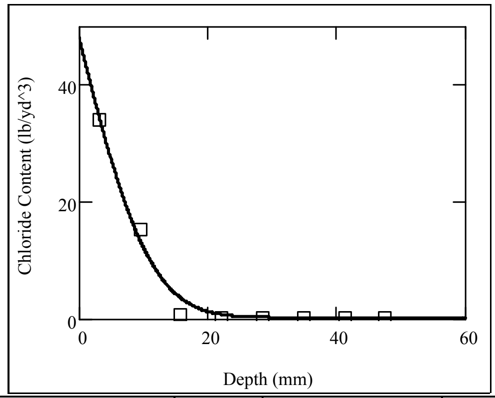
Cement:AASHTO Concrete:Class IV 364 days




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.602E-12 | Background(lb/yd^3) | 0.260 |
| Surface(lb/yd^3) | 45.818 | R^2 Value | 0.9967 |

Sample:TB6H4-A Blend:20%FA40%S

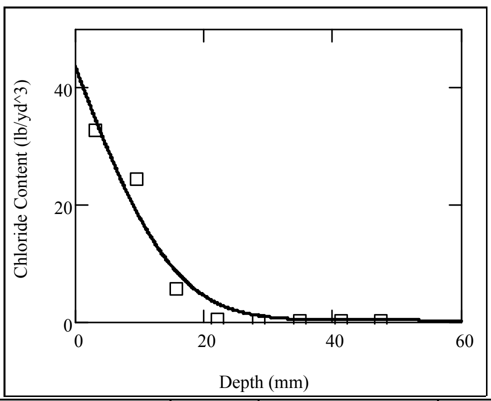
Cement:AASHTO Concrete:Class IV 364 days




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.210E-12 | Background(lb/yd^3) | 0.227 |
| Surface(lb/yd^3) | 48.077 | R^2 Value | 0.9946 |

Sample:TB5H4-B Blend:30%FA20%S

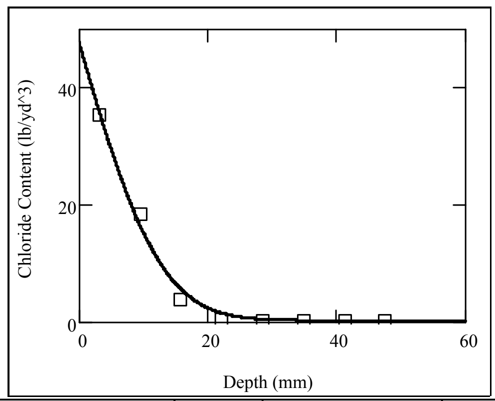
Cement:AASHTO Concrete:Class IV 364 days




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 2.319E-12 | Background(lb/yd^3) | 0.260 |
| Surface(lb/yd^3) | 43.669 | R^2 Value | 0.9791 |

Sample:TB6H4-B Blend:20%FA40%S

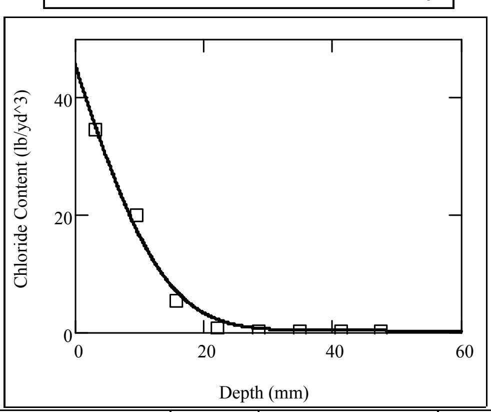
Cement:AASHTO Concrete:Class IV 365 days




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.586E-12 | Background(lb/yd^3) | 0.227 |
| Surface(lb/yd^3) | 47.730 | R^2 Value | 0.9964 |

Sample:TB5H4-C Blend:30%FA20%S

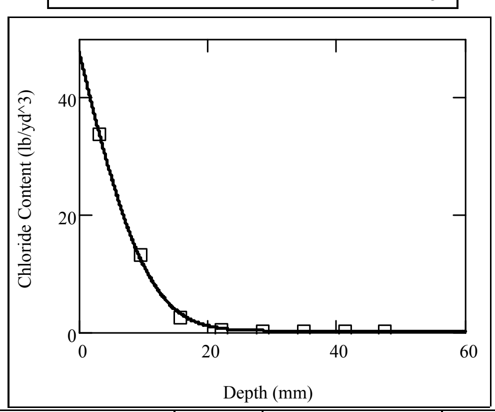
Cement:AASHTO Concrete:Class IV 364 days




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.894E-12 | Background(lb/yd^3) | 0.260 |
| Surface(lb/yd^3) | 45.611 | R^2 Value | 0.9954 |

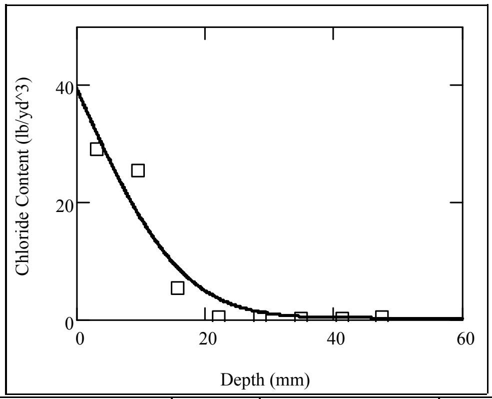
Sample:TB6H4-C Blend:20%FA40%S

Cement:AASHTO Concrete:Class IV 365 days



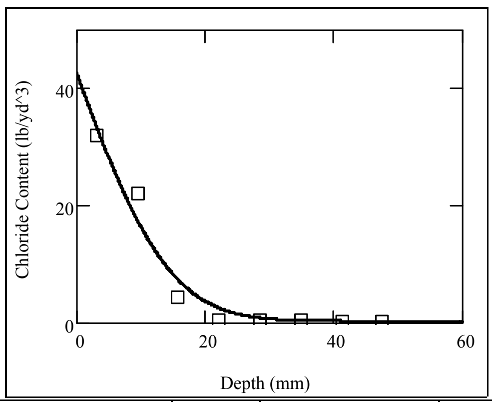

| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.137E-12 | Background(lb/yd^3) | 0.227 |
| Surface(lb/yd^3) | 47.821 | R^2 Value | 0.9996 |

| Sample:TB7H4-A Blend:40%FA20%S |
|---|
| Cement:AASHTO Concrete:Class IV 364 days |



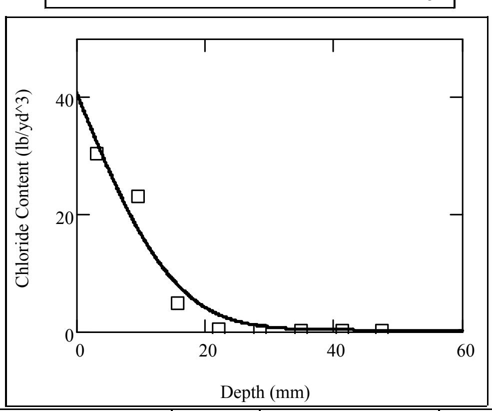

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.621E-12 | **Background(lb/yd^3)** | 0.247 |
| **Surface(lb/yd^3)** | 39.479 | **R^2 Value** | 0.9616 |

| Sample:TB7H4-B Blend:40%FA20%S |
|---|
| Cement:AASHTO Concrete:Class IV 364 days |




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.081E-12 | **Background(lb/yd^3)** | 0.247 |
| **Surface(lb/yd^3)** | 42.649 | **R^2 Value** | 0.9831 |

| Sample:TB7H4-C Blend:40%FA20%S |
|---|
| Cement:AASHTO Concrete:Class IV 364 days |




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.298E-12 | **Background(lb/yd^3)** | 0.247 |
| **Surface(lb/yd^3)** | 40.823 | **R^2 Value** | 0.9774 |

## *AASHTO Cement - Class V Concrete (364 days)*

Sample TB1H5-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 47.381 | 47.228 | 46.908 | 47.172 |
| 0.500 | 27.580 | 27.768 | 27.810 | 27.719 |
| 0.750 | 11.293 | 11.277 | 11.219 | 11.263 |
| 1.000 | 1.840 | 1.948 | 1.893 | 1.894 |
| 1.250 | 0.301 | 0.274 | 0.295 | 0.290 |
| 1.500 | 0.292 | 0.292 | 0.291 | 0.292 |
| 1.750 | 0.361 | 0.374 | 0.380 | 0.372 |
| 2.000 | 0.353 | 0.351 | 0.346 | 0.350 |

Sample TB1H5-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 47.742 | 48.230 | 47.801 | 47.924 |
| 0.500 | 32.327 | 32.102 | 32.094 | 32.174 |
| 0.750 | 316.368 | 16.328 | 16.190 | 16.295 |
| 1.000 | 3.480 | 3.566 | 3.673 | 3.573 |
| 1.250 | 0.521 | 0.477 | 0.497 | 0.498 |
| 1.500 | 0.365 | 0.379 | 0.377 | 0.374 |
| 1.750 | 0.328 | 0.301 | 0.304 | 0.311 |
| 2.000 | 0.354 | 0.347 | 0.372 | 0.358 |

Sample TB1H5-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 46.400 | 46.213 | 46.827 | 46.480 |
| 0.500 | 31.040 | 31.192 | 31.216 | 31.149 |
| 0.750 | 12.780 | 12.884 | 12.527 | 12.730 |
| 1.000 | 2.749 | 2.689 | 2.705 | 2.714 |
| 1.250 | 0.808 | 0.793 | 0.807 | 0.803 |
| 1.500 | 0.276 | 0.278 | 0.247 | 0.267 |
| 1.750 | 0.231 | 0.229 | 0.245 | 0.235 |
| 2.000 | 0.313 | 0.263 | 0.269 | 0.282 |

Sample TB2H5-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 41.059 | 41.267 | 40.662 | 40.996 |
| 0.500 | 11.113 | 11.129 | 10.835 | 11.026 |
| 0.750 | 0.843 | 0.864 | 0.829 | 0.845 |
| 1.000 | 0.360 | 0.412 | 0.351 | 0.374 |
| 1.250 | 0.344 | 0.369 | 0.358 | 0.357 |
| 1.500 | 0.365 | 0.295 | 0.364 | 0.341 |
| 1.750 | 0.302 | 0.308 | 0.325 | 0.312 |
| 2.000 | 0.313 | 0.284 | 0.285 | 0.294 |

Sample TB2H5-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 44.513 | 44.227 | 43.766 | 44.169 |
| 0.500 | 15.801 | 15.676 | 15.918 | 15.798 |
| 0.750 | 1.088 | 1.135 | 1.161 | 1.128 |
| 1.000 | 0.368 | 0.413 | 0.405 | 0.395 |
| 1.250 | 0.245 | 0.262 | 0.257 | 0.255 |
| 1.500 | 0.268 | 0.286 | 0.240 | 0.265 |
| 1.750 | 0.282 | 0.302 | 0.319 | 0.301 |
| 2.000 | 0.296 | 0.283 | 0.291 | 0.290 |

Sample TB2H5-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 44.488 | 44.747 | 44.789 | 44.675 |
| 0.500 | 24.289 | 23.974 | 23.574 | 23.946 |
| 0.750 | 3.251 | 3.263 | 3.287 | 3.267 |
| 1.000 | 0.509 | 0.508 | 0.545 | 0.521 |
| 1.250 | 0.378 | 0.413 | 0.395 | 0.395 |
| 1.500 | 0.311 | 0.325 | 0.305 | 0.314 |
| 1.750 | 0.300 | 0.329 | 0.338 | 0.322 |
| 2.000 | 0.320 | 0.327 | 0.325 | 0.324 |

Sample TB3H5-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 48.740 | 48.296 | 48.296 | 48.444 |
| 0.500 | 26.484 | 26.335 | 26.166 | 26.328 |
| 0.750 | 7.104 | 6.923 | 6.931 | 6.986 |
| 1.000 | 0.591 | 0.577 | 0.555 | 0.574 |
| 1.250 | 0.268 | 0.290 | 0.243 | 0.267 |
| 1.500 | 0.305 | 0.304 | 0.312 | 0.307 |
| 1.750 | 0.240 | 0.252 | 0.238 | 0.243 |
| 2.000 | 0.214 | 0.204 | 0.211 | 0.210 |

Sample TB3H5-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 53.310 | 53.029 | 53.621 | 53.320 |
| 0.500 | 28.117 | 28.237 | 27.458 | 27.937 |
| 0.750 | 10.627 | 10.628 | 10.513 | 10.589 |
| 1.000 | 1.603 | 1.575 | 1.575 | 1.584 |
| 1.250 | 0.626 | 0.635 | 0.666 | 0.642 |
| 1.500 | 0.527 | 0.518 | 0.533 | 0.526 |
| 1.750 | 0.401 | 0.415 | 0.401 | 0.406 |
| 2.000 | 0.331 | 0.319 | 0.308 | 0.319 |

Sample TB3H5-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 49.810 | 49.909 | 50.321 | 50.013 |
| 0.500 | 4.356 | 4.331 | 4.018 | 4.235 |
| 0.750 | 18.234 | 18.220 | 18.319 | 18.258 |
| 1.000 | 0.471 | 0.472 | 0.464 | 0.469 |
| 1.250 | 0.165 | 0.174 | 0.194 | 0.178 |
| 1.500 | 0.156 | 0.144 | 0.148 | 0.149 |
| 1.750 | 0.148 | 0.125 | 0.132 | 0.135 |
| 2.000 | 0.143 | 0.136 | 0.130 | 0.136 |

Sample TB4H5-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 48.932 | 49.091 | 48.646 | 48.890 |
| 0.500 | 27.394 | 27.164 | 26.695 | 27.084 |
| 0.750 | 4.698 | 4.965 | 4.918 | 4.860 |
| 1.000 | 4.386 | 4.131 | 4.006 | 4.174 |
| 1.250 | 0.173 | 0.175 | 0.175 | 0.174 |
| 1.500 | 0.164 | 0.170 | 0.156 | 0.163 |
| 1.750 | 0.192 | 0.191 | 0.174 | 0.186 |
| 2.000 | 0.398 | 0.398 | 0.429 | 0.408 |

Sample TB4H5-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 50.458 | 50.537 | 50.251 | 50.415 |
| 0.500 | 24.258 | 24.592 | 24.683 | 24.511 |
| 0.750 | 6.473 | 6.632 | 6.648 | 6.584 |
| 1.000 | 0.330 | 0.381 | 0.398 | 0.370 |
| 1.250 | 0.161 | 0.211 | 0.216 | 0.196 |
| 1.500 | 0.144 | 0.190 | 0.198 | 0.177 |
| 1.750 | 0.184 | 0.176 | 0.175 | 0.178 |
| 2.000 | 0.166 | 0.155 | 0.174 | 0.165 |

Sample TB4H5-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 48.528 | 48..264 | 48.290 | 48.361 |
| 0.500 | 22.409 | 21.985 | 21.796 | 22.063 |
| 0.750 | 6.845 | 6.812 | 6.731 | 6.796 |
| 1.000 | 0.798 | 0.823 | 0.816 | 0.812 |
| 1.250 | 0.216 | 0.205 | 0.222 | 0.214 |
| 1.500 | 0.197 | 0.196 | 0.201 | 0.198 |
| 1.750 | 0.177 | 0.188 | 0.227 | 0.197 |
| 2.000 | 0.194 | 0.179 | 0.193 | 0.189 |

Sample TB5H5-A

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 40.469 | 40.346 | 40.096 | 40.304 |
| 0.500 | 18.064 | 18.016 | 18.005 | 18.028 |
| 0.750 | 16.801 | 16.792 | 16.842 | 16.812 |
| 1.000 | 0.269 | 0.272 | 0.286 | 0.276 |
| 1.250 | 0.230 | 0.248 | 0.237 | 0.238 |
| 1.500 | 0.394 | 0.41. | 0.419 | 0.408 |
| 1.750 | 0.245 | 0.261 | 0.243 | 0.250 |
| 2.000 | 0.201 | 0.219 | 0.203 | 0.208 |

Sample TB5H5-B

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 45.947 | 45.765 | 45.979 | 45.897 |
| 0.500 | 13.282 | 13.538 | 13.258 | 13.359 |
| 0.750 | 0.874 | 0.898 | 0.897 | 0.890 |
| 1.000 | 0.273 | 0.203 | 0.259 | 0.245 |
| 1.250 | 0.285 | 0.221 | 0.282 | 0.263 |
| 1.500 | 0.315 | 0.308 | 0.304 | 0.309 |
| 1.750 | 0.234 | 0.247 | 0.252 | 0.244 |
| 2.000 | 0.284 | 0.284 | 0.285 | 0.284 |

Sample TB5H5-C

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 42.851 | 43.344 | 43.464 | 43.220 |
| 0.500 | 15.926 | 15.979 | 16.147 | 16.017 |
| 0.750 | 1.347 | 1.321 | 1.345 | 1.338 |
| 1.000 | 0.895 | 0.962 | 0.970 | 0.942 |
| 1.250 | 0.411 | 0.421 | 0.427 | 0.420 |
| 1.500 | 0.325 | 0.321 | 0.324 | 0.323 |
| 1.750 | 0.235 | 0.237 | 0.248 | 0.240 |
| 2.000 | 0.251 | 0.269 | 0.302 | 0.274 |

Sample TB6H5-A

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 39.239 | 38.925 | 39.267 | 39.144 |
| 0.500 | 22.705 | 22.763 | 22.782 | 22.750 |
| 0.750 | 3.074 | 3.112 | 2.994 | 3.060 |
| 1.000 | 0.378 | 0.369 | 0.363 | 0.370 |
| 1.250 | 0.202 | 0.140 | 0.187 | 0.176 |
| 1.500 | 0.574 | 0.558 | 0.560 | 0.564 |
| 1.750 | 0.214 | 0.221 | 0.204 | 0.213 |
| 2.000 | 0.564 | 0.564 | 0.586 | 0.571 |

Sample TB6H5-B

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 39.410 | 39.298 | 40.081 | 39.596 |
| 0.500 | 20.278 | 20.030 | 19.870 | 20.059 |
| 0.750 | 1.416 | 1.440 | 1.427 | 1.428 |
| 1.000 | 0.225 | 0.207 | 0.214 | 0.215 |
| 1.250 | 0.177 | 0.192 | 0.183 | 0.184 |
| 1.500 | 0.162 | 0.162 | 0.166 | 0.163 |
| 1.750 | 0.153 | 0.154 | 0.145 | 0.151 |
| 2.000 | 0.187 | 0.186 | 0.196 | 0.190 |

Sample TB6H5-C

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 44.254 | 44.360 | 43.897 | 44.170 |
| 0.500 | 17.177 | 17.634 | 17.777 | 17.529 |
| 0.750 | 1.218 | 1.215 | 1.241 | 1.225 |
| 1.000 | 0.315 | 0.307 | 0.302 | 0.308 |
| 1.250 | 0.209 | 0.224 | 0.204 | 0.212 |
| 1.500 | 0.226 | 0.173 | 0.181 | 0.193 |
| 1.750 | 0.255 | 0.211 | 0.256 | 0.241 |
| 2.000 | 0.410 | 0.365 | 0.384 | 0.386 |

Sample TB7H5-A

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 38.776 | 39.079 | 38.620 | 38.825 |
| 0.500 | 15.885 | 16.648 | 16.620 | 16.384 |
| 0.750 | 2.617 | 2.606 | 2.676 | 2.633 |
| 1.000 | 0.438 | 0.509 | 0.501 | 0.483 |
| 1.250 | 0.289 | 0.297 | 0.279 | 0.288 |
| 1.500 | 0.352 | 0.366 | 0.347 | 0.355 |
| 1.750 | 0.536 | 0.556 | 0.562 | 0.551 |
| 2.000 | 0.528 | 0.531 | 0.526 | 0.528 |

Sample TB7H5-B

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 40.927 | 41.241 | 41.445 | 41.204 |
| 0.500 | 19.439 | 19.340 | 19.789 | 19.523 |
| 0.750 | 2.778 | 2.873 | 2.927 | 2.859 |
| 1.000 | 0.285 | 0.287 | 0.283 | 0.285 |
| 1.250 | 0.279 | 0.285 | 0.303 | 0.289 |
| 1.500 | 0.286 | 0.306 | 0.293 | 0.295 |
| 1.750 | 0.237 | 0.235 | 0.231 | 0.234 |
| 2.000 | 0.339 | 0.332 | 0.337 | 0.336 |

Sample TB7H5-C

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 44.154 | 44.725 | 44.811 | 44.563 |
| 0.500 | 21.347 | 21.551 | 20.830 | 21.243 |
| 0.750 | 2.828 | 3.044 | 3.032 | 2.968 |
| 1.000 | 0.353 | 0.351 | 0.358 | 0.354 |
| 1.250 | 0.252 | 0.243 | 0.228 | 0.241 |
| 1.500 | 0.234 | 0.293 | 0.224 | 0.250 |
| 1.750 | 0.294 | 0.287 | 0.297 | 0.293 |
| 2.000 | 0.394 | 0.408 | 0.415 | 0.406 |

Sample TB8H5-A

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 42.016 | 41.348 | 42.089 | 41.818 |
| 0.500 | 12.337 | 12.104 | 11.891 | 12.111 |
| 0.750 | 0.619 | 0.584 | 0.591 | 0.598 |
| 1.000 | 0.193 | 0.189 | 0.212 | 0.198 |
| 1.250 | 0.183 | 0.180 | 0.180 | 0.181 |
| 1.500 | 0.158 | 0.097 | 0.139 | 0.131 |
| 1.750 | 0.150 | 0.105 | 0.127 | 0.127 |
| 2.000 | 0.166 | 0.143 | 0.151 | 0.153 |

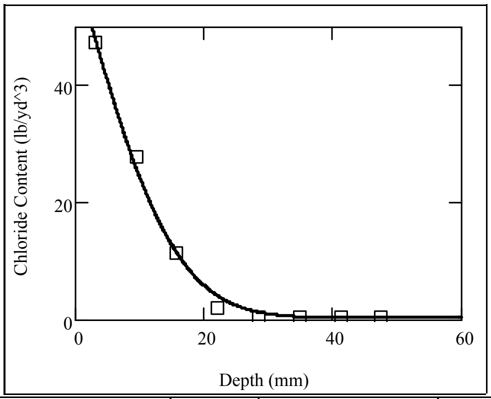
Sample TB8H5-B

| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 0.553 | 0.578 | 0.598 | 0.576 |
| 0.500 | 17.019 | 16.907 | 16.791 | 16.906 |
| 0.750 | 3.597 | 3.595 | 3.570 | 3.587 |
| 1.000 | 0.357 | 0.356 | 0.378 | 0.364 |
| 1.250 | 0.183 | 0.162 | 0.179 | 0.175 |
| 1.500 | 0.158 | 0.176 | 0.126 | 0.153 |
| 1.750 | 0.158 | 0.165 | 0.153 | 0.159 |
| 2.000 | 0.158 | 0.176 | 0.156 | 0.163 |

Sample TB8H5-C

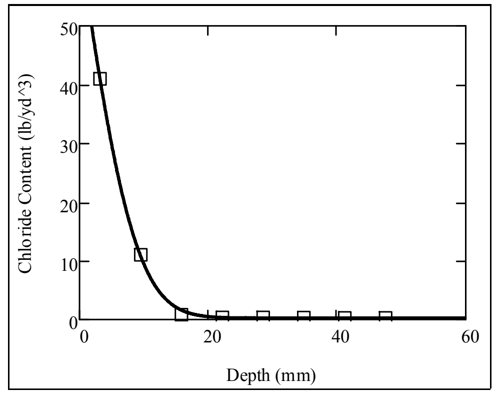
| Depth (in) | NaCl (lb/yd³) | | | |
|---|---|---|---|---|
| | A | B | C | AVG |
| 0.250 | 43.227 | 43.688 | 43.562 | 43.492 |
| 0.500 | 16.855 | 16.584 | 16.384 | 16.608 |
| 0.750 | 0.806 | 0.764 | 0.787 | 0.786 |
| 1.000 | 0.259 | 0.249 | 0.250 | 0.253 |
| 1.250 | 0.208 | 0.203 | 0.216 | 0.209 |
| 1.500 | 0.187 | 0.165 | 0.161 | 0.171 |
| 1.750 | 0.167 | 0.170 | 0.160 | 0.166 |
| 2.000 | 0.409 | 0.366 | 0.333 | 0.369 |

| Sample:TB1H5-A Blend:20%FA |
|---|
| Cement:AASHTO Concrete:Class V 365 days |



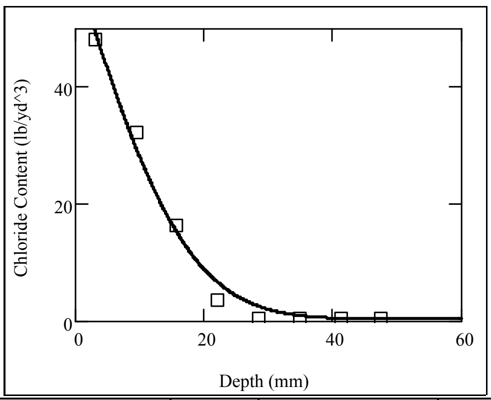

| Diffusion(m^2/sec) | 2.254E-12 | Background(lb/yd^3) | 0.264 |
|---|---|---|---|
| Surface(lb/yd^3) | 60.636 | R^2 Value | 0.9980 |

| Sample:TB2H5-A Blend:20%FA7%SF |
|---|
| Cement:AASHTO Concrete:Class V 365 days |



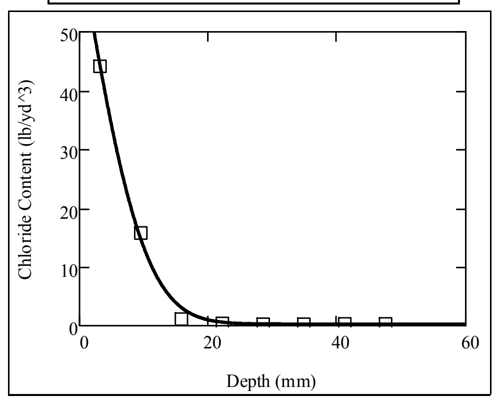

| Diffusion(m^2/sec) | 7.466E-13 | Background(lb/yd^3) | 0.308 |
|---|---|---|---|
| Surface(lb/yd^3) | 63.595 | R^2 Value | 0.9998 |

| Sample:TB1H5-B Blend:20%FA |
|---|
| Cement:AASHTO Concrete:Class V 365 days |



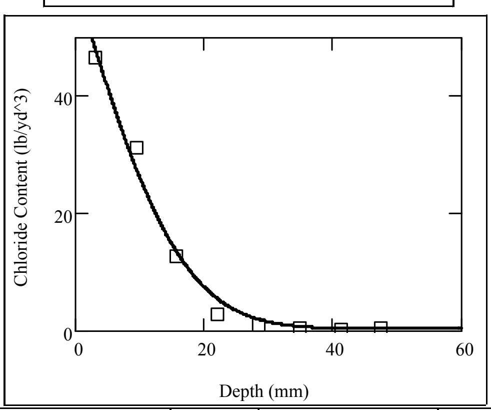

| Diffusion(m^2/sec) | 2.975E-12 | Background(lb/yd^3) | 0.264 |
|---|---|---|---|
| Surface(lb/yd^3) | 60.403 | R^2 Value | 0.9953 |

| Sample:TB2H5-B Blend:20%FA7%SF |
|---|
| Cement:AASHTO Concrete:Class V 365 days |



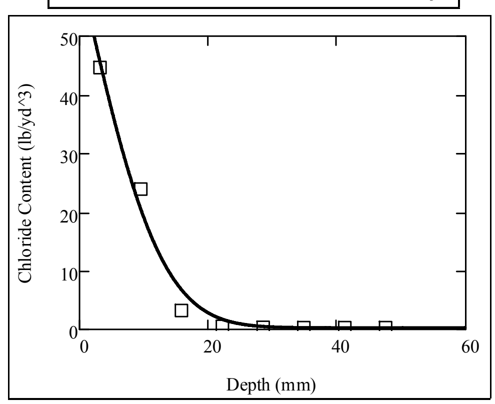

| Diffusion(m^2/sec) | 9.767E-13 | Background(lb/yd^3) | 0.308 |
|---|---|---|---|
| Surface(lb/yd^3) | 64.576 | R^2 Value | 0.9986 |

| Sample:TB1H5-C Blend:20%FA |
|---|
| Cement:AASHTO Concrete:Class V 365 days |




| Diffusion(m^2/sec) | 2.658E-12 | Background(lb/yd^3) | 0.264 |
|---|---|---|---|
| Surface(lb/yd^3) | 59.495 | R^2 Value | 0.9950 |

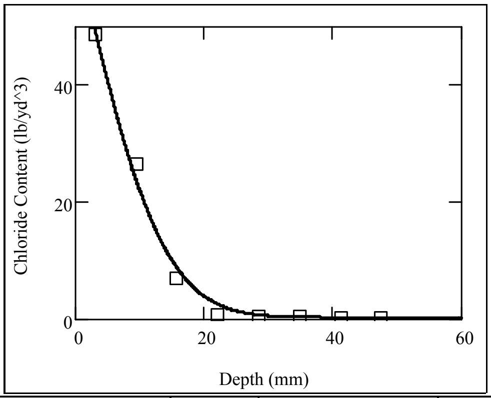
| Sample:TB2H5-C Blend:20%FA7%SF |
|---|
| Cement:AASHTO Concrete:Class V 365 days |




| Diffusion(m^2/sec) | 1.535E-12 | Background(lb/yd^3) | 0.308 |
|---|---|---|---|
| Surface(lb/yd^3) | 61.016 | R^2 Value | 0.9933 |

Sample:TB3H5-A Blend:20%FA20%S

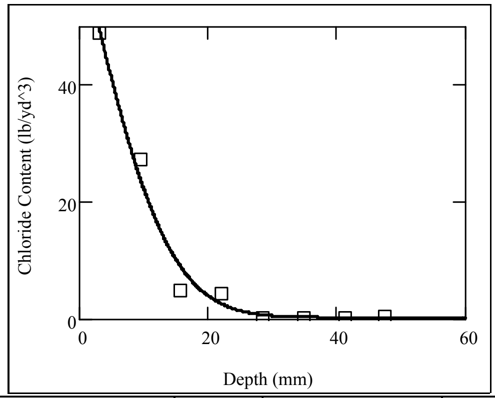
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.760E-12 | **Background(lb/yd^3)** | 0.242 |
| **Surface(lb/yd^3)** | 64.508 | **R^2 Value** | 0.9970 |

Sample:TB4H5-A Blend:10%FA40%S

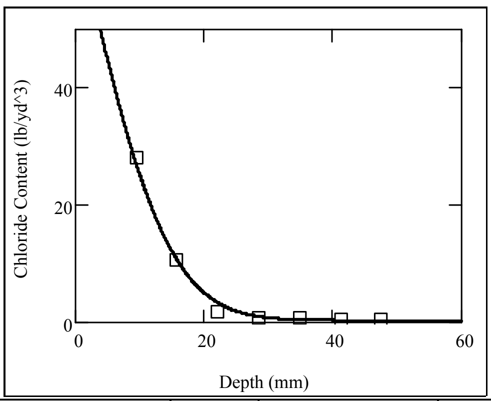
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.768E-12 | **Background(lb/yd^3)** | 0.232 |
| **Surface(lb/yd^3)** | 65.056 | **R^2 Value** | 0.9935 |

Sample:TB3H5-B Blend:20%FA20%S

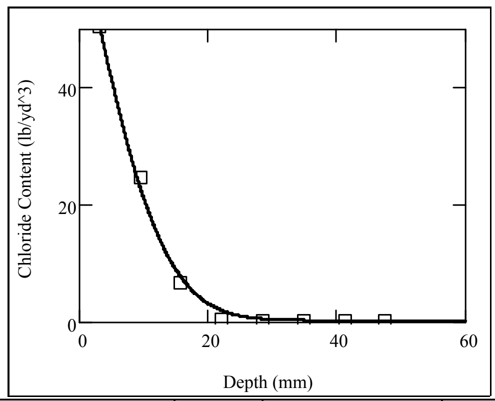
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.923E-12 | **Background(lb/yd^3)** | 0.242 |
| **Surface(lb/yd^3)** | 69.378 | **R^2 Value** | 0.9993 |

Sample:TB4H5-B Blend:10%FA40%S

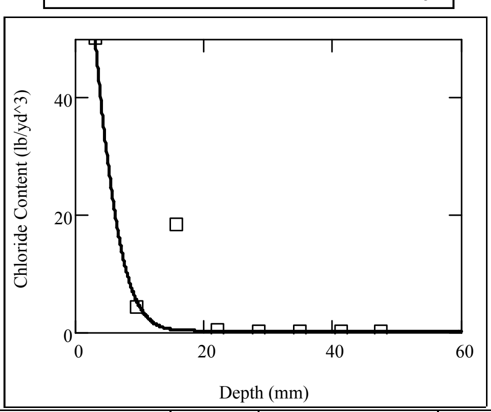
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.560E-12 | **Background(lb/yd^3)** | 0.232 |
| **Surface(lb/yd^3)** | 67.866 | **R^2 Value** | 0.9989 |

Sample:TB3H5-C Blend:20%FA20%S

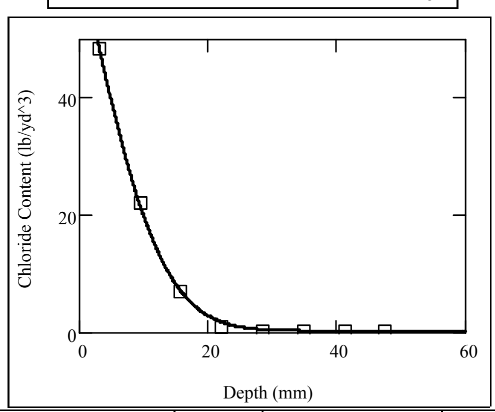
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.938E-13 | **Background(lb/yd^3)** | 0.242 |
| **Surface(lb/yd^3)** | 95.041 | **R^2 Value** | 0.9331 |

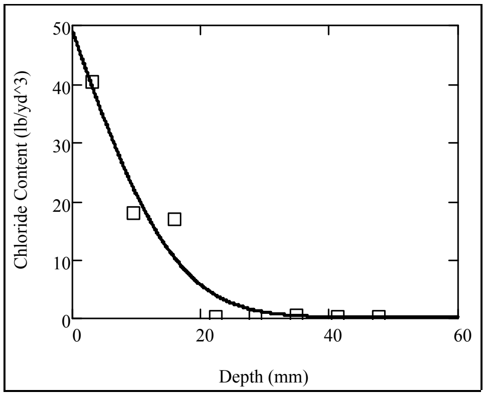
Sample:TB4H5-C Blend:10%FA40%S

Cement:AASHTO Concrete:Class V 365 days



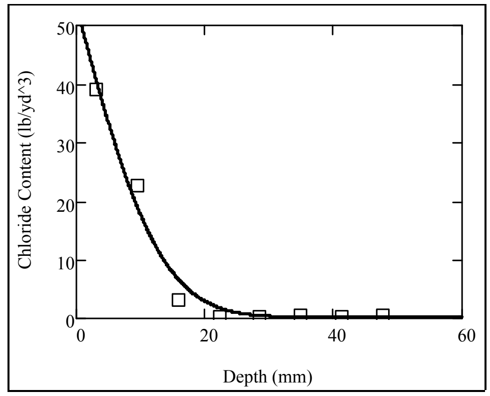

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.512E-12 | **Background(lb/yd^3)** | 0.232 |
| **Surface(lb/yd^3)** | 65.037 | **R^2 Value** | 0.9998 |

Sample:TB5H5-A Blend:30%FA20%S
Cement:AASHTO Concrete:Class V 365 days



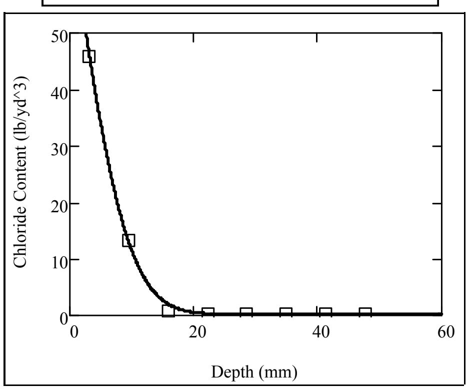

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.522E-12 | **Background(lb/yd^3)** | 0.208 |
| **Surface(lb/yd^3)** | 48.957 | **R^2 Value** | 0.9749 |

