

Evaluation of indented prestressing wires for KDOT bridge members

By

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Abstract

This paper presents the evaluation of indented prestressing wires for Kansas Department of Transportation's (KDOT) bridge members. This evaluation contains the review of KDOT's current design practice with prestressed concrete members, the development of alternate member designs utilizing indented prestressing wires, the development of a test plan, the determination of the transfer lengths, loading the specimens to failure, and analysis of the data collected.

This purpose of this research was to investigate opportunities to utilize indented prestressing wires in KDOT bridge members to optimize designs to be more efficient while upholding safety standards. Due to the proven shorter development lengths of indented wires in comparison to 7-wire strands of similar sizes, the member selected that had the highest opportunity to showcase the advantages of this was the prestressed deck panel.

For this research, six prestressed panels were created using three differing prestressing tendons: 3/8" 7-wire strand, 8 mm T4 European style indented wire, and an 8 mm T2 European style indented wire. Each prestressing tendon had two panels that were created, a 3" by 24" by 72" panel, and a 3" by 24" by 96" panel. After casting, the transfer lengths were determined and a 5 1/2" cast-in-place concrete topping was placed on top of the panels. The panels were then loaded to their ultimate experimental moment-carrying capacity using three-point loading.

The data collected was then compared to each respective theoretical value, and to each other. The indented prestressing wires were stronger for the six-foot panel, while having a less area of steel and prestressing force. The 7-wire strand was stronger for the eight-foot panel, due to the wire being fully developed, with the indented prestressing wires being close behind. All panels broke above AASHTO strength recommendations, giving another viable prestressing tendon that KDOT can utilize in their prestressed deck panels.

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Chapter One – Introduction

Background

Most pretensioned concrete members in the United States employ 7-wire prestressing strands with diameters of 3/8” or larger. Nevertheless, individual indented prestressing wires have served as a viable alternative to wooden railroad ties for the past two decades (Arnold, Peterman, Bodapati, Beck, Wu, 2013). Kansas State University has undertaken research projects funded by the United States Department of Transportation and the Federal Railroad Administration, investing over \$3.5 million to comprehensively explore the bond and structural performance of indented prestressing wires.

The results of this research have concluded several advantages to using indented prestressing wires instead of 7-wire strands. These results include:

1. The ability to specify prestressing wires that are uniquely suited for the indented application, in both diameter and indent characteristics.
2. The knowledge of how wires will bond with the concrete by physically measuring the indents.
3. Shorter development lengths due to the fact that indented prestressing wires provide bearing surfaces.

The understanding of how indented prestressing wires bond with concrete before experimentation is distinctive to this type of wire. In contrast, the bond of 7-wire strands is predominantly affected by surface conditions and requires physical tests for assessment. Accurate determination of both the transfer and development length can be achieved by measuring the indents on the wires (Arnold et al., 2013).

As the Kansas Department of Transportation (KDOT) utilizes prestressed concrete in their bridge members, there is an opportunity to utilize indented prestressing wires to optimize design efficiency.

Scope and Aim

The scope of this research involves exploring the potential applications of indented prestressing wires in KDOT bridge members. This includes a comprehensive review of current practices, the development of member designs using indented wires, the creation of a laboratory test plan, casting specimens to measure transfer lengths, and conducting load tests to failure. Three wire types—7-wire strand, a T4 European style indented wire, and a T2 European style indented wire—were employed. Six specimens were cast, and their transfer lengths were measured. These specimens were then subjected to load tests until reaching their ultimate experimental moment-carrying capacity, with all resulting data analyzed.

Thesis Outline

This thesis is organized into six chapters. Chapter One introduces the background, scope, and project aims. Chapter Two provides a review of prestressing tendon theories and a comprehensive literature review. Chapter Three discusses the materials used in the experiments. Chapter Four outlines the project methodology. Chapter Five presents the experimental results and their discussion. Chapter Six concludes the thesis and explores ideas for future work. Appendices contain all relevant data and drawings.

Chapter Two – Literature Review and Theory

As the aim of this study is to investigate opportunities to utilize indented prestressing wires in KDOT bridge members, this section will review the theories and ideas for the current practice utilizing 7-wire strand, develop alternate member designs, and develop a test plan for laboratory investigation.

Review of Current Practice

KDOT has utilized prestressed concrete members in their bridge design in the form of bridge girders and deck panels. As deck panels typically have a length of 8 feet, with a development length longer than 4 feet, this member was selected that could benefit the most by utilizing indented prestressing wires. The development length of the prestressing steel will be discussed in further detail in sections to come.

Drawings from KDOT were provided for their prestressed concrete panels. This drawing is attached in Appendix A. Specifications for the panels are listed below:

- Concrete shall be 4000 psi compressive strength at release
- Concrete shall be 5000 psi compressive strength at 28 days
- Use 3/8" nominal diameter, seven-wire, low relaxation prestressing tendons conforming to ASTM A416, Grade 270
- Initial prestressing force of 16.1 kips per strand
- Use epoxy coated reinforcing steel conforming to ASTM A615, Grade 60
- The strands shall be spaced at 6" maximum, with 3" covers on both sides
- The #3 reinforcing steel shall be spaced at 1' with 3" covers on both sides
- The panel shall be 3" when the panel width < 8'-3"

- The rake perpendicular to the strands should make depressions of approximately 1/4"

Taking these specifications from KDOT into consideration, the preliminary design of the panels began.

Preliminary Design of Panels

Due to the limitations of the prestressed bed at Kansas State University, the maximum number of prestressing tendons that could be accommodated was four. These would be spaced at 6" on center (O.C.) with 3" of cover at the sides. This gave a total width of the panel to be 24". Additionally, #3 epoxy-coated Grade 60 bars would be spaced at 1' O.C. with a cover of 3". The panel would have a thickness of 3" and two panels, 1 – 6' panel and 1 – 8' panel, would be made during one pour. Drawings for the 8' panel is shown below.

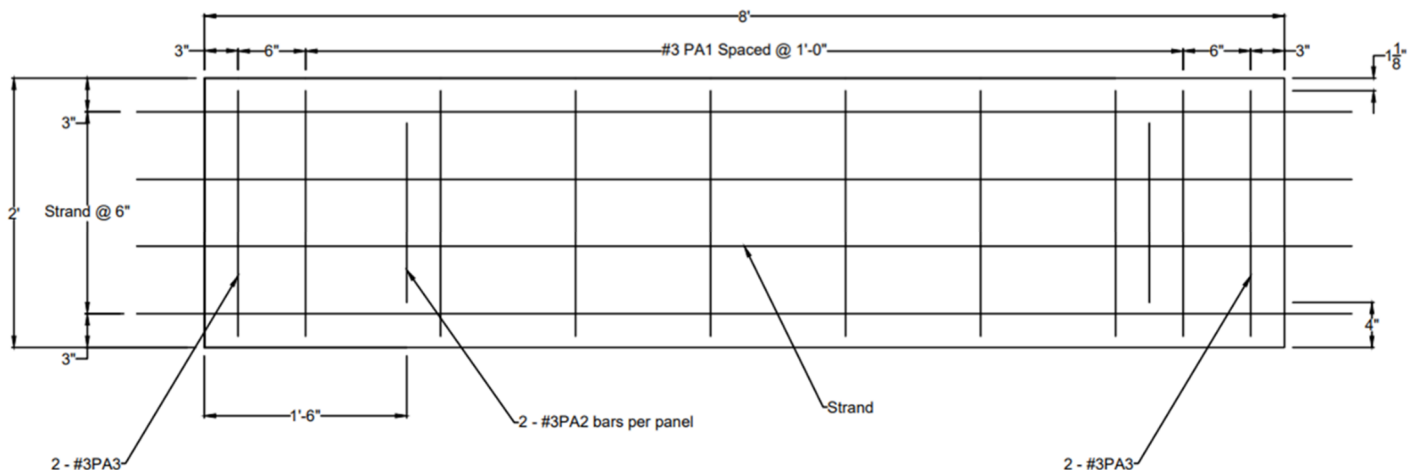


Figure 1: 8' Panel

The reinforcing steel is shown as #3PA3 in the drawing, while the lifting loops are shown as #3PA2. The lifting loops would be inset 1'-6" as directed by KDOT.

Additionally, a 5-1/2" concrete topping would be poured on top of the panels. This topping would have a 28-day compressive strength of 4000 psi, with a mix design approved by

KDOT. The topping would use #5 epoxy coated reinforcing steel conforming to ASTM A615, Grade 60, spaced at 6" O.C. each way.

Prestressing Tendons

In this project, three distinct prestressing tendons will be employed: 7-wire strands, a European T4 style indented wire, and a European T2 style indented wire. This setup facilitates a comparison between the 7-wire strands, serving as the control group, and the indented wires, which are the independent variable. Additionally, it enables a comparison within the indented wire group, where the T2 style indented wire exhibits a greater indentation compared to the T4 style indented wire.

As specified from KDOT, the 7-wire strand shall be 3/8" nominal diameter, seven-wire, low relaxation prestressing tendons conforming to ASTM A416, Grade 270. The selected indented wires will have a nominal diameter of 8 millimeters, with an assumed ultimate strength of 250 ksi. The drawing of the indented wire's cross-section can be seen below.

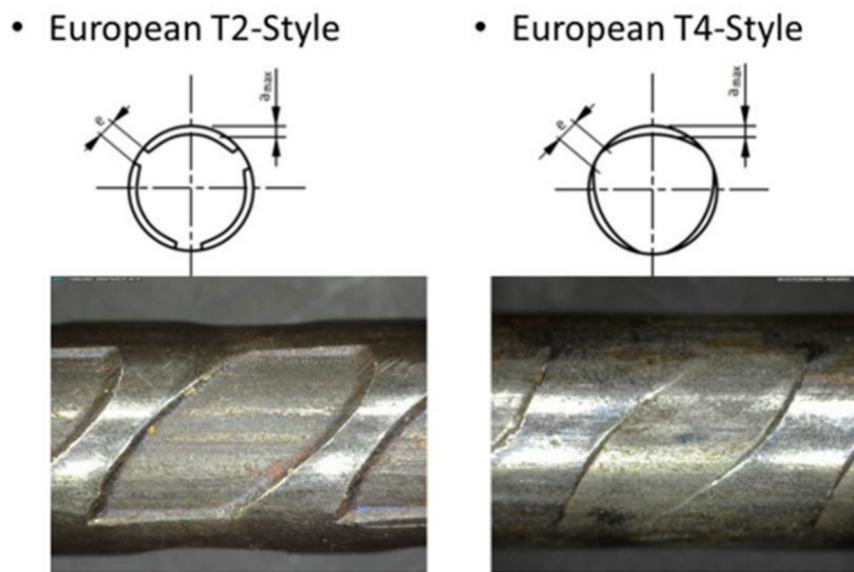


Figure 2: Indented Wire Styles (prEN 10138-2:2009, 2009)

Both wires are fabricated from Nucor LMP, with the T2 style featuring an abrupt ending to the indentation, while the T4 style exhibits a "feathering" effect around the wire to create a smooth indentation termination. A target depth of 0.004" of the indentation was selected for the T2 style (T2-004). A depth of 0.00252" of the indentation was chosen for the T4 style (T4-VAE).

Transfer and Development Lengths

In pretensioned, prestressed concrete members, the transfer length (L_t) is the length necessary for transferring the effective prestressing force from the prestressing tendons to the concrete. To load a pretensioned member to its ultimate flexural capacity, an additional length beyond the transfer length is required to develop the prestressing steel stress from the effective prestress to the stress at nominal flexural capacity. This additional bond length is known as the flexural bond length, and the development length (L_d) is the sum of the transfer length and the flexural bond length (Ghosh and Fintel, 1986; Momeni et al., 2016).

7-Wire Strand

From Section 5.11.4.1 of the AASHTO LRFD Bridge Design Specifications, the transfer length for the 7-wire strand is assumed to be 60 diameters of the prestressing strand. For the 3/8" strand, this length comes to be 22.5".

Additionally, from section 21.2.3 of ACI 318-19, the transfer length for the 7-wire strand is assumed to be:

$$L_t = \left(\frac{f_{se}}{3000} \right) d_b$$

where, f_{se} is the effective stress in the prestressed reinforcement after allowance for all prestress loss, and d_b is the nominal diameter of the prestressing strand.

From Section 5.11.4.2 of the AASHTO LRFD Bridge Design Specifications and Section 25.4.8.1 of ACI 318-19, the development length is calculated as:

$$L_d = (f_{ps} - \frac{2}{3}f_{se})d_b$$

where, f_{ps} is the stress in the prestressed reinforcement at nominal flexural strength, f_{se} is the effective stress in the prestressed reinforcement after all losses, and d_b is the nominal diameter of the prestressing strand.

Indented Wires

In the current design standards used in the United States, there is a notable absence of specific guidelines addressing the transfer and development lengths of indented prestressing wires. However, researchers such as Momeni, Peterman, and Beck in 2018 have taken a significant step forward by developing a prediction model for the development length of 5.32-millimeter diameter indented prestressing wires. Furthermore, the work of Bodapati, Peterman, Beck, and Wu in 2021 has provided valuable average transfer length values for wires of the same diameter. The findings of this research are shown in the table below with indented wires being labeled WB-WM.

