ORNL/TM-2015/765

# PCEA Baseline Characterization: Billet XCP01S8 11 Compressive, Tensile, and Flexure Strengths


Michael Trammell
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**December 2015**

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

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Next Generation Nuclear Plant (NGNP) Program

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## ABBREVIATIONS

| | |
|---|---|
| AG | Against-Grain |
| ASTM | American Society for Testing and Materials |
| MPO | Memorandum Purchase Order |
| INL | Idaho National Laboratory |
| ORNL | Oak Ridge National Laboratory |
| SOW | Statement of Work |
| WG | With-Grain |

## EXECUTIVE SUMMARY

Grade PCEA graphite is one of several grades being considered for the core structures of the Next Generation Nuclear Plant (NGNP). An experimental program is underway to describe the statistical nature of the mechanical properties of PCEA graphite, information needed to support the design of graphite components and licensing of the NGNP. It will be necessary to characterize several billets from various lots or batches. The exact number of billets will depend on the observed variability in properties.

Reported herein are initial data on compression, tensile, and flexural strength for a single billet of PCEA graphite, specifically, billet number XCP01S8 11. The average density of the billet as a whole (based on ~784 compression and flexure test specimens distributed throughout the billet) exceeds 1.7 kg/cm³ (1700 kg/m³) and thus meets the requirement of ASTM D 7219-08, the specification for isotropic and near isotropic nuclear grade graphite. Further, the average Young's modulus for each orientation is within the specified ASTM range of 8-15 GPa with a limited number of samples falling below the lower limit.

Data reported herein indicate that the compressive strength throughout the billet had a range (including all orientations) of 30 to 72 MPa with an average strength of 60 MPa. The spatial variability was closely related to variability in the density with compressive strength increasing in proportion to increasing density. Compressive strength appeared to be higher and exhibit less variability at one end of the billet. Although the average compressive strength of the billet exceeds 45 MPa specified for extruded graphite, some individual values corresponding to low density section of the billet fall below this minimum value.

Individual tensile specimen strengths ranged from 2.2 to 25.6 MPa and the average strength throughout the billet was 16.4 MPa. Again the average tensile strength of the billet exceeds the minimum of 15 MPa specified in ASTM D7219-08. However, 32% of the individual specimen strengths fall below this minimum.

Average flexural strength for specimens with radial and tangent orientations relative to the billet axis are also comparable, and exceed the 21MPa minimum specified in ASTM D 7219. However, a limited number of individual specimens exhibited flexural strengths significantly lower than the specified minimum.

## 1. BACKGROUND

Grade PCEA graphite is one of several grades being considered for the core structures of the Next Generation Nuclear Plant (NGNP). Reported herein are preliminary data on density, compressive, tensile, and flexure strength for PCEA graphite obtained in a recently implemented experimental program designed to characterize the mechanical properties of nuclear grade graphite. These data are needed to support the design of graphite components and licensing of the NGNP.

In order to describe the statistical nature of the mechanical properties of graphite it will be necessary to characterize several billets from various lots or batches. The exact number of billets will depend on the observed variability in properties. The ongoing experimental program here will characterize the distributions of structure, strength (tensile, compressive and flexural strengths), and elastic properties of PCEA graphite. The work reported herein is responsive to INL MPO-00153522, SOW-11968.

## 2. EXPERIMENTAL METHODS

### 2.1 MATERIALS

Grade PCEA graphite is an extruded, near isotropic, graphite [1] produced by GrafTech International. PCEA is a medium grained graphite with a maximum particle size of 0.760 mm and a

nominal density of 1830 kg/m³. The billet of PCEA graphite was provided by INL. ORNL subsequently prepared the various test specimens and performed the characterization testing.

The billet described and characterized at ORNL was billet number XCP01S8 11. The billet was sawn into eight slabs and each slab was subsequently sectioned to yield blanks for machining individual tension, compression and flexure test specimens. The slabbing plan (ORNL drawing number JPS-NGNP011211-1, sheet 1) is shown in Figure 1. The further reduction of the slabs to obtain test specimen blanks is detailed on sheets 2 through 4 (Figure 2 through 4), and detail drawings of the tensile, compressive, and flexure specimen sizes are shown on sheet 5 (Figure 5) of the drawing set. Each specimen was given a unique number identifying the slab, specimen type, orientation of the specimen with respect to the central axis of the billet, and spatial location within the slab. The legend for interpreting specimen identification is given in Figure 5. Effectively the entire billet was consumed, yielding 48 tensile specimens from each slab, as well 38 compressive specimens and 60 flexure specimens for totals of 384, 304, and 480, respectively. A grand total of 1148 specimens were extracted from the billet and subsequently tested. The various specimen types were reasonably distributed throughout the billet volume in order to facilitate identification of spatial variations in mechanical properties.

An X-Y coordinate system with its origin coincident with the central axis of the PCEA billet was applied to the circular face of the slabs from which the various test specimens were obtained in order to graphically present spatial variations in the various properties. Sketches identifying the four quadrants of the coordinate system as applied to the odd and even numbered slabs are shown in Figure 2 and 3, respectively. The X-Y coordinates for each specimen is given in the appendices of test results.

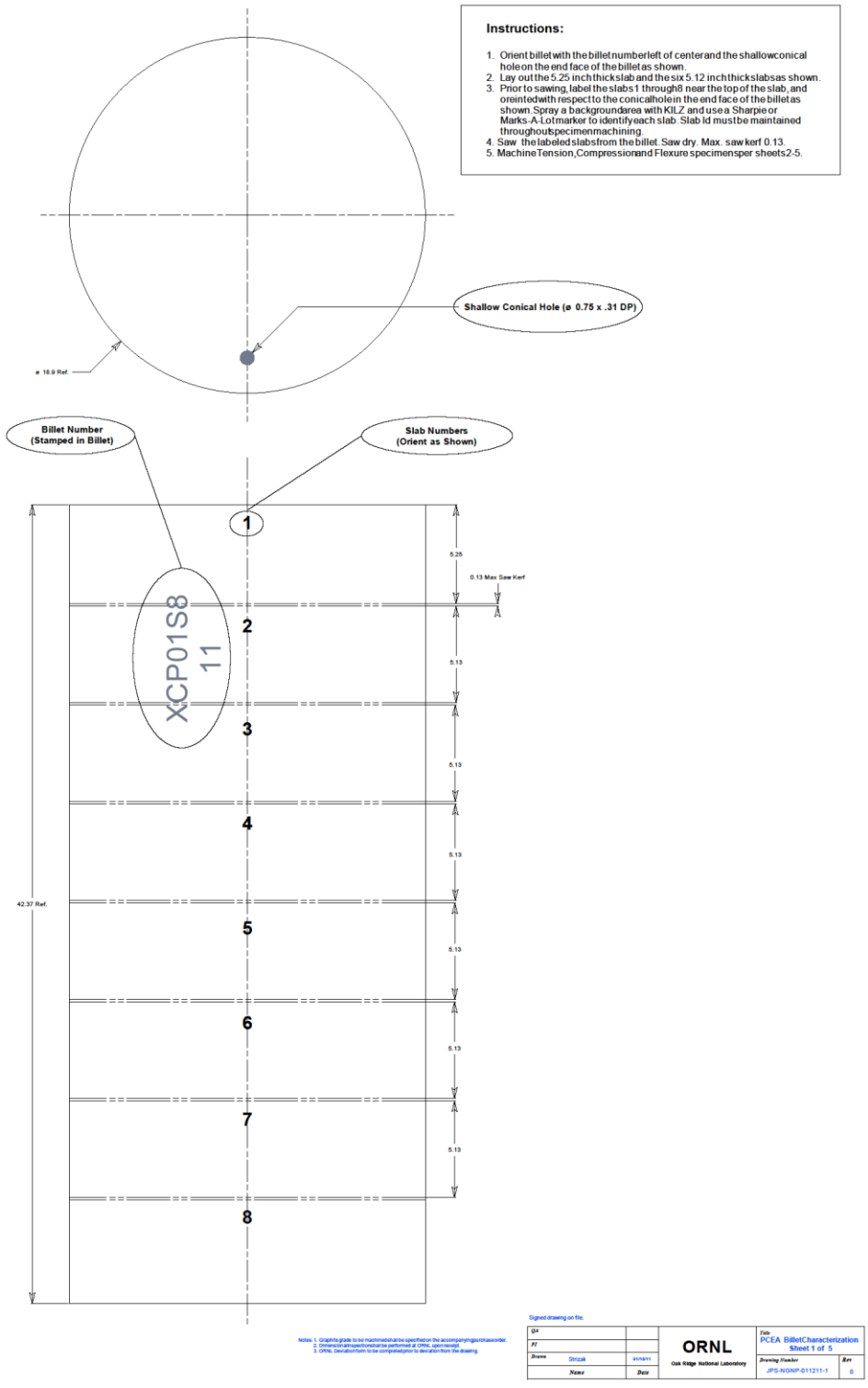


**Figure 1: Billet slabbing diagram**

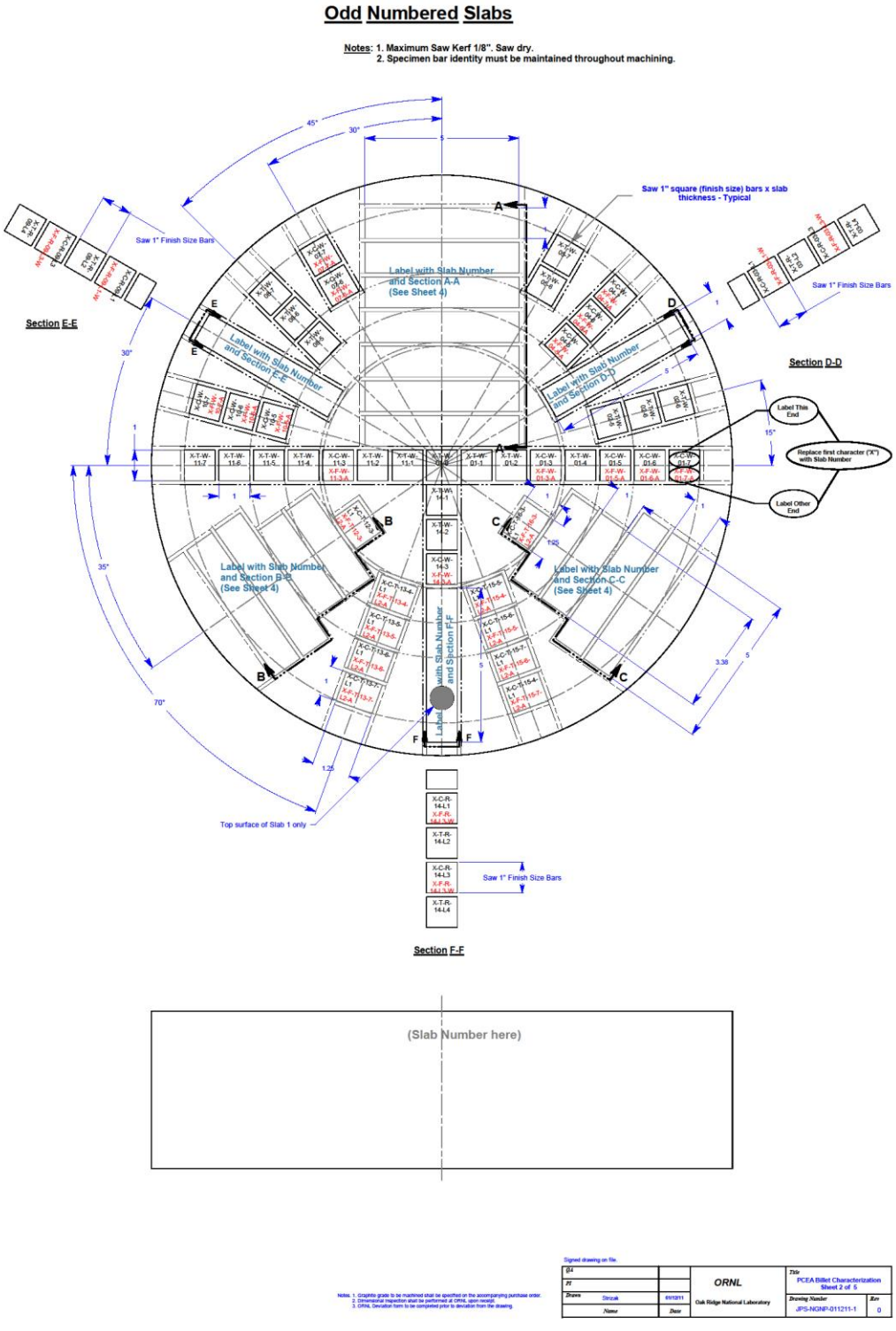


**Figure 2: Specimen distribution for odd numbered slabs**

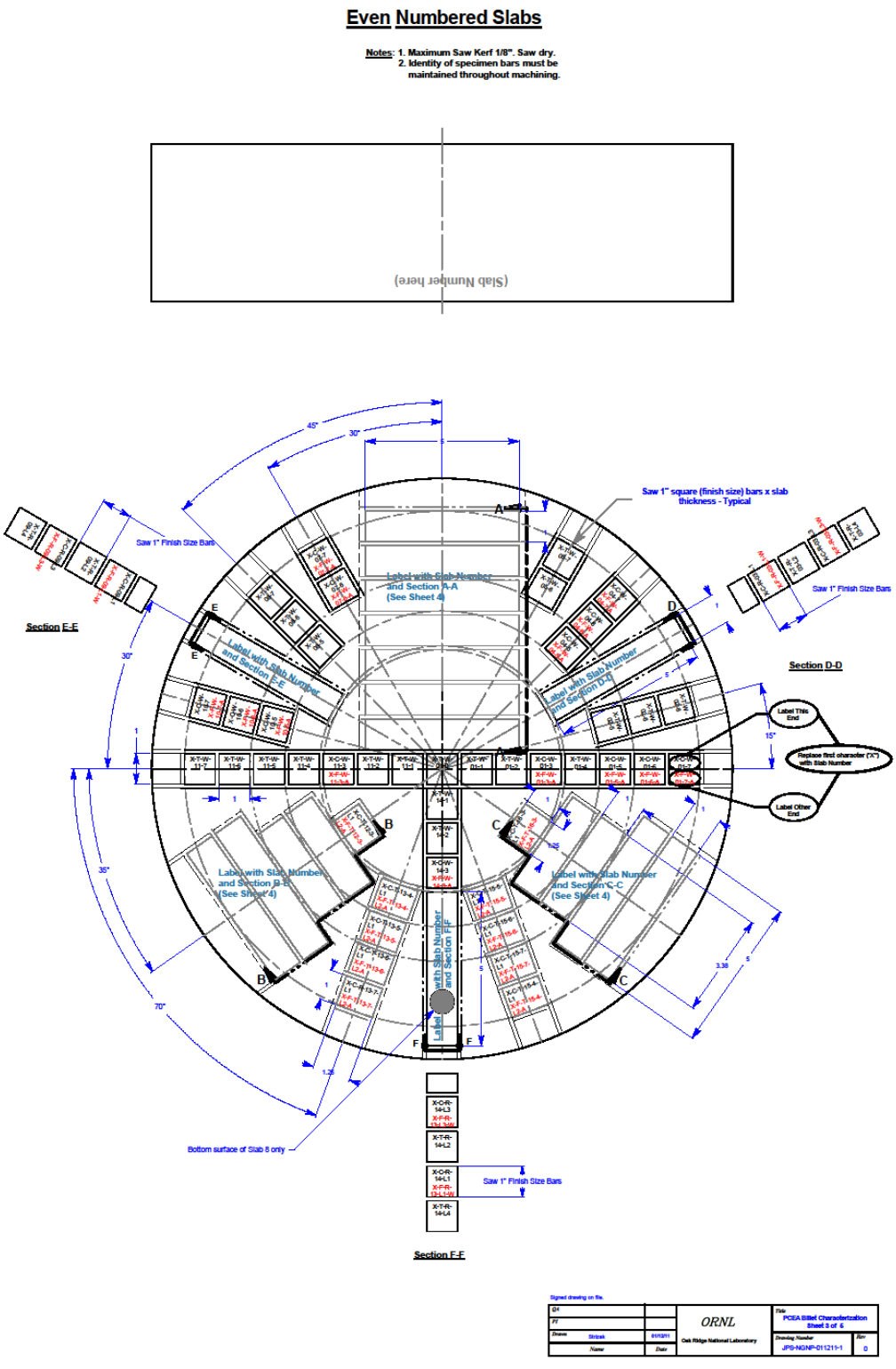


**Figure 3: Specimen distribution for even numbered slabs**

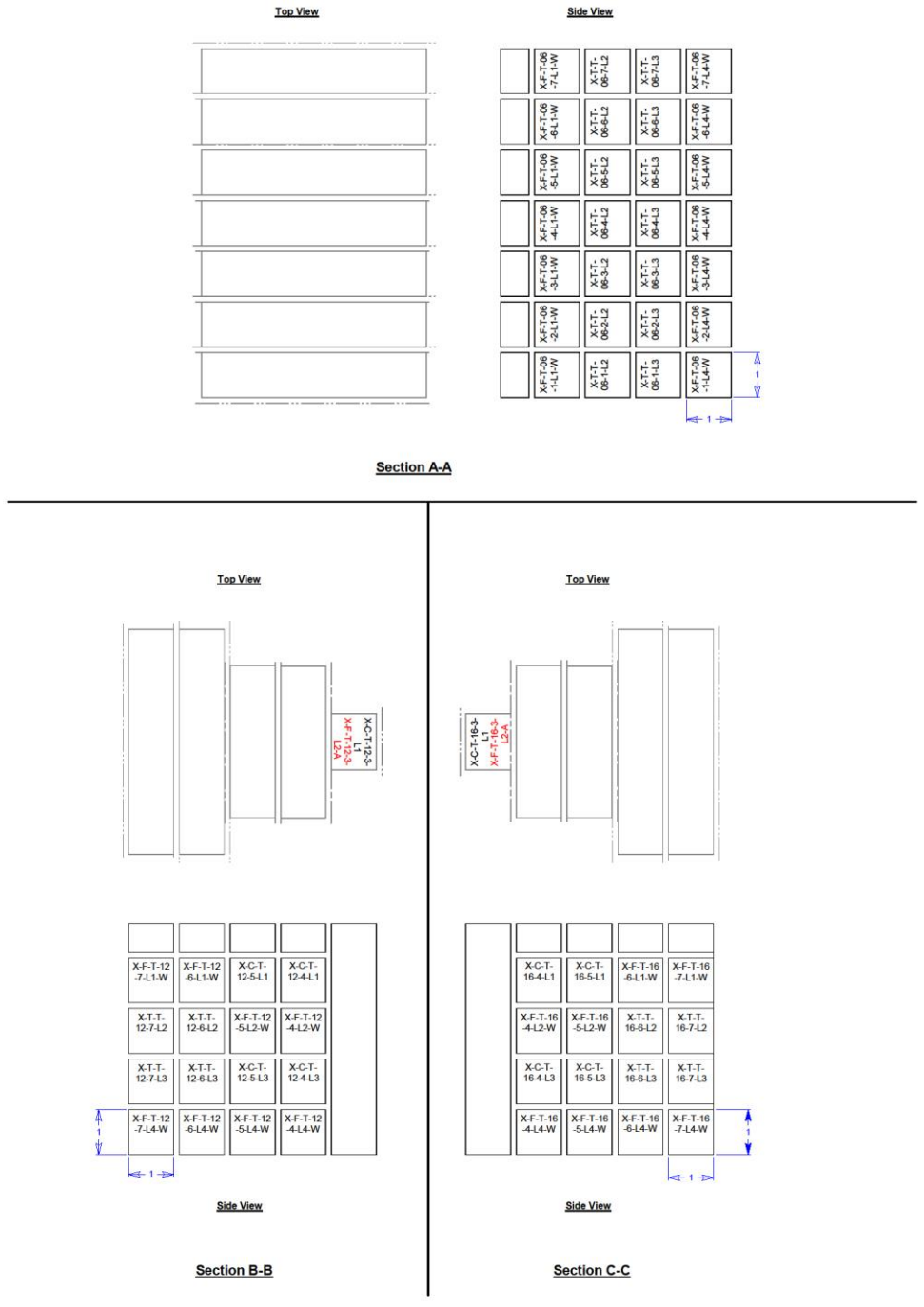


**Figure 4: Specimen distribution for slab sections**

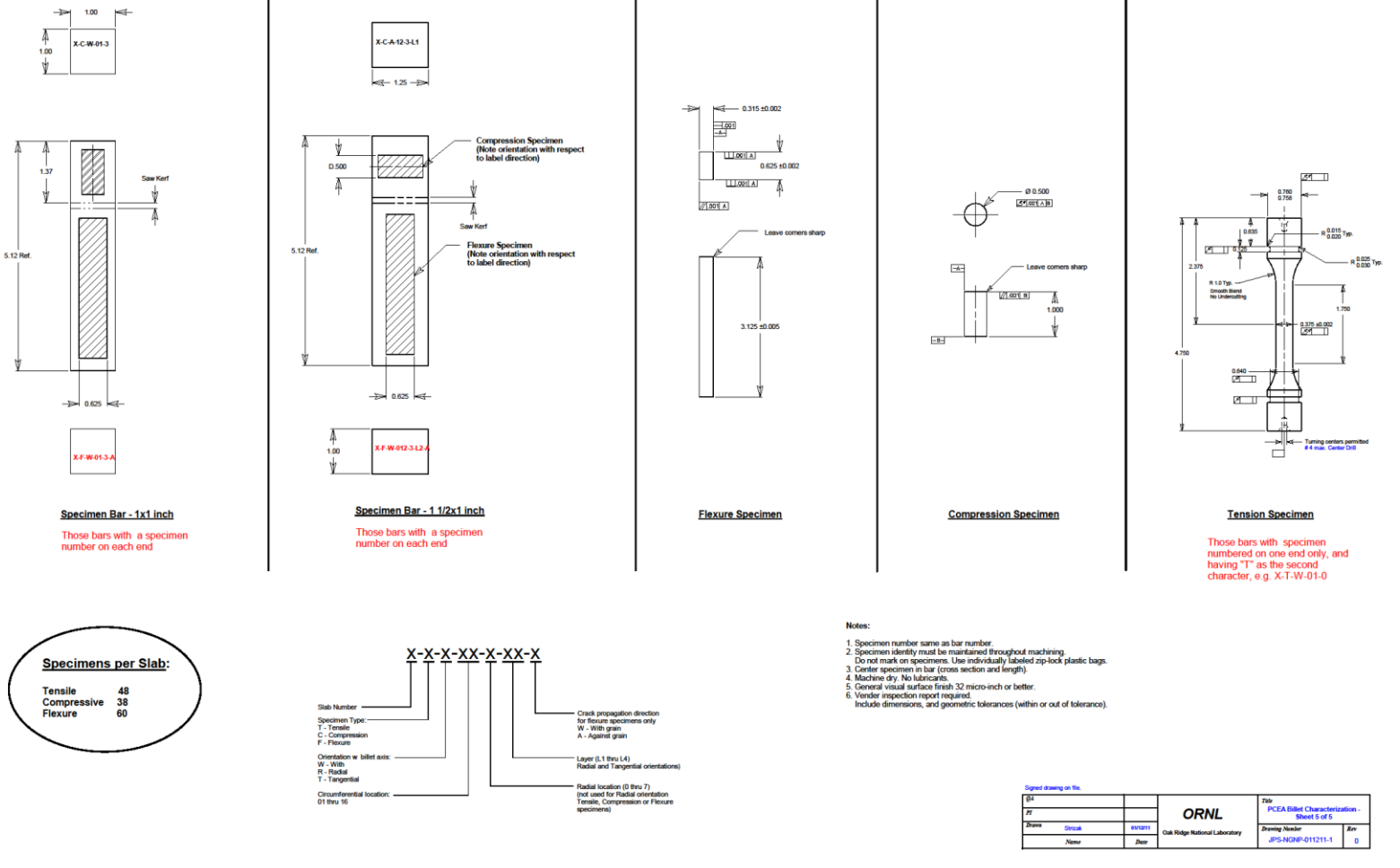


**Figure 5: Specimen types and sizes**

## 2.2 DENSITY MEASUREMENTS

Prior to strength testing, dimensional measurements were made on the compressive and flexure specimens, and the specimens were weighed in order to determine density in accordance with ASTM C559 [2]. Since each specimen was given a unique number identifying the slab, specimen type, orientation of the specimen with respect to the central axis of the billet, and spatial location within the slab, variations in density throughout the billet would be observable.

## 2.3 COMPRESSIVE TESTING

Specimens were tested in accordance with ASTM standard C 695 "Standard test method for Compressive Strength of Carbon and Graphite [3] as modified by C 781, "Standard Practice for Testing of Graphite and Boronated Graphite Components for High Temperature Nuclear Reactors, Annex 5, "Modification to test method C 695" [4].

Compression tests were conducted on an Instron Model 4210 electromechanical test system with a 10KN load cell. The load train used for compressive testing is shown in Figure 6. The specimen rests on a lower platen which has an integral spherical seat in order to assure uniform contact and distributed load across the end faces of the specimen. Tests were conducted at a crosshead speed of 0.2 in/min. The fractured specimens have been archived for future microstructural examination.

C695 requires that the diameter of the specimens be greater than ten times the maximum particle size of the graphite. The specimens used here had a diameter of 0.5 in, 12 times the advertised particle size for PCEA, i.e., 0.8mm (.031 in). C695 also requires that the ratio of specimen height to diameter (h/d) be between 1.9 and 2.1. The 0.5 in diameter specimen used had a height of 1.0 in (see Figure 5) with h/d equal to 2.0.


**Figure 6: Compression test setup**

## 2.4 TENSILE TESTING

Specimens were tested in accordance with ASTM standard C 749, "Standard test method for Tensile Stress-Strain of Carbon and Graphite" [5]. Tensile tests were conducted on the same Instron Model 4210 electromechanical test system used for compressive testing. The specimen dimensions, specimen gripping devices, and the flexible linkage (chains) for eliminating parasitic stresses from grip misalignment conformed to ASTM C749. One of the four specimen sizes promoted by C749 was used. The uniform gage test section had a 0.375 in diameter and was 1.75 in long (see Figure 5). Tests were performed at a cross-head speed of 0.02 in/min. The tensile load train assembly is shown in Figure 7. The fractured specimens have been archived for future microstructural examination.


**Figure 7: Tensile test setup**

## 2.5 FLEXURE TESTING

The flexural specimens were tested in accordance with ASTM standard C651-91 (reapproved 2005) "Standard Test Method for Flexural Strength of Manufactures Carbon and Graphite Articles Using Four-Point Loading at Room Temperature" [6]. Again, the same Instron Model 4210 test system was employed. The ORNL design test flexure shown in Figure 8 features 1) adjustable support and loading spans, 2) the four bearing rollers are free to rotate in order to relieve frictional constraints, and 3) the height of each load roller and each support roller below/above the respective mounting base is adjustable

and the rollers are also free to articulate independently thus insuring uniform contact with the specimen surfaces. The support rollers are free to rotate outward while the load rollers can rotate inward. Rubber bands initially hold the rollers at the prescribed distances apart. The diameter of the rollers was 0.250 in while the support and load spans were 0.800 and 2.400 in, respectively. Crosshead speed was 0.05 in/min. The fractured specimens had been archived for future microstructural examination.

The flexure specimens used measured .312 in thick x .620 in wide x 3.125 in long (see Figure 5). In conformance with C651, the w/t ratio was 2 and l/t ratio was 10 compared to the required minimum of 8. Further, the specimen thickness was 10 times the maximum particle size, twice the minimum required.

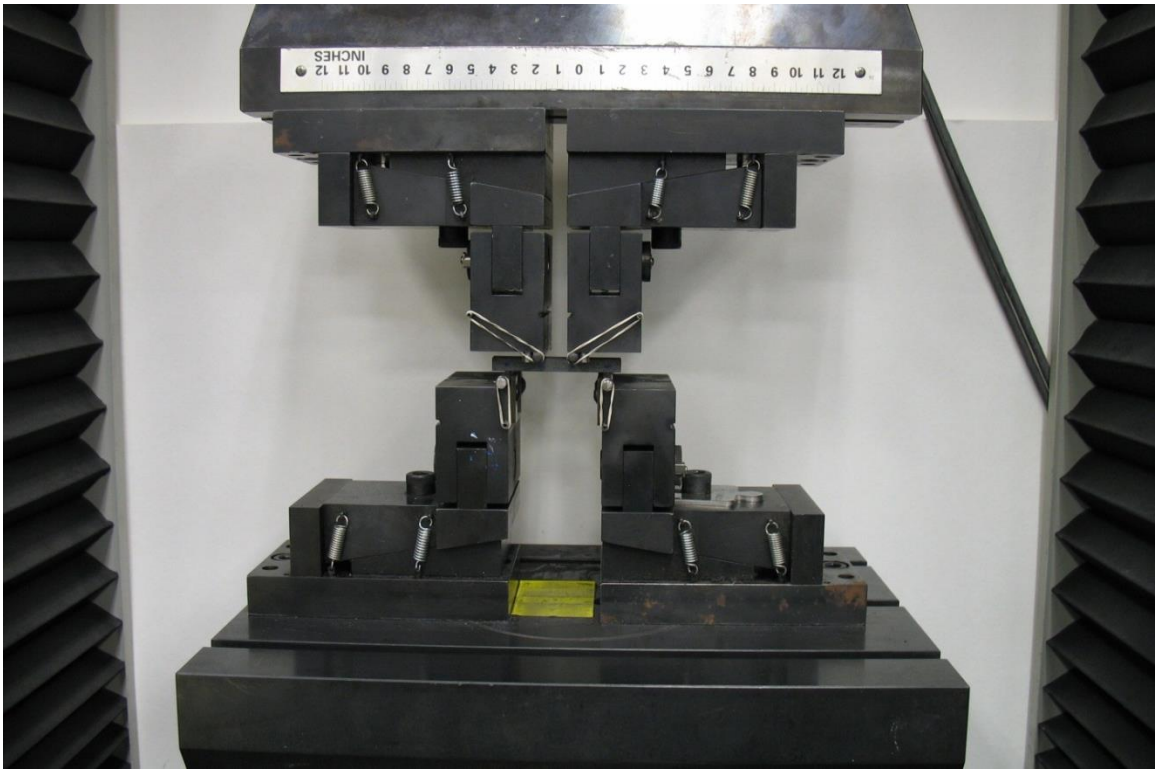


**Figure 8: Flexure test setup**

## 2.6 MODULUS MEASUREMENTS

Prior to flexure testing, the specimens were used to obtain elastic property values including dynamic modulus of elasticity (E) and dynamic shear modulus (G) by employing the sonic resonance method specified in ASTM C 747-93, "Standard Test Method for Moduli of Elasticity and Fundamental Frequencies of Carbon and Graphite Materials by Sonic Resonance" [7]. The sonic resonance system (Figure 9) is used to determine fundamental resonant frequency by inducing a vibration into the specimen using a singular elastic hammer-like strike and measuring the resulting impulse. The specimen dimensions and mass are then used to calculate the elastic properties. For the determination of E, the specimen is treated as a simply supported beam and is vibrated in the flexure mode by striking it at mid-length. For G, the specimen is supported at the midpoint of its length and width (Figure 10). Striking the specimen in one of the quadrants causes the specimen to twist around the length dimension axis in torsional vibration.

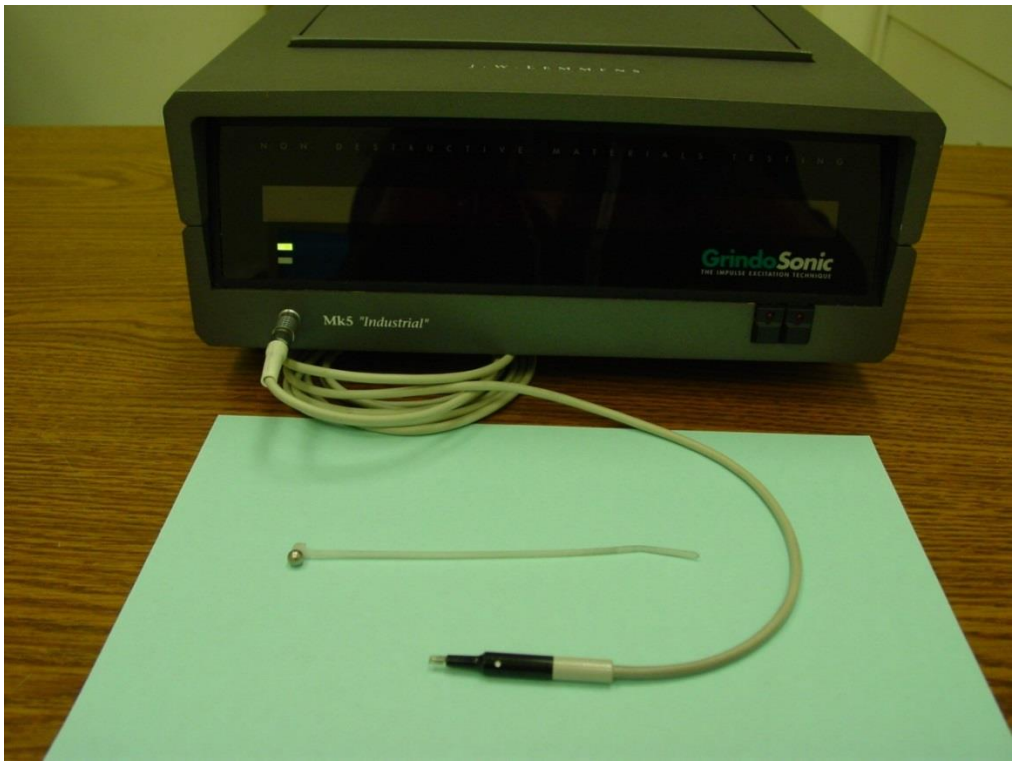


**Figure 9: Sonic resonance system**

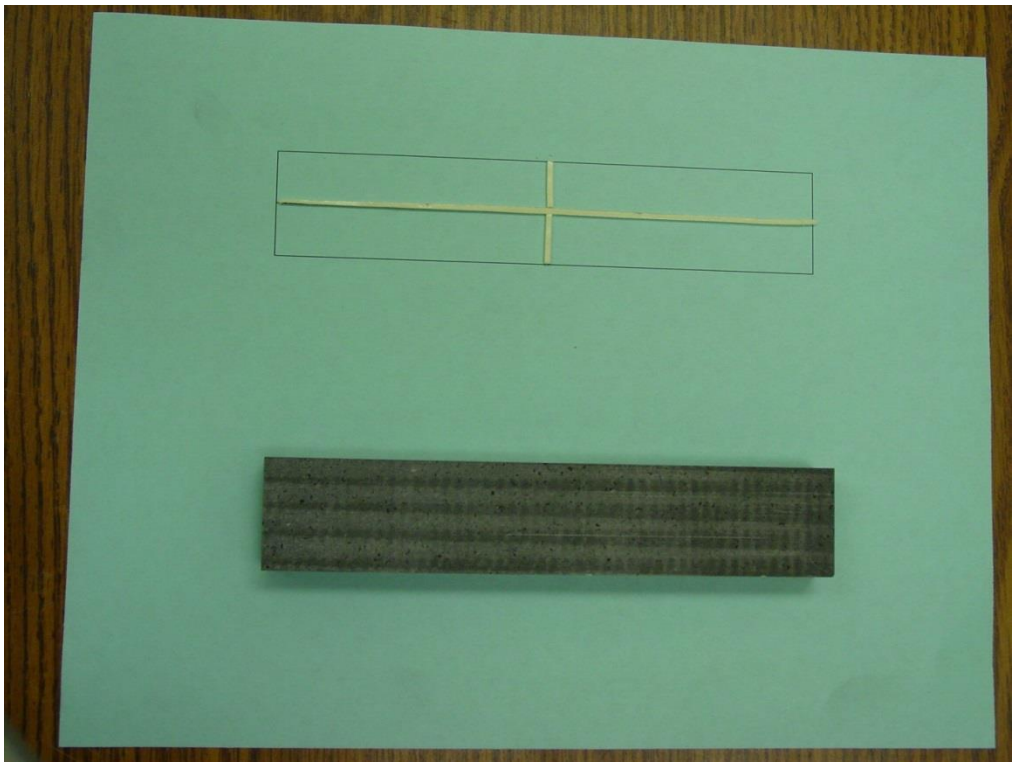

**Figure 10: Set up for torsional vibration**

## 3. RESULTS AND DISCUSSION

### 3.1 DENSITY

The dimensional, mass, and density data for PCEA billet XCP01S8 11 is provided in Appendices 1, 2 and 3. A graphical illustration of the variability in density throughout the billet utilizing data from compression and flexure test specimens can be seen in Figure 11. The X and Y positions locate the specimen radially within the billet and the Z position is simply the slab number. Density appears to decrease radially from the outside of the billet to the center axis. A relatively low density region can be seen located near the center axis at slabs 3, 4, and 5 with the highest density values coming from slab 8.

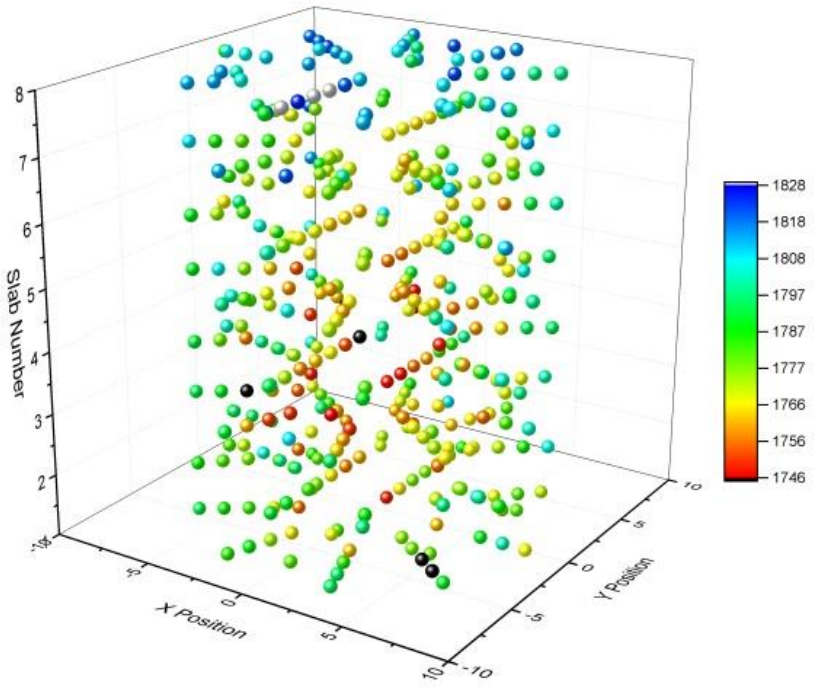


**Figure 11: Density distribution throughout billet - compression and flexure specimen**

The statistical box plot (Figure 12) also provides information on the variability in density by providing the average, minimum, and maximum values for each slab. The plot also indicates potential outliers that fall outside 1.5 IQR and the scatter in data within each slab.

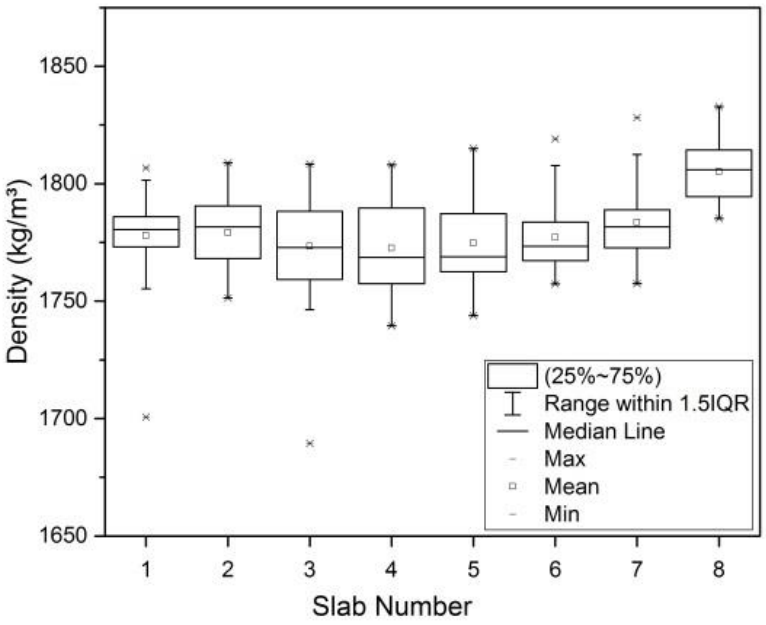


**Figure 12: Statistical analysis of density by Slab**

### 3.2 COMPRESSIVE STRENGTH

Compressive strength data for PCEA billet XCP01S8 11 is provided in APPENDIX A. Figure 13- through 20 are graphical illustrations of compressive strength data from specimens prepared with orientation parallel, radial, and tangent to the center axis of the billet. To aid in the visualization of variability of properties within the billet, an X-Y coordinate system was developed to locate specimens within the billet. Since the billet was cylindrical and cut into slices (slabs) the Z position is represented by slab number.

Statistical analysis of the compressive strength data is tabulated in Table 1. Specimen oriented parallel to the billet axis show the highest degree of variability in compressive strength with a standard deviation of 9.2 relative to the radial and tangent specimens which had standard deviations of 4.57 and 5.68 respectively. Compressive strength values also tend to be lower toward the center of the billet. The low values correspond with the low density region previously discussed which provides evidence of a strong correlation between compressive strength and density.

**Table 1: Compressive strength data**

| | | Compressive Strength, (MPa) | | |
|---|---|---|---|---|
| Slab | | Parallel | Radial | Tangent |
| Slab 1 | Average | 50.96 | 62.61 | 62.46 |
| | Standard Deviation | 7.00 | 1.56 | 2.16 |
| | Maximum | 58.10 | 64.43 | 66.38 |
| | Minimum | 36.98 | 60.28 | 59.30 |
| Slab 2 | Average | 49.36 | 64.53 | 55.91 |
| | Standard Deviation | 7.41 | 2.30 | 10.14 |
| | Maximum | 58.67 | 67.75 | 70.29 |
| | Minimum | 38.53 | 61.54 | 33.17 |
| Slab 3 | Average | 49.29 | 64.87 | 62.38 |
| | Standard Deviation | 9.95 | 5.81 | 4.59 |
| | Maximum | 62.69 | 69.23 | 69.81 |
| | Minimum | 33.25 | 53.79 | 51.73 |
| Slab 4 | Average | 49.34 | 67.93 | 61.99 |
| | Standard Deviation | 12.27 | 2.02 | 4.68 |
| | Maximum | 64.18 | 70.08 | 71.35 |
| | Minimum | 30.09 | 65.94 | 53.67 |
| Slab 5 | Average | 49.41 | 65.43 | 63.20 |
| | Standard Deviation | 11.12 | 6.90 | 3.08 |
| | Maximum | 64.57 | 69.93 | 70.01 |
| | Minimum | 32.54 | 51.56 | 57.87 |
| Slab 6 | Average | 49.76 | 62.24 | 62.22 |
| | Standard Deviation | 9.26 | 6.37 | 3.17 |
| | Maximum | 67.31 | 69.89 | 68.83 |
| | Minimum | 37.19 | 53.00 | 56.69 |
| Slab 7 | Average | 50.25 | 70.25 | 62.94 |
| | Standard Deviation | 8.90 | 0.70 | 3.55 |
| | Maximum | 62.64 | 71.28 | 70.02 |
| | Minimum | 36.88 | 69.30 | 58.48 |
| Slab 8 | Average | 58.24 | 69.36 | 66.64 |
| | Standard Deviation | 3.98 | 1.65 | 4.88 |
| | Maximum | 67.70 | 70.09 | 71.52 |
| | Minimum | 53.52 | 65.99 | 54.01 |
| Slabs 1-8 | Average | 50.84 | 65.90 | 62.22 |
| | Standard Deviation | 9.20 | 4.75 | 5.68 |
| | Maximum | 67.70 | 71.28 | 71.52 |
| | Minimum | 30.09 | 51.56 | 33.17 |

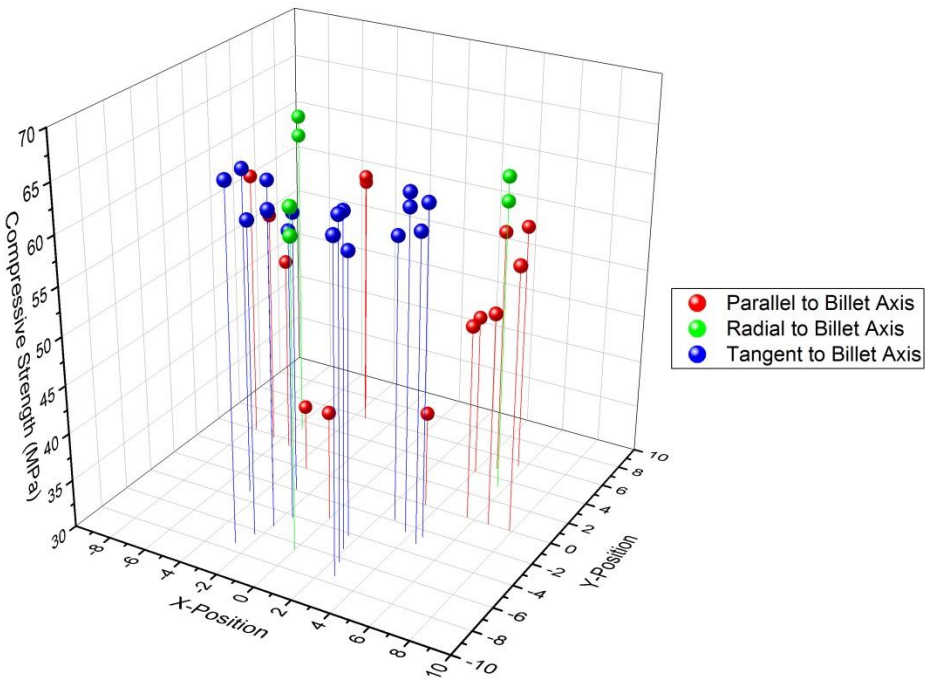


**Figure 13: Slab 1 compression strength data**

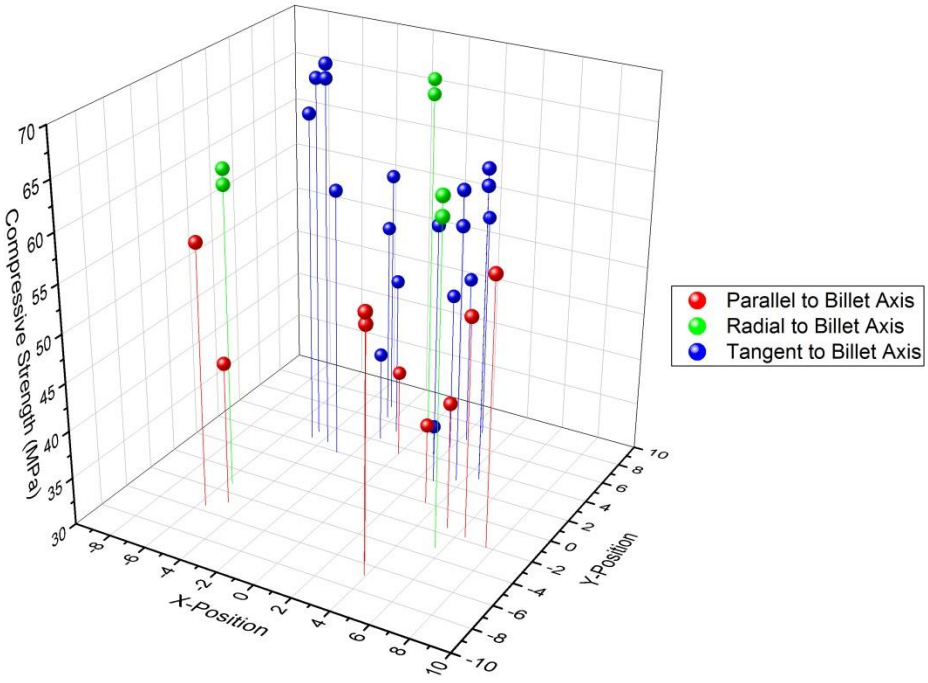


**Figure 14: Slab 2 compression strength data**

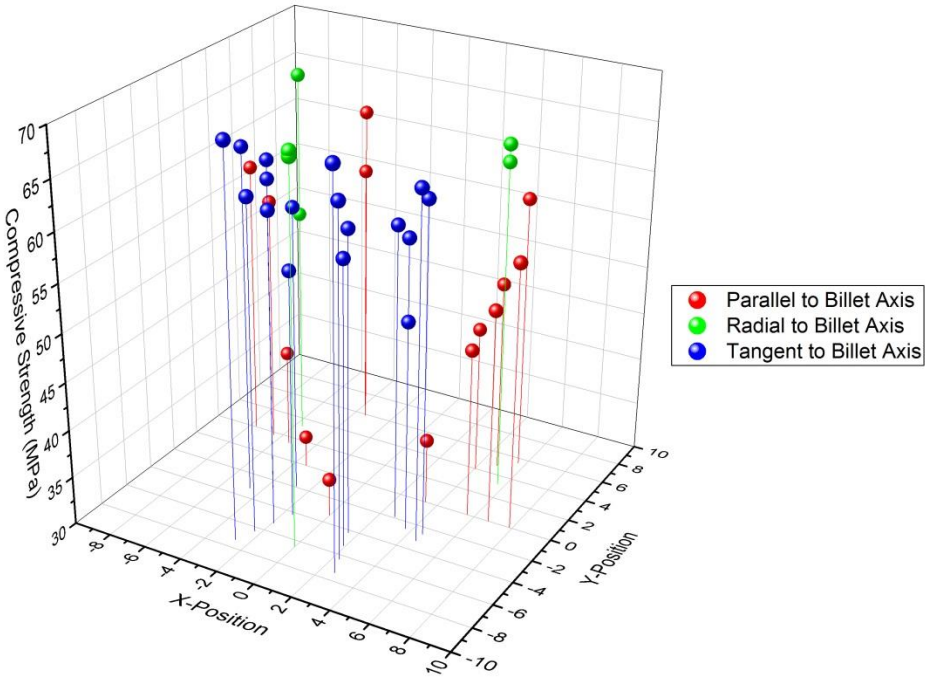


**Figure 15: Slab 3 compression strength data**

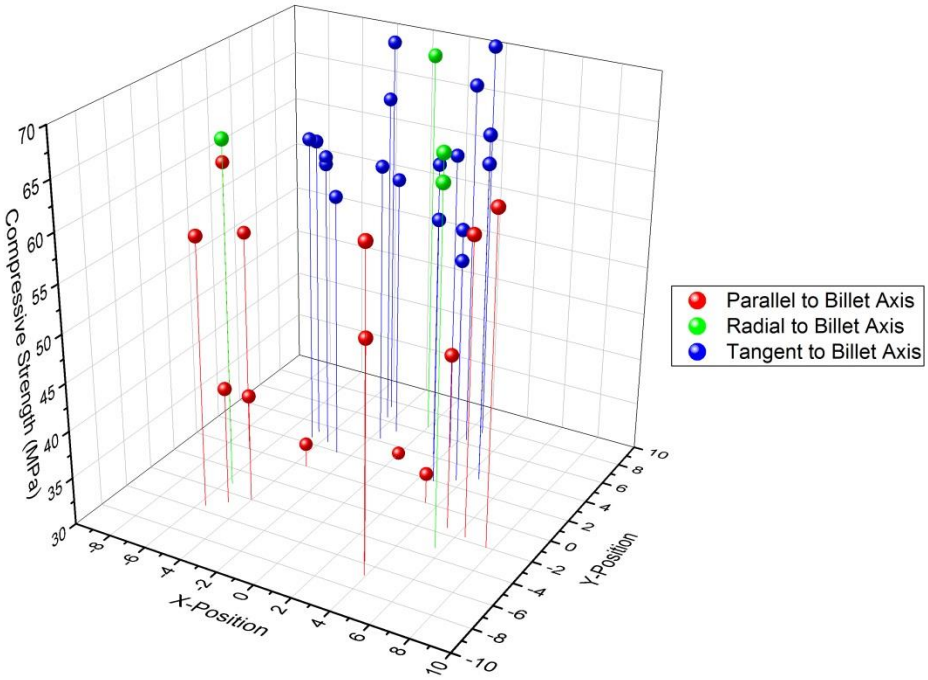


**Figure 16: Slab 4 compression strength data**

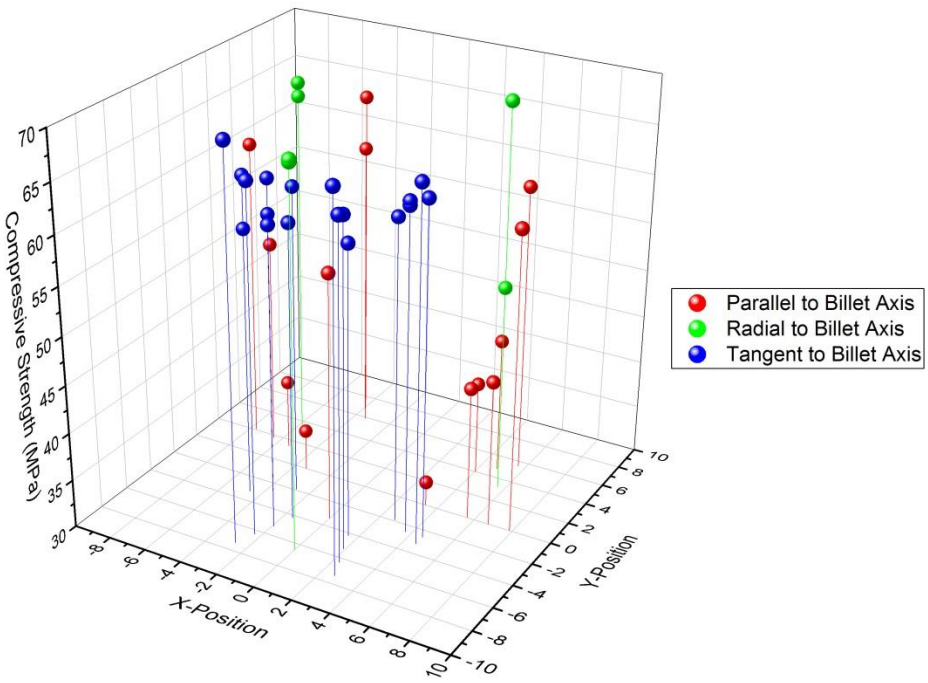


**Figure 17: Slab 5 compression strength data**

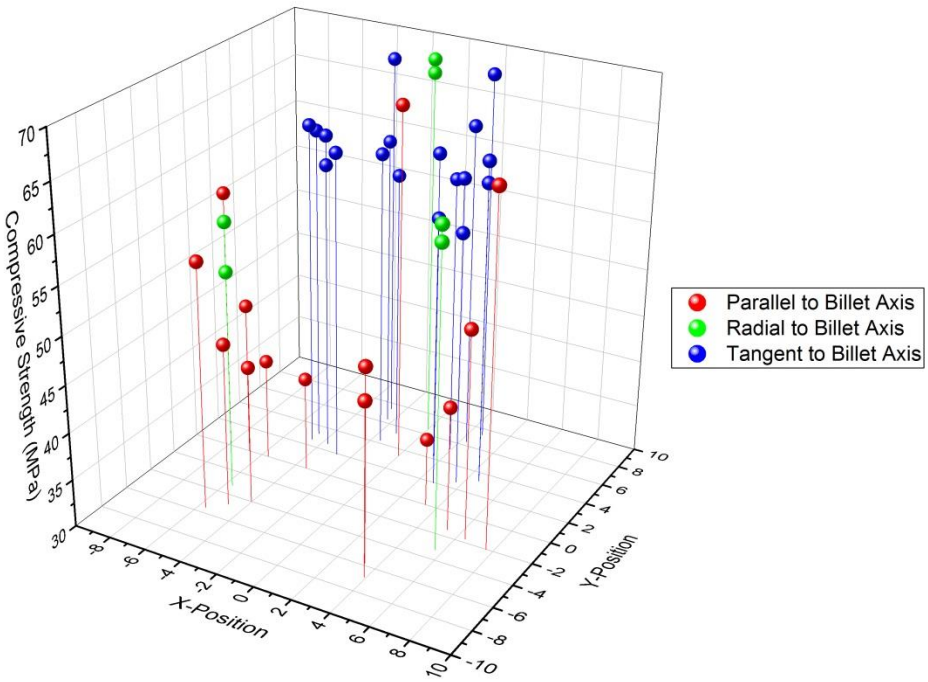


**Figure 18: Slab 6 compression strength data**

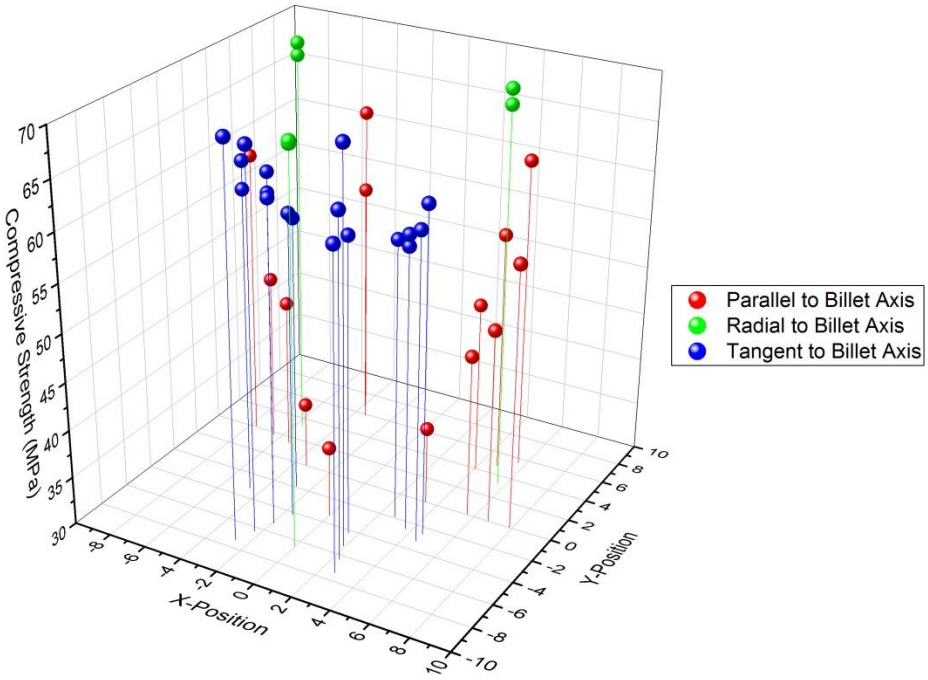


**Figure 19: Slab 7 compression strength data**

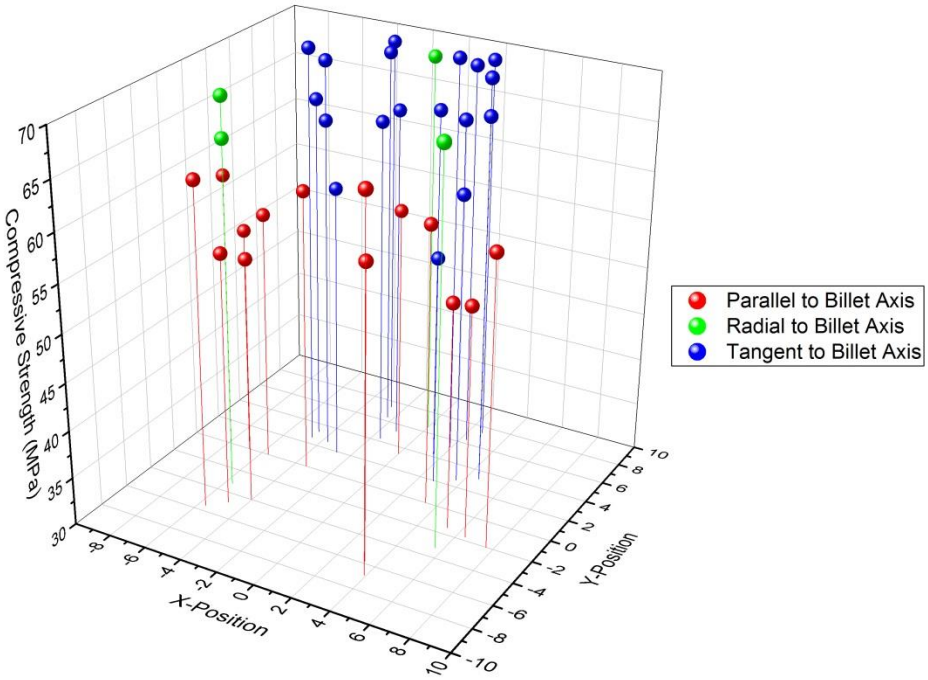


**Figure 20: Slab 8 compression strength data**

### 3.3 TENSILE STRENGTH

Tensile strength data for PCEA billet XCP01S8 11 is provided in APPENDIX B. Figure 21 through 28 are graphical illustrations of tensile strength data from specimens prepared with orientations parallel, radial, and tangent to the center axis of the billet. Similar trends from analysis of the compressive data are observed in the tensile data. Specimens oriented parallel to the billet axis have greater variability and exhibit a more pronounced strength gradient with higher strength at the outer edge of the billet and then decreasing toward the center axis of the billet. The described gradient is observed in other specimen orientations but to a much lesser degree.