Sample:TB6H5-A Blend:20%FA40%S
Cement:AASHTO Concrete:Class V 365 days



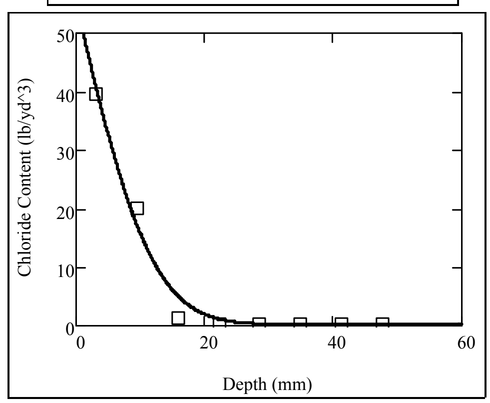

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.665E-12 | **Background(lb/yd^3)** | 0.213 |
| **Surface(lb/yd^3)** | 53.200 | **R^2 Value** | 0.9897 |

Sample:TB5H5-B Blend:30%FA20%S
Cement:AASHTO Concrete:Class V 365 days



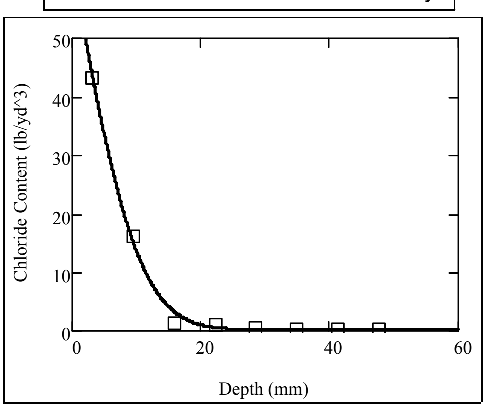

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 8.080E-13 | **Background(lb/yd^3)** | 0.208 |
| **Surface(lb/yd^3)** | 69.925 | **R^2 Value** | 0.9996 |

Sample:TB6H5-B Blend:20%FA40%S
Cement:AASHTO Concrete:Class V 365 days



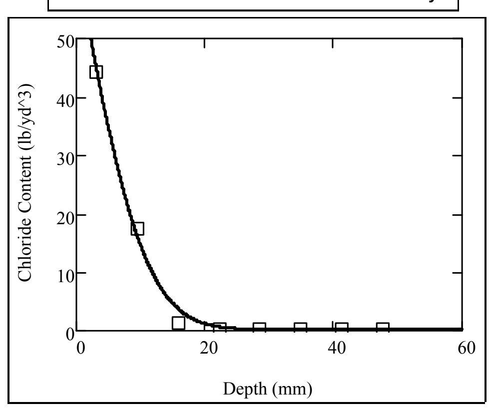

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.376E-12 | **Background(lb/yd^3)** | 0.213 |
| **Surface(lb/yd^3)** | 55.029 | **R^2 Value** | 0.9923 |

Sample:TB5H5-C Blend:30%FA20%S
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.030E-12 | **Background(lb/yd^3)** | 0.208 |
| **Surface(lb/yd^3)** | 62.525 | **R^2 Value** | 0.9985 |

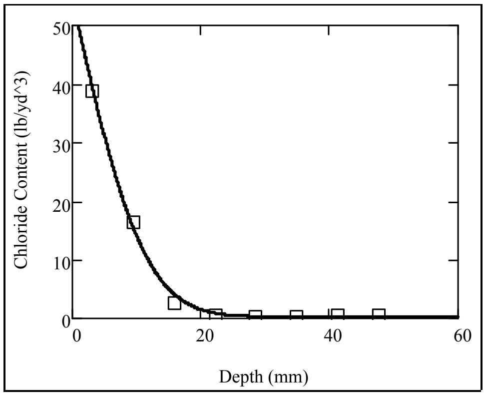
Sample:TB6H5-C Blend:20%FA40%S
Cement:AASHTO Concrete:Class V 365 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.087E-12 | **Background(lb/yd^3)** | 0.213 |
| **Surface(lb/yd^3)** | 63.376 | **R^2 Value** | 0.9976 |

**Sample:TB7H5-A Blend:40%FA20%S**

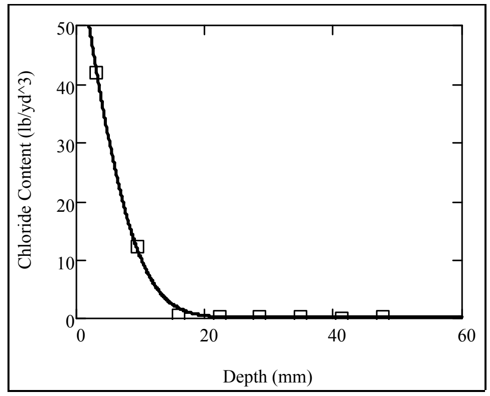
**Cement:AASHTO Concrete:Class V 365 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.221E-12 | **Background(lb/yd^3)** | 0.288 |
| **Surface(lb/yd^3)** | 54.373 | **R^2 Value** | 0.9986 |

**Sample:TB8H5-A Blend:10%FA60%S**

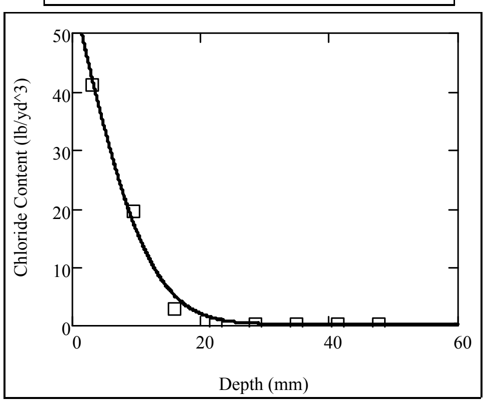
**Cement:AASHTO Concrete:Class V 365 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 8.017E-13 | **Background(lb/yd^3)** | 0.153 |
| **Surface(lb/yd^3)** | 63.865 | **R^2 Value** | 0.9995 |

**Sample:TB7H5-B Blend:40%FA20%S**

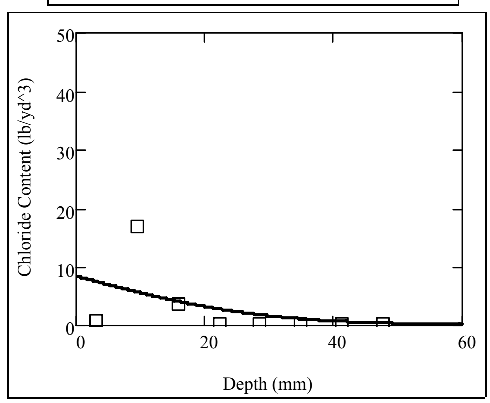
**Cement:AASHTO Concrete:Class V 365 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.361E-12 | **Background(lb/yd^3)** | 0.288 |
| **Surface(lb/yd^3)** | 56.941 | **R^2 Value** | 0.9968 |

**Sample:TB8H5-B Blend:10%FA60%S**

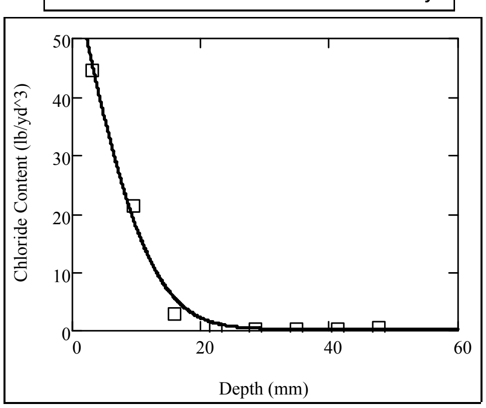
**Cement:AASHTO Concrete:Class V 365 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 7.961E-12 | **Background(lb/yd^3)** | 0.153 |
| **Surface(lb/yd^3)** | 8.428 | **R^2 Value** | 0.4918 |

**Sample:TB7H5-C Blend:40%FA20%S**

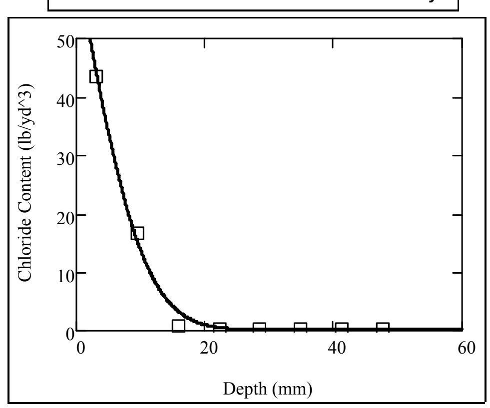
**Cement:AASHTO Concrete:Class V 365 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.365E-12 | **Background(lb/yd^3)** | 0.288 |
| **Surface(lb/yd^3)** | 61.592 | **R^2 Value** | 0.9965 |

**Sample:TB8H5-C Blend:10%FA60%S**

**Cement:AASHTO Concrete:Class V 365 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.038E-12 | **Background(lb/yd^3)** | 0.153 |
| **Surface(lb/yd^3)** | 62.985 | **R^2 Value** | 0.9976 |

## *ASTM Cement - Class IV Concrete (364 days)*

**Sample TB1A4-A**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 43.110 | 43.900 | 43.203 | 43.404 |
| 0.500 | 26.918 | 26.878 | 26.158 | 26.651 |
| 0.750 | 14.025 | 14.031 | 14.257 | 14.104 |
| 1.000 | 5.668 | 5.681 | 5.904 | 5.751 |
| 1.250 | 0.760 | 0.808 | 0.829 | 0.799 |
| 1.500 | 0.697 | 0.657 | 0.628 | 0.661 |

**Sample TB1A4-B**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 42.018 | 41.311 | 41.828 | 41.719 |
| 0.500 | 25.359 | 26.139 | 25.556 | 25.685 |
| 0.750 | 12.773 | 12.923 | 12.959 | 12.885 |
| 1.000 | 3.489 | 3.608 | 3.715 | 3.604 |
| 1.250 | 0.453 | 0.473 | 0.469 | 0.465 |
| 1.500 | 0.265 | 0.240 | 0.250 | 0.252 |

**Sample TB1A4-C**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 45.493 | 45.490 | 46.153 | 45.712 |
| 0.500 | 31.461 | 31.419 | 31.780 | 31.553 |
| 0.750 | 16.699 | 16.605 | 17.202 | 16.835 |
| 1.000 | 8.210 | 8.444 | 8.277 | 8.310 |
| 1.250 | 2.356 | 2.419 | 2.196 | 2.324 |
| 1.500 | 0.317 | 0.322 | 0.347 | 0.329 |

**Sample TB2A4-A**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 35.366 | 35.645 | 35.787 | 35.599 |
| 0.500 | 16.137 | 15.874 | 16.584 | 16.198 |
| 0.750 | 1.373 | 1.525 | 1.664 | 1.521 |
| 1.000 | 0.285 | 0.281 | 0.284 | 0.283 |
| 1.250 | 0.290 | 0.314 | 0.266 | 0.290 |
| 1.500 | 0.241 | 0.270 | 0.267 | 0.259 |

**Sample TB2A4-B**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 40.218 | 40.020 | 39.598 | 39.945 |
| 0.500 | 19.001 | 19.276 | 19.304 | 19.194 |
| 0.750 | 4.719 | 4.767 | 4.519 | 4.668 |
| 1.000 | 0.879 | 0.944 | 0.894 | 0.906 |
| 1.250 | 0.341 | 0.343 | 0.336 | 0.340 |
| 1.500 | 0.360 | 0.384 | 0.359 | 0.368 |

**Sample TB2A4-C**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.375 | 37.809 | 38.042 | 37.742 |
| 0.500 | 18.973 | 18.973 | 19.003 | 18.983 |
| 0.750 | 2.322 | 2.281 | 2.337 | 2.313 |
| 1.000 | 0.250 | 0.252 | 0.284 | 0.262 |
| 1.250 | 0.214 | 0.228 | 0.225 | 0.222 |
| 1.500 | 0.222 | 0.235 | 0.229 | 0.229 |

**Sample TB3A4-A**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 33.460 | 32.758 | 33.051 | 33.090 |
| 0.500 | 27.378 | 27.169 | 27.287 | 27.278 |
| 0.750 | 14.963 | 14.974 | 14.525 | 14.821 |
| 1.000 | 5.762 | 5.803 | 5.703 | 5.756 |
| 1.250 | 0.627 | 0.657 | 0.654 | 0.646 |
| 1.500 | 0.379 | 0.436 | 0.445 | 0.420 |

**Sample TB3A4-B**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 34.024 | 33.336 | 33.737 | 33.699 |
| 0.500 | 26.573 | 26.216 | 26.512 | 26.434 |
| 0.750 | 14.345 | 14.427 | 14.661 | 14.478 |
| 1.000 | 3.421 | 3.289 | 3.319 | 3.343 |
| 1.250 | 0.273 | 0.286 | 0.300 | 0.286 |
| 1.500 | 0.392 | 0.389 | 0.392 | 0.391 |

**Sample TB3A4-C**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 33.892 | 34.607 | 34.495 | 34.331 |
| 0.500 | 26.621 | 25.867 | 26.217 | 26.235 |
| 0.750 | 13.361 | 13.236 | 13.875 | 13.491 |
| 1.000 | 3.163 | 3.288 | 3.194 | 3.215 |
| 1.250 | 0.401 | 0.402 | 0.419 | 0.407 |
| 1.500 | 0.865 | 0.868 | 0.866 | 0.866 |

**Sample TB4A4-A**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.274 | 35.891 | 36.331 | 36.165 |
| 0.500 | 24.873 | 24.868 | 24.834 | 24.858 |
| 0.750 | 11.322 | 11.015 | 10.930 | 11.089 |
| 1.000 | 2.239 | 2.376 | 2.342 | 2.319 |
| 1.250 | 0.247 | 0.230 | 0.252 | 0.243 |
| 1.500 | 0.264 | 0.265 | 0.279 | 0.269 |

**Sample TB4A4-B**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 33.295 | 33.008 | 32.677 | 32.993 |
| 0.500 | 26.093 | 26.708 | 26.653 | 26.485 |
| 0.750 | 8.391 | 8.400 | 8.818 | 8.536 |
| 1.000 | 2.867 | 2.859 | 2.864 | 2.863 |
| 1.250 | 0.205 | 0.222 | 0.233 | 0.220 |
| 1.500 | 0.202 | 0.241 | 0.247 | 0.230 |

**Sample TB4A4-C**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.143 | 35.609 | 36.012 | 35.921 |
| 0.500 | 27.340 | 27.886 | 27.754 | 27.660 |
| 0.750 | 14.405 | 14.255 | 14.241 | 14.300 |
| 1.000 | 2.975 | 3.312 | 3.367 | 3.218 |
| 1.250 | 0.367 | 0.366 | 0.367 | 0.367 |
| 1.500 | 0.307 | 0.312 | 0.309 | 0.309 |

Sample TB5A4-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 32.859 | 32.098 | 32.871 | 32.609 |
| 0.500 | 31.085 | 30.627 | 31.388 | 31.033 |
| 0.750 | 12.793 | 12.886 | 13.006 | 12.895 |
| 1.000 | 2.068 | 2.080 | 2.088 | 2.079 |
| 1.250 | 0.279 | 0.292 | 0.291 | 0.287 |
| 1.500 | 0.539 | 0.518 | 0.550 | 0.536 |

Sample TB5A4-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.391 | 37.999 | 37.859 | 38.083 |
| 0.500 | 29.144 | 28.893 | 29.065 | 29.034 |
| 0.750 | 11.551 | 11.618 | 11.252 | 11.474 |
| 1.000 | 1.042 | 1.087 | 1.085 | 1.071 |
| 1.250 | 0.369 | 0.380 | 0.370 | 0.373 |
| 1.500 | 0.267 | 0.267 | 0.234 | 0.256 |

Sample TB5A4-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 35.169 | 35.344 | 35.566 | 35.360 |
| 0.500 | 29.552 | 29.692 | 30.109 | 29.784 |
| 0.750 | 14.735 | 14.735 | 14.970 | 14.813 |
| 1.000 | 1.740 | 1.759 | 1.796 | 1.765 |
| 1.250 | 0.270 | 0.278 | 0.272 | 0.273 |
| 1.500 | 0.536 | 0.538 | 0.536 | 0.537 |

Sample TB6A4-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 30.311 | 30.045 | 30.333 | 30.230 |
| 0.500 | 20.566 | 20.682 | 19.984 | 20.411 |
| 0.750 | 6.837 | 6.737 | 7.076 | 6.883 |
| 1.000 | 0.935 | 0.931 | 0.935 | 0.934 |
| 1.250 | 0.258 | 0.261 | 0.254 | 0.258 |
| 1.500 | 0.245 | 0.269 | 0.233 | 0.249 |

Sample TB6A4-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 29.330 | 29.591 | 29.553 | 29.491 |
| 0.500 | 18.458 | 18.672 | 18.370 | 18.500 |
| 0.750 | 5.024 | 4.929 | 5.043 | 4.999 |
| 1.000 | 1.633 | 1.586 | 1.577 | 1.599 |
| 1.250 | 0.358 | 0.351 | 0.363 | 0.357 |
| 1.500 | 0.421 | 0.414 | 0.408 | 0.414 |

Sample TB6A4-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 39.040 | 38.869 | 38.468 | 38.792 |
| 0.500 | 24.656 | 24.793 | 24.844 | 24.764 |
| 0.750 | 8.021 | 8.240 | 8.448 | 8.236 |
| 1.000 | 1.544 | 1.565 | 1.563 | 1.557 |
| 1.250 | 0.362 | 0.347 | 0.345 | 0.351 |
| 1.500 | 0.221 | 0.214 | 0.226 | 0.220 |

Sample TB7A4-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.190 | 37.722 | 37.506 | 37.806 |
| 0.500 | 25.749 | 25.950 | 25.995 | 25.898 |
| 0.750 | 7.195 | 7.542 | 7.286 | 7.341 |
| 1.000 | 0.871 | 0.861 | 0.877 | 0.870 |
| 1.250 | 0.297 | 0.299 | 0.323 | 0.306 |
| 1.500 | 0.226 | 0.235 | 0.236 | 0.232 |

Sample TB7A4-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 33.819 | 33.451 | 33.526 | 33.599 |
| 0.500 | 25.231 | 25.271 | 24.865 | 25.122 |
| 0.750 | 8.530 | 8.467 | 8.761 | 8.586 |
| 1.000 | 1.398 | 1.325 | 1.351 | 1.358 |
| 1.250 | 0.316 | 0.323 | 0.334 | 0.324 |
| 1.500 | 0.204 | 0.206 | 0.277 | 0.229 |

Sample TB7A4-C

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.867 | 36.144 | 36.720 | 36.577 |
| 0.500 | 31.338 | 31.779 | 30.999 | 31.372 |
| 0.750 | 14.034 | 14.266 | 14.634 | 14.311 |
| 1.000 | 3.070 | 3.287 | 3.156 | 3.171 |
| 1.250 | 0.538 | 0.551 | 0.567 | 0.552 |
| 1.500 | 0.580 | 0.586 | 0.616 | 0.594 |

Sample TB8A4-A

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 31.825 | 31.566 | 31.122 | 31.504 |
| 0.500 | 18.287 | 18.444 | 18.392 | 18.374 |
| 0.750 | 3.511 | 3.730 | 3.550 | 3.597 |
| 1.000 | 0.403 | 0.389 | 0.385 | 0.392 |
| 1.250 | 0.338 | 0.347 | 0.350 | 0.345 |
| 1.500 | 0.212 | 0.262 | 0.261 | 0.245 |

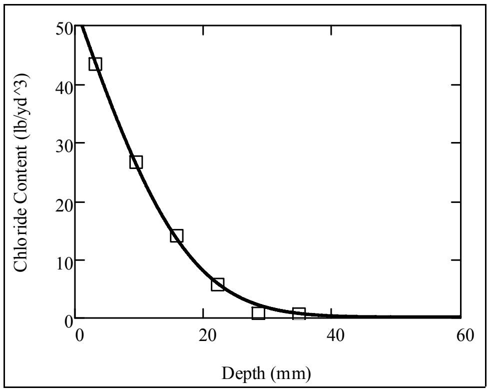
Sample TB8A4-B

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 31.655 | 31.122 | 31.269 | 31.349 |
| 0.500 | 16.689 | 16.392 | 16.719 | 16.600 |
| 0.750 | 3.198 | 3.179 | 3.118 | 3.165 |
| 1.000 | 0.379 | 0.340 | 0.378 | 0.366 |
| 1.250 | 0.237 | 0.263 | 0.265 | 0.255 |
| 1.500 | 0.291 | 0.311 | 0.283 | 0.295 |

Sample TB8A4-C

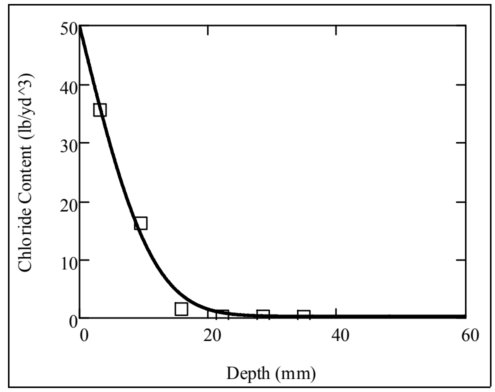
| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 31.676 | 31.433 | 31.961 | 31.690 |
| 0.500 | 20.462 | 20.111 | 20.343 | 20.305 |
| 0.750 | 4.446 | 4.049 | 4.382 | 4.292 |
| 1.000 | 0.414 | 0.412 | 0.433 | 0.420 |
| 1.250 | 0.215 | 0.186 | 0.201 | 0.201 |
| 1.500 | 0.210 | 0.201 | 0.190 | 0.200 |

| Sample:TB1A4-A Blend:20%FA |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



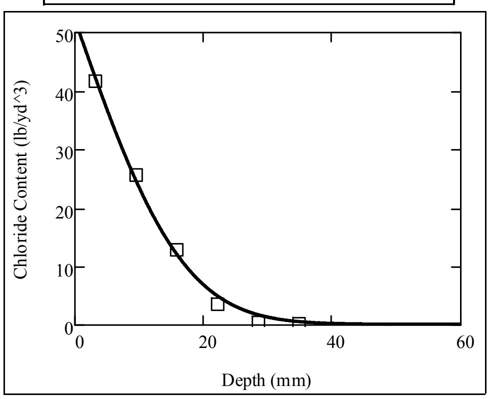

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.044E-12 | **Background(lb/yd^3)** | 0.192 |
| **Surface(lb/yd^3)** | 53.334 | **R^2 Value** | 0.9992 |

| Sample:TB2A4-A Blend:20%FA7%SF |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



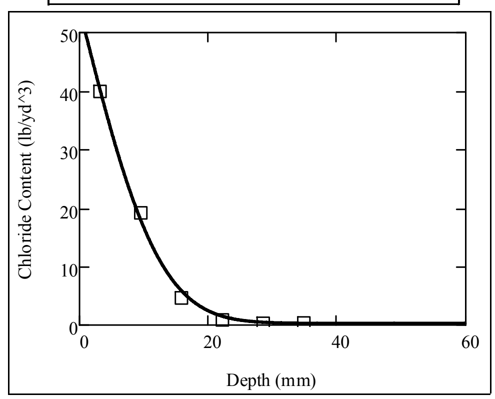

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.250E-12 | **Background(lb/yd^3)** | 0.328 |
| **Surface(lb/yd^3)** | 49.935 | **R^2 Value** | 0.9956 |

| Sample:TB1A4-B Blend:20%FA |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



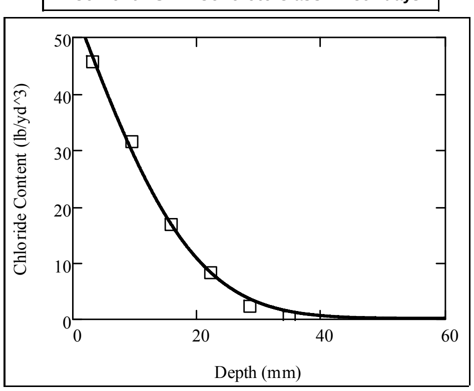

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.773E-12 | **Background(lb/yd^3)** | 0.192 |
| **Surface(lb/yd^3)** | 52.191 | **R^2 Value** | 0.9983 |

| Sample:TB2A4-B Blend:20%FA7%SF |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



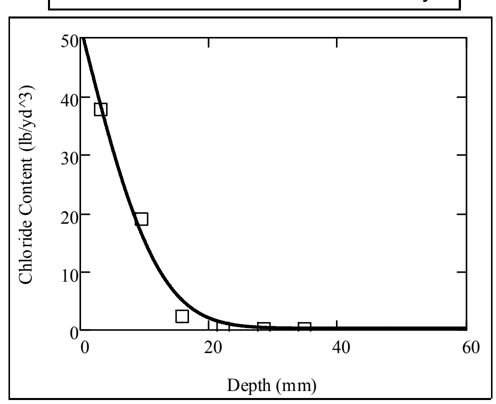

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.511E-12 | **Background(lb/yd^3)** | 0.328 |
| **Surface(lb/yd^3)** | 54.009 | **R^2 Value** | 0.9987 |

| Sample:TB1A4-C Blend:20%FA |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



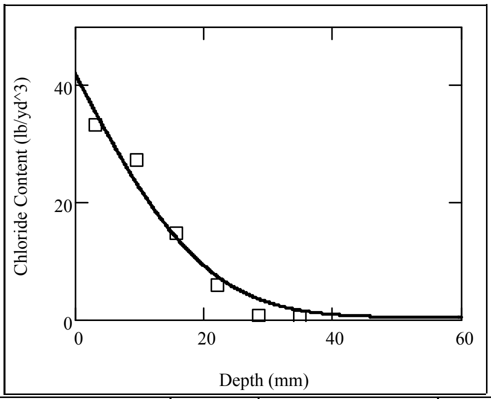

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.734E-12 | **Background(lb/yd^3)** | 0.192 |
| **Surface(lb/yd^3)** | 55.752 | **R^2 Value** | 0.9983 |

| Sample:TB2A4-C Blend:20%FA7%SF |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



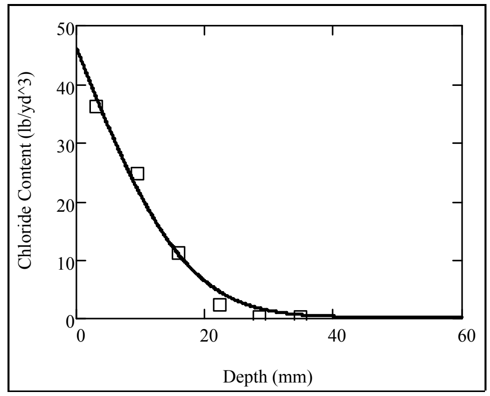

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.413E-12 | **Background(lb/yd^3)** | 0.328 |
| **Surface(lb/yd^3)** | 52.066 | **R^2 Value** | 0.9941 |

| Sample:TB3A4-A Blend:20%FA20%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



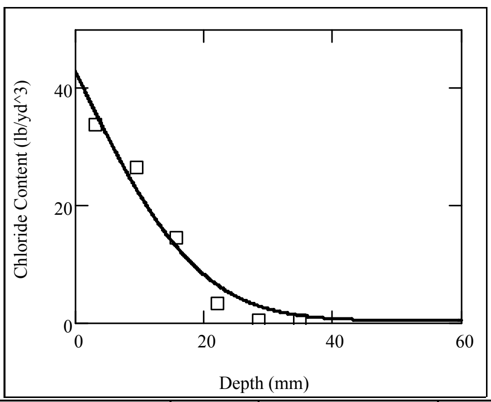

| Diffusion(m^2/sec) | 4.113E-12 | Background(lb/yd^3) | 0.341 |
|---|---|---|---|
| Surface(lb/yd^3) | 41.949 | R^2 Value | 0.9844 |

| Sample:TB4A4-A Blend:10%FA40%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



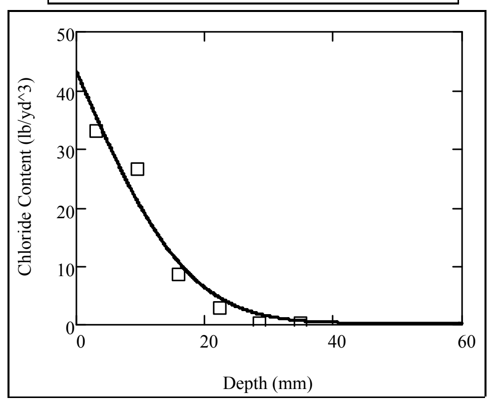

| Diffusion(m^2/sec) | 2.820E-12 | Background(lb/yd^3) | 0.270 |
|---|---|---|---|
| Surface(lb/yd^3) | 46.155 | R^2 Value | 0.9931 |

| Sample:TB3A4-B Blend:20%FA20%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



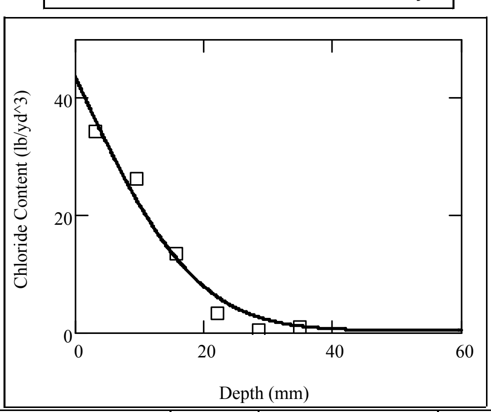

| Diffusion(m^2/sec) | 3.619E-12 | Background(lb/yd^3) | 0.341 |
|---|---|---|---|
| Surface(lb/yd^3) | 42.962 | R^2 Value | 0.9840 |

| Sample:TB4A4-B Blend:10%FA40%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



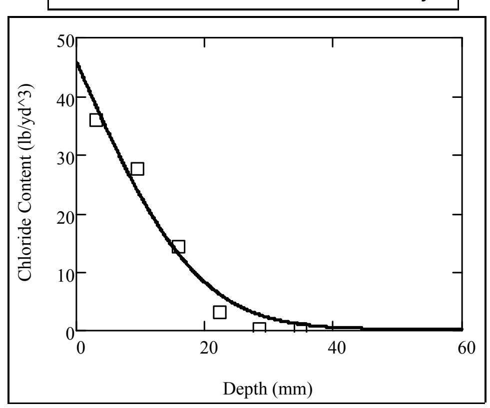

| Diffusion(m^2/sec) | 2.941E-12 | Background(lb/yd^3) | 0.270 |
|---|---|---|---|
| Surface(lb/yd^3) | 43.200 | R^2 Value | 0.9788 |

| Sample:TB3A4-C Blend:20%FA20%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



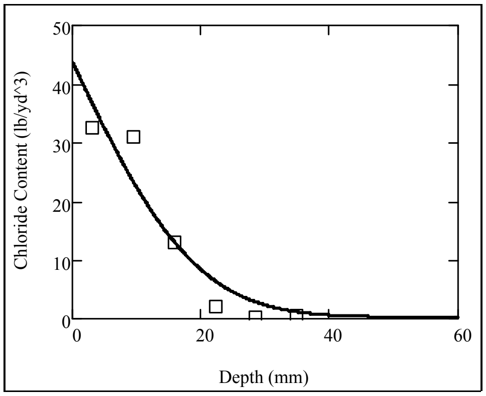

| Diffusion(m^2/sec) | 3.440E-12 | Background(lb/yd^3) | 0.341 |
|---|---|---|---|
| Surface(lb/yd^3) | 43.664 | R^2 Value | 0.9868 |

| Sample:TB4A4-C Blend:10%FA40%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



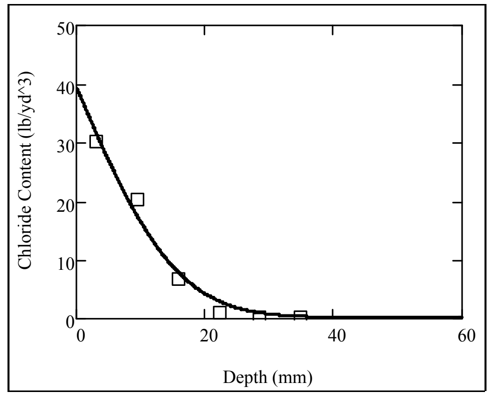

| Diffusion(m^2/sec) | 3.455E-12 | Background(lb/yd^3) | 0.270 |
|---|---|---|---|
| Surface(lb/yd^3) | 45.818 | R^2 Value | 0.9862 |

| |
|---|
| **Sample:TB5A4-A Blend:30%FA20%S** |
| **Cement:ASTM Concrete:Class IV 364 days** |



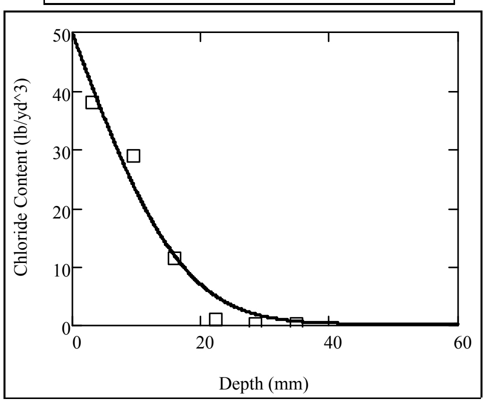

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.637E-12 | **Background(lb/yd^3)** | 0.287 |
| **Surface(lb/yd^3)** | 43.757 | **R^2 Value** | 0.9572 |

| |
|---|
| **Sample:TB6A4-A Blend:20%FA40%S** |
| **Cement:ASTM Concrete:Class IV 364 days** |



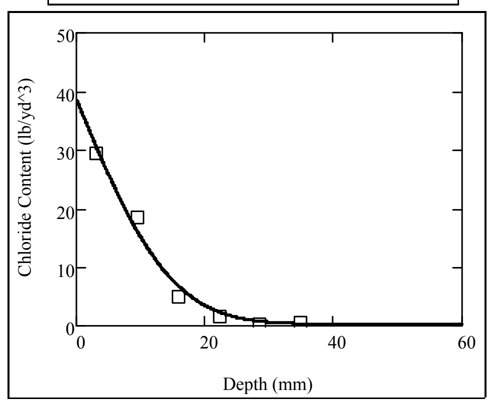

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.393E-12 | **Background(lb/yd^3)** | 0.249 |
| **Surface(lb/yd^3)** | 39.433 | **R^2 Value** | 0.9906 |

| |
|---|
| **Sample:TB5A4-B Blend:30%FA20%S** |
| **Cement:ASTM Concrete:Class IV 364 days** |



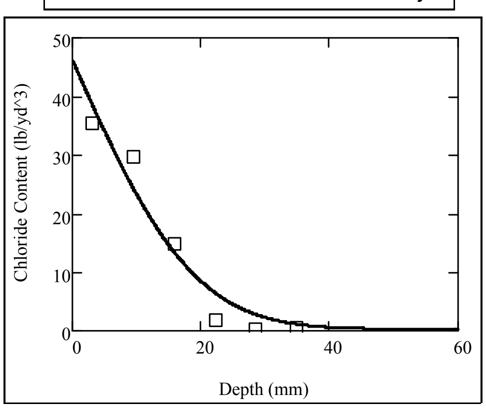

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.848E-12 | **Background(lb/yd^3)** | 0.287 |
| **Surface(lb/yd^3)** | 49.717 | **R^2 Value** | 0.9825 |

| |
|---|
| **Sample:TB6A4-B Blend:20%FA40%S** |
| **Cement:ASTM Concrete:Class IV 364 days** |



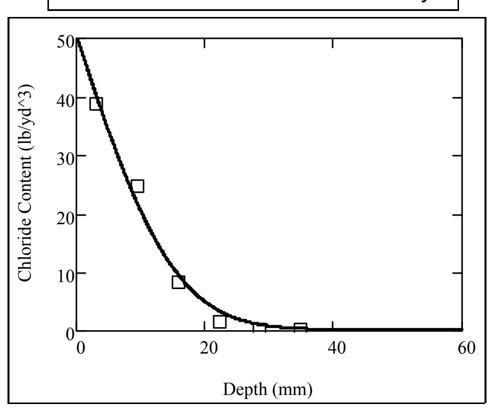

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.130E-12 | **Background(lb/yd^3)** | 0.249 |
| **Surface(lb/yd^3)** | 38.644 | **R^2 Value** | 0.9928 |

| |
|---|
| **Sample:TB5A4-C Blend:30%FA20%S** |
| **Cement:ASTM Concrete:Class IV 364 days** |