Table 1: Transfer and Development Length Comparison

	L_t (in)	L_d (in)	$L_d - L_t$ (in)	L_d/L_t
7-Wire Strand	22.5	55.2	32.7	2.45
WG	11.78	11.9	0.12	1.01
WH	7.5	11.3	3.8	1.51
WB	11.6	14.3	2.7	1.23
WD	11.08	11.6	0.52	1.05
WF	8.45	9.5	1.05	1.12
WI	10.1	10.4	0.3	1.03
WJ	9.02	13	3.98	1.44
WM	9.83	11.9	2.07	1.21

The 7-wire strand exhibited a development to transfer length ratio of 2.45, whereas the largest development to transfer length ratio for the indented wires was 1.51. This reduction is significant, as it shows that while the 7-wire strand requires a length greater than two times the transfer length, the indented wires demand less than one and a half times the transfer length to fully develop the tendon.

The average transfer length for the indented wire was 47 times the diameter, while the average development length was 56 times the diameter, with a compressive release strength of 4500 psi. The range for the transfer length varied from a minimum of 36 times the diameter to a maximum of 56 times the diameter of the indented wire. Similarly, the range for the development length spanned from a minimum of 45 times the diameter to a maximum of 68 times the diameter of the indented wire.

For the 8 mm indented wires that this project will be using, if the development length is conservatively 102 times the diameter (the maximum length of the 5.32 mm indented wires with a safety factor of 1.5), the development length would be 32.13 inches. This development length is less than half of the six-foot panel, meaning there will be no reduction in ultimate strength due to the development length of the indented wires.

Measurement of Transfer Length

The transfer length determination procedure requires surface strain distribution along the prestressed concrete panels to be measured by a Whittemore gage. The strain profile can then be plotted and the transfer length can then be calculated using computational methods. The methods that are available today are the 95% AMS (Average Maximum Strain) and the Zhao-Lee (Z-L) method.

95% AMS Method

The 95% AMS method is commonly used in the prestressed concrete industry. The strain profile is plotted, the numerical average of all strains contained within the strain plateau of the fully effective prestress force is computed as the average maximum strain, 95% of this average maximum is computed and a line is constructed to correspond with this value, and the transfer length is plotted by the intersection of the 95% line with the strain profile (Russell, Burns, 1993).

This method has assumed a bilinear shape for the surface strain distribution, which is characteristic of prismatic beams. The bilinear shape is the plateau, and the approximately linear increasing development region, which enables the average maximum strain.

Zhao-Lee Method

While the 95% AMS method has been used in the industry for decades, it has shown to have some deficiencies. These deficiencies came to light from the measurements of 220 concrete railroad ties at six prestressed concrete tie plants in the United States. A statistically-based method called the Zhao-Lee (Z-L) method was proposed to compare against the 95% AMS method. The Z-L method was shown to be an unbiased method that provides a more accurate and reliable transfer length determination (Zhao, et al., 2013). Both methods will be used to make transfer length determinations for this project.

KDOT Ultimate Moment Capacity

KDOT utilizes Chapter 5 of the AASHTO LRFD Bridge Design Specifications for the ultimate moment capacity of the panels. From the KDOT specifications, the initial prestressing force for the 7-wire strand was 16.1 kips per strand. This is 70% of the ultimate strength of the strand, which was assumed to be 270 ksi. For the indented prestressing wires, both the T2-004 and the T4-VAE, the initial prestressing force was 14.6 kips. This is 75% of the assumed

ultimate strength of the indented wires, which was assumed to be 250 ksi. The increase of percentage of initial prestressing force from the 7-wire strands to the indented wires was intended to get the compressive stress of the concrete comparable while still being within AASHTO code.

The loss of prestressing forces was very similar with a 16.6% loss for the 7-wire strand and a 16.0% loss for the indented wires. The difference was due to the initial stress in the prestressing tendons.

For the 7-wire strand, the transfer length was found to be 22.5 inches, while the development length was found to be 55.2 inches. As the development length of the strand was longer than half of both the 8-foot and 6-foot panel, the design stress in the pretensioned strand at nominal flexural strength had to be adjusted. For the 8-foot panel, this design stress was reduced 8%, and 22% for the 6-foot panel. As the development length for the indented wires was assumed to be less than half of 36", no reduction was needed for the indented wires. The initial results for the moment capacity of the panels are shown below.

Table 2: KDOT Moment Capacity for 6-foot Panels

6-Foot Panels		
	Moment Capacity of One Tendon (k-ft)	Moment Capacity of 4 Tendons (k-ft)
7-Wire Strand	6.84	27.36
Indented Wires	7.50	29.99

Table 3: KDOT Moment Capacity for the 8-foot Panels

8-Foot Panels		
	Moment Capacity of One Tendon (k-ft)	Moment Capacity of 4 Tendons (k-ft)
7-Wire Strand	7.93	31.71
Indented Wires	7.50	29.99

From the above tables, the moment capacity for 7-wire strand for the 6-foot panel was lower than the indented wires, while the moment capacity for the 8-ft panel was higher than the indented wires from the KDOT calculations. This was due to the effect that the development length has on the moment capacity of the panels. The moment capacities of the indented wires remain constant due to no reduction assumed from the development length. All calculations for the moment capacities of the panels following the KDOT calculations are shown in Appendix B.

As the cast-in-place concrete topping has #5 rebar that is below the depth of the equivalent stress block, the KDOT moment calculation is inherently conservative due to the neglect of this rebar that acts as a tension member. To get the prediction of the ultimate experimental moment closer to how the panel will perform, a strain compatibility analysis was completed.

Strain Compatibility

An initial strain compatibility analysis was completed with for the panels with the #5 rebar acting as a tension member. The results from this analysis are shown below.

Table 4: Initial Strain Compatibility with #5 Rebar

	Nominal Moment Capacity - 6 ft (k-ft)	Nominal Moment Capacity - 8 ft (k-ft)
7 – Wire Strand	43.0	56.9
Indented Wires	50.2	50.2

From the above table, the moment capacity for the 7-wire strand increased from 43 to 50.2 k-ft when going from a 6-foot length to 8 feet. This was due to the development length of the strand. The panels with the indented wires did not change with an increase in length of the panel due to the assumption that the development length was shorter than half of the panels' length. These new moment capacities are compared below to the KDOT moment capacities.

Table 5: 6-Foot Panel Moment Capacity Comparison

6-foot panels			
	KDOT Moment Capacity (k-ft)	Strain Compatibility (k-ft)	Percent Increase
7-Wire Strand	27.36	43	57
Indented Wires	29.99	50.2	67

Table 6: 8-foot Panel Moment Capacity Comparison

8-foot panels			
	KDOT Moment Capacity (k-ft)	Strain Compatibility (k-ft)	Percent Increase
7-Wire Strand	31.71	56.9	80
Indented Wires	29.99	50.2	67

From the above tables, there is a significant increase when the #5 rebar in the panel topping is treated as a tension member in the analysis. There is a 57% increase in moment capacity for the 6-foot panel and an 80% increase in the 8-foot panel for the 7-wire strand. There is an 67% increase for the indented wires for both the 6 and 8-foot panels.

Chapter Three – Materials

Panel Mix Design

The mix design for the panels was provided from Coreslab Structures, located in Kansas City, Kansas, in order to create similar panels using the KDOT specifications. The mix design provided by Coreslab Structures is shown in Appendix A. The mix design in this experiment had a design compressive strength much greater than the KDOT requirement of 5 ksi at 28 days to ensure a minimum time to reach the release strength. The w/c ratio was regulated to 0.31 and a slump of 9.5 inches. The table below shows the mix design used for all 6 panels.

Table 7: Panel Mix Design

Design	Coreslab	Ours	1/2 Pour
Total Volume (cf):	26.6	8.72	4.36
Water (gal):	27.5	9.0	4.51
Water (lb):	229.3	75.2	42.7
Type III Cement (lb):	729	239	119.5
Sand (lb):	1116	365.8	182.9
Limestone (lb):	1752	574.3	287.1
PS1466 (Glenium) (oz/100 lb cement):	9	9.00	11.8
PS1466 (Glenium) oz:	65.6	21.5	14.1
PS1466 (Glenium) mL:	1940	636	418
Delvo (oz/100 lb cement):	N/A	N/A	4.9
DELVO oz:	N/A	N/A	5.9
DELVO mL:	N/A	N/A	174.5

The volume needed for the pour, consisting of an 8 ft panel, a 6 ft panel, and 10 – 4” x 8” cylinders was found to be 8.72 cubic feet. As the concrete mixer didn’t have the capacity for this, two pours were needed. Additionally, MasterSet DELVO was used at a retarder, to ensure there would be sufficient time to blend the two mixtures without a cold joint needed.

The Type III cement was acquired from Western Material and Design, LLC in Archie, Missouri. The sand used was from Midwest Concrete Materials in Manhattan, Kansas. The limestone was sourced from Coreslab Structures in Kansas City, Kansas. MasterSet DELVO and MasterGlenium 3400 were acquired, with their labels shown below. Additionally, the sand and limestone are shown below.

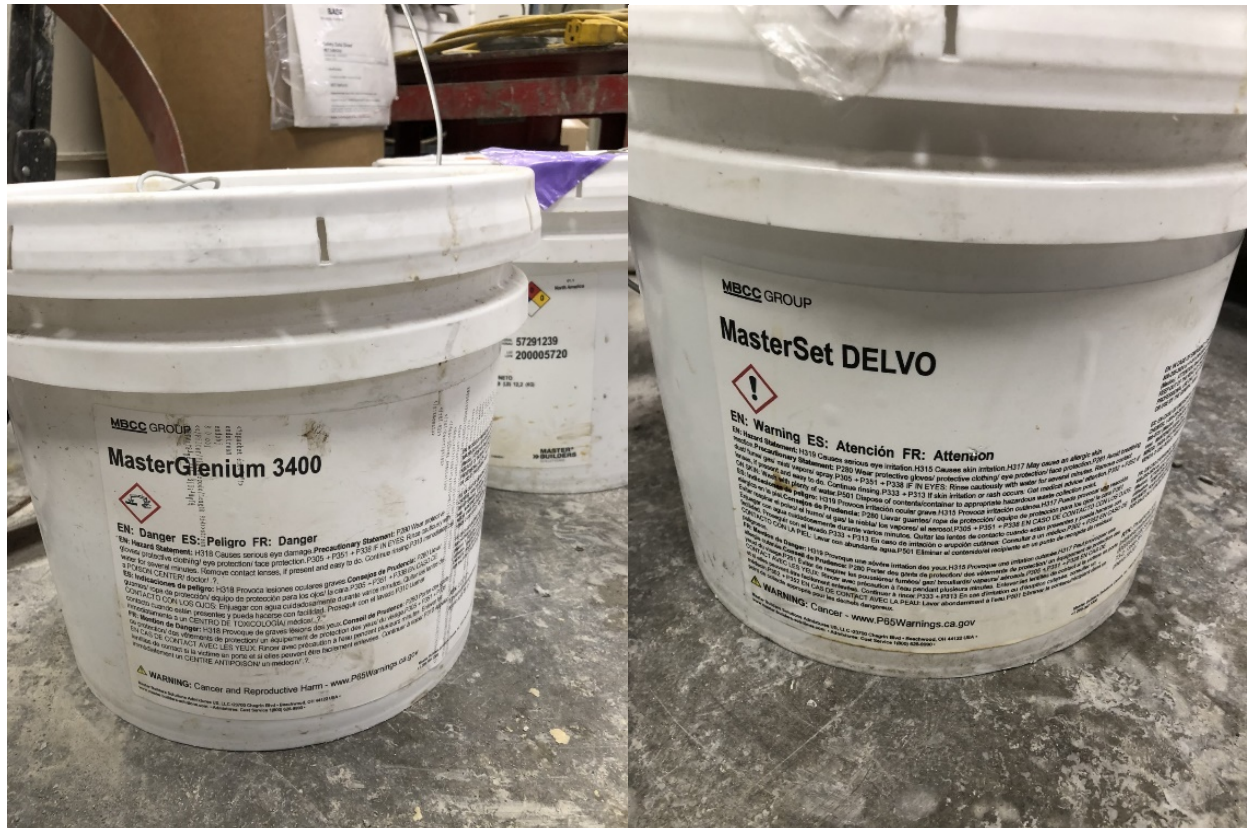


Figure 3: Admixtures



Figure 4: Limestone and Sand

The 3/8" 7-wire strand was obtained from Kansas State University, as the wire had been used in previous experiments. The strand was in covered PVC pipe to ensure weathering did not occur on the strand. This storage is shown in figure below. The T4-VAE and T2-004 indented wires were obtained from RJ Peterman and Associates from Manhattan, Kansas, who had previously scanned the wires. The wire-scan data is provided in Appendix A.



Figure 5: Strand Storage

The #3 epoxy-coated rebar used for the transverse rebar in the panels were donated by Coreslab Structures. Additionally, the #5 epoxy-coated rebar for both the transverse and longitudinal rebar in the cast-in-place topping were donated from Coreslab Structures.