Statistical analysis of the tensile strength data is tabulated in Table 2. The overall average for tensile specimens in this billet is 16.4 MPa and exceeds the minimum requirement of 15 MPa specified in ASTM D 7219-08 [8]. However, 32% of the individual specimens fall below this criterion.

**Table 2: Tensile strength data**

| | | Tensile Strength, (MPa) | | |
|---|---|---|---|---|
| Slab | | Parallel | Radial | Tangent |
| Slab 1 | Average | 9.64 | 14.78 | 20.57 |
| | Standard Deviation | 5.30 | 2.10 | 2.00 |
| | Maximum | 16.87 | 16.39 | 23.38 |
| | Minimum | 2.25 | 11.16 | 17.30 |
| Slab 2 | Average | 12.24 | 16.15 | 21.51 |
| | Standard Deviation | 5.78 | 1.85 | 2.61 |
| | Maximum | 20.50 | 19.09 | 24.11 |
| | Minimum | 3.29 | 13.72 | 13.13 |
| Slab 3 | Average | 10.84 | 15.86 | 20.43 |
| | Standard Deviation | 5.85 | 1.05 | 2.92 |
| | Maximum | 19.18 | 17.51 | 24.49 |
| | Minimum | 2.23 | 14.68 | 12.74 |
| Slab 4 | Average | 10.87 | 12.24 | 20.41 |
| | Standard Deviation | 7.10 | 2.36 | 2.26 |
| | Maximum | 23.00 | 14.36 | 23.63 |
| | Minimum | 2.94 | 9.37 | 15.81 |
| Slab 5 | Average | 11.94 | 15.82 | 19.32 |
| | Standard Deviation | 4.96 | 0.59 | 2.52 |
| | Maximum | 21.06 | 16.71 | 23.38 |
| | Minimum | 5.36 | 15.26 | 15.40 |
| Slab 6 | Average | 10.93 | 16.14 | 20.81 |
| | Standard Deviation | 4.59 | 0.75 | 2.55 |
| | Maximum | 19.57 | 17.24 | 24.56 |
| | Minimum | 4.14 | 15.09 | 15.71 |
| Slab 7 | Average | 12.04 | 16.39 | 18.97 |
| | Standard Deviation | 4.69 | 1.30 | 3.21 |
| | Maximum | 20.18 | 18.00 | 23.66 |
| | Minimum | 4.12 | 14.29 | 13.53 |
| Slab 8 | Average | 15.18 | 20.11 | 21.60 |
| | Standard Deviation | 3.04 | 2.04 | 1.79 |
| | Maximum | 19.40 | 23.31 | 25.06 |
| | Minimum | 10.55 | 17.94 | 17.84 |
| Slabs 1-8 | Average | 11.81 | 15.96 | 20.48 |
| | Standard Deviation | 5.30 | 2.57 | 2.63 |
| | Maximum | 23.00 | 23.31 | 25.06 |
| | Minimum | 2.23 | 9.37 | 12.74 |

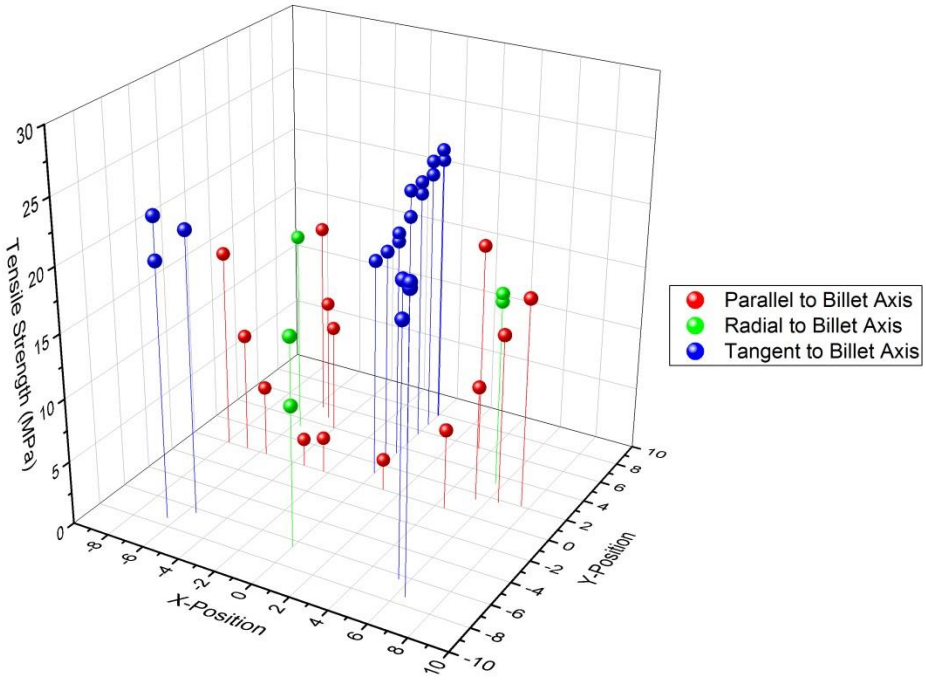


**Figure 21: Slab 1 tensile strength data**

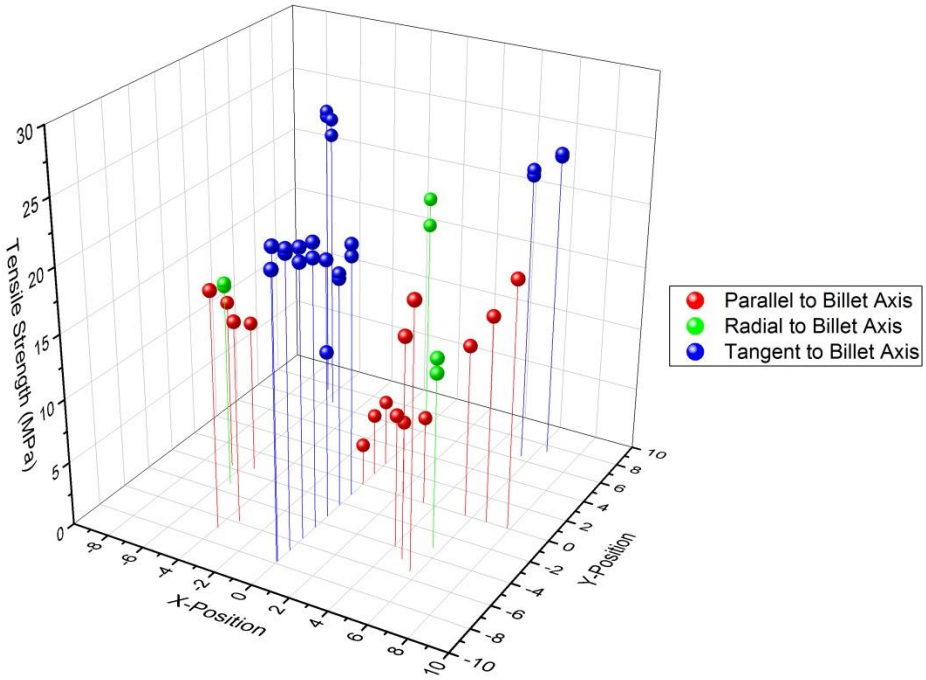


**Figure 22: Slab 2 tensile strength data**

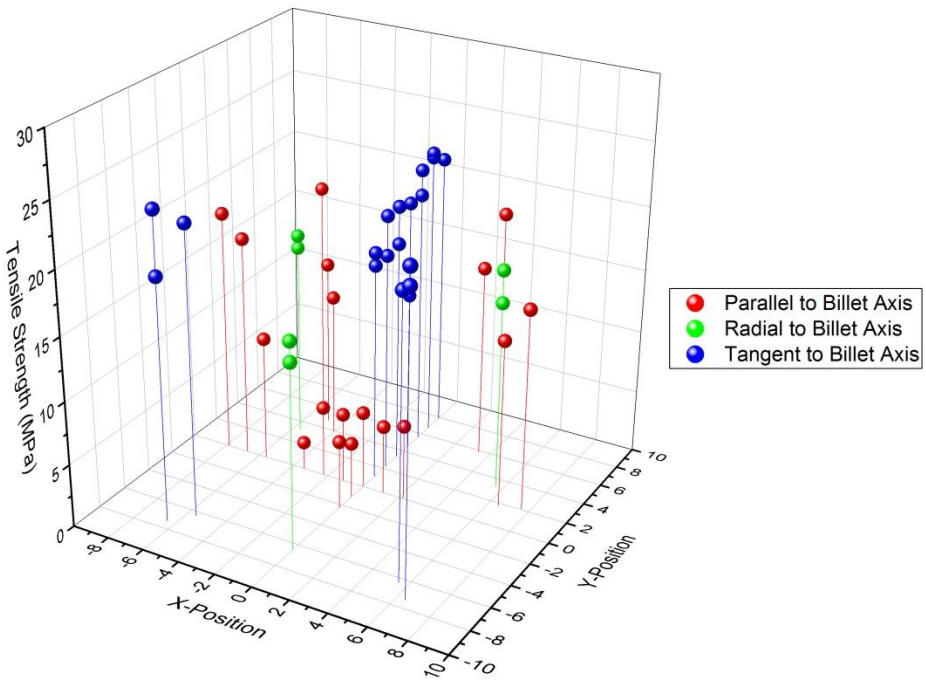


**Figure 23: Slab 3 tensile strength data**

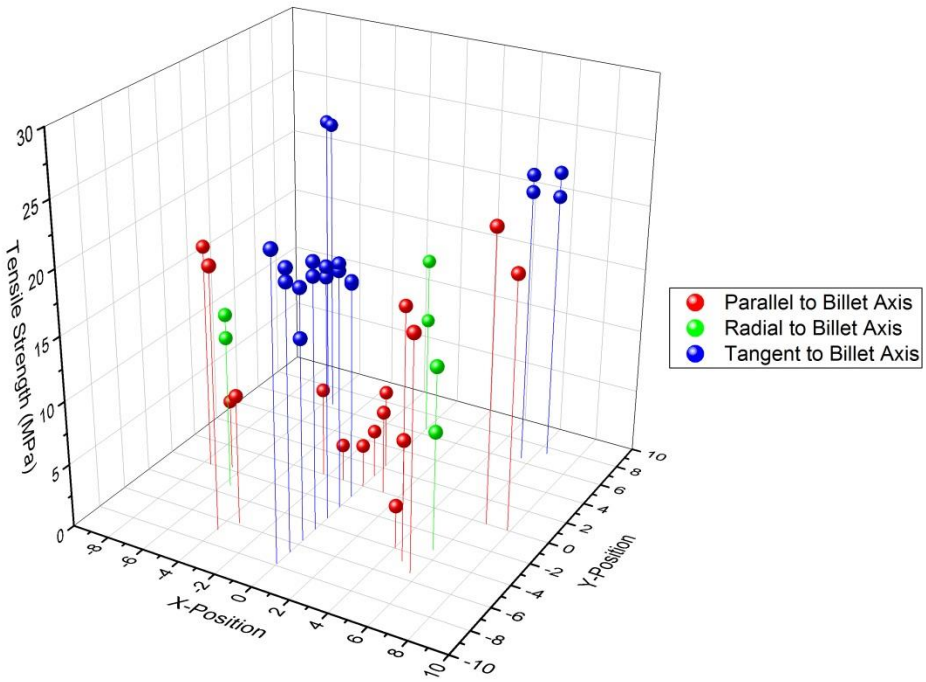


**Figure 24: Slab 4 tensile strength data**

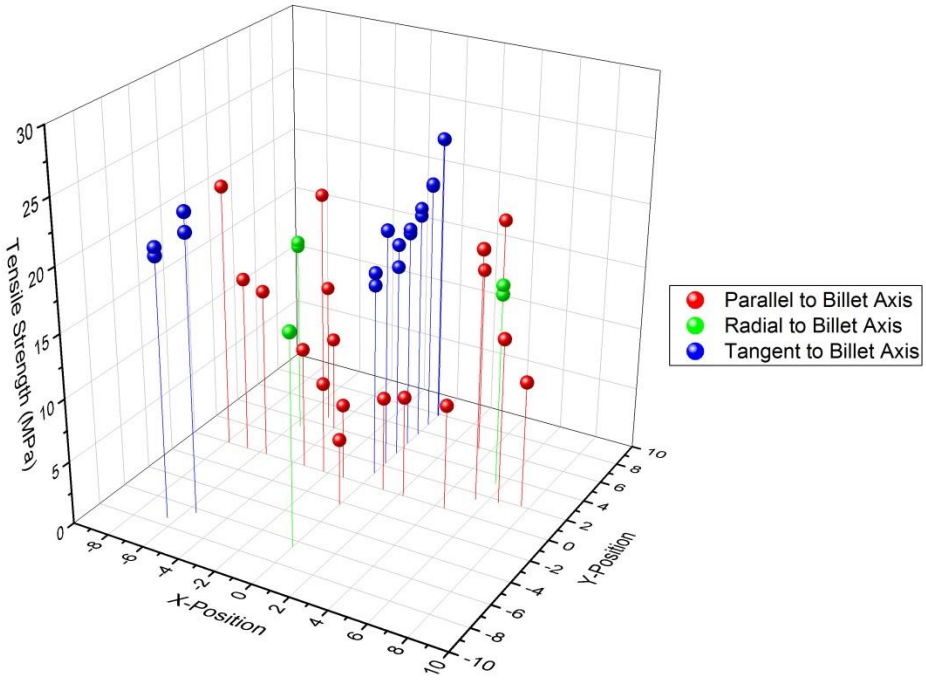


**Figure 25: Slab 5 tensile strength data**

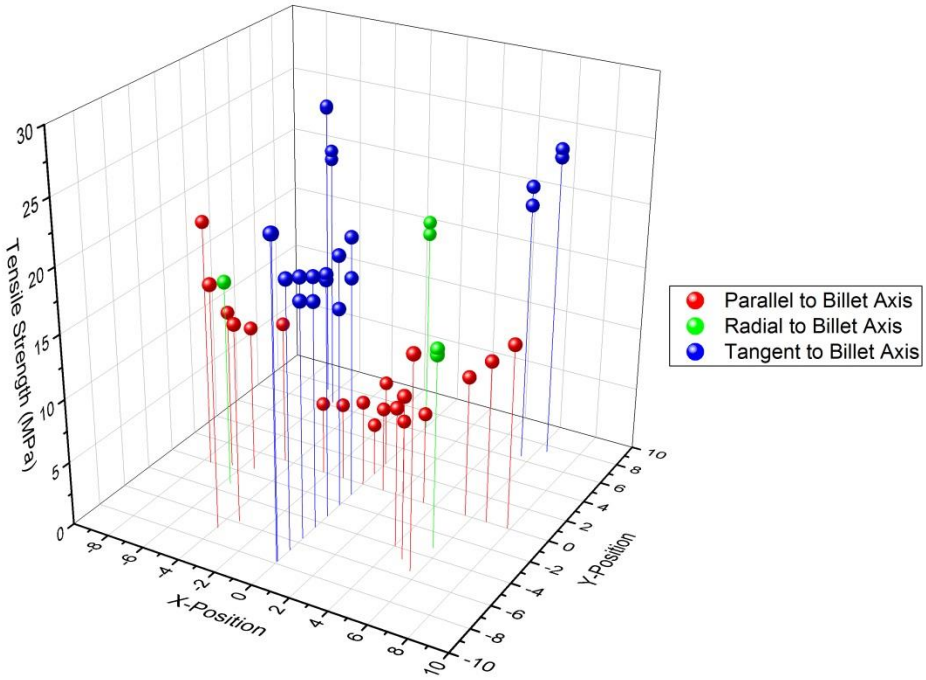


**Figure 26: Slab 6 tensile strength data**

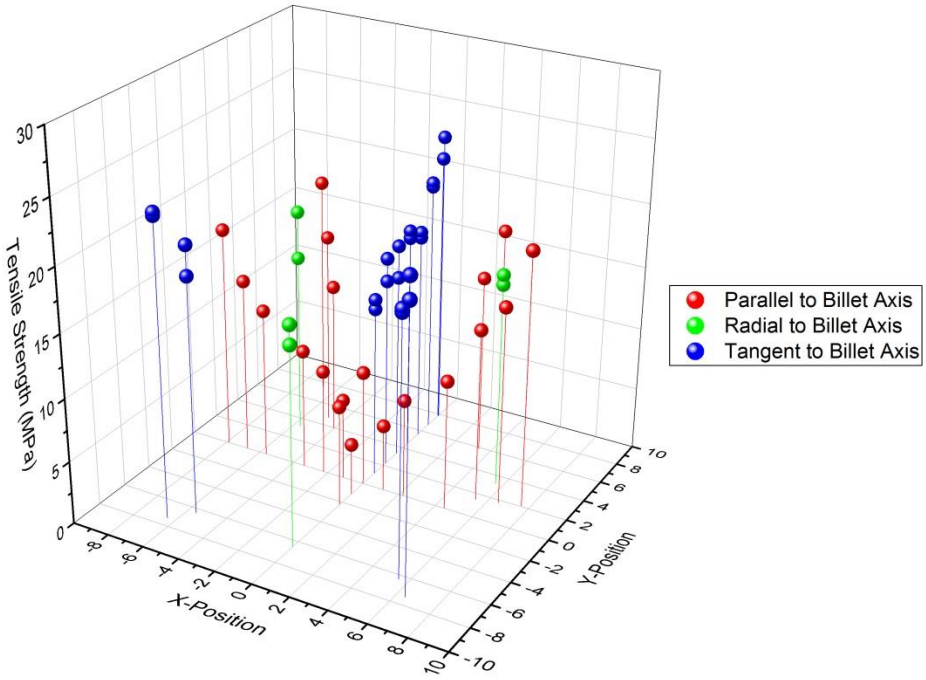


**Figure 27: Slab 7 tensile strength data**

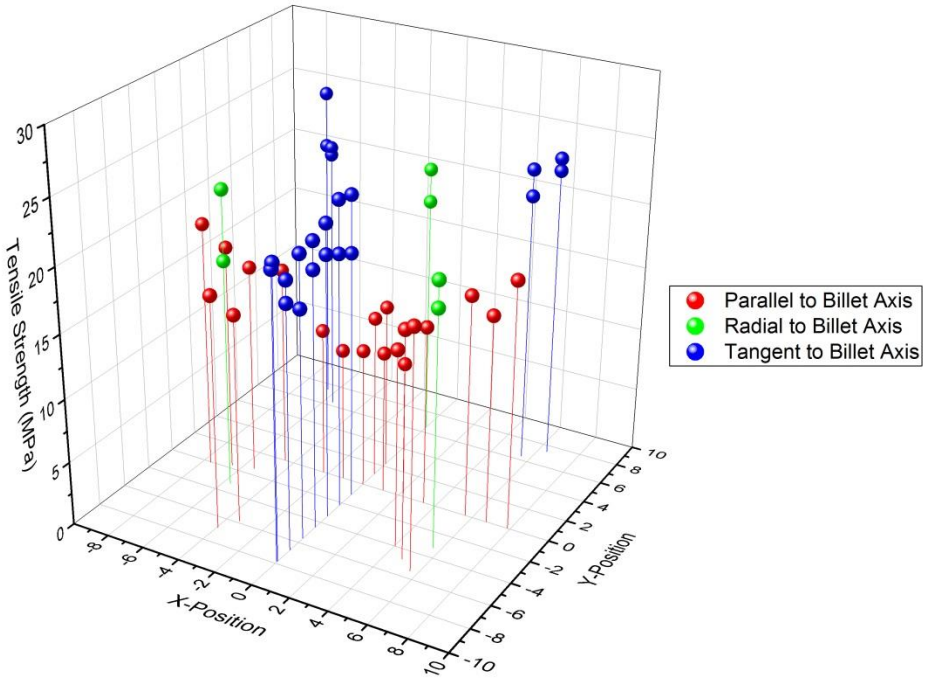


**Figure 28: Slab 8 tensile strength data**

### 3.4 FLEXURE STRENGTH

Flexure strength data for PCEA billet XCP01S8 11 is provided in APPENDIX C. Figure 29 through 36 are graphical illustrations of flexure strength data from specimens prepared with orientations parallel, radial, and tangent to the center axis of the billet. Flexure specimens having a tangent orientation are additionally designated as either having crack propagation with-grain or against-grain. Slab 8 has the highest average strength relative to the other slabs and also exhibits the least degree of variability. Slab 8 also has the highest average density providing evidence of a strong correlation between strength and density.

Statistical data from all flexure specimens tested including flexure strength, modulus of elasticity, and shear modulus are tabulated in Table 3. The average flexure strength for all orientation throughout the billet is 24 MPa and exceeds the 21 MPa minimum required in ASTM D 7219-08. However, 25% of the flexure specimen strength values fall below this minimum value.

**Table 3: Flexure strength, Modulus of Elasticity, and Shear Modulus data**

Flexure Strength, (MPa)

| | Parallel (WG) | Radial (AG) | Tangent (crack propagation WG) | Tangent (crack propagation AG) |
|---|---|---|---|---|
| Average | 21.02 | 21.93 | 27.39 | 18.58 |
| Standard Deviation | 5.45 | 2.53 | 2.55 | 5.83 |
| Maximum | 30.11 | 26.25 | 33.15 | 29.56 |
| Minimum | 2.91 | 14.46 | 20.02 | 5.14 |

Modulus of Elasticity (GPa), E

| | Parallel (WG) | Radial (AG) | Tangent (crack propagation WG) | Tangent (crack propagation AG) |
|---|---|---|---|---|
| Average | 9.43 | 9.33 | 9.98 | 9.03 |
| Standard Deviation | 0.97 | 0.33 | 0.45 | 1.03 |
| Maximum | 10.88 | 9.95 | 10.74 | 11.08 |
| Minimum | 6.49 | 8.46 | 7.50 | 7.08 |

Shear Modulus (GPa), G

| | Parallel (WG) | Radial (AG) | Tangent (crack propagation WG) | Tangent (crack propagation AG) |
|---|---|---|---|---|
| Average | 4.11 | 4.06 | 4.10 | 4.04 |
| Standard Deviation | 0.28 | 0.12 | 0.19 | 0.27 |
| Maximum | 4.53 | 4.28 | 4.46 | 4.62 |
| Minimum | 2.69 | 3.68 | 2.82 | 3.58 |

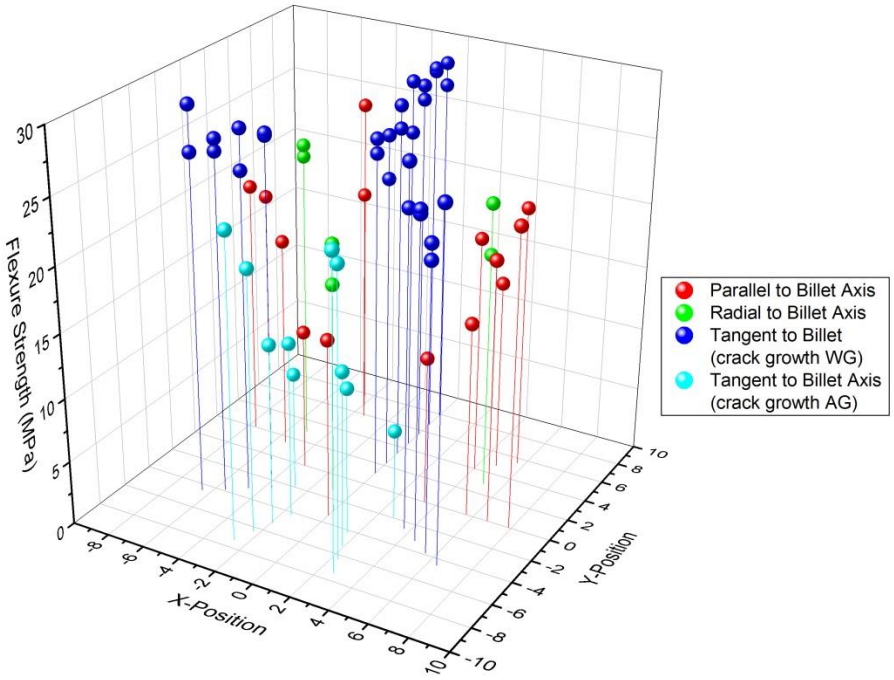


**Figure 29: Slab 1 flexure strength data**

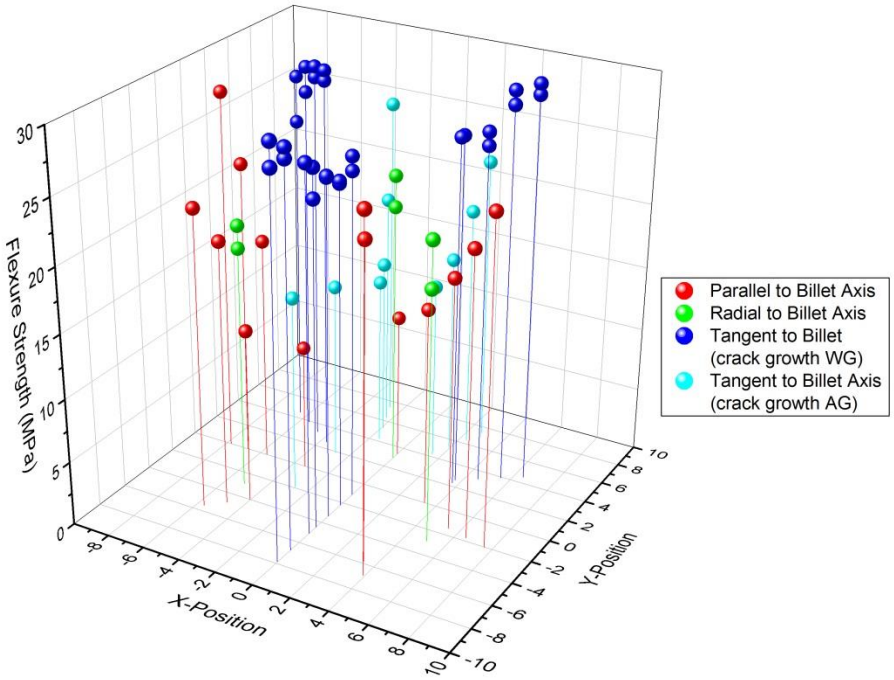


**Figure 30: Slab 2 flexure strength data**

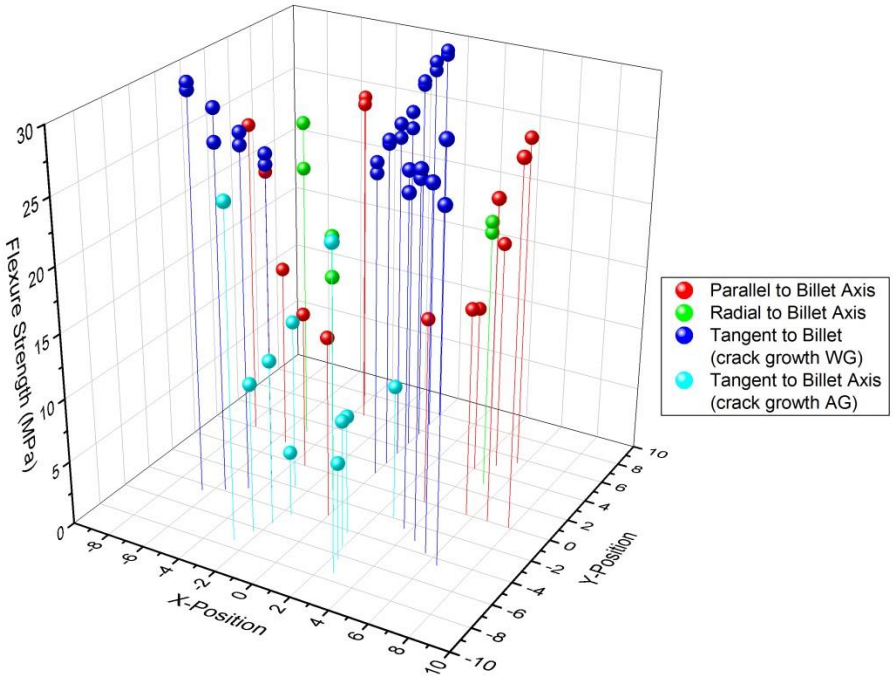


**Figure 31: Slab 3 flexure strength data**

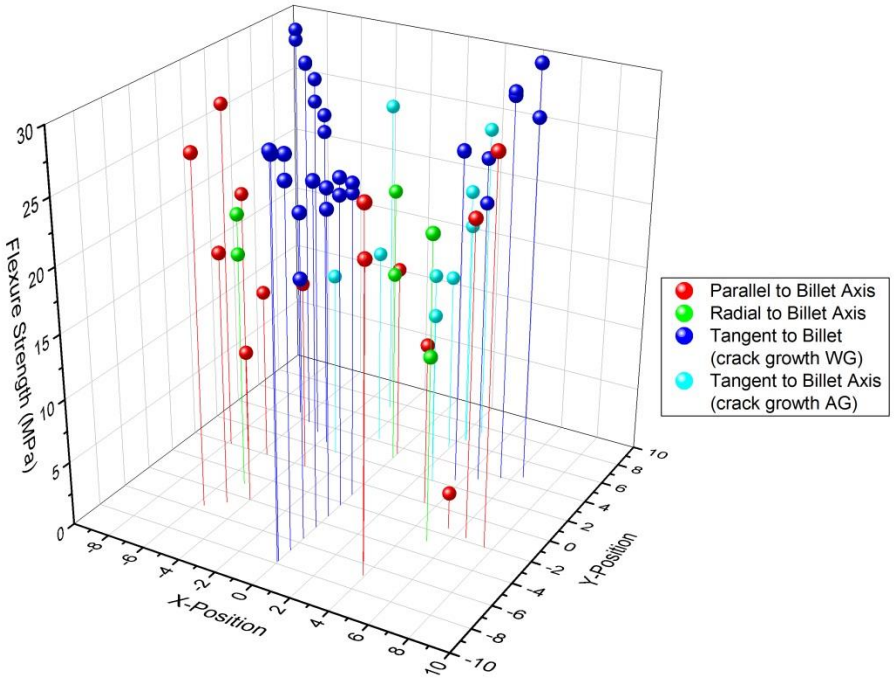


**Figure 32: Slab 4 flexure strength data**

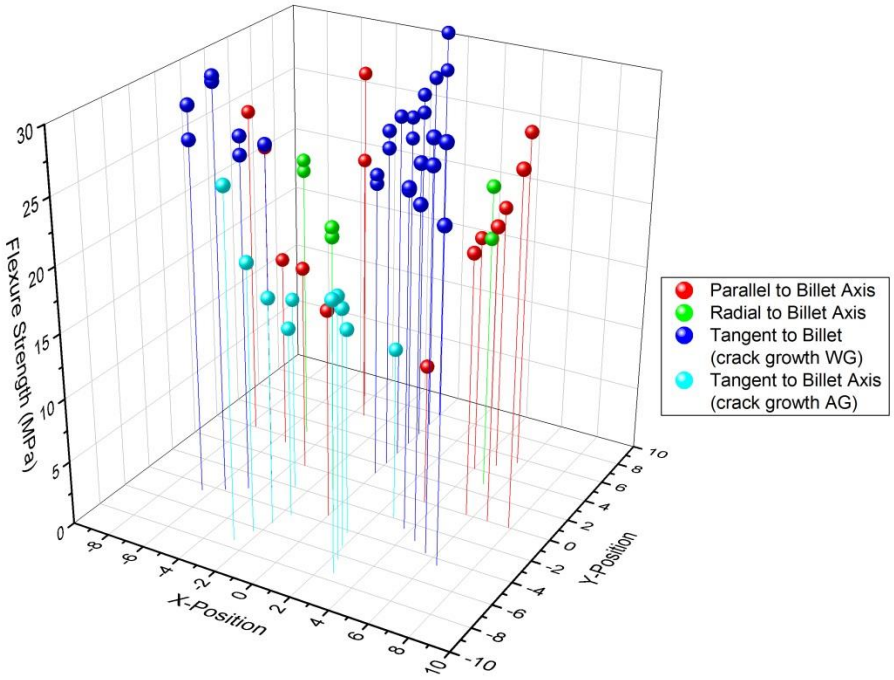


**Figure 33: Slab 5 flexure strength data**

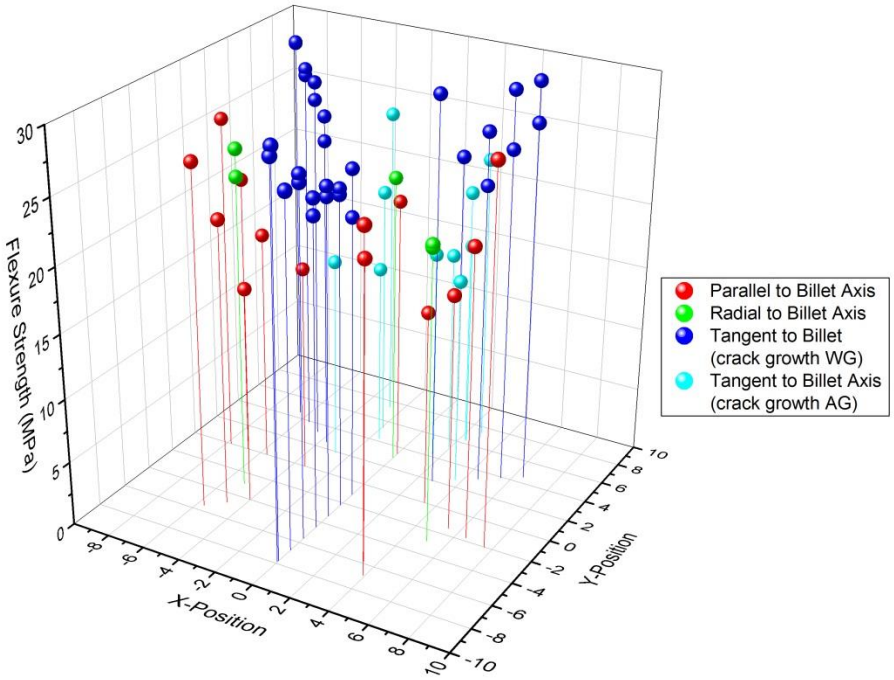


**Figure 34: Slab 6 flexure strength data**

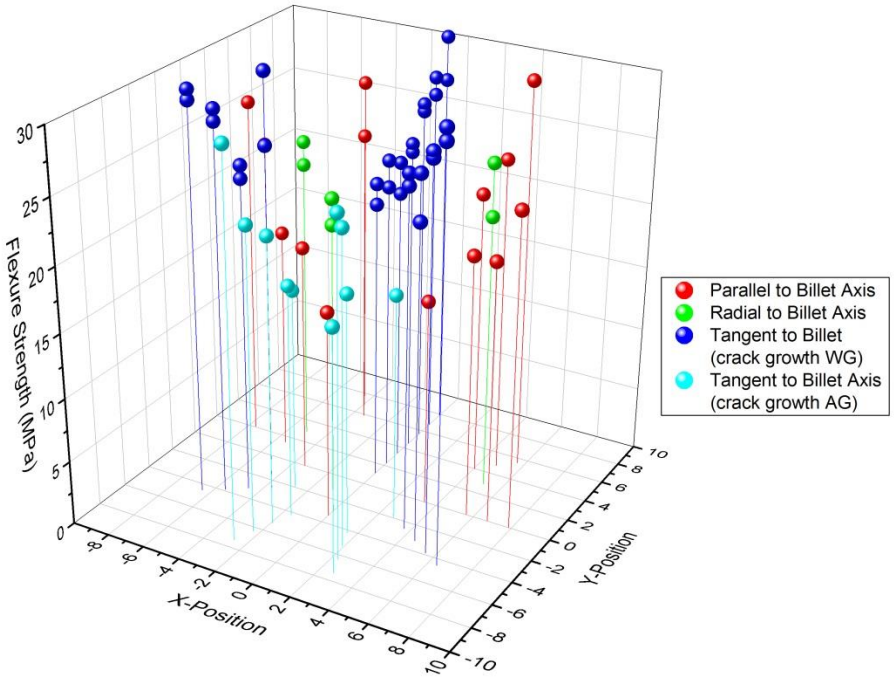


**Figure 35: Slab 7 flexure strength data**

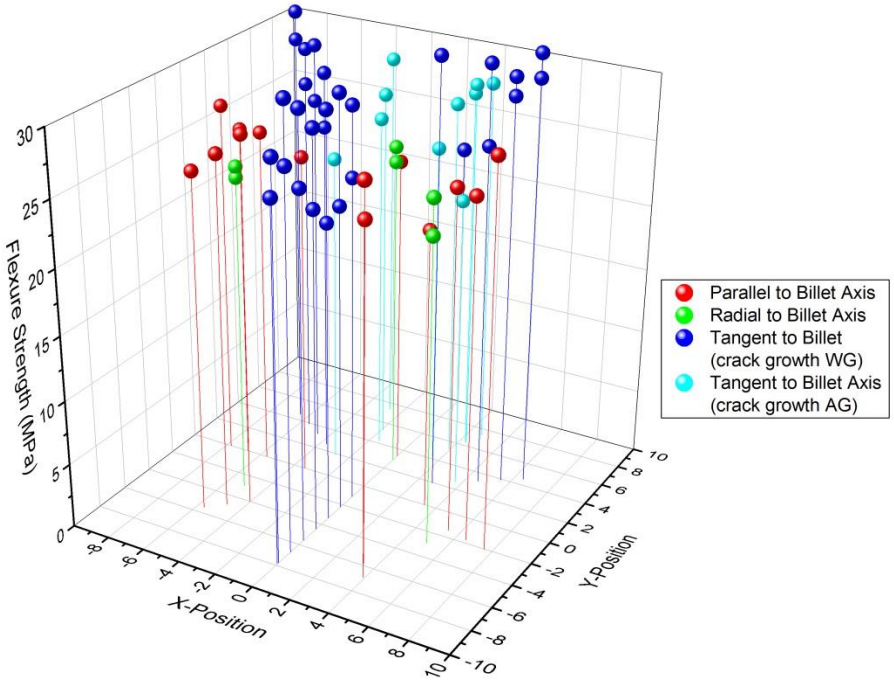


**Figure 36: Slab 8 flexure strength data**

## 4. QUALITY ASSURANCE

The work presented herein was will be conducted in accordance with the applicable requirements of the ASME/NQA-1-2000 national standard entitled *Quality Assurance Requirements for Nuclear Facility Applications.* Project and activity-specific information concerning ORNL's application of the standard's requirements is provided in Document #QAP-ORNL-NGNP-01 entitled *Quality Assurance Plan for the Next Generation Nuclear Plant Materials Program at Oak Ridge National Laboratory* .

## 5. CONCLUSION

The experimental program is underway to characterize the spatial variability, structure, strength (tensile, compressive, and flexural), and elastic properties of PCEA graphite to determine viability of use for core structures for the Next Generation Nuclear Plant (NGNP). ORNL has completed initial tensile, compression, and flexure strength testing of PCEA billet XCP01S8 11.

The average density of the billet exceeds 1.7 kg/cm$^3$ (1700 kg/m$^3$) and thus meets the requirements of ASTM D 7219. Lower density values were typically observed near the center of the billet. The observation was more pronounced at slabs 3, 4, and 5. Variability in density was lowest in slab 8.

Compressive and tensile strength values were strongly related to the variability in density with strength increasing with increased density. Compressive strength values range from 30 to 72 MPa with an average strength of 60 MPa. The average compressive strength exceeds the 45 MPa minimum specified for extruded graphite in ASTM 7219. However, several individual values corresponding to low density sections of the billet fall below this minimum. Tensile strength values ranged from 2.2 to 25.6 MPa and the average strength throughout the billet was 16.4 MPa which exceeds the minimum of 15 MPa specified in ASTM D7219 but with several individual specimens falling below this limit.

Average flexural strength for the billet exceeds the 21MPa minimum specified in ASTM D 7219. However, a limited number of individual specimens exhibited flexural strengths significantly lower than the specified minimum. Strong correlations of low flexure strengths with low values of density were also observed.

## 6. REFERENCES


1. T. Burchell, R. Bratton, W. Windes, ORNL/TM-2007/153, NGNP Graphite Selection and Acquisition Strategy, Sept 2007
2. ASTM C 559 -90, Annual Book of ASTM Standards 2009, Volume 05.005, pp. 179-180, Pub. ASTM International PA, USA (2009)
3. ASTM C 695 - 91, Annual Book of ASTM Standards 2009, Volume 05.05, pp. 209-211, Pub. ASTM International PA, USA (2009)
4. ASTM C 781 - 08, Annual Book of ASTM Standards 2009, Volume 05.005, pp. 244-253, Pub. ASTM International PA, USA (2009)
5. ASTM C 749 - 08, Annual Book of ASTM Standards 2009, Volume 05.005, pp. 229-240, Pub. ASTM International PA, USA (2009)
6. ASTM C 651 - 91, Annual Book of ASTM Standards 2009, Volume 05.005, pp. 203-205, Pub. ASTM International PA, USA (2009)
7. ASTM C 747-93, Annual Book of ASTM Standards 2009, Volume 05.05, pp. 219-226, Pub. ASTM International PA, USA (2009)
8. ASTM D 7219-08, Annual Book of ASTM Standards 2009, Volume 05.05, pp. 278-282, Pub. ASTM International PA, USA (2009)


## 7. ACKNOWLEDGEMENTS


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## APPENDIX A. Compression Specimen Measurements, Densities, and Strengths

