STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

BULK SPECIFIC GRAVITY OF COMPACTED BITUMINOUS MIXTURES:

FINDING A MORE WIDELY APPICABLE METHOD

FINAL REPORT

Project Number TNSPR-RES1153

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July 2003

Prepared for:

Tennessee Department of Transportation
In cooperation with
U.S. Department of Transportation
Federal Highway Administration

Technical Report Documentation Page

1. Report No. (TNSPR) RES 1153	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle Bulk Specific Gravity of Compacted Bituminous Mixtures: Finding A More Widely Applicable Method	5. Report Date
	6. Performing Organization Code
7. Author(s) L. K. Crouch, Daniel A. Badoe, Mark Cates, T. Adam Borden, Audrey R. Copeland, C. Todd Walker, Tim Dunn, Richard A. Maxwell, and William A. Goodwin	8. Performing Organization Report No.
9. Performing Organization Name and Address Center for Electric Power Box 5032, Tennessee Technological University Cookeville, TN 38505-0001	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. CUT 199
12. Sponsoring Agency Name and Address Materials and Tests Division Tennessee Department of Transportation 6601 Centennial Blvd. Nashville, TN 37243-0360	13. Type of Report and Period Covered January 2, 1999 to April 30, 2003
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

AASHTO T-166 Standard Specification for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens, often referred to as the SSD method states, "This method should not be used with samples that contain open or interconnecting voids and/or absorb more than 2% of water by volume." As the percentage of voids accessible from the compacted specimen surface increases, water penetrates further into the specimen. Water penetration into compacted hot-mix asphalt (HMA) samples introduced only small errors in percent air voids determination when dense-graded, well-compacted HMA mixtures were used exclusively. However, design innovations such as Superpave, stone matrix asphalt (SMA), open-graded friction courses (OGFC) and large-stone mixes (LSM) as well as construction problems such as inadequately compacted conventional HMA mixtures have made the limitations of AASHTO T-166 more apparent.

The ultimate goal of the project was to develop a new method, or adapt a current method, for determining bulk specific gravity (G_{mb}) of compacted HMA mixtures with wide applicability. The method must be repeatable and applicable to laboratory or field specimens for a wide variety of mixture types. A more reliable G_{mb} would result in more reliable HMA volumetric properties, specifically percent air voids. Consequently, dangerous pavement distress types such as rutting, bleeding, stripping, and age hardening (whose occurrence can often be predicted using percent air voids), could be avoided more often, ensuring a high degree of safety for the motoring public (a TDOT primary goal).

The project goal was accomplished in three steps. In step 1, a literature review and survey of state departments of transportation revealed thirteen existing G_{mb} determination techniques. In addition, the research team developed concepts for two new methods. The TDOT Monitoring Committee selected the seven most promising methods for further study. In step 2, a feasibility study using ten compacted HMA samples was conducted on the seven selected methods to evaluate cost, logistical factors, and preliminary repeatability. The TDOT Monitoring Committee selected the four most promising methods for further study. In the final step, fifty compacted HMA samples and four aluminum cylinders were used to evaluate the precision and accuracy of the four selected methods.

The dimensional analysis (AASHTO T-269) and the parafilm (ASTM D 1188) methods were found to form upper bounds for true sample air voids, while the SSD (AASHTO T-166) method was found to form a lower bound for true air voids. Although the true air voids can never be determined, the Instrotek Corelok System yields air void results in the range between the upper and lower bounds for true air voids. Finally, the Instrotek Corelok System was found to have the necessary precision, having an average coefficient of variation of 0.20 percent for the fifty compacted HMA samples used in the precision and accuracy step. Based on the results of the precision and accuracy study, the research team recommends the Instrotek Corelok System as the most widely applicable method for determining the G_{mb} of compacted HMA mixtures.

A 285-sample field study was conducted to ascertain the difference in magnitude in air voids based on Instrotek CoreLok tests and AASHTO T 166 tests. The average difference in air voids resulting from CoreLok and AASHTO T 166 is 1.0, 1.4, 2.1, and 3.3 for 411 S, 411 D, 307 BM 2, and 307 A HMA mixtures respectively. The difference is statistically significant for all mixture types statewide and in 14 of 15 (93.3% cases or 98.2% of HMA samples) of the TDOT Regional cases. The difference in air voids between CoreLok and AASHTO T 166 is a direct function of HMA mixture aggregate gradation.

17. Key Words Bituminous paving mixtures – compacted bulk specific gravity automatic vacuum sealing method in-place density	 air voids density compaction	18. Distribution Statement

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 261	22. Price

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

NOTICE

Department of Transportation Authorization # 401341
40 copies, July, 2003. This public document was
promulgated at a cost of $10.40 per copy.

TABLE OF CONTENTS

INTRODUCTION 1

SPECIFIC GRAVITY BASICS 4

PROJECT PLAN 8

CURRENT METHODS 10

FEASIBILITY STUDY 26

- Samples 26
- Cost 26
- Time To Perform Test 28
- Difficulty 28
- Preliminary Repeatability 29
- Analysis of Feasibility Study Results 30

PRECISION AND ACCURACY STUDY 34

- Samples 34
- Results 36
- Analysis of Results 44

FIELD STUDY 50

CONCLUSION 66

RECOMMENDATION 68

ACKNOWLEDGEMENTS 69

REFERENCES 70

APPENDICES 73

- A. Introduction 73
- B. Feasibility Study 76
- C. Precision and Accuracy Study 99
- D. Aluminum Cores 149
- E. Paired T-test Data and Results 153
- F. Field Study Data and Results 158
- G. Paired T-test Data for Field Samples 209

INTRODUCTION

Hot-mix asphalt (HMA) is used on ninety-six percent of all paved surfaces in the United States. Consequentially, the adequate performance of HMA pavements is crucial to the nation's infrastructure and economy. Pavement and materials researchers and practitioners have determined that volumetric properties of compacted HMA are the most important factors in determining the probable performance of HMA pavements. Therefore, volumetric properties are the most widely used HMA mix design parameters as well as the most widely specified pavement acceptance criteria used by state and federal departments of transportation (DOT). In addition, volumetric properties are important in forensic pavement investigations and in planning for subsequent rehabilitation or reconstruction. The importance of HMA volumetric properties cannot be overestimated.

In recent years, several new types of HMA designs have been developed in attempt to increase the service life of HMA pavements. In particular, Superpave, stone matrix asphalt (SMA), large-stone mixes (LSM), and open-graded friction courses (OGFC) are types of HMA mixes that often have a relatively large percentage of voids after compaction. The application of present methods for determining the volumetric properties of dense-graded (relatively low voids) HMA mixtures to these new types of mixtures with more voids has caused some difficulties for mix designers and technicians at many DOTs. These difficulties are described in detail on pages 86 and 87 of NCHRP Report 386 Design and Evaluation of Large-Stone Asphalt Mixes (1).

The Standard Method of Test for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens AASHTO T 166-00 (2) states that the method is not applicable to specimens with a water absorption of greater than two percent. Many of the previously mentioned new types of HMA mixtures have water absorption far in excess of two percent due to a relatively large percentage or size of voids after compaction. AASHTO T 166-00 recommends that Standard Method of Test for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens AASHTO T 275-00 (3) be used for specimens with water absorption greater than two percent. TDOT Materials and Tests Division supervisory personnel, engineers, and technicians all expressed concerns about the logistics, reliability and repeatability of AASHTO T 275-00.

In an informal meeting at Materials and Tests Division Headquarters on Friday, October 9, 1998 TDOT Materials and Test Division supervisory personnel expressed a great deal of interest in the development or adaptation of a more widely applicable method for determining the specific gravity of compacted bituminous mixtures. To maximize efficiency, the new method would need to be applicable to laboratory compacted specimens as well as specimens obtained in the field (cores) of various diameters. Further, the method should be applicable to a wide variety of HMA mixture types.

The ultimate goal of the project was to develop a new method, or adapt a current method, for determining bulk specific gravity of compacted bituminous mixtures with wide applicability. The method must be repeatable and applicable to laboratory or field specimens for a wide variety of mixture types. A more reliable specific gravity would result in more reliable HMA volumetric properties, specifically, percent air voids. Consequently, dangerous pavement distress types such as rutting, bleeding, stripping, and age hardening (whose occurrence can often be predicted using percent air voids), could be avoided more often. Further, inadequately compacted and/or highly permeable HMA pavement courses could be detected more reliably using a different method for measuring in-place density. Thus, preventing premature failure due to aging, cracking, and raveling. Minimizing pavement distress and preventing premature HMA pavement failures would ensure a higher degree of safety for the motoring public, a TDOT primary goal.

SPECIFIC GRAVITY BASICS

ASTM C 125-98 (4) defines specific gravity as the ratio of the mass of a volume of a material at a stated temperature to the mass of the same volume of distilled water at a stated temperature. Specific gravity has a variety of important applications in hot mix asphalt engineering. Perhaps most importantly specific gravity is used in determination of the percent air voids. The general equation for determining specific gravity assuming the material and water are at the desired temperature is:

Specific Gravity = {[mass of material / volume of material] / density of water}

Determination of material mass and the density of water are not difficult. However, determination of material volume is much more difficult, especially if the material is irregularly shaped.

The most widely used current method for determining bulk specific gravity of a compacted bituminous mixture (G_{mb}) is AASHTO T-166 Standard Specification for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens, often referred to as the SSD method. The SSD method is based on the ancient work of Archimedes, who determined that the volume of an irregularly shaped object could be determined by water displacement. From fluid statics:

mass of water displaced = mass of material SSD – mass of material submerged;

and ρ_w = mass of water displaced / volume of water displaced

Recognizing that material volume SSD = volume of water displaced.

Substituting: ρ_w = (mass SSD – mass submerged) / volume SSD

Therefore: volume SSD = (mass SSD – mass submerged) / ρ_w

The work of Archimedes has been extremely useful in construction materials testing. However, the concept has limitations. Water displacement is also used in measuring the theoretical maximum specific gravity (G_{mm}) of bituminous mixtures, AASHTO T-209 (5), often referred to as the Rice gravity. So, how do the two methods differ?

In the Rice method, the specific gravity of the uncompacted mixture is measured after an attempt to remove as much entrapped air as possible. The measured value, G_{mm}, is the specific gravity of the mix with no air voids (or more accurately, as few as possible air voids). The solid volume of mixture components is measured in the Rice method. In the SSD method, technicians attempt to determine the exterior volume of a compacted HMA mixture. Using the exterior volume of the compacted specimen and its mass, G_{mb} can be computed. With G_{mb} and $G_{mm,}$ critical HMA volumetric properties such as percent air voids can be calculated. The difference in the two methods is clearly water penetration.

AASHTO test method developers clearly recognized the importance of water penetration into compacted HMA specimens. AASHTO T-166 states, "This method should not be used with samples that contain open or interconnecting voids and/or absorb more than 2% of water by volume." As the percentage of voids accessible from the compacted specimen surface increases, water penetrates further into the specimen. For AASHTO T-166 to be accurate, a high percentage of the water that penetrates the sample must be maintained in the sample up to the point of SSD mass determination. If this does not happen, the sample may not appear to have a high absorption falsely indicating that there is no need for a different method of G_{mb} determination. Unfortunately, the apparent volume of the compacted specimen decreases and G_{mb} approaches G_{mm} (see figure 1).

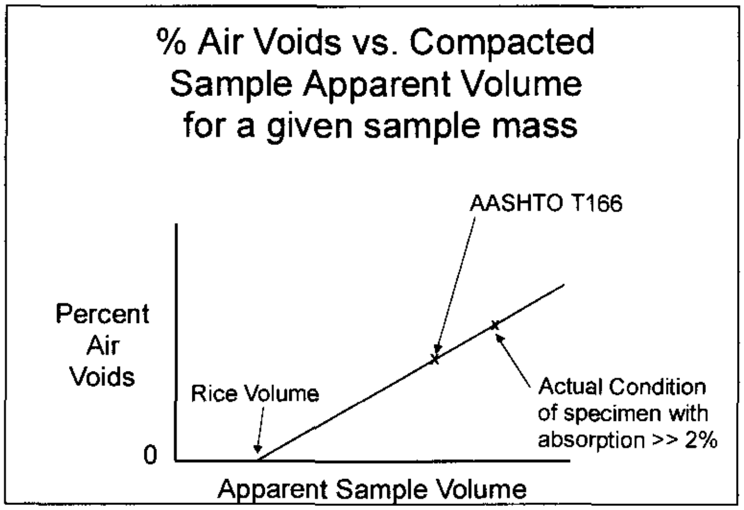

Figure 1. Percent Air Voids vs. Apparent Sample Volume

Water penetration into compacted HMA samples introduced only small errors in percent air voids determination when dense-graded, well-compacted HMA mixtures were used exclusively. However, design innovations such as Superpave, SMA, OGFC, and LSM as well as construction problems such as inadequately compacted conventional HMA mixtures such A, BM, BM2, D, and E have made the limitations of the SSD method became more apparent.

Several new test methods have been developed to determine G_{mb} of compacted bituminous mixtures. Summaries of the currently available methods discovered in the literature review are provided in the Current Methods section. The reader should keep in mind that complicated formulas associated with many of the methods are simply attempts to determine the exterior volume of the sample using mathematical manipulation of the available data.

PROJECT PLAN FOR LAB PHASE

Activity 1. Literature Review. The research team will conduct a literature review to determine what methods of determining bulk specific gravity of compacted bituminous mixtures are currently being used, how well these methods work, and what equipment and supplies are required for each method.

Activity 2. Conceptual Development of New Methods. The research team will attempt to conceptually formulate several new methods of determining the bulk specific gravity of compacted bituminous mixtures.

Activity 3. Method Review with TDOT Monitoring Team. The research team will present the available information on all new and existing methods to the TDOT Monitoring team. The research team will recommend the most promising seven methods for a feasibility study. The TDOT Monitoring Committee will select seven methods for a feasibility study.

Activity 4. Conduct Feasibility Study. The research team will conduct a feasibility study of the methods selected by the TDOT Monitoring Committee. Feasibility evaluation criteria will include, but not be limited to equipment and supply cost, difficulty of conducting test, time required, and preliminary repeatability. TDOT personnel will provide a limited number (approximately 10) of compacted bituminous mixture samples required for conducting the feasibility study. The samples provided should contain a wide variety of compacted bituminous mixtures.

Activity 5. Report on Method Feasibility. The research team will report to the TDOT Monitoring Committee on the feasibility of the methods selected. The TDOT

Monitoring Committee will select the four most promising methods for precision and accuracy evaluation.

Activity 6. Conduct Precision and Accuracy Evaluation. The research team will conduct seven replications of each selected method on 25 field samples and 25 lab samples. TDOT will provide field and lab samples for the precision and accuracy evaluation. Samples provided should include a wide as possible range of variables.

Activity 7. Analysis of Results. The results of Activity 6 will be analyzed. Accuracy will be judged by comparison to standards selected by the TDOT Monitoring Committee. Precision will be judged by average within-test coefficient of variation.

Activity 8. Implementation Recommendations. TTU personnel will use the results of Activities 4 and 7 to determine which method should be recommended to the TDOT Materials and Tests Division.

Activity 9. Prepare Final Report. The final report will be prepared and submitted for the review of the TDOT Monitoring Committee.

Activity 10. Training Seminar. A training seminar will be held to inform TDOT personnel of project results and familiarize TDOT personnel with the recommended method. The seminar will be held at a time and place designated by the chairman of TDOT Monitoring Committee.

CURRENT METHODS

Table 1 shows existing methods revealed in the literature review.

Table 1. Existing Methods

Method	Author / Reference
Saturated Surface-Dry Specimens	AASHTO T-166
Dimensional Analysis	AASHTO T-269
Paraffin Coating	AASHTO T-275
Parafilm Coating	ASTM D 1188
Cut and Measure	Buchanan NCAT
Masking Tape Wrapping	TTI, NCHRP 386
Glass Beads	TTI, NCHRP 386
Weighing in Plastic Bags	TTI, NCHRP 386
Instrotek Corelok	Ali Regimand, Instrotek
Zinc Coating	Harvey, ASTM JTEVA Sept. 1994
Rubber Membrane Jacketing	Harvey, ASTM JTEVA Sept. 1994
Sand Replacement	Rorie, Rawdon, Joines, TDOT
Catching Absorbed Water	Unknown

The following paragraphs provide a brief summary of each of the existing methods as well as two conceptual method formulations from the project. The methods currently available for use in G_{mb} determination can be divided into two groups. The first group consists of methods designed to determine the sample volume through water displacement, while the second group of methods approached sample volume determination through other means.

Water Displacement Methods

The discussion of the water displacement methods begins with a brief review of the previously discussed SSD method, AASHTO T 166.

Saturated Surface-Dry Specimens - AASHTO T 166 (2)

The sample mass in air is measured in grams (M_{dry}), then mass submerged in water in grams is measured (M_{sub}), and finally the saturated surface-dry mass in grams is determined (M_{ssd}). The bulk specific gravity is then calculated by the following equation:

$$G_{mb} = M_{dry} / (M_{ssd} - M_{sub})$$

The SSD method generally yields acceptable results for dense-graded mixtures, but as previously stated the volume measured approaches the volume of solids as water penetration into the sample increases. Water infiltrates into the sample voids during submersion and drains from the sample before a SSD mass can be obtained. A measured volume, lower than the actual sample volume, results when testing samples containing open or interconnecting voids. Sample volume is given by the following equation:

$$\text{Volume} = M_{ssd} - M_{sub}$$

AASHTO T-166 states, "This method should not be used with samples that contain open or interconnecting voids and/or absorb more than 2% of water by volume." The following equation is used to calculate the percent water absorbed by the sample:

$$\text{\% Absorbed by Volume} = [(M_{ssd} - M_{dry}) / (M_{ssd} - M_{sub})] \times 100$$

If the sample absorption exceeds this limit, then AASHTO T 275 (Paraffin-Coated Specimens) is recommended for use in determining the G_{mb} of the specimen.

The SSD test method is quick, easy, and operator insensitive. However, vulnerability to water penetration into the sample and subsequent drainage prior to SSD mass determination causes substantial concern. Previous research has shown that air void content was significantly underestimated by standard procedures that leave the outer surface of the specimen unsealed during submersion (6). Therefore, many leading researchers believe that subtle modifications could vastly improve the ability of the method to achieve accurate and repeatable results. The remaining test methods in this group were all designed to prevent water infiltration of the sample.

Paraffin Coating - AASHTO T 275 (3)

This procedure consists of coating the sample surface with melted paraffin to seal the specimen and prevent water absorption. The procedure after paraffin coating is similar to the AASHTO T-166. The following equation is used for calculating G_{mb} of paraffin-coated samples. The equation's denominator gives the sample volume.

$G_{mb} = M_d / [M_{dwp} - M_{wwp} - (M_{dwp} - M_d)/G_p]$

M_d = mass of dry specimen, g

M_{dwp} = mass of dry specimen plus paraffin, g

M_{wwp} = mass of dry specimen plus paraffin in water, g

G_p = specific gravity of paraffin at 25°C

The accuracy and repeatability of this test depends on the effectiveness of the application of the paraffin. If the paraffin wax is heated to a high enough temperature, it may enter the sample voids in the same manner as water infiltration with the SSD method, thus reducing the true sample volume (7). If correctly performed, this method should exhibit more accurate results than the saturated surface-dry test method, but the test is rather difficult to perform, time consuming, highly sensitive to operator efficiency, features poor repeatability, and the application of paraffin prevents future testing of the sample (8). However, any volume occupied by paraffin would not be considered part of the sample volume.

The AASHTO T 275 method can prevent water infiltration, but various other problems were introduced in the process. In an attempt to improve the paraffin coated sample application without sacrificing the positive aspects of the method, researchers modified the method by using parafilm, a close substitute for paraffin wax, to seal samples.

Parafilm Wrapping - ASTM D 1188 (9)

This method consists of wrapping the sample surface with parafilm in order to seal the surface. Parafilm is viewed as an acceptable substitute for paraffin wax when performing the AASHTO T 275 method of G_{mb} determination (8). It is reported that parafilm provides G_{mb} values equal to or slightly higher than those determined using the paraffin wax method (10). The parafilm test method eliminates the necessity of working with hot wax, avoids the concern of paraffin permeating interior sample voids, and also features the advantage of easy removal from the sample to allow further evaluation. The following equation is used for calculating G_{mb} of parafilm wrapped samples. The equation's denominator gives the sample volume.

$G_{mb} = M_d / [M_{dwp} - M_{wwp} - (M_{dwp} - M_d)/G_p]$

M_d = mass of dry specimen, g

M_{dwp} = mass of dry specimen plus parafilm. g

M_{wwp} = mass of dry specimen plus parafilm in water, g

G_p = specific gravity of parafilm at $25^{\circ}C$

The specific gravity of parafilm is determined using an aluminum cylinder as outlined in ASTM D 1188 for each operator. Unfortunately, bridging of the parafilm over surface voids is considered to be a problem (11). Bridging over surface irregularities increases observed sample volume, thus resulting in a lower observed G_{mb}. Water penetration due to an inadequate sealing of the surface by the parafilm also tends to be a problem, which decreases the observed volume of the sample. Repeatability and operator sensitivity are sources of concern with this method.

Masking Tape Wrapping (1) and *Weighing in Plastic Bags* (1)

These procedures utilize masking tape and plastic bags, respectively, to prevent permeation of water into open or interconnecting voids of samples. These methods use essentially the same equations and procedures as parafilm. The methods have the same repeatability and accuracy concerns as parafilm, but to a higher degree. Plastic bags seal well but usually do not conform acceptably to the sample exterior, resulting in a very high observed sample volume and thus a very low G_{mb}. Masking tape fits well but seals poorly resulting in water infiltration into the sample and thus a low observed sample volume and high G_{mb}.

Zinc Coating (10)

Zinc stearate is a hydrophobic powder, similar to talcum powder, used to dust the sample to prevent water infiltration. For this procedure, a dry sample mass is obtained, and then the sample is completely coated with zinc stearate powder and weighed in air and in water. The G_{mb} can then be determined by an equation similar to that of the Paraffin and Parafilm test methods. The mass in air with zinc stearate (M_{zs}) and mass in water with zinc stearate (M_{wzs}) are used instead of the mass in air with parafilm (M_{dwp}) and mass in water with parafilm (M_{wwp}).

Previous research has shown that in most cases the zinc stearate was incapable of preventing water penetration of all surface voids of the sample, providing results similar to unsealed samples (10). It is also reported that repeated inhalation of zinc stearate dust poses a health hazard (10). Considering the difficulty in obtaining accurate results and health hazards involved with this method, it was clear that this method was not a viable candidate as the most widely applicable method for determining G_{mb}.

Instrotek Corelok Vacuum Sealer (12)

The Instrotek Corelok method utilizes an automatic vacuum-sealing chamber in combination with puncture resistant polymer bags to prevent water infiltration. The sample is placed into a plastic bag, which is flexible enough to conform to the surface texture and requires no trimming or adjustment. The plastic bag is placed into the Corelok vacuum chamber, which automatically evacuates the air and then seals the sample to prepare it for analysis. The process of sample preparation requires very little operator involvement, virtually eliminating operator sensitivity. Once the test has been completed, the sample can be removed from the sealed bag and used for future testing. The procedure is similar to AASHTO T 275. The following equation is used for calculating G_{mb} with the Instrotek Corelok method. The equation's denominator gives the sample volume.

$$G_{mb} = M_d / [M_{ds} - M_{ss} - (M_{ds} - M_d)/F_t]$$

M_d = mass of dry specimen in air, g

M_{ds} = mass of dry, sealed specimen in air, g

M_{ss} = mass of sealed specimen submerged, g

F_t = apparent specific gravity of polymer bag at 25°C, provided by manufacturer

Rubber Membrane Jacketing (10)

The membrane procedure requires the use of a cylindrically shaped rubber membrane having the same diameter of the sample, and the membrane height shall exceed the height of the sample by three to four inches. The membrane should have one open end for the placement and removal of samples, while the opposite end shall be closed and affixed with a small tube so that a vacuum can be applied to seal the sample.

The procedure for this method is similar to the other water displacement methods. A dry mass is first recorded, and then the sample is placed into the membrane with its base resting firmly against the closed end. The open end of the membrane is folded as tightly against the sample as possible and clamped. A vacuum can now be connected to the tube in order to evacuate all air from within the membrane, allowing the membrane to more closely adhere to the surface contours of the sample. After the removal of air is evident, the vacuum is removed and the tube is clamped. The procedure is then completed by determining the mass of the sample with membrane and clamps in air and then submerged in water. The equation used to calculate the G_{mb} for this method is the same as that used for AASHTO T 275. Additional research is needed to make the membrane more durable, easier to clamp shut, and more flexible to better follow the surface of the specimens (10) In addition, the membranes would have to be calibrated with an aluminum cylinder similar to the parafilm calibration procedure.

Catching Absorbed Water

The catching absorbed water method procedure is identical to the SSD method procedure with the exception that the absorbed water which leaks from the specimen is caught and its mass is used in the calculation of G_{mb}. The following equation is used for calculating G_{mb} with the catching absorbed water method. The equation's denominator gives the sample volume.

$G_{mb} = M_d / [(M_{ssd} + M_{abs}) - M_{subm}]$

M_d = mass of dry specimen in air, g

M_{ssd} = mass of the saturated surface-dry specimen in air, g

M_{abs} = mass of caught absorbed water, g

M_{subm} = mass of specimen in water, g

The catching of absorbed water is difficult and very subjective. This method was considered to be incapable of achieving the desired precision and accuracy.

Methods Not Involving Water Displacement

Dimensional Analysis AASHTO T-269 (13)

The dimensional analysis method assumes that the sample volume can be approximated by a simple geometric figure, typically a right circular cylinder. The dry mass of the sample is divided by its calculated volume to obtain the G_{mb}. The dimensional analysis method works well for samples with smooth planar surfaces. However, as surface irregularities are introduced, the method begins to overestimate the sample volume. Typically, dimensional analysis produces a low observed G_{mb} value compared to the actual G_{mb}.

Cut and Measure – NCAT (11)

This method consists of sawing compacted samples into cubical samples to remove surface irregularities, then usually determining G_{mb} by dimensional analysis. However, further research has shown that the surface of the sample, cut or uncut, influences the measured air voids (6). Although any method of G_{mb} measurement could be used on the cubical sample; theoretically, the truest measure of the sample G_{mb} could be determined by using AASHTO T 269, provided that the dimensions of the cut sample are accurately determined (11). NCAT researchers reported that it was quite difficult to obtain flawless samples using commercially available HMA saws. Several samples had small portions of the material break off along the cut edges, and it was extremely difficult to cut a cube of true parallel faces (11). Permanent sample damage, precluding further testing, is another disadvantage of this method.

Glass Beads - NCHRP 386 (1)

The glass beads method is capable of determining the bulk specific gravity of specimens containing water-permeable air voids by using 8 mm-dia. glass beads in place of water. The glass beads procedure is a displacement method but glass beads are displaced rather than water. It was developed for use with specimens that absorb more than 2% water by volume, as determined by AASHTO T 166. The test begins by positioning the sample on a bed of two to three inches of glass beads previously placed in a cylindrical metal measure. The measure is then filled with beads to the top of the specimen. Then the cylinder is to be tapped with a rubber mallet at four equally spaced locations to densify the beads. A metal cone (fitted to the top of the measure when inverted) is to be securely fastened to the measure to form a pycnometer. The measure is then filled. Compactive effort is applied when the measure is one-third full, two-thirds full, and then after overflowing by use of the previously mentioned rubber mallet.

The following equation is used for calculating G_{mb} with the glass beads method. The equation's denominator gives the sample volume.

$G_{mb} = M_d / [(M_d + M_{mb} - M_{sbmc}) / G_{beads}]$

M_d = mass of specimen, g

M_{mb} = mass of measure plus beads, g

M_{sbmc} = mass of specimen plus beads, measure, and cone,g

G_{beads} = specific gravity of glass beads, g

The specific gravity of the beads and calibration of the measure is determined by carrying out a similar process (see NCHRP Report 386). The following equation is used to determine the specific gravity of the glass beads:

$G_{beads} = [(M_{mcb} - M_{mc}) / V_{mc}] / \gamma_w$

M_{mcb} = mass of measure plus cone and beads

M_{mc} = mass of measure plus cone

V_{mc} = volume of measure plus cone

γ_w = density of water

The specific gravity of the beads should be measured often to avoid error due to degradation of the beads and contamination from asphalt specimens that may alter bead specific gravity.

The glass beads method appears to be operator sensitive. Test results are highly dependent on the compactive effort supplied by the operator, which determines the density at which the beads will be packed within the test apparatus.

Sand Replacement - TDOT (Rorie, Rawdon, Joines)

The sand replacement method is very similar to the glass beads method. Volume of the sample is determined by the displacement of loose sand. This procedure utilizes a conical funnel mounted on a frame, which allows calibrated sand to free flow into a cylindrical container in which the test sample was previously placed. The cylindrical container is to be filled until overflowing. The excess sand is to be carefully struck off to a smooth level surface, using a minimal number of strokes and taking care to not densify the sand. The following equation is used for calculating G_{mb} with the sand replacement method. The equation's denominator gives the sample volume.

$G_{mb} = M_d / (M_d + M_{ms} - M_{sms})$

M_d = mass of specimen, g

M_{ms} = mass of measure plus sand, g

M_{sms} = mass of specimen plus measure and sand, g

The developers of this method recommend repeating this process at least once to confirm the results. If the difference in results exceeds one percent, the test is repeated and the average of the two closest (within one percent) replications are used to calculate G_{mb}. Unfortunately, repetition causes this test to become more time consuming. The major disadvantage of the sand replacement method appears to be the possibility of sand entering the interconnected voids of samples, thus reducing observed sample volume and increasing observed G_{mb}. Sand intrusion might also render the sample useless for further testing.

Conceptual Development

Concepts for two new methods were developed for the project. The first concept called for a high surface-tension heavy liquid media. The procedure for the method would have been similar to the SSD method. The concept was abandoned when no safe, economical liquid media with the desired properties could be identified. The second concept developed was for a modification of the relative density test (14). This concept was subsequently abandoned due to its similarity to the existing sand replacement and glass beads methods.

Questionnaire

A questionnaire was sent to state DOTs in September 1999 to ascertain what methods were currently being used and if method modifications or new methods were being developed. 43 of 50 state DOTs responded to the questionnaire. A copy of the cover letter and questionnaire are provided in Appendix A. Figures 2, 3, and 4 show primary method, use of AASHTO T-275, and possible new methods or revisions, respectively.

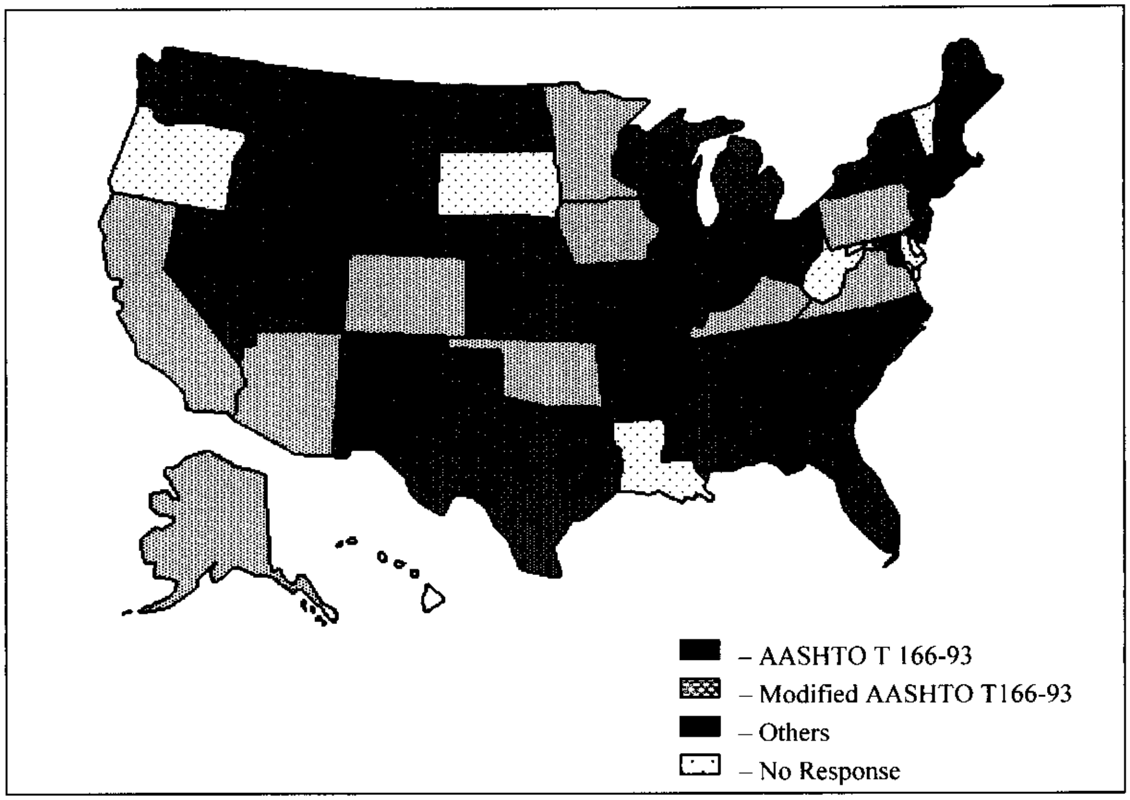

Figure 2. Primary Method

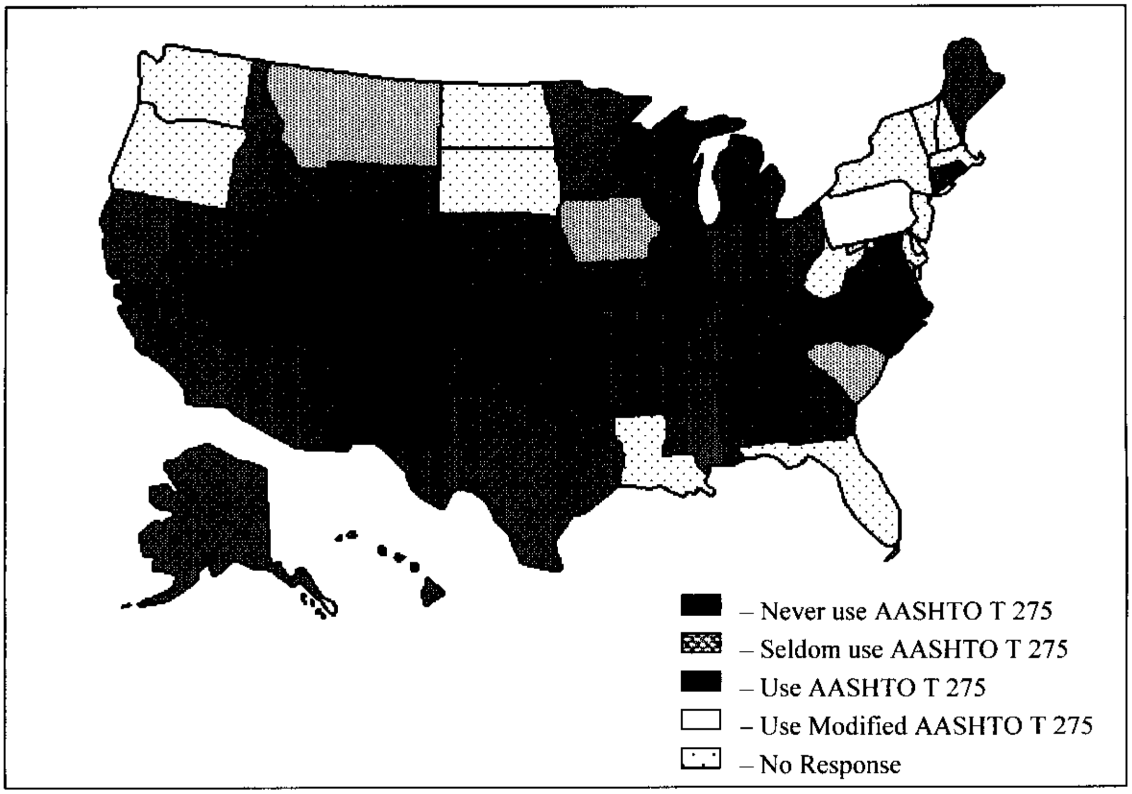

Figure 3. AASHTO T 275 Use

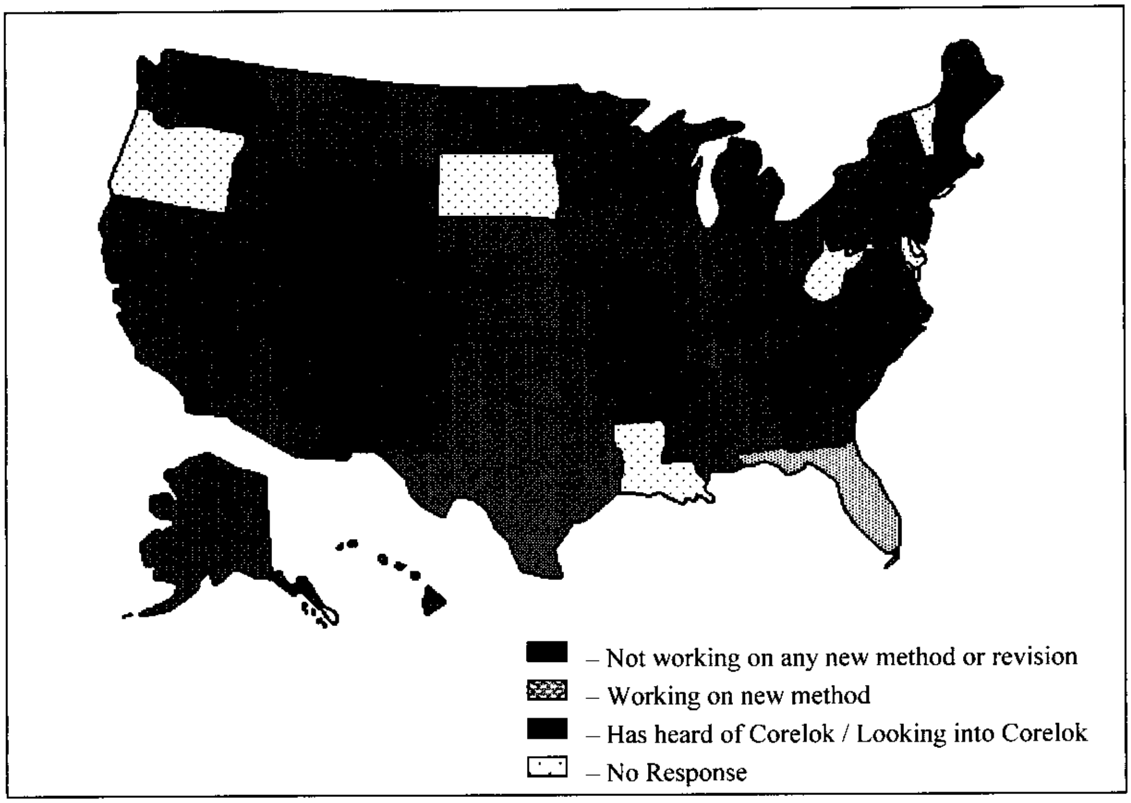

Figure 4. Possible New Methods or Revisions

Over 97 percent of state DOTs responding indicated that AASHTO T-166 (SSD method) or a modification of AASHTO T-166 was their primary G_{mb} determination method. About one-third of state DOTs responding (32.5%) reported never using AASHTO T-275 (paraffin coating). Another 7 percent reported only seldom use of AASHTO T-275. Almost seven of every ten states responding (69.8%) indicated that they were not currently working on a new method or a revision to their current G_{mb} determination method. In addition to the data from state DOTs, the Federal Aviation Administration reported using ASTM D 1188 (parafilm) or ASTM D 2726 (SSD). Further, the Federal Highway Administration Research and Development Lab reported using AASHTO T-166 (SSD) and involvement with the Instrotek Corelok pooled fund study.

The monitoring committee reviewed each available method at TDOT Materials and Tests Division Headquarters on November 12, 1999. At this meeting, the committee selected seven methods, shown in Table 2, for the feasibility study.

Table 2. Methods Selected for the Feasibility Study

Method	Author / Reference
Saturated Surface-Dry Specimens	AASHTO T-166
Dimensional Analysis	AASHTO T-269
Dimensional Analysis with top and bottom surfaces cut plane	AASHTO T-269 and Buchanan, NCAT
Dimensional Analysis with all surfaces cut plane	AASHTO T-269 and Buchanan, NCAT
Parafilm Coating	ASTM D 1188
Glass Beads	TTI, NCHRP 386
Instrotek Corelok	Ali Regimand, Instrotek

FEASIBILITY STUDY

The seven methods selected by the TDOT Monitoring Committee for the feasibility study were evaluated for:

- Cost
- Time required to perform each test
- Difficulty of test
- Preliminary repeatability

Samples

Ten compacted bituminous mixture samples were provided by the TDOT Materials and Tests Division (M&TD) for use in the feasibility study. The samples supplied included both field samples (cores) and laboratory compacted samples. Laboratory compacted samples were compacted with several different apparatus including the Superpave Gyratory Compactor, Marshall Hammer, and Corps of Engineers Gyratory. The samples also included a wide variety of mixture types, ranging from dense-graded surface mixtures to high void Novachip mixtures. In summary, the samples provided covered the spectrum of compacted bituminous mixture samples that TDOT M & TD had experience with.

Cost

The initial equipment costs associated with the methods chosen for the feasibility study are shown in figure 5. Two methods had reoccurring cost due to the use of expendable materials, Instrotek Corelok (sample bags) and parafilm. The reoccumng costs of these methods for both 4-in (101.6-mm) and 6-in. (152.4-mm) samples are shown in figure 6. Equipment maintenance costs associated with the methods were not included in the reoccurring costs. Due to the limited nature of the feasibility study, equipment maintenance costs could not be accurately estimated.

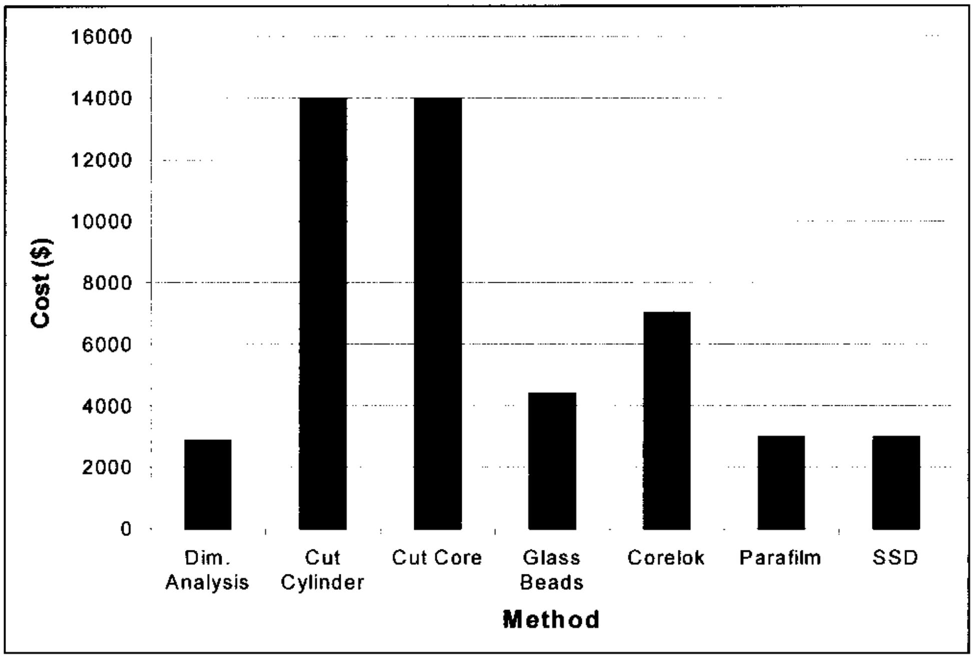

Figure 5. Initial Cost of Methods

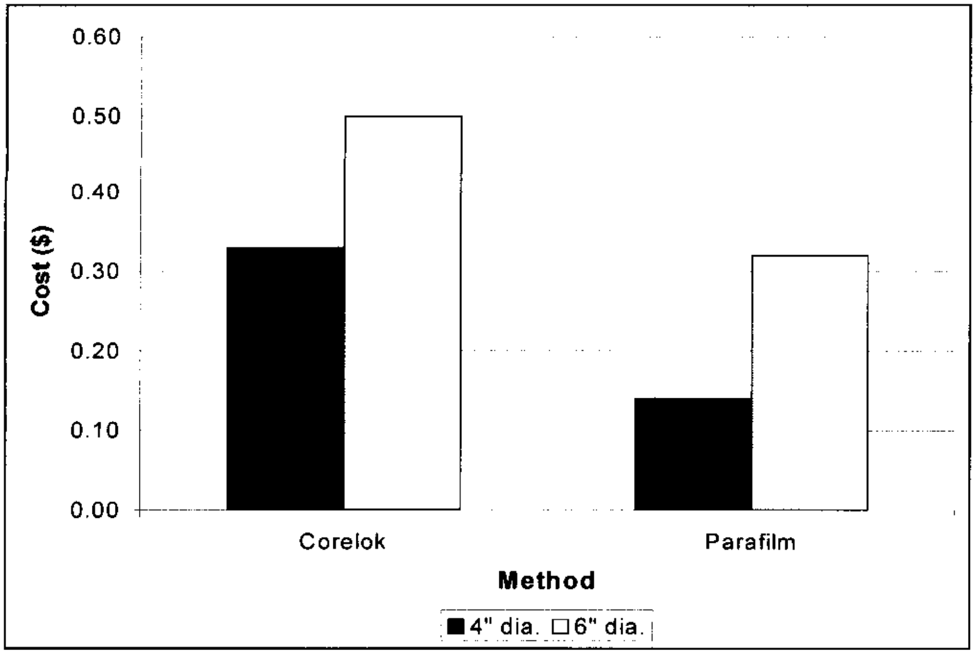

Figure 6. Reoccurring Costs of Methods

Time to Perform Test

The average time required for an experienced technician to perform a test with each of the selected methods is shown in figure 7. These times do not include the sample drying time.

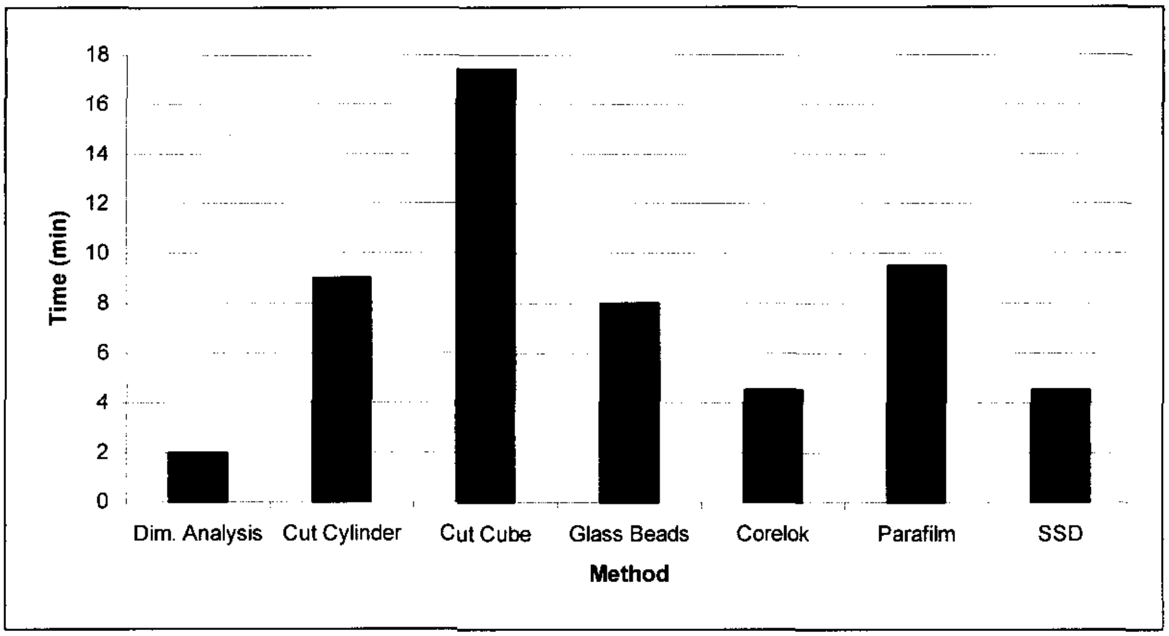

Figure 7. Time to Perform Each Method

Difficulty of Test

Although it did not require the longest time to perform, the glass beads method was by far the most physically demanding method. The average weight of the test apparatus, sample, and glass beads was 89 lbs (40.3 kg). Further, due to degradation of the glass beads periodic recalibration of the method was required. The periodic recalibration required approximately 8 additional minutes for an experienced technician. Both methods requiring sample cutting were difficult and time consuming as well. Sample damage due to cutting was also fairly common. Typically, the trailing edge of the sample would break off just before cutting was complete. Parafilm was the next most difficult method, especially for 6-in. (152.4-mm) or field samples with rough lower surfaces. Corelok and SSD were fairly easy methods to perform. However, the quickest and easiest test method to perform was dimensional analysis.

Preliminary Repeatability

Five replications of each test method were performed on each of the ten samples provided by TDOT M & TD. Data and results from these tests are contained in Appendix B. Table 3 shows the test methods in order from maximum to minimum average G_{mb} value for the ten samples used in the feasibility study. The first row indicates the TDOT M & TD designation for the sample.

Table 3. Method G_{mb} Ranking for the Feasibility Study

NC 1	NC 2	(4-6)/1	1	3	2	237/4	22/1	100/1	COE1
SSD	SSD	SSD	SSD	SSD	SSD	GB	GB	CLK	GB
GB	CALL	GB	CALL	GB	CLK	CALL	SSD	SSD	SSD
CLK	CLK	CLK	CLK	CLK	GB	SSD	CLK	CALL	CTB
PAR	GB	CALL	GB	PAR	CALL	CTB	PAR	CTB	CALL
CTB	PAR	PAR	PAR	CTB	PAR	CLK	DA	PAR	CLK
DA	DA	CTB	CTB	CALL	CTB	PAR	CTB	DA	PAR
CALL	CTB	DA	DA	DA	DA	DA	CALL	GB	DA

SSD – saturated surface-dry
GB – glass beads
CLK – Instrotek Corelok
CALL – dimensional analysis with all surfaces cut plane
CTB - dimensional analysis with top and bottom surfaces cut plane
PAR – parafilm
DA – dimensional analysis

Analysis

TDOT M & TD and the research team agreed that the precision or repeatability of a laboratory test method is a very important criterion for method selection. To address this concern, coefficients of variation were calculated and compared graphically. Figure 8 shows the maximum, minimum, and average coefficients of variation each method achieved in the feasibility study. Figure 9 is a close-up view of the lower portion of figure 8 included to show more detail for comparison of the methods with lower variability. Data from one severely damaged cut sample was not included in figures 8 and 9.

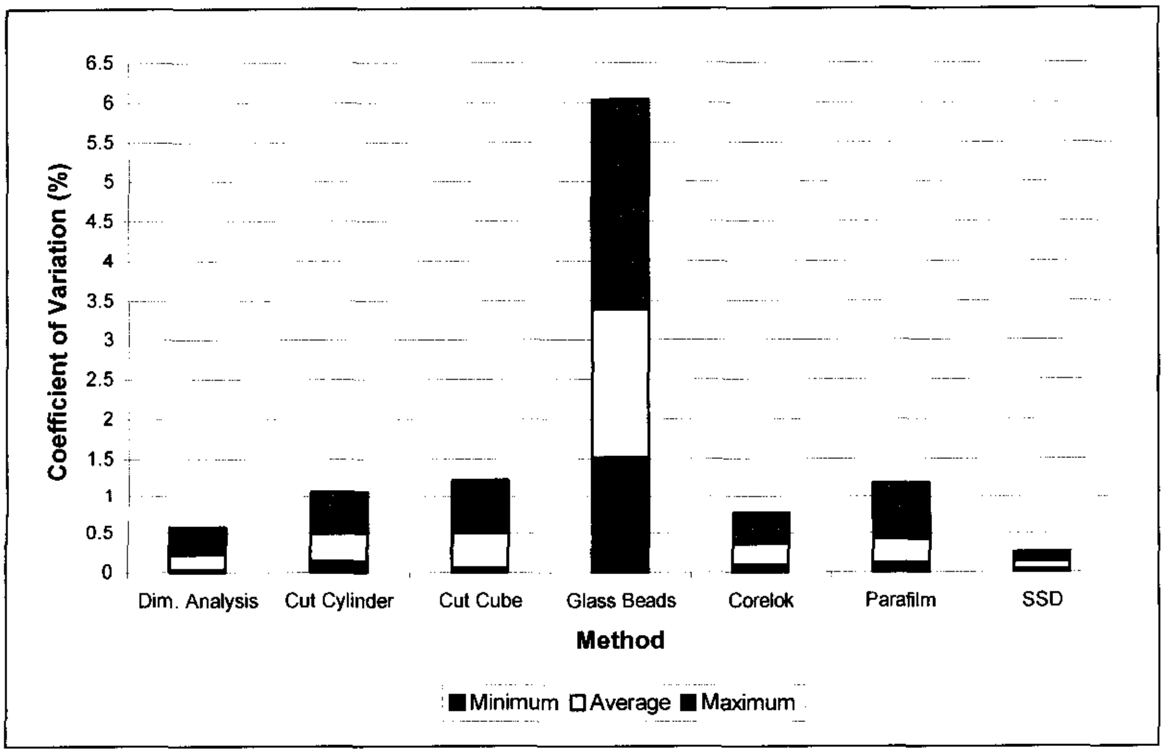

Figure 8. Coefficients of Variation of Methods

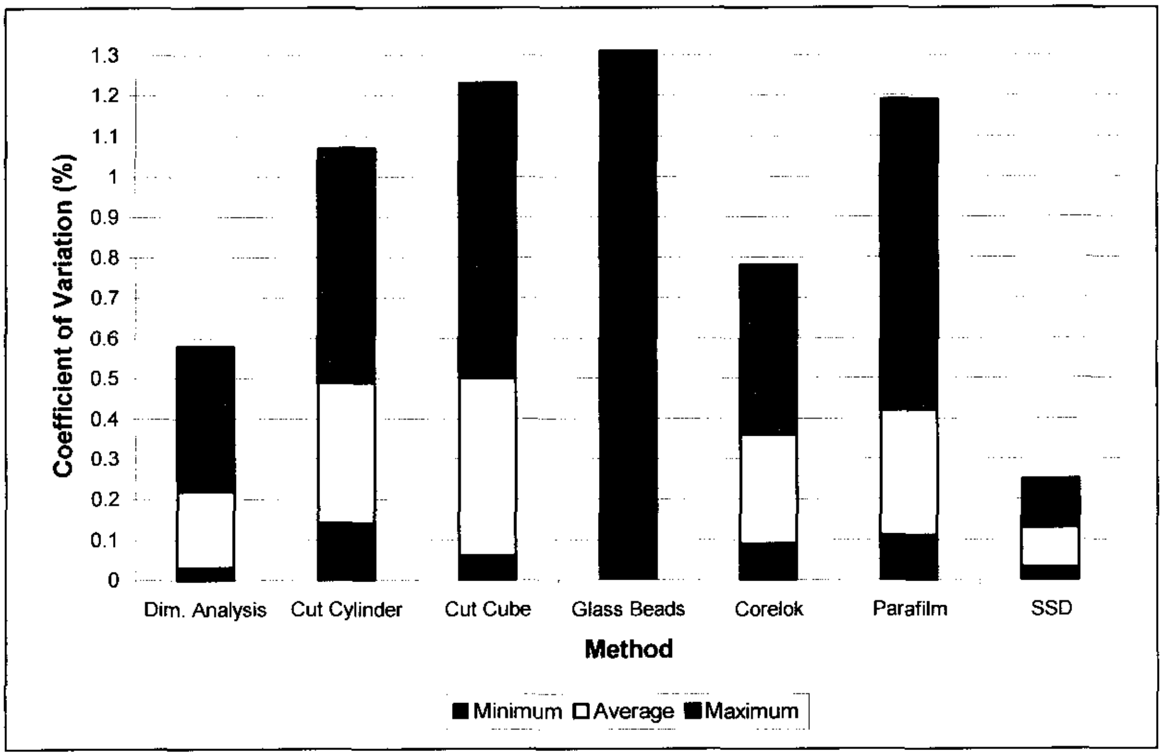

Figure 9. Coefficients of Variation of Methods, Modified

The test method exhibiting the lowest precision was glass beads with an average coefficient of variation approximately seven times that of any other test method. The two dimensional analysis on cut surface methods had the next highest average coefficients of variation. However and perhaps more importantly, dimensional analysis performed on specimens with cut surfaces exhibited lower precision, that is higher minimum, maximum, and average coefficients of variation, than dimensional analysis performed on the same samples prior to cutting. This implies that cutting the surface of specimens has only negative effects, lower precision G_{mb} results and sample damage which renders the sample useless for further testing. For previously mentioned reasons, the research team recommended that the TDOT Monitoring Committee select SSD, Corelok, parafilm, and dimensional analysis for the precision and accuracy study.

