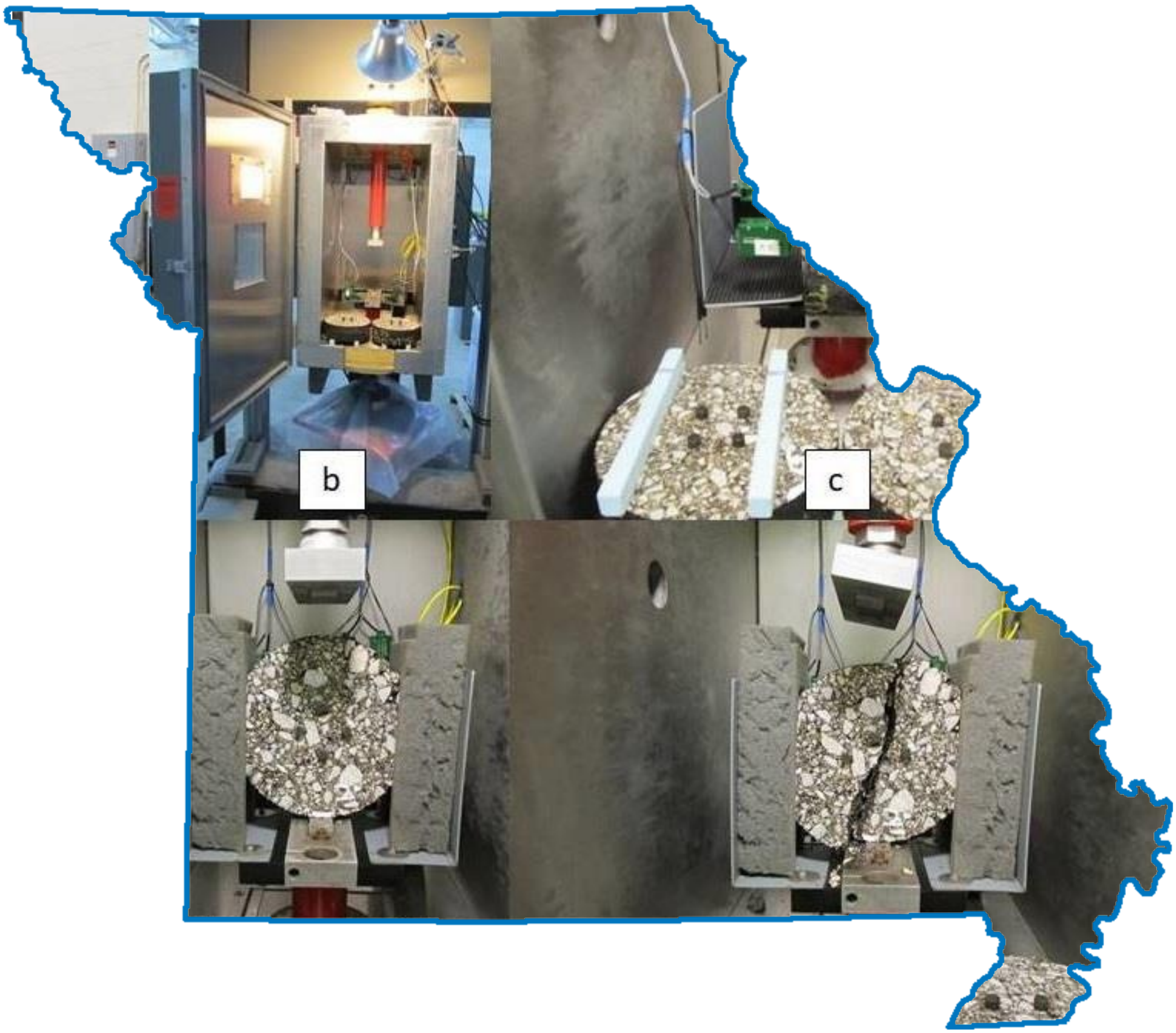
Cold Temperature Creep Compliance and Strength of Missouri Hot Mix Asphalt (HMA) Mixtures Using Indirect Tensile Test



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16. Abstract

MoDOT has for the second time in about 10 years, performed the local calibration of the mechanistic-empirical pavement design guide software, now designated as AASHTOWare Pavement ME Design. Cold-temperature creep compliance and tensile strength of hot mix asphalt (HMA) are the two inputs to the thermal cracking module within the software and are required for local calibration.

The test protocol used for this work is American Association of State Highway and Transportation Officials (AASHTO) test method T 322, "Standard Method of Test for Determining the Creep Compliance and Strength of Hot Mix Asphalt (HMA) Using the Indirect Tensile Test Device."

MoDOT-supplied materials were a) 18 different sets of the top lifts (layers) separated from six inch diameter pavement cores, and b) 54 boxes of 150 mm diameter gyratory-compacted specimens (GCSs). The 54 boxes of GCSs were produced from 27 different plant-produced mixes compacted to two levels of air voids per mix. Creep testing was performed at 0, -10, and -20°C (32, 14, and -4°F, respectively) and tensile strength testing was performed at -10°C. Poisson's ratio was estimated from the creep testing results.

With a few exceptions, expected trends of increasing creep compliance with increasing temperature, and decreasing tensile strength with increasing air voids were confirmed during top-lift core and GCS-derived specimen testing. With a couple of exceptions, GCS-derived specimen testing resulted in the expected trend of increasing creep compliance with increasing air voids, at all temperatures. Although they are not required for local calibration of the thermal cracking module, estimated Poisson's ratio values were reported but did not always follow expected trends (e.g. maximum value of 0.5), especially during the top-lift core testing.

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FINAL REPORT
Task Order Contract Number TR201713

Cold Temperature Creep Compliance and Strength of Missouri Hot Mix Asphalt (HMA) Mixtures Using Indirect Tensile Test

Prepared for

Missouri Department of Transportation

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EXECUTIVE SUMMARY

MoDOT has for the second time in about 10 years, performed the local calibration of the mechanistic-empirical pavement design guide (M-E PDG) software, now designated as AASHTOWare Pavement ME Design. Cold-temperature creep compliance and tensile strength of hot mix asphalt (HMA) are the two inputs to the thermal cracking module within the software and are required for local calibration.

The test protocol used for this work is American Association of State Highway and Transportation Officials (AASHTO) test method T 322, "Standard Method of Test for Determining the Creep Compliance and Strength of Hot Mix Asphalt (HMA) Using the Indirect Tensile Test Device." However, during the T 322 testing performed at the Missouri University of Science and Technology (Missouri S&T), experts were consulted as to some of the most recent details regarding the creep/strength testing methodologies, calculations, and expected/observed results.

MoDOT-supplied materials were a) 18 different sets of the top lifts (layers) separated from six inch diameter pavement cores, and b) 54 boxes with six 150 mm diameter gyratory-compacted specimens (GCSs) in each box. The 54 boxes of GCSs were produced from 27 different plant-produced mixes compacted to two levels of air voids per mix. The top-lift cores were prepared for T 322 testing at Missouri S&T by grinding the faces flat with a concrete cylinder end-grinder. Air void values for the top-lift cores were taken as those values determined by MoDOT prior to delivery to Missouri S&T. MoDOT-supplied GCSs were end-ground and then sawn in half at Missouri S&T to produce two finished T 322 specimens per GCS. Air voids on the GCS-derived T 322 specimens were then determined. Creep testing was performed at 0, -10, and -20°C (32, 14, and -4°F, respectively) and tensile strength testing was performed at -10°C. Poisson's ratio was estimated from the creep testing results.

With a few exceptions, expected trends of increasing creep compliance with increasing temperature, and decreasing tensile strength with increasing air voids were confirmed during top-lift core and GCS-derived specimen testing. With a couple of exceptions, GCS-derived specimen testing resulted in the expected trend of increasing creep compliance with increasing air voids, at all temperatures. Although they are not required for local calibration of the thermal cracking module, estimated Poisson's ratio values were reported but did not always follow expected trends (e.g. maximum value of 0.5), especially during the top-lift core testing.

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INTRODUCTION

MoDOT has for the second time in about 10 years, performed the local calibration of the mechanistic-empirical pavement design guide (M-E PDG) software, now designated as AASHTOWare Pavement ME Design (*1*). Creep compliance and indirect tensile (IDT) strength of hot mix asphalt (HMA) are the two primary inputs to the low-temperature or thermal cracking module within the software and are required for local calibration; i.e. the modifying of the fracture parameters in the cracking distress models based on locally available HMA mix constituents. The test protocol used for this work was American Association of State Highway and Transportation Officials (AASHTO) test method T 322-07 (2016), “Standard Method of Test for Determining the Creep Compliance and Strength of Hot Mix Asphalt (HMA) Using the Indirect Tensile Test Device” (*2*).

The two primary HMA properties derived from AASHTO T 322 are creep compliance and tensile strength. Creep compliance is defined as time-dependent strain per unit stress while indirect tensile (IDT) strength is defined as HMA strength when subjected to tension, as distinct from torsion, compression, or shear. Both properties are determined using the IDT method in which a disc-shaped specimen is loaded in compression across its diameter thus indirectly causing tension in opposite directions perpendicular to and beginning at the line of loading. As HMA is considered a viscoelastic material, creep compliance and tensile strength are not only dependent on the HMA mix constituent properties, constituent proportions, and compacted mix properties (e.g. % air voids), both are also time and temperature dependent.

The AASHTO T 322 test protocol has evolved over the years. T 322-03 was the version in force approximately 10 years ago when MoDOT first contracted with Missouri University of Science and Technology (Missouri S&T) to perform T 322 testing for local calibration of the M-E PDG (*3*). T 322-07 was published in the summer of 2007 which occurred during that initial local calibration. Some changes to T 322-03 were in response to results published in the National Cooperative Highway Research Program (NCHRP) Report 530 (*4*). However, the T 322 test procedure specifics for producing input data for local calibration of the thermal cracking module have not changed over recent years, and T 322-07 was reaffirmed in 2016 with no procedural changes. The only additional parameter included in the results of this work is a correction (reduction) to the IDT strength calculation which was suggested in the NCHRP 530 report.

MoDOT contracted with Missouri S&T to perform T 322 testing on 18 different sets of top-lift cores, 22 different HMA wearing (surface) course mixes, and 5 Superpave binder and base course mixes. The 27 different wearing, binder, and base course plant-produced mixes were gyratory-compacted by MoDOT at two levels of air voids per mix resulting in 54 different treatment combinations.

OBJECTIVES

The primary objective of this project was to determine creep compliance and tensile strength of top-lift cores and HMA surface, binder, and base course mixes (each compacted to two levels of air voids) in accordance with AASHTO T 322-07 (2016). The specimens were tested for creep compliance at 0, -10, and -20°C (32, 14, and -4°F, respectively), and for indirect tensile strength at -10°C. The test results include creep compliance at 1, 2, 5, 10, 20, 50, and 100 seconds, and tensile strength (two different tensile strength values with one based on the maximum load, and a second based on the NCHRP 530 report suggested correction).

Additionally, Poisson's ratio was estimated for each treatment combination (i.e. mixture and air voids level combination) at 0, -10, and -20°C. This estimation was based on a regression equation published in AASHTO T 322. Although not an input in the M-E PDG thermal cracking module, Poisson's ratio is an Asphalt Materials Properties input in the M-E PDG and can be entered directly or estimated from other properties.

Air voids on the finished T 322 test specimens cut from the MoDOT-supplied gyratory-compacted specimens (GCSs) were determined at Missouri S&T. Reported air void values for the top-lift cores are those values determined by MoDOT prior to delivery to Missouri S&T. T 322 testing was performed on three replicate specimens per treatment combination.

TECHNICAL APPROACH

General

MoDOT selected the materials/specimens to be tested per AASHTO T 322. The author was contracted to prepare (finish) the top-lift cores, prepare standard T 322 specimens from MoDOT-supplied gyratory-compacted specimens (GCSs), determine air voids for those GCS-derived T 322 specimens, and perform T 322 on all appropriate specimens.

Material/Specimen Inventories and Descriptions

MoDOT-supplied materials were as follows:

- MoDOT supplied 18 different sets of top lifts (HMA layers) separated from six inch diameter pavement cores (usually six top-lift cores per set). These cores were taken from pavement sections MoDOT has been monitoring for several years and most are Superpave (SP) mixes. The top-lift cores were prepared or "finished" for T 322 testing at Missouri S&T by grinding the faces flat (i.e. the riding surface and the tack-coat underside) with a concrete cylinder end-grinder, and keeping the faces as parallel as possible. Air void values for the top-lift cores were taken as those values determined by MoDOT prior to delivery to Missouri S&T and subsequent end-grinding. The air voids values reported here, therefore, closely represent in-situ conditions.
- MoDOT supplied 54 boxes, each containing six, 150 mm diameter, 120 mm tall, gyratory-compacted specimens (GCSs). The 54 boxes of GCSs were produced from 27 different plant-produced mixes compacted to two levels of air voids per mix. There were two basic sources of the 27 mixes: 16 were sampled on a statewide basis, while 11 came from a particular Long-Term Pavement Performance (LTPP) project site located just north of Bagnell Dam on U.S. Route 54. The two basic mix types included in the 27 mixes were Bituminous Pavement (BP) mixes (MoDOT standard specification Section 401) and Superpave (SP) mixes (MoDOT standard specification section 403). BP mixes included BP1 and BP2 mixes, while SP mixes included several different surface mixes such as Stone Matrix Asphalt (SMA), SP125 and SP095, a binder/base course mix, SP190, and a base course mix, SP250. The two target air void levels for the T 322 specimens were 1) the specified design level of air voids (3.5% for BP mixes and 4.0% for all other mixes) and 2) an as-constructed void level (6.5%) that satisfied requirements for the BP mixes and most of the SP mixes, but was slightly high for the SMA mixes (6.0%, maximum). MoDOT increased the GCS air voids level such that the two T 322 specimens cut from each GCS possessed the target air voids level as closely as possible. The MoDOT-supplied GCSs were end-ground and then sawn in half at Missouri S&T to produce the two finished T 322 specimens per GCS. Air voids were then determined on the T 322 specimens.

Tables 1 and 2 give the basic information about the top-lift cores and the loose mixes from which gyratory-compacted specimens were prepared, respectively. The Sample (Lab) ID and Mix Number are designations assigned to each mix by MoDOT. Definitions of the other column headings are as follows:

- SMA = Stone Matrix Asphalt
- RAP = Reclaimed Asphalt Pavement
- RAS = Reclaimed Asphalt Shingles
- GTR = Ground Tire Rubber
- Binder Additives include, but may not be limited to recycling agents, anti-strip agents, and warm-mix asphalt additives
- Virgin Binder = Recently purchased liquid asphalt binder used in the mix
- Inline Binder Grade = The grade of the binder that is pumped into the mixing chamber; this binder includes any virgin binder, GTR, and binder additives
- Contract Binder Grade = The specified binder grade for the mix. The blend of the inline binder and any RAP/RAS binder should meet this specification.

Table 1: Top-Lift Core Inventory/Description

Sample ID	Mix Number	SMA?	Virgin Binder Grade	RAP (%)	RAS (%)	Binder Additives?
16PJ5B300	SP125 06-45	Yes	PG76-22	0.0	0.0	No
16PJ5B305	SP125 13-86	No	PG64-22H	33.0	0.0	Yes
16PJ5B308	SP125 06-125	No	PG64-22	0.0	0.0	No
16PJ5B311	SP125 07-35	No	PG70-22	20.0	0.0	Yes
16PJ5B315	SP125 08-18	No	PG70-22	0.0	0.0	Yes
16PJ5B319	SP125 05-143	No	PG70-22	10.0	0.0	Yes
16PJ5B322	SP125 08-24	No	PG64-22	20.0	0.0	Yes
16PJ5B326	SP125 01-48	No	PG70-22	0.0	0.0	No
16PJ5B330	BP[1] 09-61	No	PG64-22	2.0	1.0	No
16PJ5B332	SP125 07-92	No	PG70-22	0.0	0.0	Yes
16PJ5B339	SP125 06-139	No	PG70-22	10.0	0.0	Yes
16PJ5B344	SP095 12-51	No	PG64-22H	11.0	0.0	No
16PJ5B346	SP125 12-48	No	PG64-22H	18.0	0.0	No
16PJ5B348	SP095 10-116	Yes	PG76-22	0.0	0.0	No
16PJ5B352	SP125 06-150	No	PG70-22	10.0	0.0	Yes
16PJ5B356	SP125 10-110	No	PG70-22	20.0	0.0	Yes
16PJ5B361	SP125 10-31	No	PG70-22	20.0	0.0	Yes
16PJ5B363*	SP125 07-51	No	PG64-22	20.0	0.0	Yes
	or SP125 08-20	No	PG64-22	18.0	2.0	Yes

* Multiple JMFs linked to this ID.
Visual inspection was insufficient to identify the appropriate mix number

Specimen Fabrication

Top-Lift Cores

MoDOT Central Lab staff first froze the pavement cores and removed the top lift (layer) in such a manner as to avoid damaging the top-lift core. MoDOT staff then performed AASHTO T 166 (*5*) to obtain the bulk specific gravity (G_{mb}) of the top-lift core (which usually had some tack coat still attached). Using an assumed or historical maximum specific gravity (G_{mm}) value for that mix, MoDOT staff then determined the air voids. The top-lift cores were bagged, labeled, and boxed (typically 6 top-lift cores per box) for delivery to Missouri S&T.

Initial inspection of the top-lift cores upon arrival at Missouri S&T showed that the tack coat face was not always flat and/or parallel to the riding surface (wearing) face. The surface face, on the other hand, was usually in relatively good condition although surface voids/pitting was not unusual, as one would imagine. Also, the edges of the top-lift cores created by the core drill were not always flat across the entire thickness of the specimen. Occasionally, the top edge/corner of the top-lift core was rounded off or beveled, which probably occurred during removal of the full core from the pavement.

Table 2: Loose Mix/GCS Inventory/Description

			Binder Grade		RAP	RAS	Binder	GTR
Sample ID	Mix Number	SMA?	Contract	Inline	(%)	(%)	Additives?	(%wtAC)
Statewide Sampling								
16PJ5B001	BP2 15-87	No	PG64-22	PG52-28	16.0	4.0	Yes	0.0
16PJ5B002	SP190 15-27	No	PG76-22	PG64-22V	20.0	0.0	Yes	0.0
16PJ5B003	SP095 16-13	Yes	PG76-22	PG64-22V	0.0	0.0	No	0.0
16PJ5B004	SP125 14-3	No	PG76-22*		15.0	0.0	No	8.0
16PJ5B005	BP1 16-61	No	PG64-22	PG58-28	32.0	0.0	Yes	0.0
16PJ5B006	SP125 16-9	Yes	PG76-22	PG64-22V	0.0	0.0	No	0.0
16PJ5B007	SP095 16-63	No	PG76-22	PG64-22V	25.0	0.0	No	0.0
16PJ5B008	SP190 14-18	No	PG70-22**		23.0	0.0	Yes	0.0
16PJ5B009	SP125 16-39	No	PG64-22	PG64-22	25.0	0.0	Yes	0.0
16PJ5B010	SP190 15-48	No	PG64-22	PG64-22	23.0	0.0	Yes	0.0
16PJ5B011	SP125 15-60	No	PG70-22	PG64-22H	20.0	0.0	Yes	0.0
16PJ5B012	SP190 15-57	No	PG70-22	PG64-22H	20.0	0.0	Yes	0.0
16PJ5B013	SP250 16-68	No	PG70-22	PG58-28	45.0	0.0	Yes	0.0
16PJ5B014	SP125 16-66	No	PG64-22H***		30.3	0.0	Yes	0.0
16PJ5B015	SP125 16-55	No	PG70-22	PG58-28	40.0	0.0	Yes	0.0
16PJ5B016	SP125 16-44	No	PG70-22	PG58-22	28.0	0.0	Yes	0.0
LTPP Project (U.S. 54)								
16PJ5B017	SP125 16-80	No	PG70-22	PG58-28	32.0	0.0	Yes	0.0
16CDCJB013	SP125 16-83	No	NA	PG64-22H	25.0	0.0	Yes	0.0
16CDCJB014	SP125 16-100	No	NA	PG64-22H	25.0	0.0	Yes	0.0
16CDCJB015	SP125 16-93	No	NA	PG64-22H	25.0	0.0	Yes	0.0
16CDCJB016	SP125 16-84	No	NA	PG64-22H	0.0	0.0	Yes	0.0
16CDCJB017	SP125 16-99	No	NA	PG64-22H	34.0	0.0	Yes	0.0
16CDCJB018	SP125 16-91	No	NA	PG58-28	0.0	3.5	Yes	0.0
16CDCJB019	SP125 16-89	No	NA	PG58-28	19.0	3.0	Yes	0.0
16CDCJB020	SP125 16-98	No	NA	PG58-28	36.0	0.0	Yes	0.0
16CDCJB021	SP125 16-95	No	NA	PG46-34	17.0	6.0	Yes	0.0
16CDCJB022	SP125 16-94	No	NA	PG58-28	0.0	6.5	Yes	0.0

NA = Not Available

*Shown as Inline Grade on JMF; No Contract Grade designation; JMF shows a virgin PG64-22 binder.

*Shown as Inline Grade on JMF; No Contract Grade designation; JMF shows a virgin PG64-22H binder.

***Shown as Inline Grade and virgin binder on JMF; No Contract Grade designation.

This fact proved challenging during IDT testing in that the locations on the periphery of the disk-shaped specimen at which the platens would come into contact had to be pre-determined to afford the best chance that the specimen would stay standing plumb during loading and that the entire thickness of the specimen was experiencing the stress imposed by the curved loading platen/strip. Figure 1 shows some of these issues experienced during the top-lift core specimen preparation.

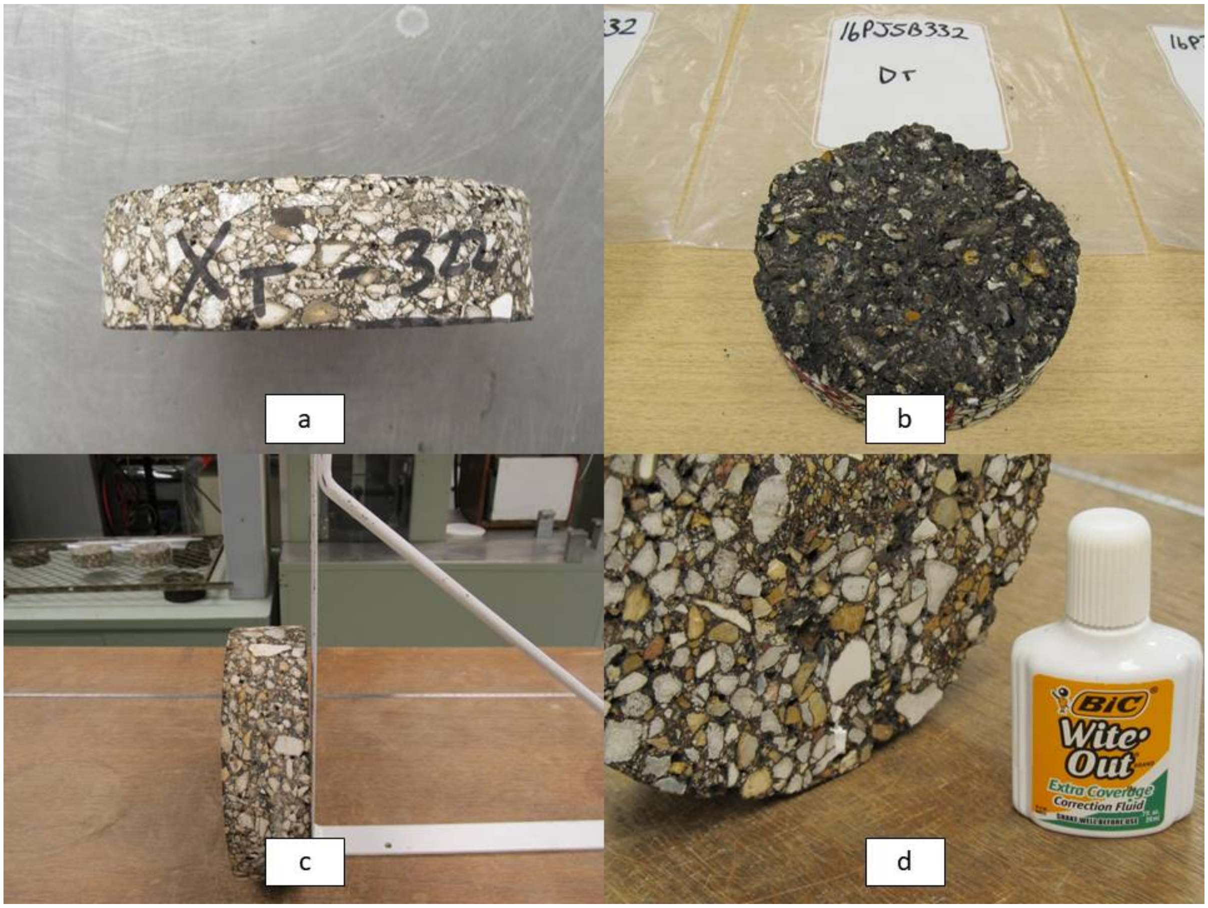

Figure 1: a) Beveled top edge b) Very rough tack coat face c) Irregular edge causing non-plumb standing condition d) Marking of optimal orientation

Three top-lift cores were chosen from each set to be prepared for IDT testing. Selection was determined such that all three had similar air void levels, and with the expectation that all three would meet specified thickness (38 to 50 mm) after end-grinding. It is important to note that thicknesses and air void levels were highly variable in many of the top-lift core samples.

Once selected, the top-lift cores were end-ground with a wet system end-grinder such that 1) both faces would be flat and as parallel as possible, 2) the faces possessed a minimum amount of surface voids, and 3) the final specimen thickness would be maximized. Figure 2 shows the end-grinder, the clamping jig for holding the top-lift cores during grinding, and a specimen after grinding.

Figure 2: a) End-grinder and grinding disk b) Clamping jig with specimen in place c) Specimen being end-ground d) Specimen after grinding

Having end-ground the top-lift core specimens, they were set in front of a fan to dry overnight. The following day, the diameter of each specimen was measured with a pi tape, and the thickness was measured at four points, approximately equidistant along the circumference. Finally, the gauge points were attached, taking care to place them on each face in locations that did not correspond with a significant surface void. Figure 3 shows these final steps in top-lift core specimen preparation prior to IDT testing.

<u>GCS-Derived T 322 Specimens</u>

Specimen preparation for the T 322 specimens cut from GCSs was much less problematic than preparation of the top-lift cores. The first step was to choose two GCSs that had MoDOT-supplied air voids (i.e. G_{mb}) values that were the same or very similar, and that were approximately 0.5% higher than the target air voids value for the T 322 specimens. The MoDOT Central Lab staff that prepared the GCSs did do trial and error testing to fine-tune the GCS air voids level such that the T 322 specimens cut from the GCS would meet as closely as possible the target air voids.

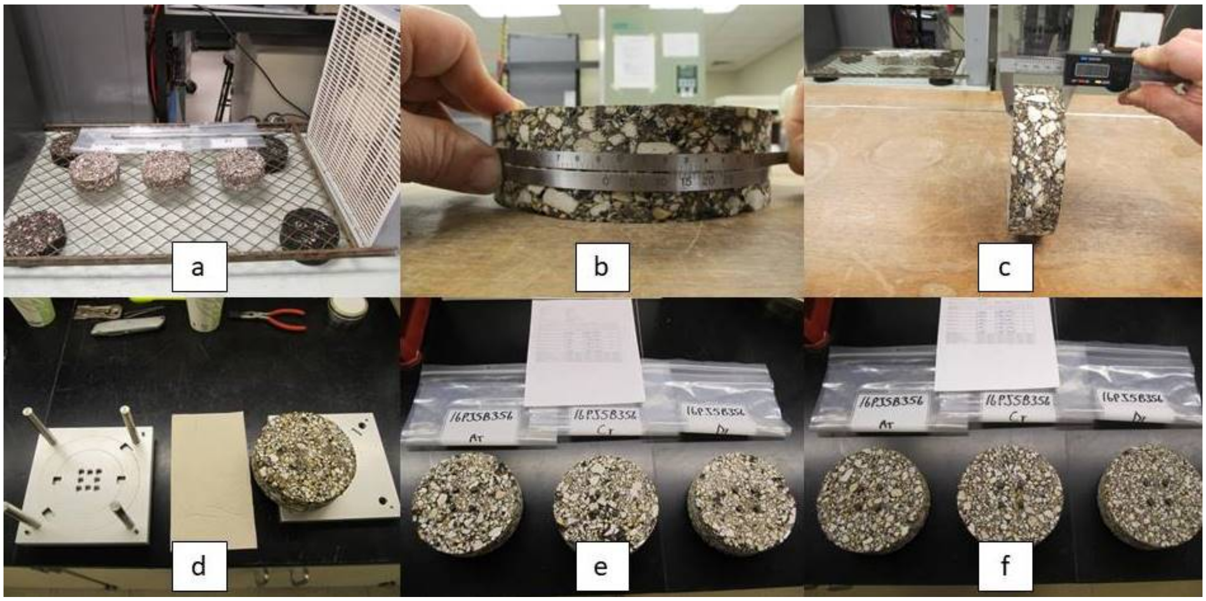

Figure 3: a) Air drying b) Diameter using a pi tape c) Thickness measurement d) Gauge point gluing template e) Tack coat face f) Surface face

The two selected GCSs were then end-ground, removing approximately 11 mm from each end of the GCS. The remaining specimen was usually 97-98 mm thick. Sawing the specimen in half removed another ~4 mm which resulted in two finished T 322 specimens 46-48 mm thick (tall). Figure 4 shows the end-grinder and saw configurations.

The four finished T 322 specimens were then air-dried overnight in front of a fan, the G_{mb} was determined the next day per AASHTO T 166, and the specimens were air-dried overnight in front of a fan, again, in preparation for having the gauge points attached. Using the MoDOT-supplied G_{mm} value, air voids were calculated for all four specimens. One of the four specimens was then identified as the outlier in that the remaining three had an average air voids value that was as close to the target as possible and their standard deviation was as low as possible. The three selected specimens then had the gauge points attached to them in preparation for IDT testing.

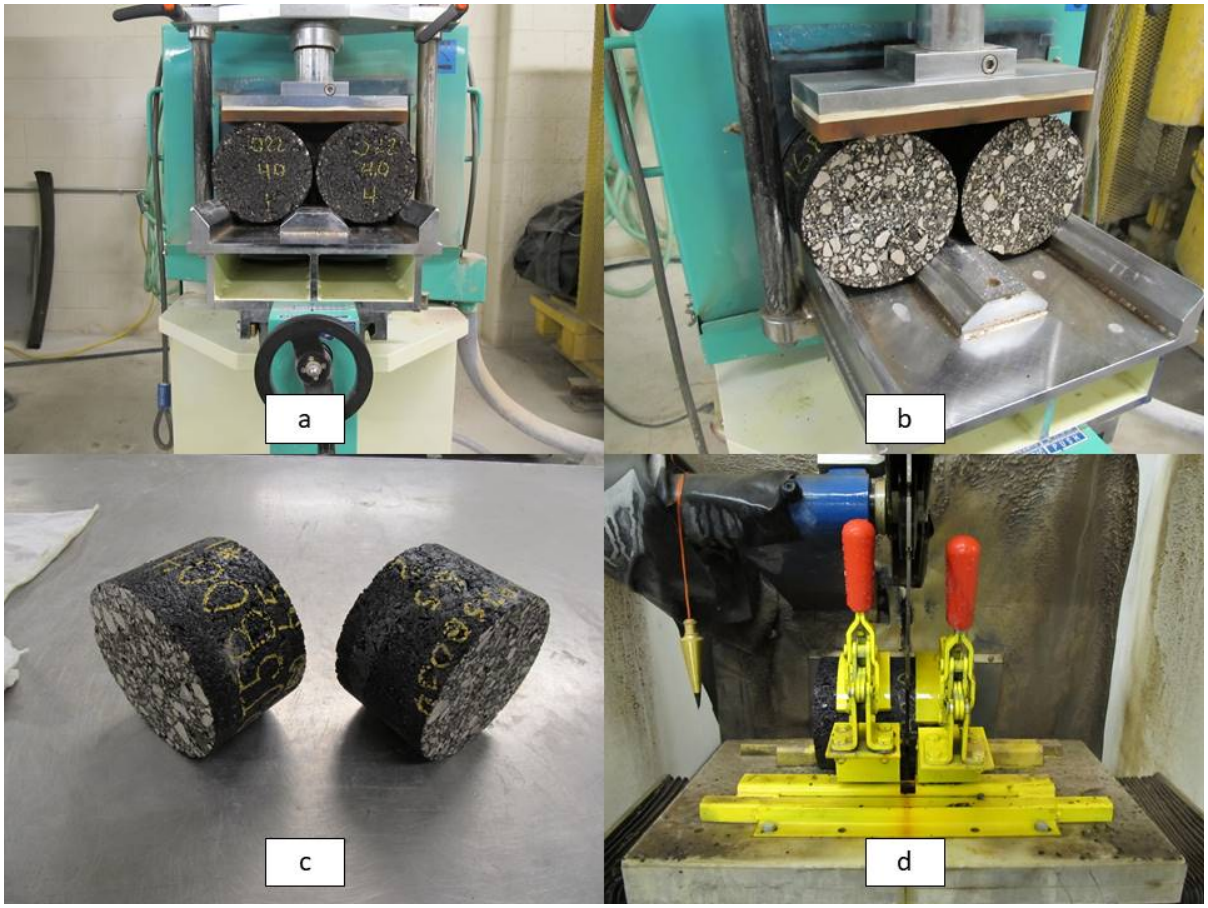

Figure 4: a) End-grinding GCSs-beginning b) End-grinding GCSs-ending c) End-ground GCSs d) Sawing end-ground GCS in half

IDT Testing

Equipment

Testing for this project was performed using a MTS 880 load frame calibrated up to 55,000 pounds (force) of compression on May 11, 2016. The system is dynamic, closed-loop servo-hydraulic and is computer controlled. In addition to the MTS 880's standard load measurement device, an electronic 25,000 pound, fatigue-rated Tovey load cell (Model FR20-25K) was mounted in-line between the loading table of the MTS 880 and the piston connected to the lower IDT loading platen/strip, as specified in T 322-07 (2016). However, the Tovey load cell output, although electronically acquired and included in the raw data output, was not used for creep compliance or tensile strength calculations but served as a redundant asset. The MTS 880 load cell seemed much more sensitive in regards to resolution and was more accurate and stable when it was zeroed-out (tared) relative to the Tovey. System control and data acquisition was performed using the MTS FlexTest 40™ system.

Specimen deformations were measured using new Epsilon Model 3910 extensometers. The extensometers are magnetic, have a 38.00 mm gauge length, a travel of ±0.50 mm, and are operational from -40 to 100°C. The fact that the extensometers are magnetic and the gauge points are ferrous metal made the attachment of the extensometers to the gauge points quick, precise, and stable once in place. The extensometers have pins that are inserted through the extensometer arm very near the mechanical center. The extensometers are attached to the gauge points with the centering pins in place and once the extensometers are properly attached to the gauge points, the pins are pulled, the extensometers are zeroed-out in the software, and the test can proceed.

The temperature chamber is MTS model 651.34. The temperature is controllable from -30 to +100°C, ±0.2°C. Figure 5 shows the equipment and specimen configurations.

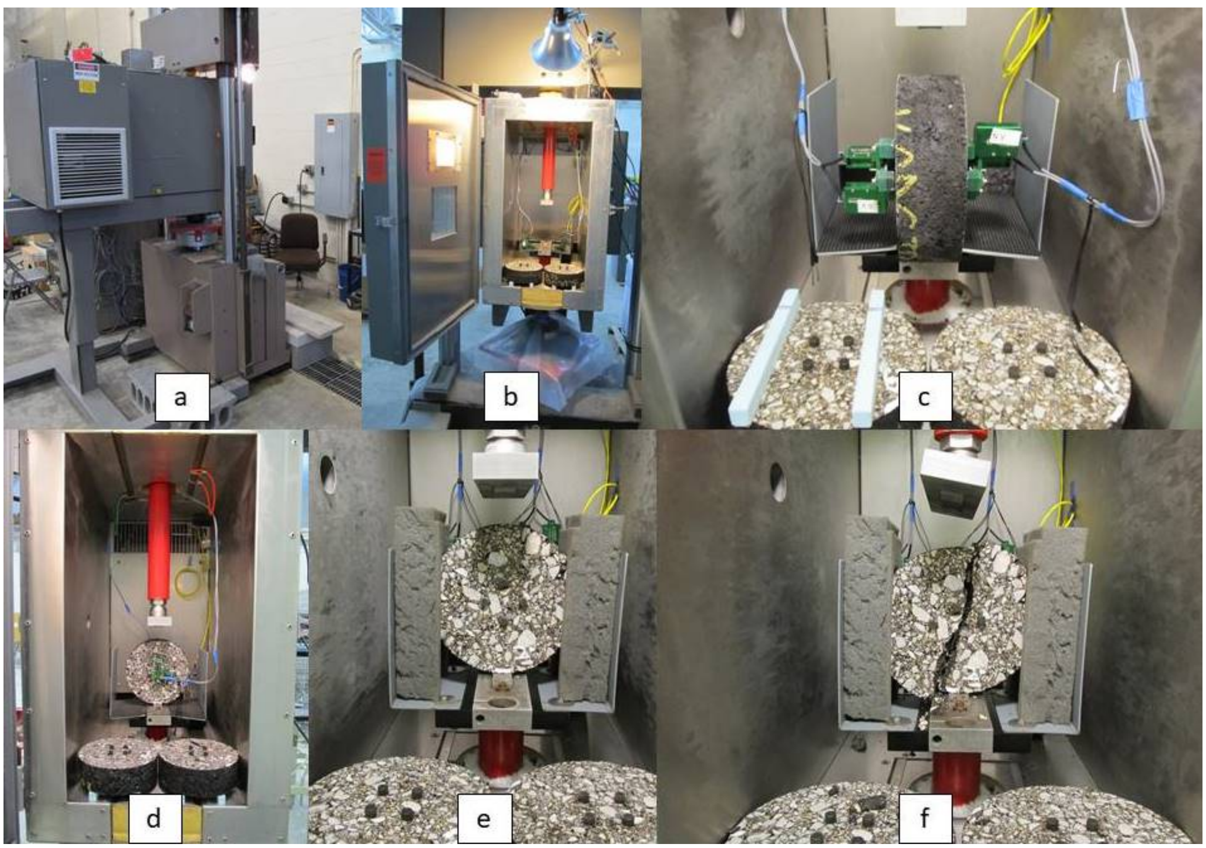

Figure 5: a) MTS 880 & temperature chamber b) Inside temperature chamber c) Extensometers on both sides of specimen d) Creep compliance setup e) IDT strength setup f) IDT strength post-failure

Creep Compliance Testing

Creep compliance is defined in T 322-07 (2016) as "the time-dependent strain divided by the applied stress." T 322-07 (2016) specifies compacted HMA test specimens that are cylindrically shaped with a diameter of 150 ± 9 mm and a thickness (height) of 38 to 50 mm (typically). A static load is imposed along a diametral axis of the temperature controlled specimen for a specified period of time (usually 100 seconds). Creep compliance testing is non-destructive in that the load is controlled so that the upper linear-elastic boundary of the HMA (typically 500 microstrain or 0.0190 mm based on a 38 mm gauge length) is not exceeded, therefore each specimen can be tested at several temperatures. However, the load must be great enough to cause sufficient horizontal deformation (≥0.00125 mm or 33 microstrain based on a 38 mm gauge length) such that signal noise in the data acquisition process is insignificant. Creep loads were selected to attempt to keep the average horizontal deformation from both specimen faces between 0.00250 mm and 0.00900 mm. During the loading period, vertical and horizontal deformations are measured on the two ground/sawn parallel faces of the specimen using two extensometers per specimen face (see Figure 5c).

Procedure

Prior to performing the creep testing, gauge points were attached to the IDT specimens using a gluing template and an instant adhesive, Loctite 416™ (see Figure 3d).

Three replicate test specimens were inserted into the temperature chamber. The chamber was turned on and the temperature control set to -20.7°C. Per recommendations in NCHRP Report 530, specimen temperature was monitored by using a dummy IDT specimen within the chamber that had a type K thermocouple embedded at its 3-dimensional center. Once the dummy specimen was observed to be at the target temperature, one of the three specimens was instrumented with the extensometers and set on the lower loading platen. Because the door had been opened to instrument and place the first specimen (usually taking less than a minute), a short amount of time was allowed to transpire for the temperature to recover (usually 15 to 30 minutes, depending on the temperature and how long the door was actually open). The basic procedure for creep testing was as follows:

1. Perform a 100 second IDT creep test at -20°C on specimen #1 of the set of three replicates that represent a particular treatment combination of mix type and level of air voids. Although not specified or even addressed in T 322-07 (2016), the static creep load should be applied as quickly as possible, with minimum overshoot, and then stabilized to ±2% of the creep load as quickly as possible. Data was acquired at a rate of 10 Hz throughout the entire creep test.
2. After software-programmed removal of the static load, continue to record deformations (rebound) of specimen #1 for at least an additional 100 seconds.

NOTE: This step is not specified in T 322 but was a simple addition of procedure that may prove to be useful for analysis purposes in the future.

3. Repeat steps 1 and 2 on specimens #2 and #3. NOTE: In between the testing of each specimen, the extensometers had to be moved from one specimen to the next, and this was done with the chamber door open. Once the next specimen was instrumented and aligned on the IDT test fixture lower loading strip, the door would be closed thus energizing the temperature chamber, and testing would resume once the dummy specimen temperature was within ±0.5°C of the target temperature.
4. Once testing is completed at -20°C, repeat steps 1 through 3 at 0°C and then again at -10°C, all with the same three specimens. NOTE: A BEMCO temperature chamber was used to pre-condition the specimens for the next temperature in the sequence. For example, specimen #1 was tested at -20°C, removed from the main temperature chamber and placed in the BEMCO chamber at 0°C. Once all specimens were tested at -20°C, the last specimen tested was left in the main chamber and the specimens in the BEMCO chamber were transferred to the main chamber which was then set to 0°C. The same procedure was used when changing from testing at 0°C to -10°C.