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 1-C-W-01-3 | 1-C-W-01-5 | 1-C-W-01-6 | 1-C-W-01-7 | 1-C-W-04-5 | 1-C-W-04-6 | 1-C-W-04-7 | 1-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00065 | 0.999750 | 1.00030 | 1.00015 | 1.00010 | 1.00045 | 1.00005 | 0.99990 |
| | T2 | 1.00085 | 0.99985 | 1.00025 | 1.00015 | 1.00025 | 1.00040 | 1.00015 | 1.00010 |
| | T3 | 1.00100 | 0.99995 | 0.99985 | 1.00010 | 1.00025 | 1.00045 | 1.00000 | 1.00010 |
| | T4 | 1.00050 | 0.99970 | 1.00005 | 1.00020 | 1.00040 | 1.00050 | 0.99995 | 1.00005 |
| Diameters | D1 | 0.50010 | 0.50035 | 0.50030 | 0.50030 | 0.50005 | 0.50045 | 0.50020 | 0.50010 |
| | D2 | 0.49995 | 0.50020 | 0.50010 | 0.50030 | 0.49995 | 0.50020 | 0.50015 | 0.50020 |
| | D3 | 0.49990 | 0.50025 | 0.50025 | 0.50020 | 0.49995 | 0.50030 | 0.50030 | 0.50020 |
| | D4 | 0.50005 | 0.50020 | 0.50035 | 0.50040 | 0.49995 | 0.50035 | 0.50020 | 0.50025 |
| Diameters | $D1^{90}$ | 0.50000 | 0.50040 | 0.50030 | 0.50025 | 0.50005 | 0.50045 | 0.50025 | 0.50010 |
| | $D2^{90}$ | 0.49995 | 0.50025 | 0.50010 | 0.50030 | 0.49990 | 0.50025 | 0.50010 | 0.50015 |
| | $D3^{90}$ | 0.49995 | 0.50030 | 0.50025 | 0.50020 | 0.49995 | 0.50030 | 0.50030 | 0.50020 |
| | $D4^{90}$ | 0.49995 | 0.50015 | 0.50030 | 0.50035 | 0.49995 | 0.50040 | 0.50030 | 0.50030 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19634 | 0.19656 | 0.19654 | 0.19658 | 0.19633 | 0.19662 | 0.19653 | 0.19650 |
| Volume | $in^3$ | 0.19647 | 0.19652 | 0.19654 | 0.19660 | 0.19637 | 0.19669 | 0.19652 | 0.19649 |
| Volume | $m^3$ | 3.2198E-06 | 3.2204E-06 | 3.2211E-06 | 3.2218E-06 | 3.2180E-06 | 3.2234E-06 | 3.2206E-06 | 3.2201E-06 |
| Weight | gm | 5.6686 | 5.795 | 5.7867 | 5.8042 | 5.7554 | 5.7463 | 5.7317 | 5.7876 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1760.56 | 1799.48 | 1796.50 | 1801.55 | 1788.50 | 1782.69 | 1779.69 | 1797.32 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.38 | 5.63 | 6.75 | 7.87 | 4.04 | 4.84 | 5.63 | -3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | 3.98 | 4.78 | 5.56 | 5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 1-C-W-07-7 | 1-C-W-10-5 | 1-C-W-10-6 | 1-C-W-10-7 | 1-C-W-11-3 | 1-C-W-14-3 | 1-C-T-13-4-L1 | 1-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00025 | 1.00040 | 1.00005 | 1.00015 | 1.00000 | 1.00045 | 1.00050 | 1.00050 |
| | T2 | 1.00035 | 1.00035 | 1.00020 | 1.00005 | 0.99995 | 1.00040 | 1.00035 | 1.00025 |
| | T3 | 1.00000 | 1.00020 | 1.00020 | 1.00000 | 1.00015 | 1.00050 | 1.00030 | 1.00040 |
| | T4 | 1.00015 | 1.00025 | 1.00010 | 1.00000 | 1.00000 | 1.00040 | 1.00055 | 1.00065 |
| Diameters | D1 | 0.50025 | 0.50010 | 0.50025 | 0.50035 | 0.50025 | 0.49995 | 0.50015 | 0.50010 |
| | D2 | 0.50010 | 0.50005 | 0.50020 | 0.50015 | 0.50010 | 0.49990 | 0.50000 | 0.50000 |
| | D3 | 0.50015 | 0.50005 | 0.50030 | 0.50020 | 0.50020 | 0.49995 | 0.50000 | 0.50015 |
| | D4 | 0.50005 | 0.50000 | 0.50020 | 0.50025 | 0.50015 | 0.49985 | 0.50005 | 0.50020 |
| Diameters | $D1^{90}$ | 0.50025 | 0.50020 | 0.50025 | 0.50040 | 0.50025 | 0.50005 | 0.50015 | 0.50015 |
| | $D2^{90}$ | 0.50010 | 0.50005 | 0.50025 | 0.50015 | 0.50010 | 0.49990 | 0.49995 | 0.50005 |
| | $D3^{90}$ | 0.50015 | 0.50010 | 0.50030 | 0.50025 | 0.50020 | 0.49995 | 0.50000 | 0.50010 |
| | $D4^{90}$ | 0.50005 | 0.50000 | 0.50015 | 0.50035 | 0.50015 | 0.49985 | 0.50005 | 0.50020 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19646 | 0.19640 | 0.19654 | 0.19656 | 0.19649 | 0.19629 | 0.19638 | 0.19644 |
| Volume | $in^3$ | 0.19650 | 0.19647 | 0.19657 | 0.19656 | 0.19649 | 0.19638 | 0.19646 | 0.19652 |
| Volume | $m^3$ | 3.2200E-06 | 3.2195E-06 | 3.2211E-06 | 3.2211E-06 | 3.2199E-06 | 3.2180E-06 | 3.2195E-06 | 3.2206E-06 |
| Weight | gm | 5.7133 | 5.7796 | 5.7884 | 5.8196 | 5.7478 | 5.7082 | 5.7114 | 5.7064 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1774.33 | 1795.21 | 1797.03 | 1806.69 | 1785.07 | 1773.81 | 1773.99 | 1771.86 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.93 | -5.33 | -6.42 | -7.66 | -3.38 | 0.00 | -1.54 | -1.92 |
| | Y | 6.85 | 1.46 | 1.75 | 2.04 | 0.00 | -3.37 | -4.22 | -5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 1-C-T-13-6-L1 | 1-C-T-13-7-L1 | 1-C-T-15-7-L1 | 1-C-T-15-4-L1 | 1-C-T-15-5-L1 | 1-C-T-15-6-L1 | 1-C-R-03-L1 | 1-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00020 | 1.00040 | 1.00005 | 0.99990 | 1.00010 | 1.00040 | 1.00020 | 1.00090 |
| | T2 | 1.00020 | 1.00030 | 1.00005 | 1.00005 | 1.00035 | 1.00045 | 1.00020 | 1.00130 |
| | T3 | 1.00025 | 1.00030 | 1.00005 | 1.00010 | 1.00030 | 1.00045 | 1.00025 | 1.00085 |
| | T4 | 1.00020 | 1.00030 | 1.00010 | 1.00015 | 1.00015 | 1.00040 | 1.00020 | 1.00100 |
| Diameters | D1 | 0.50020 | 0.49990 | 0.50025 | 0.50010 | 0.50025 | 0.49975 | 0.50010 | 0.49955 |
| | D2 | 0.50015 | 0.49990 | 0.50010 | 0.50025 | 0.50030 | 0.49985 | 0.49995 | 0.49960 |
| | D3 | 0.50005 | 0.49990 | 0.50015 | 0.50035 | 0.50030 | 0.49995 | 0.50005 | 0.49960 |
| | D4 | 0.50015 | 0.49995 | 0.50000 | 0.50040 | 0.50040 | 0.49990 | 0.50005 | 0.49970 |
| Diameters | $D1^{90}$ | 0.50015 | 0.49980 | 0.50020 | 0.50010 | 0.50030 | 0.49985 | 0.50010 | 0.49955 |
| | $D2^{90}$ | 0.50010 | 0.49985 | 0.50010 | 0.50025 | 0.50025 | 0.49990 | 0.49990 | 0.49960 |
| | $D3^{90}$ | 0.50000 | 0.49985 | 0.50015 | 0.50035 | 0.50030 | 0.49995 | 0.50005 | 0.49960 |
| | $D4^{90}$ | 0.50010 | 0.49995 | 0.50000 | 0.50035 | 0.50040 | 0.50000 | 0.50005 | 0.49970 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19644 | 0.19626 | 0.19644 | 0.19656 | 0.19660 | 0.19627 | 0.19637 | 0.19605 |
| Volume | $in^3$ | 0.19648 | 0.19632 | 0.19647 | 0.19656 | 0.19663 | 0.19635 | 0.19640 | 0.19623 |
| Volume | $m^3$ | 3.2197E-06 | 3.2172E-06 | 3.2193E-06 | 3.2212E-06 | 3.2223E-06 | 3.2176E-06 | 3.2187E-06 | 3.2159E-06 |
| Weight | gm | 5.7346 | 5.7302 | 5.7031 | 5.691 | 5.7451 | 5.7395 | 5.709 | 5.7282 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1781.08 | 1781.12 | 1771.52 | 1766.72 | 1782.89 | 1783.78 | 1773.71 | 1781.23 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -2.31 | -2.69 | 2.69 | 1.54 | 1.92 | 2.31 | 7.20 | 7.20 |
| | Y | -6.34 | -7.40 | -7.40 | -4.23 | -5.29 | -6.34 | 4.16 | 4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 1-C-R-09-L1 | 1-C-R-09-L3 | 1-C-R-14-L1 | 1-C-R-14-L3 | 1-C-T-12-3-L1 | 1-C-T-12-4-L1 | 1-C-T-12-5-L1 | 1-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00010 | 0.99980 | 1.00030 | 1.00040 | 1.00020 | 1.00025 | 1.00030 | 1.00040 |
| | T2 | 1.00000 | 0.99980 | 1.00025 | 1.00045 | 1.00020 | 1.00025 | 1.00040 | 1.00020 |
| | T3 | 0.99990 | 0.99985 | 1.00015 | 1.00040 | 1.00030 | 1.00025 | 1.00050 | 1.00045 |
| | T4 | 1.00005 | 0.99985 | 1.00030 | 1.00030 | 1.00030 | 1.00020 | 1.00045 | 1.00060 |
| Diameters | D1 | 0.50035 | 0.50035 | 0.50010 | 0.50015 | 0.50005 | 0.50015 | 0.50025 | 0.50025 |
| | D2 | 0.50015 | 0.50030 | 0.50015 | 0.50020 | 0.50020 | 0.50005 | 0.50010 | 0.50015 |
| | D3 | 0.50025 | 0.50030 | 0.50010 | 0.50015 | 0.50030 | 0.50010 | 0.50010 | 0.50015 |
| | D4 | 0.50010 | 0.50025 | 0.50030 | 0.50010 | 0.50035 | 0.50000 | 0.50005 | 0.50005 |
| Diameters | $D1^{90}$ | 0.50035 | 0.50040 | 0.50010 | 0.50020 | 0.50015 | 0.50015 | 0.50020 | 0.50025 |
| | $D2^{90}$ | 0.50015 | 0.50035 | 0.50010 | 0.50025 | 0.50035 | 0.50010 | 0.50010 | 0.50010 |
| | $D3^{90}$ | 0.50020 | 0.50035 | 0.50010 | 0.50015 | 0.50030 | 0.50005 | 0.50010 | 0.50010 |
| | $D4^{90}$ | 0.50010 | 0.50020 | 0.50025 | 0.50015 | 0.50035 | 0.49995 | 0.50005 | 0.50005 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19651 | 0.19660 | 0.19647 | 0.19648 | 0.19655 | 0.19640 | 0.19644 | 0.19646 |
| Volume | $in^3$ | 0.19652 | 0.19657 | 0.19650 | 0.19657 | 0.19660 | 0.19646 | 0.19653 | 0.19654 |
| Volume | $m^3$ | 3.2203E-06 | 3.2211E-06 | 3.2203E-06 | 3.2210E-06 | 3.2217E-06 | 3.2192E-06 | 3.2205E-06 | 3.2207E-06 |
| Weight | gm | 5.7427 | 5.7468 | 5.7442 | 5.7368 | 5.6991 | 5.7095 | 5.7228 | 5.7044 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1783.28 | 1784.13 | 1783.73 | 1781.05 | 1768.97 | 1773.55 | 1777.02 | 1771.17 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -7.20 | -7.20 | 0.00 | 0.00 | -2.76 | -3.69 | -4.61 | -3.69 |
| | Y | 4.16 | 4.16 | -7.20 | -7.20 | -1.93 | -2.58 | -3.23 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 1-C-T-12-5-L3 | 1-C-T-16-3-L1 | 1-C-T-16-4-L1 | 1-C-T-16-5-L1 | 1-C-T-16-4-L3 | 1-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00100 | 1.00030 | 1.00060 | 1.00060 | 1.00040 | 1.00000 |
| | T2 | 1.00100 | 1.00055 | 1.00075 | 1.00045 | 1.00035 | 1.00000 |
| | T3 | 1.00100 | 1.00045 | 1.00075 | 1.00045 | 1.00030 | 0.99995 |
| | T4 | 1.00095 | 1.00045 | 1.00075 | 1.00060 | 1.00040 | 0.99995 |
| Diameters | D1 | 0.49945 | 0.49985 | 0.50005 | 0.50005 | 0.50000 | 0.50025 |
| | D2 | 0.49940 | 0.49985 | 0.49995 | 0.50005 | 0.50005 | 0.50030 |
| | D3 | 0.49940 | 0.49995 | 0.49995 | 0.49990 | 0.50015 | 0.50025 |
| | D4 | 0.49935 | 0.49995 | 0.49995 | 0.49980 | 0.50020 | 0.50045 |
| Diameters | $D1^{90}$ | 0.49950 | 0.49985 | 0.50000 | 0.50000 | 0.50005 | 0.50020 |
| | $D2^{90}$ | 0.49940 | 0.49985 | 0.49995 | 0.50000 | 0.50010 | 0.50030 |
| | $D3^{90}$ | 0.49940 | 0.49995 | 0.49995 | 0.49990 | 0.50015 | 0.50030 |
| | $D4^{90}$ | 0.49930 | 0.49995 | 0.49990 | 0.49980 | 0.50010 | 0.50045 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19588 | 0.19627 | 0.19632 | 0.19630 | 0.19643 | 0.19660 |
| Volume | $in^3$ | 0.19608 | 0.19635 | 0.19646 | 0.19642 | 0.19649 | 0.19658 |
| Volume | $m^3$ | 3.2131E-06 | 3.2177E-06 | 3.2194E-06 | 3.2185E-06 | 3.2201E-06 | 3.2215E-06 |
| Weight | gm | 5.7185 | 5.7186 | 5.7482 | 5.7426 | 5.7298 | 5.7347 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1779.77 | 1777.22 | 1785.48 | 1784.26 | 1779.41 | 1780.11 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -4.61 | 2.76 | 3.69 | 4.61 | 3.69 | 4.61 |
| | Y | -3.23 | -1.93 | -2.58 | -3.23 | -2.58 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 2-C-W-01-3 | 2-C-W-01-5 | 2-C-W-01-6 | 2-C-W-01-7 | 2-C-W-04-5 | 2-C-W-04-6 | 2-C-W-04-7 | 2-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00045 | 1.00075 | 0.99930 | 1.00015 | 1.00090 | 0.99965 | 0.99965 | 1.00010 |
| | T2 | 1.00055 | 1.00090 | 0.99970 | 1.00030 | 1.00080 | 0.99960 | 0.99960 | 1.00020 |
| | T3 | 1.00060 | 1.00070 | 0.99930 | 1.00020 | 1.00060 | 0.99965 | 0.99965 | 1.00070 |
| | T4 | 1.00055 | 1.00085 | 0.99940 | 1.00020 | 1.00080 | 0.99985 | 0.99970 | 1.00030 |
| Diameters | D1 | 0.49955 | 0.49930 | 0.50055 | 0.49950 | 0.49940 | 0.50040 | 0.50060 | 0.49985 |
| | D2 | 0.49955 | 0.49950 | 0.50030 | 0.49970 | 0.49945 | 0.50035 | 0.50040 | 0.49980 |
| | D3 | 0.49955 | 0.49960 | 0.50040 | 0.49945 | 0.49945 | 0.50030 | 0.50035 | 0.49995 |
| | D4 | 0.49940 | 0.49965 | 0.50030 | 0.49960 | 0.49945 | 0.50030 | 0.50035 | 0.49965 |
| Diameters | $D1^{90}$ | 0.49950 | 0.49950 | 0.50035 | 0.49950 | 0.49940 | 0.50025 | 0.50030 | 0.49970 |
| | $D2^{90}$ | 0.49955 | 0.49950 | 0.50035 | 0.49955 | 0.49940 | 0.50030 | 0.50025 | 0.49975 |
| | $D3^{90}$ | 0.49950 | 0.49960 | 0.50030 | 0.49965 | 0.49940 | 0.50035 | 0.50025 | 0.49965 |
| | $D4^{90}$ | 0.49950 | 0.49960 | 0.50025 | 0.49950 | 0.49940 | 0.50035 | 0.50025 | 0.49985 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19597 | 0.19598 | 0.19662 | 0.19600 | 0.19589 | 0.19661 | 0.19662 | 0.19617 |
| Volume | $in^3$ | 0.19609 | 0.19612 | 0.19652 | 0.19604 | 0.19604 | 0.19654 | 0.19654 | 0.19625 |
| Volume | $m^3$ | 3.2131E-06 | 3.2141E-06 | 3.2203E-06 | 3.2126E-06 | 3.2126E-06 | 3.2208E-06 | 3.2209E-06 | 3.2157E-06 |
| Weight | gm | 5.6855 | 5.7362 | 5.7458 | 5.7522 | 5.6968 | 5.7576 | 5.7545 | 5.7282 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1769.50 | 1784.68 | 1784.27 | 1790.53 | 1773.26 | 1787.64 | 1786.61 | 1781.30 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.38 | -5.63 | -6.75 | -7.87 | -4.04 | -4.84 | -5.63 | 3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | -3.98 | -4.78 | -5.56 | -5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 2-C-W-07-7 | 2-C-W-10-5 | 2-C-W-10-6 | 2-C-W-10-7 | 2-C-W-11-3 | 2-C-W-14-3 | 2-C-T-13-4-L1 | 2-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00010 | 0.99955 | 0.99979 | 1.00035 | 1.00050 | 1.00075 | 1.00000 | 0.99915 |
| | T2 | 0.99985 | 0.99945 | 1.00050 | 1.00025 | 0.99995 | 1.00075 | 1.00000 | 0.99925 |
| | T3 | 0.99985 | 0.99955 | 0.99965 | 1.00030 | 1.00010 | 1.00070 | 1.00000 | 0.99910 |
| | T4 | 1.00005 | 0.99985 | 1.00035 | 1.00020 | 1.00010 | 1.00070 | 1.00010 | 0.99935 |
| Diameters | D1 | 0.49990 | 0.50015 | 0.50010 | 0.49965 | 0.49850 | 0.49930 | 0.49980 | 0.49935 |
| | D2 | 0.50000 | 0.50015 | 0.50015 | 0.49975 | 0.49875 | 0.49930 | 0.49965 | 0.49940 |
| | D3 | 0.50010 | 0.50010 | 0.50015 | 0.49960 | 0.49890 | 0.49930 | 0.49965 | 0.49940 |
| | D4 | 0.50010 | 0.49990 | 0.50015 | 0.49965 | 0.49890 | 0.49935 | 0.49955 | 0.49955 |
| Diameters | $D1^{90}$ | 0.49990 | 0.50010 | 0.50015 | 0.49965 | 0.49865 | 0.49950 | 0.49960 | 0.49920 |
| | $D2^{90}$ | 0.50010 | 0.50000 | 0.50010 | 0.49970 | 0.49875 | 0.49950 | 0.49970 | 0.49935 |
| | $D3^{90}$ | 0.50010 | 0.50005 | 0.50010 | 0.49965 | 0.49890 | 0.49955 | 0.49965 | 0.49935 |
| | $D4^{90}$ | 0.50020 | 0.50000 | 0.50010 | 0.49975 | 0.49885 | 0.49945 | 0.49945 | 0.49960 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19639 | 0.19639 | 0.19645 | 0.19609 | 0.19539 | 0.19588 | 0.19606 | 0.19588 |
| Volume | $in^3$ | 0.19638 | 0.19633 | 0.19646 | 0.19615 | 0.19541 | 0.19604 | 0.19608 | 0.19571 |
| Volume | $m^3$ | 3.2181E-06 | 3.2170E-06 | 3.2194E-06 | 3.2143E-06 | 3.2024E-06 | 3.2123E-06 | 3.2129E-06 | 3.2074E-06 |
| Weight | gm | 5.7727 | 5.7177 | 5.8041 | 5.7445 | 5.6453 | 5.6270 | 5.6518 | 5.6804 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1793.81 | 1777.32 | 1802.83 | 1787.17 | 1762.85 | 1751.71 | 1759.08 | 1771.05 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.93 | 5.33 | 6.42 | 7.66 | 3.38 | 0.00 | 1.54 | 1.92 |
| | Y | -6.85 | -1.46 | -1.75 | -2.04 | 0.00 | 3.37 | 4.23 | 5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 2-C-T-13-6-L1 | 2-C-T-13-7-L1 | 2-C-T-15-7-L1 | 2-C-T-15-4-L1 | 2-C-T-15-5-L1 | 2-C-T-15-6-L1 | 2-C-R-03-L1 | 2-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99960 | 1.00025 | 0.99300 | 0.99995 | 1.00030 | 1.00015 | 0.99970 | 0.99955 |
| | T2 | 0.99980 | 1.00025 | 0.99955 | 1.00005 | 0.99970 | 1.00055 | 0.99950 | 0.99955 |
| | T3 | 0.99955 | 1.00045 | 0.99935 | 0.99990 | 1.00020 | 1.00005 | 0.99975 | 0.99965 |
| | T4 | 0.99960 | 1.00025 | 0.99935 | 1.00005 | 0.99980 | 1.00005 | 0.99975 | 0.99955 |
| Diameters | D1 | 0.50035 | 0.49965 | 0.50000 | 0.49985 | 0.49985 | 0.50005 | 0.50060 | 0.50020 |
| | D2 | 0.50035 | 0.49960 | 0.50005 | 0.49995 | 0.49995 | 0.49995 | 0.50055 | 0.50035 |
| | D3 | 0.50005 | 0.49990 | 0.50010 | 0.49995 | 0.50005 | 0.50000 | 0.50040 | 0.50035 |
| | D4 | 0.50035 | 0.49990 | 0.50015 | 0.50005 | 0.50000 | 0.49995 | 0.50040 | 0.50035 |
| Diameters | $D1^{90}$ | 0.50030 | 0.49990 | 0.49990 | 0.49975 | 0.49975 | 0.50000 | 0.50035 | 0.50040 |
| | $D2^{90}$ | 0.50025 | 0.49995 | 0.49995 | 0.49980 | 0.50000 | 0.50005 | 0.50055 | 0.50020 |
| | $D3^{90}$ | 0.50025 | 0.49990 | 0.49995 | 0.50000 | 0.50000 | 0.49995 | 0.50055 | 0.50020 |
| | $D4^{90}$ | 0.50005 | 0.49990 | 0.50020 | 0.50000 | 0.50005 | 0.50000 | 0.50055 | 0.50030 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19654 | 0.19622 | 0.19638 | 0.19629 | 0.19632 | 0.19635 | 0.19674 | 0.19658 |
| Volume | $in^3$ | 0.19646 | 0.19629 | 0.19593 | 0.19626 | 0.19632 | 0.19639 | 0.19669 | 0.19648 |
| Volume | $m^3$ | 3.2196E-06 | 3.2165E-06 | 3.2110E-06 | 3.2165E-06 | 3.2170E-06 | 3.2182E-06 | 3.2229E-06 | 3.2200E-06 |
| Weight | gm | 5.7369 | 5.7446 | 5.8016 | 5.6717 | 5.6749 | 5.7748 | 5.7420 | 5.7714 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1781.88 | 1785.99 | 1806.76 | 1763.31 | 1764.01 | 1794.44 | 1781.62 | 1792.35 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 2.31 | 2.69 | -2.69 | -1.54 | -1.20 | -2.31 | -7.20 | -7.20 |
| | Y | 6.34 | 7.40 | 7.4 | 4.23 | 5.29 | 6.34 | -4.16 | -4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 2-C-R-09-L1 | 2-C-R-09-L3 | 2-C-R-14-L1 | 2-C-R-14-L3 | 2-C-T-12-3-L1 | 2-C-T-12-4-L1 | 2-C-T-12-5-L1 | 2-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99965 | 0.99930 | 0.99955 | 0.99925 | 0.99995 | 1.00020 | 1.00050 | 0.99995 |
| | T2 | 0.99975 | 0.99940 | 0.99960 | 0.99960 | 1.00005 | 1.00015 | 1.00040 | 1.00020 |
| | T3 | 0.99975 | 0.99945 | 0.99955 | 0.99960 | 1.00035 | 1.00035 | 1.00085 | 1.00015 |
| | T4 | 0.99975 | 0.99925 | 0.99950 | 0.99955 | 1.00020 | 1.00040 | 1.00060 | 0.99995 |
| Diameters | D1 | 0.50000 | 0.50025 | 0.50035 | 0.50010 | 0.50010 | 0.49990 | 0.49965 | 0.50025 |
| | D2 | 0.50025 | 0.50020 | 0.50020 | 0.49990 | 0.50000 | 0.50005 | 0.49965 | 0.50025 |
| | D3 | 0.50025 | 0.50040 | 0.50030 | 0.50005 | 0.49985 | 0.50015 | 0.49970 | 0.50015 |
| | D4 | 0.50025 | 0.50050 | 0.50025 | 0.50000 | 0.49995 | 0.49985 | 0.49965 | 0.50015 |
| Diameters | $D1^{90}$ | 0.50035 | 0.50050 | 0.50040 | 0.50025 | 0.49995 | 0.50004 | 0.49965 | 0.50025 |
| | $D2^{90}$ | 0.50035 | 0.50045 | 0.50035 | 0.49990 | 0.49975 | 0.50005 | 0.49970 | 0.50030 |
| | $D3^{90}$ | 0.50030 | 0.50050 | 0.50030 | 0.50015 | 0.50000 | 0.50015 | 0.49970 | 0.50020 |
| | $D4^{90}$ | 0.50035 | 0.50040 | 0.50020 | 0.50010 | 0.49990 | 0.50010 | 0.49965 | 0.50020 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19656 | 0.19666 | 0.19658 | 0.19639 | 0.19630 | 0.19638 | 0.19609 | 0.19652 |
| Volume | $in^3$ | 0.19651 | 0.19653 | 0.19650 | 0.19629 | 0.19631 | 0.19645 | 0.19621 | 0.19655 |
| Volume | $m^3$ | 3.2201E-06 | 3.2207E-06 | 3.2199E-06 | 3.2167E-06 | 3.2172E-06 | 3.2190E-06 | 3.2152E-06 | 3.2206E-06 |
| Weight | gm | 5.7856 | 5.7996 | 5.8243 | 5.7771 | 5.6866 | 5.6896 | 5.7335 | 5.7028 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1796.72 | 1800.75 | 1808.83 | 1795.96 | 1767.54 | 1767.53 | 1783.23 | 1770.72 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 7.20 | 7.20 | 0.00 | 0.00 | 2.76 | 3.69 | 4.61 | 3.69 |
| | Y | -4.16 | -4.16 | 7.20 | 7.20 | 1.93 | 2.58 | 3.23 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 2-C-T-12-5-L3 | 2-C-T-16-3-L1 | 2-C-T-16-4-L1 | 2-C-T-16-5-L1 | 2-C-T-16-4-L3 | 2-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00005 | 1.00040 | 0.99935 | 1.00030 | 1.00040 | 0.99970 |
| | T2 | 1.00045 | 1.00075 | 0.99945 | 1.00050 | 1.00015 | 1.00035 |
| | T3 | 1.00010 | 1.00070 | 0.99940 | 1.00065 | 0.99975 | 1.00055 |
| | T4 | 1.00015 | 1.00030 | 1.00005 | 1.00060 | 0.99950 | 0.99995 |
| Diameters | D1 | 0.49995 | 0.50005 | 0.50040 | 0.49960 | 0.50040 | 0.49980 |
| | D2 | 0.49995 | 0.50005 | 0.50050 | 0.49955 | 0.50045 | 0.49990 |
| | D3 | 0.50010 | 0.49990 | 0.50065 | 0.49950 | 0.50035 | 0.50000 |
| | D4 | 0.50005 | 0.50011 | 0.50080 | 0.49950 | 0.50020 | 0.50005 |
| Diameters | $D1^{90}$ | 0.49990 | 0.50005 | 0.50065 | 0.49965 | 0.50015 | 0.50005 |
| | $D2^{90}$ | 0.49990 | 0.50015 | 0.50055 | 0.49950 | 0.50010 | 0.50005 |
| | $D3^{90}$ | 0.50005 | 0.49995 | 0.50070 | 0.49955 | 0.50025 | 0.50005 |
| | $D4^{90}$ | 0.50010 | 0.50001 | 0.50060 | 0.49950 | 0.50025 | 0.50010 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19635 | 0.19638 | 0.19683 | 0.19599 | 0.19656 | 0.19635 |
| Volume | $in^3$ | 0.19637 | 0.19649 | 0.19672 | 0.19609 | 0.19654 | 0.19638 |
| Volume | $m^3$ | 3.2182E-06 | 3.2198E-06 | 3.2240E-06 | 3.2134E-06 | 3.2209E-06 | 3.2180E-06 |
| Weight | gm | 5.7074 | 5.6744 | 5.7540 | 5.7727 | 5.7904 | 5.7745 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1773.47 | 1762.37 | 1784.74 | 1796.46 | 1797.76 | 1794.41 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 4.61 | -2.76 | -3.69 | -4.61 | -3.69 | -4.61 |
| | Y | 3.22 | 1.93 | 2.58 | 3.23 | 2.58 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 3-C-W-01-3 | 3-C-W-01-5 | 3-C-W-01-6 | 3-C-W-01-7 | 3-C-W-04-5 | 3-C-W-04-6 | 3-C-W-04-7 | 3-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00095 | 1.00090 | 0.99990 | 1.00085 | 1.00080 | 1.00135 | 1.00110 | 1.00075 |
| | T2 | 1.00105 | 1.00075 | 0.99990 | 1.00090 | 1.00080 | 1.00110 | 1.00100 | 1.00050 |
| | T3 | 1.00105 | 1.00070 | 0.99995 | 1.00090 | 1.00085 | 1.00095 | 1.00900 | 1.00065 |
| | T4 | 1.00105 | 1.00080 | 1.00000 | 1.00090 | 1.00100 | 1.00085 | 1.00105 | 1.00060 |
| Diameters | D1 | 0.49950 | 0.50000 | 0.50025 | 0.49995 | 0.49970 | 0.50015 | 0.49995 | 0.50020 |
| | D2 | 0.49980 | 0.50010 | 0.50025 | 0.50020 | 0.50000 | 0.50020 | 0.50000 | 0.50030 |
| | D3 | 0.49970 | 0.50005 | 0.50040 | 0.49990 | 0.50010 | 0.50025 | 0.50000 | 0.50025 |
| | D4 | 0.50005 | 0.50020 | 0.50025 | 0.49990 | 0.50015 | 0.50040 | 0.50025 | 0.50035 |
| Diameters | $D1^{90}$ | 0.49970 | 0.50015 | 0.50030 | 0.50020 | 0.49985 | 0.50025 | 0.49970 | 0.50020 |
| | $D2^{90}$ | 0.49970 | 0.50005 | 0.50035 | 0.50005 | 0.49995 | 0.50025 | 0.50005 | 0.50020 |
| | $D3^{90}$ | 0.49980 | 0.49995 | 0.50040 | 0.50000 | 0.49985 | 0.50035 | 0.50010 | 0.50035 |
| | $D4^{90}$ | 0.50010 | 0.50025 | 0.50040 | 0.49990 | 0.50100 | 0.50040 | 0.50020 | 0.50045 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19619 | 0.19642 | 0.19661 | 0.19636 | 0.19641 | 0.19657 | 0.19637 | 0.19658 |
| Volume | $in^3$ | 0.19635 | 0.19656 | 0.19660 | 0.19655 | 0.19656 | 0.19677 | 0.19695 | 0.19668 |
| Volume | $m^3$ | 3.2182E-06 | 3.2213E-06 | 3.2216E-06 | 3.2206E-06 | 3.2213E-06 | 3.2246E-06 | 3.2278E-06 | 3.2233E-06 |
| Weight | gm | 5.6800 | 5.7109 | 5.7333 | 5.7603 | 5.7277 | 5.7586 | 5.7714 | 5.7631 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1764.94 | 1772.83 | 1779.65 | 1788.57 | 1778.05 | 1785.81 | 1788.04 | 1787.94 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.38 | 5.63 | 6.75 | 7.87 | 4.04 | 4.84 | 5.63 | -3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | 3.98 | 4.78 | 5.56 | 5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 3-C-W-07-7 | 3-C-W-10-5 | 3-C-W-10-6 | 3-C-W-10-7 | 3-C-W-11-3 | 3-C-W-14-3 | 3-C-T-13-4-L1 | 3-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00115 | 1.00070 | 1.00070 | 1.00100 | 1.00085 | 1.00010 | 1.00065 | 1.00095 |
| | T2 | 1.00100 | 1.00055 | 1.00080 | 1.00120 | 1.00075 | 1.00020 | 1.00065 | 1.00100 |
| | T3 | 1.00100 | 1.00050 | 1.00085 | 1.00110 | 1.00075 | 1.00015 | 1.00700 | 1.00100 |
| | T4 | 1.00115 | 1.00065 | 1.00095 | 1.00115 | 1.00075 | 1.00015 | 1.00055 | 1.00100 |
| Diameters | D1 | 0.49990 | 0.50000 | 0.50020 | 0.50010 | 0.50040 | 0.50000 | 0.50035 | 0.49985 |
| | D2 | 0.50000 | 0.50020 | 0.50030 | 0.49970 | 0.50040 | 0.49950 | 0.50025 | 0.49995 |
| | D3 | 0.50005 | 0.50035 | 0.50000 | 0.49980 | 0.50030 | 0.49950 | 0.50040 | 0.49995 |
| | D4 | 0.49990 | 0.50040 | 0.50010 | 0.49975 | 0.50025 | 0.49970 | 0.50045 | 0.50015 |
| Diameters | $D1^{90}$ | 0.50015 | 0.50005 | 0.50015 | 0.50005 | 0.50040 | 0.49980 | 0.50030 | 0.49995 |
| | $D2^{90}$ | 0.50005 | 0.50010 | 0.50010 | 0.50000 | 0.50040 | 0.49985 | 0.50035 | 0.49995 |
| | $D3^{90}$ | 0.49995 | 0.50030 | 0.50010 | 0.49980 | 0.50040 | 0.49990 | 0.50040 | 0.50010 |
| | $D4^{90}$ | 0.49980 | 0.50045 | 0.50010 | 0.49975 | 0.50030 | 0.49995 | 0.50050 | 0.50025 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19633 | 0.19653 | 0.19645 | 0.19625 | 0.19663 | 0.19617 | 0.19664 | 0.19636 |
| Volume | $in^3$ | 0.19656 | 0.19662 | 0.19662 | 0.19649 | 0.19680 | 0.19622 | 0.19707 | 0.19654 |
| Volume | $m^3$ | 3.2207E-06 | 3.2225E-06 | 3.2219E-06 | 3.2195E-06 | 3.2247E-06 | 3.2152E-06 | 3.2296E-06 | 3.2210E-06 |
| Weight | gm | 5.7937 | 5.7234 | 5.7835 | 5.7975 | 5.6377 | 5.6374 | 5.6484 | 5.6953 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1798.87 | 1776.07 | 1795.03 | 1800.75 | 1748.30 | 1753.37 | 1748.97 | 1768.17 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.93 | -5.33 | -6.42 | -7.66 | -3.38 | 0.00 | -1.54 | -1.92 |
| | Y | 6.85 | 1.46 | 1.75 | 2.04 | 0.00 | -3.37 | -4.22 | -5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 3-C-T-13-6-L1 | 3-C-T-13-7-L1 | 3-C-T-15-7-L1 | 3-C-T-15-4-L1 | 3-C-T-15-5-L1 | 3-C-T-15-6-L1 | 3-C-R-03-L1 | 3-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00080 | 1.00075 | 1.00110 | 1.00080 | 1.00070 | 1.00090 | 1.00115 | 1.00100 |
| | T2 | 1.00105 | 1.00065 | 1.00110 | 1.00070 | 1.00070 | 1.00090 | 1.00110 | 1.00095 |
| | T3 | 1.00095 | 1.00065 | 1.00115 | 1.00075 | 1.00080 | 1.00075 | 1.00105 | 1.00105 |
| | T4 | 1.00085 | 1.00075 | 1.00125 | 1.00080 | 1.00085 | 1.00090 | 1.00105 | 1.00110 |
| Diameters | D1 | 0.50035 | 0.50025 | 0.49965 | 0.50040 | 0.50015 | 0.50030 | 0.49970 | 0.49980 |
| | D2 | 0.50030 | 0.50030 | 0.49995 | 0.50040 | 0.50030 | 0.50035 | 0.49965 | 0.49995 |
| | D3 | 0.50040 | 0.50035 | 0.49985 | 0.50040 | 0.50030 | 0.50020 | 0.49985 | 0.50005 |
| | D4 | 0.50030 | 0.50040 | 0.50005 | 0.50040 | 0.50020 | 0.50025 | 0.50005 | 0.50020 |
| Diameters | $D1^{90}$ | 0.50035 | 0.50020 | 0.49985 | 0.50040 | 0.50040 | 0.50030 | 0.49980 | 0.50010 |
| | $D2^{90}$ | 0.50030 | 0.50025 | 0.49995 | 0.50040 | 0.50025 | 0.50010 | 0.49990 | 0.50015 |
| | $D3^{90}$ | 0.50025 | 0.50035 | 0.49995 | 0.50045 | 0.50030 | 0.50005 | 0.49990 | 0.50025 |
| | $D4^{90}$ | 0.50035 | 0.50035 | 0.50005 | 0.50055 | 0.50030 | 0.50020 | 0.49990 | 0.50020 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19661 | 0.19659 | 0.19628 | 0.19668 | 0.19657 | 0.19652 | 0.19623 | 0.19642 |
| Volume | $in^3$ | 0.19678 | 0.19671 | 0.19650 | 0.19683 | 0.19672 | 0.19668 | 0.19643 | 0.19662 |
| Volume | $m^3$ | 3.2247E-06 | 3.2238E-06 | 3.2202E-06 | 3.2255E-06 | 3.2236E-06 | 3.2232E-06 | 3.2191E-06 | 3.2220E-06 |
| Weight | gm | 5.7249 | 5.7952 | 5.7855 | 5.6629 | 5.7014 | 5.7305 | 5.7531 | 5.7900 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1775.31 | 1797.63 | 1796.64 | 1755.65 | 1768.65 | 1777.90 | 1787.18 | 1797.01 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -2.31 | -2.69 | 2.69 | 1.54 | 1.92 | 2.31 | 7.20 | 7.20 |
| | Y | -6.34 | -7.40 | -7.40 | -4.23 | -5.29 | -6.34 | 4.16 | 4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 3-C-R-09-L1 | 3-C-R-09-L3 | 3-C-R-14-L1 | 3-C-R-14-L3 | 3-C-T-12-3-L1 | 3-C-T-12-4-L1 | 3-C-T-12-5-L1 | 3-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00080 | 1.00080 | 1.00110 | 1.00075 | 1.00065 | 1.00100 | 1.00095 | 1.00080 |
| | T2 | 1.00070 | 1.00080 | 1.00080 | 1.00095 | 1.00075 | 1.00160 | 1.00085 | 1.00080 |
| | T3 | 1.00060 | 1.00070 | 1.00070 | 1.00085 | 1.00090 | 1.00095 | 1.00095 | 1.00080 |
| | T4 | 1.00085 | 1.00075 | 1.00060 | 1.00085 | 1.00070 | 1.00105 | 1.00095 | 1.00090 |
| Diameters | D1 | 0.50030 | 0.50005 | 0.49990 | 0.49980 | 0.50025 | 0.50020 | 0.50010 | 0.50005 |
| | D2 | 0.50025 | 0.50025 | 0.50015 | 0.50005 | 0.50035 | 0.50005 | 0.50035 | 0.49995 |
| | D3 | 0.50020 | 0.50025 | 0.50025 | 0.50000 | 0.50025 | 0.50015 | 0.50030 | 0.50010 |
| | D4 | 0.50020 | 0.50045 | 0.50030 | 0.50015 | 0.50035 | 0.50005 | 0.50030 | 0.50010 |
| Diameters | $D1^{90}$ | 0.50025 | 0.50025 | 0.50015 | 0.49980 | 0.50025 | 0.50020 | 0.50040 | 0.50000 |
| | $D2^{90}$ | 0.50030 | 0.50025 | 0.50015 | 0.50000 | 0.50035 | 0.50015 | 0.50035 | 0.49990 |
| | $D3^{90}$ | 0.50020 | 0.50030 | 0.50015 | 0.50010 | 0.50015 | 0.50020 | 0.50035 | 0.50015 |
| | $D4^{90}$ | 0.50010 | 0.50040 | 0.50015 | 0.50020 | 0.50030 | 0.50020 | 0.50035 | 0.50005 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19653 | 0.19657 | 0.19647 | 0.19636 | 0.19657 | 0.19647 | 0.19660 | 0.19638 |
| Volume | $in^3$ | 0.19668 | 0.19670 | 0.19661 | 0.19651 | 0.19672 | 0.19670 | 0.19678 | 0.19652 |
| Volume | $m^3$ | 3.2229E-06 | 3.2236E-06 | 3.2221E-06 | 3.2205E-06 | 3.2236E-06 | 3.2232E-06 | 3.2246E-06 | 3.2207E-06 |
| Weight | gm | 5.6984 | 5.8046 | 5.8247 | 5.8239 | 5.6541 | 5.6910 | 5.7736 | 5.6757 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1768.11 | 1800.66 | 1807.73 | 1808.39 | 1753.95 | 1765.62 | 1790.48 | 1762.24 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -7.20 | -7.20 | 0.00 | 0.00 | -2.76 | -3.69 | -4.61 | -3.69 |
| | Y | 4.16 | 4.16 | -7.20 | -7.20 | -1.93 | -2.58 | -3.23 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 3-C-T-12-5-L3 | 3-C-T-16-3-L1 | 3-C-T-16-4-L1 | 3-C-T-16-5-L1 | 3-C-T-16-4-L3 | 3-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | missing | 1.00085 | 1.00110 | 1.00065 | 1.00065 | 1.00085 |
| | T2 | | 1.00095 | 1.00100 | 1.00060 | 1.00060 | 1.00085 |
| | T3 | | 1.00110 | 1.00105 | 1.00080 | 1.00055 | 1.00100 |
| | T4 | | 1.00105 | 1.00110 | 1.00070 | 1.00070 | 1.00085 |
| Diameters | D1 | | 0.50010 | 0.49975 | 0.50020 | 0.50025 | 0.49975 |
| | D2 | | 0.50025 | 0.49995 | 0.50025 | 0.50030 | 0.50005 |
| | D3 | | 0.50025 | 0.49995 | 0.50035 | 0.50025 | 0.50020 |
| | D4 | | 0.50025 | 0.50005 | 0.50035 | 0.50030 | 0.49990 |
| Diameters | $D1^{90}$ | | 0.50030 | 0.49985 | 0.50005 | 0.50010 | 0.49995 |
| | $D2^{90}$ | | 0.50030 | 0.50000 | 0.50030 | 0.50015 | 0.50010 |
| | $D3^{90}$ | | 0.50030 | 0.50000 | 0.50030 | 0.50020 | 0.50015 |
| | $D4^{90}$ | | 0.50040 | 0.50015 | 0.50040 | 0.50030 | 0.50025 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | | 0.19656 | 0.19632 | 0.19657 | 0.19653 | 0.19638 |
| Volume | $in^3$ | | 0.19676 | 0.19652 | 0.19670 | 0.19664 | 0.19658 |
| Volume | $m^3$ | | 3.2242E-06 | 3.2205E-06 | 3.2234E-06 | 3.2226E-06 | 3.2210E-06 |
| Weight | gm | | 5.6414 | 5.6803 | 5.7253 | 5.6508 | 5.7294 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | | 1749.68 | 1763.77 | 1776.19 | 1753.50 | 1778.75 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -4.61 | 2.76 | 3.69 | 4.61 | 3.69 | 4.61 |
| | Y | -3.23 | -1.93 | -2.58 | -3.23 | -2.58 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 4-C-W-01-3 | 4-C-W-01-5 | 4-C-W-01-6 | 4-C-W-01-7 | 4-C-W-04-5 | 4-C-W-04-6 | 4-C-W-04-7 | 4-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00105 | specimen | 1.00095 | 1.00045 | 1.00100 | 1.00095 | 1.00090 | 1.00070 |
| | T2 | 1.00120 | received | 1.00100 | 1.00050 | 1.00095 | 1.00095 | 1.00080 | 1.00070 |
| | T3 | 1.00110 | broken | 1.00090 | 1.00045 | 1.00090 | 1.00095 | 1.00075 | 1.00075 |
| | T4 | 1.00105 | | 1.00090 | 1.00040 | 1.00090 | 1.00100 | 1.00085 | 1.00070 |
| Diameters | D1 | 0.50050 | | 0.50055 | 0.50085 | 0.50070 | 0.50060 | 0.50080 | 0.50060 |
| | D2 | 0.50050 | | 0.50050 | 0.50085 | 0.50075 | 0.50065 | 0.50080 | 0.50065 |
| | D3 | 0.50050 | | 0.50060 | 0.50080 | 0.50075 | 0.50060 | 0.50080 | 0.50065 |
| | D4 | 0.50045 | | 0.50065 | 0.50080 | 0.50080 | 0.50060 | 0.50070 | 0.50055 |
| Diameters | $D1^{90}$ | 0.50050 | | 0.50055 | 0.50080 | 0.50075 | 0.50060 | 0.50085 | 0.50065 |
| | $D2^{90}$ | 0.50055 | | 0.50055 | 0.50085 | 0.50080 | 0.50060 | 0.50080 | 0.50065 |
| | $D3^{90}$ | 0.50045 | | 0.50055 | 0.50085 | 0.50080 | 0.50055 | 0.50080 | 0.50060 |
| | $D4^{90}$ | 0.50045 | | 0.50055 | 0.50075 | 0.50090 | 0.50055 | 0.50075 | 0.50055 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19673 | | 0.19679 | 0.19699 | 0.19696 | 0.19682 | 0.19697 | 0.19683 |
| Volume | $in^3$ | 0.19696 | | 0.19697 | 0.19709 | 0.19715 | 0.19701 | 0.19714 | 0.19698 |
| Volume | $m^3$ | 3.2274E-06 | | 3.2279E-06 | 3.2296E-06 | 3.2307E-06 | 3.2284E-06 | 3.2304E-06 | 3.2278E-06 |
| Weight | gm | 5.6543 | | 5.7698 | 5.8248 | 5.7503 | 5.7100 | 5.7783 | 5.7261 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1751.95 | | 1787.50 | 1803.57 | 1779.90 | 1768.71 | 1788.72 | 1774.00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.38 | -5.63 | -6.75 | -7.87 | -4.04 | -4.84 | -5.63 | 3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | -3.98 | -4.78 | -5.56 | -5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 4-C-W-07-7 | 4-C-W-10-5 | 4-C-W-10-6 | 4-C-W-10-7 | 4-C-W-11-3 | 4-C-W-14-3 | 4-C-T-13-4-L1 | 4-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00095 | 1.00095 | 1.00075 | 1.00100 | 1.00115 | 1.00095 | 1.00105 | 1.00095 |
| | T2 | 1.00090 | 1.00095 | 1.00085 | 1.00100 | 1.00105 | 1.00090 | 1.00105 | 1.00085 |
| | T3 | 1.00085 | 1.00100 | 1.00085 | 1.00100 | 1.00105 | 1.00095 | 1.00105 | 1.00090 |
| | T4 | 1.00090 | 1.00105 | 1.00080 | 1.00090 | 1.00115 | 1.00095 | 1.00100 | 1.00095 |
| Diameters | D1 | 0.50085 | 0.50070 | 0.50090 | 0.50065 | 0.50065 | 0.50075 | 0.50075 | 0.50070 |
| | D2 | 0.50090 | 0.50075 | 0.50080 | 0.50070 | 0.50065 | 0.50070 | 0.50080 | 0.50075 |
| | D3 | 0.50080 | 0.50080 | 0.50085 | 0.50070 | 0.50060 | 0.50075 | 0.50080 | 0.50070 |
| | D4 | 0.50090 | 0.50080 | 0.50095 | 0.50080 | 0.50055 | 0.50060 | 0.50075 | 0.50070 |
| Diameters | $D1^{90}$ | 0.50080 | 0.50070 | 0.50085 | 0.50075 | 0.50070 | 0.50075 | 0.50085 | 0.50070 |
| | $D2^{90}$ | 0.50090 | 0.50075 | 0.50085 | 0.50065 | 0.50060 | 0.50070 | 0.50080 | 0.50075 |
| | $D3^{90}$ | 0.50080 | 0.50080 | 0.50085 | 0.50070 | 0.50055 | 0.50085 | 0.50080 | 0.50070 |
| | $D4^{90}$ | 0.50090 | 0.50080 | 0.50085 | 0.50080 | 0.50055 | 0.50065 | 0.50080 | 0.50070 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19702 | 0.19695 | 0.19703 | 0.19691 | 0.19683 | 0.19691 | 0.19697 | 0.19691 |
| Volume | $in^3$ | 0.19720 | 0.19714 | 0.19718 | 0.19709 | 0.19705 | 0.19711 | 0.19718 | 0.19709 |
| Volume | $m^3$ | 3.2315E-06 | 3.2306E-06 | 3.2313E-06 | 3.2300E-06 | 3.2290E-06 | 3.2299E-06 | 3.2312E-06 | 3.2297E-06 |
| Weight | gm | 5.8100 | 5.7567 | 5.7579 | 5.8197 | 5.6376 | 5.6384 | 5.6771 | 5.6785 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1797.91 | 1781.92 | 1781.90 | 1801.76 | 1745.95 | 1745.70 | 1756.98 | 1758.20 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.93 | 5.33 | 6.42 | 7.66 | 3.38 | 0.00 | 1.54 | 1.92 |
| | Y | -6.85 | -1.46 | -1.75 | -2.04 | 0.00 | 3.37 | 4.23 | 5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 4-C-T-13-6-L1 | 4-C-T-13-7-L1 | 4-C-T-15-7-L1 | 4-C-T-15-4-L1 | 4-C-T-15-5-L1 | 4-C-T-15-6-L1 | 4-C-R-03-L1 | 4-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00055 | 1.00075 | 1.00055 | 1.00065 | 1.00075 | 1.00070 | 1.00070 | 1.00060 |
| | T2 | 1.00055 | 1.00075 | 1.00050 | 1.00070 | 1.00080 | 1.00075 | 1.00065 | 1.00065 |
| | T3 | 1.00050 | 1.00070 | 1.00065 | 1.00065 | 1.00080 | 1.00075 | 1.00065 | 1.00060 |
| | T4 | 1.00050 | 1.00070 | 1.00075 | 1.00060 | 1.00075 | 1.00075 | 1.00065 | 1.00050 |
| Diameters | D1 | 0.50095 | 0.50070 | 0.50085 | 0.50065 | 0.50090 | 0.50055 | 0.50075 | 0.50060 |
| | D2 | 0.50085 | 0.50080 | 0.50095 | 0.50065 | 0.50085 | 0.50070 | 0.50075 | 0.50065 |
| | D3 | 0.50085 | 0.50080 | 0.50095 | 0.50060 | 0.50085 | 0.50075 | 0.50075 | 0.50065 |
| | D4 | 0.50080 | 0.50080 | 0.50100 | 0.50055 | 0.50085 | 0.50080 | 0.50080 | 0.50075 |
| Diameters | $D1^{90}$ | 0.50095 | 0.50070 | 0.50095 | 0.50065 | 0.50095 | 0.50065 | 0.50080 | 0.50065 |
| | $D2^{90}$ | 0.50085 | 0.50075 | 0.50100 | 0.50060 | 0.50085 | 0.50070 | 0.50075 | 0.50065 |
| | $D3^{90}$ | 0.50085 | 0.50075 | 0.50100 | 0.50060 | 0.50090 | 0.50070 | 0.50080 | 0.50065 |
| | $D4^{90}$ | 0.50085 | 0.50075 | 0.50110 | 0.50050 | 0.50085 | 0.50080 | 0.50080 | 0.50080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19703 | 0.19694 | 0.19712 | 0.19682 | 0.19704 | 0.19691 | 0.19696 | 0.19688 |
| Volume | $in^3$ | 0.19714 | 0.19708 | 0.19724 | 0.19695 | 0.19719 | 0.19704 | 0.19708 | 0.19699 |
| Volume | $m^3$ | 3.2305E-06 | 3.2297E-06 | 3.2321E-06 | 3.2274E-06 | 3.2314E-06 | 3.2291E-06 | 3.2297E-06 | 3.2282E-06 |
| Weight | gm | 5.7710 | 5.8060 | 5.8102 | 5.6644 | 5.6417 | 5.7312 | 5.8195 | 5.8121 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1786.42 | 1797.70 | 1797.63 | 1755.08 | 1745.91 | 1774.87 | 1801.86 | 1800.42 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 2.31 | 2.69 | -2.69 | -1.54 | -1.20 | -2.31 | -7.20 | -7.20 |
| | Y | 6.34 | 7.40 | 7.4 | 4.23 | 5.29 | 6.34 | -4.16 | -4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 4-C-R-09-L1 | 4-C-R-09-L3 | 4-C-R-14-L1 | 4-C-R-14-L3 | 4-C-T-12-3-L1 | 4-C-T-12-4-L1 | 4-C-T-12-5-L1 | 4-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00065 | 1.00080 | 1.00090 | 1.00075 | 1.00070 | 1.00085 | 1.00075 | 1.00095 |
| | T2 | 1.00060 | 1.00085 | 1.00085 | 1.00075 | 1.00075 | 1.00090 | 1.00075 | 1.00085 |
| | T3 | 1.00055 | 1.00075 | 1.00075 | 1.00065 | 1.00075 | 1.00090 | 1.00070 | 1.00085 |
| | T4 | 1.00060 | 1.00075 | 1.00075 | 1.00065 | 1.00075 | 1.00085 | 1.00070 | 1.00095 |
| Diameters | D1 | 0.50095 | 0.50080 | 0.50045 | 0.50075 | 0.50100 | 0.50080 | 0.50095 | 0.50100 |
| | D2 | 0.50100 | 0.50080 | 0.50055 | 0.50075 | 0.50085 | 0.50080 | 0.50085 | 0.50080 |
| | D3 | 0.50095 | 0.50075 | 0.50055 | 0.50075 | 0.50085 | 0.50075 | 0.50085 | 0.50085 |
| | D4 | 0.50105 | 0.50080 | 0.50060 | 0.50075 | 0.50085 | 0.50075 | 0.50085 | 0.50080 |
| Diameters | $D1^{90}$ | 0.50090 | 0.50085 | 0.50045 | 0.50085 | 0.50090 | 0.50085 | 0.50095 | 0.50085 |
| | $D2^{90}$ | 0.50105 | 0.50080 | 0.50055 | 0.50075 | 0.50085 | 0.50080 | 0.50090 | 0.50085 |
| | $D3^{90}$ | 0.50100 | 0.50080 | 0.50050 | 0.50075 | 0.50080 | 0.50070 | 0.50085 | 0.50085 |
| | $D4^{90}$ | 0.50105 | 0.50080 | 0.50055 | 0.50070 | 0.50080 | 0.50065 | 0.50080 | 0.50070 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19713 | 0.19698 | 0.19676 | 0.19694 | 0.19703 | 0.19695 | 0.19704 | 0.19701 |
| Volume | $in^3$ | 0.19725 | 0.19713 | 0.19692 | 0.19708 | 0.19717 | 0.19713 | 0.19719 | 0.19719 |
| Volume | $m^3$ | 3.2323E-06 | 3.2304E-06 | 3.2270E-06 | 3.2296E-06 | 3.2311E-06 | 3.2302E-06 | 3.2312E-06 | 3.2313E-06 |
| Weight | gm | 5.8178 | 5.8409 | 5.8084 | 5.8384 | 5.6535 | 5.6649 | 5.7310 | 5.6648 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1799.87 | 1808.08 | 1799.95 | 1807.78 | 1749.72 | 1753.71 | 1773.64 | 1753.11 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 7.20 | 7.20 | 0.00 | 0.00 | 2.76 | 3.69 | 4.61 | 3.69 |
| | Y | -4.16 | -4.16 | 7.20 | 7.20 | 1.93 | 2.58 | 3.23 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 4-C-T-12-5-L3 | 4-C-T-16-3-L1 | 4-C-T-16-4-L1 | 4-C-T-16-5-L1 | 4-C-T-16-4-L3 | 4-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00080 | 1.00070 | 1.00120 | 1.00035 | 1.00070 | 1.00105 |
| | T2 | 1.00085 | 1.00060 | 1.00125 | 1.00045 | 1.00085 | 1.00110 |
| | T3 | 1.00070 | 1.00055 | 1.00195 | 1.00055 | 1.00090 | 1.00105 |
| | T4 | 1.00080 | 1.00065 | 1.00125 | 1.00040 | 1.00070 | 1.00100 |
| Diameters | D1 | 0.50070 | 0.50035 | 0.50070 | 0.50080 | 0.50030 | 0.50035 |
| | D2 | 0.50070 | 0.50045 | 0.50040 | 0.50085 | 0.50025 | 0.50030 |
| | D3 | 0.50070 | 0.50040 | 0.50040 | 0.50085 | 0.50040 | 0.50075 |
| | D4 | 0.50080 | 0.50040 | 0.50010 | 0.50090 | 0.50005 | 0.50035 |
| Diameters | $D1^{90}$ | 0.50070 | 0.50040 | 0.50060 | 0.50085 | 0.50010 | 0.49995 |
| | $D2^{90}$ | 0.50070 | 0.50040 | 0.50030 | 0.50090 | 0.50010 | 0.49995 |
| | $D3^{90}$ | 0.50075 | 0.50040 | 0.50035 | 0.50085 | 0.50025 | 0.50045 |
| | $D4^{90}$ | 0.50075 | 0.50040 | 0.50020 | 0.50090 | 0.49990 | 0.50010 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19692 | 0.19666 | 0.19665 | 0.19703 | 0.19648 | 0.19657 |
| Volume | $in^3$ | 0.19707 | 0.19679 | 0.19695 | 0.19711 | 0.19664 | 0.19673 |
| Volume | $m^3$ | 3.2295E-06 | 3.2248E-06 | 3.2271E-06 | 3.2301E-06 | 3.2223E-06 | 3.2245E-06 |
| Weight | gm | 5.6986 | 5.6533 | 5.6712 | 5.7130 | 5.6480 | 5.6845 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1764.56 | 1753.09 | 1757.39 | 1768.66 | 1752.78 | 1762.90 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 4.61 | -2.76 | -3.69 | -4.61 | -3.69 | -4.61 |
| | Y | 3.22 | 1.93 | 2.58 | 3.23 | 2.58 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 5-C-W-01-3 | 5-C-W-01-5 | 5-C-W-01-6 | 5-C-W-01-7 | 5-C-W-04-5 | 5-C-W-04-6 | 5-C-W-04-7 | 5-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00040 | 0.99965 | 1.00030 | 1.00020 | 0.99965 | 1.00070 | 1.00035 | 1.00050 |
| | T2 | 1.00035 | 0.99980 | 1.00035 | 1.00015 | 0.99975 | 1.00085 | 1.00030 | 1.00040 |
| | T3 | 1.00045 | 0.99985 | 1.00040 | 1.00000 | 0.99970 | 1.00080 | 1.00030 | 1.00040 |
| | T4 | 1.00065 | 0.99985 | 1.00035 | 1.00010 | 0.99965 | 1.00070 | 1.00030 | 1.00050 |
| Diameters | D1 | 0.50120 | 0.50170 | 0.50010 | 0.50090 | 0.50145 | 0.50075 | 0.49765 | 0.50095 |
| | D2 | 0.50070 | 0.50125 | 0.50020 | 0.50085 | 0.50115 | 0.50025 | 0.49720 | 0.50060 |
| | D3 | 0.50025 | 0.50105 | 0.50040 | 0.50100 | 0.50085 | 0.50000 | 0.49705 | 0.50040 |
| | D4 | 0.50015 | 0.50095 | 0.50080 | 0.50130 | 0.50065 | 0.49990 | 0.49680 | 0.50025 |
| Diameters | $D1^{90}$ | 0.50110 | 0.50165 | 0.50020 | 0.50095 | 0.50145 | 0.50100 | 0.49735 | 0.50090 |
| | $D2^{90}$ | 0.50055 | 0.50115 | 0.50020 | 0.50095 | 0.50110 | 0.50045 | 0.49705 | 0.50055 |
| | $D3^{90}$ | 0.50025 | 0.50100 | 0.50045 | 0.50115 | 0.50090 | 0.50005 | 0.49685 | 0.50025 |
| | $D4^{90}$ | 0.50015 | 0.50090 | 0.50095 | 0.50135 | 0.50075 | 0.49990 | 0.49685 | 0.50020 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19678 | 0.19730 | 0.19667 | 0.19718 | 0.19717 | 0.19658 | 0.19408 | 0.19675 |
| Volume | $in^3$ | 0.19691 | 0.19728 | 0.19668 | 0.19717 | 0.19715 | 0.19678 | 0.19416 | 0.19687 |
| Volume | $m^3$ | 3.2261E-06 | 3.2325E-06 | 3.2240E-06 | 3.2316E-06 | 3.2300E-06 | 3.2238E-06 | 3.1814E-06 | 3.2257E-06 |
| Weight | gm | 5.7149 | 5.7397 | 5.7166 | 5.7999 | 5.7040 | 5.6728 | 5.7080 | 5.7949 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1771.46 | 1775.65 | 1773.12 | 1794.76 | 1765.97 | 1759.68 | 1794.19 | 1796.51 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.38 | 5.63 | 6.75 | 7.87 | 4.04 | 4.84 | 5.63 | -3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | 3.98 | 4.78 | 5.56 | 5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 5-C-W-07-7 | 5-C-W-10-5 | 5-C-W-10-6 | 5-C-W-10-7 | 5-C-W-11-3 | 5-C-W-14-3 | 5-C-T-13-4-L1 | 5-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99995 | 1.00145 | 1.00040 | 1.00070 | 1.00295 | 1.00250 | 1.00005 | 1.00060 |
| | T2 | 1.00010 | 1.00130 | 1.00025 | 1.00055 | 1.00295 | 1.00245 | 1.00005 | 1.00035 |
| | T3 | 1.00010 | 1.00120 | 1.00030 | 1.00055 | 1.00285 | 1.00245 | 0.99995 | 1.00025 |
| | T4 | 1.00000 | 1.00130 | 1.00030 | 1.00065 | 1.00290 | 1.00245 | 1.00000 | 1.00050 |
| Diameters | D1 | 0.50060 | 0.49970 | 0.50045 | 0.50055 | 0.49770 | 0.49895 | 0.50140 | 0.50070 |
| | D2 | 0.50065 | 0.49980 | 0.50045 | 0.50025 | 0.49785 | 0.49905 | 0.50125 | 0.50065 |
| | D3 | 0.50085 | 0.49995 | 0.50070 | 0.50010 | 0.49815 | 0.49920 | 0.50105 | 0.50080 |
| | D4 | 0.50110 | 0.50035 | 0.50090 | 0.50000 | 0.49860 | 0.49965 | 0.50115 | 0.50110 |
| Diameters | $D1^{90}$ | 0.50060 | 0.49970 | 0.50040 | 0.50060 | 0.49765 | 0.49900 | 0.50145 | 0.50065 |
| | $D2^{90}$ | 0.50070 | 0.49985 | 0.50050 | 0.50025 | 0.49790 | 0.49910 | 0.50110 | 0.50070 |
| | $D3^{90}$ | 0.50085 | 0.50015 | 0.50070 | 0.50015 | 0.49830 | 0.49925 | 0.50105 | 0.50085 |
| | $D4^{90}$ | 0.50115 | 0.50045 | 0.50095 | 0.50005 | 0.49870 | 0.49955 | 0.50115 | 0.50115 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19699 | 0.19635 | 0.19685 | 0.19654 | 0.19487 | 0.19574 | 0.19729 | 0.19700 |
| Volume | $in^3$ | 0.19696 | 0.19655 | 0.19687 | 0.19669 | 0.19536 | 0.19616 | 0.19729 | 0.19704 |
| Volume | $m^3$ | 3.2282E-06 | 3.2217E-06 | 3.2267E-06 | 3.2227E-06 | 3.2026E-06 | 3.2155E-06 | 3.2331E-06 | 3.2296E-06 |
| Weight | gm | 5.8593 | 5.7090 | 5.7671 | 5.8135 | 5.6176 | 5.6331 | 5.6902 | 5.7071 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1815.04 | 1772.02 | 1787.28 | 1803.92 | 1754.09 | 1751.88 | 1759.98 | 1767.12 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.93 | -5.33 | -6.42 | -7.66 | -3.38 | 0.00 | -1.54 | -1.92 |
| | Y | 6.85 | 1.46 | 1.75 | 2.04 | 0.00 | -3.37 | -4.22 | -5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 5-C-T-13-6-L1 | 5-C-T-13-7-L1 | 5-C-T-15-7-L1 | 5-C-T-15-4-L1 | 5-C-T-15-5-L1 | 5-C-T-15-6-L1 | 5-C-R-03-L1 | 5-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99995 | 0.99995 | 1.00005 | 1.00180 | 1.00225 | 1.00055 | 1.00040 | 0.99960 |
| | T2 | 1.00005 | 0.99980 | 0.99995 | 1.00155 | 1.00235 | 1.00035 | 1.00045 | 0.99970 |
| | T3 | 1.00000 | 0.99985 | 1.00005 | 1.00155 | 1.00225 | 1.00060 | 1.00050 | 0.99970 |
| | T4 | 0.99990 | 1.00020 | 1.00010 | 1.00160 | 1.00215 | 1.00070 | 1.00035 | 0.99960 |
| Diameters | D1 | 0.50060 | 0.50065 | 0.50100 | 0.49965 | 0.50050 | 0.50125 | 0.50015 | 0.50105 |
| | D2 | 0.50060 | 0.50065 | 0.50080 | 0.49975 | 0.50050 | 0.50095 | 0.50025 | 0.50055 |
| | D3 | 0.50075 | 0.50080 | 0.50060 | 0.49990 | 0.50065 | 0.50085 | 0.50050 | 0.50040 |
| | D4 | 0.50095 | 0.50115 | 0.50065 | 0.50015 | 0.50095 | 0.50085 | 0.50085 | 0.50025 |
| Diameters | $D1^{90}$ | 0.50060 | 0.50070 | 0.50090 | 0.49970 | 0.50050 | 0.50110 | 0.50020 | 0.50115 |
| | $D2^{90}$ | 0.50060 | 0.50065 | 0.50070 | 0.49975 | 0.50050 | 0.50090 | 0.50035 | 0.50055 |
| | $D3^{90}$ | 0.50070 | 0.50075 | 0.50065 | 0.50000 | 0.50070 | 0.50080 | 0.50050 | 0.50030 |
| | $D4^{90}$ | 0.50095 | 0.50100 | 0.50060 | 0.50025 | 0.50095 | 0.50080 | 0.50080 | 0.50025 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19691 | 0.19697 | 0.19693 | 0.19627 | 0.19687 | 0.19709 | 0.19670 | 0.19679 |
| Volume | $in^3$ | 0.19688 | 0.19691 | 0.19694 | 0.19655 | 0.19726 | 0.19720 | 0.19674 | 0.19675 |
| Volume | $m^3$ | 3.2268E-06 | 3.2277E-06 | 3.2272E-06 | 3.2215E-06 | 3.2333E-06 | 3.2315E-06 | 3.2248E-06 | 3.2237E-06 |
| Weight | gm | 5.7455 | 5.8037 | 5.7656 | 5.6936 | 5.7241 | 5.7220 | 5.8176 | 5.6862 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1780.57 | 1798.11 | 1786.55 | 1767.40 | 1770.35 | 1770.72 | 1804.04 | 1763.86 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -2.31 | -2.69 | 2.69 | 1.54 | 1.92 | 2.31 | 7.20 | 7.20 |
| | Y | -6.34 | -7.40 | -7.40 | -4.23 | -5.29 | -6.34 | 4.16 | 4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 5-C-R-09-L1 | 5-C-R-09-L3 | 5-C-R-14-L1 | 5-C-R-14-L3 | 5-C-T-12-3-L1 | 5-C-T-12-4-L1 | 5-C-T-12-5-L1 | 5-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00035 | 1.00015 | 0.99950 | 0.99975 | 1.00050 | 1.00035 | 1.00075 | 0.99995 |
| | T2 | 1.00020 | 1.00010 | 0.99950 | 0.99965 | 1.00035 | 1.00025 | 1.00060 | 1.00005 |
| | T3 | 1.00040 | 1.00005 | 0.99960 | 0.99960 | 1.00060 | 1.00005 | 1.00065 | 0.99990 |
| | T4 | 1.00045 | 1.00010 | 0.99965 | 0.99960 | 1.00040 | 1.00005 | 1.00075 | 0.99990 |
| Diameters | D1 | 0.50070 | 0.50100 | 0.50125 | 0.50095 | 0.50090 | 0.50040 | 0.50045 | 0.50005 |
| | D2 | 0.50050 | 0.50070 | 0.50105 | 0.50095 | 0.50085 | 0.50045 | 0.50020 | 0.50000 |
| | D3 | 0.50030 | 0.50060 | 0.50085 | 0.50110 | 0.50100 | 0.50060 | 0.49990 | 0.50020 |
| | D4 | 0.50025 | 0.50055 | 0.50090 | 0.50130 | 0.50120 | 0.50095 | 0.49980 | 0.50040 |
| Diameters | $D1^{90}$ | 0.50075 | 0.50095 | 0.50125 | 0.50095 | 0.50095 | 0.50035 | 0.50040 | 0.50005 |
| | $D2^{90}$ | 0.50035 | 0.50065 | 0.50100 | 0.50095 | 0.50085 | 0.50040 | 0.50010 | 0.50010 |
| | $D3^{90}$ | 0.50025 | 0.50050 | 0.50090 | 0.50105 | 0.50110 | 0.50060 | 0.49985 | 0.50020 |
| | $D4^{90}$ | 0.50025 | 0.50055 | 0.50090 | 0.50120 | 0.50130 | 0.50080 | 0.49980 | 0.50050 |
| Area | $in^2$ | 0.19668 | 0.19689 | 0.19715 | 0.19718 | 0.19715 | 0.19680 | 0.19640 | 0.19650 |
| Volume | $in^3$ | 0.19676 | 0.19692 | 0.19707 | 0.19708 | 0.19721 | 0.19678 | 0.19656 | 0.19646 |
| Volume | $m^3$ | 3.2241E-06 | 3.2268E-06 | 3.2292E-06 | 3.2301E-06 | 3.2322E-06 | 3.2255E-06 | 3.2206E-06 | 3.2199E-06 |
| Weight | gm | 5.8289 | 5.8286 | 5.8249 | 5.8304 | 5.6663 | 5.6837 | 5.7246 | 5.6536 |
| Density | $kg/m^3$ | 1807.90 | 1806.32 | 1803.80 | 1805.03 | 1753.07 | 1762.12 | 1777.49 | 1755.86 |
| X-Y Coordinates | X | -7.20 | -7.20 | 0.00 | 0.00 | -2.76 | -3.69 | -4.61 | -3.69 |
| | Y | 4.16 | -4.16 | -7.20 | -7.20 | -1.93 | -2.58 | -3.23 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 5-C-T-12-5-L3 | 5-C-T-16-3-L1 | 5-C-T-16-4-L1 | 5-C-T-16-5-L1 | 5-C-T-16-4-L3 | 5-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00095 | 1.00015 | 0.99955 | 1.00005 | 1.00045 | 0.99965 |
| | T2 | 1.00075 | 0.99980 | 0.99970 | 1.00005 | 1.00030 | 0.99970 |
| | T3 | 1.00040 | 0.99970 | 0.99980 | 1.00015 | 1.00030 | 0.99965 |
| | T4 | 1.00045 | 1.00000 | 0.99960 | 1.00025 | 1.00040 | 0.99960 |
| Diameters | D1 | 0.50125 | 0.50095 | 0.50120 | 0.50085 | 0.50065 | 0.50160 |
| | D2 | 0.50090 | 0.50095 | 0.50110 | 0.50085 | 0.50065 | 0.50150 |
| | D3 | 0.50075 | 0.50110 | 0.50120 | 0.50105 | 0.50085 | 0.50135 |
| | D4 | 0.50080 | 0.50120 | 0.50140 | 0.50135 | 0.50095 | 0.50140 |
| Diameters | $D1^{90}$ | 0.50120 | 0.50095 | 0.50125 | 0.50085 | 0.50065 | 0.50180 |
| | $D2^{90}$ | 0.50105 | 0.50095 | 0.50115 | 0.50105 | 0.50065 | 0.50145 |
| | $D3^{90}$ | 0.50075 | 0.50110 | 0.50125 | 0.50115 | 0.50080 | 0.50135 |
| | $D4^{90}$ | 0.50080 | 0.50130 | 0.50150 | 0.50150 | 0.50095 | 0.50140 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19709 | 0.19719 | 0.19734 | 0.19720 | 0.19695 | 0.19752 |
| Volume | $in^3$ | 0.19724 | 0.19714 | 0.19725 | 0.19720 | 0.19700 | 0.19745 |
| Volume | $m^3$ | 3.2317E-06 | 3.2310E-06 | 3.2327E-06 | 3.2319E-06 | 3.2287E-06 | 3.2356E-06 |
| Weight | gm | 5.7300 | 5.6771 | 5.6972 | 5.7126 | 5.7060 | 5.7065 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1773.04 | 1757.07 | 1762.37 | 1767.55 | 1767.29 | 1763.68 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -4.61 | 2.76 | 3.69 | 4.61 | 3.69 | 4.61 |
| | Y | -3.23 | -1.93 | -2.58 | -3.23 | -2.58 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 6-C-W-01-3 | 6-C-W-01-5 | 6-C-W-01-6 | 6-C-W-1-7 | 6-C-W-04-5 | 6-C-W-04-6 | 6-C-W-04-7 | 6-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00050 | 1.00155 | 0.99970 | 0.99965 | 0.99990 | 1.00010 | 1.00020 | 1.00035 |
| | T2 | 1.00060 | 1.00155 | 0.99950 | 0.99975 | 0.99985 | 1.00010 | 1.00020 | 1.00020 |
| | T3 | 1.00065 | 1.00160 | 0.99950 | 0.99965 | 0.99965 | 1.00020 | 1.00020 | 1.00015 |
| | T4 | 1.00055 | 1.00135 | 0.99950 | 0.99960 | 0.99980 | 1.00020 | 1.00015 | 1.00025 |
| Diameters | D1 | 0.50125 | 0.50195 | 0.50105 | 0.50200 | 0.50095 | 0.50095 | 0.50175 | 0.50155 |
| | D2 | 0.50130 | 0.50155 | 0.50115 | 0.50155 | 0.50105 | 0.50110 | 0.50155 | 0.50130 |
| | D3 | 0.50175 | 0.50110 | 0.50150 | 0.50130 | 0.50135 | 0.50150 | 0.50125 | 0.50100 |
| | D4 | 0.50255 | 0.50080 | 0.50220 | 0.50125 | 0.50170 | 0.50195 | 0.50115 | 0.50085 |
| Diameters | $D1^{90}$ | 0.50120 | 0.50175 | 0.50110 | 0.50200 | 0.50095 | 0.50105 | 0.50175 | 0.50150 |
| | $D2^{90}$ | 0.50135 | 0.50110 | 0.50120 | 0.50150 | 0.50105 | 0.50115 | 0.50145 | 0.50130 |
| | $D3^{90}$ | 0.50165 | 0.50095 | 0.50160 | 0.50135 | 0.50140 | 0.50145 | 0.50120 | 0.50095 |
| | $D4^{90}$ | 0.50255 | 0.50075 | 0.50220 | 0.50120 | 0.50185 | 0.50200 | 0.50115 | 0.50080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19769 | 0.19733 | 0.19753 | 0.19754 | 0.19736 | 0.19745 | 0.19746 | 0.19726 |
| Volume | $in^3$ | 0.19768 | 0.19766 | 0.19734 | 0.19750 | 0.19726 | 0.19740 | 0.19752 | 0.19735 |
| Volume | $m^3$ | 3.2414E-06 | 3.2385E-06 | 3.2355E-06 | 3.2361E-06 | 3.2335E-06 | 3.2361E-06 | 3.2363E-06 | 3.2333E-06 |
| Weight | gm | 5.7284 | 5.7473 | 5.7351 | 5.7686 | 5.7651 | 5.7458 | 5.7891 | 5.7489 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1767.27 | 1774.67 | 1772.57 | 1782.59 | 1782.90 | 1775.56 | 1788.78 | 1778.05 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.38 | -5.63 | -6.75 | -7.87 | -4.04 | -4.84 | -5.63 | 3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | -3.98 | -4.78 | -5.56 | -5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 6-C-W-07-7 | 6-C-W-10-5 | 6-C-W-10-6 | 6-C-W-10-7 | 6-C-W-11-3 | 6-C-W-14-3 | 6-C-T-13-4-L1 | 6-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99980 | 1.00010 | 1.00020 | 0.99925 | 0.99945 | 1.00050 | 1.00135 | 1.00095 |
| | T2 | 0.99975 | 1.00030 | 1.00010 | 0.99920 | 0.99930 | 1.00055 | 1.00130 | 1.00100 |
| | T3 | 0.99975 | 1.00020 | 1.00010 | 0.99945 | 0.99935 | 1.00055 | 1.00125 | 1.00090 |
| | T4 | 0.99985 | 1.00030 | 1.00020 | 0.99930 | 0.99930 | 1.00045 | 1.00125 | 1.00095 |
| Diameters | D1 | 0.50120 | 0.50225 | 0.50095 | 0.50145 | 0.50130 | 0.50170 | 0.50170 | 0.50185 |
| | D2 | 0.50135 | 0.50160 | 0.50110 | 0.50150 | 0.50140 | 0.50150 | 0.50130 | 0.50140 |
| | D3 | 0.50170 | 0.50140 | 0.50140 | 0.50170 | 0.50175 | 0.50130 | 0.50115 | 0.50120 |
| | D4 | 0.50210 | 0.50125 | 0.50185 | 0.50220 | 0.50215 | 0.50120 | 0.50115 | 0.50115 |
| Diameters | $D1^{90}$ | 0.50120 | 0.50205 | 0.50105 | 0.50145 | 0.50130 | 0.50180 | 0.50160 | 0.50180 |
| | $D2^{90}$ | 0.50130 | 0.50165 | 0.50110 | 0.50145 | 0.50140 | 0.50135 | 0.50135 | 0.50140 |
| | $D3^{90}$ | 0.50175 | 0.50140 | 0.50130 | 0.50175 | 0.50185 | 0.50125 | 0.50110 | 0.50120 |
| | $D4^{90}$ | 0.50225 | 0.50135 | 0.50165 | 0.50225 | 0.50240 | 0.50120 | 0.50105 | 0.50115 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19761 | 0.19762 | 0.19737 | 0.19770 | 0.19768 | 0.19746 | 0.19737 | 0.19745 |
| Volume | $in^3$ | 0.19749 | 0.19771 | 0.19733 | 0.19749 | 0.19748 | 0.19758 | 0.19765 | 0.19766 |
| Volume | $m^3$ | 3.2376E-06 | 3.2392E-06 | 3.2348E-06 | 3.2375E-06 | 3.2373E-06 | 3.2375E-06 | 3.2385E-06 | 3.2386E-06 |
| Weight | gm | 5.7423 | 5.7240 | 5.7856 | 5.8705 | 5.7059 | 5.8609 | 5.7362 | 5.7413 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1773.62 | 1767.10 | 1788.53 | 1813.29 | 1762.53 | 1810.34 | 1771.24 | 1772.75 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.93 | 5.33 | 6.42 | 7.66 | 3.38 | 0.00 | 1.54 | 1.92 |
| | Y | -6.85 | -1.46 | -1.75 | -2.04 | 0.00 | 3.37 | 4.23 | 5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 6-C-T-13-6-L1 | 6-C-T-13-7-L1 | 6-C-T-15-7-L1 | 6-C-T-15-4-L1 | 6-C-T-15-5-L1 | 6-C-T-15-6-L1 | 6-C-R-03-L1 | 6-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00120 | 1.00115 | 0.99960 | 0.99920 | 0.99970 | 1.00015 | 0.99960 | 1.00115 |
| | T2 | 1.00125 | 1.00125 | 0.99970 | 0.99900 | 0.99960 | 1.00010 | 0.99970 | 1.00130 |
| | T3 | 1.00135 | 1.00115 | 0.99980 | 0.99895 | 0.99970 | 0.99990 | 0.99965 | 1.00120 |
| | T4 | 1.00100 | 1.00115 | 0.99965 | 0.99895 | 0.99970 | 1.00000 | 0.99965 | 1.00115 |
| Diameters | D1 | 0.50080 | 0.50115 | 0.50215 | 0.50095 | 0.50170 | 0.50105 | 0.50185 | 0.50190 |
| | D2 | 0.50090 | 0.50095 | 0.50160 | 0.50100 | 0.50145 | 0.50110 | 0.50130 | 0.50155 |
| | D3 | 0.50100 | 0.50075 | 0.50130 | 0.50105 | 0.50135 | 0.50120 | 0.50105 | 0.50120 |
| | D4 | 0.50130 | 0.50070 | 0.50115 | 0.50135 | 0.50115 | 0.50155 | 0.50085 | 0.50115 |
| Diameters | $D1^{90}$ | 0.50085 | 0.50105 | 0.50220 | 0.50100 | 0.50190 | 0.50110 | 0.50165 | 0.50190 |
| | $D2^{90}$ | 0.50090 | 0.50085 | 0.50155 | 0.50105 | 0.50145 | 0.50115 | 0.50120 | 0.50155 |
| | $D3^{90}$ | 0.50095 | 0.50075 | 0.50135 | 0.50125 | 0.50130 | 0.50125 | 0.50100 | 0.50125 |
| | $D4^{90}$ | 0.50125 | 0.50060 | 0.50125 | 0.50150 | 0.50125 | 0.50155 | 0.50085 | 0.50120 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19713 | 0.19702 | 0.19758 | 0.19725 | 0.19749 | 0.19733 | 0.19731 | 0.19750 |
| Volume | $in^3$ | 0.19733 | 0.19726 | 0.19756 | 0.19703 | 0.19745 | 0.19730 | 0.19727 | 0.19778 |
| Volume | $m^3$ | 3.2343E-06 | 3.2323E-06 | 3.2368E-06 | 3.2292E-06 | 3.2352E-06 | 3.2337E-06 | 3.2322E-06 | 3.2403E-06 |
| Weight | gm | 5.7469 | 5.7654 | 5.7621 | 5.7138 | 5.7213 | 5.7376 | 5.7527 | 5.7212 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1776.87 | 1783.66 | 1780.18 | 1769.42 | 1768.48 | 1774.29 | 1779.82 | 1765.62 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 2.31 | 2.69 | -2.69 | -1.54 | -1.20 | -2.31 | -7.20 | -7.20 |
| | Y | 6.34 | 7.40 | 7.4 | 4.23 | 5.29 | 6.34 | -4.16 | -4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 6-C-R-09-L1 | 6-C-R-09-L3 | 6-C-R-14-L1 | 6-C-R-14-L3 | 6-C-T-12-3-L1 | 6-C-T-12-4-L1 | 6-C-T-12-5-L1 | 6-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00100 | 0.99915 | 1.00065 | 0.99790 | 0.99980 | 1.00035 | 0.99980 | 1.00030 |
| | T2 | 1.00090 | 0.99900 | 1.00075 | 0.99780 | 0.99975 | 1.00035 | 0.99965 | 1.00040 |
| | T3 | 1.00065 | 0.99910 | 1.00075 | 0.99780 | 0.99975 | 1.00040 | 0.99965 | 1.00030 |
| | T4 | 1.00080 | 0.99930 | 1.00065 | 0.99785 | 0.99980 | 1.00035 | 0.99975 | 1.00025 |
| Diameters | D1 | 0.50125 | 0.50105 | 0.50085 | 0.50190 | 0.50095 | 0.50150 | 0.50150 | 0.50080 |
| | D2 | 0.50110 | 0.50135 | 0.50095 | 0.50150 | 0.50080 | 0.50115 | 0.50155 | 0.50085 |
| | D3 | 0.50080 | 0.50155 | 0.50125 | 0.50135 | 0.50070 | 0.50090 | 0.50170 | 0.50095 |
| | D4 | 0.50075 | 0.50215 | 0.50185 | 0.50105 | 0.50060 | 0.50075 | 0.50230 | 0.50135 |
| Diameters | $D1^{90}$ | 0.50120 | 0.50120 | 0.50085 | 0.50200 | 0.50095 | 0.50155 | 0.50145 | 0.50085 |
| | $D2^{90}$ | 0.50105 | 0.50165 | 0.50095 | 0.50145 | 0.50085 | 0.50115 | 0.50160 | 0.50090 |
| | $D3^{90}$ | 0.50085 | 0.50145 | 0.50115 | 0.50120 | 0.50065 | 0.50090 | 0.50185 | 0.50115 |
| | $D4^{90}$ | 0.50080 | 0.50210 | 0.50175 | 0.50110 | 0.50060 | 0.50080 | 0.50230 | 0.50155 |
| Area | $in^2$ | 0.19712 | 0.19758 | 0.19729 | 0.19749 | 0.19695 | 0.19721 | 0.19775 | 0.19718 |
| Volume | $in^3$ | 0.19731 | 0.19736 | 0.19734 | 0.19710 | 0.19693 | 0.19732 | 0.19763 | 0.19719 |
| Volume | $m^3$ | 3.2329E-06 | 3.2350E-06 | 3.2353E-06 | 3.2292E-06 | 3.2267E-06 | 3.2328E-06 | 3.2396E-06 | 3.2321E-06 |
| Weight | gm | 5.8174 | 5.8170 | 5.8854 | 5.8346 | 5.6912 | 5.7435 | 5.7449 | 5.7080 |
| Density | $kg/m^3$ | 1799.46 | 1798.17 | 1819.10 | 1806.82 | 1763.79 | 1776.64 | 1773.32 | 1766.01 |
| X-Y Coordinates | X | 7.20 | 7.20 | 0.00 | 0.00 | 2.76 | 3.69 | 4.61 | 3.69 |
| | Y | -4.16 | -4.16 | 7.20 | 7.20 | 1.93 | 2.58 | 3.23 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 6-C-T-12-5-L3 | 6-C-T-16-3-L1 | 6-C-T-16-4-L1 | 6-C-T-16-5-L1 | 6-C-T-16-4-L3 | 6-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00090 | 0.99980 | 1.00045 | 1.00055 | 0.99965 | 1.00005 |
| | T2 | 1.00085 | 0.99945 | 1.00040 | 1.00055 | 0.99980 | 0.99990 |
| | T3 | 1.00055 | 0.99965 | 1.00050 | 1.00050 | 0.99995 | 1.00000 |
| | T4 | 1.00065 | 0.99985 | 1.00055 | 1.00055 | 0.99985 | 1.00005 |
| Diameters | D1 | 0.50125 | 0.50215 | 0.50175 | 0.50095 | 0.50130 | 0.50190 |
| | D2 | 0.50125 | 0.50180 | 0.50145 | 0.50095 | 0.50145 | 0.50155 |
| | D3 | 0.50155 | 0.50155 | 0.50135 | 0.50110 | 0.50165 | 0.50125 |
| | D4 | 0.50180 | 0.50140 | 0.50105 | 0.50135 | 0.50205 | 0.50120 |
| Diameters | $D1^{90}$ | 0.50140 | 0.50205 | 0.50165 | 0.50090 | 0.50130 | 0.50180 |
| | $D2^{90}$ | 0.50135 | 0.50165 | 0.50135 | 0.50095 | 0.50130 | 0.50150 |
| | $D3^{90}$ | 0.50165 | 0.50135 | 0.50125 | 0.50115 | 0.50160 | 0.50125 |
| | $D4^{90}$ | 0.50205 | 0.50135 | 0.50110 | 0.50145 | 0.50205 | 0.50110 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19756 | 0.19766 | 0.19743 | 0.19721 | 0.19760 | 0.19749 |
| Volume | $in^3$ | 0.19766 | 0.19762 | 0.19755 | 0.19728 | 0.19749 | 0.19752 |
| Volume | $m^3$ | 3.2398E-06 | 3.2380E-06 | 3.2368E-06 | 3.2335E-06 | 3.2375E-06 | 3.2362E-06 |
| Weight | gm | 5.6932 | 5.7273 | 5.7224 | 5.7328 | 5.7170 | 5.7508 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1757.27 | 1768.77 | 1767.93 | 1772.93 | 1765.89 | 1777.02 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 4.61 | -2.76 | -3.69 | -4.61 | -3.69 | -4.61 |
| | Y | 3.22 | 1.93 | 2.58 | 3.23 | 2.58 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 7-C-W-01-3 | 7-C-W-01-5 | 7-C-W-01-6 | 7-C-W-01-7 | 7-C-W-04-5 | 7-C-W-04-6 | 7-C-W-04-7 | 7-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99990 | 0.99965 | 1.00045 | 1.00000 | 1.00035 | 1.00020 | 0.99950 | 1.00010 |
| | T2 | 0.99995 | 0.99955 | 1.00050 | 0.99985 | 1.00025 | 1.00025 | 0.99970 | 1.00020 |
| | T3 | 0.99975 | 0.99960 | 1.00050 | 1.00000 | 1.00035 | 1.00030 | 0.99975 | 1.00010 |
| | T4 | 0.99985 | 0.99955 | 1.00065 | 1.00010 | 1.00040 | 1.00030 | 0.99955 | 1.00000 |
| Diameters | D1 | 0.50075 | 0.50100 | 0.49990 | 0.50070 | 0.50025 | 0.50030 | 0.50105 | 0.50070 |
| | D2 | 0.50080 | 0.50100 | 0.49990 | 0.50060 | 0.50025 | 0.50025 | 0.50095 | 0.50055 |
| | D3 | 0.50085 | 0.50105 | 0.50000 | 0.50050 | 0.50020 | 0.50035 | 0.50080 | 0.50045 |
| | D4 | 0.50090 | 0.50125 | 0.50020 | 0.50045 | 0.50020 | 0.50050 | 0.50080 | 0.50040 |
| Diameters | $D1^{90}$ | 0.50070 | 0.50095 | 0.49995 | 0.50065 | 0.50025 | 0.50025 | 0.50095 | 0.50070 |
| | $D2^{90}$ | 0.50075 | 0.50095 | 0.50000 | 0.50050 | 0.50020 | 0.50025 | 0.50085 | 0.50055 |
| | $D3^{90}$ | 0.50090 | 0.50110 | 0.50015 | 0.50045 | 0.50020 | 0.50035 | 0.50075 | 0.50045 |
| | $D4^{90}$ | 0.50115 | 0.50130 | 0.50025 | 0.50040 | 0.50025 | 0.50050 | 0.50080 | 0.50045 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19702 | 0.19720 | 0.19638 | 0.19677 | 0.19653 | 0.19662 | 0.19703 | 0.19677 |
| Volume | $in^3$ | 0.19698 | 0.19708 | 0.19647 | 0.19677 | 0.19659 | 0.19665 | 0.19696 | 0.19680 |
| Volume | $m^3$ | 3.2281E-06 | 3.2301E-06 | 3.2199E-06 | 3.2244E-06 | 3.2216E-06 | 3.2229E-06 | 3.2276E-06 | 3.2248E-06 |
| Weight | gm | 5.6914 | 5.7593 | 5.7045 | 5.7679 | 5.7182 | 5.7450 | 5.8252 | 5.7644 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1763.08 | 1783.00 | 1771.66 | 1788.83 | 1774.97 | 1782.57 | 1804.82 | 1787.54 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.38 | 5.63 | 6.75 | 7.87 | 4.04 | 4.84 | 5.63 | -3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | 3.98 | 4.78 | 5.56 | 5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 7-C-W-07-7 | 7-C-W-10-5 | 7-C-W-10-6 | 7-C-W-10-7 | 7-C-W-11-3 | 7-C-W-14-3 | 7-C-T-13-4-L1 | 7-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99910 | 0.99990 | 0.99960 | 0.99995 | 0.99975 | 0.99985 | 0.99905 | 0.99935 |
| | T2 | 0.99915 | 0.99970 | 0.99945 | 0.99980 | 0.99980 | 0.99985 | 0.99895 | 0.99940 |
| | T3 | 0.99900 | 0.99985 | 0.99945 | 0.99995 | 0.99970 | 0.99985 | 0.99905 | 0.99955 |
| | T4 | 0.99900 | 0.99990 | 0.99960 | 1.00005 | 0.99970 | 0.99985 | 0.99910 | 0.99950 |
| Diameters | D1 | 0.50110 | 0.50100 | 0.50085 | 0.50060 | 0.50070 | 0.50035 | 0.50150 | 0.50130 |
| | D2 | 0.50105 | 0.50080 | 0.50085 | 0.50060 | 0.50070 | 0.50035 | 0.50115 | 0.50100 |
| | D3 | 0.50115 | 0.50075 | 0.50090 | 0.50060 | 0.50075 | 0.50055 | 0.50105 | 0.50100 |
| | D4 | 0.50120 | 0.50065 | 0.50105 | 0.50065 | 0.50105 | 0.50070 | 0.50100 | 0.50090 |
| Diameters | $D1^{90}$ | 0.50115 | 0.50095 | 0.50090 | 0.50080 | 0.50065 | 0.50035 | 0.50135 | 0.50130 |
| | $D2^{90}$ | 0.50105 | 0.50080 | 0.50090 | 0.50065 | 0.50075 | 0.50040 | 0.50110 | 0.50110 |
| | $D3^{90}$ | 0.50115 | 0.50065 | 0.50100 | 0.50065 | 0.50085 | 0.50050 | 0.50110 | 0.50090 |
| | $D4^{90}$ | 0.50135 | 0.50065 | 0.50115 | 0.50055 | 0.50110 | 0.50080 | 0.50115 | 0.50085 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19725 | 0.19696 | 0.19710 | 0.19685 | 0.19699 | 0.19674 | 0.19727 | 0.19717 |
| Volume | $in^3$ | 0.19705 | 0.19695 | 0.19699 | 0.19684 | 0.19691 | 0.19668 | 0.19709 | 0.19708 |
| Volume | $m^3$ | 3.2294E-06 | 3.2271E-06 | 3.2283E-06 | 3.2256E-06 | 3.2273E-06 | 3.2236E-06 | 3.2296E-06 | 3.2293E-06 |
| Weight | gm | 5.8223 | 5.7140 | 5.7215 | 5.8141 | 5.6719 | 5.7129 | 5.6993 | 5.7099 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1802.91 | 1770.61 | 1772.29 | 1802.48 | 1757.48 | 1772.24 | 1764.69 | 1768.17 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.93 | -5.33 | -6.42 | -7.66 | -3.38 | 0.00 | -1.54 | -1.92 |
| | Y | 6.85 | 1.46 | 1.75 | 2.04 | 0.00 | -3.37 | -4.22 | -5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 7-C-T-13-6-L1 | 7-C-T-13-7-L1 | 7-C-T-15-7-L1 | 7-C-T-15-4-L1 | 7-C-T-15-5-L1 | 7-C-T-15-6-L1 | 7-C-R-03-L1 | 7-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99960 | 0.99980 | 0.99960 | 0.99945 | 0.99935 | 0.99940 | 0.99975 | 0.99995 |
| | T2 | 0.99955 | 0.99990 | 0.99955 | 1.00025 | 0.99935 | 0.99940 | 0.99965 | 0.99975 |
| | T3 | 0.99975 | 0.99975 | 0.99955 | 0.99940 | 0.99950 | 0.99930 | 0.99970 | 1.00005 |
| | T4 | 0.99980 | 0.99965 | 0.99960 | 0.99940 | 0.99945 | 0.99930 | 0.99970 | 0.99995 |
| Diameters | D1 | 0.50130 | 0.50100 | 0.50095 | 0.50135 | 0.50120 | 0.50075 | 0.50085 | 0.50080 |
| | D2 | 0.50105 | 0.50080 | 0.50105 | 0.50095 | 0.50090 | 0.50075 | 0.50065 | 0.50055 |
| | D3 | 0.50080 | 0.50075 | 0.50110 | 0.50075 | 0.50085 | 0.50095 | 0.50055 | 0.50040 |
| | D4 | 0.50065 | 0.50060 | 0.50130 | 0.50070 | 0.50080 | 0.50120 | 0.50055 | 0.50045 |
| Diameters | $D1^{90}$ | 0.50135 | 0.50085 | 0.50115 | 0.50120 | 0.50125 | 0.50075 | 0.50080 | 0.50065 |
| | $D2^{90}$ | 0.50100 | 0.50075 | 0.50110 | 0.50085 | 0.50095 | 0.50090 | 0.50065 | 0.50055 |
| | $D3^{90}$ | 0.50075 | 0.50060 | 0.50120 | 0.50075 | 0.50090 | 0.50105 | 0.50055 | 0.50045 |
| | $D4^{90}$ | 0.50070 | 0.50055 | 0.50150 | 0.50070 | 0.50080 | 0.50140 | 0.50055 | 0.50040 |
| Area | $in^2$ | 0.19710 | 0.19693 | 0.19727 | 0.19706 | 0.19710 | 0.19711 | 0.19686 | 0.19677 |
| Volume | $in^3$ | 0.19707 | 0.19690 | 0.19717 | 0.19700 | 0.19700 | 0.19695 | 0.19681 | 0.19676 |
| Volume | $m^3$ | 3.2288E-06 | 3.2264E-06 | 3.2313E-06 | 3.2281E-06 | 3.2280E-06 | 3.2280E-06 | 3.2249E-06 | 3.2242E-06 |
| Weight | gm | 5.7713 | 5.8227 | 5.7282 | 5.7139 | 5.7781 | 5.7327 | 5.8314 | 5.8437 |
| Density | $kg/m^3$ | 1787.45 | 1804.72 | 1772.73 | 1770.07 | 1789.98 | 1775.94 | 1808.23 | 1812.45 |
| X-Y Coordinates | X | -2.31 | -2.69 | 2.69 | 1.54 | 1.92 | 2.31 | 7.20 | 7.20 |
| | Y | -6.34 | -7.40 | -7.40 | -4.23 | -5.29 | -6.34 | 4.16 | 4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 7-C-R-09-L1 | 7-C-R-09-L3 | 7-C-R-14-L1 | 7-C-R-14-L3 | 7-C-T-12-3-L1 | 7-C-T-12-4-L1 | 7-C-T-12-5-L1 | 7-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99915 | 0.99940 | 0.99995 | 0.99920 | 0.99985 | 0.99970 | 0.99965 | 0.99950 |
| | T2 | 0.99945 | 0.99940 | 1.00005 | 0.99915 | 0.99990 | 0.99950 | 0.99975 | 0.99970 |
| | T3 | 0.99895 | 0.99945 | 1.00005 | 0.99900 | 0.99995 | 0.99940 | 0.99965 | 0.99965 |
| | T4 | 0.99895 | 0.99945 | 1.00010 | 0.99910 | 0.99995 | 0.99955 | 0.99955 | 0.99965 |
| Diameters | D1 | 0.50100 | 0.50080 | 0.50025 | 0.50120 | 0.50050 | 0.50060 | 0.50105 | 0.50115 |
| | D2 | 0.50100 | 0.50055 | 0.50035 | 0.50105 | 0.50055 | 0.50065 | 0.50095 | 0.50120 |
| | D3 | 0.50110 | 0.50050 | 0.50050 | 0.50100 | 0.50075 | 0.50085 | 0.50080 | 0.50125 |
| | D4 | 0.50135 | 0.50045 | 0.50060 | 0.50100 | 0.50100 | 0.50095 | 0.50080 | 0.50160 |
| Diameters | $D1^{90}$ | 0.50100 | 0.50070 | 0.50040 | 0.50125 | 0.50050 | 0.50065 | 0.50095 | 0.50115 |
| | $D2^{90}$ | 0.50105 | 0.50055 | 0.50045 | 0.50125 | 0.50050 | 0.50065 | 0.50090 | 0.50115 |
| | $D3^{90}$ | 0.50115 | 0.50045 | 0.50055 | 0.50110 | 0.50070 | 0.50085 | 0.50085 | 0.50130 |
| | $D4^{90}$ | 0.50135 | 0.50045 | 0.50070 | 0.50110 | 0.50095 | 0.50100 | 0.50080 | 0.50165 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19723 | 0.19679 | 0.19672 | 0.19723 | 0.19689 | 0.19696 | 0.19705 | 0.19738 |
| Volume | $in^3$ | 0.19703 | 0.19668 | 0.19672 | 0.19708 | 0.19682 | 0.19684 | 0.19699 | 0.19726 |
| Volume | $m^3$ | 3.2293E-06 | 3.2229E-06 | 3.2238E-06 | 3.2291E-06 | 3.2261E-06 | 3.2261E-06 | 3.2279E-06 | 3.2332E-06 |
| Weight | gm | 5.8703 | 5.8628 | 5.8936 | 5.8813 | 5.6842 | 5.7268 | 5.7239 | 5.7422 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1817.84 | 1819.10 | 1828.13 | 1821.32 | 1761.95 | 1775.15 | 1773.26 | 1776.00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -7.20 | -7.20 | 0.00 | 0.00 | -2.76 | -3.69 | -4.61 | -3.69 |
| | Y | 4.16 | 4.16 | -7.20 | -7.20 | -1.93 | -2.58 | -3.23 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 7-C-T-12-5-L3 | 7-C-T-16-3-L1 | 7-C-T-16-4-L1 | 7-C-T-16-5-L1 | 7-C-T-16-4-L3 | 7-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99985 | 1.00015 | 1.00010 | 1.00040 | 1.00030 | 1.00035 |
| | T2 | 0.99970 | 1.00025 | 0.99990 | 1.00040 | 1.00045 | 1.00020 |
| | T3 | 0.99975 | 1.00020 | 1.00005 | 1.00045 | 1.00040 | 1.00050 |
| | T4 | 0.99975 | 1.00025 | 1.00010 | 1.00035 | 1.00030 | 1.00025 |
| Diameters | D1 | 0.50060 | 0.50060 | 0.50025 | 0.50010 | 0.50020 | 0.50070 |
| | D2 | 0.50060 | 0.50035 | 0.50025 | 0.50010 | 0.50030 | 0.50045 |
| | D3 | 0.50075 | 0.50025 | 0.50040 | 0.50025 | 0.50040 | 0.50030 |
| | D4 | 0.50100 | 0.50020 | 0.50055 | 0.50040 | 0.50060 | 0.50035 |
| Diameters | $D1^{90}$ | 0.50060 | 0.50050 | 0.50025 | 0.50015 | 0.50030 | 0.50055 |
| | $D2^{90}$ | 0.50060 | 0.50050 | 0.50035 | 0.50020 | 0.50035 | 0.50045 |
| | $D3^{90}$ | 0.50070 | 0.50030 | 0.50050 | 0.50030 | 0.50050 | 0.50025 |
| | $D4^{90}$ | 0.50100 | 0.50025 | 0.50060 | 0.50050 | 0.50070 | 0.50025 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19692 | 0.19664 | 0.19666 | 0.19655 | 0.19668 | 0.19667 |
| Volume | $in^3$ | 0.19684 | 0.19671 | 0.19665 | 0.19661 | 0.19673 | 0.19675 |
| Volume | $m^3$ | 3.2263E-06 | 3.2230E-06 | 3.2228E-06 | 3.2221E-06 | 3.2242E-06 | 3.2240E-06 |
| Weight | gm | 5.7539 | 5.6885 | 5.7203 | 5.7118 | 5.7195 | 5.7106 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1783.46 | 1764.95 | 1774.95 | 1772.69 | 1773.95 | 1771.30 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -4.61 | 2.76 | 3.69 | 4.61 | 3.69 | 4.61 |
| | Y | -3.23 | -1.93 | -2.58 | -3.23 | -2.58 | -2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 8-C-W-01-3 | 8-C-W-01-5 | 8-C-W-01-6 | 8-C-W-01-7 | 8-C-W-04-5 | 8-C-W-04-6 | 8-C-W-04-7 | 8-C-W-07-6 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99935 | 1.00015 | 0.99960 | 0.99955 | 1.00025 | 0.99980 | 0.99940 | 1.00005 |
| | T2 | 0.99940 | 1.00005 | 0.99965 | 0.99955 | 1.00030 | 0.99975 | 0.99940 | 1.00005 |
| | T3 | 0.99935 | 1.00005 | 0.99970 | 0.99945 | 1.00030 | 0.99980 | 0.99935 | 0.99995 |
| | T4 | 0.99930 | 1.00015 | 0.99960 | 0.99955 | 1.00025 | 0.99985 | 0.99930 | 0.99995 |
| Diameters | D1 | 0.50090 | 0.50075 | 0.50070 | 0.50085 | 0.50055 | 0.50080 | 0.50080 | 0.50100 |
| | D2 | 0.50075 | 0.50065 | 0.50055 | 0.50075 | 0.50045 | 0.50075 | 0.50075 | 0.50080 |
| | D3 | 0.50085 | 0.50065 | 0.50050 | 0.50060 | 0.50040 | 0.50085 | 0.50085 | 0.50070 |
| | D4 | 0.50105 | 0.50075 | 0.50060 | 0.50065 | 0.50035 | 0.50100 | 0.50095 | 0.50070 |
| Diameters | $D1^{90}$ | 0.50085 | 0.50085 | 0.50070 | 0.50085 | 0.50050 | 0.50085 | 0.50080 | 0.50095 |
| | $D2^{90}$ | 0.50080 | 0.50065 | 0.50055 | 0.50075 | 0.50040 | 0.50075 | 0.50075 | 0.50080 |
| | $D3^{90}$ | 0.50090 | 0.50065 | 0.50055 | 0.50065 | 0.50030 | 0.50080 | 0.50080 | 0.50070 |
| | $D4^{90}$ | 0.50105 | 0.50070 | 0.50060 | 0.50065 | 0.50035 | 0.50100 | 0.50090 | 0.50075 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19705 | 0.19691 | 0.19682 | 0.19691 | 0.19667 | 0.19702 | 0.19700 | 0.19698 |
| Volume | $in^3$ | 0.19690 | 0.19691 | 0.19674 | 0.19683 | 0.19673 | 0.19695 | 0.19685 | 0.19699 |
| Volume | $m^3$ | 3.2270E-06 | 3.2270E-06 | 3.2241E-06 | 3.2253E-06 | 3.2238E-06 | 3.2279E-06 | 3.2262E-06 | 3.2279E-06 |
| Weight | gm | 5.7932 | 5.7909 | 5.7686 | 5.7679 | 5.7746 | 5.7926 | 5.8175 | 5.8080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1795.22 | 1794.50 | 1789.23 | 1788.32 | 1791.24 | 1794.54 | 1803.22 | 1799.31 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | -3.38 | -5.63 | -6.75 | -7.87 | -4.04 | -4.84 | -5.63 | 3.38 |
| | Y | 0.00 | 0.00 | 0.00 | 0.00 | -3.98 | -4.78 | -5.56 | -5.85 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 8-C-W-07-7 | 8-C-W-10-5 | 8-C-W-10-6 | 8-C-W-10-7 | 8-C-W-11-3 | 8-C-W-14-3 | 8-C-T-13-4-L1 | 8-C-T-13-5-L1 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99995 | 1.00080 | 1.00025 | 0.99995 | 1.00010 | 0.99985 | 0.99990 | 0.99960 |
| | T2 | 1.00010 | 1.00065 | 1.00020 | 0.99980 | 1.00005 | 0.99990 | 0.99975 | 0.99970 |
| | T3 | 1.00010 | 1.00055 | 1.00010 | 0.99995 | 0.99995 | 0.99995 | 0.99970 | 0.99955 |
| | T4 | 1.00005 | 1.00065 | 1.00020 | 1.00005 | 1.00005 | 0.99990 | 0.99985 | 0.99960 |
| Diameters | D1 | 0.50055 | 0.50135 | 0.50095 | 0.50075 | 0.50085 | 0.50045 | 0.50065 | 0.50125 |
| | D2 | 0.50050 | 0.50115 | 0.50095 | 0.50065 | 0.50075 | 0.50030 | 0.50050 | 0.50085 |
| | D3 | 0.50040 | 0.50100 | 0.50090 | 0.50070 | 0.50070 | 0.50020 | 0.50040 | 0.50075 |
| | D4 | 0.50045 | 0.50110 | 0.50110 | 0.50085 | 0.50080 | 0.50015 | 0.50040 | 0.50075 |
| Diameters | $D1^{90}$ | 0.50055 | 0.50130 | 0.50085 | 0.50070 | 0.50095 | 0.50045 | 0.50055 | 0.50130 |
| | $D2^{90}$ | 0.50045 | 0.50120 | 0.50080 | 0.50065 | 0.50080 | 0.50025 | 0.50050 | 0.50085 |
| | $D3^{90}$ | 0.50045 | 0.50100 | 0.50095 | 0.50075 | 0.50075 | 0.50010 | 0.50040 | 0.50080 |
| | $D4^{90}$ | 0.50045 | 0.50105 | 0.50110 | 0.50090 | 0.50075 | 0.50010 | 0.50045 | 0.50070 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19672 | 0.19725 | 0.19710 | 0.19693 | 0.19697 | 0.19655 | 0.19673 | 0.19706 |
| Volume | $in^3$ | 0.19673 | 0.19739 | 0.19710 | 0.19690 | 0.19698 | 0.19654 | 0.19670 | 0.19700 |
| Volume | $m^3$ | 3.2239E-06 | 3.2345E-06 | 3.2304E-06 | 3.2270E-06 | 3.2279E-06 | 3.2205E-06 | 3.2232E-06 | 3.2280E-06 |
| Weight | gm | 5.8285 | 5.7773 | 5.7840 | 5.8027 | 5.8038 | 5.7771 | 5.7538 | 5.8080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1807.92 | 1786.16 | 1790.47 | 1798.18 | 1797.99 | 1793.85 | 1785.15 | 1799.24 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 3.93 | 5.33 | 6.42 | 7.66 | 3.38 | 0.00 | 1.54 | 1.92 |
| | Y | -6.85 | -1.46 | -1.75 | -2.04 | 0.00 | 3.37 | 4.23 | 5.29 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 8-C-T-13-6-L1 | 8-C-T-13-7-L1 | 8-C-T-15-7-L1 | 8-C-T-15-4-L1 | 8-C-T-15-5-L1 | 8-C-T-15-6-L1 | 8-C-R-03-L1 | 8-C-R-03-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99955 | 0.99950 | 0.99930 | 0.99960 | 1.00005 | 0.99975 | 0.99955 | 0.99980 |
| | T2 | 0.99955 | 0.99965 | 0.99925 | 0.99945 | 0.99995 | 0.99960 | 0.99945 | 0.99980 |
| | T3 | 0.99940 | 0.99965 | 0.99920 | 0.99955 | 1.00010 | 0.99960 | 0.99945 | 1.00035 |
| | T4 | 0.99930 | 0.99955 | 0.99920 | 0.99955 | 1.00025 | 0.99980 | 0.99955 | 0.99990 |
| Diameters | D1 | 0.50090 | 0.50055 | 0.50060 | 0.50100 | 0.50105 | 0.50080 | 0.50100 | 0.50050 |
| | D2 | 0.50080 | 0.50050 | 0.50065 | 0.50085 | 0.50085 | 0.50055 | 0.50070 | 0.50045 |
| | D3 | 0.50065 | 0.50055 | 0.50065 | 0.50070 | 0.50070 | 0.50040 | 0.50070 | 0.50045 |
| | D4 | 0.50070 | 0.50085 | 0.50095 | 0.50075 | 0.50075 | 0.50050 | 0.50075 | 0.50075 |
| Diameters | $D1^{90}$ | 0.50100 | 0.50060 | 0.50065 | 0.50095 | 0.50110 | 0.50080 | 0.50120 | 0.50055 |
| | $D2^{90}$ | 0.50085 | 0.50055 | 0.50055 | 0.50070 | 0.50090 | 0.50055 | 0.50085 | 0.50050 |
| | $D3^{90}$ | 0.50070 | 0.50060 | 0.50065 | 0.50065 | 0.50075 | 0.50040 | 0.50075 | 0.50055 |
| | $D4^{90}$ | 0.50075 | 0.50090 | 0.50080 | 0.50070 | 0.50075 | 0.50050 | 0.50080 | 0.50080 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19697 | 0.19685 | 0.19689 | 0.19697 | 0.19702 | 0.19679 | 0.19701 | 0.19680 |
| Volume | $in^3$ | 0.19688 | 0.19674 | 0.19670 | 0.19687 | 0.19706 | 0.19674 | 0.19692 | 0.19676 |
| Volume | $m^3$ | 3.2260E-06 | 3.2245E-06 | 3.2240E-06 | 3.2263E-06 | 3.2289E-06 | 3.2238E-06 | 3.2269E-06 | 3.2248E-06 |
| Weight | gm | 5.8170 | 5.8594 | 5.8583 | 5.7678 | 5.7978 | 5.7952 | 5.7808 | 5.8504 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1803.13 | 1817.16 | 1817.09 | 1787.77 | 1795.59 | 1797.61 | 1791.47 | 1814.19 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 2.31 | 2.69 | -2.69 | -1.54 | -1.20 | -2.31 | -7.20 | -7.20 |
| | Y | 6.34 | 7.40 | 7.4 | 4.23 | 5.29 | 6.34 | -4.16 | -4.16 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 8-C-R-09-L1 | 8-C-R-09-L3 | 8-C-R-14-L1 | 8-C-R-14-L3 | 8-C-T-12-3-L1 | 8-C-T-12-4-L1 | 8-C-T-12-5-L1 | 8-C-T-12-4-L3 |
|---|---|---|---|---|---|---|---|---|---|
| Thickness | T1 | 0.99970 | 0.99985 | 0.99920 | 1.00015 | 1.00040 | 0.99945 | 0.99950 | 0.99975 |
| | T2 | 0.99955 | 0.99965 | 0.99945 | 1.00020 | 1.00040 | 0.99950 | 0.99960 | 0.99975 |
| | T3 | 0.99970 | 0.99960 | 0.99945 | 1.00020 | 1.00035 | 0.99955 | 0.99955 | 0.99945 |
| | T4 | 0.99975 | 0.99970 | 0.99935 | 1.00010 | 1.00040 | 0.99955 | 0.99930 | 0.99950 |
| Diameters | D1 | 0.50080 | 0.50055 | 0.50110 | 0.50115 | 0.50055 | 0.50095 | 0.50110 | 0.50105 |
| | D2 | 0.50070 | 0.50050 | 0.50090 | 0.50085 | 0.50035 | 0.50075 | 0.50110 | 0.50080 |
| | D3 | 0.50060 | 0.50040 | 0.50085 | 0.50065 | 0.50020 | 0.50065 | 0.50115 | 0.50060 |
| | D4 | 0.50060 | 0.50045 | 0.50080 | 0.50070 | 0.50025 | 0.50070 | 0.50140 | 0.50065 |
| Diameters | $D1^{90}$ | 0.50075 | 0.50060 | 0.50115 | 0.50115 | 0.50055 | 0.50080 | 0.50115 | 0.50095 |
| | $D2^{90}$ | 0.50070 | 0.50050 | 0.50090 | 0.50085 | 0.50035 | 0.50070 | 0.50110 | 0.50075 |
| | $D3^{90}$ | 0.50060 | 0.50045 | 0.50075 | 0.50070 | 0.50020 | 0.50065 | 0.50125 | 0.50060 |
| | $D4^{90}$ | 0.50070 | 0.50045 | 0.50085 | 0.50070 | 0.50020 | 0.50065 | 0.50135 | 0.50060 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19689 | 0.19673 | 0.19707 | 0.19701 | 0.19661 | 0.19692 | 0.19729 | 0.19694 |
| Volume | $in^3$ | 0.19683 | 0.19668 | 0.19695 | 0.19706 | 0.19670 | 0.19683 | 0.19716 | 0.19687 |
| Volume | $m^3$ | 3.2253E-06 | 3.2229E-06 | 3.2273E-06 | 3.2290E-06 | 3.2231E-06 | 3.2254E-06 | 3.2314E-06 | 3.2260E-06 |
| Weight | gm | 5.8270 | 5.8499 | 5.8802 | 5.8503 | 5.7778 | 5.7752 | 5.8198 | 5.8435 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1806.64 | 1815.10 | 1822.02 | 1811.80 | 1792.61 | 1790.51 | 1801.01 | 1811.37 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 7.20 | 7.20 | 0.00 | 0.00 | 2.76 | 3.69 | 4.61 | 3.69 |
| | Y | -4.16 | -4.16 | 7.20 | 7.20 | 1.93 | 2.58 | 3.23 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Specimen ID | | 8-C-T-12-5-L3 | 8-C-T-16-3-L1 | 8-C-T-16-4-L1 | 8-C-T-16-5-L1 | 8-C-T-16-4-L3 | 8-C-T-16-5-L3 |
|---|---|---|---|---|---|---|---|
| Thickness | T1 | 1.00020 | 0.99960 | 0.99985 | 1.00060 | 1.00055 | 0.99985 |
| | T2 | 1.00015 | 0.99960 | 0.99990 | 1.00060 | 1.00050 | 0.99980 |
| | T3 | 0.99995 | 0.99965 | 0.99980 | 1.00040 | 1.00050 | 0.99980 |
| | T4 | 1.00005 | 0.99970 | 0.99970 | 1.00035 | 1.00060 | 0.99985 |
| Diameters | D1 | 0.50040 | 0.50100 | 0.50025 | 0.50000 | 0.50010 | 0.50015 |
| | D2 | 0.50030 | 0.50070 | 0.50025 | 0.50000 | 0.50010 | 0.50015 |
| | D3 | 0.50020 | 0.50060 | 0.50045 | 0.50015 | 0.50025 | 0.50025 |
| | D4 | 0.50020 | 0.50055 | 0.50065 | 0.50040 | 0.50055 | 0.50060 |
| Diameters | $D1^{90}$ | 0.50035 | 0.50105 | 0.50040 | 0.50000 | 0.50015 | 0.50020 |
| | $D2^{90}$ | 0.50025 | 0.50060 | 0.50035 | 0.50000 | 0.50015 | 0.50010 |
| | $D3^{90}$ | 0.50020 | 0.50055 | 0.50045 | 0.50010 | 0.50025 | 0.50030 |
| | $D4^{90}$ | 0.50025 | 0.50050 | 0.50065 | 0.50030 | 0.50060 | 0.50055 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Area | $in^2$ | 0.19656 | 0.19690 | 0.19669 | 0.19644 | 0.19656 | 0.19658 |
| Volume | $in^3$ | 0.19658 | 0.19683 | 0.19662 | 0.19650 | 0.19663 | 0.19649 |
| Volume | $m^3$ | 3.2213E-06 | 3.2254E-06 | 3.2225E-06 | 3.2207E-06 | 3.2228E-06 | 3.2207E-06 |
| Weight | gm | 5.8405 | 5.7831 | 5.7669 | 5.7695 | 5.8342 | 5.8291 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Density | $kg/m^3$ | 1813.06 | 1793.01 | 1789.55 | 1791.38 | 1810.29 | 1809.86 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X-Y Coordinates | X | 4.61 | -2.76 | -3.69 | -4.61 | -3.69 | -4.61 |
| | Y | 3.22 | 1.93 | 2.58 | 3.23 | 2.58 | 2.58 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Slab **1** Specimen ID | Strength (MPa) |
|---|---|
| 1-C-W-01-3 | 40.06 |
| 1-C-W-01-5 | 50.36 |
| 1-C-W-01-6 | 52.18 |
| 1-C-W-01-7 | 57.44 |
| 1-C-W-04-5 | 47.05 |
| 1-C-W-04-6 | 55.72 |
| 1-C-W-04-7 | 56.02 |
| 1-C-W-07-6 | 57.16 |
| 1-C-W-07-7 | 55.66 |
| 1-C-W-10-5 | 50.53 |
| 1-C-W-10-6 | 54.75 |
| 1-C-W-10-7 | 58.10 |
| 1-C-W-11-3 | 36.98 |
| 1-C-W-14-3 | 41.47 |
| 1-C-T-13-4-L1 | 59.79 |
| 1-C-T-13-5-L1 | 62.45 |
| 1-C-T-13-6-L1 | 62.07 |
| 1-C-T-13-7-L1 | 66.38 |
| 1-C-T-15-7-L1 | 63.68 |
| 1-C-T-15-4-L1 | 59.30 |
| 1-C-T-15-5-L1 | 64.01 |
| 1-C-T-15-6-L1 | 64.63 |
| 1-C-R-03-L1 | 60.28 |
| 1-C-R-03-L3 | 62.71 |
| 1-C-R-09-L1 | 62.29 |
| 1-C-R-09-L3 | 64.22 |
| 1-C-R-14-L1 | 64.43 |
| 1-C-R-14-L3 | 61.72 |
| 1-C-T-12-3-L1 | 59.33 |
| 1-C-T-12-4-L1 | 62.60 |
| 1-C-T-12-5-L1 | 63.75 |
| 1-C-T-12-4-L3 | 59.53 |
| 1-C-T-12-5-L3 | 63.80 |
| 1-C-T-16-3-L1 | 59.52 |
| 1-C-T-16-4-L1 | 64.55 |
| 1-C-T-16-5-L1 | 61.74 |
| 1-C-T-16-4-L3 | 63.14 |
| 1-C-T-16-5-L3 | 63.94 |