The test method with the highest precision, lowest average coefficient of variation, was the SSD method. The dimensional analysis method was a close second in precision. Instrotek Corelok and parafilm finished third and fourth respectively. However, it is important to note that the average coefficient of variation was less than one half percent for the top four methods. All four methods appeared to be capable of producing high precision results. Therefore it appeared that method precision would not be a critical factor in selecting the most widely applicable method for determining G_{mb}.

Table 4 shows the test methods in order from maximum to minimum average G_{mb} value for the ten samples used in the feasibility study with the three lowest precision methods removed. For nine of the ten samples in the feasibility study, the methods followed a similar trend. The SSD method yielded the highest G_{mb}, followed by Corelok. In all ten cases the dimensional analysis method yielded the lowest G_{mb} and parafilm yielded the second lowest G_{mb}.

Table 4. Modified Method G_{mb} Ranking for the Feasibility Study

NC 1	NC 2	(4-6)/1	1	3	2	237/4	22/1	100/1	COE1
SSD	SSD	SSD	SSD	SSD	SSD	SSD	SSD	CLK	SSD
CLK	CLK	CLK	CLK	CLK	CLK	CLK	CLK	SSD	CLK
PAR	PAR	PAR	PAR	PAR	PAR	PAR	PAR	PAR	PAR
DA	DA	DA	DA	DA	DA	DA	DA	DA	DA

SSD – saturated surface-dry
PAR – parafilm
CLK – Instrotek Corelok
DA – dimensional analysis

The results of the cost and time to perform method sections were combined to produce figure 10. Figure 10 shows the cost of testing 10,000 samples including initial cost, reoccurring cost, and labor. The estimates in Figure 10 assume that maintenance costs will be minimal for 10,000 samples. The dimensional analysis method is the least expensive while Parafilm coating is the most expensive method.

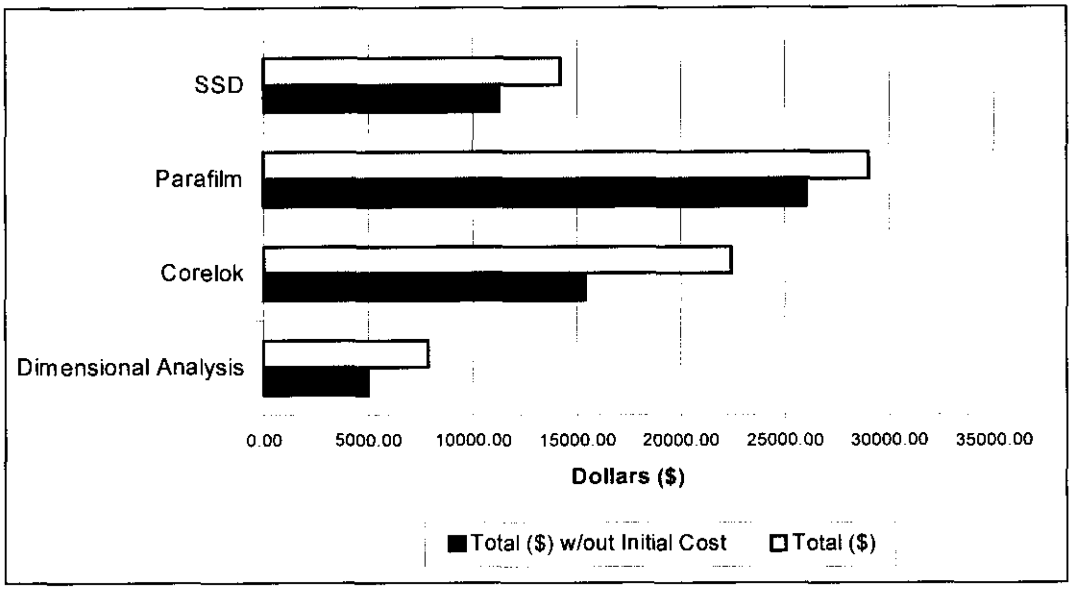

Figure 10. Costs over life of 10,000 samples

The monitoring committee reviewed results of the feasibility study at meeting at TDOT Materials and Tests Division Headquarters on June 22, 2000 and concurred with the recommendations of the research team, selecting the Instrotek Corelok, parafilm, SSD, and dimensional analysis methods for the precision and accuracy study.

PRECISION AND ACCURACY STUDY

The precision and accuracy evaluation consisted of seven replications of each of the four selected methods on fifty samples provided by the TDOT Materials and Tests Division and three replications of each test method on four aluminum samples fabricated by the TTU Civil Engineering Technician.

HMA Samples

The TDOT Materials and Tests Division provided fifty compacted bituminous mixture samples for use in the precision and accuracy study. The fifty samples were divided into ten sample groups. Each sample group contained five samples of the same mixture compacted in the same manner. Six sample groups, thirty of the fifty samples, were laboratory compacted. The remaining four sample groups, twenty of the fifty samples, were field cores. The sample groups provided a wide variety of bituminous mixture types, ranging from dense-graded surface mixtures such as D mix, through binder mixtures such as BM2, to coarse base mixtures such as the A mix. Some of the laboratory sample groups provided were compacted using the Superpave Gyratory Compactor and some sample groups were compacted using the Marshall hammer. Laboratory sample groups were compacted to various densities. Further, both 4-in (101.6-mm) and 6-in. (152.4-mm) sample groups were provided. Theoretical maximum specific gravity (G_{mm}) values were also provided for each bituminous mixture. In summary, the sample groups covered the spectrum of compacted bituminous mixture samples that TDOT Materials and Tests Division commonly specifies and tests.

Aluminum Samples

Aluminum cylinders were used as specimens with known air voids to access the accuracy of the four G_{mb} methods. Four aluminum cylinders were machined to 4-in. (101.6-mm) in diameter and 2.5-in. (63.5-mm) in height. The specific gravity of the aluminum alloy was found to be 2.701 by referencing the alloy number on the internet (15). Each cylinder contained a different number of 0.25-in. (6.35-mm) holes drilled through the depth of the cylinder (see figure 11). Air voids of the aluminum cylinders were calculated using the following:

$\% \text{ air voids} = [n(0.25)^2/(4)^2] * 100$ FPS, where n is the number of ¼ inch holes

$\% \text{ air voids} = [n(6.35)^2/(101.6)^2] * 100$ SI, where n is the number of 6.35 mm holes

Aluminum cylinders were produced with 0, 8, 16, 24 holes yielding 0, 3.125, 6.25, 9.375 percent air voids respectively.

Figure 11. Aluminum Cylinders

Results

Figures 12 through 21 show the maximum, minimum, and average air voids for each sample group with each test method. Therefore each column on the respective plots represents 35 results (7 replications of 5 samples in the group). Air voids were calculated using the G_{mb} values from the test method, the G_{mm} values TDOT M & TD provided for each sample group, and the following equation from AASHTO T-269:

Percent air voids = $100(1 - G_{mb}/G_{mm})$

G_{mb} data, results, absorptions, and sample volumes for all samples are contained in Appendix C.

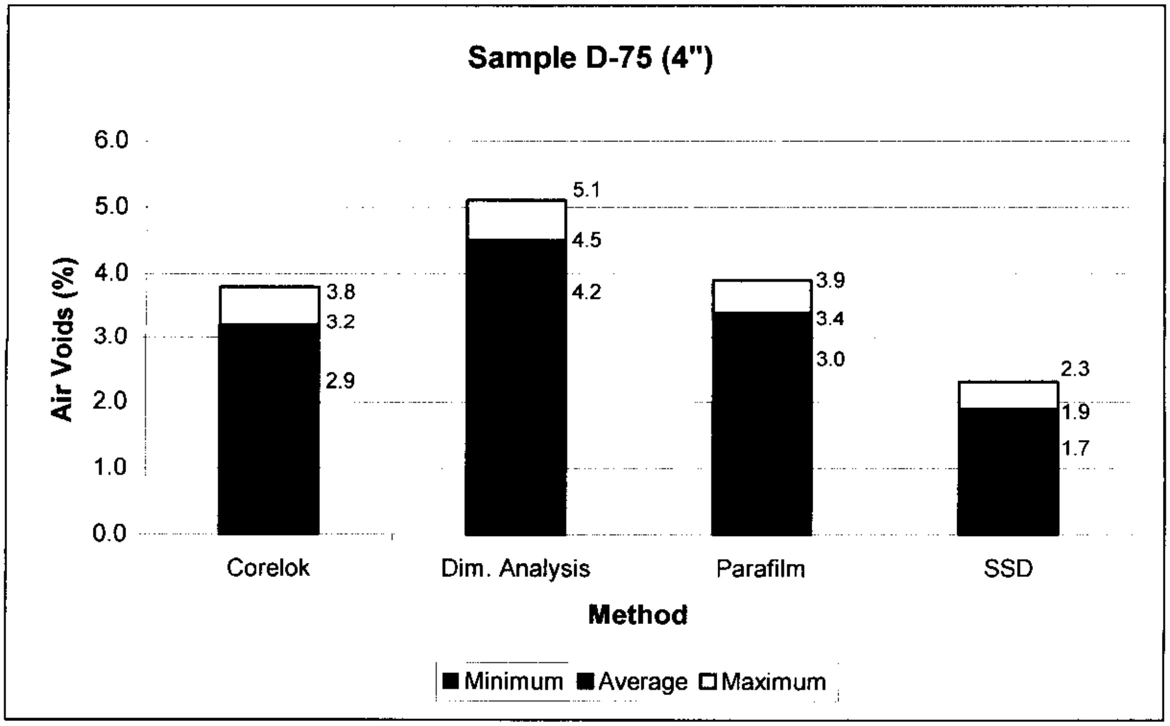

Figure 12. Air Void Values for Sample D-75 (lab sample)

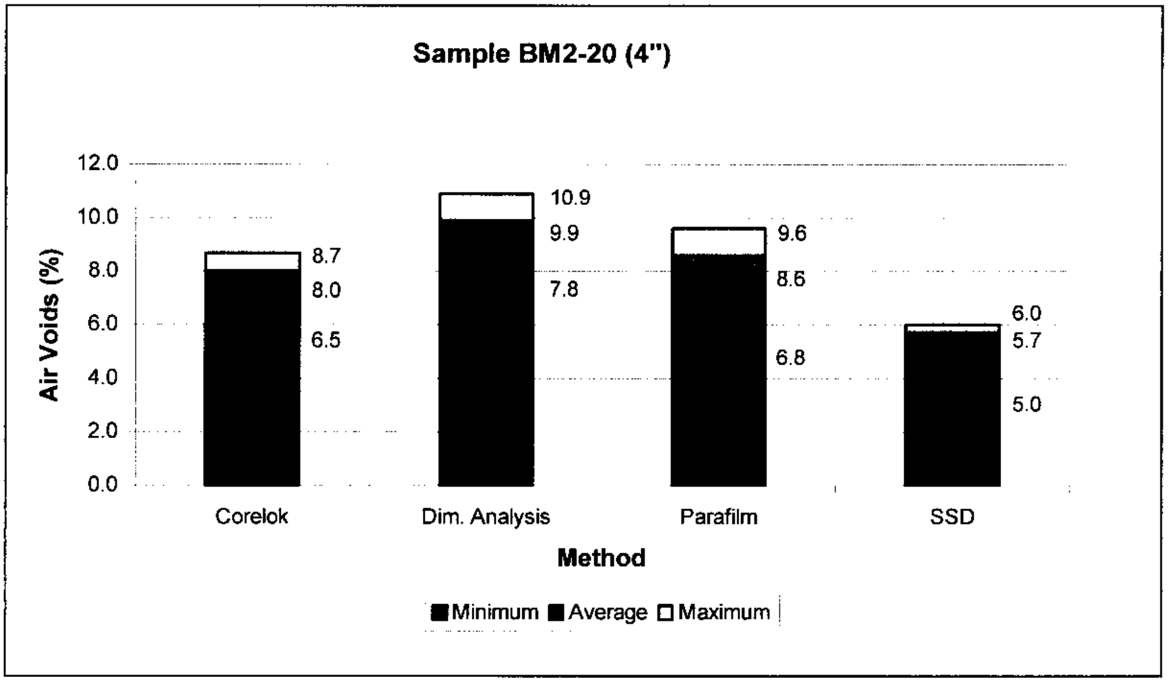

Figure 13. Air Void Values for Sample BM2-20 (lab sample)

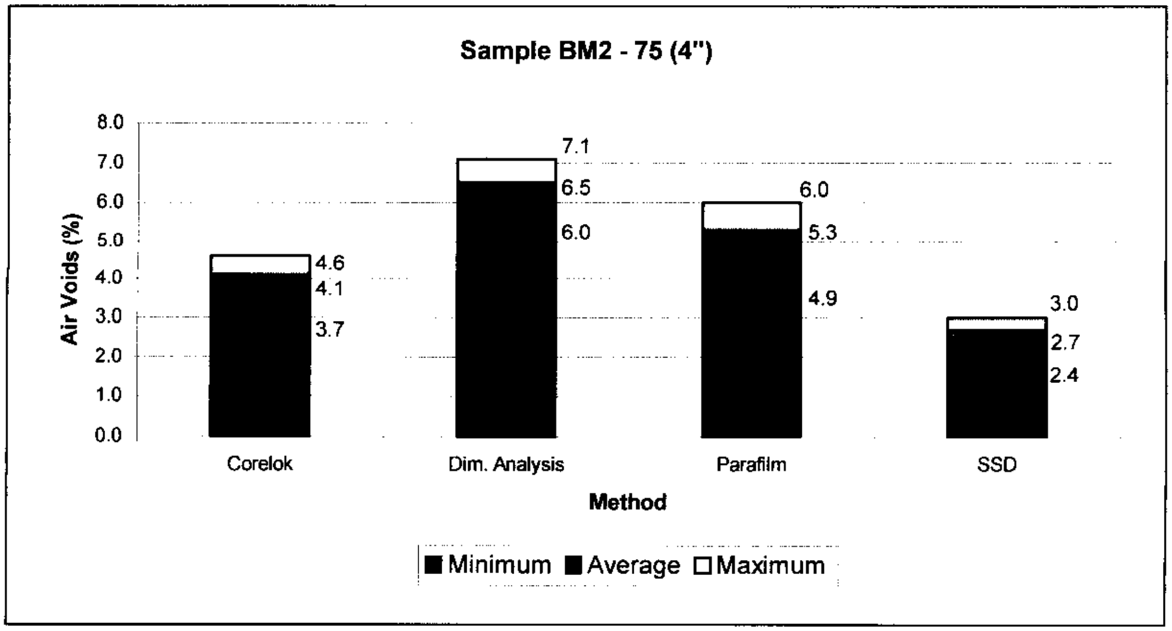

Figure 14. Air Void Values for Sample BM2-75 (lab sample)

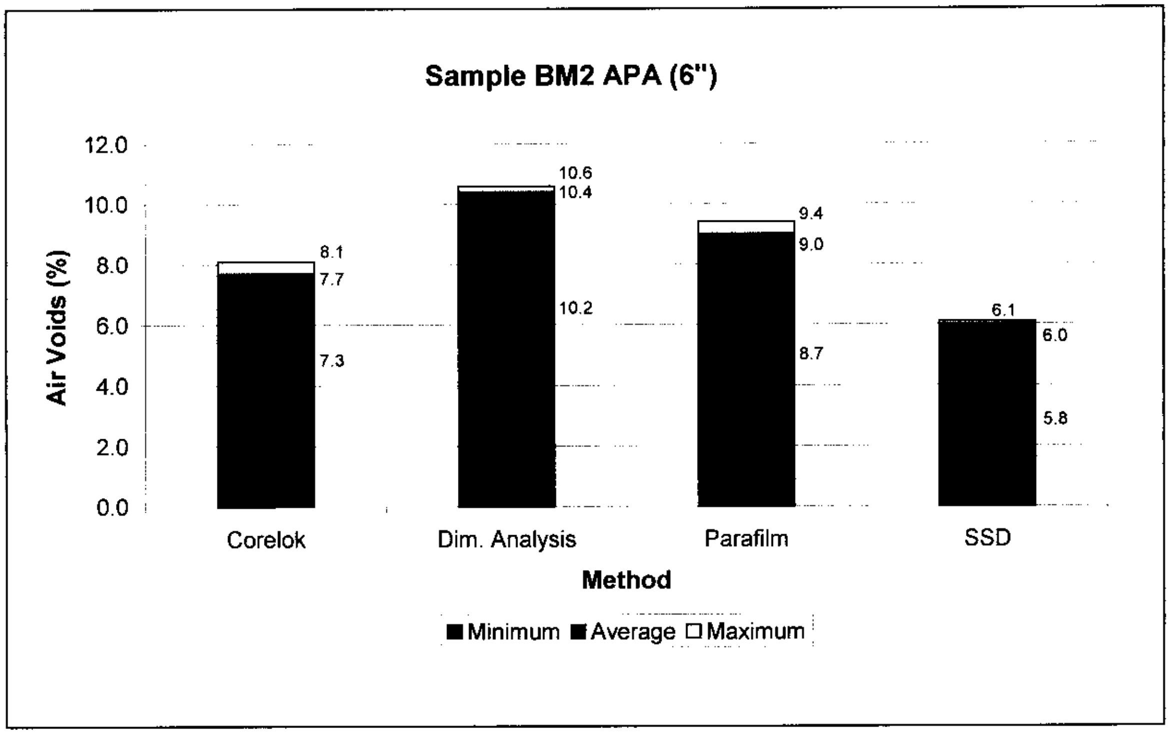

Figure 15. Air Void Values for Sample BM2 APA (lab sample)

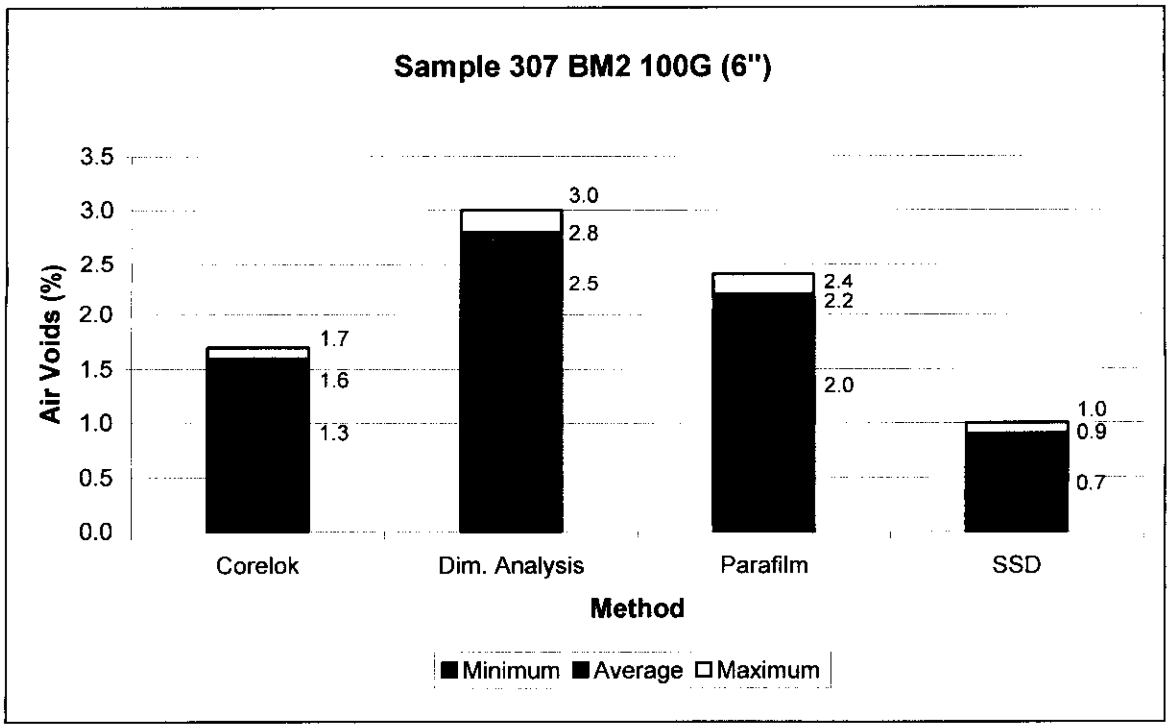

Figure 16. Air Void Values for Sample 307 BM2 100G (lab sample)

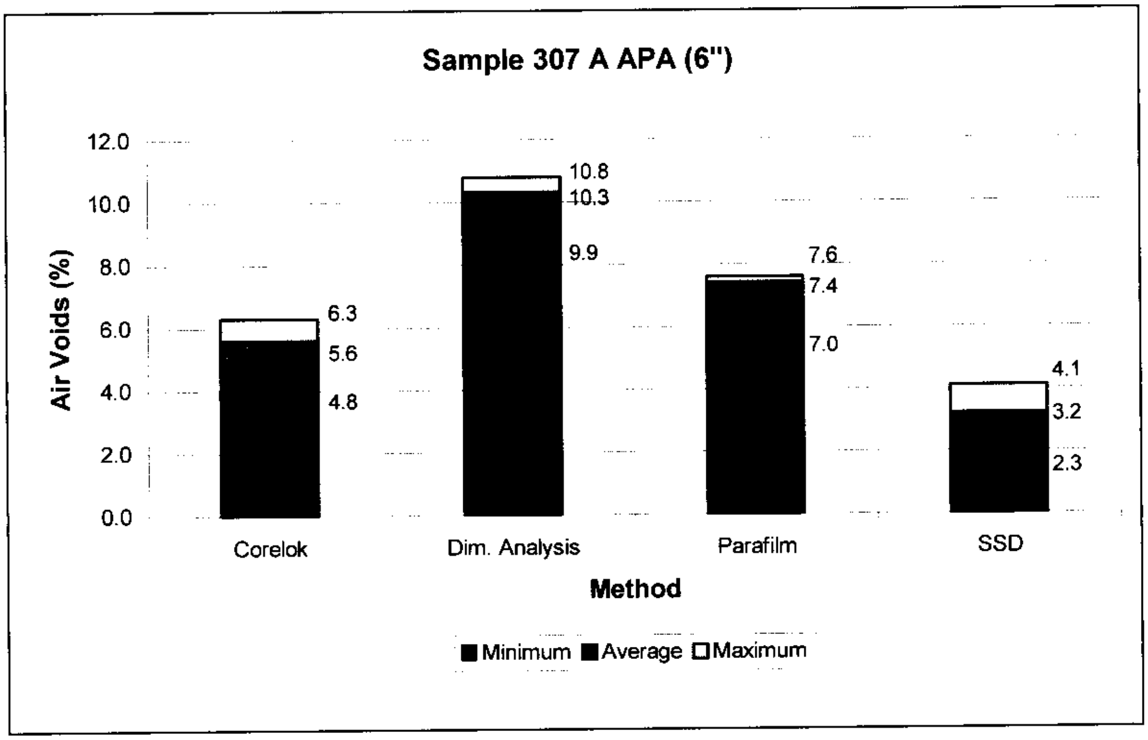

Figure 17. Air Void Values for Sample 307 A APA (lab sample)

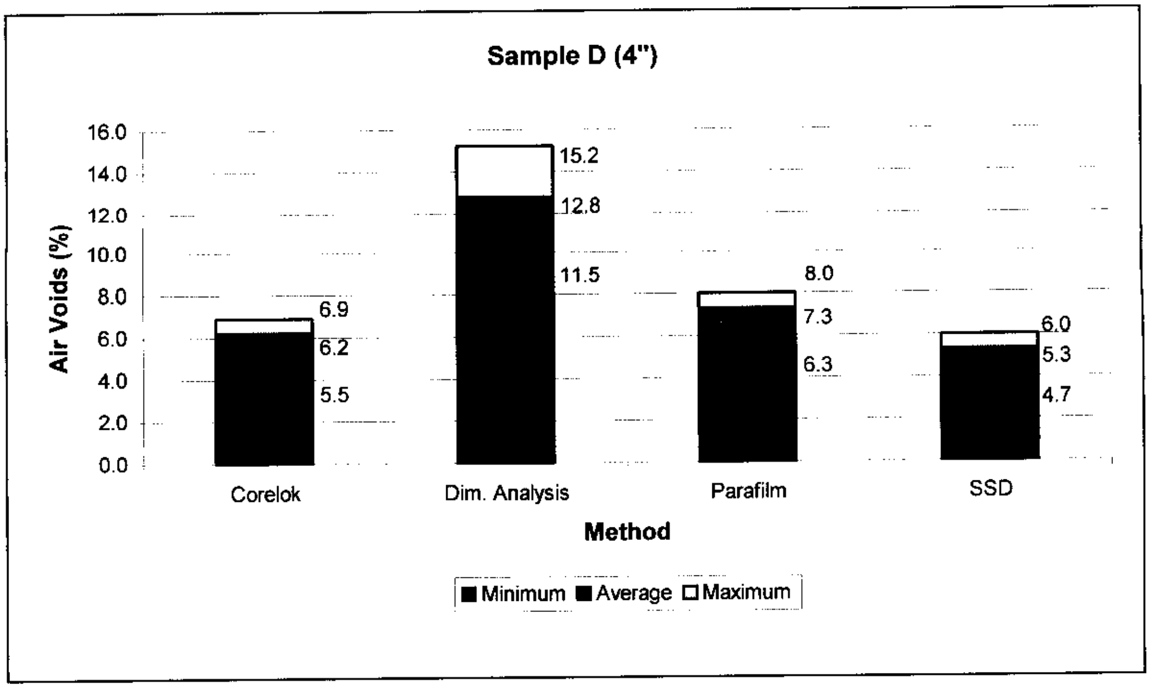

Figure 18. Air Void Values for Sample D (field sample)

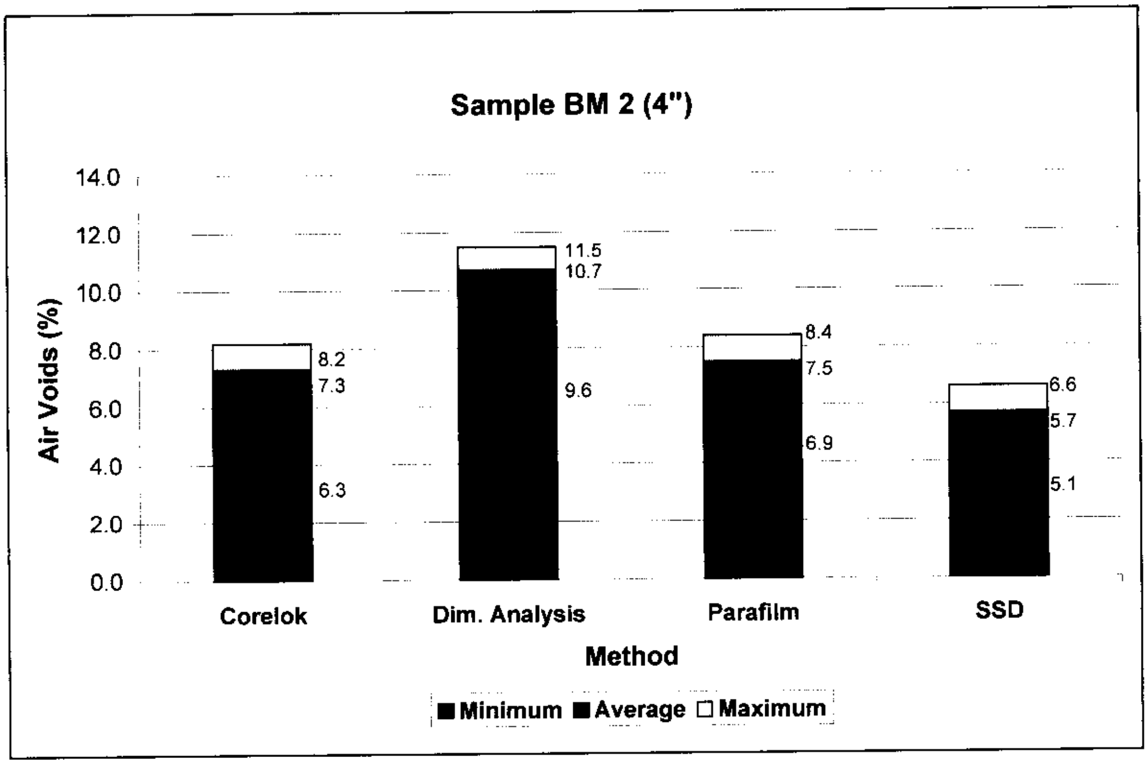

Figure 19. Air Void Values for Sample BM 2 (4") (field sample)

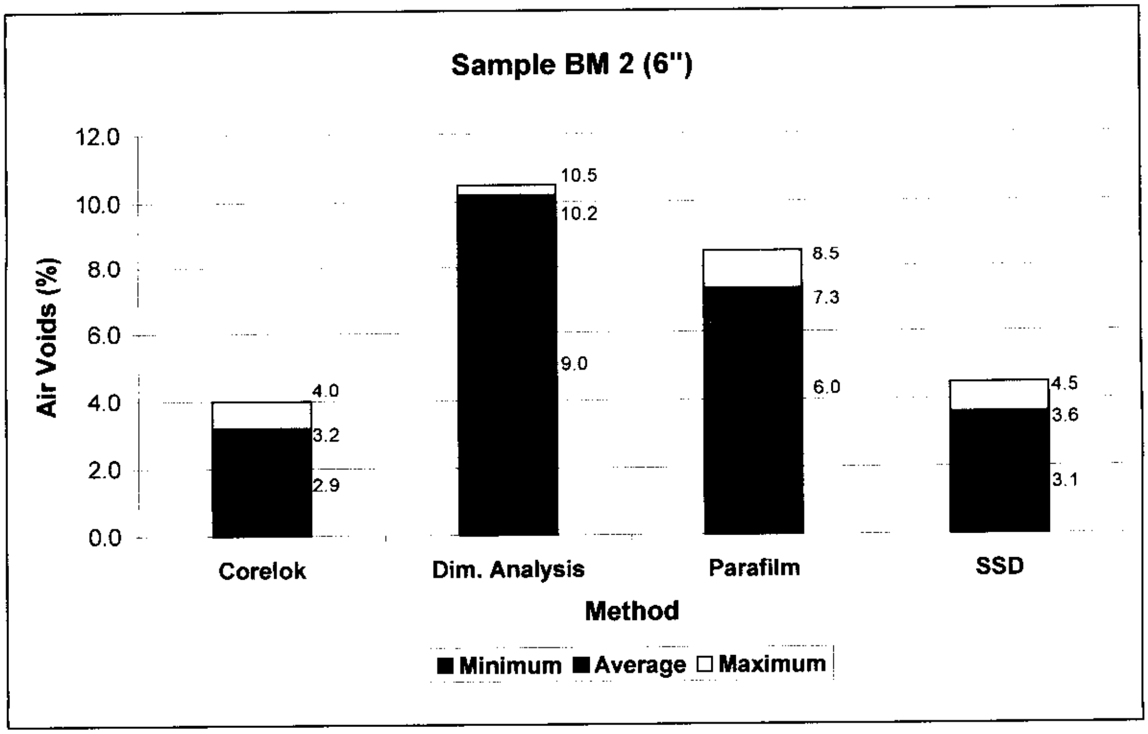

Figure 20. Air Void Values for Sample BM 2 (6") (field sample)

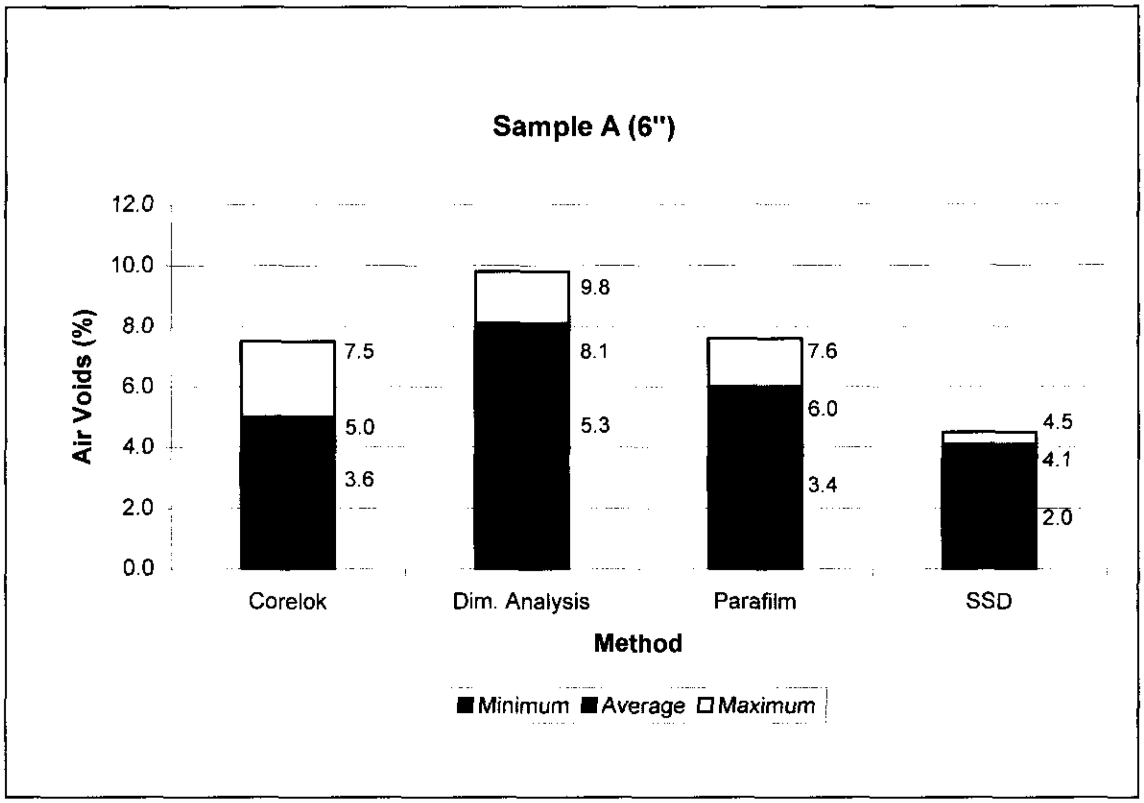

Figure 21. Air Void Values for Sample A (field sample)

Figure 22 shows the G_{mb} results of the four methods on the aluminum cylinder samples. Each column represents the average value of three replications. Figures 23 through 25 show the percent air voids results from each method compared to the actual air voids for 0, 8, 16, and 24 hole aluminum cylinders respectively. Percent air voids for each method were calculated using the AASHTO T-269 equation. The G_{mb} used was the average G_{mb} from the three replications of the test method. The aluminum alloy specific gravity found on the internet was used as the G_{mm} value. Actual percent air voids were calculated as shown previously in the samples subsection. G_{mb} data, results, and sample volumes for all aluminum cylinders are contained in Appendix D.

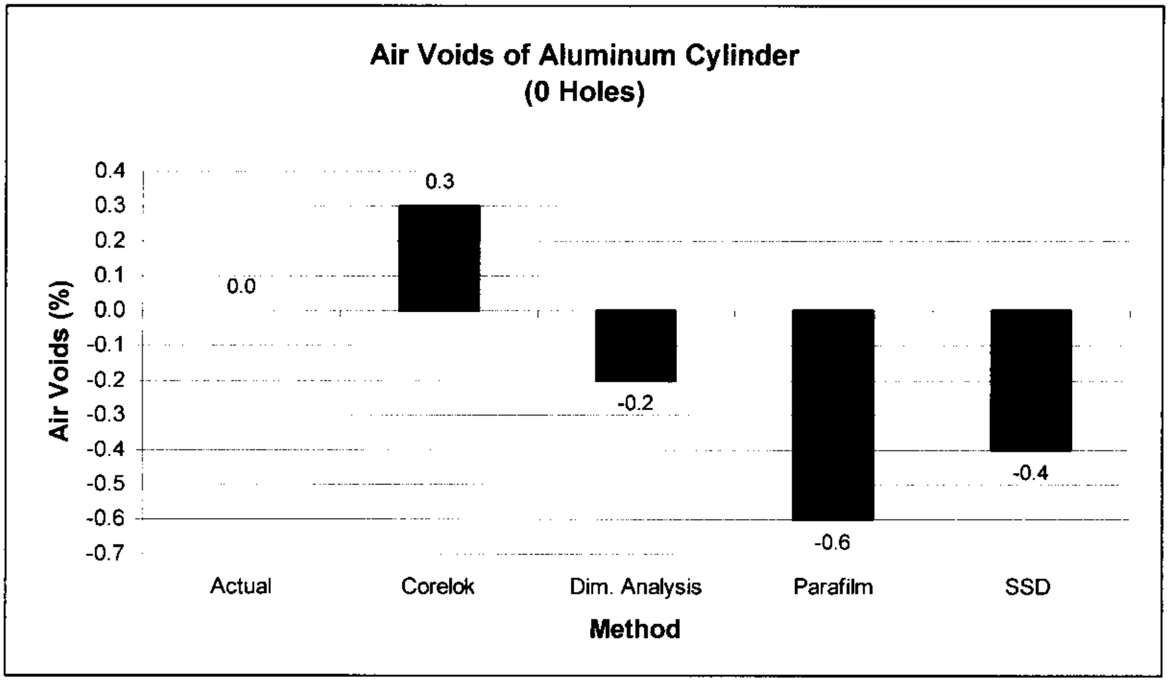

Figure 22. Air Voids of Aluminum Cylinders for each method

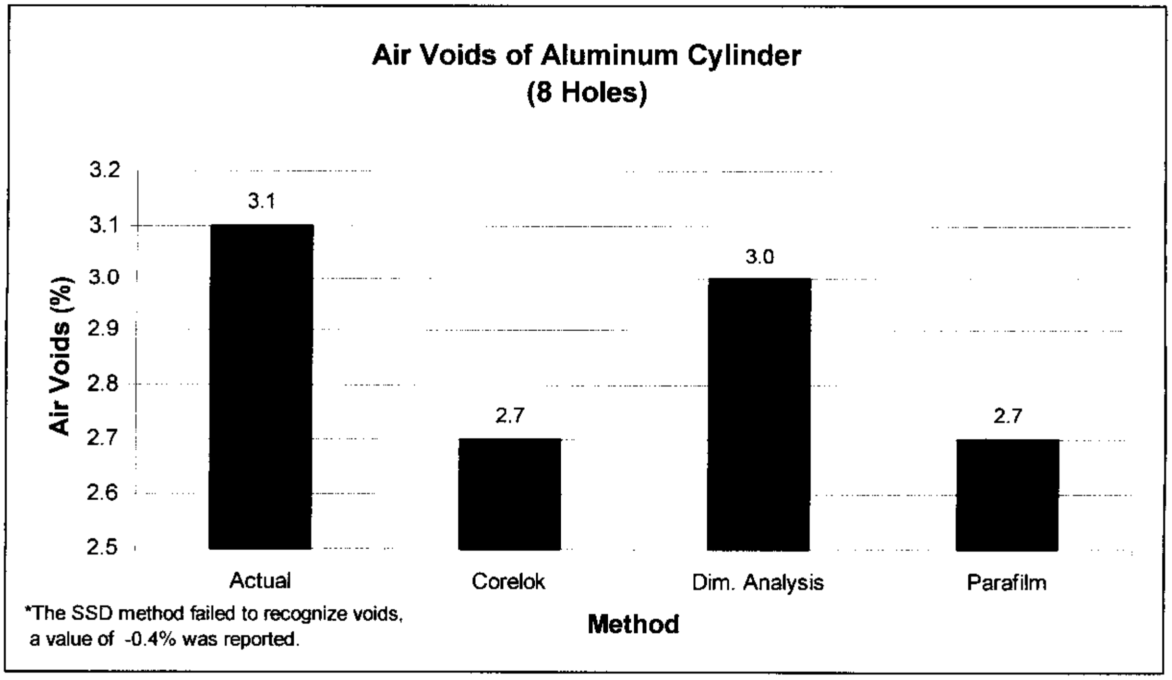

Figure 23. Air Voids of Aluminum Cylinder with eight holes

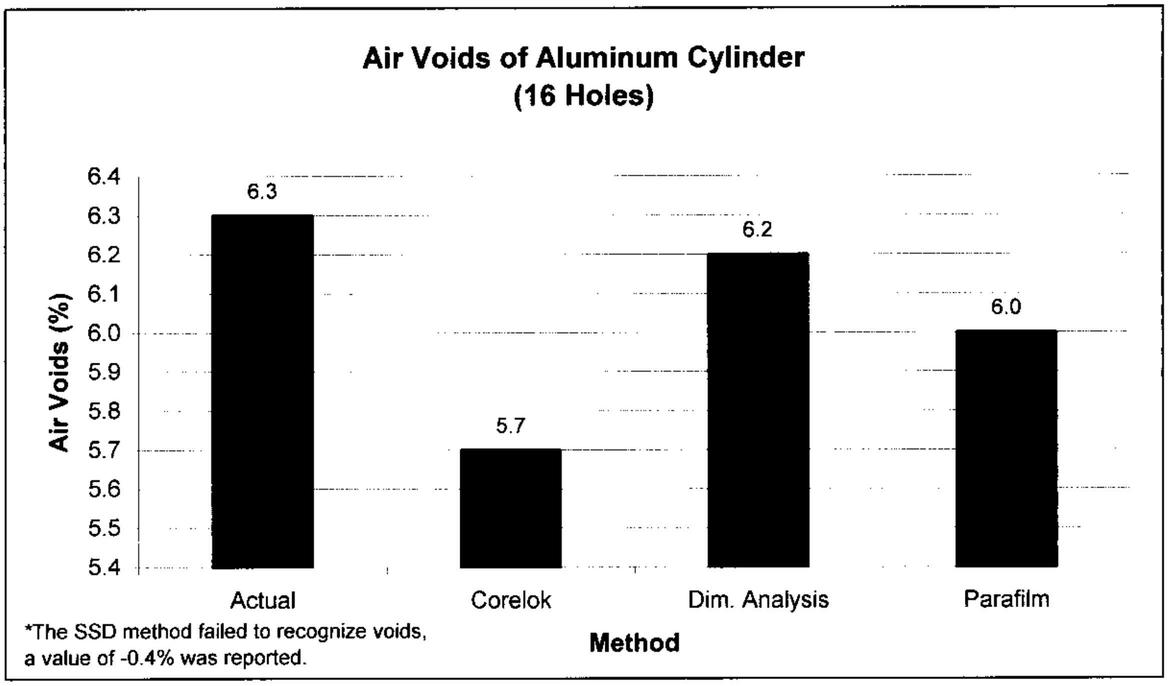

Figure 24. Air Voids of Aluminum Cylinder with sixteen holes

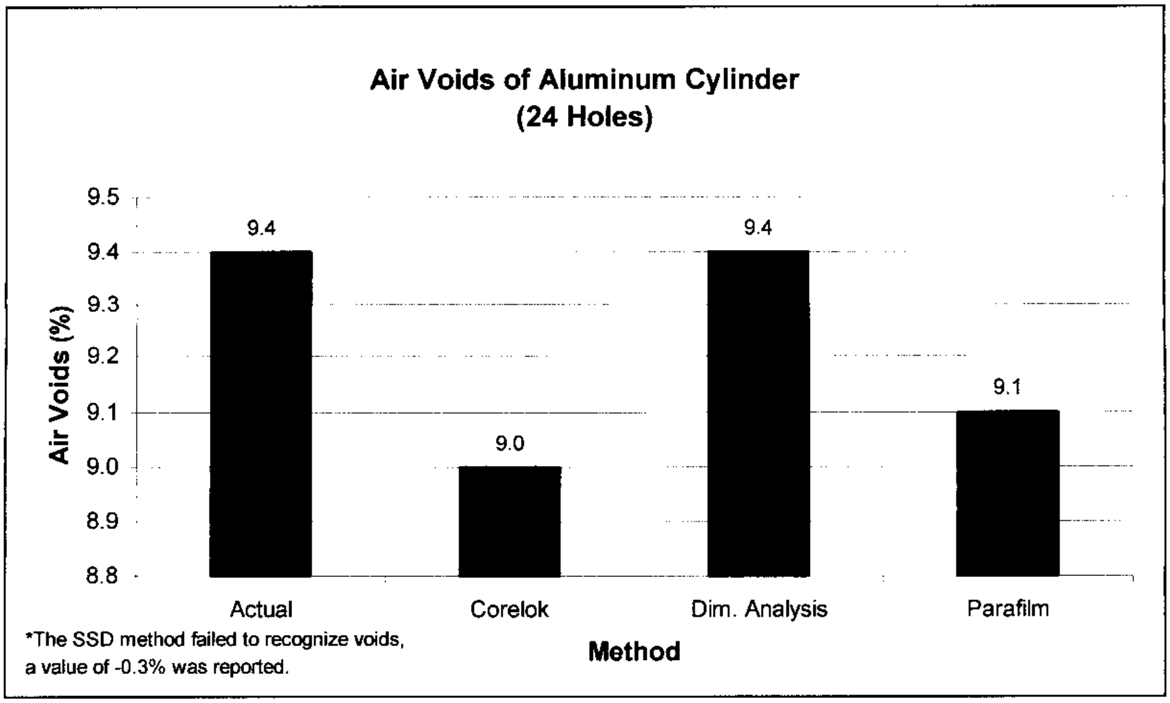

Figure 25. Air Voids of Aluminum Cylinder with twenty-four holes

Analysis

Logistics Review

Logistical factors were addressed in the Feasibility Study. However, after completing the approximately 1400 tests required for the precision and accuracy study, the authors thought it was appropriate to review method logistics again. SSD, dimensional analysis, and Instrotek Corelok were quick and easy to perform. The Parafilm method however, had difficulties with 6-inch (152.4-mm) samples and operator sensitivity. Parafilm seemed to very susceptible to tearing on surface irregularities. Further, water infiltration on several 6-inch (152.4-mm) samples necessitated that these tests be repeated. ASTM D 1188 requires that parafilm be calibrated on a 4-inch (101.6-mm) diameter aluminum cylinder, but offers no guidelines for using the method on 6-inch (152.4-mm) samples. The authors noticed variations in parafilm specific gravity between boxes. In addition, different operators stretch the parafilm differing amounts. Table 5 shows specific gravity variations in parafilm calibrations.

Table 5. Parafilm Specific Gravity Variations in Calibration Tests

Operator	Box 1	Box 2	Box 3	Box 4	Box 5	Average
1	0.658	0.683	0.621			0.654
2	0.658			0.462	0.516	0.545

There is a 17 percent difference in average parafilm specific gravity between operators. The difference in parafilm stretch may be more pronounced on larger 6-inch (152.4-mm) samples. These factors raise questions about the accuracy of parafilm.

Precision

Tables 6 and 7 show the coefficients of variation for laboratory and field sample groups respectively. As previously stated, data for calculating coefficients of variation for all sample groups used in the precision and accuracy study are contained in Appendix C.

Table 6. Coefficients of Variation for Laboratory Sample Groups

	Dimensional Analysis	Parafilm	Instrotek Corelok	SSD
D-75	0.23	0.34	0.17	0.04
BM2-20	0.22	0.24	0.23	0.09
BM2-75	0.21	0.35	0.14	0.07
307 BM2 APA	0.15	0.13	0.17	0.08
307 BM2 100G	0.08	0.09	0.11	0.03
307 A APA	0.28	0.39	0.21	0.07
Average	0.19	0.26	0.17	0.07

Table 7. Coefficients of Variation for Field Sample Groups

	Dimensional Analysis	Parafilm	Instrotek Corelok	SSD
D	0.72	0.27	0.31	0.12
4" BM2	0.34	0.18	0.53	0.13
6" BM2	0.98	0.40	0.10	0.08
A	0.35	0.16	0.08	0.11
Average	0.60	0.25	0.25	0.11

The overall average coefficients of variation for the methods for all sample groups were 0.34, 0.26, 0.20, and 0.08 for dimensional analysis, parafilm, Instrotek Corelok, and SSD respectively. The test method with the highest precision, lowest average coefficient of variation, was the SSD method. The Instrotek Corelok method had the second best precision. Parafilm and dimensional analysis finished third and fourth respectively. The coefficients of variation for SSD, Instrotek Corelok, and parafilm were very similar for laboratory and field sample groups. However, the coefficient of variation for dimensional analysis on field sample groups was 215 percent higher than for laboratory sample groups. This increase indicates a relative weakness in handling the surface irregularities common with field samples. The percent changes in coefficient of variation from laboratory to field sample groups for the remaining methods were –3.8, 47.1, and 57.1 for parafilm, Instrotek Corelok, and SSD respectively.

All four methods performed were very repeatable. No coefficient of variation for any method ever exceeded one percent in the precision and accuracy study. Based on these results, all four methods are considered capable of producing high precision results. Therefore, precision would not be a critical factor in selecting the most widely applicable G_{mb} determination technique.

Accuracy

The aluminum cylinders fabricated by the Civil Engineering Technician were used to determine if the SSD method had a problem with surface-accessible voids and what the extent of the problem was. The negative air voids shown in figures 23 through

25 result from the average G_{mb} determined from the SSD method being greater than the aluminum alloy specific gravity found on the internet. Negative air voids are not physically possible. The specific gravity of the solid aluminum determined from the SSD method and found on the internet should be identical. The authors suspect the internet value may be in error. However, the slight negative air voids had no bearing on the point the research team wanted to make with this procedure. Figures 22 through 25 clearly show that the SSD method is blind to surface-accessible voids. AASHTO test method developers recognized this fact; AASHTO T-166 states " This method should not be used with samples that contain open or interconnecting voids and/or absorb more than 2% of water by volume". Water penetration into surface-accessible voids results in an underestimation of sample volume thus increasing G_{mb} and reducing apparent air voids. It is apparent that air void values based on SSD G_{mb} results will form a lower bound for actual air void contents of compacted bituminous samples with surface accessible voids. This limitation of applicability ruled out further consideration of the SSD method as the most widely applicable method for determining G_{mb}.

The average air voids calculated from the G_{mb} results of four methods for the ten sample groups were ranked from maximum to minimum. Dimensional analysis results produced the highest percent air voids and parafilm results produced the second highest air void content for all ten sample groups. The SSD method results produced the lowest air voids for nine of ten sample groups. Instrotek Corelok results produced air void contents higher than SSD and lower than parafilm and dimensional analysis for nine of the ten sample groups. Considering the air void ranking and the mechanics of the method can imply the accuracy of the method's G_{mb} determination.

The dimensional analysis method was the most accurate method for determining G_{mb} of the aluminum cylinders. The dimensional analysis worked well for samples that closely approximated a right circular cylinder. However, as surface irregularities are introduced the dimensional analysis method tends to overestimate sample volume thus reducing G_{mb} and increasing apparent air voids. The overestimation of volume is due to attempting to approximate a non-planar surface with a plane surface. As evidence of the overestimation, recall that the dimensional analysis method produced the highest air voids for every sample group. The dimensional analysis method is clearly not applicable to compacted bituminous mixture samples with surface irregularities. This limitation of applicability ruled out further consideration of the dimensional analysis method as the most widely applicable method for determining G_{mb}.

Air voids values produced from Instrotek Corelok and parafilm method results fell between the upper bound of dimensional analysis and the lower bound of SSD values for nine of ten sample groups. For these nine sample groups, parafilm produced air voids which averaged 0.9 percent higher than those produced by Instrotek Corelok. Considering only four of the nine sample groups, which contained the larger 6-inch (152.4-mm) samples, parafilm produced air voids that averaged 1.2 percent higher than those produced by Instrotek Corelok. During testing, it appeared to the authors that parafilm bridged over surface irregularities. This observation was supported by the findings of a recent study at the National Center for Asphalt Technology, Buchanan (11) reported that parafilm tended to overestimate percent air voids by bridging over surface voids. Parafilm appears to be a second upper bound, below dimensional analysis, for actual air voids. Due to these reasons and logistical difficulties with 6-inch (152.4-mm) samples, parafilm was not considered further as the most widely applicable method for determining G_{mb}.

Instrotek Corelok appeared to be the most widely applicable method. The method had good logistical performance on all sample types. However, the research team wanted to attempt to evaluate the accuracy of the method. If Instrotek Corelok was the most accurate method for determining G_{mb}, air voids calculated from Instrotek Corelok should consistently fall between the previously established upper and lower bounds. Paired t-tests at the 95% confidence level were conducted to determine if there were significant differences between the G_{mb} results of Instrotek Corelok and SSD, and Instrotek Corelok and parafilm. Complete t-test data and results are provided in Appendix E. The first t-test showed that Instrotek Corelok G_{mb} results are significantly lower than SSD G_{mb} results for nine of the ten sample groups. The second t-test showed that Instrotek Corelok G_{mb} results are significantly higher than parafilm G_{mb} results for nine of the ten sample groups. Thus, the air voids resulting from Instrotek Corelok tests are significantly higher than those resulting from the method serving as a lower bound, SSD, and significantly lower than those resulting from the method serving as an upper bound, parafilm. The previous analysis does not show that Instrotek Corelok results are accurate, the true value of a sample's air voids is never known, so accuracy cannot be truly evaluated. However, the previous analysis does show that Instrotek Corelok air voids are in the range between the upper and lower bounds for actual air voids for nine of ten sample groups tested.

FIELD STUDY

Primary Objective

The Instrotek CoreLok Method appeared to be the most widely applicable method (most accurate and versatile) for determining TDOT HMA mixture G_{mb} and percent air voids. Therefore, a field study was conducted to further evaluate the CoreLok. The primary objective of the field study was to determine the magnitude of the difference in percent air voids resulting from CoreLok and AASHTO T 166 methods for common TDOT HMA mixtures.

Samples

HMA samples for the field study were collected in all four TDOT Regions. Sample sets were distributed equally across the state. No TDOT Region provided less than twelve or more than thirteen sample sets. Each sample set contained five to eight field cores. Table 8 provides information on the HMA samples sets for the field study.

Table 8. HMA Samples for the Field Study

	411 S	411 D	307 BM2	307 A
Number of Sample Sets	4	18	20	8
Number of Samples	23	103	114	45

Procedure

The TDOT Monitoring Committee selected HMA placement projects. TDOT personnel provided traffic control, obtained nuclear densities, obtained core samples of the HMA layer being placed, obtained loose HMA samples and conducted theoretical maximum specific gravity tests. TTU personnel observed nuclear density measurement, transported HMA core samples, and conducted two replications of AASHTO T 166 and two Instrotek CoreLok tests on each core sample.

Two types of core sets were obtained in the field: Random and Transverse. Random core sets were obtained by selecting coring locations within the HMA lot using a random number generator for both transverse and longitudinal locations. The normal one-foot (0.305-meter) exclusions at the lane edges were disregarded. Transverse core sets were obtained by selecting points of interest:

- ➢ As close as possible to each mat edge;
- ➢ Approximately one foot from each mat edge;
- ➢ In each wheel path;
- ➢ Approximate center of each mat.

HMA cores samples were placed in iced coolers and transported to TTU for storage and subsequent laboratory testing. Prior to each AASHTO T 166 or CoreLok test, each HMA cores sample was dried to constant mass in an oven, which limited the maximum temperature to 125°F (51.7 °C). When not being tested or dried, HMA core samples were stored in a commercial upright refrigerator maintained at approximately 40°F (4.4 °C). Air voids were calculated as per AASTHO T 209 using the AASHTO T 166 or CoreLok test results and the theoretical maximum specific gravities for each mixture provided by TDOT.

Results

Results of laboratory AASHTO T 166 and CoreLok testing, nuclear density tests, theoretical maximum specific gravity, and calculated air voids for each core are shown in Appendix F.

Analysis of Results

The results were analyzed to determine the following:

A. Percent of HMA samples with air voids greater than 10 percent (less than 90% compaction).
B. Correlations between nuclear density and AASHTO T 166.
C. Effect of confinement on HMA sample air voids.
D. Difference in air voids resulting from CoreLok and AASHTO T 166.

A. Percent of HMA samples with air voids greater than 10 percent

Figure 26 shows the percent of HMA samples with air voids greater than 10 percent by mixture type and method. It is important to note that this analysis does not exclude the inner and outer one-foot typically excluded by TDOT. If CoreLok were the

TDOT method for acceptance, the instance of failure (air voids greater than 10 percent) would not substantially increase for the dense-graded surface mixtures. However, the failure rate would increase greatly for the coarser and more open binder and base mixtures.

B. Correlations between nuclear density and AASHTO T 166

Correlations between air voids from nuclear density measurements and air voids from AASHTO T 166 are shown in figures 26, 27, and 28 for TDOT surface, binder, and base mixtures respectively. Coefficients of determination (R^2) were lower than expected indicating considerable data scatter. All R^2 values were less than 0.52 indicating weak relationships or no relationships, particularly for 307 A Base Mixtures. At approximately 7% air voids by AASHTO T 166, nuclear density air voids ranged from 3.5 to 20.5 for 307 A Base Mixtures. Paired t-tests at the 95% confidence level showed significant differences for all mixture types in a statewide analysis.

