AASHTO

Garrett T. Eucalitto, *President*
Commissioner, Connecticut Department of Transportation
Jim Tymon, *Executive Director*

January 2025 ERRATA for *Standard Specifications for Transportation Materials and Methods of Sampling and Testing and Provisional Standards,* 44th Edition (HM-44)

January 2025

Dear Customer:

AASHTO has issued a second erratum, which includes technical and other revisions, for the *Standard Specifications for Transportation Materials and Methods of Sampling and Testing and AASHTO Provisional Standards,* 44th Edition (HM-44).

The new changes in this erratum are detailed in the table under the "January 2025" heading and are underlined on the pages within the text. Pages with the new changes have a gray box in the page header reading as follows:

January 2025 Errata

The previous changes are detailed in the table under the "September 2024" heading and are displayed in **bold** on the pages within the text. Due to the extensiveness of the new changes, pages with the previous changes are affected; these pages have a gray box in the page header reading as follows:

September 2024 Errata

Please feel free to download additional copies of this listing from the AASHTO online Store as follows:

1. Follow this link to the item page: https://store.transportation.org/Item/CollectionDetail?ID=265
2. Scroll down to "Preview:" and click on "January 2025 Errata."

AASHTO staff sincerely apologizes for any inconvenience.

Original Page	Section	Existing Text	Corrected Text
January 2025			
R 9-16	Figure 6	Greek symbols are incorrectly displayed as “S”.	Greek symbols are correctly displayed as “σ”.
T 322-8	Equation 1	The variable “D_{avg}” is incorrect.	The correct variable is “b_{avg}”.
T 322-8 through T 322-10	Equations 2 through 7 and 9 through 14	Equation numbering is incorrect.	Equation numbering is corrected.
September 2024			
lxx	Part 1 Front Matter	In Specifications, Practices, and Test Methods History, T 27 and T 30 are incorrectly listed as discontinued.	In Specifications, Practices, and Test Methods History, T 27 and T 30 are correctly listed as active.
lxix	Part 2 Front Matter		
T 283-9	T 283	In Section 12.1, tensile strength Equations 5 and 6 are missing “π” in the denominator.	Equations should read as follows: $S_t = \frac{2000P}{\pi t D}$ (5) $S_t = \frac{2P}{\pi t D}$ (6)
N/A	HM-44 Part 1 file	The original Part 1 file, available July 31 through September 24, 2024, omitted R 120.	The replacement Part 1 file includes R 120.

T 24M/T 24	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	2007	Active			
T 25	Method of Test for Absorption of Concrete	Test for Absorption of Concrete	1924	Discontinued	1947		
T 26	Quality of Water to be Used in Concrete	Quality of Water to be Used in Concrete	1924	Discontinued	2014	Lack of use	
T 27	Sieve Analysis of Aggregates for Concrete	Sieve Analysis of Fine and Coarse Aggregates	1924	Active			
T 28	Method of Mechanical Analysis of Sand or Other Fine Highway Material	Method of Mechanical Analysis of Sand or Other Fine Highway Material	1924	Discontinued	1935		
T 29	Method of Mechanical Analysis of Coarse Aggregates	Method of Mechanical Analysis of Coarse Aggregates	1924	Discontinued	1935		
T 30	Method of Mechanical Analysis of Extracted Aggregates	Mechanical Analysis of Extracted Aggregate	1924	Active			
T 31	Paving Brick	Sampling and Testing Paving Brick	1924	Discontinued	1971		
T 32	Testing Brick (Compression, Flexure, Absorption)	Sampling and Testing Brick	1924	Discontinued	2011	Replaced by ASTM C67	
T 33	Methods of Testing Culvert Pipe	Testing Culvert Pipe	1935	Discontinued	1984	Lack of use	
T 34	Drain Tile	Sampling and Testing Drain Tile	1924	Discontinued	1938		
T 35	Methods of Making Compression and Tension Tests of Fine Aggregate for Concrete	Methods of Making Compression and Tension Tests of Fine Aggregate for Concrete	1924	Discontinued	1942		
T 36	Method of Sampling Mineral Filler	Sampling Mineral Filler	1924	Discontinued	1947		
T 37	Determination of Fineness of Mineral Filler	Sieve Analysis of Mineral Filler for Asphalt Mixtures	1924	Active			