| Slab **2** Specimen ID | Strength (MPa) |
|---|---|
| 2-C-W-01-3 | 38.83 |
| 2-C-W-01-5 | 48.20 |
| 2-C-W-01-6 | 52.05 |
| 2-C-W-01-7 | 58.67 |
| 2-C-W-04-5 | 47.85 |
| 2-C-W-04-6 | 45.04 |
| 2-C-W-04-7 | 57.60 |
| 2-C-W-07-6 | 54.23 |
| 2-C-W-07-7 | 56.54 |
| 2-C-W-10-5 | 43.34 |
| 2-C-W-10-6 | 52.99 |
| 2-C-W-10-7 | 57.96 |
| 2-C-W-11-3 | 38.53 |
| 2-C-W-14-3 | 39.19 |
| 2-C-T-13-4-L1 | 33.17 |
| 2-C-T-13-5-L1 | 46.92 |
| 2-C-T-13-6-L1 | 48.03 |
| 2-C-T-13-7-L1 | 54.01 |
| 2-C-T-15-7-L1 | 56.09 |
| 2-C-T-15-4-L1 | 39.62 |
| 2-C-T-15-5-L1 | 46.99 |
| 2-C-T-15-6-L1 | 51.44 |
| 2-C-R-03-L1 | 61.54 |
| 2-C-R-03-L3 | 63.09 |
| 2-C-R-09-L1 | 65.26 |
| 2-C-R-09-L3 | 63.30 |
| 2-C-R-14-L1 | 67.75 |
| 2-C-R-14-L3 | 66.24 |
| 2-C-T-12-3-L1 | 57.35 |
| 2-C-T-12-4-L1 | 57.19 |
| 2-C-T-12-5-L1 | 61.12 |
| 2-C-T-12-4-L3 | 60.78 |
| 2-C-T-12-5-L3 | 62.82 |
| 2-C-T-16-3-L1 | 58.46 |
| 2-C-T-16-4-L1 | 68.86 |
| 2-C-T-16-5-L1 | 68.19 |
| 2-C-T-16-4-L3 | 70.29 |
| 2-C-T-16-5-L3 | 65.05 |

| Slab 3 Specimen ID | Strength (MPa) |
|---|---|
| 3-C-W-01-3 | 36.79 |
| 3-C-W-01-5 | 47.58 |
| 3-C-W-01-6 | 52.19 |
| 3-C-W-01-7 | 57.44 |
| 3-C-W-04-5 | 45.46 |
| 3-C-W-04-6 | 49.98 |
| 3-C-W-04-7 | 58.53 |
| 3-C-W-07-6 | 57.41 |
| 3-C-W-07-7 | 62.69 |
| 3-C-W-10-5 | 40.22 |
| 3-C-W-10-6 | 55.83 |
| 3-C-W-10-7 | 58.70 |
| 3-C-W-11-3 | 33.25 |
| 3-C-W-14-3 | 33.95 |
| 3-C-T-13-4-L1 | 55.61 |
| 3-C-T-13-5-L1 | 62.10 |
| 3-C-T-13-6-L1 | 63.97 |
| 3-C-T-13-7-L1 | 69.73 |
| 3-C-T-15-7-L1 | 69.81 |
| 3-C-T-15-4-L1 | 61.11 |
| 3-C-T-15-5-L1 | 59.26 |
| 3-C-T-15-6-L1 | 65.58 |
| 3-C-R-03-L1 | 63.82 |
| 3-C-R-03-L3 | 65.54 |
| 3-C-R-09-L1 | 53.79 |
| 3-C-R-09-L3 | 68.10 |
| 3-C-R-14-L1 | 69.23 |
| 3-C-R-14-L3 | 68.72 |
| 3-C-T-12-3-L1 | 59.57 |
| 3-C-T-12-4-L1 | 64.26 |
| 3-C-T-12-5-L1 | 65.59 |
| 3-C-T-12-4-L3 | 62.40 |
| 3-C-T-12-5-L3 | x |
| 3-C-T-16-3-L1 | 60.25 |
| 3-C-T-16-4-L1 | 59.92 |
| 3-C-T-16-5-L1 | 65.49 |
| 3-C-T-16-4-L3 | 51.73 |
| 3-C-T-16-5-L3 | 64.01 |

| Slab **4** Specimen ID | Strength (MPa) |
|---|---|
| 4-C-W-01-3 | 32.51 |
| 4-C-W-01-5 | x |
| 4-C-W-01-6 | 53.82 |
| 4-C-W-01-7 | 60.60 |
| 4-C-W-04-5 | 41.30 |
| 4-C-W-04-6 | 42.39 |
| 4-C-W-04-7 | 58.22 |
| 4-C-W-07-6 | 52.89 |
| 4-C-W-07-7 | 63.05 |
| 4-C-W-10-5 | 48.31 |
| 4-C-W-10-6 | 60.86 |
| 4-C-W-10-7 | 64.18 |
| 4-C-W-11-3 | 33.22 |
| 4-C-W-14-3 | 30.09 |
| 4-C-T-13-4-L1 | 61.26 |
| 4-C-T-13-5-L1 | 61.58 |
| 4-C-T-13-6-L1 | 68.04 |
| 4-C-5-13-7-L1 | 71.35 |
| 4-C-T-15-7-L1 | 69.96 |
| 4-C-T-15-4-L1 | 59.80 |
| 4-C-T-15-5-L1 | 57.82 |
| 4-C-T-15-6-L1 | 64.97 |
| 4-C-R-03-L1 | 65.98 |
| 4-C-R-03-L3 | 65.94 |
| 4-C-R-09-L1 | 66.43 |
| 4-C-R-09-L3 | 69.12 |
| 4-C-R-14-L1 | 70.08 |
| 4-C-R-14-L3 | 70.02 |
| 4-C-T-12-3-L1 | 57.89 |
| 4-C-T-12-4-L1 | 53.67 |
| 4-C-T-12-5-L1 | 66.05 |
| 4-C-T-12-4-L3 | 56.80 |
| 4-C-T-12-5-L3 | 63.26 |
| 4-C-T-16-3-L1 | 57.83 |
| 4-C-T-16-4-L1 | 61.01 |
| 4-C-T-16-5-L1 | 61.82 |
| 4-C-T-16-4-L3 | 60.31 |
| 4-C-T-16-5-L3 | 62.48 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

| Slab **5** Specimen ID | Strength (MPa) |
|---|---|
| 5-C-W-01-3 | 32.54 |
| 5-C-W-01-5 | 43.92 |
| 5-C-W-01-6 | 45.22 |
| 5-C-W-01-7 | 60.99 |
| 5-C-W-04-5 | 39.85 |
| 5-C-W-04-6 | 44.22 |
| 5-C-W-04-7 | 60.05 |
| 5-C-W-07-6 | 60.09 |
| 5-C-W-07-7 | 64.57 |
| 5-C-W-10-5 | 37.28 |
| 5-C-W-10-6 | 51.65 |
| 5-C-W-10-7 | 61.39 |
| 5-C-W-11-3 | 34.28 |
| 5-C-W-14-3 | 55.73 |
| 5-C-T-13-4-L1 | 60.58 |
| 5-C-T-13-5-L1 | 61.01 |
| 5-C-T-13-6-L1 | 65.75 |
| 5-C-T-13-7-L1 | 70.01 |
| 5-C-T-15-7-L1 | 68.07 |
| 5-C-T-15-4-L1 | 60.00 |
| 5-C-T-15-5-L1 | 63.65 |
| 5-C-T-15-6-L1 | 64.57 |
| 5-C-R-03-L1 | 69.93 |
| 5-C-R-03-L3 | 51.56 |
| 5-C-R-09-L1 | 67.61 |
| 5-C-R-09-L3 | 66.28 |
| 5-C-R-14-L1 | 68.51 |
| 5-C-R-14-L3 | 68.70 |
| 5-C-T-12-3-L1 | 61.88 |
| 5-C-T-12-4-L1 | 62.78 |
| 5-C-T-12-5-L1 | 63.15 |
| 5-C-T-12-4-L3 | 59.25 |
| 5-C-T-12-5-L3 | 57.87 |
| 5-C-T-16-3-L1 | 61.33 |
| 5-C-T-16-4-L1 | 63.70 |
| 5-C-T-16-5-L1 | 66.31 |
| 5-C-T-16-4-L3 | 63.28 |
| 5-C-T-16-5-L3 | 64.36 |

| Slab **6** Specimen ID | Strength (MPa) |
|---|---|
| 6-C-W-01-3 | 39.99 |
| 6-C-W-01-5 | 40.74 |
| 6-C-W-01-6 | 46.22 |
| 6-C-W-1-7 | 57.64 |
| 6-C-W-04-5 | 44.52 |
| 6-C-W-04-6 | 47.23 |
| 6-C-W-04-7 | 55.89 |
| 6-C-W-07-6 | 50.31 |
| 6-C-W-07-7 | 48.18 |
| 6-C-W-10-5 | 43.13 |
| 6-C-W-10-6 | 51.92 |
| 6-C-W-10-7 | 66.34 |
| 6-C-W-11-3 | 37.19 |
| 6-C-W-14-3 | 67.31 |
| 6-C-T-13-4-L1 | 62.57 |
| 6-C-T-13-5-L1 | 59.40 |
| 6-C-T-13-6-L1 | 64.21 |
| 6-C-T-13-7-L1 | 68.83 |
| 6-C-T-15-7-L1 | 68.50 |
| 6-C-T-15-4-L1 | 61.27 |
| 6-C-T-15-5-L1 | 58.47 |
| 6-C-T-15-6-L1 | 60.84 |
| 6-C-R-03-L1 | 53.00 |
| 6-C-R-03-L3 | 58.06 |
| 6-C-R-09-L1 | 62.82 |
| 6-C-R-09-L3 | 61.14 |
| 6-C-R-14-L1 | 69.89 |
| 6-C-R-14-L3 | 68.56 |
| 6-C-T-12-3-L1 | 58.22 |
| 6-C-T-12-4-L1 | 62.11 |
| 6-C-T-12-5-L1 | 63.74 |
| 6-C-T-12-4-L3 | 56.69 |
| 6-C-T-12-5-L3 | 61.59 |
| 6-C-T-16-3-L1 | 62.48 |
| 6-C-T-16-4-L1 | 63.40 |
| 6-C-T-16-5-L1 | 63.13 |
| 6-C-T-16-4-L3 | 60.42 |
| 6-C-T-16-5-L3 | 64.10 |

| Slab **7** Specimen ID | Strength (MPa) |
|---|---|
| 7-C-W-01-3 | 38.07 |
| 7-C-W-01-5 | 46.95 |
| 7-C-W-01-6 | 50.19 |
| 7-C-W-01-7 | 57.32 |
| 7-C-W-04-5 | 48.03 |
| 7-C-W-04-6 | 55.10 |
| 7-C-W-04-7 | 62.37 |
| 7-C-W-07-6 | 55.43 |
| 7-C-W-07-7 | 62.64 |
| 7-C-W-10-5 | 45.71 |
| 7-C-W-10-6 | 47.55 |
| 7-C-W-10-7 | 59.93 |
| 7-C-W-11-3 | 36.88 |
| 7-C-W-14-3 | 37.37 |
| 7-C-T-13-4-L1 | 61.20 |
| 7-C-T-13-5-L1 | 63.28 |
| 7-C-T-13-6-L1 | 68.80 |
| 7-C-T-13-7-L1 | 70.02 |
| 7-C-T-15-7-L1 | 62.63 |
| 7-C-T-15-4-L1 | 60.48 |
| 7-C-T-15-5-L1 | 69.96 |
| 7-C-T-15-6-L1 | 64.77 |
| 7-C-R-03-L1 | 69.30 |
| 7-C-R-03-L3 | 70.82 |
| 7-C-R-09-L1 | 71.28 |
| 7-C-R-09-L3 | 70.07 |
| 7-C-R-14-L1 | 70.10 |
| 7-C-R-14-L3 | 69.92 |
| 7-C-T-12-3-L1 | 58.48 |
| 7-C-T-12-4-L1 | 63.11 |
| 7-C-T-12-5-L1 | 61.47 |
| 7-C-T-12-4-L3 | 61.06 |
| 7-C-T-12-5-L3 | 64.25 |
| 7-C-T-16-3-L1 | 58.86 |
| 7-C-T-16-4-L1 | 60.26 |
| 7-C-T-16-5-L1 | 61.60 |
| 7-C-T-16-4-L3 | 59.12 |
| 7-C-T-16-5-L3 | 63.58 |

| Slab **8** Specimen ID | Strength (MPa) |
|---|---|
| 8-C-W-01-3 | 59.52 |
| 8-C-W-01-5 | 56.15 |
| 8-C-W-01-6 | 54.02 |
| 8-C-W-01-7 | 59.26 |
| 8-C-W-04-5 | 55.43 |
| 8-C-W-04-6 | 56.25 |
| 8-C-W-04-7 | 63.64 |
| 8-C-W-07-6 | 60.16 |
| 8-C-W-07-7 | 67.70 |
| 8-C-W-10-5 | 53.52 |
| 8-C-W-10-6 | 54.01 |
| 8-C-W-10-7 | 60.00 |
| 8-C-W-11-3 | 59.17 |
| 8-C-W-14-3 | 56.52 |
| 8-C-T-13-4-L1 | 66.64 |
| 8-C-T-13-5-L1 | 71.20 |
| 8-C-T-13-6-L1 | 70.01 |
| 8-C-T-13-7-L1 | 70.05 |
| 8-C-T-15-7-L1 | 70.04 |
| 8-C-T-15-4-L1 | 64.33 |
| 8-C-T-15-5-L1 | 64.93 |
| 8-C-T-15-6-L1 | 69.70 |
| 8-C-R-03-L1 | 65.99 |
| 8-C-R-03-L3 | 70.07 |
| 8-C-R-09-L1 | 70.04 |
| 8-C-R-09-L3 | 70.09 |
| 8-C-R-14-L1 | 69.97 |
| 8-C-R-14-L3 | 69.99 |
| 8-C-T-12-3-L1 | 54.01 |
| 8-C-T-12-4-L1 | 60.31 |
| 8-C-T-12-5-L1 | 67.81 |
| 8-C-T-12-4-L3 | 67.56 |
| 8-C-T-12-5-L3 | 71.45 |
| 8-C-T-16-3-L1 | 58.65 |
| 8-C-T-16-4-L1 | 64.70 |
| 8-C-T-16-5-L1 | 66.08 |
| 8-C-T-16-4-L3 | 70.61 |
| 8-C-T-16-5-L3 | 71.52 |