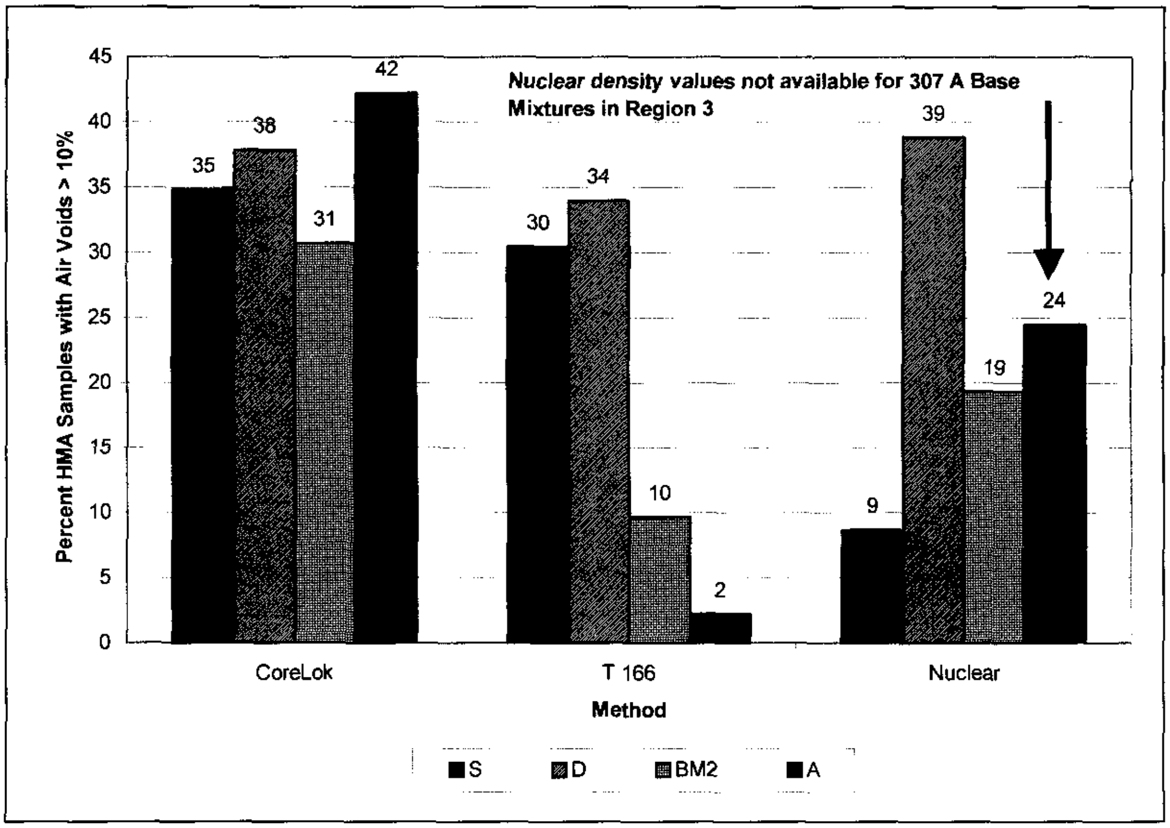

Figure 26. Percent HMA Samples with Air Voids Greater than 10% in Tennessee

C. Effect of confinement on HMA sample air voids

Density achieved during compaction is a function of many factors. One important factor is HMA's resistance to compaction. Without resistance to compaction the HMA is "shoved" rather than compacted. Resistance to HMA mixture movement is provided by confinement. Better confinement produces superior density. In some cases HMA layers must be placed without lateral confinement. Lower densities (higher air voids) are the typical result of lack of lateral confinement. Figure 30 shows the intuitive effect of confinement. Figure 31 is a typical TDOT field data plot of air voids versus distance from a pavement edge plot. The Corelok air voids trend appears to have a similar shape to the

T 166 trend in Figure 31, however the CoreLok magnitude is higher. It is possible that both methods are measuring the same internal (inaccessible) air voids in the samples, but CoreLok is also measuring the surface accessible air voids that AASHTO T 166 is not, resulting in upward displacement.

Figure 32 is a column graph showing average HMA air voids for each mixture type statewide for each of the three methods (CoreLok, AASHTO T 166, and nuclear). Air voids of samples one foot or less from an edge are compared to air voids of samples more than one foot from an edge. On average, HMA air voids increase within 1 foot of an edge regardless of mixture type or measurement method. The CoreLok method indicates the maximum average increase in air voids (2.28) for all HMA mixture types combined into one data set and AATHO T 166 indicates the lowest average increase (1.33).

The CoreLok method indicates that on average HMA air voids within 1 foot of an edge always exceed 10% regardless of mixture type. However, AASHTO T 166 indicates that 411 S, 307 BM2, and 307 A mixture average air voids are less than 10% on average within 1 foot of the edge. AASHTO T 166 is probably missing the surface accessible voids present in 307 BM2 and 307 A mixtures. Nuclear density indicates that 411 S and 307 BM2 mixture air voids are less than 10% on average within 1 foot of the edge.

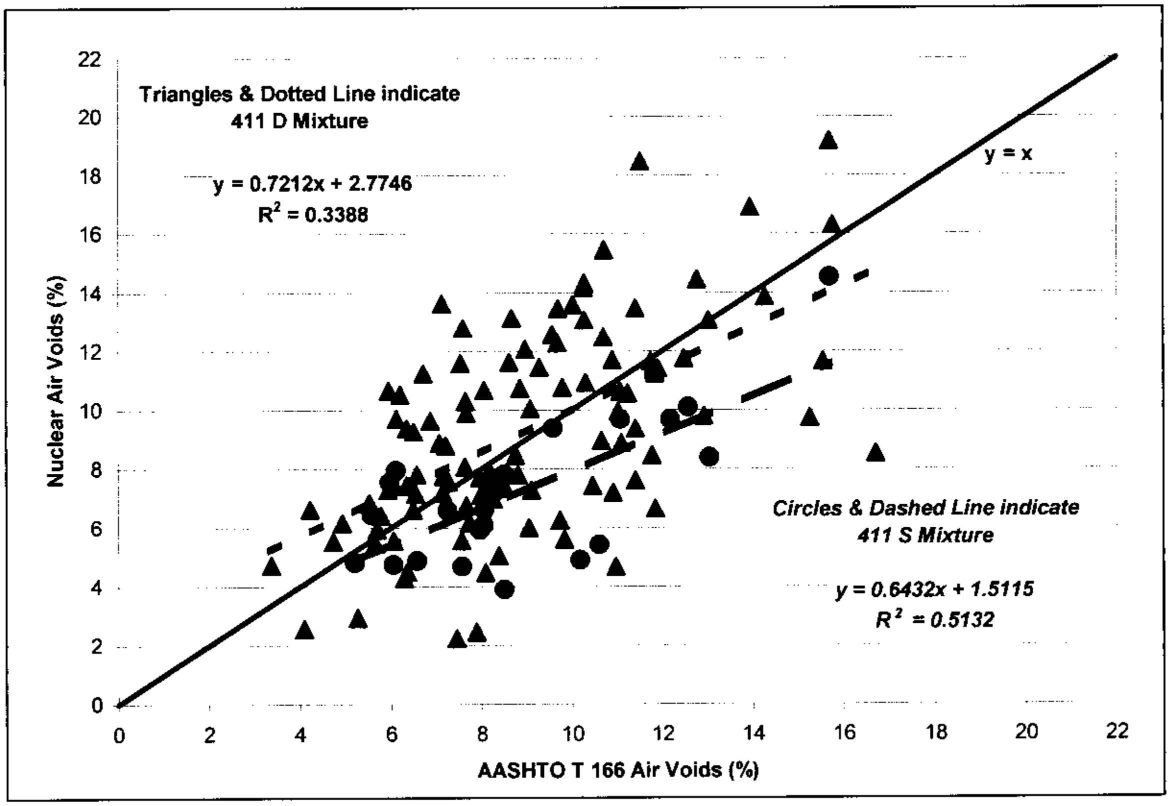

Figure 27. Comparison of Nuclear and AASHTO T 166 Air Voids for TDOT Surface Mixtures Statewide

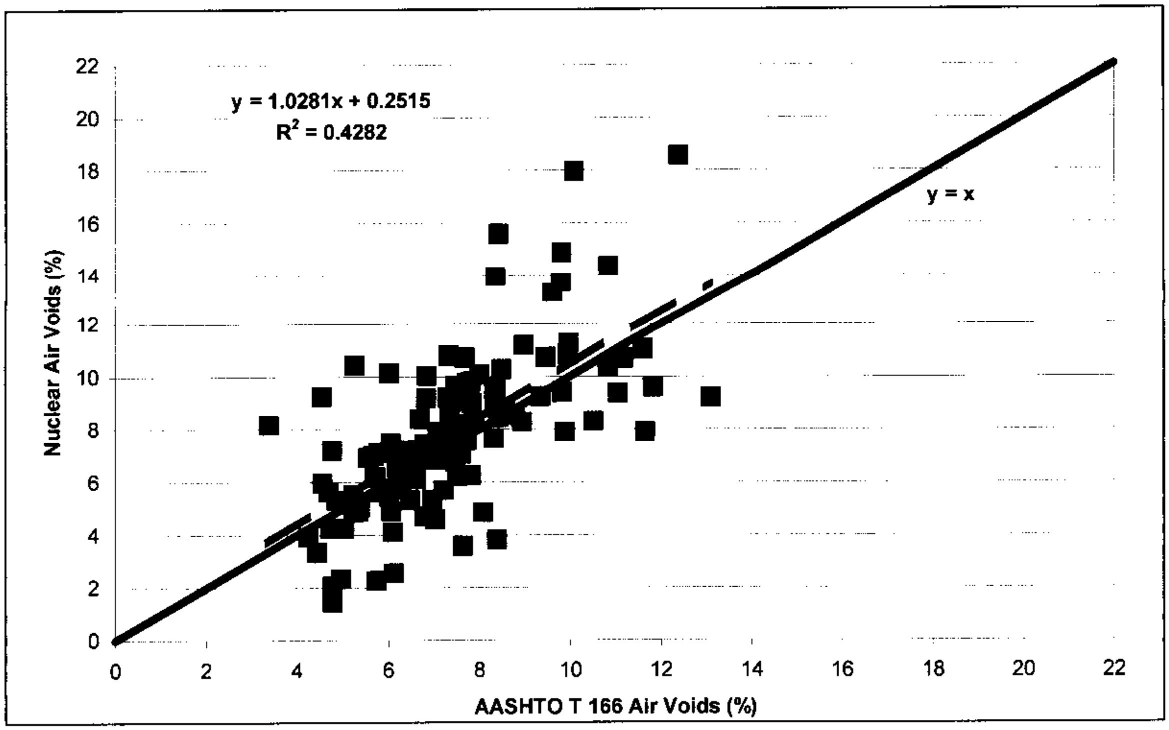

Figure 28. Comparison of Nuclear and AASHTO T 166 Air Voids for TDOT Binder Mixtures Statewide

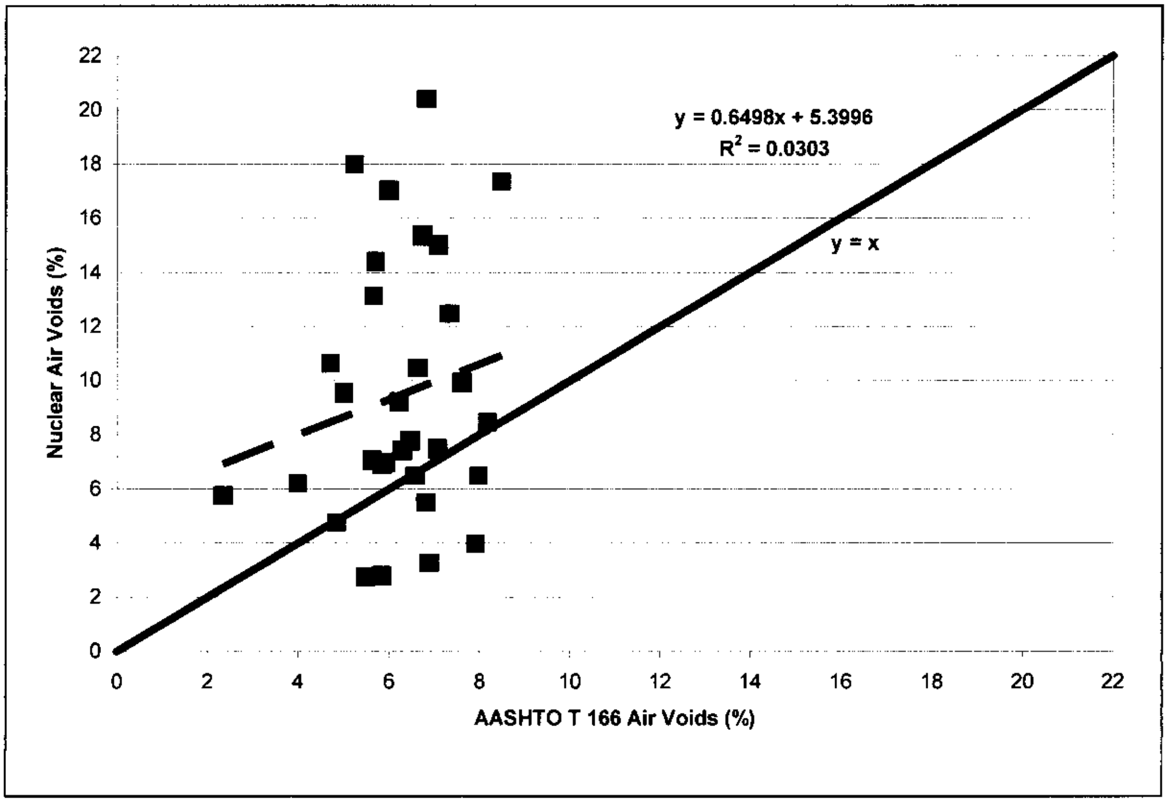

Figure 29. Comparison of Nuclear and AASHTO T 166 Air Voids for TDOT Base Mixtures Statewide

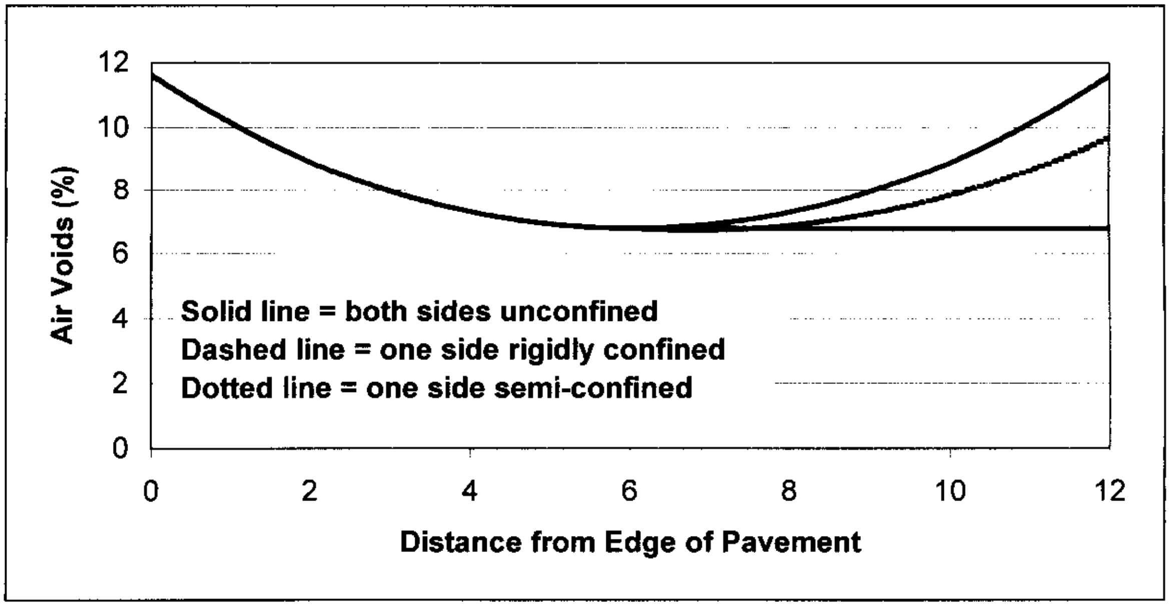

Figure 30. Intuitive Effect of Confinement on HMA Air Voids

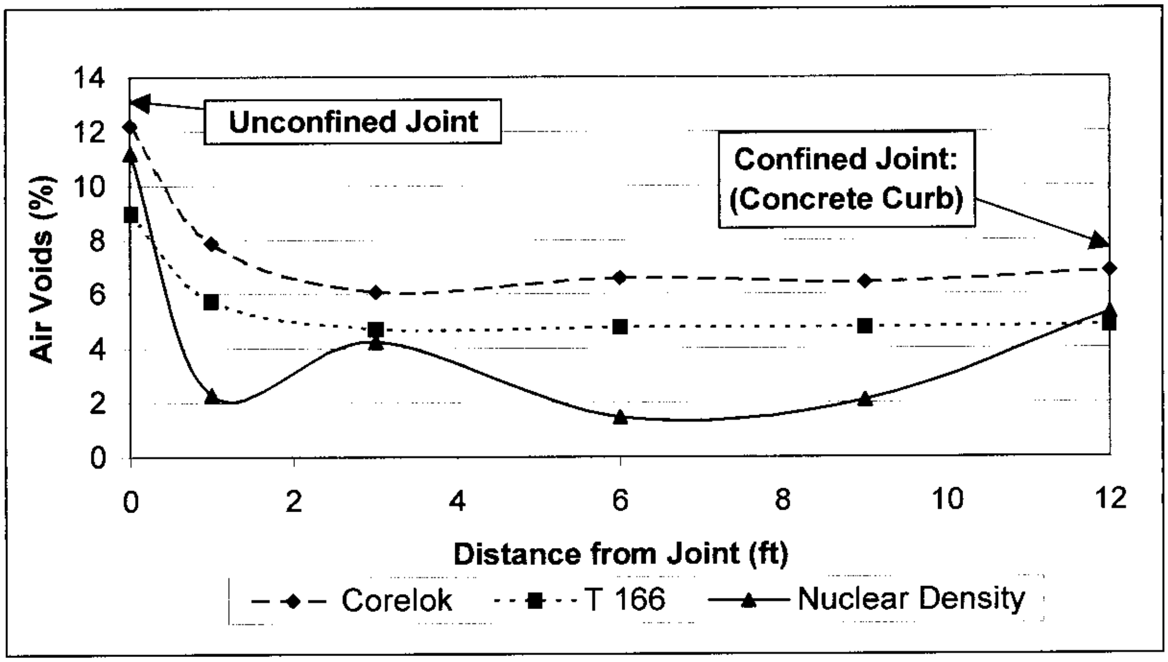

Figure 31. Percent Air Voids vs. Distance from Joint

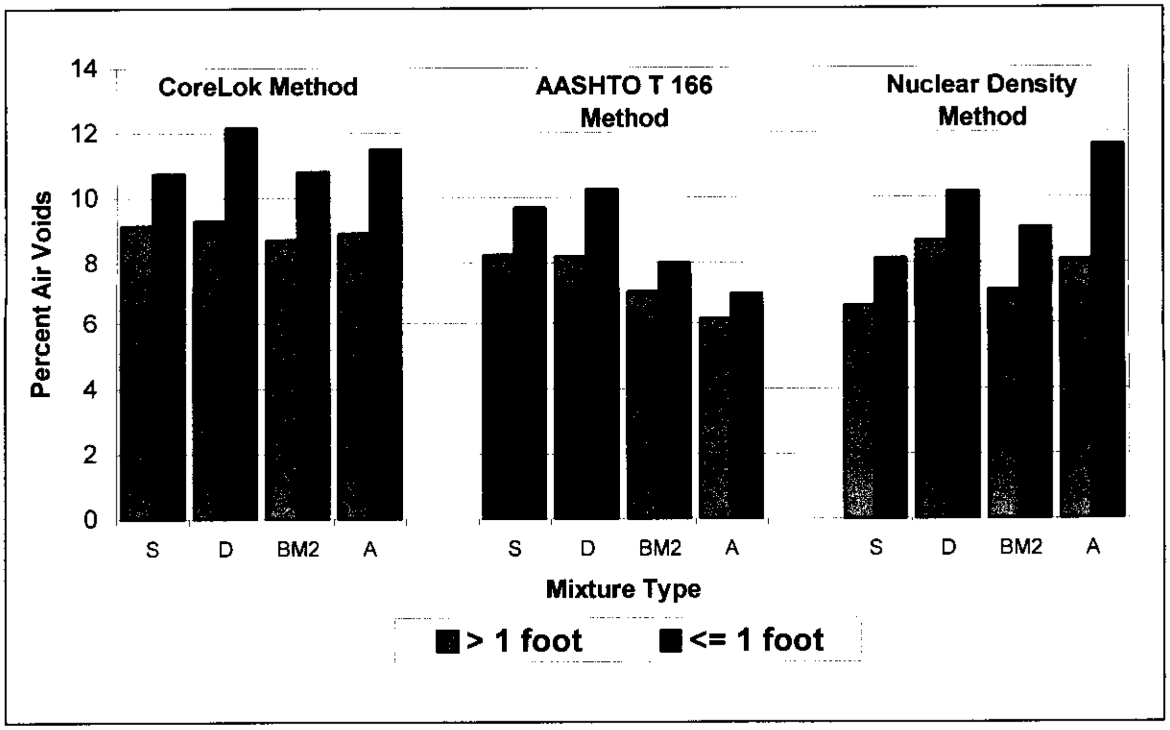

Figure 32. Effect of Edge Nearness on Percent Air Voids

D. Difference in air voids resulting from CoreLok and AASHTO T 166

Correlations between air voids from CoreLok and air voids from AASHTO T 166 are shown in figures 33, 34, and 35 for TDOT surface, binder, and base mixtures respectively. Coefficients of determination (R^2) for 411 S and 411 D were greater than 0.91 (0.9843 and 0.9195 respectively) indicating a very strong relationship between the two methods. The coefficient of determination for 307 BM2 was fair (0.6257) indicating some possible relationship between CoreLok and AASHTO T 166. The coefficient of determination for 307 A was very poor (0.2043) indicating no relationship between CoreLok and AASHTO T 166. It appears that AASHTO T 166 results correlate better with the more accurate CoreLok results for finer, more dense-graded HMA mixtures.

The regression equations for 411 S, 411 D, 307 BM2, and 307 A mixtures are:

S Mixtures	CoreLok Air Voids = 1.0972(T 166 Air Voids) + 0.1121
D Mixtures	CoreLok Air Voids = 1.1677(T 166 Air Voids) - 0.0883
BM2 Mixture	CoreLok Air Voids = 1.1144(T 166 Air Voids) + 1.1291
A Mixtures	CoreLok Air Voids = 1.0388(T 166 Air Voids) + 3.0583

The regression equations indicate that the difference in CoreLok and AASHTO T 166 air voids increases as AASHTO T 166 air voids increase. The magnitude of the difference is a function of mixture aggregate gradation.

The difference in air voids is:

- Greater for A mixtures than for BM2 mixtures for T 166 air void values < 25.5 percent.
- Greater for BM2 mixtures than for S mixtures for all T 166 air void values.
- Greater for BM2 mixtures than for D mixtures for T 166 air void values < 22.8 percent.
- Greater for D mixtures than for S mixtures for T 166 air void values > 2.84 percent.

For all practical purposes (in the T 166 air void range of 2.84 to 22.8 percent):

A difference > BM2 difference > D difference > S difference

The average differences in air voids statewide (shown in Table 9) further confirmed that the magnitude of difference in air voids is a function of mixture aggregate gradation. Paired t-tests at the 95% confidence interval showed significant differences between CoreLok and AASHTO T 166 for all mixture types in a statewide analysis.

Table 9. Average air void difference between CoreLok and AASHTO T 166

TDOT HMA Mixture	411 S	411 D	307 BM2	307 A
Number of Core Samples Average	23	103	114	45
Air Void Difference	1.0	1.4	2.1	3.3

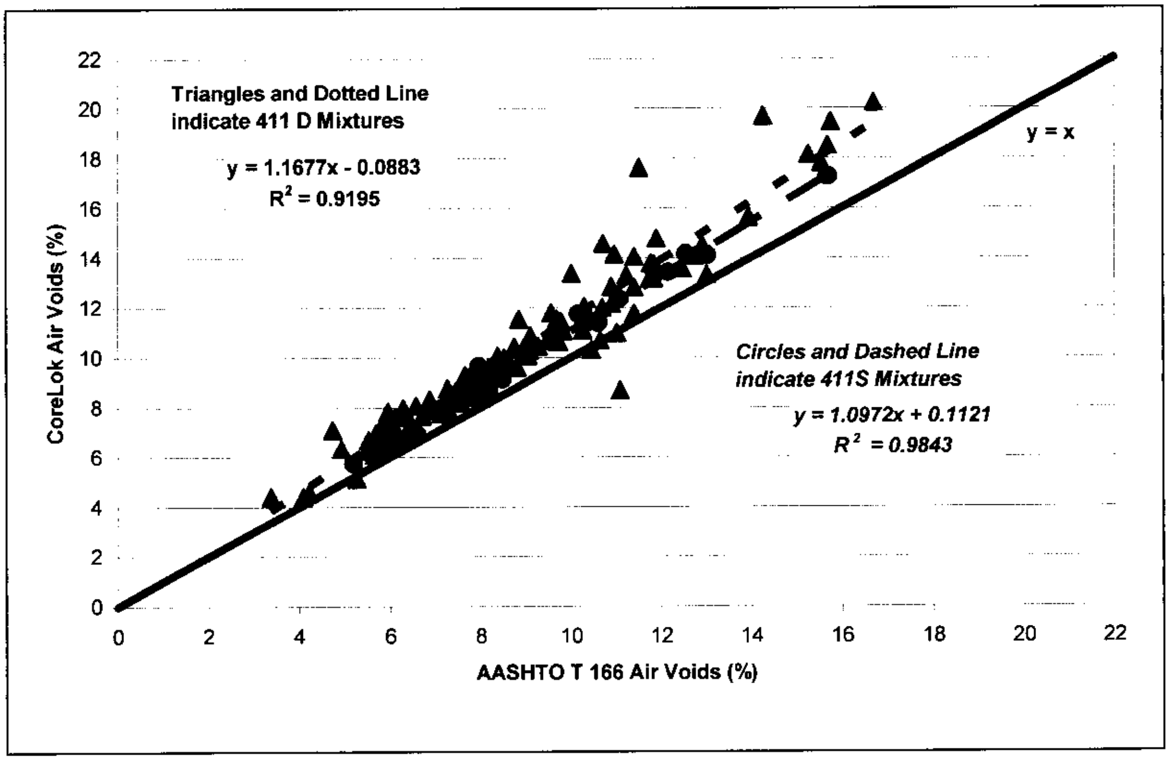

Figure 33. Comparison of CoreLok and AASHTO T 166 Air Voids for TDOT Surface Mixtures Statewide

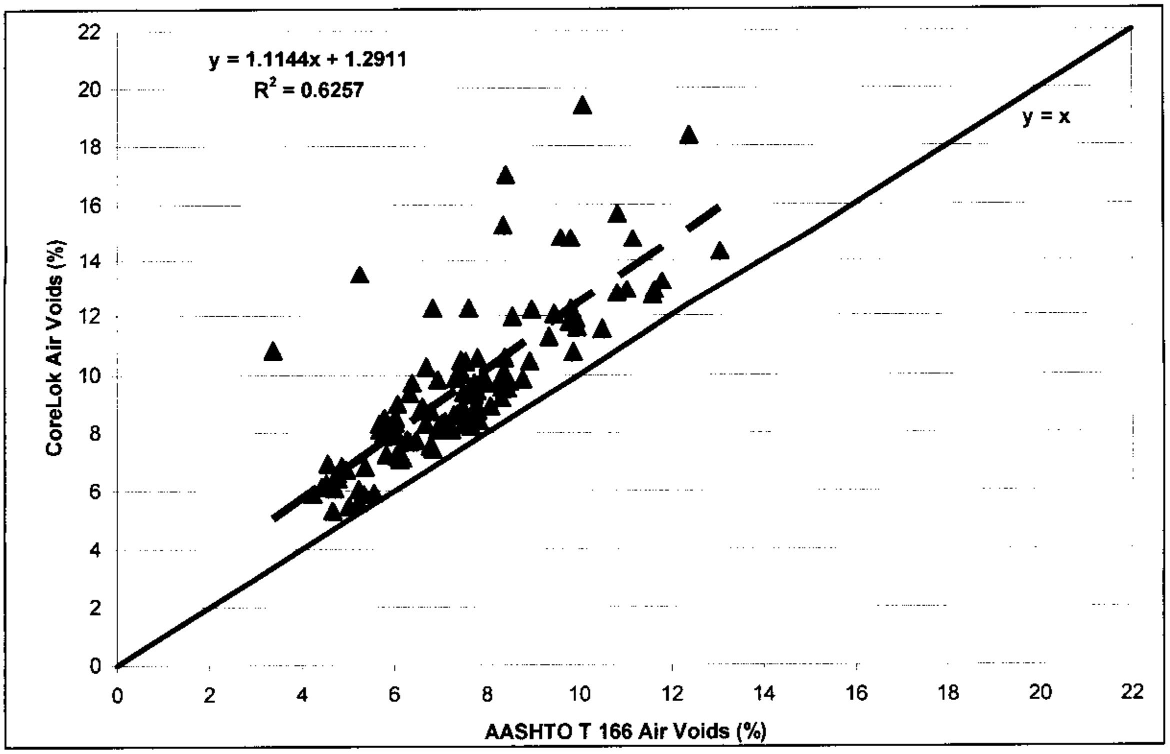

Figure 34. Comparison of CoreLok and AASHTO T 166 Air Voids for TDOT Binder Mixtures Statewide

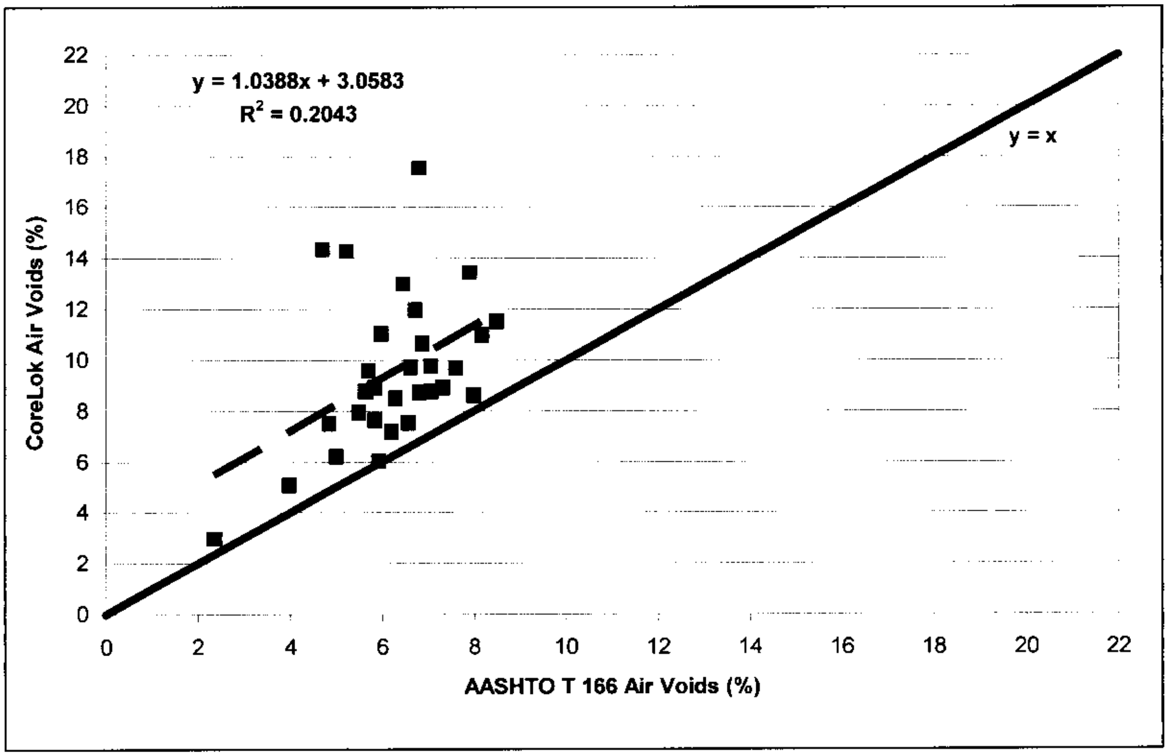

Figure 35. Comparison of CoreLok and AASHTO T 166 Air Voids for TDOT Base Mixtures Statewide

Literature Review for the Field Study

Bell, Hicks, and Wilson (16) found that percent compaction or void content was the most significant factor affecting HMA mix performance. The research indicated that an increase in void content is associated with a decrease in modulus, fatigue life, and resistance to permanent deformation. For typical pavement structures using HMA mixtures with four to twelve percent air voids, estimates of pavement life based on a fatigue criterion and vertical strain subgrade deformation criterion decreased thirty fold to threefold respectively.

Hall, Griffith, and Williams (17) conducted AASHTO T 269, AASHTO T 166, and Instrotek CoreLok tests on 144 (24 per site) 12.5-mm HMA surface course cores from 6 sites in Arkansas. Air voids of the HMA samples were reported to range from 2.5 to 9.5 percent. A paired t-test with alpha = 0.05 showed a significant difference in Average G_{mb} between CoreLok and T 166 for all 6 sampling sites. In all cases T 166 average G_{mb} was greater than CoreLok average G_{mb} . The differences in G_{mb} ranged from 0.008 to 0.022. Percent air void differences ranged 0.36 to 0.90. CoreLok had the lowest multi-operator variability when compared with AASHTO T 269 and AASHTO T 166. Table 10 is a comparison of Arkansas and TDOT results

Choubane, Upshaw, Sholar, Page, and Musselman (18) compared five different nuclear gauges with FM 1-T166 (a modified AASHTO T 166 with one-half the soaking time), AASHTO T 269, and ASTM D 1188 methods at 10 different stations along I-95 in Florida. The HMA used in the study was a 12.5-mm coarse-graded superpave mixture. R^2

values of 0.90, 0.61, 0.90, 0.74, and 0.75 were reported for comparisons of corrected nuclear densities and FM 1-T166. Florida Department of Transportation (FDOT) concluded nuclear density data had higher variability than FM 1-T166, AASHTO T 269, or ASTM D 1188. The TDOT R^2 for correlation between nuclear density and AASHTO T 166 for superpave surface mixtures was 0.51 for a statewide analysis. The CoreLok system was not part of the FDOT study.

Tarefder, Zaman, and Hobson (19) compared CoreLok, AASHTO T 269 (ASTM D 3203), and AASHTO T 166 methods using 170 pavement cores (surface and base) and 22 laboratory-fabricated base samples in a research project for Oklahoma DOT. For laboratory HMA samples with AASHTO T 269 air voids less than 10% and T 166 absorptions less than two percent, the average difference in CoreLok and T 166 G_{mb} was 0.035 (T 166 greater than CoreLok). For the few laboratory HMA samples with AASHTO T 269 air voids greater than ten percent the average difference in CoreLok and T 166 G_{mb} was 0.068 (T 166 greater than CoreLok). According to the paper, AASHTO T 166 underestimated air voids for high air void, open-graded HMA mixtures. The authors also indicated that it is evident that the difference in AASHTO T 166 and CoreLok G_{mb} values increases as AASHTO T 269 air voids increase. For field cores:

- 66 of 77 Type A (base) field cores showed AASHTO T 166 G_{mb} to be greater than CoreLok G_{mb} (T 166 air voids less than CoreLok air voids in 66 of 77 cases or for 85.7% of samples)

- 91 of 93 Type B (surface) field cores showed AASHTO T 166 G_{mb} to be greater than CoreLok G_{mb} (T 166 air voids less than CoreLok air voids in 91 of 93 cases or for 97.8% of samples)

Table 11 shows a comparison of Oklahoma DOT and TDOT research results.

Table 10. Comparison of Arkansas DOT and TDOT research results

	Arkansas DOT	TDOT
Number of samples of HMA surface mixture	144	126
Paired t-test significant difference between CoreLok and AASHTO T 166	Significant at all 6 sites	Significant in all 4 TDOT Regions
Surface course air voids CoreLok vs. AASHTO T 166	CoreLok > AASHTO T 166 Range = 0.36 to 0.90 at 6 sites	CoreLok > AASHTO T 166 Range of averages = 0.9 to 1.50 in 4 TDOT Regions
Multi-operator variability	CoreLok superior to AASHTO T 269 and AASHTO T 166	Not evaluated

Table 11. Comparison of Oklahoma DOT and TDOT research results

	Oklahoma DOT	TDOT
Number of HMA base cores	77	45
Number of HMA surface cores	93	126
Percent of base cores with CoreLok air voids higher than AASHTO T166 air voids	85.7	100
Percent of surface cores with CoreLok air voids higher than AASHTO T166 air voids	97.8	96

CONCLUSIONS

1. Figure 26 shows the relationship between percent air voids and apparent sample volume. It is not possible to know the exact point on the line representing the true sample volume and true percent air voids. However, for the vast majority of compacted bituminous mixtures that point lies between the SSD (AASHTO T-166) results and the parafilm results. For 90 percent of TDOT sample groups tested Instrotek Corelok yielded results in this range between the upper and lower bounds for accurate results.

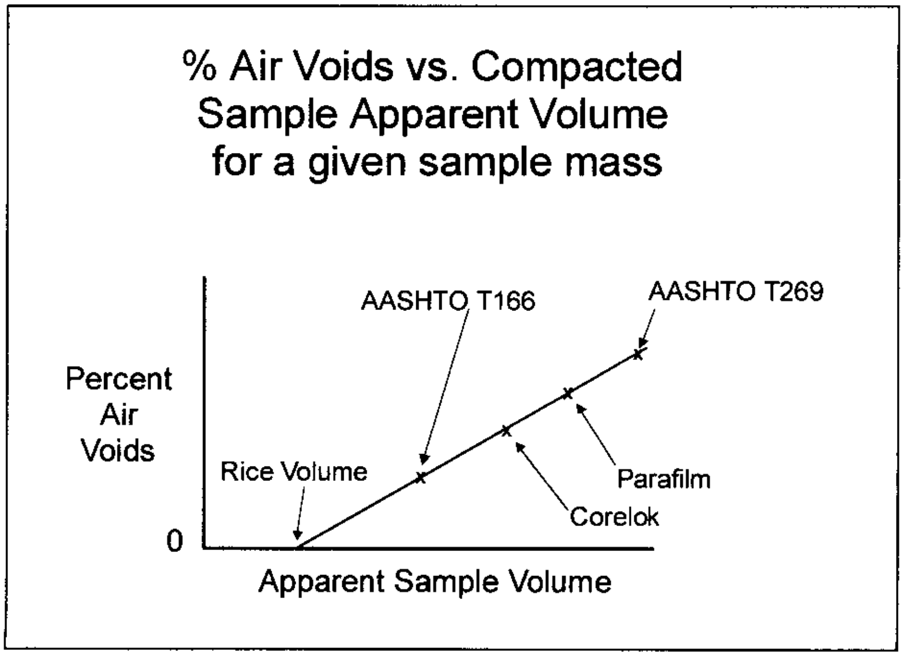

Figure 26. Air Void Percentage vs. Sample Apparent Volume

2. The average difference in air voids resulting from CoreLok and AASHTO T 166 is 1.0, 1.4, 2.1, and 3.3 for 411 S, 411 D, 307 BM 2, and 307 A HMA mixtures respectively. The difference is statistically significant for all mixture types statewide. The difference in air voids between CoreLok and AASHTO T 166 is a direct function of HMA mixture aggregate gradation.

3. On average, HMA air voids increase within 1 foot of an edge regardless of mixture type or measurement method.
4. If the inner and outer foot of pavements were not excluded from testing, the occurrence of failures (AASHTO T 166 air voids greater than 10%) of HMA core samples would be 30, 34, 10, and 2 percent for 411 S, 411 D, 307 BM 2, and 307 A HMA mixtures respectively.
5. If the inner and outer foot of pavements were not excluded from testing and CoreLok was the TDOT method for determining acceptance, the failure rate would increase 5, 4, 21, and 40 percent for 411 S, 411 D, 307 BM 2, and 307 A HMA mixtures respectively.
6. The difference in nuclear density air voids and AASHTO T 166 air voids is statistically significant at the 95% confidence interval for all mixture types statewide.
7. Oklahoma DOT and TDOT findings both indicated that AASHTO T 166 underestimated air voids for high air void, open-graded HMA mixtures. Further, Oklahoma DOT results showed CoreLok to produce higher air voids than AASHTO T166 for 97.8 and 85.7 percent of HMA surface and base mixtures, respectively. TDOT results showed CoreLok to produce higher air voids than AASHTO T166 for 96.0 and 100 percent of HMA surface and base mixtures, respectively.

RECOMMENDATIONS

1. The research team recommended that the TDOT Monitoring Committee select the Instrotek Corelok method as the most widely applicable method for determining the G_{mb} of compacted bituminous mixtures.
2. The research team recommends that TDOT conduct a test project using the Instrotek CoreLok for acceptance.

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge the support of the Tennessee Department of Transportation and the Federal Highway Administration. We would especially like to thank Bobby Rorie and William Rawdon of TDOT Materials and Tests, who recognized a problem existed, began looking for a viable solution, and initiated the project. The authors also wish to especially thank Greg Duncan and Brian Egan for chairing the TDOT Monitoring Committee and patiently answering many questions. The authors appreciate Heather Hall, Jay Norris, Matt Richardson, the coring crew and all TDOT Employees who aided in sampling the field specimens. The authors would like to thank John Davis of Rogers Group, Inc and Austin Bateman of Highways, Inc. for providing practice HMA samples to allow the authors to become more experienced with the various test methods. The authors appreciate the willingness of the contractors and batch plants to help whenever necessary. The authors wish to express their appreciation for the assistance of Heather J. Sauter.

The authors gratefully acknowledge the financial support, financial project management, and computer assistance of the TTU Center for Electric Power. In particular, Dr. Charles Hickman, Dr. Ken Purdy, Dr. Sastry Munukutla, Sandy Garrison, Etter Staggs, Helen Knott, Keith Jones, Chris Davis, Linda Lee, and Tony Greenway were all very helpful. We would also like to thank Dr. H. Wayne Leimer for providing a demonstration of Diamond Pacific saw performance.

Obtaining the field specimens would not have been possible without the aid of Shane Beasley and Jamey Dotson. The authors express gratitude to Robb Garner for his work with the field samples in the laboratory.

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APPENDIX A

Cover Letter and Questionnaire for State Departments of Transportation

Date

Dear ----:

The Tennessee Department of Transportation Division of Materials & Tests has awarded a contract to Tennessee Technological University for the purpose of finding a more widely applicable method for determining the bulk specific gravity of compacted bituminous materials. Of particular interest to the department is the determination of air void content of higher void content, newer mixture types such as Superpave, SMA, and large-stone mixtures. The intent of the research is to find or develop a method applicable to both field and laboratory specimens.

There are several states as well as an ASTM committee and other agencies investigating the presently standardized methods. In addition, several states are studying new methods. It would help us to have the attached questionnaire completed so that we may learn what others are doing. It is our intention to keep respondents to our request informed about our progress through a web site.

Thank you for your consideration of this request and should you have a need to discuss, please call me.

Sincerely,

L.K. Crouch, Ph.D., P.E.
Principal Investigator

Enclosure

Tennessee Technological University
Cookeville, Tennessee

Questionnaire for State Materials Engineers
on
Bulk Specific Gravity of Compacted Bituminous Mixtures

To: (name and address)

Contact Person: ____________________
(if not the same) ____________________
____
Phone: ____________________
Fax: ____________________
E-mail: ____________________

1.

Laboratory Method	Presently Used	Do Not Use	Modified
AASHTO T 166-93	________	________	________
AASHTO T 275-91	________	________	________
ASTM D 1188-96	________	________	________
ASTM D 2726-96a	________	________	________

Other: ____
____

2. Are you presently working on a new method and/or a revision in a previous method to address new, higher voids mixture types ?

_____ Yes _____ No If yes, please provide details.

3. Please send references, reports, non-standard test methods, etc., that you deem relevant to the study.

4. Other comments: (write on the back or attach additional sheets)

If possible, please provide the requested information by 10/26/99. Thank you again.

Mail to: L. K. Crouch
Department of Civil and Environmental Engineering
Campus Box 5015
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APPENDIX B

Feasibility Study Data and Results

Table B1. Cost Estimate of Feasibility Study Methods

Method	Initial	Labor*	Reoccuring**	Total	Cost per Test ($)
Corelok Vacuum Seal	7025	11250	4150	22425	2.24
Cut and Measure: Cubical	13947	43750	N/A	57697	5.77
Cut and Measure: Cylindrical	13947	22500	N/A	36447	3.64
Dimensional Analysis	2856	5000	N/A	7856	0.79
Glass Beads	4256	20000	N/A	24256	2.43
Parafilm Wrapping	2984	23750	2300	29034	2.90
SSD	2987	11250	N/A	14237	1.42

*This estimates the labor costs associated with the time required to perform each method as determined by the Feasibility Study. It was assumed that the test procedures were performed by an experienced technician earning $15 per hour.

**It was assumed that half of the 10,000 samples were 4 in. dia. and half were 6 in. dia. No maintenance costs were assumed due to the limited time frame of the Feasibility Study.

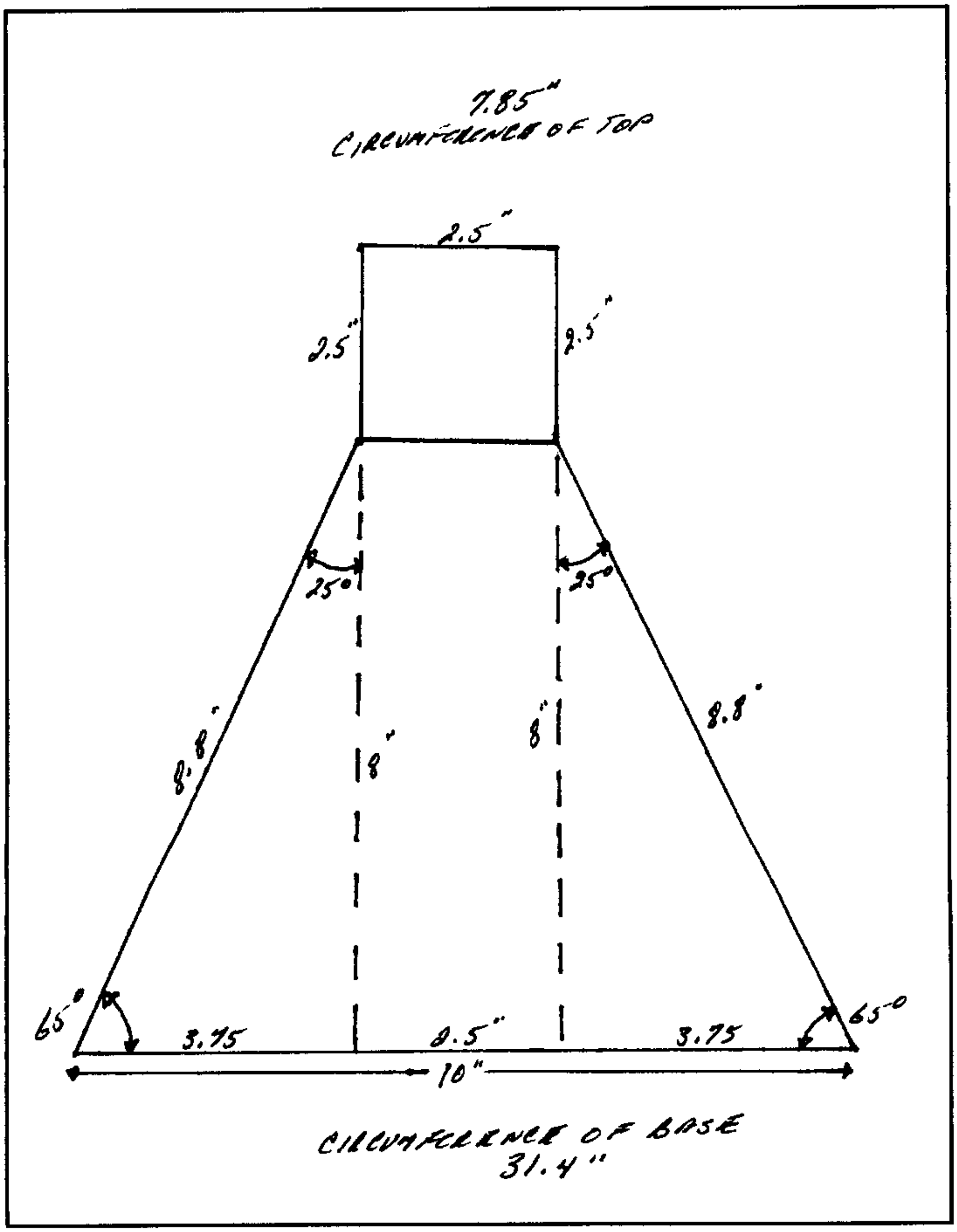

Figure B1: Pattern for Cone Elevation

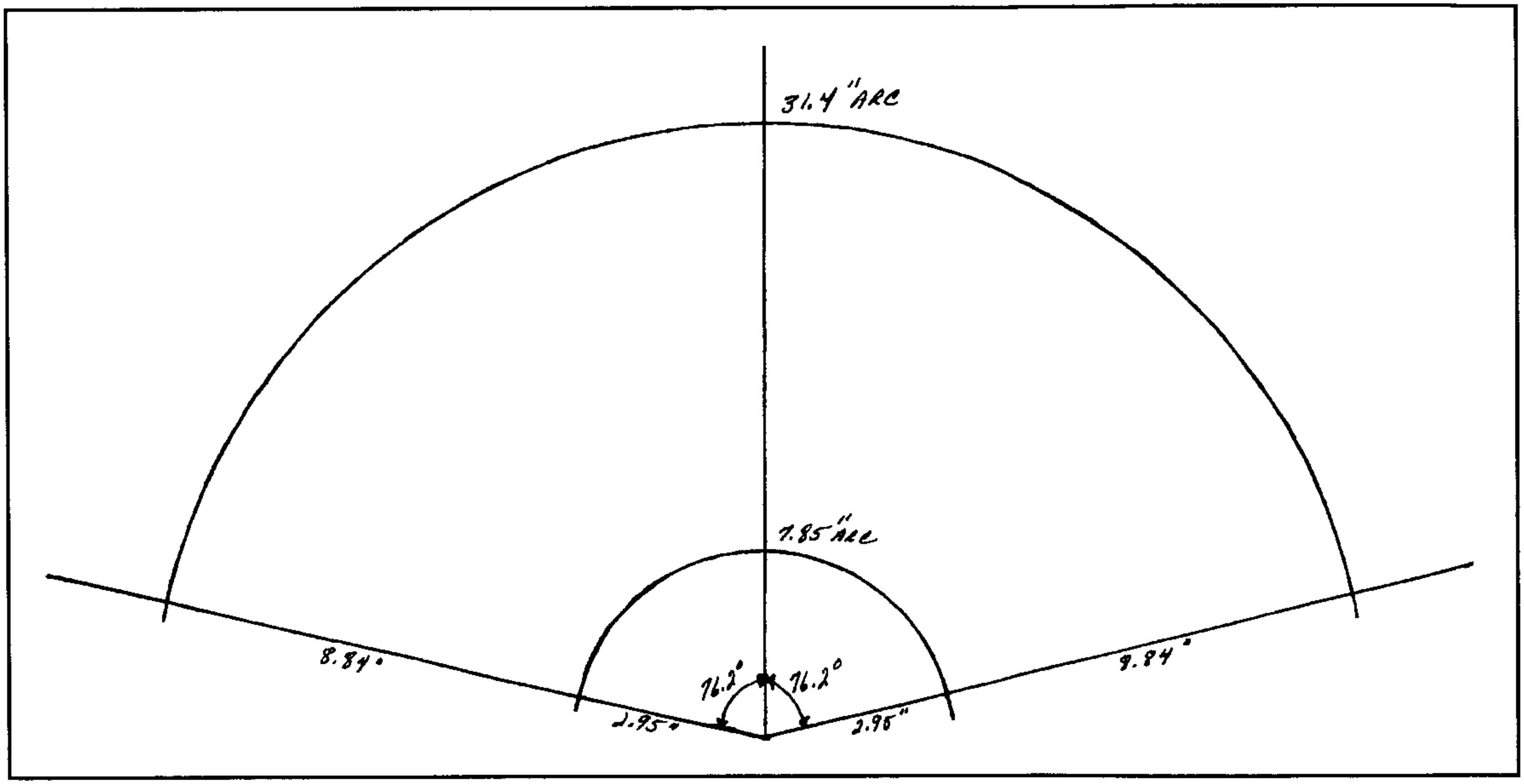

Figure B2: Pattern for Cone Layout

Glass Beads – Cone Construction

Materials List

1) 1 pc. aluminum: 2-1/2" O.D. x 2-7/16" I.D. x 2-1/2" length
2) 1 pc. aluminum: 12" x 12" x 1/16"
3) 1 pc. aluminum: 24" x 24" x 1/16"
4) 4 pcs. angle iron (90° brackets): 3/4" x 3/4" x 1/8"
5) 4 machine screws: 5/16" x 18 N.C. x 3/4"
6) 4 machine screws: 1/4" x 20 N.C. x 1/4"
7) 1/2 cubic foot measure

Note: Items No. 1 thru No. 6 of the materials list should be available at any sheet metal fabricator shop.

Cone Construction

1. Fabrication begins with the layout or transfer of pattern (see following sheets) to the material. After the lines have been transferred to the 24" x 24" x 1/16" aluminum sheet, the stock is formed to the cone shape using a metal forming machine. This machine will retain the material in a relatively close geometric form, greatly assisting in the ease of fabrication and assembly. The sides of the cone are pressed together at the top until a 2-1/2" diameter is achieved, then fasten with an 1/8" rivet or sheet metal screw. Repeat this procedure at the base until a 10" diameter is met, and then spot weld along seam. The altitude of the cone shall be measured at this time by placing a scale through the top opening; the correct altitude is 8".
2. The 2-1/2" x 2-7/16" x 1/16" nose piece will now be installed. This part should be fit snugly into the small diameter, trued up, and then spot welded into place. A plumbers (6") level and a level surface will work sufficiently for this procedure.

The altitude of the assembly shall be measured once again to ensure correctness; the correct altitude is now 10-1/5" total. Tig welding can now be done over the entire assembly.

3. The cone is now ready to affix to the base plate. Carefully center and scribe the circumference of the large cone diameter onto the 12" x 12" x 1/16" aluminum sheet. Then carefully cut inside the reference line to form a base plate the cone will fit firmly into, a jig saw is sufficient for this procedure. Spot-weld at random points around the circumference to insure the accuracy of the finished assembly.
4. Prior to assembling the cone to the 1/2 cubic foot measure, it is necessary to ensure the top and bottom openings are parallel and the top rim is smooth and even (AASHTO PPbb-96). A machine lathe can be used to accomplish this task.
5. The cone assembly is now ready to be attached to the measure. The cone must be installed in the same position for each use. To ensure this occurs, the angle iron brackets should be placed so the cone will only be accepted by the measure at the same location each time the apparatus is used. Attach the cone base to the measure by drilling and tapping four holes randomly around the rim. Take care to ensure the brackets remain even around the rim to guarantee the units will mate with the most snug fit possible. Then, center the cone on the measure and scribe the location of the bracket holes onto the underside of the cone base. Drill four 5/16" x 18 N.C. taps after threading through angle iron, twist in bolts from the bottom side so as to create studs to accept the cone base assembly. The units can now be secured together firmly using four 5/16" wing nuts. Any gap greater than 0.01" can be detected by using a simple mechanics feeler gauge, any gap out of

tolerance shall be corrected. A belt sander can be used to remove any high points in the surface to attain a tight, uniform mating surface. The apparatus is now ready for calibration, which can be done following the guidelines of AASHTO PPbb-96.