Figure 6 shows a typical load versus time plot and includes the average horizontal deformation (average of both specimen faces) on a second y-axis. As shown in Figure 6, the load application (and removal) was almost instantaneous and reached the target load within 0.2 seconds. Target load overshoot rarely exceeded 2% of the target load and stability within the ±2% range was controlled very well. The oscillation in the horizontal deformation series is a result of extensometer signal noise.

Tensile Strength Testing

The tensile strength testing portion of T 322-07 (2016) is a destructive test; i.e. the specimen is loaded until tensile failure occurs and cannot be used again. The specimen is not instrumented during testing. The specimen temperature is first stabilized at the target temperature (-10°C in this study) and then loaded at a rate of 12.5 mm of vertical ram movement per minute. Tensile strength is calculated as a function of the maximum load at failure and the specimen dimensions.

The issue of instrumented specimens during strength testing is one of the curiosities of T 322. T 322-07 (2016) Section 11.4 states, “After the creep tests have been completed at each temperature, determine the tensile strength by applying a load to the specimen at a rate of 12.5 mm of ram (vertical) movement per minute. *Record the vertical and horizontal deformations on both ends of the specimen and the load, until the load starts to decrease*.” The italicized sentence was also in T 322-03. However, this “first failure” definition seems to be the only reason to record vertical and horizontal deformations during strength testing (i.e. monitor the y-x differential). There is no instance in T 322-07 (2016) where the deformations that could be obtained during strength testing are used for any calculation or analysis purposes.

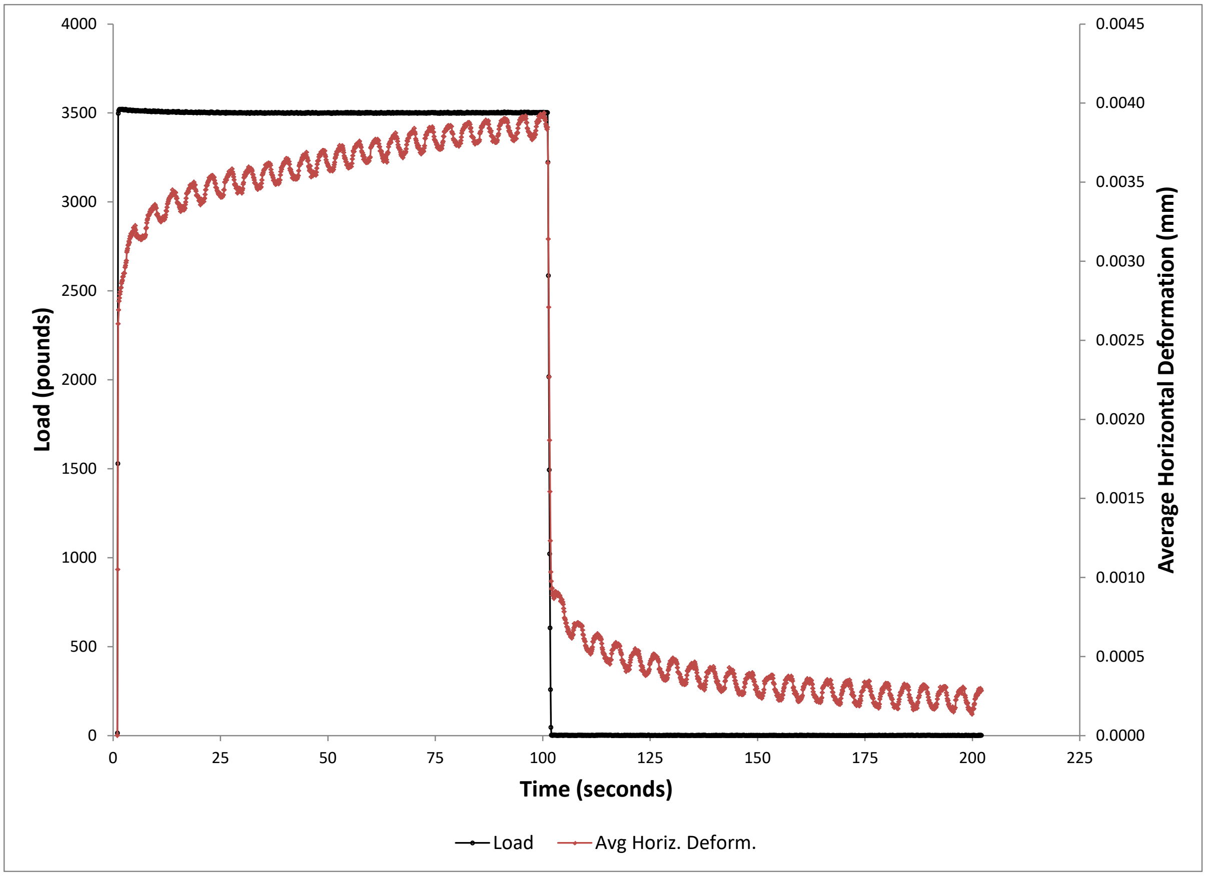

Figure 6: Load & Average Horizontal Deformation vs Time (-20°C)

NCHRP Report 530 recommended not performing IDT strength testing while the specimen is instrumented. In that report, Equation 1 was developed that transforms "uncorrected" IDT strength (i.e. strength calculated as a function of maximum load) into a "corrected" or true tensile strength (i.e. that strength calculated using the "first failure" definition). The relationship looks to have been developed using 16 data points and resulted in a R^2 value of 74%.

$$\text{Tensile Strength} = (0.78 \times \text{IDT Strength}) + 38 \quad (1)$$

where:

Tensile Strength = strength corrected to first failure
IDT Strength = strength calculated as a function of maximum load

The need for "first failure" tensile strength stems from the fact that the procedure outlined in T 322-03 was used during the national calibration of the thermal cracking distress model in the M-E PDG. Appendix HH of the M-E PDG documentation (*6*) goes into great detail about the IDT procedure and how "first failure" represents the true tensile strength of a HMA mixture at low temperatures better than simply using the maximum load. Thus, the argument is that any local calibration of the thermal cracking model should also be performed using the “first failure” concept. Therefore, the NCHRP Report 530 corrected tensile strength values are included in the results of this study.

Procedure

Immediately following the creep compliance testing of a particular set of replicate specimens at -10°C, that same set of specimens was tested for tensile strength but they were not instrumented for deformation measurements. Because specimens were not instrumented, maximum load as recorded with the MTS load cell was used for calculation purposes. The data acquisition rate was increased to 20 Hz per T 322 specifications. It is important to note a deviation in the method in that this increase in data rate was not implemented until after the top-lift core specimen testing.

A set of foam rubber “book ends” were constructed that were placed on either side of the specimen during testing to minimize debris movement throughout the temperature chamber upon failure. Figure 5 (e and f) shows this configuration.

Data Reduction

<u>Creep Compliance</u>

Creep compliance is calculated as a function of the horizontal and vertical deformations, the gauge length over which these deformations are measured, the dimensions of the test specimen, and the magnitude of the static load. Creep compliance determination, as defined in T 322-07 (2016), is given in Equation 2:

$$D(t) = \frac{\Delta X_{tm,t} \times D_{avg} \times b_{avg}}{P_{avg} \times GL} \times C_{cmpl} \qquad (2)$$

where:

$D(t)$ = creep compliance at time t $(kPa)^{-1}$
GL = gauge length in meters (0.038 meters for 150 mm diameter specimens)
D_{avg} = average diameter of all specimens [typically 3 specimens] (nearest 0.001 meter)
b_{avg} = average thickness of all specimens [typically 3 specimens] (nearest 0.001 meter)
P_{avg} = average creep load (kN)
$\Delta X_{tm,t}$ = trimmed mean of the normalized, horizontal deformations (nearest 0.001 meter) of all specimen faces [typically 6 specimen faces] at time t

C_{cmpl} = correction factor = $0.6354 \times \left(\frac{X}{Y}\right)^{-1} - 0.332$ (3)

where:

$\frac{X}{Y}$ = absolute value of the ratio of the normalized, trimmed mean of the horizontal deformations (i.e. $\Delta X_{tm,t}$) to the normalized, trimmed mean of the vertical deformations (i.e. $\Delta Y_{tm,t}$) at a time corresponding to ½ the total creep test time [typically 50 seconds] for all specimen faces

Equation 3 gives a non-dimensional correction factor that accounts for horizontal and vertical stress correction factors, and horizontal specimen bulging during loading (*6, 7*). Equation 3 restrictions are given by Equation 4:

$$\left[0.704 - 0.213\left(\frac{b_{avg}}{D_{avg}}\right)\right] \le C_{cmpl} \le \left[1.566 - 0.195\left(\frac{b_{avg}}{D_{avg}}\right)\right] \quad (4)$$

Normalization of the measured vertical and horizontal deformations of a specific specimen face is accomplished by multiplying said deformations by a constant that is a function of specimen dimensions and the creep load:

$$\text{Normalization Constant} = \frac{b_n}{b_{avg}} \times \frac{D_n}{D_{avg}} \times \frac{P_{avg}}{P_n} \quad (5)$$

where:

b_n, D_n, and P_n = thickness, diameter, and creep load of specimen n, respectively.

The trimmed mean of the normalized deformations (i.e. $\Delta X_{tm,t}$ and $\Delta Y_{tm,t}$) is simply the average of the remaining values (usually 4) after the maximum and minimum values have been discarded.

Creep compliance values needed for input into the M-E PDG thermal cracking module are calculated at 1, 2, 5, 10, 20, 50, and 100 seconds of loading, at -20, -10, and 0°C. The first major step is to determine the deformations at these times during testing at each of the temperatures.

Upon inspection of the raw acquired data, one first identifies the points in time at which 1) the load is first applied to the specimen and 2) the load stabilizes to ± 2% of the target creep load. In viscoelastic theory, the load versus time profile for creep testing is a step function; i.e. the load is applied instantaneously, held constant for the desired length of time, and then removed instantaneously. However, instantaneous loading in the real world is impossible. Under ideal real-world conditions the elapsed time between the initial application of load and stabilization at the creep load (± 2%) would be 0.1 second or less. During creep testing for this study, the MTS 880 was able to deliver the target creep load within 0.2 of a second, which is nearly instantaneous, and held the load stable well within ±2% of the target load for the entire 100 second duration. Overshooting of the target load was rarely above 2% of the target load and unloading also occurred almost instantaneously.

Poisson's Ratio

Poisson's ratio, ν, is calculated as follows:

$$\nu = -0.10 + 1.480\left(\frac{X}{Y}\right)^2 - 0.778\left(\frac{b_{avg}}{D_{avg}}\right)^2\left(\frac{X}{Y}\right)^2 \quad (6)$$

where:

$0.05 \leq \nu \leq 0.50$

Equation 6 is the result of a regression analysis performed on a family of curves representing different aspect ratios of the average thickness and diameter of three replicate specimens, b_{avg} and D_{avg}, respectively (*7*). Therefore, reported Poisson's ratio values are *estimations* based on measured X/Y data and specimen aspect ratios.

Tensile Strength

Calculation of tensile strength per T 322-07 (2016) is given by Equation 7 and is a primary input to the M-E PDG thermal cracking module.

$$S_{t,n} = \frac{2 \times P_{f,n}}{\pi \times b_n \times D_n} \quad (7)$$

where:

$S_{t,n}$ = tensile strength of specimen, n
$P_{f,n}$ = maximum load observed for specimen, n

RESULTS AND DISCUSSION

Top-lift core testing proved to be more challenging than the testing of the GCS-derived T 322 specimens. The top-lift core specimens were more variable in their thicknesses, air void levels, and surface irregularities than the GCS-derived specimens, which is not surprising considering the numerous sources of variability that can exist during pavement layer construction and the extraction of cores.

Top-lift core summary test data is given in Table 3, while GCS-derived specimen summary test data is given in Tables 4 and 5. Discussion of the results follows each table. More detailed data summaries are given for the top-lift cores and GCS-derived specimens in Appendix A and Appendix B, respectively. Complete data reduction files in Excel™ format were sent to the research team. Formatting of the Summary worksheets in each file was such that the research team could easily copy and paste the creep compliance and tensile strength data directly into the M-E PDG software.

Top-Lift Core Testing

Table 3: Top-Lift Core Test Data Summary

		Air Voids		Creep Compliance at 100 sec [(1/psi)E-07]			Tensile Strength at -10°C		Poisson's Ratio (Estimated)		
		Average	Coef. Var.	Test Temperature (°C)			T 322	NCHRP 530	Test Temperature (°C)		
Sample ID	Mix Number	(%)	(%)	-20	-10	0	(psi)	(psi)	-20	-10	0
16PJ5B300	SP125 06-45	3.7	8.8	4.639	7.879	20.009	561	476	0.1996	0.2094	0.1927
16PJ5B305	SP125 13-86	6.1	5.7	4.398	6.329	14.434	486	417	0.2630	0.2639	0.2725
16PJ5B308	SP125 06-125	6.6	10.7	4.680	6.119	15.250	467	403	0.2180	0.2504	0.2099
16PJ5B311	SP125 07-35	4.9	11.7	3.398	5.265	11.802	607	512	0.2666	0.3440	0.2919
16PJ5B315	SP125 08-18	2.0	45.8	2.999	4.787	13.500	844	697	0.2612	0.3523	0.4599
16PJ5B319	SP125 05-143	3.8	32.7	3.045	4.294	7.514	663	555	0.4352	0.3202	0.4183
16PJ5B322	SP125 08-24	5.9	13.8	4.288	6.883	14.196	420	366	0.4837	0.4133	0.4334
16PJ5B326	SP125 01-48	5.4	6.6	4.236	7.044	15.606	426	371	0.2316	0.2023	0.1563
16PJ5B330	BP[1] 09-61	9.0	22.6	5.546	9.946	12.109	396	347	0.2659	0.2500	0.6809
16PJ5B332	SP125 07-92	NOT TESTABLE									
16PJ5B339	SP125 06-139	6.8	14.5	6.083	6.968	13.483	431	374	0.1786	0.3020	0.2902
16PJ5B344	SP095 12-51	NOT TESTABLE									
16PJ5B346	SP125 12-48	9.1	3.8	5.210	7.798	15.081	379	334	0.2988	0.2931	0.3923
16PJ5B348	SP095 10-116	5.0	5.6	4.962	8.653	22.708	642	539	0.2809	0.2857	0.3081
16PJ5B352	SP125 06-150	6.9	4.1	4.643	5.845	7.863	362	321	0.3387	0.2999	0.3746
16PJ5B356	SP125 10-110	8.9	13.4	4.668	7.270	18.941	440	381	0.2428	0.2216	0.3103
16PJ5B361	SP125 10-31	NOT TESTABLE									
16PJ5B363*	SP125 07-51 or SP125 08-20	7.5	3.3	4.703	7.393	20.321	427	371	0.2745	0.3936	0.5520

* Multiple JMFs linked to this ID. Visual inspection of the specimens was insufficient to identify the appropriate mix number

Probably the first thing one observes in Table 3 is that three of the sets of top-lift cores were not testable. This was due to the inability to produce at least three finished T 322 specimens of sufficient thickness per set of delivered specimens. For example, in the case of the sample (lab) ID 16PJ5B344 set of cores, only three specimens were delivered and one of those was about an inch thick and had a very rough tack coat face (see Figure 1B). It was, therefore, not possible to produce three finished T 322 specimens that would meet thickness specifications.

The issue of insufficient specimen thickness was observed during the very first day of testing on the top-lift cores. The sample ID 16PJ5B330 set of cores was chosen specifically because there were only four delivered, and the as-delivered thicknesses ranged from 34.1 mm (1.344 in.) to 41.0 mm (1.616 in.). It was obvious upon initial inspection that after end-grinding, none of the four specimens would meet the minimum thickness specification of 38.0 mm. This set was, therefore, used to establish an initial routine procedure for preparation of top-lift core specimens and subsequent AASHTO T 322 testing, assuming that the results would be problematic and, essentially, invalid. Figure 7 shows that the assumption was correct in that the creep compliance curve at 0°C starts out lower than the curve at -10°C in the initial few seconds, and then crosses the -10°C curve around 20 seconds.

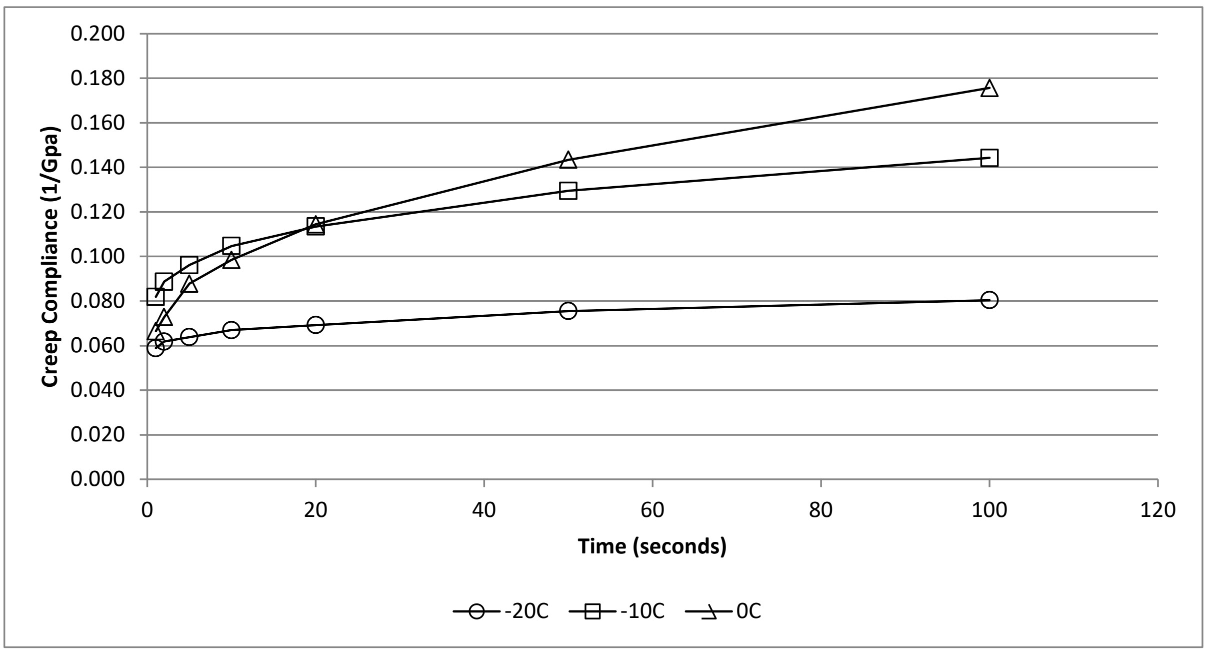

Figure 7: Sample ID 16PJ5B330 top-lift core creep compliance curves

Referring to Figure 7, it seemed logical that the anomalous behavior of the three 16PJ5B330 specimens used for T 322 testing was a function of the thickness which, after end-grinding, ranged from 24.8 mm (0.977 in.) to 35.3 mm (1.389 in.).

There was a second set of top-lift core data that produced the crossover effect of creep compliance curves: sample ID 16PJ5B339. Figure 8 shows that plot.

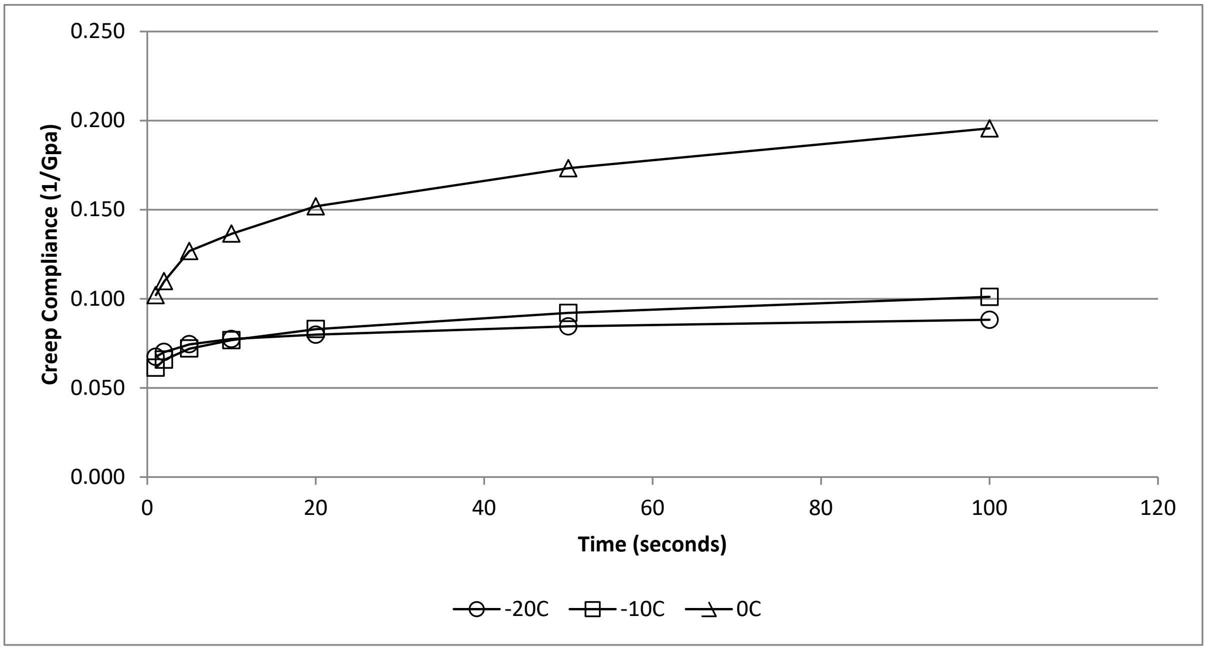

Figure 8: Sample ID 16PJ5B339 top-lift core creep compliance curves

The thicknesses for the 16PJ5B339 specimens were 37.2, 38.0, and 43.2 mm. Therefore, it is not unreasonable to assume that the minimum to out-of-specification thicknesses were a factor in the crossing of the -10 and -20°C curves in the initial few seconds, as shown in Figure 8. All of the other 13 top-lift core datasets produced typical creep compliance curves. Referring to Table 3 again, the 15 tested top-lift core sets resulted in an increasing creep compliance with increasing temperature at 100 seconds.

Although T 322 tensile strength at -10°C is a function of multiple factors, the expected trend of decreasing tensile strength with increasing air voids was observable and is shown in Figure 9.

It is important to note the extreme coefficient of variability values for the air voids of many of the three top-lift core specimen sets. Although not an unexpected trait due, again, to the inherent variability that can exist during pavement layer construction, and the physical deterioration of the surface lift over time, the high air voids variability within the three replicate T 322 specimens can certainly contribute much to variability within the test results.

Poisson's ratio, ν, is a measure of compressibility that 1) has a maximum value of 0.5 for an incompressible elastic material (*7*), and 2) increases with increasing temperature (*8*). Again referring to Table 3, there were several violations to both of these principles. Sample IDs 16PJ5B330 and 16PJ5B363 show estimated Poisson's ratio values greater than 0.5 at 0°C, and 11 of the 15 datasets violate the principle that Poisson's ratio increases with increasing temperature. This phenomenon may be a result of applying data to the regression equation (Equation 6) that is either outside of, or at the limits of the data range used to generate the equation. This was the case for sample ID 16PJ5B330 as the aspect ratio (b_{avg}/D_{avg}, where b = thickness or height, and D = diameter) for this set of specimens was 0.21 while the minimum aspect ratio used to generate Equation 6 was 0.20.

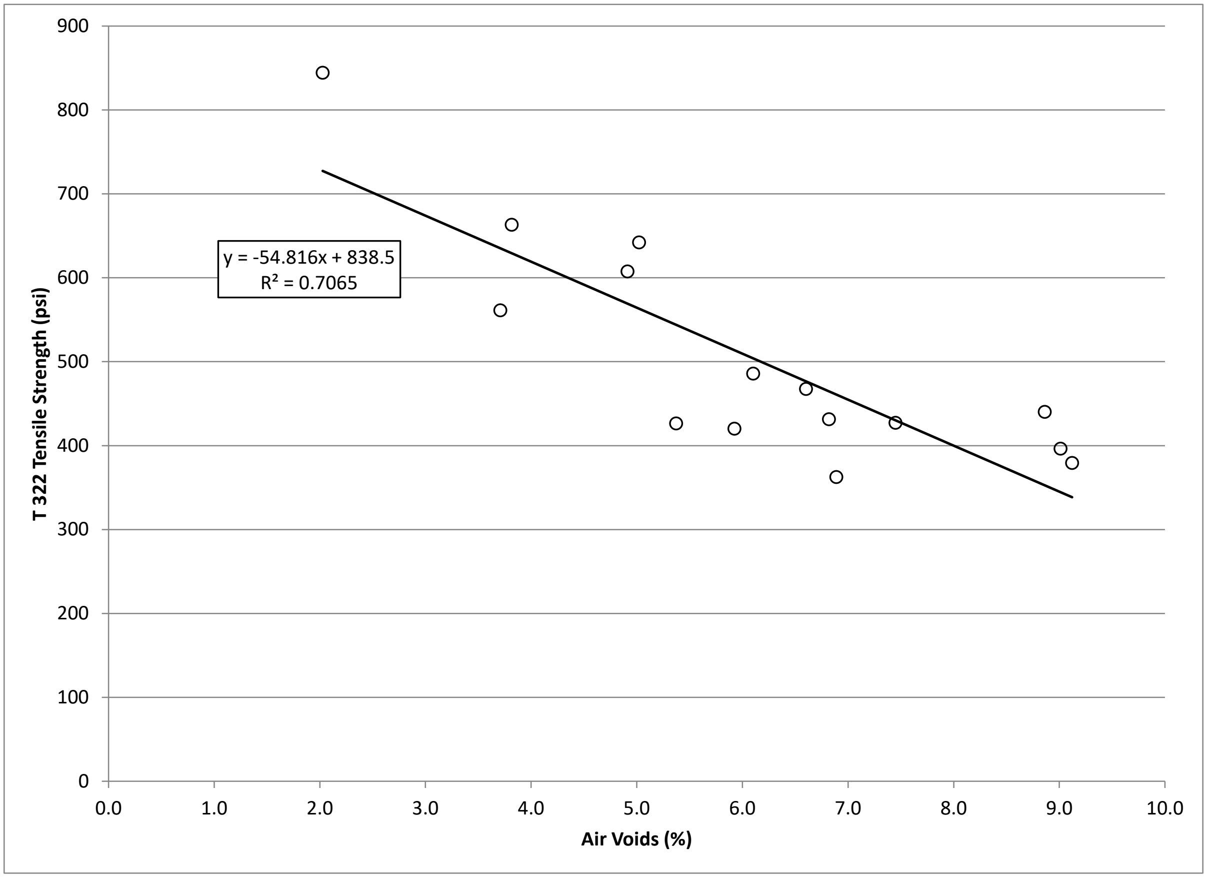

Figure 9: T 322 tensile strength vs. air voids for top-lift cores

Regarding the multiple violations of the principle of increasing Poisson's ratio with increasing temperature, it is not clear why this has occurred but it may be due to the highly variable top-lift core specimen thicknesses, especially relative to the GCS-derived specimen thicknesses. A thickness comparison of the top-lift cores to the GCS-derived specimens will be further discussed in the next section.

GCS-Derived Specimen Testing

The results for the GCS-derived specimen testing were more consistent with expected trends than the top-lift core testing. An inspection of Tables 4 and 5 shows that creep compliance at 100 seconds always increased with increasing temperature. In all but two cases (sample IDs 16PJ5B002 and 16PJ5B012), creep compliance at 100 seconds increased with increasing air voids at all three temperatures. It is notable that both of these exceptions were SP190 mixes.

Table 4: GCS-Derived Specimen Test Data Summary: Statewide Sampling

		Air Voids			Creep Compliance at 100 sec [(1/psi)E-07]			Tensile Strength at -10°C		Poisson's Ratio (Estimated)		
		Target	Average	Coef. Var.	Test Temperature (°C)			T 322	NCHRP 530	Test Temperature (°C)		
Sample ID	Mix Number	(%)	(%)	(%)	-20	-10	0	(psi)	(psi)	-20	-10	0
16PJ5B001	BP2 15-87	3.5	3.4	0.9	2.771	4.369	7.724	812	671	0.3003	0.3366	0.4635
		6.5	6.5	2.4	4.031	6.319	12.784	626	527	0.1742	0.2041	0.2594
16PJ5B002	SP190 15-27	4.0	3.9	8.6	3.375	3.635	6.801	734	610	0.2354	0.3641	0.3135
		6.5	6.5	6.2	2.528	3.504	6.607	603	508	0.5543	0.6036	0.6089
16PJ5B003	SP095 16-13	4.0	4.0	3.1	3.546	5.555	13.762	728	606	0.2679	0.3362	0.3243
		6.5	6.3	0.4	3.854	6.460	15.201	604	509	0.2625	0.2874	0.3852
16PJ5B004	SP125 14-3	4.0	3.8	6.6	3.363	4.713	9.153	696	581	0.2651	0.2491	0.3609
		6.5	6.5	4.7	3.805	4.995	10.479	582	492	0.1903	0.2539	0.2706
16PJ5B005	BP1 16-61	3.5	3.5	5.7	3.649	4.988	8.954	743	617	0.2240	0.2536	0.3094
		6.5	6.3	1.0	4.176	6.301	11.680	571	483	0.2273	0.2473	0.2777
16PJ5B006	SP125 16-9	4.0	3.8	6.4	3.791	6.182	16.416	658	551	0.2680	0.3467	0.4131
		6.5	6.4	6.0	4.485	7.362	18.405	599	505	0.2857	0.3577	0.4990
16PJ5B007	SP095 16-63	4.0	3.8	4.6	3.574	5.511	10.648	669	560	0.2456	0.2973	0.3533
		6.5	6.4	2.3	4.306	6.320	13.253	593	500	0.2439	0.2787	0.3285
16PJ5B008	SP190 14-18	4.0	3.9	4.6	3.422	4.678	7.097	729	606	0.2404	0.2613	0.3744
		6.5	6.5	0.9	4.519	6.182	11.761	617	520	0.1920	0.2090	0.2875
16PJ5B009	SP125 16-39	4.0	3.8	1.7	3.136	4.149	6.400	750	623	0.2478	0.2740	0.3133
		6.5	5.9	1.6	4.009	5.525	9.227	624	525	0.1706	0.1682	0.1758
16PJ5B010	SP190 15-48	4.0	3.9	3.6	3.342	4.120	6.794	736	612	0.2102	0.2428	0.2299
		6.5	6.3	5.5	4.212	5.218	8.139	565	479	0.1919	0.2328	0.2528
16PJ5B011	SP125 15-60	4.0	4.0	4.0	3.382	4.293	7.569	742	617	0.2401	0.3022	0.3054
		6.5	6.5	2.3	3.660	4.743	8.317	623	524	0.2654	0.3223	0.3581
16PJ5B012	SP190 15-57	4.0	3.8	2.5	2.499	3.364	6.248	754	626	0.4336	0.3741	0.4401
		6.5	6.5	0.1	2.997	3.766	6.194	610	514	0.3787	0.4513	0.6054
16PJ5B013	SP250 16-68	4.0	4.1	7.4	3.275	4.956	9.707	694	579	0.2739	0.2436	0.2618
		6.5	6.4	0.9	4.123	5.802	14.250	529	450	0.2774	0.3053	0.2478
16PJ5B014	SP125 16-66	4.0	4.0	15.2	3.529	4.781	8.383	704	587	0.2222	0.2845	0.3762
		6.5	6.1	1.9	3.994	5.484	10.030	604	509	0.2079	0.2687	0.3342
16PJ5B015	SP125 16-55	4.0	3.9	4.1	3.266	5.158	10.574	717	597	0.3322	0.3567	0.3547
		6.5	6.3	0.4	3.995	5.951	12.903	602	507	0.2818	0.3312	0.4107
16PJ5B016	SP125 16-44	4.0	3.7	6.0	2.757	3.687	6.502	767	636	0.2670	0.3696	0.4410
		6.5	6.0	0.5	3.667	5.470	9.758	638	535	0.1667	0.1789	0.2627
16PJ5B017*	SP125 16-80	4.0	4.2	4.0	2.004	3.067	5.509	812	671	0.4552	0.4625	0.5734
		6.5	6.4	1.0	2.751	3.614	7.181	689	576	0.3610	0.4798	0.5168

*The control mix on the LTPP study project

In all cases shown in Tables 4 and 5, tensile strength at -10°C decreased with increasing air voids.

The air voids coefficient of variation rarely exceeded 10% which is a significant, and expected, improvement over the top-lift core data. The relatively low air voids variability within a set of T 322 specimens improves the confidence in the results.

Regarding the estimated Poisson’s ratio results, there were only 14 cases in which the calculated Poisson’s ratio did not increase with increasing temperature, and only three cases in which it exceeded 0.5. This is most likely due to much less variability in the GCS-derived specimen thicknesses. Table 6 shows a comparison between all 15 top-lift core sets and a selection of 15 low air voids GCS-derived specimen sets.

Table 5: GCS-Derived Specimen Test Data Summary: LTPP Project

Sample ID	Mix Number	Air Voids Target (%)	Air Voids Average (%)	Air Voids Coef. Var. (%)	Creep Compliance at 100 sec [(1/psi)E-07] -20 °C	Creep Compliance -10 °C	Creep Compliance 0 °C	Tensile Strength at -10°C T 322 (psi)	Tensile Strength at -10°C NCHRP 530 (psi)	Poisson's Ratio (Estimated) -20 °C	Poisson's Ratio -10 °C	Poisson's Ratio 0 °C
16CDCJB013	SP125 16-83	4.0	3.8	5.0	2.954	4.009	7.041	878	723	0.2753	0.3424	0.4428
		6.5	6.5	6.7	3.673	4.988	10.968	728	605	0.2065	0.3030	0.2692
16CDCJB014	SP125 16-100	4.0	3.8	11.5	3.382	4.685	10.386	776	643	0.2236	0.2705	0.2543
		6.5	6.3	2.2	3.828	5.280	13.006	670	561	0.2409	0.3073	0.3061
16CDCJB015	SP125 16-93	4.0	3.8	6.4	3.744	4.912	11.978	739	614	0.1651	0.2674	0.2169
		6.5	6.4	4.4	3.951	6.106	14.578	589	497	0.2279	0.2508	0.2990
16CDCJB016	SP125 16-84	4.0	3.7	3.4	3.070	4.295	9.364	906	745	0.2244	0.2661	0.3087
		6.5	6.2	1.8	3.886	5.959	13.179	739	614	0.1508	0.1756	0.2105
16CDCJB017	SP125 16-99	4.0	3.9	5.2	2.836	3.665	5.709	871	718	0.2185	0.2482	0.2819
		6.5	6.3	5.5	3.226	4.256	6.461	708	590	0.2016	0.2387	0.3321
16CDCJB018	SP125 16-91	4.0	3.9	5.5	3.649	5.514	11.564	689	575	0.2556	0.3381	0.4159
		6.5	6.4	1.5	3.880	6.210	15.374	591	499	0.2660	0.3015	0.3094
16CDCJB019	SP125 16-89	4.0	4.0	4.9	3.293	4.391	7.464	702	585	0.2181	0.2788	0.3421
		6.5	6.5	1.1	3.847	5.749	10.267	620	521	0.2122	0.2209	0.3195
16CDCJB020	SP125 16-98	4.0	4.1	3.5	3.232	4.428	9.198	789	654	0.2276	0.3038	0.3268
		6.5	6.5	4.3	3.569	5.035	10.888	716	597	0.2085	0.2844	0.2537
16CDCJB021	SP125 16-95	4.0	4.1	6.6	3.368	5.133	9.174	692	577	0.2974	0.3104	0.3470
		6.5	6.4	1.8	4.361	6.544	12.211	582	492	0.2477	0.2834	0.3159
16CDCJB022	SP125 16-94	4.0	4.0	3.5	3.121	4.477	7.798	943	774	0.2236	0.2558	0.2734
		6.5	6.4	3.7	3.891	5.531	10.155	603	509	0.2625	0.2875	0.3067

Table 6: T 322 Specimen Thickness Statistics

Top-lift cores Sample ID	Avg. (mm)	St.Dev. (mm)	Coef.Var. (%)	GCS-derived (low air voids) Sample ID	Avg. (mm)	St.Dev. (mm)	Coef.Var. (%)
16PJ5B300	40.9	1.42	3.5	16PJ5B001	46.8	0.39	0.8
16PJ5B305	48.9	0.87	1.8	16PJ5B002	47.1	0.24	0.5
16PJ5B308	38.6	0.52	1.3	16PJ5B003	48.7	0.23	0.5
16PJ5B311	42.8	1.65	3.9	16PJ5B004	46.2	0.34	0.7
16PJ5B315	41.2	0.52	1.3	16PJ5B005	47.5	0.58	1.2
16PJ5B319	41.5	1.72	4.1	16PJ5B006	47.2	0.57	1.2
16PJ5B322	41.5	1.93	4.6	16PJ5B007	47.0	0.42	0.9
16PJ5B326	48.1	1.35	2.8	16PJ5B008	46.7	0.88	1.9
16PJ5B330	31.2	5.62	18.0	16PJ5B009	47.3	0.39	0.8
16PJ5B339	39.5	3.25	8.2	16PJ5B010	47.4	0.13	0.3
16PJ5B346	45.5	1.82	4.0	16PJ5B011	47.5	0.73	1.5
16PJ5B348	44.3	3.10	7.0	16PJ5B012	46.6	0.36	0.8
16PJ5B352	40.3	2.68	6.6	16PJ5B013	47.3	0.23	0.5
16PJ5B356	45.6	0.26	0.6	16PJ5B014	48.0	0.61	1.3
16PJ5B363	47.2	4.00	8.5	16PJ5B015	47.0	0.33	0.7
Avg. (mm)	42.5	2.0	5.1	Avg. (mm)	47.2	0.4	0.9
Max. (mm)	48.9	5.6	18.0	Max. (mm)	48.7	0.9	1.9
Min. (mm)	31.2	0.3	0.6	Min. (mm)	46.2	0.1	0.3
St.Dev. (mm)	4.46	1.47	4.36	St.Dev. (mm)	0.61	0.21	0.44
Coef.Var. (%)	10.5	71.6	85.8	Coef.Var. (%)	1.3	48.3	48.4

The average, standard deviation, and coefficient of variation values for each sample ID represent those statistics for the three replicate specimens per sample ID. The average, maximum, minimum, standard deviation, and coefficient of variation values at the bottom of the tables represent the statistics for all values in the columns above those same statistics, and they clearly point out the difference between the top-lift core and GCS-derived specimen thicknesses. The overall coefficient of variation of

10.5% for the top-lift core thicknesses versus 1.3% for the GCS-derived specimens can help explain test results variability and inform one as to what degree of confidence should be placed on those results. The fact that the overall average thickness of the GCS-derived specimens was approximately 5 mm greater than the top-lift core specimens is beneficial to the GCS-derived specimen test results because one is testing a greater mass of material, which would give a better indication of material behavior. It should be pointed out that even though only 15 GCS-derived specimen sets are shown in Table 6, it can safely be assumed that the statistics would not change significantly if all 54 sets (i.e. treatment combinations) were included because the GCS-derived specimen preparation procedure was consistent throughout.

CONCLUSIONS

Top-Lift Cores:

High variability in specimen thickness and air voids, and irregular surfaces contributed to more anomalies in the T 322 test results, relative to the GCS-derived specimen testing. However, expected general trends such as increasing creep compliance at 100 seconds with increasing temperature, and decreasing tensile strength with increasing air voids were confirmed. Principles governing Poisson's ratio (i.e. increasing Poisson's ratio with increasing temperature, and a maximum value of 0.5) were violated at a much greater frequency than with the GCS-derived specimens. This was most likely a result of highly variable specimen thicknesses and the application of that variability to the regression equation in AASHTO T 322 used to estimate Poisson's ratio.

GCS-derived Specimens:

The expected trend of increasing creep compliance at all time periods (i.e. 1, 2, 5, 10, 20, 50, and 100 seconds) with increasing temperature was confirmed. Increasing creep compliance with increasing air voids was confirmed except in a couple of SP190 mixes. Decreasing tensile strength with increasing air voids was also confirmed. In the majority of cases, the estimated Poisson's ratio for each treatment combination (i.e. mixture and air voids level) increased with increasing temperature.

General Comments:

The GCS-derived specimen results are more reliable than the top-lift core results. Additionally, the equipment and testing procedures were significantly improved from the T 322 testing previously performed at Missouri S&T for the M-E PDG local calibration, lending even greater confidence in the GCS-derived specimen results.

RECOMMENDATIONS

If top-lift core creep compliance and tensile strength testing per AASHTO T 322 is to be performed on a regular basis, a more refined core extraction procedure is recommended to help reduce the specimen edge irregularities. Also, if top-lift core specimens are generally expected to be thinner than desired for T 322 testing, a few more cores should be taken from the pavement and an expanded T 322 data reduction procedure should be developed such that more than three replicate specimens are used in order to reduce the error in the results.

Dr. William Buttlar of the University of Missouri in Columbia is involved with research that uses only the Disk-shaped Compact Tension (DCT) test device to obtain data for an improved thermal cracking model. As Missouri S&T now owns one of these devices, and there are four GCSs per treatment combination from this project still in the Missouri S&T asphalt laboratory, it might be useful to MoDOT to follow up work performed in this project with a study using the Missouri S&T DCT device to further the goal of Dr. Buttlar. The Missouri S&T DCT device is also configured with the Semi-Circular Bend (SCB) test hardware (e.g. Illinois Flexibility Index Test or I-FIT), and the hardware to perform a recently developed test called the InDirect tEnsile AsphaLt Cracking Test (IDEAL-CT).