T 38	Proportioning Natural Sand and Gravel for Concrete Construction	Proportioning Natural Sand and Gravel for Concrete Construction	1928	Discontinued	1942		
T 39	Wire Rope (Guardrail)	Wire Rope (Guardrail)	1924	Discontinued	1984	Lack of use	
T 40	Methods of Sampling Bituminous Materials	Sampling Bituminous Materials	1925	Reclassified	2015	Revised and reclassified as a standard practice, R 66	
T 41	Methods of Sampling Bituminous Mixtures	Sampling Bituminous Mixtures	1925	Discontinued	1955	Replaced by T 168	
T 42	Methods of Sampling and Testing Premolded Joint Fillers	Preformed Expansion Joint Filler for Concrete Construction	1925	Discontinued	2018	Replaced by ASTM D545	Discontinued in 1935; reinstated in 1938
T 43	Specific Gravity of Bituminous Materials	Specific Gravity of Bituminous Materials	1925	Discontinued	1969	Replaced by T 227, T 228, or T 229	
T 44	Percentage of Bitumen (Soluble in Carbon Disulphide)	Solubility of Bituminous Materials	1925	Active			
T 45	Percentage of Bitumen Insoluble in Carbon Tetrachloride	Determination of Proportion of Bitumen Insoluble in Carbon Tetrachloride	1925	Discontinued	1964		
T 46	Percentage of Bitumen Insoluble in Paraffin Naphtha	Percentage of Bitumen Insoluble in Paraffin Naphtha	1925	Discontinued	1961		
T 47	Loss on Heating of Oil and Asphaltic Compounds	Loss on Heating of Oil and Asphaltic Compounds	1925	Discontinued	2004	Lack of use	
T 48	Flash and Fire Points by Means of Open Cup	Flash and Fire Points by Cleveland Open Cup	1925	Active			
T 49	Penetration of Bituminous Materials	Penetration of Bituminous Materials	1925	Discontinued	1963	Based on ASTM D5, which was withdrawn by ASTM in 1961	
T 50	Method of Float Test for Bituminous Materials	Float Test for Bituminous Materials	1924	Active			

T 24M/T 24	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	2007	Active			
T 25	Method of Test for Absorption of Concrete	Test for Absorption of Concrete	1924	Discontinued	1947		
T 26	Quality of Water to be Used in Concrete	Quality of Water to be Used in Concrete	1924	Discontinued	2014	Lack of use	
T 27	Sieve Analysis of Aggregates for Concrete	Sieve Analysis of Fine and Coarse Aggregates	1924	Active			
T 28	Method of Mechanical Analysis of Sand or Other Fine Highway Material	Method of Mechanical Analysis of Sand or Other Fine Highway Material	1924	Discontinued	1935		
T 29	Method of Mechanical Analysis of Coarse Aggregates	Method of Mechanical Analysis of Coarse Aggregates	1924	Discontinued	1935		
T 30	Method of Mechanical Analysis of Extracted Aggregates	Mechanical Analysis of Extracted Aggregate	1924	Active			
T 31	Paving Brick	Sampling and Testing Paving Brick	1924	Discontinued	1971		
T 32	Testing Brick (Compression, Flexure, Absorption)	Sampling and Testing Brick	1924	Discontinued	2011	Replaced by ASTM C67	
T 33	Methods of Testing Culvert Pipe	Testing Culvert Pipe	1935	Discontinued	1984	Lack of use	
T 34	Drain Tile	Sampling and Testing Drain Tile	1924	Discontinued	1938		
T 35	Methods of Making Compression and Tension Tests of Fine Aggregate for Concrete	Methods of Making Compression and Tension Tests of Fine Aggregate for Concrete	1924	Discontinued	1942		
T 36	Method of Sampling Mineral Filler	Sampling Mineral Filler	1924	Discontinued	1947		
T 37	Determination of Fineness of Mineral Filler	Sieve Analysis of Mineral Filler for Asphalt Mixtures	1924	Active			