In accordance with KDOT specifications, the topping should be 4 ksi compressive strength at 28 days. The concrete topping was mixed by Midwest Concrete Materials, Inc (MCM) with an approved mix design from KDOT. This mix design is attached in Appendix A. The concrete was delivered with a concrete truck from MCM.

Formwork and Brass Inserts

The formwork was created with 3/4" plywood, with removable sides and ends. The ends were drilled with a 7/16" bit spaced at 6" on center with 3" of cover to each end.

Brass inserts were used to measure the transfer length of each panel, which will be discussed in Chapter 5. Two steel C-Channels, 1 – 6' and 1 – 8', were drilled at every inch on center. Brass inserts were then placed in each drilled hole. Additionally, every brass insert end

was glued with a hot-glue gun to ensure that the screws would be removed easily. The figure below shows the brass inserts.



Figure 6: Brass Inserts

Chapter Four – Methods

Calibration of Load Cells

Before the prestressed panels could be manufactured, load cells used on the prestressing bed needed to be calibrated. These included 4 S-shaped load cells, and 1 “pancake” style load cell. The S-shaped load cells were a Keli DEFY-A 20-kip load cell, and the pancake style load cell was a 200-kip Interface load cell. The load readout system was a Rice Lake 920i Programmable Weight Indicator. The S-shaped load cells were loaded to 20 kips in tension and calibrated within 1% on the Rice Lake Indicator. Various loads were checked after calibration to ensure that the load cell was within 1% of all given loads.

The pancake style load cell was calibrated to 75 kips as the 4 prestressing tendons would be tensioned to 16.1 kips at each. The load cell was loaded in tension on Kansas State University’s “Big Purple” frame. The load cell was calibrated within 1% of 75 kips and various loads to ensure accuracy of the load cell. The calibration of this load cell is shown below.



Figure 7: Calibration of "Pancake" Load Cell

Tensioning of Prestressed Tendons

As Kansas State University's prestressing bed is relatively short compared to how prestressed panels are made in the industry, load cells were needed to ensure that the load on each individual tendon did not exceed its ultimate strength. The combined load of the four S-shaped load cells were compared against the pancake load cell as well on the Rice Lake Weight Indicator.

The live-end of the bed, where the load is applied, was designed with 4 hollowed-out bolts that can be adjusted to increase or decrease the load on each individual tendon. The dead-end of the bed connected the tendon to each individual S-shaped load cell using splice chucks. Both of the arrangements can be seen in below figures.



Figure 8: Live-End of Bed



Figure 9: Dead-End of Bed

The desired prestressing force for the 3/8" 7-wire strand was 16.1 kips and the desired prestressing force for the 8-mm indented wire was 14.6 kips. The following procedure was followed to tension the tendons to their desired loads:

1. Place tendons in splice-chucks on dead-end of the prestressing bed.
2. Seat chucks on live-end of the prestressing bed while limiting excess tendon.
3. Load tendons to a maximum of 500 pounds.
4. Adjust load on each individual tendon to 500 pounds by adjusting bolt on live-end.
5. Increase the load on the tendons 1000 pounds.
6. Check the load on each individual tendon and compare the combine load from the S-shaped load cells and the pancake load cell.
7. If individual loads are not within 1% of each other, decrease load on tendons to adjust bolt.

8. Repeat steps 5-7, increasing the load on the tendons until desired prestressing load was met.

All tendons were tensioned to their desired values within 1% respective to each other and the combined load cells were compared with the pancake load cell. The #3 epoxy-coated rebar were then tied to the tensioned tendons, according to the panel design. The prestressing bed, panel forms, transverse rebar, and tensioned tendons are shown in figure below.



Figure 10: Tensioned Tendons and Panel Forms

Panel Mix Procedure

Due to the limitation of the MH9 concrete mixer from EZG Manufacturing, two separate batches of concrete needed to be made for one 6-foot and one 8-foot panel. Three separate pours were completed to create 3 – 6-foot panels and 3 – 8-foot panels. The following steps were conducted to create the panels:

1. The aggregates were dried 24 hours in advanced and cooled to room temperature.
2. All ingredients were measured and proportioned on the scale for the desired batch size.
3. All the sand, limestone, and half of the water were added to the mixer and mixed for roughly 3 minutes.
4. The remaining water, admixtures, and cement were then added to the mixer and mixed for approximately 5 minutes. Half of the water and admixtures were mixed separately before being added to the mix.
5. Pour concrete into trough and scrape mixer of excess concrete.

The mix was then moved to the prestressed bed and shoveled into the 6-foot panel and 8-foot panel forms. After the first mix ran out, steps 3-5 above were repeated to gain the required volume of concrete needed. As the concrete was being placed in the forms, the concrete was vibrated by a Milwaukee M18 FUEL Concrete Vibrator. The concrete was then mirror finished and left to cure for approximately an hour. After an hour had passed, the 1/4" finish, as specified by KDOT, was applied.

Additionally, 10 - 4"x 8" cylinders were prepared for checking the de-tension, 7-day, and 28-day compressive strength of each mix. These were in the Sure-Cure cylinders, which will be discussed in the next section. The slump for each pour was also measured to ensure KDOT specifications.

Temporary steel C-sections that were drilled every inch that held the brass inserts were also placed on top of the concrete for the transfer length data. The panels after the pour are shown in figure below.



Figure 11: Panels after Pour

Sure-Cure System

The Sure-Cure System by Exact Technology was used to regulate the curing temperature of the cylinders by reading the internal temperature of the prestressed panel. The system has a controller, temperature gauge, and 10 cylinders that are independently heated by internal heaters. The controller measures the temperature from the gauge that was implanted within a panel and the temperature within the cylinder. The controller then matches the temperature in the cylinders

with the gauge by heating the cylinders. The Sure-Cure controller and the cylinders are shown below.



Figure 12: Sure-Cure System

Measuring Transfer Lengths using Whittemore Gauge

Strain measurements were recorded using the Whittemore gauge with a gauge length of 8" to manually measure the length differences before and after de-tensioning the panels, and after 21 days of de-tensioning. The readings were recorded onto an Excel datasheet using a Mitutoyo ABS Digimatic indicator that was attached to the Whittemore gauge. This provided an absolute zero and had an error of 0.0001 inches. The Whittemore Gauge with the input tool is shown below.



Figure 13: Whittemore Strain Gage and Zero Block

After approximately 4 hours after pouring, the C-Channels holding the brass inserts were removed from the panel, leaving the brass inserts in the concrete. As the inserts were spaced at 1" on center and a gauge length of 8", the total number of collection points for the 6-foot panel totaled to 64 points, and 88 points for the 8-foot panel.

Two initial gauge readings were recorded and if the difference was more than 0.00025", an additional measurement of the same reading was recorded. The two or three readings were then averaged to give an average initial reading of each point. This was done for each panel. A snippet of the excel datasheet is shown below.

6 ft Panel				
South	Initial 1	Initial 2	Difference	Average
1	0.00625	0.00635	1E-04	0.0063
2	0.0002	0.0003	0.0001	0.00025
3	0.0039	0.0041	0.0002	0.004
4	0.0049	0.00485	5E-05	0.004875
5	0.00115	0.0012	5E-05	0.001175

Figure 14: Whittemore Gage Readings

Gauge readings were then taken after de-tensioning of the tendons, and after 21 days of the given pour.

De-tensioning of the Panels

After the initial Whittemore gage readings were recorded into the Excel datasheet, and two cylinders broke above 4000 psi compressive strength to meet KDOT specifications in the Forney 250 series frame with VFD controls, the panels were de-tensioned. ASTM C39 was followed for these compressive tests. The Forney frame is shown below.



Figure 15: Forney 250 Series Frame with VFD Controls

The panels were then left to cure for approximately 1 day. The tails of the prestressing tendons were then cut to 5” to meet KDOT specifications. The panels were then de-molded from the forms, the panels labeled with which end was the live-end and dead-end, and then moved outside. The cylinders were also de-molded from the Sure-Cure cylinders, labeled, and also moved outside to make room for the next panel pour. The moving of the panels was performed by using an overhead crane and a forklift. This is shown in the figure below.



Figure 16: Moving of Panels

Pour of Cast-In-Place Topping

Topping forms were created using 3/4" plywood that had a depth of 5.5" above the panel. A 2x4 was used to span across the midspan in order to limit the outward deflection due to the weight of the concrete topping. The #5 bars were placed on seats that had a height of 2.75", and placed at 6" on center in both the longitudinal and transverse direction of the panel. A photo of the formwork and placed rebar is shown below.



Figure 17: Topping Form and Placed Rebar

After the last panels were created and the Whittemore data points were measured after 21 days, the concrete topping could be placed on top of every panel. A KDOT approved mix design was ordered from MCM, which was delivered with a concrete truck, was placed in the forms. The concrete was designed to have a 4000-psi compressive strength at 28 days. Twelve 4" x 8" cylinders were prepared and created to ensure this compressive strength. The concrete was

vibrated and had a mirror finish. The photos of the placing of the concrete and the finished topping are shown below.



Figure 18: Placing of Topping



Figure 19: Finished Topping

Test Set-Up and Calibration of LVDTs

From the theoretical calculations, the size of the frame needed to be able to handle approximately 45 kips. The frame that was chosen for this application was Frame 2 in Lab 0108 in Engineering Complex at Kansas State University. This frame has a capacity of 55 kips, which was adequate. Two concrete supports were centered and cemented into place with hydrocal with a spacing of 66" from inside face to inside face. This gave a span long enough for both the 6-foot panel and the 8-foot panel to be tested on the supports. The test set-up with the support is shown in the figure below.



Figure 20: Test Frame and Concrete Support

To measure the mid-span deflection and the end-slips of the prestressing tendons ten linear variable differential transformers (LVDT) were needed. Eight of these LVDTs were used to measure the end-slip of the prestressing tendons and were the GCD-250 Series by Measurement Specialties that had a stroke of 0.5 inches. The LVDTs were labeled L1-L4 denoting the side of the panel that was on the live-end of the prestressing bed, and labeled D1-D4 denoting the dead-end. Two of the LVDTs were used to measure the mid-span deflection, on both sides of the panel. Both of the mid-span LVDTs were DC-EC 2000 from Measurement Specialties that had a stroke of 10 inches.

The data acquisition system was through the MTS system, and the system uses BNC cable for its signals. As the LVDTs were 6-pin connections, a box combined the regulated power supply for excitation of LVDTs and was wired so that the signal was output to BNC terminals.

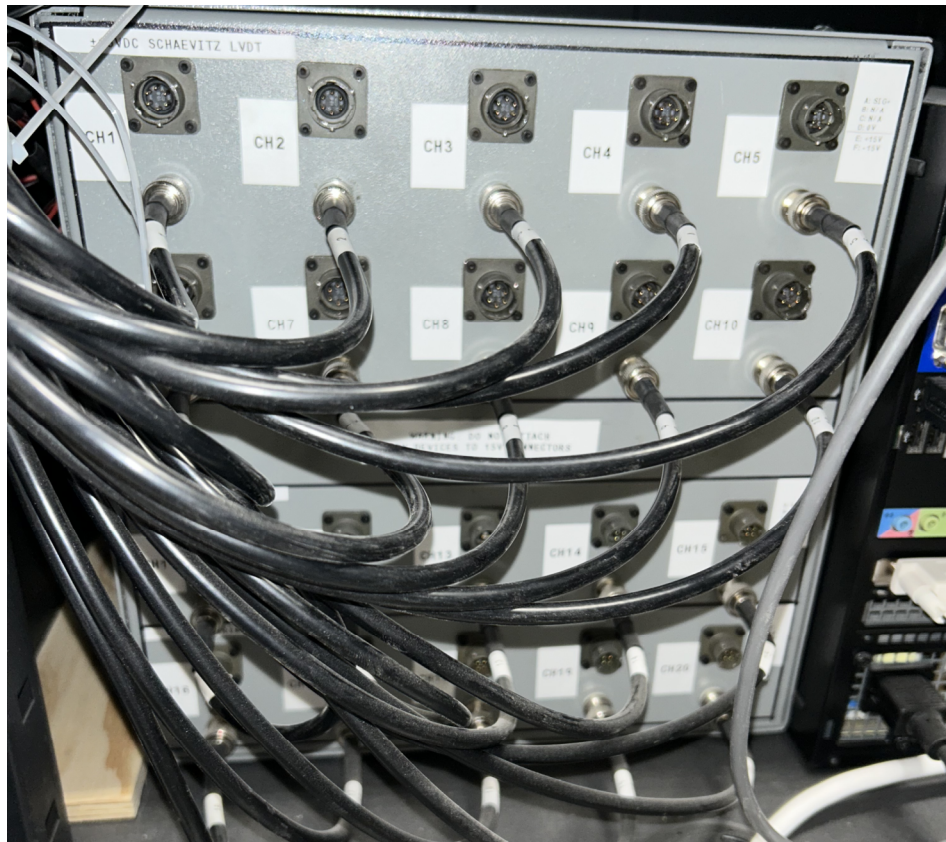


Figure 21: Conversion Box

Using the MTS software, an apparatus was created that would be able to calibrate the end-slip LVDTs. The apparatus consisted of a Mitutoyo dial gauge and a LVDT holder. The zero point was found for each LVDT, and was then calibrated at 0.25 inches and -0.25 inches. The values were checked every 0.05 inches to be within 1% of the given length.