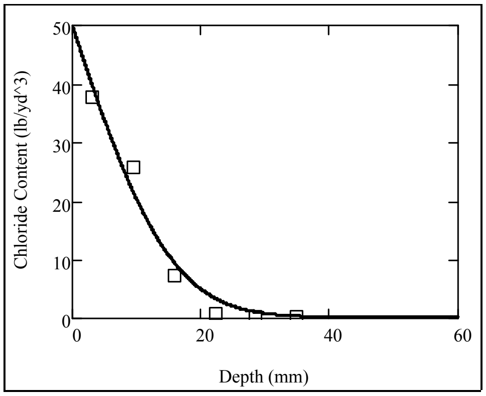

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.507E-12 | **Background(lb/yd^3)** | 0.287 |
| **Surface(lb/yd^3)** | 46.183 | **R^2 Value** | 0.9727 |

| |
|---|
| **Sample:TB6A4-C Blend:20%FA40%S** |
| **Cement:ASTM Concrete:Class IV 364 days** |



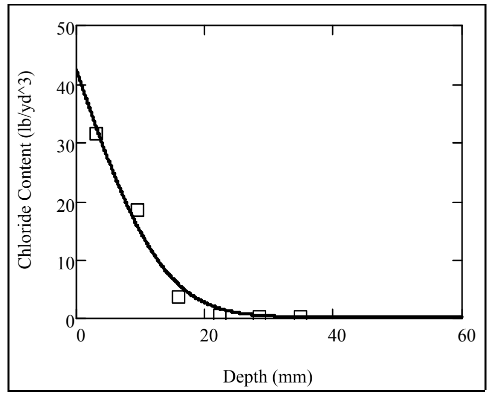

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.287E-12 | **Background(lb/yd^3)** | 0.249 |
| **Surface(lb/yd^3)** | 50.449 | **R^2 Value** | 0.9940 |

| Sample:TB7A4-A Blend:40%FA20%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



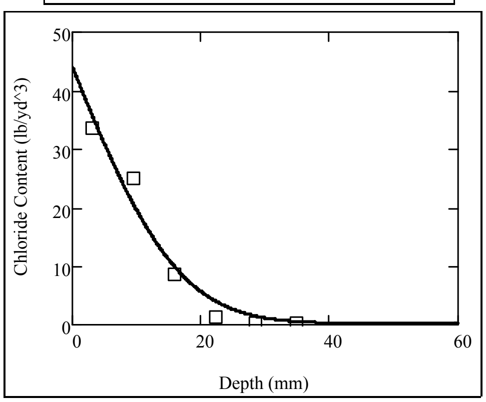

| Diffusion(m^2/sec) | 2.295E-12 | Background(lb/yd^3) | 0.232 |
|---|---|---|---|
| Surface(lb/yd^3) | 49.819 | R^2 Value | 0.9875 |

| Sample:TB8A4-A Blend:10%FA60%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



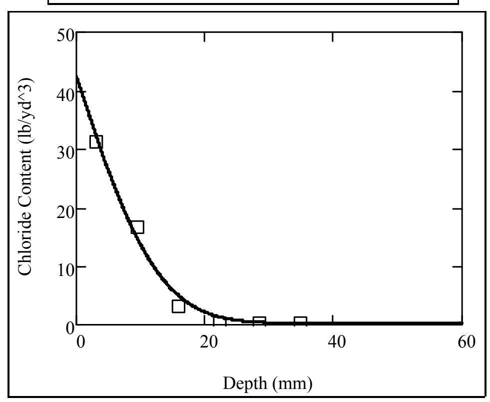

| Diffusion(m^2/sec) | 1.767E-12 | Background(lb/yd^3) | 0.245 |
|---|---|---|---|
| Surface(lb/yd^3) | 42.325 | R^2 Value | 0.9918 |

| Sample:TB7A4-B Blend:40%FA20%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



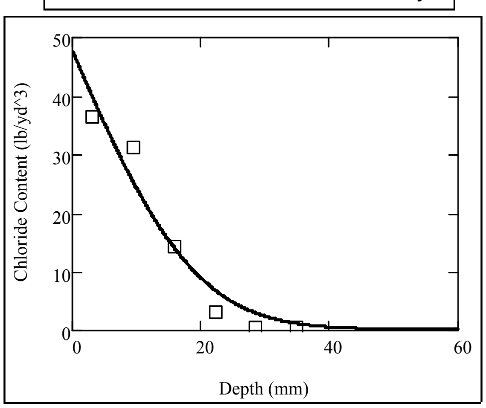

| Diffusion(m^2/sec) | 2.692E-12 | Background(lb/yd^3) | 0.232 |
|---|---|---|---|
| Surface(lb/yd^3) | 43.957 | R^2 Value | 0.9840 |

| Sample:TB8A4-B Blend:10%FA60%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |



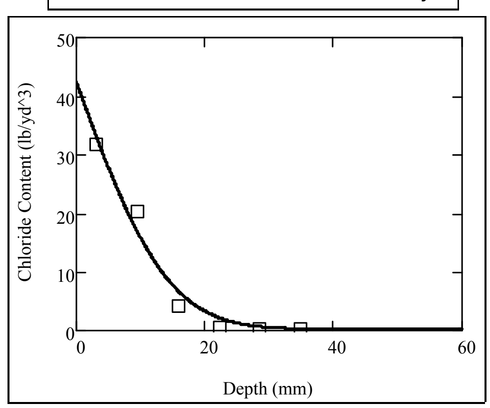

| Diffusion(m^2/sec) | 1.590E-12 | Background(lb/yd^3) | 0.245 |
|---|---|---|---|
| Surface(lb/yd^3) | 42.448 | R^2 Value | 0.9952 |

| Sample:TB7A4-C Blend:40%FA20%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |




| Diffusion(m^2/sec) | 3.600E-12 | Background(lb/yd^3) | 0.232 |
|---|---|---|---|
| Surface(lb/yd^3) | 47.680 | R^2 Value | 0.9751 |

| Sample:TB8A4-C Blend:10%FA60%S |
|---|
| Cement:ASTM Concrete:Class IV 364 days |




| Diffusion(m^2/sec) | 1.969E-12 | Background(lb/yd^3) | 0.245 |
|---|---|---|---|
| Surface(lb/yd^3) | 42.348 | R^2 Value | 0.9878 |

## ASTM CEMENT - CLASS V CONCRETE (364 DAYS)

Sample TB1A5-A

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 48.999 | 48.964 | 48.914 | 48.959 |
| 0.500 | 33.590 | 33.443 | 32.957 | 33.330 |
| 0.750 | 18.925 | 19.396 | 19.285 | 19.202 |
| 1.000 | 9.979 | 10.219 | 10.108 | 10.102 |
| 1.250 | 2.937 | 3.256 | 3.109 | 3.101 |
| 1.500 | 0.472 | 0.474 | 0.458 | 0.468 |

Sample TB1A5-B

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 43.424 | 43.031 | 43.733 | 43.396 |
| 0.500 | 27.634 | 27.831 | 28.153 | 27.873 |
| 0.750 | 18.702 | 18.680 | 18.750 | 18.711 |
| 1.000 | 9.834 | 10.214 | 9.524 | 9.857 |
| 1.250 | 3.428 | 3.511 | 3.680 | 3.540 |
| 1.500 | 0.877 | 0.928 | 0.851 | 0.885 |

Sample TB1A5-C

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 50.146 | 49.627 | 50.074 | 49.949 |
| 0.500 | 32.020 | 31.584 | 32.217 | 31.940 |
| 0.750 | 18.633 | 18.883 | 18.847 | 18.788 |
| 1.000 | 8.528 | 8.502 | 8.573 | 8.534 |
| 1.250 | 3.600 | 2.867 | 2.921 | 3.129 |
| 1.500 | 0.379 | 0.354 | 0.399 | 0.377 |

Sample TB2A5-A

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 34.282 | 33.854 | 34.546 | 34.227 |
| 0.500 | 24.203 | 24.496 | 25.000 | 24.566 |
| 0.750 | 8.374 | 8.416 | 8.805 | 8.532 |
| 1.000 | 0.644 | 0.664 | 0.677 | 0.662 |
| 1.250 | 0.264 | 0.254 | 0.276 | 0.265 |
| 1.500 | 0.256 | 0.253 | 0.252 | 0.254 |

Sample TB2A5-B

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.099 | 35.950 | 35.972 | 36.007 |
| 0.500 | 26.811 | 26.797 | 26.243 | 26.617 |
| 0.750 | 8.072 | 7.905 | 7.601 | 7.859 |
| 1.000 | 0.617 | 0.634 | 0.632 | 0.628 |
| 1.250 | 0.274 | 0.287 | 0.305 | 0.289 |
| 1.500 | 0.254 | 0.283 | 0.281 | 0.273 |

Sample TB2A5-C

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 33.821 | 34.228 | 33.931 | 33.993 |
| 0.500 | 25.943 | 25.821 | 25.527 | 25.764 |
| 0.750 | 5.552 | 5.602 | 5.386 | 5.513 |
| 1.000 | 0.409 | 0.419 | 0.404 | 0.411 |
| 1.250 | 0.279 | 0.312 | 0.278 | 0.290 |
| 1.500 | 0.272 | 0.283 | 0.284 | 0.280 |

Sample TB3A5-A

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.701 | 37.252 | 37.135 | 37.363 |
| 0.500 | 30.488 | 30.751 | 30.639 | 30.626 |
| 0.750 | 12.081 | 12.697 | 12.668 | 12.482 |
| 1.000 | 2.423 | 2.522 | 2.393 | 2.446 |
| 1.250 | 0.320 | 0.296 | 0.292 | 0.303 |
| 1.500 | 0.221 | 0.218 | 0.231 | 0.223 |

Sample TB3A5-B

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 39.944 | 39.473 | 39.579 | 39.665 |
| 0.500 | 28.619 | 28.689 | 28.237 | 28.515 |
| 0.750 | 13.176 | 13.691 | 13.772 | 13.546 |
| 1.000 | 0.551 | 0.546 | * | 0.549 |
| 1.250 | 0.259 | 0.264 | 0.253 | 0.259 |
| 1.500 | 0.207 | 0.226 | 0.188 | 0.207 |

Sample TB3A5-C

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 40.521 | 40.198 | 40.570 | 40.430 |
| 0.500 | 32.013 | 32.382 | 32.541 | 32.312 |
| 0.750 | 13.531 | 13.336 | 13.945 | 13.604 |
| 1.000 | 1.668 | 1.726 | 1.727 | 1.707 |
| 1.250 | 0.279 | 0.292 | 0.290 | 0.287 |
| 1.500 | 0.245 | 0.230 | 0.232 | 0.236 |

Sample TB4A5-A

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 40.120 | 40.034 | 40.778 | 40.311 |
| 0.500 | 38.800 | 38.096 | 38.661 | 38.519 |
| 0.750 | 14.764 | 14.796 | 14.992 | 14.851 |
| 1.000 | 1.741 | 1.760 | 1.778 | 1.760 |
| 1.250 | 0.231 | 0.239 | 0.230 | 0.233 |
| 1.500 | 0.200 | 0.197 | 0.245 | 0.214 |

Sample TB4A5-B

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 42.034 | 42.438 | 41.743 | 42.072 |
| 0.500 | 27.888 | 28.041 | 28.429 | 28.119 |
| 0.750 | 9.596 | 9.382 | 9.399 | 9.459 |
| 1.000 | 0.853 | 0.860 | 0.858 | 0.857 |
| 1.250 | 0.213 | 0.201 | 0.177 | 0.197 |
| 1.500 | 0.187 | 0.185 | 0.175 | 0.182 |

Sample TB4A5-C

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 42.774 | 42.878 | 42.312 | 42.655 |
| 0.500 | 30.660 | 31.298 | 31.023 | 30.994 |
| 0.750 | 11.782 | 11.723 | 11.775 | 11.760 |
| 1.000 | 1.323 | 1.320 | 1.390 | 1.344 |
| 1.250 | 0.235 | 0.219 | 0.220 | 0.225 |
| 1.500 | 0.180 | 0.175 | 0.185 | 0.180 |

Sample TB5A5-A

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.942 | 37.036 | 36.540 | 36.839 |
| 0.500 | 27.880 | 27.192 | 27.133 | 27.402 |
| 0.750 | 8.601 | 9.030 | 9.076 | 8.902 |
| 1.000 | 0.882 | 0.914 | 0.901 | 0.899 |
| 1.250 | 0.258 | 0.226 | 0.246 | 0.243 |
| 1.500 | 0.243 | 0.234 | 0.216 | 0.231 |

Sample TB5A5-B

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.507 | 38.630 | 37.876 | 38.338 |
| 0.500 | 25.050 | 25.205 | 25.461 | 25.239 |
| 0.750 | 6.064 | 6.080 | 6.133 | 6.092 |
| 1.000 | 0.887 | 0.886 | 0.889 | 0.887 |
| 1.250 | 0.197 | 0.237 | 0.202 | 0.212 |
| 1.500 | 0.210 | 0.190 | 0.205 | 0.202 |

Sample TB5A5-C

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 29.159 | 29.387 | 29.420 | 29.322 |
| 0.500 | 11.205 | 11.169 | 11.135 | 11.170 |
| 0.750 | 1.168 | 1.179 | 1.203 | 1.183 |
| 1.000 | 0.247 | 0.263 | 0.251 | 0.254 |
| 1.250 | 0.187 | 0.177 | 0.180 | 0.181 |
| 1.500 | 0.193 | 0.169 | 0.159 | 0.174 |

Sample TB6A5-A

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.768 | 38.573 | 39.209 | 38.850 |
| 0.500 | 27.109 | 27.197 | 26.898 | 27.068 |
| 0.750 | 5.923 | 5.744 | 5.552 | 5.740 |
| 1.000 | 0.380 | 0.387 | 0.397 | 0.388 |
| 1.250 | 0.182 | 0.215 | 0.175 | 0.191 |
| 1.500 | 0.179 | 0.149 | 0.167 | 0.165 |

Sample TB6A5-B

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 35.020 | 35.054 | 35.440 | 35.171 |
| 0.500 | 22.183 | 22.240 | 22.436 | 22.286 |
| 0.750 | 7.441 | 7.786 | 7.441 | 7.556 |
| 1.000 | 1.501 | 1.560 | 1.575 | 1.545 |
| 1.250 | 0.515 | 0.504 | 0.516 | 0.512 |
| 1.500 | 0.189 | 0.196 | 0.192 | 0.192 |

Sample TB6A5-C

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 34.628 | 34.927 | 34.994 | 34.850 |
| 0.500 | 26.235 | 26.613 | 26.268 | 26.372 |
| 0.750 | 6.796 | 6.818 | 6.773 | 6.796 |
| 1.000 | 0.663 | 0.739 | 0.681 | 0.694 |
| 1.250 | 0.384 | 0.378 | 0.371 | 0.378 |
| 1.500 | 0.337 | 0.329 | 0.327 | 0.331 |

Sample TB7A5-A

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 32.074 | 32.755 | 32.229 | 32.353 |
| 0.500 | 24.959 | 25.149 | 25.450 | 25.186 |
| 0.750 | 7.114 | 6.945 | 6.876 | 6.978 |
| 1.000 | 0.688 | 0.705 | 0.688 | 0.694 |
| 1.250 | 0.299 | 0.302 | 0.316 | 0.306 |
| 1.500 | 0.286 | 0.297 | 0.261 | 0.281 |

Sample TB7A5-B

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 33.290 | 33.678 | 33.344 | 33.437 |
| 0.500 | 24.061 | 24.219 | 23.935 | 24.072 |
| 0.750 | 7.425 | 6.789 | 7.001 | 7.072 |
| 1.000 | 0.676 | 0.705 | 0.713 | 0.698 |
| 1.250 | 0.359 | 0.365 | 0.411 | 0.378 |
| 1.500 | 0.332 | 0.352 | 0.328 | 0.337 |

Sample TB7A5-C

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 34.881 | 34.993 | 35.060 | 34.978 |
| 0.500 | 25.249 | 24.761 | 25.114 | 25.041 |
| 0.750 | 6.988 | 7.243 | 7.158 | 7.130 |
| 1.000 | 1.015 | 1.050 | 1.014 | 1.026 |
| 1.250 | 0.393 | 0.382 | 0.391 | 0.389 |
| 1.500 | 0.324 | 0.344 | 0.378 | 0.349 |

Sample TB8A5-A

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 34.884 | 34.763 | 34.884 | 34.844 |
| 0.500 | 24.420 | 24.595 | 24.354 | 24.456 |
| 0.750 | 4.612 | 4.469 | 4.727 | 4.603 |
| 1.000 | 0.347 | 0.341 | 0.358 | 0.349 |
| 1.250 | 0.232 | 0.208 | 0.201 | 0.214 |
| 1.500 | 0.219 | 0.217 | 0.225 | 0.220 |

Sample TB8A5-B

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 35.966 | 36.573 | 36.635 | 36.391 |
| 0.500 | 20.776 | 21.571 | 21.227 | 21.191 |
| 0.750 | 2.253 | 2.251 | 2.255 | 2.253 |
| 1.000 | 0.229 | 0.264 | 0.244 | 0.246 |
| 1.250 | 0.181 | 0.202 | 0.201 | 0.195 |
| 1.500 | 0.204 | 0.208 | 0.227 | 0.213 |

Sample TB8A5-C

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 39.047 | 39.517 | 39.215 | 39.260 |
| 0.500 | 21.721 | 22.069 | 21.373 | 21.721 |
| 0.750 | 5.747 | 5.717 | 5.790 | 5.751 |
| 1.000 | 0.415 | 0.424 | 0.421 | 0.419 |
| 1.250 | 0.239 | 0.244 | 0.255 | 0.246 |
| 1.500 | 0.199 | 0.189 | 0.177 | 0.188 |

**Sample TB6A5-A1**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.953 | 37.605 | 38.295 | 37.951 |
| 0.500 | 26.486 | 26.396 | 25.962 | 26.281 |
| 0.750 | 3.461 | 3.872 | 3.798 | 3.710 |
| 1.000 | 1.570 | 0.163 | 0.165 | 0.162 |
| 1.250 | 0.122 | 0.129 | 0.126 | 0.126 |
| 1.500 | 0.125 | 0.123 | 0.129 | 0.126 |
| 1.750 | 0.160 | 0.160 | 0.104 | 0.141 |
| 2.000 | 0.145 | 0.153 | 0.159 | 0.152 |

**Sample TB6A5-B1**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.117 | 36.893 | 37.575 | 37.195 |
| 0.500 | 25.607 | 25.216 | 25.595 | 25.473 |
| 0.750 | 7.475 | 7.857 | 7.697 | 7.676 |
| 1.000 | 1.958 | 1.915 | 1.999 | 1.957 |
| 1.250 | 1.286 | 1.266 | 1.300 | 1.284 |
| 1.500 | 1.197 | 1.179 | 1.194 | 1.190 |
| 1.750 | 1.307 | 1.284 | 1.322 | 1.304 |
| 2.000 | 1.310 | 1.288 | 1.308 | 1.302 |

**Sample TB6A5-C1**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 39.536 | 38.822 | 39.325 | 39.228 |
| 0.500 | 20.128 | 19.700 | 20.007 | 19.945 |
| 0.750 | 2.386 | 2.178 | 2.356 | 2.307 |
| 1.000 | 0.306 | 0.285 | 0.294 | 0.295 |
| 1.250 | 0.237 | 0.236 | 0.232 | 0.235 |
| 1.500 | 0.227 | 0.224 | 0.299 | 0.250 |
| 1.750 | 0.208 | 0.201 | 0.205 | 0.205 |
| 2.000 | 0.173 | 0.173 | 0.162 | 0.169 |

**Sample TB7A5-A1**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.541 | 35.974 | 36.684 | 36.400 |
| 0.500 | 23.835 | 24.003 | 24.230 | 24.023 |
| 0.750 | 5.677 | 5.677 | 6.012 | 5.789 |
| 1.000 | 0.393 | 0.402 | 0.431 | 0.409 |
| 1.250 | 0.143 | 0.156 | 0.138 | 0.146 |
| 1.500 | 0.132 | 0.190 | 0.142 | 0.155 |
| 1.750 | 0.145 | 0.154 | 0.150 | 0.150 |
| 2.000 | 0.160 | 0.161 | 0.151 | 0.157 |

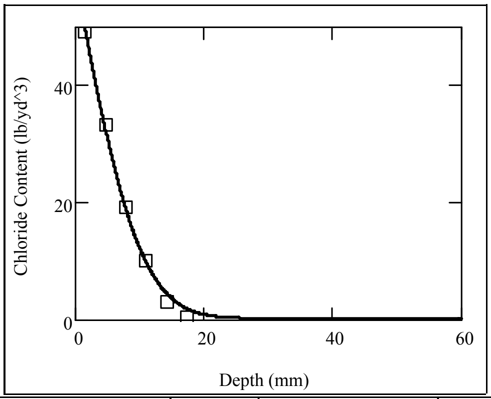
**Sample TB7A5-B1**

| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 35.541 | 35.486 | 35.254 | 17.896 |
| 0.500 | 29.899 | 30.252 | 29.563 | 15.200 |
| 0.750 | 9.4.4 | 9.572 | 9.687 | 0.750 |
| 1.000 | 0.570 | 0.583 | 0.550 | 0.785 |
| 1.250 | 0.161 | 0.179 | 0.178 | 0.706 |
| 1.500 | 0.226 | 0.215 | 0.197 | 0.863 |
| 1.750 | 0.192 | 0.181 | 0.179 | 0.971 |
| 2.000 | 0.174 | 0.184 | 0.174 | 1.087 |

**Sample TB7A5-C1**

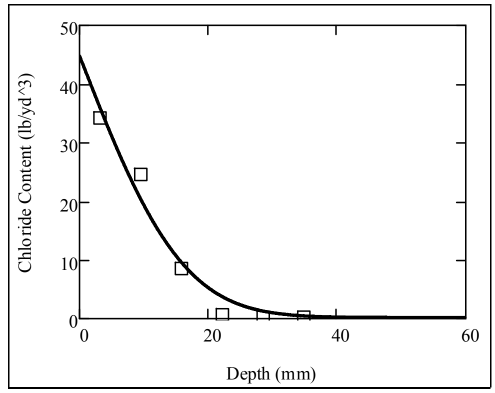
| Depth (in) | NaCl (lb/yd$^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.859 | 38.097 | 38.494 | 38.483 |
| 0.500 | 23.263 | 23.710 | 22.963 | 23.312 |
| 0.750 | 4.286 | 4.239 | 4.220 | 4.248 |
| 1.000 | 0.412 | 0.394 | 0.369 | 0.392 |
| 1.250 | 0.393 | 0.377 | 0.390 | 0.387 |
| 1.500 | 0.305 | 0.332 | 0.311 | 0.316 |
| 1.750 | 0.332 | 0.346 | 0.332 | 0.337 |
| 2.000 | 0.403 | 0.405 | 0.419 | 0.409 |

| Sample:TB1A5-A Blend:20%FA |
|---|
| Cement:ASTM Concrete:Class V 364 days |



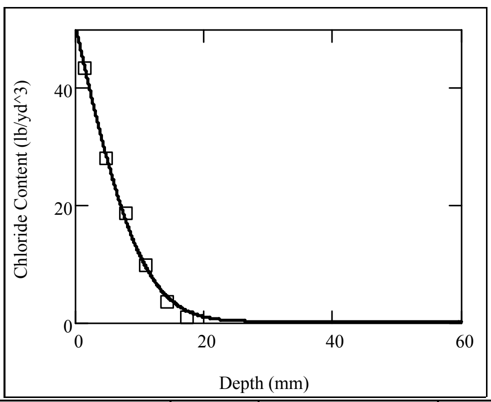

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.005E-12 | **Background(lb/yd^3)** | 0.185 |
| **Surface(lb/yd^3)** | 58.886 | **R^2 Value** | 0.9989 |

| Sample:TB2A5-A Blend:20%FA7%SF |
|---|
| Cement:ASTM Concrete:Class V 364 days |



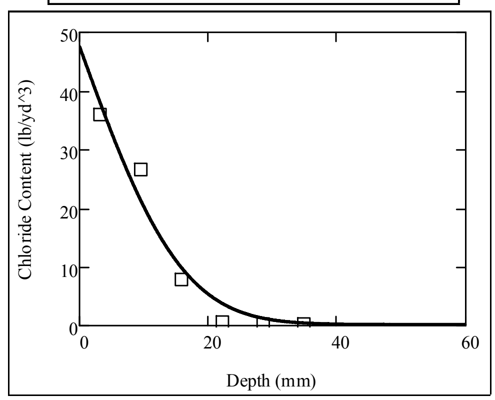

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.548E-12 | **Background(lb/yd^3)** | 0.222 |
| **Surface(lb/yd^3)** | 44.812 | **R^2 Value** | 0.9859 |

| Sample:TB1A5-B Blend:20%FA |
|---|
| Cement:ASTM Concrete:Class V 364 days |



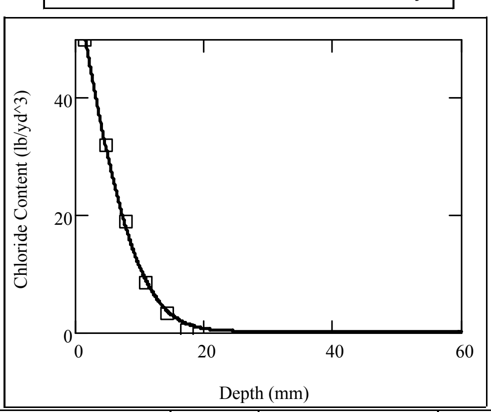

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.095E-12 | **Background(lb/yd^3)** | 0.185 |
| **Surface(lb/yd^3)** | 50.911 | **R^2 Value** | 0.9982 |

| Sample:TB2A5-B Blend:20%FA7%SF |
|---|
| Cement:ASTM Concrete:Class V 364 days |



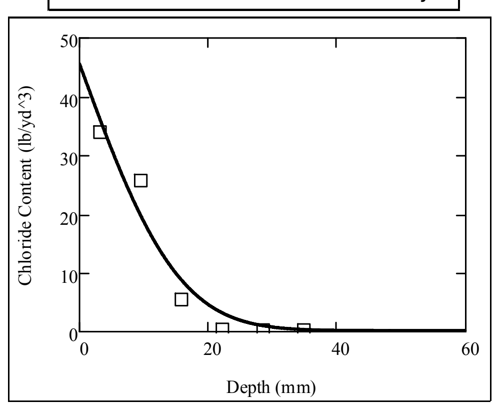

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.484E-12 | **Background(lb/yd^3)** | 0.222 |
| **Surface(lb/yd^3)** | 47.598 | **R^2 Value** | 0.9816 |

| Sample:TB1A5-C Blend:20%FA |
|---|
| Cement:ASTM Concrete:Class V 364 days |




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 9.161E-13 | **Background(lb/yd^3)** | 0.185 |
| **Surface(lb/yd^3)** | 60.068 | **R^2 Value** | 0.9995 |

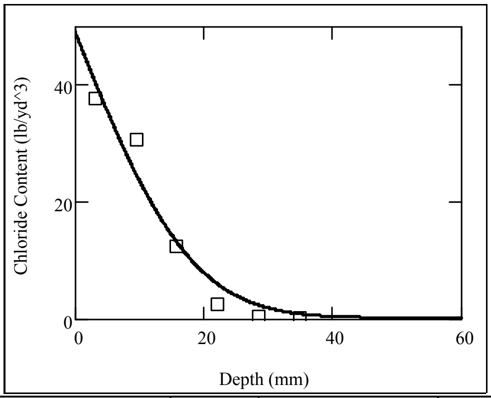
| Sample:TB2A5-C Blend:20%FA7%SF |
|---|
| Cement:ASTM Concrete:Class V 364 days |




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.325E-12 | **Background(lb/yd^3)** | 0.222 |
| **Surface(lb/yd^3)** | 45.608 | **R^2 Value** | 0.9742 |

**Sample:TB3A5-A Blend:20%FA20%S**

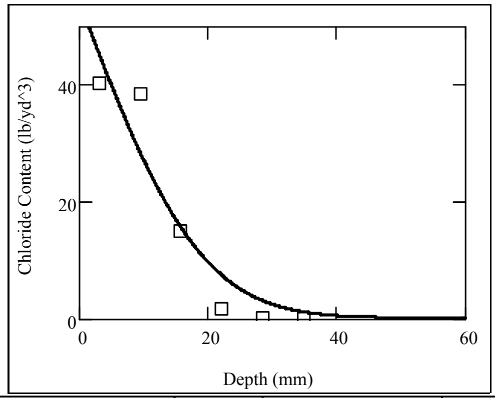
**Cement:ASTM Concrete:Class V 364 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.201E-12 | **Background(lb/yd^3)** | 0.174 |
| **Surface(lb/yd^3)** | 49.095 | **R^2 Value** | 0.9794 |

**Sample:TB4A5-A Blend:10%FA40%S**

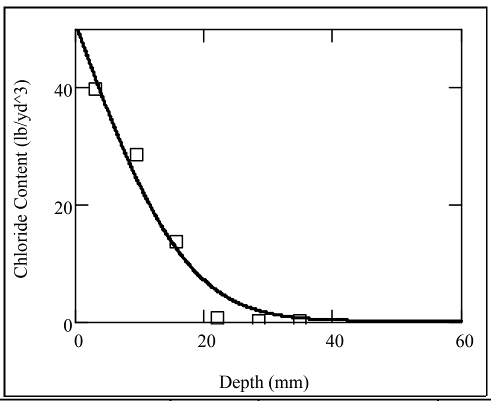
**Cement:ASTM Concrete:Class V 364 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.500E-12 | **Background(lb/yd^3)** | 0.158 |
| **Surface(lb/yd^3)** | 54.446 | **R^2 Value** | 0.9549 |

**Sample:TB3A5-B Blend:20%FA20%S**

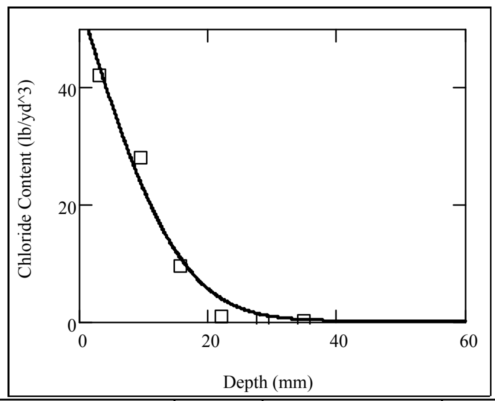
**Cement:ASTM Concrete:Class V 364 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.886E-12 | **Background(lb/yd^3)** | 0.174 |
| **Surface(lb/yd^3)** | 51.163 | **R^2 Value** | 0.9856 |

**Sample:TB4A5-B Blend:10%FA40%S**

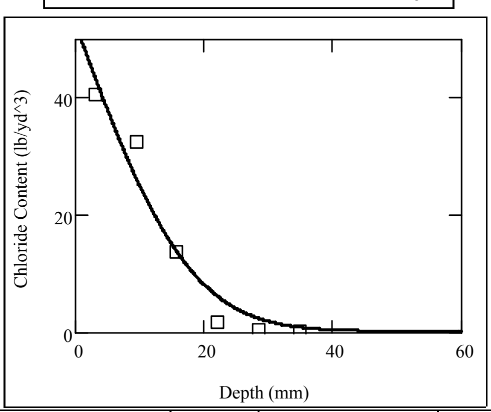
**Cement:ASTM Concrete:Class V 364 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.369E-12 | **Background(lb/yd^3)** | 0.158 |
| **Surface(lb/yd^3)** | 54.963 | **R^2 Value** | 0.9907 |

**Sample:TB3A5-C Blend:20%FA20%S**

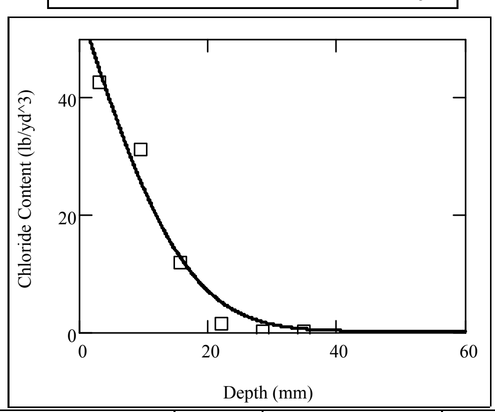
**Cement:ASTM Concrete:Class V 364 days**




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.117E-12 | **Background(lb/yd^3)** | 0.174 |
| **Surface(lb/yd^3)** | 52.775 | **R^2 Value** | 0.9795 |

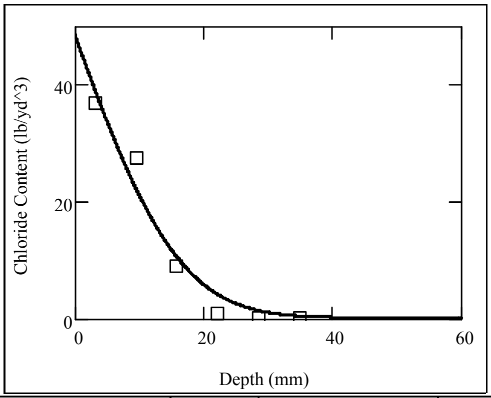
**Sample:TB4A5-C Blend:10%FA40%S**

**Cement:ASTM Concrete:Class V 364 days**



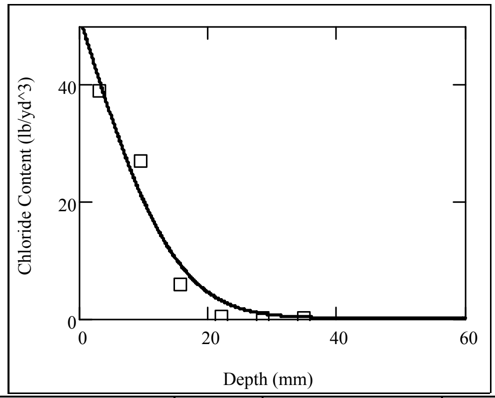

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.713E-12 | **Background(lb/yd^3)** | 0.158 |
| **Surface(lb/yd^3)** | 55.501 | **R^2 Value** | 0.9868 |

| |
|---|
| Sample:TB5A5-A Blend:30%FA20%S |
| Cement:ASTM Concrete:Class V 364 days |



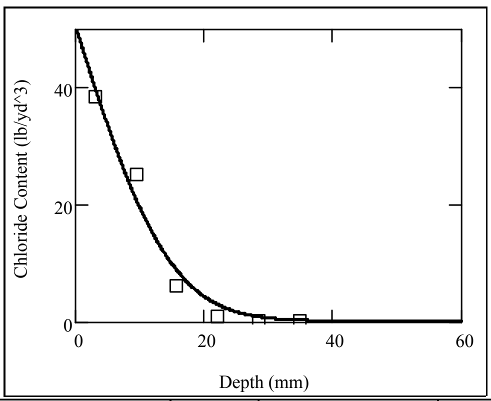

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.602E-12 | **Background(lb/yd^3)** | 0.170 |
| **Surface(lb/yd^3)** | 48.441 | **R^2 Value** | 0.9829 |

| |
|---|
| Sample:TB6A5-A Blend:20%FA40%S |
| Cement:ASTM Concrete:Class V 364 days |



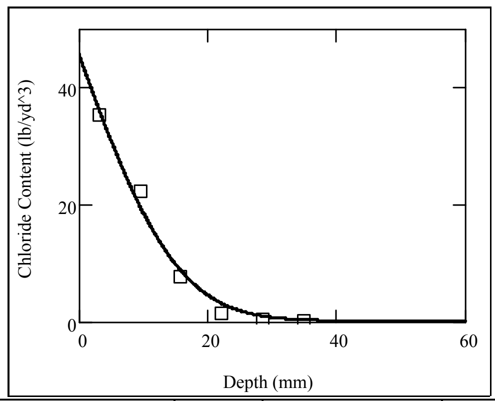

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.151E-12 | **Background(lb/yd^3)** | 0.164 |
| **Surface(lb/yd^3)** | 51.953 | **R^2 Value** | 0.9820 |

| |
|---|
| Sample:TB5A5-B Blend:30%FA20%S |
| Cement:ASTM Concrete:Class V 364 days |



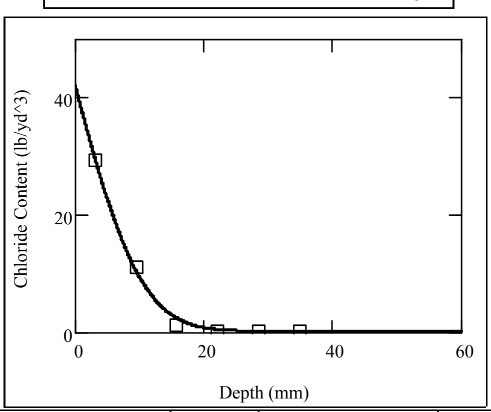

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.124E-12 | **Background(lb/yd^3)** | 0.170 |
| **Surface(lb/yd^3)** | 50.822 | **R^2 Value** | 0.9882 |

| |
|---|
| Sample:TB6A5-B Blend:20%FA40%S |
| Cement:ASTM Concrete:Class V 364 days |