Appendix A. Compression Specimen Measurements, Densities, and Strengths

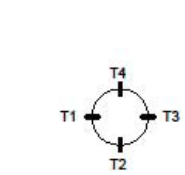
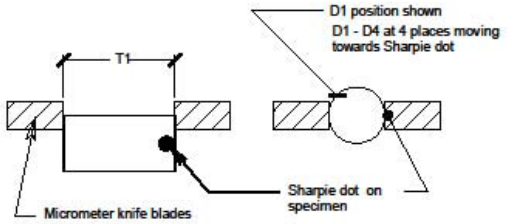



Fig. 1



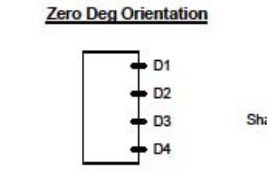




Fig. 2

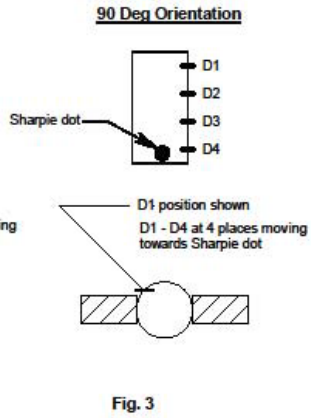



Fig. 3

## APPENDIX B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 1 -T-W- 01-0 | x | x | x | x | x |
| 1 -T-W- 01-1 | 0.37640 | 0.37535 | 0.37635 | 0.37550 | 0.37480 |
| 1 -T-W- 01-2 | 0.37640 | 0.37545 | 0.37645 | 0.37610 | 0.37840 |
| 1 -T-W- 01-4 | 0.37710 | 0.37650 | 0.37585 | 0.37495 | 0.37455 |
| 1 -T-W- 02-5 | 0.37640 | 0.37485 | 0.37650 | 0.37590 | 0.37560 |
| 1 -T-W- 02-6 | 0.37625 | 0.37620 | 0.37570 | 0.37570 | 0.37635 |
| 1 -T-W- 02-7 | 0.37655 | 0.37670 | 0.37665 | 0.37500 | 0.37605 |
| 1 -T-W- 05-6 | 0.37495 | 0.37520 | 0.37555 | 0.37555 | 0.37625 |
| 1 -T-W- 05-7 | 0.37590 | 0.37555 | 0.37635 | 0.37505 | 0.37525 |
| 1 -T-W- 08-5 | 0.37490 | 0.37610 | 0.37635 | 0.37610 | 0.37670 |
| 1 -T-W- 08-6 | 0.37710 | 0.37570 | 0.37505 | 0.37500 | 0.37425 |
| 1 -T-W- 08-7 | 0.37675 | 0.37620 | 0.37675 | 0.37610 | 0.37595 |
| 1 -T-W- 11-1 | x | x | x | x | x |
| 1 -T-W- 11-2 | 0.37330 | 0.37485 | 0.37635 | 0.37655 | 0.37755 |
| 1 -T-W- 11-4 | 0.37455 | 0.37565 | 0.37650 | 0.37570 | 0.37650 |
| 1 -T-W- 11-5 | 0.37520 | 0.37650 | 0.37650 | 0.37615 | 0.37650 |
| 1 -T-W- 11-6 | 0.37530 | 0.37585 | 0.37585 | 0.37540 | 0.37670 |
| 1 -T-W- 11-7 | 0.37660 | 0.37640 | 0.37600 | 0.37545 | 0.37505 |
| 1 -T-W- 14-1 | x | x | x | x | x |
| 1 -T-W- 14-2 | x | x | x | x | x |
| 1 -T-R- 03-L2 | 0.37625 | 0.37510 | 0.37555 | 0.37540 | 0.37635 |
| 1 -T-R- 03-L4 | 0.37505 | 0.37470 | 0.37565 | 0.37535 | 0.37515 |
| 1 -T-R- 09-L2 | 0.37920 | 0.37665 | 0.37705 | 0.37700 | 0.37725 |
| 1 -T-R- 09-L4 | x | x | x | x | x |
| 1 -T-R- 14-L2 | 0.37570 | 0.37545 | 0.37645 | 0.37605 | 0.37865 |
| 1 -T-R- 14-L4 | 0.37785 | 0.37620 | 0.37635 | 0.37580 | 0.37615 |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| x | x | x | x | x |
| 0.37665 | 0.37530 | 0.37650 | 0.37575 | 0.37505 |
| 0.37650 | 0.37540 | 0.37645 | 0.37605 | 0.37815 |
| 0.37665 | 0.37650 | 0.37580 | 0.37495 | 0.37465 |
| 0.37590 | 0.37460 | 0.37650 | 0.37595 | 0.37555 |
| 0.37620 | 0.37610 | 0.37550 | 0.37565 | 0.37625 |
| 0.37635 | 0.37660 | 0.37660 | 0.37495 | 0.37610 |
| 0.37490 | 0.37525 | 0.37555 | 0.37550 | 0.37630 |
| 0.37625 | 0.37550 | 0.37635 | 0.37510 | 0.37540 |
| 0.37485 | 0.37610 | 0.37625 | 0.37600 | 0.37700 |
| 0.37730 | 0.37570 | 0.37500 | 0.37480 | 0.37425 |
| 0.37665 | 0.37600 | 0.37675 | 0.37600 | 0.37595 |
| x | x | x | x | x |
| 0.37335 | 0.37510 | 0.37635 | 0.37650 | 0.37720 |
| 0.37430 | 0.37545 | 0.37645 | 0.37565 | 0.37605 |
| 0.37520 | 0.37635 | 0.37660 | 0.37635 | 0.37655 |
| 0.37540 | 0.37590 | 0.37585 | 0.37540 | 0.37660 |
| 0.37695 | 0.37645 | 0.37605 | 0.37550 | 0.37520 |
| x | x | x | x | x |
| x | x | x | x | x |
| 0.37635 | 0.37530 | 0.37565 | 0.37550 | 0.37620 |
| 0.37470 | 0.37465 | 0.37555 | 0.37530 | 0.37515 |
| 0.37865 | 0.37660 | 0.37705 | 0.37695 | 0.37690 |
| x | x | x | x | x |
| 0.37570 | 0.37565 | 0.37660 | 0.37600 | 0.37850 |
| 0.37750 | 0.37620 | 0.37615 | 0.37565 | 0.37585 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 1 -T-T- 06-1-L2 | 0.37585 | 0.37645 | 0.37690 | 0.37545 | 0.37635 |
| 1 -T-T- 06-2-L2 | 0.37575 | 0.37585 | 0.37565 | 0.37510 | 0.37615 |
| 1 -T-T- 06-3-L2 | 0.37575 | 0.37490 | 0.37465 | 0.37425 | 0.37365 |
| 1 -T-T- 06-4-L2 | 0.37685 | 0.37630 | 0.37720 | 0.37585 | 0.37670 |
| 1 -T-T- 06-5-L2 | 0.37695 | 0.37600 | 0.37585 | 0.37585 | 0.37580 |
| 1 -T-T- 06-6-L2 | 0.37440 | 0.37380 | 0.37425 | 0.37560 | 0.37700 |
| 1 -T-T- 06-7-L2 | 0.37425 | 0.37490 | 0.37530 | 0.37550 | 0.37660 |
| 1 -T-T- 06-1-L3 | x | x | x | x | x |
| 1 -T-T- 06-2-L3 | 0.37500 | 0.37520 | 0.37535 | 0.37495 | 0.37630 |
| 1 -T-T- 06-3-L3 | 0.37470 | 0.37405 | 0.37545 | 0.37500 | 0.37490 |
| 1 -T-T- 06-4-L3 | 0.37650 | 0.37595 | 0.37610 | 0.37535 | 0.37540 |
| 1 -T-T- 06-5-L3 | 0.37515 | 0.37550 | 0.37620 | 0.37675 | 0.37635 |
| 1 -T-T- 06-6-L3 | 0.37540 | 0.37550 | 0.37570 | 0.37455 | 0.37560 |
| 1 -T-T- 06-7-L3 | 0.37425 | 0.37530 | 0.37590 | 0.37480 | 0.37515 |
| 1 -T-T- 12-6-L2 | x | | | x | x |
| 1 -T-T- 12-6-L3 | 0.37625 | 0.37580 | 0.37605 | 0.37530 | 0.37465 |
| 1 -T-T- 12-7-L2 | 0.37595 | 0.37645 | 0.37645 | 0.37650 | 0.37680 |
| 1 -T-T- 12-7-L3 | 0.37565 | 0.37560 | 0.37600 | 0.37565 | 0.37605 |
| 1 -T-T- 16-6-L2 | 0.37550 | 0.37515 | 0.37610 | 0.37500 | 0.37490 |
| 1 -T-T- 16-6-L3 | 0.37640 | 0.37575 | 0.37520 | 0.37550 | 0.37465 |
| 1 -T-T- 16-7-L2 | 0.37525 | 0.37590 | 0.37605 | 0.37605 | 0.37620 |
| 1 -T-T- 16-7-L3 | 0.37610 | 0.37570 | 0.37675 | 0.37570 | 0.37710 |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37580 | 0.37625 | 0.37680 | 0.37540 | 0.37570 |
| 0.37570 | 0.37580 | 0.37575 | 0.37515 | 0.37605 |
| 0.37575 | 0.37445 | 0.37445 | 0.37415 | 0.37365 |
| 0.37650 | 0.37615 | 0.37710 | 0.37560 | 0.37650 |
| 0.37690 | 0.37565 | 0.37565 | 0.37555 | 0.37580 |
| 0.37460 | 0.37375 | 0.37405 | 0.37520 | 0.37685 |
| 0.37445 | 0.37490 | 0.37525 | 0.37540 | 0.37625 |
| x | x | x | x | x |
| 0.37490 | 0.37535 | 0.37515 | 0.37485 | 0.37590 |
| 0.37470 | 0.37395 | 0.37545 | 0.37520 | 0.37470 |
| 0.37630 | 0.37610 | 0.37615 | 0.37535 | 0.37550 |
| 0.37490 | 0.37540 | 0.37605 | 0.37665 | 0.37620 |
| 0.37530 | 0.37545 | 0.37550 | 0.37430 | 0.37510 |
| 0.37430 | 0.37535 | 0.37580 | 0.37455 | 0.37515 |
| x | x | x | x | x |
| 0.37625 | 0.37560 | 0.37595 | 0.37515 | 0.37460 |
| 0.37580 | 0.37645 | 0.37640 | 0.37640 | 0.37680 |
| 0.37550 | 0.37570 | 0.37600 | 0.37575 | 0.37640 |
| 0.37555 | 0.37530 | 0.37620 | 0.37505 | 0.37490 |
| 0.37675 | 0.37590 | 0.37540 | 0.37560 | 0.37490 |
| 0.37510 | 0.37585 | 0.37605 | 0.37605 | 0.37600 |
| 0.37600 | 0.37550 | 0.37665 | 0.37565 | 0.37690 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 2 -T-W- 01-0 | 0.37460 | 0.37495 | 0.37465 | 0.37385 | 0.37315 | 0.37480 | 0.37520 | 0.37470 | 0.37395 | 0.37320 |
| 2 -T-W- 01-1 | 0.37750 | 0.37685 | 0.37705 | 0.37600 | 0.37550 | 0.37760 | 0.37670 | 0.37690 | 0.37615 | 0.37585 |
| 2 -T-W- 01-2 | 0.37815 | 0.37650 | 0.37645 | 0.37595 | 0.37590 | 0.37825 | 0.37640 | 0.37645 | 0.37605 | 0.37605 |
| 2 -T-W- 01-4 | x | x | x | x | x | x | x | x | x | x |
| 2 -T-W- 02-5 | 0.37740 | 0.37535 | 0.37560 | 0.37560 | 0.37600 | 0.37750 | 0.37535 | 0.37575 | 0.37580 | 0.37570 |
| 2 -T-W- 02-6 | 0.37690 | 0.37645 | 0.37635 | 0.37500 | 0.37470 | 0.37695 | 0.37630 | 0.37595 | 0.37495 | 0.37445 |
| 2 -T-W- 02-7 | 0.37690 | 0.37660 | 0.37630 | 0.37530 | 0.37510 | 0.37705 | 0.37645 | 0.37625 | 0.37535 | 0.37510 |
| 2 -T-W- 05-6 | 0.37635 | 0.37645 | 0.37710 | 0.37565 | 0.37490 | 0.37630 | 0.37650 | 0.37725 | 0.37580 | 0.37510 |
| 2 -T-W- 05-7 | 0.37720 | 0.37645 | 0.37550 | 0.37565 | 0.37600 | 0.37710 | 0.37630 | 0.37545 | 0.37555 | 0.37580 |
| 2 -T-W- 08-5 | 0.37515 | 0.37540 | 0.37615 | 0.37630 | 0.37700 | 0.37510 | 0.37590 | 0.37630 | 0.37600 | 0.37685 |
| 2 -T-W- 08-6 | 0.37790 | 0.37680 | 0.37525 | 0.37600 | 0.37590 | 0.37820 | 0.37685 | 0.37515 | 0.37600 | 0.37585 |
| 2 -T-W- 08-7 | 0.37320 | 0.37400 | 0.37440 | 0.37460 | 0.37445 | 0.37345 | 0.37385 | 0.37465 | 0.37480 | 0.37445 |
| 2 -T-W- 11-1 | x | | | x | x | x | x | x | x | x |
| 2 -T-W- 11-2 | 0.37670 | 0.37630 | 0.37420 | 0.37205 | 0.37585 | 0.37675 | 0.37635 | 0.37430 | 0.37215 | 0.37575 |
| 2 -T-W- 11-4 | 0.37585 | 0.37615 | 0.37685 | 0.37575 | 0.37740 | 0.37590 | 0.37590 | 0.37680 | 0.37585 | 0.37745 |
| 2 -T-W- 11-5 | 0.37665 | 0.37570 | 0.37580 | 0.37475 | 0.37425 | 0.37655 | 0.37585 | 0.37585 | 0.37470 | 0.37440 |
| 2 -T-W- 11-6 | 0.37755 | 0.37715 | 0.37615 | 0.37685 | 0.37645 | 0.37750 | 0.37710 | 0.37610 | 0.37710 | 0.37660 |
| 2 -T-W- 11-7 | 0.37555 | 0.37640 | 0.37620 | 0.37540 | 0.37615 | 0.37570 | 0.37605 | 0.37610 | 0.37545 | 0.37605 |
| 2 -T-W- 14-1 | 0.37520 | 0.37575 | 0.37680 | 0.37650 | 0.37680 | 0.37515 | 0.37555 | 0.37690 | 0.37640 | 0.37660 |
| 2 -T-W- 14-2 | 0.37640 | 0.37610 | 0.37580 | 0.37610 | 0.37830 | 0.37640 | 0.37605 | 0.37590 | 0.37605 | 0.37800 |
| 2 -T-R- 03-L2 | 0.37565 | 0.37558 | 0.37575 | 0.37470 | 0.37530 | 0.37585 | 0.37585 | 0.37585 | 0.37480 | 0.37535 |
| 2 -T-R- 03-L4 | 0.37755 | 0.37640 | 0.37660 | 0.37555 | 0.37550 | 0.37735 | 0.37625 | 0.37650 | 0.37545 | 0.37535 |
| 2 -T-R- 09-L2 | 0.37485 | 0.37535 | 0.37580 | 0.37480 | 0.37485 | 0.37505 | 0.37550 | 0.37575 | 0.37470 | 0.37485 |
| 2 -T-R- 09-L4 | 0.37575 | 0.37585 | 0.37555 | 0.37540 | 0.37640 | 0.37557 | 0.37580 | 0.37570 | 0.37530 | 0.37645 |
| 2 -T-R- 14-L2 | 0.37530 | 0.37510 | 0.37620 | 0.37570 | 0.37750 | 0.37515 | 0.37520 | 0.37620 | 0.37555 | 0.37750 |
| 2 -T-R- 14-L4 | 0.37740 | 0.37580 | 0.37595 | 0.37430 | 0.37445 | 0.37705 | 0.37570 | 0.37585 | 0.37445 | 0.37425 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 2 -T-T- 06-1-L2 | 0.37580 | 0.37555 | 0.37680 | 0.37565 | 0.37520 | 0.37585 | 0.37560 | 0.37670 | 0.37590 | 0.37530 |
| 2 -T-T- 06-2-L2 | 0.37450 | 0.37460 | 0.37545 | 0.37560 | 0.37660 | 0.37435 | 0.37460 | 0.37550 | 0.37565 | 0.37695 |
| 2 -T-T- 06-3-L2 | 0.37600 | 0.37575 | 0.37590 | 0.37470 | 0.37385 | 0.37575 | 0.37585 | 0.37585 | 0.37470 | 0.37395 |
| 2 -T-T- 06-4-L2 | 0.37640 | 0.37620 | 0.37655 | 0.37555 | 0.37510 | 0.37625 | 0.37615 | 0.37665 | 0.37540 | 0.37485 |
| 2 -T-T- 06-5-L2 | 0.37745 | 0.37700 | 0.37585 | 0.37605 | 0.37605 | 0.37755 | 0.37705 | 0.37600 | 0.37625 | 0.37615 |
| 2 -T-T- 06-6-L2 | 0.37575 | 0.37555 | 0.37510 | 0.37475 | 0.37585 | 0.37570 | 0.37555 | 0.37520 | 0.37480 | 0.37590 |
| 2 -T-T- 06-7-L2 | 0.37520 | 0.37560 | 0.37665 | 0.37735 | 0.37745 | 0.37520 | 0.37580 | 0.37675 | 0.37710 | 0.37735 |
| 2 -T-T- 06-1-L3 | 0.37695 | 0.37620 | 0.37655 | 0.37600 | 0.37575 | 0.37705 | 0.37605 | 0.37660 | 0.37590 | 0.37570 |
| 2 -T-T- 06-2-L3 | 0.37490 | 0.37500 | 0.37535 | 0.37630 | 0.37625 | 0.37500 | 0.37480 | 0.37530 | 0.37650 | 0.37630 |
| 2 -T-T- 06-3-L3 | 0.37345 | 0.37375 | 0.37515 | 0.37575 | 0.37620 | 0.37345 | 0.37360 | 0.37535 | 0.37575 | 0.37630 |
| 2 -T-T- 06-4-L3 | 0.37580 | 0.37365 | 0.37570 | 0.37550 | 0.37555 | 0.37580 | 0.37370 | 0.37585 | 0.37550 | 0.37585 |
| 2 -T-T- 06-5-L3 | 0.37655 | 0.37555 | 0.37595 | 0.37505 | 0.37445 | 0.37640 | 0.37535 | 0.37580 | 0.37465 | 0.37445 |
| 2 -T-T- 06-6-L3 | 0.37760 | 0.37520 | 0.37595 | 0.37545 | 0.37530 | 0.37715 | 0.37505 | 0.37585 | 0.37520 | 0.37535 |
| 2 -T-T- 06-7-L3 | 0.37440 | 0.37465 | 0.37575 | 0.37500 | 0.37655 | 0.37430 | 0.37440 | 0.37580 | 0.37490 | 0.37655 |
| 2 -T-T- 12-6-L2 | 0.37785 | 0.37770 | 0.37645 | 0.37680 | 0.37700 | 0.37790 | 0.37770 | 0.37665 | 0.37680 | 0.37700 |
| 2 -T-T- 12-6-L3 | 0.37650 | 0.37655 | 0.37645 | 0.37560 | 0.37535 | 0.37675 | 0.37660 | 0.37650 | 0.37575 | 0.37545 |
| 2 -T-T- 12-7-L2 | 0.37600 | 0.37570 | 0.37560 | 0.37485 | 0.37430 | 0.37600 | 0.37590 | 0.37570 | 0.37485 | 0.37450 |
| 2 -T-T- 12-7-L3 | 0.37525 | 0.37675 | 0.37675 | 0.37590 | 0.37575 | 0.37510 | 0.37645 | 0.37660 | 0.37565 | 0.37540 |
| 2 -T-T- 16-6-L2 | 0.37525 | 0.37545 | 0.37605 | 0.37650 | 0.37670 | 0.37540 | 0.37540 | 0.37610 | 0.37655 | 0.37685 |
| 2 -T-T- 16-6-L3 | 0.37585 | 0.37540 | 0.37620 | 0.37585 | 0.37645 | 0.37610 | 0.37575 | 0.37645 | 0.37600 | 0.37650 |
| 2 -T-T- 16-7-L2 | 0.37580 | 0.37435 | 0.37560 | 0.37400 | 0.37575 | 0.37590 | 0.37445 | 0.37585 | 0.37435 | 0.37580 |
| 2 -T-T- 16-7-L3 | 0.37565 | 0.37550 | 0.37630 | 0.37620 | 0.37620 | 0.37580 | 0.37570 | 0.37640 | 0.37630 | 0.37655 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 3 -T-W- 01-0 | 0.37610 | 0.37580 | 0.37595 | 0.37470 | 0.37725 | 0.37600 | 0.37585 | 0.37600 | 0.37515 | 0.37715 |
| 3 -T-W- 01-1 | 0.37460 | 0.37440 | 0.37530 | 0.37665 | 0.37630 | 0.37435 | 0.37425 | 0.37535 | 0.37655 | 0.37610 |
| 3 -T-W- 01-2 | 0.37610 | 0.37640 | 0.37690 | 0.37660 | 0.37710 | 0.37625 | 0.37635 | 0.37695 | 0.37635 | 0.37695 |
| 3 -T-W- 01-4 | 0.37510 | 0.37535 | 0.37650 | 0.37595 | 0.37720 | 0.37525 | 0.37515 | 0.37640 | 0.37615 | 0.37630 |
| 3 -T-W- 02-5 | x | x | x | x | x | x | x | x | x | x |
| 3 -T-W- 02-6 | 0.37700 | 0.37580 | 0.37665 | 0.37645 | 0.37675 | 0.37705 | 0.37555 | 0.37655 | 0.37630 | 0.37695 |
| 3 -T-W- 02-7 | 0.37540 | 0.37550 | 0.37635 | 0.37630 | 0.37710 | 0.37545 | 0.37555 | 0.37640 | 0.37650 | 0.37710 |
| 3 -T-W- 05-6 | 0.37635 | 0.37585 | 0.37585 | 0.37590 | 0.37585 | 0.37585 | 0.37600 | 0.37585 | 0.37605 | 0.37590 |
| 3 -T-W- 05-7 | 0.37605 | 0.37620 | 0.37600 | 0.37505 | 0.37510 | 0.37595 | 0.37615 | 0.37590 | 0.37495 | 0.37505 |
| 3 -T-W- 08-5 | 0.37600 | 0.37645 | 0.37645 | 0.37670 | 0.37640 | 0.37585 | 0.37670 | 0.37650 | 0.37675 | 0.37640 |
| 3 -T-W- 08-6 | 0.37550 | 0.37585 | 0.37600 | 0.37620 | 0.37630 | 0.37555 | 0.37585 | 0.37600 | 0.37600 | 0.37625 |
| 3 -T-W- 08-7 | 0.37570 | 0.37515 | 0.37475 | 0.37495 | 0.37545 | 0.37540 | 0.37570 | 0.37460 | 0.37490 | 0.37570 |
| 3 -T-W- 11-1 | 0.37645 | 0.37510 | 0.37595 | 0.37540 | 0.37580 | 0.37585 | 0.37505 | 0.37585 | 0.37530 | 0.37575 |
| 3 -T-W- 11-2 | 0.37765 | 0.37640 | 0.37615 | 0.37365 | 0.37595 | 0.37760 | 0.37635 | 0.37615 | 0.37380 | 0.37520 |
| 3 -T-W- 11-4 | 0.37670 | 0.37610 | 0.37610 | 0.37570 | 0.37705 | 0.37650 | 0.37620 | 0.37595 | 0.37535 | 0.37705 |
| 3 -T-W- 11-5 | 0.37620 | 0.37580 | 0.37655 | 0.37590 | 0.37720 | 0.37615 | 0.37585 | 0.37660 | 0.37585 | 0.37695 |
| 3 -T-W- 11-6 | 0.37680 | 0.37495 | 0.37565 | 0.37470 | 0.37620 | 0.37690 | 0.37505 | 0.37545 | 0.37495 | 0.37610 |
| 3 -T-W- 11-7 | 0.37625 | 0.37560 | 0.37680 | 0.37620 | 0.37630 | 0.37620 | 0.37580 | 0.37690 | 0.37630 | 0.37625 |
| 3 -T-W- 14-1 | 0.37655 | 0.37615 | 0.37645 | 0.37620 | 0.37755 | 0.37660 | 0.37590 | 0.37650 | 0.37605 | 0.37730 |
| 3 -T-W- 14-2 | 0.37650 | 0.37655 | 0.37670 | 0.37680 | 0.37755 | 0.37665 | 0.37650 | 0.37670 | 0.37675 | 0.37755 |
| 3 -T-R- 03-L2 | 0.37595 | 0.37650 | 0.37655 | 0.37490 | 0.37700 | 0.37580 | 0.37620 | 0.37645 | 0.37510 | 0.37675 |
| 3 -T-R- 03-L4 | 0.37585 | 0.37570 | 0.37530 | 0.37585 | 0.37680 | 0.37570 | 0.37520 | 0.37520 | 0.37570 | 0.37635 |
| 3 -T-R- 09-L2 | 0.37580 | 0.37685 | 0.37680 | 0.37555 | 0.37705 | 0.37595 | 0.37610 | 0.37680 | 0.37570 | 0.37725 |
| 3 -T-R- 09-L4 | 0.37650 | 0.37640 | 0.37715 | 0.37635 | 0.37605 | 0.37675 | 0.37670 | 0.37725 | 0.37640 | 0.37615 |
| 3 -T-R- 14-L2 | 0.37555 | 0.37380 | 0.37550 | 0.37540 | 0.37605 | 0.37570 | 0.37400 | 0.37560 | 0.37565 | 0.37615 |
| 3 -T-R- 14-L4 | 0.37600 | 0.37600 | 0.37610 | 0.37500 | 0.37645 | 0.37660 | 0.37585 | 0.37585 | 0.37495 | 0.37640 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen Number | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 3 -T-T- 06-1-L2 | 0.37645 | 0.37635 | 0.37660 | 0.37480 | 0.37625 | 0.37675 | 0.37615 | 0.37670 | 0.37490 | 0.37655 |
| 3 -T-T- 06-2-L2 | 0.37560 | 0.37595 | 0.37585 | 0.37360 | 0.37495 | 0.37605 | 0.37585 | 0.37570 | 0.37360 | 0.37445 |
| 3 -T-T- 06-3-L2 | 0.37590 | 0.37550 | 0.37565 | 0.37505 | 0.37510 | 0.37595 | 0.37560 | 0.37595 | 0.37510 | 0.37535 |
| 3 -T-T- 06-4-L2 | 0.37650 | 0.37605 | 0.37615 | 0.37590 | 0.37590 | 0.37645 | 0.37555 | 0.37640 | 0.37585 | 0.37600 |
| 3 -T-T- 06-5-L2 | 0.37500 | 0.37415 | 0.37400 | 0.37280 | 0.37400 | 0.37480 | 0.37410 | 0.37425 | 0.37325 | 0.37410 |
| 3 -T-T- 06-6-L2 | 0.37545 | 0.37560 | 0.37615 | 0.37520 | 0.37615 | 0.37540 | 0.37555 | 0.37615 | 0.37540 | 0.37610 |
| 3 -T-T- 06-7-L2 | 0.37605 | 0.37625 | 0.37660 | 0.37560 | 0.37690 | 0.37610 | 0.37640 | 0.37700 | 0.37580 | 0.37710 |
| 3 -T-T- 06-1-L3 | 0.37700 | 0.37460 | 0.37640 | 0.37655 | 0.37625 | 0.37735 | 0.37460 | 0.37645 | 0.37635 | 0.37635 |
| 3 -T-T- 06-2-L3 | 0.37440 | 0.37425 | 0.37500 | 0.37460 | 0.37635 | 0.37465 | 0.37460 | 0.37505 | 0.37480 | 0.37615 |
| 3 -T-T- 06-3-L3 | 0.37580 | 0.37570 | 0.37645 | 0.37555 | 0.37550 | 0.37565 | 0.37585 | 0.37655 | 0.37575 | 0.37550 |
| 3 -T-T- 06-4-L3 | 0.37565 | 0.37590 | 0.37650 | 0.36020 | 0.37540 | 0.37560 | 0.37585 | 0.37640 | 0.37600 | 0.37565 |
| 3 -T-T- 06-5-L3 | 0.37660 | 0.37415 | 0.37645 | 0.37525 | 0.37570 | 0.37680 | 0.37415 | 0.37630 | 0.37550 | 0.37545 |
| 3 -T-T- 06-6-L3 | 0.37535 | 0.37555 | 0.37560 | 0.37590 | 0.37655 | 0.37530 | 0.37555 | 0.37580 | 0.37585 | 0.37650 |
| 3 -T-T- 06-7-L3 | x | x | x | x | x | x | x | x | x | x |
| 3 -T-T- 12-6-L2 | x | x | x | x | x | x | x | x | x | x |
| 3 -T-T- 12-6-L3 | 0.37605 | 0.37625 | 0.37655 | 0.37580 | 0.37580 | 0.37620 | 0.37635 | 0.37675 | 0.37585 | 0.37610 |
| 3 -T-T- 12-7-L2 | 0.37660 | 0.37680 | 0.37700 | 0.37540 | 0.37475 | 0.37675 | 0.37675 | 0.37690 | 0.37535 | 0.37465 |
| 3 -T-T- 12-7-L3 | 0.37510 | 0.37565 | 0.37630 | 0.37620 | 0.37680 | 0.37530 | 0.37570 | 0.37640 | 0.37625 | 0.37695 |
| 3 -T-T- 16-6-L2 | x | x | x | x | x | x | x | x | x | x |
| 3 -T-T- 16-6-L3 | 0.37630 | 0.37630 | 0.37605 | 0.37540 | 0.37495 | 0.37630 | 0.37645 | 0.37595 | 0.37540 | 0.37495 |
| 3 -T-T- 16-7-L2 | 0.37525 | 0.37440 | 0.37635 | 0.37625 | 0.37625 | 0.37550 | 0.37430 | 0.37675 | 0.37640 | 0.37645 |
| 3 -T-T- 16-7-L3 | 0.37605 | 0.37635 | 0.37660 | 0.37550 | 0.37695 | 0.37585 | 0.37635 | 0.37665 | 0.37515 | 0.37670 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 4 -T-W- 01-0 | 0.37650 | 0.37680 | 0.37660 | 0.37645 | 0.37690 |
| 4 -T-W- 01-1 | 0.37665 | 0.37670 | 0.37700 | 0.37600 | 0.37760 |
| 4 -T-W- 01-2 | 0.37795 | 0.37620 | 0.37610 | 0.37525 | 0.37670 |
| 4 -T-W- 01-4 | 0.37625 | 0.37645 | 0.37645 | 0.37420 | 0.37720 |
| 4 -T-W- 02-5 | 0.37770 | 0.37655 | 0.37660 | 0.37685 | 0.37780 |
| 4 -T-W- 02-6 | 0.37825 | 0.37640 | 0.37600 | 0.37555 | 0.37710 |
| 4 -T-W- 02-7 | 0.37780 | 0.37645 | 0.37655 | 0.37590 | 0.37660 |
| 4 -T-W- 05-6 | 0.37755 | 0.37555 | 0.37670 | 0.37670 | 0.37665 |
| 4 -T-W- 05-7 | 0.37205 | 0.37300 | 0.37395 | 0.37460 | 0.37450 |
| 4 -T-W- 08-5 | 0.37955 | 0.37565 | 0.37665 | 0.37655 | 0.37715 |
| 4 -T-W- 08-6 | 0.37705 | 0.37610 | 0.37630 | 0.37730 | 0.37700 |
| 4 -T-W- 08-7 | 0.37920 | 0.37645 | 0.37625 | 0.37650 | 0.37630 |
| 4 -T-W- 11-1 | 0.37915 | 0.37750 | 0.37660 | 0.37680 | 0.37690 |
| 4 -T-W- 11-2 | 0.37940 | 0.37590 | 0.37665 | 0.37615 | 0.38000 |
| 4 -T-W- 11-4 | x | x | x | x | x |
| 4 -T-W- 11-5 | x | x | x | x | x |
| 4 -T-W- 11-6 | 0.37770 | 0.37670 | 0.37645 | 0.37615 | 0.37600 |
| 4 -T-W- 11-7 | 0.37460 | 0.37555 | 0.37660 | 0.37695 | 0.37670 |
| 4 -T-W- 14-1 | 0.37635 | 0.37645 | 0.37695 | 0.37695 | 0.38015 |
| 4 -T-W- 14-2 | 0.37790 | 0.37655 | 0.37560 | 0.37670 | 0.37840 |
| 4 -T-R- 03-L2 | 0.37930 | 0.37655 | 0.37670 | 0.37695 | 0.37730 |
| 4 -T-R- 03-L4 | 0.37600 | 0.37580 | 0.37665 | 0.37630 | 0.37790 |
| 4 -T-R- 09-L2 | 0.37575 | 0.37585 | 0.37610 | 0.37595 | 0.37900 |
| 4 -T-R- 09-L4 | 0.37530 | 0.37615 | 0.37700 | 0.37645 | 0.37665 |
| 4 -T-R- 14-L2 | 0.37575 | 0.37635 | 0.37630 | 0.37645 | 0.37815 |
| 4 -T-R- 14-L4 | 0.37485 | 0.37525 | 0.37620 | 0.37580 | 0.37665 |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37635 | 0.37670 | 0.37675 | 0.37635 | 0.37735 |
| 0.37680 | 0.37685 | 0.37680 | 0.37595 | 0.37735 |
| 0.37675 | 0.37615 | 0.37615 | 0.37580 | 0.37655 |
| 0.37820 | 0.37645 | 0.37635 | 0.37400 | 0.37825 |
| 0.37785 | 0.37635 | 0.37635 | 0.37650 | 0.37755 |
| 0.37840 | 0.37630 | 0.37605 | 0.37540 | 0.37645 |
| 0.37770 | 0.37655 | 0.37665 | 0.37580 | 0.37625 |
| 0.37740 | 0.37565 | 0.37665 | 0.37680 | 0.37645 |
| 0.37190 | 0.37275 | 0.37365 | 0.37455 | 0.37430 |
| 0.37760 | 0.37595 | 0.37660 | 0.37645 | 0.37780 |
| 0.37815 | 0.37635 | 0.37665 | 0.37680 | 0.37835 |
| 0.38090 | 0.37660 | 0.37650 | 0.37660 | 0.37645 |
| 0.37960 | 0.37705 | 0.37650 | 0.37695 | 0.37690 |
| 0.37880 | 0.37605 | 0.37655 | 0.37605 | 0.37765 |
| x | x | x | x | x |
| x | x | x | x | x |
| 0.37755 | 0.37675 | 0.37665 | 0.37620 | 0.37620 |
| 0.37465 | 0.37570 | 0.37655 | 0.37690 | 0.37675 |
| 0.37645 | 0.37655 | 0.37705 | 0.37705 | 0.37045 |
| 0.37750 | 0.37560 | 0.37460 | 0.37655 | 0.37805 |
| 0.37890 | 0.37645 | 0.37635 | 0.37685 | 0.37905 |
| 0.37580 | 0.37615 | 0.37665 | 0.37630 | 0.37770 |
| 0.37875 | 0.37580 | 0.37670 | 0.37565 | 0.37815 |
| 0.37540 | 0.37635 | 0.37685 | 0.37630 | 0.37675 |
| 0.37560 | 0.37650 | 0.37630 | 0.37645 | 0.37790 |
| 0.37465 | 0.37490 | 0.37595 | 0.37570 | 0.37670 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 4 -T-T- 06-1-L2 | 0.37865 | 0.37640 | 0.37665 | 0.37655 | 0.37640 |
| 4 -T-T- 06-2-L2 | 0.37735 | 0.37650 | 0.37615 | 0.37630 | 0.37595 |
| 4 -T-T- 06-3-L2 | 0.37595 | 0.37485 | 0.37555 | 0.37510 | 0.37460 |
| 4 -T-T- 06-4-L2 | 0.37985 | 0.37655 | 0.37700 | 0.37640 | 0.37630 |
| 4 -T-T- 06-5-L2 | 0.37970 | 0.37620 | 0.37630 | 0.37675 | 0.37645 |
| 4 -T-T- 06-6-L2 | 0.37355 | 0.37415 | 0.37505 | 0.37505 | 0.37635 |
| 4 -T-T- 06-7-L2 | 0.37840 | 0.37640 | 0.37820 | 0.37620 | 0.37535 |
| 4 -T-T- 06-1-L3 | 0.37935 | 0.37640 | 0.37615 | 0.37665 | 0.37660 |
| 4 -T-T- 06-2-L3 | 0.37780 | 0.37605 | 0.37525 | 0.37550 | 0.37790 |
| 4 -T-T- 06-3-L3 | 0.37710 | 0.37590 | 0.37665 | 0.37650 | 0.37570 |
| 4 -T-T- 06-4-L3 | 0.37630 | 0.37665 | 0.37700 | 0.37625 | 0.37765 |
| 4 -T-T- 06-5-L3 | 0.37590 | 0.37640 | 0.37680 | 0.37630 | 0.37720 |
| 4 -T-T- 06-6-L3 | 0.37820 | 0.37695 | 0.37670 | 0.37600 | 0.37720 |
| 4 -T-T- 06-7-L3 | 0.37540 | 0.37605 | 0.37615 | 0.37605 | 0.37680 |
| 4 -T-T- 12-6-L2 | 0.37480 | 0.37535 | 0.37520 | 0.37565 | 0.37755 |
| 4 -T-T- 12-6-L3 | 0.37610 | 0.37645 | 0.37675 | 0.37665 | 0.37795 |
| 4 -T-T- 12-7-L2 | 0.37450 | 0.37520 | 0.37560 | 0.37570 | 0.37685 |
| 4 -T-T- 12-7-L3 | 0.37650 | 0.37625 | 0.37685 | 0.37655 | 0.37610 |
| 4 -T-T- 16-6-L2 | x | x | x | x | x |
| 4 -T-T- 16-6-L3 | 0.37690 | 0.37695 | 0.37675 | 0.37680 | 0.37785 |
| 4 -T-T- 16-7-L2 | 0.37845 | 0.37710 | 0.37655 | 0.37615 | 0.37590 |
| 4 -T-T- 16-7-L3 | x | x | x | x | x |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37995 | 0.37640 | 0.37640 | 0.37660 | 0.37645 |
| 0.37770 | 0.37675 | 0.37635 | 0.37615 | 0.37610 |
| 0.37605 | 0.37490 | 0.37530 | 0.37495 | 0.37490 |
| 0.37805 | 0.37650 | 0.37655 | 0.37630 | 0.37590 |
| 0.37701 | 0.37615 | 0.37635 | 0.37675 | 0.37650 |
| 0.37365 | 0.37410 | 0.37500 | 0.37510 | 0.37610 |
| 0.37775 | 0.37640 | 0.37700 | 0.37625 | 0.37550 |
| 0.37800 | 0.37675 | 0.37635 | 0.37655 | 0.37640 |
| 0.37620 | 0.37610 | 0.37490 | 0.37550 | 0.37740 |
| 0.37735 | 0.37590 | 0.37680 | 0.37630 | 0.37565 |
| 0.37605 | 0.37655 | 0.37695 | 0.37650 | 0.37725 |
| 0.37620 | 0.37635 | 0.37655 | 0.37655 | 0.37710 |
| 0.37695 | 0.37680 | 0.37660 | 0.37605 | 0.37525 |
| 0.37560 | 0.37625 | 0.37655 | 0.37610 | 0.37645 |
| 0.37490 | 0.37560 | 0.37540 | 0.37555 | 0.37740 |
| 0.37610 | 0.37630 | 0.37680 | 0.37660 | 0.37805 |
| 0.37970 | 0.37485 | 0.37580 | 0.37620 | 0.37850 |
| 0.37690 | 0.37640 | 0.37670 | 0.37665 | 0.37600 |
| x | x | x | x | x |
| 0.37695 | 0.37715 | 0.37685 | 0.37700 | 0.37790 |
| 0.37845 | 0.37680 | 0.37680 | 0.37600 | 0.37600 |
| x | x | x | x | x |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 5 -T-W- 01-0 | 0.37760 | 0.37610 | 0.37635 | 0.37595 | 0.37775 |
| 5 -T-W- 01-1 | 0.37980 | 0.37575 | 0.37635 | 0.37545 | 0.37930 |
| 5 -T-W- 01-2 | 0.38105 | 0.37675 | 0.37720 | 0.37715 | 0.37745 |
| 5 -T-W- 01-4 | 0.37855 | 0.37650 | 0.37645 | 0.37740 | 0.37675 |
| 5 -T-W- 02-5 | 0.37775 | 0.37670 | 0.37660 | 0.37695 | 0.37755 |
| 5 -T-W- 02-6 | 0.37865 | 0.37590 | 0.37660 | 0.37680 | 0.37710 |
| 5 -T-W- 02-7 | 0.37875 | 0.37645 | 0.37640 | 0.37625 | 0.37970 |
| 5 -T-W- 05-6 | 0.37925 | 0.37730 | 0.37740 | 0.37655 | 0.37845 |
| 5 -T-W- 05-7 | 0.38025 | 0.37565 | 0.37665 | 0.37665 | 0.37705 |
| 5 -T-W- 08-5 | 0.37995 | 0.37725 | 0.37665 | 0.37645 | 0.37770 |
| 5 -T-W- 08-6 | 0.37880 | 0.37680 | 0.37555 | 0.37645 | 0.37900 |
| 5 -T-W- 08-7 | 0.38015 | 0.37660 | 0.37650 | 0.37615 | 0.37760 |
| 5 -T-W- 11-1 | 0.37850 | 0.37615 | 0.37780 | 0.37760 | 0.37895 |
| 5 -T-W- 11-2 | 0.38085 | 0.37535 | 0.37605 | 0.37600 | 0.37770 |
| 5 -T-W- 11-4 | 0.37775 | 0.37665 | 0.37720 | 0.37730 | 0.37690 |
| 5 -T-W- 11-5 | 0.37915 | 0.37730 | 0.37720 | 0.37790 | 0.37880 |
| 5 -T-W- 11-6 | 0.38050 | 0.37580 | 0.37645 | 0.37720 | 0.37925 |
| 5 -T-W- 11-7 | 0.37830 | 0.37600 | 0.37590 | 0.37650 | 0.37835 |
| 5 -T-W- 14-1 | 0.37940 | 0.37465 | 0.37420 | 0.37600 | 0.37985 |
| 5 -T-W- 14-2 | 0.38235 | 0.37660 | 0.37745 | 0.37660 | 0.37810 |
| 5 -T-R- 03-L2 | 0.37660 | 0.37695 | 0.37625 | 0.37570 | 0.37845 |
| 5 -T-R- 03-L4 | 0.37735 | 0.37650 | 0.37645 | 0.37645 | 0.37750 |
| 5 -T-R- 09-L2 | 0.37775 | 0.37575 | 0.37665 | 0.37605 | 0.37745 |
| 5 -T-R- 09-L4 | 0.37680 | 0.37495 | 0.37615 | 0.37590 | 0.37700 |
| 5 -T-R- 14-L2 | x | x | xx | x | x |
| 5 -T-R- 14-L4 | 0.37730 | 0.37605 | 0.37520 | 0.37565 | 0.37715 |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37785 | 0.37575 | 0.37610 | 0.37545 | 0.37775 |
| 0.37910 | 0.37645 | 0.37655 | 0.37780 | 0.37885 |
| 0.38080 | 0.37620 | 0.37685 | 0.37705 | 0.37750 |
| 0.38075 | 0.37660 | 0.37625 | 0.37625 | 0.37720 |
| 0.37770 | 0.37675 | 0.37645 | 0.37675 | 0.37840 |
| 0.37850 | 0.37565 | 0.37620 | 0.37670 | 0.37730 |
| 0.37930 | 0.37625 | 0.37630 | 0.37625 | 0.37940 |
| 0.37850 | 0.37705 | 0.37680 | 0.37725 | 0.37680 |
| 0.37990 | 0.37595 | 0.37630 | 0.37625 | 0.37755 |
| 0.37925 | 0.37650 | 0.37690 | 0.37655 | 0.37875 |
| 0.37765 | 0.37630 | 0.37575 | 0.37595 | 0.37760 |
| 0.38065 | 0.37645 | 0.37680 | 0.37605 | 0.37715 |
| 0.38215 | 0.37715 | 0.37715 | 0.37690 | 0.37805 |
| 0.38070 | 0.37660 | 0.37665 | 0.37595 | 0.37735 |
| 0.37710 | 0.37710 | 0.37700 | 0.37670 | 0.37850 |
| 0.37815 | 0.37705 | 0.37715 | 0.37750 | 0.37855 |
| 0.38035 | 0.37585 | 0.37630 | 0.37710 | 0.37790 |
| 0.37915 | 0.37585 | 0.37610 | 0.37635 | 0.37805 |
| 0.37825 | 0.37500 | 0.37315 | 0.37560 | 0.37960 |
| 0.38040 | 0.37665 | 0.37645 | 0.37680 | 0.37685 |
| 0.37745 | 0.37705 | 0.37665 | 0.37560 | 0.37940 |
| 0.37685 | 0.37630 | 0.37630 | 0.37605 | 0.37845 |
| 0.37630 | 0.37610 | 0.37645 | 0.37595 | 0.37745 |
| 0.37610 | 0.37475 | 0.37630 | 0.37590 | 0.37820 |
| x | x | x | x | x |
| 0.37715 | 0.37650 | 0.37615 | 0.37645 | 0.37735 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 5 -T-T- 06-1-L2 | 0.37690 | 0.37740 | 0.37675 | 0.37740 | 0.37825 |
| 5 -T-T- 06-2-L2 | 0.37890 | 0.37630 | 0.37630 | 0.37595 | 0.37955 |
| 5 -T-T- 06-3-L2 | 0.38715 | 0.37705 | 0.37675 | 0.37595 | 0.37995 |
| 5 -T-T- 06-4-L2 | 0.37860 | 0.37680 | 0.37600 | 0.37610 | 0.37715 |
| 5 -T-T- 06-5-L2 | 0.37565 | 0.37550 | 0.37630 | 0.37635 | 0.37585 |
| 5 -T-T- 06-6-L2 | 0.37965 | 0.37665 | 0.37585 | 0.37680 | 0.37695 |
| 5 -T-T- 06-7-L2 | 0.37660 | 0.37580 | 0.37590 | 0.37625 | 0.37750 |
| 5 -T-T- 06-1-L3 | 0.37695 | 0.37600 | 0.37630 | 0.37595 | 0.37825 |
| 5 -T-T- 06-2-L3 | 0.37690 | 0.37620 | 0.37660 | 0.37600 | 0.37605 |
| 5 -T-T- 06-3-L3 | 0.37685 | 0.37560 | 0.37545 | 0.37595 | 0.37640 |
| 5 -T-T- 06-4-L3 | 0.37350 | 0.37345 | 0.37395 | 0.37230 | 0.37360 |
| 5 -T-T- 06-5-L3 | 0.37880 | 0.37790 | 0.37765 | 0.37775 | 0.37810 |
| 5 -T-T- 06-6-L3 | 0.37980 | 0.37600 | 0.37610 | 0.37565 | 0.37725 |
| 5 -T-T- 06-7-L3 | 0.37685 | 0.37525 | 0.37620 | 0.37625 | 0.37585 |
| 5 -T-T- 12-6-L2 | 0.37760 | 0.37615 | 0.37670 | 0.37485 | 0.37565 |
| 5 -T-T- 12-6-L3 | 0.37590 | 0.37575 | 0.37525 | 0.37545 | 0.37655 |
| 5 -T-T- 12-7-L2 | 0.37855 | 0.37640 | 0.37730 | 0.37675 | 0.37855 |
| 5 -T-T- 12-7-L3 | 0.37685 | 0.37675 | 0.37720 | 0.37730 | 0.37855 |
| 5 -T-T- 16-6-L2 | x | x | x | x | x |
| 5 -T-T- 16-6-L3 | x | x | x | x | x |
| 5 -T-T- 16-7-L2 | x | x | x | x | x |
| 5 -T-T- 16-7-L3 | x | x | x | x | x |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37635 | 0.37640 | 0.37595 | 0.37625 | 0.37845 |
| 0.37815 | 0.37585 | 0.37585 | 0.37495 | 0.37810 |
| 0.37775 | 0.37595 | 0.37685 | 0.37650 | 0.37915 |
| 0.37955 | 0.37680 | 0.37645 | 0.37635 | 0.37960 |
| 0.37655 | 0.37500 | 0.37555 | 0.37600 | 0.37565 |
| 0.37875 | 0.37620 | 0.37680 | 0.37725 | 0.37790 |
| 0.37765 | 0.37605 | 0.37635 | 0.37675 | 0.37790 |
| 0.37625 | 0.37675 | 0.37630 | 0.37660 | 0.37870 |
| 0.37730 | 0.37690 | 0.37715 | 0.37640 | 0.37790 |
| 0.37675 | 0.37590 | 0.37595 | 0.37645 | 0.37815 |
| 0.37440 | 0.37350 | 0.37385 | 0.37315 | 0.37365 |
| 0.37695 | 0.37770 | 0.37715 | 0.37840 | 0.38050 |
| 0.37725 | 0.37610 | 0.37675 | 0.37650 | 0.37765 |
| 0.37520 | 0.37625 | 0.37695 | 0.37680 | 0.37885 |
| 0.37620 | 0.37645 | 0.37755 | 0.37545 | 0.37630 |
| 0.37605 | 0.37610 | 0.37585 | 0.37615 | 0.37755 |
| 0.37745 | 0.37655 | 0.37650 | 0.37625 | 0.37970 |
| 0.37600 | 0.37615 | 0.37660 | 0.37670 | 0.37985 |
| x | x | x | x | x |
| x | x | x | x | x |
| x | x | x | x | x |
| x | x | x | x | x |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 6 -T-W- 01-0 | 0.37925 | 0.37600 | 0.37610 | 0.37540 | 0.37675 |
| 6 -T-W- 01-1 | 0.37860 | 0.37665 | 0.37630 | 0.37670 | 0.37685 |
| 6 -T-W- 01-2 | 0.38040 | 0.37575 | 0.37645 | 0.37635 | 0.37665 |
| 6 -T-W- 01-4 | 0.37755 | 0.37570 | 0.37675 | 0.37620 | 0.37710 |
| 6 -T-W- 02-5 | 0.37775 | 0.37625 | 0.37675 | 0.37680 | 0.37725 |
| 6 -T-W- 02-6 | 0.37790 | 0.37685 | 0.37700 | 0.37540 | 0.37825 |
| 6 -T-W- 02-7 | 0.37825 | 0.37645 | 0.37645 | 0.37715 | 0.37750 |
| 6 -T-W- 05-6 | 0.37875 | 0.37545 | 0.37675 | 0.37665 | 0.37685 |
| 6 -T-W- 05-7 | 0.37725 | 0.37625 | 0.37650 | 0.37575 | 0.37665 |
| 6 -T-W- 08-5 | 0.37825 | 0.37665 | 0.37615 | 0.37550 | 0.37750 |
| 6 -T-W- 08-6 | 0.37845 | 0.37655 | 0.37710 | 0.37670 | 0.37720 |
| 6 -T-W- 08-7 | 0.37815 | 0.37680 | 0.37670 | 0.37505 | 0.37755 |
| 6 -T-W- 11-1 | 0.38105 | 0.37650 | 0.37650 | 0.37670 | 0.37655 |
| 6 -T-W- 11-2 | 0.37830 | 0.37690 | 0.37635 | 0.37615 | 0.37760 |
| 6 -T-W- 11-4 | 0.37890 | 0.37625 | 0.37685 | 0.37635 | 0.37895 |
| 6 -T-W- 11-5 | 0.37935 | 0.37655 | 0.37665 | 0.37540 | 0.37755 |
| 6 -T-W- 11-6 | 0.37765 | 0.37630 | 0.37645 | 0.37665 | 0.37710 |
| 6 -T-W- 11-7 | 0.37840 | 0.37645 | 0.37635 | 0.37630 | 0.37665 |
| 6 -T-W- 14-1 | 0.37900 | 0.37690 | 0.37610 | 0.37690 | 0.37820 |
| 6 -T-W- 14-2 | 0.37995 | 0.37545 | 0.37575 | 0.37590 | 0.37660 |
| 6 -T-R- 03-L2 | 0.37785 | 0.37615 | 0.37630 | 0.37570 | 0.37785 |
| 6 -T-R- 03-L4 | 0.37660 | 0.37760 | 0.37640 | 0.37640 | 0.37725 |
| 6 -T-R- 09-L2 | 0.37620 | 0.37590 | 0.37650 | 0.37575 | 0.37730 |
| 6 -T-R- 09-L4 | 0.37785 | 0.37600 | 0.37625 | 0.37640 | 0.37630 |
| 6 -T-R- 14-L2 | 0.37690 | 0.37550 | 0.37585 | 0.37625 | 0.37720 |
| 6 -T-R- 14-L4 | 0.37720 | 0.37550 | 0.37600 | 0.37595 | 0.37670 |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37705 | 0.37615 | 0.37610 | 0.37515 | 0.37735 |
| 0.37790 | 0.37660 | 0.37625 | 0.37650 | 0.37690 |
| 0.37875 | 0.37605 | 0.37635 | 0.37650 | 0.37715 |
| 0.37770 | 0.37550 | 0.37655 | 0.37630 | 0.37735 |
| 0.37785 | 0.37630 | 0.37700 | 0.37685 | 0.37710 |
| 0.37915 | 0.37670 | 0.37690 | 0.37530 | 0.37810 |
| 0.38010 | 0.37660 | 0.37630 | 0.37710 | 0.37770 |
| 0.37790 | 0.37545 | 0.37675 | 0.37675 | 0.37765 |
| 0.37770 | 0.37635 | 0.37630 | 0.37575 | 0.37645 |
| 0.37735 | 0.37660 | 0.37625 | 0.37550 | 0.37830 |
| 0.37840 | 0.37655 | 0.37715 | 0.37670 | 0.37710 |
| 0.37940 | 0.37670 | 0.37655 | 0.37490 | 0.37785 |
| 0.38055 | 0.37610 | 0.37625 | 0.37660 | 0.37735 |
| 0.37870 | 0.37675 | 0.37620 | 0.37605 | 0.37755 |
| 0.38035 | 0.37615 | 0.37670 | 0.37640 | 0.38055 |
| 0.37755 | 0.37645 | 0.37675 | 0.37550 | 0.37785 |
| 0.37790 | 0.37655 | 0.37645 | 0.37665 | 0.37735 |
| 0.37920 | 0.37650 | 0.37645 | 0.37650 | 0.37675 |
| 0.37865 | 0.37670 | 0.37625 | 0.37685 | 0.37825 |
| 0.38025 | 0.37545 | 0.37585 | 0.37580 | 0.37695 |
| 0.37695 | 0.37605 | 0.37620 | 0.37570 | 0.37795 |
| 0.37665 | 0.37640 | 0.37655 | 0.37640 | 0.37690 |
| 0.37595 | 0.37600 | 0.37585 | 0.37580 | 0.37725 |
| 0.37650 | 0.37600 | 0.37565 | 0.37615 | 0.37625 |
| 0.37870 | 0.37560 | 0.37585 | 0.37650 | 0.37585 |
| 0.37720 | 0.37545 | 0.37535 | 0.37545 | 0.37675 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | |
|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 |
| 6 -T-T- 06-1-L2 | 0.37605 | 0.37635 | 0.37640 | 0.37590 | 0.37580 |
| 6 -T-T- 06-2-L2 | 0.37270 | 0.37320 | 0.37400 | 0.37375 | 0.37290 |
| 6 -T-T- 06-3-L2 | 0.37750 | 0.37550 | 0.37550 | 0.37560 | 0.37680 |
| 6 -T-T- 06-4-L2 | 0.37755 | 0.37645 | 0.37660 | 0.37660 | 0.37760 |
| 6 -T-T- 06-5-L2 | 0.37715 | 0.37650 | 0.37645 | 0.37590 | 0.37630 |
| 6 -T-T- 06-6-L2 | 0.37740 | 0.37665 | 0.37675 | 0.37635 | 0.37600 |
| 6 -T-T- 06-7-L2 | 0.37745 | 0.37510 | 0.37610 | 0.37620 | 0.37750 |
| 6 -T-T- 06-1-L3 | 0.37690 | 0.37590 | 0.37610 | 0.37580 | 0.37995 |
| 6 -T-T- 06-2-L3 | 0.37625 | 0.37590 | 0.37565 | 0.37640 | 0.37630 |
| 6 -T-T- 06-3-L3 | 0.37725 | 0.37635 | 0.37655 | 0.37605 | 0.37730 |
| 6 -T-T- 06-4-L3 | 0.37825 | 0.37600 | 0.37515 | 0.37570 | 0.37645 |
| 6 -T-T- 06-5-L3 | 0.37685 | 0.37610 | 0.37610 | 0.37605 | 0.37700 |
| 6 -T-T- 06-6-L3 | 0.37695 | 0.37570 | 0.37625 | 0.37615 | 0.37740 |
| 6 T-T- 06-7-L3 | 0.37730 | 0.37505 | 0.37610 | 0.37665 | 0.37655 |
| 6 T-T- 12-6-L2 | 0.37785 | 0.37640 | 0.37655 | 0.37540 | 0.37670 |
| 6 T-T- 12-6-L3 | 0.37830 | 0.37560 | 0.37645 | 0.37640 | 0.37700 |
| 6 T-T- 12-7-L2 | 0.37585 | 0.37525 | 0.37565 | 0.37540 | 0.37600 |
| 6 T-T- 12-7-L3 | 0.37760 | 0.37590 | 0.37570 | 0.37560 | 0.37785 |
| 6 T-T- 16-6-L2 | 0.37695 | 0.37645 | 0.37660 | 0.37600 | 0.37620 |
| 6 T-T- 16-6-L3 | 0.37685 | 0.37660 | 0.37675 | 0.37600 | 0.37635 |
| 6 T-T- 16-7-L2 | 0.37775 | 0.37685 | 0.37620 | 0.37655 | 0.37690 |
| 6 T-T- 16-7-L3 | 0.37700 | 0.37625 | 0.37615 | 0.37600 | 0.37640 |