Table B2. Feasibility Study Corelok Vacuum Seal Data

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
3	934.1	960.6	531.4	0.777	2.364	2.364	0.23	4:05	3:51
	934.1	960.7	529.8	0.777	2.355			3:40	
	934.0	961.0	531.3	0.777	2.365			3:45	
	934.0	961.0	531.3	0.777	2.365			3:55	
	934.0	961.3	532.0	0.777	2.370			3:50	
100/1	4891.1	4948.2	2844.5	0.720	2.416	2.423	0.32	5:00	4:40
	4891.0	4948.6	2844.7	0.720	2.417			4:45	
	4891.1	4948.1	2848.5	0.720	2.421			4:30	
	4891.0	4948.4	2852.2	0.720	2.426			4:20	
	4891.0	4948.3	2859.8	0.720	2.435			4:45	
2	1192.1	1219.7	702.5	0.777	2.475	2.471	0.09	4:00	3:53
	1192.1	1219.5	701.7	0.777	2.470			3:45	
	1192.1	1219.2	701.5	0.777	2.469			4:00	
	1192.0	1218.9	701.8	0.777	2.471			3:45	
	1192.1	1218.7	702.1	0.777	2.471			3:55	
COE 1	4634.3	4691.5	2778.0	0.720	2.527	2.523	0.09	5:10	4:56
	4633.9	4691.4	2774.1	0.720	2.522			5:00	
	4633.8	4691.3	2774.0	0.720	2.522			5:25	
	4633.8	4691.0	2774.4	0.720	2.522			4:20	
	4633.9	4691.1	2773.2	0.720	2.521			4:45	
22/1	1199.1	1226.2	702.0	0.777	2.451	2.458	0.19	3:50	3:43
	1199.1	1225.9	703.8	0.777	2.459			3:45	
	1199.0	1225.8	703.6	0.777	2.458			3:55	
	1199.0	1225.7	704.2	0.777	2.461			3:35	
	1199.1	1225.8	704.4	0.777	2.462			3:30	

Table B2. Feasibility Study Corelok Vacuum Seal Data (Continued)

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
237/4	1198.1	1224.3	668.7	0.777	2.296	2.292	0.67	4:20	3:57
	1197.8	1224.5	668.6	0.777	2.297			3:50	
	1197.6	1224.5	661.1	0.777	2.265			3:50	
	1197.6	1225.0	669.3	0.777	2.301			3:55	
	1197.6	1225.0	669.4	0.777	2.302			3:50	
(4-6)/1	1193.7	1220.3	645.1	0.777	2.207	2.203	0.18	4:05	4:03
	1193.6	1220.7	645.0	0.777	2.207			3:55	
	1193.6	1220.4	643.8	0.777	2.202			3:20	
	1193.6	1220.1	643.7	0.777	2.201			4:45	
	1193.6	1220.4	642.8	0.777	2.198			4:10	
Nova Chip 1	2794.2	2851.7	1474.8	0.720	2.154	2.180	0.78	5:00	5:02
	2794.8	2850.8	1493.5	0.720	2.184			4:55	
	2794.0	2851.1	1497.2	0.720	2.192			5:15	
	2794.1	2851.2	1486.1	0.720	2.173			5:25	
	2794.0	2851.1	1500.0	0.720	2.197			4:35	
Nova Chip 2	2786.3	2843.2	1479.3	0.720	2.169	2.188	0.75	4:35	4:44
	2786.2	2843.2	1488.3	0.720	2.184			4:40	
	2786.2	2843.2	1488.3	0.720	2.184			4:55	
	2786.2	2843.1	1490.9	0.720	2.188			4:45	
	2786.2	2843.7	1505.4	0.720	2.214			4:45	
1	757.1	784.2	380.7	0.777	2.054	2.055	0.34	4:25	3:50
	757.0	783.9	380.1	0.777	2.050			3:40	
	757.0	784.2	382.1	0.777	2.062			3:45	
	757.0	784.2	382.2	0.777	2.063			3:25	
	757.0	784.2	379.4	0.777	2.047			3:55	

Table B3. Feasibility Study Cut and Measure: Cubical Samples Data

Sample	M_{dry} (g)	W (cm)	H (cm)	L (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)	Avg. Time
3	260.4	5.95	3.40	5.64	114.20	2.281	2.301	1.23	18:24
	260.3	5.95	3.34	5.65	112.34	2.318			
	260.3	5.96	3.32	5.64	111.60	2.333			
	260.3	5.95	3.42	5.65	115.04	2.264			
	260.3	5.94	3.36	5.65	112.69	2.311			
100/1	1355.2	7.85	8.71	8.20	560.82	2.418	2.417	0.06	18:18
	1355.2	7.85	8.71	8.20	561.07	2.416			
	1355.2	7.85	8.71	8.20	561.31	2.415			
	1355.2	7.85	8.71	8.20	560.36	2.420			
	1355.2	7.85	8.71	8.20	560.99	2.417			
2	428.1	5.99	4.53	6.45	174.85	2.449	2.453	0.52	16:24
	428.1	6.01	4.52	6.45	175.46	2.441			
	428.1	6.01	4.52	6.46	175.29	2.443			
	428.1	6.02	4.47	6.47	174.20	2.459			
	428.2	6.01	4.46	6.46	173.31	2.472			
COE 1	1036.9	6.99	8.09	7.27	411.26	2.522	2.525	0.10	21:05
	1036.9	7.00	8.09	7.26	410.75	2.526			
	1036.9	7.00	8.07	7.28	411.21	2.523			
	1036.9	6.99	8.09	7.27	410.94	2.524			
	1036.9	6.99	8.09	7.26	410.27	2.529			
22/1	230.8	5.39	3.42	5.44	100.19	2.305	2.287	0.95	16:25
	230.7	5.40	3.41	5.46	100.42	2.298			
	230.7	5.39	3.48	5.47	102.61	2.249			
	230.7	5.40	3.41	5.48	100.91	2.287			
	230.6	5.40	3.42	5.45	100.58	2.294			

Table B3. Feasibility Study Cut and Measure: Cubical Samples Data (Continued)

Sample	M_{dry} (g)	W (cm)	H (cm)	L (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)	Avg. Time
237/4	367.5	6.04	4.23	5.83	148.82	2.471	2.459	0.75	16:07
	367.5	6.04	4.29	5.80	150.49	2.443			
	367.5	6.04	4.23	5.79	147.87	2.486			
	367.5	6.04	4.29	5.80	150.26	2.447			
	367.4	6.05	4.28	5.79	149.99	2.451			
(4-6)/1	416.7	6.21	4.78	6.36	188.86	2.207	2.203	0.50	16:05
	416.7	6.19	4.78	6.36	188.22	2.215			
	416.7	6.22	4.80	6.38	190.73	2.186			
	416.7	6.25	4.78	6.35	189.61	2.199			
	416.7	6.21	4.79	6.36	188.98	2.206			
Nova Chip 1	472.7	6.51	5.01	6.50	211.80	2.233	2.236	0.19	16:00
	472.7	6.51	5.01	6.48	211.39	2.237			
	472.7	6.51	5.01	6.49	211.68	2.234			
	472.6	6.51	5.01	6.49	211.61	2.234			
	472.7	6.51	5.00	6.48	210.79	2.243			
Nova Chip 2	721.3	7.95	5.64	7.34	328.92	2.194	2.190	0.24	19:07
	721.4	7.94	5.65	7.35	329.39	2.191			
	721.3	7.95	5.64	7.34	328.82	2.195			
	721.4	7.94	5.65	7.35	329.66	2.189			
	721.4	7.95	5.65	7.36	330.84	2.181			
1	191.5	5.32	3.38	6.21	111.60	1.717	1.793	5.87	16:12
	191.5	5.37	3.36	6.20	111.95	1.711			
	191.5	5.29	3.38	5.93	105.97	1.808			
	191.5	5.43	3.40	5.89	108.87	1.760			
	191.5	5.29	3.12	5.90	97.36	1.968			

Table B4. Feasibility Study Cut and Measure: Cylindrical Samples Data

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)	Avg. Time
3	553.2	9.50	3.35	237.62	2.329	2.331	0.69	8:30
	553.2	9.50	3.35	237.28	2.332			
	553.2	9.49	3.32	234.95	2.356			
	553.3	9.53	3.36	239.55	2.311			
	553.3	9.51	3.35	237.98	2.326			
100/1	3705.3	14.99	8.73	1540.59	2.406	2.410	0.15	10:00
	3705.5	14.99	8.72	1538.54	2.410			
	3705.5	15.00	8.71	1539.72	2.408			
	3705.5	14.99	8.70	1535.59	2.414			
	3705.4	14.99	8.70	1535.42	2.414			
2	896.8	10.19	4.52	368.47	2.435	2.438	0.41	8:00
	896.7	10.18	4.50	366.69	2.447			
	896.7	10.18	4.55	370.28	2.423			
	896.8	10.18	4.51	367.24	2.443			
	896.7	10.19	4.50	366.89	2.445			
COE 1	3740	15.28	8.07	1480.44	2.527	2.530	0.19	10:00
	3738.5	15.29	8.06	1479.06	2.529			
	3738.6	15.26	8.06	1474.10	2.537			
	3738.7	15.28	8.08	1481.23	2.525			
	3738.7	15.28	8.06	1476.63	2.533			
22/1	641.8	10.25	3.42	282.00	2.277	2.278	1.12	8:00
	641.9	10.24	3.46	284.80	2.255			
	641.9	10.25	3.47	286.58	2.241			
	642	10.24	3.46	285.27	2.251			
	642	10.23	3.39	278.67	2.305			

Table B4. Feasibility Study Cut and Measure: Cylindrical Samples Data (Continued)

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)	Avg. Time
237/4	843.7	10.16	4.23	343.24	2.459	2.316	0.59	8:30
	843.8	10.16	4.20	340.43	2.480			
	843.8	10.16	4.24	344.22	2.452			
	843.7	10.16	4.26	345.11	2.446			
	843.7	10.16	4.25	344.85	2.448			
(4-6)/1	849.2	10.15	4.80	388.53	2.187	2.174	0.14	8:30
	849.1	10.16	4.80	389.14	2.183			
	849.1	10.17	4.79	389.02	2.184			
	849.1	10.18	4.79	389.97	2.178			
	849.1	10.17	4.79	389.14	2.183			
Nova Chip 1	1936.4	15.03	5.04	894.58	2.166	2.152	0.17	10:30
	1936.4	15.03	5.03	892.51	2.171			
	1936.3	15.03	5.04	894.69	2.165			
	1936.4	15.02	5.03	891.34	2.173			
	1936.3	15.03	5.03	892.19	2.171			
Nova Chip 2	2169.9	15.07	5.74	1023.84	2.120	2.065	0.77	10:30
	2169.9	15.05	5.70	1013.50	2.142			
	2169.8	15.04	5.68	1009.80	2.150			
	2169.8	15.08	5.69	1016.67	2.135			
	2169.8	15.03	5.65	1003.76	2.163			
1	543.7	10.17	3.38	274.77	1.980	1.968	0.76	8:15
	543.7	10.19	3.37	274.50	1.982			
	543.6	10.21	3.38	276.52	1.967			
	543.6	10.21	3.34	273.67	1.987			
	543.6	10.21	3.41	278.96	1.950			

Table B5. Feasibility Study Dimensional Analysis Data

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
3	934.0	9.57	6.36	457.83	2.041	2.032	0.58	2:10	2.05
	934.1	9.59	6.40	461.84	2.023			2:00	
	934.0	9.59	6.32	456.45	2.047			2:05	
	934.1	9.56	6.42	460.86	2.028			2:05	
	934.0	9.58	6.42	462.65	2.020			1:55	
100/1	4891.6	15.00	11.64	2055.51	2.381	2.386	0.22	2:05	2.15
	4891.5	14.98	11.62	2046.75	2.391			2:15	
	4891.5	14.96	11.63	2045.20	2.393			2:10	
	4891.6	14.99	11.64	2053.76	2.383			2:10	
	4891.3	14.99	11.63	2052.90	2.384			2:05	
2	1192.1	10.18	6.06	492.46	2.422	2.414	0.20	2:00	1.92
	1192.1	10.17	6.08	494.14	2.414			2:10	
	1192.1	10.18	6.08	494.30	2.413			1:50	
	1192.1	10.18	6.08	494.80	2.410			1:45	
	1192.1	10.18	6.08	494.90	2.410			1:50	
COE 1	4634.5	15.23	10.27	1872.88	2.476	2.472	0.24	2:05	1.98
	4634.5	15.24	10.25	1869.37	2.480			1:55	
	4634.4	15.26	10.26	1876.98	2.470			2:05	
	4634.4	15.26	10.27	1876.78	2.470			2:00	
	4634.4	15.28	10.26	1881.10	2.465			1:50	
22/1	1199.0	10.16	6.16	499.66	2.401	2.403	0.15	1:50	1.8
	1199.1	10.16	6.16	499.22	2.403			1:50	
	1199.0	10.17	6.15	499.40	2.402			1:45	
	1199.0	10.16	6.14	497.85	2.409			1:50	
	1199.0	10.17	6.15	499.60	2.401			1:45	

Table B5. Feasibility Study Dimensional Analysis Data (Continued)

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
237/4	1197.6	10.27	6.48	536.79	2.232	2.233	0.13	1:45	1.87
	1197.6	10.27	6.48	536.30	2.234			1:40	
	1197.6	10.26	6.48	535.80	2.236			2:00	
	1197.6	10.27	6.49	537.63	2.229			1:55	
	1197.6	10.26	6.49	536.03	2.235			2:00	
(4-6)/1	1193.7	10.16	6.88	557.66	2.141	2.144	0.11	1:30	1.6
	1193.7	10.16	6.87	556.69	2.145			1:40	
	1193.7	10.16	6.87	557.39	2.143			1:45	
	1193.7	10.16	6.87	557.24	2.143			1:30	
	1193.7	10.15	6.87	556.14	2.147			1:35	
Nova Chip 1	2794.8	14.99	7.47	1317.51	2.122	2.121	0.04	2:10	2.05
	2795.3	15.00	7.47	1318.57	2.121			1:50	
	2795.3	14.99	7.47	1318.74	2.121			2:10	
	2795.4	14.99	7.47	1318.96	2.120			2:00	
	2795.4	14.99	7.47	1318.29	2.121			2:05	
Nova Chip 2	2785.5	15.02	7.47	1323.71	2.105	2.110	0.27	1:45	1.77
	2785.5	14.97	7.47	1315.05	2.119			1:45	
	2785.5	15.01	7.47	1321.59	2.109			1:45	
	2785.5	15.02	7.47	1323.54	2.106			1:50	
	2785.5	15.01	7.47	1321.25	2.109			1:45	
1	757.3	10.25	4.78	393.75	1.924	1.934	0.30	1:50	1.77
	757.4	10.24	4.76	391.25	1.937			1:35	
	757.3	10.24	4.76	391.51	1.935			2:00	
	757.3	10.24	4.74	390.79	1.939			1:50	
	757.3	10.24	4.76	391.35	1.936			1:35	

Table B6. Feasibility Study Glass Beads Data

Sample	M_{dry} (kg)	M_{mb} (kg)	M_{sbmc} (kg)	G_{beads}	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
3	0.93	39.64	39.98	1.576	2.460	2.463	3.80	7:10	6:33
	0.93	39.64	40.01	1.576	2.578			5:55	
	0.93	39.64	39.98	1.576	2.460			6:55	
	0.93	39.64	39.99	1.576	2.498			7:00	
	0.93	39.64	39.94	1.576	2.319			5:45	
100/1	4.89	39.64	41.31	1.576	2.392	2.357	1.51	8:55	8:46
	4.89	39.64	41.32	1.576	2.399			8:30	
	4.89	39.64	41.22	1.576	2.327			8:50	
	4.89	39.64	41.23	1.576	2.333			9:15	
	4.89	39.64	41.23	1.576	2.333			8:20	
2	1.19	39.64	40.06	1.576	2.425	2.468	3.43	6:00	5:48
	1.19	39.64	40.08	1.576	2.483			5:50	
	1.19	39.64	40.05	1.576	2.397			5:45	
	1.19	39.64	40.06	1.576	2.425			5:30	
	1.19	39.64	40.12	1.576	2.608			5:55	
COE 1	4.63	39.64	41.44	1.576	2.574	2.561	1.87	6:45	7:55
	4.63	39.64	41.35	1.576	2.494			6:30	
	4.63	39.64	41.40	1.576	2.541			7:30	
	4.63	39.64	41.49	1.576	2.624			8:55	
	4.63	39.64	41.44	1.576	2.574			9:55	
22/1	1.20	39.64	40.10	1.576	2.535	2.525	3.03	6:30	6:37
	1.20	39.64	40.09	1.576	2.505			7:40	
	1.20	39.64	40.10	1.576	2.535			6:20	
	1.20	39.64	40.06	1.576	2.418			5:50	
	1.20	39.64	40.12	1.576	2.631			6:45	

Table B6. Feasibility Study Glass Beads Data (Continued)

Sample	M_{dry} (kg)	M_{mb} (kg)	M_{sbmc} (kg)	G_{beads}	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
237/4	1.20	39.64	40.11	1.576	2.568	2.490	2.73	8:40	7:10
	1.20	39.64	40.08	1.576	2.476			6:20	
	1.20	39.64	40.10	1.576	2.537			7:00	
	1.20	39.64	40.05	1.576	2.391			6:40	
	1.20	39.64	40.08	1.576	2.476			7:10	
(4-6)/1	1.19	39.64	39.99	1.576	2.217	2.242	5.57	6:30	6:46
	1.19	39.64	39.94	1.576	2.104			7:20	
	1.19	39.64	40.05	1.576	2.397			6:40	
	1.19	39.64	39.96	1.576	2.148			6:30	
	1.19	39.64	40.03	1.576	2.342			6:50	
Nova Chip 1	2.79	39.64	40.50	1.576	2.269	2.205	1.74	12:20	11:15
	2.79	39.64	40.42	1.576	2.187			11:20	
	2.79	39.64	40.41	1.576	2.167			11:10	
	2.79	39.64	40.43	1.576	2.197			10:25	
	2.79	39.64	40.44	1.576	2.207			11:00	
Nova Chip 2	2.78	39.64	40.30	1.576	2.059	2.155	4.09	9:00	10:02
	2.78	39.64	40.46	1.576	2.230			11:00	
	2.78	39.64	40.30	1.576	2.059			9:20	
	2.78	39.64	40.44	1.576	2.209			11:20	
	2.79	39.64	40.45	1.576	2.219			9:30	
1	0.76	39.64	39.77	1.576	1.894	2.053	6.04	9:20	8:56
	0.76	39.64	39.83	1.576	2.106			8:40	
	0.76	39.64	39.79	1.576	1.950			9:15	
	0.76	39.64	39.85	1.576	2.175			8:30	
	0.76	39.64	39.84	1.576	2.140			8:55	

Table B7. Feasibility Study Glass Beads Calibration

Specific Gravity of Glass Beads: $G_{beads} = [(M_{mcb} - M_{mc}) / V_{mc}] / \gamma_w$							
M_{mcb} (kg)	M_{mc} (kg)	V_{mc} (m^3)	G_{beads}	Avg. G_{beads}	V (G_{beads}, %)	Time	Avg. Time
39.62	9.55	0.019	1.576	1.577	0.10	8:10	8:02
39.67	9.55		1.579			8:00	
39.62	9.55		1.576			8:10	
39.67	9.55		1.579			7:50	

Table B8. Feasibility Study Glass Beads Apparatus Volume Determination

Volume of Apparatus: $V_{mc} = (M_{mcw} - M_{mc}) / \gamma_w$				
M_{mc} (kg)	M_{mcw} (kg)	V_{mc} (m^3)	Avg. V_{mc}	V (V_{mc}, %)
9.56	28.86	0.019	0.019	0.08
9.57	28.65	0.019		
9.57	28.67	0.019		
9.57	28.66	0.019		
9.57	28.65	0.019		

Table B9. Feasibility Study Parafilm Wrapping Data

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
3	934.1	937.4	537.5	2.363	2.333	0.76	10	7.6
	934.2	937.2	530.4	2.320			7	
	934.1	937.2	532.8	2.335			7	
	934.1	937.2	531.0	2.324			7	
	934.1	937.4	530.5	2.322			7	
100/1	4891.0	4900.1	2853.4	2.405	2.404	0.25	18	14.2
	4891.3	4898.8	2860.9	2.412			13	
	4890.2	4898.0	2854.4	2.406			15	
	4890.0	4898.0	2849.4	2.400			13	
	4890.0	4899.5	2846.0	2.397			12	
2	1192.0	1195.5	707.0	2.465	2.450	0.33	10	7.8
	1192.2	1194.7	703.8	2.446			7	
	1192.0	1194.6	704.0	2.448			7	
	1192.1	1194.8	704.2	2.449			7	
	1192.1	1195.0	703.3	2.444			8	
COE 1	4634.4	4643.9	2785.0	2.511	2.504	0.32	18	15
	4635.2	4642.0	2771.5	2.491			14	
	4633.9	4640.5	2783.6	2.508			15	
	4634.1	4642.3	2781.0	2.505			14	
	4634.3	4643.2	2783.0	2.508			14	
22/1	1198.8	1202.4	711.2	2.466	2.445	0.47	10	7.7
	1199.1	1201.7	706.5	2.439			7.5	
	1199.0	1201.8	706.4	2.439			7	
	1199.0	1201.9	706.8	2.442			7	
	1199.0	1202.0	706.4	2.440			7	

Table B9. Feasibility Study Parafilm Wrapping Data (Continued)

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_{mb}	Avg. G_{mb}	V (%)	Time	Avg. Time
237/4	1198.1	1202.0	670.7	2.278	2.269	0.35	10	8.2
	1198.2	1201.1	667.5	2.263			7	
	1196.9	1199.2	669.4	2.273			7	
	1196.8	1199.7	669.0	2.272			8	
	1196.9	1199.6	666.0	2.259			9	
4-6/1	1193.7	1196.5	645.7	2.183	2.182	0.10	7	6.8
	1193.7	1196.7	645.6	2.183			7	
	1193.7	1197.2	645.5	2.183			7	
	1193.7	1196.7	644.6	2.179			7	
	1193.7	1197.1	646.0	2.185			6	
Nova Chip 1	2793.4	2799.3	1526.0	2.208	2.175	1.19	13	11.6
	2794.8	2801.0	1519.0	2.195			18	
	2795.2	2800.2	1503.0	2.166			8	
	2795.2	2800.9	1496.4	2.156			10	
	2795.0	2802.2	1490.9	2.148			9	
Nova Chip 2	2785.5	2791.2	1485.0	2.146	2.146	0.18	11	11.2
	2785.2	2791.6	1488.6	2.152			13	
	2785.8	2791.7	1484.5	2.145			10	
	2786.0	2792.7	1483.4	2.143			11	
	2785.9	2793.2	1482.6	2.142			11	
1	756.9	759.6	379.0	2.008	2.011	0.23	7	6
	756.9	759.3	378.7	2.006			5	
	756.8	759.3	380.7	2.017			6	
	756.9	760.0	378.8	2.008			6	
	756.7	759.7	379.7	2.013			6	

Table B10. Feasibility Study Specific Gravity Determination of Parafilm

	A_{al} (g)	B_{al} (g)	G_{al}	D_{al} (g)	E_{al} (g)	F	
	(dry mass in air)	(mass under water)	(sp. gravity of aluminum	(dry mass of wrapped	(mass of wrapped specimen	(Sp. Gravity of	**Average Sp. Gravity**
Trial 1	1445.4	932.3	2.8170	1448.8	930.7	0.680	**0.70**
Trial 2	1445.4	932.1	2.8159	1449.1	930.7	0.725	
Trial 3	1445.3	932.4	2.8179	1449.1	931	0.731	
Trial 4	1445.4	932.4	2.8175	1448.5	931	0.689	
Trial 5	1445.5	932.3	2.8166	1449.2	930.5	0.673	

Table B11. Feasibility Study Saturated Surface-Dry Specimens Data

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)	Time	Avg. Time
3	934.2	934.7	540.5	2.370	2.374	0.12	0.11	4:45	4:34
	934.1	934.4	541.1	2.375				4:30	
	934.3	934.7	541.7	2.377				4:45	
	934.1	934.6	541.4	2.376				4:20	
	934.1	934.6	541.1	2.374				4:30	
100/1	4891.6	4895.0	2874.6	2.421	2.422	0.03	0.17	5:05	4:45
	4891.3	4895.1	2875.3	2.422				4:25	
	4891.6	4894.8	2875.4	2.422				4:45	
	4891.4	4895.1	2876.2	2.423				4:50	
	4891.0	4894.3	2875.2	2.422				4:40	
2	1192.5	1193.5	714.9	2.492	2.494	0.06	0.18	4:40	4:34
	1192.0	1192.9	714.9	2.494				4:30	
	1191.9	1192.6	715.0	2.496				4:35	
	1192.1	1193.0	715.1	2.494				4:40	
	1192.0	1192.9	715.0	2.494				4:25	
COE 1	4634.6	4638.7	2807.5	2.531	2.534	0.07	0.19	5:00	4:46
	4634.1	4638.0	2809.5	2.534				4:50	
	4634.0	4637.2	2808.7	2.534				4:35	
	4634.0	4637.2	2808.1	2.533				4:40	
	4633.9	4637.0	2809.4	2.536				4:45	
22/1	1199.3	1200.3	715.4	2.473	2.475	0.06	0.23	4:40	4:32
	1198.7	1200.0	715.6	2.475				4:25	
	1198.8	1199.8	715.7	2.476				4:40	
	1198.9	1200.0	716.0	2.477				4:25	
	1198.6	1199.7	715.6	2.476				4:30	

Table B11. Feasibility Study Saturated Surface-Dry Specimens Data (Continued)

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)	Time	Avg. Time
237/4	1197.6	1202.1	693.1	2.353	2.351	0.06	1.00	4:35	4:32
	1197.5	1203.0	693.3	2.349				4:30	
	1197.7	1202.8	693.0	2.349				4:40	
	1197.8	1203.4	693.8	2.350				4:25	
	1198.2	1203.0	693.5	2.352				4:30	
(4-6)/1	1193.6	1203.4	675.1	2.259	2.260	0.18	1.82	4:40	4:35
	1194.1	1203.8	677.0	2.267				4:25	
	1194.4	1204.5	675.5	2.258				4:35	
	1192.6	1202.3	673.8	2.257				4:40	
	1193.7	1202.4	674.6	2.262				4:35	
Nova Chip 1	2794.3	2818.5	1576.1	2.249	2.245	0.22	2.11	4:45	4:48
	2793.3	2818.8	1577.3	2.250				4:50	
	2794.8	2823.6	1575.2	2.239				4:50	
	2795.2	2820.6	1576.4	2.247				4:40	
	2795.2	2822.5	1575.3	2.241				4:55	
Nova Chip 2	2785.8	2811.9	1568.3	2.240	2.240	0.25	2.22	4:50	4:38
	2786.3	2814.2	1574.0	2.247				4:25	
	2784.9	2814.2	1571.0	2.240				4:40	
	2785.2	2816.4	1567.9	2.231				4:35	
	2785.8	2809.2	1566.2	2.241				4:40	
1	757.1	770.4	443.6	2.317	2.313	0.21	3.95	4:35	4:26
	757.4	770.5	442.5	2.309				4:20	
	758.1	770.2	442.7	2.315				4:30	
	757.0	770.5	443.7	2.316				4:20	
	757.0	769.7	441.4	2.306				4:25	

Table B12. Feasibility Study Results Summary

Average G_{mb} Values							
Sample	Corelok	Cut Cube	Cut Cylinder	Dim. Analysis	Glass Beads	Parafilm	SSD
Nova Chip 1	2.180	1.793	2.152	2.121	2.205	2.175	2.245
Nova Chip 2	2.188	2.190	2.065	2.110	2.155	2.146	2.240
4-6/1	2.203	2.203	2.174	2.144	2.242	2.182	2.260
1	2.055	2.236	1.968	1.934	2.053	2.011	2.313
3	2.364	2.301	2.331	2.032	2.463	2.333	2.374
2	2.471	2.453	2.438	2.414	2.468	2.450	2.494
237/4	2.292	2.459	2.316	2.233	2.490	2.269	2.351
22/1	2.458	2.287	2.374	2.403	2.525	2.445	2.475
100/1	2.423	2.417	2.410	2.386	2.357	2.404	2.422
COE 1	2.523	2.525	2.530	2.472	2.561	2.504	2.534
Average	2.32	2.29	2.28	2.22	2.35	2.29	2.37
Average Coefficients of Variation (%)							
Sample	Corelok	Cut Cube	Cut Cylinder	Dim. Analysis	Glass Beads	Parafilm	SSD
Nova Chip 1	0.78	0.19	0.17	0.03	1.74	1.19	0.22
Nova Chip 2	0.75	0.24	0.77	0.27	4.09	0.18	0.25
4-6/1	0.18	0.50	0.14	0.11	5.57	0.10	0.18
1	0.34	5.87	0.76	0.30	6.04	0.23	0.21
3	0.23	1.23	0.69	0.58	3.80	0.76	0.14
2	0.09	0.52	0.41	0.20	3.43	0.33	0.07
237/4	0.67	0.75	0.59	0.13	2.73	0.35	0.07
22/1	0.19	0.95	1.07	0.15	3.03	0.47	0.07
100/1	0.32	0.06	0.15	0.22	1.51	0.25	0.03
COE 1	0.09	0.10	0.19	0.24	1.87	0.32	0.06
Average	0.36	1.04	0.49	0.22	3.38	0.42	0.13

APPENDIX C

Precision and Accuracy Data and Results

Table C1. Corelok Vacuum Seal Data for D Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
D Mix: Marshall - 75 Blows (1)	1194.8	1218.2	700.0	0.792	2.445	2.445	0.14
	1194.6	1218.2	700.4	0.792	2.448		
	1194.5	1218.2	699.3	0.792	2.443		
	1194.4	1218.1	698.7	0.792	2.440		
	1194.4	1218.2	699.0	0.792	2.442		
	1194.4	1218.4	700.4	0.792	2.449		
	1194.5	1218.3	700.2	0.792	2.447		
D Mix: Marshall - 75 Blows (2)	1190.5	1214.2	697.3	0.792	2.445	2.442	0.11
	1190.3	1214.1	696.9	0.792	2.443		
	1190.4	1214.2	696.2	0.792	2.440		
	1190.3	1214.0	696.2	0.792	2.440		
	1190.4	1214.2	696.7	0.792	2.442		
	1190.4	1214.1	696.4	0.792	2.440		
	1190.3	1214.1	697.6	0.792	2.447		
D Mix: Marshall - 75 Blows (3)	1191.2	1215.0	693.5	0.792	2.424	2.423	0.23
	1191.2	1215.0	694.3	0.792	2.428		
	1191.1	1214.8	690.9	0.792	2.411		
	1191.2	1215.1	693.2	0.792	2.423		
	1191.0	1215.0	692.8	0.792	2.421		
	1191.1	1215.1	693.2	0.792	2.423		
	1191.2	1215.0	694.4	0.792	2.428		
D Mix: Marshall - 75 Blows (4)	1194.1	1218.0	698.8	0.792	2.442	2.444	0.11
	1194.1	1218.0	698.8	0.792	2.442		
	1194.2	1218.0	699.5	0.792	2.445		
	1194.2	1218.1	699.6	0.792	2.446		
	1194.1	1217.9	698.3	0.792	2.439		
	1194.1	1218.1	699.8	0.792	2.447		
	1194.1	1217.9	699.5	0.792	2.445		
D Mix: Marshall - 75 Blows (5)	1189.8	1213.5	697.4	0.792	2.447	2.444	0.26
	1189.8	1213.7	695.6	0.792	2.438		
	1189.8	1213.5	697.6	0.792	2.448		
	1189.8	1213.7	697.6	0.792	2.449		
	1189.8	1213.6	696.9	0.792	2.445		
	1189.7	1213.5	694.4	0.792	2.433		
	1189.9	1213.7	697.8	0.792	2.449		

Table C2. Corelok Vacuum Seal Data for BM2 Mix: Marshall - 20 Blows

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: Marshall - 20 Blows (1)	1192.5	1216.4	667.8	0.792	2.300	2.304	0.13
	1192.6	1216.2	669.4	0.792	2.307		
	1192.6	1216.4	667.8	0.792	2.300		
	1192.5	1216.3	668.7	0.792	2.304		
	1192.5	1216.3	669.2	0.792	2.306		
	1192.4	1216.4	668.6	0.792	2.304		
	1192.5	1216.1	669.4	0.792	2.307		
BM2 Mix: Marshall - 20 Blows (2)	1188.4	1212.2	670.1	0.792	2.321	2.319	0.22
	1188.4	1212.1	668.1	0.792	2.312		
	1188.3	1212.1	668.9	0.792	2.316		
	1188.4	1212.2	668.8	0.792	2.315		
	1188.4	1212.3	671.3	0.792	2.326		
	1188.5	1212.2	670.6	0.792	2.323		
	1188.3	1212.1	669.6	0.792	2.319		
BM2 Mix: Marshall - 20 Blows (3)	1196.0	1219.7	681.8	0.792	2.354	2.355	0.23
	1196.0	1219.7	682.5	0.792	2.358		
	1196.0	1219.6	683.4	0.792	2.362		
	1195.9	1219.7	679.6	0.792	2.345		
	1195.9	1219.8	682.5	0.792	2.358		
	1196.0	1219.6	681.9	0.792	2.355		
	1195.9	1219.7	681.2	0.792	2.352		
BM2 Mix: Marshall - 20 Blows (4)	1195.9	1219.1	669.4	0.792	2.298	2.300	0.38
	1195.2	1218.9	671.3	0.792	2.309		
	1196.3	1219.5	666.7	0.792	2.285		
	1195.4	1219.0	670.1	0.792	2.303		
	1195.2	1218.9	670.6	0.792	2.306		
	1195.1	1219.1	670.6	0.792	2.306		
	1195.1	1219.0	667.2	0.792	2.291		
BM2 Mix: Marshall - 20 Blows (5)	1196.4	1219.6	672.6	0.792	2.311	2.319	0.19
	1196.0	1219.8	673.9	0.792	2.319		
	1196.0	1219.8	674.6	0.792	2.322		
	1196.0	1219.8	675.0	0.792	2.323		
	1196.0	1219.9	674.8	0.792	2.323		
	1196.0	1219.9	674.7	0.792	2.322		
	1196.0	1219.8	673.5	0.792	2.317		

Table C3. Corelok Vacuum Seal Data for BM2 Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: Marshall - 75 Blows (1)	1195.5	1219.1	692.2	0.792	2.405	2.409	0.09
	1195.3	1219.1	693.5	0.792	2.412		
	1195.3	1219.1	693.1	0.792	2.410		
	1195.3	1219.2	692.9	0.792	2.409		
	1195.3	1219.2	693.2	0.792	2.411		
	1195.3	1219.1	692.8	0.792	2.409		
	1195.4	1219.1	693.0	0.792	2.409		
BM2 Mix: Marshall - 75 Blows (2)	1194.8	1218.4	693.4	0.792	2.413	2.419	0.13
	1194.8	1218.6	694.8	0.792	2.420		
	1194.7	1218.6	695.0	0.792	2.421		
	1194.8	1218.4	695.0	0.792	2.421		
	1194.7	1218.5	694.3	0.792	2.418		
	1194.9	1218.6	694.6	0.792	2.418		
	1194.7	1218.6	695.2	0.792	2.422		
BM2 Mix: Marshall - 75 Blows (3)	1196.4	1219.9	692.8	0.792	2.405	2.405	0.06
	1196.2	1219.8	692.2	0.792	2.403		
	1196.1	1220.0	692.4	0.792	2.405		
	1196.1	1219.8	692.6	0.792	2.405		
	1196.0	1219.8	692.5	0.792	2.405		
	1196.1	1219.8	693.1	0.792	2.408		
	1196.0	1219.8	692.3	0.792	2.404		
BM2 Mix: Marshall - 75 Blows (4)	1195.0	1218.7	696.4	0.792	2.427	2.428	0.17
	1194.9	1220.2	694.7	0.792	2.421		
	1194.9	1220.2	696.4	0.792	2.429		
	1194.9	1220.2	695.6	0.792	2.425		
	1194.9	1220.3	696.7	0.792	2.431		
	1194.8	1220.3	696.2	0.792	2.429		
	1194.8	1220.5	697.1	0.792	2.434		
BM2 Mix: Marshall - 75 Blows (5)	1195.9	1221.0	697.3	0.792	2.431	2.424	0.26
	1195.8	1221.3	695.7	0.792	2.424		
	1195.7	1221.1	695.0	0.792	2.420		
	1196.0	1221.3	694.7	0.792	2.418		
	1195.8	1221.2	696.7	0.792	2.428		
	1195.8	1221.4	696.9	0.792	2.430		
	1195.9	1220.9	694.1	0.792	2.415		

Table C4. Corelok Vacuum Seal Data for BM2 Mix: SGC 8-10%

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: SGC 8-10% (1)	2973.1	3015.3	1672.2	0.686	2.320	2.323	0.19
	2972.7	3014.7	1671.6	0.686	2.319		
	2972.6	3014.7	1672.8	0.686	2.321		
	2972.5	3014.6	1670.7	0.686	2.318		
	2972.4	3014.4	1673.5	0.686	2.323		
	2972.4	3014.8	1676.3	0.686	2.328		
	2972.4	3014.8	1676.8	0.686	2.329		
BM2 Mix: SGC 8-10% (2)	2970.6	3011.8	1666.4	0.686	2.311	2.316	0.17
	2969.6	3011.1	1665.6	0.686	2.311		
	2969.6	3011.2	1667.1	0.686	2.314		
	2969.2	3011.1	1669.6	0.686	2.319		
	2968.9	3011.0	1669.6	0.686	2.319		
	2969.0	3011.2	1669.6	0.686	2.319		
	2969.0	3010.9	1669.0	0.686	2.318		
BM2 Mix: SGC 8-10% (3)	2968.9	3011.0	1673.8	0.686	2.327	2.332	0.12
	2968.8	3011.0	1675.1	0.686	2.330		
	2968.5	3010.7	1676.7	0.686	2.333		
	2968.6	3010.7	1678.2	0.686	2.335		
	2968.8	3010.7	1677.1	0.686	2.333		
	2968.5	3010.9	1677.2	0.686	2.334		
	2968.7	3010.7	1677.0	0.686	2.333		
BM2 Mix: SGC 8-10% (4)	2968.4	3010.4	1676.1	0.686	2.332	2.335	0.22
	2968.6	3010.2	1673.4	0.686	2.326		
	2968.4	3010.5	1677.1	0.686	2.334		
	2968.4	3010.2	1678.1	0.686	2.335		
	2968.3	3010.6	1679.6	0.686	2.338		
	2968.6	3010.6	1677.9	0.686	2.335		
	2969.5	3011.2	1682.6	0.686	2.342		
BM2 Mix: SGC 8-10% (5)	2968.1	3010.1	1670.9	0.686	2.323	2.325	0.15
	2968.1	3010.1	1673.0	0.686	2.326		
	2968.1	3010.1	1672.6	0.686	2.326		
	2967.5	3009.5	1669.0	0.686	2.320		
	2967.7	3009.5	1672.7	0.686	2.326		
	2967.5	3009.5	1672.4	0.686	2.326		
	2968.7	3010.2	1676.2	0.686	2.331		

Table C5. Corelok Vacuum Seal Data for BM2 Mix: SGC 4%

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: SGC 4% (1)	4912.3	4954.1	2917.5	0.686	2.486	2.488	0.17
	4911.6	4953.6	2913.3	0.686	2.482		
	4911.7	4954.1	2915.8	0.686	2.485		
	4911.6	4954.0	2922.2	0.686	2.493		
	4911.5	4954.1	2918.7	0.686	2.489		
	4911.3	4953.4	2920.5	0.686	2.491		
	4911.4	4953.8	2921.0	0.686	2.492		
BM2 Mix: SGC 4% (2)	4911.5	4952.6	2911.7	0.686	2.479	2.478	0.09
	4911.0	4952.1	2910.7	0.686	2.478		
	4909.7	4951.4	2911.0	0.686	2.480		
	4909.2	4951.2	2911.3	0.686	2.481		
	4908.9	4950.9	2908.9	0.686	2.478		
	4908.5	4950.8	2905.6	0.686	2.475		
	4908.6	4950.9	2906.7	0.686	2.476		
BM2 Mix: SGC 4% (3)	4909.1	4951.0	2907.6	0.686	2.476	2.478	0.07
	4908.9	4951.0	2908.7	0.686	2.478		
	4908.9	4951.3	2910.7	0.686	2.481		
	4908.8	4951.0	2908.5	0.686	2.478		
	4908.8	4951.2	2909.6	0.686	2.479		
	4908.8	4951.2	2906.9	0.686	2.476		
	4909.0	4951.1	2909.2	0.686	2.479		
BM2 Mix: SGC 4% (4)	4906.8	4948.8	2909.4	0.686	2.480	2.482	0.12
	4906.9	4948.7	2911.7	0.686	2.483		
	4906.5	4949.0	2910.2	0.686	2.482		
	4906.6	4948.6	2910.6	0.686	2.482		
	4906.6	4948.8	2909.4	0.686	2.481		
	4906.5	4948.7	2907.4	0.686	2.478		
	4906.5	4948.9	2914.9	0.686	2.488		
BM2 Mix: SGC 4% (5)	4911.8	4953.9	2908.4	0.686	2.476	2.476	0.08
	4911.8	4954.0	2905.8	0.686	2.472		
	4911.8	4953.9	2910.3	0.686	2.478		
	4911.5	4953.8	2908.6	0.686	2.476		
	4911.8	4953.7	2910.0	0.686	2.477		
	4911.6	4953.8	2909.1	0.686	2.477		
	4911.6	4953.9	2909.5	0.686	2.477		

Table C6. Corelok Vacuum Seal Data for A Mix: SGC 8%

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
A Mix: SGC 8% (1)	2985.0	3025.3	1716.9	0.686	2.389	2.397	0.19
	2983.5	3024.8	1718.4	0.686	2.394		
	2982.9	3024.4	1718.9	0.686	2.396		
	2983.0	3024.3	1719.3	0.686	2.396		
	2982.8	3024.2	1720.7	0.686	2.399		
	2982.8	3024.3	1722.1	0.686	2.402		
	2982.8	3024.4	1720.9	0.686	2.400		
A Mix: SGC 8% (2)	2985.8	3026.8	1711.1	0.686	2.377	2.381	0.35
	2984.9	3026.6	1704.3	0.686	2.366		
	2984.9	3026.3	1712.2	0.686	2.381		
	2984.8	3026.2	1714.0	0.686	2.384		
	2984.8	3026.4	1712.4	0.686	2.381		
	2984.9	3026.7	1714.6	0.686	2.386		
	2984.9	3026.4	1718.5	0.686	2.393		
A Mix: SGC 8% (3)	2986.4	3027.9	1718.7	0.686	2.392	2.396	0.15
	2986.4	3027.8	1720.6	0.686	2.395		
	2986.4	3027.9	1722.3	0.686	2.399		
	2986.4	3027.6	1722.2	0.686	2.398		
	2986.3	3027.6	1719.6	0.686	2.393		
	2986.4	3027.7	1724.1	0.686	2.402		
	2986.3	3027.7	1720.3	0.686	2.395		
A Mix: SGC 8% (4)	2981.4	3023.0	1722.5	0.686	2.405	2.413	0.17
	2982.4	3023.1	1727.9	0.686	2.413		
	2981.7	3022.8	1726.0	0.686	2.411		
	2981.5	3022.8	1726.9	0.686	2.413		
	2981.4	3022.9	1728.9	0.686	2.417		
	2981.5	3022.9	1727.2	0.686	2.413		
	2981.4	3022.9	1728.6	0.686	2.416		
A Mix: SGC 8% (5)	2980.3	3021.9	1705.3	0.686	2.373	2.375	0.19
	2980.3	3021.8	1702.5	0.686	2.368		
	2980.2	3021.5	1706.4	0.686	2.375		
	2980.2	3021.4	1705.9	0.686	2.374		
	2980.1	3021.3	1709.7	0.686	2.381		
	2980.2	3021.4	1707.7	0.686	2.377		
	2980.2	3021.4	1708.5	0.686	2.379		

Table C7. Corelok Vacuum Seal Data for D Mix: 1.25" Core Depth

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
D Mix: 1.25" Core Depth (1)	755.5	780.9	421.2	0.792	2.306	2.305	0.18
	755.6	780.7	421.6	0.792	2.308		
	755.6	780.8	420.5	0.792	2.300		
	755.6	780.8	422.1	0.792	2.312		
	755.5	781.0	421.3	0.792	2.307		
	755.2	780.7	420.8	0.792	2.305		
	755.3	780.5	420.2	0.792	2.299		
D Mix: 1.25" Core Depth (2)	688.8	714.0	377.5	0.792	2.261	2.277	0.41
	688.7	713.7	378.5	0.792	2.268		
	688.4	713.8	380.1	0.792	2.282		
	688.2	713.7	379.5	0.792	2.279		
	688.4	713.4	380.2	0.792	2.282		
	688.4	713.5	380.9	0.792	2.288		
	688.2	713.4	379.9	0.792	2.281		
D Mix: 1.25" Core Depth (3)	600.3	625.3	331.1	0.792	2.286	2.286	0.21
	600.2	625.4	330.3	0.792	2.280		
	600.2	625.3	331.8	0.792	2.293		
	599.9	625.2	330.2	0.792	2.281		
	599.9	625.4	331.4	0.792	2.291		
	600.0	625.2	330.8	0.792	2.285		
	600.0	625.0	330.8	0.792	2.285		
D Mix: 1.25" Core Depth (4)	616.7	641.5	342.1	0.792	2.300	2.310	0.40
	616.4	641.6	342.4	0.792	2.305		
	616.4	641.5	342.8	0.792	2.309		
	616.2	641.2	344.2	0.792	2.321		
	616.1	641.2	342.9	0.792	2.311		
	616.0	641.4	344.0	0.792	2.322		
	616.0	641.6	341.3	0.792	2.299		
D Mix: 1.25" Core Depth (5)	635.7	660.8	349.6	0.792	2.274	2.289	0.35
	635.6	660.7	351.5	0.792	2.290		
	635.5	660.5	350.7	0.792	2.284		
	635.2	660.4	351.9	0.792	2.296		
	635.0	660.4	351.8	0.792	2.296		
	635.0	660.3	351.6	0.792	2.294		
	635.0	660.0	350.5	0.792	2.285		

Table C8. Corelok Vacuum Seal Data for BM2 Mix: 2.0" Core Depth

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: 2.0" Core Depth (1)	978.8	1003.4	556.2	0.792	2.352	2.347	0.85
	978.3	1003.5	556.6	0.792	2.357		
	978.3	1003.5	549.2	0.792	2.316		
	978.2	1003.6	550.3	0.792	2.322		
	978.2	1003.5	557.1	0.792	2.360		
	978.2	1003.4	557.5	0.792	2.362		
	978.2	1003.4	557.6	0.792	2.363		
BM2 Mix: 2.0" Core Depth (2)	1047.8	1072.5	596.4	0.792	2.355	2.363	0.42
	1047.2	1072.3	596.6	0.792	2.359		
	1047.1	1072.4	597.3	0.792	2.363		
	1047.0	1072.2	594.7	0.792	2.349		
	1047.0	1072.2	598.3	0.792	2.368		
	1047.0	1072.1	599.5	0.792	2.375		
	1046.9	1072.1	599.6	0.792	2.376		
BM2 Mix: 2.0" Core Depth (3)	1096.5	1121.2	615.4	0.792	2.310	2.315	0.38
	1096.3	1121.0	613.6	0.792	2.302		
	1095.8	1121.0	615.9	0.792	2.315		
	1095.7	1120.8	617.2	0.792	2.322		
	1095.7	1120.9	614.1	0.792	2.307		
	1095.6	1120.9	617.3	0.792	2.323		
	1095.6	1120.8	617.7	0.792	2.325		
BM2 Mix: 2.0" Core Depth (4)	967.8	992.6	544.6	0.792	2.323	2.333	0.63
	967.5	992.5	545.6	0.792	2.329		
	967.1	992.4	549.9	0.792	2.356		
	967.3	992.5	547.2	0.792	2.339		
	967.3	992.4	542.6	0.792	2.314		
	967.1	992.4	548.5	0.792	2.348		
	967.2	992.2	544.8	0.792	2.326		
BM2 Mix: 2.0" Core Depth (5)	967.2	991.9	544.9	0.792	2.326	2.327	0.35
	966.7	991.8	546.5	0.792	2.337		
	966.6	991.9	546.4	0.792	2.337		
	966.6	991.8	544.5	0.792	2.326		
	966.7	991.6	542.7	0.792	2.316		
	966.5	991.8	543.6	0.792	2.322		
	966.6	991.7	543.6	0.792	2.321		

Table C9. Corelok Vacuum Seal Data for BM2 Mix: 6.0" Core Depth

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: 6.0" Core Depth (1)	2356.2	2398.1	1364.0	0.686	2.422	2.421	0.10
	2354.0	2396.2	1362.2	0.686	2.421		
	2354.1	2396.1	1360.4	0.686	2.416		
	2354.1	2396.2	1362.7	0.686	2.422		
	2353.9	2396.1	1362.0	0.686	2.420		
	2353.9	2396.4	1362.8	0.686	2.423		
	2353.9	2396.1	1363.0	0.686	2.423		
BM2 Mix: 6.0" Core Depth (2)	2461.4	2503.3	1436.5	0.686	2.447	2.446	0.07
	2461.4	2503.5	1435.1	0.686	2.444		
	2461.2	2503.2	1435.2	0.686	2.445		
	2461.2	2503.5	1435.9	0.686	2.447		
	2461.1	2503.3	1434.8	0.686	2.444		
	2461.1	2503.3	1436.6	0.686	2.448		
	2460.9	2503.1	1435.7	0.686	2.447		
BM2 Mix: 6.0" Core Depth (3)	2480.6	2523.0	1443.3	0.686	2.437	2.437	0.05
	2480.5	2522.7	1443.0	0.686	2.436		
	2480.8	2522.6	1443.9	0.686	2.437		
	2480.4	2522.5	1442.9	0.686	2.436		
	2480.3	2522.5	1443.2	0.686	2.437		
	2480.2	2522.6	1443.6	0.686	2.438		
	2480.1	2522.7	1442.0	0.686	2.435		
BM2 Mix: 6.0" Core Depth (4)	2457.6	2499.5	1434.8	0.686	2.449	2.449	0.09
	2457.1	2499.2	1435.0	0.686	2.450		
	2457.1	2499.4	1435.2	0.686	2.451		
	2456.9	2498.5	1433.0	0.686	2.445		
	2456.3	2498.0	1435.2	0.686	2.451		
	2456.2	2497.6	1433.5	0.686	2.447		
	2456.2	2497.6	1434.1	0.686	2.448		
BM2 Mix: 6.0" Core Depth (5)	2563.6	2605.2	1497.5	0.686	2.448	2.448	0.20
	2563.1	2604.8	1496.7	0.686	2.447		
	2562.4	2603.6	1496.5	0.686	2.447		
	2562.1	2603.7	1492.1	0.686	2.438		
	2562.2	2603.1	1498.4	0.686	2.452		
	2561.6	2603.1	1497.9	0.686	2.452		
	2561.5	2602.8	1497.6	0.686	2.451		

Table C10. Corelok Vacuum Seal Data for A Mix: 6.0" Core Depth

Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
A Mix: 6.0" Core Depth (1)	4174.2	4215.6	2443.8	0.686	2.439	2.440	0.04
	4174.0	4215.3	2444.7	0.686	2.440		
	4173.5	4215.0	2444.2	0.686	2.440		
	4173.6	4215.0	2445.2	0.686	2.441		
	4173.5	4214.9	2444.1	0.686	2.440		
	4173.5	4214.5	2445.1	0.686	2.441		
	4173.2	4214.6	2443.1	0.686	2.439		
A Mix: 6.0" Core Depth (2)	4076.1	4117.1	2384.8	0.686	2.437	2.438	0.05
	4076.0	4117.4	2385.0	0.686	2.438		
	4075.6	4117.0	2385.1	0.686	2.438		
	4075.0	4116.7	2386.2	0.686	2.441		
	4075.1	4116.5	2384.1	0.686	2.437		
	4075.1	4116.1	2385.0	0.686	2.438		
	4075.0	4116.2	2385.1	0.686	2.439		
A Mix: 6.0" Core Depth (3)	3420.1	3461.0	1981.3	0.686	2.408	2.406	0.08
	3419.7	3460.8	1979.5	0.686	2.406		
	3419.3	3460.2	1977.3	0.686	2.402		
	3419.1	3460.1	1978.7	0.686	2.405		
	3418.7	3459.7	1978.5	0.686	2.405		
	3418.6	3459.8	1979.4	0.686	2.407		
	3418.6	3459.6	1978.3	0.686	2.405		
A Mix: 6.0" Core Depth (4)	3369.7	3410.0	1919.8	0.686	2.354	2.356	0.07
	3368.9	3409.2	1919.0	0.686	2.353		
	3367.6	3407.9	1919.1	0.686	2.355		
	3366.8	3407.1	1919.9	0.686	2.357		
	3365.8	3406.5	1919.4	0.686	2.357		
	3364.9	3405.8	1919.1	0.686	2.358		
	3364.6	3405.5	1918.1	0.686	2.357		
A Mix: 6.0" Core Depth (5)	3921.8	3963.1	2305.2	0.686	2.455	2.454	0.15
	3921.4	3962.3	2301.2	0.686	2.449		
	3920.8	3962.1	2306.4	0.686	2.457		
	3920.5	3962.0	2303.7	0.686	2.454		
	3920.5	3961.8	2300.7	0.686	2.449		
	3920.4	3961.9	2303.3	0.686	2.453		
	3920.5	3962.0	2306.7	0.686	2.458		

Table C11. Dimensional Analysis Data for D Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
D Mix: Marshall - 75 Blows (1)	1194.6	10.16	6.12	496.34	2.407	2.409	0.33
	1194.6	10.16	6.10	493.65	2.420		
	1194.7	10.16	6.12	495.90	2.409		
	1194.7	10.16	6.11	495.56	2.411		
	1194.7	10.16	6.10	494.53	2.416		
	1194.6	10.17	6.11	495.92	2.409		
	1194.6	10.18	6.14	498.85	2.395		
D Mix: Marshall - 75 Blows (2)	1190.7	10.16	6.10	494.73	2.407	2.411	0.18
	1190.8	10.16	6.09	493.69	2.412		
	1190.8	10.15	6.09	493.04	2.415		
	1190.8	10.16	6.09	494.06	2.410		
	1190.8	10.16	6.11	495.11	2.405		
	1190.6	10.16	6.07	492.68	2.417		
	1190.7	10.16	6.11	494.40	2.408		
D Mix: Marshall - 75 Blows (3)	1191.4	10.16	6.15	498.72	2.389	2.390	0.24
	1191.2	10.17	6.15	499.05	2.387		
	1191.3	10.15	6.18	500.40	2.381		
	1191.2	10.15	6.16	498.59	2.389		
	1191.2	10.16	6.14	497.21	2.396		
	1191.4	10.16	6.13	496.88	2.398		
	1191.3	10.16	6.15	498.20	2.391		
D Mix: Marshall - 75 Blows (4)	1194.3	10.15	6.12	495.49	2.410	2.409	0.23
	1194.3	10.16	6.14	497.24	2.402		
	1194.3	10.16	6.14	497.16	2.402		
	1194.3	10.16	6.11	495.43	2.411		
	1194.4	10.16	6.10	493.96	2.418		
	1194.3	10.16	6.12	495.47	2.410		
	1194.3	10.14	6.14	495.83	2.409		
D Mix: Marshall - 75 Blows (5)	1190.1	10.16	6.10	494.02	2.409	2.412	0.15
	1190.1	10.16	6.07	492.18	2.418		
	1190.1	10.15	6.09	492.63	2.416		
	1190.0	10.16	6.10	494.18	2.408		
	1190.0	10.15	6.10	493.86	2.410		
	1190.0	10.16	6.10	493.55	2.411		
	1190.0	10.17	6.08	493.27	2.412		

Table C12. Dimensional Analysis Data for BM2 Mix: Marshall - 20 Blows

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: Marshall - 20 Blows (1)	1192.9	10.16	6.56	531.01	2.246	2.244	0.25
	1192.8	10.16	6.55	530.96	2.246		
	1192.8	10.16	6.55	530.55	2.248		
	1192.8	10.16	6.56	531.28	2.245		
	1193	10.17	6.57	533.83	2.235		
	1193	10.17	6.57	533.26	2.237		
	1192.9	10.16	6.55	530.26	2.250		
BM2 Mix: Marshall - 20 Blows (2)	1188.8	10.17	6.45	523.71	2.270	2.271	0.19
	1188.9	10.16	6.44	522.46	2.276		
	1188.9	10.18	6.46	525.23	2.264		
	1188.9	10.17	6.44	523.01	2.273		
	1188.9	10.17	6.46	524.60	2.266		
	1188.9	10.17	6.44	522.92	2.274		
	1188.9	10.17	6.45	523.05	2.273		
BM2 Mix: Marshall - 20 Blows (3)	1196.7	10.16	6.34	514.40	2.326	2.322	0.18
	1196.5	10.17	6.35	515.47	2.321		
	1196.6	10.16	6.37	515.88	2.320		
	1196.5	10.16	6.37	516.37	2.317		
	1196.6	10.16	6.36	515.70	2.320		
	1196.4	10.17	6.36	515.91	2.319		
	1196.4	10.16	6.34	513.81	2.329		
BM2 Mix: Marshall - 20 Blows (4)	1196.1	10.15	6.54	529.26	2.260	2.255	0.10
	1195.7	10.16	6.55	530.51	2.254		
	1195.7	10.16	6.55	529.98	2.256		
	1195.5	10.16	6.54	530.12	2.255		
	1195.4	10.15	6.55	530.24	2.254		
	1195.5	10.16	6.54	530.02	2.256		
	1195.4	10.16	6.55	530.68	2.253		
BM2 Mix: Marshall - 20 Blows (5)	1196.6	10.16	6.53	529.13	2.261	2.261	0.36
	1196.6	10.16	6.53	528.86	2.263		
	1196.3	10.16	6.51	528.00	2.266		
	1196.3	10.17	6.57	533.21	2.244		
	1196.1	10.16	6.52	528.76	2.262		
	1196.1	10.16	6.51	527.29	2.268		
	1196.2	10.16	6.52	528.06	2.265		