T 38	Proportioning Natural Sand and Gravel for Concrete Construction	Proportioning Natural Sand and Gravel for Concrete Construction	1928	Discontinued	1942		
T 39	Wire Rope (Guardrail)	Wire Rope (Guardrail)	1924	Discontinued	1984	Lack of use	
T 40	Methods of Sampling Bituminous Materials	Sampling Bituminous Materials	1925	Reclassified	2015	Revised and reclassified as a standard practice, R 66	
T 41	Methods of Sampling Bituminous Mixtures	Sampling Bituminous Mixtures	1925	Discontinued	1955	Replaced by T 168	
T 42	Methods of Sampling and Testing Premolded Joint Fillers	Preformed Expansion Joint Filler for Concrete Construction	1925	Discontinued	2018	Replaced by ASTM D545	Discontinued in 1935; reinstated in 1938
T 43	Specific Gravity of Bituminous Materials	Specific Gravity of Bituminous Materials	1925	Discontinued	1969	Replaced by T 227, T 228, or T 229	
T 44	Percentage of Bitumen (Soluble in Carbon Disulphide)	Solubility of Bituminous Materials	1925	Active			
T 45	Percentage of Bitumen Insoluble in Carbon Tetrachloride	Determination of Proportion of Bitumen Insoluble in Carbon Tetrachloride	1925	Discontinued	1964		
T 46	Percentage of Bitumen Insoluble in Paraffin Naphtha	Percentage of Bitumen Insoluble in Paraffin Naphtha	1925	Discontinued	1961		
T 47	Loss on Heating of Oil and Asphaltic Compounds	Loss on Heating of Oil and Asphaltic Compounds	1925	Discontinued	2004	Lack of use	
T 48	Flash and Fire Points by Means of Open Cup	Flash and Fire Points by Cleveland Open Cup	1925	Active			
T 49	Penetration of Bituminous Materials	Penetration of Bituminous Materials	1925	Discontinued	1963	Based on ASTM D5, which was withdrawn by ASTM in 1961	
T 50	Method of Float Test for Bituminous Materials	Float Test for Bituminous Materials	1924	Active			

8.13.6. Intuitively, PWL is a good measure of quality because it is reasonable to assume that the more of the product that is within the specification limits, the better the quality of the product should be. (A detailed discussion and analysis of the PWL measure of quality is presented in *Optimal Procedures for Quality Assurance Specifications*, 2003.)

8.14. If the agency conducts the acceptance tests, sampling and testing must be performed in qualified laboratories and by qualified sampling and testing personnel. There are no additional requirements for verification other than the typical IA requirement.

8.15. However, if the contractor/third party conducts tests used in the acceptance decision, a validation procedure is necessary as required in FHWA 23 CFR 637 (1995). The requirements are:

8.15.1. The sampling and testing must be performed in qualified laboratories and by qualified sampling and testing personnel.

8.15.2. The quality of the material must be validated by verification sampling and testing. The verification sampling and testing is to be performed on samples that are taken independently from those used in the acceptance decision.

8.16. Statistically sound verification procedures must be developed and used. There are several forms of verification procedures, and some forms are more efficient than others. It is in the best interest of both parties to make the verification process as effective and efficient as practicable.

8.17. FHWA 23 CFR 637 states that the verification samples shall be taken independently. This requirement does not allow the direct comparison of split samples for validation. However, this does not prohibit the use of split-sample test results. For instance, the contractor may test 100 samples and the agency select the split portion of all 100 samples but test only 20 of the samples. Then the agency can compare its 20 tests results to the 80 contractor test results that are not paired with those of the agency, using the F-test and independent t-test.

8.17.1. There is a difference in the information provided by split and independent sampling procedures, and the difference is related to the concept of components of variability.

8.17.2. *Split Sample*—A sample that has been divided into two or more portions representing the same material. (Split samples are sometimes taken to verify the acceptability of an operator's test equipment and procedure. This is possible because the variability calculated from differences in split test results is comprised solely of testing variability.) (TRB, 2009)

8.17.3. *Independent Sample*—A sample taken without regard to any other sample that may also have been taken to represent the material in question. [An independent sample is sometimes taken to verify an acceptance decision. This is possible because the data sets from independent samples, unlike those from split samples, each contain independent information reflecting all sources of variability, i.e., materials (which often includes both the material and the process variabilities), sampling, and testing.] (TRB, 2009)

8.17.4. The five specimens shown in Figure 6(a) have been taken independently. The variability represented by them includes all sources of variability, i.e., material, process, sampling, and testing. Thus, if the total variability is to be evaluated, independent samples must be taken.

8.17.5. In Figure 6(b), four of the five specimens have been taken independently; however, the two on the far right are split samples from the same batch, i.e., they are two results that represent the same material. The variability represented by these two specimens includes only the component of testing variability. However, either of the two specimens on the far right can be combined with the other three to measure all sources of variability, but both cannot be used with the other three in an analysis. Specimens tested by different laboratories may be combined, from a statistical standpoint, if found not to be statistically different. However, a higher variability is likely to result, and, thus, this is not recommended.