| | | | | |
|---|---|---|---|---|
| $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 0.37580 | 0.37595 | 0.37635 | 0.37580 | 0.37580 |
| 0.37400 | 0.37410 | 0.37535 | 0.37475 | 0.37410 |
| 0.37755 | 0.37700 | 0.37620 | 0.37560 | 0.37805 |
| 0.37725 | 0.37645 | 0.37665 | 0.37700 | 0.37975 |
| 0.37700 | 0.37670 | 0.37615 | 0.37585 | 0.37630 |
| 0.37790 | 0.37685 | 0.37675 | 0.37655 | 0.37720 |
| 0.37795 | 0.37515 | 0.37610 | 0.37630 | 0.37670 |
| 0.37660 | 0.37595 | 0.37595 | 0.03757 | 0.37890 |
| 0.37575 | 0.37600 | 0.37555 | 0.37630 | 0.37680 |
| 0.37820 | 0.37645 | 0.37645 | 0.37610 | 0.37710 |
| 0.37785 | 0.37550 | 0.37475 | 0.37590 | 0.37725 |
| 0.37775 | 0.37610 | 0.37605 | 0.37600 | 0.37600 |
| 0.37800 | 0.37585 | 0.37605 | 0.37605 | 0.37600 |
| 0.37670 | 0.37510 | 0.37605 | 0.37645 | 0.37610 |
| 0.37700 | 0.37590 | 0.37560 | 0.37500 | 0.37720 |
| 0.37750 | 0.37585 | 0.37615 | 0.37635 | 0.37700 |
| 0.37685 | 0.37525 | 0.37515 | 0.37550 | 0.37565 |
| 0.37645 | 0.37610 | 0.37585 | 0.37560 | 0.37755 |
| 0.37805 | 0.37660 | 0.37665 | 0.37610 | 0.37660 |
| 0.37735 | 0.37645 | 0.37660 | 0.37605 | 0.37630 |
| 0.37815 | 0.37630 | 0.37645 | 0.37635 | 0.37800 |
| 0.37640 | 0.37630 | 0.37635 | 0.37625 | 0.37645 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 7 -T-W- 01-0 | 0.37685 | 0.37600 | 0.37595 | 0.37650 | 0.37675 | 0.37660 | 0.37580 | 0.37605 | 0.37650 | 0.37695 |
| 7 -T-W- 01-1 | 0.37770 | 0.37665 | 0.37605 | 0.37590 | 0.37625 | 0.37750 | 0.37650 | 0.37590 | 0.37595 | 0.37705 |
| 7 -T-W- 01-2 | 0.37790 | 0.37660 | 0.37650 | 0.37625 | 0.37650 | 0.37720 | 0.37655 | 0.37630 | 0.37625 | 0.37665 |
| 7 -T-W- 01-4 | 0.37770 | 0.37625 | 0.37645 | 0.37615 | 0.37695 | 0.37720 | 0.37640 | 0.37655 | 0.37610 | 0.37700 |
| 7 -T-W- 02-5 | 0.37655 | 0.37660 | 0.37660 | 0.37630 | 0.37710 | 0.37640 | 0.37665 | 0.37650 | 0.37630 | 0.37675 |
| 7 -T-W- 02-6 | 0.37745 | 0.37635 | 0.37665 | 0.37680 | 0.37715 | 0.37750 | 0.37650 | 0.37655 | 0.37675 | 0.37780 |
| 7 -T-W- 02-7 | 0.37710 | 0.37570 | 0.37655 | 0.37615 | 0.37785 | 0.37710 | 0.37590 | 0.37635 | 0.37620 | 0.37785 |
| 7 -T-W- 05-6 | 0.37775 | 0.37645 | 0.37630 | 0.37625 | 0.37615 | 0.37790 | 0.37665 | 0.37635 | 0.37620 | 0.37645 |
| 7 -T-W- 05-7 | 0.37620 | 0.37645 | 0.37650 | 0.37630 | 0.37705 | 0.37635 | 0.37655 | 0.37665 | 0.37650 | 0.37675 |
| 7 -T-W- 08-5 | 0.37895 | 0.37625 | 0.37635 | 0.37640 | 0.37760 | 0.37785 | 0.37640 | 0.37650 | 0.37635 | 0.37780 |
| 7 -T-W- 08-6 | 0.37785 | 0.37650 | 0.37655 | 0.37605 | 0.37675 | 0.37770 | 0.37660 | 0.37645 | 0.37595 | 0.37720 |
| 7 -T-W- 08-7 | 0.37755 | 0.37600 | 0.37640 | 0.37590 | 0.37680 | 0.37865 | 0.37610 | 0.37635 | 0.37605 | 0.37675 |
| 7 -T-W- 11-1 | 0.37780 | 0.37660 | 0.37635 | 0.37635 | 0.37635 | 0.37735 | 0.37645 | 0.37645 | 0.37645 | 0.37715 |
| 7 -T-W- 11-2 | 0.37725 | 0.37620 | 0.37645 | 0.37620 | 0.37775 | 0.37705 | 0.37635 | 0.37660 | 0.37610 | 0.37730 |
| 7 -T-W- 11-4 | 0.37795 | 0.37650 | 0.37580 | 0.37640 | 0.37775 | 0.37780 | 0.37635 | 0.37585 | 0.37645 | 0.37780 |
| 7 -T-W- 11-5 | 0.37675 | 0.37670 | 0.37645 | 0.37635 | 0.37675 | 0.37695 | 0.37660 | 0.37650 | 0.37650 | 0.37655 |
| 7 -T-W- 11-6 | 0.37885 | 0.37615 | 0.37625 | 0.37615 | 0.37635 | 0.37855 | 0.37630 | 0.37630 | 0.37610 | 0.37625 |
| 7 -T-W- 11-7 | 0.37835 | 0.37645 | 0.37640 | 0.37580 | 0.37730 | 0.37870 | 0.37645 | 0.37650 | 0.37590 | 0.37725 |
| 7 -T-W- 14-1 | 0.37795 | 0.37700 | 0.37665 | 0.37700 | 0.37665 | 0.37830 | 0.37700 | 0.37655 | 0.37685 | 0.37630 |
| 7 -T-W- 14-2 | 0.37860 | 0.37615 | 0.37650 | 0.37610 | 0.37665 | 0.37820 | 0.37610 | 0.37645 | 0.37610 | 0.37715 |
| 7 -T-R- 03-L2 | 0.37760 | 0.37595 | 0.37595 | 0.37590 | 0.37665 | 0.37665 | 0.37600 | 0.37595 | 0.37585 | 0.37670 |
| 7 -T-R- 03-L4 | 0.37585 | 0.37570 | 0.37600 | 0.37615 | 0.37660 | 0.37685 | 0.37580 | 0.37605 | 0.37595 | 0.37685 |
| 7 -T-R- 09-L2 | 0.37625 | 0.37605 | 0.37655 | 0.37650 | 0.37670 | 0.37675 | 0.37615 | 0.37650 | 0.37665 | 0.37705 |
| 7 -T-R- 09-L4 | 0.37640 | 0.37605 | 0.37580 | 0.37600 | 0.37535 | 0.37655 | 0.37630 | 0.37580 | 0.37620 | 0.37545 |
| 7 -T-R- 14-L2 | 0.37775 | 0.37620 | 0.37620 | 0.37595 | 0.37595 | 0.37725 | 0.37640 | 0.37635 | 0.37620 | 0.37660 |
| 7 -T-R- 14-L4 | 0.37820 | 0.37600 | 0.37605 | 0.37625 | 0.37650 | 0.37695 | 0.37600 | 0.37620 | 0.37645 | 0.37665 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 7 -T-T- 06-1-L2 | 0.37655 | 0.37595 | 0.37615 | 0.37625 | 0.37790 | 0.37670 | 0.37555 | 0.37620 | 0.37635 | 0.37775 |
| 7 -T-T- 06-2-L2 | 0.37700 | 0.37620 | 0.37650 | 0.37640 | 0.37660 | 0.37685 | 0.37595 | 0.37635 | 0.37615 | 0.37665 |
| 7 -T-T- 06-3-L2 | 0.37660 | 0.37580 | 0.37610 | 0.37555 | 0.37740 | 0.37765 | 0.37605 | 0.37590 | 0.37525 | 0.37745 |
| 7 -T-T- 06-4-L2 | 0.37595 | 0.37615 | 0.37615 | 0.37580 | 0.37675 | 0.37750 | 0.37595 | 0.37620 | 0.37590 | 0.37625 |
| 7 -T-T- 06-5-L2 | 0.37575 | 0.37590 | 0.37625 | 0.37640 | 0.37605 | 0.37605 | 0.37605 | 0.37640 | 0.37680 | 0.37765 |
| 7 -T-T- 06-6-L2 | 0.37645 | 0.37665 | 0.37650 | 0.37635 | 0.37610 | 0.37670 | 0.37615 | 0.37565 | 0.37635 | 0.37615 |
| 7 -T-T- 06-7-L2 | 0.37775 | 0.37660 | 0.37635 | 0.37625 | 0.37660 | 0.37715 | 0.37660 | 0.37635 | 0.37615 | 0.37725 |
| 7 -T-T- 06-1-L3 | 0.37735 | 0.37630 | 0.37630 | 0.37605 | 0.37790 | 0.37770 | 0.37600 | 0.37615 | 0.37635 | 0.37620 |
| 7 -T-T- 06-2-L3 | 0.37615 | 0.37605 | 0.37595 | 0.37635 | 0.37625 | 0.37670 | 0.37605 | 0.37605 | 0.37640 | 0.37680 |
| 7 -T-T- 06-3-L3 | 0.37600 | 0.37640 | 0.37610 | 0.37640 | 0.37745 | 0.37725 | 0.37650 | 0.37595 | 0.37660 | 0.37775 |
| 7 -T-T- 06-4-L3 | 0.37750 | 0.37625 | 0.37640 | 0.37620 | 0.37725 | 0.37755 | 0.37625 | 0.37635 | 0.37610 | 0.37745 |
| 7 -T-T- 06-5-L3 | 0.37790 | 0.37565 | 0.37610 | 0.37580 | 0.37630 | 0.37785 | 0.37565 | 0.37630 | 0.37600 | 0.37635 |
| 7 -T-T- 06-6-L3 | 0.37755 | 0.37650 | 0.37625 | 0.37595 | 0.37645 | 0.37905 | 0.37600 | 0.37630 | 0.37625 | 0.37675 |
| 7 -T-T- 06-7-L3 | 0.37655 | 0.37585 | 0.37625 | 0.37600 | 0.37620 | 0.37700 | 0.37615 | 0.37620 | 0.37615 | 0.37665 |
| 7 -T-T- 12-6-L2 | 0.37705 | 0.37605 | 0.37660 | 0.37615 | 0.37790 | 0.37635 | 0.37530 | 0.37645 | 0.37610 | 0.37755 |
| 7 -T-T- 12-6-L3 | 0.37765 | 0.37570 | 0.37625 | 0.37645 | 0.37670 | 0.37725 | 0.37565 | 0.37585 | 0.37625 | 0.37635 |
| 7 -T-T- 12-7-L2 | 0.37605 | 0.37585 | 0.37660 | 0.37615 | 0.37635 | 0.37590 | 0.37585 | 0.37615 | 0.37585 | 0.37650 |
| 7 -T-T- 12-7-L3 | 0.37570 | 0.37620 | 0.37620 | 0.37635 | 0.37520 | 0.37680 | 0.37570 | 0.37595 | 0.37640 | 0.37575 |
| 7 -T-T- 16-6-L2 | 0.37805 | 0.37570 | 0.37635 | 0.37645 | 0.37670 | 0.37675 | 0.37555 | 0.37585 | 0.37620 | 0.37770 |
| 7 -T-T- 16-6-L3 | 0.37750 | 0.37555 | 0.37665 | 0.37600 | 0.37610 | 0.37745 | 0.37525 | 0.37645 | 0.37550 | 0.37640 |
| 7 -T-T- 16-7-L2 | 0.37810 | 0.37660 | 0.37600 | 0.37605 | 0.37635 | 0.37710 | 0.37665 | 0.37595 | 0.37950 | 0.37680 |
| 7 -T-T- 16-7-L3 | 0.37650 | 0.37605 | 0.37660 | 0.37615 | 0.37640 | 0.37630 | 0.37630 | 0.37635 | 0.37600 | 0.37640 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 8 -T-W- 01-0 | 0.37790 | 0.37655 | 0.37630 | 0.37605 | 0.37650 | 0.37855 | 0.37660 | 0.37640 | 0.37615 | 0.37690 |
| 8 -T-W- 01-1 | 0.37645 | 0.37655 | 0.37670 | 0.37570 | 0.37570 | 0.37625 | 0.37665 | 0.37650 | 0.37575 | 0.37620 |
| 8 -T-W- 01-2 | 0.37630 | 0.37585 | 0.37630 | 0.37650 | 0.37650 | 0.37665 | 0.37595 | 0.37620 | 0.37650 | 0.37650 |
| 8 -T-W- 01-4 | 0.37785 | 0.37660 | 0.37645 | 0.37655 | 0.37655 | 0.37780 | 0.37655 | 0.37650 | 0.37635 | 0.37580 |
| 8 -T-W- 02-5 | 0.37665 | 0.37635 | 0.37600 | 0.37535 | 0.37640 | 0.37675 | 0.37640 | 0.37620 | 0.37565 | 0.37660 |
| 8 -T-W- 02-6 | 0.37755 | 0.37635 | 0.37665 | 0.37600 | 0.37700 | 0.37745 | 0.37635 | 0.37670 | 0.37605 | 0.37710 |
| 8 -T-W- 02-7 | 0.37715 | 0.37640 | 0.37650 | 0.37635 | 0.37755 | 0.37730 | 0.37645 | 0.37655 | 0.37630 | 0.37750 |
| 8 -T-W- 05-6 | 0.37705 | 0.37615 | 0.37665 | 0.37645 | 0.37665 | 0.37730 | 0.37605 | 0.37660 | 0.37655 | 0.37625 |
| 8 -T-W- 05-7 | 0.37675 | 0.37655 | 0.37670 | 0.37655 | 0.37675 | 0.37670 | 0.37665 | 0.37665 | 0.37660 | 0.37680 |
| 8 -T-W- 08-5 | 0.37685 | 0.37650 | 0.37635 | 0.37565 | 0.37760 | 0.37725 | 0.37650 | 0.37645 | 0.37570 | 0.37745 |
| 8 -T-W- 08-6 | 0.37740 | 0.37605 | 0.37570 | 0.37645 | 0.37635 | 0.37735 | 0.37590 | 0.37550 | 0.37645 | 0.37640 |
| 8 -T-W- 08-7 | 0.37710 | 0.37680 | 0.37665 | 0.37650 | 0.37760 | 0.37735 | 0.37665 | 0.37680 | 0.37665 | 0.37780 |
| 8 -T-W- 11-1 | 0.37700 | 0.37650 | 0.37615 | 0.37630 | 0.37660 | 0.37750 | 0.37655 | 0.37610 | 0.37635 | 0.37700 |
| 8 -T-W- 11-2 | 0.37780 | 0.37645 | 0.37665 | 0.37630 | 0.37730 | 0.37795 | 0.37645 | 0.37660 | 0.37635 | 0.37705 |
| 8 -T-W- 11-4 | 0.37730 | 0.37635 | 0.37605 | 0.37570 | 0.37725 | 0.37725 | 0.37630 | 0.37605 | 0.37580 | 0.37745 |
| 8 -T-W- 11-5 | 0.37795 | 0.37670 | 0.37675 | 0.37650 | 0.37725 | 0.37820 | 0.37680 | 0.37680 | 0.37655 | 0.37765 |
| 8 -T-W- 11-6 | 0.37700 | 0.37610 | 0.37635 | 0.37635 | 0.37695 | 0.37740 | 0.37610 | 0.37640 | 0.37655 | 0.37725 |
| 8 -T-W- 11-7 | 0.37685 | 0.37605 | 0.37635 | 0.37555 | 0.37720 | 0.37650 | 0.37595 | 0.37645 | 0.37570 | 0.37700 |
| 8 -T-W- 14-1 | 0.37755 | 0.37675 | 0.37655 | 0.37590 | 0.37740 | 0.37775 | 0.37670 | 0.37650 | 0.37580 | 0.37730 |
| 8 -T-W- 14-2 | 0.37695 | 0.37635 | 0.37630 | 0.37615 | 0.37660 | 0.37755 | 0.37620 | 0.37640 | 0.37630 | 0.37655 |
| 8 -T-R- 03-L2 | 0.37595 | 0.37650 | 0.37680 | 0.37630 | 0.37595 | 0.37605 | 0.37665 | 0.37665 | 0.37600 | 0.37555 |
| 8 -T-R- 03-L4 | 0.37645 | 0.37620 | 0.37610 | 0.37610 | 0.37670 | 0.37630 | 0.37635 | 0.37620 | 0.37605 | 0.37665 |
| 8 -T-R- 09-L2 | 0.37790 | 0.37625 | 0.37595 | 0.37565 | 0.37750 | 0.37705 | 0.37615 | 0.37610 | 0.37590 | 0.37770 |
| 8 -T-R- 09-L4 | 0.37795 | 0.37660 | 0.37635 | 0.37570 | 0.37770 | 0.37755 | 0.37625 | 0.37625 | 0.37570 | 0.37690 |
| 8 -T-R- 14-L2 | 0.37650 | 0.37650 | 0.37680 | 0.37650 | 0.37635 | 0.37655 | 0.37650 | 0.37675 | 0.37645 | 0.37655 |
| 8 -T-R- 14-L4 | 0.37745 | 0.37705 | 0.37665 | 0.37610 | 0.37665 | 0.37680 | 0.37615 | 0.37660 | 0.37610 | 0.37685 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen Number | Specimen Diameter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 (center) | D4 | D5 | $D1^{90}$ | $D2^{90}$ | $D3^{90}$ (center) | $D4^{90}$ | $D5^{90}$ |
| 8 -T-T- 06-1-L2 | 0.37650 | 0.37645 | 0.37620 | 0.37605 | 0.37650 | 0.37690 | 0.37655 | 0.37655 | 0.37630 | 0.37635 |
| 8 -T-T- 06-2-L2 | 0.37700 | 0.37655 | 0.37670 | 0.37690 | 0.37630 | 0.37790 | 0.37640 | 0.37670 | 0.37670 | 0.37685 |
| 8 -T-T- 06-3-L2 | 0.37655 | 0.37580 | 0.37615 | 0.37615 | 0.37765 | 0.37730 | 0.37595 | 0.37630 | 0.37605 | 0.37740 |
| 8 -T-T- 06-4-L2 | 0.37715 | 0.37650 | 0.37650 | 0.37640 | 0.37705 | 0.37710 | 0.37690 | 0.37665 | 0.37600 | 0.37585 |
| 8 -T-T- 06-5-L2 | 0.37740 | 0.37585 | 0.37620 | 0.37680 | 0.37685 | 0.37730 | 0.37620 | 0.37615 | 0.37685 | 0.37665 |
| 8 -T-T- 06-6-L2 | 0.37665 | 0.37625 | 0.37655 | 0.37615 | 0.37765 | 0.37645 | 0.37605 | 0.37615 | 0.37605 | 0.37725 |
| 8 -T-T- 06-7-L2 | 0.37675 | 0.37590 | 0.37620 | 0.37640 | 0.37695 | 0.37715 | 0.37575 | 0.37595 | 0.37620 | 0.37640 |
| 8 -T-T- 06-1-L3 | 0.37725 | 0.37640 | 0.37640 | 0.37565 | 0.37795 | 0.37660 | 0.37635 | 0.37620 | 0.37545 | 0.37695 |
| 8 -T-T- 06-2-L3 | 0.37710 | 0.37615 | 0.37635 | 0.37635 | 0.37675 | 0.37710 | 0.37605 | 0.37620 | 0.37650 | 0.37645 |
| 8 -T-T- 06-3-L3 | 0.37690 | 0.37625 | 0.37635 | 0.37575 | 0.37760 | 0.37705 | 0.37610 | 0.37605 | 0.37575 | 0.37575 |
| 8 -T-T- 06-4-L3 | 0.37690 | 0.37605 | 0.37615 | 0.37635 | 0.37645 | 0.37715 | 0.37605 | 0.37645 | 0.37625 | 0.37660 |
| 8 -T-T- 06-5-L3 | 0.37760 | 0.37595 | 0.37625 | 0.37595 | 0.37670 | 0.37780 | 0.37595 | 0.37585 | 0.37590 | 0.37660 |
| 8 -T-T- 06-6-L3 | 0.37965 | 0.37650 | 0.37590 | 0.37590 | 0.37725 | 0.37810 | 0.37655 | 0.37590 | 0.37600 | 0.37825 |
| 8 -T-T- 06-7-L3 | 0.37595 | 0.37585 | 0.37660 | 0.37675 | 0.37645 | 0.37545 | 0.37550 | 0.37665 | 0.37725 | 0.37615 |
| 8 -T-T- 12-6-L2 | 0.37705 | 0.37615 | 0.37645 | 0.37570 | 0.37740 | 0.37770 | 0.37610 | 0.37615 | 0.37570 | 0.37770 |
| 8 -T-T- 12-6-L3 | 0.37665 | 0.37630 | 0.37645 | 0.37575 | 0.37770 | 0.37770 | 0.37645 | 0.37660 | 0.37590 | 0.37735 |
| 8 -T-T- 12-7-L2 | 0.37245 | 0.37235 | 0.37285 | 0.37270 | 0.37255 | 0.37245 | 0.37220 | 0.37280 | 0.37260 | 0.37235 |
| 8 -T-T- 12-7-L3 | 0.37670 | 0.37575 | 0.37605 | 0.37555 | 0.37680 | 0.37720 | 0.37545 | 0.37605 | 0.37560 | 0.37635 |
| 8 -T-T- 16-6-L2 | 0.37585 | 0.37595 | 0.37620 | 0.37625 | 0.37625 | 0.37765 | 0.37590 | 0.37630 | 0.37640 | 0.37625 |
| 8 -T-T- 16-6-L3 | 0.37705 | 0.37615 | 0.37665 | 0.37575 | 0.37780 | 0.37705 | 0.37605 | 0.37665 | 0.37585 | 0.37720 |
| 8 -T-T- 16-7-L2 | 0.37590 | 0.37525 | 0.37575 | 0.37625 | 0.37630 | 0.37620 | 0.37525 | 0.37575 | 0.37600 | 0.37680 |
| 8 -T-T- 16-7-L3 | 0.37660 | 0.37670 | 0.37670 | 0.37695 | 0.37690 | 0.37645 | 0.37680 | 0.37670 | 0.37690 | 0.37695 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 1-T-W-01-0 | 0 | 0 | x | x | x |
| 1-T-W-01-1 | 1.13 | 0 | 0.1109 | 40.53 | 2.52 |
| 1-T-W-01-2 | 2.25 | 0 | 0.1114 | | |
| 1-T-W-01-4 | 4.5 | 0 | 0.1109 | 103.52 | 6.44 |
| 1-T-W-02-5 | 5.44 | 1.46 | 0.1109 | 148.44 | 9.23 |
| 1-T-W-02-6 | 6.52 | 1.75 | 0.1110 | 218.51 | 13.57 |
| 1-T-W-02-7 | 7.61 | 2.04 | 0.1111 | 267.58 | 16.60 |
| 1-T-W-05-6 | 3.38 | 5.85 | 0.1107 | 271.00 | 16.87 |
| 1-T-W-05-7 | 3.93 | 6.85 | 0.1108 | 273.44 | |
| 1-T-W-08-5 | -4.04 | 3.98 | 0.1111 | 138.67 | 8.61 |
| 1-T-W-08-6 | -4.84 | 4.78 | 0.1107 | 157.96 | 9.84 |
| 1-T-W-08-7 | -5.63 | 5.56 | 0.1112 | 246.83 | 15.30 |
| 1-T-W-11-1 | -1.13 | 0 | x | x | x |
| 1-T-W-11-2 | -2.25 | 0 | 0.1109 | 45.65 | 2.84 |
| 1-T-W-11-4 | -3.38 | 0 | 0.1108 | 36.13 | 2.25 |
| 1-T-W-11-5 | -5.63 | 0 | 0.1111 | 91.06 | 5.65 |
| 1-T-W-11-6 | -6.75 | 0 | 0.1109 | 152.83 | 9.50 |
| 1-T-W-11-7 | -7.87 | 0 | 0.1110 | 254.15 | 15.78 |
| 1-T-W-14-1 | 0 | -1.12 | x | x | x |
| 1-T-W-14-2 | 0 | -2.25 | x | x | x |
| 1-T-R-03-L2 | 5.63 | 3.25 | 0.1109 | 239.26 | 14.88 |
| 1-T-R-03-L4 | 5.63 | 3.25 | 0.1105 | 248.05 | 15.47 |
| 1-T-R-09-L2 | -5.63 | 3.25 | 0.1118 | 259.28 | 15.99 |
| 1-T-R-09-L4 | -5.63 | 3.25 | x | x | x |
| 1-T-R-14-L2 | 0 | -6.5 | 0.1113 | 180.18 | 11.16 |
| 1-T-R-14-L4 | 0 | -6.5 | 0.1113 | 264.40 | 16.39 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 1-T-T-06-1-L2 | 0 | 1.12 | 0.1111 | 278.81 | 17.30 |
| 1-T-T-06-2-L2 | 0 | 2.25 | 0.1109 | 279.05 | 17.36 |
| 1-T-T-06-3-L2 | 0 | 3.37 | 0.1102 | 289.79 | 18.13 |
| 1-T-T-06-4-L2 | 0 | 4.5 | 0.1113 | 336.18 | 20.82 |
| 1-T-T-06-5-L2 | 0 | 5.62 | 0.1110 | 321.78 | 19.98 |
| 1-T-T-06-6-L2 | 0 | 6.75 | 0.1104 | 350.83 | 21.91 |
| 1-T-T-06-7-L2 | 0 | 7.88 | 0.1106 | 343.75 | 21.43 |
| 1-T-T-06-1-L3 | 0 | 1.12 | x | x | x |
| 1-T-T-06-2-L3 | 0 | 2.25 | 0.1106 | x | x |
| 1-T-T-06-3-L3 | 0 | 3.37 | 0.1103 | 280.03 | 17.50 |
| 1-T-T-06-4-L3 | 0 | 4.5 | 0.1110 | 302.25 | 18.78 |
| 1-T-T-06-5-L3 | 0 | 5.62 | 0.1110 | 336.18 | 20.88 |
| 1-T-T-06-6-L3 | 0 | 6.75 | 0.1106 | 334.72 | 20.87 |
| 1-T-T-06-7-L3 | 0 | 7.8 | 0.1105 | 356.93 | 22.28 |
| 1-T-T-12-6-L2 | -5.53 | -6.34 | x | x | x |
| 1-T-T-12-6-L3 | -5.53 | -6.34 | 0.1108 | 354.74 | 22.08 |
| 1-T-T-12-7-L2 | -6.45 | -7.4 | 0.1113 | 324.46 | 20.10 |
| 1-T-T-12-7-L3 | -6.45 | -7.4 | 0.1109 | 376.22 | 23.38 |
| 1-T-T-16-6-L2 | 5.53 | -6.34 | 0.1107 | 314.70 | 19.61 |
| 1-T-T-16-6-L3 | 5.53 | -6.34 | 0.1108 | 359.86 | 22.39 |
| 1-T-T-16-7-L2 | 6.45 | -7.4 | 0.1109 | 366.70 | 22.79 |
| 1-T-T-16-7-L3 | 6.45 | -7.4 | 0.1112 | 373.78 | 23.18 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 2-T-W-01-0 | 0 | 0 | 0.1100 | 52.49 | 3.29 |
| 2-T-W-01-1 | -1.13 | 0 | 0.1114 | | |
| 2-T-W-01-2 | -2.25 | 0 | 0.1114 | | |
| 2-T-W-01-4 | -4.5 | 0 | x | | |
| 2-T-W-02-5 | -5.4 | -1.46 | 0.1110 | 194.09 | 12.05 |
| 2-T-W-02-6 | -6.52 | -1.75 | 0.1109 | 216.80 | 13.48 |
| 2-T-W-02-7 | -7.61 | -2.04 | 0.1111 | | |
| 2-T-W-05-6 | -3.38 | -5.85 | 0.1111 | 254.39 | 15.78 |
| 2-T-W-05-7 | -3.93 | -6.85 | 0.1111 | 298.58 | 18.53 |
| 2-T-W-08-5 | 4.04 | -3.98 | 0.1110 | 166.75 | 10.35 |
| 2-T-W-08-6 | 4.84 | -4.78 | 0.1113 | 276.86 | 17.16 |
| 2-T-W-08-7 | 5.63 | -5.46 | 0.1100 | 326.90 | 20.50 |
| 2-T-W-11-1 | 1.13 | 0 | x | | |
| 2-T-W-11-2 | 2.25 | 0 | 0.1105 | 98.39 | 6.14 |
| 2-T-W-11-4 | 3.38 | 0 | 0.1113 | 112.79 | 6.99 |
| 2-T-W-11-5 | 5.63 | 0 | 0.1107 | 218.02 | 13.58 |
| 2-T-W-11-6 | 6.75 | 0 | 0.1115 | 262.94 | 16.25 |
| 2-T-W-11-7 | 7.87 | 0 | 0.1110 | 312.74 | 19.43 |
| 2-T-W-14-1 | 0 | 1.12 | 0.1111 | 79.10 | 4.91 |
| 2-T-W-14-2 | 0 | 2.25 | 0.1113 | 84.23 | 5.22 |
| 2-T-R-03-L2 | -5.63 | -3.25 | 0.1107 | 257.32 | 16.02 |
| 2-T-R-03-L4 | -5.63 | -3.25 | 0.1112 | 261.72 | 16.23 |
| 2-T-R-09-L2 | 5.63 | -3.25 | 0.1105 | 237.79 | 14.83 |
| 2-T-R-09-L4 | 5.63 | -3.25 | 0.1109 | 220.70 | 13.72 |
| 2-T-R-14-L2 | 0 | 6.5 | 0.1110 | 307.37 | 19.09 |
| 2-T-R-14-L4 | 0 | 6.5 | 0.1108 | 273.19 | 17.01 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 2-T-T-06-1-L2 | 0 | -1.12 | 0.1109 | 306.15 | 19.03 |
| 2-T-T-06-2-L2 | 0 | -2.25 | 0.1107 | 289.06 | 18.01 |
| 2-T-T-06-3-L2 | 0 | -3.37 | 0.1106 | 322.02 | 20.08 |
| 2-T-T-06-4-L2 | 0 | -4.5 | 0.1110 | 336.18 | 20.88 |
| 2-T-T-06-5-L2 | 0 | -5.62 | 0.1114 | 343.02 | 21.24 |
| 2-T-T-06-6-L2 | 0 | -6.75 | 0.1107 | 362.06 | 22.55 |
| 2-T-T-06-7-L2 | 0 | -7.88 | 0.1113 | 356.20 | 22.07 |
| 2-T-T-06-1-L3 | 0 | -1.12 | 0.1112 | 321.29 | 19.92 |
| 2-T-T-06-2-L3 | 0 | -2.25 | 0.1108 | 295.41 | 18.39 |
| 2-T-T-06-3-L3 | 0 | -3.37 | 0.1104 | 210.21 | 13.13 |
| 2-T-T-06-4-L3 | 0 | -4.5 | 0.1106 | 353.27 | 22.02 |
| 2-T-T-06-5-L3 | 0 | -5.62 | 0.1107 | 358.15 | 22.31 |
| 2-T-T-06-6-L3 | 0 | -6.75 | 0.1109 | 367.68 | 22.85 |
| 2-T-T-06-7-L3 | 0 | -7.8 | 0.1106 | 379.15 | 23.64 |
| 2-T-T-12-6-L2 | 5.53 | 6.34 | 0.1117 | 375.49 | 23.17 |
| 2-T-T-12-6-L3 | 5.53 | 6.34 | 0.1111 | 366.70 | 22.75 |
| 2-T-T-12-7-L2 | 6.45 | 7.4 | 0.1106 | 383.79 | 23.92 |
| 2-T-T-12-7-L3 | 6.45 | 7.4 | 0.1110 | 388.18 | 24.11 |
| 2-T-T-16-6-L2 | -5.53 | 6.34 | 0.1111 | 382.81 | 23.77 |
| 2-T-T-16-6-L3 | -5.53 | 6.34 | 0.1111 | 363.04 | 22.54 |
| 2-T-T-16-7-L2 | -6.45 | 7.4 | 0.1106 | 379.39 | 23.66 |
| 2-T-T-16-7-L3 | -6.45 | 7.4 | 0.1111 | 374.76 | 23.26 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 3-T-W-01-0 | 0 | 0 | 0.1110 | 99.12 | 6.15 |
| 3-T-W-01-1 | 1.13 | 0 | 0.1107 | 88.13 | 5.49 |
| 3-T-W-01-2 | 2.25 | 0 | 0.1114 | 96.92 | 6.00 |
| 3-T-W-01-4 | 4.5 | 0 | 0.1110 | | |
| 3-T-W-02-5 | 5.44 | 1.46 | x | x | x |
| 3-T-W-02-6 | 6.52 | 1.75 | 0.1113 | 215.58 | 13.35 |
| 3-T-W-02-7 | 7.61 | 2.04 | 0.1111 | 257.57 | 15.98 |
| 3-T-W-05-6 | 3.38 | 5.85 | 0.1110 | 246.34 | 15.30 |
| 3-T-W-05-7 | 3.93 | 6.85 | 0.1108 | 308.35 | 19.18 |
| 3-T-W-08-5 | -4.04 | 3.98 | 0.1113 | 184.08 | 11.40 |
| 3-T-W-08-6 | -4.84 | 4.78 | 0.1110 | 215.09 | 13.36 |
| 3-T-W-08-7 | -5.63 | 5.56 | 0.1106 | 302.25 | 18.85 |
| 3-T-W-11-1 | -1.13 | 0 | 0.1108 | 89.11 | 5.54 |
| 3-T-W-11-2 | -2.25 | 0 | 0.1110 | 90.58 | 5.63 |
| 3-T-W-11-4 | -3.38 | 0 | 0.1112 | 35.89 | 2.23 |
| 3-T-W-11-5 | -5.63 | 0 | 0.1112 | 160.40 | 9.94 |
| 3-T-W-11-6 | -6.75 | 0 | 0.1108 | 282.47 | 17.57 |
| 3-T-W-11-7 | -7.87 | 0 | 0.1112 | 309.33 | 19.18 |
| 3-T-W-14-1 | 0 | -1.12 | 0.1113 | 71.78 | 4.44 |
| 3-T-W-14-2 | 0 | -2.25 | 0.1115 | 87.89 | 5.43 |
| 3-T-R-03-L2 | 5.63 | 3.25 | 0.1111 | 282.23 | 17.51 |
| 3-T-R-03-L4 | 5.63 | 3.25 | 0.1109 | 240.97 | 14.98 |
| 3-T-R-09-L2 | -5.63 | 3.25 | 0.1113 | 263.67 | 16.34 |
| 3-T-R-09-L4 | -5.63 | 3.25 | 0.1114 | 248.29 | 15.37 |
| 3-T-R-14-L2 | 0 | -6.5 | 0.1106 | 260.74 | 16.25 |
| 3-T-R-14-L4 | 0 | -6.5 | 0.1110 | 236.33 | 14.68 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 3-T-T-06-1-L2 | 0 | 1.12 | 0.1111 | 276.61 | 17.16 |
| 3-T-T-06-2-L2 | 0 | 2.25 | 0.1105 | 276.86 | 17.27 |
| 3-T-T-06-3-L2 | 0 | 3.37 | 0.1108 | 281.49 | 17.52 |
| 3-T-T-06-4-L2 | 0 | 4.5 | 0.1111 | 323.24 | 20.06 |
| 3-T-T-06-5-L2 | 0 | 5.62 | 0.1099 | 320.07 | 20.08 |
| 3-T-T-06-6-L2 | 0 | 6.75 | 0.1109 | 360.84 | 22.44 |
| 3-T-T-06-7-L2 | 0 | 7.88 | 0.1113 | 350.10 | 21.70 |
| 3-T-T-06-1-L3 | 0 | 1.12 | 0.1111 | 292.48 | 18.14 |
| 3-T-T-06-2-L3 | 0 | 2.25 | 0.1104 | 325.68 | 20.33 |
| 3-T-T-06-3-L3 | 0 | 3.37 | 0.1109 | 328.61 | 20.42 |
| 3-T-T-06-4-L3 | 0 | 4.5 | 0.1100 | 203.37 | 12.74 |
| 3-T-T-06-5-L3 | 0 | 5.62 | 0.1108 | 354.00 | 22.02 |
| 3-T-T-06-6-L3 | 0 | 6.75 | 0.1109 | 366.21 | 22.76 |
| 3-T-T-06-7-L3 | 0 | 7.8 | x | x | x |
| 3-T-T-12-6-L2 | -5.53 | -6.34 | x | x | x |
| 3-T-T-12-6-L3 | -5.53 | -6.34 | 0.1111 | 367.19 | 22.78 |
| 3-T-T-12-7-L2 | -6.45 | -7.4 | 0.1111 | 308.84 | 19.17 |
| 3-T-T-12-7-L3 | -6.45 | -7.4 | 0.1111 | 387.70 | 24.07 |
| 3-T-T-16-6-L2 | 5.53 | -6.34 | x | x | x |
| 3-T-T-16-6-L3 | 5.53 | -6.34 | 0.1109 | 351.81 | 21.87 |
| 3-T-T-16-7-L2 | 6.45 | -7.4 | 0.1109 | 372.07 | 23.13 |
| 3-T-T-16-7-L3 | 6.45 | -7.4 | 0.1112 | 394.78 | 24.49 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 4-T-W-01-0 | 0 | 0 | 0.1114 | 54.93 | 3.40 |
| 4-T-W-01-1 | -1.13 | 0 | 0.1115 | 47.61 | 2.94 |
| 4-T-W-01-2 | -2.25 | 0 | 0.1112 | 113.77 | 7.05 |
| 4-T-W-01-4 | -4.5 | 0 | 0.1113 | x | x |
| 4-T-W-02-5 | -5.4 | -1.46 | 0.1116 | x | x |
| 4-T-W-02-6 | -6.52 | -1.75 | 0.1114 | 90.33 | 5.59 |
| 4-T-W-02-7 | -7.61 | -2.04 | 0.1114 | 287.84 | 17.81 |
| 4-T-W-05-6 | -3.38 | -5.85 | 0.1114 | 165.28 | 10.23 |
| 4-T-W-05-7 | -3.93 | -6.85 | 0.1096 | 325.44 | 20.48 |
| 4-T-W-08-5 | 4.04 | -3.98 | 0.1116 | 55.18 | 3.41 |
| 4-T-W-08-6 | 4.84 | -4.78 | 0.1116 | 154.54 | 9.55 |
| 4-T-W-08-7 | 5.63 | -5.46 | 0.1117 | 296.87 | 18.32 |
| 4-T-W-11-1 | 1.13 | 0 | 0.1119 | 107.67 | 6.64 |
| 4-T-W-11-2 | 2.25 | 0 | 0.1118 | 251.71 | 15.52 |
| 4-T-W-11-4 | 3.38 | 0 | x | x | x |
| 4-T-W-11-5 | 5.63 | 0 | x | x | x |
| 4-T-W-11-6 | 6.75 | 0 | 0.1114 | 371.58 | 23.00 |
| 4-T-W-11-7 | 7.87 | 0 | 0.1111 | 321.78 | 19.97 |
| 4-T-W-14-1 | 0 | 1.12 | 0.1113 | 60.79 | 3.77 |
| 4-T-W-14-2 | 0 | 2.25 | 0.1115 | 100.34 | 6.21 |
| 4-T-R-03-L2 | -5.63 | -3.25 | 0.1119 | 226.32 | 13.95 |
| 4-T-R-03-L4 | -5.63 | -3.25 | 0.1113 | 195.80 | 12.12 |
| 4-T-R-09-L2 | 5.63 | -3.25 | 0.1115 | 232.18 | 14.36 |
| 4-T-R-09-L4 | 5.63 | -3.25 | 0.1112 | 151.37 | 9.38 |
| 4-T-R-14-L2 | 0 | 6.5 | 0.1114 | 151.37 | 9.37 |
| 4-T-R-14-L4 | 0 | 6.5 | 0.1108 | 229.25 | 14.26 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 4-T-T-06-1-L2 | 0 | -1.12 | 0.1117 | 279.79 | 17.28 |
| 4-T-T-06-2-L2 | 0 | -2.25 | 0.1114 | 302.73 | 18.75 |
| 4-T-T-06-3-L2 | 0 | -3.37 | 0.1106 | 316.16 | 19.71 |
| 4-T-T-06-4-L2 | 0 | -4.5 | 0.1116 | 318.85 | 19.70 |
| 4-T-T-06-5-L2 | 0 | -5.62 | 0.1115 | 316.41 | 19.56 |
| 4-T-T-06-6-L2 | 0 | -6.75 | 0.1103 | 346.68 | 21.66 |
| 4-T-T-06-7-L2 | 0 | -7.88 | 0.1115 | 382.08 | 23.63 |
| 4-T-T-06-1-L3 | 0 | -1.12 | 0.1116 | 276.86 | 17.11 |
| 4-T-T-06-2-L3 | 0 | -2.25 | 0.1112 | 310.79 | 19.27 |
| 4-T-T-06-3-L3 | 0 | -3.37 | 0.1113 | 305.91 | 18.96 |
| 4-T-T-06-4-L3 | 0 | -4.5 | 0.1115 | 335.69 | 20.77 |
| 4-T-T-06-5-L3 | 0 | -5.62 | 0.1114 | 255.37 | 15.81 |
| 4-T-T-06-6-L3 | 0 | -6.75 | 0.1114 | 333.98 | 20.66 |
| 4-T-T-06-7-L3 | 0 | -7.8 | 0.1111 | | |
| 4-T-T-12-6-L2 | 5.53 | 6.34 | 0.1109 | 348.14 | 21.65 |
| 4-T-T-12-6-L3 | 5.53 | 6.34 | 0.1115 | 371.09 | 22.95 |
| 4-T-T-12-7-L2 | 6.45 | 7.4 | 0.1112 | 338.62 | 20.99 |
| 4-T-T-12-7-L3 | 6.45 | 7.4 | 0.1113 | 368.65 | 22.83 |
| 4-T-T-16-6-L2 | -5.53 | 6.34 | x | x | x |
| 4-T-T-16-6-L3 | -5.53 | 6.34 | 0.1117 | 380.62 | 23.50 |
| 4-T-T-16-7-L2 | -6.45 | 7.4 | 0.1115 | 371.83 | 22.99 |
| 4-T-T-16-7-L3 | -6.45 | 7.4 | x | x | x |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 5-T-W-01-0 | 0 | 0 | 0.1114 | x | x |
| 5-T-W-01-1 | 1.13 | 0 | 0.1119 | 122.80 | 7.56 |
| 5-T-W-01-2 | 2.25 | 0 | 0.1121 | 131.84 | 8.11 |
| 5-T-W-01-4 | 4.5 | 0 | 0.1118 | 136.23 | 8.40 |
| 5-T-W-02-5 | 5.44 | 1.46 | 0.1117 | 322.02 | 19.87 |
| 5-T-W-02-6 | 6.52 | 1.75 | 0.1116 | 214.60 | 13.26 |
| 5-T-W-02-7 | 7.61 | 2.04 | 0.1119 | 164.06 | 10.11 |
| 5-T-W-05-6 | 3.38 | 5.85 | 0.1119 | 242.68 | 14.95 |
| 5-T-W-05-7 | 3.93 | 6.85 | 0.1118 | 299.80 | 18.50 |
| 5-T-W-08-5 | -4.04 | 3.98 | 0.1120 | 124.02 | 7.64 |
| 5-T-W-08-6 | -4.84 | 4.78 | 0.1116 | 180.66 | 11.16 |
| 5-T-W-08-7 | -5.63 | 5.56 | 0.1119 | 293.70 | 18.10 |
| 5-T-W-11-1 | -1.13 | 0 | 0.1122 | 98.63 | 6.06 |
| 5-T-W-11-2 | -2.25 | 0 | 0.1118 | 119.38 | 7.36 |
| 5-T-W-11-4 | -3.38 | 0 | 0.1118 | 157.47 | 9.71 |
| 5-T-W-11-5 | -5.63 | 0 | 0.1121 | 220.46 | 13.55 |
| 5-T-W-11-6 | -6.75 | 0 | 0.1120 | 229.49 | 14.12 |
| 5-T-W-11-7 | -7.87 | 0 | 0.1117 | 341.06 | 21.06 |
| 5-T-W-14-1 | 0 | -1.12 | 0.1114 | x | x |
| 5-T-W-14-2 | 0 | -2.25 | 0.1121 | 87.16 | 5.36 |
| 5-T-R-03-L2 | 5.63 | 3.25 | 0.1116 | 249.76 | 15.43 |
| 5-T-R-03-L4 | 5.63 | 3.25 | 0.1115 | 260.74 | 16.12 |
| 5-T-R-09-L2 | -5.63 | 3.25 | 0.1114 | 251.71 | 15.58 |
| 5-T-R-09-L4 | -5.63 | 3.25 | 0.1112 | 246.09 | 15.26 |
| 5-T-R-14-L2 | 0 | -6.5 | x | x | x |
| 5-T-R-14-L4 | 0 | -6.5 | 0.1113 | 269.78 | 16.71 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 5-T-T-06-1-L2 | 0 | 1.12 | 0.1116 | 249.27 | 15.40 |
| 5-T-T-06-2-L2 | 0 | 2.25 | 0.1116 | 307.62 | 19.00 |
| 5-T-T-06-3-L2 | 0 | 3.37 | 0.1124 | 280.76 | 17.22 |
| 5-T-T-06-4-L2 | 0 | 4.5 | 0.1118 | 288.57 | 17.79 |
| 5-T-T-06-5-L2 | 0 | 5.62 | 0.1109 | 293.46 | 18.24 |
| 5-T-T-06-6-L2 | 0 | 6.75 | 0.1118 | 323.97 | 19.98 |
| 5-T-T-06-7-L2 | 0 | 7.88 | 0.1114 | 372.56 | 23.05 |
| 5-T-T-06-1-L3 | 0 | 1.12 | 0.1115 | 264.65 | 16.36 |
| 5-T-T-06-2-L3 | 0 | 2.25 | 0.1115 | 306.64 | 18.97 |
| 5-T-T-06-3-L3 | 0 | 3.37 | 0.1112 | 249.76 | 15.48 |
| 5-T-T-06-4-L3 | 0 | 4.5 | 0.1096 | 277.83 | 17.48 |
| 5-T-T-06-5-L3 | 0 | 5.62 | 0.1123 | 306.15 | 18.80 |
| 5-T-T-06-6-L3 | 0 | 6.75 | 0.1116 | 325.68 | 20.13 |
| 5-T-T-06-7-L3 | 0 | 7.8 | 0.1113 | 373.29 | 23.12 |
| 5-T-T-12-6-L2 | -5.53 | -6.34 | 0.1112 | 353.03 | 21.89 |
| 5-T-T-12-6-L3 | -5.53 | -6.34 | 0.1111 | 376.71 | 23.38 |
| 5-T-T-12-7-L2 | -6.45 | -7.4 | 0.1119 | 342.04 | 21.08 |
| 5-T-T-12-7-L3 | -6.45 | -7.4 | 0.1117 | 331.79 | 20.47 |
| 5-T-T-16-6-L2 | 5.53 | -6.34 | x | x | x |
| 5-T-T-16-6-L3 | 5.53 | -6.34 | x | x | x |
| 5-T-T-16-7-L2 | 6.45 | -7.4 | x | x | x |
| 5-T-T-16-7-L3 | 6.45 | -7.4 | x | x | x |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 6-T-W-01-0 | 0 | 0 | 0.1114 | 110.11 | 6.82 |
| 6-T-W-01-1 | -1.13 | 0 | 0.1116 | 99.12 | 6.12 |
| 6-T-W-01-2 | -2.25 | 0 | 0.1117 | 93.26 | 5.76 |
| 6-T-W-01-4 | -4.5 | 0 | 0.1114 | 184.08 | 11.39 |
| 6-T-W-02-5 | -5.4 | -1.46 | 0.1116 | 188.72 | 11.66 |
| 6-T-W-02-6 | -6.52 | -1.75 | 0.1117 | 205.57 | 12.69 |
| 6-T-W-02-7 | -7.61 | -2.04 | 0.1118 | 317.38 | 19.57 |
| 6-T-W-05-6 | -3.38 | -5.85 | 0.1116 | 252.20 | 15.59 |
| 6-T-W-05-7 | -3.93 | -6.85 | 0.1113 | 306.15 | 18.96 |
| 6-T-W-08-5 | 4.04 | -3.98 | 0.1115 | 176.76 | 10.93 |
| 6-T-W-08-6 | 4.84 | -4.78 | 0.1117 | 206.30 | 12.73 |
| 6-T-W-08-7 | 5.63 | -5.46 | 0.1116 | 269.53 | 16.65 |
| 6-T-W-11-1 | 1.13 | 0 | 0.1119 | 109.37 | 6.74 |
| 6-T-W-11-2 | 2.25 | 0 | 0.1117 | 100.83 | 6.23 |
| 6-T-W-11-4 | 3.38 | 0 | 0.1121 | 118.65 | 7.30 |
| 6-T-W-11-5 | 5.63 | 0 | 0.1116 | 180.66 | 11.16 |
| 6-T-W-11-6 | 6.75 | 0 | 0.1116 | 207.76 | 12.84 |
| 6-T-W-11-7 | 7.87 | 0 | 0.1116 | 235.60 | 14.56 |
| 6-T-W-14-1 | 0 | 1.12 | 0.1119 | 67.14 | 4.14 |
| 6-T-W-14-2 | 0 | 2.25 | 0.1115 | 110.35 | 6.82 |
| 6-T-R-03-L2 | -5.63 | -3.25 | 0.1114 | 264.40 | 16.36 |
| 6-T-R-03-L4 | -5.63 | -3.25 | 0.1115 | 263.67 | 16.31 |
| 6-T-R-09-L2 | 5.63 | -3.25 | 0.1112 | 250.24 | 15.52 |
| 6-T-R-09-L4 | 5.63 | -3.25 | 0.1112 | 243.41 | 15.09 |
| 6-T-R-14-L2 | 0 | 6.5 | 0.1113 | 263.18 | 16.31 |
| 6-T-R-14-L4 | 0 | 6.5 | 0.1111 | 277.83 | 17.24 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 6-T-T-06-1-L2 | 0 | -1.12 | 0.1110 | 279.54 | 17.36 |
| 6-T-T-06-2-L2 | 0 | -2.25 | 0.1098 | 250.24 | 15.71 |
| 6-T-T-06-3-L2 | 0 | -3.37 | 0.1114 | 306.88 | 19.00 |
| 6-T-T-06-4-L2 | 0 | -4.5 | 0.1117 | 316.41 | 19.52 |
| 6-T-T-06-5-L2 | 0 | -5.62 | 0.1113 | 325.68 | 20.18 |
| 6-T-T-06-6-L2 | 0 | -6.75 | 0.1115 | 335.21 | 20.72 |
| 6-T-T-06-7-L2 | 0 | -7.88 | 0.1113 | 396.48 | 24.56 |
| 6-T-T-06-1-L3 | 0 | -1.12 | 0.0915 | 271.24 | 20.43 |
| 6-T-T-06-2-L3 | 0 | -2.25 | 0.1111 | 317.87 | 19.73 |
| 6-T-T-06-3-L3 | 0 | -3.37 | 0.1115 | 300.78 | 18.60 |
| 6-T-T-06-4-L3 | 0 | -4.5 | 0.1112 | 285.40 | 17.70 |
| 6-T-T-06-5-L3 | 0 | -5.62 | 0.1113 | 297.36 | 18.43 |
| 6-T-T-06-6-L3 | 0 | -6.75 | 0.1113 | 334.47 | 20.72 |
| 6-T-T-06-7-L3 | 0 | -7.8 | 0.1112 | 395.26 | 24.52 |
| 6-T-T-12-6-L2 | 5.53 | 6.34 | 0.1112 | 353.27 | 21.89 |
| 6-T-T-12-6-L3 | 5.53 | 6.34 | 0.1114 | 330.81 | 20.47 |
| 6-T-T-12-7-L2 | 6.45 | 7.4 | 0.1108 | 383.30 | 23.84 |
| 6-T-T-12-7-L3 | 6.45 | 7.4 | 0.1113 | 394.78 | 24.46 |
| 6-T-T-16-6-L2 | -5.53 | 6.34 | 0.1114 | 333.25 | 20.62 |
| 6-T-T-16-6-L3 | -5.53 | 6.34 | 0.1114 | 343.51 | 21.27 |
| 6-T-T-16-7-L2 | -6.45 | 7.4 | 0.1116 | 389.65 | 24.07 |
| 6-T-T-16-7-L3 | -6.45 | 7.4 | 0.1112 | 385.99 | 23.92 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 7-T-W-01-0 | 0 | 0 | 0.1113 | 148.19 | 9.18 |
| 7-T-W-01-1 | 1.13 | 0 | 0.1114 | 85.69 | 5.31 |
| 7-T-W-01-2 | 2.25 | 0 | 0.1114 | 126.71 | 7.84 |
| 7-T-W-01-4 | 4.5 | 0 | 0.1114 | 166.75 | 10.32 |
| 7-T-W-02-5 | 5.44 | 1.46 | 0.1114 | 221.68 | 13.72 |
| 7-T-W-02-6 | 6.52 | 1.75 | 0.1116 | 254.15 | 15.70 |
| 7-T-W-02-7 | 7.61 | 2.04 | 0.1114 | 326.17 | 20.18 |
| 7-T-W-05-6 | 3.38 | 5.85 | 0.1114 | 230.71 | 14.28 |
| 7-T-W-05-7 | 3.93 | 6.85 | 0.1113 | 284.67 | 17.63 |
| 7-T-W-08-5 | -4.04 | 3.98 | 0.1117 | 194.82 | 12.03 |
| 7-T-W-08-6 | -4.84 | 4.78 | 0.1115 | 248.05 | 15.34 |
| 7-T-W-08-7 | -5.63 | 5.56 | 0.1114 | 308.35 | 19.08 |
| 7-T-W-11-1 | -1.13 | 0 | 0.1115 | 104.49 | 6.46 |
| 7-T-W-11-2 | -2.25 | 0 | 0.1115 | 135.01 | 8.35 |
| 7-T-W-11-4 | -3.38 | 0 | 0.1115 | 154.79 | 9.57 |
| 7-T-W-11-5 | -5.63 | 0 | 0.1114 | 193.60 | 11.98 |
| 7-T-W-11-6 | -6.75 | 0 | 0.1115 | 225.83 | 13.97 |
| 7-T-W-11-7 | -7.87 | 0 | 0.1116 | 285.89 | 17.67 |
| 7-T-W-14-1 | 0 | -1.12 | 0.1116 | 66.65 | 4.12 |
| 7-T-W-14-2 | 0 | -2.25 | 0.1115 | 129.64 | 8.02 |
| 7-T-R-03-L2 | 5.63 | 3.25 | 0.1112 | 260.99 | 16.18 |
| 7-T-R-03-L4 | 5.63 | 3.25 | 0.1111 | 272.71 | 16.92 |
| 7-T-R-09-L2 | -5.63 | 3.25 | 0.1113 | 230.71 | 14.29 |
| 7-T-R-09-L4 | -5.63 | 3.25 | 0.1110 | 289.79 | 18.00 |
| 7-T-R-14-L2 | 0 | -6.5 | 0.1113 | 278.32 | 17.24 |
| 7-T-R-14-L4 | 0 | -6.5 | 0.1113 | 254.15 | 15.74 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 7-T-T-06-1-L2 | 0 | 1.12 | 0.1114 | 218.51 | 13.53 |
| 7-T-T-06-2-L2 | 0 | 2.25 | 0.1113 | 271.24 | 16.80 |
| 7-T-T-06-3-L2 | 0 | 3.37 | 0.1113 | 276.37 | 17.13 |
| 7-T-T-06-4-L2 | 0 | 4.5 | 0.1112 | 284.67 | 17.65 |
| 7-T-T-06-5-L2 | 0 | 5.62 | 0.1112 | 266.11 | 16.50 |
| 7-T-T-06-6-L2 | 0 | 6.75 | 0.1112 | 321.29 | 19.92 |
| 7-T-T-06-7-L2 | 0 | 7.88 | 0.1115 | 375.24 | 23.21 |
| 7-T-T-06-1-L3 | 0 | 1.12 | 0.1114 | 230.47 | 14.26 |
| 7-T-T-06-2-L3 | 0 | 2.25 | 0.1112 | 242.43 | 15.03 |
| 7-T-T-06-3-L3 | 0 | 3.37 | 0.1114 | 236.33 | 14.63 |
| 7-T-T-06-4-L3 | 0 | 4.5 | 0.1115 | 276.61 | 17.11 |
| 7-T-T-06-5-L3 | 0 | 5.62 | 0.1113 | 272.95 | 16.91 |
| 7-T-T-06-6-L3 | 0 | 6.75 | 0.1115 | 326.66 | 20.21 |
| 7-T-T-06-7-L3 | 0 | 7.8 | 0.1112 | 347.90 | 21.57 |
| 7-T-T-12-6-L2 | -5.53 | -6.34 | 0.1114 | 338.87 | 20.98 |
| 7-T-T-12-6-L3 | -5.53 | -6.34 | 0.1113 | 301.27 | 18.67 |
| 7-T-T-12-7-L2 | -6.45 | -7.4 | 0.1111 | 376.95 | 23.39 |
| 7-T-T-12-7-L3 | -6.45 | -7.4 | 0.1111 | 380.62 | 23.63 |
| 7-T-T-16-6-L2 | 5.53 | -6.34 | 0.1114 | 324.95 | 20.12 |
| 7-T-T-16-6-L3 | 5.53 | -6.34 | 0.1112 | 328.61 | 20.37 |
| 7-T-T-16-7-L2 | 6.45 | -7.4 | 0.1116 | 382.81 | 23.66 |
| 7-T-T-16-7-L3 | 6.45 | -7.4 | 0.1112 | 354.49 | 21.98 |