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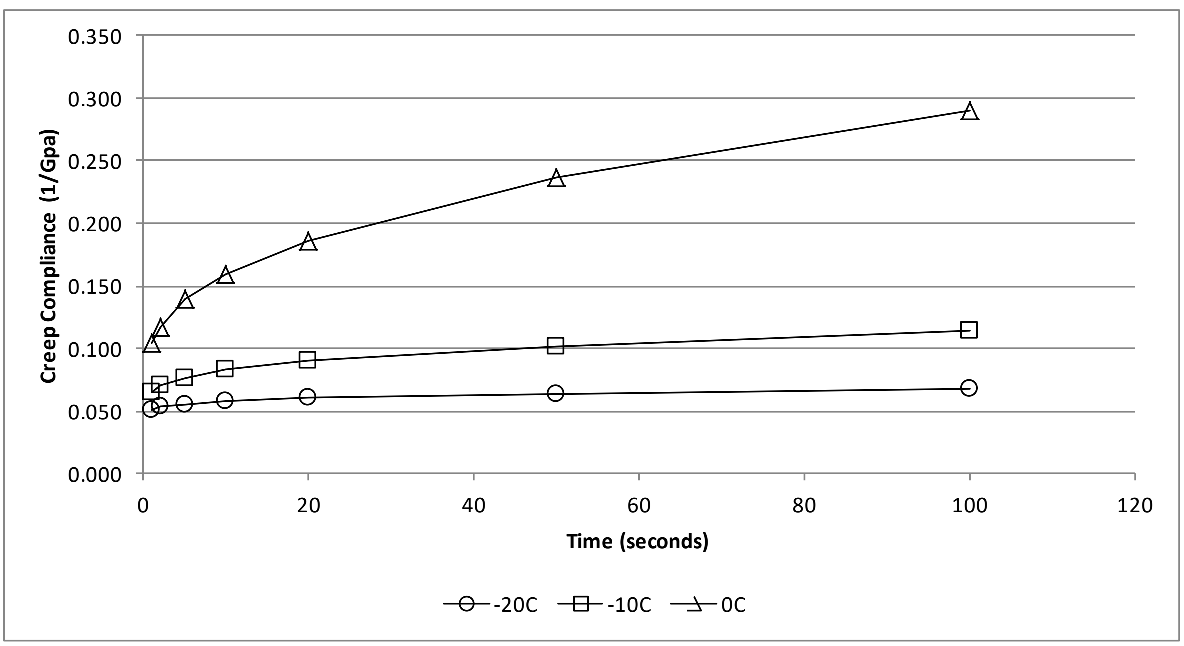
APPENDIX A: TOP-LIFT CORE SUMMARY DATA

Lab ID	16PJ5B300		SMA?	Yes
Mix Number	SP125 06-45		Virgin Binder Grade	PG76-22
Average Air Voids* (%)	3.7		RAP (%)	0.0
Air Voids Standard Deviation (%)	0.3		RAS (%)	0.0
Air Voids Coeff. of Variation (%)	8.8		Binder Additives?	No

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

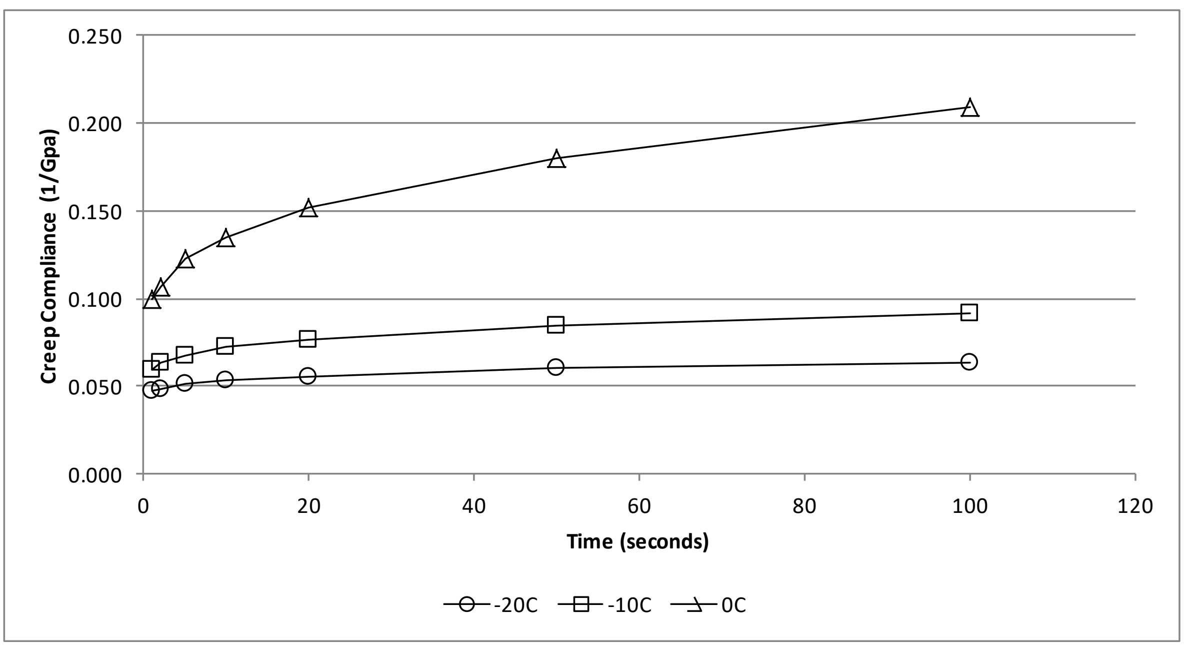
Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	NCHRP 530 Correction (psi)
-20	1	3.50767E-07	0.0508744	0.1996		
	2	3.65928E-07	0.0530734			
	5	3.77800E-07	0.0547952			
	10	3.97475E-07	0.0576489			
	20	4.19433E-07	0.0608336			
	50	4.42024E-07	0.0641101			
	100	4.63944E-07	0.0672894			
-10	1	4.47483E-07	0.0649020	0.2094	561	476
	2	4.87939E-07	0.0707696			
	5	5.23023E-07	0.0758580			
	10	5.72399E-07	0.0830195			
	20	6.25786E-07	0.0907626			
	50	7.04623E-07	0.1021969			
	100	7.87922E-07	0.1142784			
0	1	7.21196E-07	0.1046006	0.1927		
	2	8.08303E-07	0.1172344			
	5	9.60779E-07	0.1393492			
	10	1.09571E-06	0.1589187			
	20	1.27937E-06	0.1855567			
	50	1.63449E-06	0.2370626			
	100	2.00093E-06	0.2902102			



Lab ID	16PJ5B305		SMA?	No
Mix Number	SP125 13-86		Virgin Binder Grade	PG64-22H
Average Air Voids* (%)	6.1		RAP (%)	33.0
Air Voids Standard Deviation (%)	0.4		RAS (%)	0.0
Air Voids Coeff. of Variation (%)	5.7		Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.27368E-07	0.0474808	0.2630		
	2	3.32913E-07	0.0482849			
	5	3.55657E-07	0.0515838			
	10	3.68983E-07	0.0535165			
	20	3.84921E-07	0.0558280			
	50	4.17982E-07	0.0606231			
	100	4.39784E-07	0.0637853			
-10	1	4.11142E-07	0.0596311	0.2639	486	417
	2	4.38762E-07	0.0636370			
	5	4.66301E-07	0.0676312			
	10	4.98739E-07	0.0723360			
	20	5.27938E-07	0.0765710			
	50	5.84002E-07	0.0847023			
	100	6.32855E-07	0.0917878			
0	1	6.85440E-07	0.0994146	0.2725		
	2	7.36033E-07	0.1067525			
	5	8.43765E-07	0.1223778			
	10	9.29978E-07	0.1348820			
	20	1.04651E-06	0.1517830			
	50	1.24141E-06	0.1800513			
	100	1.44337E-06	0.2093425			

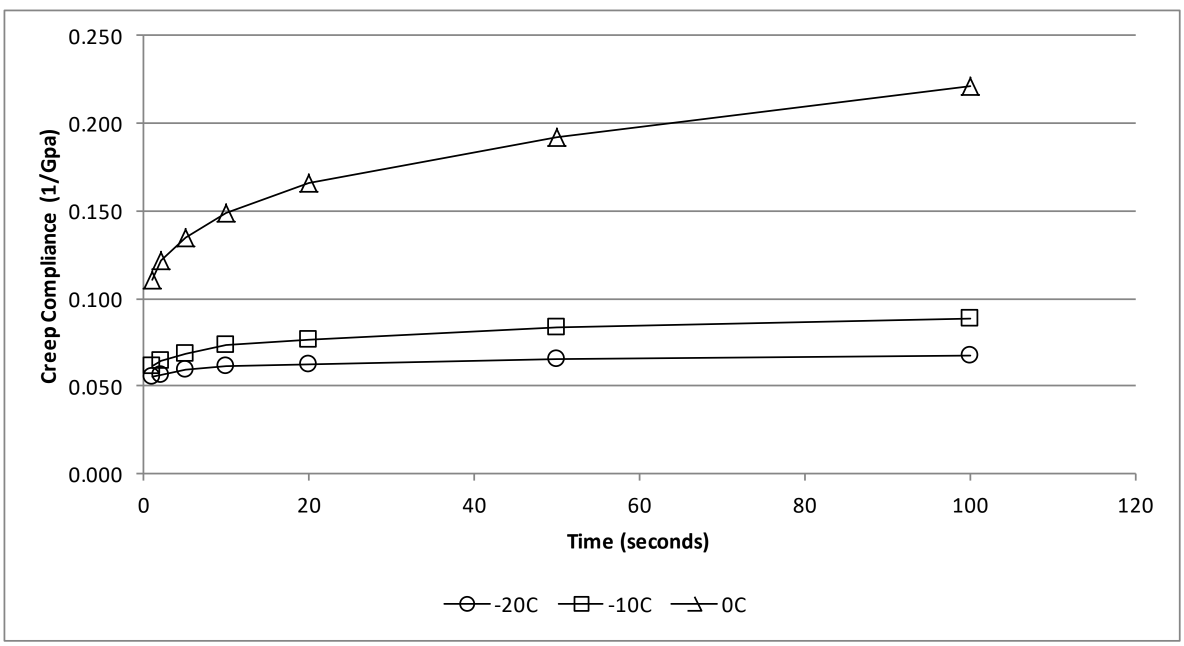


Lab ID	16PJ5B308
Mix Number	SP125 06-125
Average Air Voids* (%)	6.6
Air Voids Standard Deviation (%)	0.7
Air Voids Coeff. of Variation (%)	10.7

SMA?	No
Virgin Binder Grade	PG64-22
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	No

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

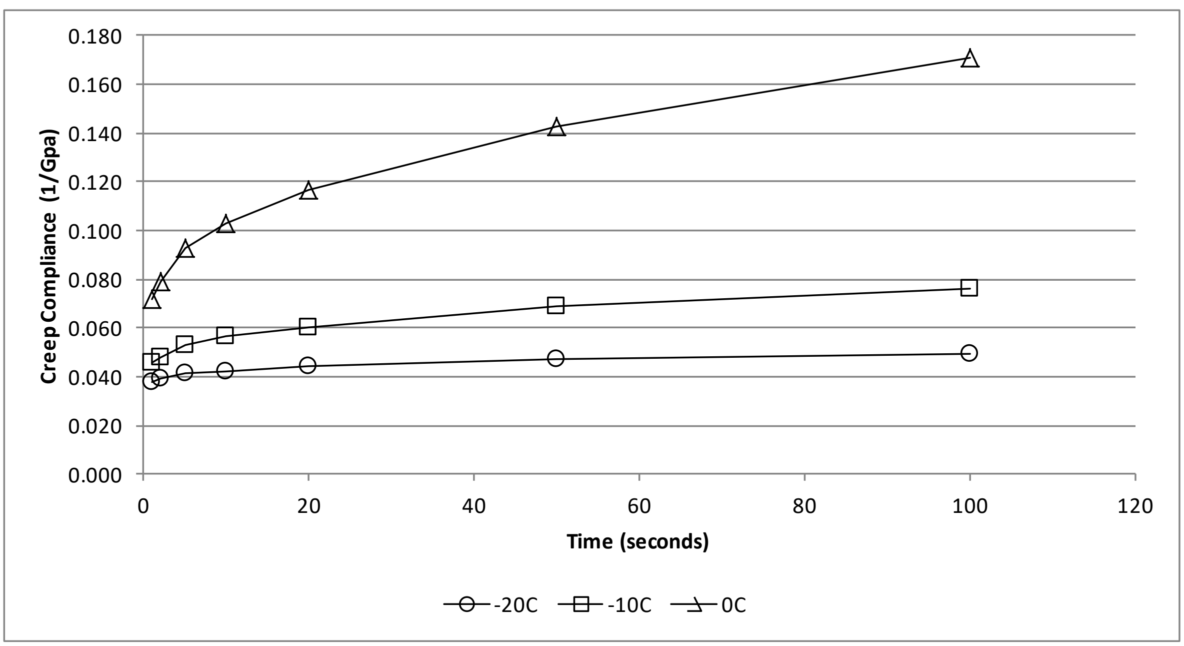
Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.79787E-07	0.0550834	0.2180		
	2	3.89176E-07	0.0564452			
	5	4.10863E-07	0.0595907			
	10	4.25828E-07	0.0617611			
	20	4.31933E-07	0.0626466			
	50	4.54866E-07	0.0659728			
	100	4.68013E-07	0.0678796			
-10	1	4.23398E-07	0.0614086	0.2504	467	403
	2	4.44751E-07	0.0645057			
	5	4.75585E-07	0.0689777			
	10	5.08580E-07	0.0737632			
	20	5.30073E-07	0.0768806			
	50	5.75822E-07	0.0835159			
	100	6.11907E-07	0.0887496			
0	1	7.61013E-07	0.1103756	0.2099		
	2	8.42213E-07	0.1221526			
	5	9.28563E-07	0.1346766			
	10	1.02767E-06	0.1490506			
	20	1.14066E-06	0.1654387			
	50	1.32517E-06	0.1921999			
	100	1.52496E-06	0.2211767			



Lab ID	16PJ5B311		SMA?	No
Mix Number	SP125 07-35		Virgin Binder Grade	PG70-22
Average Air Voids* (%)	4.9		RAP (%)	20.0
Air Voids Standard Deviation (%)	0.6		RAS (%)	0.0
Air Voids Coeff. of Variation (%)	11.7		Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

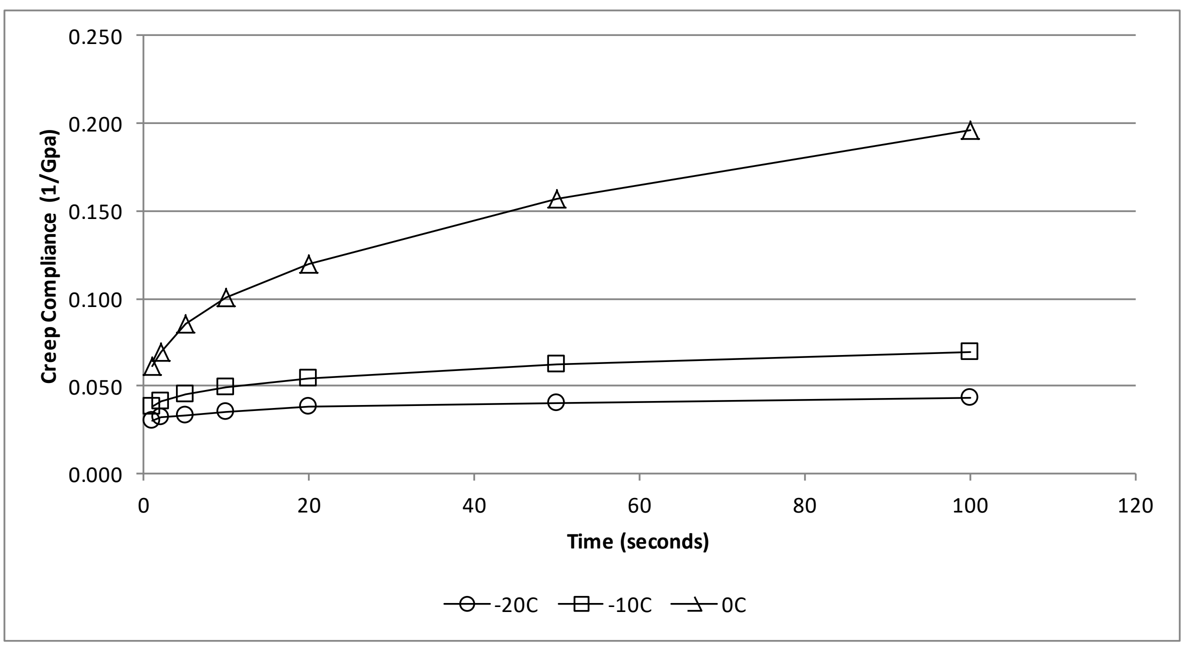
	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.62818E-07	0.0381186	0.2666		
	2	2.70805E-07	0.0392769			
	5	2.84073E-07	0.0412013			
	10	2.91691E-07	0.0423062			
	20	3.05042E-07	0.0442426			
	50	3.23767E-07	0.0469585			
	100	3.39757E-07	0.0492776			
-10	1	3.13647E-07	0.0454906	0.3440	607	512
	2	3.32030E-07	0.0481569			
	5	3.66121E-07	0.0531013			
	10	3.88553E-07	0.0563548			
	20	4.14408E-07	0.0601048			
	50	4.76521E-07	0.0691135			
	100	5.26528E-07	0.0763664			
0	1	4.94632E-07	0.0717403	0.2919		
	2	5.46758E-07	0.0793006			
	5	6.38589E-07	0.0926196			
	10	7.11348E-07	0.1031724			
	20	8.04297E-07	0.1166534			
	50	9.84758E-07	0.1428270			
	100	1.18018E-06	0.1711709			



Lab ID	16PJ5B315	SMA?	No
Mix Number	SP125 08-18	Virgin Binder Grade	PG70-22
Average Air Voids* (%)	2.0	RAP (%)	0.0
Air Voids Standard Deviation (%)	0.9	RAS (%)	0.0
Air Voids Coeff. of Variation (%)	45.8	Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.12228E-07	0.0307811	0.2612		
	2	2.22170E-07	0.0322230			
	5	2.33179E-07	0.0338197			
	10	2.43181E-07	0.0352704			
	20	2.64663E-07	0.0383862			
	50	2.77543E-07	0.0402542			
	100	2.99850E-07	0.0434896			
-10	1	2.63957E-07	0.0382837	0.3523	844	697
	2	2.86624E-07	0.0415713			
	5	3.10288E-07	0.0450035			
	10	3.41174E-07	0.0494831			
	20	3.77463E-07	0.0547464			
	50	4.30776E-07	0.0624788			
	100	4.78718E-07	0.0694322			
0	1	4.24555E-07	0.0615765	0.4599		
	2	4.82069E-07	0.0699182			
	5	5.91015E-07	0.0857195			
	10	6.96285E-07	0.1009876			
	20	8.28648E-07	0.1201852			
	50	1.07837E-06	0.1564043			
	100	1.35001E-06	0.1958020			

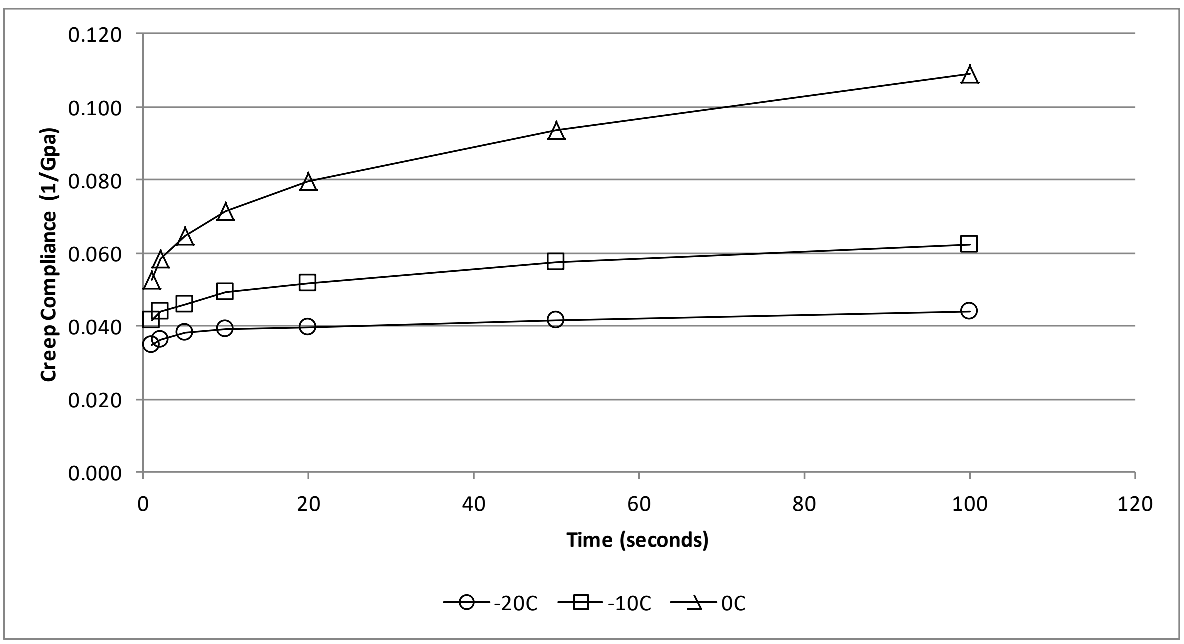


Lab ID	16PJ5B319
Mix Number	SP125 05-143
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	1.2
Air Voids Coeff. of Variation (%)	32.7

SMA?	No
Virgin Binder Grade	PG70-22
RAP (%)	10.0
RAS (%)	0.0
Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

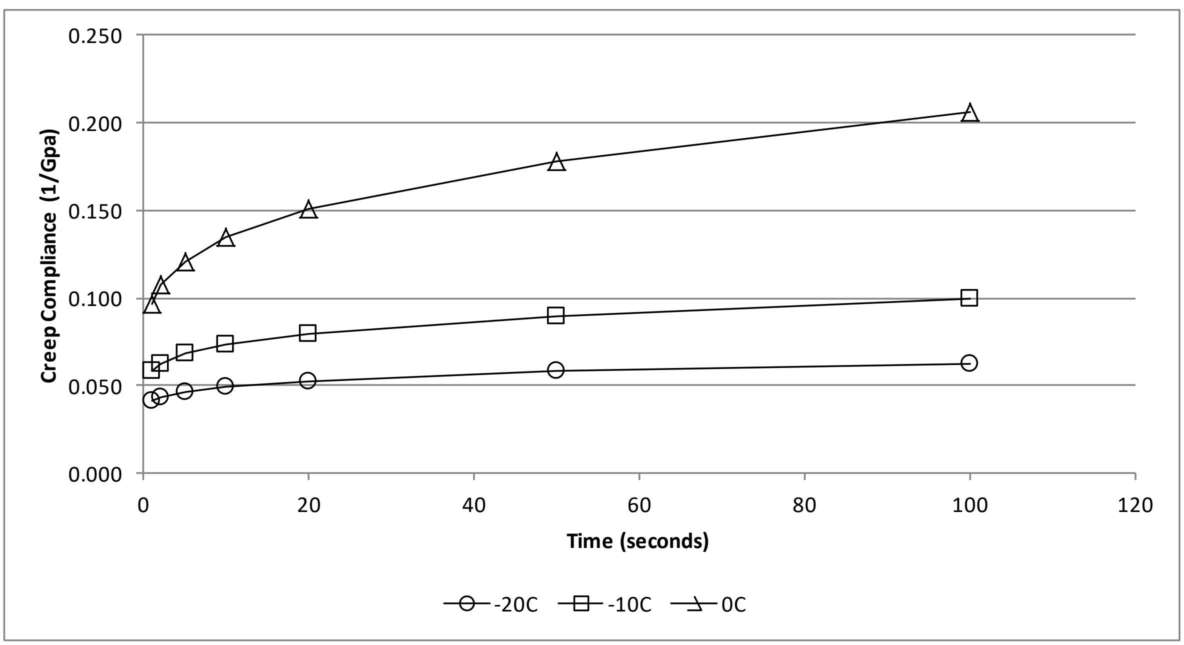
Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.41326E-07	0.0350013	0.4352		
	2	2.48445E-07	0.0360339			
	5	2.62995E-07	0.0381442			
	10	2.69133E-07	0.0390345			
	20	2.73982E-07	0.0397378			
	50	2.85210E-07	0.0413663			
	100	3.04529E-07	0.0441682			
-10	1	2.86190E-07	0.0415084	0.3202	663	555
	2	3.03812E-07	0.0440642			
	5	3.17413E-07	0.0460369			
	10	3.40774E-07	0.0494251			
	20	3.57565E-07	0.0518604			
	50	3.94870E-07	0.0572710			
	100	4.29365E-07	0.0622741			
0	1	3.61821E-07	0.0524776	0.4183		
	2	4.02227E-07	0.0583381			
	5	4.45086E-07	0.0645543			
	10	4.94304E-07	0.0716928			
	20	5.48002E-07	0.0794810			
	50	6.45962E-07	0.0936889			
	100	7.51361E-07	0.1089758			



Lab ID	16PJ5B322		SMA?	No
Mix Number	SP125 08-24		Virgin Binder Grade	PG64-22
Average Air Voids* (%)	5.9		RAP (%)	20.0
Air Voids Standard Deviation (%)	0.8		RAS (%)	0.0
Air Voids Coeff. of Variation (%)	13.8		Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

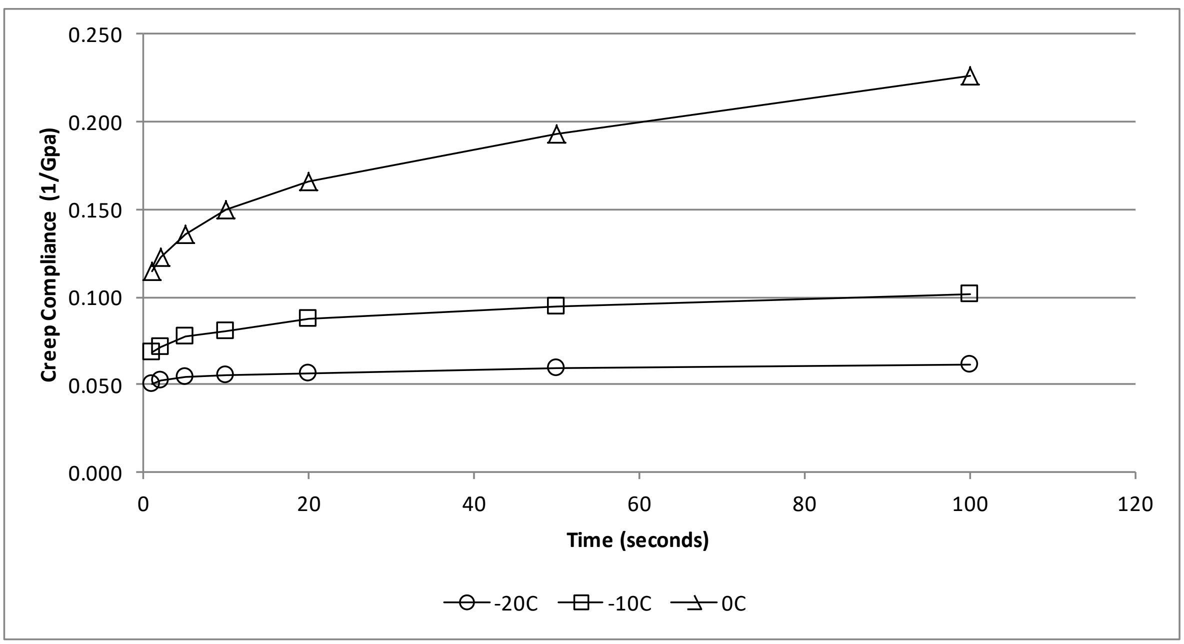
Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	NCHRP 530 Correction (psi)
-20	1	2.85773E-07	0.0414479	0.4837		
	2	3.00015E-07	0.0435135			
	5	3.21835E-07	0.0466783			
	10	3.41195E-07	0.0494861			
	20	3.60022E-07	0.0522167			
	50	4.01010E-07	0.0581616			
	100	4.28833E-07	0.0621969			
-10	1	4.03970E-07	0.0585909	0.4133	420	366
	2	4.28771E-07	0.0621879			
	5	4.72950E-07	0.0685956			
	10	5.07196E-07	0.0735626			
	20	5.46807E-07	0.0793077			
	50	6.16719E-07	0.0894475			
	100	6.88305E-07	0.0998301			
0	1	6.69158E-07	0.0970531	0.4334		
	2	7.42795E-07	0.1077334			
	5	8.35590E-07	0.1211921			
	10	9.31747E-07	0.1351385			
	20	1.03685E-06	0.1503820			
	50	1.22450E-06	0.1775990			
	100	1.41964E-06	0.2059014			



Lab ID	16PJ5B326		SMA?	No
Mix Number	SP125 01-48		Virgin Binder Grade	PG70-22
Average Air Voids* (%)	5.4		RAP (%)	0.0
Air Voids Standard Deviation (%)	0.4		RAS (%)	0.0
Air Voids Coeff. of Variation (%)	6.6		Binder Additives?	No

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

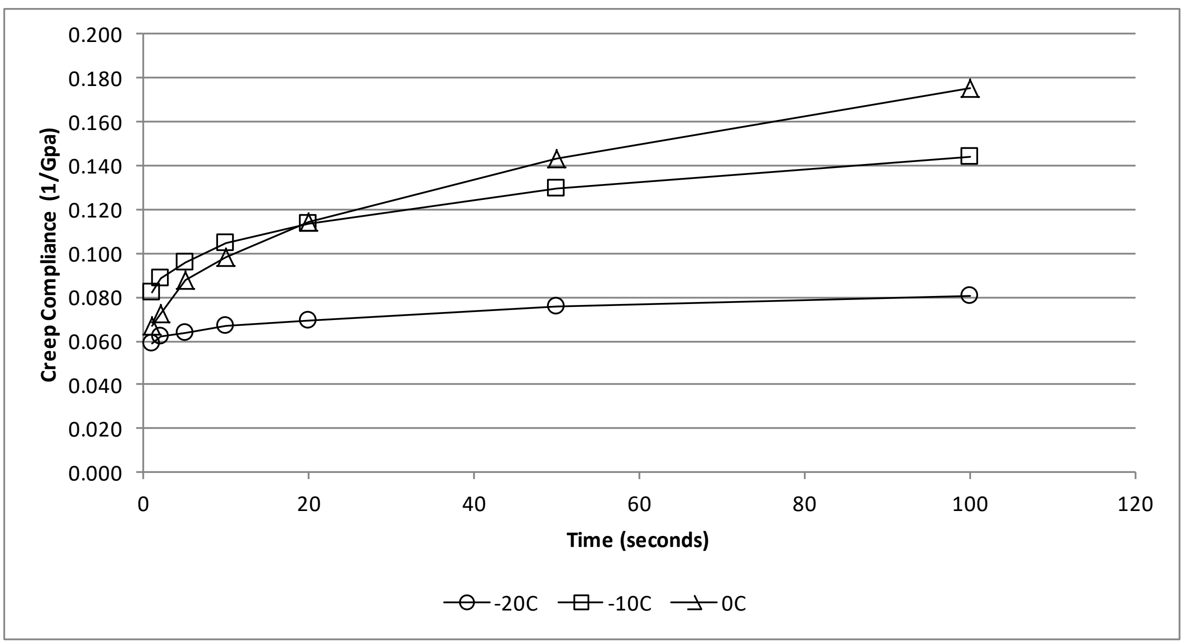
Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.47347E-07	0.0503785	0.2316		
	2	3.60610E-07	0.0523021			
	5	3.73328E-07	0.0541466			
	10	3.85580E-07	0.0559237			
	20	3.90952E-07	0.0567028			
	50	4.12982E-07	0.0598980			
	100	4.23551E-07	0.0614309			
-10	1	4.73424E-07	0.0686644	0.2023	426	371
	2	4.90611E-07	0.0711572			
	5	5.31603E-07	0.0771024			
	10	5.56583E-07	0.0807255			
	20	6.04388E-07	0.0876590			
	50	6.55256E-07	0.0950369			
	100	7.04354E-07	0.1021580			
0	1	7.89744E-07	0.1145426	0.1563		
	2	8.49668E-07	0.1232340			
	5	9.39010E-07	0.1361918			
	10	1.02991E-06	0.1493752			
	20	1.14206E-06	0.1656422			
	50	1.32829E-06	0.1926528			
	100	1.56064E-06	0.2263510			



Lab ID	16PJ5B330		SMA?	No
Mix Number	BP[1] 09-61		Virgin Binder Grade	PG64-22
Average Air Voids* (%)	9.0		RAP (%)	2.0
Air Voids Standard Deviation (%)	2.0		RAS (%)	1.0
Air Voids Coeff. of Variation (%)	22.6		Binder Additives?	No

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	4.06011E-07	0.0588869	0.2659		
	2	4.26130E-07	0.0618049			
	5	4.40021E-07	0.0638197			
	10	4.61850E-07	0.0669857			
	20	4.77335E-07	0.0692315			
	50	5.20519E-07	0.0754949			
	100	5.54551E-07	0.0804309			
-10	1	5.64765E-07	0.0819123	0.2500	396	347
	2	6.11451E-07	0.0886834			
	5	6.62767E-07	0.0961262			
	10	7.21814E-07	0.1046903			
	20	7.82308E-07	0.1134642			
	50	8.92497E-07	0.1294458			
	100	9.94638E-07	0.1442600			
0	1	4.58291E-07	0.0664695	0.6809		
	2	5.02070E-07	0.0728191			
	5	6.05267E-07	0.0877866			
	10	6.79127E-07	0.0984991			
	20	7.88752E-07	0.1143988			
	50	9.88946E-07	0.1434345			
	100	1.21094E-06	0.1756323			

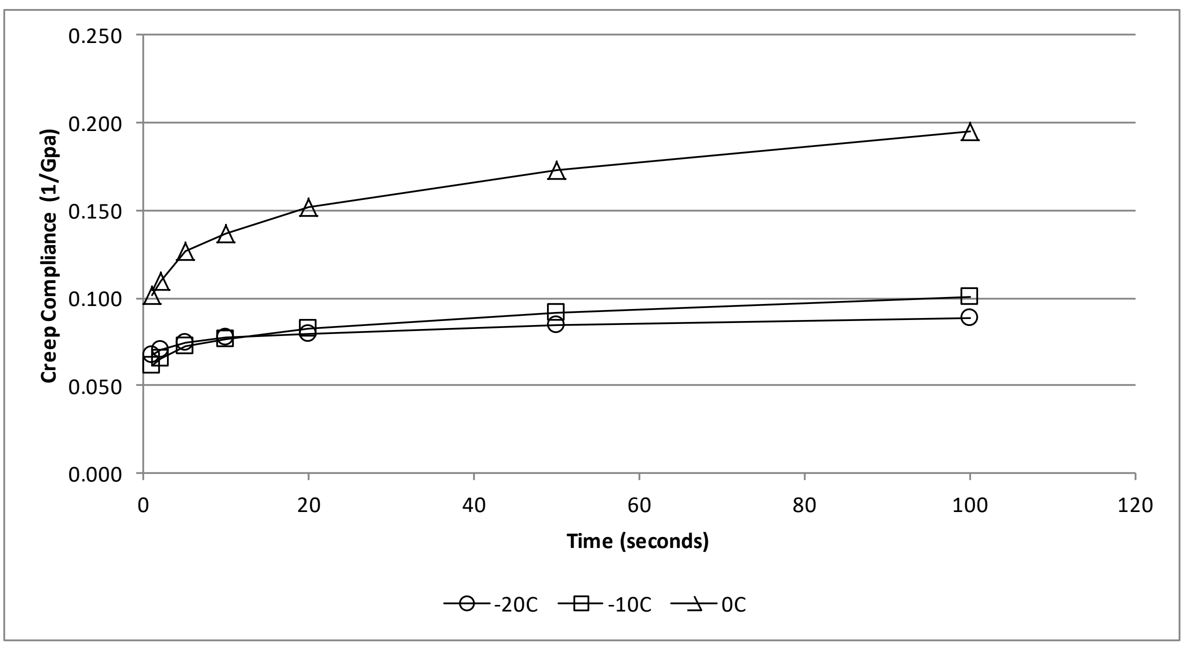


Lab ID	16PJ5B339
Mix Number	SP125 06-139
Average Air Voids* (%)	6.8
Air Voids Standard Deviation (%)	1.0
Air Voids Coeff. of Variation (%)	14.5

SMA?	No
Virgin Binder Grade	PG70-22
RAP (%)	10.0
RAS (%)	0.0
Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

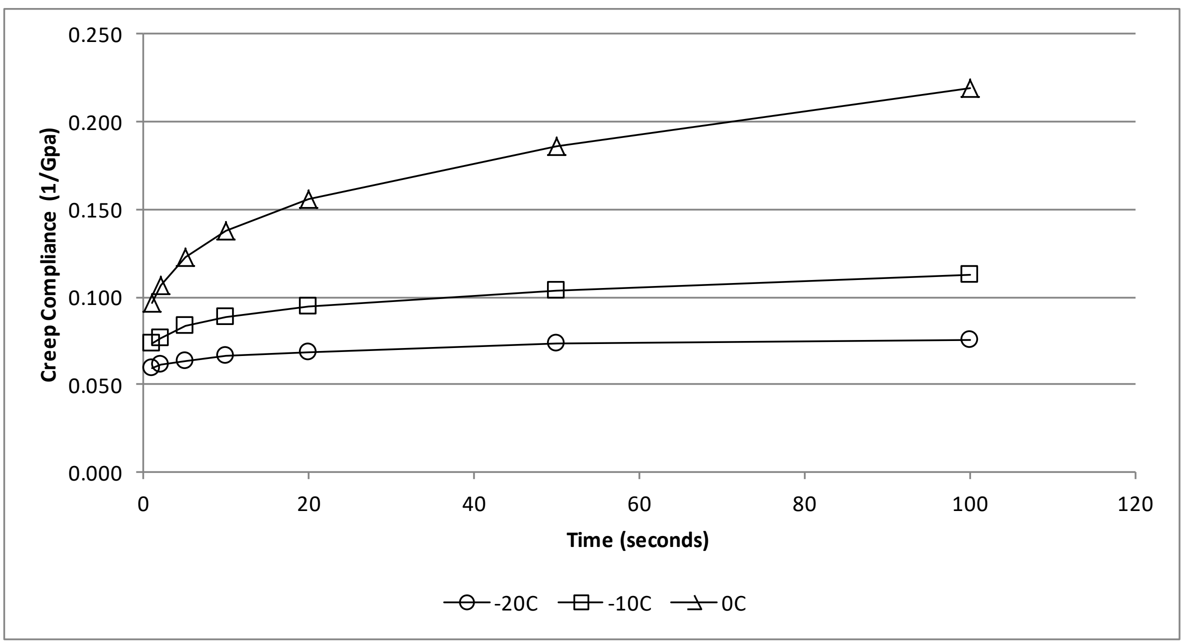
	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	4.65452E-07	0.0675082	0.1786		
	2	4.83786E-07	0.0701672			
	5	5.13626E-07	0.0744951			
	10	5.33768E-07	0.0774166			
	20	5.50749E-07	0.0798794			
	50	5.83030E-07	0.0845613			
	100	6.08305E-07	0.0882271			
-10	1	4.23409E-07	0.0614103	0.3020	431	374
	2	4.53928E-07	0.0658366			
	5	4.97159E-07	0.0721068			
	10	5.29602E-07	0.0768122			
	20	5.72241E-07	0.0829965			
	50	6.34958E-07	0.0920929			
	100	6.96841E-07	0.1010683			
0	1	7.03673E-07	0.1020592	0.2902		
	2	7.57064E-07	0.1098028			
	5	8.74215E-07	0.1267941			
	10	9.41324E-07	0.1365276			
	20	1.04714E-06	0.1518743			
	50	1.19457E-06	0.1732574			
	100	1.34831E-06	0.1955560			



Lab ID	16PJ5B346		SMA?	No
Mix Number	SP125 12-48		Virgin Binder Grade	PG64-22H
Average Air Voids* (%)	9.1		RAP (%)	18.0
Air Voids Standard Deviation (%)	0.3		RAS (%)	0.0
Air Voids Coeff. of Variation (%)	3.8		Binder Additives?	No

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	4.07677E-07	0.0591286	0.2988		
	2	4.24124E-07	0.0615139			
	5	4.39391E-07	0.0637282			
	10	4.56546E-07	0.0662164			
	20	4.75628E-07	0.0689840			
	50	5.03912E-07	0.0730863			
	100	5.20964E-07	0.0755595			
-10	1	5.05564E-07	0.0733259	0.2931	379	334
	2	5.27331E-07	0.0764828			
	5	5.74930E-07	0.0833865			
	10	6.10408E-07	0.0885321			
	20	6.50069E-07	0.0942846			
	50	7.13974E-07	0.1035532			
	100	7.79767E-07	0.1130957			
0	1	6.63167E-07	0.0961842	0.3923		
	2	7.38643E-07	0.1071311			
	5	8.45006E-07	0.1225577			
	10	9.47330E-07	0.1373985			
	20	1.07722E-06	0.1562381			
	50	1.28222E-06	0.1859701			
	100	1.50811E-06	0.2187335			