Table C13. Dimensional Analysis Data for BM2 Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: Marshall - 75 Blows (1)	1195.3	10.15	6.27	507.54	2.355	2.351	0.30
	1195.4	10.17	6.27	508.83	2.349		
	1195.5	10.16	6.26	506.92	2.358		
	1195.5	10.17	6.27	508.75	2.350		
	1195.5	10.16	6.26	507.08	2.358		
	1195.4	10.18	6.28	511.42	2.337		
	1195.5	10.16	6.28	508.37	2.352		
BM2 Mix: Marshall - 75 Blows (2)	1195.2	10.19	6.23	507.61	2.355	2.358	0.15
	1195.1	10.19	6.22	506.82	2.358		
	1195.0	10.20	6.21	506.73	2.358		
	1195.0	10.19	6.22	506.87	2.358		
	1194.9	10.17	6.22	505.42	2.364		
	1194.9	10.19	6.23	507.73	2.353		
	1194.8	10.19	6.22	506.17	2.360		
BM2 Mix: Marshall - 75 Blows (3)	1196.4	10.16	6.30	510.38	2.344	2.342	0.24
	1196.3	10.17	6.28	509.80	2.347		
	1196.2	10.17	6.30	511.36	2.339		
	1196.2	10.16	6.33	513.17	2.331		
	1196.2	10.16	6.28	509.76	2.347		
	1196.1	10.17	6.30	510.67	2.342		
	1196.2	10.16	6.29	510.19	2.345		
BM2 Mix: Marshall - 75 Blows (4)	1195.1	10.16	6.23	505.29	2.365	2.366	0.16
	1195	10.17	6.21	504.74	2.368		
	1194.9	10.17	6.22	505.70	2.363		
	1194.9	10.17	6.23	505.84	2.362		
	1194.8	10.18	6.21	505.18	2.365		
	1194.8	10.17	6.21	504.18	2.370		
	1194.8	10.16	6.21	503.56	2.373		
BM2 Mix: Marshall - 75 Blows (5)	1195.9	10.17	6.21	504.24	2.372	2.369	0.21
	1195.9	10.17	6.21	504.18	2.372		
	1195.9	10.17	6.22	505.28	2.367		
	1195.9	10.16	6.22	503.91	2.373		
	1195.9	10.17	6.24	506.54	2.361		
	1195.9	10.16	6.22	503.54	2.375		
	1195.9	10.18	6.22	505.65	2.365		

Table C14. Dimensional Analysis Data for BM2 Mix: SGC 8-10%

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: SGC 8-10% (1)	2972.9	15.01	7.43	1313.52	2.263	2.262	0.10
	2973.5	15.02	7.43	1314.69	2.262		
	2973.6	15.02	7.43	1315.58	2.260		
	2973.7	15.02	7.43	1315.97	2.260		
	2973.7	15.01	7.43	1315.04	2.261		
	2973.7	15.01	7.42	1313.02	2.265		
	2973.9	15.02	7.42	1312.67	2.266		
BM2 Mix: SGC 8-10% (2)	2970.4	15.03	7.43	1317.75	2.254	2.254	0.22
	2970.4	15.05	7.43	1321.16	2.248		
	2970.4	15.01	7.43	1314.31	2.260		
	2970.4	15.05	7.42	1321.09	2.248		
	2970.3	15.01	7.43	1314.03	2.260		
	2970.2	15.02	7.43	1316.65	2.256		
	2970.4	15.03	7.44	1317.88	2.254		
BM2 Mix: SGC 8-10% (3)	2970.5	15.01	7.42	1312.00	2.264	2.262	0.15
	2970.2	15.01	7.42	1313.63	2.261		
	2970.2	15.02	7.43	1315.42	2.258		
	2970.1	15.03	7.42	1314.96	2.259		
	2970.1	15.02	7.42	1315.24	2.258		
	2970.1	15.01	7.42	1311.73	2.264		
	2970.0	15.02	7.40	1310.42	2.266		
BM2 Mix: SGC 8-10% (4)	2969.3	15.03	7.43	1318.77	2.252	2.256	0.17
	2969.5	15.03	7.43	1317.71	2.254		
	2969.5	15.01	7.42	1312.79	2.262		
	2969.6	15.01	7.43	1314.92	2.258		
	2969.8	15.03	7.43	1318.10	2.253		
	2969.9	15.03	7.43	1317.99	2.253		
	2970.0	15.02	7.42	1314.91	2.259		
BM2 Mix: SGC 8-10% (5)	2968.6	15.03	7.41	1313.10	2.261	2.261	0.09
	2968.8	15.02	7.42	1314.29	2.259		
	2968.5	15.02	7.41	1312.83	2.261		
	2968.7	15.02	7.42	1313.79	2.260		
	2968.6	15.02	7.41	1312.10	2.262		
	2968.6	15.02	7.41	1312.66	2.262		
	2968.6	15.01	7.41	1310.49	2.265		

Table C15. Dimensional Analysis Data for BM2 Mix: SGC 4%

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: SGC 4% (1)	4912	14.99	11.34	1999.90	2.456	2.456	0.08
	4912.2	14.98	11.34	1998.51	2.458		
	4912.4	14.99	11.33	1997.55	2.459		
	4912.4	15.00	11.34	2002.11	2.454		
	4912.5	14.99	11.34	2000.86	2.455		
	4912.6	14.99	11.33	2000.39	2.456		
	4912.6	14.99	11.34	2001.09	2.455		
BM2 Mix: SGC 4% (2)	4910.1	15.00	11.37	2008.64	2.444	2.444	0.11
	4910.2	14.99	11.37	2006.49	2.447		
	4909.8	14.99	11.37	2005.99	2.448		
	4909.6	15.00	11.37	2009.15	2.444		
	4909.6	15.01	11.38	2012.11	2.440		
	4909.7	15.01	11.37	2009.98	2.443		
	4909.9	15.00	11.37	2008.74	2.444		
BM2 Mix: SGC 4% (3)	4911.1	15.01	11.34	2005.43	2.449	2.448	0.03
	4911	15.00	11.35	2005.42	2.449		
	4911.1	15.00	11.36	2005.55	2.449		
	4911.1	15.00	11.36	2005.53	2.449		
	4909.6	15.00	11.36	2006.09	2.447		
	4909.6	15.00	11.36	2006.35	2.447		
	4909.6	15.00	11.35	2005.76	2.448		
BM2 Mix: SGC 4% (4)	4904.3	15.00	11.34	2004.87	2.446	2.450	0.12
	4903	15.00	11.34	2003.01	2.448		
	4902.7	15.00	11.33	2001.16	2.450		
	4902.5	14.99	11.34	2000.52	2.451		
	4902.5	14.99	11.33	1998.87	2.453		
	4902.6	14.99	11.32	1997.19	2.455		
	4902.7	15.00	11.34	2003.01	2.448		
BM2 Mix: SGC 4% (5)	4913.9	15.00	11.38	2011.57	2.443	2.443	0.07
	4913.5	15.00	11.38	2010.25	2.444		
	4913.5	15.00	11.38	2010.61	2.444		
	4913	15.00	11.39	2010.48	2.444		
	4912.3	15.00	11.39	2011.90	2.442		
	4912.3	15.00	11.39	2013.73	2.439		
	4912.3	14.99	11.39	2009.85	2.444		

Table C16. Dimensional Analysis Data for A Mix: SGC 8%

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
A Mix: SGC 8% (1)	2985.1	15.00	7.43	1312.37	2.275	2.277	0.22
	2984.8	15.00	7.42	1311.30	2.276		
	2984.7	15.00	7.45	1315.90	2.268		
	2984.8	15.00	7.41	1310.45	2.278		
	2984.8	15.00	7.40	1308.10	2.282		
	2984.7	15.00	7.40	1307.04	2.284		
	2984.7	15.00	7.42	1311.30	2.276		
A Mix: SGC 8% (2)	2984.4	15.00	7.39	1305.59	2.286	2.284	0.16
	2984.4	15.00	7.41	1307.77	2.282		
	2984.3	14.99	7.39	1304.59	2.288		
	2984.3	14.98	7.40	1304.00	2.289		
	2984.3	15.00	7.42	1309.51	2.279		
	2984.4	15.01	7.40	1307.86	2.282		
	2984.4	15.00	7.41	1308.44	2.281		
A Mix: SGC 8% (3)	2977.6	15.02	7.42	1314.18	2.266	2.277	0.53
	2977.5	15.03	7.41	1313.44	2.267		
	2977.5	15.02	7.41	1311.83	2.270		
	2977.5	14.99	7.36	1298.11	2.294		
	2977.5	15.02	7.37	1305.52	2.281		
	2977.4	15.01	7.34	1298.30	2.293		
	2977.5	15.00	7.42	1311.63	2.270		
A Mix: SGC 8% (4)	2975.6	15.01	7.46	1318.92	2.256	2.262	0.27
	2975.5	14.99	7.42	1310.30	2.271		
	2975.5	15.01	7.42	1311.39	2.269		
	2975.5	15.01	7.44	1316.44	2.260		
	2975.6	15.00	7.46	1316.63	2.260		
	2975.3	15.00	7.44	1313.49	2.265		
	2975.4	15.02	7.44	1319.07	2.256		
A Mix: SGC 8% (5)	2983.2	15.02	7.46	1319.86	2.260	2.268	0.24
	2983.2	15.01	7.44	1315.27	2.268		
	2983.2	15.00	7.45	1316.18	2.267		
	2983.1	15.01	7.41	1311.78	2.274		
	2983.1	14.99	7.44	1313.44	2.271		
	2983.1	15.01	7.42	1311.45	2.275		
	2983.1	15.01	7.45	1317.74	2.264		

Table C17. Dimensional Analysis Data for D Mix: 1.25" Core Depth

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
D Mix: 1.25" Core Depth (1)	755.1	9.62	4.79	348.17	2.169	2.147	0.80
	755.1	9.64	4.87	355.83	2.122		
	755.2	9.65	4.83	353.00	2.139		
	755.3	9.64	4.83	352.95	2.140		
	755.3	9.67	4.80	352.55	2.142		
	755.2	9.62	4.78	347.91	2.171		
	755.2	9.67	4.79	351.85	2.146		
D Mix: 1.25" Core Depth (2)	688.6	9.72	4.43	328.54	2.096	2.124	0.89
	688.4	9.70	4.38	323.65	2.127		
	688.4	9.67	4.37	321.13	2.144		
	688.4	9.65	4.41	322.26	2.136		
	688.3	9.71	4.43	327.95	2.099		
	688.3	9.69	4.37	322.33	2.135		
	688.3	9.66	4.41	323.02	2.131		
D Mix: 1.25" Core Depth (3)	599.9	9.69	3.89	286.74	2.092	2.073	0.56
	599.8	9.70	3.90	288.44	2.079		
	599.8	9.69	3.95	291.27	2.059		
	599.8	9.72	3.91	289.88	2.069		
	599.8	9.69	3.93	289.77	2.070		
	599.8	9.68	3.95	290.95	2.062		
	599.8	9.69	3.91	288.39	2.080		
D Mix: 1.25" Core Depth (4)	616	9.70	3.87	286.28	2.152	2.163	0.90
	615.9	9.67	3.87	283.64	2.171		
	615.9	9.68	3.85	283.35	2.174		
	615.9	9.67	3.84	282.02	2.184		
	615.9	9.69	3.86	284.46	2.165		
	615.8	9.72	3.90	289.89	2.124		
	615.9	9.70	3.85	284.00	2.169		
D Mix: 1.25" Core Depth (5)	635.3	9.69	4.03	297.00	2.139	2.158	0.45
	635.2	9.67	3.99	292.99	2.168		
	635.2	9.65	4.02	293.93	2.161		
	635.2	9.65	4.04	294.86	2.154		
	635.2	9.67	3.99	293.15	2.167		
	635.2	9.67	4.01	294.34	2.158		
	635.2	9.67	4.02	294.56	2.156		

Table C18. Dimensional Analysis Data for BM2 Mix: 2.0" Core Depth

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: 2.0" Core Depth (1)	977.4	9.54	6.02	429.93	2.273	2.263	0.38
	977.3	9.52	6.08	432.57	2.259		
	977.3	9.52	6.07	431.68	2.264		
	977.4	9.53	6.06	432.07	2.262		
	977.3	9.54	6.06	432.63	2.259		
	977.3	9.53	6.10	434.33	2.250		
	977.3	9.53	6.03	429.69	2.274		
BM2 Mix: 2.0" Core Depth (2)	1045.8	9.55	6.41	458.97	2.279	2.280	0.11
	1045.8	9.54	6.43	459.20	2.277		
	1045.8	9.54	6.42	459.33	2.277		
	1045.8	9.54	6.41	457.85	2.284		
	1045.8	9.54	6.42	458.58	2.281		
	1045.7	9.53	6.44	458.43	2.281		
	1045.8	9.53	6.43	458.41	2.281		
BM2 Mix: 2.0" Core Depth (3)	1094.8	9.56	6.85	491.39	2.228	2.233	0.23
	1094.8	9.57	6.84	491.62	2.227		
	1094.8	9.56	6.81	488.44	2.241		
	1094.8	9.57	6.82	489.67	2.236		
	1094.8	9.56	6.82	489.69	2.236		
	1094.8	9.58	6.81	490.13	2.234		
	1094.7	9.57	6.84	491.02	2.229		
BM2 Mix: 2.0" Core Depth (4)	966.5	9.55	6.06	433.94	2.227	2.240	0.48
	966.5	9.55	6.03	431.58	2.239		
	966.5	9.55	5.99	429.14	2.252		
	966.5	9.56	6.05	434.15	2.226		
	966.5	9.55	6.01	429.99	2.248		
	966.5	9.56	6.02	432.29	2.236		
	966.5	9.55	5.99	429.45	2.251		
BM2 Mix: 2.0" Core Depth (5)	966.2	9.55	6.02	431.14	2.241	2.248	0.48
	966.2	9.56	5.99	430.00	2.247		
	966.2	9.54	5.99	428.05	2.257		
	966.2	9.56	6.00	429.94	2.247		
	966.2	9.55	6.00	429.67	2.249		
	966.2	9.55	6.06	433.27	2.230		
	966.2	9.53	5.99	426.91	2.263		

Table C19. Dimensional Analysis Data for BM2 Mix: 6.0" Core Depth

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: 6.0" Core Depth (1)	2352.6	15.20	5.73	1039.81	2.263	2.259	0.88
	2352.7	15.22	5.81	1055.72	2.229		
	2352.7	15.21	5.79	1051.38	2.238		
	2352.6	15.19	5.68	1030.24	2.284		
	2352.7	15.18	5.74	1038.55	2.265		
	2352.7	15.20	5.75	1042.52	2.257		
	2352.7	15.18	5.72	1033.41	2.277		
BM2 Mix: 6.0" Core Depth (2)	2459.4	15.23	5.87	1068.41	2.302	2.257	0.93
	2459.4	15.21	6.02	1093.56	2.249		
	2459.4	15.20	6.02	1091.10	2.254		
	2459.4	15.21	6.02	1092.94	2.250		
	2459.4	15.19	6.01	1089.48	2.257		
	2459.3	15.21	6.06	1099.85	2.236		
	2459.4	15.20	6.03	1094.23	2.248		
BM2 Mix: 6.0" Core Depth (3)	2478.5	15.21	6.01	1092.24	2.269	2.259	1.10
	2478.4	15.23	6.05	1102.27	2.248		
	2478.3	15.21	6.11	1109.67	2.233		
	2478.4	15.22	6.03	1096.20	2.261		
	2478.3	15.21	5.97	1083.60	2.287		
	2478.4	15.21	6.13	1114.25	2.224		
	2478.3	15.23	5.95	1082.97	2.288		
BM2 Mix: 6.0" Core Depth (4)	2454.4	15.22	6.06	1101.81	2.228	2.258	1.11
	2454.4	15.20	6.00	1087.47	2.257		
	2454.4	15.22	6.04	1099.22	2.233		
	2454.4	15.22	6.01	1092.03	2.248		
	2454.3	15.20	5.91	1071.01	2.292		
	2454.3	15.21	5.91	1072.50	2.288		
	2454.4	15.20	5.98	1084.16	2.264		
BM2 Mix: 6.0" Core Depth (5)	2557.7	15.21	6.12	1110.29	2.304	2.295	0.88
	2557.7	15.22	6.18	1124.36	2.275		
	2557.7	15.22	6.06	1103.27	2.318		
	2557.7	15.20	6.13	1111.14	2.302		
	2557.7	15.22	6.07	1103.96	2.317		
	2557.6	15.22	6.16	1121.05	2.281		
	2557.6	15.23	6.19	1127.57	2.268		

Table C20. Dimensional Analysis Data for A Mix: 6.0" Core Depth

Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
A Mix: 6.0" Core Depth (1)	4171.9	15.30	9.67	1776.23	2.349	2.355	0.21
	4172.3	15.28	9.67	1770.89	2.356		
	4172.4	15.28	9.64	1767.43	2.361		
	4172.6	15.29	9.63	1768.53	2.359		
	4172.5	15.28	9.66	1771.26	2.356		
	4172.6	15.28	9.70	1777.71	2.347		
	4172.8	15.28	9.66	1772.08	2.355		
A Mix: 6.0" Core Depth (2)	4074.9	15.23	9.50	1729.58	2.356	2.372	0.55
	4074.9	15.23	9.47	1723.31	2.365		
	4074.9	15.23	9.39	1709.79	2.383		
	4075.1	15.24	9.39	1711.55	2.381		
	4075.1	15.23	9.41	1713.54	2.378		
	4075.2	15.26	9.46	1729.41	2.356		
	4075.2	15.22	9.40	1707.67	2.386		
A Mix: 6.0" Core Depth (3)	3419.6	15.25	8.01	1462.47	2.338	2.316	0.64
	3418.7	15.26	8.01	1465.32	2.333		
	3418.3	15.26	8.09	1478.59	2.312		
	3418.2	15.26	8.07	1475.53	2.317		
	3418.2	15.25	8.11	1481.44	2.307		
	3418.2	15.26	8.15	1488.52	2.296		
	3418.2	15.25	8.11	1480.82	2.308		
A Mix: 6.0" Core Depth (4)	3365.1	15.25	8.12	1481.70	2.271	2.271	0.21
	3365	15.25	8.11	1481.81	2.271		
	3364.9	15.25	8.08	1476.00	2.280		
	3364.8	15.25	8.13	1484.64	2.266		
	3364.8	15.25	8.11	1481.08	2.272		
	3364.7	15.25	8.11	1480.36	2.273		
	3364.7	15.25	8.14	1485.42	2.265		
A Mix: 6.0" Core Depth (5)	3921.3	15.25	9.02	1646.16	2.382	2.385	0.12
	3921.2	15.25	9.01	1643.97	2.385		
	3921.1	15.24	9.01	1644.01	2.385		
	3920.9	15.23	9.02	1641.76	2.388		
	3920.8	15.24	9.00	1640.75	2.390		
	3920.8	15.25	9.02	1645.13	2.383		
	3920.7	15.25	9.02	1645.11	2.383		

Table C21. Parafilm Wrapping Data for D Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
D Mix: Marshall - 75 Blows (1)	1194.5	1198.3	704.9	0.685	2.448	2.444	0.22
	1194.5	1198.5	705.0	0.685	2.449		
	1194.5	1198.4	704.9	0.685	2.449		
	1194.5	1197.7	703.3	0.685	2.439		
	1194.5	1197.3	703.0	0.685	2.437		
	1194.5	1197.1	703.6	0.685	2.439		
	1194.5	1197.3	704.5	0.685	2.444		
D Mix: Marshall - 75 Blows (2)	1190.3	1193.5	699.2	0.685	2.431	2.436	0.36
	1190.4	1193.2	699.7	0.685	2.432		
	1190.4	1193.2	700.4	0.685	2.436		
	1190.5	1193.1	700.1	0.685	2.434		
	1190.4	1193.3	703.0	0.685	2.449		
	1190.4	1193.1	702.4	0.685	2.446		
	1190.4	1193.2	697.9	0.685	2.423		
D Mix: Marshall - 75 Blows (3)	1191.2	1194.1	697.9	0.685	2.421	2.420	0.26
	1191.2	1194.1	698.6	0.685	2.425		
	1191.3	1194.0	698.8	0.685	2.425		
	1191.2	1193.9	698.9	0.685	2.426		
	1191.2	1193.7	697.5	0.685	2.418		
	1191.3	1193.8	695.9	0.685	2.410		
	1191.3	1194.0	696.1	0.685	2.412		
D Mix: Marshall - 75 Blows (4)	1194.1	1197.5	704.7	0.685	2.448	2.431	0.34
	1194.2	1197.1	702.4	0.685	2.435		
	1194.1	1196.8	701.4	0.685	2.430		
	1194.1	1196.8	700.6	0.685	2.426		
	1194.1	1196.8	699.8	0.685	2.422		
	1194.1	1197.0	701.3	0.685	2.430		
	1194.1	1196.9	701.5	0.685	2.430		
D Mix: Marshall - 75 Blows (5)	1189.8	1193.5	702.8	0.685	2.452	2.430	0.52
	1189.8	1193.3	700.2	0.685	2.438		
	1189.8	1192.4	696.3	0.685	2.417		
	1189.8	1192.5	699.0	0.685	2.430		
	1189.9	1192.5	699.8	0.685	2.434		
	1189.8	1192.4	696.6	0.685	2.418		
	1189.9	1192.4	697.3	0.685	2.421		

Table C22. Parafilm Wrapping Data for BM2 Mix: Marshall - 20 Blows

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: Marshall - 20 Blows (1)	1192.8	1195.3	666.2	0.685	2.270	2.277	0.44
	1192.8	1195.3	665.0	0.685	2.265		
	1192.7	1195.4	666.1	0.685	2.270		
	1192.8	1195.8	666.8	0.463	2.283		
	1192.8	1195.6	666.0	0.463	2.278		
	1192.8	1195.6	669.8	0.463	2.295		
	1192.8	1195.4	665.7	0.463	2.276		
BM2 Mix: Marshall - 20 Blows (2)	1187.6	1190.1	671.2	0.463	2.313	2.306	0.17
	1187.6	1190.3	669.3	0.463	2.305		
	1187.6	1190.0	670.2	0.463	2.308		
	1187.6	1190.0	669.3	0.463	2.304		
	1187.5	1190.0	669.6	0.463	2.306		
	1187.5	1190.1	668.2	0.463	2.300		
	1187.5	1190.1	670.1	0.463	2.309		
BM2 Mix: Marshall - 20 Blows (3)	1196.0	1198.6	682.7	0.463	2.344	2.348	0.25
	1196.0	1198.6	683.0	0.463	2.345		
	1196.0	1198.4	682.3	0.463	2.341		
	1196.0	1198.7	685.6	0.463	2.358		
	1196.1	1198.7	683.8	0.463	2.349		
	1196.1	1198.7	685.1	0.463	2.355		
	1196.1	1198.6	683.8	0.463	2.348		
BM2 Mix: Marshall - 20 Blows (4)	1196.3	1199.0	671.7	0.463	2.294	2.289	0.12
	1196.3	1198.9	670.8	0.463	2.290		
	1196.3	1199.0	670.7	0.463	2.290		
	1196.4	1198.9	670.7	0.463	2.288		
	1196.3	1198.8	670.0	0.463	2.286		
	1196.4	1198.9	671.3	0.463	2.291		
	1196.3	1198.8	670.4	0.463	2.287		
BM2 Mix: Marshall - 20 Blows (5)	1196.3	1198.8	672.7	0.463	2.297	2.296	0.23
	1196.4	1198.7	672.4	0.463	2.295		
	1196.3	1198.6	671.1	0.463	2.289		
	1196.4	1198.6	674.1	0.463	2.302		
	1196.3	1198.7	674.6	0.517	2.303		
	1196.3	1198.7	671.7	0.517	2.290		
	1196.3	1198.6	672.7	0.517	2.294		

Table C23. Parafilm Wrapping Data for BM2 Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: Marshall - 75 Blows (1)	1195.4	1198.0	689.0	0.463	2.375	2.386	0.44
	1195.4	1198.0	693.8	0.463	2.398		
	1195.4	1197.9	690.9	0.463	2.383		
	1195.4	1197.9	689.5	0.463	2.377		
	1195.4	1197.9	689.3	0.463	2.376		
	1195.4	1197.8	694.0	0.463	2.397		
	1195.4	1197.9	693.3	0.463	2.395		
BM2 Mix: Marshall - 75 Blows (2)	1195.1	1197.5	692.9	0.463	2.393	2.396	0.34
	1195.1	1197.7	696.9	0.463	2.413		
	1195.0	1197.5	693.5	0.463	2.397		
	1195.0	1197.6	692.4	0.463	2.392		
	1195.1	1197.4	693.9	0.463	2.397		
	1195.0	1197.3	692.4	0.463	2.390		
	1195.0	1197.3	692.5	0.463	2.391		
BM2 Mix: Marshall - 75 Blows (3)	1196.1	1198.6	688.8	0.463	2.371	2.370	0.27
	1196.1	1198.6	691.1	0.463	2.382		
	1196.1	1198.4	687.1	0.463	2.362		
	1196.1	1198.5	689.5	0.463	2.374		
	1196.1	1198.5	688.1	0.463	2.368		
	1196.0	1198.5	687.6	0.463	2.366		
	1196.1	1198.5	688.3	0.463	2.368		
BM2 Mix: Marshall - 75 Blows (4)	1194.8	1197.2	691.1	0.463	2.385	2.396	0.45
	1194.8	1197.3	691.6	0.463	2.388		
	1194.8	1197.2	693.0	0.463	2.394		
	1194.8	1197.4	697.4	0.517	2.414		
	1194.9	1197.5	691.8	0.517	2.387		
	1194.8	1197.4	695.6	0.517	2.405		
	1194.8	1197.6	694.7	0.517	2.402		
BM2 Mix: Marshall - 75 Blows (5)	1196.1	1198.9	692.1	0.517	2.386	2.389	0.24
	1196.1	1198.7	694.8	0.517	2.398		
	1196.1	1198.7	693.9	0.517	2.393		
	1196.1	1198.6	693.3	0.517	2.390		
	1196.1	1198.5	692.2	0.517	2.384		
	1196.1	1198.4	691.5	0.517	2.381		
	1196.1	1198.5	693.1	0.517	2.389		

Table C24. Parafilm Wrapping Data for BM2 Mix: SGC 8-10%

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: SGC 8-10% (1)	2977.1	2979.4	1681.6	0.463	2.303	2.295	0.16
	2977.2	2980.2	1676.8	0.463	2.296		
	2977.2	2980.3	1677.0	0.463	2.296		
	2977.2	2980.3	1674.9	0.463	2.292		
	2977.0	2980.1	1674.7	0.463	2.292		
	2977.0	2980.2	1676.4	0.463	2.295		
	2977.0	2980.1	1675.3	0.463	2.293		
BM2 Mix: SGC 8-10% (2)	2968.0	2971.3	1665.8	0.463	2.286	2.282	0.12
	2968.0	2971.2	1662.1	0.463	2.279		
	2968.1	2971.3	1663.1	0.463	2.281		
	2968.0	2971.1	1663.1	0.463	2.281		
	2968.1	2971.0	1666.4	0.463	2.286		
	2967.9	2971.3	1662.9	0.463	2.281		
	2968.0	2971.2	1664.1	0.463	2.283		
BM2 Mix: SGC 8-10% (3)	2971.6	2974.8	1674.7	0.517	2.297	2.296	0.15
	2971.2	2974.2	1677.6	0.517	2.302		
	2971.2	2974.3	1672.7	0.517	2.293		
	2971.2	2974.5	1673.5	0.517	2.295		
	2971.3	2974.4	1675.2	0.517	2.298		
	2971.4	2974.8	1671.6	0.517	2.292		
	2971.5	2974.6	1673.2	0.517	2.294		
BM2 Mix: SGC 8-10% (4)	2971.2	2974.7	1677.2	0.463	2.303	2.301	0.11
	2971.1	2974.4	1674.6	0.463	2.298		
	2971.2	2974.3	1675.2	0.463	2.299		
	2971.1	2974.4	1675.1	0.463	2.299		
	2971.1	2974.5	1677.8	0.463	2.304		
	2971.2	2974.3	1675.5	0.463	2.300		
	2971.3	2974.6	1677.3	0.463	2.303		
BM2 Mix: SGC 8-10% (5)	2970.3	2973.6	1673.4	0.463	2.297	2.298	0.11
	2970.3	2973.5	1673.4	0.463	2.297		
	2970.3	2973.6	1674.0	0.463	2.298		
	2970.3	2973.6	1677.2	0.463	2.304		
	2970.3	2973.4	1674.1	0.463	2.298		
	2970.3	2973.6	1673.0	0.463	2.296		
	2970.3	2973.4	1674.3	0.463	2.298		

Table C25. Parafilm Wrapping Data for BM2 Mix: SGC 4%

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: SGC 4% (1)	4911.7	4915.3	2919.2	0.463	2.470	2.470	0.07
	4911.6	4914.7	2919.2	0.463	2.470		
	4911.6	4914.7	2920.9	0.463	2.472		
	4911.7	4914.7	2918.0	0.463	2.468		
	4911.6	4914.8	2917.9	0.463	2.468		
	4911.7	4914.6	2919.6	0.463	2.470		
	4911.8	4914.7	2921.6	0.463	2.472		
BM2 Mix: SGC 4% (2)	4909.2	4912.3	2909.8	0.463	2.460	2.460	0.18
	4909.1	4912.3	2910.0	0.463	2.460		
	4909.2	4912.5	2911.6	0.517	2.461		
	4909.2	4912.2	2916.6	0.517	2.467		
	4909.3	4912.6	2905.6	0.517	2.454		
	4909.3	4912.5	2911.6	0.517	2.461		
	4909.3	4912.4	2906.8	0.517	2.455		
BM2 Mix: SGC 4% (3)	4909.5	4912.8	2912.5	0.463	2.463	2.462	0.07
	4909.5	4912.6	2911.5	0.463	2.462		
	4909.4	4912.6	2912.9	0.463	2.464		
	4909.5	4912.9	2911.0	0.517	2.461		
	4909.4	4912.7	2910.3	0.517	2.460		
	4909.5	4912.5	2914.1	0.517	2.464		
	4909.4	4912.6	2913.7	0.517	2.464		
BM2 Mix: SGC 4% (4)	4902.3	4905.6	2913.2	0.517	2.468	2.466	0.05
	4902.2	4905.5	2911.9	0.517	2.467		
	4902.2	4905.3	2911.1	0.517	2.466		
	4902.1	4905.3	2911.2	0.517	2.466		
	4902.3	4905.3	2910.6	0.517	2.465		
	4902.1	4905.3	2911.8	0.517	2.467		
	4902.3	4905.3	2910.5	0.517	2.465		
BM2 Mix: SGC 4% (5)	4911.8	4915.0	2913.4	0.517	2.462	2.459	0.10
	4911.6	4915.1	2909.3	0.517	2.457		
	4911.7	4914.9	2913.3	0.517	2.461		
	4911.7	4914.9	2911.7	0.517	2.460		
	4911.6	4914.9	2908.1	0.517	2.455		
	4911.6	4914.8	2912.0	0.517	2.460		
	4911.7	4914.8	2912.6	0.517	2.461		

Table C26. Parafilm Wrapping Data for A Mix: SGC 8%

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
A Mix: SGC 8% (1)	2982.4	2987.9	1742.0	0.700	2.409	2.358	0.97
	2983.1	2989.0	1712.0	0.658	2.353		
	2981.9	2987.6	1716.0	0.683	2.360		
	2981.2	2986.8	1706.4	0.683	2.343		
	2981.3	2986.3	1708.5	0.683	2.347		
	2981.6	2986.8	1708.8	0.683	2.347		
	2981.3	2986.3	1710.3	0.683	2.350		
A Mix: SGC 8% (2)	2984.6	2990.3	1712.0	0.700	2.350	2.346	0.31
	2984.6	2990.0	1711.2	0.658	2.349		
	2984.6	2990.6	1703.1	0.658	2.335		
	2984.4	2990.2	1712.0	0.683	2.350		
	2984.4	2989.5	1706.6	0.683	2.340		
	2984.4	2990.3	1715.0	0.683	2.356		
	2984.3	2989.3	1708.9	0.683	2.344		
A Mix: SGC 8% (3)	2985.9	2991.0	1710.0	0.700	2.344	2.343	0.24
	2986.5	2992.6	1703.3	0.658	2.333		
	2986.2	2992.3	1710.0	0.658	2.346		
	2978.7	2983.6	1702.4	0.683	2.338		
	2975.7	2981.2	1705.8	0.683	2.348		
	2976.6	2982.2	1703.0	0.683	2.342		
	2977.1	2982.8	1707.1	0.683	2.349		
A Mix: SGC 8% (4)	2981.2	2984.9	1710.0	0.700	2.348	2.350	0.21
	2980.3	2986.6	1707.2	0.658	2.347		
	2976.2	2982.5	1708.2	0.658	2.353		
	2974.6	2979.1	1710.6	0.683	2.357		
	2974.6	2979.2	1709.0	0.683	2.354		
	2973.9	2978.9	1704.8	0.683	2.348		
	2974.2	2979.0	1702.7	0.683	2.343		
A Mix: SGC 8% (5)	2979.8	2985.0	1702.0	0.700	2.336	2.344	0.22
	2980.5	2986.5	1710.0	0.658	2.352		
	2981.3	2987.4	1708.5	0.658	2.348		
	2979.4	2984.2	1704.8	0.683	2.342		
	2979.1	2984.2	1705.2	0.683	2.343		
	2979.7	2984.5	1707.0	0.683	2.345		
	2980.4	2985.2	1705.2	0.683	2.341		

Table C27. Parafilm Wrapping Data for D Mix: 1.25" Core Depth

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
D Mix: 1.25" Core Depth (1)	755.0	758.3	420.3	0.658	2.267	2.265	0.73
	755.1	758.3	414.8	0.658	2.230		
	755.0	758.3	421.0	0.658	2.272		
	755.0	758.2	421.3	0.658	2.274		
	755.0	758.5	420.4	0.658	2.269		
	755.1	758.4	419.8	0.658	2.264		
	755.0	758.4	422.3	0.658	2.281		
D Mix: 1.25" Core Depth (2)	687.7	691.2	380.7	0.658	2.253	2.249	0.17
	687.7	691.0	380.3	0.658	2.250		
	687.8	691.1	380.9	0.658	2.254		
	687.9	691.2	379.7	0.658	2.244		
	687.7	691.3	379.9	0.658	2.248		
	687.7	691.0	380.2	0.658	2.249		
	687.8	691.3	379.5	0.658	2.244		
D Mix: 1.25" Core Depth (3)	599.8	603.1	332.2	0.658	2.256	2.254	0.18
	599.8	603.5	331.0	0.658	2.247		
	599.9	603.4	332.1	0.658	2.255		
	599.8	603.2	332.3	0.658	2.257		
	599.8	603.3	331.4	0.658	2.250		
	599.8	603.5	332.2	0.658	2.258		
	599.8	603.4	332.2	0.658	2.257		
D Mix: 1.25" Core Depth (4)	615.6	619.1	345.2	0.658	2.292	2.291	0.13
	615.7	619.0	345.0	0.658	2.289		
	615.7	619.0	345.3	0.658	2.292		
	615.6	618.8	344.9	0.658	2.288		
	615.6	618.6	345.8	0.658	2.295		
	615.6	618.9	345.6	0.658	2.295		
	615.6	618.7	344.9	0.658	2.288		
D Mix: 1.25" Core Depth (5)	634.5	638.0	352.7	0.658	2.266	2.271	0.12
	634.5	638.0	353.3	0.658	2.271		
	634.5	638.1	353.4	0.658	2.272		
	634.5	637.9	353.1	0.658	2.269		
	634.5	637.9	353.6	0.658	2.273		
	634.5	638.0	353.1	0.658	2.269		
	634.5	638.1	353.6	0.658	2.274		

Table C28. Parafilm Wrapping Data for BM2 Mix: 2.0" Core Depth

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: 2.0" Core Depth (1)	977.5	981.5	557.7	0.658	2.340	2.339	0.15
	977.5	981.3	557.5	0.658	2.338		
	977.6	981.5	557.5	0.658	2.338		
	977.6	981.4	557.1	0.658	2.336		
	977.5	981.4	558.8	0.658	2.346		
	977.8	981.6	557.2	0.658	2.336		
	977.6	981.6	557.8	0.658	2.340		
BM2 Mix: 2.0" Core Depth (2)	1045.9	1049.9	598.8	0.658	2.350	2.349	0.18
	1046.0	1050.1	597.4	0.658	2.343		
	1046.0	1049.9	598.4	0.658	2.348		
	1045.9	1049.7	599.3	0.658	2.352		
	1045.9	1050.3	598.3	0.658	2.349		
	1045.9	1049.9	598.3	0.658	2.348		
	1045.9	1049.8	600.0	0.658	2.356		
BM2 Mix: 2.0" Core Depth (3)	1095.1	1098.7	619.6	0.683	2.311	2.309	0.10
	1095.1	1098.7	619.5	0.683	2.311		
	1095.3	1098.9	619.0	0.683	2.308		
	1095.2	1098.9	618.6	0.683	2.306		
	1095.2	1098.9	618.8	0.683	2.307		
	1095.3	1098.9	619.6	0.683	2.311		
	1095.3	1099.0	620.0	0.683	2.313		
BM2 Mix: 2.0" Core Depth (4)	966.6	970.3	551.6	0.683	2.339	2.336	0.20
	966.6	970.2	551.0	0.683	2.335		
	966.6	970.1	550.0	0.683	2.329		
	966.5	969.9	551.0	0.683	2.335		
	966.5	970.2	552.1	0.683	2.342		
	966.7	970.1	550.3	0.683	2.330		
	966.5	970.2	551.4	0.683	2.338		
BM2 Mix: 2.0" Core Depth (5)	966.7	970.6	548.7	0.683	2.323	2.327	0.26
	966.7	970.5	549.1	0.683	2.325		
	966.8	970.3	549.6	0.683	2.326		
	966.6	970.5	547.6	0.683	2.317		
	966.6	970.2	551.1	0.683	2.336		
	966.6	970.3	549.8	0.683	2.329		
	966.6	970.2	550.4	0.683	2.332		

Table C29. Parafilm Wrapping Data for BM2 Mix: 6.0" Core Depth

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
BM2 Mix: 6.0" Core Depth (1)	2352.2	2356.3	1327.7	0.683	2.300	2.308	0.28
	2352.1	2356.4	1328.8	0.683	2.303		
	2352.0	2356.5	1329.1	0.683	2.304		
	2352.0	2356.2	1332.4	0.683	2.311		
	2352.0	2355.9	1336.2	0.683	2.320		
	2352.1	2356.3	1331.3	0.683	2.309		
	2352.0	2356.3	1332.3	0.683	2.311		
BM2 Mix: 6.0" Core Depth (2)	2458.9	2463.1	1406.2	0.683	2.340	2.338	0.38
	2459.0	2463.2	1408.9	0.683	2.346		
	2459.1	2463.3	1406.3	0.683	2.340		
	2458.9	2463.0	1396.7	0.683	2.319		
	2458.8	2463.1	1404.8	0.683	2.337		
	2458.9	2463.0	1405.9	0.683	2.339		
	2458.9	2463.3	1408.3	0.683	2.345		
BM2 Mix: 6.0" Core Depth (3)	2478.0	2482.1	1407.4	0.683	2.319	2.324	0.53
	2478.5	2482.4	1420.0	0.683	2.346		
	2478.7	2482.8	1406.3	0.683	2.315		
	2478.9	2482.9	1411.3	0.683	2.326		
	2478.7	2482.6	1407.6	0.683	2.318		
	2478.5	2482.5	1414.2	0.683	2.333		
	2478.9	2482.8	1403.3	0.683	2.309		
BM2 Mix: 6.0" Core Depth (4)	2453.9	2457.9	1403.3	0.683	2.340	2.343	0.23
	2453.8	2457.8	1408.9	0.683	2.353		
	2453.7	2458.1	1403.1	0.683	2.340		
	2453.9	2457.8	1406.3	0.683	2.346		
	2453.8	2458.2	1405.1	0.683	2.344		
	2453.8	2458.0	1401.3	0.683	2.336		
	2453.9	2458.1	1403.9	0.683	2.341		
BM2 Mix: 6.0" Core Depth (5)	2557.0	2561.2	1472.3	0.683	2.362	2.371	0.58
	2556.3	2560.5	1486.1	0.683	2.393		
	2556.3	2560.6	1482.6	0.683	2.385		
	2556.3	2560.7	1473.9	0.683	2.366		
	2556.3	2560.4	1476.7	0.683	2.372		
	2556.6	2560.9	1469.4	0.683	2.356		
	2556.4	2560.8	1471.9	0.683	2.362		

Table C30. Parafilm Wrapping Data for A Mix: 6.0" Core Depth

Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_p	G_{mb}	Avg. G_{mb}	V (%)
A Mix: 6.0" Core Depth (1)	4172.1	4177.8	2438.2	0.683	2.410	2.408	0.17
	4172.3	4177.6	2440.2	0.683	2.412		
	4172.4	4177.4	2440.6	0.683	2.413		
	4172.0	4178.6	2432.8	0.683	2.403		
	4172.6	4178.5	2436.5	0.621	2.408		
	4172.7	4178.6	2436.7	0.621	2.409		
	4172.6	4178.1	2432.5	0.621	2.403		
A Mix: 6.0" Core Depth (2)	4073.9	4079.3	2388.6	0.683	2.421	2.423	0.08
	4073.7	4079.2	2391.0	0.683	2.425		
	4073.9	4079.0	2390.4	0.683	2.423		
	4073.9	4079.5	2391.7	0.683	2.426		
	4074.0	4079.1	2391.4	0.683	2.425		
	4073.9	4079.2	2388.7	0.683	2.421		
	4073.7	4079.0	2389.1	0.683	2.422		
A Mix: 6.0" Core Depth (3)	3419.0	3424.4	1974.9	0.683	2.372	2.371	0.07
	3418.5	3424.3	1972.0	0.621	2.369		
	3418.8	3424.2	1974.4	0.621	2.372		
	3418.8	3423.6	1972.8	0.621	2.369		
	3419.0	3424.2	1974.4	0.621	2.372		
	3418.2	3423.6	1971.5	0.621	2.368		
	3418.0	3423.6	1973.6	0.621	2.372		
A Mix: 6.0" Core Depth (4)	3371.6	3376.8	1916.8	0.683	2.321	2.327	0.31
	3366.3	3371.7	1924.8	0.683	2.339		
	3365.2	3370.5	1918.7	0.621	2.332		
	3365.4	3371.0	1912.4	0.621	2.322		
	3365.4	3371.1	1911.5	0.621	2.320		
	3365.2	3371.1	1912.8	0.621	2.323		
	3364.1	3367.6	1918.6	0.621	2.331		
A Mix: 6.0" Core Depth (5)	3919.5	3926.3	2303.2	0.683	2.430	2.434	0.19
	3919.4	3926.5	2309.9	0.683	2.440		
	3918.9	3924.4	2308.5	0.683	2.437		
	3919.0	3924.4	2309.4	0.683	2.439		
	3919.9	3925.2	2305.2	0.683	2.431		
	3920.0	3925.2	2304.6	0.683	2.430		
	3919.8	3925.0	2304.0	0.683	2.430		

Table C31. Precision and Accuracy Evaluation Parafilm Calibration

Operator 1 Calibration							
Box 1							
Trial	M_{dry} (g)	M_{sub} (g)	G_{ac}	M_{dwac} (g)	M_{wwac} (g)	G_p	Avg. G_p
1	1445.5	932.3	2.817	1448.7	930.7	0.667	0.658
2	1445.5	932.4	2.817	1448.7	931.0	0.696	
3	1445.5	932.2	2.816	1448.5	930.3	0.612	
Box 2							
1	1445.5	932.2	2.816	1449.3	930.6	0.704	0.683
2	1445.5	932.3	2.817	1449.7	930.3	0.677	
2	1445.6	932.3	2.816	1449.4	930.4	0.667	
Box 3							
1	1445.5	932.1	2.816	1448.8	929.8	0.589	0.621
2	1445.6	931.8	2.814	1448.9	930.0	0.647	
3	1445.5	932.0	2.815	1448.7	930.1	0.627	
Operator 2 Calibration							
Box 1							
Trial	M_{dry} (g)	M_{sub} (g)	G_{ac}	M_{dwac} (g)	M_{wwac} (g)	G_p	Avg. G_p
1	1445.5	932.4	2.817	1448.7	930.7	0.653	0.658
2	1445.5	932.2	2.816	1448.7	930.6	0.663	
Box 4							
1	1445.5	932.4	2.817	1447.8	930.2	0.511	0.462
2	1445.5	932.2	2.816	1447.9	928.8	0.414	
Box 5							
1	1445.5	932.2	2.816	1447.7	930.9	0.629	0.516
2	1445.5	932.1	2.816	1447.8	928.7	0.404	

Table C32. Saturated Surface-Dry Specimens Data for D Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
D Mix: Marshall - 75 Blows (1)	1194.8	1194.7	712.5	2.478	2.477	0.03	0.07
	1194.4	1194.7	712.5	2.477			
	1194.4	1194.8	712.8	2.478			
	1194.5	1194.9	712.8	2.478			
	1194.5	1194.9	712.6	2.477			
	1194.5	1195.0	712.6	2.476			
	1194.5	1194.8	712.7	2.478			
D Mix: Marshall - 75 Blows (2)	1190.4	1190.6	709.1	2.472	2.473	0.03	0.06
	1190.3	1190.6	709.1	2.472			
	1190.3	1190.6	709.3	2.473			
	1190.3	1190.6	709.3	2.473			
	1190.4	1190.7	709.0	2.471			
	1190.4	1190.7	709.3	2.473			
	1190.5	1190.7	709.4	2.474			
D Mix: Marshall - 75 Blows (3)	1191.1	1191.8	707.5	2.459	2.460	0.05	0.13
	1191.2	1191.7	707.6	2.461			
	1191.2	1191.9	707.7	2.460			
	1191.3	1191.9	707.9	2.461			
	1191.3	1191.9	707.4	2.459			
	1191.2	1191.9	708.1	2.462			
	1191.3	1191.9	707.8	2.461			
D Mix: Marshall - 75 Blows (4)	1194.2	1194.4	711.3	2.472	2.472	0.05	0.05
	1194.1	1194.3	711.5	2.473			
	1194.1	1194.4	711.6	2.473			
	1194.1	1194.4	711.4	2.472			
	1194.1	1194.4	711.2	2.471			
	1194.2	1194.4	711.8	2.475			
	1194.1	1194.4	711.1	2.471			
D Mix: Marshall - 75 Blows (5)	1189.9	1190.1	709.3	2.475	2.474	0.04	0.06
	1189.8	1190.1	709.4	2.475			
	1189.8	1190.1	709.2	2.474			
	1189.8	1190.1	709.2	2.474			
	1189.9	1190.2	708.9	2.472			
	1189.9	1190.1	709.1	2.474			
	1189.8	1190.1	709.2	2.474			

Table C33. Saturated Surface-Dry Specimens Data for BM2 Mix: Marshall–20 Blows

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
BM2 Mix: Marshall - 20 Blows (1)	1192.7	1197.7	696.3	2.379	2.376	0.12	1.18
	1192.6	1198.1	697.1	2.380			
	1192.6	1199.2	696.5	2.372			
	1192.8	1198.7	696.3	2.374			
	1192.9	1198.8	696.9	2.377			
	1192.9	1199.3	697.0	2.375			
	1192.9	1198.9	696.5	2.374			
BM2 Mix: Marshall - 20 Blows (2)	1188.6	1190.8	689.9	2.373	2.373	0.04	0.49
	1188.3	1190.8	689.8	2.372			
	1188.2	1189.9	689.4	2.374			
	1188.2	1190.8	690.2	2.374			
	1187.5	1190.0	689.4	2.372			
	1187.5	1190.3	689.5	2.371			
	1187.6	1190.4	689.9	2.373			
BM2 Mix: Marshall - 20 Blows (3)	1196.0	1196.7	696.6	2.392	2.393	0.08	0.18
	1195.9	1196.7	697.0	2.393			
	1195.9	1196.8	696.6	2.391			
	1195.7	1196.6	697.1	2.394			
	1195.9	1196.8	697.3	2.394			
	1195.8	1196.8	697.8	2.396			
	1195.8	1196.8	697.1	2.393			
BM2 Mix: Marshall - 20 Blows (4)	1195.3	1200.4	695.9	2.369	2.368	0.11	1.04
	1195.6	1200.6	695.2	2.366			
	1195.5	1201.6	696.9	2.369			
	1196.0	1200.8	695.7	2.368			
	1195.9	1199.8	695.5	2.371			
	1195.9	1201.3	696.9	2.371			
	1195.6	1202.0	696.4	2.365			
BM2 Mix: Marshall - 20 Blows (5)	1196.2	1199.7	696.9	2.379	2.376	0.10	0.81
	1196.2	1200.3	696.2	2.373			
	1196.1	1200.0	696.4	2.375			
	1196.1	1200.2	696.9	2.377			
	1196.1	1200.8	698.0	2.379			
	1196.1	1199.9	697.0	2.378			
	1196.1	1200.5	696.7	2.374			

Table C34. Saturated Surface-Dry Specimens Data for BM2 Mix: Marshall - 75 Blows

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
BM2 Mix: Marshall - 75 Blows (1)	1195.6	1197.4	709.0	2.448	2.446	0.07	0.42
	1195.3	1197.4	708.6	2.445			
	1195.3	1197.6	708.5	2.444			
	1195.3	1197.4	709.0	2.447			
	1195.4	1197.3	709.0	2.448			
	1195.2	1197.5	708.7	2.445			
	1195.4	1197.4	708.9	2.447			
BM2 Mix: Marshall - 75 Blows (2)	1194.8	1196.3	707.4	2.444	2.445	0.08	0.32
	1194.9	1196.5	707.5	2.444			
	1194.9	1196.3	708.1	2.448			
	1194.7	1196.3	707.4	2.444			
	1194.8	1196.4	707.5	2.444			
	1194.8	1196.5	708.3	2.447			
	1195.0	1196.7	708.3	2.447			
BM2 Mix: Marshall - 75 Blows (3)	1196.1	1197.3	708.4	2.447	2.448	0.08	0.32
	1196.1	1197.8	709.2	2.448			
	1196.1	1197.5	709.7	2.452			
	1195.9	1197.4	709.0	2.449			
	1195.9	1197.6	708.9	2.447			
	1195.9	1197.6	709.0	2.448			
	1196.1	1197.7	709.4	2.450			
BM2 Mix: Marshall - 75 Blows (4)	1194.8	1195.9	709.7	2.457	2.460	0.06	0.20
	1194.9	1195.8	710.2	2.461			
	1195.0	1195.8	710.0	2.460			
	1194.7	1195.7	710.0	2.460			
	1194.7	1195.7	710.3	2.461			
	1194.7	1195.7	710.5	2.462			
	1195.0	1195.9	710.4	2.461			
BM2 Mix: Marshall - 75 Blows (5)	1195.9	1197.6	711.1	2.458	2.460	0.08	0.36
	1196.0	1197.8	711.4	2.459			
	1196.1	1197.8	711.5	2.460			
	1195.9	1197.6	711.0	2.458			
	1195.9	1197.8	711.7	2.460			
	1195.9	1197.5	711.8	2.462			
	1196.1	1197.8	712.2	2.463			

Table C35. Saturated Surface-Dry Specimens Data for BM2 Mix: SGC 8-10%

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
BM2 Mix: SGC 8-10% (1)	2973.8	2985.1	1729.5	2.368	2.367	0.07	1.10
	2974.1	2988.8	1732.2	2.367			
	2974.6	2989.7	1732.4	2.366			
	2975.7	2989.0	1730.8	2.365			
	2974.7	2989.1	1733.2	2.369			
	2975.8	2988.9	1732.9	2.369			
	2975.6	2990.5	1732.7	2.366			
BM2 Mix: SGC 8-10% (2)	2970.4	2980.7	1725.6	2.367	2.367	0.13	1.05
	2970.1	2980.2	1728.5	2.373			
	2965.8	2979.1	1725.3	2.365			
	2965.8	2982.6	1727.6	2.363			
	2966.2	2981.5	1727.4	2.365			
	2968.6	2981.1	1726.5	2.366			
	2968.7	2982.3	1727.9	2.367			
BM2 Mix: SGC 8-10% (3)	2970.0	2978.8	1729.2	2.377	2.374	0.07	0.92
	2970.4	2979.7	1727.3	2.372			
	2969.7	2980.2	1729.1	2.374			
	2969.3	2981.8	1730.1	2.372			
	2969.6	2982.9	1732.8	2.375			
	2970.0	2983.0	1732.2	2.374			
	2970.2	2983.6	1732.9	2.375			
BM2 Mix: SGC 8-10% (4)	2970.0	2979.3	1729.2	2.376	2.374	0.06	0.92
	2969.3	2981.2	1729.3	2.372			
	2969.5	2982.6	1731.4	2.373			
	2970.3	2982.6	1731.5	2.374			
	2970.9	2981.5	1729.7	2.373			
	2970.3	2982.0	1731.6	2.375			
	2970.9	2982.4	1730.0	2.372			
BM2 Mix: SGC 8-10% (5)	2968.6	2981.0	1729.3	2.372	2.368	0.09	1.11
	2969.0	2984.0	1729.0	2.366			
	2968.6	2983.6	1728.7	2.366			
	2968.8	2984.1	1730.6	2.368			
	2969.7	2983.4	1729.5	2.368			
	2970.2	2982.9	1729.0	2.369			
	2970.2	2983.6	1729.5	2.368			

Table C36. Saturated Surface-Dry Specimens Data for BM2 Mix: SGC 4%

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
BM2 Mix: SGC 4% (1)	4912.4	4913.7	2950.8	2.503	2.502	0.04	0.09
	4911.4	4913.4	2949.9	2.501			
	4911.3	4912.9	2949.1	2.501			
	4911.5	4913.7	2951.6	2.503			
	4911.1	4912.8	2950.3	2.502			
	4911.4	4913.1	2950.9	2.503			
	4911.5	4913.5	2951.5	2.503			
BM2 Mix: SGC 4% (2)	4909.4	4911.3	2943.2	2.494	2.494	0.03	0.12
	4908.8	4911.6	2942.4	2.493			
	4908.7	4911.0	2943.2	2.495			
	4908.9	4911.7	2943.9	2.495			
	4908.8	4910.5	2942.8	2.495			
	4908.8	4910.9	2943.3	2.495			
	4909.0	4911.8	2944.6	2.495			
BM2 Mix: SGC 4% (3)	4909.3	4911.0	2944.4	2.496	2.497	0.03	0.09
	4908.9	4910.7	2943.9	2.496			
	4909.0	4910.6	2944.5	2.497			
	4909.3	4911.6	2945.6	2.497			
	4908.9	4911.0	2944.3	2.496			
	4909.2	4910.6	2945.1	2.498			
	4909.2	4911.3	2945.5	2.497			
BM2 Mix: SGC 4% (4)	4902.2	4904.3	2943.7	2.500	2.502	0.03	0.11
	4901.9	4904.4	2944.9	2.502			
	4901.8	4903.8	2944.5	2.502			
	4902.1	4904.3	2945.4	2.502			
	4901.9	4903.8	2944.2	2.501			
	4901.9	4904.3	2944.9	2.502			
	4902.0	4904.4	2944.8	2.502			
BM2 Mix: SGC 4% (5)	4911.9	4913.5	2946.0	2.497	2.497	0.02	0.08
	4911.7	4913.0	2945.2	2.496			
	4911.4	4913.0	2945.6	2.496			
	4911.5	4913.3	2946.3	2.497			
	4911.4	4912.9	2945.7	2.497			
	4911.4	4913.0	2945.3	2.496			
	4911.5	4913.2	2946.5	2.497			

Table C37. Saturated Surface-Dry Specimens Data for A Mix: SGC 8%

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
A Mix: SGC 8% (1)	2982.8	2991.8	1781.6	2.465	2.468	0.10	0.68
	2982.5	2992.4	1783.7	2.468			
	2984.7	2990.5	1782.0	2.470			
	2982.0	2990.1	1783.7	2.472			
	2982.6	2990.3	1783.0	2.470			
	2982.8	2991.0	1782.1	2.467			
	2981.9	2990.3	1781.5	2.467			
A Mix: SGC 8% (2)	2985.0	2993.1	1765.4	2.431	2.435	0.07	0.63
	2984.4	2991.7	1766.6	2.436			
	2984.3	2991.2	1765.8	2.435			
	2984.1	2991.9	1766.2	2.435			
	2984.9	2992.8	1767.5	2.436			
	2984.3	2992.4	1766.2	2.434			
	2984.1	2992.4	1767.6	2.436			
A Mix: SGC 8% (3)	2987.4	2997.0	1781.0	2.457	2.460	0.08	0.77
	2986.0	2997.0	1782.7	2.459			
	2977.5	2987.1	1777.6	2.462			
	2977.1	2986.9	1776.4	2.459			
	2978.5	2986.5	1776.8	2.462			
	2977.0	2984.8	1775.4	2.462			
	2975.3	2984.5	1775.1	2.460			
A Mix: SGC 8% (4)	2982.8	2987.6	1782.3	2.475	2.476	0.07	0.47
	2975.6	2982.9	1780.0	2.474			
	2975.4	2981.3	1779.9	2.477			
	2974.7	2980.3	1779.3	2.477			
	2974.9	2980.5	1778.7	2.475			
	2974.7	2979.8	1778.8	2.477			
	2974.7	2979.8	1780.0	2.479			
A Mix: SGC 8% (5)	2981.1	2989.9	1764.2	2.432	2.432	0.05	0.74
	2980.4	2990.0	1765.3	2.434			
	2983.1	2991.7	1764.2	2.430			
	2980.0	2990.0	1764.4	2.431			
	2983.4	2990.5	1764.2	2.433			
	2980.8	2991.0	1765.4	2.432			
	2981.1	2989.9	1765.0	2.434			