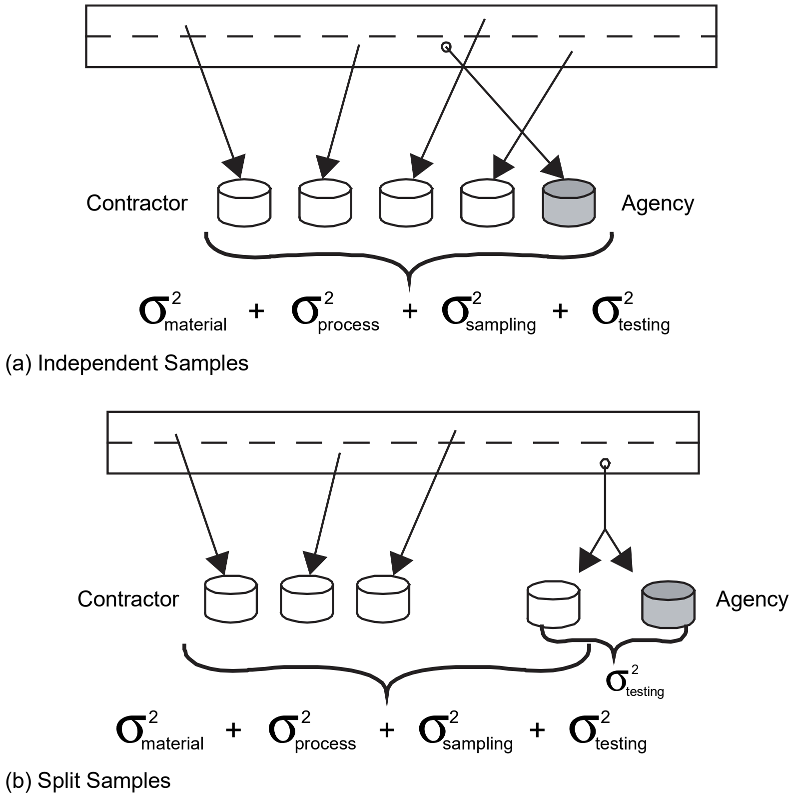


Figure 6—Components of Variance for: (a) Independent Samples and (b) Split Samples

8.17.6. The analysis of the variability for split samples will be a smaller value, $\sigma^2_{testing}$, than the variability for independent samples, $\sigma^2_{overall}$, because the latter includes all components of variability. But the decision of whether to use split or independent samples should not be made based on the magnitude of the variability but, instead, on the component(s) of variability that is (are) desired to be measured. So, the choice of whether to use split or independent samples is not an arbitrary decision.

8.18. *Definition of Verification*—The process of determining or testing the truth or accuracy of test results by examining the data and/or providing objective evidence. [Verification sampling and testing may be part of an IA program (to verify contractor QC testing or agency acceptance) or part of an acceptance program (to verify contractor testing used in the agency's acceptance decision)]. (TRB, 2009)

8.19. *Verification Procedures*—The ability of the comparison procedure to identify differences between two sets of test results depends on the number of tests from each set that are being compared. The greater the number of test results from each set, the greater the ability of the procedure to identify statistically valid differences. A rule of thumb is a minimum agency rate of 10 percent of the contractor's testing rate. It is preferred to conduct a risk analysis to determine whether a higher rate is warranted. It also must be decided whether the test method or the process is to be verified. This relates to the use of split or independent samples.

12. CALCULATIONS

12.1. *Calculate the tensile strength as follows*:

SI units:

$$S_t = \frac{2000P}{\pi t D} \quad (5)$$

where:

S_t = tensile strength, kPa;
P = maximum load, N;
t = specimen thickness, mm; and
D = specimen diameter, mm.

U.S. Customary units:

$$S_t = \frac{2P}{\pi t D} \quad (6)$$

where:

S_t = tensile strength, psi;
P = maximum load, lbf;
t = specimen thickness, in.; and
D = specimen diameter, in.

12.2. Express the numerical index of resistance of asphalt mixtures to the detrimental effect of water as the ratio of the original strength that is retained after the moisture and freeze–thaw conditioning. Calculate the tensile strength ratio to two decimal places as follows:

$$\text{tensile strength ratio (TSR)} = \frac{S_2}{S_1} \quad (7)$$

where:

S_1 = average tensile strength of the dry subset, kPa (psi); and
S_2 = average tensile strength of the conditioned subset, kPa (psi).