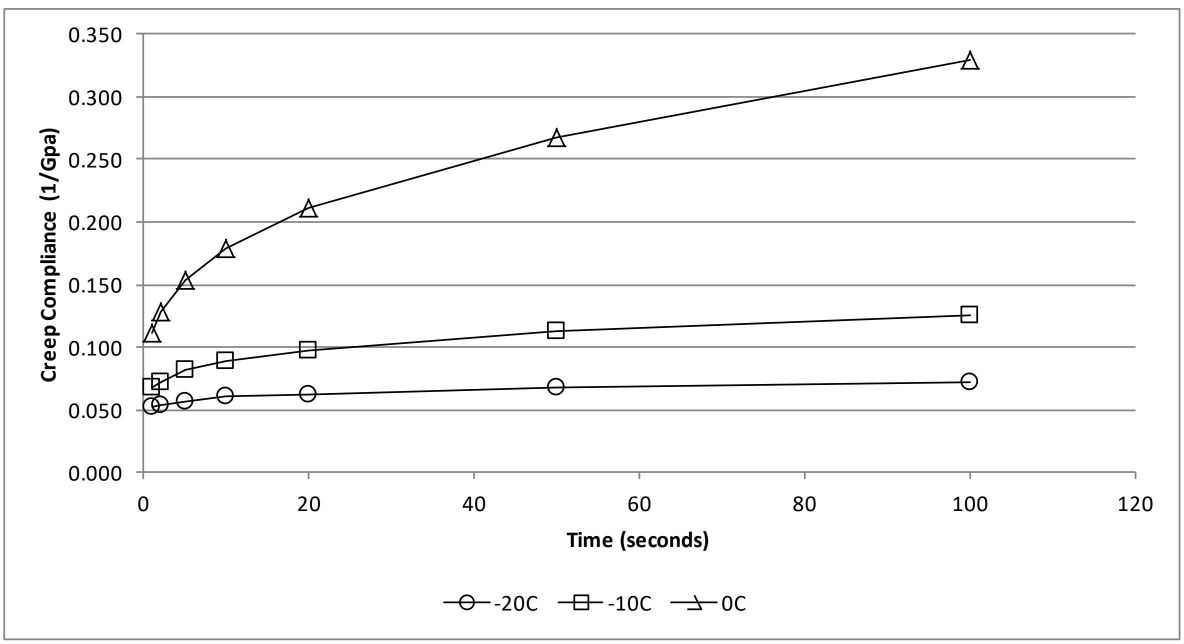


Lab ID	16PJ5B348
Mix Number	SP095 10-116
Average Air Voids* (%)	5.0
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	5.6

SMA?	Yes
Virgin Binder Grade	PG76-22
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	No

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.58192E-07	0.0519513	0.2809		
	2	3.72834E-07	0.0540750			
	5	3.93986E-07	0.0571429			
	10	4.14206E-07	0.0600755			
	20	4.31321E-07	0.0625579			
	50	4.68733E-07	0.0679840			
	100	4.96216E-07	0.0719701			
-10	1	4.66629E-07	0.0676788	0.2857	642	539
	2	4.95946E-07	0.0719309			
	5	5.63003E-07	0.0816567			
	10	6.10360E-07	0.0885252			
	20	6.66482E-07	0.0966650			
	50	7.73280E-07	0.1121547			
	100	8.65331E-07	0.1255057			
0	1	7.69005E-07	0.1115347	0.3081		
	2	8.87921E-07	0.1287820			
	5	1.06023E-06	0.1537732			
	10	1.23390E-06	0.1789617			
	20	1.45685E-06	0.2112988			
	50	1.84686E-06	0.2678647			
	100	2.27080E-06	0.3293517			

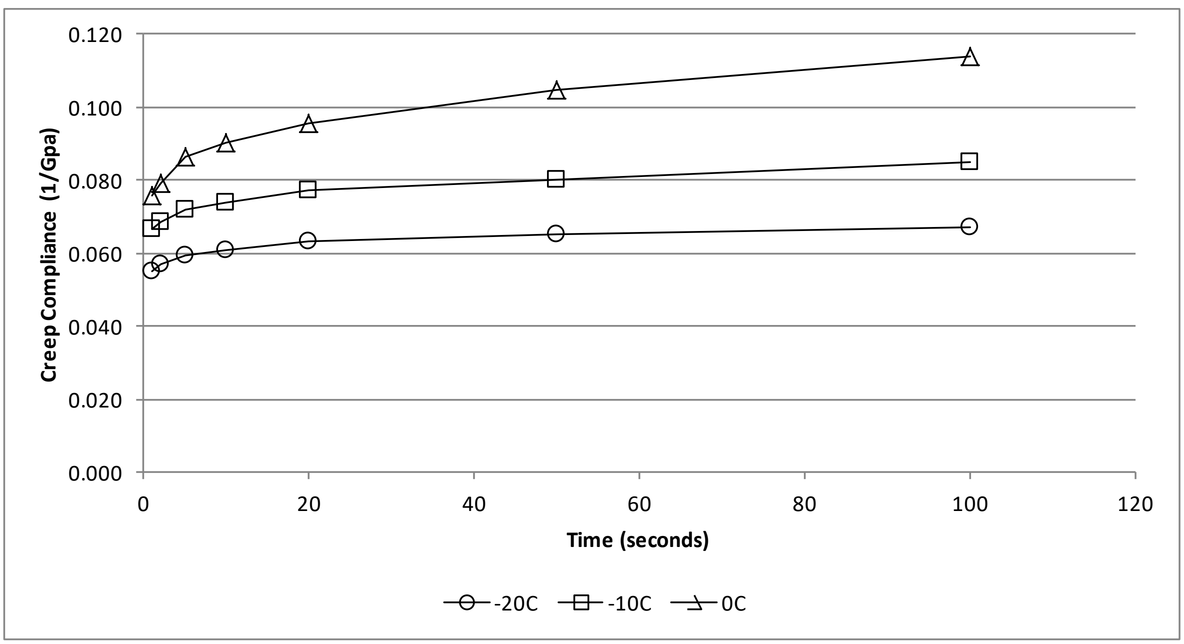


Lab ID	16PJ5B352
Mix Number	SP125 06-150
Average Air Voids* (%)	6.9
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	4.1

SMA?	No
Virgin Binder Grade	PG70-22
RAP (%)	10.0
RAS (%)	0.0
Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.80099E-07	0.0551287	0.3387		
	2	3.93543E-07	0.0570786			
	5	4.08709E-07	0.0592782			
	10	4.20785E-07	0.0610297			
	20	4.35068E-07	0.0631012			
	50	4.50094E-07	0.0652806			
	100	4.64270E-07	0.0673367			
-10	1	4.57937E-07	0.0664181	0.2999	362	321
	2	4.74262E-07	0.0687858			
	5	4.96058E-07	0.0719472			
	10	5.09627E-07	0.0739151			
	20	5.32073E-07	0.0771706			
	50	5.51400E-07	0.0799737			
	100	5.84511E-07	0.0847761			
0	1	5.21276E-07	0.0756047	0.3746		
	2	5.47402E-07	0.0793939			
	5	5.94120E-07	0.0861698			
	10	6.20996E-07	0.0900678			
	20	6.57233E-07	0.0953236			
	50	7.21983E-07	0.1047148			
	100	7.86344E-07	0.1140495			

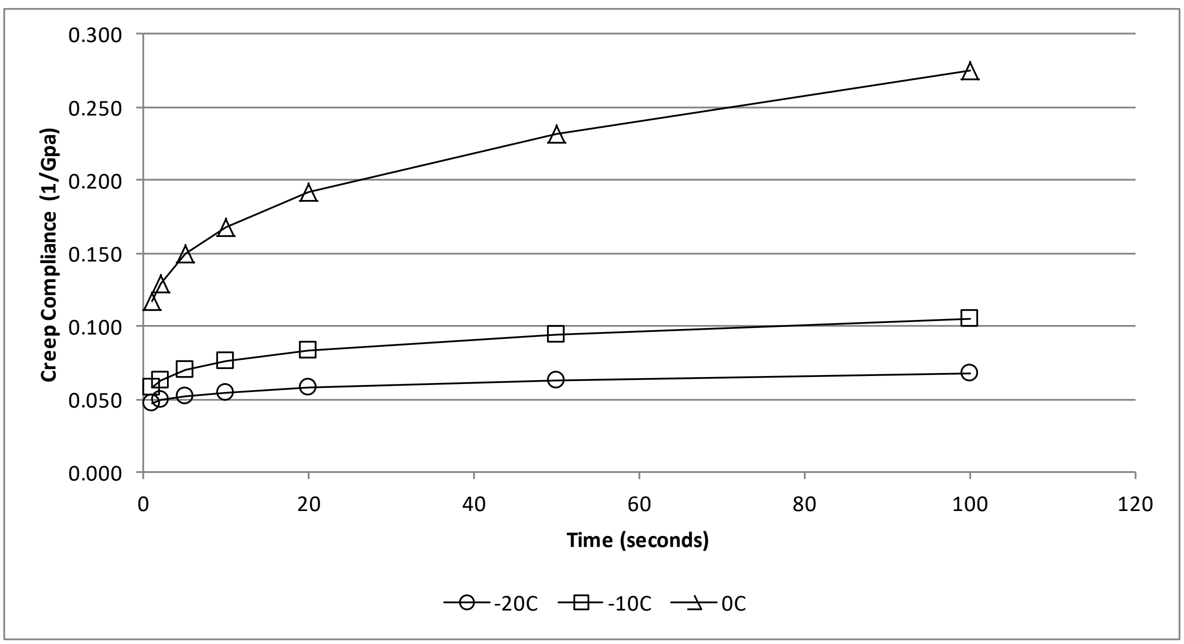


Lab ID	16PJ5B356
Mix Number	SP125 10-110
Average Air Voids* (%)	8.9
Air Voids Standard Deviation (%)	1.2
Air Voids Coeff. of Variation (%)	13.4

SMA?	No
Virgin Binder Grade	PG70-22
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

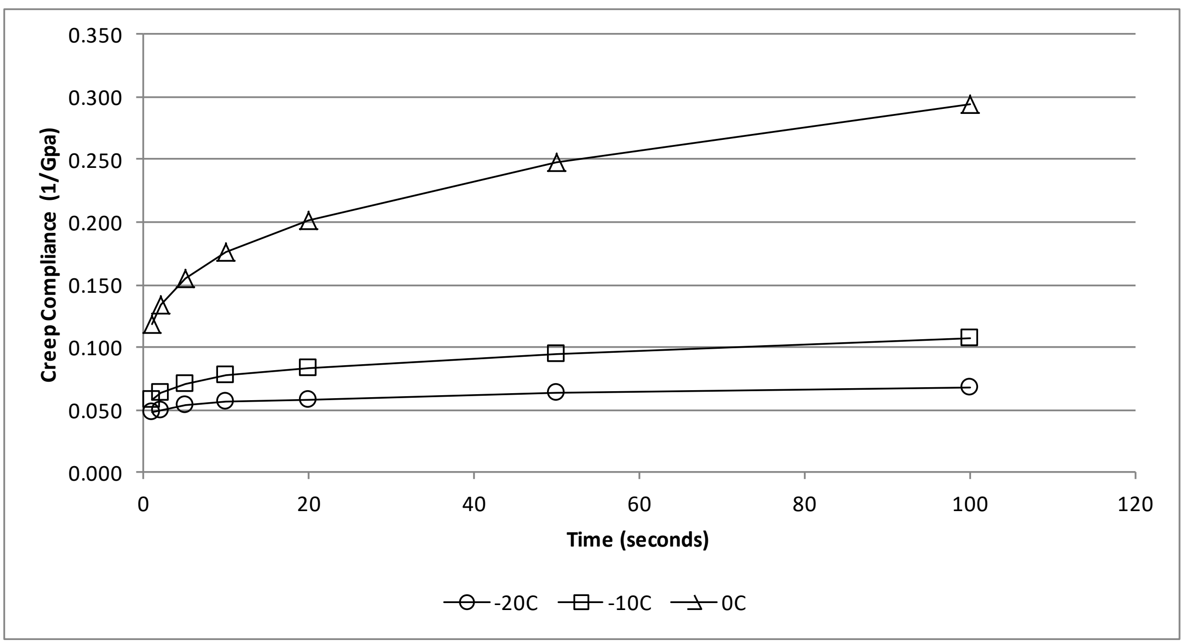
Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.28178E-07	0.0475981	0.2428		
	2	3.44689E-07	0.0499929			
	5	3.59971E-07	0.0522094			
	10	3.79734E-07	0.0550758			
	20	4.01596E-07	0.0582466			
	50	4.35408E-07	0.0631506			
	100	4.66840E-07	0.0677094			
-10	1	3.99164E-07	0.0578939	0.2216	440	381
	2	4.30495E-07	0.0624381			
	5	4.83302E-07	0.0700971			
	10	5.23440E-07	0.0759186			
	20	5.71809E-07	0.0829339			
	50	6.49406E-07	0.0941883			
	100	7.26951E-07	0.1054354			
0	1	8.06942E-07	0.1170370	0.3103		
	2	8.94197E-07	0.1296924			
	5	1.03307E-06	0.1498335			
	10	1.15922E-06	0.1681313			
	20	1.31891E-06	0.1912921			
	50	1.59867E-06	0.2318677			
	100	1.89411E-06	0.2747169			



Lab ID	16PJ5B363		SMA?	No
Mix Number	SP125 07-51 or 08-20		Virgin Binder Grade	PG64-22
Average Air Voids* (%)	7.5		RAP (%)	20.0 or 18.0
Air Voids Standard Deviation (%)	0.2		RAS (%)	0.0 or 2.0
Air Voids Coeff. of Variation (%)	3.3		Binder Additives?	Yes

*Based on T166 Gmb and T209 Gmm values determined at MoDOT Central Lab.
T166 was performed on top lift cores BEFORE end-grinding at MST.

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.32619E-07	0.0482423	0.2745		
	2	3.43990E-07	0.0498915			
	5	3.69091E-07	0.0535321			
	10	3.85615E-07	0.0559287			
	20	4.02908E-07	0.0584368			
	50	4.40511E-07	0.0638907			
	100	4.70344E-07	0.0682176			
-10	1	4.01272E-07	0.0581995	0.3936	427	371
	2	4.39836E-07	0.0637928			
	5	4.88740E-07	0.0708858			
	10	5.32530E-07	0.0772369			
	20	5.77966E-07	0.0838268			
	50	6.55707E-07	0.0951023			
	100	7.39319E-07	0.1072292			
0	1	8.20586E-07	0.1190160	0.5520		
	2	9.26174E-07	0.1343302			
	5	1.07158E-06	0.1554196			
	10	1.21790E-06	0.1766416			
	20	1.39305E-06	0.2020453			
	50	1.70459E-06	0.2472293			
	100	2.03207E-06	0.2947272			



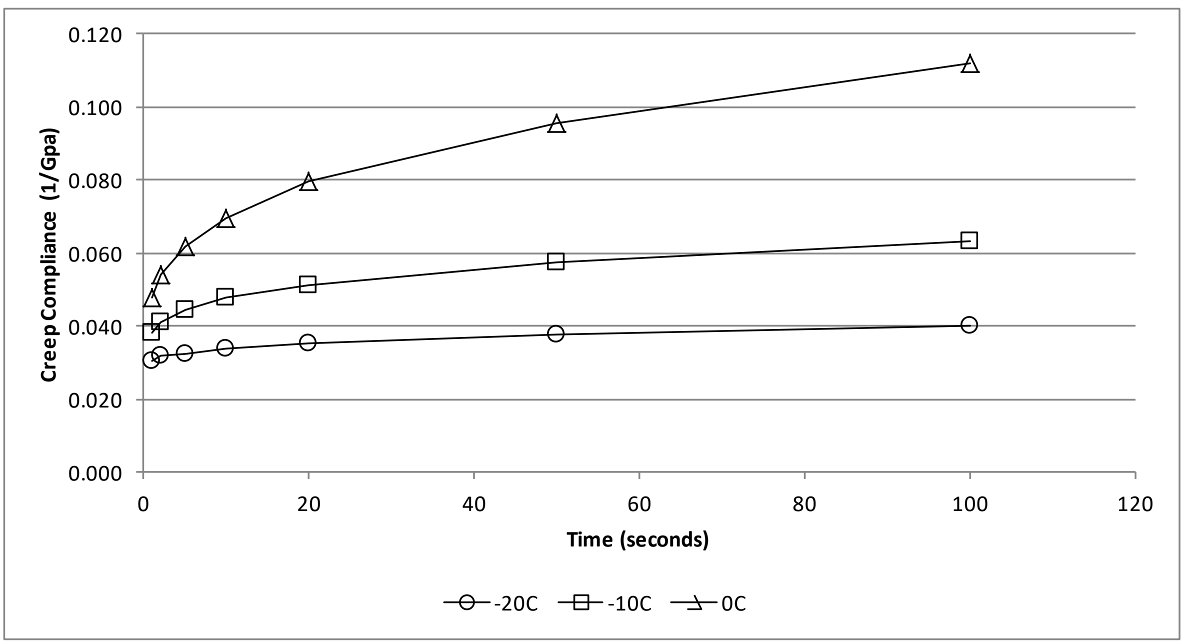
APPENDIX B: GCS-DERIVED SPECIMEN SUMMARY DATA

Lab ID	16PJ5B001
Mix Number	BP2 15-87
Average Air Voids* (%)	3.4
Air Voids Standard Deviation (%)	0.0
Air Voids Coeff. of Variation (%)	0.9

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG52-28
RAP (%)	16.0
RAS (%)	4.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	NCHRP 530 Correction (psi)
-20	1	2.08572E-07	0.0302509	0.3003		
	2	2.18506E-07	0.0316916			
	5	2.23730E-07	0.0324493			
	10	2.33538E-07	0.0338718			
	20	2.41784E-07	0.0350678			
	50	2.60507E-07	0.0377833			
	100	2.77079E-07	0.0401869			
-10	1	2.62693E-07	0.0381004	0.3366	812	671
	2	2.81914E-07	0.0408881			
	5	3.06339E-07	0.0444308			
	10	3.28258E-07	0.0476097			
	20	3.53107E-07	0.0512138			
	50	3.94720E-07	0.0572493			
	100	4.36936E-07	0.0633722			
0	1	3.30825E-07	0.0479821	0.4635		
	2	3.72401E-07	0.0540122			
	5	4.25221E-07	0.0616731			
	10	4.77794E-07	0.0692982			
	20	5.48170E-07	0.0795053			
	50	6.58999E-07	0.0955798			
	100	7.72416E-07	0.1120295			

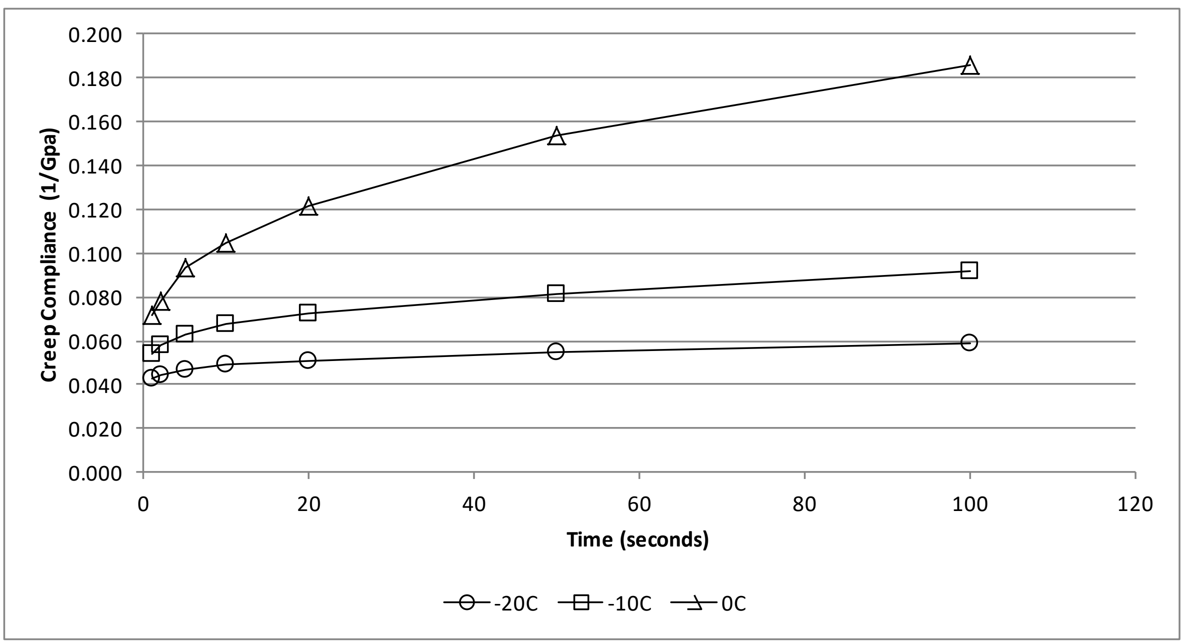


Lab ID	16PJ5B001
Mix Number	BP2 15-87
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	2.4

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG52-28
RAP (%)	16.0
RAS (%)	4.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.97388E-07	0.0431325	0.1742		
	2	3.08493E-07	0.0447431			
	5	3.24042E-07	0.0469983			
	10	3.37076E-07	0.0488887			
	20	3.51902E-07	0.0510391			
	50	3.78185E-07	0.0548511			
	100	4.03115E-07	0.0584669			
-10	1	3.69799E-07	0.0536349	0.2041	626	527
	2	3.98773E-07	0.0578371			
	5	4.30775E-07	0.0624787			
	10	4.64951E-07	0.0674355			
	20	5.01021E-07	0.0726669			
	50	5.58484E-07	0.0810012			
	100	6.31880E-07	0.0916464			
0	1	4.92848E-07	0.0714816	0.2594		
	2	5.39567E-07	0.0782576			
	5	6.41144E-07	0.0929901			
	10	7.23338E-07	0.1049113			
	20	8.37728E-07	0.1215021			
	50	1.05705E-06	0.1533116			
	100	1.27841E-06	0.1854172			

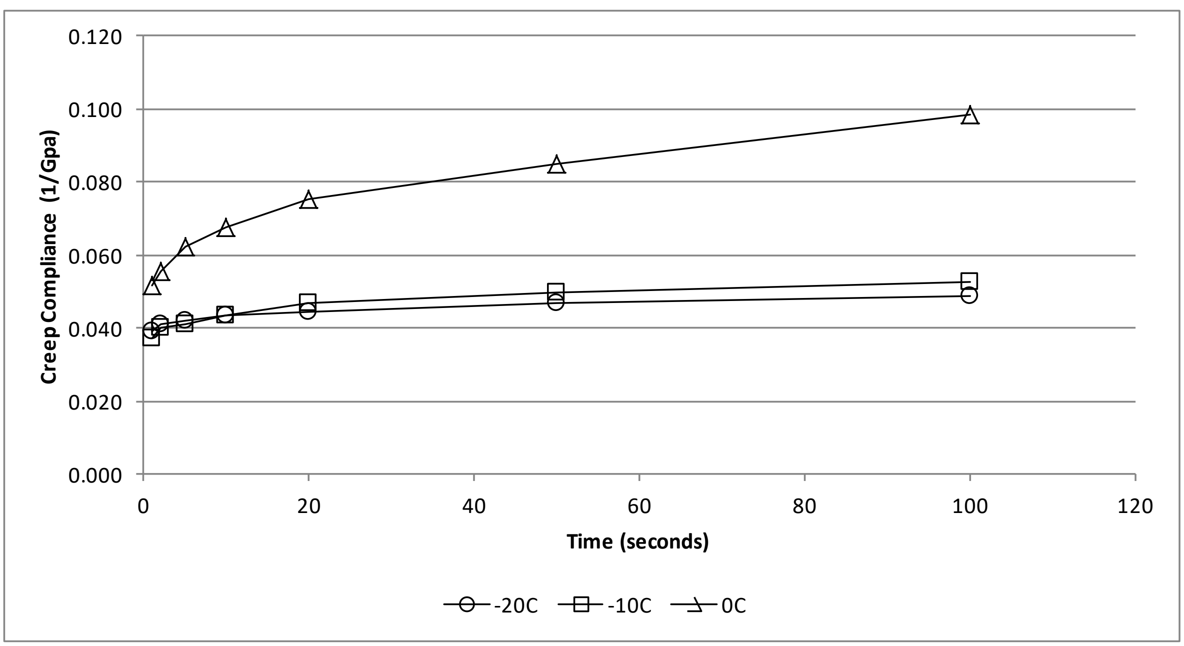


Lab ID	16PJ5B002
Mix Number	SP190 15-27
Average Air Voids* (%)	3.9
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	8.6

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.71550E-07	0.0393851	0.2354		
	2	2.82088E-07	0.0409133			
	5	2.90850E-07	0.0421842			
	10	2.99852E-07	0.0434899			
	20	3.05039E-07	0.0442422			
	50	3.22474E-07	0.0467710			
	100	3.37450E-07	0.0489430			
-10	1	2.57288E-07	0.0373165	0.3641	734	610
	2	2.75128E-07	0.0399040			
	5	2.83576E-07	0.0411292			
	10	3.01311E-07	0.0437014			
	20	3.24320E-07	0.0470386			
	50	3.42522E-07	0.0496786			
	100	3.63504E-07	0.0527218			
0	1	3.55629E-07	0.0515797	0.3135		
	2	3.82556E-07	0.0554850			
	5	4.29406E-07	0.0622801			
	10	4.65950E-07	0.0675804			
	20	5.18677E-07	0.0752277			
	50	5.84853E-07	0.0848258			
	100	6.80109E-07	0.0986415			

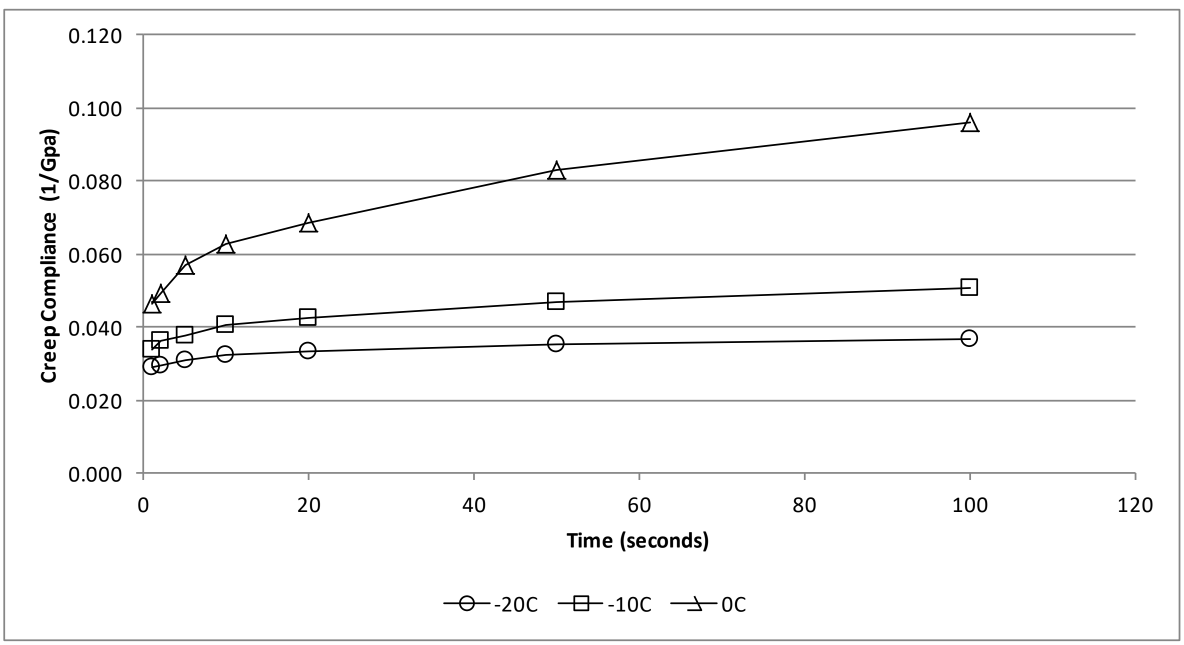


Lab ID	16PJ5B002
Mix Number	SP190 15-27
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.4
Air Voids Coeff. of Variation (%)	6.2

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	1.99656E-07	0.0289577	0.5543		
	2	2.02733E-07	0.0294040			
	5	2.14942E-07	0.0311748			
	10	2.22272E-07	0.0322379			
	20	2.28875E-07	0.0331955			
	50	2.43504E-07	0.0353173			
	100	2.52767E-07	0.0366607			
-10	1	2.33596E-07	0.0338802	0.6036	603	508
	2	2.49248E-07	0.0361504			
	5	2.60985E-07	0.0378527			
	10	2.79207E-07	0.0404955			
	20	2.94197E-07	0.0426696			
	50	3.23693E-07	0.0469477			
	100	3.50352E-07	0.0508142			
0	1	3.19361E-07	0.0463194	0.6089		
	2	3.38600E-07	0.0491098			
	5	3.94327E-07	0.0571923			
	10	4.31664E-07	0.0626075			
	20	4.72163E-07	0.0684814			
	50	5.71314E-07	0.0828621			
	100	6.60749E-07	0.0958336			

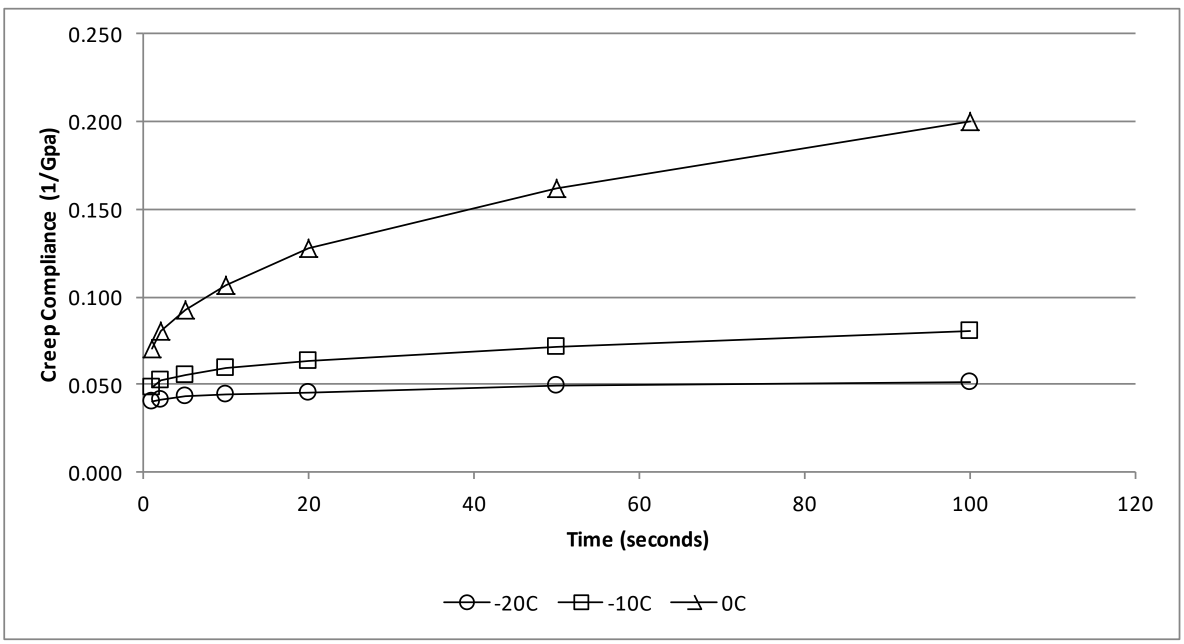


Lab ID	16PJ5B003
Mix Number	SP095 16-13
Average Air Voids* (%)	4.0
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	3.1

*Based on Gmb from T166 on Sawn Specimens

SMA?	Yes
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.79057E-07	0.0404738	0.2679		
	2	2.86953E-07	0.0416191			
	5	3.00779E-07	0.0436243			
	10	3.08681E-07	0.0447704			
	20	3.14914E-07	0.0456744			
	50	3.39625E-07	0.0492584			
	100	3.54628E-07	0.0514344			
-10	1	3.37317E-07	0.0489237	0.3362	728	606
	2	3.62172E-07	0.0525286			
	5	3.80444E-07	0.0551787			
	10	4.12759E-07	0.0598656			
	20	4.35959E-07	0.0632305			
	50	4.93780E-07	0.0716168			
	100	5.55501E-07	0.0805686			
0	1	4.86958E-07	0.0706272	0.3243		
	2	5.55711E-07	0.0805991			
	5	6.37178E-07	0.0924149			
	10	7.35616E-07	0.1066921			
	20	8.77993E-07	0.1273421			
	50	1.11378E-06	0.1615405			
	100	1.37616E-06	0.1995947			

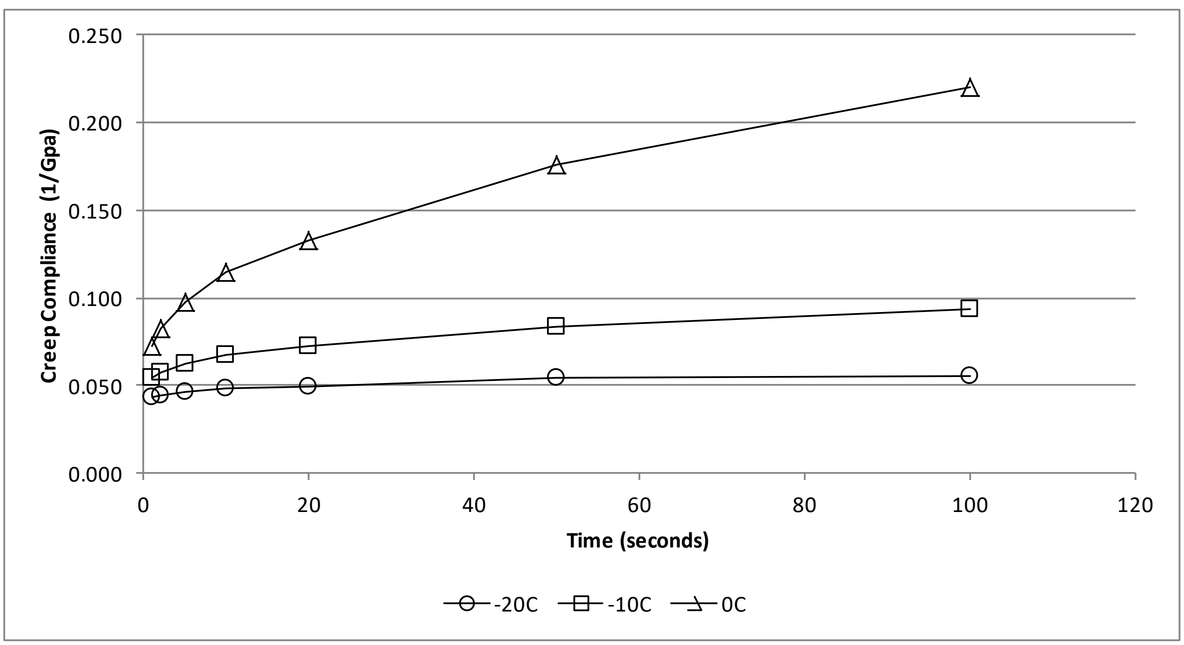


Lab ID	16PJ5B003
Mix Number	SP095 16-13
Average Air Voids* (%)	6.3
Air Voids Standard Deviation (%)	0.0
Air Voids Coeff. of Variation (%)	0.4

*Based on Gmb from T166 on Sawn Specimens

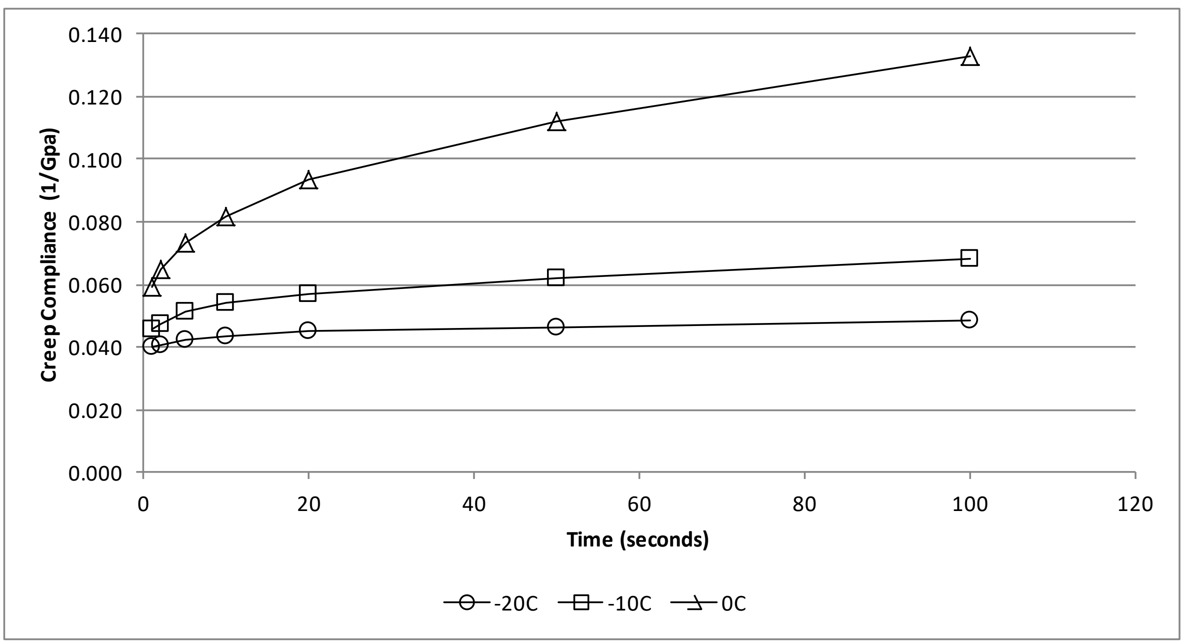
SMA?	Yes
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.97859E-07	0.0432009	0.2625		
	2	3.08363E-07	0.0447243			
	5	3.23432E-07	0.0469098			
	10	3.37107E-07	0.0488932			
	20	3.41350E-07	0.0495086			
	50	3.74694E-07	0.0543448			
	100	3.85385E-07	0.0558953			
-10	1	3.74064E-07	0.0542533	0.2874	604	509
	2	3.98593E-07	0.0578110			
	5	4.30589E-07	0.0624516			
	10	4.68503E-07	0.0679506			
	20	5.02971E-07	0.0729498			
	50	5.75049E-07	0.0834038			
	100	6.45998E-07	0.0936941			
0	1	5.02436E-07	0.0728721	0.3852		
	2	5.69424E-07	0.0825880			
	5	6.76106E-07	0.0980608			
	10	7.92318E-07	0.1149160			
	20	9.16990E-07	0.1329981			
	50	1.21002E-06	0.1754987			
	100	1.52007E-06	0.2204676			



Lab ID	16PJ5B004		SMA?	No
Mix Number	SP125 14-3		Contract Binder Gr.	PG76-22**
Average Air Voids* (%)	3.8		Inline Binder Grade	
Air Voids Standard Deviation (%)	0.3		RAP (%)	15.0
Air Voids Coeff. of Variation (%)	6.6		RAS (%)	0.0
*Based on Gmb from T166 on Sawn Specimens			Binder Additives?	No
**JMF shows this as Inline Grade, but no Contract Grade designation			GTR (%wtAC)	8.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.74926E-07	0.0398747	0.2651		
	2	2.81525E-07	0.0408317			
	5	2.89991E-07	0.0420596			
	10	2.97979E-07	0.0432181			
	20	3.10580E-07	0.0450458			
	50	3.17640E-07	0.0460698			
	100	3.36257E-07	0.0487699			
-10	1	3.14139E-07	0.0455620	0.2491	696	581
	2	3.27496E-07	0.0474993			
	5	3.53756E-07	0.0513080			
	10	3.74913E-07	0.0543765			
	20	3.91676E-07	0.0568078			
	50	4.26140E-07	0.0618063			
	100	4.71306E-07	0.0683572			
0	1	4.09406E-07	0.0593793	0.3609		
	2	4.48284E-07	0.0650181			
	5	5.03498E-07	0.0730262			
	10	5.61502E-07	0.0814389			
	20	6.42980E-07	0.0932564			
	50	7.73006E-07	0.1121150			
	100	9.15262E-07	0.1327476			



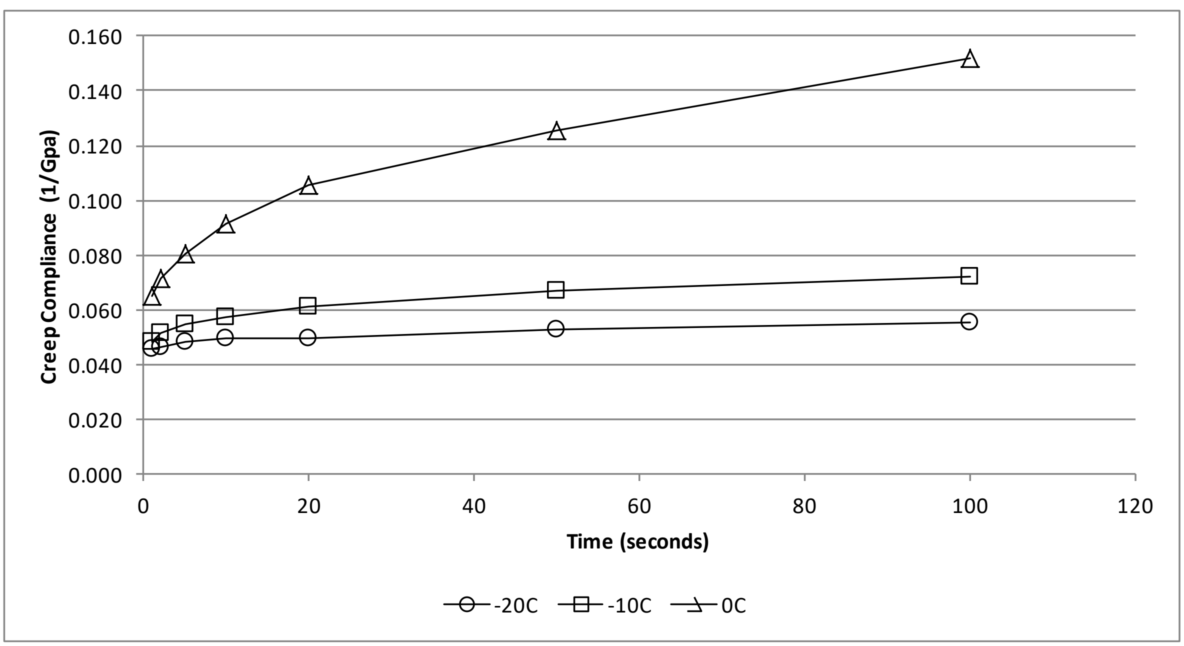
Lab ID	16PJ5B004
Mix Number	SP125 14-3
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	4.7