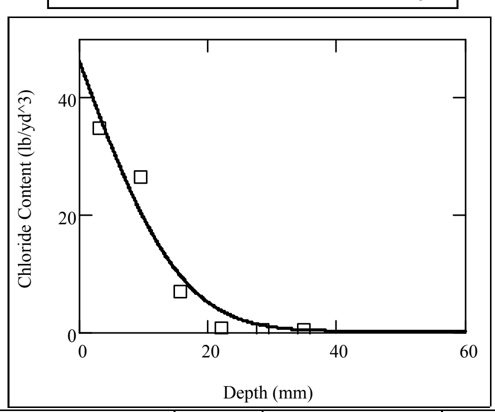

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.313E-12 | **Background(lb/yd^3)** | 0.164 |
| **Surface(lb/yd^3)** | 45.595 | **R^2 Value** | 0.9947 |

| |
|---|
| Sample:TB5A5-C Blend:30%FA20%S |
| Cement:ASTM Concrete:Class V 364 days |



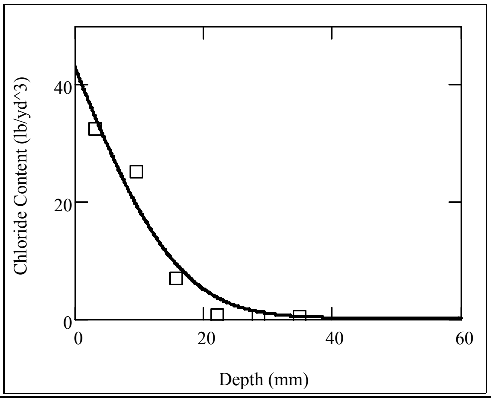

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.067E-12 | **Background(lb/yd^3)** | 0.170 |
| **Surface(lb/yd^3)** | 42.146 | **R^2 Value** | 0.9987 |

| |
|---|
| Sample:TB6A5-C Blend:20%FA40%S |
| Cement:ASTM Concrete:Class V 364 days |



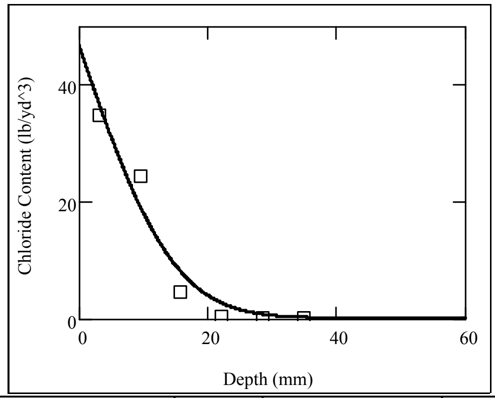

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.463E-12 | **Background(lb/yd^3)** | 0.164 |
| **Surface(lb/yd^3)** | 46.341 | **R^2 Value** | 0.9777 |

| Sample:TB7A5-A Blend:40%FA20%S |
|---|
| Cement:ASTM Concrete:Class V 364 days |



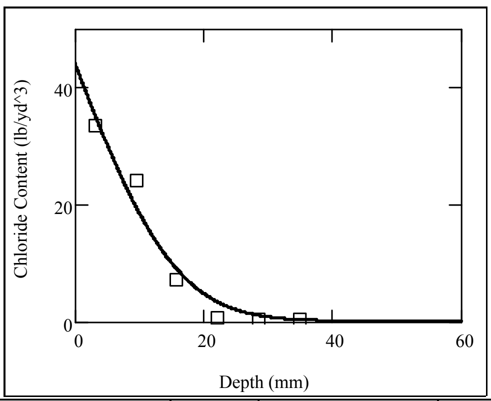

| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 2.581E-12 | Background(lb/yd^3) | 0.154 |
| Surface(lb/yd^3) | 42.996 | R^2 Value | 0.9760 |

| Sample:TB8A5-A Blend:10%FA60%S |
|---|
| Cement:ASTM Concrete:Class V 364 days |



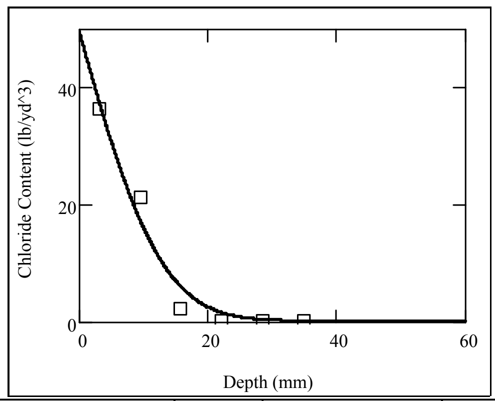

| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 2.116E-12 | Background(lb/yd^3) | 0.162 |
| Surface(lb/yd^3) | 46.776 | R^2 Value | 0.9798 |

| Sample:TB7A5-B Blend:40%FA20%S |
|---|
| Cement:ASTM Concrete:Class V 364 days |



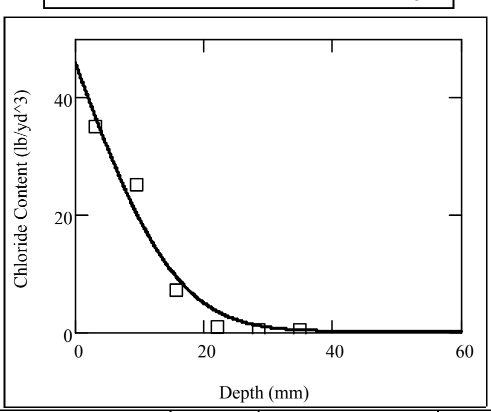

| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 2.444E-12 | Background(lb/yd^3) | 0.154 |
| Surface(lb/yd^3) | 44.069 | R^2 Value | 0.9840 |

| Sample:TB8A5-B Blend:10%FA60%S |
|---|
| Cement:ASTM Concrete:Class V 364 days |



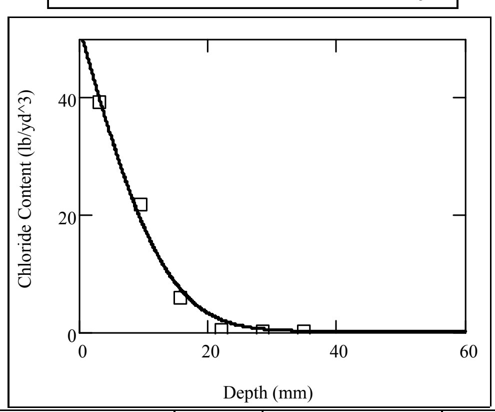

| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.632E-12 | Background(lb/yd^3) | 0.162 |
| Surface(lb/yd^3) | 49.719 | R^2 Value | 0.9872 |

| Sample:TB7A5-C Blend:40%FA20%S |
|---|
| Cement:ASTM Concrete:Class V 364 days |




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 2.431E-12 | Background(lb/yd^3) | 0.154 |
| Surface(lb/yd^3) | 46.064 | R^2 Value | 0.9846 |

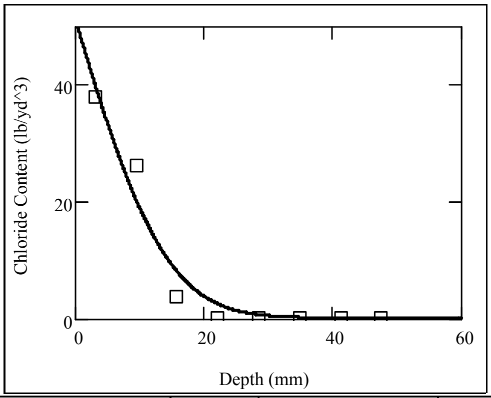
| Sample:TB8A5-C Blend:10%FA60%S |
|---|
| Cement:ASTM Concrete:Class V 364 days |




| | | | |
|---|---|---|---|
| Diffusion(m^2/sec) | 1.801E-12 | Background(lb/yd^3) | 0.162 |
| Surface(lb/yd^3) | 52.216 | R^2 Value | 0.9962 |

Sample:TB6A5-1-A Blend:20%FA40%S

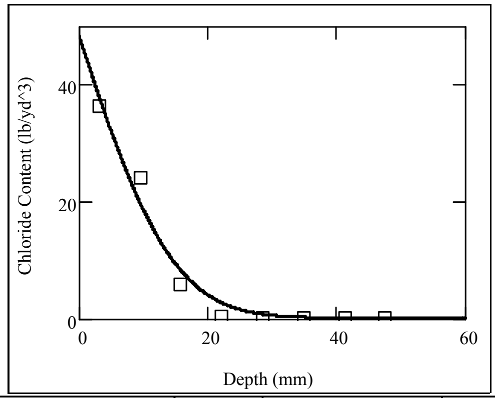
Cement:ASTM Concrete:Class V 364 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.981E-12 | **Background(lb/yd^3)** | 0.164 |
| **Surface(lb/yd^3)** | 51.418 | **R^2 Value** | 0.9797 |

Sample:TB7A5-1-A Blend:40%FA20%S

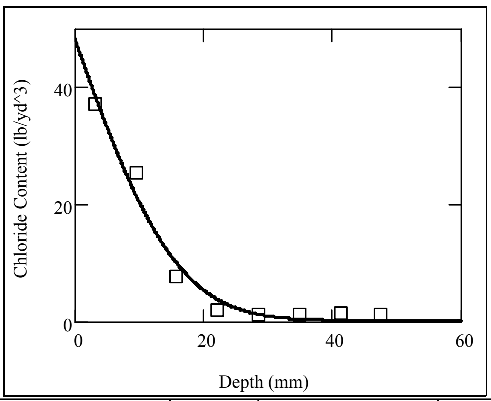
Cement:ASTM Concrete:Class V 364 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.104E-12 | **Background(lb/yd^3)** | 0.154 |
| **Surface(lb/yd^3)** | 48.384 | **R^2 Value** | 0.9889 |

Sample:TB6A5-1-B Blend:20%FA40%S

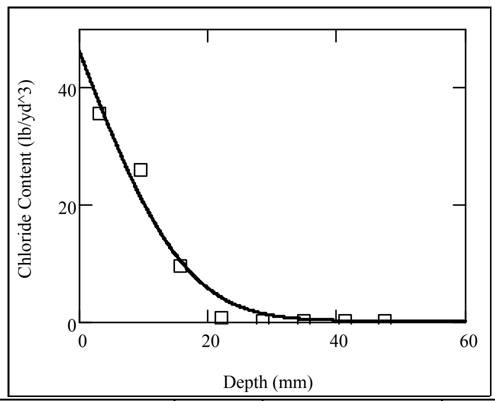
Cement:ASTM Concrete:Class V 364 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.473E-12 | **Background(lb/yd^3)** | 0.164 |
| **Surface(lb/yd^3)** | 48.298 | **R^2 Value** | 0.9895 |

Sample:TB7A5-1-B Blend:40%FA20%S

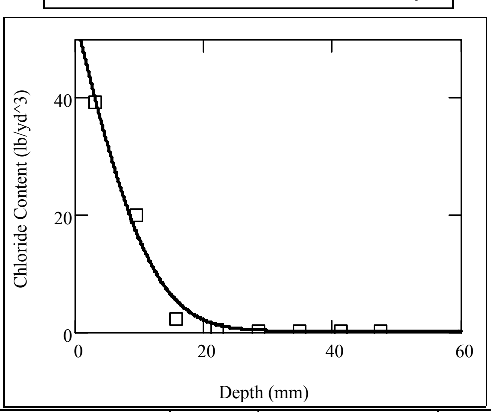
Cement:ASTM Concrete:Class V 364 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.660E-12 | **Background(lb/yd^3)** | 0.154 |
| **Surface(lb/yd^3)** | 46.322 | **R^2 Value** | 0.9867 |

Sample:TB6A5-1-C Blend:20%FA40%S

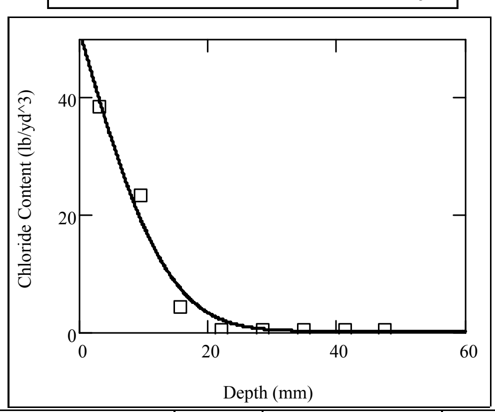
Cement:ASTM Concrete:Class V 364 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.443E-12 | **Background(lb/yd^3)** | 0.164 |
| **Surface(lb/yd^3)** | 54.030 | **R^2 Value** | 0.9941 |

Sample:TB7A5-1-C Blend:40%FA20%S

Cement:ASTM Concrete:Class V 364 days




| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.830E-12 | **Background(lb/yd^3)** | 0.154 |
| **Surface(lb/yd^3)** | 51.715 | **R^2 Value** | 0.9903 |

## *AASHTO Cement – Class V (182 day exposure)*

**Sample TB1H5-A**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.179 | 37.197 | 37.207 | 37.194 |
| 0.500 | 13.599 | 13.824 | 13.774 | 13.732 |
| 0.750 | 1.130 | 1.118 | 1.119 | 1.122 |
| 1.000 | 0.356 | 0.332 | 0.347 | 0.345 |
| 1.250 | 0.359 | 0.357 | 0.354 | 0.357 |
| 1.500 | 0.292 | 0.287 | 0.274 | 0.284 |

**Sample TB1H5-B**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.635 | 38.503 | 38.724 | 38.621 |
| 0.500 | 14.775 | 14.883 | 14.940 | 14.866 |
| 0.750 | 1.059 | 1.078 | 1.090 | 1.076 |
| 1.000 | 0.291 | 0.293 | 0.310 | 0.298 |
| 1.250 | 0.308 | 0.284 | 0.277 | 0.290 |
| 1.500 | 0.275 | 0.278 | 0.283 | 0.279 |

**Sample TB2H5-A**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.140 | 36.001 | 36.375 | 36.172 |
| 0.500 | 0.630 | 0.633 | 0.622 | 0.628 |
| 0.750 | 0.399 | 0.391 | 0.415 | 0.402 |
| 1.000 | 4.972 | 5.071 | 5.125 | 5.056 |
| 1.250 | 0.382 | 0.419 | 0.432 | 0.411 |
| 1.500 | 0.337 | 0.347 | 0.328 | 0.337 |

**Sample TB2H5-B**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 40.964 | 41.144 | 41.370 | 41.159 |
| 0.500 | 12.676 | 12.768 | 12.601 | 12.682 |
| 0.750 | 0.471 | 0.479 | 0.458 | 0.469 |
| 1.000 | 0.244 | 0.261 | 0.240 | 0.248 |
| 1.250 | 0.249 | 0.227 | 0.227 | 0.234 |
| 1.500 | 0.227 | 0.235 | 0.226 | 0.229 |

**Sample TB2H5-C**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.270 | 35.918 | 35.962 | 36.050 |
| 0.500 | 3.469 | 3.623 | 3.192 | 3.428 |
| 0.750 | 0.431 | 0.417 | 0.414 | 0.421 |
| 1.000 | 0.339 | 0.350 | 0.331 | 0.340 |
| 1.250 | 0.339 | 0.332 | 0.332 | 0.334 |
| 1.500 | 0.352 | 0.347 | 0.345 | 0.348 |

**Sample TB5H5-A**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.578 | 37.294 | 37.160 | 37.344 |
| 0.500 | 12.140 | 12.180 | 11.957 | 12.092 |
| 0.750 | 0.879 | 0.857 | 0.815 | 0.850 |
| 1.000 | 0.301 | 0.311 | 0.276 | 0.296 |
| 1.250 | 0.278 | 0.268 | 0.260 | 0.269 |
| 1.500 | 0.276 | 0.289 | 0.259 | 0.275 |

**Sample TB5H5-B**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.259 | 36.574 | 35.884 | 36.239 |
| 0.500 | 17.195 | 17.344 | 17.301 | 17.280 |
| 0.750 | 2.535 | 2.516 | 2.550 | 2.534 |
| 1.000 | 0.405 | 0.386 | 0.404 | 0.398 |
| 1.250 | 0.358 | 0.394 | 0.387 | 0.380 |
| 1.500 | 0.308 | 0.294 | 0.325 | 0.309 |

**Sample TB6H5-A**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 34.636 | 35.217 | 35.395 | 35.083 |
| 0.500 | 9.302 | 9.378 | 9.378 | 9.353 |
| 0.750 | 0.944 | 0.955 | 0.954 | 0.951 |
| 1.000 | 0.333 | 0.351 | 0.365 | 0.350 |
| 1.250 | 0.252 | 0.261 | 0.255 | 0.256 |
| 1.500 | 0.261 | 0.283 | 0.247 | 0.264 |

**Sample TB6H5-B**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 40.130 | 39.856 | 40.087 | 40.024 |
| 0.500 | 16.054 | 16.217 | 16.066 | 16.112 |
| 0.750 | 2.483 | 2.505 | 2.558 | 2.515 |
| 1.000 | 0.347 | 0.349 | 0.357 | 0.351 |
| 1.250 | 0.249 | 0.235 | 0.241 | 0.242 |
| 1.500 | 0.219 | 0.204 | 0.211 | 0.211 |

**Sample TB7H5-A**

| Depth (in) | NaCl (lb/yd³) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.365 | 37.890 | 37.890 | 37.715 |
| 0.500 | 17.443 | 17.979 | 17.497 | 17.640 |
| 0.750 | 3.037 | 3.090 | 2.983 | 3.037 |
| 1.000 | 0.304 | 0.306 | 0.314 | 0.308 |
| 1.250 | 0.252 | 0.252 | 0.255 | 0.253 |
| 1.500 | 0.239 | 0.232 | 0.226 | 0.232 |

**Sample TB3H5-A**

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 40.184 | 40.078 | 40.086 | 40.116 |
| 0.500 | 7.385 | 7.407 | 7.308 | 7.367 |
| 0.750 | 0.323 | 0.330 | 0.339 | 0.331 |
| 1.000 | 0.242 | 0.195 | 0.220 | 0.219 |
| 1.250 | 0.222 | 0.203 | 0.196 | 0.207 |
| 1.500 | 0.208 | 0.209 | 0.207 | 0.208 |

**Sample TB3H5-B**

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 41.388 | 41.398 | 41.826 | 41.537 |
| 0.500 | 17.149 | 17.075 | 16.726 | 16.983 |
| 0.750 | 2.288 | 2.585 | 2.537 | 2.470 |
| 1.000 | 0.257 | 0.320 | 0.301 | 0.293 |
| 1.250 | 0.277 | 0.287 | 0.295 | 0.286 |
| 1.500 | 0.215 | 0.264 | 0.208 | 0.229 |

**Sample TB4H5-A**

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 38.756 | 38.806 | 38.539 | 38.700 |
| 0.500 | 4.181 | 4.129 | 4.231 | 4.180 |
| 0.750 | 0.356 | 0.363 | 0.355 | 0.358 |
| 1.000 | 0.235 | 0.255 | 0.240 | 0.243 |
| 1.250 | 0.226 | 0.232 | 0.228 | 0.229 |
| 1.500 | 0.253 | 0.244 | 0.235 | 0.244 |

**Sample TB7H5-B**

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 37.108 | 37.293 | 37.526 | 37.309 |
| 0.500 | 17.355 | 17.279 | 17.289 | 17.308 |
| 0.750 | 4.427 | 5.197 | 4.890 | 4.838 |
| 1.000 | 0.744 | 0.783 | 0.786 | 0.771 |
| 1.250 | 0.359 | 0.373 | 0.372 | 0.368 |
| 1.500 | 0.377 | 0.389 | 0.373 | 0.380 |

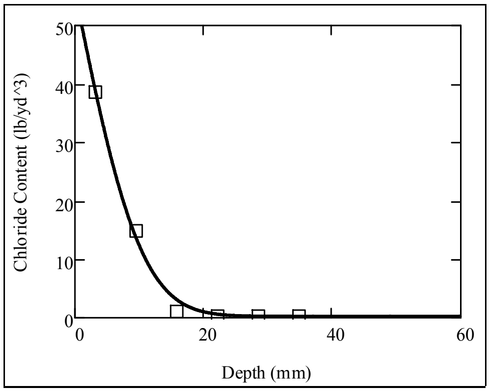
**Sample TB8H5-A**

| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 35.219 | 34.781 | 34.694 | 34.898 |
| 0.500 | 8.998 | 9.024 | 8.998 | 9.007 |
| 0.750 | 0.586 | 0.553 | 0.580 | 0.573 |
| 1.000 | 0.237 | 0.229 | 0.243 | 0.236 |
| 1.250 | 0.192 | 0.215 | 0.207 | 0.205 |
| 1.500 | 0.175 | 0.168 | 0.177 | 0.173 |

**Sample TB8H5-B**

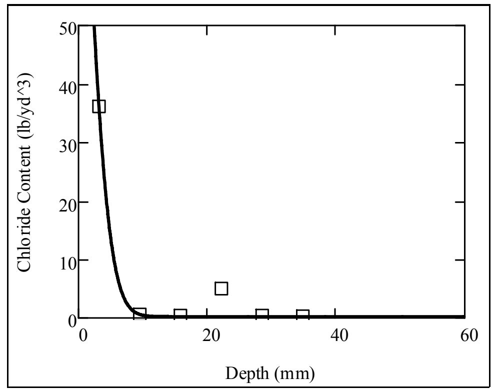
| Depth (in) | NaCl ($lb/yd^3$) A | B | C | AVG |
|---|---|---|---|---|
| 0.250 | 36.544 | 36.255 | 36.156 | 36.318 |
| 0.500 | 6.088 | 6.145 | 6.127 | 6.120 |
| 0.750 | 0.366 | 0.363 | 0.401 | 0.377 |
| 1.000 | 0.215 | 0.216 | 0.220 | 0.217 |
| 1.250 | 0.235 | 0.233 | 0.225 | 0.231 |
| 1.500 | 0.196 | 0.207 | 0.196 | 0.200 |

**Sample:TB1H5-A Blend:20%FA**
**Cement:AASHTO Concrete:Class V 182 days**



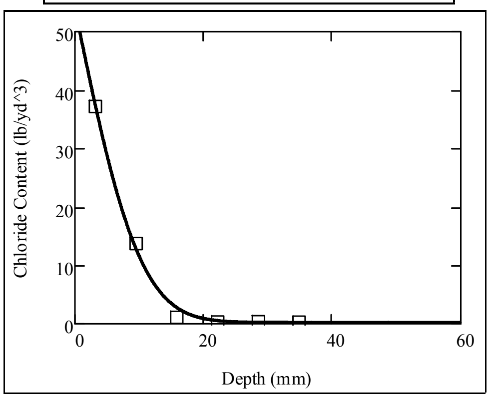

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.105E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 55.723 | **R^2 Value** | 0.9978 |

**Sample:TB2H5-B Blend:20%FA7%SF**
**Cement:AASHTO Concrete:Class V 182 days**



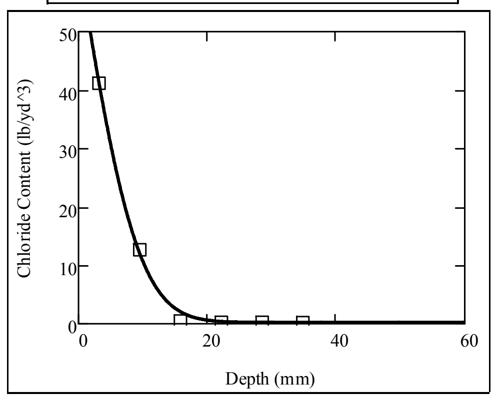

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 3.335E-13 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 110.100 | **R^2 Value** | 0.9914 |

**Sample:TB1H5-B Blend:20%FA**
**Cement:AASHTO Concrete:Class V 182 days**



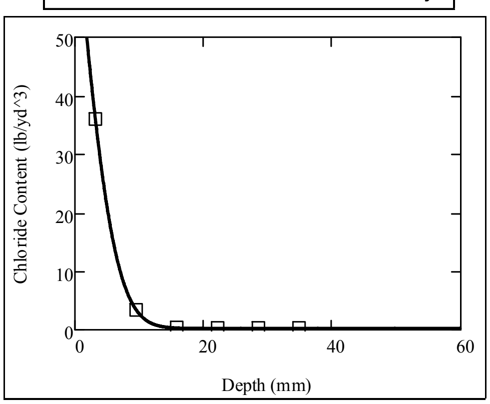

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.030E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 53.985 | **R^2 Value** | 0.9984 |

**Sample:TB2H5-C Blend:20%FA7%SF**
**Cement:AASHTO Concrete:Class V 182 days**



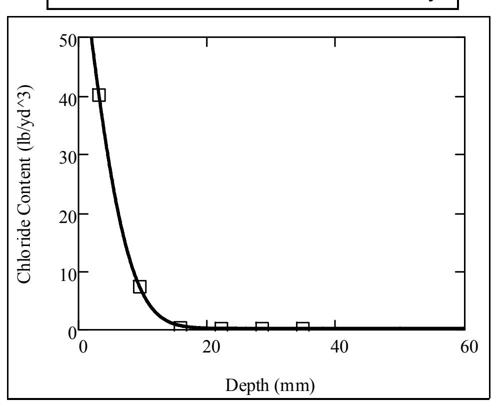

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.676E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 62.229 | **R^2 Value** | 0.9990 |

**Sample:TB2H5-A Blend:20%FA7%SF**
**Cement:AASHTO Concrete:Class V 182 days**



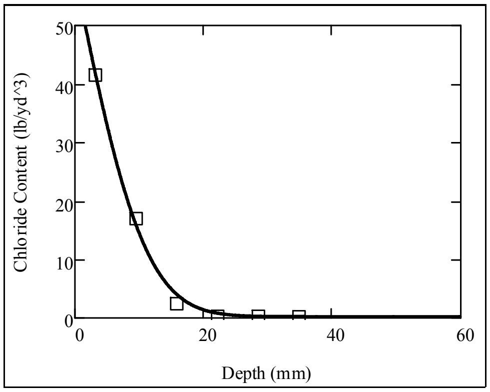

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 7.143E-13 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 71.412 | **R^2 Value** | 1.0000 |

**Sample:TB3H5-A Blend:10%FA40%S**
**Cement:AASHTO Concrete:Class V 182 days**



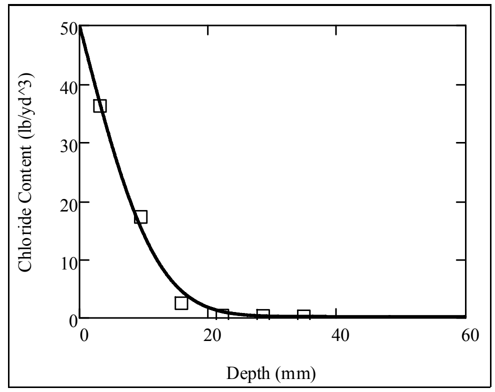

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.089E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 68.118 | **R^2 Value** | 1.0000 |

| Sample:TB3H5-B Blend:10%FA40%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



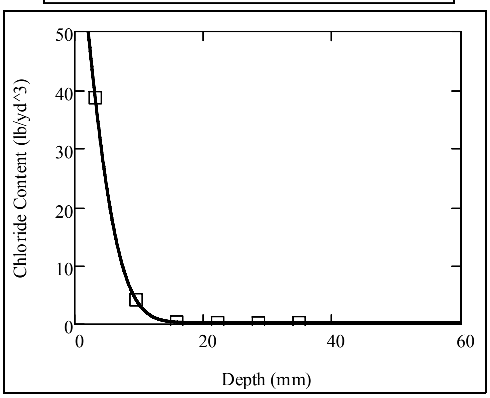

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.345E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 58.641 | **R^2 Value** | 0.9987 |

| Sample:TB5H5-B Blend:30%FA20%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



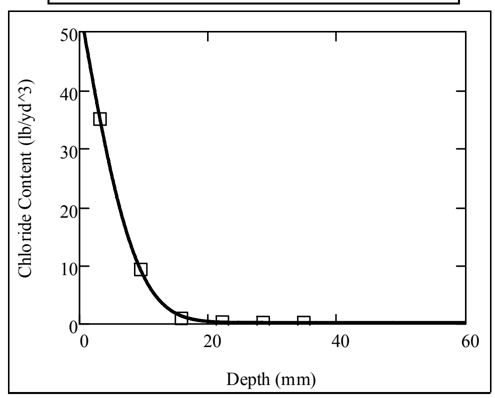

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.751E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 50.009 | **R^2 Value** | 0.9963 |

| Sample:TB4H5-A Blend:10%FA40%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



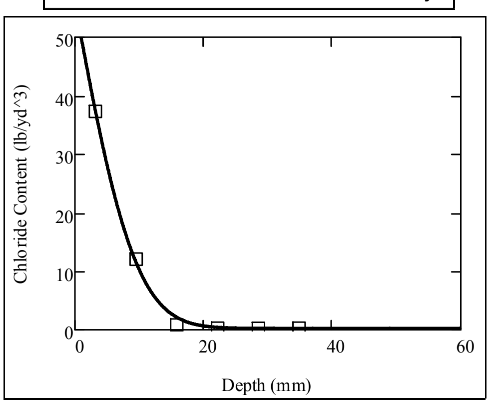

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 7.690E-13 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 74.384 | **R^2 Value** | 1.0000 |

| Sample:TB6H5-A Blend:20%FA40%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



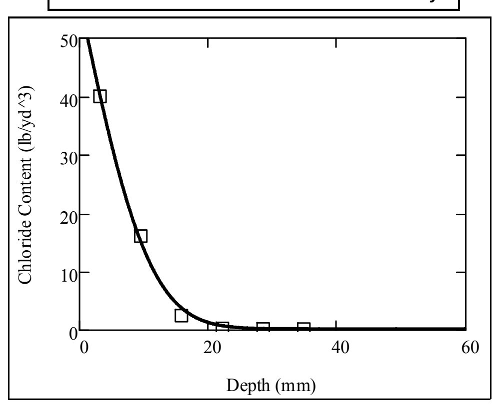

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.497E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 54.407 | **R^2 Value** | 0.9999 |

| Sample:TB5H5-A Blend:30%FA20%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



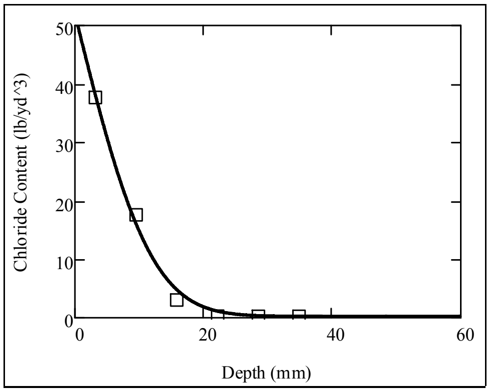

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 1.777E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 55.688 | **R^2 Value** | 0.9992 |

| Sample:TB6H5-B Blend:20%FA40%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



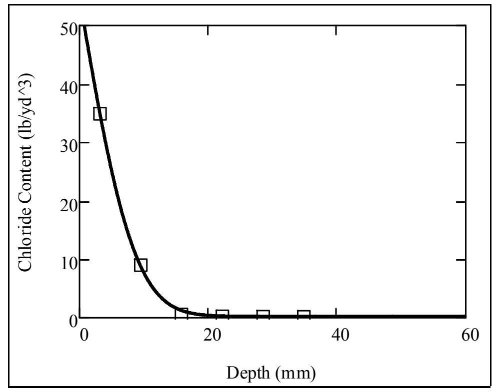

| | | | |
|---|---|---|---|
| **Diffusion(m^2/sec)** | 2.323E-12 | **Background(lb/yd^3)** | 0.269 |
| **Surface(lb/yd^3)** | 56.549 | **R^2 Value** | 0.9990 |

| Sample:TB7H5-A Blend:40%FA20%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



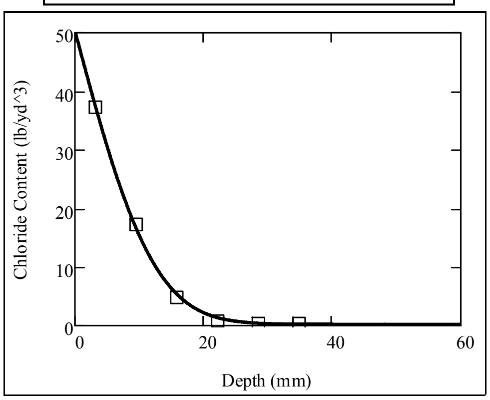

| Diffusion(m^2/sec) | 2.748E-12 | Background(lb/yd^3) | 0.269 |
|---|---|---|---|
| Surface(lb/yd^3) | 51.959 | R^2 Value | 0.9975 |

| Sample:TB8H5-A Blend:10%FA60%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |



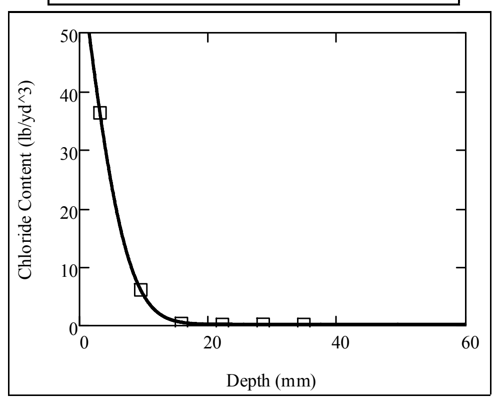

| Diffusion(m^2/sec) | 1.436E-12 | Background(lb/yd^3) | 0.269 |
|---|---|---|---|
| Surface(lb/yd^3) | 54.719 | R^2 Value | 0.9998 |

| Sample:TB7H5-B Blend:40%FA20%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |




| Diffusion(m^2/sec) | 3.003E-12 | Background(lb/yd^3) | 0.269 |
|---|---|---|---|
| Surface(lb/yd^3) | 50.327 | R^2 Value | 0.9995 |

| Sample:TB8H5-B Blend:10%FA60%S |
|---|
| Cement:AASHTO Concrete:Class V 182 days |




| Diffusion(m^2/sec) | 1.021E-12 | Background(lb/yd^3) | 0.269 |
|---|---|---|---|
| Surface(lb/yd^3) | 62.930 | R^2 Value | 1.0000 |

# APPENDIX H – RAPID MIGRATION TEST DATA

**Mix** TB1A4
**Cast Date** 11/1/2005

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB1A4 | 12/30/2005 | 56 | A | 6.05219E-12 | 4.798 |
| | | | B | 4.73797E-12 | |
| | | | C | 3.60472E-12 | |
| | 1/31/2006 | 91 | A | 8.99358E-12 | 8.261 |
| | | | B | 7.30791E-12 | |
| | | | C | 8.48178E-12 | |

**Mix** TB2A4
**Cast Date** 11/3/2005

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB2A4 | 12/29/2005 | 56 | A | 3.16289E-12 | 3.274 |
| | | | B | 4.73198E-12 | |
| | | | C | 1.92581E-12 | |
| | 2/2/2006 | 91 | A | 3.46287E-12 | 3.350 |
| | | | B | 3.38885E-12 | |
| | | | C | 3.1985E-12 | |

**Mix** TB3A4
**Cast Date** 11/8/2005

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB3A4 | 1/3/2006 | 56 | A | 4.6576E-12 | 5.419 |
| | | | B | 5.49363E-12 | |
| | | | C | 6.10531E-12 | |
| | 2/7/2006 | 91 | A | 4.19971E-12 | 4.732 |
| | | | B | 5.53406E-12 | |
| | | | C | 4.46273E-12 | |

**Mix** TB4A4
**Cast Date** 11/10/2005

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB4A4 | 1/5/2006 | 56 | A | 4.24109E-12 | 4.292 |
| | | | B | 4.27788E-12 | |
| | | | C | 4.35658E-12 | |
| | 2/9/2006 | 91 | A | 2.74579E-12 | 2.373 |
| | | | B | 2.44981E-12 | |
| | | | C | 1.92194E-12 | |