13. REPORT

13.1. *Report the following information*:

13.1.1. Number of specimens in each subset;

13.1.2. Average air voids of each subset;

13.1.3. Tensile strength of each specimen in each subset;

13.1.4. Tensile strength ratio;

13.1.5. Results of visually estimated moisture damage observed when the specimen fractures; and

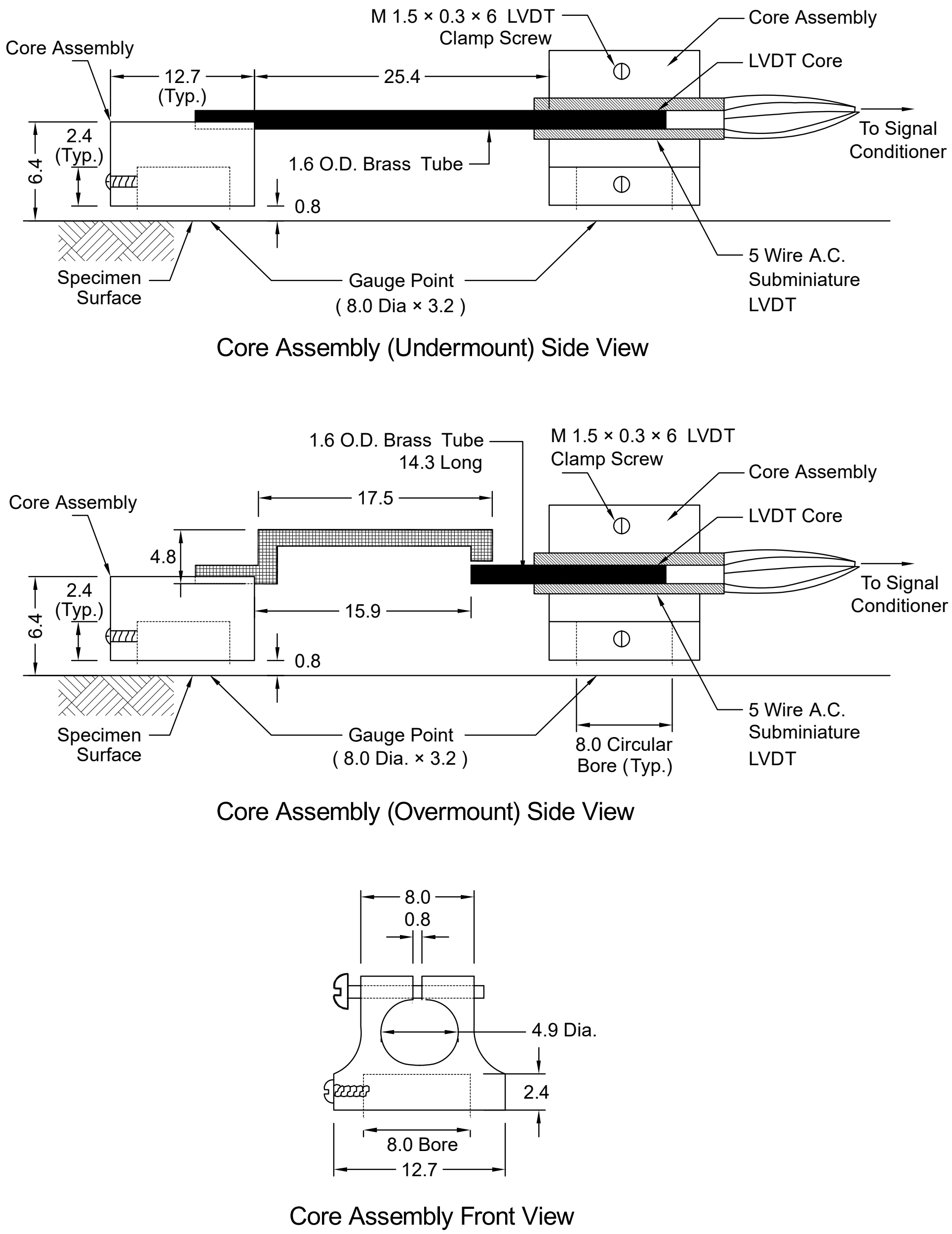
13.1.6. Results of observations of cracked or broken aggregate.