*Based on Gmb from T166 on Sawn Specimens

**JMF shows this as Inline Grade, but no Contract Grade designation

SMA?	No
Contract Binder Gr.	PG76-22**
Inline Binder Grade	
RAP (%)	15.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	8.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.16303E-07	0.0458759	0.1903		
	2	3.18668E-07	0.0462188			
	5	3.34405E-07	0.0485013			
	10	3.44370E-07	0.0499467			
	20	3.40025E-07	0.0493164			
	50	3.63430E-07	0.0527110			
	100	3.80523E-07	0.0551902			
-10	1	3.35397E-07	0.0486452	0.2539	582	492
	2	3.54431E-07	0.0514059			
	5	3.75586E-07	0.0544741			
	10	3.97449E-07	0.0576451			
	20	4.22382E-07	0.0612613			
	50	4.63453E-07	0.0672182			
	100	4.99477E-07	0.0724430			
0	1	4.46754E-07	0.0647961	0.2706		
	2	4.92698E-07	0.0714598			
	5	5.56926E-07	0.0807753			
	10	6.28092E-07	0.0910970			
	20	7.26583E-07	0.1053820			
	50	8.64242E-07	0.1253478			
	100	1.04792E-06	0.1519880			

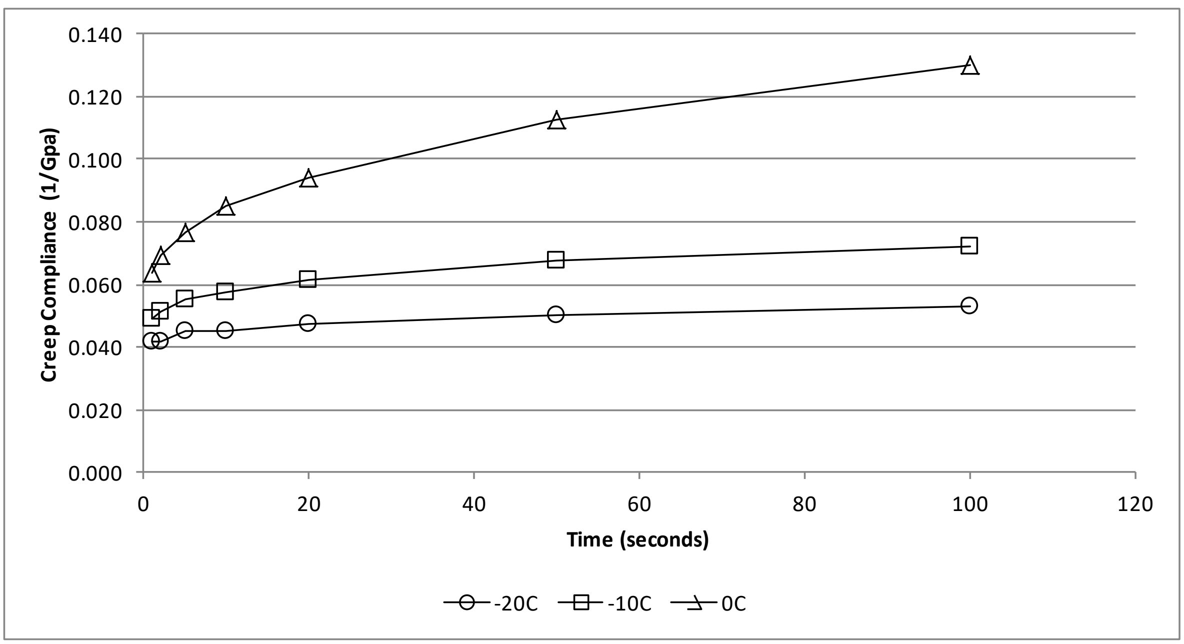


Lab ID	16PJ5B005
Mix Number	BP1 16-61
Average Air Voids* (%)	3.5
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	5.7

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG58-28
RAP (%)	32.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.87796E-07	0.0417413	0.2240		
	2	2.88703E-07	0.0418729			
	5	3.10149E-07	0.0449833			
	10	3.12176E-07	0.0452774			
	20	3.28023E-07	0.0475757			
	50	3.44382E-07	0.0499484			
	100	3.64895E-07	0.0529235			
-10	1	3.37362E-07	0.0489303	0.2536	743	617
	2	3.53517E-07	0.0512734			
	5	3.80489E-07	0.0551852			
	10	3.94645E-07	0.0572384			
	20	4.25134E-07	0.0616605			
	50	4.64604E-07	0.0673851			
	100	4.98765E-07	0.0723398			
0	1	4.37713E-07	0.0634850	0.3094		
	2	4.76022E-07	0.0690411			
	5	5.28492E-07	0.0766512			
	10	5.85280E-07	0.0848877			
	20	6.48079E-07	0.0939959			
	50	7.74572E-07	0.1123421			
	100	8.95416E-07	0.1298691			

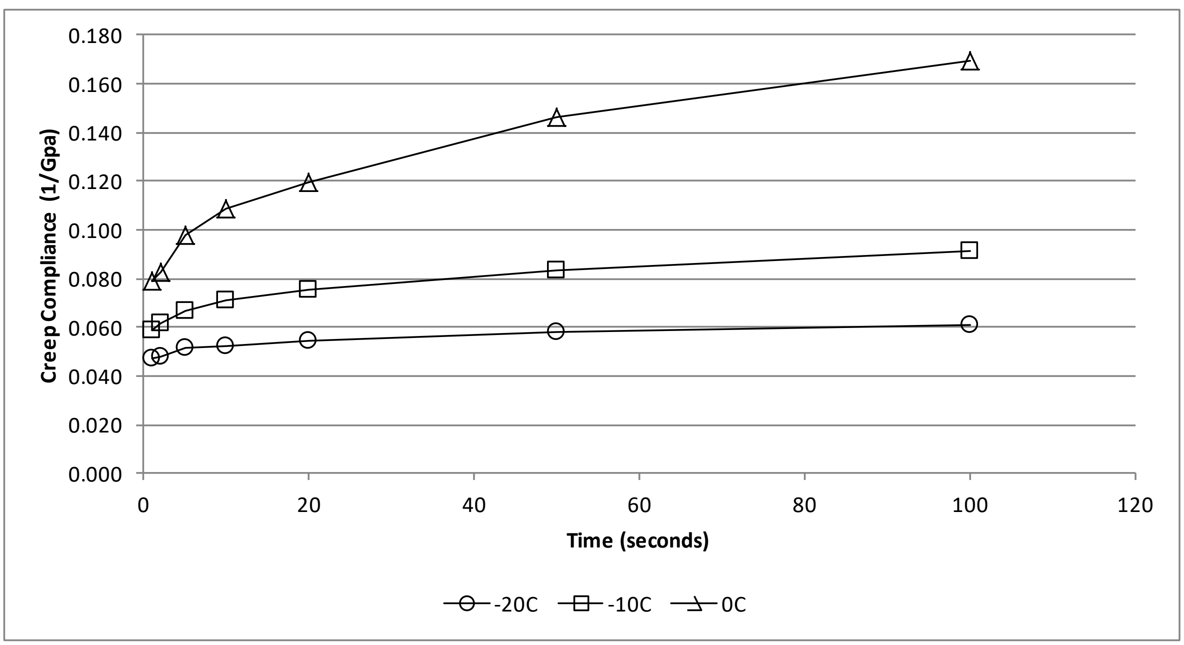


Lab ID	16PJ5B005
Mix Number	BP1 16-61
Average Air Voids* (%)	6.3
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.0

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG58-28
RAP (%)	32.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.27470E-07	0.0474955	0.2273		
	2	3.29771E-07	0.0478292			
	5	3.53017E-07	0.0512008			
	10	3.60156E-07	0.0522362			
	20	3.73608E-07	0.0541873			
	50	4.00042E-07	0.0580212			
	100	4.17551E-07	0.0605606			
-10	1	4.06388E-07	0.0589417	0.2473	571	483
	2	4.26965E-07	0.0619260			
	5	4.58889E-07	0.0665562			
	10	4.91740E-07	0.0713208			
	20	5.18094E-07	0.0751432			
	50	5.75103E-07	0.0834116			
	100	6.30114E-07	0.0913904			
0	1	5.42096E-07	0.0786244	0.2777		
	2	5.67731E-07	0.0823425			
	5	6.72991E-07	0.0976091			
	10	7.50542E-07	0.1088569			
	20	8.23553E-07	0.1194462			
	50	1.00984E-06	0.1464647			
	100	1.16798E-06	0.1694014			

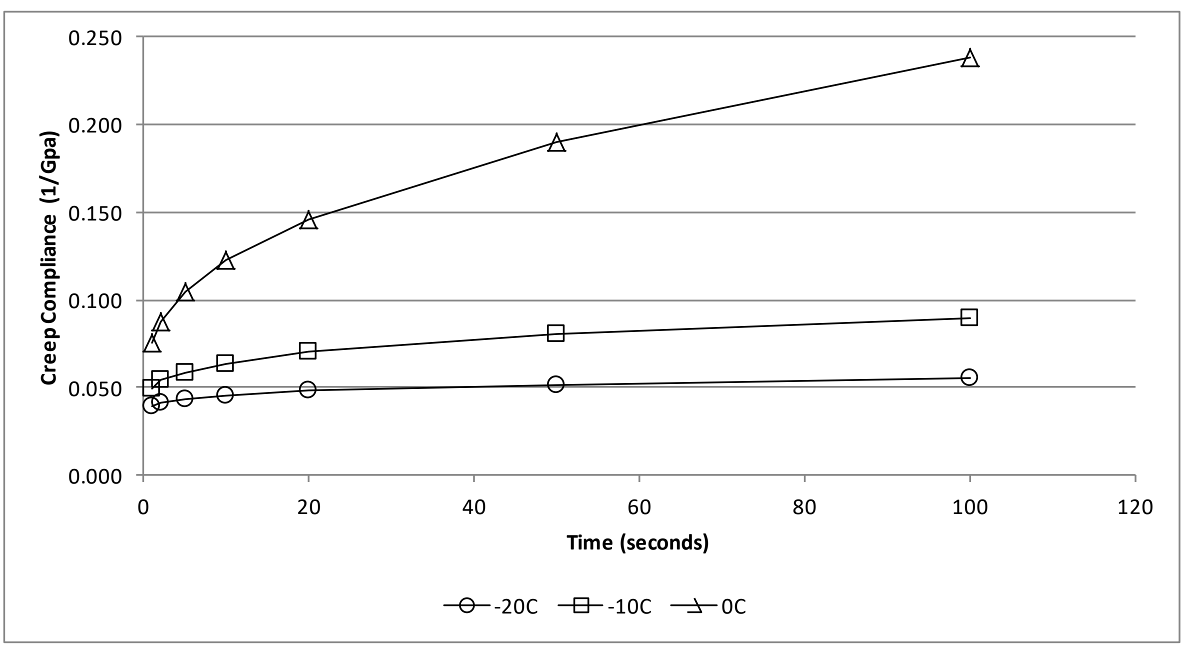


Lab ID	16PJ5B006
Mix Number	SP125 16-9
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	6.4

*Based on Gmb from T166 on Sawn Specimens

SMA?	Yes
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	0.0

Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	Indirect Tensile Strength NCHRP 530 Correction (psi)
-20	1	2.72648E-07	0.0395443	0.2680		
	2	2.87062E-07	0.0416348			
	5	2.98243E-07	0.0432565			
	10	3.13224E-07	0.0454293			
	20	3.35669E-07	0.0486846			
	50	3.56341E-07	0.0516828			
	100	3.79143E-07	0.0549900			
-10	1	3.43963E-07	0.0498877	0.3467	658	551
	2	3.73479E-07	0.0541686			
	5	4.06034E-07	0.0588903			
	10	4.37429E-07	0.0634438			
	20	4.86570E-07	0.0705710			
	50	5.52965E-07	0.0802008			
	100	6.18153E-07	0.0896555			
0	1	5.23700E-07	0.0759563	0.4131		
	2	6.02795E-07	0.0874281			
	5	7.22674E-07	0.1048149			
	10	8.44565E-07	0.1224939			
	20	1.00650E-06	0.1459808			
	50	1.30967E-06	0.1899510			
	100	1.64159E-06	0.2380930			

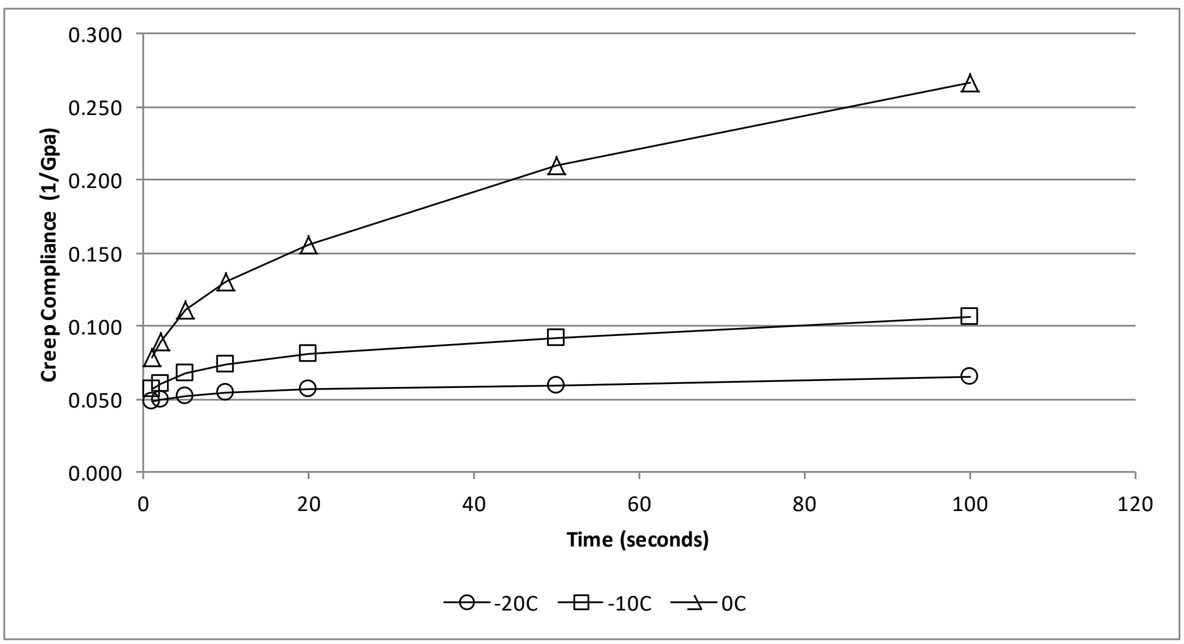


Lab ID	16PJ5B006
Mix Number	SP125 16-9
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.4
Air Voids Coeff. of Variation (%)	6.0

*Based on Gmb from T166 on Sawn Specimens

SMA?	Yes
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.31927E-07	0.0481420	0.2857		
	2	3.42134E-07	0.0496224			
	5	3.61385E-07	0.0524144			
	10	3.77659E-07	0.0547749			
	20	3.91131E-07	0.0567287			
	50	4.12447E-07	0.0598204			
	100	4.48544E-07	0.0650557			
-10	1	3.96480E-07	0.0575046	0.3577	599	505
	2	4.19583E-07	0.0608554			
	5	4.69881E-07	0.0681505			
	10	5.07179E-07	0.0735601			
	20	5.58729E-07	0.0810369			
	50	6.32023E-07	0.0916672			
	100	7.36177E-07	0.1067735			
0	1	5.44762E-07	0.0790110	0.4990		
	2	6.15970E-07	0.0893389			
	5	7.62359E-07	0.1105708			
	10	9.01003E-07	0.1306794			
	20	1.07407E-06	0.1557802			
	50	1.44923E-06	0.2101924			
	100	1.84051E-06	0.2669435			

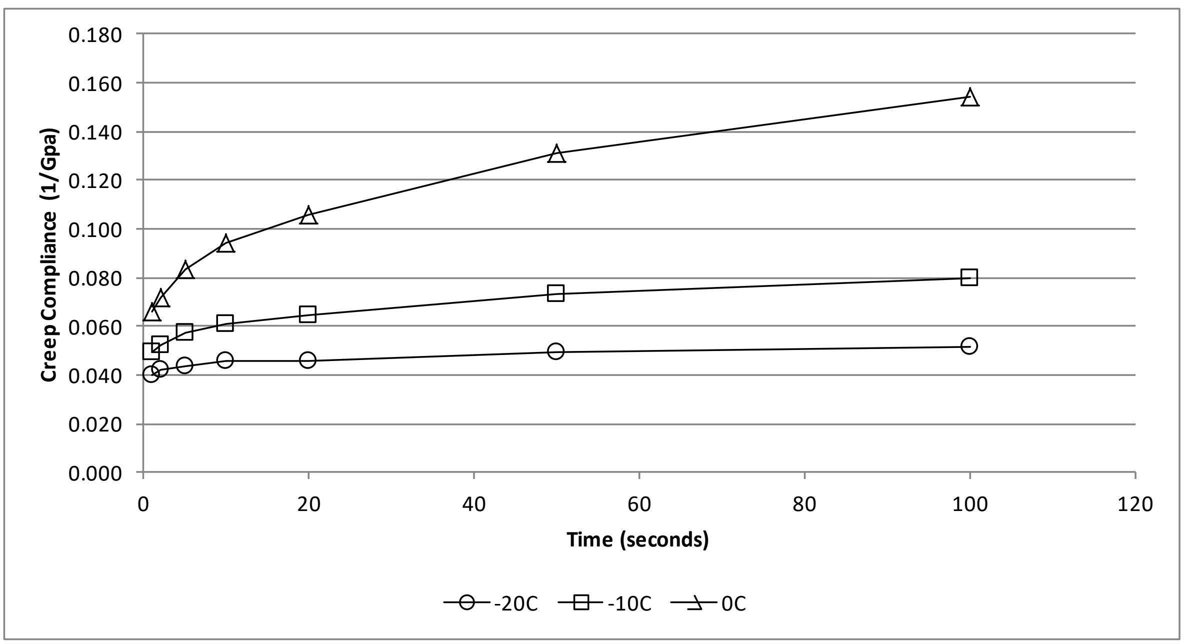


Lab ID	16PJ5B007
Mix Number	SP095 16-63
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	4.6

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.76225E-07	0.0400630	0.2456		
	2	2.88200E-07	0.0417999			
	5	2.98607E-07	0.0433093			
	10	3.15538E-07	0.0457649			
	20	3.13183E-07	0.0454233			
	50	3.40674E-07	0.0494106			
	100	3.57425E-07	0.0518401			
-10	1	3.42541E-07	0.0496813	0.2973	669	560
	2	3.60715E-07	0.0523173			
	5	3.93447E-07	0.0570646			
	10	4.18810E-07	0.0607432			
	20	4.45136E-07	0.0645615			
	50	5.04738E-07	0.0732060			
	100	5.51080E-07	0.0799274			
0	1	4.54500E-07	0.0659196	0.3533		
	2	4.93022E-07	0.0715068			
	5	5.76390E-07	0.0835983			
	10	6.46817E-07	0.0938128			
	20	7.31495E-07	0.1060944			
	50	9.03105E-07	0.1309843			
	100	1.06483E-06	0.1544401			

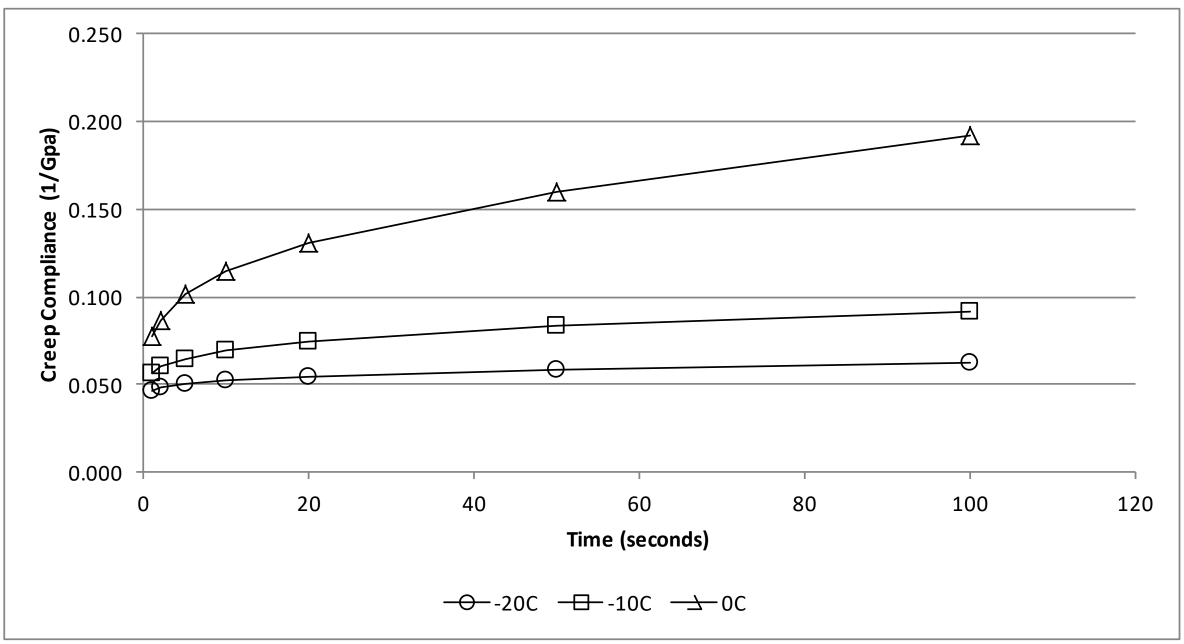


Lab ID	16PJ5B007
Mix Number	SP095 16-63
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	2.3

*Based on Gmb from T166 on Sawn Specimens

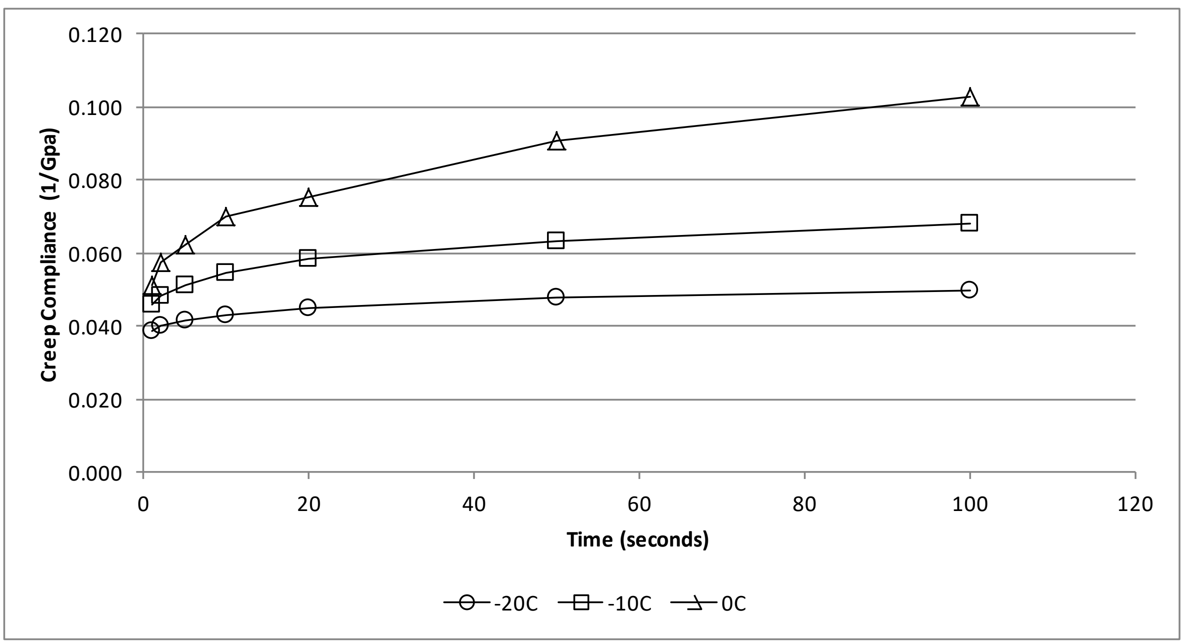
SMA?	No
Contract Binder Gr.	PG76-22
Inline Binder Grade	PG64-22V
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	No
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.18854E-07	0.0462459	0.2439		
	2	3.30674E-07	0.0479602			
	5	3.50155E-07	0.0507857			
	10	3.61246E-07	0.0523943			
	20	3.78353E-07	0.0548754			
	50	4.04619E-07	0.0586851			
	100	4.30570E-07	0.0624490			
-10	1	3.87821E-07	0.0562487	0.2787	593	500
	2	4.16117E-07	0.0603527			
	5	4.45320E-07	0.0645883			
	10	4.79279E-07	0.0695135			
	20	5.15112E-07	0.0747107			
	50	5.76346E-07	0.0835919			
	100	6.31979E-07	0.0916608			
0	1	5.37895E-07	0.0780151	0.3285		
	2	5.99240E-07	0.0869124			
	5	7.00437E-07	0.1015899			
	10	7.88112E-07	0.1143060			
	20	9.00049E-07	0.1305411			
	50	1.10189E-06	0.1598163			
	100	1.32530E-06	0.1922188			



Lab ID	16PJ5B008		SMA?	No
Mix Number	SP190 14-18		Contract Binder Gr.	PG70-22**
Average Air Voids* (%)	3.9		Inline Binder Grade	
Air Voids Standard Deviation (%)	0.2		RAP (%)	23.0
Air Voids Coeff. of Variation (%)	4.6		RAS (%)	0.0
*Based on Gmb from T166 on Sawn Specimens			Binder Additives?	Yes
**JMF shows this as Inline Grade, but no Contract Grade designation			GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.66824E-07	0.0386995	0.2404		
	2	2.76492E-07	0.0401017			
	5	2.85458E-07	0.0414021			
	10	2.98193E-07	0.0432492			
	20	3.10762E-07	0.0450722			
	50	3.28763E-07	0.0476831			
	100	3.42223E-07	0.0496352			
-10	1	3.17870E-07	0.0461031	0.2613	729	606
	2	3.33456E-07	0.0483636			
	5	3.54618E-07	0.0514329			
	10	3.74941E-07	0.0543806			
	20	4.03060E-07	0.0584589			
	50	4.36793E-07	0.0633514			
	100	4.67848E-07	0.0678556			
0	1	3.52933E-07	0.0511886	0.3744		
	2	3.95494E-07	0.0573615			
	5	4.29293E-07	0.0622637			
	10	4.82585E-07	0.0699930			
	20	5.19098E-07	0.0752888			
	50	6.23969E-07	0.0904990			
	100	7.09682E-07	0.1029306			



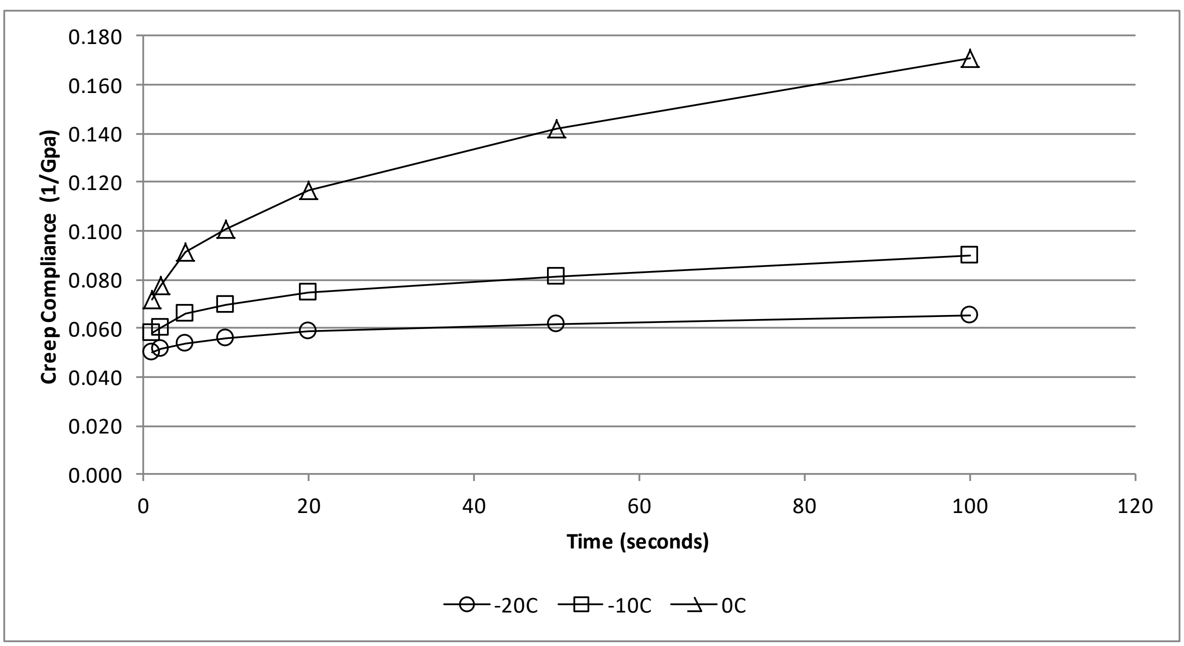
Lab ID	16PJ5B008
Mix Number	SP190 14-18
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	0.9

*Based on Gmb from T166 on Sawn Specimens

**JMF shows this as Inline Grade, but no Contract Grade designation

SMA?	No
Contract Binder Gr.	PG70-22**
Inline Binder Grade	
RAP (%)	23.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.44433E-07	0.0499557	0.1920		
	2	3.54138E-07	0.0513634			
	5	3.70922E-07	0.0537977			
	10	3.83867E-07	0.0556752			
	20	4.05819E-07	0.0588590			
	50	4.23461E-07	0.0614179			
	100	4.51888E-07	0.0655408			
-10	1	3.98623E-07	0.0578154	0.2090	617	520
	2	4.16517E-07	0.0604107			
	5	4.53456E-07	0.0657683			
	10	4.77579E-07	0.0692670			
	20	5.14695E-07	0.0746502			
	50	5.61603E-07	0.0814536			
	100	6.18199E-07	0.0896622			
0	1	4.95670E-07	0.0718908	0.2875		
	2	5.36816E-07	0.0778585			
	5	6.26841E-07	0.0909156			
	10	6.92641E-07	0.1004590			
	20	8.02634E-07	0.1164122			
	50	9.78884E-07	0.1419751			
	100	1.17608E-06	0.1705758			

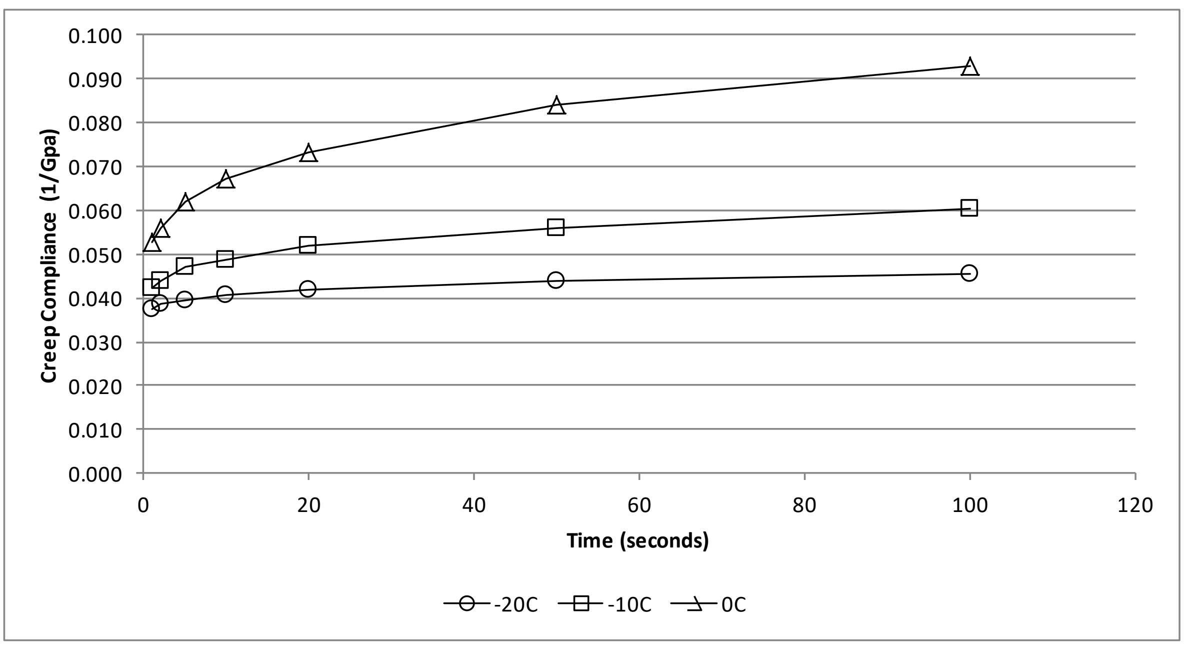


Lab ID	16PJ5B009
Mix Number	SP125 16-39
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.7

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG64-22
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.58140E-07	0.0374401	0.2478		
	2	2.67260E-07	0.0387628			
	5	2.71981E-07	0.0394476			
	10	2.79952E-07	0.0406037			
	20	2.87826E-07	0.0417456			
	50	3.03137E-07	0.0439663			
	100	3.13641E-07	0.0454898			
-10	1	2.92533E-07	0.0424284	0.2740	750	623
	2	3.02398E-07	0.0438591			
	5	3.23608E-07	0.0469353			
	10	3.36634E-07	0.0488246			
	20	3.58891E-07	0.0520527			
	50	3.86037E-07	0.0559900			
	100	4.14859E-07	0.0601702			
0	1	3.63345E-07	0.0526987	0.3133		
	2	3.84660E-07	0.0557902			
	5	4.28117E-07	0.0620932			
	10	4.61930E-07	0.0669973			
	20	5.04430E-07	0.0731613			
	50	5.79979E-07	0.0841188			
	100	6.40049E-07	0.0928313			

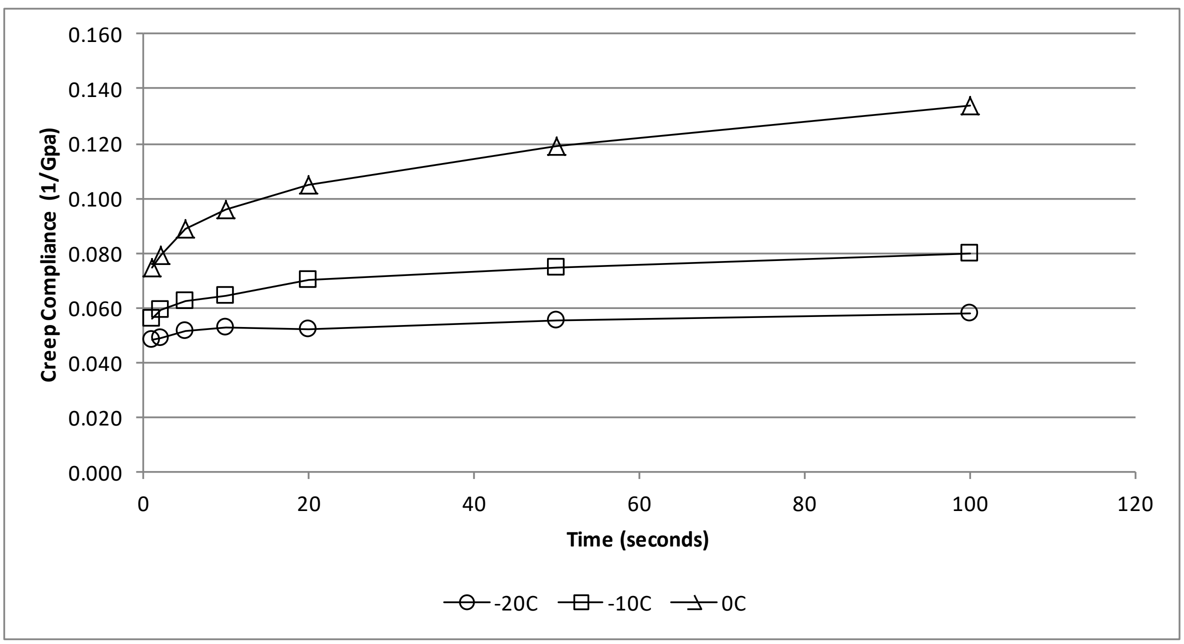


Lab ID	16PJ5B009
Mix Number	SP125 16-39
Average Air Voids* (%)	5.9
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.6

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG64-22
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.32364E-07	0.0482054	0.1706		
	2	3.36706E-07	0.0488350			
	5	3.53907E-07	0.0513299			
	10	3.63273E-07	0.0526882			
	20	3.58787E-07	0.0520377			
	50	3.81207E-07	0.0552894			
	100	4.00915E-07	0.0581478			
-10	1	3.85465E-07	0.0559070	0.1682	624	525
	2	4.10681E-07	0.0595643			
	5	4.30320E-07	0.0624127			
	10	4.44764E-07	0.0645076			
	20	4.83341E-07	0.0701027			
	50	5.13334E-07	0.0744528			
	100	5.52500E-07	0.0801334			
0	1	5.15002E-07	0.0746947	0.1758		
	2	5.45298E-07	0.0790888			
	5	6.10817E-07	0.0885914			
	10	6.60628E-07	0.0958160			
	20	7.25284E-07	0.1051936			
	50	8.20005E-07	0.1189317			
	100	9.22673E-07	0.1338224			

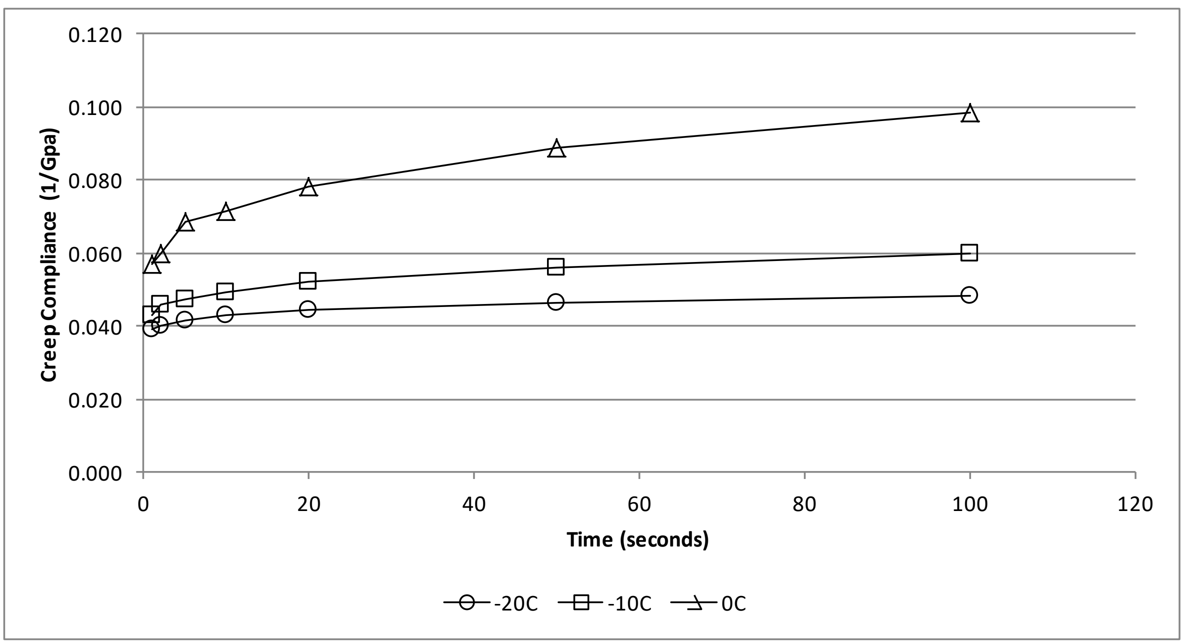


Lab ID	16PJ5B010
Mix Number	SP190 15-48
Average Air Voids* (%)	3.9
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	3.6

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG64-22
RAP (%)	23.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.69401E-07	0.0390733	0.2102		
	2	2.75785E-07	0.0399992			
	5	2.87010E-07	0.0416273			
	10	2.96965E-07	0.0430712			
	20	3.05522E-07	0.0443123			
	50	3.19207E-07	0.0462970			
	100	3.34231E-07	0.0484761			
-10	1	2.95435E-07	0.0428492	0.2428	736	612
	2	3.17199E-07	0.0460058			
	5	3.25414E-07	0.0471973			
	10	3.39746E-07	0.0492760			
	20	3.59590E-07	0.0521541			
	50	3.85885E-07	0.0559679			
	100	4.11965E-07	0.0597505			
0	1	3.94131E-07	0.0571639	0.2299		
	2	4.12367E-07	0.0598087			
	5	4.72717E-07	0.0685618			
	10	4.93813E-07	0.0716215			
	20	5.38651E-07	0.0781247			
	50	6.11776E-07	0.0887307			
	100	6.79373E-07	0.0985347			