For the mid-span LVDTs, gage blocks were used to calibrate. The calibration was from 0-10 inches, and every inch was measured to ensure that all were calibrated within 1% of the given value. These were connected to a small C-Channel that was stuck to the panel with hydrocal. Additionally, the load cell was checked to ensure it was within its calibration date, and a known load was tested against its readout. The readout was within 0.01% accurate of the known load.

The steel supports that held the roller and rocker were cemented with hydrocal to the concrete supports with the space between being 72" for the 6-foot panels and 96" for the 8-foot panels. The panels were then aligned with a laser level, and stuck into place with hydrocal. The actuator was connected with a rocker, which was welded to the actuator plate, and the bottom was placed with hydrocal for each panel. The test set-up is shown below in the following figures.

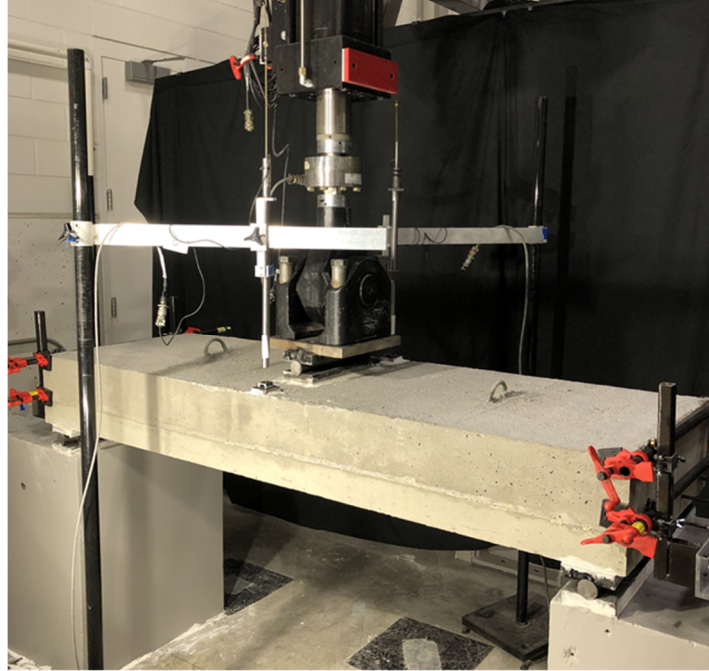


Figure 22: Test Set-Up Side View

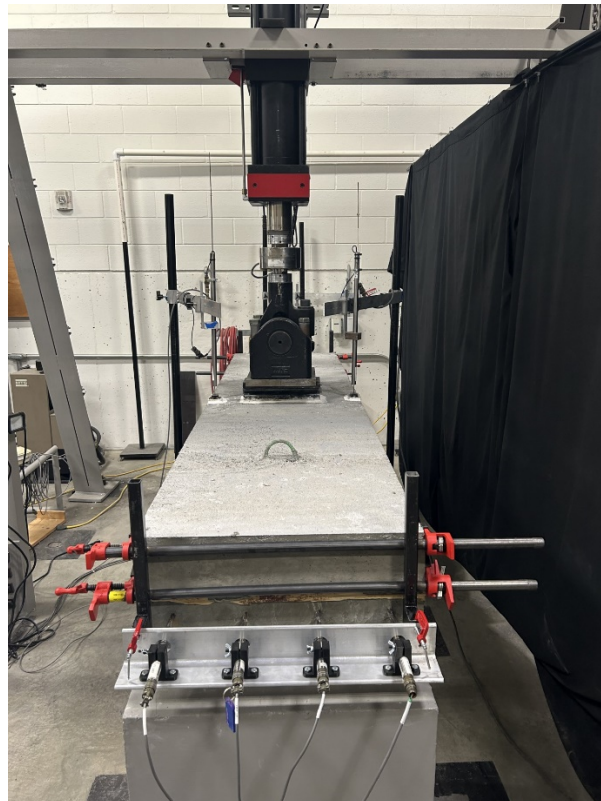


Figure 23: Test Set-Up Front View

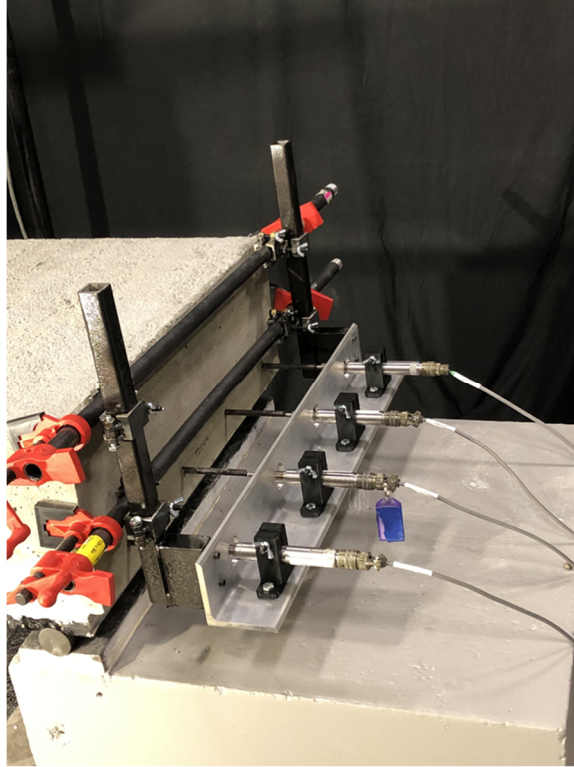


Figure 24: End-Slip LVDTs

Testing Procedure

The testing of the panels utilized the MTS system software. The data acquisition system was set to gather data for the load, mid-span deflections, and all end-slips for every increment of 20 lbf. Additionally, data was gathered if any end-slip increased 0.002 inches. When the end-slip occurred, the load, mid-span deflections, and other end-slips were recorded. The user interface is shown below.

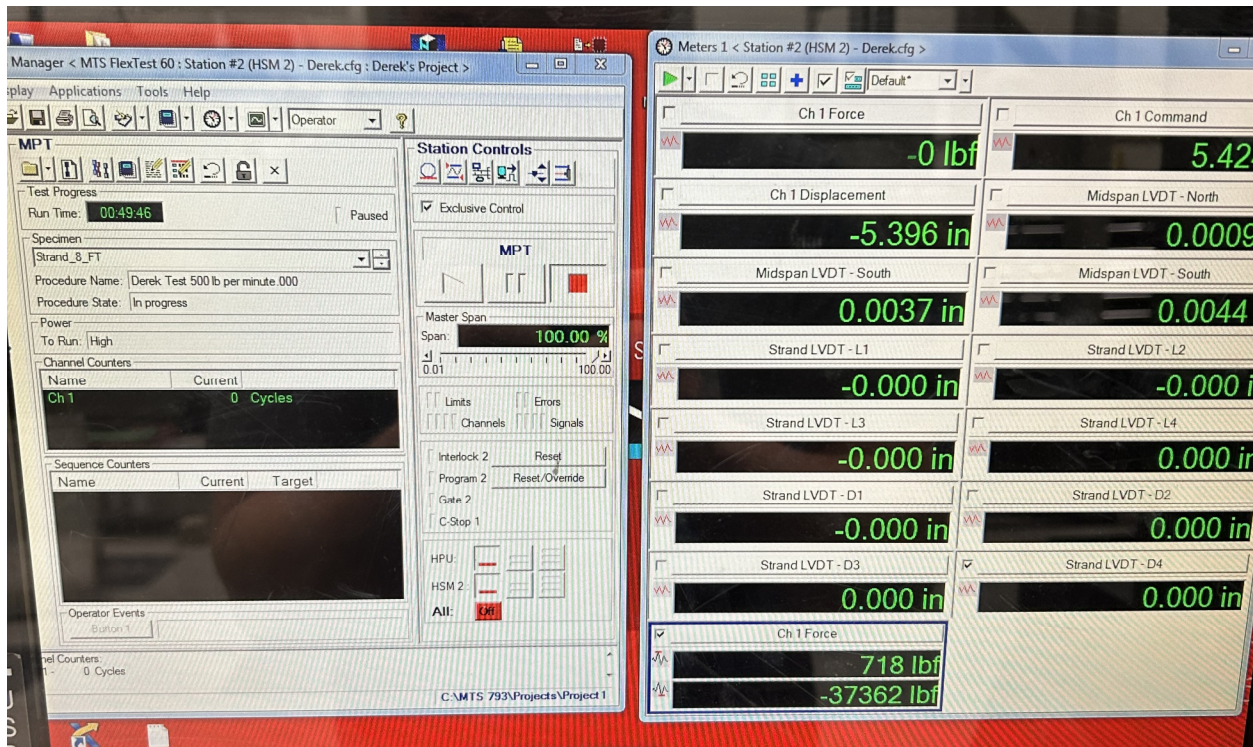


Figure 25: User Interface for MTS System

For the 6-foot panels the loading rate was 1000 lb/min, and for the 8-foot panels the loading rate was 750 lb/min to give the same moment loading. The LVDT's and actuator load readings were zeroed when the actuator had a noticeable gap with the load applicator.

A video of the testing was set up to ensure the failure mechanism was recorded. The testing then occurred until the ultimate load occurred. Figures of the panels after testing are shown below. All figures of the panels after testing will be shown in Chapter 6.



Figure 26: Panel after Testing

After every test, concrete cylinder compressive tests in the Forney load frame were done to ensure the compressive strength of both the panel concrete and the topping. The results of this testing are shown in Chapter 5.

Data Processing

Both the transfer lengths and the data from the panel testing needed to be processed. For the transfer lengths after de-tensioning, initial average Whittemore data was subtracted by the Whittemore data collected right after de-tensioning. The data was then multiplied by 10^6 and divided by 8" to give the difference in micro-strain. This is shown in the "Delta" column in the "Transfer Lengths" Excel sheet, which is located in Appendix C.

This same procedure occurred for the 21-day Whittemore data points, with the 21-day Whittemore data points being subtracted from the initial average data points. Additionally, the

length along the panel was also calculated for each point. This gave a “raw” strain data in micro-strain along the panel. A graph of the micro-strain vs. the length along the panel was created, with one example shown below.

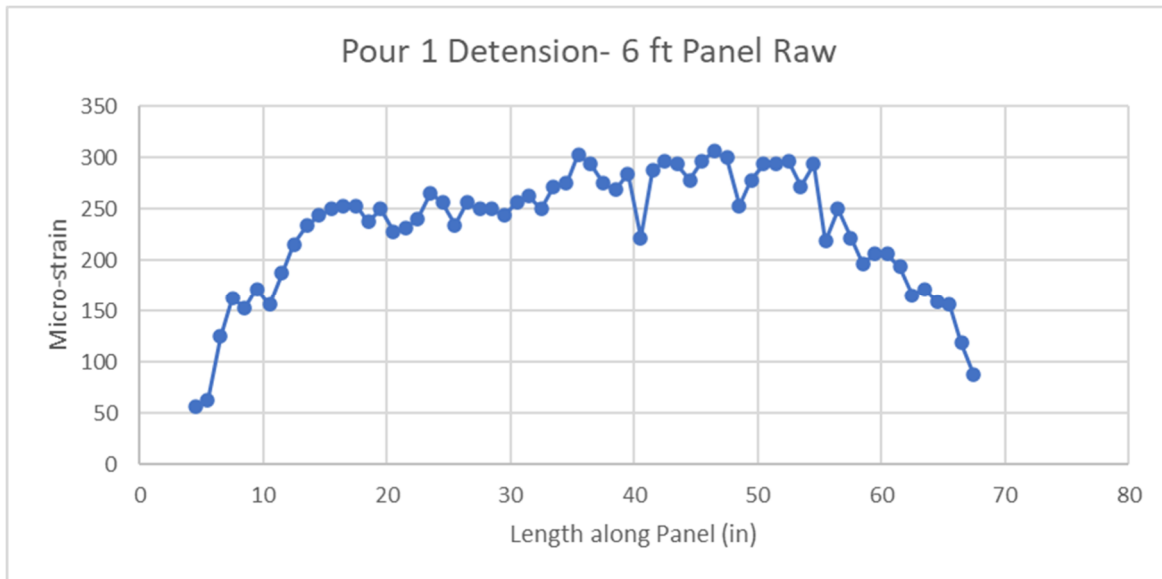


Figure 27: Example of Micro-strain vs. Length along Panel

Historically, the 95% AMS method is done with points every 2” on center with a three-point average. As the points on this project were spaced at every 1” on center, a five-point average of the points would be the same average as the three-point average at every 2” on center. The raw data, along with a three-point and five-point average were used for transfer length determinations. All of the graphs for these are shown in Appendix C and discussed in Chapter 5. A 5-point smoothing of Figure 27 is shown below.