14. KEYWORDS

14.1. Accelerated water conditioning; diametral tensile strength; freeze–thaw cycle; liquid antistripping additives; long-term stripping; portland cement; pulverulent solids; water saturation.

15. REFERENCE

15.1. ASTM. D979/D979M, Standard Practice for Sampling Asphalt Mixtures.



Notes: 1. All dimensions shown in millimeters unless otherwise noted.
2. Tolerances ±0.2 mm unless otherwise noted.
3. Not to scale.

Figure 3—Cross Section of LVDT Mounting System for 150-mm Specimen

11. TENSILE CREEP/STRENGTH TESTING (THERMAL CRACKING ANALYSIS)

11.1. Determine the tensile creep compliance of each of the three specimens at three measurements at 10°C intervals. The following test temperatures are recommended:

- For mixtures made using binder grades PG XX-34 or softer: −30, −20, and −10°C;
- For mixtures made using binder grades PG XX-28 and PG XX-22, or mixtures for which binder grade is unknown: −20, −10, and 0°C;

- For mixtures made using binder grades PG XX-16 or harder: −10, 0, and +10°C; and
- For mixtures subjected to severe age hardening, the test temperatures should be increased by 10°C.

Note 2—The original Superpave mixture analysis procedures specified test temperatures of 0, –10, and –20°C.

11.2. Lower the temperature of the environmental chamber to the test temperature and, once the test temperature ±0.5°C is achieved, allow each specimen to remain at the test temperature from 3 ± 1 h prior to testing. Under no circumstances shall the specimen be kept at 0°C or less for more than 24 h.

11.3. Zero or rebalance the electronic measuring system and apply a static load of fixed magnitude (±2 percent) without impact to the specimen for 100 ± 2 s. If a complete analysis is required, a period of 1000 ± 20.5 s has been found suitable. Use a fixed load that produces a horizontal deformation of 0.00125 mm to 0.0190 mm for specimens150-mm in diameter. If either limit is violated, stop the test and allow a recovery time of 5 min before restarting with an adjusted load. Comply strictly with these limits to prevent both nonlinear response, characterized by exceeding the upper limit, and significant problems associated with noise and drift inherent in sensors, when violating the lower deformation limit.

11.4. 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 min. Record the vertical and horizontal deformations on both ends of the specimen and the load until the load starts to decrease. The tensile strength should normally be determined at the middle temperature used for the creep tests.

Note 3—In some cases, it is acceptable to unload the specimen between the creep compliance and strength tests. This will facilitate control on certain testing machines.

12. CALCULATIONS

12.1. Calculate the air voids for each test specimen in accordance with T 269.

12.2. *Creep Compliance—Mathematical Model*:

12.2.1. The three reference specimens are analyzed simultaneously to reduce variability in determining Poisson's ratio and, therefore, creep compliance.

12.2.2. Obtain average thickness and diameter in mm and creep load in kN for the three replicates:

$$b_{avg} = \frac{\sum_{n=1}^{3} b_n}{3} \quad (1)$$

$$D_{avg} = \frac{\sum_{n=1}^{3} D_n}{3} \quad (2)$$

$$P_{avg} = \frac{\sum_{n=1}^{3} P_n}{3} \quad (3)$$

where:

Σ = sum of the three specimens, values for thickness, diameter, creep load, kN;
b_{avg}, D_{avg}, P_{avg} = average thickness, diameter, and creep load of three replicate specimens; and
b_n, D_n, P_n = thickness, diameter, and creep load of specimen n (n = 1 to 3).

12.2.3. Compute normalized horizontal and vertical deformation arrays for each of the six specimen faces (three specimens, two faces per specimen).

$$\Delta X_{n,i,t} = \Delta X_{i,t} \times \frac{b_n}{b_{avg}} \times \frac{D_n}{D_{avg}} \times \frac{P_{avg}}{P_n} \qquad (4)$$

$$\Delta Y_{n,i,t} = \Delta Y_{i,t} \times \frac{b_n}{b_{avg}} \times \frac{D_n}{D_{avg}} \times \frac{P_{avg}}{P_n} \qquad (5)$$

where:

$\Delta X_{n,i,t}$ = normalized horizontal deformation for face i (i = 1 to 6) at time t (t = 0 to t_{final}, where t_{final} is the total creep time);

$\Delta Y_{n,i,t}$ = normalized vertical deformation for face i at time t;

$\Delta X_{i,t}$ = measured horizontal deformation for face i at time t; and

$\Delta Y_{i,t}$ = measured vertical deformation for face i at time t.