**Mix** TB5A4
**Cast Date** 11/15/2005

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB5A4 | 1/10/2006 | 56 | A | 4.92886E-12 | 5.840 |
| | | | B | 6.53728E-12 | |
| | | | C | 6.05255E-12 | |
| | 2/14/2006 | 91 | A | 2.79893E-12 | 2.997 |
| | | | B | 2.94618E-12 | |
| | | | C | 3.24586E-12 | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB6A4 | 4/18/2006 | 56 | A | - | - |
| | | | B | - | |
| | | | C | - | |
| | 5/23/2006 | 91 | A | 2.83983E-12 | 3.154 |
| | | | B | 3.26538E-12 | |
| | | | C | 3.35683E-12 | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB7A4 | 4/18/2006 | 56 | A | - | - |
| | | | B | - | |
| | | | C | - | |
| | 5/23/2006 | 91 | A | 3.25611E-12 | 3.953 |
| | | | B | 3.3784E-12 | |
| | | | C | 5.22506E-12 | |

**Mix** TB8A4
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB8A4 | 5/25/2006 | 56 | A | 3.31019E-12 | 3.492 |
| | | | B | 3.30716E-12 | |
| | | | C | 3.85789E-12 | |
| | 6/30/2006 | 91 | A | 3.13051E-12 | 3.564 |
| | | | B | 4.59472E-12 | |
| | | | C | 2.9667E-12 | |

**Mix** TB1A5
**Cast Date** 3/30/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB1A5 | 5/25/2006 | 56 | A | 4.52735E-12 | 6.254 |
| | | | B | 8.44437E-12 | |
| | | | C | 5.79018E-12 | |
| | 6/30/2006 | 91 | A | 7.87119E-12 | 8.092 |
| | | | B | 8.01398E-12 | |
| | | | C | 8.39056E-12 | |

**Mix** TB2A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB2A5 | 6/27/2006 | 56 | A | 3.80329E-12 | 3.399 |
| | | | B | 2.4238E-12 | |
| | | | C | 3.96974E-12 | |
| | 8/1/2006 | 91 | A | 5.43783E-12 | 5.710 |
| | | | B | 6.175E-12 | |
| | | | C | 5.51589E-12 | |

**Mix** TB3A5
**Cast Date** 5/2/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB3A5 | 6/27/2006 | 56 | A | 4.77571E-12 | 5.375 |
| | | | B | 6.50949E-12 | |
| | | | C | 4.83894E-12 | |
| | 8/1/2006 | 91 | A | 8.82728E-12 | 7.921 |
| | | | B | 7.76483E-12 | |
| | | | C | 7.17153E-12 | |

**Mix** TB4A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB4A5 | 6/29/2006 | 56 | A | 7.46785E-12 | 5.226 |
| | | | B | 3.99664E-12 | |
| | | | C | 4.21396E-12 | |
| | 8/3/2006 | 91 | A | 3.9488E-12 | 3.356 |
| | | | B | 2.51639E-12 | |
| | | | C | 3.6019E-12 | |

**Mix** TB5A5
**Cast Date** 5/4/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB5A5 | 6/29/2006 | 56 | A | 5.78297E-12 | 4.953 |
| | | | B | 5.02183E-12 | |
| | | | C | 4.05415E-12 | |
| | 8/3/2006 | 91 | A | 3.68598E-12 | 4.766 |
| | | | B | 4.44222E-12 | |
| | | | C | 6.16843E-12 | |

**Mix** TB6A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB6A5 | 7/4/2006 | 56 | A | 4.0733E-12 | 4.071 |
| | | | B | 4.03423E-12 | |
| | | | C | 4.10447E-12 | |
| | 8/8/2006 | 91 | A | 2.50908E-12 | 2.835 |
| | | | B | 3.33976E-12 | |
| | | | C | 2.65753E-12 | |

**Mix** TB7A5
**Cast Date** 5/9/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB7A5 | 7/4/2006 | 56 | A | 4.63336E-12 | 4.997 |
| | | | B | 5.86821E-12 | |
| | | | C | 4.48918E-12 | |
| | 8/8/2006 | 91 | A | 3.24447E-12 | 3.260 |
| | | | B | 3.24853E-12 | |
| | | | C | 3.28603E-12 | |

**Mix** TB8A5
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB8A5 | 7/6/2006 | 56 | A | 4.13148E-12 | 3.694 |
| | | | B | 2.94168E-12 | |
| | | | C | 4.00894E-12 | |
| | 8/10/2006 | 91 | A | 2.20726E-12 | 2.559 |
| | | | B | 2.79446E-12 | |
| | | | C | 2.67531E-12 | |

**Mix** TB1H4
**Cast Date** 5/11/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB1H4 | 7/6/2006 | 56 | A | 8.35393E-12 | 8.611 |
| | | | B | 9.05857E-12 | |
| | | | C | 8.42122E-12 | |
| | 8/10/2006 | 91 | A | 5.60134E-12 | 5.371 |
| | | | B | 5.96325E-12 | |
| | | | C | 4.54861E-12 | |

**Mix** TB2H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB2H4 | 7/11/2006 | 56 | A | 2.81839E-12 | 3.612 |
| | | | B | 2.32762E-12 | |
| | | | C | 5.68859E-12 | |
| | 8/15/2006 | 91 | A | 2.49975E-12 | 2.665 |
| | | | B | 2.48324E-12 | |
| | | | C | 3.01151E-12 | |

**Mix** TB3H4
**Cast Date** 5/16/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB3H4 | 7/11/2006 | 56 | A | 6.22446E-12 | 4.313 |
| | | | B | 2.32743E-12 | |
| | | | C | 4.38711E-12 | |
| | 8/15/2006 | 91 | A | 3.71537E-12 | 3.945 |
| | | | B | 4.25505E-12 | |
| | | | C | 3.86318E-12 | |

**Mix** TB4H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB4H4 | 7/13/2006 | 56 | A | 4.33246E-12 | 4.429 |
| | | | B | 4.00796E-12 | |
| | | | C | 4.94669E-12 | |
| | 8/17/2006 | 91 | A | 2.70819E-12 | 3.177 |
| | | | B | 3.48692E-12 | |
| | | | C | 3.33577E-12 | |

**Mix** TB5H4
**Cast Date** 5/18/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB5H4 | 7/13/2006 | 56 | A | 5.49574E-12 | 5.240 |
| | | | B | 5.81555E-12 | |
| | | | C | 4.40771E-12 | |
| | 8/17/2006 | 91 | A | 3.61978E-12 | 3.296 |
| | | | B | 2.87643E-12 | |
| | | | C | 3.3917E-12 | |

**Mix** TB6H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB6H4 | 7/18/2006 | 56 | A | 3.91244E-12 | 3.890 |
| | | | B | 3.553E-12 | |
| | | | C | 4.20329E-12 | |
| | 8/22/2006 | 91 | A | 5.13082E-12 | 4.688 |
| | | | B | 3.73939E-12 | |
| | | | C | 5.19505E-12 | |

**Mix** TB7H4
**Cast Date** 5/23/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB7H4 | 7/18/2006 | 56 | A | 5.91943E-12 | 5.342 |
| | | | B | 5.48342E-12 | |
| | | | C | 4.62182E-12 | |
| | 8/22/2006 | 91 | A | 5.67963E-12 | 4.431 |
| | | | B | 3.39006E-12 | |
| | | | C | 4.22319E-12 | |

**Mix** TB8H4
**Cast Date** 5/25/2006

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB8H4 | 7/20/2006 | 56 | A | 3.21279E-12 | 3.636 |
| | | | B | 4.79829E-12 | |
| | | | C | 2.89801E-12 | |
| | 8/24/2006 | 91 | A | 1.55939E-12 | 2.009 |
| | | | B | 1.83496E-12 | |
| | | | C | 2.63401E-12 | |

**Mix** TB1H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB1H5 | 3/29/2007 | 56 | A | 3.72233E-12 | 4.589 |
| | | | B | 4.18442E-12 | |
| | | | C | 5.85986E-12 | |
| | 5/3/2007 | 91 | A | 6.44673E-12 | 5.888 |
| | | | B | 5.57973E-12 | |
| | | | C | 5.63835E-12 | |

**Mix** TB2H5
**Cast Date** 2/1/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB2H5 | 3/29/2007 | 56 | A | 2.84781E-12 | 2.965 |
| | | | B | 3.2028E-12 | |
| | | | C | 2.84574E-12 | |
| | 5/3/2007 | 91 | A | 2.60757E-12 | 2.838 |
| | | | B | 2.22684E-12 | |
| | | | C | 3.68078E-12 | |

**Mix** TB3H5
**Cast Date** 2/6/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB3H5 | 4/3/2007 | 56 | A | 4.7497E-12 | 4.522 |
| | | | B | 3.57098E-12 | |
| | | | C | 5.24456E-12 | |
| | 5/8/2007 | 91 | A | 5.68547E-12 | 5.818 |
| | | | B | 5.95095E-12 | |
| | | | C | 5.81847E-12 | |

**Mix** TB4H5
**Cast Date** 2/6/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB4H5 | 4/3/2007 | 56 | A | 3.89571E-12 | 5.260 |
| | | | B | 4.27851E-12 | |
| | | | C | 7.60723E-12 | |
| | 5/8/2007 | 91 | A | 3.91929E-12 | 3.989 |
| | | | B | 4.74117E-12 | |
| | | | C | 3.30641E-12 | |

**Mix** TB5H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB5H5 | 4/5/2007 | 56 | A | 4.02352E-12 | 4.289 |
| | | | B | 4.98751E-12 | |
| | | | C | 3.85526E-12 | |
| | 5/10/2007 | 91 | A | 4.40374E-12 | 4.411 |
| | | | B | 4.60713E-12 | |
| | | | C | 4.22295E-12 | |

**Mix** TB6H5
**Cast Date** 2/8/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB6H5 | 4/5/2007 | 56 | A | 4.39649E-12 | 3.264 |
| | | | B | 2.63099E-12 | |
| | | | C | 2.76342E-12 | |
| | 5/10/2007 | 91 | A | 4.16038E-12 | 3.523 |
| | | | B | 3.76919E-12 | |
| | | | C | 2.63996E-12 | |

**Mix** TB7H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB7H5 | 4/12/2007 | 56 | A | 3.6459E-12 | 7.715 |
| | | | B | 5.68844E-12 | |
| | | | C | 1.38112E-11 | |
| | 5/17/2007 | 91 | A | 4.94424E-12 | 6.354 |
| | | | B | 5.82632E-12 | |
| | | | C | 8.29285E-12 | |

**Mix** TB8H5
**Cast Date** 2/15/2007

| Identifier | Date | Age (days) | Sample | Diffusion ($m^2/s$) | Ave. Diffusion ($x10^{-12}$ $m^2/s$) |
|---|---|---|---|---|---|
| TB8H5 | 4/12/2007 | 56 | A | 3.0401E-12 | 3.027 |
| | | | B | 2.98284E-12 | |
| | | | C | 3.05954E-12 | |
| | 5/17/2007 | 91 | A | 3.80474E-12 | 3.139 |
| | | | B | 3.19484E-12 | |
| | | | C | 2.41673E-12 | |

# APPENDIX I – SURFACE RESISTIVITY TEST DATA

**Mix** TB1A4
**Cast Date** 11/1/2005

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB1A4 | 11/2/2005 | 1 | A | 4.4 | 4.5 | 4.5 | 4.4 | 4.4 | 4.5 | 4.5 | 4.6 | 4.5 | 4.5 |
| | | | B | 4.2 | 4.4 | 4.6 | 4.5 | 4.3 | 4.4 | 4.6 | 4.4 | 4.4 | |
| | | | C | 4.6 | 4.4 | 4.6 | 4.5 | 4.6 | 4.4 | 4.4 | 4.5 | 4.5 | |
| | 11/4/2005 | 3 | A | 6.0 | 6.3 | 6.3 | 6.0 | 6.1 | 6.3 | 6.3 | 6.2 | 6.2 | 6.2 |
| | | | B | 5.9 | 6.1 | 6.2 | 6.4 | 6.1 | 6.2 | 6.4 | 6.1 | 6.2 | |
| | | | C | 6.2 | 5.9 | 6.3 | 6.0 | 6.3 | 6.0 | 6.3 | 6.0 | 6.1 | |
| | 11/8/2005 | 7 | A | 7.2 | 7.2 | 7.4 | 7.4 | 7.2 | 7.4 | 7.4 | 7.4 | 7.3 | 7.3 |
| | | | B | 6.9 | 7.3 | 7.6 | 7.5 | 6.9 | 7.2 | 7.4 | 7.5 | 7.3 | |
| | | | C | 7.4 | 7.1 | 7.5 | 7.3 | 7.6 | 7.3 | 7.6 | 7.2 | 7.4 | |
| | 11/15/2005 | 14 | A | 7.8 | 7.8 | 8.0 | 7.8 | 7.8 | 7.8 | 8.0 | 8.0 | 7.9 | 7.9 |
| | | | B | 7.6 | 7.9 | 8.0 | 8.0 | 7.4 | 7.9 | 8.2 | 7.9 | 7.9 | |
| | | | C | 8.1 | 7.7 | 8.0 | 7.8 | 7.9 | 7.6 | 8.3 | 7.6 | 7.9 | |
| | 11/29/2005 | 28 | A | 9.6 | 9.6 | 9.9 | 9.9 | 9.9 | 9.7 | 9.9 | 10.0 | 9.8 | 9.9 |
| | | | B | 9.3 | 9.7 | 10.1 | 10.2 | 9.5 | 9.9 | 10.1 | 10.1 | 9.9 | |
| | | | C | 10.1 | 9.7 | 10.5 | 9.8 | 10.1 | 9.9 | 10.2 | 9.9 | 10.0 | |
| | 12/27/2005 | 56 | A | 14.0 | 14.0 | 15.0 | 14.5 | 14.0 | 14.0 | 14.0 | 14.0 | 14.2 | 14.2 |
| | | | B | 14.0 | 14.0 | 14.0 | 14.0 | 14.0 | 15.0 | 14.0 | 14.0 | 14.1 | |
| | | | C | 15.0 | 14.0 | 14.5 | 14.0 | 15.0 | 14.0 | 14.5 | 14.0 | 14.4 | |
| | 1/31/2006 | 91 | A | 18.5 | 19.4 | 19.3 | 17.9 | 18.8 | 18.9 | 19.0 | 19.1 | 18.9 | 18.6 |
| | | | B | 18.3 | 19.3 | 19.4 | 18.0 | 18.1 | 18.4 | 18.1 | 18.8 | 18.6 | |
| | | | C | 19.2 | 17.9 | 18.4 | 17.5 | 18.2 | 18.0 | 19.8 | 18.5 | 18.4 | |
| | 5/2/2006 | 182 | A | 24.4 | 27.0 | 27.1 | 26.5 | 29.8 | 26.5 | 25.3 | 25.7 | 26.5 | 26.1 |
| | | | B | 25.3 | 26.9 | 27.2 | 27.2 | 25.5 | 25.1 | 26.1 | 27.4 | 26.3 | |
| | | | C | 25.6 | 25.1 | 26.9 | 24.6 | 26.0 | 24.9 | 25.8 | 25.1 | 25.5 | |
| | 11/1/2006 | 365 | A | 47.2 | 48.8 | 47.9 | 50.9 | 48.8 | 47.4 | 48.3 | 49.8 | 48.6 | 47.7 |
| | | | B | 47.1 | 49.9 | 47.4 | 44.7 | 42.5 | 50.5 | 47.6 | 48.4 | 47.3 | |
| | | | C | 45.2 | 50.5 | 46.8 | 45.6 | 45.9 | 51.9 | 45.0 | 47.4 | 47.3 | |

**Mix** TB2A4
**Cast Date** 11/3/2005

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB2A4 | 11/4/2005 | 1 | A | 3.1 | 3.2 | 3.2 | 3.2 | 3.1 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 |
| | | | B | 3.3 | 3.4 | 3.2 | 3.4 | 3.3 | 3.4 | 3.2 | 3.2 | 3.3 | |
| | | | C | 3.2 | 3.4 | 3.2 | 3.1 | 3.3 | 3.4 | 3.3 | 3.1 | 3.3 | |
| | 11/6/2005 | 3 | A | 5.1 | 5.3 | 5.2 | 5.2 | 5.1 | 5.3 | 5.2 | 5.1 | 5.2 | 5.1 |
| | | | B | 5.2 | 5.3 | 5.1 | 5.2 | 5.1 | 5.4 | 5.1 | 5.3 | 5.2 | |
| | | | C | 5.0 | 5.0 | 4.9 | 4.8 | 5.1 | 5.2 | 5.0 | 4.9 | 5.0 | |
| | 11/10/2005 | 7 | A | 8.3 | 8.5 | 8.5 | 8.6 | 8.4 | 8.6 | 8.8 | 8.6 | 8.5 | 8.7 |
| | | | B | 8.7 | 8.9 | 8.6 | 8.9 | 8.6 | 8.9 | 8.5 | 8.5 | 8.7 | |
| | | | C | 8.9 | 8.8 | 8.8 | 8.4 | 8.9 | 8.8 | 8.8 | 8.6 | 8.8 | |
| | 11/17/2005 | 14 | A | 18.1 | 20.1 | 20.5 | 19.9 | 18.4 | 20.5 | 20.9 | 19.0 | 19.7 | 20.0 |
| | | | B | 20.2 | 20.7 | 19.4 | 21.3 | 20.1 | 20.7 | 19.9 | 20.5 | 20.4 | |
| | | | C | 20.4 | 20.2 | 20.1 | 18.6 | 20.4 | 20.6 | 20.1 | 19.9 | 20.0 | |
| | 12/1/2005 | 28 | A | 35.7 | 35.7 | 35.7 | 37.6 | 35.7 | 37.3 | 36.3 | 35.8 | 36.2 | 36.7 |
| | | | B | 36.9 | 38.2 | 35.6 | 37.8 | 36.1 | 36.5 | 34.9 | 38.5 | 36.8 | |
| | | | C | 38.1 | 37.0 | 36.6 | 36.7 | 38.5 | 36.5 | 37.3 | 35.4 | 37.0 | |
| | 12/29/2005 | 56 | A | 50.9 | 51.5 | 51.7 | 51.4 | 54.4 | 52.0 | 52.4 | 52.3 | 52.1 | 52.5 |
| | | | B | 55.0 | 52.2 | 49.7 | 54.2 | 55.8 | 53.3 | 49.0 | 54.9 | 53.0 | |
| | | | C | 54.3 | 55.0 | 52.0 | 50.2 | 53.9 | 50.6 | 54.0 | 50.1 | 52.5 | |
| | 2/2/2006 | 91 | A | 56.7 | 58.3 | 60.7 | 58.6 | 55.2 | 60.4 | 62.5 | 51.7 | 58.0 | 58.6 |
| | | | B | 60.8 | 58.8 | 54.2 | 60.4 | 55.7 | 58.8 | 56.6 | 64.3 | 58.7 | |
| | | | C | 58.8 | 59.6 | 54.9 | 63.5 | 57.4 | 61.5 | 55.9 | 61.1 | 59.1 | |
| | 5/4/2006 | 182 | A | 61.9 | 61.4 | 65.5 | 61.5 | 64.2 | 66.2 | 67.2 | 63.2 | 63.9 | 66.0 |
| | | | B | 69.4 | 64.3 | 67.2 | 65.4 | 66.4 | 64.3 | 70.0 | 68.0 | 66.9 | |
| | | | C | 67.6 | 65.8 | 69.0 | 68.7 | 65.6 | 64.2 | 68.3 | 68.1 | 67.2 | |
| | 11/7/2006 | 369 | A | 110.6 | 105.6 | 108.3 | 111.0 | 95.0 | 104.2 | 109.4 | 111.0 | 106.9 | 105.6 |
| | | | B | 112.1 | 109.2 | 110.8 | 103.0 | 112.7 | 104.1 | 105.1 | 101.4 | 107.3 | |
| | | | C | 101.7 | 103.7 | 98.8 | 109.5 | 105.8 | 104.8 | 93.7 | 101.7 | 102.5 | |

**Mix** TB3A4
**Cast Date** 11/8/2005

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB3A4 | 11/9/2005 | 1 | A | 3.5 | 3.6 | 3.5 | 3.6 | 3.5 | 3.8 | 3.5 | 3.7 | 3.6 | 3.6 |
| | | | B | 3.6 | 3.5 | 3.5 | 3.4 | 3.6 | 3.5 | 3.5 | 3.4 | 3.5 | |
| | | | C | 3.7 | 3.5 | 3.5 | 3.5 | 3.7 | 3.5 | 3.6 | 3.5 | 3.6 | |
| | 11/11/2005 | 3 | A | 4.8 | 5.0 | 4.7 | 4.9 | 4.6 | 5.1 | 4.6 | 4.9 | 4.8 | 4.8 |
| | | | B | 5.0 | 4.8 | 4.8 | 4.6 | 5.0 | 4.8 | 4.8 | 4.7 | 4.8 | |
| | | | C | 5.2 | 4.6 | 4.7 | 4.8 | 5.2 | 4.6 | 4.7 | 4.9 | 4.8 | |
| | 11/15/2005 | 7 | A | 7.7 | 8.3 | 7.8 | 8.4 | 7.7 | 8.6 | 7.7 | 8.3 | 8.1 | 8.1 |
| | | | B | 8.5 | 7.9 | 7.8 | 7.9 | 8.4 | 7.9 | 7.8 | 8.5 | 8.1 | |
| | | | C | 8.7 | 7.7 | 8.0 | 8.1 | 8.6 | 7.7 | 8.0 | 8.0 | 8.1 | |
| | 11/22/2005 | 14 | A | 13.7 | 13.0 | 14.1 | 12.4 | 13.9 | 13.0 | 14.3 | 12.7 | 13.4 | 13.2 |
| | | | B | 14.2 | 13.1 | 12.8 | 13.0 | 14.2 | 13.3 | 12.7 | 12.7 | 13.3 | |
| | | | C | 13.5 | 12.9 | 12.5 | 13.1 | 13.5 | 12.8 | 13.0 | 13.2 | 13.1 | |
| | 12/6/2005 | 28 | A | 18.8 | 17.4 | 18.2 | 17.6 | 19.0 | 17.5 | 18.1 | 17.4 | 18.0 | 18.3 |
| | | | B | 19.7 | 18.4 | 17.6 | 17.5 | 19.1 | 18.7 | 18.2 | 18.3 | 18.4 | |
| | | | C | 19.5 | 18.1 | 18.0 | 18.7 | 19.2 | 17.3 | 18.1 | 19.0 | 18.5 | |
| | 1/3/2006 | 56 | A | 26.0 | 23.7 | 25.7 | 24.3 | 26.6 | 24.2 | 27.4 | 24.6 | 25.3 | 25.8 |
| | | | B | 29.0 | 25.0 | 24.5 | 25.2 | 27.6 | 27.3 | 24.0 | 26.0 | 26.1 | |
| | | | C | 27.0 | 26.1 | 25.8 | 25.6 | 27.8 | 25.6 | 24.9 | 25.6 | 26.1 | |
| | 2/7/2006 | 91 | A | 35.6 | 32.2 | 31.1 | 31.3 | 33.3 | 29.9 | 31.6 | 30.7 | 32.0 | 32.5 |
| | | | B | 34.4 | 33.3 | 31.1 | 31.2 | 33.4 | 34.1 | 31.2 | 32.3 | 32.6 | |
| | | | C | 33.8 | 32.2 | 32.9 | 32.5 | 36.9 | 30.8 | 31.4 | 32.5 | 32.9 | |
| | 5/9/2006 | 182 | A | 45.2 | 50.8 | 44.8 | 46.9 | 45.9 | 52.9 | 46.6 | 49.6 | 47.8 | 47.5 |
| | | | B | 50.9 | 45.6 | 44.1 | 49.2 | 55.0 | 45.0 | 44.4 | 42.9 | 47.1 | |
| | | | C | 49.2 | 49.1 | 47.8 | 46.9 | 49.5 | 45.5 | 45.2 | 46.3 | 47.4 | |
| | 11/7/2006 | 364 | A | 82.1 | 80.5 | 76.4 | 68.2 | 79.1 | 78.2 | 79.0 | 72.7 | 77.0 | 77.2 |
| | | | B | 90.3 | 74.4 | 73.8 | 80.1 | 88.8 | 80.2 | 80.6 | 77.8 | 80.8 | |
| | | | C | 82.5 | 74.2 | 69.2 | 75.3 | 73.3 | 66.7 | 77.4 | 72.2 | 73.9 | |

**Mix** TB4A4
**Cast Date** 11/10/2005

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB4A4 | 11/11/2005 | 1 | A | 3.0 | 3.1 | 3.1 | 3.1 | 3.0 | 3.3 | 3.1 | 3.1 | 3.1 | 3.1 |
| | | | B | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | |
| | | | C | 3.1 | 3.1 | 3.0 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | |
| | 11/13/2005 | 3 | A | 4.8 | 5.3 | 5.0 | 5.0 | 4.8 | 5.3 | 5.0 | 5.0 | 5.0 | 5.0 |
| | | | B | 4.9 | 4.9 | 5.1 | 4.8 | 4.9 | 4.9 | 5.1 | 4.7 | 4.9 | |
| | | | C | 5.0 | 4.9 | 4.9 | 5.0 | 4.8 | 5.0 | 4.8 | 5.0 | 4.9 | |
| | 11/17/2005 | 7 | A | 10.8 | 11.7 | 10.9 | 10.8 | 10.5 | 11.7 | 11.0 | 10.5 | 11.0 | 10.9 |
| | | | B | 11.0 | 10.8 | 11.5 | 10.8 | 11.0 | 10.8 | 11.4 | 10.7 | 11.0 | |
| | | | C | 10.8 | 10.7 | 10.4 | 10.8 | 10.8 | 10.8 | 10.6 | 10.9 | 10.7 | |
| | 11/24/2005 | 14 | A | 18.3 | 20.1 | 18.8 | 18.6 | 18.2 | 20.2 | 19.0 | 18.5 | 19.0 | 18.7 |
| | | | B | 19.3 | 18.9 | 20.1 | 18.2 | 18.3 | 18.9 | 20.2 | 17.8 | 19.0 | |
| | | | C | 18.7 | 18.3 | 17.5 | 18.7 | 18.3 | 18.3 | 17.8 | 18.6 | 18.3 | |
| | 12/8/2005 | 28 | A | 23.3 | 25.5 | 23.7 | 23.8 | 23.8 | 24.1 | 24.1 | 23.8 | 24.0 | 24.1 |
| | | | B | 24.3 | 24.5 | 25.6 | 23.3 | 23.3 | 23.9 | 26.1 | 23.1 | 24.3 | |
| | | | C | 23.4 | 23.3 | 23.5 | 24.4 | 25.2 | 23.6 | 22.8 | 24.8 | 23.9 | |
| | 1/5/2006 | 56 | A | 30.3 | 29.5 | 29.7 | 28.1 | 27.2 | 30.6 | 30.3 | 28.5 | 29.3 | 30.4 |
| | | | B | 29.5 | 29.3 | 34.5 | 31.9 | 30.1 | 29.9 | 33.8 | 31.4 | 31.3 | |
| | | | C | 31.4 | 30.3 | 29.3 | 29.6 | 31.2 | 32.1 | 30.8 | 30.1 | 30.6 | |
| | 2/9/2006 | 91 | A | 36.0 | 36.6 | 35.0 | 36.4 | 35.8 | 37.3 | 35.5 | 35.2 | 36.0 | 36.5 |
| | | | B | 37.1 | 36.0 | 38.5 | 36.4 | 39.1 | 36.0 | 39.6 | 36.8 | 37.4 | |
| | | | C | 38.8 | 34.7 | 34.2 | 37.3 | 37.4 | 35.1 | 35.6 | 35.4 | 36.1 | |
| | 5/11/2006 | 182 | A | 49.4 | 48.2 | 49.3 | 46.3 | 48.4 | 49.8 | 48.0 | 49.0 | 48.6 | 49.5 |
| | | | B | 50.4 | 47.7 | 53.7 | 49.9 | 50.0 | 47.1 | 53.5 | 48.7 | 50.1 | |
| | | | C | 53.9 | 51.6 | 48.0 | 42.5 | 51.4 | 52.5 | 50.0 | 49.8 | 50.0 | |
| | 11/22/2006 | 377 | A | 90.6 | 88.6 | 88.4 | 89.8 | 89.1 | 89.9 | 87.8 | 89.8 | 89.3 | 89.7 |
| | | | B | 92.5 | 92.3 | 94.1 | 88.1 | 92.6 | 89.3 | 94.2 | 87.8 | 91.4 | |
| | | | C | 91.8 | 86.4 | 85.2 | 90.4 | 90.0 | 89.6 | 84.5 | 89.0 | 88.4 | |

**Mix** TB5A4
**Cast Date** 11/15/2005

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB5A4 | 11/16/2005 | 1 | A | 2.6 | 2.7 | 2.6 | 2.6 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.7 |
| | | | B | 2.6 | 2.6 | 2.5 | 2.7 | 2.6 | 2.7 | 2.5 | 2.7 | 2.6 | |
| | | | C | 2.7 | 2.7 | 2.8 | 2.7 | 2.7 | 2.7 | 2.8 | 2.7 | 2.7 | |
| | 11/18/2005 | 3 | A | 4.2 | 4.2 | 3.9 | 4.0 | 4.2 | 4.2 | 3.9 | 4.0 | 4.1 | 4.2 |
| | | | B | 4.1 | 4.2 | 3.9 | 4.2 | 4.0 | 4.2 | 4.0 | 4.2 | 4.1 | |
| | | | C | 4.2 | 4.2 | 4.4 | 4.3 | 4.3 | 4.2 | 4.3 | 4.3 | 4.3 | |
| | 11/22/2005 | 7 | A | 8.1 | 7.6 | 7.4 | 7.6 | 8.2 | 8.0 | 7.5 | 7.7 | 7.8 | 7.9 |
| | | | B | 7.6 | 7.7 | 7.6 | 8.2 | 7.5 | 7.8 | 7.6 | 8.3 | 7.8 | |
| | | | C | 8.0 | 8.1 | 8.2 | 8.0 | 7.9 | 7.8 | 8.3 | 7.8 | 8.0 | |
| | 11/29/2005 | 14 | A | 13.9 | 13.9 | 12.6 | 13.5 | 13.9 | 13.7 | 12.7 | 13.3 | 13.4 | 14.9 |
| | | | B | 14.3 | 15.9 | 15.0 | 14.9 | 15.1 | 15.9 | 16.1 | 15.3 | 15.3 | |
| | | | C | 16.6 | 16.4 | 14.7 | 15.7 | 16.0 | 15.7 | 15.6 | 16.1 | 15.9 | |
| | 12/13/2005 | 28 | A | 22.4 | 21.5 | 20.4 | 22.1 | 22.5 | 21.8 | 20.2 | 22.5 | 21.7 | 22.3 |
| | | | B | 20.4 | 23.9 | 22.1 | 22.9 | 21.6 | 23.6 | 21.8 | 22.8 | 22.4 | |
| | | | C | 22.8 | 21.9 | 23.2 | 22.5 | 23.7 | 22.6 | 23.4 | 22.6 | 22.8 | |
| | 1/10/2006 | 56 | A | 34.9 | 32.9 | 29.8 | 31.4 | 34.8 | 34.2 | 30.2 | 32.0 | 32.5 | 30.7 |
| | | | B | 33.0 | 34.0 | 33.3 | 33.4 | 33.5 | 34.1 | 31.2 | 34.2 | 33.3 | |
| | | | C | 21.1 | 26.1 | 29.3 | 27.6 | 23.8 | 22.9 | 27.7 | 31.7 | 26.3 | |
| | 2/14/2006 | 91 | A | 43.5 | 41.8 | 41.0 | 43.9 | 45.3 | 43.6 | 41.8 | 41.2 | 42.8 | 43.1 |
| | | | B | 41.9 | 43.4 | 45.4 | 47.2 | 41.5 | 44.4 | 43.7 | 47.3 | 44.4 | |
| | | | C | 41.8 | 42.7 | 41.8 | 42.0 | 41.2 | 42.1 | 42.7 | 43.6 | 42.2 | |
| | 5/16/2006 | 182 | A | 62.9 | 60.0 | 58.5 | 59.8 | 62.4 | 61.2 | 64.2 | 59.2 | 61.0 | 62.3 |
| | | | B | 61.6 | 63.3 | 62.1 | 63.6 | 59.4 | 61.0 | 63.5 | 63.9 | 62.3 | |
| | | | C | 65.1 | 65.2 | 61.5 | 64.1 | 64.4 | 63.2 | 63.1 | 62.4 | 63.6 | |
| | 11/14/2006 | 364 | A | 110.7 | 113.7 | 115.1 | 127.5 | 114.2 | 116.0 | 125.2 | 124.2 | 118.3 | 123.5 |
| | | | B | 129.5 | 117.8 | 140.2 | 129.5 | 129.6 | 118.8 | 139.2 | 128.4 | 129.1 | |
| | | | C | 119.6 | 122.9 | 123.9 | 126.7 | 122.6 | 121.5 | 130.2 | 118.0 | 123.2 | |

**Mix** TB6A4
**Cast Date** 2/21/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB6A4 | 2/22/2006 | 1 | A | 3.0 | 2.9 | 2.7 | 2.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.0 | 3.3 |
| | | | B | 3.4 | 3.3 | 3.3 | 3.3 | 3.3 | 3.2 | 3.2 | 3.3 | 3.3 | |
| | | | C | 3.3 | 3.4 | 3.5 | 3.4 | 3.4 | 3.6 | 3.6 | 3.5 | 3.5 | |
| | 2/24/2006 | 3 | A | 4.6 | 4.5 | 4.5 | 4.5 | 4.7 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| | | | B | 4.9 | 4.7 | 4.6 | 4.5 | 4.5 | 4.4 | 4.5 | 4.5 | 4.6 | |
| | | | C | 4.4 | 4.2 | 4.5 | 4.4 | 4.6 | 4.5 | 4.6 | 4.4 | 4.5 | |
| | 2/28/2006 | 7 | A | 10.9 | 10.6 | 10.8 | 10.8 | 11.0 | 10.6 | 10.9 | 11.0 | 10.8 | 10.7 |
| | | | B | 11.0 | 10.9 | 10.4 | 10.5 | 10.9 | 10.7 | 10.5 | 10.3 | 10.7 | |
| | | | C | 10.8 | 10.8 | 11.0 | 10.3 | 10.4 | 10.6 | 10.8 | 10.5 | 10.7 | |
| | 3/7/2006 | 14 | A | 20.7 | 20.0 | 20.4 | 19.7 | 21.4 | 20.1 | 20.3 | 19.9 | 20.3 | 20.5 |
| | | | B | 19.9 | 19.6 | 20.1 | 20.3 | 19.6 | 19.1 | 19.8 | 20.1 | 19.8 | |
| | | | C | 19.8 | 19.0 | 21.4 | 20.0 | 23.2 | 23.6 | 23.0 | 21.2 | 21.4 | |
| | 3/21/2006 | 28 | A | 28.9 | 28.3 | 28.8 | 29.1 | 29.6 | 29.1 | 28.7 | 28.8 | 28.9 | 28.8 |
| | | | B | 29.4 | 30.1 | 29.0 | 27.9 | 28.6 | 29.0 | 28.0 | 28.0 | 28.8 | |
| | | | C | 28.9 | 28.7 | 28.9 | 27.8 | 28.7 | 27.9 | 28.7 | 29.4 | 28.6 | |
| | 4/18/2006 | 56 | A | 42.4 | 40.5 | 40.2 | 40.2 | 39.0 | 39.9 | 40.2 | 40.5 | 40.4 | 40.0 |
| | | | B | 42.0 | 40.0 | 38.9 | 39.7 | 42.5 | 42.5 | 38.2 | 38.7 | 40.3 | |
| | | | C | 39.1 | 40.7 | 40.7 | 37.5 | 39.2 | 38.6 | 41.2 | 38.2 | 39.4 | |
| | 5/23/2006 | 91 | A | 47.8 | 47.2 | 47.7 | 44.6 | 47.2 | 46.7 | 49.2 | 46.4 | 47.1 | 47.0 |
| | | | B | 48.5 | 49.8 | 47.5 | 46.7 | 47.9 | 49.7 | 44.0 | 47.2 | 47.7 | |
| | | | C | 46.4 | 45.8 | 43.6 | 45.8 | 47.0 | 46.8 | 45.6 | 50.0 | 46.4 | |
| | 11/24/2006 | 276 | A | 102.0 | 98.7 | 95.4 | 99.1 | 97.5 | 98.6 | 95.4 | 98.6 | 98.2 | 97.3 |
| | | | B | 101.8 | 96.7 | 95.5 | 93.4 | 100.5 | 98.0 | 93.9 | 94.4 | 96.8 | |
| | | | C | 97.3 | 96.0 | 100.3 | 95.0 | 95.8 | 96.0 | 101.1 | 94.2 | 97.0 | |
| | 2/20/2007 | 364 | A | 123.5 | 122.9 | 127.5 | 121.7 | 127.7 | 120.7 | 124.3 | 117.9 | 123.3 | 122.2 |
| | | | B | 126.8 | 119.7 | 119.0 | 129.2 | 121.4 | 117.9 | 128.2 | 130.0 | 124.0 | |
| | | | C | 123.6 | 121.1 | 116.9 | 117.2 | 122.1 | 118.8 | 116.2 | 119.2 | 119.4 | |