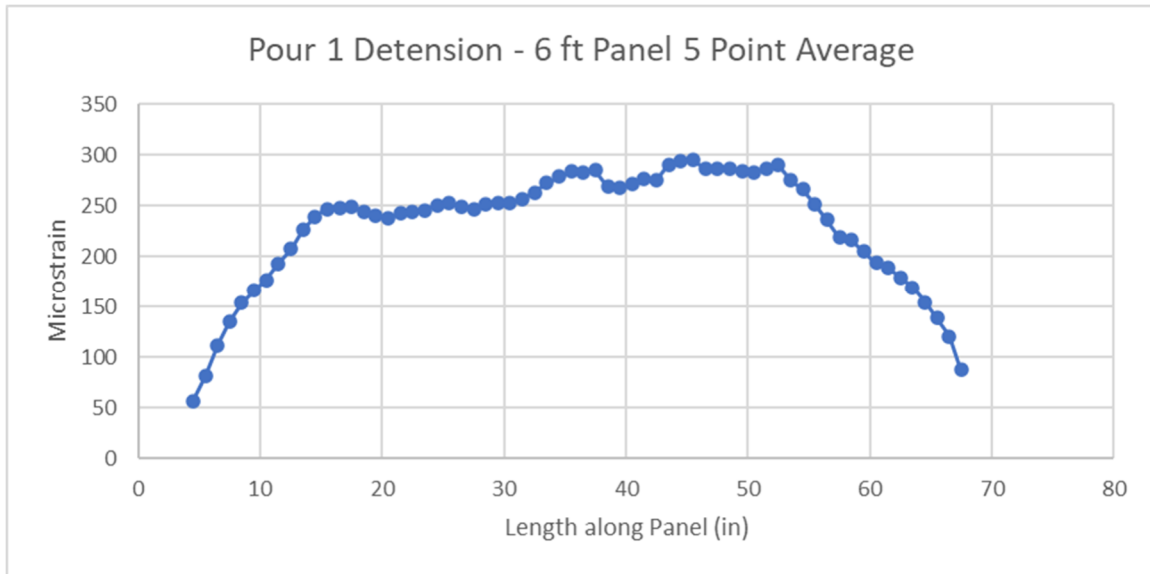


Figure 28: Example of 5-point smoothing

This micro-strain data was then fed into an excel that used macros that calculated the transfer length from one-side of the panel. This excel calculated the transfer length using the 95% method, that is common in the industry, and the Zhao-Lee method that was discussed in Chapter 2. This was done for both sides of the panels for the raw, three-point, and five-point data. These data sheets are found in Appendix C.

Data from the testing of the panels were collected from the MTS System with a .dat file.. As there were two mid-span LVDTs, a column was created that calculated the average mid-span LVDT deflection. A moment column was also created in lb-ft. Graphs were created with the moment vs. average mid-span displacement. Additionally, if end-slip was plotted, it was recorded on the secondary axis. This will be discussed in Chapter 5.

Chapter Five – Results and Discussion

Concrete Compressive Strength

As previously mentioned, ASTM C39 compressive tests were performed on the 10 – 4” by 8” cylinders at de-tension, 7-day, and 28-day curing periods to determine the compressive strength of each pour. The compressive strengths for all pours can be seen below.

Table 8: Average Compression Strengths for All Pours

Average Compressive Strength			
	De-tension (psi)	7 Day (psi)	28 Day (psi)
Pour 1 - 7 Wire Strand	4829	9805	10702
Pour 2 - T4-VAE	4422	10790	10782
Pour 3 - T2-004	4632	11653	11569
Cast-in-Place Topping	-	-	5018

From the table above, all three pours were much greater than the required 5000 psi 28-day compressive strength as the mix was used for early release strength. Additionally, there was little gain in compressive strength after 7 days. The topping pour also exceeded the desired 4000 psi 28-day compressive strength. All cylinder compressive tests are recorded in Appendix D.

Transfer Lengths

The transfer lengths were measured by using the Whittemore gage readings as mentioned above in Chapter 4 and running the data through a macro in Excel. The Excel macro gave the transfer lengths according to the 95% method and the Zhao-Lee method. All Whittemore and transfer length data are in Appendix C. The transfer lengths at de-tension and at 21 days are shown below.

Table 9: Average Transfer Lengths at De-tension

Average Transfer Lengths at De-tension (in)		
	Z-L Method	95% Method
7 Wire	18.8	19.4
T4VAE	20.9	20.5
T2004	20.5	19.4

Table 10: Zhao-Lee Average Transfer Lengths at 21 Days

Average Transfer Lengths at 21 Days (in)			
	Z-L Method	Average Increase from de-tension (Inches)	Average Increase from de-tension (Diameters)
7 Wire	27.9	9.1	24.2
T4-VAE	23.7	2.7	8.7
T2-004	22.6	2.1	6.7

Table 11: 95% AMS Method Average Transfer Lengths at 21 Days

Average Transfer Lengths at 21 Days (in)			
	95% Method	Average Increase from de-tension (Inches)	Average Increase from de-tension (Diameters)
7 Wire	25.9	6.5	17.2
T4-VAE	21.3	0.9	2.3
T2-004	20.8	1.4	3.8

For the 7-wire strand, the transfer length according to AASHTO was 22.5”, which was smaller than the experimental length of 27.9” at 21 days according to the Z-L method. The transfer lengths for both indented wires showed a significantly shorter transfer length than the 7-wire strand at 21 days for both the Zhao-Lee and 95% AMS method. The average increase in diameters from de-tension to 21 days for the 7-wire strand with the Zhao-Lee method was 24.2. For both indented wires this value was 8.7 and 6.7, significantly shorter. Additionally, the T2-004 had the shortest transfer length, which was predicted due to its indentation characteristics.

Ultimate Load Test Results

The panels were loaded to their ultimate loads. Each test's moment vs. average mid-span displacement is shown below. If the panel experienced end-slip, it is recorded on the secondary axis.

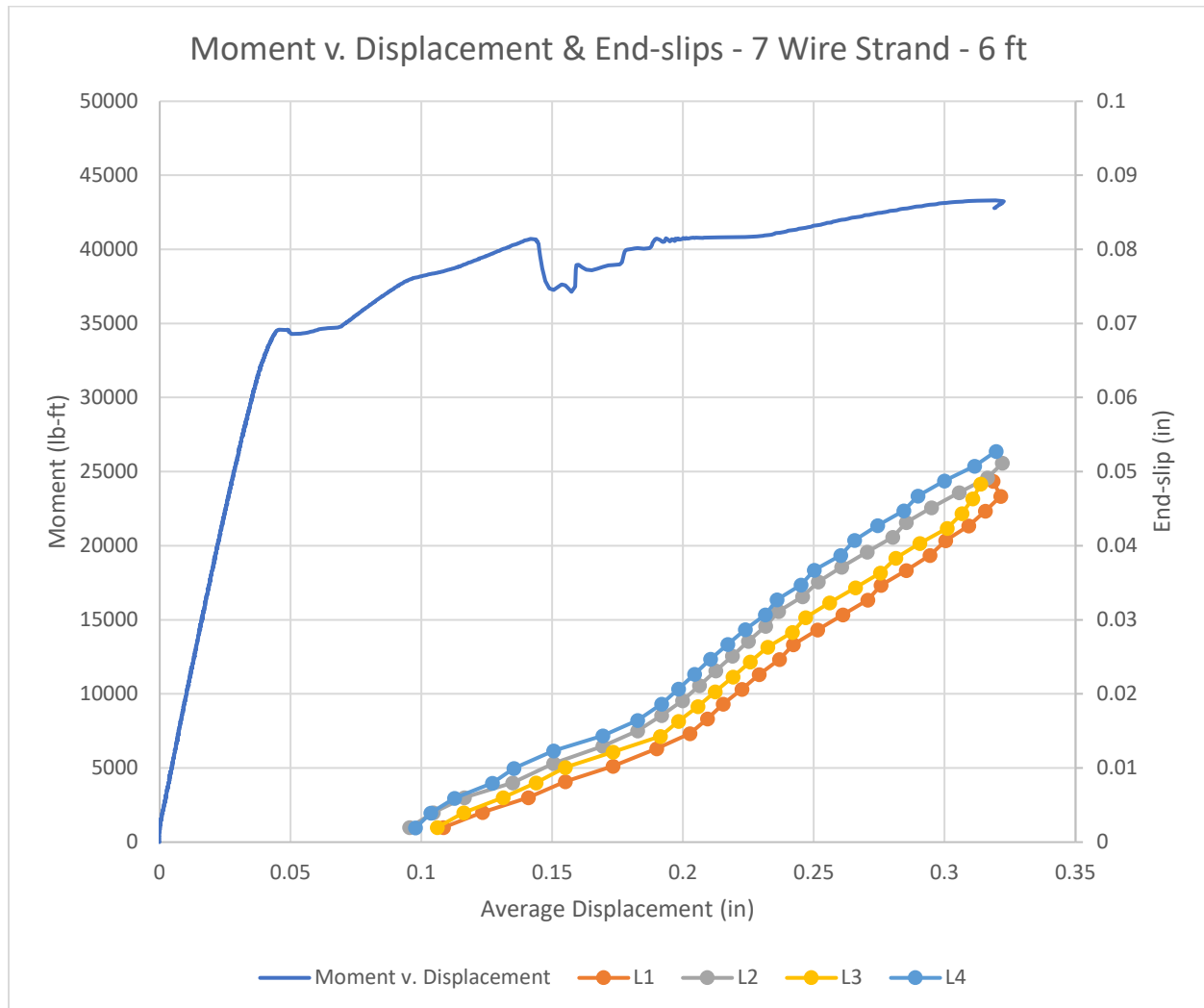


Figure 29: Moment v. Displacement - 7 Wire Strand - 6 ft

At approximately 35,000 lb-ft, the panel undergoes a transition from elastic to the in-elastic. The moment-displacement line then plateaus due to flexural cracking through the panel

and the topping. The crack shifted when it crossed through the plane between the panel and the topping. A figure of this is shown below.



Figure 30: Crack at Plane of Panel and Topping

Additionally, at approximately 40,000 lb-ft with an average displacement of 0.14 inches, a separate flexural crack emerged. The actuator was load-controlled and was not instantaneous in increasing the load on the panel. This is why the region of average displacement from 0.14 to 0.175" decreases, and is not a smooth line. Loads such as dead and live loads are instantaneous and data from these loads would not have this decrease.