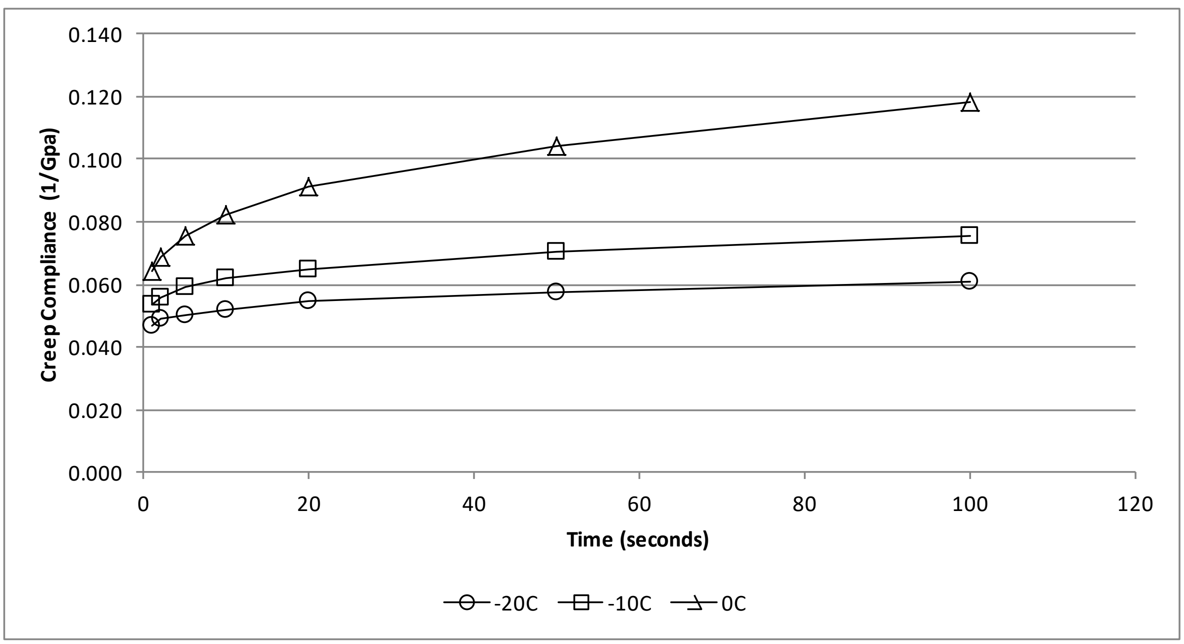


Lab ID	16PJ5B010
Mix Number	SP190 15-48
Average Air Voids* (%)	6.3
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	5.5

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG64-22
Inline Binder Grade	PG64-22
RAP (%)	23.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.22646E-07	0.0467958	0.1919		
	2	3.36641E-07	0.0488256			
	5	3.47823E-07	0.0504474			
	10	3.57860E-07	0.0519032			
	20	3.78669E-07	0.0549213			
	50	3.98041E-07	0.0577309			
	100	4.21233E-07	0.0610947			
-10	1	3.69335E-07	0.0535676	0.2328	565	479
	2	3.85628E-07	0.0559307			
	5	4.06569E-07	0.0589678			
	10	4.27087E-07	0.0619437			
	20	4.46913E-07	0.0648193			
	50	4.84997E-07	0.0703428			
	100	5.21789E-07	0.0756792			
0	1	4.43808E-07	0.0643688	0.2528		
	2	4.73206E-07	0.0686327			
	5	5.18984E-07	0.0752722			
	10	5.66513E-07	0.0821658			
	20	6.29280E-07	0.0912693			
	50	7.18613E-07	0.1042261			
	100	8.13935E-07	0.1180512			

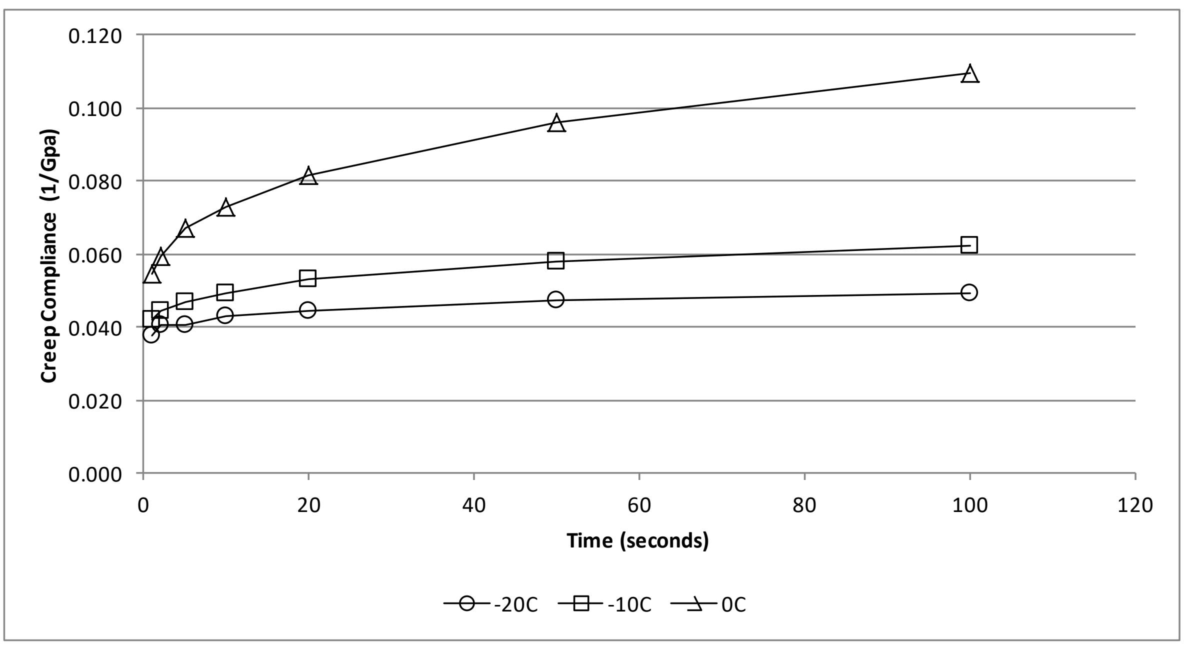


Lab ID	16PJ5B011
Mix Number	SP125 15-60
Average Air Voids* (%)	4.0
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	4.0

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG64-22H
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.61266E-07	0.0378934	0.2401		
	2	2.79363E-07	0.0405181			
	5	2.81449E-07	0.0408207			
	10	2.97926E-07	0.0432106			
	20	3.06534E-07	0.0444590			
	50	3.27080E-07	0.0474389			
	100	3.38218E-07	0.0490544			
-10	1	2.88580E-07	0.0418550	0.3022	742	617
	2	3.06260E-07	0.0444192			
	5	3.22498E-07	0.0467744			
	10	3.41159E-07	0.0494810			
	20	3.66147E-07	0.0531051			
	50	3.98857E-07	0.0578493			
	100	4.29325E-07	0.0622684			
0	1	3.76862E-07	0.0546592	0.3054		
	2	4.07918E-07	0.0591634			
	5	4.61834E-07	0.0669834			
	10	5.02907E-07	0.0729405			
	20	5.61763E-07	0.0814768			
	50	6.63044E-07	0.0961664			
	100	7.56880E-07	0.1097762			

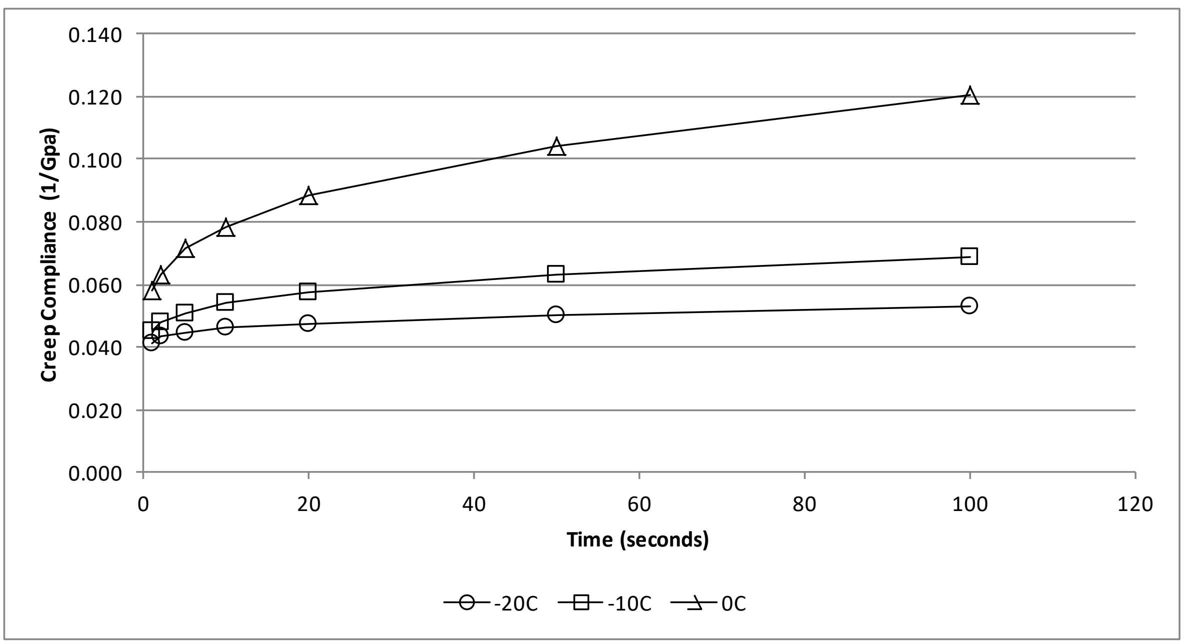


Lab ID	16PJ5B011
Mix Number	SP125 15-60
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	2.3

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG64-22H
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.85638E-07	0.0414283	0.2654		
	2	2.97928E-07	0.0432108			
	5	3.07213E-07	0.0445575			
	10	3.20529E-07	0.0464888			
	20	3.26444E-07	0.0473467			
	50	3.45587E-07	0.0501232			
	100	3.66013E-07	0.0530858			
-10	1	3.10444E-07	0.0450261	0.3223	623	524
	2	3.28592E-07	0.0476582			
	5	3.50681E-07	0.0508619			
	10	3.71555E-07	0.0538896			
	20	3.94543E-07	0.0572236			
	50	4.35082E-07	0.0631034			
	100	4.74322E-07	0.0687946			
0	1	4.00227E-07	0.0580481	0.3581		
	2	4.35169E-07	0.0631159			
	5	4.92524E-07	0.0714346			
	10	5.38345E-07	0.0780804			
	20	6.09746E-07	0.0884362			
	50	7.20031E-07	0.1044317			
	100	8.31697E-07	0.1206275			

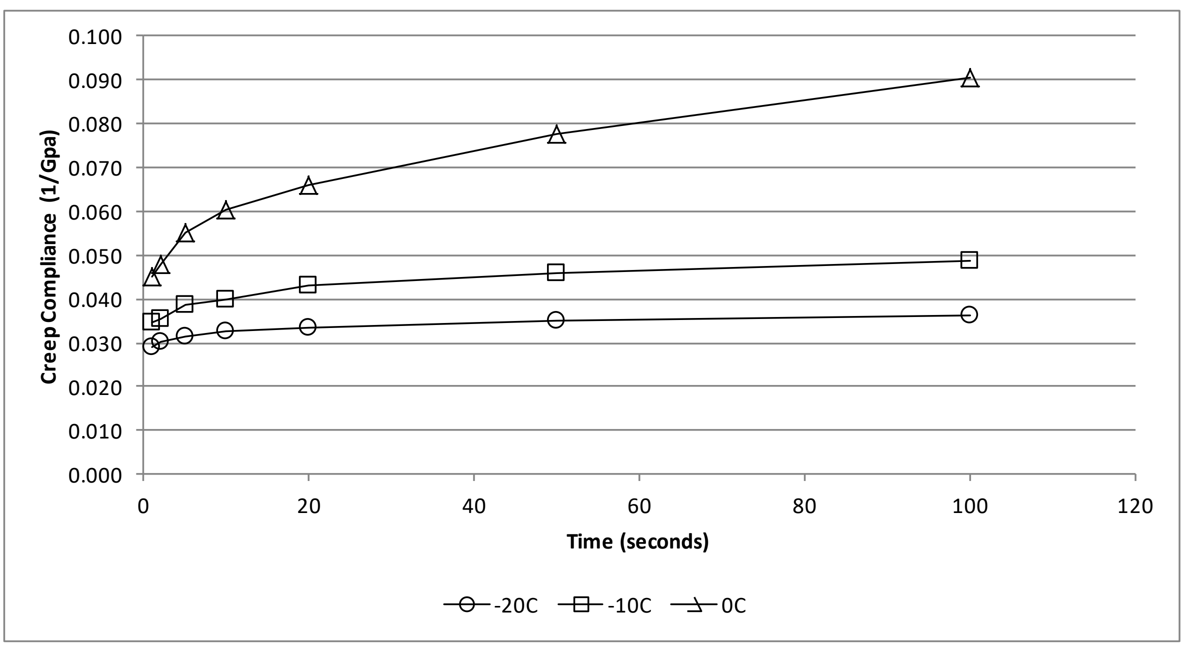


Lab ID	16PJ5B012
Mix Number	SP190 15-57
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	2.5

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG64-22H
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	NCHRP 530 Correction (psi)
-20	1	2.00613E-07	0.0290964	0.4336		
	2	2.06984E-07	0.0300205			
	5	2.17226E-07	0.0315059			
	10	2.23744E-07	0.0324513			
	20	2.30671E-07	0.0334560			
	50	2.41302E-07	0.0349979			
	100	2.49936E-07	0.0362501			
-10	1	2.39105E-07	0.0346793	0.3741	754	626
	2	2.43322E-07	0.0352909			
	5	2.66022E-07	0.0385833			
	10	2.73478E-07	0.0396646			
	20	2.95636E-07	0.0428784			
	50	3.16646E-07	0.0459256			
	100	3.36381E-07	0.0487880			
0	1	3.09811E-07	0.0449343	0.4401		
	2	3.30739E-07	0.0479696			
	5	3.79261E-07	0.0550072			
	10	4.16247E-07	0.0603715			
	20	4.55021E-07	0.0659953			
	50	5.35750E-07	0.0777040			
	100	6.24788E-07	0.0906178			

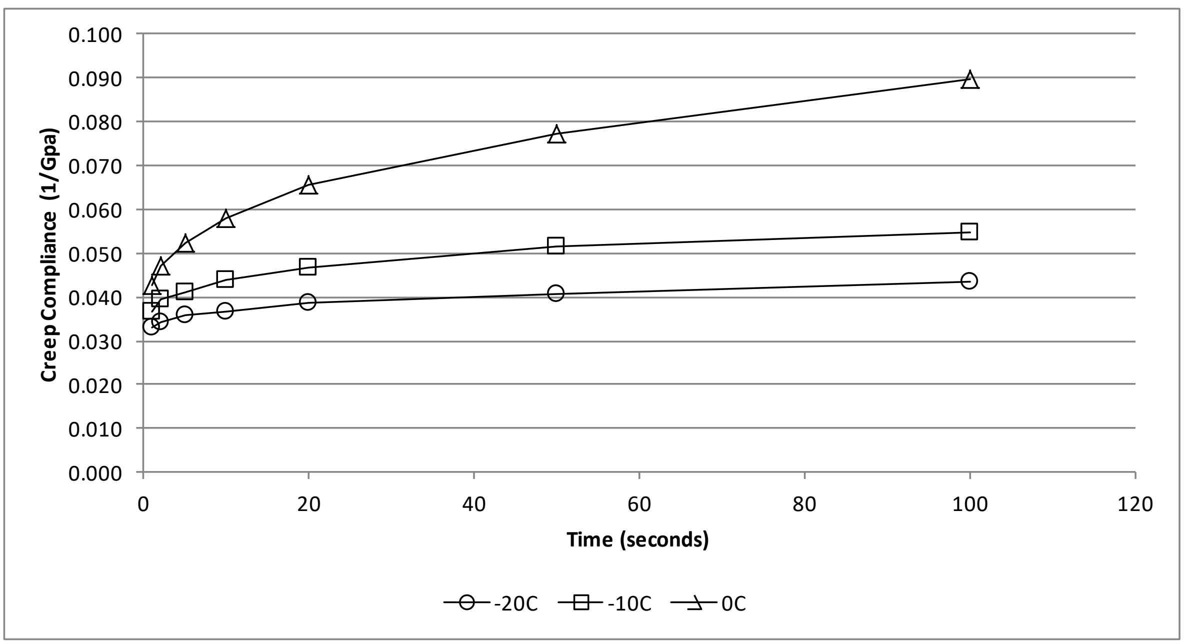


Lab ID	16PJ5B012
Mix Number	SP190 15-57
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.0
Air Voids Coeff. of Variation (%)	0.1

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG64-22H
RAP (%)	20.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.26714E-07	0.0328820	0.3787		
	2	2.34768E-07	0.0340502			
	5	2.46191E-07	0.0357071			
	10	2.53952E-07	0.0368327			
	20	2.65932E-07	0.0385702			
	50	2.80980E-07	0.0407527			
	100	2.99720E-07	0.0434708			
-10	1	2.53241E-07	0.0367296	0.4513	610	514
	2	2.71157E-07	0.0393280			
	5	2.83138E-07	0.0410657			
	10	3.02325E-07	0.0438486			
	20	3.22292E-07	0.0467445			
	50	3.54309E-07	0.0513881			
	100	3.76622E-07	0.0546244			
0	1	2.93107E-07	0.0425116	0.6054		
	2	3.25772E-07	0.0472493			
	5	3.61153E-07	0.0523808			
	10	3.98140E-07	0.0577453			
	20	4.53479E-07	0.0657716			
	50	5.33476E-07	0.0773741			
	100	6.19355E-07	0.0898298			

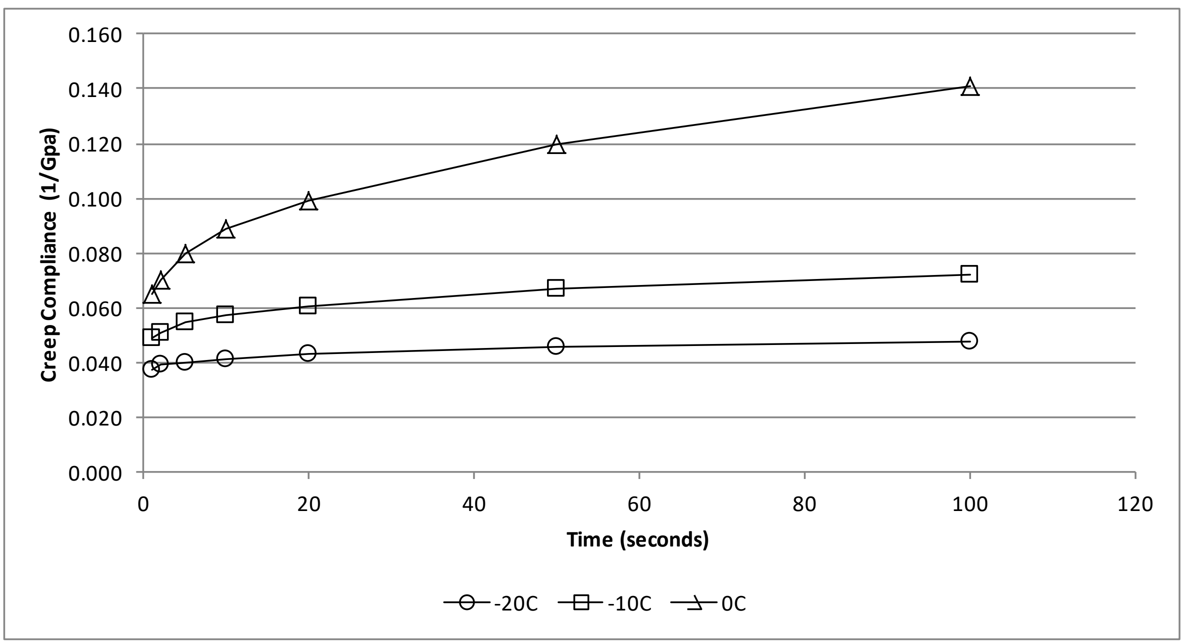


Lab ID	16PJ5B013
Mix Number	SP250 16-68
Average Air Voids* (%)	4.1
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	7.4

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-28
RAP (%)	45.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.58369E-07	0.0374733	0.2739		
	2	2.69921E-07	0.0391488			
	5	2.74277E-07	0.0397806			
	10	2.85731E-07	0.0414418			
	20	2.98392E-07	0.0432782			
	50	3.16494E-07	0.0459036			
	100	3.27494E-07	0.0474990			
-10	1	3.36543E-07	0.0488114	0.2436	694	579
	2	3.49637E-07	0.0507106			
	5	3.76200E-07	0.0545632			
	10	3.94397E-07	0.0572025			
	20	4.15551E-07	0.0602706			
	50	4.60778E-07	0.0668301			
	100	4.95552E-07	0.0718737			
0	1	4.49143E-07	0.0651427	0.2618		
	2	4.84536E-07	0.0702760			
	5	5.52328E-07	0.0801084			
	10	6.14301E-07	0.0890968			
	20	6.82423E-07	0.0989771			
	50	8.25254E-07	0.1196929			
	100	9.70653E-07	0.1407812			

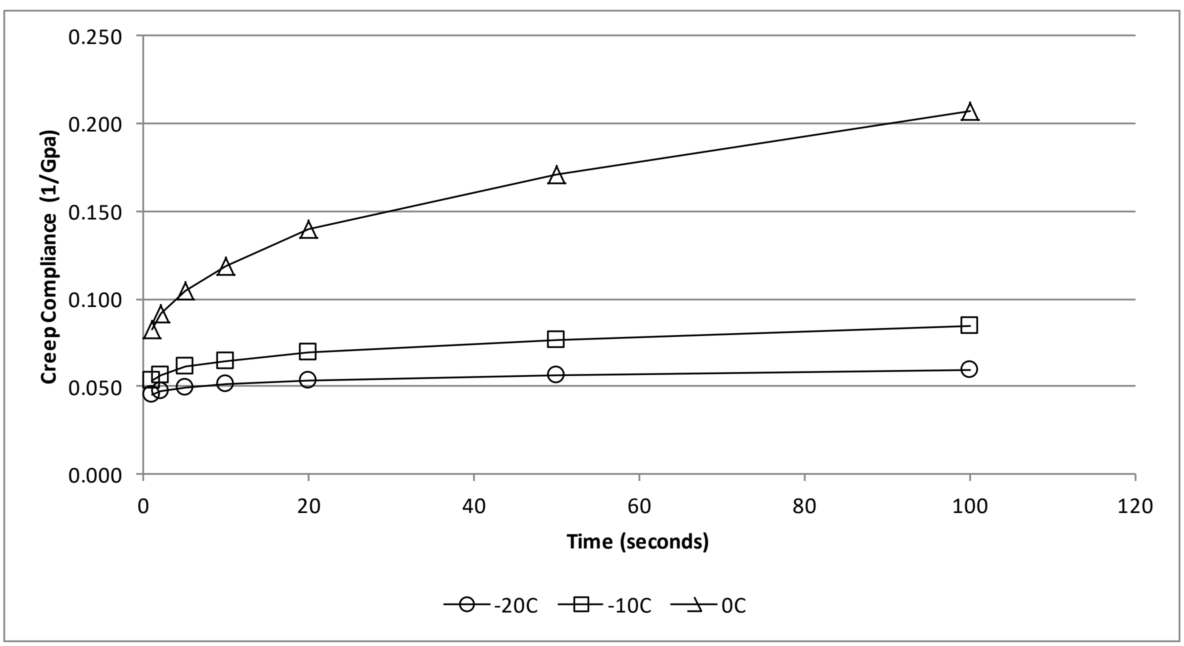


Lab ID	16PJ5B013
Mix Number	SP250 16-68
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	0.9

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-28
RAP (%)	45.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.16044E-07	0.0458383	0.2774		
	2	3.26945E-07	0.0474194			
	5	3.42580E-07	0.0496871			
	10	3.52780E-07	0.0511664			
	20	3.68121E-07	0.0533915			
	50	3.92044E-07	0.0568612			
	100	4.12324E-07	0.0598025			
-10	1	3.71812E-07	0.0539268	0.3053	529	450
	2	3.92363E-07	0.0569074			
	5	4.22302E-07	0.0612497			
	10	4.47175E-07	0.0648573			
	20	4.75898E-07	0.0690232			
	50	5.30325E-07	0.0769171			
	100	5.80228E-07	0.0841549			
0	1	5.68509E-07	0.0824552	0.2478		
	2	6.32730E-07	0.0917698			
	5	7.24953E-07	0.1051455			
	10	8.19321E-07	0.1188324			
	20	9.63126E-07	0.1396896			
	50	1.17988E-06	0.1711269			
	100	1.42504E-06	0.2066841			



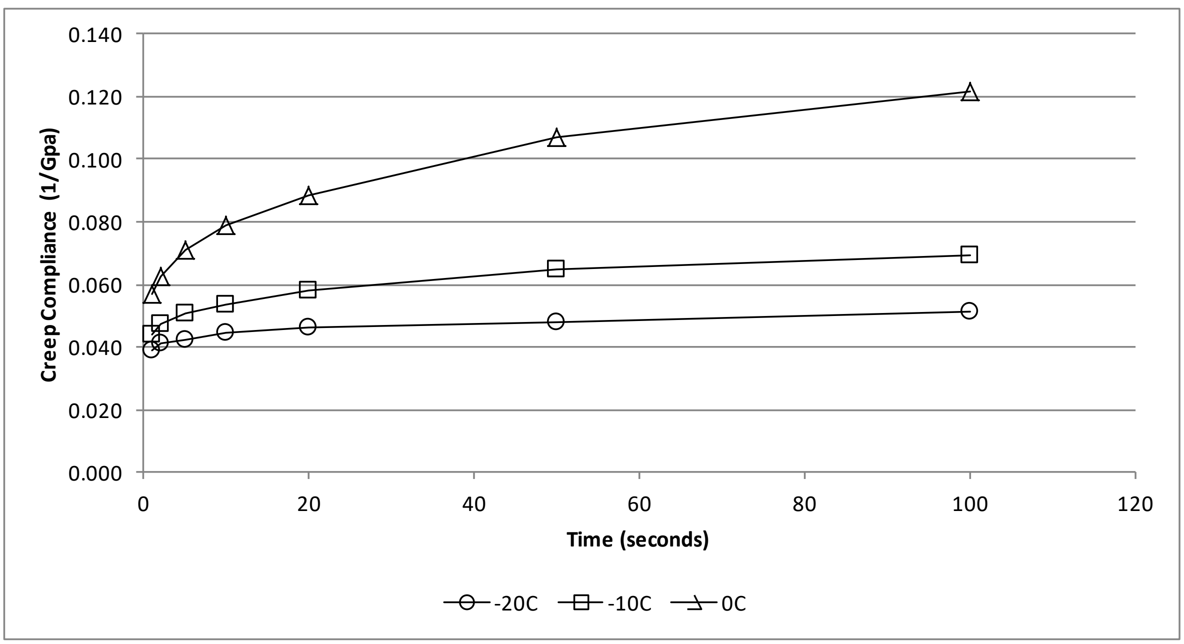
Lab ID	16PJ5B014
Mix Number	SP125 16-66
Average Air Voids* (%)	4.0
Air Voids Standard Deviation (%)	0.6
Air Voids Coeff. of Variation (%)	15.2

*Based on Gmb from T166 on Sawn Specimens

**JMF shows this as Inline Grade, but no Contract Grade designation

SMA?	No
Contract Binder Gr.	PG64-22H**
Inline Binder Grade	
RAP (%)	30.3
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.68793E-07	0.0389851	0.2222		
	2	2.85279E-07	0.0413762			
	5	2.90124E-07	0.0420790			
	10	3.06050E-07	0.0443887			
	20	3.19086E-07	0.0462796			
	50	3.30171E-07	0.0478873			
	100	3.52864E-07	0.0511786			
-10	1	3.03252E-07	0.0439830	0.2845	704	587
	2	3.25256E-07	0.0471744			
	5	3.48091E-07	0.0504863			
	10	3.68524E-07	0.0534499			
	20	3.99098E-07	0.0578843			
	50	4.47997E-07	0.0649765			
	100	4.78087E-07	0.0693406			
0	1	3.92380E-07	0.0569099	0.3762		
	2	4.30375E-07	0.0624206			
	5	4.87949E-07	0.0707710			
	10	5.42648E-07	0.0787045			
	20	6.07736E-07	0.0881446			
	50	7.36442E-07	0.1068119			
	100	8.38283E-07	0.1215827			



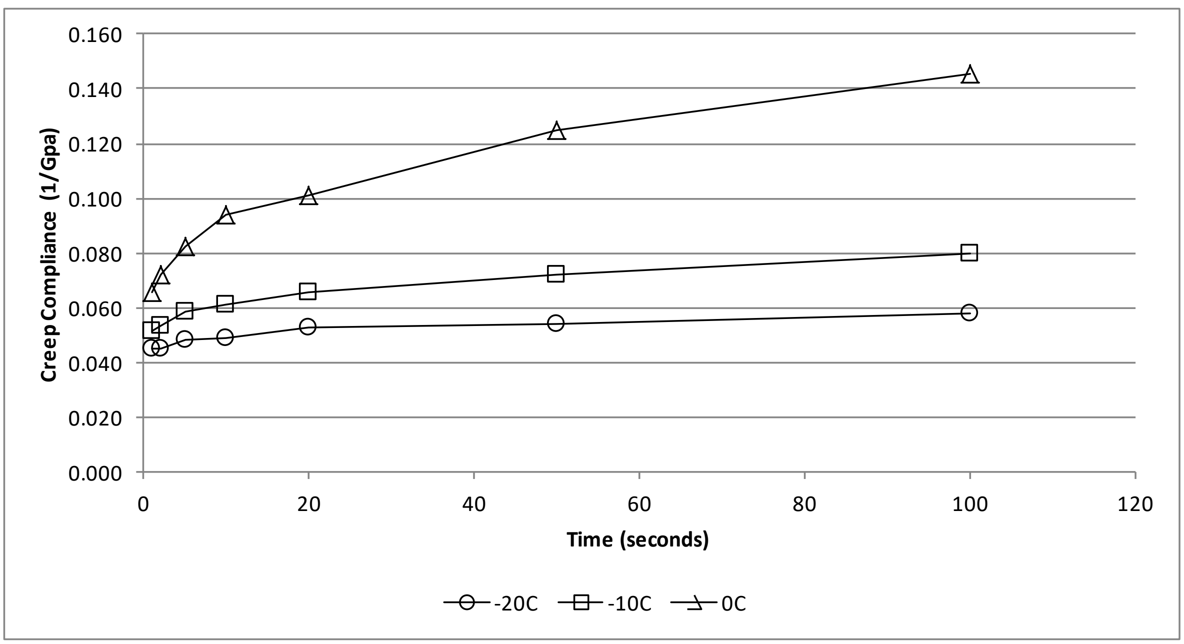
Lab ID	16PJ5B014
Mix Number	SP125 16-66
Average Air Voids* (%)	6.1
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.9

*Based on Gmb from T166 on Sawn Specimens

**JMF shows this as Inline Grade, but no Contract Grade designation

SMA?	No
Contract Binder Gr.	PG64-22H**
Inline Binder Grade	
RAP (%)	30.3
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.10341E-07	0.0450111	0.2079		
	2	3.11609E-07	0.0451951			
	5	3.34923E-07	0.0485764			
	10	3.37866E-07	0.0490033			
	20	3.62725E-07	0.0526088			
	50	3.74626E-07	0.0543349			
	100	3.99371E-07	0.0579239			
-10	1	3.56661E-07	0.0517293	0.2687	604	509
	2	3.68976E-07	0.0535155			
	5	4.04977E-07	0.0587369			
	10	4.23930E-07	0.0614859			
	20	4.52062E-07	0.0655661			
	50	4.97681E-07	0.0721825			
	100	5.48435E-07	0.0795438			
0	1	4.54734E-07	0.0659535	0.3342		
	2	4.97822E-07	0.0722029			
	5	5.67391E-07	0.0822931			
	10	6.46556E-07	0.0937750			
	20	6.98663E-07	0.1013325			
	50	8.58984E-07	0.1245851			
	100	1.00302E-06	0.1454762			

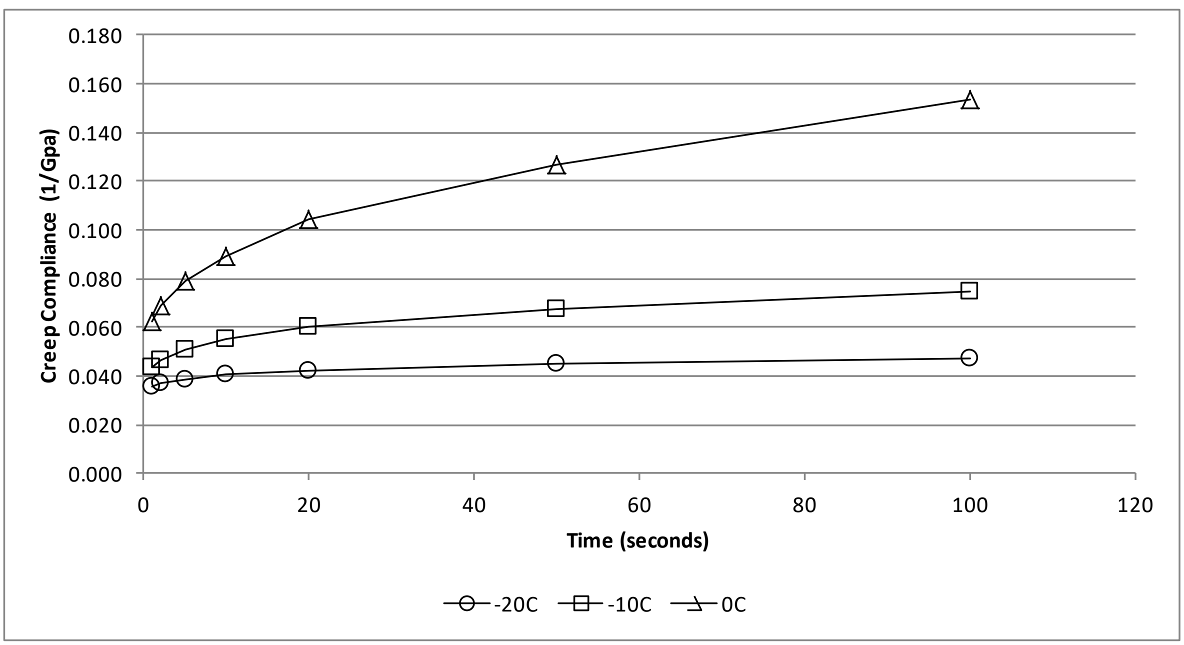


Lab ID	16PJ5B015
Mix Number	SP125 16-55
Average Air Voids* (%)	3.9
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	4.1

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-28
RAP (%)	40.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.43167E-07	0.0352683	0.3322		
	2	2.54994E-07	0.0369838			
	5	2.62916E-07	0.0381328			
	10	2.78941E-07	0.0404569			
	20	2.89115E-07	0.0419326			
	50	3.10952E-07	0.0450998			
	100	3.26564E-07	0.0473641			
-10	1	3.00092E-07	0.0435246	0.3567	717	597
	2	3.21673E-07	0.0466548			
	5	3.50682E-07	0.0508621			
	10	3.77765E-07	0.0547902			
	20	4.16570E-07	0.0604184			
	50	4.64935E-07	0.0674332			
	100	5.15776E-07	0.0748069			
0	1	4.28451E-07	0.0621415	0.3547		
	2	4.73276E-07	0.0686429			
	5	5.42472E-07	0.0786789			
	10	6.13307E-07	0.0889527			
	20	7.17705E-07	0.1040942			
	50	8.71145E-07	0.1263488			
	100	1.05740E-06	0.1533632			

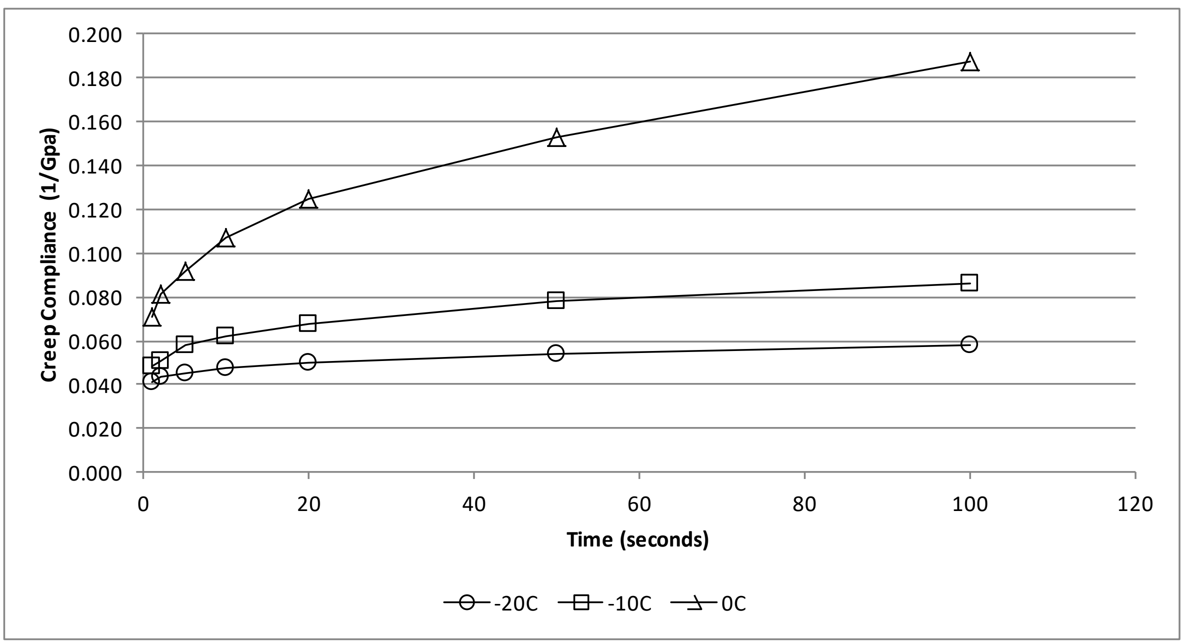


Lab ID	16PJ5B015
Mix Number	SP125 16-55
Average Air Voids* (%)	6.3
Air Voids Standard Deviation (%)	0.0
Air Voids Coeff. of Variation (%)	0.4

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-28
RAP (%)	40.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.84899E-07	0.0413211	0.2818		
	2	3.00474E-07	0.0435801			
	5	3.11786E-07	0.0452207			
	10	3.27733E-07	0.0475337			
	20	3.46098E-07	0.0501973			
	50	3.71420E-07	0.0538699			
	100	3.99478E-07	0.0579394			
-10	1	3.35655E-07	0.0486826	0.3312	602	507
	2	3.52846E-07	0.0511760			
	5	3.97984E-07	0.0577227			
	10	4.30247E-07	0.0624021			
	20	4.68498E-07	0.0679500			
	50	5.38615E-07	0.0781195			
	100	5.95137E-07	0.0863173			
0	1	4.91031E-07	0.0712180	0.4107		
	2	5.63222E-07	0.0816884			
	5	6.34857E-07	0.0920782			
	10	7.38044E-07	0.1070443			
	20	8.60930E-07	0.1248673			
	50	1.05318E-06	0.1527502			
	100	1.29032E-06	0.1871445			

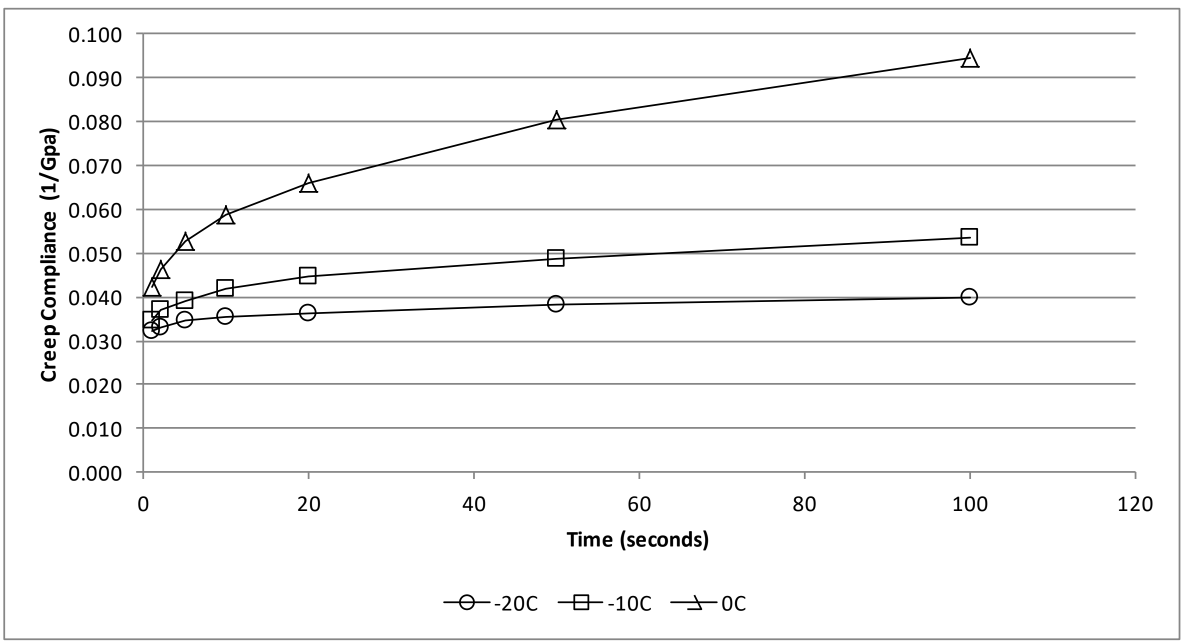


Lab ID	16PJ5B016
Mix Number	SP125 16-44
Average Air Voids* (%)	3.7
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	6.0