**Mix** TB7A4
**Cast Date** 2/21/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB7A4 | 2/22/2006 | 1 | A | 3.2 | 3.4 | 3.2 | 3.4 | 3.1 | 2.8 | 2.7 | 2.8 | 3.1 | 2.9 |
| | | | B | 2.7 | 2.7 | 2.8 | 2.8 | 2.7 | 2.6 | 2.7 | 2.8 | 2.7 | |
| | | | C | 2.9 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.9 | 2.9 | 2.8 | |
| | 2/24/2006 | 3 | A | 4.2 | 3.9 | 3.8 | 3.7 | 4.2 | 4.3 | 4.4 | 4.5 | 4.1 | 4.1 |
| | | | B | 4.0 | 4.1 | 4.1 | 4.0 | 3.6 | 3.7 | 3.8 | 3.8 | 3.9 | |
| | | | C | 3.9 | 3.8 | 3.9 | 3.9 | 4.5 | 4.5 | 4.5 | 4.2 | 4.2 | |
| | 2/28/2006 | 7 | A | 7.5 | 7.5 | 7.6 | 7.5 | 7.5 | 7.9 | 7.2 | 7.3 | 7.5 | 7.5 |
| | | | B | 7.4 | 7.6 | 7.6 | 7.6 | 7.5 | 7.5 | 7.5 | 7.6 | 7.5 | |
| | | | C | 7.5 | 7.7 | 7.5 | 7.8 | 7.6 | 7.5 | 7.5 | 7.4 | 7.6 | |
| | 3/7/2006 | 14 | A | 15.6 | 14.8 | 14.2 | 14.9 | 15.2 | 15.3 | 15.8 | 15.5 | 15.2 | 16.3 |
| | | | B | 15.2 | 17.3 | 17.6 | 16.7 | 16.5 | 16.9 | 17.0 | 16.8 | 16.8 | |
| | | | C | 17.5 | 16.7 | 17.3 | 17.0 | 17.0 | 17.0 | 17.1 | 16.9 | 17.1 | |
| | 3/21/2006 | 28 | A | 24.5 | 23.5 | 21.1 | 22.8 | 23.8 | 23.1 | 23.3 | 23.0 | 23.1 | 23.6 |
| | | | B | 22.9 | 23.9 | 24.8 | 23.9 | 22.7 | 24.0 | 24.2 | 24.1 | 23.8 | |
| | | | C | 23.3 | 24.6 | 22.7 | 24.7 | 24.3 | 24.9 | 22.9 | 24.0 | 23.9 | |
| | 4/18/2006 | 56 | A | 36.0 | 37.6 | 31.1 | 34.9 | 38.1 | 36.9 | 32.5 | 34.8 | 35.2 | 36.9 |
| | | | B | 37.4 | 38.6 | 39.7 | 37.4 | 37.0 | 38.3 | 39.4 | 37.3 | 38.1 | |
| | | | C | 37.8 | 39.6 | 35.1 | 38.3 | 37.6 | 38.5 | 34.6 | 36.1 | 37.2 | |
| | 5/23/2006 | 91 | A | 46.9 | 48.2 | 45.6 | 47.0 | 47.8 | 47.8 | 44.0 | 48.4 | 47.0 | 49.0 |
| | | | B | 49.0 | 48.2 | 51.7 | 49.4 | 49.8 | 50.0 | 51.4 | 49.4 | 49.9 | |
| | | | C | 49.3 | 52.0 | 49.6 | 48.7 | 50.7 | 52.3 | 50.0 | 49.8 | 50.3 | |
| | 11/24/2006 | 276 | A | 117.4 | 121.1 | 112.6 | 121.3 | 116.3 | 116.8 | 107.7 | 115.4 | 116.1 | 119.4 |
| | | | B | 116.2 | 119.4 | 124.0 | 118.1 | 115.9 | 118.6 | 121.6 | 115.8 | 118.7 | |
| | | | C | 121.6 | 128.7 | 122.7 | 122.0 | 122.3 | 123.7 | 118.8 | 128.4 | 123.5 | |
| | 2/20/2007 | 364 | A | 162.2 | 152.2 | 140.2 | 150.2 | 158.6 | 158.6 | 154.3 | 146.1 | 152.8 | 152.1 |
| | | | B | 154.4 | 158.8 | 156.6 | 149.8 | 150.3 | 141.1 | 149.3 | 147.3 | 151.0 | |
| | | | C | 156.3 | 155.6 | 148.2 | 156.9 | 149.7 | 156.0 | 145.0 | 151.7 | 152.4 | |

**Mix** TB8A4
**Cast Date** 3/30/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB8A4 | 3/31/2006 | 1 | A | 2.9 | 3.0 | 2.9 | 2.9 | 2.9 | 3.0 | 2.8 | 2.9 | 2.9 | 3.0 |
| | | | B | 3.0 | 3.1 | 2.9 | 3.0 | 2.9 | 3.0 | 3.1 | 3.1 | 3.0 | |
| | | | C | 3.2 | 3.0 | 3.1 | 3.2 | 3.2 | 2.9 | 3.1 | 3.2 | 3.1 | |
| | 4/2/2006 | 3 | A | 7.5 | 7.3 | 7.1 | 6.8 | 7.3 | 7.2 | 6.9 | 7.1 | 7.2 | 7.2 |
| | | | B | 6.8 | 6.9 | 7.1 | 6.9 | 7.0 | 7.1 | 7.2 | 7.1 | 7.0 | |
| | | | C | 7.7 | 6.9 | 7.8 | 7.7 | 7.5 | 7.3 | 7.7 | 7.4 | 7.5 | |
| | 4/6/2006 | 7 | A | 16.8 | 16.6 | 16.3 | 16.8 | 17.2 | 17.2 | 17.3 | 16.4 | 16.8 | 17.5 |
| | | | B | 16.5 | 16.7 | 18.2 | 16.9 | 16.4 | 17.8 | 17.9 | 16.8 | 17.2 | |
| | | | C | 19.7 | 18.9 | 18.3 | 16.9 | 19.2 | 19.0 | 18.5 | 17.4 | 18.5 | |
| | 4/13/2006 | 14 | A | 27.8 | 27.4 | 25.3 | 24.9 | 27.3 | 26.5 | 26.1 | 26.4 | 26.5 | 26.9 |
| | | | B | 23.8 | 28.1 | 25.7 | 26.6 | 24.0 | 24.4 | 25.8 | 25.6 | 25.5 | |
| | | | C | 30.1 | 29.1 | 28.8 | 28.9 | 29.6 | 25.8 | 29.3 | 28.5 | 28.8 | |
| | 4/27/2006 | 28 | A | 36.9 | 38.4 | 35.9 | 34.3 | 37.2 | 37.5 | 35.8 | 34.5 | 36.3 | 36.5 |
| | | | B | 33.3 | 33.9 | 35.5 | 35.1 | 37.7 | 34.8 | 35.9 | 35.8 | 35.3 | |
| | | | C | 39.7 | 35.8 | 37.7 | 38.8 | 37.1 | 39.6 | 35.5 | 39.2 | 37.9 | |
| | 5/25/2006 | 56 | A | 44.6 | 46.9 | 44.0 | 41.1 | 44.6 | 43.7 | 44.4 | 44.4 | 44.2 | 43.8 |
| | | | B | 44.4 | 41.4 | 41.0 | 42.8 | 43.0 | 38.3 | 42.0 | 44.6 | 42.2 | |
| | | | C | 48.6 | 42.6 | 45.2 | 44.2 | 48.2 | 43.7 | 44.2 | 43.8 | 45.1 | |
| | 6/29/2006 | 91 | A | 59.2 | 56.8 | 54.5 | 55.0 | 57.5 | 56.7 | 56.8 | 55.4 | 56.5 | 56.3 |
| | | | B | 49.7 | 52.4 | 55.5 | 55.8 | 47.5 | 53.6 | 52.4 | 54.3 | 52.7 | |
| | | | C | 62.6 | 51.6 | 61.7 | 60.3 | 61.8 | 59.7 | 60.9 | 59.7 | 59.8 | |
| | 11/24/2006 | 239 | A | 99.7 | 97.3 | 97.4 | 93.8 | 96.5 | 100.0 | 98.2 | 94.9 | 97.2 | 99.7 |
| | | | B | 95.2 | 95.0 | 101.1 | 93.1 | 92.8 | 95.7 | 102.0 | 97.4 | 96.5 | |
| | | | C | 108.8 | 102.4 | 106.6 | 102.8 | 108.6 | 101.3 | 108.3 | 104.5 | 105.4 | |
| | 3/29/2007 | 364 | A | 108.8 | 117.0 | 110.7 | 110.1 | 114.5 | 113.7 | 109.4 | 106.6 | 111.4 | 111.7 |
| | | | B | 106.8 | 102.2 | 113.4 | 107.9 | 113.8 | 101.9 | 102.4 | 109.8 | 107.3 | |
| | | | C | 123.9 | 112.4 | 120.4 | 108.2 | 124.9 | 108.0 | 117.4 | 116.4 | 116.5 | |

**Mix** TB1A5
**Cast Date** 3/30/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 4.9 | 5.0 | 5.1 | 4.9 | 5.1 | 5.0 | 5.0 | 4.9 | 5.0 | |
| | 3/31/2006 | 1 | B | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.7 | 4.8 | 4.6 | 4.8 |
| | | | C | 4.6 | 4.6 | 4.7 | 4.8 | 4.7 | 4.8 | 4.7 | 4.7 | 4.7 | |
| | | | A | 6.1 | 6.3 | 6.7 | 6.5 | 6.2 | 6.4 | 6.5 | 6.6 | 6.4 | |
| | 4/2/2006 | 3 | B | 6.3 | 6.1 | 6.2 | 6.2 | 6.2 | 6.0 | 6.2 | 6.2 | 6.2 | 6.3 |
| | | | C | 6.2 | 6.4 | 6.4 | 6.3 | 6.3 | 6.2 | 6.4 | 6.3 | 6.3 | |
| | | | A | 7.9 | 8.6 | 8.6 | 8.9 | 8.1 | 10.2 | 8.6 | 9.2 | 8.8 | |
| | 4/6/2006 | 7 | B | 8.3 | 8.5 | 8.5 | 8.0 | 7.9 | 7.9 | 7.2 | 7.2 | 7.9 | 8.1 |
| | | | C | 7.4 | 8.1 | 8.0 | 7.6 | 7.4 | 7.7 | 7.6 | 7.3 | 7.6 | |
| | | | A | 7.2 | 7.9 | 7.7 | 7.6 | 7.4 | 7.8 | 7.9 | 7.3 | 7.6 | |
| | 4/13/2006 | 14 | B | 7.2 | 7.2 | 7.2 | 7.3 | 7.3 | 7.4 | 7.3 | 7.4 | 7.3 | 7.5 |
| | | | C | 7.4 | 7.9 | 7.5 | 7.5 | 7.3 | 7.4 | 7.8 | 7.6 | 7.6 | |
| | | | A | 9.2 | 9.6 | 9.6 | 9.4 | 9.1 | 9.6 | 9.7 | 9.5 | 9.5 | |
| TB1A5 | 4/27/2006 | 28 | B | 9.1 | 8.9 | 8.8 | 9.4 | 8.9 | 8.9 | 9.1 | 9.0 | 9.0 | 9.3 |
| | | | C | 9.1 | 9.2 | 9.6 | 9.2 | 9.2 | 9.1 | 9.3 | 9.7 | 9.3 | |
| | | | A | 13.5 | 13.8 | 14.1 | 13.7 | 13.2 | 14.3 | 14.3 | 14.1 | 13.9 | |
| | 5/25/2006 | 56 | B | 13.6 | 13.2 | 13.5 | 13.7 | 13.8 | 13.4 | 13.0 | 13.7 | 13.5 | 13.6 |
| | | | C | 13.4 | 13.2 | 14.1 | 13.5 | 13.2 | 13.2 | 14.1 | 13.6 | 13.5 | |
| | | | A | 20.5 | 20.4 | 21.0 | 20.5 | 20.3 | 21.0 | 20.8 | 20.7 | 20.7 | |
| | 6/29/2006 | 91 | B | 19.5 | 18.9 | 19.7 | 20.0 | 19.2 | 19.2 | 19.3 | 19.9 | 19.5 | 20.0 |
| | | | C | 19.2 | 19.3 | 21.0 | 20.6 | 19.3 | 19.6 | 20.7 | 20.0 | 20.0 | |
| | | | A | 44.7 | 46.1 | 44.9 | 45.0 | 42.3 | 44.2 | 44.7 | 45.0 | 44.6 | |
| | 11/24/2006 | 239 | B | 41.5 | 40.8 | 42.0 | 43.4 | 42.0 | 40.8 | 41.5 | 42.8 | 41.9 | 43.4 |
| | | | C | 42.5 | 42.6 | 45.4 | 44.1 | 42.6 | 42.6 | 45.4 | 44.0 | 43.7 | |
| | | | A | 48.4 | 48.9 | 50.0 | 50.1 | 45.3 | 51.0 | 50.3 | 49.9 | 49.2 | |
| | 3/29/2007 | 364 | B | 49.9 | 47.5 | 48.0 | 50.7 | 48.5 | 47.7 | 46.8 | 47.8 | 48.4 | 48.5 |
| | | | C | 46.6 | 46.4 | 49.2 | 50.0 | 47.5 | 47.6 | 46.8 | 49.8 | 48.0 | |

**Mix** TB2A5
**Cast Date** 5/2/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 4.6 | 4.5 | 4.4 | 4.3 | 7.7 | 7.1 | 6.4 | 4.3 | 5.4 | |
| | 5/3/2006 | 1 | B | 4.3 | 4.1 | 4.5 | 4.6 | 4.3 | 4.2 | 4.5 | 4.5 | 4.4 | 4.9 |
| | | | C | 15.3 | 13.8 | 14.7 | 13.3 | 12.3 | 11.0 | 9.9 | 10.1 | 12.6 | |
| | | | A | 5.7 | 5.6 | 5.7 | 5.6 | 5.8 | 5.6 | 5.8 | 5.9 | 5.7 | |
| | 5/5/2006 | 3 | B | 5.8 | 5.7 | 5.8 | 5.8 | 5.7 | 5.7 | 5.7 | 5.8 | 5.8 | 5.7 |
| | | | C | 5.5 | 5.6 | 5.6 | 5.7 | 12.8 | 10.6 | 11.6 | 12.2 | 5.6 | |
| | | | A | 9.9 | 9.7 | 9.8 | 9.6 | 10.0 | 10.3 | 9.9 | 9.8 | 9.9 | |
| | 5/9/2006 | 7 | B | 9.8 | 9.7 | 10.0 | 10.1 | 9.7 | 9.8 | 9.1 | 10.1 | 9.8 | 10.0 |
| | | | C | 10.1 | 10.3 | 10.3 | 9.9 | 11.0 | 11.3 | 10.5 | 10.0 | 10.4 | |
| | | | A | 22.1 | 22.5 | 22.9 | 22.5 | 22.0 | 23.0 | 22.4 | 21.7 | 22.4 | |
| | 5/16/2006 | 14 | B | 21.0 | 21.2 | 22.7 | 23.4 | 22.3 | 20.9 | 23.0 | 23.0 | 22.2 | 22.3 |
| | | | C | 21.8 | 22.2 | 23.6 | 22.8 | 21.5 | 22.3 | 23.3 | 21.3 | 22.4 | |
| | | | A | 40.8 | 38.7 | 41.5 | 41.3 | 41.7 | 39.7 | 41.6 | 40.2 | 40.7 | |
| TB2A5 | 5/30/2006 | 28 | B | 42.9 | 41.9 | 42.7 | 39.2 | 41.3 | 42.4 | 43.0 | 39.3 | 41.6 | 41.2 |
| | | | C | 38.7 | 37.5 | 41.5 | 41.4 | 44.7 | 40.2 | 45.2 | 41.2 | 41.3 | |
| | | | A | 62.5 | 56.1 | 61.6 | 61.5 | 63.1 | 58.4 | 60.6 | 60.3 | 60.5 | |
| | 6/27/2006 | 56 | B | 62.7 | 61.4 | 63.0 | 55.1 | 63.0 | 61.5 | 65.7 | 57.2 | 61.2 | 61.1 |
| | | | C | 62.4 | 58.1 | 65.8 | 60.1 | 58.7 | 60.2 | 65.2 | 61.3 | 61.5 | |
| | | | A | 74.2 | 68.7 | 70.0 | 67.3 | 73.3 | 67.6 | 70.3 | 67.3 | 69.8 | |
| | 8/1/2006 | 91 | B | 73.8 | 70.1 | 72.3 | 72.9 | 73.2 | 68.7 | 74.7 | 67.0 | 71.6 | 70.3 |
| | | | C | 69.1 | 66.7 | 73.1 | 71.7 | 68.3 | 64.4 | 73.4 | 69.4 | 69.5 | |
| | | | A | 104.0 | 102.0 | 93.6 | 106.4 | 102.6 | 104.7 | 93.6 | 107.3 | 101.8 | |
| | 11/1/2006 | 183 | B | 115.4 | 103.1 | 107.2 | 104.5 | 108.7 | 100.7 | 102.6 | 102.3 | 105.6 | 102.9 |
| | | | C | 99.0 | 92.9 | 109.3 | 101.7 | 96.6 | 100.8 | 107.4 | 102.4 | 101.3 | |
| | | | A | 131.3 | 132.4 | 128.9 | 128.7 | 130.6 | 133.5 | 130.3 | 126.4 | 130.3 | |
| | 5/1/2007 | 364 | B | 128.0 | 129.2 | 139.5 | 128.2 | 132.2 | 129.7 | 131.2 | 125.0 | 130.4 | 129.8 |
| | | | C | 126.9 | 131.7 | 130.2 | 127.5 | 124.5 | 127.7 | 133.2 | 128.5 | 128.8 | |

**Mix** TB3A5
**Cast Date** 5/2/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 14.7 | 12.2 | 12.2 | 11.7 | 4.2 | 5.5 | 4.2 | 3.3 | 4.3 | |
| | 5/3/2006 | 1 | B | 3.3 | 2.8 | 1.9 | 6.8 | 1.3 | 2.2 | 1.8 | 1.6 | 2.7 | 2.7 |
| | | | C | 1.6 | 1.6 | 1.5 | 1.3 | 0.5 | 1.0 | 1.1 | 1.2 | 1.2 | |
| | | | A | 8.1 | 8.4 | 8.7 | 8.2 | 6.4 | 5.8 | 5.3 | 5.2 | 7.0 | |
| | 5/5/2006 | 3 | B | 5.1 | 4.9 | 5.0 | 5.0 | 5.1 | 5.0 | 5.0 | 5.1 | 5.0 | 5.8 |
| | | | C | 5.2 | 5.1 | 5.3 | 5.2 | 4.9 | 5.3 | 5.5 | 5.7 | 5.3 | |
| | | | A | 8.1 | 8.7 | 8.5 | 8.0 | 8.5 | 8.7 | 8.5 | 8.5 | 8.4 | |
| | 5/9/2006 | 7 | B | 7.9 | 8.0 | 8.2 | 8.5 | 8.2 | 7.9 | 8.0 | 8.4 | 8.1 | 8.3 |
| | | | C | 8.1 | 8.3 | 8.6 | 8.5 | 8.3 | 8.4 | 8.4 | 8.3 | 8.4 | |
| | | | A | 12.4 | 13.1 | 13.3 | 12.9 | 12.4 | 12.8 | 13.1 | 13.2 | 12.9 | |
| | 5/16/2006 | 14 | B | 12.3 | 12.6 | 12.3 | 12.1 | 12.1 | 12.6 | 12.4 | 12.2 | 12.3 | 12.6 |
| | | | C | 12.5 | 12.8 | 13.1 | 12.4 | 12.5 | 13.1 | 13.0 | 12.2 | 12.7 | |
| | | | A | 17.5 | 19.5 | 19.7 | 18.7 | 18.0 | 19.4 | 18.9 | 18.8 | 18.8 | |
| TB3A5 | 5/30/2006 | 28 | B | 18.4 | 17.4 | 17.6 | 18.7 | 18.0 | 17.2 | 18.0 | 18.2 | 17.9 | 18.5 |
| | | | C | 17.9 | 18.5 | 18.8 | 19.0 | 18.5 | 18.7 | 19.5 | 19.7 | 18.8 | |
| | | | A | 27.8 | 27.9 | 28.9 | 28.6 | 27.1 | 28.1 | 29.0 | 27.9 | 28.2 | |
| | 6/27/2006 | 56 | B | 27.7 | 25.5 | 26.5 | 28.2 | 26.9 | 25.2 | 26.3 | 27.2 | 26.7 | 27.6 |
| | | | C | 26.8 | 26.8 | 28.3 | 28.7 | 27.8 | 28.2 | 29.1 | 28.9 | 28.1 | |
| | | | A | 35.0 | 37.0 | 37.1 | 34.7 | 32.8 | 37.1 | 37.4 | 34.3 | 35.7 | |
| | 8/1/2006 | 91 | B | 34.6 | 34.0 | 34.0 | 36.6 | 34.0 | 32.5 | 34.8 | 35.8 | 34.5 | 35.4 |
| | | | C | 34.9 | 35.5 | 36.2 | 37.6 | 35.5 | 34.3 | 37.6 | 37.4 | 36.1 | |
| | | | A | 62.1 | 64.7 | 70.1 | 62.8 | 64.1 | 65.1 | 66.0 | 70.0 | 65.6 | |
| | 11/1/2006 | 183 | B | 60.0 | 61.8 | 67.6 | 60.4 | 57.7 | 61.5 | 66.7 | 61.6 | 62.2 | 64.2 |
| | | | C | 67.1 | 64.5 | 62.9 | 61.4 | 66.2 | 66.3 | 64.0 | 67.2 | 65.0 | |
| | | | A | 91.3 | 95.2 | 95.2 | 97.7 | 90.9 | 89.7 | 93.4 | 92.7 | 93.3 | |
| | 5/1/2007 | 364 | B | 91.8 | 90.4 | 93.2 | 90.7 | 95.1 | 88.6 | 94.3 | 95.0 | 92.4 | 92.3 |
| | | | C | 89.7 | 87.7 | 92.8 | 96.0 | 91.4 | 86.8 | 89.9 | 95.5 | 91.2 | |

**Mix** TB4A5
**Cast Date** 5/4/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 3.5 | 3.6 | 3.6 | 3.7 | 3.5 | 3.5 | 3.6 | 3.7 | 3.6 | |
| | 5/5/2006 | 1 | B | 3.6 | 3.3 | 3.2 | 3.4 | 3.3 | 3.3 | 3.4 | 3.3 | 3.4 | 3.5 |
| | | | C | 3.5 | 3.8 | 3.4 | 3.4 | 3.4 | 3.6 | 3.4 | 3.5 | 3.5 | |
| | | | A | 4.4 | 4.4 | 4.3 | 4.6 | 4.3 | 4.2 | 4.4 | 4.5 | 4.4 | |
| | 5/7/2006 | 3 | B | 4.4 | 4.3 | 4.0 | 4.2 | 4.6 | 4.3 | 4.1 | 4.2 | 4.3 | 4.3 |
| | | | C | 4.1 | 4.3 | 4.2 | 4.3 | 4.2 | 4.4 | 4.1 | 4.7 | 4.3 | |
| | | | A | 9.8 | 10.1 | 9.8 | 10.2 | 9.7 | 10.6 | 10.2 | 10.2 | 10.1 | |
| | 5/11/2006 | 7 | B | 10.5 | 9.2 | 8.8 | 9.3 | 10.4 | 9.4 | 8.9 | 9.3 | 9.5 | 9.8 |
| | | | C | 9.5 | 9.9 | 9.4 | 10.0 | 9.1 | 10.0 | 9.7 | 10.0 | 9.7 | |
| | | | A | 17.5 | 16.0 | 17.3 | 17.5 | 17.7 | 17.4 | 17.7 | 17.4 | 17.3 | |
| | 5/18/2006 | 14 | B | 15.3 | 16.0 | 16.4 | 15.1 | 15.5 | 16.2 | 16.5 | 15.6 | 15.8 | 16.6 |
| | | | C | 17.1 | 16.6 | 16.1 | 16.6 | 17.5 | 16.4 | 18.0 | 16.1 | 16.8 | |
| | | | A | 22.1 | 22.1 | 20.9 | 22.5 | 22.5 | 23.1 | 21.8 | 22.4 | 22.2 | |
| TB4A5 | 6/1/2006 | 28 | B | 21.9 | 19.8 | 19.2 | 19.4 | 22.9 | 20.7 | 19.0 | 19.9 | 20.4 | 21.3 |
| | | | C | 20.7 | 21.7 | 20.7 | 21.9 | 20.5 | 23.3 | 20.3 | 22.1 | 21.4 | |
| | | | A | 31.0 | 31.6 | 30.5 | 31.6 | 31.4 | 31.2 | 31.1 | 32.1 | 31.3 | |
| | 6/29/2006 | 56 | B | 30.8 | 29.4 | 29.0 | 27.2 | 30.3 | 29.0 | 28.8 | 27.2 | 29.0 | 30.7 |
| | | | C | 31.5 | 33.6 | 30.1 | 30.5 | 32.3 | 34.1 | 30.2 | 32.2 | 31.8 | |
| | | | A | 36.1 | 36.4 | 34.3 | 37.5 | 36.1 | 36.1 | 34.4 | 34.6 | 35.7 | |
| | 8/3/2006 | 91 | B | 33.1 | 31.5 | 31.9 | 31.4 | 34.0 | 32.4 | 31.9 | 30.5 | 32.1 | 34.2 |
| | | | C | 32.6 | 37.3 | 33.5 | 35.5 | 32.9 | 37.6 | 33.9 | 35.7 | 34.9 | |
| | | | A | 61.8 | 61.4 | 61.9 | 58.5 | 61.3 | 61.8 | 62.1 | 59.3 | 61.0 | |
| | 11/7/2006 | 187 | B | 53.5 | 59.4 | 63.7 | 53.5 | 53.5 | 60.4 | 64.8 | 54.6 | 57.9 | 60.4 |
| | | | C | 60.5 | 65.7 | 60.2 | 66.7 | 60.3 | 62.2 | 57.1 | 64.7 | 62.2 | |
| | | | A | 77.8 | 78.2 | 76.9 | 75.4 | 73.2 | 81.8 | 78.2 | 74.6 | 77.0 | |
| | 5/3/2007 | 364 | B | 73.0 | 79.5 | 80.8 | 77.8 | 74.9 | 77.9 | 78.0 | 81.0 | 77.9 | 78.2 |
| | | | C | 75.8 | 78.7 | 82.1 | 80.1 | 79.5 | 78.9 | 78.3 | 84.4 | 79.7 | |

**Mix** TB5A5
**Cast Date** 5/4/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB5A5 | 5/5/2006 | 1 | A | 3.4 | 3.4 | 3.4 | 3.4 | 3.3 | 3.3 | 3.3 | 3.3 | 3.4 | 3.3 |
| | | | B | 3.3 | 3.1 | 3.2 | 3.3 | 3.1 | 3.3 | 3.2 | 3.3 | 3.2 | |
| | | | C | 3.3 | 3.2 | 3.3 | 3.1 | 3.4 | 3.3 | 3.2 | 3.3 | 3.3 | |
| | 5/7/2006 | 3 | A | 4.1 | 4.0 | 4.1 | 4.1 | 4.2 | 4.0 | 4.0 | 4.0 | 4.1 | 4.0 |
| | | | B | 3.8 | 4.0 | 3.9 | 3.9 | 3.9 | 4.0 | 3.9 | 3.9 | 3.9 | |
| | | | C | 4.0 | 3.9 | 4.0 | 4.2 | 4.0 | 4.0 | 4.0 | 4.1 | 4.0 | |
| | 5/11/2006 | 7 | A | 7.5 | 7.5 | 7.3 | 7.6 | 7.6 | 7.3 | 7.6 | 7.7 | 7.5 | 7.3 |
| | | | B | 7.6 | 7.9 | 7.5 | 7.4 | 7.8 | 7.9 | 7.5 | 7.7 | 7.7 | |
| | | | C | 7.3 | 7.4 | 7.5 | 7.5 | 7.5 | 6.1 | 5.7 | 5.5 | 6.8 | |
| | 5/18/2006 | 14 | A | 14.0 | 14.0 | 14.1 | 15.2 | 13.9 | 14.4 | 14.0 | 15.1 | 14.3 | 13.7 |
| | | | B | 15.0 | 14.0 | 13.5 | 13.9 | 14.9 | 13.8 | 13.8 | 13.5 | 14.1 | |
| | | | C | 12.7 | 12.4 | 12.5 | 13.3 | 12.5 | 12.4 | 12.5 | 13.1 | 12.7 | |
| | 6/1/2006 | 28 | A | 21.7 | 20.6 | 20.2 | 20.0 | 22.0 | 20.6 | 19.2 | 19.7 | 20.5 | 20.4 |
| | | | B | 21.0 | 19.9 | 20.2 | 21.7 | 20.3 | 19.5 | 20.4 | 22.0 | 20.6 | |
| | | | C | 19.7 | 20.6 | 20.4 | 19.8 | 20.1 | 20.9 | 20.2 | 19.1 | 20.1 | |
| | 6/29/2006 | 56 | A | 36.8 | 35.2 | 36.6 | 34.7 | 36.7 | 36.6 | 37.4 | 35.0 | 36.1 | 35.1 |
| | | | B | 33.3 | 33.5 | 33.5 | 38.1 | 34.3 | 32.1 | 34.9 | 35.9 | 34.5 | |
| | | | C | 33.6 | 36.7 | 34.4 | 34.4 | 34.0 | 36.6 | 34.5 | 34.3 | 34.8 | |
| | 8/3/2006 | 91 | A | 45.0 | 43.4 | 43.9 | 41.6 | 45.0 | 43.2 | 43.4 | 42.2 | 43.5 | 42.9 |
| | | | B | 43.0 | 39.8 | 42.6 | 46.1 | 41.9 | 41.5 | 43.1 | 46.6 | 43.1 | |
| | | | C | 41.0 | 43.3 | 42.2 | 40.8 | 41.4 | 44.0 | 42.4 | 42.0 | 42.1 | |
| | 11/7/2006 | 187 | A | 79.4 | 82.5 | 90.4 | 87.2 | 84.5 | 82.4 | 90.4 | 87.5 | 85.5 | 83.7 |
| | | | B | 88.7 | 83.0 | 75.6 | 90.8 | 85.2 | 83.7 | 79.8 | 85.5 | 84.0 | |
| | | | C | 81.6 | 81.5 | 80.3 | 83.5 | 78.7 | 82.2 | 79.3 | 84.1 | 81.4 | |
| | 5/3/2007 | 364 | A | 104.2 | 111.0 | 117.5 | 117.3 | 111.7 | 112.2 | 115.3 | 114.4 | 113.0 | 111.2 |
| | | | B | 111.9 | 106.1 | 113.1 | 107.0 | 114.2 | 109.2 | 112.8 | 110.7 | 110.6 | |
| | | | C | 111.3 | 108.6 | 111.9 | 111.1 | 106.8 | 110.3 | 109.5 | 110.6 | 110.0 | |

**Mix** TB6A5
**Cast Date** 5/9/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB6A5 | 5/10/2006 | 1 | A | 2.6 | 2.5 | 2.5 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| | | | B | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | |
| | | | C | 2.7 | 2.6 | 2.7 | 2.7 | 2.5 | 2.5 | 2.5 | 2.2 | 2.6 | |
| | 5/12/2006 | 3 | A | 4.1 | 3.8 | 3.9 | 3.8 | 4.1 | 3.9 | 4.0 | 3.9 | 3.9 | 4.0 |
| | | | B | 4.0 | 3.9 | 3.9 | 3.8 | 4.0 | 4.1 | 4.0 | 3.8 | 3.9 | |
| | | | C | 3.9 | 4.1 | 4.0 | 4.0 | 3.9 | 4.0 | 4.0 | 4.1 | 4.0 | |
| | 5/16/2006 | 7 | A | 9.1 | 8.8 | 9.1 | 9.1 | 9.2 | 8.8 | 8.9 | 9.0 | 9.0 | 8.9 |
| | | | B | 8.8 | 9.2 | 8.5 | 8.3 | 8.9 | 8.9 | 8.6 | 8.4 | 8.7 | |
| | | | C | 8.6 | 8.9 | 9.3 | 9.1 | 8.7 | 9.7 | 9.2 | 9.0 | 9.1 | |
| | 5/23/2006 | 14 | A | 17.3 | 15.9 | 16.6 | 15.8 | 16.2 | 15.5 | 16.8 | 15.7 | 16.2 | 16.1 |
| | | | B | 16.2 | 15.9 | 15.7 | 16.8 | 16.2 | 15.7 | 15.9 | 16.6 | 16.1 | |
| | | | C | 18.3 | 13.4 | 12.8 | 18.6 | 18.3 | 13.5 | 13.4 | 18.6 | 15.9 | |
| | 6/6/2006 | 28 | A | 25.0 | 31.1 | 24.2 | 22.9 | 24.2 | 22.8 | 23.6 | 23.3 | 24.6 | 26.9 |
| | | | B | 24.5 | 23.0 | 23.4 | 24.9 | 23.4 | 23.6 | 23.9 | 24.8 | 23.9 | |
| | | | C | 31.1 | 33.3 | 35.2 | 33.4 | 29.3 | 30.6 | 32.9 | 30.0 | 32.0 | |
| | 7/5/2006 | 57 | A | 37.4 | 33.5 | 35.7 | 34.0 | 37.6 | 33.6 | 36.0 | 35.0 | 35.4 | 36.5 |
| | | | B | 35.9 | 33.7 | 37.4 | 38.3 | 36.4 | 33.8 | 36.2 | 37.7 | 36.2 | |
| | | | C | 36.4 | 38.4 | 38.8 | 39.2 | 36.9 | 37.6 | 39.5 | 37.9 | 38.1 | |
| | 8/8/2006 | 91 | A | 97.4 | 95.3 | 115.8 | 111.2 | 94.0 | 101.5 | 97.2 | 103.2 | 102.0 | 104.2 |
| | | | B | 99.1 | 103.4 | 104.5 | 112.0 | 100.2 | 109.4 | 120.2 | 103.4 | 106.5 | |
| | | | C | 103.7 | 111.2 | 105.2 | 98.1 | 97.1 | 113.2 | 107.3 | 97.6 | 104.2 | |
| | 11/7/2006 | 182 | A | 77.8 | 70.2 | 75.2 | 68.9 | 73.7 | 71.2 | 75.5 | 71.8 | 73.0 | 74.7 |
| | | | B | 74.7 | 70.4 | 75.6 | 78.7 | 74.9 | 73.7 | 79.1 | 76.3 | 75.4 | |
| | | | C | 73.2 | 77.5 | 73.7 | 75.7 | 71.8 | 78.2 | 77.2 | 78.3 | 75.7 | |
| | 5/8/2007 | 364 | A | 108.5 | 113.1 | 110.5 | 106.5 | 105.8 | 105.2 | 112.2 | 100.2 | 107.8 | 108.5 |
| | | | B | 101.2 | 112.8 | 101.4 | 104.7 | 110.5 | 118.4 | 110.3 | 108.5 | 108.5 | |
| | | | C | 106.8 | 108.5 | 111.0 | 114.7 | 107.9 | 101.7 | 112.2 | 110.3 | 109.1 | |