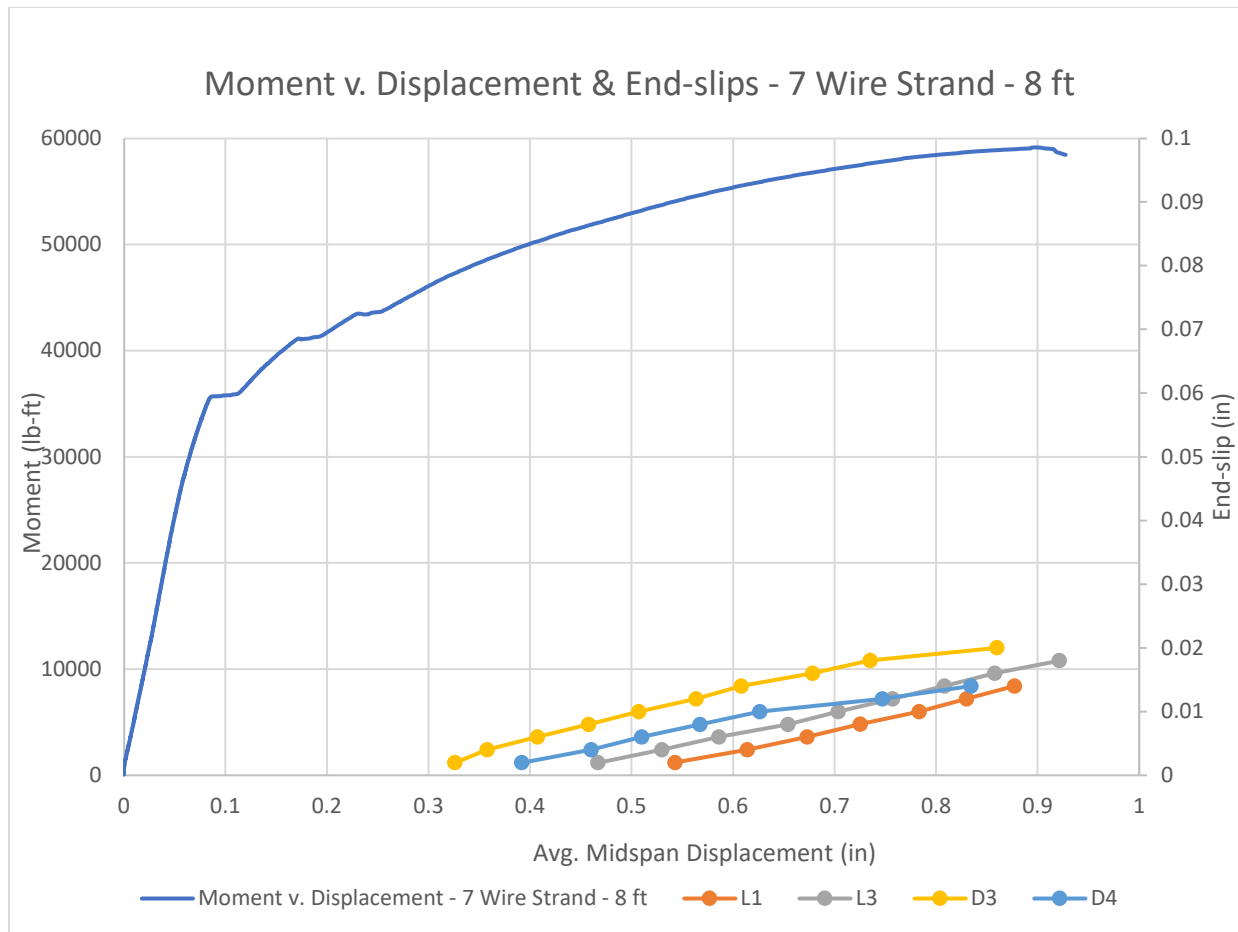


Figure 31: Moment v. Displacement - 7 Wire Strand - 8 ft

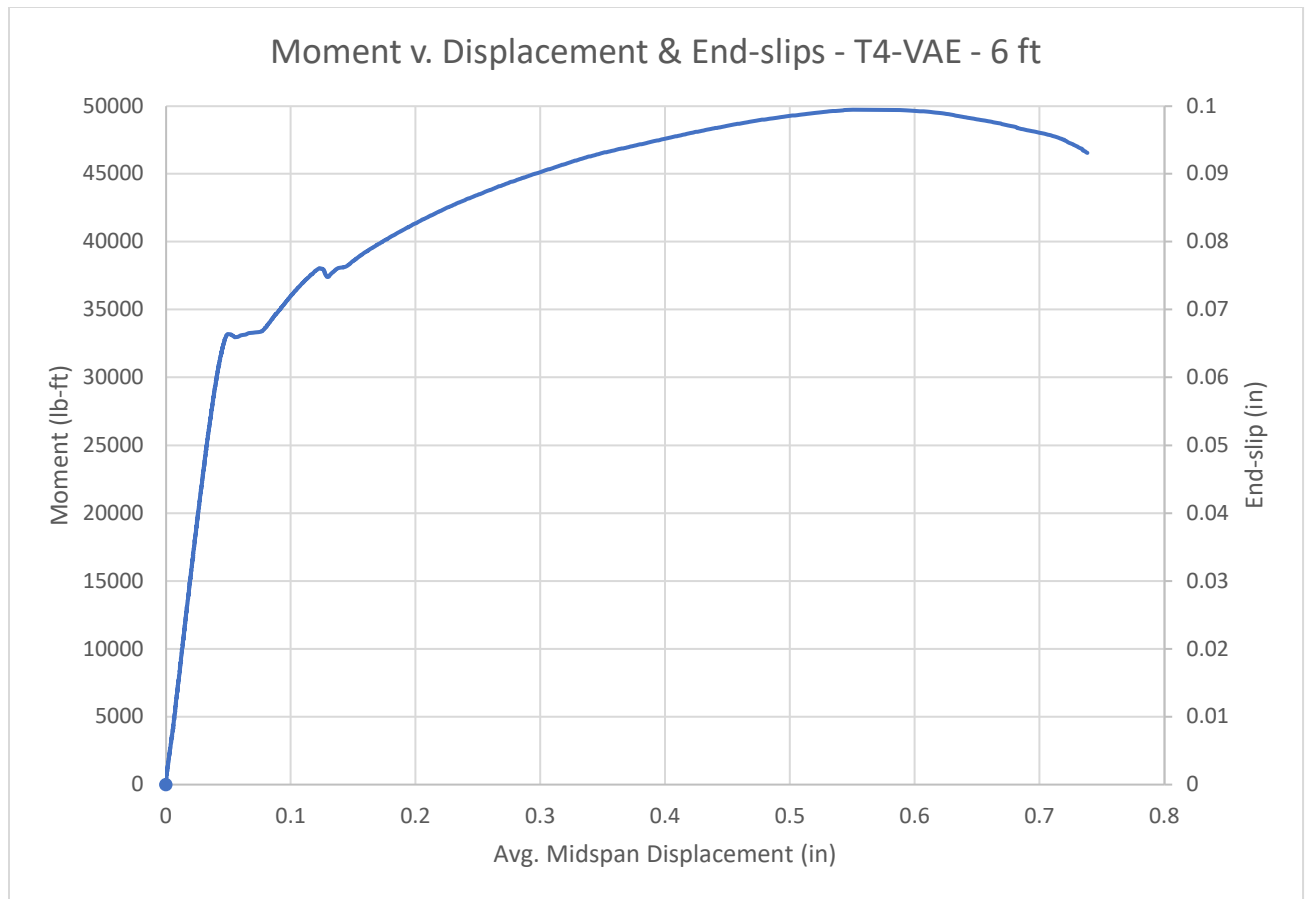


Figure 32: Moment v. Displacement - T4-VAE - 6 ft

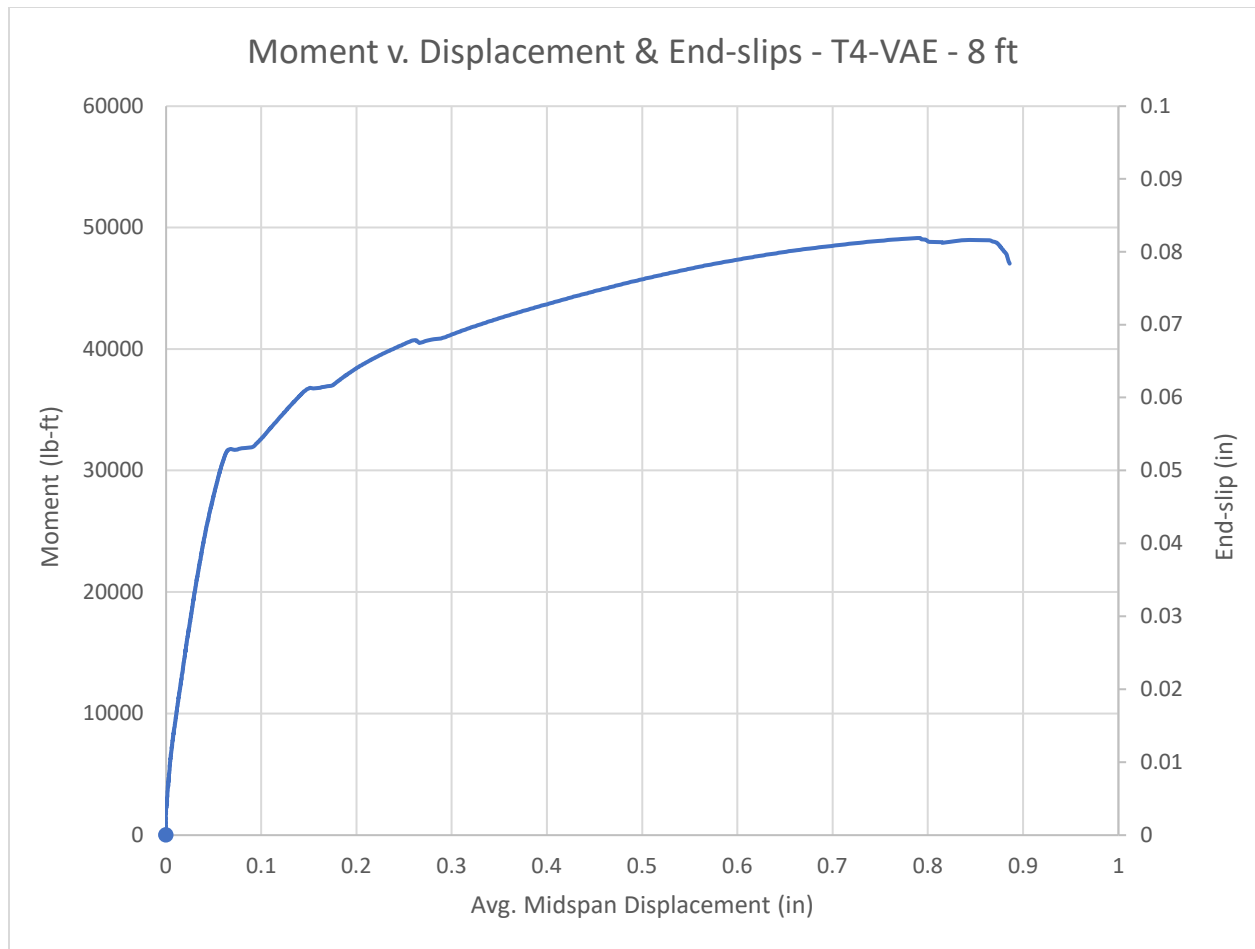


Figure 33: Moment v. Displacement - T4-VAE - 8 ft



Figure 34: Moment v. Displacement - T2-004 - 6 ft

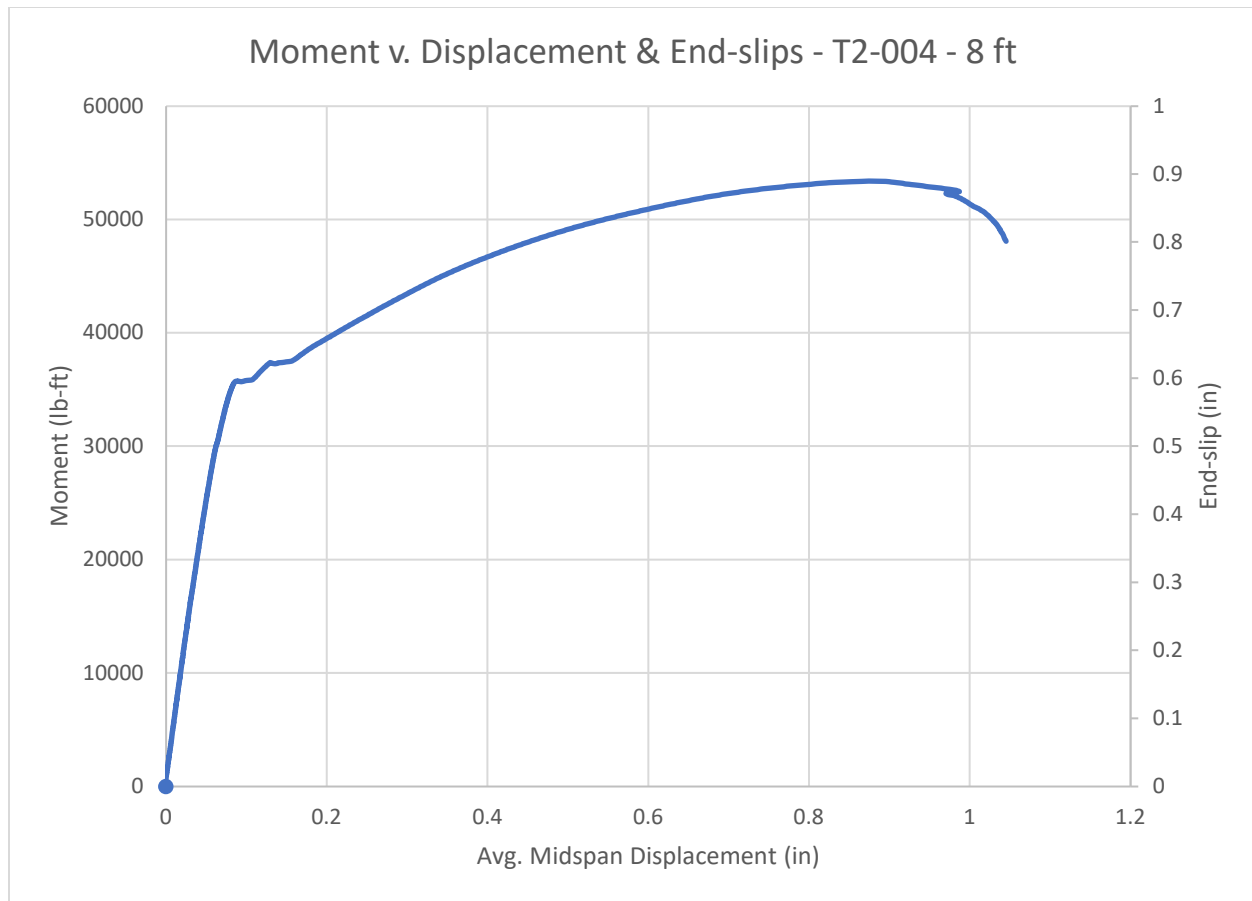


Figure 35: Moment v. Displacement - T2-004 - 8 ft

All plateaus on the above graphs were due to the introduction of new flexural cracks. As these cracks would form, the load was constant as the displacement would increase. The combined graphs for the 6-foot and 8-foot panels are shown below.