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-22
RAP (%)	28.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.23424E-07	0.0324049	0.2670		
	2	2.29084E-07	0.0332259			
	5	2.38544E-07	0.0345978			
	10	2.45440E-07	0.0355981			
	20	2.49274E-07	0.0361541			
	50	2.63601E-07	0.0382321			
	100	2.75679E-07	0.0399839			
-10	1	2.38932E-07	0.0346541	0.3696	767	636
	2	2.55444E-07	0.0370490			
	5	2.69640E-07	0.0391079			
	10	2.89010E-07	0.0419174			
	20	3.08870E-07	0.0447978			
	50	3.35100E-07	0.0486021			
	100	3.68656E-07	0.0534690			
0	1	2.91874E-07	0.0423327	0.4410		
	2	3.20089E-07	0.0464250			
	5	3.64574E-07	0.0528770			
	10	4.05626E-07	0.0588310			
	20	4.56157E-07	0.0661600			
	50	5.55461E-07	0.0805628			
	100	6.50175E-07	0.0942999			

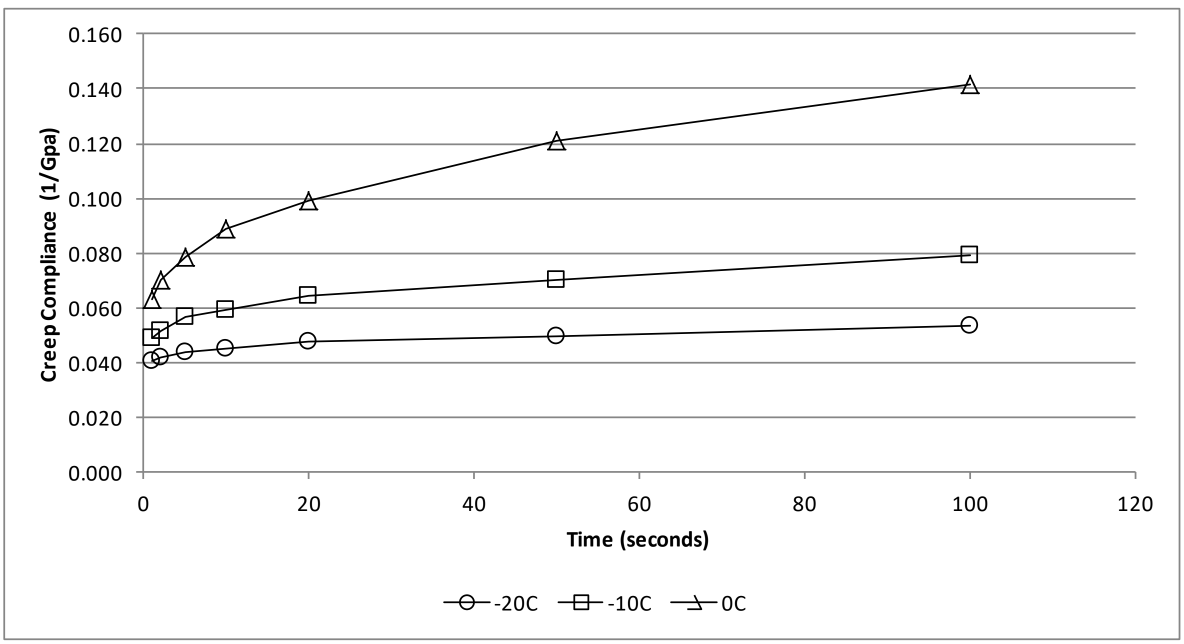


Lab ID	16PJ5B016
Mix Number	SP125 16-44
Average Air Voids* (%)	6.0
Air Voids Standard Deviation (%)	0.0
Air Voids Coeff. of Variation (%)	0.5

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-22
RAP (%)	28.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.80987E-07	0.0407538	0.1667		
	2	2.87938E-07	0.0417619			
	5	3.04106E-07	0.0441069			
	10	3.12292E-07	0.0452942			
	20	3.29049E-07	0.0477246			
	50	3.42181E-07	0.0496291			
	100	3.66728E-07	0.0531894			
-10	1	3.38244E-07	0.0490582	0.1789	638	535
	2	3.54319E-07	0.0513897			
	5	3.89252E-07	0.0564562			
	10	4.08762E-07	0.0592859			
	20	4.44905E-07	0.0645280			
	50	4.84467E-07	0.0702660			
	100	5.47009E-07	0.0793369			
0	1	4.36928E-07	0.0633711	0.2627		
	2	4.85509E-07	0.0704172			
	5	5.40812E-07	0.0784381			
	10	6.12605E-07	0.0888508			
	20	6.84174E-07	0.0992311			
	50	8.33246E-07	0.1208521			
	100	9.75783E-07	0.1415254			

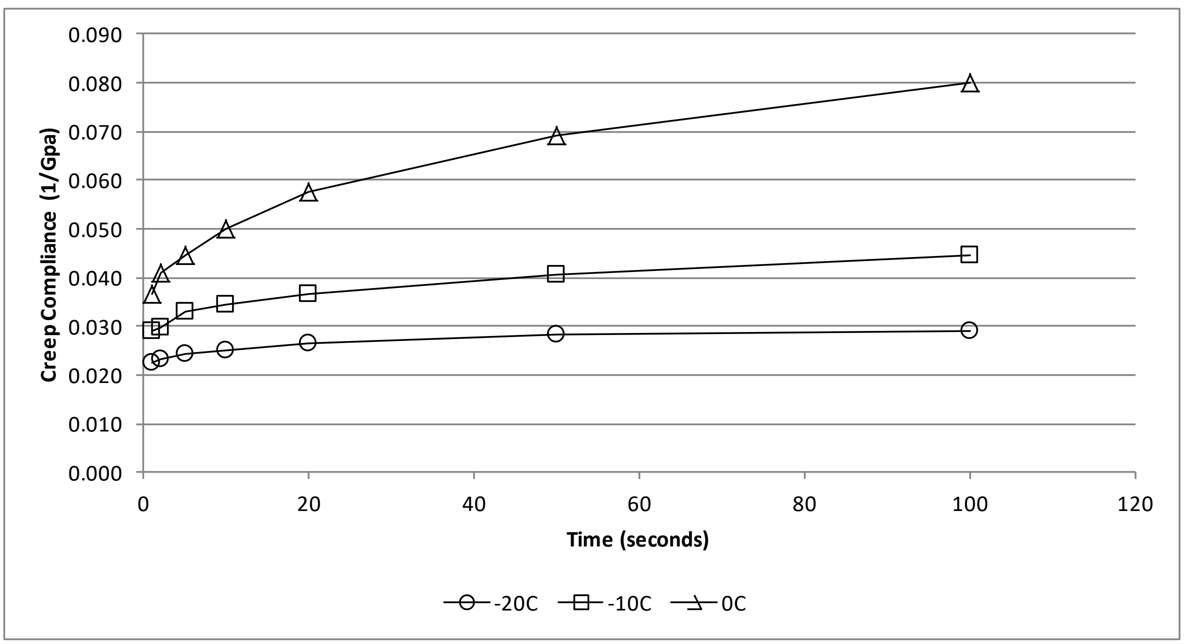


Lab ID	16PJ5B017
Mix Number	SP125 16-80
Average Air Voids* (%)	4.2
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	4.0

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-28
RAP (%)	32.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	1.53861E-07	0.0223156	0.4552		
	2	1.60538E-07	0.0232841			
	5	1.66612E-07	0.0241650			
	10	1.71915E-07	0.0249342			
	20	1.82065E-07	0.0264063			
	50	1.94676E-07	0.0282354			
	100	2.00429E-07	0.0290698			
-10	1	1.99721E-07	0.0289671	0.4625	812	671
	2	2.05753E-07	0.0298420			
	5	2.26453E-07	0.0328442			
	10	2.37747E-07	0.0344823			
	20	2.52961E-07	0.0366890			
	50	2.80127E-07	0.0406289			
	100	3.06727E-07	0.0444870			
0	1	2.51261E-07	0.0364423	0.5734		
	2	2.83478E-07	0.0411150			
	5	3.07557E-07	0.0446074			
	10	3.45627E-07	0.0501290			
	20	3.96287E-07	0.0574766			
	50	4.75837E-07	0.0690143			
	100	5.50943E-07	0.0799075			

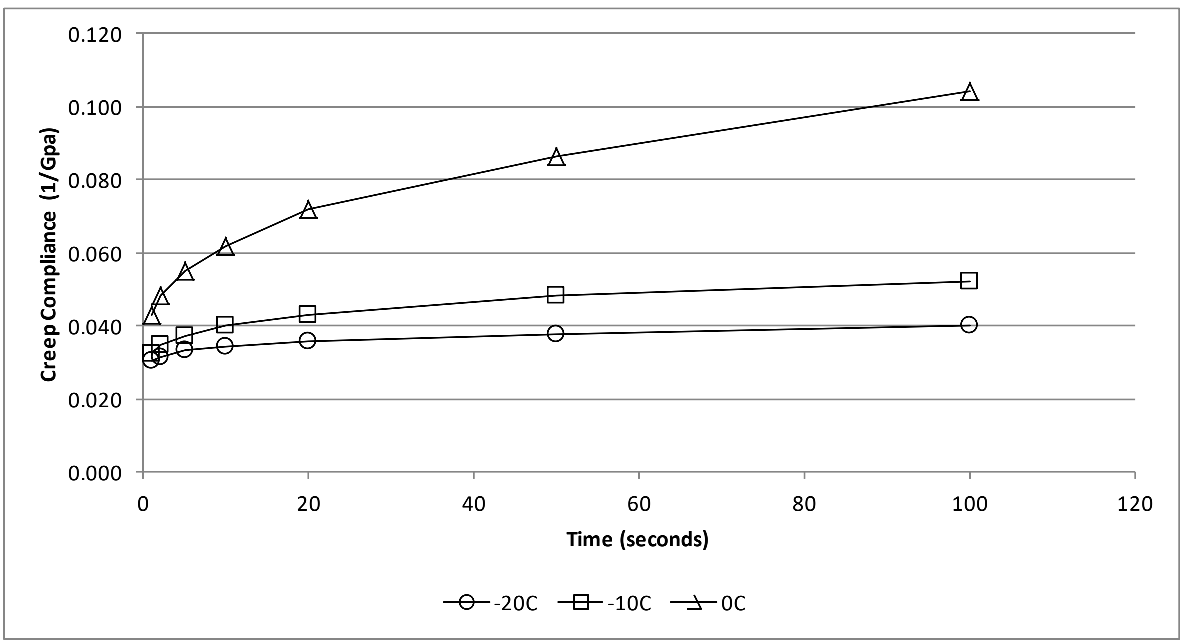


Lab ID	16PJ5B017
Mix Number	SP125 16-80
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.0

*Based on Gmb from T166 on Sawn Specimens

SMA?	No
Contract Binder Gr.	PG70-22
Inline Binder Grade	PG58-28
RAP (%)	32.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.11066E-07	0.0306126	0.3610		
	2	2.16677E-07	0.0314264			
	5	2.29382E-07	0.0332691			
	10	2.36702E-07	0.0343307			
	20	2.46174E-07	0.0357045			
	50	2.61388E-07	0.0379111			
	100	2.75143E-07	0.0399060			
-10	1	2.23236E-07	0.0323777	0.4798	689	576
	2	2.38519E-07	0.0345943			
	5	2.56084E-07	0.0371418			
	10	2.76043E-07	0.0400367			
	20	2.98021E-07	0.0432243			
	50	3.31696E-07	0.0481085			
	100	3.61358E-07	0.0524105			
0	1	2.96787E-07	0.0430453	0.5168		
	2	3.33940E-07	0.0484339			
	5	3.78735E-07	0.0549309			
	10	4.24830E-07	0.0616164			
	20	4.95750E-07	0.0719024			
	50	5.96245E-07	0.0864781			
	100	7.18075E-07	0.1041480			

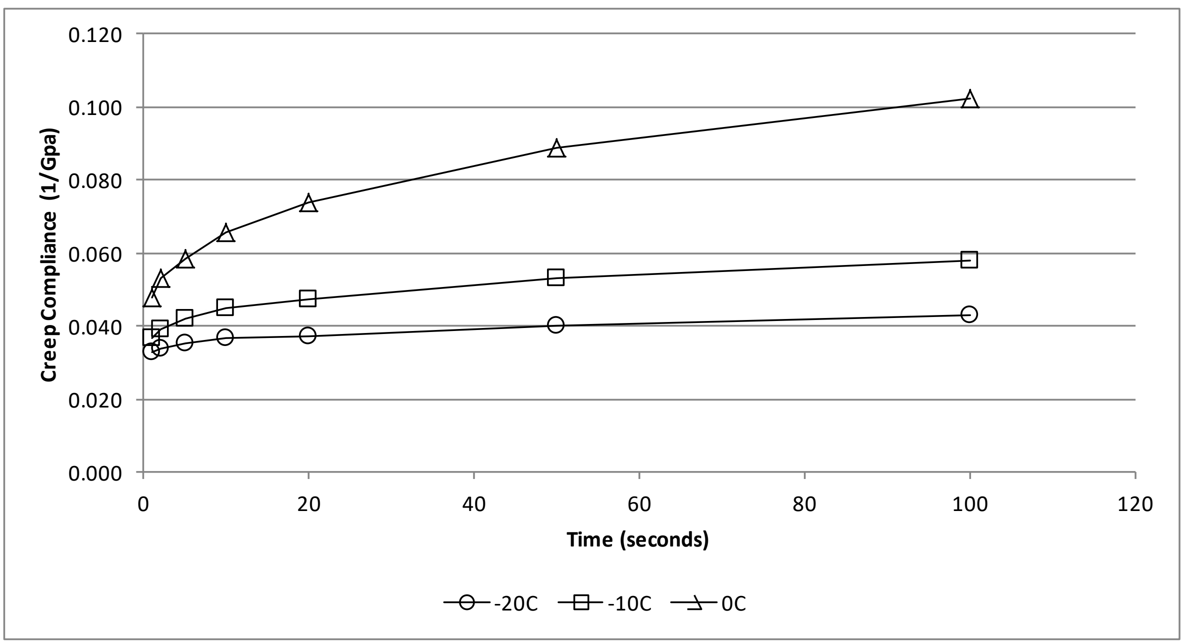


Lab ID	16CDCJB013
Mix Number	SP125 16-83
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	5.0

*Based on Gmb from T166 on Sawn Specimens
NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.25296E-07	0.0326764	0.2753		
	2	2.33152E-07	0.0338158			
	5	2.43307E-07	0.0352887			
	10	2.54015E-07	0.0368418			
	20	2.56924E-07	0.0372636			
	50	2.75643E-07	0.0399786			
	100	2.95442E-07	0.0428502			
-10	1	2.52376E-07	0.0366041	0.3424	878	723
	2	2.71469E-07	0.0393733			
	5	2.89157E-07	0.0419386			
	10	3.11123E-07	0.0451246			
	20	3.24950E-07	0.0471301			
	50	3.67881E-07	0.0533566			
	100	4.00881E-07	0.0581429			
0	1	3.30009E-07	0.0478638	0.4428		
	2	3.65305E-07	0.0529830			
	5	4.02898E-07	0.0584354			
	10	4.53662E-07	0.0657981			
	20	5.08814E-07	0.0737972			
	50	6.13866E-07	0.0890338			
	100	7.04101E-07	0.1021212			



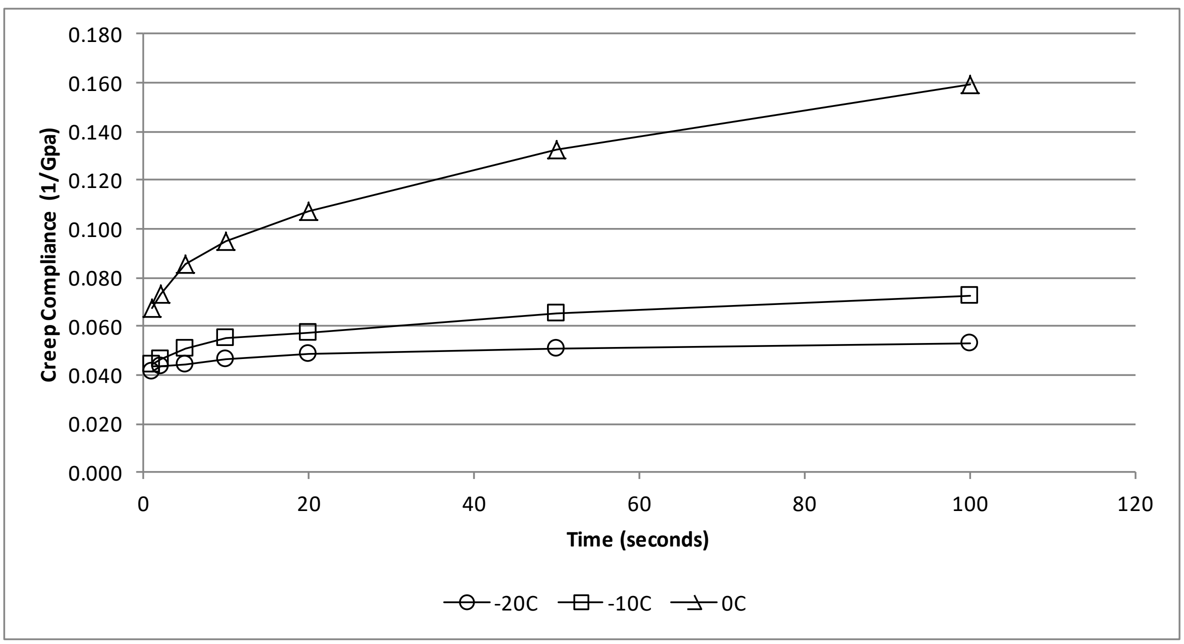
Lab ID	16CDCJB013
Mix Number	SP125 16-83
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.4
Air Voids Coeff. of Variation (%)	6.7

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.83510E-07	0.0411196	0.2065		
	2	2.98135E-07	0.0432408			
	5	3.06571E-07	0.0444643			
	10	3.22553E-07	0.0467823			
	20	3.36061E-07	0.0487416			
	50	3.49356E-07	0.0506698			
	100	3.67349E-07	0.0532794			
-10	1	3.05048E-07	0.0442435	0.3030	728	605
	2	3.20421E-07	0.0464731			
	5	3.50519E-07	0.0508384			
	10	3.80091E-07	0.0551275			
	20	3.96747E-07	0.0575433			
	50	4.49537E-07	0.0651999			
	100	4.98823E-07	0.0723481			
0	1	4.65324E-07	0.0674895	0.2692		
	2	5.03033E-07	0.0729587			
	5	5.89230E-07	0.0854606			
	10	6.54675E-07	0.0949525			
	20	7.40856E-07	0.1074520			
	50	9.11941E-07	0.1322658			
	100	1.09676E-06	0.1590718			

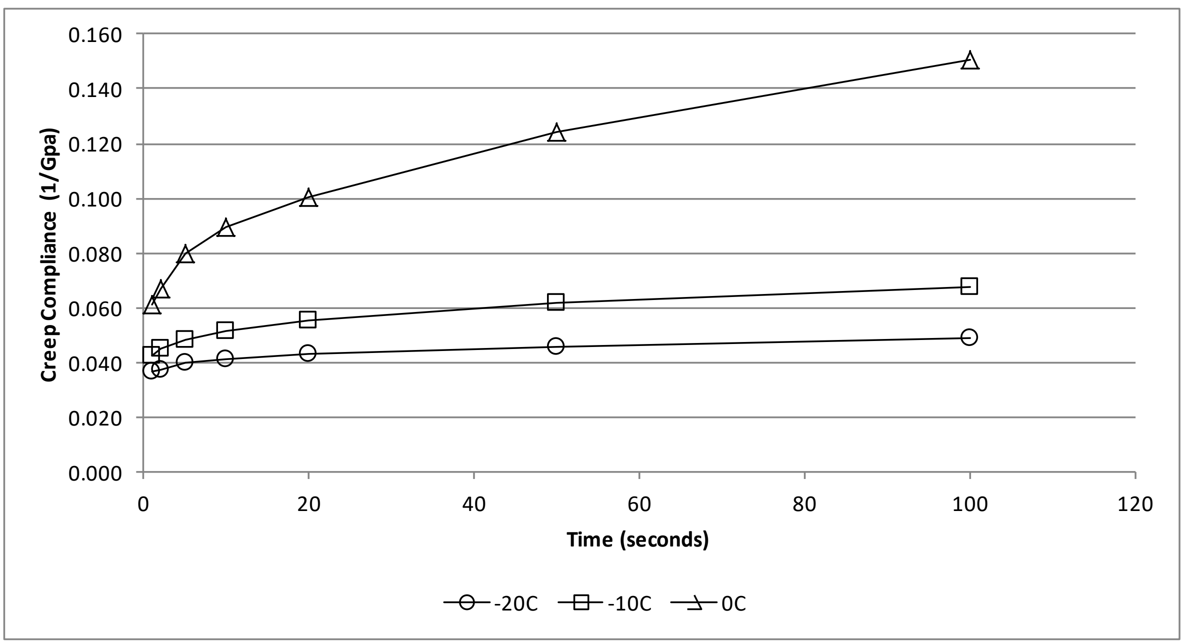


Lab ID	16CDCJB014
Mix Number	SP125 16-100
Average Air Voids* (%)	3.8
Air Voids Standard Deviation (%)	0.4
Air Voids Coeff. of Variation (%)	11.5

*Based on Gmb from T166 on Sawn Specimens
NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.55306E-07	0.0370290	0.2236		
	2	2.59048E-07	0.0375718			
	5	2.77292E-07	0.0402178			
	10	2.83446E-07	0.0411104			
	20	2.96159E-07	0.0429543			
	50	3.16551E-07	0.0459119			
	100	3.38233E-07	0.0490565			
-10	1	2.91673E-07	0.0423036	0.2705	776	643
	2	3.12881E-07	0.0453796			
	5	3.33391E-07	0.0483542			
	10	3.55285E-07	0.0515297			
	20	3.82942E-07	0.0555411			
	50	4.27688E-07	0.0620309			
	100	4.68493E-07	0.0679492			
0	1	4.23134E-07	0.0613703	0.2543		
	2	4.61250E-07	0.0668986			
	5	5.51899E-07	0.0800462			
	10	6.17399E-07	0.0895461			
	20	6.91862E-07	0.1003461			
	50	8.54703E-07	0.1239642			
	100	1.03859E-06	0.1506354			



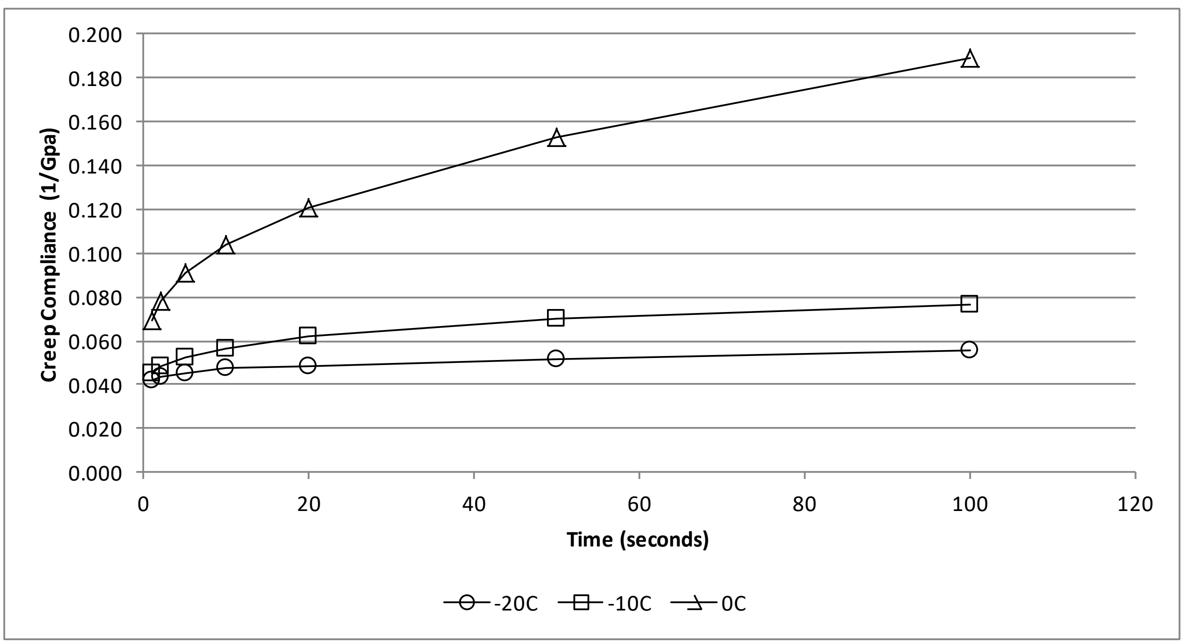
Lab ID	16CDCJB014
Mix Number	SP125 16-100
Average Air Voids* (%)	6.3
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	2.2

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

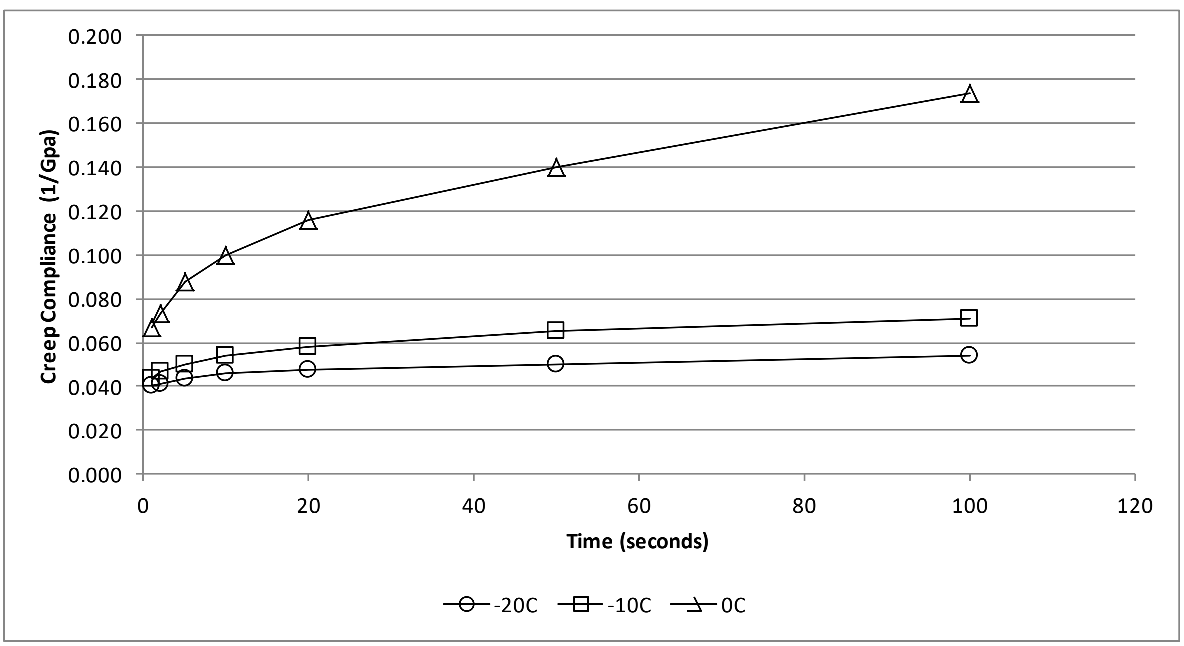
SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.87079E-07	0.0416373	0.2409		
	2	2.97848E-07	0.0431991			
	5	3.10914E-07	0.0450942			
	10	3.26639E-07	0.0473750			
	20	3.34594E-07	0.0485287			
	50	3.57719E-07	0.0518827			
	100	3.82783E-07	0.0555180			
-10	1	3.09898E-07	0.0449469	0.3073	670	561
	2	3.34058E-07	0.0484511			
	5	3.60934E-07	0.0523491			
	10	3.87524E-07	0.0562056			
	20	4.27422E-07	0.0619923			
	50	4.81706E-07	0.0698655			
	100	5.28042E-07	0.0765861			
0	1	4.77703E-07	0.0692850	0.3061		
	2	5.37004E-07	0.0778859			
	5	6.28663E-07	0.0911799			
	10	7.14276E-07	0.1035969			
	20	8.33046E-07	0.1208231			
	50	1.05328E-06	0.1527659			
	100	1.30062E-06	0.1886394			



Lab ID	16CDCJB015		SMA?	No
Mix Number	SP125 16-93		Contract Binder Gr.	NA
Average Air Voids* (%)	3.8		Inline Binder Grade	PG64-22H
Air Voids Standard Deviation (%)	0.2		RAP (%)	25.0
Air Voids Coeff. of Variation (%)	6.4		RAS (%)	0.0
*Based on Gmb from T166 on Sawn Specimens			Binder Additives?	Yes
NA = Not Available			GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.77162E-07	0.0401990	0.1651		
	2	2.85151E-07	0.0413577			
	5	3.00957E-07	0.0436502			
	10	3.15007E-07	0.0456879			
	20	3.27300E-07	0.0474708			
	50	3.44853E-07	0.0500167			
	100	3.74439E-07	0.0543077			
-10	1	3.01133E-07	0.0436756	0.2674	739	614
	2	3.21544E-07	0.0466360			
	5	3.46147E-07	0.0502044			
	10	3.71636E-07	0.0539013			
	20	4.00317E-07	0.0580611			
	50	4.48436E-07	0.0650401			
	100	4.91216E-07	0.0712449			
0	1	4.60367E-07	0.0667705	0.2169		
	2	5.07741E-07	0.0736415			
	5	6.02277E-07	0.0873529			
	10	6.86177E-07	0.0995216			
	20	8.00993E-07	0.1161742			
	50	9.66494E-07	0.1401782			
	100	1.19779E-06	0.1737254			



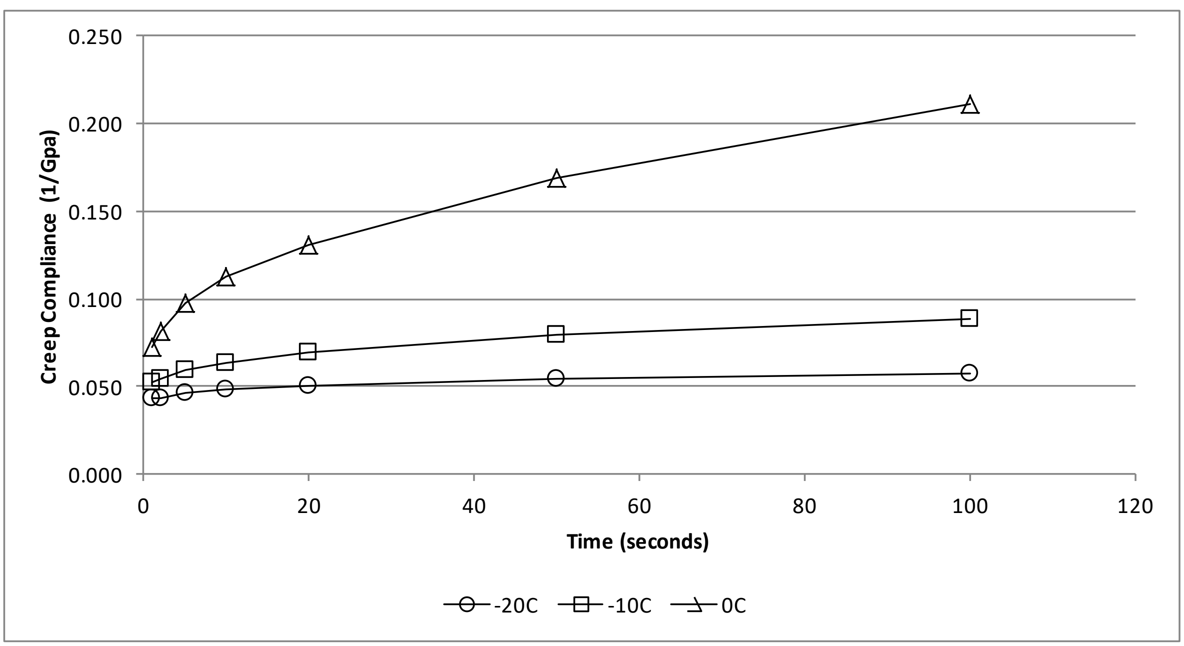
Lab ID	16CDCJB015
Mix Number	SP125 16-93
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	4.4

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	25.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.95976E-07	0.0429277	0.2279		
	2	3.01281E-07	0.0436971			
	5	3.20562E-07	0.0464936			
	10	3.34631E-07	0.0485341			
	20	3.44901E-07	0.0500237			
	50	3.75187E-07	0.0544163			
	100	3.95095E-07	0.0573036			
-10	1	3.60276E-07	0.0522536	0.2508	589	497
	2	3.76294E-07	0.0545769			
	5	4.09218E-07	0.0593520			
	10	4.36428E-07	0.0632985			
	20	4.76573E-07	0.0691211			
	50	5.45342E-07	0.0790951			
	100	6.10624E-07	0.0885635			
0	1	5.03305E-07	0.0729982	0.2990		
	2	5.64130E-07	0.0818201			
	5	6.75336E-07	0.0979492			
	10	7.75324E-07	0.1124513			
	20	8.98864E-07	0.1303692			
	50	1.16458E-06	0.1689086			
	100	1.45777E-06	0.2114319			



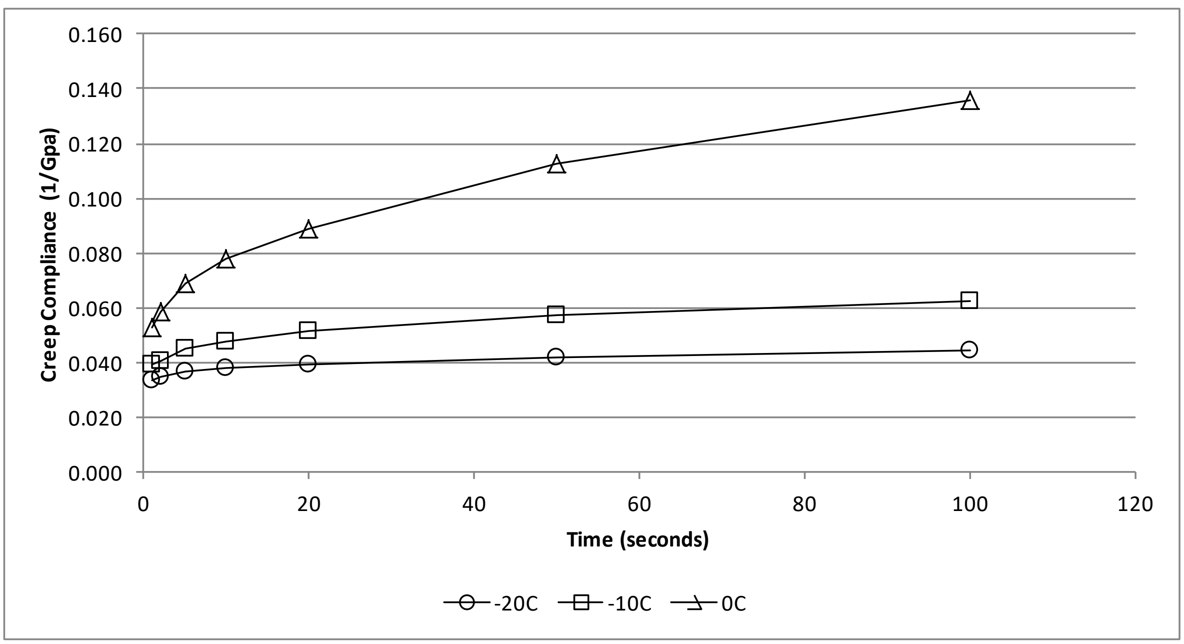
Lab ID	16CDCJB016
Mix Number	SP125 16-84
Average Air Voids* (%)	3.7
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	3.4

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.33138E-07	0.0338138	0.2244		
	2	2.40658E-07	0.0349045			
	5	2.52604E-07	0.0366372			
	10	2.62081E-07	0.0380116			
	20	2.70145E-07	0.0391813			
	50	2.88774E-07	0.0418831			
	100	3.07034E-07	0.0445315			
-10	1	2.71443E-07	0.0393694	0.2661	906	745
	2	2.80729E-07	0.0407163			
	5	3.13046E-07	0.0454035			
	10	3.30944E-07	0.0479994			
	20	3.54916E-07	0.0514762			
	50	3.94846E-07	0.0572676			
	100	4.29528E-07	0.0622978			
0	1	3.62972E-07	0.0526447	0.3087		
	2	4.02590E-07	0.0583908			
	5	4.73409E-07	0.0686621			
	10	5.38924E-07	0.0781643			
	20	6.10908E-07	0.0886047			
	50	7.74864E-07	0.1123845			
	100	9.36442E-07	0.1358194			

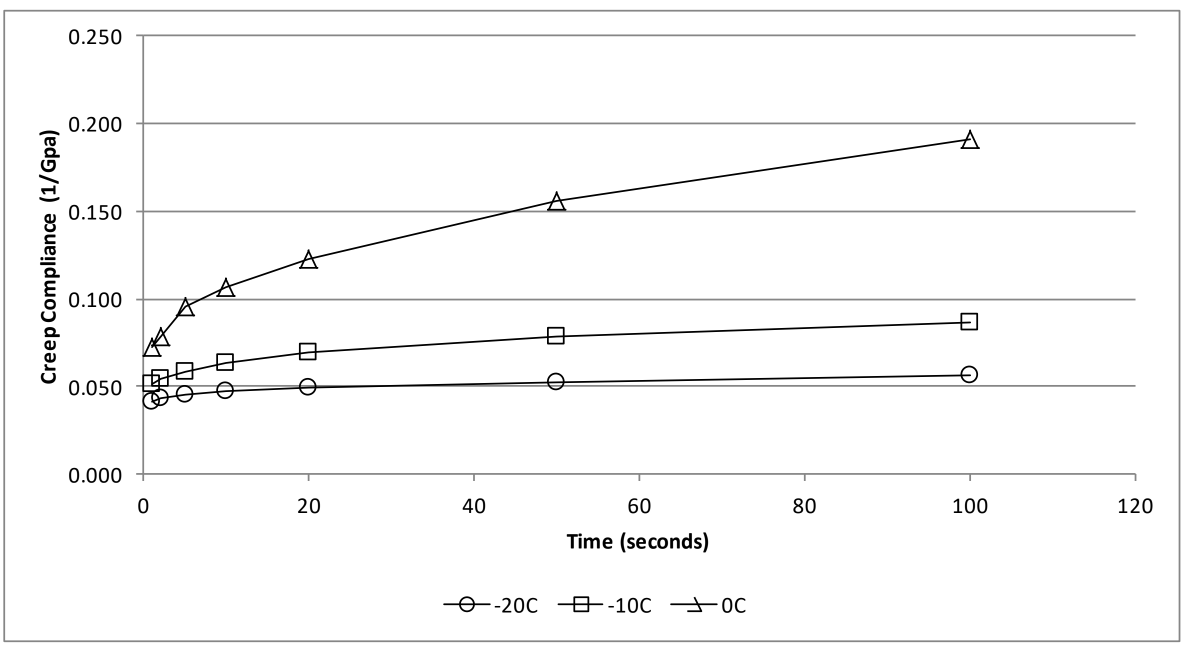


Lab ID	16CDCJB016
Mix Number	SP125 16-84
Average Air Voids* (%)	6.2
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.8

*Based on Gmb from T166 on Sawn Specimens
NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	0.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.84968E-07	0.0413311	0.1508		
	2	2.97893E-07	0.0432058			
	5	3.13336E-07	0.0454455			
	10	3.26030E-07	0.0472867			
	20	3.39729E-07	0.0492735			
	50	3.60778E-07	0.0523264			
	100	3.88558E-07	0.0563556			
-10	1	3.52894E-07	0.0511829	0.1756	739	614
	2	3.78337E-07	0.0548732			
	5	4.01838E-07	0.0582817			
	10	4.39324E-07	0.0637185			
	20	4.80307E-07	0.0696626			
	50	5.40544E-07	0.0783993			
	100	5.95936E-07	0.0864332			
0	1	5.01742E-07	0.0727715	0.2105		
	2	5.44913E-07	0.0790329			
	5	6.60599E-07	0.0958117			
	10	7.38953E-07	0.1071760			
	20	8.48218E-07	0.1230236			
	50	1.07767E-06	0.1563023			
	100	1.31794E-06	0.1911504			