12.2.4. Obtain the average horizontal and vertical deformations $\Delta X_{a,i}$ and $\Delta Y_{a,i}$ at a time corresponding to one half the total creep test time for each of the six specimen faces. Thus, for a 100-s creep test, obtain the deformations corresponding to t = 50 s.

$$\Delta X_{a,i} = \Delta X_{n,i,t_{mid}} \qquad (6)$$

$$\Delta Y_{n,i,t_{mid}} \;\; \Delta Y_{a,i} = \Delta Y_{n,i,t_{mid}} \qquad (7)$$

where:

$\Delta_{a,i}$ $\Delta X_{a,i} + \Delta Y_{a,i}$ = average horizontal and vertical deformations for face i;

$\Delta X_{n,i,t_{mid}}$ = normalized horizontal deformation at a time corresponding to half the total creep test time for face i; and

$\Delta Y_{n,i,t_{mid}}$ = normalized vertical deformation at a time corresponding to half the total creep test time for face i.

12.2.5. Obtain the trimmed mean of the deflections ΔX_t and ΔY_t. This is accomplished by numerically ranking the six $\Delta X_{a,i}$ and $\Delta Y_{a,i}$ values and averaging the four middle values. Thus, the highest and lowest values of horizontal and vertical deformation are not included in the trimmed mean. Compute:

$$\Delta X_t = \frac{\sum_{j=2}^{5} \Delta X_{r,j}}{4} \qquad (8)$$

$$\Delta Y_t = \frac{\sum_{j=2}^{5} \Delta X_{r,j}}{4} \qquad (9)$$

where:

$\Delta X_{r,j}$ = $\Delta X_{a,i}$ values sorted in ascending order;

$\Delta Y_{r,j}$ = $\Delta Y_{a,i}$ values sorted in ascending order;

ΔX_t = trimmed mean of horizontal deformations; and

ΔY_t = trimmed mean of vertical deformations.

12.2.6. Obtain the ratio of the horizontal to vertical deformations, X/Y, as follows:

$$\frac{X}{Y} = \frac{\Delta X_t}{\Delta Y_t} \tag{10}$$

12.2.7. Compute the trimmed mean, $\Delta X_{tm,t}$, of the six horizontal deformation arrays.

$$\Delta X_{tm,t} = \frac{\sum_{j=2}^{5} \Delta X_{r,j,t}}{4} \tag{11}$$

where:

$\Delta X_{r,j,t}$ = $\Delta X_{i,t}$ arrays sorted, where the $i = 6$ arrays are sorted according to the sorting order already established in Section 12.2.5 for $\Delta X_{r,j}$; and

$\Delta X_{tm,t}$ = trimmed mean of the $\Delta X_{i,t}$ arrays.

12.2.8. Compute creep compliance, $D(t)$:

$$D(t) = \frac{\Delta X_{tm,t} \times D_{avg} \times b_{avg}}{P_{avg} \times GL} \times C_{cmpl} \tag{12}$$

where:

$D(t)$ = creep compliance at time t (kPa); and

GL = gauge length in meters (38×10^{-3} for 150-mm-diameter specimens); and

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

$$\left[0.704 - 0.213\left(\frac{b_{avg}}{D_{avg}}\right)\right] \le C_{cmpl} \le \left[1.566 - 0.195\frac{b_{avg}}{D_{avg}}\right] \tag{13}$$

12.2.9. Poisson's ratio, ν, may be computed as:

$$\nu = -0.10 + 1.480\left(\frac{X}{Y}\right)^2 - 0.778\left(\frac{b_{avg}}{D_{avg}}\right)^2\left(\frac{X}{Y}\right)^2 \tag{14}$$

where:

$0.05 \le \nu \le 0.50$

12.3. *Tensile Strength—Mathematical Model*:

12.3.1. Calculate tensile strength for each specimen, $S_{t,n}$, as:

$$S_{t,n} = \frac{2 \times P_{f,n}}{\pi \times b_n \times D_n} \tag{15}$$

where:

$P_{f,n}$ = maximum load observed for specimen, n; and

$S_{t,n}$ = tensile strength of specimen, n.

12.3.2. Compute the average tensile strength:

$$S_t = \frac{\sum_{n=1}^{3} S_{t,n}}{3} \tag{16}$$