Table C38. Saturated Surface-Dry Specimens Data for D Mix: 1.25" Core Depth

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
D Mix: 1.25" Core Depth (1)	755.2	756.6	432.1	2.327	2.324	0.16	0.45
	755.0	756.4	431.8	2.326			
	754.9	756.2	431.8	2.327			
	754.9	756.2	430.8	2.320			
	755.2	756.2	431.5	2.326			
	754.8	756.1	430.4	2.317			
	754.9	757.4	432.5	2.323			
D Mix: 1.25" Core Depth (2)	688.1	689.6	390.6	2.301	2.299	0.08	0.71
	687.7	690.1	390.8	2.298			
	688.0	689.9	390.6	2.299			
	687.6	690.1	390.5	2.295			
	688.3	690.0	390.7	2.300			
	687.7	689.6	390.5	2.299			
	688.1	691.0	391.7	2.299			
D Mix: 1.25" Core Depth (3)	600.2	601.3	341.4	2.309	2.309	0.07	0.43
	599.8	600.9	341.1	2.309			
	599.8	601.0	341.3	2.310			
	599.7	601.0	341.0	2.307			
	599.8	601.1	341.6	2.311			
	599.9	600.9	340.9	2.307			
	599.9	600.8	340.9	2.308			
D Mix: 1.25" Core Depth (4)	616.2	617.1	353.3	2.336	2.330	0.15	0.42
	615.8	616.9	352.9	2.333			
	615.6	616.8	352.8	2.332			
	615.5	617.0	352.4	2.326			
	615.9	617.0	352.6	2.329			
	615.9	616.6	351.8	2.326			
	615.7	616.9	352.5	2.329			
D Mix: 1.25" Core Depth (5)	635.1	637.0	363.5	2.322	2.314	0.15	0.72
	634.6	636.9	362.4	2.312			
	634.5	636.8	362.5	2.313			
	634.6	636.8	362.3	2.312			
	635.2	636.8	362.3	2.314			
	634.8	636.5	362.1	2.313			
	634.9	636.7	362.4	2.315			

Table C39. Saturated Surface-Dry Specimens Data for BM2 Mix: 2.0" Core Depth

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
BM2 Mix: 2.0" Core Depth (1)	978.0	980.7	572.5	2.396	2.393	0.09	0.69
	977.9	981.1	571.7	2.389			
	977.5	980.6	572.1	2.393			
	977.6	980.0	571.4	2.393			
	977.3	980.0	571.4	2.392			
	977.3	980.1	571.6	2.392			
	977.2	979.9	571.6	2.393			
BM2 Mix: 2.0" Core Depth (2)	1046.9	1048.1	611.0	2.395	2.392	0.09	0.32
	1046.5	1048.5	610.6	2.390			
	1045.9	1047.1	609.5	2.390			
	1046.1	1047.2	610.0	2.393			
	1045.8	1047.0	609.7	2.391			
	1045.8	1047.3	610.2	2.393			
	1045.7	1047.2	610.5	2.395			
BM2 Mix: 2.0" Core Depth (3)	1095.7	1099.3	635.0	2.360	2.356	0.08	1.08
	1094.9	1100.8	636.3	2.357			
	1094.5	1101.0	636.2	2.355			
	1095.2	1100.0	634.7	2.354			
	1094.8	1099.6	634.9	2.356			
	1094.7	1099.4	634.9	2.357			
	1094.4	1099.3	634.9	2.357			
BM2 Mix: 2.0" Core Depth (4)	967.4	968.7	562.2	2.380	2.373	0.19	0.49
	966.8	968.9	560.6	2.368			
	966.5	968.0	559.8	2.368			
	966.8	969.3	562.1	2.374			
	966.5	967.9	560.3	2.371			
	966.4	968.7	561.5	2.373			
	966.2	969.2	562.6	2.376			
BM2 Mix: 2.0" Core Depth (5)	966.7	971.0	564.7	2.379	2.373	0.18	1.03
	966.2	971.3	563.2	2.368			
	965.8	970.4	562.8	2.369			
	966.0	970.3	563.3	2.373			
	966.2	969.2	561.7	2.371			
	965.7	969.5	562.2	2.371			
	965.8	970.0	563.7	2.377			

Table C40. Saturated Surface-Dry Specimens Data for BM2 Mix: 6.0" Core Depth

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
BM2 Mix: 6.0" Core Depth (1)	2353.9	2356.0	1380.9	2.414	2.408	0.15	0.24
	2353.8	2355.6	1379.6	2.412			
	2353.1	2355.9	1379.1	2.409			
	2352.6	2355.0	1376.6	2.405			
	2351.7	2354.0	1376.7	2.406			
	2351.6	2354.4	1376.6	2.405			
	2352.0	2354.4	1377.2	2.407			
BM2 Mix: 6.0" Core Depth (2)	2460.9	2461.7	1453.7	2.441	2.440	0.08	0.08
	2461.3	2461.4	1452.7	2.440			
	2460.3	2460.9	1453.7	2.443			
	2459.4	2460.5	1451.8	2.438			
	2458.8	2459.8	1451.5	2.439			
	2458.6	2459.6	1450.6	2.437			
	2458.7	2459.9	1452.2	2.440			
BM2 Mix: 6.0" Core Depth (3)	2480.1	2481.0	1460.6	2.431	2.428	0.06	0.09
	2479.8	2480.3	1460.0	2.430			
	2479.3	2480.1	1459.0	2.428			
	2478.3	2479.4	1458.2	2.427			
	2477.8	2478.7	1458.3	2.428			
	2477.5	2478.5	1457.7	2.427			
	2477.6	2478.7	1457.9	2.427			
BM2 Mix: 6.0" Core Depth (4)	2456.2	2456.6	1452.6	2.446	2.444	0.05	0.06
	2456.1	2456.1	1451.4	2.445			
	2455.3	2456.0	1451.1	2.443			
	2454.3	2455.2	1450.5	2.443			
	2453.8	2454.6	1450.2	2.443			
	2453.6	2454.5	1450.4	2.444			
	2453.6	2454.4	1450.4	2.444			
BM2 Mix: 6.0" Core Depth (5)	2561.1	2563.2	1515.0	2.443	2.440	0.07	0.14
	2560.0	2561.2	1512.9	2.442			
	2558.9	2560.4	1511.8	2.440			
	2557.6	2558.9	1510.4	2.439			
	2557.2	2558.6	1509.9	2.438			
	2556.7	2558.2	1509.9	2.439			
	2556.7	2558.0	1510.4	2.441			

Table C41. Saturated Surface-Dry Specimens Data for A Mix: 6.0" Core Depth

Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
A Mix: 6.0" Core Depth (1)	4173.3	4178.3	2480.1	2.457	2.455	0.07	0.27
	4171.9	4177.3	2477.1	2.454			
	4171.6	4176.8	2475.9	2.453			
	4173.8	4176.8	2477.6	2.456			
	4173.0	4177.0	2477.9	2.456			
	4172.4	4177.3	2477.6	2.455			
	4171.4	4176.5	2476.7	2.454			
A Mix: 6.0" Core Depth (2)	4074.6	4077.5	2411.6	2.446	2.447	0.12	0.15
	4073.7	4077.3	2410.4	2.444			
	4073.6	4076.5	2410.4	2.445			
	4076.1	4077.2	2414.6	2.452			
	4075.3	4076.2	2413.2	2.451			
	4073.6	4076.8	2412.0	2.447			
	4074.1	4076.9	2412.5	2.448			
A Mix: 6.0" Core Depth (3)	3418.5	3426.4	2024.7	2.439	2.437	0.06	0.47
	3417.8	3425.1	2021.8	2.436			
	3417.3	3423.6	2020.2	2.435			
	3418.3	3426.2	2023.5	2.437			
	3418.2	3424.5	2021.5	2.436			
	3419.4	3424.6	2020.8	2.436			
	3419.0	3424.4	2022.1	2.438			
A Mix: 6.0" Core Depth (4)	3364.8	3383.5	1990.3	2.415	2.405	0.23	1.45
	3362.6	3383.7	1985.0	2.404			
	3364.5	3383.7	1986.8	2.409			
	3364.5	3384.2	1982.9	2.401			
	3365.7	3385.9	1985.7	2.404			
	3364.7	3384.1	1986.6	2.408			
	3362.7	3386.4	1984.3	2.398			
A Mix: 6.0" Core Depth (5)	3920.3	3923.3	2335.8	2.469	2.469	0.08	0.19
	3919.6	3922.6	2332.8	2.465			
	3921.1	3923.4	2337.2	2.472			
	3920.5	3922.7	2335.3	2.470			
	3919.5	3922.9	2336.1	2.470			
	3919.7	3922.9	2336.2	2.470			
	3919.1	3922.6	2334.6	2.468			

Table C42. Corelok Vacuum Seal Air Void Values for Laboratory Compacted Samples

Laboratory Compated Samples		Corelok Vacuum Seal			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-75 1	2.519	2.445	2.440	2.9	3.2
D-75 2		2.442		3.1	
D-75 3		2.423		3.8	
D-75 4		2.444		3.0	
D-75 5		2.444		3.0	
BM2-20 1	2.520	2.304	2.319	8.6	8.0
BM2-20 2		2.319		8.0	
BM2-20 3		2.355		6.5	
BM2-20 4		2.300		8.7	
BM2-20 5		2.319		8.0	
BM2-75 1	2.520	2.409	2.417	4.4	4.1
BM2-75 2		2.419		4.0	
BM2-75 3		2.405		4.6	
BM2-75 4		2.428		3.7	
BM2-75 5		2.424		3.8	
BM2-SGC (8-10%) 1	2.520	2.323	2.326	7.8	7.7
BM2-SGC (8-10%) 2		2.316		8.1	
BM2-SGC (8-10%) 3		2.332		7.5	
BM2-SGC (8-10%) 4		2.335		7.3	
BM2-SGC (8-10%) 5		2.325		7.7	
BM2-SGC (4%) 1	2.520	2.488	2.480	1.3	1.6
BM2-SGC (4%) 2		2.478		1.7	
BM2-SGC (4%) 3		2.478		1.7	
BM2-SGC (4%) 4		2.482		1.5	
BM2-SGC (4%) 5		2.476		1.7	
A-SGC (8%) 1	2.535	2.397	2.392	5.4	5.6
A-SGC (8%) 2		2.381		6.1	
A-SGC (8%) 3		2.396		5.5	
A-SGC (8%) 4		2.413		4.8	
A-SGC (8%) 5		2.375		6.3	

Table C43. Dimensional Analysis Air Void Values for Laboratory Compacted Samples

Laboratory Compated Samples		Dimensional Analysis			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-75 1	2.519	2.409	2.406	4.4	4.5
D-75 2		2.411		4.3	
D-75 3		2.390		5.1	
D-75 4		2.409		4.4	
D-75 5		2.412		4.2	
BM2-20 1	2.520	2.244	2.271	11.0	9.9
BM2-20 2		2.271		9.9	
BM2-20 3		2.322		7.9	
BM2-20 4		2.255		10.5	
BM2-20 5		2.261		10.3	
BM2-75 1	2.520	2.351	2.357	6.7	6.5
BM2-75 2		2.358		6.4	
BM2-75 3		2.342		7.1	
BM2-75 4		2.366		6.1	
BM2-75 5		2.369		6.0	
BM2-SGC (8-10%) 1	2.520	2.262	2.259	10.2	10.4
BM2-SGC (8-10%) 2		2.254		10.6	
BM2-SGC (8-10%) 3		2.262		10.2	
BM2-SGC (8-10%) 4		2.256		10.5	
BM2-SGC (8-10%) 5		2.261		10.3	
BM2-SGC (4%) 1	2.520	2.456	2.448	2.5	2.8
BM2-SGC (4%) 2		2.444		3.0	
BM2-SGC (4%) 3		2.448		2.9	
BM2-SGC (4%) 4		2.450		2.8	
BM2-SGC (4%) 5		2.443		3.1	
A-SGC (8%) 1	2.535	2.277	2.274	10.2	10.3
A-SGC (8%) 2		2.284		9.9	
A-SGC (8%) 3		2.277		10.2	
A-SGC (8%) 4		2.262		10.8	
A-SGC (8%) 5		2.268		10.5	

Table C44. Parafilm Wrapping Air Void Values for Laboratory Compacted Samples

Laboratory Compated Samples		Parafilm Wrapping			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-75 1	2.519	2.444	2.432	3.0	3.4
D-75 2		2.436		3.3	
D-75 3		2.420		3.9	
D-75 4		2.431		3.5	
D-75 5		2.430		3.5	
BM2-20 1	2.520	2.277	2.303	9.6	8.6
BM2-20 2		2.306		8.5	
BM2-20 3		2.348		6.8	
BM2-20 4		2.289		9.2	
BM2-20 5		2.296		8.9	
BM2-75 1	2.520	2.386	2.387	5.3	5.3
BM2-75 2		2.396		4.9	
BM2-75 3		2.370		6.0	
BM2-75 4		2.396		4.9	
BM2-75 5		2.389		5.2	
BM2-SGC (8-10%) 1	2.520	2.295	2.294	8.9	9.0
BM2-SGC (8-10%) 2		2.282		9.4	
BM2-SGC (8-10%) 3		2.296		8.9	
BM2-SGC (8-10%) 4		2.301		8.7	
BM2-SGC (8-10%) 5		2.298		8.8	
BM2-SGC (4%) 1	2.520	2.470	2.463	2.0	2.2
BM2-SGC (4%) 2		2.460		2.4	
BM2-SGC (4%) 3		2.462		2.3	
BM2-SGC (4%) 4		2.466		2.1	
BM2-SGC (4%) 5		2.459		2.4	
A-SGC (8%) 1	2.535	2.358	2.348	7.0	7.4
A-SGC (8%) 2		2.346		7.5	
A-SGC (8%) 3		2.343		7.6	
A-SGC (8%) 4		2.350		7.3	
A-SGC (8%) 5		2.344		7.5	

Table C45. Saturated Surface-Dry Air Void Values for Laboratory Compacted Samples

Laboratory Compated Samples		Saturated Surface-Dry Specimens			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-75 1	2.519	2.477	2.471	1.7	1.9
D-75 2		2.473		1.8	
D-75 3		2.460		2.3	
D-75 4		2.472		1.9	
D-75 5		2.474		1.8	
BM2-20 1	2.520	2.376	2.377	5.7	5.7
BM2-20 2		2.373		5.8	
BM2-20 3		2.393		5.0	
BM2-20 4		2.368		6.0	
BM2-20 5		2.376		5.7	
BM2-75 1	2.520	2.446	2.452	2.9	2.7
BM2-75 2		2.445		3.0	
BM2-75 3		2.448		2.9	
BM2-75 4		2.460		2.4	
BM2-75 5		2.460		2.4	
BM2-SGC (8-10%) 1	2.520	2.367	2.370	6.1	6.0
BM2-SGC (8-10%) 2		2.367		6.1	
BM2-SGC (8-10%) 3		2.374		5.8	
BM2-SGC (8-10%) 4		2.374		5.8	
BM2-SGC (8-10%) 5		2.368		6.0	
BM2-SGC (4%) 1	2.520	2.502	2.498	0.7	0.9
BM2-SGC (4%) 2		2.494		1.0	
BM2-SGC (4%) 3		2.497		0.9	
BM2-SGC (4%) 4		2.502		0.7	
BM2-SGC (4%) 5		2.497		0.9	
A-SGC (8%) 1	2.535	2.468	2.454	2.6	3.2
A-SGC (8%) 2		2.435		3.9	
A-SGC (8%) 3		2.460		3.0	
A-SGC (8%) 4		2.476		2.3	
A-SGC (8%) 5		2.432		4.1	

Table C46. Corelok Vacuum Seal Air Void Values for Field Cut Samples

Field Cut Samples		Corelok Vacuum Seal			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-1.25" 1	2.445	2.305	2.293	5.7	6.2
D-1.25" 2		2.277		6.9	
D-1.25" 3		2.286		6.5	
D-1.25" 4		2.310		5.5	
D-1.25" 5		2.289		6.4	
BM2-2" 1	2.522	2.347	2.337	6.9	7.3
BM2-2" 2		2.363		6.3	
BM2-2" 3		2.315		8.2	
BM2-2" 4		2.333		7.5	
BM2-2" 5		2.327		7.7	
BM2-6" 1	2.522	2.421	2.440	4.0	3.2
BM2-6" 2		2.446		3.0	
BM2-6" 3		2.437		3.4	
BM2-6" 4		2.449		2.9	
BM2-6" 5		2.448		2.9	
A-6" 1	2.546	2.440	2.419	4.2	5.0
A-6" 2		2.438		4.2	
A-6" 3		2.406		5.5	
A-6" 4		2.356		7.5	
A-6" 5		2.454		3.6	

Table C47. Dimensional Analysis Air Void Values for Field Cut Samples

Field Cut Samples		Dimensional Analysis			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-1.25" 1	2.445	2.147	2.133	12.2	12.8
D-1.25" 2		2.124		13.1	
D-1.25" 3		2.073		15.2	
D-1.25" 4		2.163		11.5	
D-1.25" 5		2.158		11.7	
BM2-2" 1	2.522	2.263	2.253	10.3	10.7
BM2-2" 2		2.280		9.6	
BM2-2" 3		2.233		11.5	
BM2-2" 4		2.240		11.2	
BM2-2" 5		2.248		10.9	
BM2-6" 1	2.522	2.259	2.266	10.4	10.2
BM2-6" 2		2.257		10.5	
BM2-6" 3		2.259		10.4	
BM2-6" 4		2.258		10.5	
BM2-6" 5		2.295		9.0	
A-6" 1	2.546	2.355	2.340	7.5	8.1
A-6" 2		2.372		6.8	
A-6" 3		2.316		9.0	
A-6" 4		2.271		10.8	
A-6" 5		2.385		6.3	

Table C48. Parafilm Wrapping Air Void Values for Field Cut Samples

Field Cut Samples		Parafilm Wrapping			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-1.25" 1	2.445	2.265	2.266	7.4	7.3
D-1.25" 2		2.249		8.0	
D-1.25" 3		2.254		7.8	
D-1.25" 4		2.291		6.3	
D-1.25" 5		2.271		7.1	
BM2-2" 1	2.522	2.339	2.332	7.3	7.5
BM2-2" 2		2.349		6.9	
BM2-2" 3		2.309		8.4	
BM2-2" 4		2.336		7.4	
BM2-2" 5		2.327		7.7	
BM2-6" 1	2.522	2.308	2.337	8.5	7.3
BM2-6" 2		2.338		7.3	
BM2-6" 3		2.324		7.9	
BM2-6" 4		2.343		7.1	
BM2-6" 5		2.371		6.0	
A-6" 1	2.546	2.408	2.393	5.4	6.0
A-6" 2		2.423		4.8	
A-6" 3		2.371		6.9	
A-6" 4		2.327		8.6	
A-6" 5		2.434		4.4	

Table C49. Saturated Surface-Dry Air Void Values for Field Cut Samples

Field Cut Samples		Saturated Surface-Dry Specimens			
Sample	G_{mm}	G_{mb}	Avg. G_{mb}	V_a (%)	Avg. V_a (%)
D-1.25" 1	2.445	2.324	2.315	4.9	5.3
D-1.25" 2		2.299		6.0	
D-1.25" 3		2.309		5.6	
D-1.25" 4		2.330		4.7	
D-1.25" 5		2.314		5.4	
BM2-2" 1	2.522	2.393	2.377	5.1	5.7
BM2-2" 2		2.392		5.2	
BM2-2" 3		2.356		6.6	
BM2-2" 4		2.373		5.9	
BM2-2" 5		2.373		5.9	
BM2-6" 1	2.522	2.408	2.432	4.5	3.6
BM2-6" 2		2.440		3.3	
BM2-6" 3		2.428		3.7	
BM2-6" 4		2.444		3.1	
BM2-6" 5		2.440		3.3	
A-6" 1	2.546	2.455	2.443	3.6	4.1
A-6" 2		2.447		3.9	
A-6" 3		2.437		4.3	
A-6" 4		2.405		5.5	
A-6" 5		2.469		3.0	

APPENDIX D

Aluminum Cylinder Data and Results

Table D1. Corelok Vacuum Seal Data for Aluminum Cylinder Experiment

Corelok Vacuum Seal							
Sample	M_{dry} (g)	M_{dwb} (g)	M_{wwb} (g)	G_b	G_{mb}	Avg. G_{mb}	V (%)
8 Hole	1336.7	1362.0	820.8	0.792	2.625	2.629	0.15
	1336.7	1362.1	821.9	0.792	2.631		
	1336.7	1362.0	822.3	0.792	2.633		
16 Hole	1292.3	1317.4	778.4	0.792	2.547	2.548	0.07
	1292.3	1317.4	778.1	0.792	2.546		
	1292.3	1317.5	778.8	0.792	2.550		
24 Hole	1248.8	1274.0	734.2	0.792	2.458	2.459	0.03
	1248.8	1273.9	734.5	0.792	2.460		
	1248.8	1273.9	734.2	0.792	2.458		

Table D2. Dimensional Analysis Data for Aluminum Cylinder Experiment

Dimensional Analysis							
Sample	M_{dry} (g)	Dia. (cm)	Ht. (cm)	Vol. (cm^3)	G_{mb}	Avg. G_{mb}	V (%)
8 Hole	1336.7	10.11	6.36	510.53	2.618271	2.620	0.06
	1336.8	10.11	6.36	510.30	2.619614		
	1336.7	10.11	6.36	509.95	2.621216		
16 Hole	1292.4	10.12	6.34	510.08	2.533717	2.534	0.05
	1292.4	10.12	6.35	510.33	2.532481		
	1292.4	10.12	6.34	509.86	2.534798		
24 Hole	1248.7	10.13	6.34	510.45	2.44626	2.446	0.01
	1248.7	10.13	6.34	510.37	2.446659		
	1248.8	10.13	6.34	510.43	2.446548		

Table D3. Parafilm Wrapping Data for Aluminum Cylinder Experiment

Parafilm Wrapping						
Sample	M_{dry} (g)	M_{dwp} (g)	M_{wwp} (g)	G_{mb}	Avg. G_{mb}	V (%)
8 Hole	1336.7	1339.4	826.2	2.626	2.628	0.07
	1336.7	1339.3	826.9	2.630		
	1336.7	1339.3	826.4	2.627		
16 Hole	1292.3	1295.8	781.0	2.537	2.539	0.11
	1292.3	1295.5	782.2	2.542		
	1292.3	1295.6	781.2	2.538		
24 Hole	1248.6	1251.1	738.4	2.454	2.455	0.04
	1248.8	1251.3	738.9	2.456		
	1248.8	1251.3	738.7	2.455		

Table D4. Saturated Surface-Dry Data for Aluminum Cylinder Experiment

Saturated Surface-Dry Specimens							
Sample	M_{dry} (g)	M_{ssd} (g)	M_{sub} (g)	G_{mb}	Avg. G_{mb}	V (%)	Abs (%)
8 Hole	1336.8	1337.2	844.3	2.712	2.713	0.02	0.04
	1336.8	1336.9	844.1	2.713			
	1336.8	1336.9	844.2	2.713			
16 Hole	1292.3	1292.7	816.0	2.711	2.711	0.02	0.08
	1292.4	1292.8	815.9	2.710			
	1292.3	1292.7	816.0	2.711			
24 Hole	1248.8	1249.9	788.6	2.707	2.708	0.04	0.20
	1248.8	1249.5	788.5	2.709			
	1248.8	1249.7	788.7	2.709			

Table D5. G_{mb} Results for Aluminum Cylinder Experiment

G_{mb} Results for Aluminum Cylinder Experiment				
Cylinder	Corelok Vacuum Seal	Dimensional Analysis	Parafilm Wrapping	Saturated Surface-Dry Specimens
8 Hole	2.629	2.620	2.628	2.713
16 Hole	2.548	2.534	2.539	2.711
24 Hole	2.459	2.446	2.455	2.708

Table D6. *Air Voids Results for Aluminum Cylinder Experiment*

Air Voids (%) Results for Aluminum Cylinder Experiment									
Cylinder	Actual	Corelok		Dim. Analysis		Parafilm		SSD	
		Meas	% Diff	Meas	% Diff	Meas	% Diff	Meas	% Diff
8 Hole	3.125	2.666	14.7	2.999	4.0	2.703	13.5	-0.444	114.2
16 Hole	6.25	5.665	9.4	6.183	1.1	5.998	4.0	-0.370	105.9
24 Hole	9.375	8.960	4.4	9.441	-0.7	9.108	2.9	-0.259	102.8

APPENDIX E

T-test Data and Results

Table E1. Corelok vs. Parafilm t-test Values for Laboratory Compacted Samples

t-tests Using G_{mb} Values Laboratory Compacted Samples				Corelok vs. Parafilm		Significantly Different? (Act.>Theor.)
Sample	Corelok	Parafilm	SSD			
D-75 1	2.445	2.444	2.477	T-test	0.048	Yes
D-75 2	2.442	2.436	2.473	Theor.	2.262	
D-75 3	2.423	2.420	2.460	Act.	2.293	
D-75 4	2.444	2.431	2.472	T dist	0.963	
D-75 5	2.444	2.430	2.474			
BM2-20 1	2.304	2.277	2.376	T-test	0.013	Yes
BM2-20 2	2.319	2.306	2.373	Theor.	2.262	
BM2-20 3	2.355	2.348	2.393	Act.	3.100	
BM2-20 4	2.300	2.289	2.368	T dist	0.990	
BM2-20 5	2.319	2.296	2.376			
BM2-75 1	2.409	2.386	2.446	T-test	0.000	Yes
BM2-75 2	2.419	2.396	2.445	Theor.	2.262	
BM2-75 3	2.405	2.370	2.448	Act.	5.419	
BM2-75 4	2.428	2.396	2.460	T dist	1.000	
BM2-75 5	2.424	2.389	2.460			
BM2-SGC (8-10%) 1	2.323	2.295	2.367	T-test	0.000	Yes
BM2-SGC (8-10%) 2	2.316	2.282	2.367	Theor.	2.262	
BM2-SGC (8-10%) 3	2.332	2.296	2.374	Act.	7.041	
BM2-SGC (8-10%) 4	2.335	2.301	2.374	T dist	1.000	
BM2-SGC (8-10%) 5	2.325	2.298	2.368			
BM2-SGC (4%) 1	2.488	2.470	2.502	T-test	0.000	Yes
BM2-SGC (4%) 2	2.478	2.460	2.494	Theor.	2.262	
BM2-SGC (4%) 3	2.478	2.462	2.497	Act.	10.282	
BM2-SGC (4%) 4	2.482	2.466	2.502	T dist	1.000	
BM2-SGC (4%) 5	2.476	2.459	2.497			
A-SGC (8%) 1	2.397	2.358	2.468	T-test	0.002	Yes
A-SGC (8%) 2	2.381	2.346	2.435	Theor.	2.262	
A-SGC (8%) 3	2.396	2.343	2.460	Act.	4.371	
A-SGC (8%) 4	2.413	2.350	2.476	T dist	0.999	
A-SGC (8%) 5	2.375	2.344	2.432			

Table E2. Corelok vs. SSD t-test Values for Laboratory Compacted Samples

t-tests Using G_{mb} Values Laboratory Compacted Samples				Corelok vs. SSD		Significantly Different? (Act.>Theor.)
Sample	Corelok	Parafilm	SSD			
D-75 1	2.445	2.444	2.477	T-test	0.000	Yes
D-75 2	2.442	2.436	2.473	Theor.	2.262	
D-75 3	2.423	2.420	2.460	Act.	7.693	
D-75 4	2.444	2.431	2.472	T dist	1.000	
D-75 5	2.444	2.430	2.474			
BM2-20 1	2.304	2.277	2.376	T-test	0.001	Yes
BM2-20 2	2.319	2.306	2.373	Theor.	2.262	
BM2-20 3	2.355	2.348	2.393	Act.	5.109	
BM2-20 4	2.300	2.289	2.368	T dist	1.000	
BM2-20 5	2.319	2.296	2.376			
BM2-75 1	2.409	2.386	2.446	T-test	0.000	Yes
BM2-75 2	2.419	2.396	2.445	Theor.	2.262	
BM2-75 3	2.405	2.370	2.448	Act.	5.839	
BM2-75 4	2.428	2.396	2.460	T dist	1.000	
BM2-75 5	2.424	2.389	2.460			
BM2-SGC (8-10%) 1	2.323	2.295	2.367	T-test	0.000	Yes
BM2-SGC (8-10%) 2	2.316	2.282	2.367	Theor.	2.262	
BM2-SGC (8-10%) 3	2.332	2.296	2.374	Act.	7.879	
BM2-SGC (8-10%) 4	2.335	2.301	2.374	T dist	1.000	
BM2-SGC (8-10%) 5	2.325	2.298	2.368			
BM2-SGC (4%) 1	2.488	2.470	2.502	T-test	0.000	Yes
BM2-SGC (4%) 2	2.478	2.460	2.494	Theor.	2.262	
BM2-SGC (4%) 3	2.478	2.462	2.497	Act.	6.196	
BM2-SGC (4%) 4	2.482	2.466	2.502	T dist	1.000	
BM2-SGC (4%) 5	2.476	2.459	2.497			
A-SGC (8%) 1	2.397	2.358	2.468	T-test	0.000	Yes
A-SGC (8%) 2	2.381	2.346	2.435	Theor.	2.262	
A-SGC (8%) 3	2.396	2.343	2.460	Act.	7.674	
A-SGC (8%) 4	2.413	2.350	2.476	T dist	1.000	
A-SGC (8%) 5	2.375	2.344	2.432			

Table E3. Corelok vs. Parafilm t-test Values for Field Cut Samples

t-tests Using G_{mb} Values Field Cut Samples				Corelok vs. Parafilm		Significantly Different? (Act.>Theor.)
Sample	Corelok	Parafilm	SSD			
D-1.25" 1	2.305	2.265	2.324	T-test	0.003	Yes
D-1.25" 2	2.277	2.249	2.299	Theor.	2.262	
D-1.25" 3	2.286	2.254	2.309	Act.	4.107	
D-1.25" 4	2.310	2.291	2.330	T dist	0.998	
D-1.25" 5	2.289	2.271	2.314			
BM2-2" 1	2.347	2.339	2.393	T-test	0.171	No
BM2-2" 2	2.363	2.349	2.392	Theor.	2.262	
BM2-2" 3	2.315	2.309	2.356	Act.	1.488	
BM2-2" 4	2.333	2.336	2.373	T dist	0.868	
BM2-2" 5	2.327	2.327	2.373			
BM2-6" 1	2.421	2.308	2.408	T-test	0.000	Yes
BM2-6" 2	2.446	2.338	2.440	Theor.	2.262	
BM2-6" 3	2.437	2.324	2.428	Act.	6.547	
BM2-6" 4	2.449	2.343	2.444	T dist	1.000	
BM2-6" 5	2.448	2.371	2.440			
A-6" 1	2.440	2.408	2.455	T-test	0.002	Yes
A-6" 2	2.438	2.423	2.447	Theor.	2.262	
A-6" 3	2.406	2.371	2.437	Act.	4.223	
A-6" 4	2.356	2.327	2.405	T dist	0.998	
A-6" 5	2.454	2.434	2.469			

Table E4. Corelok vs. SSD t-test Values for Field Cut Samples

t-tests Using G_{mb} Values Field Cut Samples				Corelok vs. SSD		Significantly Different? (Act.>Theor.)
Sample	Corelok	Parafilm	SSD			
D-1.25" 1	2.305	2.265	2.324	T-test	0.000	Yes
D-1.25" 2	2.277	2.249	2.299	Theor.	2.262	
D-1.25" 3	2.286	2.254	2.309	Act.	7.581	
D-1.25" 4	2.310	2.291	2.330	T dist	1.000	
D-1.25" 5	2.289	2.271	2.314			
BM2-2" 1	2.347	2.339	2.393	T-test	0.000	Yes
BM2-2" 2	2.363	2.349	2.392	Theor.	2.262	
BM2-2" 3	2.315	2.309	2.356	Act.	6.002	
BM2-2" 4	2.333	2.336	2.373	T dist	1.000	
BM2-2" 5	2.327	2.327	2.373			
BM2-6" 1	2.421	2.308	2.408	T-test	0.004	Yes
BM2-6" 2	2.446	2.338	2.440	Theor.	2.262	
BM2-6" 3	2.437	2.324	2.428	Act.	3.809	
BM2-6" 4	2.449	2.343	2.444	T dist	0.997	
BM2-6" 5	2.448	2.371	2.440			
A-6" 1	2.440	2.408	2.455	T-test	0.031	Yes
A-6" 2	2.438	2.423	2.447	Theor.	2.262	
A-6" 3	2.406	2.371	2.437	Act.	2.557	
A-6" 4	2.356	2.327	2.405	T dist	0.976	
A-6" 5	2.454	2.434	2.469			

Appendix F:

Field Study Data and Results

Legend

Core Sample Not Obtained = #

Core Sample Destroyed in Field = #

Core Sample Destroyed in Lab = ▓

S0727011 **Rice = 2.455**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	447.4	237.9	447.5	2.199	10.4	10.6
	2	650.9	352.3	650.9	2.228	9.2	9.2
	3	754.0	420.0	754.1	2.302	6.2	6.2
	4	678.8	375.2	678.8	2.284	7.0	6.9
	5	576.1	310.2	576.1	2.220	9.6	9.4
	6						
	7						
	1	447.5	236.8	447.6	2.190	10.8	
	2	650.9	352.7	650.8	2.231	9.1	
	3	754.1	420.0	754.1	2.303	6.2	
	4	678.8	375.2	678.9	2.285	6.9	
	5	576.1	311.4	576.1	2.229	9.2	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	447.6	248.6	450.0	2.222	9.5	9.6
	2	650.9	364.5	654.2	2.247	8.5	8.5
	3	754.1	428.6	755.0	2.310	5.9	6.0
	4	678.8	384.5	680.1	2.296	6.5	6.6
	5	576.1	322.3	578.0	2.253	8.2	8.3
	6						
	7						
	1	447.7	247.6	449.5	2.217	9.7	
	2	651.2	363.6	653.6	2.246	8.5	
	3	754.2	428.4	755.3	2.307	6.0	
	4	679.0	383.8	680.2	2.291	6.7	
	5	576.4	322.5	578.5	2.252	8.3	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	135.4	3.4	138.8	2.224	9.4	1.5
	2	137.8	3.4	141.2	2.263	7.8	3.8
	3	138.2	3.4	141.6	2.269	7.6	6.5
	4	142.3	3.4	145.7	2.335	4.9	8.8
	5	138.8	3.4	142.2	2.279	7.2	11.7
	6						
	7						

S0820013 **Rice = 2.316**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	470.4	218.2	470.3	1.913	17.4	17.2
	2	411.1	198.5	411.0	1.990	14.1	14.2
	3	467.1	226.2	467.2	1.991	14.0	14.1
	4	623.2	325.1	623.2	2.136	7.8	7.7
	5	633.1	327.5	633.1	2.116	8.6	8.6
	6	495.0	245.1	494.9	2.031	12.3	12.3
	1	470.4	219.1	470.4	1.920	17.1	
	2	411.1	197.8	411.1	1.985	14.3	
	3	467.2	225.8	467.2	1.987	14.2	
	4	623.2	325.2	623.2	2.138	7.7	
	5	633.1	327.6	633.1	2.116	8.6	
	6	495.0	244.9	495.1	2.030	12.3	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	470.4	234.4	475.1	1.954	15.6	15.7
	2	411.1	211.3	413.8	2.030	12.3	12.6
	3	467.2	238.7	470.7	2.014	13.0	13.0
	4	623.2	334.5	624.4	2.150	7.2	7.2
	5	633.1	337.0	634.6	2.127	8.1	8.2
	6	495.0	256.7	496.9	2.061	11.0	11.1
	1	470.5	234.6	475.7	1.951	15.7	
	2	411.0	210.8	414.3	2.020	12.8	
	3	467.3	238.5	470.5	2.014	13.0	
	4	623.2	334.9	625.2	2.147	7.3	
	5	633.2	336.9	634.9	2.125	8.3	
	6	495.1	256.5	497.0	2.059	11.1	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	124.5	-1.0	123.5	1.979	14.5	0.0
	2	130.9	-1.0	129.9	2.082	10.1	1.0
	3	133.4	-1.0	132.4	2.122	8.4	3.0
	4	136.0	-1.0	135.0	2.163	6.6	6.0
	5	134.6	-1.0	133.6	2.141	7.6	9.0
	6	131.5	-1.0	130.5	2.091	9.7	12.0
		129.6	-1.0	128.6	2.061	11.0	13.0

S1030011 (Problem) **Rice = 2.455**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	409.0	219.6	408.9	2.233	9.0	8.7
	2	497.8	267.1	497.5	2.218	9.7	9.7
	3	667.3	366.7	667.1	2.269	7.6	7.5
	4	799.6	447.8	799.5	2.315	5.7	5.7
	5	680.0	378.1	679.8	2.302	6.2	6.2
	6	602.4	332.7	602.2	2.286	6.9	6.7
	7						
	1	408.8	221.1	408.8	2.251	8.3	
	2	497.4	267.0	497.3	2.218	9.7	
	3	667.1	367.1	667.0	2.272	7.5	
	4	799.5	447.5	799.4	2.314	5.7	
	5	679.7	378.5	679.7	2.306	6.1	
	6	602.2	333.6	602.3	2.295	6.5	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	408.9	230.3	410.0	2.275	7.3	7.6
	2	497.4	279.3	499.2	2.262	7.9	8.0
	3	667.0	380.9	669.9	2.308	6.0	6.0
	4	799.4	457.3	800.3	2.331	5.1	5.2
	5	679.7	387.9	680.6	2.322	5.4	5.6
	6	602.0	342.5	603.2	2.309	5.9	6.1
	7						
	1	408.3	229.3	409.7	2.263	7.8	
	2	496.4	278.5	498.4	2.257	8.0	
	3	665.5	379.4	668.1	2.305	6.1	
	4	798.4	456.4	799.9	2.324	5.3	
	5	678.7	386.6	679.8	2.315	5.7	
	6	600.8	340.9	602.0	2.301	6.3	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	142.6	3.4	146.0	2.340	4.7	1.0
	2	141.7	3.4	145.1	2.325	5.3	3.0
	3	142.5	3.4	145.9	2.338	4.8	6.0
	4	142.4	3.4	145.8	2.337	4.8	9.0
	5	139.9	3.4	143.3	2.296	6.5	11.0
	6	137.6	3.4	141.0	2.260	8.0	12.0
	7						

S0716022 **Rice = 2.410**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	643.4	341.1	643.4	2.175	9.8	9.7
	2	583.6	310.5	583.5	2.189	9.2	9.3
	3	470.9	244.3	470.9	2.136	11.4	11.4
	4	519.2	268.6	519.2	2.125	11.8	11.7
	5	511.1	273.2	511.1	2.207	8.4	8.4
	6	638.9	326.0	638.9	2.085	13.5	13.4
	7						
	1	643.4	341.9	643.4	2.180	9.5	
	2	583.5	310.0	583.5	2.184	9.4	
	3	470.9	244.0	470.8	2.135	11.4	
	4	519.2	269.0	519.1	2.129	11.6	
	5	511.1	273.2	511.0	2.207	8.4	
	6	638.9	326.6	638.9	2.089	13.3	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	643.4	353.6	645.5	2.204	8.5	8.5
	2	583.5	322.6	585.8	2.217	8.0	8.1
	3	470.8	255.1	473.5	2.156	10.6	10.6
	4	519.1	282.1	522.1	2.163	10.3	10.2
	5	511.0	282.0	512.6	2.216	8.1	8.0
	6	638.9	346.8	648.6	2.117	12.2	12.2
	7						
	1	643.4	354.0	645.6	2.206	8.4	
	2	583.6	322.5	586.0	2.215	8.1	
	3	470.8	255.1	473.7	2.154	10.6	
	4	519.1	282.6	522.2	2.167	10.1	
	5	510.8	281.8	512.3	2.216	8.0	
	6	638.8	347.0	648.8	2.117	12.2	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	143.9	0.6	144.5	2.316	3.9	1.0
	2	139.8	0.6	140.4	2.250	6.6	3.0
	3	141.6	0.6	142.2	2.279	5.4	6.0
	4	142.4	0.6	143.0	2.292	4.9	9.0
	5	140.6	0.6	141.2	2.263	6.1	11.0
	6	135.2	0.6	135.8	2.176	9.7	12.0
	7						

D0519011 **Rice = 2.446**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	548.3	284.0	548.2	2.127	13.0	13.1
	2	552.2	298.4	552.2	2.230	8.8	8.9
	3	622.6	339.9	622.7	2.252	7.9	8.0
	4	649.9	359.8	649.9	2.283	6.7	6.8
	5	636.1	349.7	636.0	2.271	7.2	7.1
	6	685.1	373.7	685.2	2.245	8.2	8.2
	7						
	1	548.1	283.3	548.0	2.122	13.2	
	2	552.0	298.0	552.1	2.229	8.9	
	3	622.4	339.3	622.4	2.249	8.1	
	4	650.7	358.7	650.7	2.277	6.9	
	5	636.0	349.9	635.9	2.272	7.1	
	6	685.0	373.6	685.1	2.245	8.2	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	548.1	299.3	552.9	2.161	11.6	11.7
	2	552.0	307.7	553.4	2.247	8.2	8.2
	3	622.4	350.8	624.8	2.272	7.1	7.1
	4	650.7	368.2	651.1	2.300	6.0	6.1
	5	636.0	360.2	638.2	2.288	6.5	6.5
	6	685.0	384.7	687.6	2.261	7.5	7.6
	7						
	1	548.1	299.5	553.7	2.156	11.8	
	2	551.5	307.8	553.5	2.245	8.2	
	3	622.5	350.1	624.2	2.271	7.2	
	4	650.4	368.3	651.7	2.295	6.2	
	5	635.6	359.7	637.6	2.287	6.5	
	6	684.9	384.1	687.1	2.260	7.6	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	135.7	-0.8	134.9	2.162	11.6	0.0
	2	142.0	-0.8	141.2	2.263	7.5	1.0
	3	142.5	-0.8	141.7	2.271	7.2	3.0
	4	145.0	-0.8	144.2	2.311	5.5	6.0
	5	143.4	-0.8	142.6	2.285	6.6	9.0
	6	145.0	-0.8	144.2	2.311	5.5	11.0
	7						

D0820011 (Problem) **Rice = 2.465**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	596.0	309.4	596.1	2.123	13.9	13.8
	2	547.0	292.3	547.0	2.199	10.8	10.6
	3	589.2	327.0	589.3	2.300	6.7	6.8
	4	678.9	363.5	678.9	2.195	11.0	10.9
	5	729.0	404.3	729.1	2.288	7.2	7.0
	6	648.8	322.8	648.8	2.028	17.7	17.6
	7						
	1	596.1	310.0	596.1	2.127	13.7	
	2	547.1	292.9	547.1	2.206	10.5	
	3	589.3	326.8	589.3	2.297	6.8	
	4	678.9	364.2	679.0	2.199	10.8	
	5	730.5	406.2	730.4	2.298	6.8	
	6	648.8	323.6	648.8	2.033	17.5	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	596.0	328.0	602.6	2.170	12.0	11.8
	2	546.9	303.0	548.8	2.225	9.7	9.7
	3	589.2	334.7	589.9	2.309	6.3	6.4
	4	678.9	379.5	681.8	2.246	8.9	9.1
	5	729.1	421.9	736.3	2.319	5.9	5.7
	6	648.8	346.4	657.2	2.088	15.3	11.5
	7						
	1	596.0	329.0	602.5	2.179	11.6	
	2	547.0	302.6	548.4	2.225	9.7	
	3	589.1	334.5	589.8	2.307	6.4	
	4	678.8	379.4	683.1	2.235	9.3	
	5	730.5	417.9	731.4	2.330	5.5	
	6	800.2	450.3	802.1	2.275	7.7	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	140.0	0.8	140.8	2.256	8.5	0.0
	2	143.4	0.8	144.2	2.311	6.3	1.0
	3	146.1	0.8	146.9	2.354	4.5	3.0
	4	141.8	0.8	142.6	2.285	7.3	6.0
	5	143.9	0.8	144.7	2.319	5.9	9.0
	6	124.6	0.8	125.4	2.010	18.5	11.0
	7						

D0905011 **Rice = 2.546**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok							
	2	479.5	248.6	479.6	2.132	16.3	14.6
	3	600.5	328.2	600.6	2.254	11.5	11.5
	4	679.6	379.0	679.7	2.307	9.4	9.3
	5	729.3	402.1	729.2	2.271	10.8	10.4
	6	755.4	419.0	755.5	2.289	10.1	9.9
	7						
	2	479.7	257.3	479.6	2.217	12.9	
	3	600.6	327.8	600.6	2.250	11.6	
	4	679.6	379.4	679.7	2.312	9.2	
	5	729.2	404.6	729.3	2.291	10.0	
	6	755.4	420.9	755.6	2.301	9.6	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166							
	2	479.7	273.6	484.2	2.278	10.5	10.7
	3	600.6	344.3	605.4	2.300	9.7	9.7
	4	679.7	393.6	682.7	2.351	7.7	7.7
	5	729.2	418.7	733.1	2.319	8.9	9.0
	6	755.4	435.0	759.5	2.328	8.6	8.6
	7						
	2	479.6	274.5	485.9	2.269	10.9	
	3	600.7	345.0	606.4	2.298	9.7	
	4	679.7	394.3	683.4	2.351	7.7	
	5	729.4	419.2	734.1	2.316	9.0	
	6	755.5	434.1	759.0	2.325	8.7	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density		138.8	-7.4	131.4	2.106	17.3	0.0
	2	141.7	-7.4	134.3	2.152	15.5	1.0
	3	144.9	-7.4	137.5	2.204	13.5	3.0
	4	149.9	-7.4	142.5	2.284	10.3	6.0
	5	147.1	-7.4	139.7	2.239	12.1	9.0
	6	147.8	-7.4	140.4	2.250	11.6	10.5
	7						

D0905012 (Random) Rice = 2.546

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	602.1	325.7	602.1	2.229	12.5	13.4
	2	499.1	276.8	499.2	2.309	9.3	9.3
	3	511.4	278.2	511.3	2.254	11.5	11.8
	4	635.5	362.3	635.5	2.382	6.4	6.7
	5	662.1	373.4	662.1	2.346	7.9	7.7
	6						
	7						
	1	602.1	319.9	602.2	2.182	14.3	
	2	499.2	276.7	499.4	2.311	9.2	
	3	511.3	276.5	511.3	2.237	12.1	
	4	635.5	360.8	635.5	2.369	7.0	
	5	662.0	374.7	662.1	2.356	7.5	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	602.2	343.9	606.7	2.291	10.0	10.0
	2	499.2	288.1	500.9	2.346	7.9	8.1
	3	511.3	293.3	515.3	2.303	9.5	9.6
	4	635.5	372.2	636.3	2.406	5.5	5.5
	5	662.1	386.1	663.4	2.388	6.2	6.4
	6						
	7						
	1	603.1	343.7	607.0	2.291	10.0	
	2	499.3	287.5	501.3	2.335	8.3	
	3	511.7	292.1	514.4	2.302	9.6	
	4	635.4	372.2	636.5	2.404	5.6	
	5	661.9	385.4	663.4	2.381	6.5	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	144.7	-7.4	137.3	2.200	13.6	10.2
	2	149.3	-7.4	141.9	2.274	10.7	6.3
	3	146.3	-7.4	138.9	2.226	12.6	3.6
	4	155.4	-7.4	148.0	2.372	6.8	6.7
	5	151.4	-7.4	144.0	2.308	9.4	5.4
	6						
	7						

D0920011 Rice = **2.442**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	745.9	407.3	745.9	2.245	8.1	8.1
	2	712.9	383.3	713.0	2.205	9.7	10.0
	3	707.1	383.0	707.1	2.224	8.9	9.0
	4	721.0	397.9	721.0	2.276	6.8	7.1
	5	767.0	431.5	767.1	2.332	4.5	4.4
	6	698.8	386.3	698.8	2.282	6.6	6.3
	7	613.5	312.0	613.4	2.077	14.9	14.8
	1	745.9	407.4	746.0	2.244	8.1	
	2	713.0	381.4	713.0	2.191	10.3	
	3	707.1	383.0	707.1	2.222	9.0	
	4	720.9	395.8	720.9	2.260	7.5	
	5	767.0	432.7	767.0	2.337	4.3	
	6	698.8	388.1	698.8	2.293	6.1	
	7	613.4	313.1	613.4	2.085	14.6	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	745.9	421.1	747.7	2.284	6.5	6.6
	2	712.9	396.3	715.0	2.237	8.4	8.5
	3	707.1	395.6	709.0	2.256	7.6	7.6
	4	720.9	409.0	722.3	2.301	5.8	5.8
	5	767.0	442.2	767.4	2.359	3.4	3.4
	6	698.8	398.2	699.2	2.322	4.9	4.9
	7	613.3	337.5	622.9	2.149	12.0	11.9
	1	745.8	420.7	747.9	2.279	6.7	
	2	713.1	395.5	715.2	2.231	8.7	
	3	707.2	395.4	709.0	2.255	7.7	
	4	721.0	409.0	722.4	2.301	5.8	
	5	767.0	442.6	767.5	2.361	3.3	
	6	699.0	398.3	699.4	2.321	4.9	
	7	613.5	337.3	622.1	2.154	11.8	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	140.6	-0.1	140.5	2.252	7.8	0.0
	2	141.3	-0.1	141.2	2.263	7.3	1.0
	3	140.2	-0.1	140.1	2.245	8.1	3.0
	4	142.5	-0.1	142.4	2.282	6.5	6.0
	5	145.3	-0.1	145.2	2.327	4.7	9.0
	6	143.1	-0.1	143.0	2.292	6.2	11.0
	7	135.1	-0.1	135.0	2.163	11.4	12.0

D0920012 (Random)

Rice = 2.442

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	658.0	353.9	658.0	2.208	9.6	9.6
	2	693.2	377.6	693.2	2.242	8.2	8.3
	3	595.2	316.5	595.1	2.185	10.5	10.4
	4	697.3	376.9	697.1	2.221	9.0	9.1
	5	564.2	314.2	564.1	2.315	5.2	5.1
	6						
	7						
	1	658.0	353.2	658.0	2.206	9.7	
	2	693.2	377.2	693.1	2.239	8.3	
	3	595.1	316.9	595.2	2.189	10.4	
	4	697.1	376.5	697.0	2.219	9.1	
	5	564.2	314.4	564.2	2.318	5.1	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	658.0	364.8	659.9	2.230	8.7	8.8
	2	693.2	389.2	694.8	2.268	7.1	7.2
	3	595.1	329.5	596.5	2.229	8.7	8.8
	4	697.0	388.7	698.4	2.251	7.8	8.0
	5	564.2	320.8	564.4	2.316	5.2	5.3
	6						
	7						
	1	657.9	364.2	660.0	2.224	8.9	
	2	692.7	388.5	694.5	2.264	7.3	
	3	594.9	329.4	596.5	2.227	8.8	
	4	696.4	387.7	698.1	2.244	8.1	
	5	564.0	320.4	564.5	2.311	5.4	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	140.7	-0.1	140.6	2.253	7.7	5.3
	2	139.2	-0.1	139.1	2.229	8.7	10.8
	3	139.7	-0.1	139.6	2.237	8.4	0.8
	4	141.7	-0.1	141.6	2.269	7.1	9.5
	5	148.1	-0.1	148.0	2.372	2.9	2.7
	6						
	7						

D0927011 (Random) **Rice = 2.231**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok							
	2	627.9	316.8	627.9	2.060	7.7	7.5
	3	487.6	217.9	487.6	1.851	17.0	17.0
	4	586.5	289.0	586.6	2.015	9.7	9.7
	5	580.6	287.3	580.7	2.023	9.3	9.3
	6						
	7						
	2	627.9	318.0	627.9	2.068	7.3	
	3	487.6	217.9	487.9	1.852	17.0	
	4	586.5	289.0	586.6	2.015	9.7	
	5	580.7	287.4	580.7	2.024	9.3	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166							
	2	628.0	331.5	631.5	2.093	6.2	6.2
	3	487.6	250.2	501.7	1.939	13.1	13.3
	4	586.6	306.6	593.5	2.045	8.4	8.3
	5	580.7	304.5	587.0	2.056	7.9	7.8
	6						
	7						
	2	628.5	332.1	632.5	2.092	6.2	
	3	490.3	249.4	503.7	1.928	13.6	
	4	588.5	307.5	594.9	2.048	8.2	
	5	581.9	305.3	588.2	2.057	7.8	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density		139.7	-2.7	137.0	2.196	1.6	6.9
	2	139.4	-2.7	136.7	2.191	1.8	4.4
	3	135.2	-2.7	132.5	2.123	4.8	0.2
	4	137.9	-2.7	135.2	2.167	2.9	8.0
	5	136.5	-2.7	133.8	2.144	3.9	7.7
	6						
	7						

D0927012 **Rice =** **2.231**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	429.3	183.3	429.4	1.791	19.7	19.7
	2	376.3	174.3	376.3	1.922	13.9	14.1
	3	451.9	221.1	451.9	2.013	9.8	10.1
	4	503.9	247.8	503.9	2.017	9.6	9.6
	5	534.5	265.7	534.5	2.036	8.7	8.7
	6	554.7	274.3	554.6	2.024	9.3	9.3
	7						
	1	429.4	183.7	429.4	1.792	19.7	
	2	376.3	173.0	376.3	1.909	14.4	
	3	451.9	219.9	451.9	1.999	10.4	
	4	503.9	247.8	503.9	2.016	9.6	
	5	534.5	266.0	534.5	2.040	8.6	
	6	554.5	274.5	554.6	2.024	9.3	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	429.3	219.5	444.1	1.911	14.3	14.3
	2	376.3	193.1	383.7	1.974	11.5	11.0
	3	451.9	236.6	457.8	2.043	8.4	8.4
	4	503.8	263.7	508.8	2.055	7.9	7.9
	5	534.5	280.2	539.0	2.065	7.4	7.5
	6	554.5	291.3	560.9	2.057	7.8	7.7
	7						
	1	429.4	221.3	445.6	1.914	14.2	
	2	376.3	196.3	384.6	1.998	10.4	
	3	451.9	236.5	457.5	2.045	8.3	
	4	503.9	263.3	508.6	2.054	7.9	
	5	534.6	280.3	539.3	2.064	7.5	
	6	555.1	291.1	560.1	2.064	7.5	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	122.6	-2.7	119.9	1.921	13.9	0.0
	2	135.4	-2.7	132.7	2.127	4.7	1.0
	3	134.9	-2.7	132.2	2.119	5.0	3.0
	4	138.5	-2.7	135.8	2.176	2.5	6.0
	5	138.8	-2.7	136.1	2.181	2.2	9.0
	6	132.5	-2.7	129.8	2.080	6.8	11.0
	7						

D0412021 (Problem) **Rice = 2.353**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	792.3	420.4	792.3	2.168	7.8	7.9
	2	736.1	390.8	736.1	2.172	7.7	7.7
	3	728.3	384.0	728.3	2.155	8.4	8.4
	4	674.7	354.9	674.6	2.153	8.5	8.6
	5	614.7	316.5	614.6	2.107	10.5	10.5
	6	595.0	314.3	595.0	2.168	7.9	7.9
	7	799.6	422.5	799.6	2.158	8.3	8.3
	1	792.3	420.3	792.3	2.168	7.9	
	2	736.1	391.0	736.1	2.173	7.6	
	3	728.3	383.5	728.2	2.154	8.5	
	4	674.6	354.4	674.6	2.150	8.6	
	5	614.6	316.5	614.6	2.107	10.5	
	6	595.0	313.7	595.0	2.164	8.0	
	7	799.6	422.2	799.6	2.156	8.4	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	792.3	436.3	794.2	2.214	5.9	6.0
	2	736.1	404.2	737.3	2.210	6.1	6.1
	3	728.2	394.5	729.4	2.174	7.6	7.7
	4	674.6	366.3	676.5	2.175	7.6	7.5
	5	614.6	329.2	616.6	2.138	9.1	9.3
	6	595.0	324.4	596.4	2.188	7.0	7.1
	7	799.6	437.7	802.6	2.191	6.9	6.9
	1	792.2	436.4	794.5	2.212	6.0	
	2	736.0	404.7	738.0	2.208	6.2	
	3	727.9	394.2	729.5	2.171	7.7	
	4	674.5	366.6	676.5	2.177	7.5	
	5	614.4	328.5	616.8	2.131	9.4	
	6	594.9	324.1	596.3	2.186	7.1	
	7	799.2	436.9	801.6	2.191	6.9	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	134.1	-2.9	131.2	2.103	10.6	0.0
	2	135.5	-2.9	132.6	2.125	9.7	1.0
	3	135.2	-2.9	132.3	2.120	9.9	3.0
	4	132.7	-2.9	129.8	2.080	11.6	6.0
	5	132.9	-2.9	130.0	2.083	11.5	9.0
	6	136.7	-2.9	133.8	2.144	8.9	11.0
	7	135.6	-2.9	132.7	2.127	9.6	12.0