**Mix** TB7A5
**Cast Date** 5/9/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB7A5 | 5/10/2006 | 1 | A | 2.6 | 2.1 | 2.6 | 2.6 | 1.7 | 1.7 | 1.9 | 1.8 | 2.1 | 1.7 |
| | | | B | 2.0 | 2.1 | 2.2 | 2.0 | 2.1 | 2.0 | 2.0 | 2.1 | 2.1 | |
| | | | C | 0.3 | 0.2 | 1.2 | 1.0 | 1.1 | 1.2 | 0.8 | 0.6 | 0.8 | |
| | 5/12/2006 | 3 | A | 3.4 | 3.5 | 3.4 | 3.5 | 3.4 | 3.5 | 3.4 | 3.5 | 3.5 | 3.5 |
| | | | B | 3.5 | 3.4 | 3.6 | 3.5 | 3.5 | 3.4 | 3.6 | 3.6 | 3.5 | |
| | | | C | 3.5 | 3.5 | 3.4 | 3.6 | 3.5 | 3.5 | 3.4 | 3.5 | 3.5 | |
| | 5/16/2006 | 7 | A | 6.0 | 6.5 | 6.5 | 6.1 | 6.2 | 6.3 | 6.6 | 6.1 | 6.3 | 6.3 |
| | | | B | 6.3 | 6.1 | 6.5 | 6.1 | 6.4 | 5.9 | 6.6 | 6.2 | 6.3 | |
| | | | C | 6.4 | 6.5 | 6.2 | 6.5 | 6.3 | 6.5 | 6.3 | 6.6 | 6.4 | |
| | 5/23/2006 | 14 | A | 12.7 | 12.9 | 13.4 | 13.4 | 12.7 | 12.7 | 13.1 | 13.3 | 13.0 | 13.1 |
| | | | B | 12.9 | 12.2 | 13.5 | 12.4 | 12.9 | 12.6 | 13.3 | 12.3 | 12.8 | |
| | | | C | 13.3 | 13.4 | 12.8 | 13.6 | 13.3 | 13.5 | 13.4 | 13.6 | 13.4 | |
| | 6/6/2006 | 28 | A | 25.0 | 31.8 | 31.0 | 27.2 | 27.0 | 31.9 | 31.0 | 29.3 | 29.3 | 31.3 |
| | | | B | 30.3 | 31.2 | 33.0 | 34.0 | 28.9 | 34.3 | 35.7 | 28.2 | 32.0 | |
| | | | C | 31.4 | 32.2 | 31.6 | 34.3 | 34.0 | 28.8 | 32.4 | 35.6 | 32.5 | |
| | 7/5/2006 | 57 | A | 35.5 | 36.3 | 38.5 | 37.9 | 36.4 | 36.5 | 37.1 | 39.8 | 37.3 | 38.1 |
| | | | B | 36.8 | 36.3 | 37.9 | 36.6 | 38.7 | 41.0 | 42.2 | 38.9 | 38.6 | |
| | | | C | 38.6 | 38.9 | 37.5 | 39.0 | 37.9 | 38.6 | 38.1 | 39.0 | 38.5 | |
| | 8/8/2006 | 91 | A | 101.2 | 108.6 | 107.4 | 98.9 | 95.4 | 99.4 | 102.8 | 98.3 | 101.5 | 105.9 |
| | | | B | 94.3 | 103.4 | 102.6 | 104.2 | 100.3 | 115.3 | 104.3 | 115.5 | 105.0 | |
| | | | C | 112.6 | 101.5 | 120.1 | 109.7 | 111.3 | 105.3 | 113.9 | 115.2 | 111.2 | |
| | 11/7/2006 | 182 | A | 92.0 | 84.3 | 86.1 | 90.2 | 86.4 | 87.1 | 87.7 | 90.2 | 88.0 | 87.9 |
| | | | B | 92.5 | 86.0 | 88.9 | 83.6 | 88.5 | 81.7 | 88.6 | 83.2 | 86.6 | |
| | | | C | 85.0 | 89.7 | 88.8 | 93.7 | 89.7 | 91.2 | 85.5 | 89.2 | 89.1 | |
| | 5/8/2007 | 364 | A | 128.5 | 120.5 | 122.2 | 114.3 | 134.5 | 119.6 | 117.4 | 118.8 | 122.0 | 124.6 |
| | | | B | 127.9 | 120.6 | 122.5 | 121.5 | 124.3 | 133.5 | 129.7 | 113.5 | 124.2 | |
| | | | C | 126.5 | 144.6 | 123.6 | 127.1 | 125.0 | 124.2 | 126.5 | 124.5 | 127.8 | |

**Mix** TB8A5
**Cast Date** 5/11/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB8A5 | 5/12/2006 | 1 | A | 2.7 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.5 | 2.6 | 2.6 | 2.7 |
| | | | B | 2.8 | 2.8 | 2.7 | 2.6 | 2.8 | 2.8 | 2.7 | 2.6 | 2.7 | |
| | | | C | 2.7 | 2.6 | 2.7 | 2.7 | 2.7 | 2.7 | 2.8 | 2.6 | 2.7 | |
| | 5/14/2006 | 3 | A | 3.9 | 3.8 | 3.6 | 3.8 | 4.0 | 3.9 | 3.6 | 3.8 | 3.8 | 4.0 |
| | | | B | 4.0 | 3.9 | 3.7 | 3.4 | 3.6 | 3.8 | 3.4 | 3.6 | 3.7 | |
| | | | C | 3.5 | 3.2 | 3.4 | 3.1 | 5.7 | 5.9 | 6.0 | 6.3 | 4.6 | |
| | 5/18/2006 | 7 | A | 13.6 | 13.2 | 13.2 | 12.7 | 13.1 | 12.8 | 13.3 | 12.6 | 13.1 | 12.9 |
| | | | B | 12.9 | 13.6 | 12.3 | 12.7 | 13.3 | 12.7 | 12.5 | 12.7 | 12.8 | |
| | | | C | 12.4 | 12.9 | 13.2 | 12.5 | 12.6 | 13.1 | 12.9 | 12.4 | 12.8 | |
| | 5/25/2006 | 14 | A | 22.8 | 22.0 | 21.2 | 20.7 | 21.8 | 22.0 | 21.3 | 20.7 | 21.6 | 22.1 |
| | | | B | 23.1 | 21.1 | 22.7 | 23.1 | 22.8 | 21.9 | 22.3 | 22.5 | 22.4 | |
| | | | C | 22.0 | 22.0 | 21.7 | 22.5 | 22.7 | 21.4 | 22.1 | 22.9 | 22.2 | |
| | 6/8/2006 | 28 | A | 32.5 | 31.7 | 30.6 | 30.8 | 32.8 | 31.8 | 30.5 | 31.6 | 31.5 | 32.1 |
| | | | B | 32.3 | 30.7 | 33.1 | 34.1 | 34.1 | 30.2 | 32.7 | 34.2 | 32.7 | |
| | | | C | 32.0 | 31.0 | 32.5 | 32.6 | 32.5 | 30.7 | 32.0 | 32.6 | 32.0 | |
| | 7/6/2006 | 56 | A | 39.9 | 41.6 | 42.8 | 40.3 | 39.4 | 42.3 | 42.7 | 40.3 | 41.2 | 42.2 |
| | | | B | 40.0 | 43.7 | 45.0 | 42.6 | 40.4 | 44.6 | 43.0 | 43.0 | 42.8 | |
| | | | C | 41.8 | 42.5 | 44.2 | 41.5 | 41.6 | 42.8 | 43.7 | 42.2 | 42.5 | |
| | 11/22/2006 | 195 | A | 98.0 | 95.4 | 92.7 | 90.5 | 97.2 | 94.8 | 92.1 | 91.1 | 94.0 | 94.4 |
| | | | B | 97.7 | 90.4 | 95.5 | 98.3 | 98.5 | 90.9 | 90.0 | 98.3 | 95.0 | |
| | | | C | 94.0 | 94.8 | 93.5 | 95.6 | 95.2 | 94.0 | 93.3 | 92.7 | 94.1 | |
| | 5/10/2007 | 364 | A | 107.5 | 113.0 | 98.3 | 100.9 | 108.1 | 103.2 | 98.3 | 100.1 | 103.7 | 106.0 |
| | | | B | 110.6 | 104.7 | 97.1 | 115.9 | 108.9 | 104.5 | 98.4 | 112.7 | 106.6 | |
| | | | C | 105.6 | 116.9 | 105.5 | 100.4 | 109.6 | 114.0 | 109.1 | 100.4 | 107.7 | |

**Mix** TB1H4
**Cast Date** 5/11/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB1H4 | 5/12/2006 | 1 | A | 3.2 | 3.2 | 3.2 | 3.0 | 3.3 | 3.2 | 3.2 | 3.1 | 3.2 | 3.1 |
| | | | B | 3.0 | 3.0 | 3.0 | 3.1 | 2.9 | 3.1 | 2.9 | 3.1 | 3.0 | |
| | | | C | 3.2 | 3.2 | 3.2 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | |
| | 5/14/2006 | 3 | A | 3.6 | 3.8 | 3.7 | 3.4 | 3.5 | 3.7 | 3.6 | 3.4 | 3.6 | 3.5 |
| | | | B | 3.5 | 3.3 | 3.7 | 3.7 | 3.5 | 3.4 | 3.3 | 3.6 | 3.5 | |
| | | | C | 3.6 | 3.5 | 3.5 | 3.6 | 3.5 | 3.6 | 3.6 | 3.5 | 3.6 | |
| | 5/18/2006 | 7 | A | 4.8 | 5.0 | 5.1 | 5.2 | 4.8 | 5.2 | 5.2 | 5.3 | 5.1 | 4.9 |
| | | | B | 5.0 | 4.9 | 5.1 | 5.0 | 4.9 | 4.8 | 5.2 | 5.1 | 5.0 | |
| | | | C | 4.6 | 4.6 | 4.7 | 4.8 | 4.7 | 4.8 | 4.6 | 4.7 | 4.7 | |
| | 5/25/2006 | 14 | A | 6.6 | 6.0 | 6.5 | 6.6 | 6.5 | 6.0 | 6.5 | 6.5 | 6.4 | 6.3 |
| | | | B | 6.1 | 6.4 | 6.1 | 6.2 | 6.4 | 6.4 | 6.4 | 6.1 | 6.3 | |
| | | | C | 6.0 | 6.3 | 6.1 | 6.0 | 6.1 | 6.1 | 6.3 | 5.9 | 6.1 | |
| | 6/8/2006 | 28 | A | 10.4 | 9.2 | 10.6 | 9.8 | 10.6 | 9.3 | 10.5 | 9.4 | 10.0 | 10.1 |
| | | | B | 10.3 | 10.1 | 9.4 | 9.6 | 10.2 | 10.2 | 9.7 | 9.9 | 9.9 | |
| | | | C | 9.5 | 9.9 | 9.7 | 9.3 | 9.7 | 12.0 | 9.6 | 12.5 | 10.3 | |
| | 7/6/2006 | 56 | A | 18.5 | 17.1 | 18.6 | 18.1 | 18.5 | 17.2 | 19.3 | 17.6 | 18.1 | 17.8 |
| | | | B | 17.3 | 18.5 | 18.1 | 17.7 | 16.8 | 19.2 | 17.9 | 17.8 | 17.9 | |
| | | | C | 17.6 | 17.6 | 17.1 | 17.2 | 17.4 | 17.7 | 17.2 | 16.7 | 17.3 | |
| | 11/22/2006 | 195 | A | 64.8 | 57.5 | 61.7 | 63.5 | 63.8 | 57.6 | 62.5 | 65.6 | 62.1 | 62.1 |
| | | | B | 63.6 | 63.7 | 64.0 | 59.3 | 65.6 | 63.9 | 63.8 | 59.7 | 63.0 | |
| | | | C | 63.0 | 60.3 | 61.3 | 61.0 | 62.2 | 60.3 | 61.0 | 60.1 | 61.2 | |
| | 5/10/2007 | 364 | A | 75.2 | 77.5 | 70.6 | 76.5 | 73.7 | 78.7 | 69.6 | 73.2 | 74.4 | 73.7 |
| | | | B | 69.4 | 69.8 | 72.9 | 78.2 | 69.3 | 76.1 | 69.8 | 75.8 | 72.7 | |
| | | | C | 71.6 | 74.2 | 74.0 | 78.4 | 71.2 | 72.5 | 74.6 | 75.5 | 74.0 | |

**Mix** TB2H4
**Cast Date** 5/16/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB2H4 | 5/17/2006 | 1 | A | 3.2 | 3.1 | 3.0 | 3.2 | 3.0 | 3.1 | 3.0 | 3.2 | 3.1 | 3.1 |
| | | | B | 3.1 | 3.1 | 3.1 | 3.2 | 3.0 | 3.0 | 3.1 | 3.2 | 3.1 | |
| | | | C | 3.1 | 3.1 | 3.2 | 3.0 | 3.0 | 3.0 | 3.1 | 2.9 | 3.1 | |
| | 5/19/2006 | 3 | A | 3.8 | 3.8 | 3.6 | 3.8 | 3.7 | 3.9 | 3.8 | 3.9 | 3.8 | 3.9 |
| | | | B | 3.9 | 3.9 | 4.0 | 3.9 | 3.9 | 3.8 | 3.9 | 4.0 | 3.9 | |
| | | | C | 3.8 | 3.9 | 4.0 | 4.1 | 3.8 | 3.8 | 4.1 | 4.1 | 4.0 | |
| | 5/23/2006 | 7 | A | 8.2 | 8.1 | 7.4 | 7.5 | 8.2 | 8.1 | 7.4 | 7.8 | 7.8 | 7.9 |
| | | | B | 7.9 | 8.0 | 8.0 | 7.9 | 8.1 | 8.4 | 8.1 | 8.0 | 8.1 | |
| | | | C | 7.6 | 7.5 | 8.0 | 7.4 | 7.6 | 7.6 | 8.0 | 7.6 | 7.7 | |
| | 5/30/2006 | 14 | A | 22.3 | 21.9 | 20.3 | 19.6 | 22.2 | 20.5 | 20.5 | 19.3 | 20.8 | 21.2 |
| | | | B | 21.3 | 21.2 | 21.3 | 20.5 | 21.7 | 22.1 | 21.6 | 20.5 | 21.3 | |
| | | | C | 20.3 | 21.4 | 23.0 | 20.8 | 21.7 | 20.9 | 22.6 | 20.7 | 21.4 | |
| | 6/14/2006 | 29 | A | 43.2 | 43.2 | 43.3 | 43.5 | 42.6 | 43.0 | 45.1 | 41.3 | 43.2 | 43.2 |
| | | | B | 43.5 | 44.0 | 47.2 | 45.5 | 43.6 | 44.4 | 45.5 | 44.9 | 44.8 | |
| | | | C | 40.2 | 41.8 | 42.1 | 41.0 | 41.1 | 41.3 | 44.8 | 41.2 | 41.7 | |
| | 7/11/2006 | 56 | A | 70.5 | 68.9 | 66.2 | 67.8 | 72.0 | 69.9 | 67.2 | 68.4 | 68.9 | 70.1 |
| | | | B | 73.1 | 76.2 | 71.3 | 68.9 | 71.9 | 73.1 | 71.6 | 69.0 | 71.9 | |
| | | | C | 67.0 | 69.2 | 74.1 | 70.2 | 70.6 | 68.1 | 71.3 | 66.1 | 69.6 | |
| | 11/14/2006 | 182 | A | 143.2 | 138.9 | 140.6 | 139.5 | 136.6 | 142.6 | 149.4 | 134.2 | 140.6 | 142.2 |
| | | | B | 154.6 | 142.5 | 147.1 | 142.0 | 148.4 | 145.9 | 146.7 | 139.4 | 145.8 | |
| | | | C | 149.4 | 141.0 | 135.9 | 129.5 | 145.6 | 137.6 | 147.1 | 134.2 | 140.0 | |
| | 5/15/2007 | 364 | A | 157.2 | 165.3 | 173.8 | 160.5 | 162.4 | 151.9 | 176.7 | 164.4 | 164.0 | 166.1 |
| | | | B | 169.3 | 166.9 | 172.0 | 151.7 | 170.9 | 164.9 | 181.3 | 169.5 | 168.3 | |
| | | | C | 156.8 | 180.2 | 164.2 | 167.0 | 157.1 | 170.3 | 171.7 | 161.5 | 166.1 | |

**Mix** TB3H4
**Cast Date** 5/16/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB3H4 | 5/17/2006 | 1 | A | 3.0 | 2.8 | 3.0 | 2.9 | 3.0 | 3.0 | 2.8 | 3.0 | 2.9 | 3.0 |
| | | | B | 3.0 | 3.0 | 2.8 | 3.2 | 3.0 | 3.1 | 3.0 | 3.1 | 3.0 | |
| | | | C | 3.2 | 3.0 | 3.1 | 3.1 | 3.0 | 3.0 | 3.1 | 3.1 | 3.1 | |
| | 5/19/2006 | 3 | A | 3.5 | 3.7 | 3.7 | 3.8 | 3.4 | 3.7 | 3.7 | 3.7 | 3.7 | 3.8 |
| | | | B | 3.7 | 3.8 | 3.7 | 3.9 | 3.8 | 3.8 | 3.8 | 3.9 | 3.8 | |
| | | | C | 3.7 | 3.8 | 3.9 | 4.0 | 3.7 | 3.9 | 3.8 | 3.9 | 3.8 | |
| | 5/23/2006 | 7 | A | 7.1 | 6.5 | 7.0 | 7.5 | 7.0 | 6.7 | 7.0 | 7.3 | 7.0 | 6.9 |
| | | | B | 6.6 | 6.9 | 6.8 | 6.6 | 6.6 | 6.9 | 6.5 | 6.9 | 6.7 | |
| | | | C | 7.0 | 6.9 | 6.8 | 7.1 | 7.1 | 7.1 | 7.0 | 6.9 | 7.0 | |
| | 5/30/2006 | 14 | A | 12.5 | 11.8 | 12.3 | 12.0 | 12.8 | 11.7 | 12.3 | 11.4 | 12.1 | 12.1 |
| | | | B | 11.8 | 12.3 | 10.9 | 12.1 | 11.7 | 12.5 | 11.1 | 12.2 | 11.8 | |
| | | | C | 12.4 | 12.2 | 12.0 | 12.2 | 12.6 | 12.0 | 12.0 | 12.5 | 12.2 | |
| | 6/14/2006 | 29 | A | 19.4 | 19.5 | 16.5 | 18.2 | 18.2 | 18.4 | 18.5 | 19.1 | 18.5 | 18.9 |
| | | | B | 17.3 | 19.3 | 18.5 | 19.5 | 19.4 | 17.2 | 18.3 | 19.3 | 18.6 | |
| | | | C | 18.9 | 19.0 | 19.9 | 20.4 | 19.4 | 18.7 | 19.7 | 19.8 | 19.5 | |
| | 7/11/2006 | 56 | A | 31.7 | 29.0 | 30.8 | 30.4 | 31.1 | 29.5 | 30.5 | 32.9 | 30.7 | 30.1 |
| | | | B | 28.7 | 30.8 | 29.0 | 28.7 | 28.6 | 30.3 | 29.5 | 28.2 | 29.2 | |
| | | | C | 30.4 | 30.6 | 30.9 | 30.6 | 30.7 | 28.2 | 30.2 | 29.9 | 30.2 | |
| | 11/14/2006 | 182 | A | 83.9 | 85.9 | 73.8 | 92.7 | 81.4 | 85.3 | 74.6 | 90.2 | 83.5 | 84.5 |
| | | | B | 87.1 | 84.7 | 85.1 | 82.8 | 87.7 | 84.4 | 83.9 | 81.3 | 84.6 | |
| | | | C | 86.9 | 87.9 | 83.2 | 86.3 | 86.9 | 82.8 | 84.5 | 85.1 | 85.5 | |
| | 5/15/2007 | 364 | A | 105.8 | 102.0 | 102.8 | 103.2 | 103.6 | 115.7 | 105.3 | 103.2 | 105.2 | 105.4 |
| | | | B | 111.6 | 114.4 | 103.4 | 105.5 | 106.6 | 107.0 | 100.4 | 102.7 | 106.5 | |
| | | | C | 102.6 | 115.3 | 100.4 | 94.0 | 99.8 | 109.4 | 101.5 | 113.2 | 104.5 | |

**Mix** TB4H4
**Cast Date** 5/18/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB4H4 | 5/19/2006 | 1 | A | 2.7 | 2.9 | 2.8 | 2.8 | 2.8 | 2.9 | 2.8 | 2.7 | 2.8 | 2.7 |
| | | | B | 2.6 | 2.5 | 2.2 | 2.4 | 2.4 | 2.4 | 2.7 | 2.7 | 2.5 | |
| | | | C | 2.8 | 2.7 | 2.8 | 2.7 | 2.7 | 2.7 | 2.8 | 2.8 | 2.8 | |
| | 5/21/2006 | 3 | A | 3.5 | 3.8 | 3.8 | 3.6 | 3.5 | 3.6 | 3.8 | 3.8 | 3.7 | 3.6 |
| | | | B | 3.5 | 3.6 | 3.8 | 3.6 | 3.4 | 3.6 | 3.5 | 3.7 | 3.6 | |
| | | | C | 3.6 | 3.6 | 3.6 | 3.7 | 3.5 | 3.6 | 3.7 | 3.6 | 3.6 | |
| | 5/25/2006 | 7 | A | 7.8 | 7.8 | 8.3 | 7.7 | 7.7 | 7.8 | 8.4 | 7.7 | 7.9 | 7.9 |
| | | | B | 8.0 | 8.1 | 7.9 | 7.6 | 7.9 | 7.9 | 7.7 | 7.7 | 7.9 | |
| | | | C | 8.1 | 8.1 | 8.2 | 7.8 | 8.1 | 8.2 | 8.2 | 7.8 | 8.1 | |
| | 6/1/2006 | 14 | A | 14.8 | 14.4 | 15.3 | 13.4 | 14.5 | 14.8 | 15.8 | 14.2 | 14.7 | 14.9 |
| | | | B | 15.2 | 15.1 | 14.3 | 14.4 | 15.2 | 14.6 | 14.2 | 13.9 | 14.6 | |
| | | | C | 15.0 | 15.4 | 16.2 | 14.6 | 15.0 | 15.8 | 16.4 | 14.8 | 15.4 | |
| | 6/15/2006 | 28 | A | 23.0 | 22.9 | 23.6 | 17.2 | 24.0 | 22.5 | 25.0 | 21.8 | 22.5 | 25.4 |
| | | | B | 27.7 | 28.0 | 25.0 | 24.4 | 24.9 | 26.2 | 26.8 | 25.2 | 26.0 | |
| | | | C | 25.0 | 27.0 | 27.5 | 26.3 | 26.5 | 31.5 | 30.1 | 27.2 | 27.6 | |
| | 7/13/2006 | 56 | A | 30.6 | 31.4 | 33.5 | 31.4 | 32.1 | 30.7 | 32.2 | 30.8 | 31.6 | 31.4 |
| | | | B | 31.0 | 31.3 | 31.7 | 30.1 | 30.3 | 31.8 | 31.7 | 30.7 | 31.1 | |
| | | | C | 31.1 | 34.1 | 30.3 | 31.5 | 31.3 | 33.4 | 30.8 | 30.1 | 31.6 | |
| | 11/16/2006 | 182 | A | 70.6 | 71.8 | 77.1 | 69.1 | 70.4 | 69.9 | 79.5 | 68.2 | 72.1 | 72.6 |
| | | | B | 71.2 | 66.7 | 70.5 | 68.8 | 76.7 | 66.6 | 70.8 | 67.3 | 69.8 | |
| | | | C | 76.2 | 77.7 | 81.4 | 71.0 | 74.1 | 77.6 | 77.2 | 73.1 | 76.0 | |
| | 5/17/2007 | 364 | A | 89.2 | 82.9 | 93.7 | 87.0 | 90.7 | 79.4 | 89.5 | 91.6 | 88.0 | 88.1 |
| | | | B | 89.0 | 97.6 | 90.7 | 87.4 | 87.7 | 83.9 | 90.7 | 90.1 | 89.6 | |
| | | | C | 89.3 | 91.8 | 91.1 | 79.9 | 82.8 | 83.8 | 85.8 | 89.6 | 86.8 | |

**Mix** TB5H4
**Cast Date** 5/18/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB5H4 | 5/19/2006 | 1 | A | 2.6 | 2.6 | 2.8 | 2.6 | 3.5 | 3.3 | 3.2 | 3.2 | 3.0 | 2.8 |
| | | | B | 3.4 | 3.3 | 3.1 | 2.9 | 2.7 | 2.7 | 2.6 | 2.6 | 2.9 | |
| | | | C | 2.6 | 2.6 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.6 | 2.6 | |
| | 5/21/2006 | 3 | A | 3.0 | 3.0 | 3.0 | 3.3 | 3.0 | 3.0 | 3.0 | 3.2 | 3.1 | 3.1 |
| | | | B | 3.1 | 3.2 | 3.3 | 3.0 | 3.1 | 3.1 | 3.3 | 3.1 | 3.2 | |
| | | | C | 3.0 | 3.2 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.2 | 3.1 | |
| | 5/25/2006 | 7 | A | 5.5 | 5.7 | 5.7 | 5.6 | 5.9 | 5.9 | 6.0 | 5.9 | 5.8 | 5.7 |
| | | | B | 5.9 | 5.9 | 6.0 | 5.9 | 6.1 | 5.4 | 5.8 | 6.0 | 5.9 | |
| | | | C | 5.5 | 5.6 | 5.7 | 5.5 | 5.6 | 5.6 | 5.6 | 5.5 | 5.6 | |
| | 6/1/2006 | 14 | A | 11.2 | 11.7 | 11.6 | 11.9 | 11.4 | 11.9 | 11.8 | 12.6 | 11.8 | 11.7 |
| | | | B | 12.2 | 10.9 | 11.9 | 12.9 | 12.2 | 10.8 | 12.1 | 13.1 | 12.0 | |
| | | | C | 11.4 | 11.6 | 11.4 | 11.2 | 11.5 | 11.6 | 11.4 | 11.2 | 11.4 | |
| | 6/15/2006 | 28 | A | 21.0 | 21.5 | 21.9 | 22.0 | 21.3 | 21.6 | 22.2 | 22.0 | 21.7 | 21.9 |
| | | | B | 22.5 | 19.9 | 23.5 | 24.1 | 22.5 | 20.0 | 22.6 | 24.1 | 22.4 | |
| | | | C | 21.6 | 22.3 | 21.5 | 21.3 | 21.6 | 22.3 | 20.4 | 21.5 | 21.6 | |
| | 7/13/2006 | 56 | A | 33.6 | 35.4 | 36.1 | 35.6 | 33.8 | 35.1 | 35.7 | 36.0 | 35.2 | 35.4 |
| | | | B | 32.9 | 38.3 | 39.3 | 37.6 | 33.3 | 39.8 | 39.2 | 37.4 | 37.2 | |
| | | | C | 34.6 | 34.1 | 35.6 | 32.8 | 32.9 | 33.6 | 34.9 | 32.2 | 33.8 | |
| | 11/16/2006 | 182 | A | 103.6 | 95.1 | 91.0 | 93.7 | 94.2 | 97.2 | 94.9 | 96.7 | 95.8 | 99.1 |
| | | | B | 98.2 | 91.3 | 111.6 | 112.9 | 99.3 | 95.2 | 107.4 | 108.9 | 103.1 | |
| | | | C | 101.4 | 101.3 | 92.6 | 96.1 | 103.8 | 95.6 | 98.4 | 97.5 | 98.3 | |
| | 5/17/2007 | 364 | A | 117.5 | 127.2 | 137.4 | 128.2 | 113.0 | 110.6 | 120.4 | 111.0 | 120.7 | 119.6 |
| | | | B | 127.2 | 123.3 | 116.3 | 123.6 | 118.8 | 105.9 | 114.1 | 133.7 | 120.4 | |
| | | | C | 106.4 | 114.2 | 126.7 | 119.3 | 124.4 | 117.4 | 115.9 | 118.1 | 117.8 | |

**Mix** TB6H4
**Cast Date** 5/23/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB6H4 | 5/24/2006 | 1 | A | 2.2 | 2.3 | 2.3 | 2.2 | 2.3 | 2.3 | 2.2 | 2.2 | 2.3 | 2.3 |
| | | | B | 2.2 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.2 | 2.3 | |
| | | | C | 2.4 | 2.3 | 2.3 | 2.2 | 2.3 | 2.3 | 2.3 | 2.2 | 2.3 | |
| | 5/26/2006 | 3 | A | 3.5 | 3.5 | 3.6 | 3.6 | 3.5 | 3.6 | 3.5 | 3.6 | 3.6 | 3.5 |
| | | | B | 3.5 | 3.5 | 3.6 | 3.7 | 3.4 | 3.5 | 3.6 | 3.4 | 3.5 | |
| | | | C | 3.3 | 3.5 | 3.6 | 3.7 | 3.4 | 3.5 | 3.6 | 3.6 | 3.5 | |
| | 5/30/2006 | 7 | A | 8.2 | 7.9 | 8.4 | 8.9 | 8.2 | 7.9 | 8.3 | 8.4 | 8.3 | 8.5 |
| | | | B | 8.4 | 8.5 | 8.8 | 8.3 | 8.4 | 8.6 | 9.0 | 8.3 | 8.5 | |
| | | | C | 8.9 | 8.2 | 9.0 | 9.0 | 8.9 | 8.1 | 8.6 | 8.9 | 8.7 | |
| | 6/6/2006 | 14 | A | 20.3 | 20.5 | 21.1 | 18.7 | 16.3 | 18.4 | 18.0 | 18.0 | 18.9 | 20.7 |
| | | | B | 19.2 | 18.4 | 19.4 | 19.4 | 20.4 | 22.0 | 22.2 | 23.5 | 20.6 | |
| | | | C | 23.5 | 21.1 | 22.2 | 21.7 | 23.7 | 20.7 | 24.7 | 22.5 | 22.5 | |
| | 6/20/2006 | 28 | A | 25.1 | 25.8 | 24.8 | 25.3 | 24.7 | 23.7 | 24.5 | 26.0 | 25.0 | 25.5 |
| | | | B | 24.8 | 25.4 | 26.8 | 25.0 | 25.8 | 25.7 | 27.7 | 25.7 | 25.9 | |
| | | | C | 27.4 | 24.4 | 23.0 | 23.8 | 26.8 | 25.7 | 27.2 | 27.2 | 25.7 | |
| | 7/18/2006 | 56 | A | 35.2 | 38.2 | 37.8 | 38.3 | 35.2 | 37.6 | 37.6 | 39.6 | 37.4 | 36.9 |
| | | | B | 37.3 | 36.0 | 36.3 | 35.6 | 37.5 | 36.5 | 35.9 | 36.9 | 36.5 | |
| | | | C | 33.7 | 37.7 | 37.0 | 37.9 | 35.2 | 38.2 | 37.4 | 37.7 | 36.9 | |
| | 1/25/2007 | 247 | A | 83.6 | 85.4 | 84.5 | 86.3 | 85.9 | 82.8 | 86.7 | 88.9 | 85.5 | 84.8 |
| | | | B | 85.6 | 86.3 | 91.3 | 85.7 | 84.3 | 87.0 | 89.7 | 84.9 | 86.9 | |
| | | | C | 87.6 | 81.7 | 79.2 | 79.5 | 86.6 | 80.3 | 81.9 | 79.7 | 82.1 | |
| | 5/22/2007 | 364 | A | 110.1 | 108.7 | 122.1 | 111.9 | 111.3 | 119.6 | 115.9 | 111.6 | 113.9 | 119.1 |
| | | | B | 130.4 | 123.4 | 130.5 | 113.7 | 125.3 | 132.8 | 118.6 | 106.3 | 122.6 | |
| | | | C | 117.1 | 118.9 | 125.7 | 125.0 | 126.3 | 115.0 | 124.4 | 112.8 | 120.7 | |

**Mix** TB7H4
**Cast Date** 5/23/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB7H4 | 5/24/2006 | 1 | A | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.2 |
| | | | B | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.1 | 2.2 | 2.2 | 2.2 | |
| | | | C | 2.2 | 2.2 | 2.3 | 2.2 | 2.2 | 2.2 | 2.3 | 2.2 | 2.2 | |
| | 5/26/2006 | 3 | A | 2.9 | 2.9 | 2.9 | 2.9 | 2.8 | 2.9 | 2.9 | 3.0 | 2.9 | 3.0 |
| | | | B | 2.9 | 3.0 | 3.0 | 3.1 | 2.9 | 3.0 | 3.0 | 3.1 | 3.0 | |
| | | | C | 3.0 | 3.0 | 3.0 | 3.2 | 3.0 | 3.0 | 3.1 | 3.1 | 3.1 | |
| | 5/30/2006 | 7 | A | 5.7 | 5.9 | 5.9 | 5.7 | 5.8 | 5.9 | 5.7 | 5.7 | 5.8 | 5.9 |
| | | | B | 5.8 | 6.0 | 5.8 | 5.7 | 5.9 | 5.9 | 5.9 | 5.8 | 5.9 | |
| | | | C | 6.1 | 5.8 | 6.1 | 5.8 | 6.1 | 5.8 | 6.1 | 5.7 | 5.9 | |
| | 6/6/2006 | 14 | A | 15.6 | 19.4 | 16.6 | 15.1 | 15.4 | 16.8 | 14.5 | 17.5 | 16.4 | 15.4 |
| | | | B | 15.0 | 15.0 | 14.6 | 14.2 | 13.9 | 13.8 | 13.7 | 13.5 | 14.2 | |
| | | | C | 13.5 | 15.8 | 15.4 | 15.8 | 13.8 | 14.6 | 16.8 | 18.7 | 15.6 | |
| | 6/20/2006 | 28 | A | 21.1 | 21.4 | 21.5 | 20.6 | 20.8 | 21.6 | 21.4 | 21.1 | 21.2 | 21.4 |
| | | | B | 21.4 | 21.5 | 22.2 | 21.2 | 21.0 | 23.3 | 22.3 | 21.2 | 21.8 | |
| | | | C | 21.8 | 20.5 | 20.9 | 20.5 | 21.5 | 22.6 | 20.7 | 21.2 | 21.2 | |
| | 7/18/2006 | 56 | A | 33.3 | 33.2 | 33.0 | 34.7 | 33.4 | 33.5 | 33.7 | 34.7 | 33.7 | 34.7 |
| | | | B | 34.2 | 34.4 | 35.6 | 37.2 | 33.6 | 35.1 | 36.4 | 38.0 | 35.6 | |
| | | | C | 35.6 | 36.6 | 33.2 | 34.3 | 36.2 | 35.6 | 33.3 | 35.0 | 35.0 | |
| | 1/25/2007 | 247 | A | 87.5 | 89.6 | 93.1 | 87.8 | 90.2 | 92.2 | 91.8 | 87.4 | 90.0 | 93.6 |
| | | | B | 94.9 | 95.0 | 96.3 | 108.1 | 94.8 | 93.3 | 102.7 | 102.4 | 98.4 | |
| | | | C | 87.6 | 86.9 | 95.3 | 95.1 | 88.7 | 92.0 | 96.8 | 96.6 | 92.4 | |
| | 5/22/2007 | 364 | A | 147.2 | 138.3 | 151.1 | 149.2 | 150.3 | 155.8 | 157.0 | 161.3 | 151.3 | 151.6 |
| | | | B | 162.6 | 150.4 | 153.4 | 162.2 | 153.6 | 151.7 | 157.3 | 159.4 | 156.3 | |
| | | | C | 148.1 | 153.0 | 156.1 | 139.9 | 143.7 | 146.5 | 139.2 | 151.6 | 147.3 | |