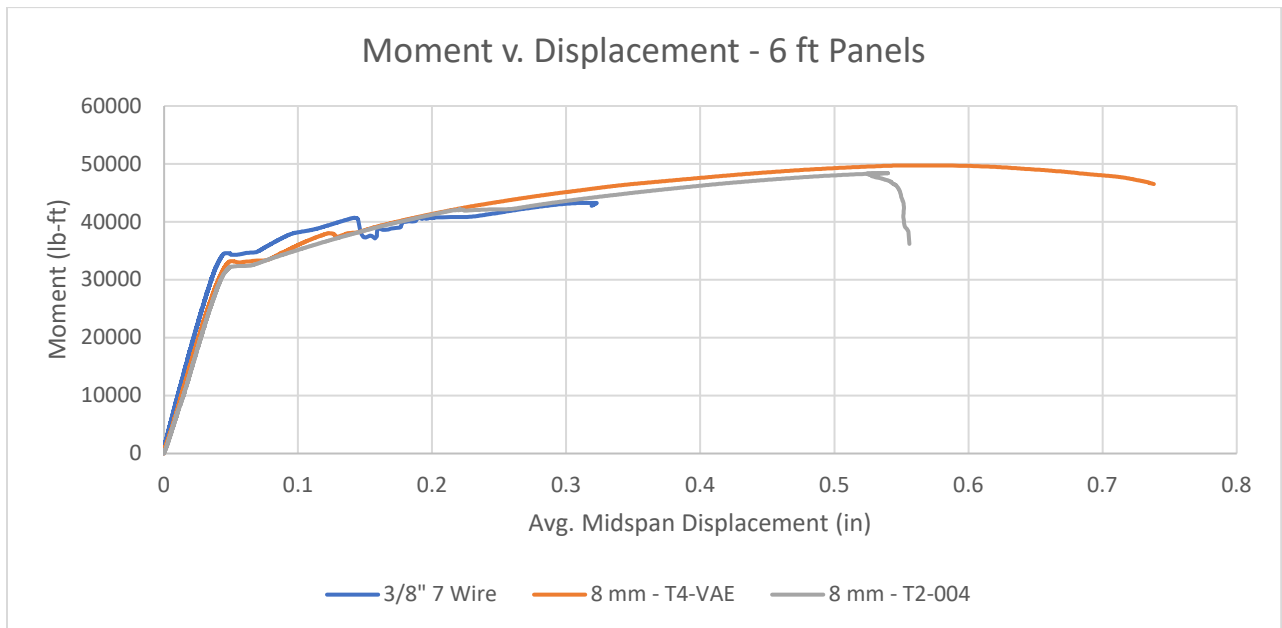


Figure 36: Combined 6-foot Panel Loadings

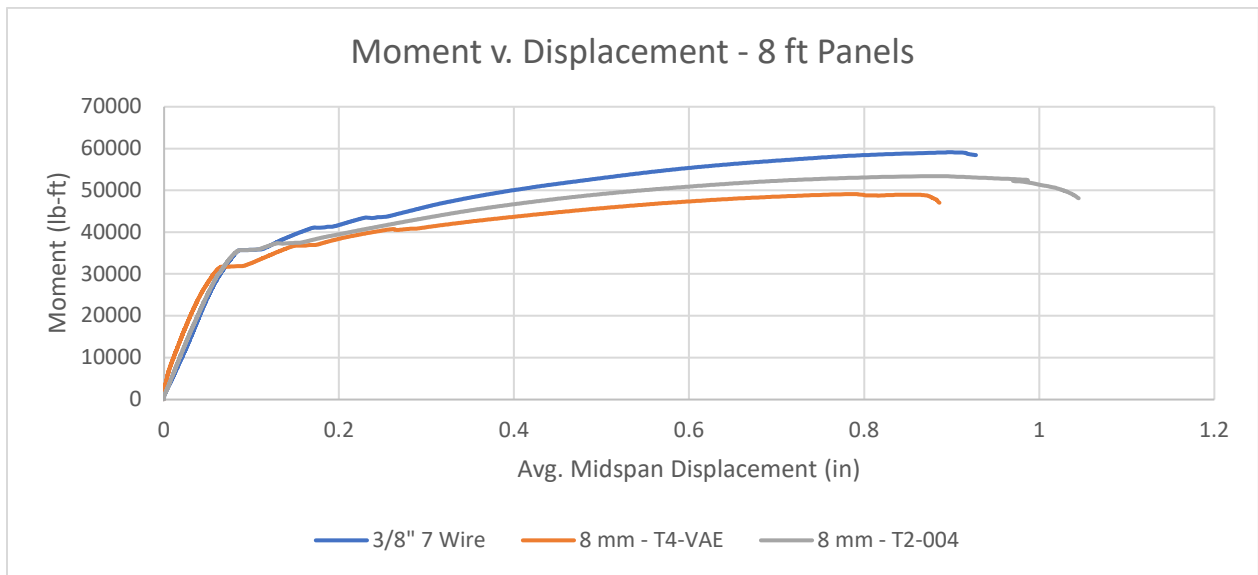


Figure 37: Combine 8-foot Panel Loadings

The stiffnesses of the panels are all relatively close, as shown above in the graphs. The maximum experimental and theoretical moment capacities are shown in the tables below.

Table 12: Ultimate Experimental Moment and Theoretical Moments - 6 ft Panels

6 ft Panels			
	Experimental Moment (k-ft)	KDOT Calculated Moment (k-ft)	Strain Compatibility Moment (k-ft)
3/8" 7 - Wire	43.30	27.36	43.0
8 mm - T4-VAE	49.72	29.99	50.2
8 mm - T2-004	48.40	29.99	50.2

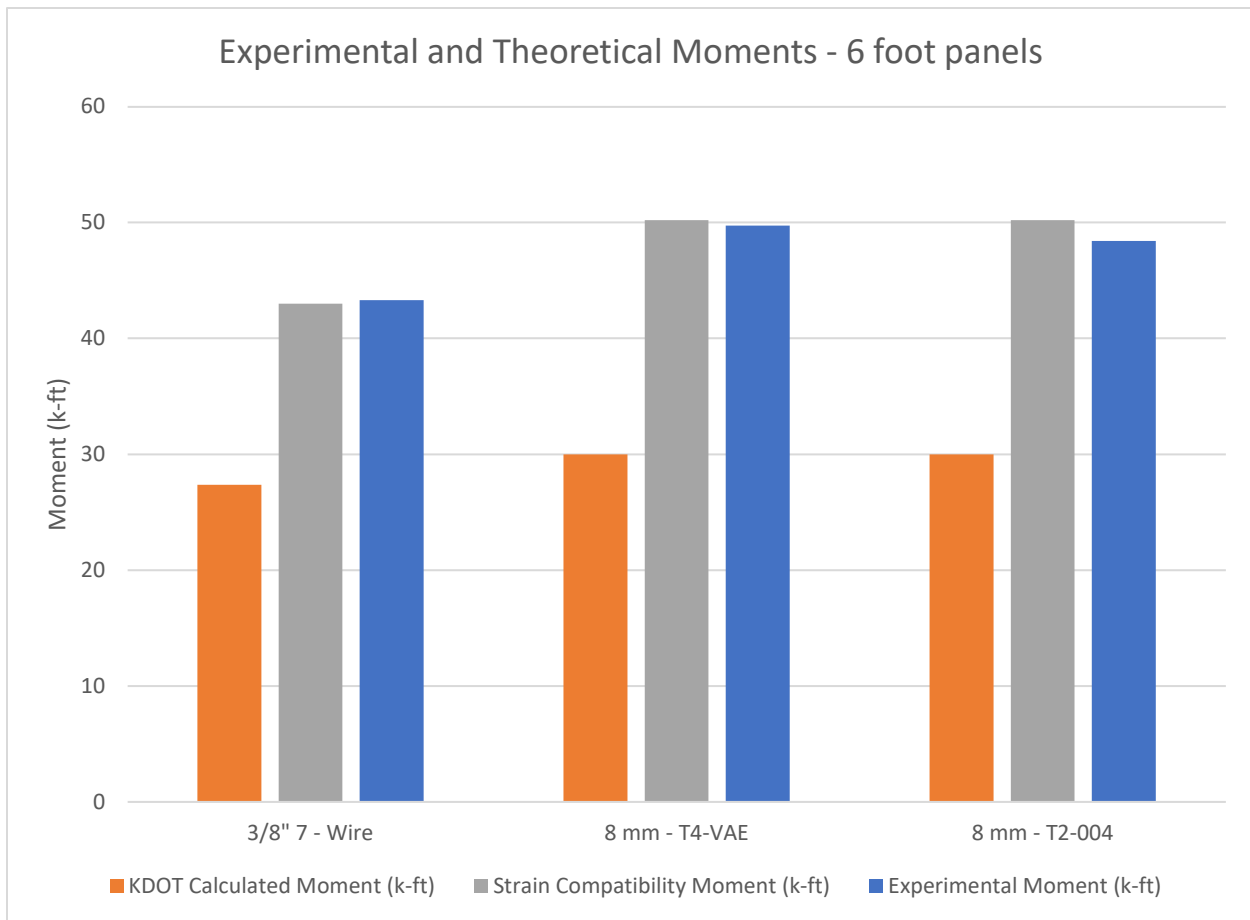


Figure 38: Experimental and Theoretical Moments – 6-foot Panels

Table 13: Ultimate Experimental Moment and Theoretical Moments - 8 ft Panels

8 ft Panels			
	Experimental Moment (k-ft)	KDOT Calculated Moment (k-ft)	Strain Compatibility Moment (k-ft)
3/8" 7 - Wire	59.15	31.71	56.9
8 mm - T4-VAE	49.15	29.99	50.2
8 mm - T2-004	53.39	29.99	50.2

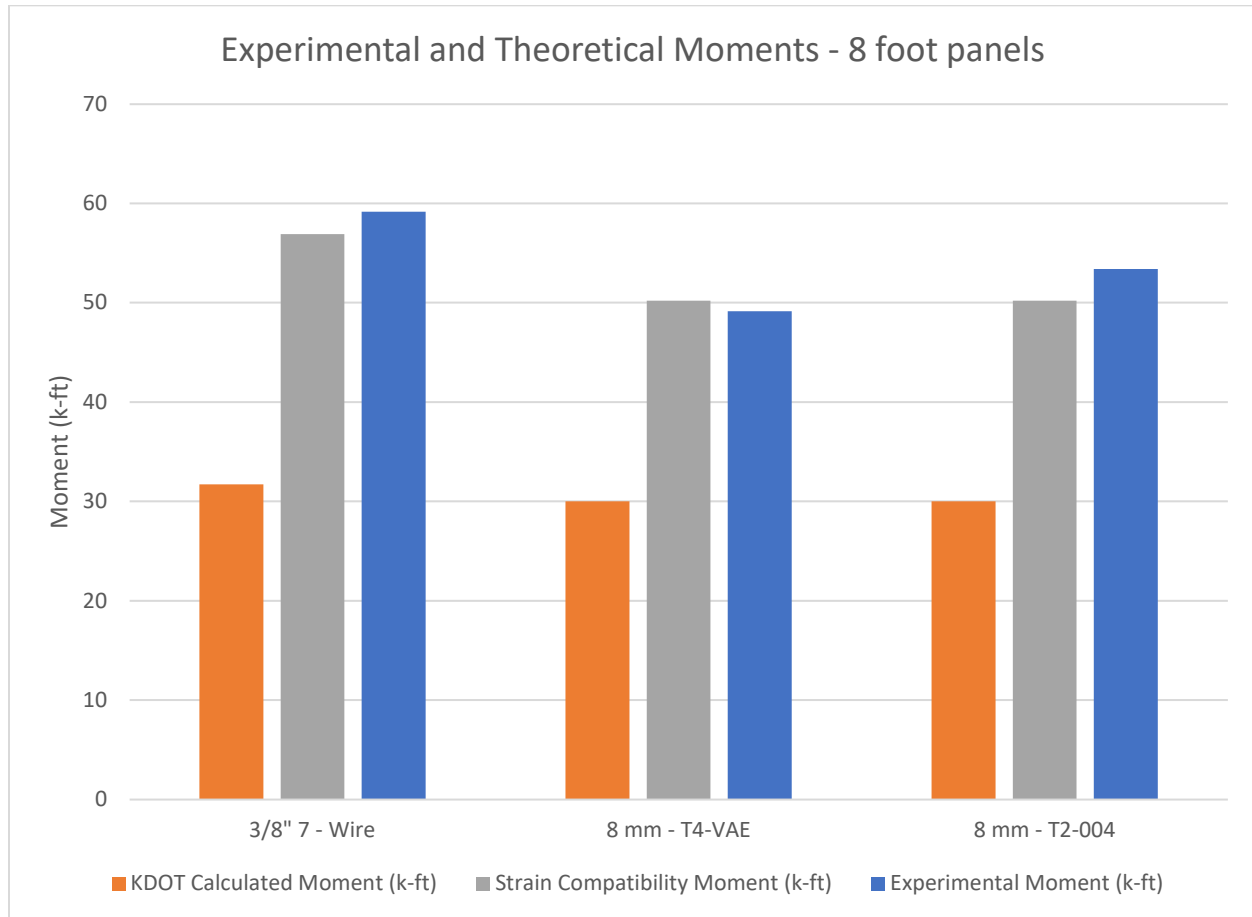


Figure 39: Experimental and Theoretical Moments – 8-foot panels

The theoretical moments above are from the KDOT calculations and strain compatibility analysis that was shown in Chapter 2 above. From the bar charts above, the experimental moment capacity of the panels closely resembled the strain compatibility analysis that included the #5 rebar in the concrete topping as a tension member.

With the 6-foot panels, the indented wires have about 5 to 6 kip-feet stronger than the 7-wire strand. This is due to the development length of the 7-wire strand being longer than half of the 6-foot panel. The indented wires were fully developed and the wire was ruptured, where the 7-wire strand failed before rupture, and experienced end-slip.