D0427021 **Rice = 2.436**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	641.6	327.5	641.6	2.084	14.4	14.5
	2	627.8	334.7	627.6	2.191	10.1	10.1
	3	850.1	458.5	850.0	2.208	9.3	9.3
	4	568.3	308.0	568.3	2.237	8.2	8.0
	5	622.8	335.0	622.8	2.212	9.2	8.9
	6	945.2	532.1	945.4	2.324	4.6	4.4
	7						
	1	641.6	326.8	641.5	2.081	14.6	
	2	627.6	334.6	627.5	2.190	10.1	
	3	850.0	459.1	849.9	2.212	9.2	
	4	568.3	309.0	568.2	2.247	7.8	
	5	622.8	336.7	622.8	2.226	8.6	
	6	945.4	533.4	945.3	2.332	4.3	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	641.5	351.8	653.6	2.126	12.7	12.9
	2	627.5	348.3	631.1	2.219	8.9	9.1
	3	849.9	472.1	852.6	2.234	8.3	8.3
	4	568.2	319.7	569.2	2.277	6.5	6.3
	5	622.8	347.2	624.7	2.244	7.9	8.1
	6	945.3	543.6	946.7	2.345	3.7	4.1
	7						
	1	641.7	352.0	655.1	2.117	13.1	
	2	628.0	348.0	631.9	2.212	9.2	
	3	850.1	472.8	853.0	2.236	8.2	
	4	568.0	321.4	569.6	2.288	6.1	
	5	623.4	345.6	624.7	2.234	8.3	
	6	946.1	544.3	950.8	2.327	4.5	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	139.3	-2.2	137.1	2.197	9.8	0.0
	2	142.9	-2.2	140.7	2.255	7.4	1.0
	3	141.4	-2.2	139.2	2.231	8.4	2.5
	4	145.5	-2.2	143.3	2.296	5.7	5.5
	5	145.2	-2.2	143.0	2.292	5.9	8.5
	6	148.1	-2.2	145.9	2.338	4.0	10.5
	7						

D051502A1 **Rice =** **2.417**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	427.1	217.5	427.1	2.099	13.2	13.3
	2	485.5	252.4	485.4	2.142	11.4	11.8
	3	499.9	262.0	499.7	2.159	10.7	10.7
	4	544.1	284.9	544.0	2.152	11.0	11.0
	5	531.3	279.6	531.1	2.167	10.4	10.3
	6						
	7						
	1	427.1	216.7	427.1	2.091	13.5	
	2	485.4	250.4	485.3	2.123	12.2	
	3	499.7	261.8	499.6	2.158	10.7	
	4	544.0	284.6	543.9	2.151	11.0	
	5	531.1	279.8	530.9	2.169	10.2	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	427.1	227.6	430.8	2.102	13.0	13.0
	2	485.3	260.7	487.0	2.144	11.3	11.4
	3	499.6	270.2	501.1	2.164	10.5	10.6
	4	543.9	292.7	545.2	2.154	10.9	11.0
	5	530.9	287.2	532.4	2.165	10.4	10.5
	6						
	7						
	1	427.1	227.4	430.5	2.103	13.0	
	2	484.8	259.8	486.5	2.139	11.5	
	3	499.0	269.2	500.7	2.156	10.8	
	4	542.8	291.6	544.4	2.147	11.2	
	5	530.5	286.9	532.1	2.164	10.5	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	127.8	3.3	131.1	2.101	13.1	1.0
	2	133.4	3.3	136.7	2.191	9.4	3.0
	3	134.0	3.3	137.3	2.200	9.0	6.0
	4	132.5	3.3	135.8	2.176	10.0	9.0
	5	136.3	3.3	139.6	2.237	7.4	11.0
	6						
	7						

D051602T1 Rice = 2.546

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	626.5	339.8	626.5	2.234	12.2	12.1
	2	607.2	324.8	607.2	2.199	13.6	13.7
	3	550.8	295.9	550.8	2.215	13.0	12.8
	4	478.5	254.6	478.5	2.198	13.7	13.6
	5	574.2	313.7	574.2	2.259	11.3	11.5
	6						
	7						
	1	626.5	341.0	626.5	2.244	11.9	
	2	607.2	324.1	607.2	2.193	13.9	
	3	550.8	296.8	550.8	2.223	12.7	
	4	478.5	255.1	478.5	2.204	13.5	
	5	574.2	312.3	574.2	2.246	11.8	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	626.5	358.5	631.7	2.293	9.9	10.3
	2	607.2	345.6	615.6	2.249	11.7	11.8
	3	550.8	314.2	556.6	2.272	10.8	10.9
	4	478.5	273.0	488.6	2.219	12.8	12.5
	5	574.2	331.2	578.3	2.324	8.7	8.9
	6						
	7						
	1	626.6	358.8	634.3	2.274	10.7	
	2	607.8	346.1	617.4	2.240	12.0	
	3	551.1	314.5	557.8	2.265	11.0	
	4	479.0	272.1	486.2	2.237	12.1	
	5	574.2	331.1	578.9	2.317	9.0	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	147.8	-6.3	141.5	2.268	10.9	1.0
	2	147.3	-6.3	141.0	2.260	11.2	2.5
	3	146.6	-6.3	140.3	2.248	11.7	6.5
	4	146.5	-6.3	140.2	2.247	11.8	10.0
	5	148.1	-6.3	141.8	2.272	10.7	11.5
	6						
	7						

D051602T2 **Rice =** **2.471**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	498.4	267.3	498.2	2.215	10.4	10.3
	2	665.4	360.1	665.1	2.225	9.9	9.6
	3	784.6	436.9	784.4	2.298	7.0	7.1
	4	720.8	384.0	720.6	2.181	11.7	11.4
	5	693.8	361.6	693.8	2.127	13.9	14.1
	6	658.9	342.5	658.9	2.123	14.1	14.1
	7						
	1	498.2	267.8	498.1	2.219	10.2	
	2	665.1	362.1	664.9	2.241	9.3	
	3	784.4	436.1	784.2	2.293	7.2	
	4	720.6	386.3	720.4	2.197	11.1	
	5	693.8	360.1	693.8	2.120	14.2	
	6	658.9	341.8	658.8	2.121	14.1	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	498.1	281.5	503.2	2.247	9.1	9.1
	2	664.9	376.7	669.8	2.269	8.2	8.2
	3	784.2	447.5	786.7	2.312	6.4	6.5
	4	720.4	404.0	727.3	2.228	9.8	9.8
	5	693.8	387.3	705.0	2.184	11.6	11.4
	6	658.8	365.6	669.1	2.171	12.2	12.8
	7						
	1	498.3	281.2	503.0	2.247	9.1	
	2	664.9	377.4	670.5	2.269	8.2	
	3	783.9	448.1	787.6	2.309	6.6	
	4	721.3	405.7	729.2	2.230	9.8	
	5	695.1	387.9	704.6	2.195	11.2	
	6	658.9	364.7	672.5	2.141	13.4	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	140.1	-1.4	138.7	2.223	10.0	1.0
	2	143.4	-1.4	142.0	2.276	7.9	2.5
	3	141.3	-1.4	139.9	2.242	9.3	6.5
	4	139.0	-1.4	137.6	2.205	10.8	9.5
	5	134.8	-1.4	133.4	2.138	13.5	11.0
	6	133.3	-1.4	131.9	2.114	14.5	12.0
	7						

D0620021 **Rice = 2.441**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	787.7	431.3	787.6	2.252	7.7	7.8
	2	811.6	450.9	811.6	2.292	6.1	6.1
	3	611.5	330.2	611.5	2.224	8.9	8.8
	4	694.9	377.6	694.9	2.235	8.4	8.7
	5	716.0	394.0	716.0	2.269	7.0	7.1
	6	703.6	369.5	703.6	2.147	12.0	12.0
	7	743.3	406.0	743.2	2.248	7.9	8.0
	1	787.6	431.2	787.6	2.251	7.8	
	2	811.6	451.1	811.6	2.293	6.1	
	3	611.5	330.9	611.5	2.230	8.7	
	4	694.9	375.8	694.9	2.223	8.9	
	5	716.0	393.6	716.0	2.266	7.2	
	6	703.6	369.6	703.5	2.148	12.0	
	7	743.2	405.6	743.2	2.244	8.1	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	787.6	444.0	788.8	2.284	6.4	6.3
	2	811.6	459.9	812.4	2.302	5.7	5.7
	3	611.5	342.8	612.8	2.265	7.2	7.3
	4	694.9	386.8	696.6	2.243	8.1	11.1
	5	716.0	408.5	716.8	2.322	4.9	4.7
	6	703.5	386.6	709.4	2.179	10.7	10.7
	7	743.2	416.8	744.5	2.268	7.1	7.1
	1	787.7	444.6	788.9	2.288	6.3	
	2	811.6	460.1	812.4	2.304	5.6	
	3	611.5	342.7	613.0	2.262	7.3	
	4	650.0	386.6	696.5	2.097	14.1	
	5	715.8	408.7	716.1	2.329	4.6	
	6	703.9	386.6	709.4	2.181	10.7	
	7	743.2	416.6	744.7	2.265	7.2	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	143.9	-2.9	141.0	2.260	7.4	1.0
	2	146.9	-2.9	144.0	2.308	5.5	3.0
	3	143.7	-2.9	140.8	2.256	7.6	6.0
	4	141.7	-2.9	138.8	2.224	8.9	9.0
	5	146.8	-2.9	143.9	2.306	5.5	11.0
	6	136.2	-2.9	133.3	2.136	12.5	12.0
	7	143.4	-2.9	140.5	2.252	7.8	14.0

D0620022 **Rice =** **2.513**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	575.7	322.1	575.7	2.328	7.3	7.1
	2	627.7	351.1	627.7	2.323	7.6	7.4
	3	580.0	332.1	580.0	2.400	4.5	4.6
	4	611.6	343.3	611.6	2.334	7.1	7.1
	5	500.9	276.0	500.9	2.291	8.8	8.9
	7						
	1	575.7	323.3	575.7	2.340	6.9	
	2	627.7	352.3	627.7	2.333	7.2	
	3	580.0	331.6	580.0	2.396	4.6	
	4	611.6	343.4	611.6	2.335	7.1	
	5	500.9	275.6	500.9	2.286	9.0	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	575.7	332.3	577.3	2.350	6.5	6.5
	2	627.7	363.1	629.4	2.357	6.2	5.9
	3	580.0	339.4	580.6	2.405	4.3	4.2
	4	611.6	353.4	613.1	2.355	6.3	6.4
	5	500.9	286.7	503.0	2.316	7.8	8.0
	7						
	1	575.8	332.1	577.4	2.347	6.6	
	2	630.1	364.7	630.5	2.371	5.7	
	3	580.3	340.0	580.9	2.409	4.1	
	4	611.5	353.0	613.2	2.350	6.5	
	5	501.3	287.1	504.1	2.310	8.1	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	145.6	0.0	145.6	2.333	7.1	0.0
	2	145.4	0.0	145.4	2.330	7.3	1.0
	3	146.4	0.0	146.4	2.346	6.6	3.0
	4	145.2	0.0	145.2	2.327	7.4	6.0
	5	144.7	0.0	144.7	2.319	7.7	9.0
		138.0	0.0	138.0	2.212	12.0	10.5
	7						

D0814021 **Rice = 2.282**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	697.7	315.8	697.6	1.859	18.5	18.5
	2	770.0	363.5	770.0	1.925	15.6	15.6
	3	825.5	410.4	825.5	2.020	11.5	11.5
	4	850.1	424.0	850.1	2.026	11.2	11.1
	5	985.1	500.9	985.1	2.063	9.6	9.6
	6	1008.3	505.7	1008.3	2.033	10.9	10.9
	7						
	1	697.6	316.2	697.6	1.861	18.5	
	2	770.0	363.4	769.9	1.925	15.6	
	3	825.5	410.4	825.5	2.020	11.5	
	4	850.1	425.1	850.1	2.031	11.0	
	5	985.1	500.4	985.0	2.061	9.7	
	6	1008.3	506.1	1008.3	2.035	10.8	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	697.6	357.5	720.2	1.923	15.7	15.7
	2	769.9	395.2	787.6	1.962	14.0	13.9
	3	825.5	431.5	835.0	2.046	10.3	10.3
	4	850.1	440.8	855.5	2.050	10.2	10.3
	5	985.0	518.7	991.2	2.085	8.6	8.7
	6	1008.3	527.8	1017.0	2.061	9.7	9.7
	7						
	1	697.8	357.8	720.3	1.925	15.6	
	2	770.0	395.7	787.4	1.966	13.9	
	3	825.5	432.2	835.0	2.049	10.2	
	4	850.0	440.4	856.0	2.045	10.4	
	5	985.3	518.7	991.6	2.084	8.7	
	6	1008.4	528.0	1017.2	2.061	9.7	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	121.0	-5.9	115.1	1.845	19.2	0.0
	2	124.2	-5.9	118.3	1.896	16.9	1.0
	3	127.9	-5.9	122.0	1.955	14.3	3.0
	4	129.7	-5.9	123.8	1.984	13.1	6.0
	5	129.6	-5.9	123.7	1.982	13.1	9.0
	6	130.8	-5.9	124.9	2.002	12.3	11.0
	7						

D0814022 (Random) **Rice = 2.282**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	869.2	430.9	869.1	2.014	11.7	11.6
	2	923.4	477.4	923.2	2.103	7.9	7.8
	3	1016.9	531.7	1016.8	2.126	6.9	6.8
	4	967.3	493.9	967.1	2.074	9.1	8.9
	5	1096.3	569.0	1096.2	2.107	7.7	7.7
	6						
	7						
	1	869.1	432.7	869.1	2.022	11.4	
	2	923.2	478.4	923.2	2.107	7.7	
	3	1016.8	532.0	1016.8	2.127	6.8	
	4	967.1	496.7	967.1	2.085	8.6	
	5	1096.2	569.1	1096.1	2.107	7.7	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	869.1	451.4	875.8	2.048	10.3	10.3
	2	923.2	491.4	927.0	2.119	7.1	7.1
	3	1016.8	545.0	1020.1	2.140	6.2	6.2
	4	967.1	512.5	971.0	2.109	7.6	7.6
	5	1096.1	586.0	1101.0	2.128	6.7	6.7
	6						
	7						
	1	869.6	453.6	878.2	2.048	10.3	
	2	923.3	492.4	928.1	2.119	7.1	
	3	1016.7	546.2	1021.1	2.141	6.2	
	4	967.1	513.0	971.7	2.108	7.6	
	5	1096.3	586.7	1101.6	2.129	6.7	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	128.1	-5.9	122.2	1.958	14.2	0.0
	2	128.9	-5.9	123.0	1.971	13.6	1.0
	3	133.3	-5.9	127.4	2.042	10.5	3.0
	4	130.1	-5.9	124.2	1.990	12.8	6.0
	5	132.3	-5.9	126.4	2.026	11.2	9.0
	6						
	7						

D0822021 **Rice =** **2.340**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	511.9	233.8	511.9	1.884	19.5	19.5
	2	392.8	181.4	392.8	1.914	18.2	18.1
	3	497.6	245.9	497.6	2.028	13.4	13.3
	4	579.5	290.8	579.5	2.052	12.3	12.5
	5	629.2	328.0	629.2	2.135	8.8	8.6
	6	588.9	296.0	588.8	2.056	12.1	12.1
	7	607.1	284.8	607.1	1.921	17.9	17.8
	1	511.9	234.0	511.8	1.885	19.4	
	2	392.8	181.6	392.7	1.917	18.1	
	3	497.6	246.2	497.6	2.030	13.3	
	4	579.5	289.2	579.5	2.041	12.8	
	5	629.2	329.2	629.1	2.143	8.4	
	6	588.8	296.0	588.8	2.056	12.1	
	7	607.1	285.3	607.1	1.924	17.8	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	511.8	264.0	523.7	1.971	15.8	15.8
	2	392.7	205.5	403.6	1.982	15.3	15.3
	3	497.6	265.5	504.8	2.079	11.1	11.2
	4	579.5	305.5	584.1	2.080	11.1	11.1
	5	629.1	341.1	632.5	2.159	7.7	7.7
	6	588.8	311.1	593.5	2.085	10.9	10.9
	7	607.1	314.3	621.3	1.978	15.5	15.5
	1	511.7	264.3	523.8	1.972	15.7	
	2	392.7	205.6	403.6	1.983	15.2	
	3	497.6	265.2	505.0	2.075	11.3	
	4	579.7	305.6	584.0	2.082	11.0	
	5	629.1	341.1	632.5	2.159	7.7	
	6	588.9	311.0	593.5	2.085	10.9	
	7	607.0	314.3	621.6	1.975	15.6	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	123.1	-0.9	122.2	1.958	16.3	0.0
	2	132.7	-0.9	131.8	2.112	9.7	1.0
	3	131.5	-0.9	130.6	2.093	10.6	3.0
	4	131.4	-0.9	130.5	2.091	10.6	6.0
	5	137.9	-0.9	137.0	2.196	6.2	9.0
	6	136.4	-0.9	135.5	2.171	7.2	11.5
	7	129.9	-0.9	129.0	2.067	11.7	12.5

BM20820014 Rice = 2.555

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	791.7	438.0	791.9	2.279	10.8	10.8
	2	827.5	476.3	827.5	2.397	6.2	6.1
	3	907.1	520.4	907.1	2.384	6.7	6.7
	4	779.1	447.7	779.2	2.395	6.3	5.9
	5	820.7	469.3	820.6	2.377	7.0	6.9
	6	810.3	455.1	810.3	2.321	9.2	9.0
	7	810.4	454.6	810.3	2.318	9.3	9.4
	1	791.8	437.9	791.8	2.277	10.9	
	2	827.5	476.5	827.5	2.399	6.1	
	3	907.2	520.0	907.1	2.382	6.8	
	4	779.1	450.3	779.1	2.415	5.5	
	5	820.6	469.3	820.6	2.378	6.9	
	6	810.2	456.2	810.3	2.329	8.8	
	7	810.3	453.7	810.2	2.313	9.5	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	791.7	484.4	801.6	2.496	2.3	3.4
	2	827.5	499.6	835.9	2.461	3.7	4.4
	3	907.1	540.7	913.7	2.432	4.8	5.0
	4	779.2	464.9	783.5	2.446	4.3	4.2
	5	820.6	492.4	828.2	2.444	4.4	4.6
	6	810.3	485.1	822.6	2.401	6.0	6.1
	7	810.3	483.7	821.4	2.399	6.1	6.3
	1	791.7	479.5	803.7	2.442	4.4	
	2	827.4	495.2	836.7	2.423	5.2	
	3	907.1	540.4	914.5	2.425	5.1	
	4	779.1	465.5	783.8	2.448	4.2	
	5	820.6	492.6	829.8	2.434	4.8	
	6	810.2	485.4	823.1	2.399	6.1	
	7	810.2	483.7	823.1	2.387	6.6	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	136.9	9.5	146.4	2.346	8.2	0.3
	2	144.6	9.5	154.1	2.470	3.3	1.0
	3	146.2	9.5	155.7	2.495	2.3	3.0
	4	143.7	9.5	153.2	2.455	3.9	6.0
	5	140.4	9.5	149.9	2.402	6.0	9.0
	6	142.1	9.5	151.6	2.429	4.9	12.0
	7	139.1	9.5	148.6	2.381	6.8	13.0

BM20823011 **Rice = 2.582**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1048.1	565.4	1048.1	2.200	14.8	14.9
	2	812.4	447.9	812.3	2.268	12.2	12.0
	3	897.9	506.8	897.8	2.335	9.6	9.8
	4	1030.1	577.0	1030.1	2.306	10.7	10.6
	5	1194.0	676.1	1194.1	2.336	9.5	9.6
	7						
	1	1048.0	564.6	1048.1	2.197	14.9	
	2	812.3	449.3	812.4	2.276	11.9	
	3	897.8	505.1	897.8	2.324	10.0	
	4	1030.2	577.5	1030.1	2.309	10.6	
	5	1193.9	675.8	1194.0	2.334	9.6	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1048.1	621.9	1072.5	2.326	9.9	9.9
	2	812.4	481.7	826.0	2.360	8.6	8.6
	3	897.9	532.5	908.5	2.388	7.5	7.8
	4	1030.0	607.2	1043.4	2.361	8.5	8.4
	5	1193.9	704.9	1205.5	2.385	7.6	7.7
	7						
	1	1047.8	620.7	1070.6	2.329	9.8	
	2	812.4	482.1	826.3	2.360	8.6	
	3	897.7	531.2	909.2	2.375	8.0	
	4	1029.0	606.9	1041.5	2.368	8.3	
	5	1193.5	705.0	1205.9	2.383	7.7	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	137.1	-1.0	136.1	2.181	15.5	0.0
	2	148.1	-1.0	147.1	2.357	8.7	1.0
	3	146.3	-1.0	145.3	2.329	9.8	3.0
	4	155.9	-1.0	154.9	2.482	3.9	6.0
	5	156.3	-1.0	155.3	2.489	3.6	9.0
		145.9	-1.0	144.9	2.322	10.1	11.0
	7						

BM20829013 **Rice = 2.506**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	905.6	464.0	905.6	2.081	17.0	17.0
	2	960.3	529.5	960.4	2.262	9.7	9.7
	3	1625.9	904.3	1626.1	2.275	9.2	8.5
	4	935.8	515.0	935.9	2.257	9.9	9.9
	5	954.3	532.9	954.4	2.299	8.3	8.3
	6	1909.3	1088.1	1909.2	2.346	6.4	6.4
	7	1021.1	570.9	1021.4	2.300	8.2	8.1
	1	905.6	463.5	905.6	2.078	17.1	
	2	960.3	529.4	960.3	2.262	9.7	
	3	1626.0	915.2	1626.0	2.310	7.8	
	4	935.9	515.7	935.9	2.261	9.8	
	5	954.4	532.4	954.4	2.296	8.4	
	6	1909.2	1088.1	1909.1	2.344	6.5	
	7	1021.5	571.8	1021.3	2.305	8.0	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	905.7	530.7	925.8	2.292	8.5	8.4
	2	960.3	563.1	971.9	2.349	6.3	6.4
	3	1626.0	952.5	1640.7	2.363	5.7	5.8
	4	935.9	545.0	946.1	2.333	6.9	6.9
	5	954.4	558.5	962.8	2.361	5.8	5.7
	6	1909.2	1125.2	1925.2	2.387	4.8	4.8
	7	1021.4	598.8	1031.4	2.361	5.8	5.7
	1	905.7	530.7	924.9	2.298	8.3	
	2	960.9	562.7	972.8	2.343	6.5	
	3	1627.9	952.4	1642.3	2.360	5.8	
	4	936.1	544.8	946.4	2.331	7.0	
	5	955.1	557.8	961.3	2.367	5.5	
	6	1910.7	1122.5	1923.0	2.387	4.8	
	7	1021.5	598.3	1030.1	2.366	5.6	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	130.4	1.6	132.0	2.115	15.6	0.0
	2	143.5	1.6	145.1	2.325	7.2	1.0
	3	143.6	1.6	145.2	2.327	7.1	3.0
	4	144.0	1.6	145.6	2.333	6.9	6.0
	5	143.8	1.6	145.4	2.330	7.0	9.0
	6	143.5	1.6	145.1	2.325	7.2	11.0
	7	145.1	1.6	146.7	2.351	6.2	12.0

BM20830011 **Rice = 2.522**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	698.9	391.7	698.9	2.323	7.9	7.9
	2	923.2	526.7	923.4	2.367	6.1	6.3
	3	684.7	392.1	684.8	2.388	5.3	5.3
	4	830.9	460.6	830.8	2.282	9.5	9.4
	5	941.0	527.7	941.2	2.312	8.3	8.3
	6						
	7						
	1	698.8	391.8	698.9	2.322	7.9	
	2	923.2	526.2	923.2	2.361	6.4	
	3	684.7	391.7	684.8	2.388	5.3	
	4	830.9	461.3	830.9	2.287	9.3	
	5	941.2	528.2	941.1	2.313	8.3	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	698.9	408.4	703.2	2.371	6.0	6.0
	2	923.1	544.0	926.8	2.411	4.4	4.5
	3	684.6	400.8	685.5	2.405	4.7	4.7
	4	830.8	482.3	838.1	2.335	7.4	7.5
	5	941.0	544.6	944.4	2.354	6.7	6.7
	6						
	7						
	1	698.6	409.9	704.9	2.368	6.1	
	2	922.7	543.7	927.5	2.404	4.7	
	3	684.5	400.6	685.4	2.403	4.7	
	4	831.0	481.8	838.3	2.331	7.6	
	5	940.8	544.8	944.6	2.353	6.7	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	149.3	-3.7	145.6	2.333	7.5	1.0
	2	146.5	-3.7	142.8	2.288	9.3	2.0
	3	152.2	-3.7	148.5	2.380	5.6	5.0
	4	148.9	-3.7	145.2	2.327	7.7	8.0
	5	147.8	-3.7	144.1	2.309	8.4	9.0
	6						
	7						

BM20830012 (Random) **Rice = 2.522**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	776.5	436.3	776.5	2.325	7.8	7.8
	2	750.2	427.6	750.1	2.370	6.0	6.0
	3	830.1	470.9	830.1	2.349	6.9	6.8
	4	963.2	545.0	963.2	2.338	7.3	7.3
	5	1032.6	572.7	1032.5	2.277	9.7	9.6
	6						
	7						
	1	776.6	436.6	776.7	2.328	7.7	
	2	750.2	427.4	750.2	2.369	6.1	
	3	830.1	470.4	830.2	2.350	6.8	
	4	963.1	545.2	963.1	2.340	7.2	
	5	1032.5	573.9	1032.5	2.284	9.4	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	776.2	451.9	781.1	2.358	6.5	6.5
	2	750.1	437.6	751.5	2.390	5.2	5.2
	3	830.1	485.1	832.9	2.387	5.4	5.4
	4	962.9	560.2	965.8	2.374	5.9	5.8
	5	1032.5	592.0	1038.8	2.311	8.4	8.3
	6						
	7						
	1	776.3	451.4	780.4	2.360	6.4	
	2	750.1	438.2	752.0	2.390	5.2	
	3	830.3	484.6	832.5	2.387	5.4	
	4	962.8	560.1	965.3	2.376	5.8	
	5	1032.5	591.3	1037.8	2.312	8.3	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	152.7	-3.7	149.0	2.388	5.3	5.1
	2	153.4	-3.7	149.7	2.399	4.9	4.8
	3	153.1	-3.7	149.4	2.394	5.1	1.9
	4	152.2	-3.7	148.5	2.380	5.6	5.1
	5	146.9	-3.7	143.2	2.295	9.0	2.6
	6						
	7						

BM20906012 **Rice =** **2.599**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	965.4	547.1	965.4	2.346	9.7	9.8
	2	1026.0	582.1	1026.0	2.348	9.7	9.8
	3	1247.9	717.4	1246.8	2.386	8.2	8.2
	4	1324.5	759.5	1323.9	2.376	8.6	8.6
	5	1281.9	730.9	1281.7	2.358	9.3	9.3
	6						
	7						
	1	965.3	546.8	965.4	2.345	9.8	
	2	1026.0	581.1	1026.0	2.342	9.9	
	3	1246.7	717.3	1246.7	2.387	8.2	
	4	1323.6	759.5	1323.6	2.376	8.6	
	5	1281.6	730.4	1281.7	2.355	9.4	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	965.3	568.9	973.6	2.385	8.2	8.4
	2	1026.0	608.5	1037.0	2.394	7.9	7.8
	3	1246.6	738.6	1254.2	2.418	7.0	7.0
	4	1323.6	783.4	1332.4	2.411	7.2	7.3
	5	1281.6	762.3	1296.0	2.401	7.6	7.6
	6						
	7						
	1	965.1	566.9	973.5	2.374	8.7	
	2	1025.8	610.0	1038.2	2.396	7.8	
	3	1246.0	737.6	1253.7	2.414	7.1	
	4	1323.0	781.9	1330.9	2.410	7.3	
	5	1281.1	763.3	1297.3	2.399	7.7	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	143.3	2.2	145.5	2.332	10.3	1.0
	2	146.4	2.2	148.6	2.381	8.4	3.0
	3	147.3	2.2	149.5	2.396	7.8	6.0
	4	145.0	2.2	147.2	2.359	9.2	9.0
	5	142.6	2.2	144.8	2.321	10.7	11.0
	6						
	7						

BM21005011 Rice = **2.418**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	968.2	501.7	968.2	2.105	12.9	12.9
	2						
	3	1084.4	588.6	1084.4	2.218	8.3	8.2
	4	983.5	528.9	983.5	2.196	9.2	9.2
	5	1021.7	553.1	1021.7	2.213	8.5	8.4
	6	948.0	517.1	948.1	2.235	7.6	7.5
	7						
	1	968.2	501.7	968.2	2.106	12.9	
	2						
	3	1084.4	589.0	1084.4	2.220	8.2	
	4	983.5	528.6	983.5	2.195	9.2	
	5	1021.7	553.6	1021.7	2.215	8.4	
	6	948.0	518.0	948.1	2.240	7.4	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	968.2	527.1	976.6	2.154	10.9	11.0
	2						
	3	1084.4	600.7	1086.3	2.233	7.6	7.7
	4	983.5	542.3	985.8	2.218	8.3	8.3
	5	1021.6	565.2	1023.3	2.230	7.8	7.8
	6	948.0	530.1	950.4	2.256	6.7	6.8
	7						
	1	968.3	529.0	979.8	2.148	11.2	
	2						
	3	1084.2	600.3	1086.1	2.232	7.7	
	4	983.5	542.3	986.2	2.216	8.4	
	5	1021.2	564.5	1023.1	2.227	7.9	
	6	947.8	529.1	950.3	2.250	6.9	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	137.1	-0.4	136.7	2.191	9.4	0.0
	2	N / A	N / A	N / A	N / A	N / A	1.0
	3	137.6	-0.4	137.2	2.199	9.1	3.5
	4	137.0	-0.4	136.6	2.189	9.5	6.5
	5	137.7	-0.4	137.3	2.200	9.0	9.5
	6	137.4	-0.4	137.0	2.196	9.2	12.0
	7						

BM20416021 **Rice = 2.383**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1128.6	599.2	1128.5	2.160	9.4	9.3
	2	1119.9	597.9	1119.9	2.174	8.8	8.8
	3	1165.5	627.9	1165.4	2.196	7.8	7.7
	4	1159.4	623.0	1159.3	2.190	8.1	8.1
	5	1148.6	622.3	1148.5	2.212	7.2	7.2
	6	1048.2	542.3	1048.2	2.100	11.9	11.9
	7						
	1	1128.5	599.7	1128.5	2.162	9.3	
	2	1119.9	598.2	1119.9	2.175	8.7	
	3	1165.4	629.6	1165.4	2.203	7.5	
	4	1159.3	622.7	1159.3	2.188	8.2	
	5	1148.5	621.9	1148.5	2.210	7.3	
	6	1048.2	542.0	1048.2	2.099	11.9	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1128.5	632.2	1144.7	2.202	7.6	7.7
	2	1119.9	631.1	1135.5	2.220	6.8	6.8
	3	1165.4	656.3	1178.7	2.231	6.4	6.3
	4	1159.3	649.5	1173.4	2.213	7.1	7.2
	5	1148.5	646.5	1159.7	2.238	6.1	6.1
	6	1048.2	579.3	1067.1	2.149	9.8	9.9
	7						
	1	1131.9	632.7	1148.1	2.196	7.8	
	2	1122.3	634.5	1139.6	2.222	6.8	
	3	1169.2	659.2	1182.5	2.234	6.2	
	4	1162.4	651.1	1177.2	2.209	7.3	
	5	1150.6	645.8	1159.6	2.239	6.0	
	6	1051.4	580.1	1070.7	2.143	10.1	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	130.4	7.0	137.4	2.202	7.6	0.0
	2	130.6	7.0	137.6	2.205	7.5	1.0
	3	131.2	7.0	138.2	2.215	7.1	3.0
	4	133.2	7.0	140.2	2.247	5.7	6.0
	5	131.0	7.0	138.0	2.212	7.2	9.0
	6	125.6	7.0	132.6	2.125	10.8	11.0
	7						

BM20416022 (Random) **Rice = 2.383**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1169.1	628.2	1169.0	2.189	8.1	8.1
	2	1005.4	517.8	1005.4	2.090	12.3	12.2
	3	877.4	437.5	877.4	2.025	15.0	14.8
	4	989.1	514.7	989.1	2.115	11.3	11.3
	5	880.8	463.5	880.8	2.145	10.0	10.0
	6						
	7						
	1	1169.0	628.7	1169.0	2.191	8.1	
	2	1005.4	518.1	1005.4	2.092	12.2	
	3	877.4	439.8	877.4	2.036	14.6	
	4	989.1	514.4	989.1	2.113	11.3	
	5	880.8	463.8	880.8	2.146	9.9	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1169.0	656.6	1184.5	2.214	7.1	6.9
	2	1005.4	559.8	1027.6	2.149	9.8	9.8
	3	877.4	485.6	900.0	2.117	11.2	11.2
	4	989.1	552.7	1010.1	2.162	9.3	9.4
	5	880.8	488.9	892.7	2.181	8.5	8.4
	6						
	7						
	1	1172.2	662.5	1190.2	2.221	6.8	
	2	1010.5	561.4	1031.7	2.149	9.8	
	3	881.2	485.6	902.1	2.116	11.2	
	4	992.2	554.2	1014.0	2.158	9.4	
	5	883.7	489.9	894.6	2.184	8.4	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	130.6	7.0	137.6	2.205	7.5	1.8
	2	127.7	7.0	134.7	2.159	9.4	10.9
	3	125.8	7.0	132.8	2.128	10.7	11.3
	4	127.9	7.0	134.9	2.162	9.3	6.2
	5	129.1	7.0	136.1	2.181	8.5	4.9
	6						
	7						

BM20426021 **Rice = 2.468**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	873.5	453.3	873.5	2.112	14.4	14.4
	2	936.8	500.8	936.7	2.182	11.6	11.6
	3	840.4	452.1	840.3	2.202	10.8	10.8
	4	786.0	413.7	786.0	2.149	12.9	12.9
	5	898.9	472.5	898.9	2.141	13.3	13.2
	6	941.4	498.0	941.3	2.156	12.7	12.7
	7						
	1	873.5	454.1	873.5	2.116	14.3	
	2	936.7	501.2	936.7	2.184	11.5	
	3	840.3	452.2	840.3	2.202	10.8	
	4	786.0	414.1	786.0	2.151	12.8	
	5	898.9	472.7	898.9	2.142	13.2	
	6	941.3	497.6	941.3	2.154	12.7	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	873.5	475.9	882.6	2.148	13.0	13.1
	2	936.7	519.4	942.9	2.212	10.4	11.8
	3	840.3	467.5	845.2	2.225	9.9	10.2
	4	786.0	432.2	792.8	2.180	11.7	10.8
	5	898.9	493.9	907.0	2.176	11.8	11.7
	6	941.3	518.6	949.6	2.184	11.5	11.6
	7						
	1	873.7	476.7	884.5	2.142	13.2	
	2	936.9	519.5	944.3	2.142	13.2	
	3	840.4	467.6	845.6	2.206	10.6	
	4	786.3	432.0	792.4	2.223	9.9	
	5	899.4	494.7	907.8	2.182	11.6	
	6	941.4	519.3	951.3	2.177	11.8	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	137.0	2.8	139.8	2.240	9.2	12.5
	2	138.4	2.8	141.2	2.263	8.3	11.5
	3	139.0	2.8	141.8	2.272	7.9	9.5
	4	139.0	2.8	141.8	2.272	7.9	6.5
	5	136.4	2.8	139.2	2.231	9.6	3.5
	6	134.2	2.8	137.0	2.196	11.0	1.0
	7						

BM20514021 **Rice = 2.405**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1018.4	547.4	1018.4	2.193	8.8	8.9
	2	807.3	430.1	807.2	2.179	9.4	9.4
	3	820.5	442.9	820.4	2.212	8.0	8.2
	4	769.7	408.1	769.7	2.167	9.9	9.7
	5	810.5	428.6	810.5	2.159	10.2	9.9
	6	1082.1	566.0	1081.9	2.125	11.6	11.6
	7						
	1	1018.4	546.6	1018.4	2.190	9.0	
	2	807.2	430.0	807.2	2.177	9.5	
	3	820.4	441.5	820.3	2.203	8.4	
	4	769.7	409.6	769.7	2.176	9.5	
	5	810.5	431.0	810.4	2.173	9.6	
	6	1081.9	566.3	1081.7	2.126	11.6	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1018.4	569.4	1027.0	2.226	7.5	7.5
	2	807.2	451.8	816.3	2.215	7.9	7.8
	3	820.3	456.6	824.2	2.232	7.2	7.2
	4	769.7	424.6	773.6	2.205	8.3	8.3
	5	810.4	447.8	814.9	2.208	8.2	8.3
	6	1081.7	595.0	1095.0	2.163	10.0	9.9
	7						
	1	1018.9	570.8	1028.6	2.226	7.5	
	2	808.6	453.2	817.2	2.221	7.6	
	3	820.6	457.5	825.0	2.233	7.2	
	4	769.8	425.1	774.5	2.203	8.4	
	5	810.3	447.5	815.3	2.203	8.4	
	6	1083.7	599.3	1099.1	2.168	9.8	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	138.7	-3.1	135.6	2.173	9.6	1.0
	2	138.8	-3.1	135.7	2.175	9.6	3.0
	3	142.9	-3.1	139.8	2.240	6.8	6.0
	4	138.8	-3.1	135.7	2.175	9.6	9.0
	5	141.7	-3.1	138.6	2.221	7.6	10.5
	6	136.3	-3.1	133.2	2.135	11.2	11.5
	7						

BM20515021 **Rice = 2.513**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1076.1	594.2	1076.1	2.264	9.9	9.9
	2	1023.2	568.8	1023.1	2.286	9.0	8.9
	3	1036.3	591.5	1036.2	2.366	5.9	5.9
	4	885.6	496.4	885.5	2.315	7.9	7.6
	5	945.7	529.7	945.5	2.312	8.0	8.1
	6	1005.3	568.1	1005.3	2.335	7.1	7.1
	7	958.1	517.7	958.0	2.209	12.1	12.1
	1	1076.1	594.2	1076.0	2.265	9.9	
	2	1023.1	569.6	1022.9	2.291	8.8	
	3	1036.2	591.3	1036.2	2.364	5.9	
	4	885.5	498.7	885.4	2.330	7.3	
	5	945.5	528.8	945.4	2.306	8.2	
	6	1005.3	568.1	1005.3	2.335	7.1	
	7	958.0	517.9	958.0	2.210	12.1	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1076.0	614.9	1084.1	2.293	8.7	8.8
	2	1022.9	585.7	1027.9	2.313	8.0	8.1
	3	1036.2	602.8	1038.5	2.378	5.4	5.3
	4	885.4	509.6	887.4	2.344	6.7	6.8
	5	945.4	543.0	948.4	2.332	7.2	7.2
	6	1005.3	582.1	1007.4	2.364	5.9	6.1
	7	958.0	550.8	971.9	2.275	9.5	9.5
	1	1076.8	616.0	1086.0	2.291	8.8	
	2	1022.5	586.2	1029.6	2.306	8.2	
	3	1035.8	602.4	1037.7	2.380	5.3	
	4	885.0	509.9	887.9	2.341	6.8	
	5	945.0	543.1	948.6	2.330	7.3	
	6	1004.8	581.6	1008.3	2.355	6.3	
	7	959.1	552.9	974.4	2.275	9.5	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	143.1	0.3	143.4	2.298	8.6	0.0
	2	148.9	0.3	149.2	2.391	4.9	1.0
	3	148.8	0.3	149.1	2.389	4.9	3.0
	4	149.1	0.3	149.4	2.394	4.7	6.0
	5	145.7	0.3	146.0	2.340	6.9	9.0
	6	152.5	0.3	152.8	2.449	2.6	11.0
	7	139.7	0.3	140.0	2.244	10.7	12.0

BM20515022 (Random) **Rice = 2.513**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1083.5	605.4	1083.3	2.300	8.5	8.3
	2	1237.0	706.8	1237.0	2.364	5.9	5.9
	3	981.8	544.5	981.7	2.280	9.3	9.5
	4	1021.5	569.8	1021.5	2.296	8.6	8.9
	5	852.0	473.8	851.9	2.293	8.7	8.6
	6						
	7						
	1	1083.3	607.1	1083.2	2.308	8.1	
	2	1237.0	707.0	1237.1	2.364	5.9	
	3	981.7	541.8	981.7	2.266	9.8	
	4	1021.5	566.9	1021.5	2.281	9.2	
	5	851.9	474.6	851.8	2.298	8.5	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1083.2	624.4	1087.9	2.337	7.0	7.0
	2	1237.1	718.9	1239.6	2.376	5.5	5.6
	3	981.7	560.2	986.4	2.303	8.3	8.4
	4	1021.5	586.6	1025.9	2.325	7.5	7.8
	5	851.8	490.8	856.1	2.332	7.2	7.4
	6						
	7						
	1	1082.8	624.1	1087.7	2.336	7.1	
	2	1236.9	718.3	1240.0	2.371	5.7	
	3	981.7	561.5	988.7	2.298	8.6	
	4	1021.3	585.6	1027.8	2.310	8.1	
	5	851.7	490.1	856.6	2.324	7.5	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	149.3	0.3	149.6	2.397	4.6	3.3
	2	145.6	0.3	145.9	2.338	7.0	3.3
	3	142.7	0.3	143.0	2.292	8.8	1.5
	4	146.7	0.3	147.0	2.356	6.3	0.6
	5	145.0	0.3	145.3	2.329	7.3	8.7
	6						
	7						

BM20716021 **Rice = 2.350**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1167.7	597.5	1167.7	2.073	11.8	11.8
	2	1226.4	656.2	1226.4	2.177	7.4	7.5
	3	1146.4	623.6	1146.4	2.222	5.4	5.6
	4	1185.2	628.3	1185.2	2.155	8.3	8.3
	5	1041.6	549.8	1041.6	2.148	8.6	8.6
	6						
	7						
	1	1167.7	597.6	1167.7	2.073	11.8	
	2	1226.4	653.9	1226.3	2.169	7.7	
	3	1146.4	622.1	1146.4	2.215	5.7	
	4	1185.2	628.2	1185.2	2.155	8.3	
	5	1041.6	549.9	1041.6	2.148	8.6	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1167.7	637.1	1189.9	2.112	10.1	9.8
	2	1226.3	673.0	1234.0	2.186	7.0	6.8
	3	1146.4	635.0	1150.5	2.224	5.4	5.2
	4	1185.2	647.8	1194.2	2.169	7.7	7.5
	5	1041.6	572.0	1052.2	2.169	7.7	7.4
	6						
	7						
	1	1171.0	637.8	1188.3	2.127	9.5	
	2	1226.8	675.0	1233.8	2.195	6.6	
	3	1146.3	635.2	1149.1	2.231	5.1	
	4	1185.7	649.5	1194.0	2.178	7.3	
	5	1042.4	574.1	1051.1	2.185	7.0	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	122.8	3.8	126.6	2.028	13.7	1.0
	2	132.8	3.8	136.6	2.188	6.9	3.0
	3	134.7	3.8	138.5	2.220	5.5	6.0
	4	133.7	3.8	137.5	2.204	6.2	9.0
	5	130.4	3.8	134.2	2.150	8.5	12.0
	6						
	7						

BM20723021 **Rice = 2.510**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	935.8	487.5	935.8	2.119	15.6	15.7
	2	980.9	540.4	980.9	2.261	9.9	9.7
	3	951.1	531.0	951.0	2.301	8.3	8.4
	4	785.6	411.7	785.4	2.139	14.8	14.8
	5	737.4	384.1	737.4	2.126	15.3	15.3
	6	841.2	419.8	841.2	2.028	19.2	19.4
	7						
	1	935.8	486.4	935.7	2.114	15.8	
	2	980.9	541.9	980.8	2.270	9.6	
	3	951.0	530.4	951.0	2.297	8.5	
	4	785.4	411.1	785.4	2.136	14.9	
	5	737.4	384.2	737.4	2.127	15.3	
	6	841.2	417.7	841.2	2.018	19.6	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	935.7	540.0	958.4	2.236	10.9	10.8
	2	980.8	569.1	994.0	2.308	8.0	8.0
	3	951.0	546.5	954.5	2.331	7.1	7.1
	4	785.4	454.5	800.5	2.270	9.6	9.6
	5	737.4	430.2	750.8	2.300	8.4	8.4
	6	841.2	487.8	860.7	2.256	10.1	10.1
	7						
	1	936.0	540.1	958.1	2.239	10.8	
	2	981.0	569.6	994.3	2.310	8.0	
	3	951.2	546.5	954.2	2.333	7.0	
	4	785.4	454.7	801.0	2.268	9.6	
	5	737.2	430.6	751.1	2.300	8.4	
	6	841.5	487.9	860.7	2.257	10.1	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	134.2	-0.1	134.1	2.149	14.4	1.0
	2	140.9	-0.1	140.8	2.256	10.1	3.0
	3	144.3	-0.1	144.2	2.311	7.9	6.0
	4	135.9	-0.1	135.8	2.176	13.3	9.0
	5	134.9	-0.1	134.8	2.160	13.9	11.0
	6	128.6	-0.1	128.5	2.059	18.0	12.0
	7						

BM20730021 **Rice = 2.450**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1125.9	555.9	1125.9	1.999	18.4	18.4
	2	1196.6	642.9	1196.6	2.188	10.7	10.5
	3	1376.6	757.6	1376.5	2.250	8.2	8.2
	4	1407.2	781.5	1407.1	2.275	7.1	7.2
	5	1367.7	749.5	1367.6	2.238	8.6	8.8
	6	1319.3	694.4	1319.3	2.135	12.9	12.8
	7						
	1	1125.9	556.4	1125.9	2.001	18.3	
	2	1196.6	645.3	1196.5	2.198	10.3	
	3	1376.5	756.7	1376.5	2.246	8.3	
	4	1407.1	780.7	1407.1	2.272	7.3	
	5	1367.6	747.7	1367.5	2.232	8.9	
	6	1319.3	695.1	1319.2	2.138	12.7	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1125.9	633.8	1158.2	2.147	12.4	12.4
	2	1196.5	672.1	1209.8	2.225	9.2	8.9
	3	1376.5	781.8	1386.6	2.276	7.1	7.0
	4	1407.1	801.6	1413.8	2.298	6.2	6.1
	5	1367.5	769.3	1374.9	2.258	7.8	7.8
	6	1319.2	733.9	1337.4	2.186	10.8	10.8
	7						
	1	1134.4	634.8	1163.7	2.145	12.5	
	2	1198.9	673.2	1209.2	2.237	8.7	
	3	1378.3	783.0	1386.8	2.283	6.8	
	4	1407.9	801.2	1412.6	2.303	6.0	
	5	1368.3	769.4	1375.1	2.259	7.8	
	6	1322.1	733.7	1339.2	2.183	10.9	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	119.0	5.5	124.5	1.995	18.6	0.0
	2	134.7	5.5	140.2	2.247	8.3	1.0
	3	139.2	5.5	144.7	2.319	5.4	5.0
	4	141.1	5.5	146.6	2.349	4.1	8.0
	5	137.8	5.5	143.3	2.296	6.3	11.0
	6	131.5	5.5	137.0	2.196	10.4	13.0
	7						

BM20820021 **Rice = 2.519**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	799.3	431.5	799.2	2.213	12.2	12.2
	2	851.2	477.5	851.2	2.318	8.0	7.9
	3	853.9	486.7	853.9	2.367	6.0	6.1
	4	934.5	529.2	934.5	2.344	6.9	6.6
	5	1012.8	576.9	1012.8	2.359	6.3	6.4
	6	1060.8	601.8	1060.8	2.346	6.9	6.9
	7						
	1	799.2	431.1	799.2	2.210	12.3	
	2	851.2	478.2	851.2	2.323	7.8	
	3	853.9	486.1	853.8	2.365	6.1	
	4	934.5	532.1	934.5	2.361	6.3	
	5	1012.8	575.9	1012.7	2.355	6.5	
	6	1060.8	601.9	1060.7	2.347	6.8	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	799.2	462.2	810.8	2.293	9.0	9.0
	2	851.2	496.0	854.7	2.373	5.8	5.7
	3	853.8	499.1	854.8	2.400	4.7	4.7
	4	934.5	548.5	937.9	2.400	4.7	4.8
	5	1012.7	591.7	1014.1	2.397	4.8	4.8
	6	1060.7	620.2	1062.9	2.396	4.9	4.9
	7						
	1	799.3	462.1	810.7	2.293	9.0	
	2	851.5	496.3	854.7	2.376	5.7	
	3	853.8	499.3	855.0	2.400	4.7	
	4	934.6	548.3	938.1	2.398	4.8	
	5	1012.7	592.0	1014.0	2.400	4.7	
	6	1061.0	620.4	1063.0	2.397	4.8	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	137.2	2.4	139.6	2.237	11.2	0.0
	2	151.2	2.4	153.6	2.462	2.3	1.0
	3	148.1	2.4	150.5	2.412	4.3	3.0
	4	152.5	2.4	154.9	2.482	1.5	6.0
	5	151.5	2.4	153.9	2.466	2.1	9.0
	6	146.4	2.4	148.8	2.385	5.3	12.0
	7						

BM20826021 **Rice = 2.563**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	853.3	485.7	853.3	2.363	7.8	7.8
	2	887.4	504.6	887.4	2.358	8.0	7.9
	3	850.0	486.3	849.9	2.380	7.1	7.2
	4	972.6	551.4	972.6	2.346	8.5	8.5
	5	905.6	513.3	905.5	2.348	8.4	8.4
	6	854.5	484.6	854.4	2.352	8.2	8.2
	7						
	1	853.3	485.9	853.2	2.365	7.7	
	2	887.4	505.0	887.2	2.362	7.8	
	3	849.9	486.1	849.9	2.379	7.2	
	4	972.6	550.9	972.6	2.343	8.6	
	5	905.5	513.4	905.4	2.349	8.3	
	6	854.4	485.0	854.4	2.355	8.1	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	853.2	506.1	861.3	2.402	6.3	6.3
	2	887.2	528.0	896.0	2.411	5.9	6.0
	3	849.9	503.9	857.6	2.403	6.2	6.2
	4	972.6	575.2	979.6	2.405	6.2	6.0
	5	905.4	536.3	912.0	2.410	6.0	6.0
	6	854.4	507.5	861.2	2.416	5.8	5.7
	7						
	1	853.0	506.3	861.4	2.402	6.3	
	2	887.4	528.0	896.7	2.407	6.1	
	3	850.0	504.2	857.4	2.407	6.1	
	4	972.5	576.1	979.3	2.412	5.9	
	5	905.0	535.8	911.6	2.408	6.0	
	6	855.6	508.1	862.0	2.418	5.7	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	145.5	4.7	150.2	2.407	6.1	0.0
	2	139.0	4.7	143.7	2.303	10.1	1.0
	3	144.7	4.7	149.4	2.394	6.6	3.0
	4	146.0	4.7	150.7	2.415	5.8	0.0
	5	146.5	4.7	151.2	2.423	5.5	1.0
	6	145.3	4.7	150.0	2.404	6.2	3.0
	7						

BM20826022 (Random) **Rice = 2.563**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	856.9	478.5	856.9	2.304	10.1	10.1
	2	829.1	461.4	829.1	2.295	10.4	10.5
	3	729.0	405.0	729.0	2.296	10.4	10.6
	4	838.4	466.6	838.4	2.295	10.4	10.3
	5	802.7	465.0	802.6	2.425	5.4	5.5
	6						
	7						
	1	856.9	478.8	856.9	2.306	10.0	
	2	829.1	461.0	829.0	2.294	10.5	
	3	729.0	403.8	729.0	2.287	10.8	
	4	838.4	467.8	838.4	2.303	10.1	
	5	802.6	464.7	802.6	2.422	5.5	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	856.9	501.7	863.7	2.367	7.6	7.5
	2	829.0	491.8	841.9	2.368	7.6	7.5
	3	729.0	428.2	736.5	2.365	7.7	7.8
	4	838.4	498.2	848.8	2.391	6.7	6.7
	5	802.6	475.5	804.9	2.437	4.9	5.0
	6						
	7						
	1	860.1	502.1	864.1	2.376	7.3	
	2	829.0	492.0	841.6	2.371	7.5	
	3	728.8	428.1	736.8	2.361	7.9	
	4	838.3	497.6	848.1	2.392	6.7	
	5	803.0	474.8	805.0	2.432	5.1	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	144.4	4.7	149.1	2.389	6.8	3.8
	2	143.1	4.7	147.8	2.369	7.6	3.0
	3	139.5	4.7	144.2	2.311	9.8	4.0
	4	144.2	4.7	148.9	2.386	6.9	3.5
	5	148.4	4.7	153.1	2.454	4.3	6.5
	6						
	7						

BM20827021 **Rice = 2.603**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1099.7	611.1	1099.7	2.282	12.3	12.3
	2	1172.6	652.2	1172.5	2.284	12.3	12.3
	3	1295.3	713.0	1295.3	2.251	13.5	13.5
	4	1434.5	811.7	1434.4	2.330	10.5	10.5
	5	1652.3	948.1	1652.3	2.371	8.9	8.9
	6	1730.2	985.4	1730.2	2.346	9.9	9.9
	7						
	1	1099.7	611.8	1099.6	2.286	12.2	
	2	1172.5	652.2	1172.5	2.284	12.3	
	3	1295.3	713.3	1295.3	2.252	13.5	
	4	1434.4	811.3	1434.4	2.328	10.6	
	5	1652.3	948.3	1652.3	2.371	8.9	
	6	1730.2	985.0	1730.1	2.345	9.9	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1099.6	663.6	1121.0	2.404	7.6	7.6
	2	1172.5	708.7	1192.1	2.426	6.8	6.8
	3	1295.3	791.1	1316.5	2.465	5.3	5.3
	4	1434.4	858.3	1453.9	2.408	7.5	7.4
	5	1652.3	988.8	1668.7	2.430	6.6	6.6
	6	1730.1	1028.2	1745.8	2.411	7.4	7.3
	7						
	1	1099.8	663.7	1120.8	2.406	7.6	
	2	1172.5	708.2	1191.8	2.425	6.9	
	3	1295.1	791.6	1316.6	2.467	5.2	
	4	1434.9	858.6	1454.0	2.410	7.4	
	5	1652.5	988.7	1668.2	2.432	6.6	
	6	1730.6	1028.0	1744.9	2.414	7.3	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	145.5	5.4	150.9	2.418	7.1	0.0
	2	140.7	5.4	146.1	2.341	10.1	1.0
	3	140.1	5.4	145.5	2.332	10.4	3.0
	4	143.7	5.4	149.1	2.389	8.2	6.0
	5	147.1	5.4	152.5	2.444	6.1	9.0
	6	139.5	5.4	144.9	2.322	10.8	11.0
	7						

A0820012 **Rice =** **2.625**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1612.9	888.2	1612.9	2.248	14.4	14.3
	[redacted]						
	[redacted]						
	4	1668.7	965.1	1668.7	2.397	8.7	8.6
	5	1725.2	1007.0	1725.1	2.427	7.5	7.5
	6	1555.3	881.8	1555.3	2.334	11.1	11.0
	7	1537.0	889.9	1536.9	2.402	8.5	8.5
	1	1612.9	888.5	1612.9	2.249	14.3	
	[redacted]						
	[redacted]						
	4	1668.7	966.3	1668.7	2.400	8.6	
	5	1725.1	1007.0	1725.1	2.427	7.5	
	6	1555.3	883.0	1555.3	2.339	10.9	
	7	1536.9	889.8	1536.9	2.402	8.5	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1612.9	990.8	1632.3	2.514	4.2	4.7
	[redacted]						
	[redacted]						
	4	1668.7	993.2	1681.2	2.425	7.6	8.0
	5	1725.1	1035.6	1735.4	2.465	6.1	6.6
	6	1555.3	930.2	1570.7	2.428	7.5	8.2
	7	1536.9	931.6	1551.8	2.478	5.6	6.3
	1	1617.7	988.6	1638.7	2.488	5.2	
	[redacted]						
	[redacted]						
	4	1675.2	987.5	1684.1	2.405	8.4	
	5	1727.9	1030.1	1738.4	2.440	7.1	
	6	1561.1	922.8	1575.4	2.392	8.9	
	7	1542.0	926.9	1558.5	2.441	7.0	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	136.9	9.5	146.4	2.346	10.6	0.3
	[redacted]	144.6	9.5	154.1	2.470	5.9	1.0
	[redacted]	146.2	9.5	155.7	2.495	4.9	3.0
	4	143.7	9.5	153.2	2.455	6.5	6.0
	5	140.4	9.5	149.9	2.402	8.5	9.0
	6	142.1	9.5	151.6	2.429	7.4	12.0
	7	139.1	9.5	148.6	2.381	9.3	13.0