**Mix** TB8H4
**Cast Date** 5/25/2006

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB8H4 | 5/26/2006 | 1 | A | 2.3 | 2.4 | 2.4 | 2.5 | 2.3 | 2.4 | 2.5 | 2.4 | 2.4 | 2.4 |
| | | | B | 2.4 | 2.4 | 2.5 | 2.4 | 2.4 | 2.4 | 2.5 | 2.4 | 2.4 | |
| | | | C | 2.4 | 2.4 | 2.2 | 2.3 | 2.4 | 2.4 | 2.2 | 2.3 | 2.3 | |
| | 5/28/2006 | 3 | A | 4.0 | 4.0 | 4.0 | 4.3 | 3.8 | 3.9 | 4.0 | 4.2 | 4.0 | 4.0 |
| | | | B | 3.8 | 3.9 | 4.1 | 4.9 | 3.8 | 3.9 | 4.0 | 4.1 | 4.1 | |
| | | | C | 3.8 | 3.8 | 3.9 | 3.9 | 3.9 | 3.9 | 3.9 | 4.0 | 3.9 | |
| | 6/1/2006 | 7 | A | 12.9 | 13.9 | 13.8 | 14.6 | 13.9 | 14.3 | 13.9 | 14.6 | 14.0 | 13.7 |
| | | | B | 13.7 | 13.4 | 13.8 | 13.6 | 13.4 | 13.3 | 14.3 | 13.7 | 13.7 | |
| | | | C | 13.1 | 13.8 | 13.6 | 13.8 | 13.4 | 13.7 | 13.5 | 13.9 | 13.6 | |
| | 6/8/2006 | 14 | A | 19.1 | 20.9 | 21.2 | 23.2 | 21.6 | 23.7 | 24.3 | 25.8 | 22.5 | 23.7 |
| | | | B | 23.4 | 24.0 | 24.7 | 26.7 | 24.7 | 23.7 | 24.5 | 24.0 | 24.5 | |
| | | | C | 23.1 | 24.1 | 23.4 | 25.0 | 23.5 | 24.9 | 24.4 | 25.4 | 24.2 | |
| | 6/22/2006 | 28 | A | 38.6 | 36.9 | 35.3 | 37.7 | 37.2 | 37.3 | 37.1 | 36.0 | 37.0 | 36.2 |
| | | | B | 34.1 | 37.5 | 37.7 | 37.1 | 34.5 | 34.7 | 36.8 | 35.9 | 36.0 | |
| | | | C | 35.3 | 37.4 | 33.9 | 35.5 | 35.0 | 36.2 | 35.7 | 35.9 | 35.6 | |
| | 7/20/2006 | 56 | A | 45.3 | 46.1 | 47.2 | 46.7 | 46.1 | 46.5 | 51.0 | 47.1 | 47.0 | 46.7 |
| | | | B | 44.6 | 44.9 | 48.0 | 45.4 | 44.5 | 45.5 | 47.3 | 47.8 | 46.0 | |
| | | | C | 45.6 | 48.3 | 46.7 | 47.6 | 46.9 | 46.9 | 47.3 | 47.5 | 47.1 | |
| | 1/25/2007 | 245 | A | 85.8 | 83.6 | 87.7 | 86.5 | 88.1 | 84.1 | 90.1 | 85.0 | 86.4 | 85.8 |
| | | | B | 80.2 | 78.9 | 84.6 | 82.0 | 87.2 | 87.0 | 84.8 | 84.8 | 83.7 | |
| | | | C | 90.7 | 86.9 | 87.4 | 87.9 | 90.5 | 87.3 | 81.2 | 86.5 | 87.3 | |
| | 5/24/2007 | 364 | A | 121.2 | 118.7 | 104.6 | 115.2 | 130.7 | 121.2 | 117.1 | 111.4 | 117.5 | 118.0 |
| | | | B | 117.6 | 122.6 | 110.3 | 122.7 | 132.1 | 122.8 | 116.8 | 115.9 | 120.1 | |
| | | | C | 118.5 | 119.4 | 111.9 | 116.1 | 120.8 | 119.6 | 123.5 | 101.6 | 116.4 | |

**Mix** TB1H5
**Cast Date** 2/1/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB1H5 | 2/2/2007 | 1 | A | 3.0 | 3.0 | 3.1 | 3.0 | 3.0 | 3.0 | 3.1 | 3.0 | 3.0 | 3.1 |
| | | | B | 3.1 | 3.1 | 3.1 | 3.2 | 2.9 | 3.0 | 3.1 | 3.2 | 3.1 | |
| | | | C | 3.1 | 3.0 | 3.0 | 3.1 | 3.0 | 3.0 | 3.0 | 3.1 | 3.0 | |
| | 2/4/2007 | 3 | A | 3.4 | 3.4 | 3.7 | 3.5 | 3.5 | 3.4 | 3.6 | 3.5 | 3.5 | 3.5 |
| | | | B | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.5 | 3.5 | 3.6 | 3.6 | |
| | | | C | 3.5 | 3.5 | 3.4 | 3.5 | 3.4 | 3.5 | 3.4 | 3.5 | 3.5 | |
| | 2/8/2007 | 7 | A | 5.3 | 5.4 | 5.4 | 5.8 | 5.3 | 5.2 | 5.4 | 5.8 | 5.5 | 5.7 |
| | | | B | 5.5 | 5.7 | 5.9 | 6.0 | 5.6 | 5.7 | 5.9 | 6.1 | 5.8 | |
| | | | C | 5.6 | 5.7 | 5.8 | 5.8 | 5.6 | 5.7 | 5.7 | 5.7 | 5.7 | |
| | 2/15/2007 | 14 | A | 7.1 | 7.2 | 7.2 | 7.2 | 7.2 | 7.1 | 7.8 | 7.2 | 7.3 | 7.4 |
| | | | B | 7.2 | 7.3 | 7.6 | 7.6 | 7.0 | 7.3 | 7.5 | 7.6 | 7.4 | |
| | | | C | 7.4 | 7.4 | 7.8 | 7.7 | 7.5 | 7.7 | 7.7 | 7.8 | 7.6 | |
| | 3/1/2007 | 28 | A | 9.0 | 9.4 | 9.4 | 9.4 | 9.5 | 9.6 | 9.6 | 9.3 | 9.4 | 9.3 |
| | | | B | 9.6 | 9.7 | 9.8 | 8.9 | 9.4 | 9.5 | 9.8 | 8.9 | 9.5 | |
| | | | C | 9.1 | 9.2 | 9.2 | 9.3 | 9.0 | 9.1 | 9.1 | 9.2 | 9.2 | |
| | 3/29/2007 | 56 | A | 15.0 | 14.2 | 14.3 | 14.4 | 14.4 | 14.5 | 15.0 | 14.4 | 14.5 | 14.6 |
| | | | B | 13.3 | 14.8 | 14.9 | 15.0 | 13.6 | 14.3 | 14.8 | 14.9 | 14.5 | |
| | | | C | 14.4 | 15.5 | 14.7 | 14.7 | 14.4 | 14.6 | 14.7 | 15.0 | 14.8 | |
| | 5/3/2007 | 91 | A | 22.3 | 22.3 | 23.8 | 21.8 | 22.8 | 22.4 | 24.4 | 21.9 | 22.7 | 22.6 |
| | | | B | 22.3 | 22.1 | 21.8 | 23.1 | 21.9 | 22.4 | 22.4 | 23.0 | 22.4 | |
| | | | C | 22.9 | 23.1 | 22.4 | 22.7 | 23.1 | 22.5 | 22.2 | 23.0 | 22.7 | |
| | 8/2/2007 | 182 | A | 41.8 | 42.1 | 43.2 | 40.7 | 40.1 | 39.8 | 42.0 | 43.4 | 41.6 | 40.1 |
| | | | B | 42.3 | 42.3 | 46.5 | 45.0 | 38.6 | 4.0 | 43.0 | 38.1 | 37.5 | |
| | | | C | 40.6 | 39.8 | 41.2 | 43.7 | 40.1 | 41.3 | 41.8 | 41.4 | 41.2 | |
| | 1/31/2008 | 364 | A | 44.4 | 44.3 | 44.1 | 44.1 | 44.3 | 44.1 | 44.1 | 44.1 | 44.2 | 43.7 |
| | | | B | 44.6 | 43.5 | 42.6 | 41.2 | 44.0 | 44.4 | 44.3 | 41.6 | 43.3 | |
| | | | C | 43.6 | 44.2 | 42.6 | 44.5 | 43.7 | 43.3 | 43.2 | 43.3 | 43.6 | |

**Mix** TB2H5
**Cast Date** 2/1/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB2H5 | 2/2/2007 | 1 | A | 3.3 | 3.1 | 3.2 | 3.3 | 3.1 | 3.0 | 3.2 | 3.3 | 3.2 | 3.2 |
| | | | B | 3.0 | 3.1 | 3.0 | 3.1 | 3.0 | 3.1 | 3.0 | 3.1 | 3.1 | |
| | | | C | 3.4 | 3.1 | 3.3 | 3.2 | 3.3 | 3.1 | 3.3 | 3.2 | 3.2 | |
| | 2/4/2007 | 3 | A | 3.5 | 3.4 | 3.5 | 3.7 | 3.4 | 3.5 | 3.3 | 3.7 | 3.5 | 3.5 |
| | | | B | 3.4 | 3.5 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.6 | 3.4 | |
| | | | C | 3.8 | 3.7 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 | 3.5 | 3.6 | |
| | 2/8/2007 | 7 | A | 6.5 | 6.6 | 7.0 | 7.4 | 6.6 | 6.9 | 7.0 | 7.4 | 6.9 | 6.9 |
| | | | B | 6.7 | 6.7 | 6.8 | 7.1 | 6.8 | 6.8 | 6.9 | 7.2 | 6.9 | |
| | | | C | 6.7 | 6.8 | 6.9 | 7.2 | 6.7 | 6.8 | 6.9 | 7.0 | 6.9 | |
| | 2/15/2007 | 14 | A | 15.4 | 17.4 | 16.0 | 16.4 | 15.9 | 15.9 | 16.4 | 17.2 | 16.3 | 16.2 |
| | | | B | 15.4 | 15.8 | 15.8 | 16.2 | 15.0 | 15.5 | 15.9 | 16.0 | 15.7 | |
| | | | C | 16.1 | 16.6 | 16.7 | 17.1 | 16.1 | 16.6 | 16.7 | 17.1 | 16.6 | |
| | 3/1/2007 | 28 | A | 30.4 | 32.6 | 32.6 | 32.5 | 29.4 | 26.7 | 21.5 | 21.7 | 28.4 | 29.8 |
| | | | B | 29.1 | 30.2 | 30.7 | 29.3 | 30.0 | 29.8 | 30.2 | 27.9 | 29.7 | |
| | | | C | 32.2 | 31.8 | 30.5 | 30.8 | 31.9 | 31.4 | 30.6 | 30.6 | 31.2 | |
| | 3/29/2007 | 56 | A | 54.2 | 61.0 | 59.0 | 59.7 | 54.3 | 58.9 | 59.7 | 59.1 | 58.2 | 56.7 |
| | | | B | 52.3 | 52.0 | 54.5 | 56.5 | 51.4 | 54.1 | 54.8 | 53.3 | 53.6 | |
| | | | C | 59.0 | 59.5 | 57.8 | 56.0 | 59.6 | 60.2 | 57.2 | 56.3 | 58.2 | |
| | 5/3/2007 | 91 | A | 79.5 | 85.9 | 86.0 | 83.6 | 78.8 | 86.2 | 88.1 | 83.3 | 83.9 | 82.9 |
| | | | B | 82.5 | 79.8 | 79.5 | 80.9 | 83.5 | 78.8 | 85.7 | 84.7 | 81.9 | |
| | | | C | 82.3 | 82.7 | 81.3 | 85.1 | 82.2 | 83.8 | 79.8 | 85.8 | 82.9 | |
| | 8/2/2007 | 182 | A | 39.7 | 42.1 | 43.2 | 40.7 | 40.1 | 39.8 | 40.5 | 41.6 | 41.0 | 42.4 |
| | | | B | 46.8 | 42.2 | 41.7 | 42.0 | 40.2 | 45.3 | 42.7 | 40.8 | 42.7 | |
| | | | C | 43.4 | 43.0 | 48.0 | 39.0 | 40.5 | 43.6 | 43.4 | 47.6 | 43.6 | |
| | 1/31/2008 | 364 | A | 92.9 | 93.0 | 92.9 | 85.7 | 93.0 | 94.7 | 94.4 | 87.5 | 91.8 | 90.7 |
| | | | B | 92.1 | 89.4 | 89.9 | 83.7 | 92.0 | 86.5 | 92.8 | 82.2 | 88.6 | |
| | | | C | 97.4 | 89.8 | 88.1 | 89.1 | 97.5 | 91.8 | 89.3 | 91.2 | 91.8 | |

**Mix** TB3H5
**Cast Date** 2/6/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 3.7 | 3.6 | 3.3 | 3.4 | 3.7 | 3.6 | 3.3 | 3.5 | 3.5 | |
| | 2/7/2007 | 1 | B | 3.4 | 3.7 | 3.4 | 3.3 | 3.5 | 3.7 | 3.5 | 3.3 | 3.5 | 3.4 |
| | | | C | 3.3 | 3.3 | 3.5 | 3.3 | 3.3 | 3.3 | 3.5 | 3.3 | 3.4 | |
| | | | A | 4.0 | 4.1 | 3.8 | 3.8 | 3.8 | 3.8 | 3.7 | 4.0 | 3.9 | |
| | 2/9/2007 | 3 | B | 3.9 | 3.8 | 3.6 | 3.8 | 3.8 | 3.9 | 3.6 | 3.8 | 3.8 | 3.8 |
| | | | C | 4.0 | 3.8 | 3.8 | 3.8 | 4.1 | 3.9 | 3.8 | 3.6 | 3.9 | |
| | | | A | 5.3 | 5.3 | 5.5 | 5.7 | 5.4 | 5.4 | 5.6 | 5.7 | 5.5 | |
| | 2/13/2007 | 7 | B | 5.3 | 5.3 | 5.4 | 5.4 | 5.4 | 5.5 | 5.7 | 5.6 | 5.5 | 5.4 |
| | | | C | 5.3 | 5.4 | 5.4 | 5.4 | 5.5 | 5.3 | 5.3 | 5.5 | 5.4 | |
| | | | A | 9.6 | 10.0 | 10.3 | 10.4 | 9.4 | 10.0 | 10.3 | 10.3 | 10.0 | |
| | 2/20/2007 | 14 | B | 9.4 | 9.5 | 9.7 | 10.3 | 9.4 | 9.5 | 9.6 | 10.4 | 9.7 | 9.9 |
| | | | C | 9.7 | 9.8 | 9.8 | 10.5 | 9.8 | 9.8 | 9.8 | 9.9 | 9.9 | |
| | | | A | 11.6 | 11.8 | 12.6 | 12.9 | 12.3 | 11.8 | 11.8 | 12.8 | 12.2 | |
| TB3H5 | 3/6/2007 | 28 | B | 11.9 | 12.0 | 12.4 | 12.7 | 11.7 | 11.9 | 12.2 | 12.9 | 12.2 | 12.3 |
| | | | C | 12.4 | 12.5 | 12.5 | 12.7 | 12.2 | 12.2 | 12.3 | 12.8 | 12.5 | |
| | | | A | 25.2 | 25.6 | 24.7 | 22.3 | 25.2 | 24.4 | 23.2 | 21.8 | 24.1 | |
| | 4/3/2007 | 56 | B | 25.8 | 24.2 | 21.9 | 23.0 | 23.6 | 23.9 | 22.6 | 21.8 | 23.4 | 23.8 |
| | | | C | 23.6 | 24.6 | 23.4 | 25.0 | 23.5 | 24.3 | 24.1 | 23.3 | 24.0 | |
| | | | A | 36.2 | 33.9 | 32.1 | 31.4 | 34.5 | 33.3 | 33.8 | 29.8 | 33.1 | |
| | 5/8/2007 | 91 | B | 31.2 | 33.7 | 33.6 | 28.4 | 35.1 | 34.0 | 32.9 | 28.0 | 32.1 | 33.2 |
| | | | C | 34.2 | 36.9 | 34.3 | 33.1 | 34.6 | 38.0 | 32.1 | 31.5 | 34.3 | |
| | | | A | 30.3 | 31.2 | 29.5 | 28.8 | 29.9 | 31.2 | 29.8 | 29.6 | 30.0 | |
| | 8/7/2007 | 182 | B | 29.4 | 29.5 | 27.3 | 31.4 | 30.5 | 31.1 | 29.1 | 27.4 | 29.5 | 29.7 |
| | | | C | 29.6 | 30.5 | 29.1 | 29.7 | 29.2 | 30.2 | 30.3 | 29.3 | 29.7 | |
| | | | A | 60.1 | 64.8 | 54.6 | 56.2 | 57.6 | 60.2 | 58.6 | 62.1 | 59.3 | |
| | 2/5/2008 | 364 | B | 55.8 | 57.4 | 55.2 | 56.4 | 56.2 | 56.9 | 54.9 | 55.3 | 56.0 | 58.1 |
| | | | C | 61.0 | 57.7 | 57.8 | 61.5 | 58.6 | 55.9 | 58.2 | 60.9 | 59.0 | |

**Mix** TB4H5
**Cast Date** 2/6/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 3.5 | 3.3 | 3.3 | 3.5 | 3.5 | 3.3 | 3.4 | 3.5 | 3.4 | |
| | 2/7/2007 | 1 | B | 3.6 | 3.4 | 3.4 | 3.6 | 3.9 | 3.4 | 3.3 | 3.5 | 3.5 | 3.4 |
| | | | C | 3.3 | 3.4 | 3.5 | 3.4 | 3.3 | 3.4 | 3.5 | 3.5 | 3.4 | |
| | | | A | 4.4 | 4.0 | 4.2 | 4.2 | 4.3 | 4.3 | 4.2 | 4.2 | 4.2 | |
| | 2/9/2007 | 3 | B | 4.2 | 4.2 | 4.1 | 4.0 | 4.2 | 4.2 | 4.2 | 4.0 | 4.1 | 4.2 |
| | | | C | 4.0 | 4.3 | 4.1 | 4.1 | 4.0 | 4.2 | 4.2 | 4.1 | 4.1 | |
| | | | A | 7.8 | 8.0 | 8.3 | 8.3 | 8.0 | 8.1 | 8.4 | 8.4 | 8.2 | |
| | 2/13/2007 | 7 | B | 7.7 | 7.8 | 8.0 | 8.5 | 7.6 | 7.8 | 7.9 | 8.0 | 7.9 | 8.0 |
| | | | C | 7.7 | 7.8 | 7.9 | 8.1 | 7.7 | 7.8 | 8.0 | 8.2 | 7.9 | |
| | | | A | 15.1 | 16.1 | 15.7 | 15.8 | 15.2 | 15.2 | 16.1 | 16.4 | 15.7 | |
| | 2/20/2007 | 14 | B | 14.3 | 16.1 | 15.6 | 15.7 | 14.6 | 15.4 | 16.4 | 16.0 | 15.5 | 15.6 |
| | | | C | 15.2 | 15.7 | 15.8 | 16.1 | 15.1 | 15.2 | 15.4 | 15.5 | 15.5 | |
| | | | A | 18.7 | 19.6 | 19.9 | 19.9 | 20.2 | 20.4 | 18.7 | 19.6 | 19.6 | |
| TB4H5 | 3/6/2007 | 28 | B | 19.1 | 18.8 | 18.9 | 20.4 | 19.1 | 19.4 | 19.7 | 20.4 | 19.5 | 19.6 |
| | | | C | 19.0 | 19.5 | 20.3 | 20.5 | 19.0 | 19.2 | 19.6 | 20.1 | 19.7 | |
| | | | A | 35.8 | 34.5 | 36.7 | 37.0 | 32.3 | 35.6 | 35.8 | 35.2 | 35.4 | |
| | 4/3/2007 | 56 | B | 33.4 | 33.9 | 32.6 | 34.8 | 33.0 | 36.7 | 32.0 | 35.7 | 34.0 | 34.5 |
| | | | C | 34.2 | 34.2 | 35.6 | 34.8 | 33.3 | 34.7 | 31.7 | 34.1 | 34.1 | |
| | | | A | 49.8 | 50.4 | 42.5 | 41.5 | 44.8 | 43.2 | 39.7 | 42.9 | 44.4 | |
| | 5/8/2007 | 91 | B | 44.4 | 35.5 | 45.0 | 38.8 | 44.4 | 42.2 | 42.9 | 39.6 | 41.6 | 42.9 |
| | | | C | 47.5 | 40.1 | 44.8 | 43.5 | 43.0 | 38.4 | 41.9 | 42.8 | 42.8 | |
| | | | A | 31.3 | 28.4 | 42.4 | 31.2 | 24.0 | 28.6 | 30.4 | 42.2 | 32.3 | |
| | 8/7/2007 | 182 | B | 29.6 | 28.8 | 43.4 | 28.6 | 30.2 | 31.1 | 30.9 | 32.0 | 31.8 | 30.5 |
| | | | C | 28.2 | 28.2 | 20.3 | 26.6 | 30.2 | 28.3 | 30.1 | 26.2 | 27.3 | |
| | | | A | 56.4 | 51.4 | 55.1 | 54.7 | 55.6 | 53.2 | 54.7 | 56.1 | 54.7 | |
| | 2/5/2008 | 364 | B | 56.3 | 53.3 | 54.5 | 52.2 | 55.8 | 52.8 | 57.2 | 49.1 | 53.9 | 54.4 |
| | | | C | 53.2 | 55.3 | 56.8 | 54.0 | 52.8 | 56.2 | 55.9 | 53.8 | 54.8 | |

**Mix** TB5H5
**Cast Date** 2/8/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 3.0 | 2.9 | 3.0 | 3.0 | 2.9 | 2.9 | 2.9 | 3.0 | 3.0 | |
| | 2/9/2007 | 1 | B | 3.0 | 2.9 | 2.9 | 2.9 | 2.9 | 2.8 | 2.9 | 2.9 | 2.9 | 2.9 |
| | | | C | 3.0 | 2.9 | 2.9 | 2.8 | 3.0 | 2.9 | 2.8 | 3.0 | 2.9 | |
| | | | A | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.8 | 3.8 | 3.8 | 3.7 | |
| | 2/11/2007 | 3 | B | 3.6 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| | | | C | 3.6 | 3.6 | 3.7 | 3.7 | 3.8 | 3.8 | 3.9 | 3.7 | 3.7 | |
| | | | A | 6.1 | 6.4 | 6.4 | 6.5 | 6.1 | 6.1 | 6.5 | 6.5 | 6.3 | |
| | 2/15/2007 | 7 | B | 6.1 | 6.3 | 6.3 | 6.5 | 6.1 | 6.3 | 6.5 | 6.6 | 6.3 | 6.4 |
| | | | C | 6.4 | 6.5 | 6.5 | 6.7 | 6.4 | 6.5 | 6.5 | 6.6 | 6.5 | |
| | | | A | 10.7 | 10.7 | 11.0 | 11.3 | 10.5 | 10.6 | 10.6 | 11.4 | 10.9 | |
| | 2/22/2007 | 14 | B | 10.7 | 11.3 | 11.2 | 11.5 | 10.7 | 10.9 | 11.3 | 11.2 | 11.1 | 11.0 |
| | | | C | 11.0 | 11.1 | 11.2 | 11.3 | 11.1 | 11.3 | 11.1 | 10.8 | 11.1 | |
| | | | A | 19.3 | 19.2 | 19.6 | 21.3 | 19.2 | 19.7 | 19.6 | 20.4 | 19.8 | |
| TB5H5 | 3/8/2007 | 28 | B | 21.1 | 20.7 | 20.1 | 20.9 | 20.9 | 20.9 | 20.8 | 20.1 | 20.7 | 20.4 |
| | | | C | 21.1 | 22.1 | 21.0 | 20.4 | 19.4 | 21.0 | 20.7 | 19.8 | 20.7 | |
| | | | A | 34.4 | 36.0 | 31.8 | 33.9 | 34.1 | 33.5 | 33.0 | 34.2 | 33.9 | |
| | 4/5/2007 | 56 | B | 39.3 | 34.3 | 37.8 | 38.8 | 34.6 | 35.8 | 35.8 | 36.2 | 36.6 | 35.7 |
| | | | C | 42.4 | 37.3 | 34.2 | 37.3 | 34.6 | 38.9 | 34.3 | 35.3 | 36.8 | |
| | | | A | 51.0 | 48.5 | 49.5 | 49.8 | 52.5 | 47.0 | 51.8 | 48.5 | 49.8 | |
| | 5/10/2007 | 91 | B | 53.4 | 53.3 | 50.8 | 52.9 | 48.3 | 54.9 | 49.7 | 53.1 | 52.1 | 51.2 |
| | | | C | 51.3 | 55.7 | 50.6 | 49.2 | 52.6 | 51.6 | 50.4 | 53.1 | 51.8 | |
| | | | A | 42.9 | 44.4 | 42.3 | 45.1 | 42.1 | 43.5 | 38.1 | 44.5 | 42.9 | |
| | 8/9/2007 | 182 | B | 40.6 | 44.8 | 47.7 | 41.8 | 42.4 | 42.0 | 46.2 | 42.5 | 43.5 | 43.3 |
| | | | C | 46.6 | 43.0 | 43.7 | 48.5 | 47.3 | 45.1 | 43.8 | 30.1 | 43.5 | |
| | | | A | 80.8 | 80.8 | 88.8 | 93.0 | 88.5 | 81.0 | 89.6 | 95.4 | 87.2 | |
| | 2/7/2008 | 364 | B | 94.7 | 96.3 | 95.4 | 94.0 | 95.7 | 96.7 | 96.2 | 93.0 | 95.3 | 91.9 |
| | | | C | 94.4 | 96.8 | 91.5 | 90.0 | 93.2 | 94.9 | 92.3 | 91.4 | 93.1 | |

**Mix** TB6H5
**Cast Date** 2/8/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | 2.8 | 2.7 | 2.7 | 2.7 | 2.6 | 2.7 | 2.7 | 2.7 | 2.7 | |
| | 2/9/2007 | 1 | B | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.6 | 2.7 | 2.7 | 2.7 | 2.7 |
| | | | C | 2.8 | 2.7 | 2.6 | 2.8 | 2.7 | 2.7 | 2.7 | 2.8 | 2.7 | |
| | | | A | 3.5 | 3.6 | 3.6 | 3.6 | 3.6 | 3.8 | 3.8 | 3.8 | 3.7 | |
| | 2/11/2007 | 3 | B | 3.6 | 3.6 | 3.8 | 3.8 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| | | | C | 3.6 | 3.6 | 3.7 | 3.7 | 3.8 | 3.8 | 3.9 | 3.7 | 3.7 | |
| | | | A | 8.3 | 8.3 | 8.4 | 8.6 | 8.3 | 8.3 | 8.4 | 8.5 | 8.4 | |
| | 2/15/2007 | 7 | B | 8.2 | 8.3 | 8.4 | 8.4 | 8.3 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |
| | | | C | 8.3 | 8.4 | 8.5 | 8.5 | 8.2 | 8.4 | 8.5 | 8.6 | 8.4 | |
| | | | A | 14.2 | 14.3 | 14.5 | 14.7 | 14.2 | 14.3 | 14.6 | 15.0 | 14.5 | |
| | 2/22/2007 | 14 | B | 14.4 | 14.5 | 14.5 | 14.4 | 14.2 | 14.3 | 14.3 | 14.5 | 14.4 | 14.4 |
| | | | C | 14.2 | 14.4 | 13.9 | 14.9 | 14.1 | 13.9 | 14.8 | 14.9 | 14.4 | |
| | | | A | 25.8 | 25.6 | 26.1 | 24.8 | 25.0 | 26.3 | 25.8 | 25.2 | 25.6 | |
| TB6H5 | 3/8/2007 | 28 | B | 25.0 | 24.8 | 25.2 | 26.3 | 24.8 | 25.7 | 25.4 | 26.6 | 25.5 | 25.5 |
| | | | C | 27.5 | 25.4 | 24.0 | 24.9 | 24.7 | 26.2 | 24.5 | 26.3 | 25.4 | |
| | | | A | 43.2 | 41.7 | 41.0 | 37.0 | 37.9 | 43.7 | 42.7 | 40.3 | 40.9 | |
| | 4/5/2007 | 56 | B | 39.2 | 41.2 | 42.2 | 43.2 | 39.6 | 42.6 | 41.6 | 43.8 | 41.7 | 40.9 |
| | | | C | 39.8 | 41.6 | 40.8 | 41.6 | 40.1 | 41.9 | 35.1 | 39.9 | 40.1 | |
| | | | A | 54.8 | 53.0 | 50.8 | 51.0 | 52.9 | 51.3 | 53.5 | 53.0 | 52.5 | |
| | 5/10/2007 | 91 | B | 50.5 | 51.5 | 52.6 | 58.2 | 50.5 | 52.8 | 52.4 | 55.9 | 53.1 | 52.4 |
| | | | C | 53.7 | 53.1 | 52.1 | 50.8 | 58.0 | 46.8 | 48.9 | 49.1 | 51.6 | |
| | | | A | 39.2 | 41.5 | 42.7 | 42.4 | 40.2 | 44.0 | 41.4 | 40.7 | 41.5 | |
| | 8/9/2007 | 182 | B | 40.8 | 44.2 | 33.4 | 36.4 | 41.8 | 39.6 | 35.7 | 40.6 | 39.1 | 37.8 |
| | | | C | 38.6 | 42.8 | 44.7 | 26.3 | 27.3 | 29.6 | 23.4 | 30.1 | 32.9 | |
| | | | A | 81.7 | 79.4 | 80.0 | 78.1 | 8.3.5 | 81.3 | 80.5 | 78.6 | 79.9 | |
| | 2/7/2008 | 364 | B | 78.3 | 80.2 | 79.0 | 78.7 | 77.4 | 82.1 | 78.3 | 80.5 | 79.3 | 79.4 |
| | | | C | 79.2 | 78.0 | 77.7 | 77.4 | 81.8 | 81.2 | 77.0 | 79.7 | 79.0 | |

**Mix** TB7H5
**Cast Date** 2/15/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB7H5 | 2/16/2007 | 1 | A | 3.2 | 3.1 | 3.1 | 3.0 | 3.0 | 3.0 | 3.1 | 3.2 | 3.1 | 3.2 |
| | | | B | 3.2 | 3.4 | 3.4 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| | | | C | 3.0 | 3.0 | 3.1 | 3.2 | 3.0 | 3.1 | 3.2 | 3.1 | 3.1 | |
| | 2/18/2007 | 3 | A | 3.2 | 3.3 | 3.3 | 3.5 | 3.3 | 3.3 | 3.4 | 3.5 | 3.4 | 3.4 |
| | | | B | 3.4 | 3.5 | 3.6 | 3.7 | 3.4 | 3.5 | 3.5 | 3.6 | 3.5 | |
| | | | C | 3.3 | 3.3 | 3.4 | 3.5 | 3.3 | 3.4 | 3.4 | 3.4 | 3.4 | |
| | 2/22/2007 | 7 | A | 4.9 | 5.0 | 5.0 | 5.1 | 4.8 | 5.0 | 5.0 | 5.2 | 5.0 | 5.1 |
| | | | B | 5.1 | 5.3 | 5.2 | 5.2 | 5.1 | 5.2 | 5.2 | 5.4 | 5.2 | |
| | | | C | 4.9 | 4.9 | 4.9 | 5.0 | 4.9 | 5.0 | 5.0 | 5.0 | 5.0 | |
| | 3/1/2007 | 14 | A | 8.9 | 8.9 | 9.0 | 9.1 | 8.8 | 8.9 | 8.9 | 9.0 | 8.9 | 9.1 |
| | | | B | 9.0 | 9.5 | 9.5 | 9.6 | 9.3 | 9.4 | 9.6 | 9.6 | 9.4 | |
| | | | C | 8.6 | 8.9 | 9.0 | 9.1 | 8.7 | 8.8 | 9.1 | 9.0 | 8.9 | |
| | 3/16/2007 | 29 | A | 17.0 | 17.0 | 18.1 | 17.4 | 17.2 | 17.3 | 16.4 | 18.1 | 17.3 | 17.6 |
| | | | B | 17.2 | 17.7 | 18.3 | 18.9 | 18.0 | 18.5 | 18.7 | 18.7 | 18.3 | |
| | | | C | 17.8 | 17.4 | 17.2 | 16.8 | 17.0 | 17.4 | 17.6 | 17.6 | 17.4 | |
| | 4/12/2007 | 56 | A | 28.5 | 28.2 | 28.0 | 26.6 | 28.4 | 27.3 | 27.4 | 26.6 | 27.6 | 28.9 |
| | | | B | 31.7 | 30.1 | 31.1 | 31.3 | 31.6 | 28.8 | 29.8 | 31.2 | 30.7 | |
| | | | C | 28.4 | 28.2 | 29.5 | 27.9 | 28.8 | 26.0 | 28.2 | 29.3 | 28.3 | |
| | 5/17/2007 | 91 | A | 46.8 | 49.0 | 36.8 | 44.3 | 45.5 | 46.1 | 40.7 | 43.4 | 44.1 | 45.0 |
| | | | B | 47.6 | 48.7 | 46.2 | 48.5 | 46.3 | 46.8 | 47.0 | 47.9 | 47.4 | |
| | | | C | 44.2 | 44.0 | 43.7 | 45.4 | 42.5 | 42.7 | 42.8 | 43.6 | 43.6 | |
| | 2/14/2008 | 364 | A | 80.7 | 77.4 | 79.4 | 78.9 | 81.5 | 77.2 | 79.8 | 79.8 | 79.3 | 80.3 |
| | | | B | 82.7 | 83.9 | 81.3 | 81.9 | 81.6 | 83.2 | 80.2 | 83.0 | 82.2 | |
| | | | C | 78.3 | 76.9 | 81.3 | 80.8 | 79.7 | 77.5 | 81.3 | 79.9 | 79.5 | |

**Mix** TB8H5
**Cast Date** 2/15/2007

| Identifier | Date | Days | Sample | 0° | 90° | 180° | 270° | 0° | 90° | 180° | 270° | Average | Gen. Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB8H5 | 2/16/2007 | 1 | A | 3.0 | 2.9 | 3.0 | 3.1 | 3.0 | 3.0 | 3.0 | 3.1 | 3.0 | 3.1 |
| | | | B | 3.1 | 3.3 | 3.1 | 3.0 | 3.2 | 3.2 | 3.1 | 3.2 | 3.2 | |
| | | | C | 3.3 | 3.3 | 3.2 | 3.2 | 3.2 | 3.3 | 3.2 | 3.1 | 3.2 | |
| | 2/18/2007 | 3 | A | 4.1 | 4.2 | 4.3 | 4.4 | 4.0 | 4.1 | 4.2 | 4.2 | 4.2 | 4.2 |
| | | | B | 4.1 | 4.1 | 4.3 | 4.3 | 4.1 | 4.2 | 4.2 | 4.3 | 4.2 | |
| | | | C | 4.2 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.2 | 4.3 | |
| | 2/22/2007 | 7 | A | 10.5 | 11.9 | 11.5 | 12.0 | 11.4 | 11.0 | 11.6 | 12.2 | 11.5 | 11.7 |
| | | | B | 12.3 | 11.6 | 11.4 | 11.2 | 12.0 | 11.9 | 11.1 | 12.0 | 11.7 | |
| | | | C | 11.6 | 11.9 | 11.3 | 12.2 | 11.3 | 11.5 | 12.3 | 12.0 | 11.8 | |
| | 3/1/2007 | 14 | A | 21.8 | 22.2 | 20.7 | 22.3 | 21.0 | 22.5 | 21.4 | 22.2 | 21.4 | 22.0 |
| | | | B | 22.2 | 22.3 | 23.5 | 21.1 | 23.4 | 23.8 | 21.7 | 21.9 | 22.5 | |
| | | | C | 21.8 | 20.9 | 21.6 | 22.5 | 21.3 | 22.5 | 22.5 | 23.2 | 22.0 | |
| | 3/16/2007 | 29 | A | 35.3 | 37.5 | 32.7 | 36.4 | 33.8 | 35.6 | 34.6 | 34.9 | 35.1 | 36.0 |
| | | | B | 39.3 | 40.5 | 36.0 | 33.4 | 38.8 | 39.9 | 37.0 | 35.0 | 37.5 | |
| | | | C | 35.8 | 32.7 | 35.2 | 38.2 | 33.3 | 35.2 | 35.9 | 37.4 | 35.5 | |
| | 4/12/2007 | 56 | A | 47.4 | 50.7 | 51.0 | 44.8 | 49.8 | 48.0 | 48.9 | 43.6 | 48.0 | 49.6 |
| | | | B | 51.9 | 52.3 | 51.0 | 43.9 | 51.8 | 50.8 | 48.9 | 49.6 | 50.0 | |
| | | | C | 48.1 | 47.0 | 55.0 | 55.0 | 51.9 | 45.5 | 53.1 | 50.4 | 50.8 | |
| | 5/17/2007 | 91 | A | 60.8 | 60.7 | 59.9 | 58.3 | 56.3 | 61.4 | 59.3 | 63.3 | 60.0 | 62.9 |
| | | | B | 65.1 | 70.0 | 67.8 | 63.8 | 63.0 | 68.2 | 66.4 | 62.5 | 65.9 | |
| | | | C | 59.1 | 59.7 | 66.7 | 66.8 | 59.7 | 62.0 | 64.5 | 63.6 | 62.8 | |
| | 2/14/2008 | 364 | A | 63.6 | 65.8 | 65.2 | 60.2 | 64.5 | 65.4 | 65.4 | 59.0 | 63.6 | 66.3 |
| | | | B | 72.7 | 69.4 | 66.6 | 68.3 | 72.4 | 69.0 | 66.2 | 66.9 | 68.9 | |
| | | | C | 63.9 | 63.5 | 66.5 | 70.5 | 66.4 | 63.4 | 67.1 | 70.1 | 66.4 | |