Appendix B. Tensile Specimen Measurements and Strengths

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 8-T-W-01-0 | 0 | 0 | 0.1115 | 177.49 | 10.97 |
| 8-T-W-01-1 | -1.13 | 0 | 0.1112 | 170.17 | 10.55 |
| 8-T-W-01-2 | -2.25 | 0 | 0.1112 | 188.96 | 11.71 |
| 8-T-W-01-4 | -4.5 | 0 | 0.1115 | 253.42 | 15.68 |
| 8-T-W-02-5 | -5.4 | -1.46 | 0.1112 | 265.38 | 16.46 |
| 8-T-W-02-6 | -6.52 | -1.75 | 0.1115 | 287.60 | 17.79 |
| 8-T-W-02-7 | -7.61 | -2.04 | 0.1115 | 313.72 | 19.40 |
| 8-T-W-05-6 | -3.38 | -5.85 | 0.1114 | 262.94 | 16.28 |
| 8-T-W-05-7 | -3.93 | -6.85 | 0.1114 | 293.46 | 18.16 |
| 8-T-W-08-5 | 4.04 | -3.98 | 0.1114 | 247.56 | 15.32 |
| 8-T-W-08-6 | 4.84 | -4.78 | 0.1112 | 284.91 | 17.66 |
| 8-T-W-08-7 | 5.63 | -5.46 | 0.1116 | 301.51 | 18.62 |
| 8-T-W-11-1 | 1.13 | 0 | 0.1114 | 181.40 | 11.23 |
| 8-T-W-11-2 | 2.25 | 0 | 0.1116 | 175.29 | 10.83 |
| 8-T-W-11-4 | 3.38 | 0 | 0.1114 | 228.52 | 14.15 |
| 8-T-W-11-5 | 5.63 | 0 | 0.1117 | 281.74 | 17.39 |
| 8-T-W-11-6 | 6.75 | 0 | 0.1114 | 263.43 | 16.30 |
| 8-T-W-11-7 | 7.87 | 0 | 0.1112 | 312.01 | 19.34 |
| 8-T-W-14-1 | 0 | 1.12 | 0.1115 | 207.28 | 12.82 |
| 8-T-W-14-2 | 0 | 2.25 | 0.1114 | 209.72 | 12.99 |
| 8-T-R-03-L2 | -5.63 | -3.25 | 0.1112 | 289.31 | 17.94 |
| 8-T-R-03-L4 | -5.63 | -3.25 | 0.1112 | 375.98 | 23.31 |
| 8-T-R-09-L2 | 5.63 | -3.25 | 0.1114 | 299.07 | 18.51 |
| 8-T-R-09-L4 | 5.63 | -3.25 | 0.1114 | 332.28 | 20.56 |
| 8-T-R-14-L2 | 0 | 6.5 | 0.1114 | 305.18 | 18.90 |
| 8-T-R-14-L4 | 0 | 6.5 | 0.1114 | 346.19 | 21.42 |

| Specimen ID | X-Y coordinates | | Area, $in^2$ | Load, lb | Strength (MPa) |
|---|---|---|---|---|---|
| | X, in | Y, in | | | |
| 8-T-T-06-1-L2 | 0 | -1.12 | 0.1113 | 310.55 | 19.24 |
| 8-T-T-06-2-L2 | 0 | -2.25 | 0.1115 | 321.04 | 19.85 |
| 8-T-T-06-3-L2 | 0 | -3.37 | 0.1114 | 330.32 | 20.45 |
| 8-T-T-06-4-L2 | 0 | -4.5 | 0.1114 | 323.49 | 20.02 |
| 8-T-T-06-5-L2 | 0 | -5.62 | 0.1114 | 288.33 | 17.84 |
| 8-T-T-06-6-L2 | 0 | -6.75 | 0.1113 | 333.50 | 20.65 |
| 8-T-T-06-7-L2 | 0 | -7.88 | 0.1113 | 356.45 | 22.09 |
| 8-T-T-06-1-L3 | 0 | -1.12 | 0.1113 | 380.62 | 23.57 |
| 8-T-T-06-2-L3 | 0 | -2.25 | 0.1113 | 384.77 | 23.83 |
| 8-T-T-06-3-L3 | 0 | -3.37 | 0.1112 | 366.94 | 22.74 |
| 8-T-T-06-4-L3 | 0 | -4.5 | 0.1113 | 357.18 | 22.13 |
| 8-T-T-06-5-L3 | 0 | -5.62 | 0.1113 | 352.78 | 21.85 |
| 8-T-T-06-6-L3 | 0 | -6.75 | 0.1116 | 307.13 | 18.97 |
| 8-T-T-06-7-L3 | 0 | -7.8 | 0.1112 | 363.04 | 22.51 |
| 8-T-T-12-6-L2 | 5.53 | 6.34 | 0.1114 | 342.04 | 21.17 |
| 8-T-T-12-6-L3 | 5.53 | 6.34 | 0.1114 | 375.00 | 23.20 |
| 8-T-T-12-7-L2 | 6.45 | 7.4 | 0.1090 | 375.49 | 23.75 |
| 8-T-T-12-7-L3 | 6.45 | 7.4 | 0.1111 | 367.92 | 22.83 |
| 8-T-T-16-6-L2 | -5.53 | 6.34 | 0.1112 | 347.66 | 21.55 |
| 8-T-T-16-6-L3 | -5.53 | 6.34 | 0.1114 | 339.11 | 20.99 |
| 8-T-T-16-7-L2 | -6.45 | 7.4 | 0.1110 | 336.91 | 20.93 |
| 8-T-T-16-7-L3 | -6.45 | 7.4 | 0.1115 | 405.27 | 25.06 |

# APPENDIX C. Flexure Specimen Measurements, Densities, and Strengths

| Specimen ID | Averages Thickness mm | Width mm | Length mm | Weight g | Density kg/m$^3$ | Strength MPa |
|---|---|---|---|---|---|---|
| 1-F-R-03-L1-W | 8.04386 | 15.91183 | 79.38770 | 18.147 | 1785.94 | 22.33 |
| 1-F-R-03-L3-W | 8.03974 | 15.89913 | 79.38135 | 18.031 | 1777.00 | 18.46 |
| 1-F-R-09-L1-W | 8.04355 | 15.91405 | 79.40040 | 18.263 | 1796.89 | 23.58 |
| 1-F-R-09-L3-W | 8.04069 | 15.91469 | 79.38135 | 18.091 | 1780.95 | 22.71 |
| 1-F-R-14-L1-W | 8.05593 | 15.90866 | 77.88275 | 17.834 | 1786.73 | 20.94 |
| 1-F-R-14-L3-W | 8.03815 | 15.90897 | 79.39405 | 18.087 | 1781.48 | 17.93 |
| 1-F-T-06-1-L1-W | 8.05815 | 15.91882 | 79.38135 | 18.017 | 1769.37 | 25.37 |
| 1-F-T-06-1-L4-W | 8.05148 | 15.92294 | 79.40040 | 17.796 | 1748.24 | 26.45 |
| 1-F-T-06-2-L1-W | 8.03910 | 15.92072 | 79.39405 | 18.124 | 1783.59 | 26.14 |
| 1-F-T-06-2-L4-W | 8.05148 | 15.91850 | 79.40675 | 17.957 | 1764.41 | 22.90 |
| 1-F-T-06-3-L1-W | 8.04386 | 15.91024 | 79.37500 | 18.127 | 1784.44 | 26.09 |
| 1-F-T-06-3-L4-W | 8.04577 | 15.91564 | 79.40675 | 18.081 | 1778.17 | 27.80 |
| 1-F-T-06-4-L1-W | 8.04958 | 15.91120 | 79.39405 | 18.220 | 1791.78 | 25.24 |
| 1-F-T-06-4-L4-W | 8.04640 | 15.92263 | 79.39405 | 18.086 | 1778.03 | 29.03 |
| 1-F-T-06-5-L1-W | 8.03783 | 15.91437 | 79.39405 | 18.070 | 1779.27 | 27.17 |
| 1-F-T-06-5-L4-W | 8.04005 | 15.91405 | 79.37500 | 18.008 | 1773.14 | 28.21 |
| 1-F-T-06-6-L1-W | 8.04069 | 15.91818 | 79.39405 | 18.157 | 1786.77 | 29.00 |
| 1-F-T-06-6-L4-W | 8.04037 | 15.89850 | 79.38770 | 18.019 | 1775.60 | 28.77 |
| 1-F-T-06-7-L1-W | 8.03751 | 15.91818 | 79.38770 | 18.133 | 1785.26 | 28.89 |
| 1-F-T-06-7-L4-W | 8.04450 | 15.91850 | 79.40675 | 18.161 | 1786.00 | 27.22 |
| 1-F-T-12-3-L2-A | 8.03720 | 15.91913 | 79.38135 | 17.828 | 1755.34 | 9.25 |
| 1-F-T-12-4-L2-W | 8.04291 | 15.91056 | 79.41310 | 17.858 | 1757.28 | 27.62 |
| 1-F-T-12-4-L4-W | 8.05402 | 15.90770 | 79.41310 | 17.990 | 1768.15 | 27.44 |
| 1-F-T-12-5-L2-W | 8.04513 | 15.91088 | 79.38770 | 18.061 | 1777.30 | 24.95 |
| 1-F-T-12-5-L4-W | 8.04069 | 15.91596 | 79.36865 | 18.118 | 1783.76 | 28.02 |
| 1-F-T-12-6-L1-W | 8.04355 | 15.91723 | 79.38770 | 18.040 | 1774.88 | 26.42 |
| 1-F-T-12-6-L4-W | 8.04990 | 15.92263 | 79.41310 | 18.181 | 1786.16 | 27.33 |
| 1-F-T-12-7-L1-W | 8.04005 | 15.91437 | 79.37500 | 18.010 | 1773.30 | 26.39 |
| 1-F-T-12-7-L4-W | 8.04545 | 15.92040 | 79.40675 | 18.224 | 1791.77 | 29.81 |
| 1-F-T-13-4-L2-A | 8.04799 | 15.91342 | 79.38135 | 17.943 | 1764.92 | 13.72 |

Appendix 3. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 1-F-T-13-5-L2-A | 8.04291 | 15.91564 | 79.39405 | 18.038 | 1774.86 | 14.18 |
| 1-F-T-13-6-L2-A | 8.04005 | 15.91342 | 79.40040 | 18.157 | 1787.31 | 20.36 |
| 1-F-T-13-7-L2-A | 8.03878 | 15.88230 | 79.40040 | 18.090 | 1784.48 | 23.61 |
| 1-F-T-15-7-L2-A | 8.03942 | 15.90961 | 79.40675 | 18.218 | 1793.74 | 24.05 |
| 1-F-T-15-4-L2-A | 8.02354 | 15.92104 | 79.39405 | 17.857 | 1760.69 | 11.51 |
| 1-F-T-15-5-L2-A | 8.04355 | 15.90897 | 79.39405 | 18.132 | 1784.71 | 13.69 |
| 1-F-T-15-7-L2-A | 8.05085 | 15.91469 | 79.37500 | 18.242 | 1793.70 | 22.36 |
| 1-F-T-16-3-L2-A | 8.04069 | 15.91564 | 79.37500 | 18.048 | 1776.76 | 7.02 |
| 1-F-T-16-4-L2-W | 8.05212 | 15.91469 | 79.39405 | 18.094 | 1778.44 | 27.84 |
| 1-F-T-16-4-L4-W | 8.05466 | 15.91850 | 79.39405 | 18.112 | 1779.22 | 24.57 |
| 1-F-T-16-5-L2-W | 8.05053 | 15.91659 | 79.38770 | 18.118 | 1781.08 | 25.13 |
| 1-F-T-16-5-L4-W | 8.42709 | 15.90961 | 79.42580 | 18.110 | 1700.67 | 24.82 |
| 1-F-T-16-6-L1-W | 8.42740 | 15.92263 | 79.45120 | 18.213 | 1708.33 | 23.46 |
| 1-F-T-16-6-L4-W | 8.37152 | 15.91786 | 79.45120 | 18.043 | 1704.19 | 22.25 |
| 1-F-T-16-7-L1-W | 8.05117 | 15.90485 | 79.39405 | 18.258 | 1795.88 | 26.91 |
| 1-F-T-16-7-L4-W | 8.03053 | 15.90421 | 79.38770 | 18.139 | 1788.97 | |
| 1-F-W-01-3-A | 8.03974 | 15.91278 | 79.42580 | 17.892 | 1760.80 | 11.67 |
| 1-F-W-01-5-A | 8.04990 | 15.92072 | 79.39405 | 18.206 | 1789.26 | 15.22 |
| 1-F-W-01-6-A | 8.05085 | 15.91913 | 79.36865 | 18.315 | 1800.52 | 20.36 |
| 1-F-W-01-7-A | 8.00354 | 15.91691 | 79.40040 | 17.880 | 1767.68 | 23.22 |
| 1-F-W-04-5-A | 8.03688 | 15.90580 | 79.38135 | 17.955 | 1769.39 | 18.72 |
| 1-F-W-04-6-A | 8.04228 | 15.91374 | 79.38770 | 18.103 | 1781.75 | 15.04 |
| 1-F-W-04-7A | 8.04450 | 15.92263 | 79.38135 | 18.022 | 1772.44 | 20.70 |
| 1-F-W-07-6-A | 8.03910 | 15.91628 | 79.40040 | 18.000 | 1771.74 | 18.68 |
| 1-F-W-07-7-A | 8.05402 | 15.91945 | 79.43850 | 18.067 | 1773.84 | 25.07 |
| 1-F-W-10-5-A | 8.03656 | 15.90516 | 79.34325 | 18.131 | 1787.74 | 16.73 |
| 1-F-W-10-6-A | 8.04450 | 15.92040 | 79.36865 | 18.146 | 1785.17 | 19.75 |
| 1-F-W-10-7-A | 8.04037 | 15.91755 | 79.40040 | 18.302 | 1801.04 | 20.03 |
| 1-F-W-11-3-A | 8.04037 | 15.91723 | 79.40040 | 18.001 | 1771.46 | 11.11 |
| 1-F-W-14-3-A | 8.04069 | 15.90643 | 79.39405 | 17.958 | 1768.50 | 14.03 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 2-F-R-03-L1-W | 8.03053 | 15.91405 | 79.38135 | 18.117 | 1785.84 | 18.88 |
| 2-F-R-03-L3-W | 8.02386 | 15.91024 | 79.38135 | 17.966 | 1772.85 | 20.61 |
| 2-F-R-09-L1-W | 8.02989 | 15.91945 | 79.39405 | 18.061 | 1779.57 | 22.99 |
| 2-F-R-09-L3-W | 8.03053 | 15.90802 | 79.38770 | 17.989 | 1773.75 | 19.46 |
| 2-F-R-14-L1-W | 8.03561 | 15.91437 | 79.39405 | 18.046 | 1777.40 | 22.81 |
| 2-F-R-14-L3-W | 8.01688 | 15.92739 | 79.38135 | 17.956 | 1771.50 | 20.44 |
| 2-F-T-06-1-L1-W | 8.04291 | 15.91659 | 79.40040 | 17.833 | 1754.44 | 26.34 |
| 2-F-T-06-1-L4-W | 8.05085 | 15.92612 | 79.38770 | 17.912 | 1759.70 | 25.28 |
| 2-F-T-06-2-L1-W | 8.02323 | 15.90675 | 79.40675 | 17.786 | 1755.05 | 25.14 |
| 2-F-T-06-2-L4-W | 8.01529 | 15.90897 | 79.37500 | 17.778 | 1756.46 | 24.97 |
| 2-F-T-06-3-L1-W | 8.02259 | 15.89881 | 79.37500 | 17.800 | 1758.15 | 26.00 |
| 2-F-T-06-3-L4-W | 8.03085 | 15.91596 | 79.39405 | 17.918 | 1765.66 | 26.08 |
| 2-F-T-06-4-L1-W | 8.04037 | 15.91691 | 79.38770 | 17.938 | 1765.57 | 25.07 |
| 2-F-T-06-4-L4-W | 8.02323 | 15.91786 | 79.39405 | 18.027 | 1777.88 | 27.29 |
| 2-F-T-06-5-L4-W | 8.01846 | 15.92453 | 79.40040 | 18.088 | 1784.06 | 27.92 |
| 2-F-T-06-6-L1-W | 8.02164 | 15.92072 | 79.38135 | 18.134 | 1788.75 | 29.80 |
| 2-F-T-06-6-L4-W | 8.02926 | 15.91659 | 79.39405 | 18.154 | 1789.20 | 29.03 |
| 2-F-T-06-7-L1-W | 8.02894 | 15.92009 | 79.39405 | 18.231 | 1796.47 | 29.00 |
| 2-F-T-06-7-L4-W | 8.02608 | 15.89532 | 79.38135 | 18.134 | 1790.62 | 30.77 |
| 2-F-T-12-3-L2-A | 8.02799 | 15.91564 | 79.38770 | 17.799 | 1754.74 | 15.31 |
| 2-F-T-12-4-L2-W | 8.02767 | 15.87849 | 79.40675 | 17.880 | 1766.49 | 27.08 |
| 2-F-T-12-4-L4-W | 8.02989 | 15.91437 | 79.40040 | 17.941 | 1768.17 | 27.06 |
| 2-F-T-12-5-L2-W | 8.04482 | 15.92453 | 79.40040 | 18.090 | 1778.42 | 27.26 |
| 2-F-T-12-5-L4-W | 8.03910 | 15.92104 | 79.38770 | 18.021 | 1773.56 | 26.26 |
| 2-F-T-12-6-L1-W | 8.02386 | 15.92517 | 79.38135 | 18.214 | 1795.64 | 29.13 |
| 2-F-T-12-6-L4-W | 8.02831 | 15.91818 | 79.41310 | 18.133 | 1786.74 | 30.18 |
| 2-F-T-12-7-L1-W | 8.04482 | 15.91691 | 79.37500 | 18.236 | 1794.20 | 29.82 |
| 2-F-T-12-7-L4-W | 8.02481 | 15.92199 | 79.37500 | 18.295 | 1803.92 | 30.60 |
| 2-F-T-13-4-L2-A | 8.02069 | 15.90834 | 79.38770 | 17.851 | 1762.27 | 13.94 |
| 2-F-T-13-5-L2-A | 8.02672 | 15.90167 | 79.39405 | 17.893 | 1765.69 | 15.60 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 2-F-T-13-6-L2-A | 8.03212 | 15.91628 | 79.38135 | 17.920 | 1765.83 | 18.96 |
| 2-F-T-13-7-L2-A | 8.01878 | 15.91691 | 79.39405 | 18.058 | 1782.03 | 22.34 |
| 2-F-T-15-7-L2-A | 8.01751 | 15.91564 | 79.37500 | 18.101 | 1787.13 | 25.25 |
| 2-F-T-15-4-L2-A | 8.02704 | 15.92231 | 79.39405 | 17.862 | 1760.28 | 13.19 |
| 2-F-T-15-5-L2-A | 8.02069 | 15.91342 | 79.40675 | 17.948 | 1770.86 | 13.86 |
| 2-F-T-15-6-L2-A | 8.02640 | 15.92294 | 79.38770 | 18.005 | 1774.58 | 18.36 |
| 2-F-T-16-3-L2-A | 8.02862 | 15.91882 | 79.40040 | 17.837 | 1757.71 | 13.79 |
| 2-F-T-16-4-L2-W | 8.04418 | 15.91945 | 79.41310 | 18.271 | 1796.64 | 29.71 |
| 2-F-T-16-4-L4-W | 8.02354 | 15.92326 | 79.38135 | 18.175 | 1792.08 | 28.98 |
| 2-F-T-16-5-L2-W | 8.01561 | 15.03521 | 79.39405 | 17.133 | 1790.60 | 28.69 |
| 2-F-T-16-5-L4-W | 8.02100 | 15.92009 | 79.40040 | 18.102 | 1785.38 | 29.48 |
| 2-F-T-16-6-L1-W | 8.02989 | 15.92453 | 79.38770 | 18.114 | 1784.37 | 28.93 |
| 2-F-T-16-6-L4-W | 8.03116 | 15.92167 | 79.36865 | 18.059 | 1779.42 | 27.04 |
| 2-F-T-16-7-L1-W | 8.03116 | 15.91755 | 79.41945 | 17.953 | 1768.30 | 27.68 |
| 2-F-T-16-7-L4-W | 8.03370 | 15.89723 | 79.40675 | 17.942 | 1769.20 | 24.22 |
| 2-F-W-01-3-A | 8.02132 | 15.89977 | 79.39405 | 17.921 | 1769.86 | 9.87 |
| 2-F-W-01-5-A | 8.02259 | 15.91818 | 79.39405 | 18.085 | 1783.70 | 17.54 |
| 2-F-W-01-6-A | 8.01434 | 15.91120 | 79.40675 | 18.161 | 1793.54 | 23.14 |
| 2-F-W-01-7A | 8.02672 | 15.90993 | 79.38135 | 18.200 | 1795.34 | 28.23 |
| 2-F-W-04-5-A | 8.02989 | 15.91945 | 79.39405 | 18.045 | 1778.00 | 13.59 |
| 2-F-W-04-6-A | 8.02577 | 15.92580 | 79.40675 | 18.085 | 1781.86 | 20.58 |
| 2-F-W-04-7-A | 7.99624 | 15.91913 | 79.40675 | 18.057 | 1786.42 | 23.19 |
| 2-F-W-07-6-A | 8.01656 | 15.90929 | 79.36865 | 18.091 | 1787.21 | 24.15 |
| 2-F-W-07-7-A | 8.02354 | 15.91501 | 79.38135 | 18.206 | 1796.07 | 26.94 |
| 2-F-W-10-5-A | 8.02164 | 15.91342 | 79.39405 | 18.023 | 1778.33 | 19.50 |
| 2-F-W-10-6-A | 8.02958 | 15.91501 | 79.40040 | 18.238 | 1797.44 | 22.19 |
| 2-F-W-10-7-A | 8.03085 | 15.91913 | 79.40040 | 18.094 | 1782.51 | 25.33 |
| 2-F-W-11-3-A | 8.03243 | 15.91469 | 79.40040 | 17.805 | 1754.18 | 15.49 |
| 2-F-W-14-3-A | 8.03053 | 15.91723 | 79.40675 | 17.776 | 1751.32 | 11.41 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 3-F-R-03-L1-W | 8.05117 | 15.92167 | 79.38135 | 18.052 | 1774.02 | 20.95 |
| 3-F-R-03-L3-W | 8.04672 | 15.91120 | 79.34325 | 17.976 | 1769.54 | 20.16 |
| 3-F-R-09-L1-W | 8.05275 | 15.90262 | 79.37500 | 17.173 | 1689.47 | 25.27 |
| 3-F-R-09-L3-W | 8.04990 | 15.90802 | 79.35595 | 17.989 | 1770.20 | 21.78 |
| 3-F-R-14-L1-W | 8.04958 | 15.90770 | 79.38135 | 17.968 | 1767.67 | 21.49 |
| 3-F-R-14-L3-W | 8.04545 | 15.90262 | 79.35595 | 17.861 | 1759.17 | 18.48 |
| 3-F-T-06-1-L1-W | 8.04037 | 15.88262 | 79.38135 | 17.783 | 1754.24 | 23.93 |
| 3-F-T-06-1-L4-W | 8.03783 | 15.89945 | 79.38135 | 17.724 | 1747.12 | 24.73 |
| 3-F-T-06-2-L1-W | 8.00957 | 15.91374 | 79.36230 | 17.777 | 1757.37 | 25.80 |
| 3-F-T-06-2-L4-W | 8.05148 | 15.91469 | 79.38135 | 17.772 | 1747.20 | 25.53 |
| 3-F-T-06-3-L1-W | 8.05339 | 15.91278 | 79.33690 | 17.772 | 1747.98 | 26.43 |
| 3-F-T-06-3-L4-W | 8.04323 | 15.89945 | 79.31785 | 17.793 | 1754.15 | 25.41 |
| 3-F-T-06-4-L1-W | 8.01434 | 15.90993 | 79.36230 | 17.922 | 1771.07 | 26.77 |
| 3-F-T-06-4-L4-W | 8.02799 | 15.89437 | 79.38135 | 17.808 | 1758.11 | 25.56 |
| 3-F-T-06-5-L1-W | 8.03307 | 15.91469 | 79.36230 | 18.021 | 1776.17 | 28.53 |
| 3-F-T-06-5-L4-W | 8.02259 | 15.87310 | 79.36230 | 18.003 | 1781.37 | 28.28 |
| 3-F-T-06-6-L1-W | 8.04259 | 15.90707 | 79.34960 | 18.096 | 1782.59 | 28.84 |
| 3-F-T-06-6-L4-W | 8.03148 | 15.91596 | 79.35595 | 18.101 | 1784.41 | 29.47 |
| 3-F-T-06-7-L1-W | 8.02132 | 15.90802 | 79.36230 | 18.130 | 1790.28 | 29.82 |
| 3-F-T-06-7-L4-W | 8.04418 | 15.91247 | 79.32420 | 18.244 | 1796.78 | 29.51 |
| 3-F-T-12-3-L2-A | 8.04196 | 15.92231 | 79.37500 | 17.766 | 1747.99 | 13.41 |
| 3-F-T-12-4-L2-W | 8.05148 | 15.90802 | 79.34325 | 17.896 | 1760.98 | 25.34 |
| 3-F-T-12-4-L4-W | 8.04990 | 15.91183 | 79.40040 | 17.933 | 1763.27 | 26.13 |
| 3-F-T-12-5-L2-W | 8.04259 | 15.89627 | 79.34325 | 18.091 | 1783.45 | 27.72 |
| 3-F-T-12-5-L4-W | 7.99116 | 15.88421 | 79.33055 | 17.902 | 1777.81 | 26.81 |
| 3-F-T-12-6-L1-W | 8.05783 | 15.91501 | 79.40040 | 18.202 | 1787.60 | 27.06 |
| 3-F-T-12-6-L4-W | 8.04831 | 15.92294 | 79.37500 | 18.199 | 1789.11 | 29.52 |
| 3-F-T-12-7-L1-W | 8.04164 | 15.91532 | 79.35595 | 18.335 | 1805.27 | 30.80 |
| 3-F-T-12-7-L4-W | 8.01211 | 15.91977 | 79.33690 | 18.145 | 1793.07 | 31.31 |
| 3-F-T-13-4-L2-A | 8.04513 | 15.91374 | 79.35595 | 17.777 | 1749.74 | 5.14 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 3-F-T-13-5-L2-A | 8.04482 | 15.90104 | 79.38135 | 17.779 | 1750.84 | 12.95 |
| 3-F-T-13-6-L2-A | 8.05244 | 15.86833 | 79.34960 | 17.847 | 1760.20 | 11.74 |
| 3-F-T-13-7-L2-A | 8.04736 | 15.91120 | 79.37500 | 18.200 | 1790.74 | 25.61 |
| 3-F-T-15-7-L2-A | 8.04513 | 15.91278 | 79.35595 | 18.229 | 1794.34 | 24.60 |
| 3-F-T-15-4-L2-A | 8.03529 | 15.91723 | 79.36230 | 17.763 | 1749.98 | 9.34 |
| 3-F-T-15-5-L2-A | 8.03212 | 15.91278 | 79.38135 | 17.853 | 1759.61 | 9.93 |
| 3-F-T-15-6-L2-A | 8.05275 | 15.91405 | 79.38135 | 17.935 | 1763.02 | 7.63 |
| 3-F-T-16-3-L2-A | 8.03688 | 15.87341 | 79.34960 | 17.786 | 1757.02 | 10.54 |
| 3-F-T-16-4-L2-W | 8.05212 | 15.90548 | 79.33690 | 17.926 | 1764.21 | 27.22 |
| 3-F-T-16-4-L4-W | 8.05720 | 15.92421 | 79.38135 | 18.004 | 1767.70 | 25.64 |
| 3-F-T-16-5-L2-W | 8.05307 | 15.90167 | 79.38135 | 18.018 | 1772.49 | 27.91 |
| 3-F-T-16-5-L4-W | 8.04990 | 15.82452 | 79.34960 | 17.896 | 1770.48 | 27.26 |
| 3-F-T-16-6-L1-W | 8.04450 | 15.91062 | 79.36865 | 18.149 | 1786.56 | 27.63 |
| 3-F-T-16-6-L4-W | 8.04767 | 15.89469 | 79.34960 | 18.011 | 1774.48 | 27.61 |
| 3-F-T-16-7-L1-W | 8.04164 | 15.92485 | 79.38135 | 18.212 | 1791.51 | 31.10 |
| 3-F-T-16-7-L4-W | 8.05402 | 15.86230 | 79.33690 | 17.897 | 1765.74 | 26.72 |
| 3-F-W-01-3-A | 8.03402 | 15.90739 | 79.36865 | 17.845 | 1759.26 | 14.73 |
| 3-F-W-01-5-A | 7.78605 | 15.92072 | 79.40675 | 17.272 | 1754.71 | 16.33 |
| 3-F-W-01-6-A | 8.04323 | 15.91818 | 79.31785 | 18.101 | 1782.41 | 24.81 |
| 3-F-W-01-7-A | 8.04577 | 15.92263 | 79.38770 | 18.327 | 1802.01 | 28.03 |
| 3-F-W-04-5-A | 8.04132 | 15.92104 | 79.36865 | 17.981 | 1769.56 | 13.26 |
| 3-F-W-04-6-A | 8.04672 | 15.91532 | 79.36865 | 17.971 | 1768.03 | 18.14 |
| 3-F-W-04-7-A | 8.05371 | 15.88008 | 79.38135 | 18.267 | 1799.29 | 25.97 |
| 3-F-W-07-6-A | 8.04704 | 15.91278 | 79.34325 | 18.288 | 1800.01 | 25.78 |
| 3-F-W-07-7-A | 8.04577 | 15.90707 | 79.34960 | 18.245 | 1796.56 | 25.70 |
| 3-F-W-10-5-A | 8.03434 | 15.92358 | 79.34325 | 18.019 | 1775.13 | 14.52 |
| 3-F-W-10-6-A | 8.03942 | 15.91310 | 79.36865 | 18.157 | 1788.20 | 21.69 |
| 3-F-W-10-7-A | 8.04291 | 15.89056 | 79.35595 | 18.209 | 1795.37 | 24.81 |
| 3-F-W-11-3-A | 8.04513 | 15.89945 | 79.37500 | 17.749 | 1748.13 | 12.57 |
| 3-F-W-14-3-A | 8.03434 | 15.90612 | 79.37500 | 17.715 | 1746.40 | 14.21 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| Specimen ID | Averages Thickness mm | Width mm | Length mm | Weight g | Density kg/m$^3$ | Strength MPa |
|---|---|---|---|---|---|---|
| 4-F-R-03-L1-W | 8.03148 | 15.89627 | 79.37500 | 17.952 | 1771.49 | 21.46 |
| 4-F-R-03-L3-W | 8.02894 | 15.91691 | 79.36230 | 18.016 | 1776.34 | 18.45 |
| 4-F-R-09-L1-W | 8.03402 | 15.90548 | 79.38135 | 17.985 | 1773.01 | 23.43 |
| 4-F-R-09-L3-W | 8.03339 | 15.91088 | 79.36865 | 17.879 | 1762.39 | 14.46 |
| 4-F-R-14-L1-W | 8.02450 | 15.91882 | 79.33690 | 17.792 | 1755.58 | 15.17 |
| 4-F-R-14-L3-W | 8.03466 | 15.92040 | 79.33690 | 17.953 | 1769.05 | 21.62 |
| 4-F-T-06-1-L1-W | 8.03466 | 15.90262 | 79.34960 | 17.661 | 1741.95 | 23.69 |
| 4-F-T-06-1-L4-W | 8.02513 | 15.91183 | 79.36865 | 17.630 | 1739.53 | 24.41 |
| 4-F-T-06-2-L1-W | 8.04037 | 15.89786 | 79.34960 | 17.735 | 1748.52 | 25.40 |
| 4-F-T-06-2-L4-W | 8.03561 | 15.88961 | 79.36865 | 17.751 | 1751.63 | 24.13 |
| 4-F-T-06-3-L1-W | 8.02799 | 15.90866 | 79.37500 | 17.834 | 1759.24 | 23.73 |
| 4-F-T-06-3-L4-W | 8.02640 | 15.91088 | 79.37500 | 17.909 | 1766.74 | 25.26 |
| 4-F-T-06-4-L1-W | 8.03910 | 15.91437 | 79.33563 | 17.915 | 1765.03 | 26.33 |
| 4-F-T-06-4-L4-W | 8.04101 | 15.90358 | 79.31150 | 17.870 | 1761.91 | 26.36 |
| 4-F-T-06-5-L1-W | 8.03212 | 15.90358 | 79.36865 | 17.849 | 1760.52 | 24.73 |
| 4-F-T-06-5-L4-W | 8.01942 | 15.90929 | 79.39405 | 17.803 | 1757.57 | 20.02 |
| 4-F-T-06-6-L1-W | 8.03307 | 15.90961 | 79.34325 | 18.007 | 1775.79 | 27.55 |
| 4-F-T-06-6-L4-W | 8.03053 | 15.91278 | 79.33690 | 17.984 | 1773.87 | 29.35 |
| 4-F-T-06-7-L1-W | 8.03116 | 15.90389 | 79.32420 | 18.165 | 1792.87 | 30.13 |
| 4-F-T-06-7-L4-W | 8.03720 | 15.90008 | 79.38770 | 18.190 | 1792.98 | 29.88 |
| 4-F-T-12-4-L2-W | 8.02672 | 15.83404 | 79.38135 | 17.662 | 1750.62 | 25.91 |
| 4-F-T-12-4-L4-W | 8.03656 | 15.88897 | 79.38135 | 17.821 | 1758.12 | 25.97 |
| 4-F-T-12-5-L2-W | 8.02799 | 15.91659 | 79.37500 | 17.893 | 1764.18 | 25.34 |
| 4-F-T-12-5-L4-W | 8.03466 | 15.91501 | 79.36230 | 17.836 | 1757.56 | 22.04 |
| 4-F-T-12-6-L1-W | 8.03370 | 15.92136 | 79.38770 | 18.144 | 1786.83 | 29.79 |
| 4-F-T-12-6-L4-W | 8.02958 | 15.91342 | 79.35595 | 18.194 | 1794.29 | 30.07 |
| 4-F-T-12-7-L1-W | 8.03402 | 15.90739 | 79.33690 | 18.173 | 1792.34 | 28.19 |
| 4-F-T-12-7-L4-W | 8.04101 | 15.91818 | 79.33690 | 18.217 | 1793.90 | 32.05 |
| 4-F-T-12-3-L2-A | 8.03497 | 15.92294 | 79.33055 | 17.796 | 1753.37 | 13.55 |
| 4-F-T-13-4-L2-A | 8.03339 | 15.91850 | 79.32420 | 17.806 | 1755.34 | 14.83 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 4-F-T-13-5-L2-A | 8.03783 | 15.91469 | 79.37500 | 17.876 | 1760.56 | 14.16 |
| 4-F-T-13-6-L2-A | 8.03466 | 15.91532 | 79.33055 | 17.925 | 1767.00 | 17.82 |
| 4-F-T-13-7-L2-A | 8.03339 | 15.91850 | 79.37500 | 18.263 | 1799.23 | 24.83 |
| 4-F-T-15-7-L2-A | 8.02926 | 15.91437 | 79.37500 | 18.158 | 1790.27 | 25.09 |
| 4-F-T-15-4-L2-A | 8.03148 | 15.89532 | 79.31150 | 17.808 | 1758.79 | 15.48 |
| 4-F-T-15-5-L2-A | 8.03085 | 15.91818 | 79.32420 | 17.849 | 1760.17 | |
| 4-F-T-15-6-L2-A | 8.03815 | 15.91628 | 79.32420 | 18.066 | 1780.16 | 20.48 |
| 4-F-T-16-3-L2-A | 8.01434 | 15.91723 | 79.36230 | 17.654 | 1743.79 | 14.65 |
| 4-F-T-16-4-L2-W | 8.03370 | 15.91374 | 79.33690 | 17.843 | 1759.16 | 25.17 |
| 4-F-T-16-4-L4-W | 8.04037 | 15.88199 | 79.35595 | 17.847 | 1761.18 | 26.43 |
| 4-F-T-16-5-L2-W | 8.04037 | 15.87627 | 79.34960 | 17.872 | 1764.43 | 28.54 |
| 4-F-T-16-5-L4-W | 8.03847 | 15.90866 | 79.33055 | 17.921 | 1766.51 | 26.88 |
| 4-F-T-16-6-L1-W | 8.04037 | 15.86643 | 79.36865 | 18.120 | 1789.59 | 29.25 |
| 4-F-T-16-6-L4-W | 8.04005 | 15.81944 | 79.34325 | 17.965 | 1780.19 | 29.16 |
| 4-F-T-16-7-L1-W | 8.03783 | 15.90739 | 79.36865 | 18.297 | 1802.99 | 30.45 |
| 4-F-T-16-7-L4-W | 8.04069 | 15.90739 | 79.31150 | 18.288 | 1802.76 | 31.19 |
| 4-F-W-01-3-A | 8.03243 | 15.91850 | 79.36865 | 17.759 | 1749.93 | 15.00 |
| 4-F-W-01-5-A | 8.03402 | 15.92771 | 79.35595 | 17.995 | 1772.09 | 13.50 |
| 4-F-W-01-6-A | 8.02259 | 15.91818 | 79.36865 | 18.064 | 1782.20 | 20.86 |
| 4-F-W-01-7-A | 8.03212 | 15.92167 | 79.38770 | 18.296 | 1802.12 | 27.35 |
| 4-F-W-04-5-A | 8.03021 | 15.92040 | 79.37500 | 17.825 | 1756.57 | 11.92 |
| 4-F-W-04-6-A | 8.03402 | 15.91850 | 79.29880 | 18.042 | 1779.03 | 19.73 |
| 4-F-W-04-7-A | 7.99560 | 15.92231 | 79.31150 | 18.086 | 1791.22 | 27.14 |
| 4-F-W-07-6-A | 8.03085 | 15.90961 | 79.33055 | 18.056 | 1781.40 | 22.77 |
| 4-F-W-07-7-A | 8.03497 | 15.92167 | 79.35595 | 18.166 | 1789.40 | 27.38 |
| 4-F-W-10-5-A | 8.03402 | 15.92548 | 79.32420 | 17.852 | 1758.96 | 2.91 |
| 4-F-W-10-6-A | 8.03212 | 15.92167 | 79.33690 | 18.166 | 1790.46 | 24.32 |
| 4-F-W-10-7-A | 8.03148 | 15.91437 | 79.36230 | 18.290 | 1803.08 | 29.42 |
| 4-F-W-11-3-A | 8.03212 | 15.89342 | 79.33055 | 17.700 | 1747.78 | 12.74 |
| 4-F-W-14-3-A | 8.03053 | 15.90707 | 79.34960 | 17.797 | 1755.77 | 15.29 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 5-F-R-03-L1-W | 8.04482 | 15.90707 | 79.31785 | 17.946 | 1768.03 | 19.68 |
| 5-F-R-03-L3-W | 8.03307 | 15.90199 | 79.30515 | 18.073 | 1784.00 | 23.57 |
| 5-F-R-09-L1-W | 8.03307 | 15.91437 | 79.31150 | 17.871 | 1762.55 | 21.60 |
| 5-F-R-09-L3-W | 8.01719 | 15.89469 | 79.40040 | 17.896 | 1768.72 | 22.41 |
| 5-F-R-14-L1-W | 8.03085 | 15.91532 | 79.33690 | 17.963 | 1771.44 | 21.45 |
| 5-F-R-14-L3-W | 8.05307 | 15.90802 | 79.31785 | 18.042 | 1775.56 | 22.14 |
| 5-F-T-06-1-L1-W | 8.05053 | 15.90834 | 79.36230 | 17.724 | 1743.81 | 23.79 |
| 5-F-T-06-1-L4-W | 8.02831 | 15.86230 | 79.36865 | 17.746 | 1755.75 | 23.14 |
| 5-F-T-06-2-L1-W | 8.02926 | 15.92072 | 79.33055 | 17.800 | 1755.26 | 25.18 |
| 5-F-T-06-2-L4-W | 8.02926 | 15.91437 | 79.37500 | 17.808 | 1755.77 | 26.46 |
| 5-F-T-06-3-L1-W | 8.02958 | 15.88643 | 79.35595 | 17.821 | 1760.49 | 26.98 |
| 5-F-T-06-3-L4-W | 8.03910 | 15.91564 | 79.28610 | 17.871 | 1761.65 | 26.97 |
| 5-F-T-06-4-L1-W | 8.02926 | 15.92009 | 79.26070 | 17.912 | 1767.93 | 26.37 |
| 5-F-T-06-4-L4-W | 8.03529 | 15.87532 | 79.31150 | 17.877 | 1766.99 | 24.80 |
| 5-F-T-06-5-L4-W | 8.03085 | 15.91469 | 79.34960 | 17.912 | 1766.20 | 27.53 |
| 5-F-T-06-6-L1-W | 8.04228 | 15.90993 | 79.33690 | 17.913 | 1764.60 | 26.20 |
| 5-F-T-06-5-L1-W | 8.04037 | 15.91564 | 79.38135 | 17.916 | 1763.69 | 28.29 |
| 5-F-T-06-6-L4-W | 8.03116 | 15.87722 | 79.40040 | 17.903 | 1768.28 | 28.26 |
| 5-F-T-06-7-L1-W | 8.02958 | 15.89278 | 79.36230 | 18.165 | 1793.61 | 28.35 |
| 5-F-T-06-7-L4-W | 8.03370 | 15.91850 | 79.39405 | 18.198 | 1792.33 | 31.15 |
| 5-F-T-12-3-L2-A | 8.02069 | 15.89500 | 79.33690 | 17.734 | 1753.31 | 15.17 |
| 5-F-T-12-4-L2-W | 8.02767 | 15.90104 | 79.35595 | 17.828 | 1759.98 | 26.78 |
| 5-F-T-12-4-L4-W | 8.01529 | 15.91850 | 79.36230 | 17.841 | 1761.91 | 26.80 |
| 5-F-T-12-5-L2-W | 8.03085 | 15.88484 | 79.32420 | 17.956 | 1774.43 | 27.45 |
| 5-F-T-12-5-L4-W | 8.04259 | 15.88707 | 79.39405 | 17.950 | 1769.44 | 26.08 |
| 5-F-T-12-6-L1-W | 8.03942 | 15.90834 | 79.36865 | 18.282 | 1801.05 | 31.33 |
| 5-F-T-12-6-L4-W | 8.04069 | 15.92326 | 79.36865 | 18.356 | 1806.36 | 31.72 |
| 5-F-T-12-7-L1-W | 8.02545 | 15.88389 | 79.32420 | 18.030 | 1783.05 | 27.28 |
| 5-F-T-12-7-L4-W | 8.02989 | 15.91818 | 79.33055 | 18.147 | 1789.62 | 29.74 |
| 5-F-T-13-4-L2-A | 8.03053 | 15.91120 | 79.38135 | 17.829 | 1757.77 | 14.87 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 5-F-T-13-5-L2-A | 8.03180 | 15.90326 | 79.34325 | 17.927 | 1768.88 | 17.70 |
| 5-F-T-13-6-L2-A | 8.03243 | 15.82611 | 79.40040 | 17.986 | 1781.93 | 20.80 |
| 5-F-T-13-7-L2-A | 8.04164 | 15.92136 | 79.35595 | 18.270 | 1798.19 | 26.70 |
| 5-F-T-15-7-L2-A | 8.03370 | 15.85722 | 79.38770 | 17.933 | 1773.20 | 20.60 |
| 5-F-T-15-4-L2-A | 8.03021 | 15.90993 | 79.29880 | 17.902 | 1767.01 | 15.99 |
| 5-F-T-15-5-L2-A | 8.03370 | 15.89310 | 79.36230 | 17.835 | 1760.09 | 18.36 |
| 5-F-T-15-6-L2-A | 8.01878 | 15.90897 | 79.33690 | 17.892 | 1767.80 | 20.05 |
| 5-F-T-16-3-L2-A | 7.97497 | 15.90675 | 79.38135 | 17.694 | 1757.10 | 13.42 |
| 5-F-T-16-4-L2-W | 8.04101 | 15.89977 | 79.34960 | 17.876 | 1762.08 | 25.98 |
| 5-F-T-16-4-L4-W | 8.01910 | 15.88072 | 79.36865 | 17.842 | 1765.22 | 25.82 |
| 5-F-T-16-5-L2-W | 8.05148 | 15.90929 | 79.31150 | 17.922 | 1764.10 | 28.30 |
| 5-F-T-16-5-L4-W | 8.04355 | 15.89945 | 79.35595 | 17.938 | 1767.52 | 25.45 |
| 5-F-T-16-6-L2-W | 8.02640 | 15.91215 | 79.36230 | 18.003 | 1776.16 | 28.76 |
| 5-F-T-16-7-L2-W | 8.03243 | 15.91691 | 79.39405 | 18.254 | 1798.31 | 30.63 |
| 5-F-T-16-6-L4-W | 8.04196 | 15.90739 | 79.34960 | 17.823 | 1755.80 | 25.33 |
| 5-F-T-16-7-L4-W | 8.02608 | 15.89945 | 79.30515 | 18.285 | 1806.79 | 30.90 |
| 5-F-W-01-3-A | 8.03053 | 15.92548 | 79.37500 | 17.896 | 1762.93 | 11.05 |
| 5-F-W-01-5-A | 8.03116 | 15.90866 | 79.36230 | 17.986 | 1773.82 | 20.50 |
| 5-F-W-01-6-A | 8.02799 | 15.88961 | 79.34960 | 18.105 | 1788.69 | 22.79 |
| 5-F-W-01-7-A | 8.02354 | 15.91437 | 79.29245 | 18.206 | 1798.15 | 27.21 |
| 5-F-W-04-5-A | 8.02735 | 15.89437 | 79.40040 | 17.884 | 1765.33 | 18.78 |
| 5-F-W-04-6-A | 8.03275 | 15.86357 | 79.35595 | 17.956 | 1775.65 | 20.90 |
| 5-F-W-04-7-A | 8.03148 | 15.91818 | 79.33690 | 18.196 | 1793.96 | 26.38 |
| 5-F-W-07-6-A | 8.02100 | 15.92358 | 79.33690 | 18.002 | 1776.55 | 21.42 |
| 5-F-W-07-7-A | 8.02958 | 15.87976 | 79.39405 | 18.297 | 1807.40 | 27.52 |
| 5-F-W-10-5-A | 8.02926 | 15.88707 | 79.33690 | 17.901 | 1768.82 | 15.29 |
| 5-F-W-10-6-A | 8.03815 | 15.90421 | 79.34325 | 17.973 | 1771.91 | 23.57 |
| 5-F-W-10-7-A | 8.02672 | 15.90135 | 79.30515 | 18.241 | 1802.08 | 25.81 |
| 5-F-W-11-3-A | 8.03021 | 15.91913 | 79.36230 | 17.892 | 1763.59 | 16.18 |
| 5-F-W-14-3-A | 8.03402 | 15.85849 | 79.36865 | 17.791 | 1759.37 | 16.28 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 6-F-R-03-L1-W | 8.03878 | 15.90897 | 79.38135 | 18.232 | 1795.91 | 26.25 |
| 6-F-R-03-L3-W | 8.03688 | 15.91882 | 79.31785 | 18.131 | 1786.70 | 24.21 |
| 6-F-R-09-L1-W | 8.03085 | 15.90866 | 79.38135 | 17.932 | 1768.14 | 22.46 |
| 6-F-R-09-L3-W | 8.03656 | 15.91437 | 79.38135 | 17.953 | 1768.31 | 22.65 |
| 6-F-R-14-L1-W | 8.02704 | 15.90834 | 79.34960 | 17.930 | 1769.52 | 22.65 |
| 6-F-R-14-L3-W | 8.03307 | 15.90961 | 79.37500 | 17.976 | 1772.02 | 22.64 |
| 6-F-T-06-1-L1-W | 8.03370 | 15.91278 | 79.33690 | 17.857 | 1760.64 | 25.44 |
| 6-F-T-06-1-L4-W | 8.03339 | 15.89246 | 79.36865 | 17.833 | 1759.89 | 21.90 |
| 6-F-T-06-2-L1-W | 8.03529 | 15.91120 | 79.36865 | 17.903 | 1764.30 | 24.60 |
| 6-F-T-06-2-L4-W | 8.02640 | 15.91310 | 79.37500 | 17.862 | 1761.86 | 24.17 |
| 6-F-T-06-3-L1-W | 8.02831 | 15.92136 | 79.39405 | 17.883 | 1762.17 | 25.37 |
| 6-F-T-06-3-L4-W | 8.02862 | 15.89945 | 79.37500 | 17.920 | 1768.61 | 24.63 |
| 6-F-T-06-4-L1-W | 8.04355 | 15.91818 | 79.35595 | 17.961 | 1767.71 | 25.15 |
| 6-F-T-06-4-L4-W | 8.03085 | 15.91469 | 79.38135 | 17.945 | 1768.75 | 23.90 |
| 6-F-T-06-5-L1-W | 8.03815 | 15.87881 | 79.35595 | 17.903 | 1767.55 | 26.83 |
| 6-F-T-06-5-L4-W | 8.03688 | 15.91469 | 79.37500 | 18.005 | 1773.47 | 27.41 |
| 6-F-T-06-6-L1-W | 8.02761 | 15.91564 | 79.38770 | 18.043 | 1778.87 | 26.83 |
| 6-F-T-06-6-L4-W | 8.02894 | 15.91183 | 79.35595 | 18.032 | 1778.63 | 26.88 |
| 6-F-T-06-7-L1-W | 8.02545 | 15.90739 | 79.39405 | 18.237 | 1799.27 | 29.77 |
| 6-F-T-06-7-L4-W | 8.03180 | 15.90675 | 79.35595 | 18.247 | 1799.77 | 30.41 |
| 6-F-T-12-3-L2-A | 8.03497 | 15.89977 | 79.37500 | 17.899 | 1765.10 | 16.15 |
| 6-F-T-12-4-L2-W | 8.04450 | 15.89945 | 79.37500 | 17.918 | 1764.92 | 25.50 |
| 6-F-T-12-4-L4-W | 8.01338 | 15.89977 | 79.35595 | 17.845 | 1764.94 | 23.33 |
| 6-F-T-12-5-L2-W | 8.01402 | 15.89532 | 79.36230 | 17.840 | 1764.66 | 27.28 |
| 6-F-T-12-5-L4-W | 8.03402 | 15.90262 | 79.37500 | 17.911 | 1766.18 | 25.92 |
| 6-F-T-12-6-L1-W | 8.01561 | 15.89881 | 79.37500 | 18.118 | 1791.12 | 30.23 |
| 6-F-T-12-6-L4-W | 8.03815 | 15.90294 | 79.36865 | 18.129 | 1786.86 | 27.79 |
| 6-F-T-12-7-L1-W | 8.03688 | 15.90294 | 79.36230 | 18.255 | 1799.71 | 30.81 |
| 6-F-T-12-7-L4-W | 8.02259 | 15.89913 | 79.37500 | 18.264 | 1803.95 | 30.07 |
| 6-F-T-13-4-L2-A | 8.01751 | 15.91342 | 79.33690 | 17.841 | 1762.55 | 16.51 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 6-F-T-13-5-L2-A | 8.02545 | 15.91183 | 79.38770 | 17.897 | 1765.38 | 15.93 |
| 6-F-T-13-6-L2-A | 8.03783 | 15.89945 | 79.38770 | 17.918 | 1766.10 | 16.24 |
| 6-F-T-13-7-L2-A | 8.03497 | 15.91120 | 79.35595 | 18.006 | 1774.80 | 22.52 |
| 6-F-T-15-7-L2-A | 8.03307 | 15.89469 | 79.33055 | 18.101 | 1787.02 | 24.48 |
| 6-F-T-15-4-L2-A | 8.03593 | 15.91564 | 79.36230 | 17.860 | 1759.57 | 14.25 |
| 6-F-T-15-5-L2-A | 8.02799 | 15.91564 | 79.36230 | 17.855 | 1760.82 | 19.65 |
| 6-F-T-15-6-L2-A | 8.03116 | 15.91850 | 79.37500 | 17.936 | 1767.51 | 20.40 |
| 6-F-T-16-3-L2-A | 8.03624 | 15.89913 | 79.35595 | 17.887 | 1764.13 | 15.79 |
| 6-F-T-16-4-L2-W | 8.02926 | 15.90485 | 79.40040 | 17.948 | 1770.06 | 26.33 |
| 6-F-T-16-4-L4-W | 8.02799 | 15.89945 | 79.38135 | 17.928 | 1769.39 | 24.48 |
| 6-F-T-16-5-L2-W | 8.02545 | 15.90199 | 79.35595 | 17.953 | 1772.71 | 27.00 |
| 6-F-T-16-5-L4-W | 8.02989 | 15.89881 | 79.36865 | 17.997 | 1776.14 | 28.31 |
| 6-F-T-16-6-L1-W | 8.03053 | 15.90262 | 79.34325 | 18.082 | 1784.53 | 28.30 |
| 6-F-T-16-6-L4-W | 8.02608 | 15.89850 | 79.37500 | 18.120 | 1789.02 | 28.77 |
| 6-F-T-16-7-L1-W | 8.02164 | 15.89945 | 79.34325 | 18.290 | 1807.42 | 30.26 |
| 6-F-T-16-7-L4-W | 8.02577 | 15.90485 | 79.36865 | 18.392 | 1815.37 | 30.20 |
| 6-F-W-01-3-A | 8.02862 | 15.89754 | 79.39405 | 17.909 | 1767.31 | 16.16 |
| 6-F-W-01-5-A | 8.03497 | 15.90866 | 79.32420 | 18.019 | 1777.08 | 18.03 |
| 6-F-W-01-6-A | 8.03243 | 15.91056 | 79.37500 | 18.007 | 1775.11 | 21.95 |
| 6-F-W-01-7-A | 8.02704 | 15.92453 | 79.36865 | 18.105 | 1784.55 | 26.23 |
| 6-F-W-04-5-A | 8.03275 | 15.91088 | 79.38770 | 17.999 | 1773.93 | 16.82 |
| 6-F-W-04-6-A | 8.03180 | 15.90834 | 79.38135 | 17.934 | 1768.16 | 22.18 |
| 6-F-W-04-7-A | 8.02735 | 15.91596 | 79.37500 | 18.086 | 1783.42 | 26.51 |
| 6-F-W-07-6-A | 8.03497 | 15.90231 | 79.36865 | 18.004 | 1775.32 | 22.81 |
| 6-F-W-07-7-A | 8.03656 | 15.91501 | 79.33690 | 18.294 | 1802.84 | 25.87 |
| 6-F-W-10-5-A | 8.04196 | 15.91183 | 79.36230 | 17.987 | 1771.18 | 18.23 |
| 6-F-W-10-6-A | 8.02577 | 15.91659 | 79.39405 | 18.001 | 1774.89 | 22.34 |
| 6-F-W-10-7-A | 8.02577 | 15.91247 | 79.35595 | 18.321 | 1807.78 | 28.85 |
| 6-F-W-11-3-A | 8.03434 | 15.91628 | 79.38135 | 17.879 | 1761.30 | 15.25 |
| 6-F-W-14-3-A | 8.03593 | 15.91247 | 79.38135 | 18.006 | 1773.88 | 20.60 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 7-F-R-03-L1-W | 8.01783 | 15.91056 | 79.33055 | 17.931 | 1771.83 | 21.31 |
| 7-F-R-03-L3-W | 8.03497 | 15.88389 | 79.31785 | 17.988 | 1776.93 | 25.30 |
| 7-F-R-09-L1-W | 8.03847 | 15.90421 | 79.32420 | 18.025 | 1777.40 | 22.07 |
| 7-F-R-09-L3-W | 8.02894 | 15.90739 | 79.34960 | 18.063 | 1782.33 | 23.83 |
| 7-F-R-14-L1-W | 8.03815 | 15.92167 | 79.29880 | 17.973 | 1770.96 | 22.32 |
| 7-F-R-14-L3-W | 8.03180 | 15.90866 | 79.36865 | 17.974 | 1772.35 | 24.21 |
| 7-F-T-06-1-L1-W | 8.03180 | 15.92167 | 79.33055 | 17.923 | 1766.72 | 21.58 |
| 7-F-T-06-1-L4-W | 8.02894 | 15.91786 | 79.35595 | 18.096 | 1784.27 | 23.12 |
| 7-F-T-06-2-L1-W | 8.03053 | 15.91183 | 79.37500 | 17.925 | 1767.30 | 24.27 |
| 7-F-T-06-2-L4-W | 8.02037 | 15.91056 | 79.36230 | 18.038 | 1781.13 | 22.27 |
| 7-F-T-06-3-L1-W | 8.03593 | 15.91596 | 79.35595 | 17.902 | 1763.82 | 21.18 |
| 7-F-T-06-3-L4-W | 8.02354 | 15.89437 | 79.31785 | 18.008 | 1780.27 | 23.54 |
| 7-F-T-06-4-L1-W | 8.02799 | 15.90040 | 79.38770 | 17.885 | 1764.90 | 23.76 |
| 7-F-T-06-4-L4-W | 8.02100 | 15.91882 | 79.35595 | 17.994 | 1775.86 | 24.38 |
| 7-F-T-06-5-L1-W | 8.03751 | 15.91024 | 79.37500 | 18.082 | 1781.41 | 26.83 |
| 7-F-T-06-5-L4-W | 8.03402 | 15.91120 | 79.33055 | 18.063 | 1781.20 | 26.29 |
| 7-F-T-06-6-L1-W | 8.02196 | 15.91151 | 79.36865 | 18.063 | 1782.99 | 27.01 |
| 7-F-T-06-6-L4-W | 8.01942 | 15.91723 | 79.33055 | 18.102 | 1787.62 | 28.30 |
| 7-F-T-06-7-L1-W | 8.03529 | 15.90358 | 79.38770 | 18.180 | 1792.03 | 30.84 |
| 7-F-T-06-7-L4-W | 8.02513 | 15.90612 | 79.37500 | 18.077 | 1784.13 | 27.61 |
| 7-F-T-12-3-L2-A | 8.04355 | 15.90643 | 79.38770 | 17.933 | 1765.55 | 15.87 |
| 7-F-T-12-4-L2-W | 8.03751 | 15.90707 | 79.35595 | 18.339 | 1807.53 | 31.99 |
| 7-F-T-12-4-L4-W | 8.03878 | 15.89913 | 79.36865 | 18.114 | 1785.67 | 26.71 |
| 7-F-T-12-5-L2-W | 8.01846 | 15.41748 | 79.38135 | 17.465 | 1779.69 | 25.35 |
| 7-F-T-12-5-L4-W | 8.04418 | 15.90993 | 79.36865 | 18.097 | 1781.59 | 24.38 |
| 7-F-T-12-6-L1-W | 8.03085 | 15.89818 | 79.33055 | 18.092 | 1786.23 | 28.55 |
| 7-F-T-12-6-L4-W | 8.03910 | 15.91310 | 79.34960 | 18.241 | 1796.97 | 29.44 |
| 7-F-T-12-7-L1-W | 8.03053 | 15.90961 | 79.36230 | 18.333 | 1808.07 | 30.84 |
| 7-F-T-12-7-L4-W | 8.03243 | 15.90675 | 79.34325 | 18.324 | 1807.51 | 30.09 |
| 7-F-T-13-4-L2-A | 8.02989 | 15.90104 | 79.35595 | 17.968 | 1773.31 | 18.09 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 7-F-T-13-5-L2-A | 8.03370 | 15.91088 | 79.37500 | 18.087 | 1782.68 | 22.24 |
| 7-F-T-13-6-L2-A | 8.03339 | 15.90834 | 79.36865 | 18.100 | 1784.46 | 23.49 |
| 7-F-T-13-7-L2-A | 8.01846 | 15.91596 | 79.36865 | 18.367 | 1813.28 | 29.56 |
| 7-F-T-15-7-L2-A | 8.02831 | 15.90421 | 79.33690 | 18.017 | 1778.57 | 18.68 |
| 7-F-T-15-4-L2-A | 8.03085 | 15.90548 | 79.33055 | 17.924 | 1768.83 | 18.62 |
| 7-F-T-15-5-L2-A | 8.02926 | 15.91691 | 79.33055 | 18.231 | 1798.19 | 24.11 |
| 7-F-T-15-6-L2-A | 8.03243 | 15.91628 | 79.33055 | 18.084 | 1783.06 | 25.87 |
| 7-F-T-16-3-L2-A | 8.03116 | 15.90104 | 79.48930 | 17.881 | 1761.49 | 17.52 |
| 7-F-T-16-4-L2-W | 8.03085 | 15.90770 | 79.40040 | 17.946 | 1769.20 | 26.10 |
| 7-F-T-16-4-L4-W | 8.02767 | 15.91882 | 79.31785 | 18.080 | 1783.72 | 26.99 |
| 7-F-T-16-5-L2-W | 8.03593 | 15.90929 | 79.35595 | 17.986 | 1772.84 | 27.61 |
| 7-F-T-16-5-L4-W | 8.02989 | 15.86389 | 79.34960 | 18.009 | 1781.66 | 24.23 |
| 7-F-T-16-6-L1-W | 8.02704 | 15.90389 | 79.37500 | 18.093 | 1785.53 | 29.71 |
| 7-F-T-16-6-L4-W | 8.03910 | 15.92072 | 79.34960 | 18.165 | 1788.63 | 29.27 |
| 7-F-T-16-7-L1-W | 8.03815 | 15.91056 | 79.36230 | 18.366 | 1809.50 | 31.87 |
| 7-F-T-16-7-L4-W | 8.02926 | 15.91945 | 79.34325 | 18.316 | 1806.00 | 30.97 |
| 7-F-W-01-3-A | 8.02704 | 15.88421 | 79.38135 | 18.023 | 1780.69 | 16.07 |
| 7-F-W-01-5-A | 8.03275 | 15.88421 | 79.39405 | 18.055 | 1782.30 | 20.30 |
| 7-F-W-01-6-A | 8.00894 | 15.92072 | 79.36865 | 17.940 | 1772.70 | 20.27 |
| 7-F-W-01-7-A | 8.02545 | 15.92136 | 79.37500 | 18.224 | 1796.85 | 24.35 |
| 7-F-W-04-5-A | 8.01783 | 15.89754 | 79.38770 | 18.075 | 1786.23 | 22.09 |
| 7-F-W-04-6-A | 8.03561 | 15.91151 | 79.40040 | 18.089 | 1781.81 | 24.51 |
| 7-F-W-04-7-A | 8.03815 | 15.91469 | 79.36865 | 18.347 | 1807.02 | 30.11 |
| 7-F-W-07-6-A | 8.01815 | 15.88770 | 79.39405 | 18.037 | 1783.37 | 23.32 |
| 7-F-W-07-7-A | 8.01243 | 15.91437 | 79.36865 | 18.080 | 1786.47 | 26.80 |
| 7-F-W-10-5-A | 8.03307 | 15.90358 | 79.33055 | 17.885 | 1764.71 | 17.40 |
| 7-F-W-10-6-A | 8.03529 | 15.90866 | 79.34960 | 18.152 | 1789.55 | 23.79 |
| 7-F-W-10-7-A | 8.03116 | 15.89818 | 79.36230 | 18.165 | 1792.65 | 26.55 |
| 7-F-W-11-3-A | 8.02926 | 15.87881 | 79.37500 | 18.003 | 1778.97 | 17.77 |
| 7-F-W-14-3-A | 8.03212 | 15.88770 | 79.38135 | 17.981 | 1775.02 | 16.13 |