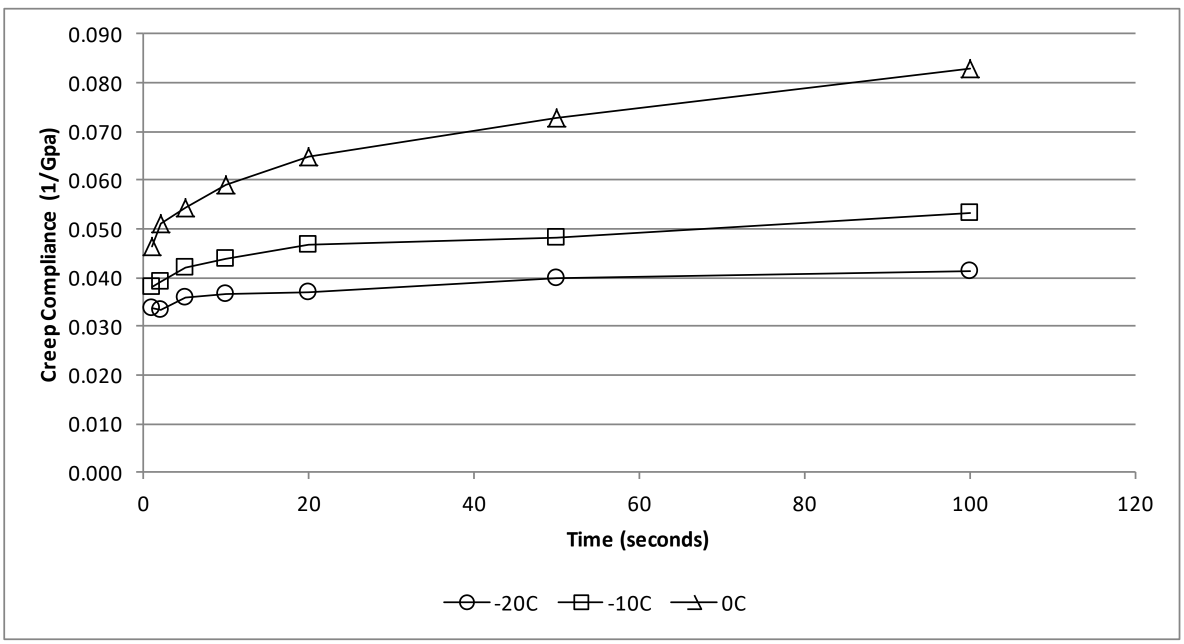
Lab ID	16CDCJB017
Mix Number	SP125 16-99
Average Air Voids* (%)	3.9
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	5.2

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	34.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.32632E-07	0.0337404	0.2185		
	2	2.29782E-07	0.0333271			
	5	2.48317E-07	0.0360154			
	10	2.52685E-07	0.0366489			
	20	2.53596E-07	0.0367809			
	50	2.74092E-07	0.0397537			
	100	2.83576E-07	0.0411292			
-10	1	2.63465E-07	0.0382124	0.2482	871	718
	2	2.70377E-07	0.0392148			
	5	2.90240E-07	0.0420957			
	10	3.01856E-07	0.0437804			
	20	3.21608E-07	0.0466453			
	50	3.33287E-07	0.0483392			
	100	3.66480E-07	0.0531534			
0	1	3.18603E-07	0.0462095	0.2819		
	2	3.51613E-07	0.0509971			
	5	3.75550E-07	0.0544689			
	10	4.08086E-07	0.0591878			
	20	4.47978E-07	0.0649738			
	50	5.01185E-07	0.0726907			
	100	5.70877E-07	0.0827987			



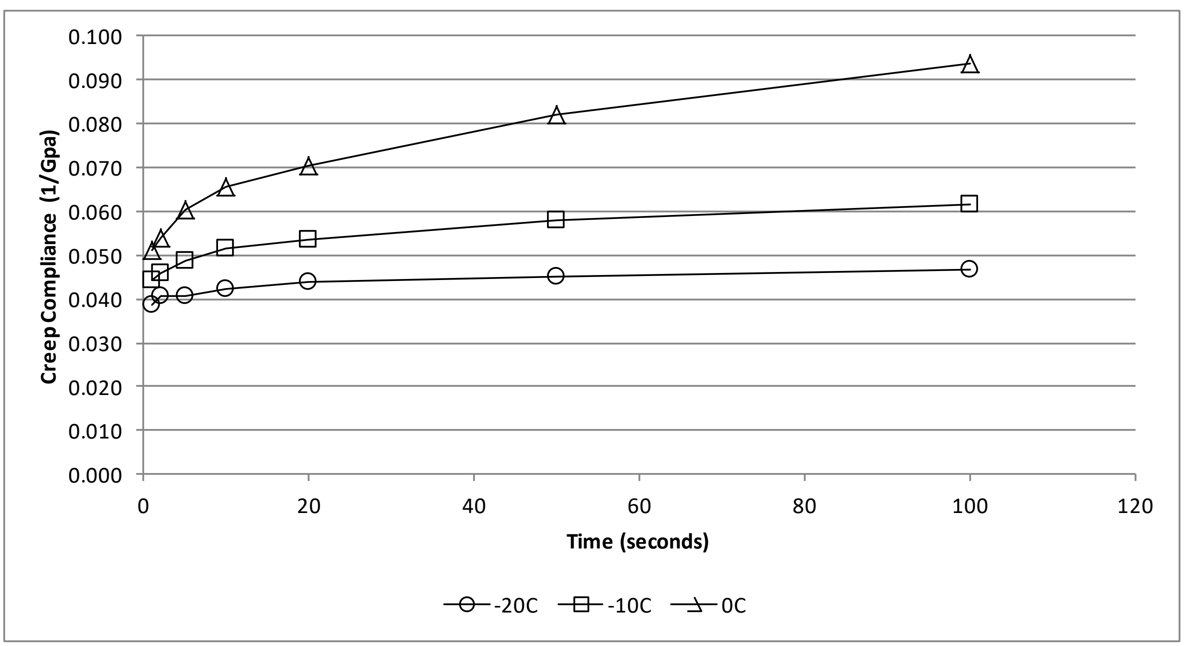
Lab ID	16CDCJB017
Mix Number	SP125 16-99
Average Air Voids* (%)	6.3
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	5.5

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG64-22H
RAP (%)	34.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.66020E-07	0.0385830	0.2016		
	2	2.80232E-07	0.0406442			
	5	2.80448E-07	0.0406755			
	10	2.90165E-07	0.0420849			
	20	3.01507E-07	0.0437299			
	50	3.11650E-07	0.0452010			
	100	3.22580E-07	0.0467862			
-10	1	3.04460E-07	0.0441581	0.2387	708	590
	2	3.15313E-07	0.0457323			
	5	3.35858E-07	0.0487120			
	10	3.56152E-07	0.0516554			
	20	3.67991E-07	0.0533725			
	50	4.00558E-07	0.0580961			
	100	4.25612E-07	0.0617299			
0	1	3.52414E-07	0.0511133	0.3321		
	2	3.72996E-07	0.0540985			
	5	4.16472E-07	0.0604041			
	10	4.52074E-07	0.0655678			
	20	4.84241E-07	0.0702333			
	50	5.65580E-07	0.0820304			
	100	6.46072E-07	0.0937048			



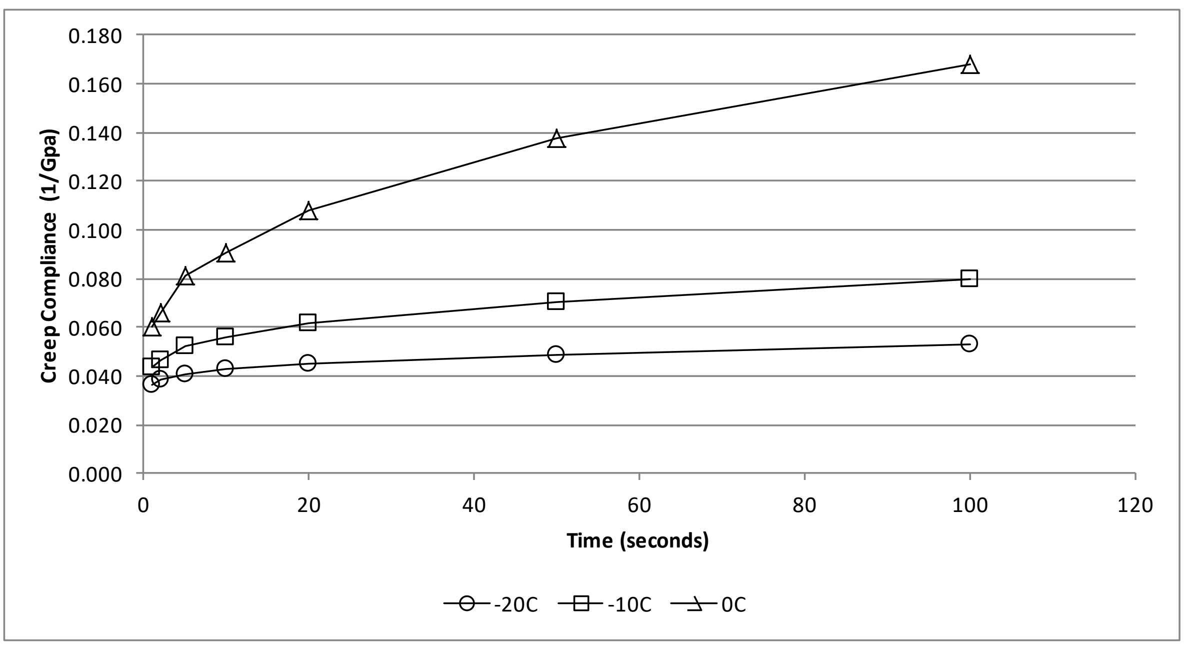
Lab ID	16CDCJB018
Mix Number	SP125 16-91
Average Air Voids* (%)	3.9
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	5.5

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG58-28
RAP (%)	0.0
RAS (%)	3.5
Binder Additives?	Yes
GTR (%wtAC)	0.0

	Creep Compliance			Estimated	Indirect Tensile Strength	
Temp	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.51531E-07	0.0364815	0.2556		
	2	2.65634E-07	0.0385270			
	5	2.82113E-07	0.0409170			
	10	2.95380E-07	0.0428412			
	20	3.12243E-07	0.0452870			
	50	3.36310E-07	0.0487776			
	100	3.64922E-07	0.0529275			
-10	1	3.00429E-07	0.0435736	0.3381	689	575
	2	3.18103E-07	0.0461370			
	5	3.59430E-07	0.0521309			
	10	3.87103E-07	0.0561446			
	20	4.25586E-07	0.0617260			
	50	4.86812E-07	0.0706061			
	100	5.51379E-07	0.0799707			
0	1	4.14446E-07	0.0601103	0.4159		
	2	4.56329E-07	0.0661849			
	5	5.57146E-07	0.0808071			
	10	6.23739E-07	0.0904657			
	20	7.45636E-07	0.1081454			
	50	9.50134E-07	0.1378053			
	100	1.15641E-06	0.1677237			



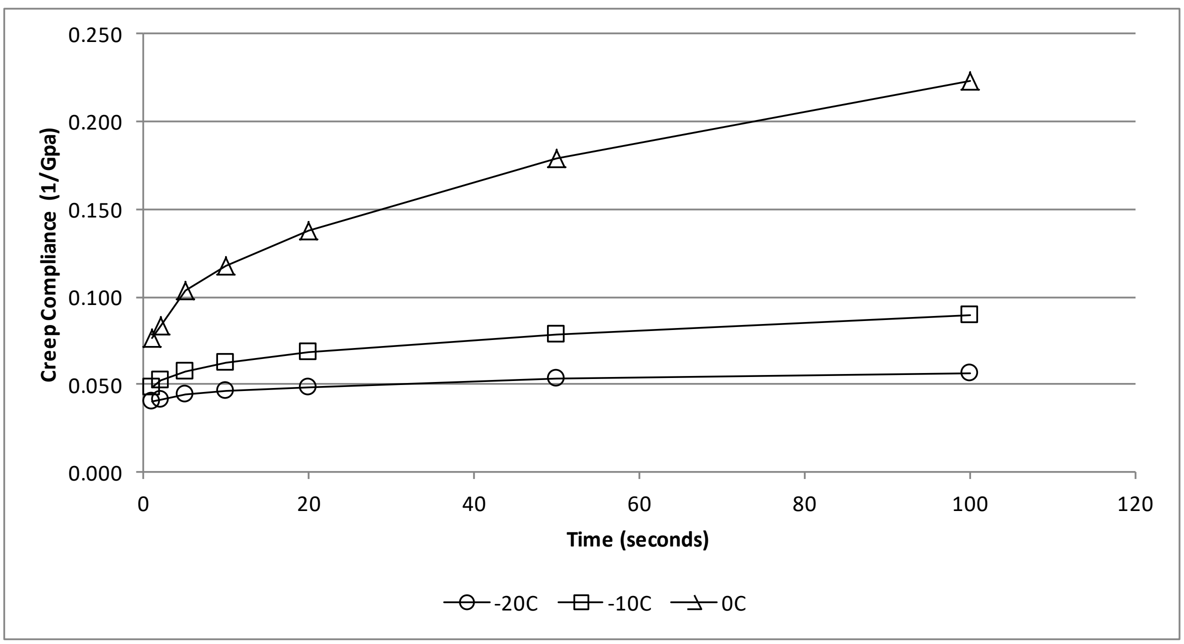
Lab ID	16CDCJB018
Mix Number	SP125 16-91
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.5

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG58-28
RAP (%)	0.0
RAS (%)	3.5
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	NCHRP 530 Correction (psi)
-20	1	2.77359E-07	0.0402276	0.2660		
	2	2.87460E-07	0.0416925			
	5	3.05312E-07	0.0442818			
	10	3.22132E-07	0.0467213			
	20	3.34415E-07	0.0485028			
	50	3.66889E-07	0.0532128			
	100	3.88006E-07	0.0562755			
-10	1	3.34586E-07	0.0485276	0.3015	591	499
	2	3.63673E-07	0.0527463			
	5	3.98262E-07	0.0577630			
	10	4.33074E-07	0.0628121			
	20	4.74628E-07	0.0688389			
	50	5.43855E-07	0.0788795			
	100	6.20996E-07	0.0900678			
0	1	5.26408E-07	0.0763490	0.3094		
	2	5.76808E-07	0.0836589			
	5	7.17068E-07	0.1040019			
	10	8.10207E-07	0.1175105			
	20	9.48129E-07	0.1375145			
	50	1.23439E-06	0.1790328			
	100	1.53744E-06	0.2229865			



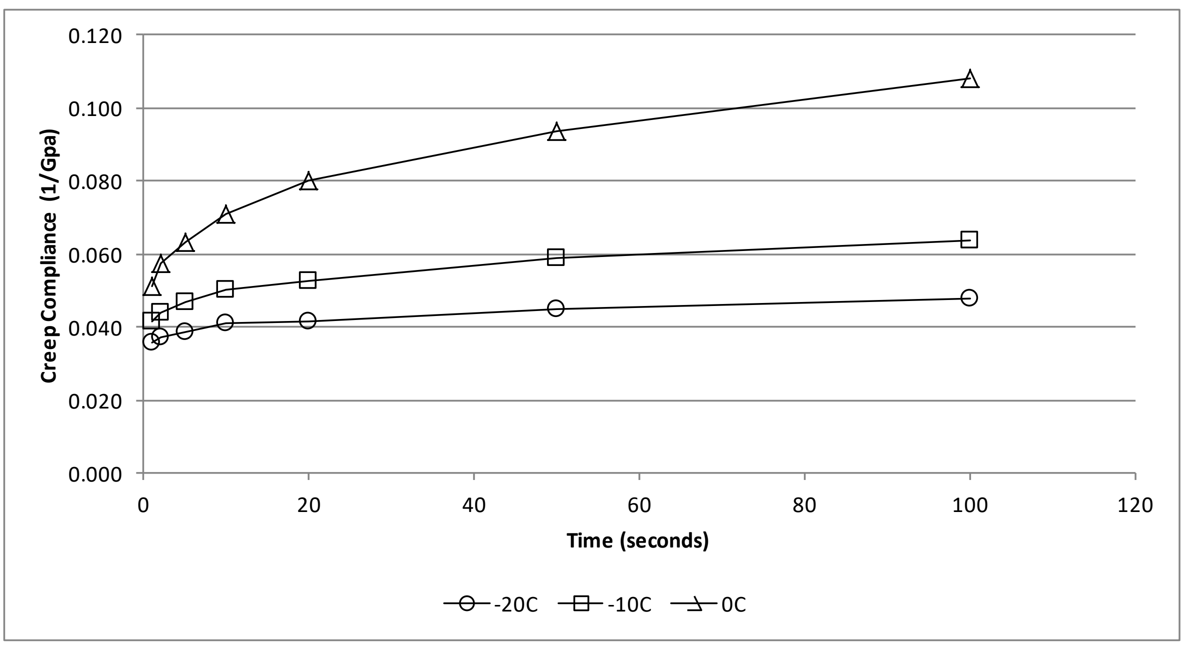
Lab ID	16CDCJB019
Mix Number	SP125 16-89
Average Air Voids* (%)	4.0
Air Voids Standard Deviation (%)	0.2
Air Voids Coeff. of Variation (%)	4.9

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG58-28
RAP (%)	19.0
RAS (%)	3.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.46795E-07	0.0357945	0.2181		
	2	2.56371E-07	0.0371835			
	5	2.67768E-07	0.0388365			
	10	2.84493E-07	0.0412622			
	20	2.87892E-07	0.0417552			
	50	3.09530E-07	0.0448935			
	100	3.29266E-07	0.0477560			
-10	1	2.85561E-07	0.0414171	0.2788	702	585
	2	3.03860E-07	0.0440711			
	5	3.24487E-07	0.0470628			
	10	3.46472E-07	0.0502515			
	20	3.61926E-07	0.0524930			
	50	4.07187E-07	0.0590575			
	100	4.39094E-07	0.0636852			
0	1	3.51668E-07	0.0510051	0.3421		
	2	3.96675E-07	0.0575328			
	5	4.35357E-07	0.0631432			
	10	4.87968E-07	0.0707738			
	20	5.52027E-07	0.0800648			
	50	6.46013E-07	0.0936963			
	100	7.46426E-07	0.1082599			

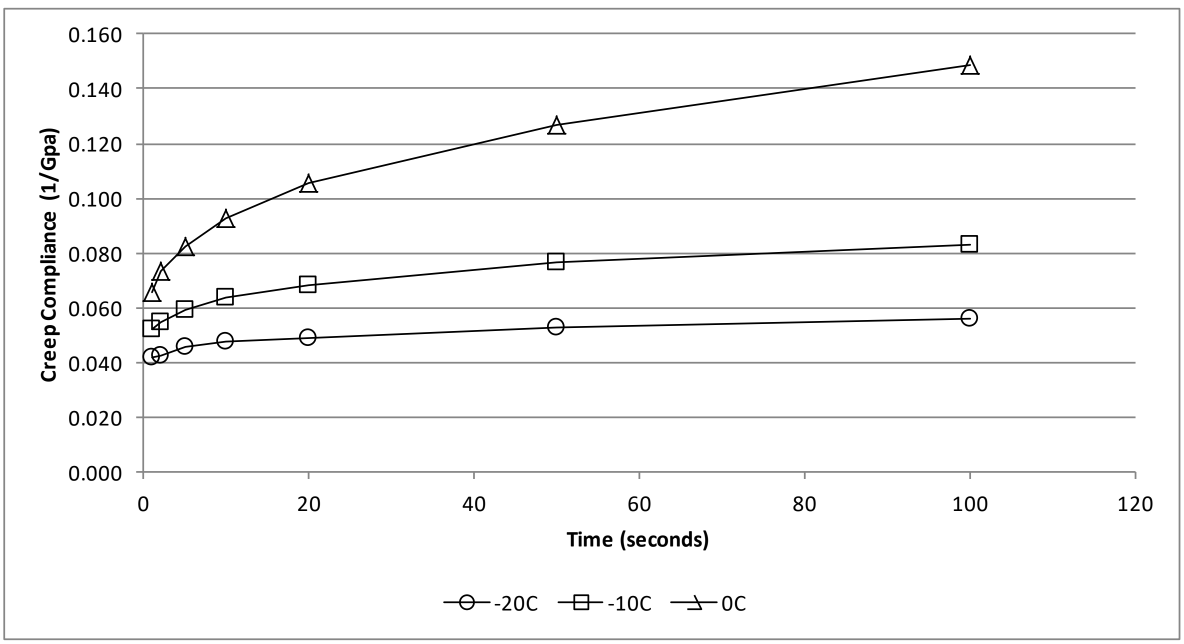


Lab ID	16CDCJB019
Mix Number	SP125 16-89
Average Air Voids* (%)	6.5
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.1

*Based on Gmb from T166 on Sawn Specimens
NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG58-28
RAP (%)	19.0
RAS (%)	3.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp (deg C)	Creep Compliance Time (sec)	Creep Compliance D(t) (1/psi)	Creep Compliance D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	Indirect Tensile Strength NCHRP 530 Correction (psi)
-20	1	2.89203E-07	0.0419453	0.2122		
	2	2.93485E-07	0.0425664			
	5	3.16669E-07	0.0459289			
	10	3.28315E-07	0.0476180			
	20	3.38969E-07	0.0491633			
	50	3.64137E-07	0.0528135			
	100	3.84655E-07	0.0557895			
-10	1	3.59137E-07	0.0520885	0.2209	620	521
	2	3.78718E-07	0.0549283			
	5	4.09529E-07	0.0593971			
	10	4.41849E-07	0.0640848			
	20	4.72125E-07	0.0684759			
	50	5.28050E-07	0.0765872			
	100	5.74860E-07	0.0833764			
0	1	4.52138E-07	0.0655771	0.3195		
	2	5.05841E-07	0.0733661			
	5	5.66369E-07	0.0821449			
	10	6.37909E-07	0.0925209			
	20	7.26437E-07	0.1053608			
	50	8.75224E-07	0.1269406			
	100	1.02674E-06	0.1489159			



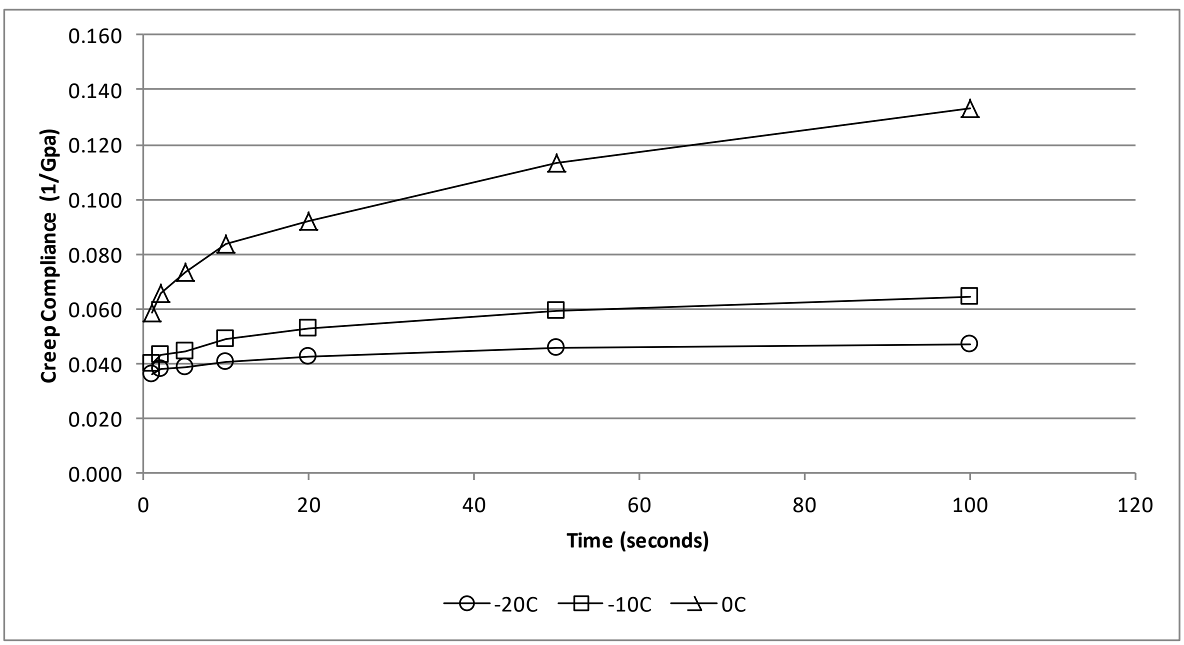
Lab ID	16CDCJB020
Mix Number	SP125 16-98
Average Air Voids* (%)	4.1
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	3.5

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG58-28
RAP (%)	36.0
RAS (%)	0.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

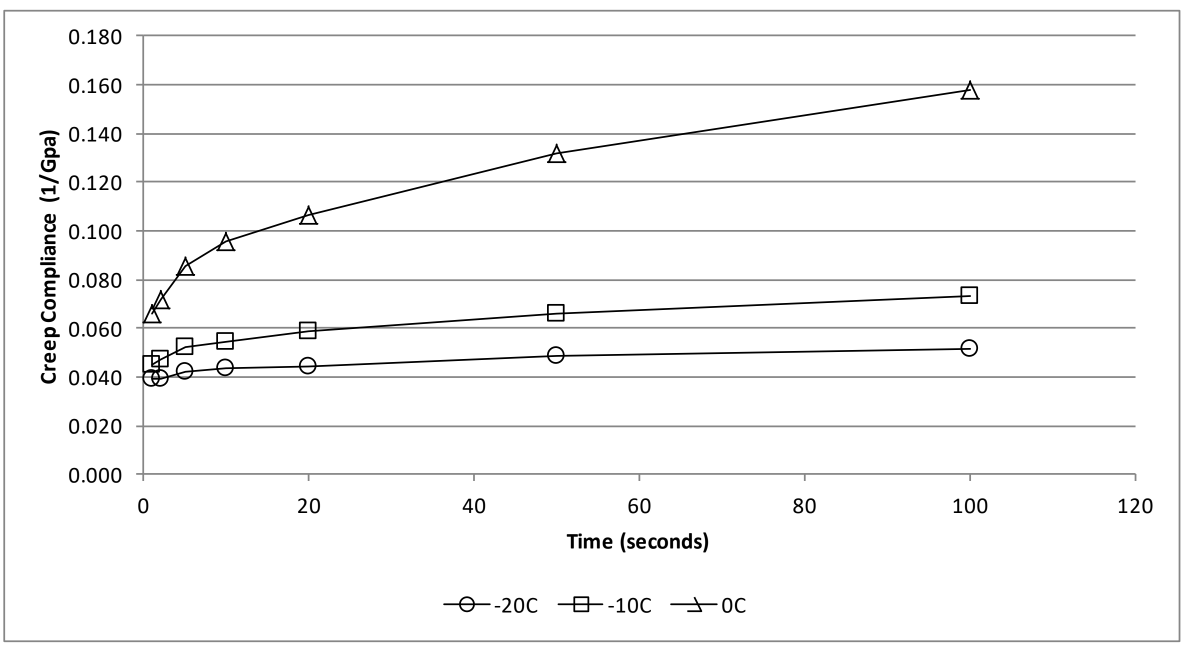
Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.47653E-07	0.0359190	0.2276		
	2	2.62177E-07	0.0380255			
	5	2.67728E-07	0.0388306			
	10	2.79616E-07	0.0405549			
	20	2.95257E-07	0.0428234			
	50	3.15489E-07	0.0457579			
	100	3.23212E-07	0.0468779			
-10	1	2.74349E-07	0.0397910	0.3038	789	654
	2	2.95703E-07	0.0428881			
	5	3.08666E-07	0.0447682			
	10	3.36839E-07	0.0488543			
	20	3.66572E-07	0.0531668			
	50	4.07939E-07	0.0591665			
	100	4.42775E-07	0.0642191			
0	1	4.05678E-07	0.0588386	0.3268		
	2	4.52741E-07	0.0656645			
	5	5.07557E-07	0.0736150			
	10	5.77133E-07	0.0837061			
	20	6.34299E-07	0.0919974			
	50	7.80661E-07	0.1132253			
	100	9.19786E-07	0.1334037			



Lab ID	16CDCJB020		SMA?	No
Mix Number	SP125 16-98		Contract Binder Gr.	NA
Average Air Voids* (%)	6.5		Inline Binder Grade	PG58-28
Air Voids Standard Deviation (%)	0.3		RAP (%)	36.0
Air Voids Coeff. of Variation (%)	4.3		RAS (%)	0.0
			Binder Additives?	Yes
			GTR (%wtAC)	0.0

*Based on Gmb from T166 on Sawn Specimens
NA = Not Available

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.70819E-07	0.0392790	0.2085		
	2	2.71859E-07	0.0394297			
	5	2.92110E-07	0.0423669			
	10	2.98648E-07	0.0433153			
	20	3.07239E-07	0.0445612			
	50	3.33167E-07	0.0483219			
	100	3.56869E-07	0.0517595			
-10	1	3.11942E-07	0.0452433	0.2844	716	597
	2	3.25010E-07	0.0471387			
	5	3.58444E-07	0.0519879			
	10	3.77331E-07	0.0547272			
	20	4.04787E-07	0.0587094			
	50	4.55881E-07	0.0661200			
	100	5.03454E-07	0.0730199			
0	1	4.57190E-07	0.0663098	0.2537		
	2	4.96729E-07	0.0720445			
	5	5.87647E-07	0.0852310			
	10	6.58143E-07	0.0954555			
	20	7.35808E-07	0.1067200			
	50	9.10697E-07	0.1320854			
	100	1.08879E-06	0.1579150			

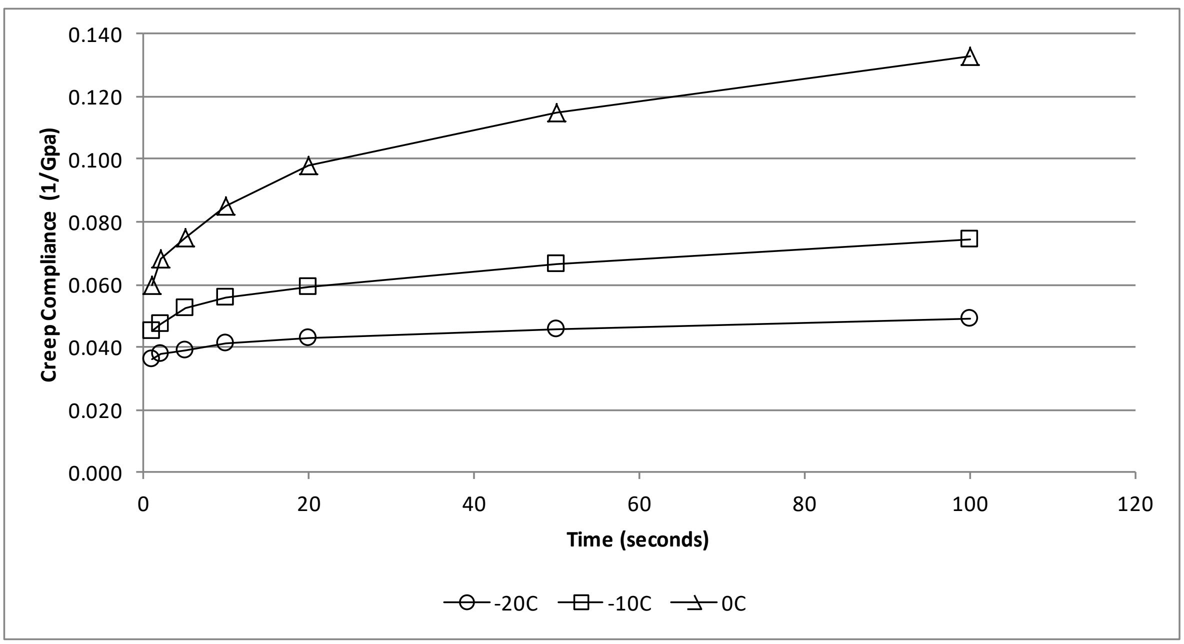


Lab ID	16CDCJB021
Mix Number	SP125 16-95
Average Air Voids* (%)	4.1
Air Voids Standard Deviation (%)	0.3
Air Voids Coeff. of Variation (%)	6.6

*Based on Gmb from T166 on Sawn Specimens
NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG46-34
RAP (%)	17.0
RAS (%)	6.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.49693E-07	0.0362149	0.2974		
	2	2.61108E-07	0.0378705			
	5	2.69695E-07	0.0391159			
	10	2.82924E-07	0.0410347			
	20	2.93931E-07	0.0426311			
	50	3.16464E-07	0.0458992			
	100	3.36848E-07	0.0488556			
-10	1	3.11477E-07	0.0451760	0.3104	692	577
	2	3.24756E-07	0.0471018			
	5	3.62575E-07	0.0525871			
	10	3.84241E-07	0.0557294			
	20	4.08677E-07	0.0592736			
	50	4.58334E-07	0.0664757			
	100	5.13319E-07	0.0744506			
0	1	4.13172E-07	0.0599255	0.3470		
	2	4.71837E-07	0.0684342			
	5	5.15803E-07	0.0748109			
	10	5.87183E-07	0.0851636			
	20	6.74225E-07	0.0977881			
	50	7.93340E-07	0.1150643			
	100	9.17381E-07	0.1330549			



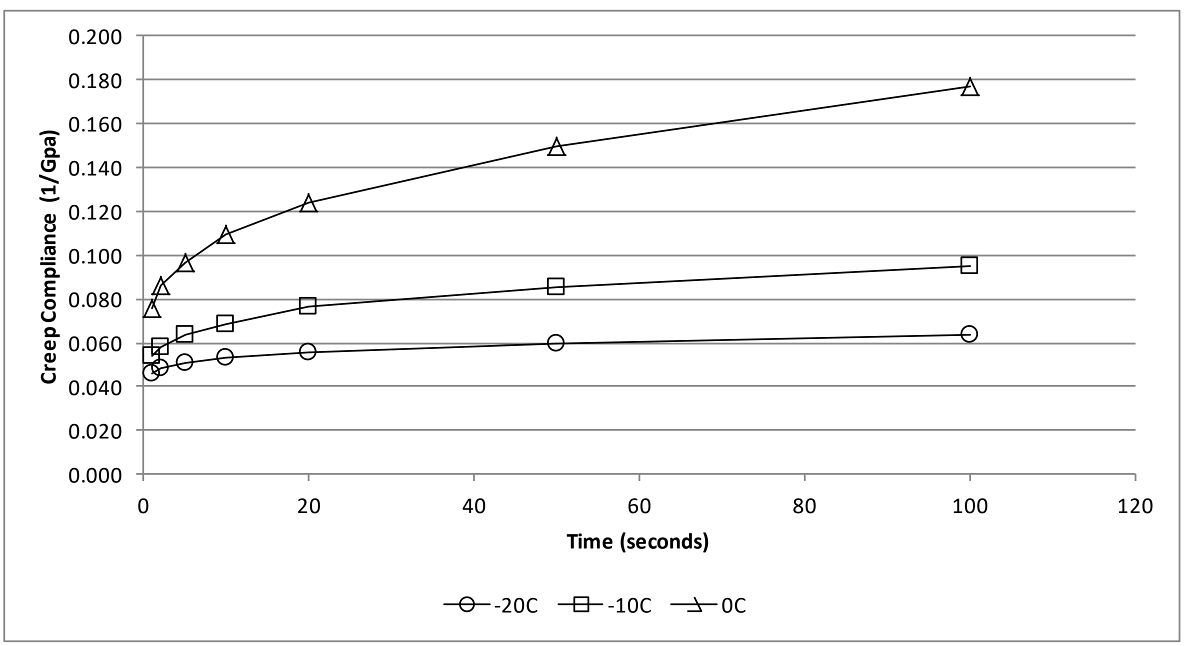
Lab ID	16CDCJB021
Mix Number	SP125 16-95
Average Air Voids* (%)	6.4
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	1.8

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG46-34
RAP (%)	17.0
RAS (%)	6.0
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	3.18290E-07	0.0461641	0.2477		
	2	3.31490E-07	0.0480785			
	5	3.50912E-07	0.0508955			
	10	3.64999E-07	0.0529386			
	20	3.83556E-07	0.0556301			
	50	4.09255E-07	0.0593574			
	100	4.36132E-07	0.0632557			
-10	1	3.73267E-07	0.0541379	0.2834	582	492
	2	3.99984E-07	0.0580128			
	5	4.39433E-07	0.0637344			
	10	4.73124E-07	0.0686208			
	20	5.25607E-07	0.0762328			
	50	5.89583E-07	0.0855118			
	100	6.54371E-07	0.0949085			
0	1	5.21991E-07	0.0757084	0.3159		
	2	5.91395E-07	0.0857746			
	5	6.64861E-07	0.0964300			
	10	7.52251E-07	0.1091048			
	20	8.54658E-07	0.1239577			
	50	1.03437E-06	0.1500231			
	100	1.22105E-06	0.1770984			



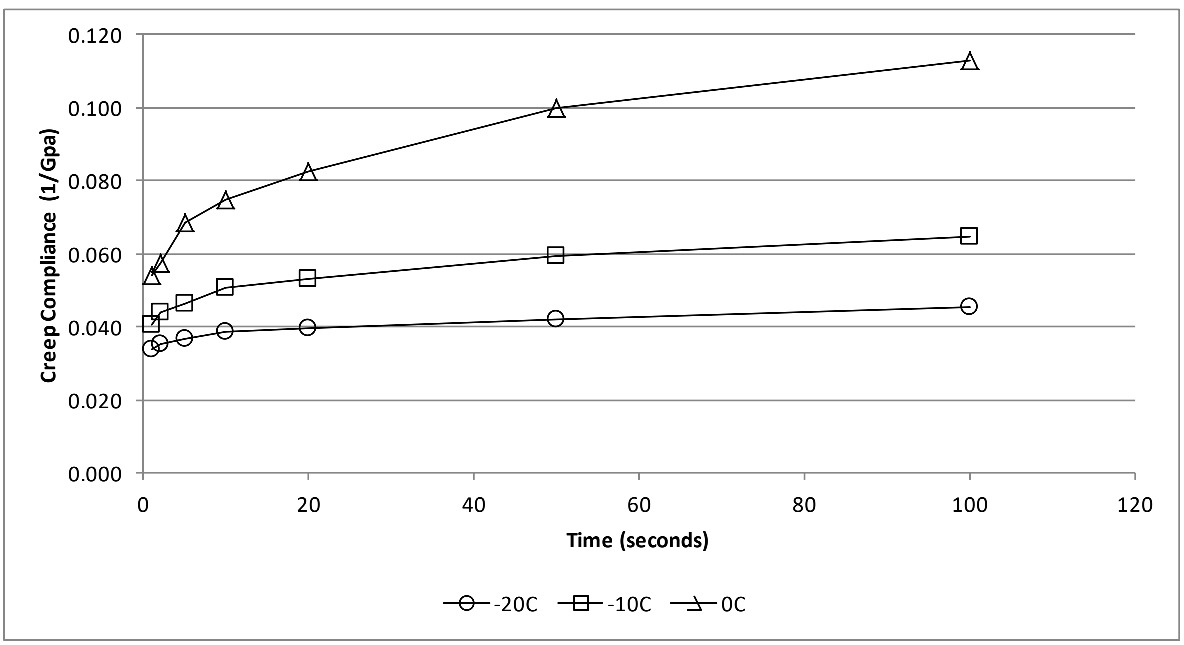
Lab ID	16CDCJB022
Mix Number	SP125 16-94
Average Air Voids* (%)	4.0
Air Voids Standard Deviation (%)	0.1
Air Voids Coeff. of Variation (%)	3.5

*Based on Gmb from T166 on Sawn Specimens

NA = Not Available

SMA?	No
Contract Binder Gr.	NA
Inline Binder Grade	PG58-28
RAP (%)	0.0
RAS (%)	6.5
Binder Additives?	Yes
GTR (%wtAC)	0.0

Temp	Creep Compliance			Estimated	Indirect Tensile Strength	
	Time	D(t)	D(t)	Poisson's Ratio	Based on Max Load	NCHRP 530 Correction
(deg C)	(sec)	(1/psi)	(1/GPa)		(psi)	(psi)
-20	1	2.33883E-07	0.0339218	0.2236		
	2	2.44235E-07	0.0354232			
	5	2.54435E-07	0.0369026			
	10	2.67410E-07	0.0387846			
	20	2.74499E-07	0.0398126			
	50	2.91027E-07	0.0422099			
	100	3.12096E-07	0.0452657			
-10	1	2.81330E-07	0.0408035	0.2558	943	774
	2	3.03229E-07	0.0439797			
	5	3.21442E-07	0.0466213			
	10	3.48256E-07	0.0505103			
	20	3.67300E-07	0.0532724			
	50	4.09496E-07	0.0593924			
	100	4.47667E-07	0.0649286			
0	1	3.73098E-07	0.0541132	0.2734		
	2	3.97633E-07	0.0576719			
	5	4.72923E-07	0.0685917			
	10	5.15252E-07	0.0747310			
	20	5.69396E-07	0.0825838			
	50	6.88307E-07	0.0998304			
	100	7.79828E-07	0.1131044			



Lab ID	16CDCJB022		SMA?	No
Mix Number	SP125 16-94		Contract Binder Gr.	NA
Average Air Voids* (%)	6.4		Inline Binder Grade	PG58-28
Air Voids Standard Deviation (%)	0.2		RAP (%)	0.0
Air Voids Coeff. of Variation (%)	3.7		RAS (%)	6.5
*Based on Gmb from T166 on Sawn Specimens			Binder Additives?	Yes
NA = Not Available			GTR (%wtAC)	0.0

Temp (deg C)	Creep Compliance Time (sec)	D(t) (1/psi)	D(t) (1/GPa)	Estimated Poisson's Ratio	Indirect Tensile Strength Based on Max Load (psi)	NCHRP 530 Correction (psi)
-20	1	2.83213E-07	0.0410766	0.2625		
	2	2.94030E-07	0.0426455			
	5	3.10939E-07	0.0450979			
	10	3.21193E-07	0.0465851			
	20	3.36295E-07	0.0487754			
	50	3.63066E-07	0.0526583			
	100	3.89055E-07	0.0564276			
-10	1	3.45068E-07	0.0500479	0.2875	603	509
	2	3.61097E-07	0.0523726			
	5	3.93743E-07	0.0571076			
	10	4.20503E-07	0.0609888			
	20	4.48868E-07	0.0651028			
	50	5.04945E-07	0.0732360			
	100	5.53116E-07	0.0802226			
0	1	4.80020E-07	0.0696210	0.3067		
	2	5.11619E-07	0.0742040			
	5	6.00671E-07	0.0871200			
	10	6.55545E-07	0.0950788			
	20	7.44310E-07	0.1079530			
	50	8.68137E-07	0.1259126			
	100	1.01552E-06	0.1472886