A0829011 **Rice = 2.571**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1406.8	771.6	1406.9	2.238	13.0	13.0
	2	1963.9	1111.6	1963.8	2.323	9.6	9.6
	3	1105.9	620.6	1105.9	2.311	10.1	10.1
	4	1450.2	789.2	1450.1	2.217	13.8	13.4
	5	1620.4	900.9	1620.5	2.275	11.5	11.6
	6	886.0	501.2	885.8	2.344	8.8	8.8
	7	1682.3	903.9	1682.2	2.181	15.2	15.3
	1	1406.9	771.6	1406.9	2.238	13.0	
	2	1964.0	1111.5	1964.0	2.323	9.6	
	3	1105.9	621.0	1105.8	2.314	10.0	
	4	1450.1	795.2	1450.1	2.238	13.0	
	5	1620.3	900.5	1620.5	2.273	11.6	
	6	885.8	501.4	885.7	2.345	8.8	
	7	1682.2	901.5	1682.3	2.174	15.4	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1406.9	817.0	1422.4	2.324	9.6	9.7
	2	1963.9	1148.2	1980.6	2.359	8.2	8.1
	3	1105.8	649.1	1120.0	2.348	8.7	8.6
	4	1450.1	851.0	1469.7	2.344	8.8	8.9
	5	1620.3	946.5	1634.3	2.356	8.4	8.3
	6	885.7	519.1	890.1	2.387	7.1	7.2
	7	1682.2	977.2	1709.1	2.298	10.6	10.7
	1	1408.9	816.4	1424.4	2.317	9.9	
	2	1969.2	1147.6	1980.2	2.365	8.0	
	3	1106.1	649.7	1119.8	2.353	8.5	
	4	1451.0	849.9	1470.5	2.338	9.1	
	5	1621.3	947.4	1634.1	2.361	8.2	
	6	885.6	518.6	889.8	2.386	7.2	
	7	1683.8	977.3	1711.2	2.294	10.8	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	N / A	N / A	N / A	N / A	N / A	12.0
	2	N / A	N / A	N / A	N / A	N / A	11.0
	3	N / A	N / A	N / A	N / A	N / A	9.0
	4	N / A	N / A	N / A	N / A	N / A	6.0
	5	N / A	N / A	N / A	N / A	N / A	3.0
	6	N / A	N / A	N / A	N / A	N / A	1.0
	7	N / A	N / A	N / A	N / A	N / A	0.0

A0829012

Rice = 2.538

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1416.7	735.3	1416.8	2.101	17.2	17.2
	2	1977.7	1099.4	1977.7	2.272	10.5	10.5
	3	1623.1	918.5	1623.1	2.327	8.3	8.4
	4	1838.1	1019.1	1838.2	2.265	10.8	10.7
	5	1870.5	1068.4	1870.6	2.354	7.2	7.2
	6	1698.4	955.8	1698.4	2.310	9.0	9.1
	7	1661.8	911.3	1661.9	2.236	11.9	11.9
	1	1416.7	736.4	1416.8	2.104	17.1	
	2	1977.8	1098.6	1977.7	2.269	10.6	
	3	1623.2	917.9	1623.1	2.325	8.4	
	4	1838.1	1019.3	1838.2	2.266	10.7	
	5	1870.5	1068.7	1870.5	2.355	7.2	
	6	1698.4	954.5	1698.4	2.306	9.1	
	7	1661.9	911.5	1661.9	2.237	11.9	

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1416.7	845.8	1440.1	2.384	6.1	6.2
	2	1977.7	1174.2	2001.4	2.391	5.8	5.8
	3	1623.1	962.2	1634.4	2.415	4.9	4.9
	4	1838.1	1091.7	1858.8	2.396	5.6	5.7
	5	1870.6	1109.4	1883.7	2.416	4.8	4.8
	6	1698.4	1006.0	1712.1	2.405	5.2	5.2
	7	1661.9	988.5	1682.1	2.396	5.6	5.5
	1	1416.5	844.9	1440.4	2.379	6.3	
	2	1978.7	1174.1	2000.9	2.393	5.7	
	3	1623.9	962.9	1636.3	2.411	5.0	
	4	1838.7	1090.8	1859.3	2.393	5.7	
	5	1871.0	1109.5	1883.3	2.418	4.7	
	6	1698.2	1006.1	1711.9	2.406	5.2	
	7	1662.0	987.7	1680.2	2.400	5.4	

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	N / A	N / A	N / A	N / A	N / A	0.0
	2	N / A	N / A	N / A	N / A	N / A	1.0
	3	N / A	N / A	N / A	N / A	N / A	3.5
	4	N / A	N / A	N / A	N / A	N / A	6.5
	5	N / A	N / A	N / A	N / A	N / A	9.5
	6	N / A	N / A	N / A	N / A	N / A	11.5
	7	N / A	N / A	N / A	N / A	N / A	12.5

A0905013 **Rice = 2.571**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1439.6	814.0	1439.7	2.326	9.5	9.7
	2	1514.1	872.7	1514.1	2.386	7.2	7.2
	3	2079.7	1219.3	2079.8	2.438	5.2	5.1
	4	1856.2	1105.1	1856.1	2.495	3.0	3.0
	5	2668.9	1544.1	2669.0	2.441	5.1	6.0
	6						
	7						
	1	1439.6	811.6	1439.6	2.317	9.9	
	2	1514.1	872.9	1514.1	2.386	7.2	
	3	2079.7	1220.7	2079.8	2.442	5.0	
	4	1856.2	1105.2	1856.3	2.495	3.0	
	5	2668.8	1544.8	2668.9	2.391	7.0	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1439.6	840.0	1446.1	2.375	7.6	7.6
	2	1514.0	888.9	1516.2	2.414	6.1	6.2
	3	2079.8	1239.7	2081.7	2.470	3.9	4.0
	4	1856.1	1118.0	1856.7	2.513	2.3	2.3
	5	2668.8	1574.3	2676.1	2.422	5.8	5.9
	6						
	7						
	1	1438.1	839.2	1444.5	2.376	7.6	
	2	1513.5	887.8	1516.1	2.409	6.3	
	3	2079.3	1238.7	2081.7	2.467	4.1	
	4	1855.6	1116.8	1856.4	2.509	2.4	
	5	2667.6	1570.4	2675.0	2.415	6.1	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	138.7	5.8	144.5	2.316	9.9	1.0
	2	139.8	5.8	145.6	2.333	9.2	3.0
	3	144.7	5.8	150.5	2.412	6.2	6.0
	4	145.4	5.8	151.2	2.423	5.8	9.0
	5	143.4	5.8	149.2	2.391	7.0	11.0
	6						
	7						

A0906011 **Rice = 2.631**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1434.8	768.1	1434.7	2.175	17.3	17.5
	2	1566.1	899.3	1566.1	2.374	9.8	9.7
	3	1675.7	979.2	1675.7	2.430	7.6	7.6
	4	1564.5	905.6	1564.6	2.400	8.8	8.8
	5	1383.7	799.0	1383.6	2.394	9.0	8.9
	6	1414.5	799.5	1414.6	2.326	11.6	11.5
	7						
	1	1434.7	764.5	1434.9	2.164	17.7	
	2	1566.0	900.0	1566.1	2.377	9.7	
	3	1675.6	979.1	1675.6	2.430	7.6	
	4	1564.6	905.7	1564.6	2.400	8.8	
	5	1383.8	800.2	1383.6	2.399	8.8	
	6	1414.6	800.4	1414.6	2.329	11.5	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1434.7	877.2	1460.1	2.461	6.4	6.8
	2	1566.1	944.0	1580.9	2.459	6.5	6.6
	3	1675.8	1006.6	1683.1	2.477	5.8	5.8
	4	1564.6	931.1	1571.3	2.444	7.1	7.1
	5	1383.6	827.4	1393.0	2.446	7.0	7.3
	6	1414.5	847.9	1432.1	2.421	8.0	8.5
	7						
	1	1434.6	875.5	1463.0	2.442	7.2	
	2	1566.8	941.5	1580.0	2.454	6.7	
	3	1675.7	1006.2	1682.7	2.477	5.9	
	4	1564.4	930.7	1570.4	2.446	7.0	
	5	1384.3	821.9	1391.5	2.430	7.6	
	6	1415.3	842.3	1433.7	2.393	9.0	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	124.9	5.8	130.7	2.095	20.4	0.0
	2	141.2	5.8	147.0	2.356	10.5	1.0
	3	147.0	5.8	152.8	2.449	6.9	4.5
	4	133.7	5.8	139.5	2.236	15.0	7.5
	5	137.9	5.8	143.7	2.303	12.5	10.5
	6	129.9	5.8	135.7	2.175	17.3	14.0
	7						

A1015011 **Rice = 2.503**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1685.7	920.6	1685.8	2.225	11.1	11.0
	2	1527.1	817.5	1527.0	2.173	13.2	13.0
	3	1520.9	847.2	1520.9	2.282	8.8	8.8
	4	1285.5	715.2	1285.5	2.282	8.8	8.7
	5	1821.0	971.1	1821.0	2.162	13.6	13.4
	6	1425.3	787.1	1425.2	2.258	9.8	9.8
	7						
	1	1685.7	921.9	1685.7	2.228	11.0	
	2	1527.1	820.2	1527.1	2.183	12.8	
	3	1520.9	848.3	1520.9	2.285	8.7	
	4	1285.5	716.3	1285.6	2.287	8.6	
	5	1821.0	975.2	1820.9	2.172	13.2	
	6	1425.2	787.1	1425.1	2.259	9.7	
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1685.4	991.6	1707.2	2.355	5.9	6.0
	2	1526.8	900.5	1551.2	2.346	6.3	6.5
	3	1520.6	894.1	1537.2	2.364	5.5	5.6
	4	1285.2	747.8	1298.7	2.333	6.8	6.8
	5	1820.2	1058.9	1847.5	2.308	7.8	7.9
	6	1424.4	827.4	1440.1	2.325	7.1	7.1
	7						
	1	1685.3	989.7	1706.6	2.351	6.1	
	2	1526.5	898.3	1551.8	2.336	6.7	
	3	1520.6	894.0	1538.6	2.359	5.8	
	4	1285.2	745.4	1296.5	2.332	6.8	
	5	1820.0	1057.1	1847.8	2.302	8.0	
	6	1424.4	827.3	1439.3	2.327	7.0	
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	121.7	7.9	129.6	2.077	17.0	0.0
	2	136.1	7.9	144.0	2.308	7.8	1.0
	3	137.2	7.9	145.1	2.325	7.1	3.0
	4	139.7	7.9	147.6	2.365	5.5	6.0
	5	142.1	7.9	150.0	2.404	4.0	9.0
	6	136.6	7.9	144.5	2.316	7.5	11.0
	7						

A1015012 (Random) **Rice = 2.503**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1						
	2	2008.6	1105.4	2008.9	2.243	10.4	10.7
	3	1810.0	1006.1	1809.6	2.274	9.1	8.9
	4	1745.1	979.8	1745.0	2.303	8.0	8.0
	5	1921.3	1084.2	1921.3	2.316	7.5	7.5
	6						
	7						
	1						
	2	2008.6	1099.4	2008.3	2.229	10.9	
	3	1809.6	1010.1	1809.6	2.285	8.7	
	4	1744.9	980.4	1745.0	2.305	7.9	
	5	1921.2	1083.7	1921.1	2.314	7.6	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1						
	2	2006.0	1168.6	2026.3	2.339	6.6	6.9
	3	1807.9	1055.3	1821.0	2.361	5.7	5.9
	4	1743.9	1016.9	1754.8	2.363	5.6	5.5
	5	1920.0	1124.5	1931.6	2.379	5.0	4.9
	6						
	7						
	1						
	2	2011.5	1163.2	2029.2	2.323	7.2	
	3	1811.5	1054.2	1824.4	2.352	6.0	
	4	1746.2	1016.3	1753.9	2.367	5.4	
	5	1923.1	1124.1	1930.8	2.384	4.8	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	N / A	N / A	N / A	N / A	N / A	6.7
	2	143.2	7.9	151.1	2.421	3.3	6.6
	3	143.9	7.9	151.8	2.433	2.8	2.4
	4	144.0	7.9	151.9	2.434	2.7	10.3
	5	140.9	7.9	148.8	2.385	4.7	6.4
	6						
	7						

A0515023 (Problem) **Rice = 2.571**

	ID	Initial Weight (grams)	Sealed Submerged Weight (grams)	Weight After Submersion (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
CoreLok	1	1057.8	584.2	1057.8	2.266	11.8	12.0
	2	1185.1	668.0	1185.0	2.323	9.6	9.6
	3	1353.4	785.9	1353.3	2.415	6.1	6.2
	4	1267.2	719.9	1267.1	2.346	8.8	8.8
	5	1347.3	731.7	1347.2	2.214	13.9	14.3
	6						
	7						
	1	1057.8	583.0	1057.7	2.260	12.1	
	2	1185.0	668.3	1184.9	2.325	9.6	
	3	1353.3	784.0	1353.2	2.407	6.4	
	4	1267.1	719.7	1267.0	2.345	8.8	
	5	1347.2	726.1	1347.1	2.194	14.7	
	6						
	7						

	ID	Dry Weight (grams)	Submerged Weight (grams)	Saturated Surface Dry Weight (grams)	Bulk Specific Gravity	Air Voids (%)	Average Air Voids (%)
AASHTO T 166	1	1057.7	632.9	1072.3	2.407	6.4	6.7
	2	1184.9	706.7	1194.2	2.431	5.5	5.7
	3	1353.2	801.8	1354.9	2.447	4.8	5.0
	4	1267.0	754.9	1276.3	2.430	5.5	5.7
	5	1347.1	812.3	1365.0	2.437	5.2	5.2
	6						
	7						
	1	1062.5	629.0	1073.8	2.389	7.1	
	2	1186.9	705.9	1196.8	2.418	6.0	
	3	1353.2	802.0	1357.1	2.438	5.2	
	4	1268.9	752.0	1276.2	2.421	5.8	
	5	1350.5	811.5	1366.0	2.436	5.3	
	6						
	7						

	ID	Field Nuclear Density (pcf)	Correction Factor (pcf)	Corrected Nuclear Density (pcf)	Bulk Specific Gravity	Air Voids (%)	Joint Distance (feet)
Nuclear Density	1	138.8	-3.0	135.8	2.176	15.4	1.0
	2	141.7	-3.0	138.7	2.223	13.5	2.0
	3	144.9	-3.0	141.9	2.274	11.6	5.5
	4	149.9	-3.0	146.9	2.354	8.4	8.5
	5	147.1	-3.0	144.1	2.309	10.2	10.0
	6						
	7						

Appendix G:

Paired t-tests on Field Samples

Legend

C = CoreLok

T = AASHTO T 166

N = Nuclear Density

If Absolute Value of **t Stat** is Greater than **t Critical two-tail**, then **YES** there is a Statistical Difference between methods

If Absolute Value of **t Stat** is Less than **t Critical two-tail**, then **NO** there is not a Statistical Difference between methods

S0727011

	C	*T*	
Mean	8.46843	7.77414	
Variance	3.34128	2.18745	
Observations	5.00000	5.00000	
Pearson Correlation	0.99442		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.98290**		**YES**
P(T<=t) one-tail	0.00818		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01636		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	8.46843	7.37114	
Variance	3.34128	2.63340	
Observations	5.00000	5.00000	
Pearson Correlation	0.65907		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**1.70758**		**NO**
P(T<=t) one-tail	0.08145		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.16290		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	7.77414	7.37114	
Variance	2.18745	2.63340	
Observations	5.00000	5.00000	
Pearson Correlation	0.67736		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.71933**		**NO**
P(T<=t) one-tail	0.25586		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.51172		
t Critical two-tail	**2.77645**		

S0820013

	C	*T*	
Mean	12.37406	11.29960	
Variance	13.12962	9.98480	
Observations	6.00000	6.00000	
Pearson Correlation	0.99778		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**5.10540**		**YES**
P(T<=t) one-tail	0.00188		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00375		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	12.37406	9.48428	
Variance	13.12962	7.85117	
Observations	6.00000	6.00000	
Pearson Correlation	0.87587		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.95982**		**YES**
P(T<=t) one-tail	0.00537		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01074		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	11.29960	9.48428	
Variance	9.98480	7.85117	
Observations	6.00000	6.00000	
Pearson Correlation	0.87297		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**2.88381**		**YES**
P(T<=t) one-tail	0.01722		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.03443		
t Critical two-tail	**2.57058**		

S1030012 (Problem)

	C	*T*	
Mean	7.40326	6.40425	
Variance	2.31669	1.22772	
Observations	6.00000	6.00000	
Pearson Correlation	0.97528		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**4.84756**		**YES**
P(T<=t) one-tail	0.00234		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00468		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	7.40326	5.77184	
Variance	2.31669	1.67165	
Observations	6.00000	6.00000	
Pearson Correlation	-0.19531		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**1.83220**		**NO**
P(T<=t) one-tail	0.06321		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.12641		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	6.40425	5.77184	
Variance	1.22772	1.67165	
Observations	6.00000	6.00000	
Pearson Correlation	-0.10004		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**0.86786**		**NO**
P(T<=t) one-tail	0.21258		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.42515		
t Critical two-tail	**2.57058**		

S0716022

	C	*T*	
Mean	10.6488	9.5892	
Variance	3.4544	2.7841	
Observations	6.0000	6.0000	
Pearson Correlation	0.9777		
Hypothesized Mean Difference	0.0000		
df	5.0000		
t Stat	**6.2154**		**YES**
P(T<=t) one-tail	0.0008		
t Critical one-tail	2.0150		
P(T<=t) two-tail	0.0016		
t Critical two-tail	**2.5706**		

	C	*N*	
Mean	10.6488	6.1181	
Variance	3.4544	3.9733	
Observations	6.0000	6.0000	
Pearson Correlation	0.5179		
Hypothesized Mean Difference	0.0000		
df	5.0000		
t Stat	**5.8568**		**YES**
P(T<=t) one-tail	0.0010		
t Critical one-tail	2.0150		
P(T<=t) two-tail	0.0021		
t Critical two-tail	**2.5706**		

	T	*N*	
Mean	9.5892	6.1181	
Variance	2.7841	3.9733	
Observations	6.0000	6.0000	
Pearson Correlation	0.5694		
Hypothesized Mean Difference	0.0000		
df	5.0000		
t Stat	**4.9340**		**YES**
P(T<=t) one-tail	0.0022		
t Critical one-tail	2.0150		
P(T<=t) two-tail	0.0043		
t Critical two-tail	**2.5706**		

D0519011

	C	*T*	
Mean	8.68765	7.86593	
Variance	5.32332	4.18179	
Observations	6.00000	6.00000	
Pearson Correlation	0.99819		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**6.86906**		**YES**
P(T<=t) one-tail	0.00050		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00100		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	8.68765	7.35553	
Variance	5.32332	5.10133	
Observations	6.00000	6.00000	
Pearson Correlation	0.94782		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**4.41509**		**YES**
P(T<=t) one-tail	0.00346		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00692		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	7.86593	7.35553	
Variance	4.18179	5.10133	
Observations	6.00000	6.00000	
Pearson Correlation	0.93653		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**1.57272**		**NO**
P(T<=t) one-tail	0.08830		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.17659		
t Critical two-tail	**2.57058**		

D0820011 (Problem)

	C	*T*	
Mean	11.11224	9.03190	
Variance	17.19644	6.48711	
Observations	6.00000	6.00000	
Pearson Correlation	0.92080		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**2.47688**		**NO**
P(T<=t) one-tail	0.02803		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.05605		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	11.11224	8.48373	
Variance	17.19644	25.72963	
Observations	6.00000	6.00000	
Pearson Correlation	0.89654		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**2.82103**		**YES**
P(T<=t) one-tail	0.01853		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.03706		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	9.03190	8.48373	
Variance	6.48711	25.72963	
Observations	6.00000	6.00000	
Pearson Correlation	0.65496		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**0.34335**		**NO**
P(T<=t) one-tail	0.37265		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.74530		
t Critical two-tail	**2.57058**		

D0905011

	C	*T*	
Mean	11.13904	9.12895	
Variance	4.42051	1.32334	
Observations	5.00000	5.00000	
Pearson Correlation	0.95151		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.20759**		**YES**
P(T<=t) one-tail	0.00681		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01361		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	11.13904	12.58283	
Variance	4.42051	3.85978	
Observations	5.00000	5.00000	
Pearson Correlation	0.97595		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-6.91979**		**YES**
P(T<=t) one-tail	0.00114		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00229		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	9.12895	12.58283	
Variance	1.32334	3.85978	
Observations	5.00000	5.00000	
Pearson Correlation	0.99488		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-9.32335**		**YES**
P(T<=t) one-tail	0.00037		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00074		
t Critical two-tail	**2.77645**		

D0905012 (Random)

	C	*T*	
Mean	9.76041	7.90567	
Variance	7.81786	3.82093	
Observations	5.00000	5.00000	
Pearson Correlation	0.98224		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.36682**		**YES**
P(T<=t) one-tail	0.00600		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01200		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	9.76041	10.60638	
Variance	7.81786	7.10267	
Observations	5.00000	5.00000	
Pearson Correlation	0.96824		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-2.70122**		**NO**
P(T<=t) one-tail	0.02701		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.05403		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	7.90567	10.60638	
Variance	3.82093	7.10267	
Observations	5.00000	5.00000	
Pearson Correlation	0.97963		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-7.13253**		**YES**
P(T<=t) one-tail	0.00102		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00204		
t Critical two-tail	**2.77645**		

D0920011

	C	*T*	
Mean	8.52638	6.95886	
Variance	10.91510	7.63021	
Observations	7.00000	7.00000	
Pearson Correlation	0.99615		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**6.87917**		**YES**
P(T<=t) one-tail	0.00023		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00047		
t Critical two-tail	**2.44691**		

	C	*N*	
Mean	8.52638	7.41241	
Variance	10.91510	4.39627	
Observations	7.00000	7.00000	
Pearson Correlation	0.96926		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**2.14790**		**NO**
P(T<=t) one-tail	0.03766		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.07532		
t Critical two-tail	**2.44691**		

	T	*N*	
Mean	6.95886	7.41241	
Variance	7.63021	4.39627	
Observations	7.00000	7.00000	
Pearson Correlation	0.95757		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**-1.24137**		**NO**
P(T<=t) one-tail	0.13040		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.26080		
t Critical two-tail	**2.44691**		

D0920012 (Random)

	C	*T*	
Mean	8.50942	7.60533	
Variance	4.18484	2.13387	
Observations	5.00000	5.00000	
Pearson Correlation	0.98432		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.06229**		**YES**
P(T<=t) one-tail	0.01879		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.03757		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	8.50942	7.02241	
Variance	4.18484	5.60381	
Observations	5.00000	5.00000	
Pearson Correlation	0.87759		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**2.92872**		**YES**
P(T<=t) one-tail	0.02143		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.04287		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	7.60533	7.02241	
Variance	2.13387	5.60381	
Observations	5.00000	5.00000	
Pearson Correlation	0.82849		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.91989**		**NO**
P(T<=t) one-tail	0.20484		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.40968		
t Critical two-tail	**2.77645**		

D0927011 (Random)

	C	*T*	
Mean	14.32572	12.44551	
Variance	16.33333	8.78794	
Observations	4.00000	4.00000	
Pearson Correlation	0.99779		
Hypothesized Mean Difference	0.00000		
df	3.00000		
t Stat	**3.41461**		**YES**
P(T<=t) one-tail	0.02100		
t Critical one-tail	2.35336		
P(T<=t) two-tail	0.04201		
t Critical two-tail	**3.18245**		

	C	*N*	
Mean	14.32572	7.09823	
Variance	16.33333	1.55894	
Observations	4.00000	4.00000	
Pearson Correlation	0.85316		
Hypothesized Mean Difference	0.00000		
df	3.00000		
t Stat	**4.74455**		**YES**
P(T<=t) one-tail	0.00888		
t Critical one-tail	2.35336		
P(T<=t) two-tail	0.01776		
t Critical two-tail	**3.18245**		

	T	*N*	
Mean	12.44551	7.09823	
Variance	8.78794	1.55894	
Observations	4.00000	4.00000	
Pearson Correlation	0.86747		
Hypothesized Mean Difference	0.00000		
df	3.00000		
t Stat	**5.39793**		**YES**
P(T<=t) one-tail	0.00623		
t Critical one-tail	2.35336		
P(T<=t) two-tail	0.01246		
t Critical two-tail	**3.18245**		

D0927012

	C	*T*	
Mean	11.91170	9.43650	
Variance	18.36129	7.23150	
Observations	6.00000	6.00000	
Pearson Correlation	0.99916		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.78485**		**YES**
P(T<=t) one-tail	0.00641		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01283		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	11.91170	5.84068	
Variance	18.36129	18.36763	
Observations	6.00000	6.00000	
Pearson Correlation	0.85539		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**6.45260**		**YES**
P(T<=t) one-tail	0.00067		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00133		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	9.43650	5.84068	
Variance	7.23150	18.36763	
Observations	6.00000	6.00000	
Pearson Correlation	0.84206		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.54029**		**YES**
P(T<=t) one-tail	0.00828		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01656		
t Critical two-tail	**2.57058**		

D0412021 (Problem)

	C	*T*	
Mean	8.4665	7.2131	
Variance	0.8881	1.2474	
Observations	7.0000	7.0000	
Pearson Correlation	0.9363		
Hypothesized Mean Difference	0.0000		
df	6.0000		
t Stat	**8.1751**		**YES**
P(T<=t) one-tail	0.0001		
t Critical one-tail	1.9432		
P(T<=t) two-tail	0.0002		
t Critical two-tail	**2.4469**		

	C	*N*	
Mean	8.4665	10.2541	
Variance	0.8881	1.0278	
Observations	7.0000	7.0000	
Pearson Correlation	0.6239		
Hypothesized Mean Difference	0.0000		
df	6.0000		
t Stat	**-5.5591**		**YES**
P(T<=t) one-tail	0.0007		
t Critical one-tail	1.9432		
P(T<=t) two-tail	0.0014		
t Critical two-tail	**2.4469**		

	T	*N*	
Mean	7.2131	10.2541	
Variance	1.2474	1.0278	
Observations	7.0000	7.0000	
Pearson Correlation	0.4847		
Hypothesized Mean Difference	0.0000		
df	6.0000		
t Stat	**-7.4143**		**YES**
P(T<=t) one-tail	0.0002		
t Critical one-tail	1.9432		
P(T<=t) two-tail	0.0003		
t Critical two-tail	**2.4469**		

D0427021

	C	*T*	
Mean	9.19090	8.11621	
Variance	10.69894	8.69433	
Observations	6.00000	6.00000	
Pearson Correlation	0.99212		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**5.20304**		**YES**
P(T<=t) one-tail	0.00173		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00346		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	9.19090	5.68380	
Variance	10.69894	6.37700	
Observations	6.00000	6.00000	
Pearson Correlation	0.95046		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**7.32785**		**YES**
P(T<=t) one-tail	0.00037		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00074		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	8.11621	5.68380	
Variance	8.69433	6.37700	
Observations	6.00000	6.00000	
Pearson Correlation	0.95060		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**6.22928**		**YES**
P(T<=t) one-tail	0.00078		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00156		
t Critical two-tail	**2.57058**		

D051602A1

	C	*T*	
Mean	11.41642	11.30774	
Variance	1.43118	1.04373	
Observations	5.00000	5.00000	
Pearson Correlation	0.99146		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**1.07192**		**NO**
P(T<=t) one-tail	0.17206		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.34412		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	11.41642	9.76046	
Variance	1.43118	4.30168	
Observations	5.00000	5.00000	
Pearson Correlation	0.93300		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.52589**		**YES**
P(T<=t) one-tail	0.01216		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.02432		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	11.30774	9.76046	
Variance	1.04373	4.30168	
Observations	5.00000	5.00000	
Pearson Correlation	0.95336		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.02838**		**YES**
P(T<=t) one-tail	0.01942		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.03884		
t Critical two-tail	**2.77645**		

D051602T1

	C	*T*	
Mean	12.74688	10.87273	
Variance	0.90630	1.97374	
Observations	5.00000	5.00000	
Pearson Correlation	0.95826		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**7.44603**		**YES**
P(T<=t) one-tail	0.00087		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00174		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	12.74688	11.27359	
Variance	0.90630	0.19929	
Observations	5.00000	5.00000	
Pearson Correlation	0.75443		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.83452**		**YES**
P(T<=t) one-tail	0.00422		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00843		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	10.87273	11.27359	
Variance	1.97374	0.19929	
Observations	5.00000	5.00000	
Pearson Correlation	0.80187		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.82968**		**NO**
P(T<=t) one-tail	0.22668		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.45336		
t Critical two-tail	**2.77645**		

D051602T2

	C	*T*	
Mean	11.09902	9.62093	
Variance	7.38226	5.02751	
Observations	6.00000	6.00000	
Pearson Correlation	0.98065		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**5.33137**		**YES**
P(T<=t) one-tail	0.00156		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00311		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	11.09902	10.98668	
Variance	7.38226	6.33068	
Observations	6.00000	6.00000	
Pearson Correlation	0.87765		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**0.21024**		**NO**
P(T<=t) one-tail	0.42089		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.84178		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	9.62093	10.98668	
Variance	5.02751	6.33068	
Observations	6.00000	6.00000	
Pearson Correlation	0.90643		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-3.14592**		**YES**
P(T<=t) one-tail	0.01275		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.02550		
t Critical two-tail	**2.57058**		

D0620021

	C	*T*	
Mean	8.34518	7.56174	
Variance	3.46835	5.94177	
Observations	7.00000	7.00000	
Pearson Correlation	0.78025		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**1.35910**		**NO**
P(T<=t) one-tail	0.11149		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.22298		
t Critical two-tail	**2.44691**		

	C	*N*	
Mean	8.34518	7.87156	
Variance	3.46835	5.65167	
Observations	7.00000	7.00000	
Pearson Correlation	0.97012		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**1.72166**		**NO**
P(T<=t) one-tail	0.06796		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.13591		
t Critical two-tail	**2.44691**		

	T	*N*	
Mean	7.56174	7.87156	
Variance	5.94177	5.65167	
Observations	7.00000	7.00000	
Pearson Correlation	0.86004		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**-0.64287**		**NO**
P(T<=t) one-tail	0.27204		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.54408		
t Critical two-tail	**2.44691**		

D0620022

	C	*T*	
Mean	7.01201	6.21014	
Variance	2.43876	1.80293	
Observations	5.00000	5.00000	
Pearson Correlation	0.96995		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.29920**		**YES**
P(T<=t) one-tail	0.00633		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01265		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	7.01201	7.23877	
Variance	2.43876	0.15779	
Observations	5.00000	5.00000	
Pearson Correlation	0.97032		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.42965**		**NO**
P(T<=t) one-tail	0.34479		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.68958		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	6.21014	7.23877	
Variance	1.80293	0.15779	
Observations	5.00000	5.00000	
Pearson Correlation	0.94934		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-2.36229**		**NO**
P(T<=t) one-tail	0.03873		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.07747		
t Critical two-tail	**2.77645**		

D0814021

	C	*T*	
Mean	12.8650	11.4185	
Variance	11.8121	7.5468	
Observations	6.0000	6.0000	
Pearson Correlation	0.9964		
Hypothesized Mean Difference	0.0000		
df	5.0000		
t Stat	**4.8062**		**YES**
P(T<=t) one-tail	0.0024		
t Critical one-tail	2.0150		
P(T<=t) two-tail	0.0049		
t Critical two-tail	**2.5706**		

	C	*N*	
Mean	12.8650	14.8155	
Variance	11.8121	7.1905	
Observations	6.0000	6.0000	
Pearson Correlation	0.9705		
Hypothesized Mean Difference	0.0000		
df	5.0000		
t Stat	**-4.5249**		**YES**
P(T<=t) one-tail	0.0031		
t Critical one-tail	2.0150		
P(T<=t) two-tail	0.0063		
t Critical two-tail	**2.5706**		

	T	*N*	
Mean	11.4185	14.8155	
Variance	7.5468	7.1905	
Observations	6.0000	6.0000	
Pearson Correlation	0.9633		
Hypothesized Mean Difference	0.0000		
df	5.0000		
t Stat	**-11.2769**		**YES**
P(T<=t) one-tail	0.0000		
t Critical one-tail	2.0150		
P(T<=t) two-tail	0.0001		
t Critical two-tail	**2.5706**		

D0814022 (Random)

	C	*T*	
Mean	8.5404	7.5787	
Variance	3.3948	2.5048	
Observations	5.0000	5.0000	
Pearson Correlation	0.9924		
Hypothesized Mean Difference	0.0000		
df	4.0000		
t Stat	**6.4344**		**YES**
P(T<=t) one-tail	0.0015		
t Critical one-tail	2.1318		
P(T<=t) two-tail	0.0030		
t Critical two-tail	**2.7765**		

	C	*N*	
Mean	8.5404	12.4699	
Variance	3.3948	2.4106	
Observations	5.0000	5.0000	
Pearson Correlation	0.7696		
Hypothesized Mean Difference	0.0000		
df	4.0000		
t Stat	**-7.4198**		**YES**
P(T<=t) one-tail	0.0009		
t Critical one-tail	2.1318		
P(T<=t) two-tail	0.0018		
t Critical two-tail	**2.7765**		

	T	*N*	
Mean	7.5787	12.4699	
Variance	2.5048	2.4106	
Observations	5.0000	5.0000	
Pearson Correlation	0.7954		
Hypothesized Mean Difference	0.0000		
df	4.0000		
t Stat	**-10.9019**		**YES**
P(T<=t) one-tail	0.0002		
t Critical one-tail	2.1318		
P(T<=t) two-tail	0.0004		
t Critical two-tail	**2.7765**		

D0822021

	C	*T*	
Mean	14.5747	12.4994	
Variance	15.7896	9.3926	
Observations	7.0000	7.0000	
Pearson Correlation	0.9934		
Hypothesized Mean Difference	0.0000		
df	6.0000		
t Stat	**5.5262**		**YES**
P(T<=t) one-tail	0.0007		
t Critical one-tail	1.9432		
P(T<=t) two-tail	0.0015		
t Critical two-tail	**2.4469**		

	C	*N*	
Mean	14.5747	10.3229	
Variance	15.7896	10.8437	
Observations	7.0000	7.0000	
Pearson Correlation	0.8027		
Hypothesized Mean Difference	0.0000		
df	6.0000		
t Stat	**4.7419**		**YES**
P(T<=t) one-tail	0.0016		
t Critical one-tail	1.9432		
P(T<=t) two-tail	0.0032		
t Critical two-tail	**2.4469**		

	T	*N*	
Mean	12.4994	10.3229	
Variance	9.3926	10.8437	
Observations	7.0000	7.0000	
Pearson Correlation	0.7581		
Hypothesized Mean Difference	0.0000		
df	6.0000		
t Stat	**2.5922**		**YES**
P(T<=t) one-tail	0.0205		
t Critical one-tail	1.9432		
P(T<=t) two-tail	0.0411		
t Critical two-tail	**2.4469**		

BM20820014

	C	*T*	
Mean	7.84456	4.84940	
Variance	3.58128	1.08433	
Observations	7.00000	7.00000	
Pearson Correlation	0.10862		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**3.84959**		**YES**
P(T<=t) one-tail	0.00423		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00846		
t Critical two-tail	**2.44691**		

	C	*N*	
Mean	7.84456	5.06477	
Variance	3.58128	4.20540	
Observations	7.00000	7.00000	
Pearson Correlation	0.82469		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**6.24766**		**YES**
P(T<=t) one-tail	0.00039		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00078		
t Critical two-tail	**2.44691**		

	T	*N*	
Mean	4.84940	5.06477	
Variance	1.08433	4.20540	
Observations	7.00000	7.00000	
Pearson Correlation	-0.10763		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**-0.23763**		**NO**
P(T<=t) one-tail	0.41004		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.82007		
t Critical two-tail	**2.44691**		

BM20823011

	C	*T*	
Mean	11.33282	8.42951	
Variance	4.71980	0.76789	
Observations	5.00000	5.00000	
Pearson Correlation	0.98574		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.92940**		**YES**
P(T<=t) one-tail	0.00394		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00788		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	11.33282	8.14284	
Variance	4.71980	21.95499	
Observations	5.00000	5.00000	
Pearson Correlation	0.80097		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**2.21528**		**NO**
P(T<=t) one-tail	0.04554		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.09109		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	8.42951	8.14284	
Variance	0.76789	21.95499	
Observations	5.00000	5.00000	
Pearson Correlation	0.73612		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.15696**		**NO**
P(T<=t) one-tail	0.44144		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.88288		
t Critical two-tail	**2.77645**		

BM20829013

	C	*T*	
Mean	9.71383	6.23529	
Variance	11.68590	1.38158	
Observations	7.00000	7.00000	
Pearson Correlation	0.95903		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**3.97503**		**YES**
P(T<=t) one-tail	0.00366		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00732		
t Critical two-tail	**2.44691**		

	C	*N*	
Mean	9.71383	8.17825	
Variance	11.68590	10.80092	
Observations	7.00000	7.00000	
Pearson Correlation	0.93650		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**3.38061**		**YES**
P(T<=t) one-tail	0.00742		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.01485		
t Critical two-tail	**2.44691**		

	T	*N*	
Mean	6.23529	8.17825	
Variance	1.38158	10.80092	
Observations	7.00000	7.00000	
Pearson Correlation	0.81055		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**-2.11271**		**NO**
P(T<=t) one-tail	0.03954		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.07908		
t Critical two-tail	**2.44691**		

BM20830011

	C	*T*	
Mean	7.44251	5.88660	
Variance	2.69645	1.63771	
Observations	5.00000	5.00000	
Pearson Correlation	0.96512		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**6.59963**		**YES**
P(T<=t) one-tail	0.00137		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00273		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	7.44251	7.70959	
Variance	2.69645	1.81820	
Observations	5.00000	5.00000	
Pearson Correlation	0.35614		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.34845**		**NO**
P(T<=t) one-tail	0.37253		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.74507		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	5.88660	7.70959	
Variance	1.63771	1.81820	
Observations	5.00000	5.00000	
Pearson Correlation	0.14221		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-2.36728**		**NO**
P(T<=t) one-tail	0.03852		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.07705		
t Critical two-tail	**2.77645**		

BM20830012 (Random)

	C	*T*	
Mean	7.49405	6.24839	
Variance	1.74476	1.60324	
Observations	5.00000	5.00000	
Pearson Correlation	0.98038		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**10.63421**		**YES**
P(T<=t) one-tail	0.00022		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00044		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	7.49405	5.98121	
Variance	1.74476	2.94070	
Observations	5.00000	5.00000	
Pearson Correlation	0.92782		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.87153**		**YES**
P(T<=t) one-tail	0.00411		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00821		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	6.24839	5.98121	
Variance	1.60324	2.94070	
Observations	5.00000	5.00000	
Pearson Correlation	0.95006		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.92388**		**NO**
P(T<=t) one-tail	0.20392		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.40783		
t Critical two-tail	**2.77645**		

BM20906012

	C	*T*	
Mean	9.15769	7.68453	
Variance	0.51320	0.30073	
Observations	5.00000	5.00000	
Pearson Correlation	0.90502		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**10.27177**		**YES**
P(T<=t) one-tail	0.00025		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00051		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	9.15769	9.28401	
Variance	0.51320	1.50657	
Observations	5.00000	5.00000	
Pearson Correlation	0.49811		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.26411**		**NO**
P(T<=t) one-tail	0.40237		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.80475		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	7.68453	9.28401	
Variance	0.30073	1.50657	
Observations	5.00000	5.00000	
Pearson Correlation	0.57011		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-3.50741**		**YES**
P(T<=t) one-tail	0.01236		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.02473		
t Critical two-tail	**2.77645**		

BM21005011

	C	*T*	
Mean	9.25145	8.34323	
Variance	4.59715	2.57259	
Observations	5.00000	5.00000	
Pearson Correlation	0.99734		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.64715**		**YES**
P(T<=t) one-tail	0.01091		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.02183		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	9.25145	9.22780	
Variance	4.59715	0.04085	
Observations	5.00000	5.00000	
Pearson Correlation	0.58522		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.02602**		**NO**
P(T<=t) one-tail	0.49025		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.98049		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	8.34323	9.22780	
Variance	2.57259	0.04085	
Observations	5.00000	5.00000	
Pearson Correlation	0.55696		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-1.31796**		**NO**
P(T<=t) one-tail	0.12896		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.25793		
t Critical two-tail	**2.77645**		

BM20416021

	C	*T*	
Mean	8.84335	7.34028	
Variance	2.80681	1.99123	
Observations	6.00000	6.00000	
Pearson Correlation	0.97770		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**8.79389**		**YES**
P(T<=t) one-tail	0.00016		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00032		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	8.84335	7.64353	
Variance	2.80681	2.88478	
Observations	6.00000	6.00000	
Pearson Correlation	0.87837		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.53106**		**YES**
P(T<=t) one-tail	0.00836		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01672		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	7.34028	7.64353	
Variance	1.99123	2.88478	
Observations	6.00000	6.00000	
Pearson Correlation	0.81787		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-0.75987**		**NO**
P(T<=t) one-tail	0.24080		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.48161		
t Critical two-tail	**2.57058**		

BM20416022 (Random)

	C	*T*	
Mean	11.28382	9.14050	
Variance	6.32073	2.52469	
Observations	5.00000	5.00000	
Pearson Correlation	0.99359		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**5.03193**		**YES**
P(T<=t) one-tail	0.00366		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00732		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	11.28382	9.06474	
Variance	6.32073	1.43229	
Observations	5.00000	5.00000	
Pearson Correlation	0.99422		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.72952**		**YES**
P(T<=t) one-tail	0.01015		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.02031		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	9.14050	9.06474	
Variance	2.52469	1.43229	
Observations	5.00000	5.00000	
Pearson Correlation	0.99611		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.41259**		**NO**
P(T<=t) one-tail	0.35053		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.70106		
t Critical two-tail	**2.77645**		

BM20426021

	C	*T*	
Mean	12.58475	11.42151	
Variance	1.58252	1.23673	
Observations	6.00000	6.00000	
Pearson Correlation	0.99552		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**15.49500**		**YES**
P(T<=t) one-tail	0.00001		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00002		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	12.58475	9.00622	
Variance	1.58252	1.47517	
Observations	6.00000	6.00000	
Pearson Correlation	0.43499		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**6.66733**		**YES**
P(T<=t) one-tail	0.00057		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00115		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	11.42151	9.00622	
Variance	1.23673	1.47517	
Observations	6.00000	6.00000	
Pearson Correlation	0.44808		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**4.82821**		**YES**
P(T<=t) one-tail	0.00238		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00476		
t Critical two-tail	**2.57058**		

BM20514021

	C	*T*	
Mean	9.64410	8.18569	
Variance	1.32871	0.96506	
Observations	6.00000	6.00000	
Pearson Correlation	0.98482		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**14.18910**		**YES**
P(T<=t) one-tail	0.00002		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00003		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	9.64410	9.10504	
Variance	1.32871	2.50806	
Observations	6.00000	6.00000	
Pearson Correlation	0.71699		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**1.19593**		**NO**
P(T<=t) one-tail	0.14267		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.28534		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	8.18569	9.10504	
Variance	0.96506	2.50806	
Observations	6.00000	6.00000	
Pearson Correlation	0.68647		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-1.94747**		**NO**
P(T<=t) one-tail	0.05451		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.10902		
t Critical two-tail	**2.57058**		

BM20515021

	C	*T*	
Mean	8.50711	7.40253	
Variance	4.11389	2.16022	
Observations	7.00000	7.00000	
Pearson Correlation	0.97391		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**4.27421**		**YES**
P(T<=t) one-tail	0.00262		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00524		
t Critical two-tail	**2.44691**		

	C	*N*	
Mean	8.50711	6.17470	
Variance	4.11389	7.55696	
Observations	7.00000	7.00000	
Pearson Correlation	0.84947		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**4.16232**		**YES**
P(T<=t) one-tail	0.00296		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00593		
t Critical two-tail	**2.44691**		

	T	*N*	
Mean	7.40253	6.17470	
Variance	2.16022	7.55696	
Observations	7.00000	7.00000	
Pearson Correlation	0.81502		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**1.83584**		**NO**
P(T<=t) one-tail	0.05802		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.11605		
t Critical two-tail	**2.44691**		

BM20515022 (Random)

	C	*T*	
Mean	8.27278	7.23725	
Variance	1.92492	1.16253	
Observations	5.00000	5.00000	
Pearson Correlation	0.98378		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**6.09870**		**YES**
P(T<=t) one-tail	0.00183		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00366		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	8.27278	6.79237	
Variance	1.92492	2.37213	
Observations	5.00000	5.00000	
Pearson Correlation	0.22582		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**1.81349**		**NO**
P(T<=t) one-tail	0.07198		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.14396		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	7.23725	6.79237	
Variance	1.16253	2.37213	
Observations	5.00000	5.00000	
Pearson Correlation	0.36070		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.65077**		**NO**
P(T<=t) one-tail	0.27534		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.55069		
t Critical two-tail	**2.77645**		

BM20716021

	C	*T*	
Mean	8.36696	7.33445	
Variance	5.04977	2.71552	
Observations	5.00000	5.00000	
Pearson Correlation	0.99608		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.70547**		**YES**
P(T<=t) one-tail	0.01037		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.02074		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	8.36696	8.16421	
Variance	5.04977	10.75757	
Observations	5.00000	5.00000	
Pearson Correlation	0.93242		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**0.31566**		**NO**
P(T<=t) one-tail	0.38402		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.76804		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	7.33445	8.16421	
Variance	2.71552	10.75757	
Observations	5.00000	5.00000	
Pearson Correlation	0.90337		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.96354**		**NO**
P(T<=t) one-tail	0.19492		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.38984		
t Critical two-tail	**2.77645**		

BM20723021

	C	*T*	
Mean	13.89396	9.00077	
Variance	16.77467	2.00179	
Observations	6.00000	6.00000	
Pearson Correlation	0.81651		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.92746**		**YES**
P(T<=t) one-tail	0.00555		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01110		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	13.89396	12.93374	
Variance	16.77467	12.29570	
Observations	6.00000	6.00000	
Pearson Correlation	0.99231		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.12116**		**YES**
P(T<=t) one-tail	0.01311		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.02622		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	9.00077	12.93374	
Variance	2.00179	12.29570	
Observations	6.00000	6.00000	
Pearson Correlation	0.81126		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-3.85417**		**YES**
P(T<=t) one-tail	0.00598		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01195		
t Critical two-tail	**2.57058**		

BM20730021

	C	*T*	
Mean	10.97616	8.84284	
Variance	16.96593	5.75984	
Observations	6.00000	6.00000	
Pearson Correlation	0.96540		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**2.73928**		**YES**
P(T<=t) one-tail	0.02041		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.04083		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	10.97616	8.82827	
Variance	16.96593	27.68648	
Observations	6.00000	6.00000	
Pearson Correlation	0.99727		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**4.40845**		**YES**
P(T<=t) one-tail	0.00348		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00697		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	8.84284	8.82827	
Variance	5.75984	27.68648	
Observations	6.00000	6.00000	
Pearson Correlation	0.94870		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**0.01158**		**NO**
P(T<=t) one-tail	0.49560		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.99121		
t Critical two-tail	**2.57058**		

BM20820021

	C	*T*	
Mean	7.67588	5.64071	
Variance	5.30886	2.82876	
Observations	6.00000	6.00000	
Pearson Correlation	0.99619		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**7.72276**		**YES**
P(T<=t) one-tail	0.00029		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00058		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	7.67588	4.43357	
Variance	5.30886	13.09315	
Observations	6.00000	6.00000	
Pearson Correlation	0.86034		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.94333**		**YES**
P(T<=t) one-tail	0.00546		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01092		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	5.64071	4.43357	
Variance	2.82876	13.09315	
Observations	6.00000	6.00000	
Pearson Correlation	0.86831		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**1.27799**		**NO**
P(T<=t) one-tail	0.12868		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.25737		
t Critical two-tail	**2.57058**		

BM20826021

	C	*T*	
Mean	7.98075	6.03570	
Variance	0.23959	0.03700	
Observations	6.00000	6.00000	
Pearson Correlation	-0.51821		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**7.78873**		**YES**
P(T<=t) one-tail	0.00028		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00056		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	7.98075	6.70989	
Variance	0.23959	2.98538	
Observations	6.00000	6.00000	
Pearson Correlation	-0.25428		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**1.62827**		**NO**
P(T<=t) one-tail	0.08220		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.16440		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	6.03570	6.70989	
Variance	0.03700	2.98538	
Observations	6.00000	6.00000	
Pearson Correlation	-0.02226		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-0.94758**		**NO**
P(T<=t) one-tail	0.19343		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.38685		
t Critical two-tail	**2.57058**		

BM20826022 (Random)

	C	*T*	
Mean	9.37095	6.90915	
Variance	4.84092	1.28418	
Observations	5.00000	5.00000	
Pearson Correlation	0.93937		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.58599**		**YES**
P(T<=t) one-tail	0.00507		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01014		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	9.37095	7.07254	
Variance	4.84092	3.96708	
Observations	5.00000	5.00000	
Pearson Correlation	0.83044		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.15550**		**YES**
P(T<=t) one-tail	0.00710		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01420		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	6.90915	7.07254	
Variance	1.28418	3.96708	
Observations	5.00000	5.00000	
Pearson Correlation	0.88336		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.32501**		**NO**
P(T<=t) one-tail	0.38073		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.76146		
t Critical two-tail	**2.77645**		

BM20827021

	C	*T*	
Mean	11.22334	6.84551	
Variance	2.98793	0.74777	
Observations	6.00000	6.00000	
Pearson Correlation	-0.44498		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**4.76436**		**YES**
P(T<=t) one-tail	0.00252		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00504		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	11.22334	8.77965	
Variance	2.98793	3.72771	
Observations	6.00000	6.00000	
Pearson Correlation	0.43208		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**3.05797**		**YES**
P(T<=t) one-tail	0.01408		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.02817		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	6.84551	8.77965	
Variance	0.74777	3.72771	
Observations	6.00000	6.00000	
Pearson Correlation	-0.31686		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-2.01402**		**NO**
P(T<=t) one-tail	0.05007		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.10013		
t Critical two-tail	**2.57058**		

A0820012

	C	*T*	
Mean	9.99858	6.75269	
Variance	7.50900	1.99900	
Observations	5.00000	5.00000	
Pearson Correlation	-0.51796		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**1.97381**		**NO**
P(T<=t) one-tail	0.05982		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.11965		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	9.99858	7.89988	
Variance	7.50900	3.01076	
Observations	5.00000	5.00000	
Pearson Correlation	0.97569		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**4.21196**		**YES**
P(T<=t) one-tail	0.00678		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.01356		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	6.75269	7.89988	
Variance	1.99900	3.01076	
Observations	5.00000	5.00000	
Pearson Correlation	-0.61539		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-0.90528**		**NO**
P(T<=t) one-tail	0.20826		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.41651		
t Critical two-tail	**2.77645**		

A0829011

	C	*T*	
Mean	11.66861	8.78688	
Variance	5.43643	1.31412	
Observations	7.00000	7.00000	
Pearson Correlation	0.91998		
Hypothesized Mean Difference	0.00000		
df	6.00000		
t Stat	**5.63209**		**YES**
P(T<=t) one-tail	0.00067		
t Critical one-tail	1.94318		
P(T<=t) two-tail	0.00134		
t Critical two-tail	**2.44691**		

	C	*N*
Mean	N/A	N/A
Variance	N/A	N/A
Observations	N/A	N/A
Pearson Correlation	N/A	
Hypothesized Mean Difference	N/A	
df	N/A	
t Stat	N/A	
P(T<=t) one-tail	N/A	
t Critical one-tail	N/A	
P(T<=t) two-tail	N/A	
t Critical two-tail	N/A	

	T	*N*
Mean	N/A	N/A
Variance	N/A	N/A
Observations	N/A	N/A
Pearson Correlation	N/A	
Hypothesized Mean Difference	N/A	
df	N/A	
t Stat	N/A	
P(T<=t) one-tail	N/A	
t Critical one-tail	N/A	
P(T<=t) two-tail	N/A	
t Critical two-tail	N/A	

A0829012

	C	*T*	
Mean	10.72489	5.44719	
Variance	10.55770	0.24290	
Observations	7.00000	7.00000	
Pearson Correlation		0.90599	
Hypothesized Mean Difference		0.00000	
df		6.00000	
t Stat		**4.96834**	**YES**
P(T<=t) one-tail		0.00127	
t Critical one-tail		1.94318	
P(T<=t) two-tail		0.00253	
t Critical two-tail		**2.44691**	

	C	*N*
Mean	N/A	N/A
Variance	N/A	N/A
Observations	N/A	N/A
Pearson Correlation	N/A	
Hypothesized Mean Difference	N/A	
df	N/A	
t Stat	N/A	
P(T<=t) one-tail	N/A	
t Critical one-tail	N/A	
P(T<=t) two-tail	N/A	
t Critical two-tail	N/A	

	T	*N*
Mean	N/A	N/A
Variance	N/A	N/A
Observations	N/A	N/A
Pearson Correlation	N/A	
Hypothesized Mean Difference	N/A	
df	N/A	
t Stat	N/A	
P(T<=t) one-tail	N/A	
t Critical one-tail	N/A	
P(T<=t) two-tail	N/A	
t Critical two-tail	N/A	

A0905013

	C	*T*	
Mean	6.19603	5.21648	
Variance	6.26123	4.23960	
Observations	5.00000	5.00000	
Pearson Correlation	0.96624		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**2.96891**		**YES**
P(T<=t) one-tail	0.02059		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.04119		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	6.19603	7.62349	
Variance	6.26123	3.47153	
Observations	5.00000	5.00000	
Pearson Correlation	0.93584		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-3.18141**		**YES**
P(T<=t) one-tail	0.01674		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.03349		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	5.21648	7.62349	
Variance	4.23960	3.47153	
Observations	5.00000	5.00000	
Pearson Correlation	0.89985		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-5.99206**		**YES**
P(T<=t) one-tail	0.00195		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00390		
t Critical two-tail	**2.77645**		

A0906011

	C	*T*	
Mean	10.68668	7.03606	
Variance	12.94360	0.77228	
Observations	6.00000	6.00000	
Pearson Correlation	0.20039		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**2.53443**		**NO**
P(T<=t) one-tail	0.02612		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.05225		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	10.68668	13.77056	
Variance	12.94360	23.52470	
Observations	6.00000	6.00000	
Pearson Correlation	0.82961		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-2.75550**		**YES**
P(T<=t) one-tail	0.02002		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.04005		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	7.03606	13.77056	
Variance	0.77228	23.52470	
Observations	6.00000	6.00000	
Pearson Correlation	0.60703		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-3.77235**		**YES**
P(T<=t) one-tail	0.00650		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.01299		
t Critical two-tail	**2.57058**		

A1015011

	C	*T*	
Mean	10.78706	6.64901	
Variance	4.23814	0.65457	
Observations	6.00000	6.00000	
Pearson Correlation	0.48351		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**5.59497**		**YES**
P(T<=t) one-tail	0.00126		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.00252		
t Critical two-tail	**2.57058**		

	C	*N*	
Mean	10.78706	8.14441	
Variance	4.23814	20.99440	
Observations	6.00000	6.00000	
Pearson Correlation	-0.02641		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**1.27611**		**NO**
P(T<=t) one-tail	0.12899		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.25798		
t Critical two-tail	**2.57058**		

	T	*N*	
Mean	6.64901	8.14441	
Variance	0.65457	20.99440	
Observations	6.00000	6.00000	
Pearson Correlation	-0.57803		
Hypothesized Mean Difference	0.00000		
df	5.00000		
t Stat	**-0.71928**		**NO**
P(T<=t) one-tail	0.25209		
t Critical one-tail	2.01505		
P(T<=t) two-tail	0.50418		
t Critical two-tail	**2.57058**		

A1015012 (Random)

	C	*T*	
Mean	8.76448	5.77213	
Variance	1.96046	0.71492	
Observations	4.00000	4.00000	
Pearson Correlation	0.98268		
Hypothesized Mean Difference	0.00000		
df	3.00000		
t Stat	**10.13595**		**YES**
P(T<=t) one-tail	0.00102		
t Critical one-tail	2.35336		
P(T<=t) two-tail	0.00205		
t Critical two-tail	**3.18245**		

	C	*N*	
Mean	8.76448	3.38517	
Variance	1.96046	0.85539	
Observations	4.00000	4.00000	
Pearson Correlation	-0.38683		
Hypothesized Mean Difference	0.00000		
df	3.00000		
t Stat	**5.50624**		**YES**
P(T<=t) one-tail	0.00590		
t Critical one-tail	2.35336		
P(T<=t) two-tail	0.01179		
t Critical two-tail	**3.18245**		

	T	*N*	
Mean	5.77213	3.38517	
Variance	0.71492	0.85539	
Observations	4.00000	4.00000	
Pearson Correlation	-0.52904		
Hypothesized Mean Difference	0.00000		
df	3.00000		
t Stat	**3.08302**		**NO**
P(T<=t) one-tail	0.02700		
t Critical one-tail	2.35336		
P(T<=t) two-tail	0.05401		
t Critical two-tail	**3.18245**		

A0515023 (Problem)

	C	*T*	
Mean	10.16698	5.67081	
Variance	9.46905	0.43812	
Observations	5.00000	5.00000	
Pearson Correlation	0.33256		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**3.43781**		**YES**
P(T<=t) one-tail	0.01317		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.02635		
t Critical two-tail	**2.77645**		

	C	*N*	
Mean	10.16698	14.08112	
Variance	9.46905	9.57071	
Observations	5.00000	5.00000	
Pearson Correlation	0.97853		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-13.68583**		**YES**
P(T<=t) one-tail	0.00008		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00017		
t Critical two-tail	**2.77645**		

	T	*N*	
Mean	5.67081	14.08112	
Variance	0.43812	9.57071	
Observations	5.00000	5.00000	
Pearson Correlation	0.32424		
Hypothesized Mean Difference	0.00000		
df	4.00000		
t Stat	**-6.38284**		**YES**
P(T<=t) one-tail	0.00155		
t Critical one-tail	2.13185		
P(T<=t) two-tail	0.00309		
t Critical two-tail	**2.77645**		