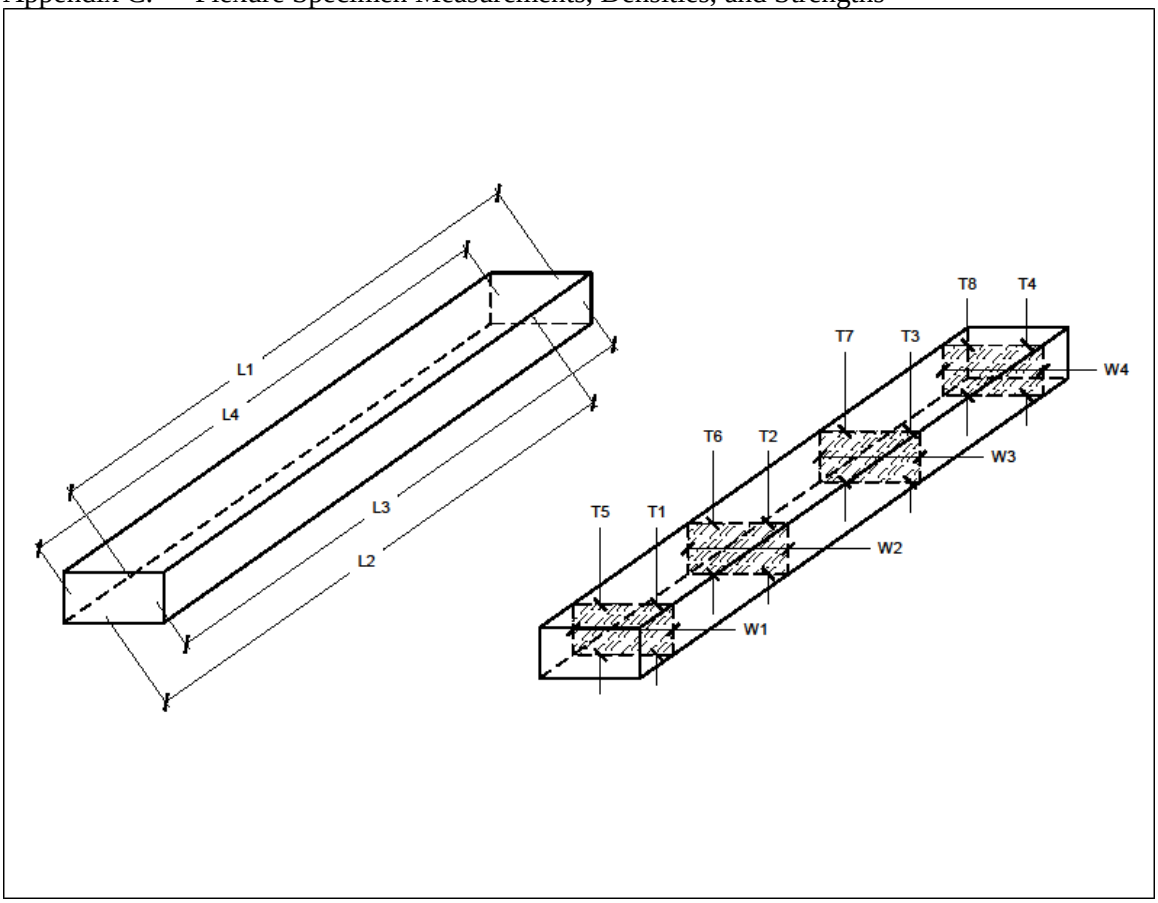
Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 8-F-R-03-L1-W | 8.02608 | 15.91691 | 79.34325 | 18.245 | 1800.00 | 25.11 |
| 8-F-R-03-L3-W | 8.02926 | 15.91850 | 79.35595 | 18.284 | 1802.66 | 24.31 |
| 8-F-R-09-L1-W | 8.04259 | 15.90866 | 79.33055 | 18.217 | 1794.76 | 23.39 |
| 8-F-R-09-L3-W | 8.04545 | 15.90389 | 79.37500 | 18.392 | 1810.89 | 26.07 |
| 8-F-R-14-L1-W | 8.02672 | 15.90485 | 79.36230 | 18.303 | 1806.51 | 23.99 |
| 8-F-R-14-L3-W | 8.02513 | 15.90008 | 79.33055 | 18.153 | 1793.31 | 25.11 |
| 8-F-T-06-1-L1-W | 8.04164 | 15.90548 | 79.34960 | 18.175 | 1790.76 | 24.91 |
| 8-F-T-06-1-L4-W | 8.04291 | 15.90008 | 79.31785 | 18.377 | 1811.72 | 30.08 |
| 8-F-T-06-2-L1-W | 8.04513 | 15.90294 | 79.35595 | 18.169 | 1789.54 | 23.47 |
| 8-F-T-06-2-L4-W | 8.03910 | 15.90294 | 79.40040 | 18.490 | 1821.50 | 31.45 |
| 8-F-T-06-3-L1-W | 8.02386 | 15.90485 | 79.36230 | 18.111 | 1788.20 | 22.88 |
| 8-F-T-06-3-L4-W | 8.03243 | 15.89913 | 79.32420 | 18.567 | 1832.80 | 30.82 |
| 8-F-T-06-4-L1-W | 8.01624 | 15.89850 | 79.36865 | 18.065 | 1785.92 | 24.48 |
| 8-F-T-06-4-L4-W | 8.02989 | 15.90548 | 79.36865 | 18.574 | 1832.31 | 30.11 |
| 8-F-T-06-5-L1-W | 8.02513 | 15.90739 | 79.33055 | 18.118 | 1789.04 | 26.56 |
| 8-F-T-06-5-L4-W | 8.04228 | 15.89596 | 79.30515 | 18.512 | 1825.94 | 31.97 |
| 8-F-T-06-6-L1-W | 8.02989 | 15.89754 | 79.36230 | 18.153 | 1791.82 | 28.66 |
| 8-F-T-06-6-L4-W | 8.02958 | 15.90485 | 79.38135 | 18.544 | 1829.21 | 33.15 |
| 8-F-T-06-7-L1-W | 8.02926 | 15.91215 | 79.36865 | 18.145 | 1789.39 | 27.12 |
| 8-F-T-06-7-L4-W | 8.02926 | 15.90358 | 79.31785 | 18.426 | 1819.24 | 29.80 |
| 8-F-T-12-3-L2-A | 8.03561 | 15.92136 | 79.36865 | 18.251 | 1797.38 | 22.41 |
| 8-F-T-12-4-L2-W | 8.00894 | 15.92072 | 79.38135 | 18.154 | 1793.56 | 26.16 |
| 8-F-T-12-4-L4-W | 8.04291 | 15.92263 | 79.35595 | 18.428 | 1813.30 | 32.26 |
| 8-F-T-12-5-L2-W | 8.04386 | 15.91723 | 79.37500 | 18.249 | 1795.66 | 26.36 |
| 8-F-T-12-5-L4-W | 8.04228 | 15.91913 | 79.31785 | 18.573 | 1829.00 | 31.26 |
| 8-F-T-12-6-L1-W | 8.03783 | 15.92072 | 79.35595 | 18.247 | 1796.84 | 29.89 |
| 8-F-T-12-6-L4-W | 8.03942 | 15.91596 | 79.34960 | 18.434 | 1815.59 | 32.89 |
| 8-F-T-12-7-L1-W | 8.02196 | 15.91532 | 79.38770 | 18.222 | 1797.82 | 31.11 |
| 8-F-T-12-7-L4-W | 8.03656 | 15.91723 | 79.36865 | 18.495 | 1821.66 | 32.88 |
| 8-F-T-13-4-L2-A | 8.04037 | 15.89913 | 79.33690 | 18.330 | 1807.33 | 24.79 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths

| | Averages | | | | | |
|---|---|---|---|---|---|---|
| | Thickness | Width | Length | Weight | Density | Strength |
| Specimen ID | mm | mm | mm | g | kg/m$^3$ | MPa |
| 8-F-T-13-5-L2-A | 8.02831 | 15.90262 | 79.37500 | 18.358 | 1811.54 | 27.68 |
| 8-F-T-13-6-L2-A | 8.04577 | 15.89754 | 79.34960 | 18.446 | 1817.44 | 28.73 |
| 8-F-T-13-7-L2-A | 8.02608 | 15.90135 | 79.37500 | 18.405 | 1816.83 | 28.44 |
| 8-F-T-15-7-L2-A | 8.02862 | 15.90675 | 79.35595 | 18.412 | 1816.77 | 28.84 |
| 8-F-T-15-4-L2-A | 8.04196 | 15.89596 | 79.36865 | 18.336 | 1807.20 | 26.09 |
| 8-F-T-15-5-L2-A | 8.02958 | 15.90643 | 79.34960 | 18.388 | 1814.36 | 27.31 |
| 8-F-T-15-6-L2-A | 8.02926 | 15.90548 | 79.30515 | 18.383 | 1815.07 | 28.09 |
| 8-F-T-16-3-L2-A | 8.03751 | 15.91564 | 79.34960 | 18.383 | 1811.03 | 23.87 |
| 8-F-T-16-4-L2-W | 8.03815 | 15.91786 | 79.34960 | 18.255 | 1798.03 | 25.65 |
| 8-F-T-16-4-L4-W | 8.04418 | 15.90580 | 79.34325 | 18.419 | 1814.34 | 29.68 |
| 8-F-T-16-5-L2-W | 8.03910 | 15.91501 | 79.36865 | 18.292 | 1801.35 | 27.08 |
| 8-F-T-16-5-L4-W | 8.04037 | 15.91183 | 79.33055 | 18.483 | 1821.11 | 31.19 |
| 8-F-T-16-6-L1-W | 8.04926 | 15.90866 | 79.34960 | 18.249 | 1795.99 | 27.79 |
| 8-F-T-16-6-L4-W | 8.03688 | 15.89342 | 79.33690 | 18.448 | 1820.41 | 30.40 |
| 8-F-T-16-7-L1-W | 8.04005 | 15.92072 | 79.30515 | 18.323 | 1804.99 | 30.62 |
| 8-F-T-16-7-L4-W | 8.04228 | 15.90802 | 79.36230 | 18.470 | 1819.10 | 32.67 |
| 8-F-W-01-3-A | 8.01719 | 15.91723 | 79.36230 | 18.381 | 1814.95 | 24.82 |
| 8-F-W-01-5-A | 8.02799 | 15.92040 | 79.37500 | 18.362 | 1809.99 | 25.99 |
| 8-F-W-01-6-A | 8.02862 | 15.91405 | 79.38135 | 18.312 | 1805.49 | 25.89 |
| 8-F-W-01-7-A | 8.02926 | 15.91818 | 79.32420 | 18.332 | 1808.15 | 27.35 |
| 8-F-W-04-5-A | 8.04196 | 15.90421 | 79.34325 | 18.311 | 1804.38 | 28.27 |
| 8-F-W-04-6-A | 8.02926 | 15.90421 | 79.34960 | 18.379 | 1813.80 | 27.05 |
| 8-F-W-04-7-A | 8.03402 | 15.89532 | 79.31785 | 18.360 | 1812.59 | 25.99 |
| 8-F-W-07-6-A | 8.02513 | 15.90739 | 79.34960 | 18.384 | 1814.87 | 25.64 |
| 8-F-W-07-7-A | 7.98259 | 15.90929 | 79.36230 | 18.274 | 1813.11 | 29.01 |
| 8-F-W-10-5-A | 8.04132 | 15.90421 | 79.34325 | 18.285 | 1801.96 | 26.11 |
| 8-F-W-10-6-A | 8.03847 | 15.89659 | 79.26705 | 18.335 | 1810.14 | 26.02 |
| 8-F-W-10-7-A | 8.04386 | 15.90770 | 79.36230 | 18.441 | 1815.93 | 29.28 |
| 8-F-W-11-3-A | 8.02735 | 15.92644 | 79.30515 | 18.344 | 1809.26 | 21.60 |
| 8-F-W-14-3-A | 8.02132 | 15.89596 | 79.33055 | 18.329 | 1812.03 | 23.78 |

Appendix C. Flexure Specimen Measurements, Densities, and Strengths



# APPENDIX D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 1-F-R-03-L1-W | 9.54 | 4.13 |
| 1-F-R-03-L3-W | 9.34 | 4.07 |
| 1-F-R-09-L1-W | 9.90 | 4.26 |
| 1-F-R-09-L3-W | 9.57 | 4.11 |
| 1-F-R-14-L1-W | 9.64 | 4.19 |
| 1-F-R-14-L3-W | 9.56 | 4.15 |
| 1-F-T-06-1-L1-W | 9.57 | 4.03 |
| 1-F-T-06-1-L4-W | 9.75 | 3.90 |
| 1-F-T-06-2-L1-W | 9.86 | 4.09 |
| 1-F-T-06-2-L4-W | 9.88 | 4.01 |
| 1-F-T-06-3-L1-W | 10.15 | 4.15 |
| 1-F-T-06-3-L4-W | 10.11 | 4.11 |
| 1-F-T-06-4-L1-W | 10.35 | 4.21 |
| 1-F-T-06-4-L4-W | 10.09 | 4.11 |
| 1-F-T-06-5-L1-W | 10.00 | 4.09 |
| 1-F-T-06-5-L4-W | 10.14 | 4.11 |
| 1-F-T-06-6-L1-W | 10.35 | 4.22 |
| 1-F-T-06-6-L4-W | 10.20 | 4.13 |
| 1-F-T-06-7-L1-W | 10.27 | 4.19 |
| 1-F-T-06-7-L4-W | 10.35 | 4.20 |
| 1-F-T-12-3-L2-A | 7.08 | 3.59 |
| 1-F-T-12-4-L2-W | 9.82 | 3.87 |
| 1-F-T-12-4-L4-W | 9.99 | 3.90 |
| 1-F-T-12-5-L2-W | 10.18 | 4.11 |
| 1-F-T-12-5-L4-W | 10.31 | 4.18 |
| 1-F-T-12-6-L1-W | 10.09 | 4.09 |
| 1-F-T-12-6-L4-W | 10.37 | 4.21 |
| 1-F-T-12-7-L1-W | 10.30 | 4.17 |
| 1-F-T-12-7-L4-W | 10.50 | 4.30 |
| 1-F-T-13-4-L2-A | 8.44 | 3.88 |
| 1-F-T-13-5-L2-A | 8.79 | 3.99 |
| 1-F-T-13-6-L2-A | 9.77 | 4.23 |
| 1-F-T-13-7-L2-A | 10.17 | 4.31 |
| 1-F-T-15-7-L2-A | 8.13 | 4.41 |
| 1-F-T-15-4-L2-A | 7.85 | 3.78 |
| 1-F-T-15-5-L2-A | 9.03 | 4.08 |
| 1-F-T-15-6-L2-A | 9.91 | 4.30 |
| 1-F-T-16-3-L2-A | 8.00 | 3.83 |
| 1-F-T-16-4-L2-W | 10.14 | 4.15 |
| 1-F-T-16-4-L4-W | 10.35 | 4.15 |
| 1-F-T-16-5-L2-W | 10.32 | 4.20 |
| 1-F-T-16-5-L4-W | 8.92 | 3.76 |
| 1-F-T-16-6-L1-W | 9.02 | 3.83 |
| 1-F-T-16-6-L4-W | 9.09 | 3.81 |
| 1-F-T-16-7-L1-W | 10.65 | 4.32 |
| 1-F-T-16-7-L4-W | 10.61 | 2.82 |
| 1-F-W-01-3-A | 7.94 | 3.71 |
| 1-F-W-01-5-A | 9.24 | 4.06 |
| 1-F-W-01-6-A | 6.49 | 4.22 |
| 1-F-W-01-7-A | 9.71 | 4.22 |
| 1-F-W-04-5-A | 8.79 | 3.97 |
| 1-F-W-04-6-A | 9.30 | 4.11 |
| 1-F-W-04-7A | 9.56 | 2.69 |
| 1-F-W-07-6-A | 9.22 | 4.07 |
| 1-F-W-07-7-A | 9.85 | 4.22 |
| 1-F-W-10-5-A | 9.21 | 4.11 |
| 1-F-W-10-6-A | 9.38 | 4.13 |
| 1-F-W-10-7-A | 10.18 | 4.37 |
| 1-F-W-11-3-A | 7.79 | 3.72 |
| 1-F-W-14-3-A | 8.41 | 3.91 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 2-F-R-03-L1-W | 9.39 | 4.10 |
| 2-F-R-03-L3-W | 9.11 | 4.01 |
| 2-F-R-09-L1-W | 9.28 | 4.06 |
| 2-F-R-09-L3-W | 9.31 | 4.02 |
| 2-F-R-14-L1-W | 9.47 | 4.12 |
| 2-F-R-14-L3-W | 9.18 | 4.02 |
| 2-F-T-06-1-L1-W | 9.68 | 3.91 |
| 2-F-T-06-1-L4-W | 9.81 | 3.97 |
| 2-F-T-06-2-L1-W | 9.55 | 3.87 |
| 2-F-T-06-2-L4-W | 9.68 | 3.95 |
| 2-F-T-06-3-L1-W | 9.72 | 3.86 |
| 2-F-T-06-3-L4-W | 9.93 | 4.00 |
| 2-F-T-06-4-L1-W | 9.78 | 3.98 |
| 2-F-T-06-4-L4-W | 10.10 | 4.15 |
| 2-F-T-06-5-L4-W | 10.18 | 4.15 |
| 2-F-T-06-6-L1-W | 10.36 | 4.24 |
| 2-F-T-06-6-L4-W | 10.28 | 4.20 |
| 2-F-T-06-7-L1-W | 10.48 | 4.27 |
| 2-F-T-06-7-L4-W | 10.43 | 4.26 |
| 2-F-T-12-3-L2-A | 7.63 | 3.70 |
| 2-F-T-12-4-L2-W | 9.92 | 4.05 |
| 2-F-T-12-4-L4-W | 9.90 | 4.07 |
| 2-F-T-12-5-L2-W | 10.11 | 4.14 |
| 2-F-T-12-5-L4-W | 10.02 | 4.06 |
| 2-F-T-12-6-L1-W | 10.42 | 4.28 |
| 2-F-T-12-6-L4-W | 10.30 | 4.21 |
| 2-F-T-12-7-L1-W | 10.51 | 4.29 |
| 2-F-T-12-7-L4-W | 10.74 | 4.42 |
| 2-F-T-13-4-L2-A | 7.89 | 3.79 |
| 2-F-T-13-5-L2-A | 8.29 | 3.88 |
| 2-F-T-13-6-L2-A | 8.98 | 4.00 |
| 2-F-T-13-7-L2-A | 9.49 | 4.16 |
| 2-F-T-15-7-L2-A | 9.80 | 4.26 |
| 2-F-T-15-4-L2-A | 7.89 | 3.74 |
| 2-F-T-15-5-L2-A | 8.44 | 3.92 |
| 2-F-T-15-6-L2-A | 8.93 | 4.04 |
| 2-F-T-16-3-L2-A | 7.94 | 3.80 |
| 2-F-T-16-4-L2-W | 10.62 | 4.32 |
| 2-F-T-16-4-L4-W | 10.46 | 4.31 |
| 2-F-T-16-5-L2-W | 10.29 | 4.22 |
| 2-F-T-16-5-L4-W | 10.30 | 4.20 |
| 2-F-T-16-6-L1-W | 10.26 | 4.14 |
| 2-F-T-16-6-L4-W | 10.15 | 4.13 |
| 2-F-T-16-7-L1-W | 9.91 | 4.00 |
| 2-F-T-16-7-L4-W | 9.90 | 4.00 |
| 2-F-W-01-3-A | 8.10 | 3.75 |
| 2-F-W-01-5-A | 9.23 | 4.00 |
| 2-F-W-01-6-A | 9.62 | 4.23 |
| 2-F-W-01-7A | 10.45 | 4.33 |
| 2-F-W-04-5-A | 8.87 | 3.99 |
| 2-F-W-04-6-A | 9.45 | 4.17 |
| 2-F-W-04-7-A | 9.95 | 4.30 |
| 2-F-W-07-6-A | 9.84 | 4.25 |
| 2-F-W-07-7-A | 10.10 | 4.32 |
| 2-F-W-10-5-A | 9.38 | 4.12 |
| 2-F-W-10-6-A | 10.14 | 4.36 |
| 2-F-W-10-7-A | 10.02 | 4.29 |
| 2-F-W-11-3-A | 7.68 | 3.65 |
| 2-F-W-14-3-A | 7.33 | 3.54 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 3-F-R-03-L1-W | 9.35 | 4.06 |
| 3-F-R-03-L3-W | 9.12 | 3.98 |
| 3-F-R-09-L1-W | 9.24 | 3.96 |
| 3-F-R-09-L3-W | 9.18 | 3.99 |
| 3-F-R-14-L1-W | 9.31 | 4.03 |
| 3-F-R-14-L3-W | 9.16 | 3.96 |
| 3-F-T-06-1-L1-W | 9.43 | 3.91 |
| 3-F-T-06-1-L4-W | 9.52 | 3.89 |
| 3-F-T-06-2-L1-W | 9.46 | 3.87 |
| 3-F-T-06-2-L4-W | 9.59 | 3.86 |
| 3-F-T-06-3-L1-W | 9.57 | 3.80 |
| 3-F-T-06-3-L4-W | 9.63 | 3.85 |
| 3-F-T-06-4-L1-W | 9.88 | 4.01 |
| 3-F-T-06-4-L4-W | 9.77 | 3.93 |
| 3-F-T-06-5-L1-W | 9.96 | 4.03 |
| 3-F-T-06-5-L4-W | 10.08 | 4.08 |
| 3-F-T-06-6-L1-W | 10.20 | 4.14 |
| 3-F-T-06-6-L4-W | 10.19 | 4.15 |
| 3-F-T-06-7-L1-W | 10.31 | 4.21 |
| 3-F-T-06-7-L4-W | 10.50 | 4.26 |
| 3-F-T-12-3-L2-A | 7.90 | 3.61 |
| 3-F-T-12-4-L2-W | 9.95 | 3.99 |
| 3-F-T-12-4-L4-W | 9.97 | 4.04 |
| 3-F-T-12-5-L2-W | 10.24 | 4.15 |
| 3-F-T-12-5-L4-W | 10.06 | 4.13 |
| 3-F-T-12-6-L1-W | 10.59 | 4.30 |
| 3-F-T-12-6-L4-W | 10.48 | 4.27 |
| 3-F-T-12-7-L1-W | 10.67 | 4.37 |
| 3-F-T-12-7-L4-W | 10.54 | 4.45 |
| 3-F-T-13-4-L2-A | x | x |
| 3-F-T-13-5-L2-A | 8.20 | 3.78 |
| 3-F-T-13-6-L2-A | 8.61 | 3.88 |
| 3-F-T-13-7-L2-A | 10.17 | 4.35 |
| 3-F-T-15-7-L2-A | 10.34 | 4.38 |
| 3-F-T-15-4-L2-A | 7.62 | 3.70 |
| 3-F-T-15-5-L2-A | 8.00 | 3.78 |
| 3-F-T-15-6-L2-A | 8.78 | 3.93 |
| 3-F-T-16-3-L2-A | 7.50 | 3.71 |
| 3-F-T-16-4-L2-W | 9.93 | 3.99 |
| 3-F-T-16-4-L4-W | 10.09 | 4.01 |
| 3-F-T-16-5-L2-W | 10.02 | 4.03 |
| 3-F-T-16-5-L4-W | 10.07 | 4.01 |
| 3-F-T-16-6-L1-W | 10.36 | 4.20 |
| 3-F-T-16-6-L4-W | 10.14 | 4.09 |
| 3-F-T-16-7-L1-W | 10.55 | 4.31 |
| 3-F-T-16-7-L4-W | 9.76 | 4.01 |
| 3-F-W-01-3-A | 8.12 | 3.73 |
| 3-F-W-01-5-A | 8.51 | 3.75 |
| 3-F-W-01-6-A | 10.00 | 4.17 |
| 3-F-W-01-7-A | 10.73 | 4.37 |
| 3-F-W-04-5-A | 8.19 | 3.86 |
| 3-F-W-04-6-A | 9.07 | 4.02 |
| 3-F-W-04-7-A | 10.31 | 4.39 |
| 3-F-W-07-6-A | 10.29 | 4.37 |
| 3-F-W-07-7-A | 10.49 | 4.41 |
| 3-F-W-10-5-A | 8.87 | 3.99 |
| 3-F-W-10-6-A | 9.72 | 4.23 |
| 3-F-W-10-7-A | 10.44 | 4.40 |
| 3-F-W-11-3-A | 7.42 | 3.56 |
| 3-F-W-14-3-A | 7.36 | 3.65 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 4-F-R-03-L1-W | 8.89 | 3.93 |
| 4-F-R-03-L3-W | 8.98 | 3.95 |
| 4-F-R-09-L1-W | 9.03 | 3.96 |
| 4-F-R-09-L3-W | 8.52 | 3.79 |
| 4-F-R-14-L1-W | 8.46 | 3.68 |
| 4-F-R-14-L3-W | 8.77 | 3.91 |
| 4-F-T-06-1-L1-W | 9.05 | 3.79 |
| 4-F-T-06-1-L4-W | 9.02 | 3.82 |
| 4-F-T-06-2-L1-W | 9.25 | 3.82 |
| 4-F-T-06-2-L4-W | 9.23 | 3.83 |
| 4-F-T-06-3-L1-W | 9.43 | 3.88 |
| 4-F-T-06-3-L4-W | 9.59 | 3.84 |
| 4-F-T-06-4-L1-W | 9.65 | 3.92 |
| 4-F-T-06-4-L4-W | 9.69 | 3.96 |
| 4-F-T-06-5-L1-W | 9.51 | 3.87 |
| 4-F-T-06-5-L4-W | 9.19 | 3.85 |
| 4-F-T-06-6-L1-W | 9.86 | 4.04 |
| 4-F-T-06-6-L4-W | 9.80 | 3.99 |
| 4-F-T-06-7-L1-W | 10.20 | 4.18 |
| 4-F-T-06-7-L4-W | 10.26 | 4.20 |
| 4-F-T-12-4-L2-W | 7.72 | 3.66 |
| 4-F-T-12-4-L4-W | 9.62 | 3.86 |
| 4-F-T-12-5-L2-W | 9.59 | 3.88 |
| 4-F-T-12-5-L4-W | 9.52 | 3.84 |
| 4-F-T-12-6-L1-W | 10.15 | 4.13 |
| 4-F-T-12-6-L4-W | 10.18 | 4.26 |
| 4-F-T-12-7-L1-W | 10.17 | 4.17 |
| 4-F-T-12-7-L4-W | 10.30 | 4.19 |
| 4-F-T-12-3-L2-A | 7.73 | 3.68 |
| 4-F-T-13-4-L2-A | 7.87 | 3.71 |
| 4-F-T-13-5-L2-A | 8.26 | 3.81 |
| 4-F-T-13-6-L2-A | 8.78 | 3.93 |
| 4-F-T-13-7-L2-A | 10.06 | 4.29 |
| 4-F-T-15-7-L2-A | 9.98 | 4.28 |
| 4-F-T-15-4-L2-A | 7.77 | 3.73 |
| 4-F-T-15-5-L2-A | x | x |
| 4-F-T-15-6-L2-A | 9.44 | 4.10 |
| 4-F-T-16-3-L2-A | 7.30 | 3.58 |
| 4-F-T-16-4-L2-W | 9.66 | 3.91 |
| 4-F-T-16-4-L4-W | 9.65 | 3.91 |
| 4-F-T-16-5-L2-W | 9.70 | 3.91 |
| 4-F-T-16-5-L4-W | 9.71 | 3.95 |
| 4-F-T-16-6-L1-W | 10.10 | 4.12 |
| 4-F-T-16-6-L4-W | 9.97 | 4.03 |
| 4-F-T-16-7-L1-W | 10.39 | 4.26 |
| 4-F-T-16-7-L4-W | 10.44 | 4.28 |
| 4-F-W-01-3-A | 7.89 | 3.64 |
| 4-F-W-01-5-A | 8.51 | 3.79 |
| 4-F-W-01-6-A | 9.42 | 3.98 |
| 4-F-W-01-7-A | 10.43 | 4.30 |
| 4-F-W-04-5-A | 7.82 | 3.67 |
| 4-F-W-04-6-A | 9.32 | 4.09 |
| 4-F-W-04-7-A | 9.97 | 4.30 |
| 4-F-W-07-6-A | 9.60 | 4.15 |
| 4-F-W-07-7-A | 9.98 | 4.25 |
| 4-F-W-10-5-A | 9.73 | x |
| 4-F-W-10-6-A | 9.89 | 4.24 |
| 4-F-W-10-7-A | 10.46 | 4.42 |
| 4-F-W-11-3-A | 7.07 | 3.50 |
| 4-F-W-14-3-A | 7.62 | 3.68 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 5-F-R-03-L1-W | 8.93 | 3.91 |
| 5-F-R-03-L3-W | 9.41 | 4.12 |
| 5-F-R-09-L1-W | 8.95 | 3.92 |
| 5-F-R-09-L3-W | 9.10 | 3.97 |
| 5-F-R-14-L1-W | 9.38 | 4.08 |
| 5-F-R-14-L3-W | 9.06 | 4.06 |
| 5-F-T-06-1-L1-W | 9.37 | 3.86 |
| 5-F-T-06-1-L4-W | 9.35 | 3.91 |
| 5-F-T-06-2-L1-W | 9.58 | 3.91 |
| 5-F-T-06-2-L4-W | 9.48 | 3.93 |
| 5-F-T-06-3-L1-W | 9.62 | 3.91 |
| 5-F-T-06-3-L4-W | 9.57 | 3.95 |
| 5-F-T-06-4-L1-W | 9.78 | 3.97 |
| 5-F-T-06-4-L4-W | 9.64 | 3.98 |
| 5-F-T-06-5-L4-W | 9.98 | 4.07 |
| 5-F-T-06-6-L1-W | 9.71 | 3.94 |
| 5-F-T-06-5-L1-W | 9.77 | 3.97 |
| 5-F-T-06-6-L4-W | 9.85 | 3.99 |
| 5-F-T-06-7-L1-W | 10.26 | 4.21 |
| 5-F-T-06-7-L4-W | 10.32 | 4.22 |
| 5-F-T-12-3-L2-A | 7.82 | 3.71 |
| 5-F-T-12-4-L2-W | 9.70 | 3.97 |
| 5-F-T-12-4-L4-W | 9.70 | 4.00 |
| 5-F-T-12-5-L2-W | 9.93 | 4.06 |
| 5-F-T-12-5-L4-W | 9.97 | 4.10 |
| 5-F-T-12-6-L1-W | 10.48 | 4.30 |
| 5-F-T-12-6-L4-W | 10.61 | 4.36 |
| 5-F-T-12-7-L1-W | 10.06 | 4.12 |
| 5-F-T-12-7-L4-W | 10.54 | 4.29 |
| 5-F-T-13-4-L2-A | 8.44 | 3.89 |
| 5-F-T-13-5-L2-A | 9.05 | 4.04 |
| 5-F-T-13-6-L2-A | 9.50 | 4.16 |
| 5-F-T-13-7-L2-A | 10.43 | 4.41 |
| 5-F-T-15-7-L2-A | 9.26 | 4.33 |
| 5-F-T-15-4-L2-A | 8.58 | 3.92 |
| 5-F-T-15-5-L2-A | 8.66 | 3.91 |
| 5-F-T-15-6-L2-A | 9.12 | 4.08 |
| 5-F-T-16-3-L2-A | 7.96 | 3.76 |
| 5-F-T-16-4-L2-W | 9.77 | 3.95 |
| 5-F-T-16-4-L4-W | 9.71 | 3.99 |
| 5-F-T-16-5-L2-W | 9.70 | 4.04 |
| 5-F-T-16-5-L4-W | 9.86 | 4.03 |
| 5-F-T-16-6-L2-W | 10.04 | 4.08 |
| 5-F-T-16-7-L2-W | 10.62 | 4.38 |
| 5-F-T-16-6-L4-W | 9.51 | 3.93 |
| 5-F-T-16-7-L4-W | 10.68 | 3.55 |
| 5-F-W-01-3-A | 7.90 | 3.72 |
| 5-F-W-01-5-A | 9.28 | 4.02 |
| 5-F-W-01-6-A | 9.77 | 4.18 |
| 5-F-W-01-7-A | 10.35 | 4.31 |
| 5-F-W-04-5-A | 8.83 | 4.00 |
| 5-F-W-04-6-A | 9.22 | 4.08 |
| 5-F-W-04-7-A | 10.10 | 4.32 |
| 5-F-W-07-6-A | 9.47 | 4.18 |
| 5-F-W-07-7-A | 10.55 | 4.48 |
| 5-F-W-10-5-A | 8.96 | 4.02 |
| 5-F-W-10-6-A | 9.18 | 4.15 |
| 5-F-W-10-7-A | 10.37 | 4.41 |
| 5-F-W-11-3-A | 8.27 | 3.83 |
| 5-F-W-14-3-A | 8.02 | 3.78 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 6-F-R-03-L1-W | 9.64 | 4.23 |
| 6-F-R-03-L3-W | 9.50 | 4.12 |
| 6-F-R-09-L1-W | 9.19 | 4.00 |
| 6-F-R-09-L3-W | 9.27 | 4.00 |
| 6-F-R-14-L1-W | 9.17 | 4.01 |
| 6-F-R-14-L3-W | 9.31 | 4.05 |
| 6-F-T-06-1-L1-W | 9.37 | 3.93 |
| 6-F-T-06-1-L4-W | 7.50 | 3.95 |
| 6-F-T-06-2-L1-W | 9.41 | 3.97 |
| 6-F-T-06-2-L4-W | 9.42 | 3.94 |
| 6-F-T-06-3-L1-W | 9.56 | 3.97 |
| 6-F-T-06-3-L4-W | 9.62 | 4.05 |
| 6-F-T-06-4-L1-W | 9.66 | 4.02 |
| 6-F-T-06-4-L4-W | 9.68 | 4.02 |
| 6-F-T-06-5-L1-W | 9.78 | 4.01 |
| 6-F-T-06-5-L4-W | 9.88 | 4.09 |
| 6-F-T-06-6-L1-W | 9.99 | 4.12 |
| 6-F-T-06-6-L4-W | 10.00 | 4.13 |
| 6-F-T-06-7-L1-W | 10.39 | 4.27 |
| 6-F-T-06-7-L4-W | 10.46 | 4.29 |
| 6-F-T-12-3-L2-A | 8.08 | 3.76 |
| 6-F-T-12-4-L2-W | 9.49 | 3.91 |
| 6-F-T-12-4-L4-W | 9.35 | 3.92 |
| 6-F-T-12-5-L2-W | 9.60 | 3.96 |
| 6-F-T-12-5-L4-W | 9.48 | 3.94 |
| 6-F-T-12-6-L1-W | 10.00 | 4.16 |
| 6-F-T-12-6-L4-W | 10.03 | 4.15 |
| 6-F-T-12-7-L1-W | 10.30 | 4.22 |
| 6-F-T-12-7-L4-W | 10.33 | 4.27 |
| 6-F-T-13-4-L2-A | 8.17 | 3.83 |
| 6-F-T-13-5-L2-A | 8.44 | 3.89 |
| 6-F-T-13-6-L2-A | 8.79 | 3.96 |
| 6-F-T-13-7-L2-A | 9.69 | 4.20 |
| 6-F-T-15-7-L2-A | 9.97 | 4.30 |
| 6-F-T-15-4-L2-A | 8.26 | 3.84 |
| 6-F-T-15-5-L2-A | 8.70 | 3.95 |
| 6-F-T-15-6-L2-A | 9.22 | 4.08 |
| 6-F-T-16-3-L2-A | 8.52 | 3.75 |
| 6-F-T-16-4-L2-W | 9.60 | 3.98 |
| 6-F-T-16-4-L4-W | 9.55 | 3.95 |
| 6-F-T-16-5-L2-W | 9.76 | 4.04 |
| 6-F-T-16-5-L4-W | 9.81 | 4.05 |
| 6-F-T-16-6-L1-W | 9.99 | 4.11 |
| 6-F-T-16-6-L4-W | 10.12 | 4.19 |
| 6-F-T-16-7-L1-W | 10.39 | 4.31 |
| 6-F-T-16-7-L4-W | 10.51 | 4.37 |
| 6-F-W-01-3-A | 8.26 | 3.82 |
| 6-F-W-01-5-A | 9.02 | 4.01 |
| 6-F-W-01-6-A | 9.42 | 4.07 |
| 6-F-W-01-7-A | 9.85 | 4.20 |
| 6-F-W-04-5-A | 8.95 | 4.03 |
| 6-F-W-04-6-A | 9.25 | 4.07 |
| 6-F-W-04-7-A | 10.07 | 4.31 |
| 6-F-W-07-6-A | 9.56 | 4.16 |
| 6-F-W-07-7-A | 10.39 | 4.40 |
| 6-F-W-10-5-A | 9.22 | 4.07 |
| 6-F-W-10-6-A | 9.48 | 4.14 |
| 6-F-W-10-7-A | 10.88 | 4.52 |
| 6-F-W-11-3-A | 8.04 | 3.76 |
| 6-F-W-14-3-A | 9.33 | 4.08 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 7-F-R-03-L1-W | 9.34 | 4.05 |
| 7-F-R-03-L3-W | 9.67 | 4.11 |
| 7-F-R-09-L1-W | 9.52 | 4.08 |
| 7-F-R-09-L3-W | 9.57 | 4.11 |
| 7-F-R-14-L1-W | 9.43 | 4.03 |
| 7-F-R-14-L3-W | 9.51 | 4.07 |
| 7-F-T-06-1-L1-W | 9.50 | 4.00 |
| 7-F-T-06-1-L4-W | 9.37 | 4.08 |
| 7-F-T-06-2-L1-W | 9.59 | 4.01 |
| 7-F-T-06-2-L4-W | 9.57 | 4.06 |
| 7-F-T-06-3-L1-W | 9.61 | 3.98 |
| 7-F-T-06-3-L4-W | 9.62 | 4.09 |
| 7-F-T-06-4-L1-W | 9.50 | 3.99 |
| 7-F-T-06-4-L4-W | 9.80 | 4.14 |
| 7-F-T-06-5-L1-W | 9.99 | 4.13 |
| 7-F-T-06-5-L4-W | 9.97 | 4.18 |
| 7-F-T-06-6-L1-W | 10.07 | 4.19 |
| 7-F-T-06-6-L4-W | 10.01 | 4.21 |
| 7-F-T-06-7-L1-W | 10.44 | 4.31 |
| 7-F-T-06-7-L4-W | 10.07 | 4.21 |
| 7-F-T-12-3-L2-A | 8.37 | 3.81 |
| 7-F-T-12-4-L2-W | 10.63 | 4.37 |
| 7-F-T-12-4-L4-W | 9.99 | 4.22 |
| 7-F-T-12-5-L2-W | 9.89 | 4.15 |
| 7-F-T-12-5-L4-W | 9.78 | 4.13 |
| 7-F-T-12-6-L1-W | 10.20 | 4.22 |
| 7-F-T-12-6-L4-W | 10.25 | 4.25 |
| 7-F-T-12-7-L1-W | 10.62 | 4.38 |
| 7-F-T-12-7-L4-W | 10.66 | 4.39 |
| 7-F-T-13-4-L2-A | 8.94 | 3.99 |
| 7-F-T-13-5-L2-A | 9.71 | 4.22 |
| 7-F-T-13-6-L2-A | 10.14 | 4.33 |
| 7-F-T-13-7-L2-A | 11.08 | 4.62 |
| 7-F-T-15-7-L2-A | 9.43 | 4.14 |
| 7-F-T-15-4-L2-A | 8.78 | 3.94 |
| 7-F-T-15-5-L2-A | 10.61 | 4.47 |
| 7-F-T-15-6-L2-A | 9.92 | 4.25 |
| 7-F-T-16-3-L2-A | 8.38 | 3.85 |
| 7-F-T-16-4-L2-W | 9.84 | 4.11 |
| 7-F-T-16-4-L4-W | 9.97 | 4.20 |
| 7-F-T-16-5-L2-W | 10.00 | 4.13 |
| 7-F-T-16-5-L4-W | 9.94 | 4.21 |
| 7-F-T-16-6-L1-W | 10.21 | 4.23 |
| 7-F-T-16-6-L4-W | 10.37 | 4.28 |
| 7-F-T-16-7-L1-W | 10.65 | 4.41 |
| 7-F-T-16-7-L4-W | 10.57 | 4.39 |
| 7-F-W-01-3-A | 8.87 | 3.98 |
| 7-F-W-01-5-A | 9.39 | 4.13 |
| 7-F-W-01-6-A | 9.27 | 4.03 |
| 7-F-W-01-7-A | 10.38 | 4.32 |
| 7-F-W-04-5-A | 9.64 | 4.22 |
| 7-F-W-04-6-A | 9.81 | 4.20 |
| 7-F-W-04-7-A | 10.86 | 4.53 |
| 7-F-W-07-6-A | 9.85 | 4.24 |
| 7-F-W-07-7-A | 10.04 | 4.28 |
| 7-F-W-10-5-A | 8.95 | 3.93 |
| 7-F-W-10-6-A | 10.00 | 4.26 |
| 7-F-W-10-7-A | 10.56 | 4.40 |
| 7-F-W-11-3-A | 8.84 | 3.98 |
| 7-F-W-14-3-A | 8.85 | 3.96 |

Appendix D. Elastic and Shear Modulus Data

| Specimen ID | Modulus of Elasticity, E (GPa) | Shear Modulus, G (GPa) |
|---|---|---|
| 8-F-R-03-L1-W | 9.79 | 4.21 |
| 8-F-R-03-L3-W | 9.78 | 4.21 |
| 8-F-R-09-L1-W | 9.64 | 4.15 |
| 8-F-R-09-L3-W | 9.95 | 4.27 |
| 8-F-R-14-L1-W | 9.86 | 4.28 |
| 8-F-R-14-L3-W | 9.76 | 4.20 |
| 8-F-T-06-1-L1-W | 9.75 | 4.09 |
| 8-F-T-06-1-L4-W | 10.02 | 4.24 |
| 8-F-T-06-2-L1-W | 9.67 | 4.07 |
| 8-F-T-06-2-L4-W | 10.41 | 4.44 |
| 8-F-T-06-3-L1-W | 9.54 | 4.03 |
| 8-F-T-06-3-L4-W | 10.46 | 4.43 |
| 8-F-T-06-4-L1-W | 9.47 | 4.04 |
| 8-F-T-06-4-L4-W | 10.51 | 4.46 |
| 8-F-T-06-5-L1-W | 9.75 | 4.11 |
| 8-F-T-06-5-L4-W | 10.51 | 4.41 |
| 8-F-T-06-6-L1-W | 9.86 | 4.15 |
| 8-F-T-06-6-L4-W | 10.57 | 4.45 |
| 8-F-T-06-7-L1-W | 9.94 | 4.23 |
| 8-F-T-06-7-L4-W | 10.39 | 4.34 |
| 8-F-T-12-3-L2-A | 9.56 | 4.21 |
| 8-F-T-12-4-L2-W | 9.76 | 4.19 |
| 8-F-T-12-4-L4-W | 10.50 | 4.41 |
| 8-F-T-12-5-L2-W | 10.22 | 4.29 |
| 8-F-T-12-5-L4-W | 10.61 | 4.46 |
| 8-F-T-12-6-L1-W | 10.21 | 4.26 |
| 8-F-T-12-6-L4-W | 10.63 | 4.40 |
| 8-F-T-12-7-L1-W | 10.24 | 4.27 |
| 8-F-T-12-7-L4-W | 10.65 | 4.45 |
| 8-F-T-13-4-L2-A | 10.34 | 4.36 |
| 8-F-T-13-5-L2-A | 10.61 | 4.45 |
| 8-F-T-13-6-L2-A | 10.89 | 4.48 |
| 8-F-T-13-7-L2-A | 10.86 | 4.52 |
| 8-F-T-15-7-L2-A | 10.74 | 4.50 |
| 8-F-T-15-4-L2-A | 10.40 | 4.37 |
| 8-F-T-15-5-L2-A | 10.65 | 4.45 |
| 8-F-T-15-6-L2-A | 10.72 | 4.48 |
| 8-F-T-16-3-L2-A | 10.41 | 4.39 |
| 8-F-T-16-4-L2-W | 9.96 | 4.21 |
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| 8-F-T-16-6-L4-W | 10.56 | 4.41 |
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| 8-F-W-01-5-A | 10.48 | 4.36 |
| 8-F-W-01-6-A | 10.56 | 4.37 |
| 8-F-W-01-7-A | 10.48 | 4.35 |
| 8-F-W-04-5-A | 10.41 | 4.37 |
| 8-F-W-04-6-A | 10.59 | 4.43 |
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| 8-F-W-07-6-A | 10.67 | 4.47 |
| 8-F-W-07-7-A | 10.47 | 4.45 |
| 8-F-W-10-5-A | 10.30 | 4.29 |
| 8-F-W-10-6-A | 10.63 | 4.41 |
| 8-F-W-10-7-A | 10.73 | 4.46 |
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