For the 8-foot panels, the 7-wire stand was stronger than the indented wires, as the length of the panels was increased, the 7-wire strands were fully developed and ruptured, the same as the indented wires. The 7-wire strand had a greater area of steel, and a higher strength, giving the increase in the experimental moment.

Failure Mechanisms

The failure mechanisms are summarized in the list below.

- 6-foot Panels
 - 7-Wire Strand: Strand slip failure
 - T4-VAE Indented Wire: Rupture of wire
 - T2-004 Indented Wire: Rupture of wire
- 8-foot Panels
 - 7-Wire Strand: Rupture of strand while experiencing end-slip of strand
 - T4-VAE Indented Wire: Rupture of wire
 - T2-004 Indented Wire: Rupture of wire



Figure 40: 6-foot 7-Wire Strand Failure

From above, the failure mechanism is the pull-out of the 7-wire strand for the 6-foot panel. The strand was not developed, making the failure brittle.



Figure 41: 8-foot 7-Wire Strand Failure

The 7-wire strand on the 8-foot panel was fully developed and ruptured completely, as shown above.



Figure 42: 6-ft T4-VAE Failure

All indented wires failed with the rupture of the wire. All the indented wires were fully developed. The assumption that the indented wires would be fully developed for both the 6-foot and 8-foot panel lengths was proven to be correct. Crack drawings for all panels were recorded and are shown in Appendix D.

Chapter Six – Summary, Conclusions, and Future Work

In the review of KDOT's existing pretensioned member designs, specific members that could realize significant advantages by incorporating indented prestressing wires were identified. Prestressed bridge deck panels were chosen as the prime candidate for this. One of the primary factors driving this choice is the relatively short length of these panels, typically less than 8 feet-3 inches. Indented prestressing wires typically have shorter development lengths when compared to conventional 7-wire strand of approximately the same diameter which directly correlates to the maximum moment capacity of the member. Deck panels can directly show the advantages of the indented prestressing wires due to its length.

New member designs employing four prestressing tendons were developed. The design strengths of these panels using KDOT's methodology and strain compatibility analysis were then calculated. KDOT's approach proved to be conservative due to its omission of #5 rebar in the concrete topping. Strain compatibility analysis aligned more closely with experimental results.

Six prestressed panels with varying lengths (6 feet and 8 feet) and prestressing tendons were fabricated, which included 3/8" 7-wire low-relaxation strand, 8 mm T4 European-style indented wire, and 8 mm T2 European-style indented wire. The transfer length was determined using a Whittemore gage and applied two computational methods: the 95% AMS method and the Zhao-Lee method. It was notable that the transfer length of the 7-wire strand closely matched theoretical expectations, while the transfer length of the indented wire was somewhat longer than anticipated.

The experimental tests involved loading the panels to their ultimate moment capacity, and then comparing the results to theoretical values. The outcomes provided compelling evidence that indented wires could be a valuable addition to KDOT's prestressed concrete

design. In the 6-foot panels, indented wires exhibited superior strength despite having a smaller area of prestressing tendon, lower initial prestressing force, and nearly equivalent transfer lengths. For the 8-foot panels, the 7-wire strand demonstrated greater strength, benefiting from full development of the strand and the higher tensile strength of the strand. However, the indented wires still exceeded acceptable AASHTO strength guidelines, emphasizing their feasibility in KDOT's applications.

Future work that could further emphasize indented wires value could include panels that do not have rebar acting as a tension member in the concrete topping. This would highlight the direct comparison between 7-wire strand and indented wires.

The relatively low minimum release strength of 4000 psi, with an actual release strength closer to 4500 psi, may be the reason that the T2-004 indented wire did not have a significantly shorter transfer length than the T4-VAE. Previous research has shown that the transfer length is typically proportional to the bite per length and jacking force for a given release strength.

This research underscores the potential of indented prestressing wires in enhancing the design and performance of prestressed concrete members, particularly in shorter spans. KDOT should consider more research into these tendons in short prestressing members to optimize design efficiency while upholding safety standards.

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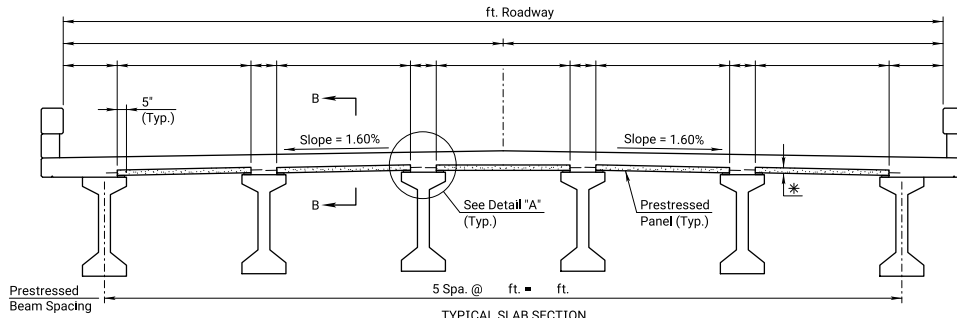
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APPENDIX A – KDOT Drawings, Mix Designs, and Wire Scans

STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
KANSAS	0	0	0	0



TYPICAL SLAB SECTION

TOLERANCES FOR PANELS	
Thickness	+ 1/4" - 1/8"
Length	± 1/4"
Width	± 1/4"
Square Ends (deviation from square)	± 1/4"
Deviation from straightness of mating edge	± 1/8"
Position of Strands:	
	± 1/8" Vertical, ± 1/2" Horizontal

GENERAL NOTES FOR PANELS

Use Concrete (Grade 5.0)(AE)(PB). (F_c = 5000 psi; f_c at release = 4000 psi).
 Use reinforcing steel conforming to the requirements of ASTM A615, Grade 60. All reinforcing steel shall be epoxy coated.

Use 3/8" nominal diameter, uncoated, seven-wire, low relaxation prestressing tendons conforming to the requirements of ASTM A416, Grade 270.

Initial prestressing force = 16.1 kips per strand.

Submit shop details showing the length of the panels and the method of releasing the strands. Release strands symmetrically beginning with the center strand. Lift panels using four corner PA2 bars or by using alternate lifting devices approved by the Engineer.

Store the panels on a flat surface to prevent warping.

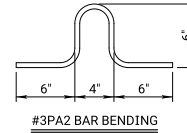
Bedding material for the precast units shall meet the following requirements for expanded or extruded polystyrene:

PROPERTY	TEST REQUIREMENTS
Compression Strength 60 psi Min.	ASTM D 1621
Water Absorption 2% by Vol. Max.	ASTM D 2842
Oxygen Index 24 Min.	ASTM D 2863

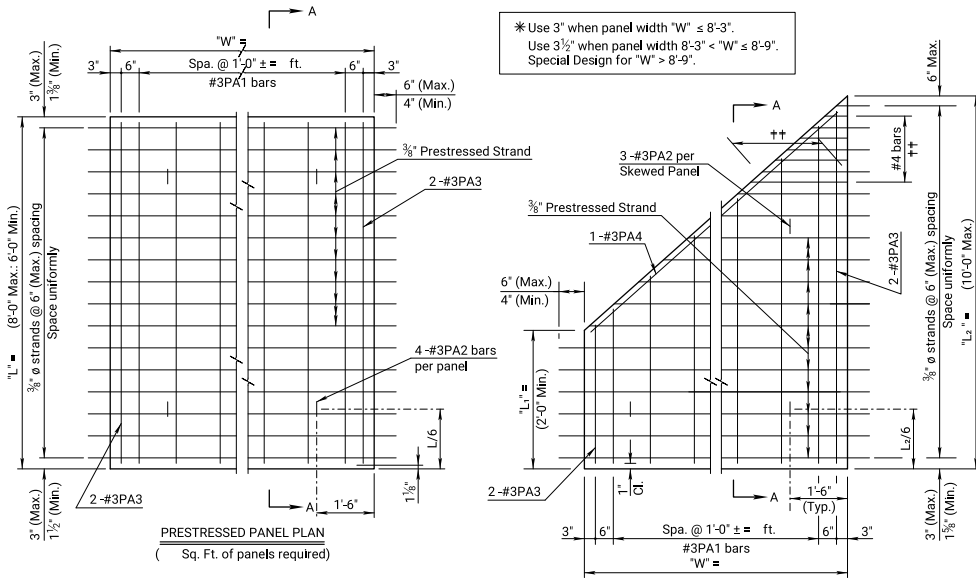
Glue all panel bedding material to the girder. The glue used shall be the type recommended by the panel bedding material manufacturer. Provide a 1/2" gap in the bedding strips for venting purposes. Locate the gaps near the center of each panel.

Deposit concrete in continuous strips over the girders and allow to flow under the ends of the composite deck panels. Consolidate concrete by additional insertion of vibrators directly over girder line. Concrete should then be placed on the remainder of the panels.

Handle the panels so that the PA2 bars are not damaged. Repair any damage to the PA2 bar epoxy coating in accordance with the KDOT Specifications.

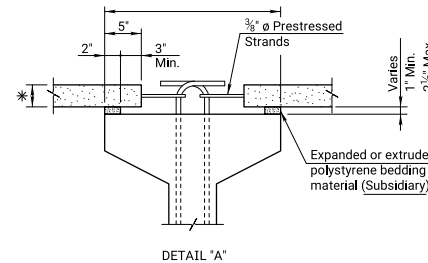


Note to Designer: (To be removed)
 Modify "Typical slab Section" to correspond to your structure.

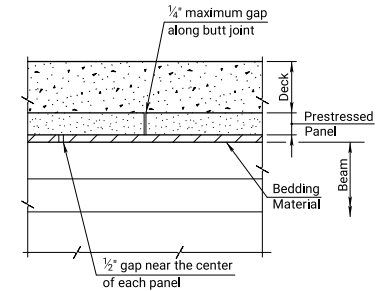


PRESTRESSED PANEL PLAN
 (Sq. Ft. of panels required)

SKEWED PRESTRESSED PANEL PLAN
 (Sq. Ft. of panels required)



DETAIL "A"



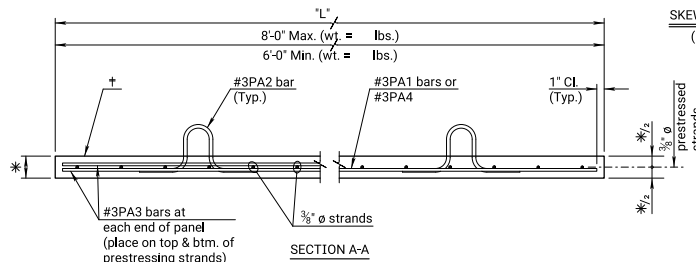
SECTION B-B

BILL OF MATERIALS (Panels)		
Concrete	Cu. Yds.	
Reinforcing Steel	Lbs.	
3/8" Ø Prestressed Strands	Lin. Ft.	

Quantities shown for information only. These quantities shall not be paid for directly but shall be included in the unit price bid for "Prestressed Concrete Panels".

† When initial set occurs, rake the surface perpendicular to the strands making depressions of approximately 1/4". Use care with the rake to prevent pulling out the coarse aggregate. The Contractor shall make every effort to insure that this surface remains free of foreign material until the deck concrete is placed.

†† Any strand embedded 2'-0" or shorter shall have a #4 epoxy-coated reinforcing bar placed on each side of it, centered between the strands. The reinforcing bars do not need to extend beyond the limits of the panel. Strands 2'-0" or shorter may then be debonded at the fabricator's option.



SECTION A-A

03	08-16-18	Notes, dimension, table corrections	M.L.L.	J.P.J.
02	07-30-07	LRFV Review	J.P.J.	K.F.H.
01	10-04-04	Current Release	J.P.J.	K.F.H.
NO	DATE	REVISIONS	BY	APPD
KANSAS DEPARTMENT OF TRANSPORTATION				
Br. No.			Sta.	
PRESTRESSED CONCRETE PANEL DETAILS				
Proj. 0			Co.	
DESIGNED	DETAILED	QUANTITIES	CADD	
DESIGN CK	DETAIL CK	QUAN CK	CADD CK	
KDOT Graphics Certified 07-18-2022 Sh. No. 0				

CS-729-LS

Coreslab Mix Design

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Plant*****P2245***Coreslab (Kansas City)*****
Number          : CS-729-LS
Description      : 22KCA10A134CSMODOT
Status          : Active
Status          : Active
Date            : 2023-06-09 - 09:42:28
User            : D
Total Volume    : 26.6 cf
Total Weight    : 3837 lb
Base Cost       : 0.00
Price           : 0.00
Mix Time        : 10 sec
Dry mix time    : 160
Moisture        : Bins
%Moist. target  : 6.9%(248/3579)
Strength        : 0 psi
Class           : 0
Slump           : 9.50 "
Slump Tolerance :
Temperature     : DEFAULT
Air %           : 7.0 %
Max/Batch       : Auto
Water density   : DEFAULT
W/C             : 0.31
Max W/C         :
Max job site water : 0 gal
Allow returns   : Yes
Allow use as return : Yes
Discharge Sequence: PROCESS
Custom Process Code :
Wash Mix        : No
Color Code      :

```

Pref.	BatcherCode	Material	Quantit	Volume	Rank	Cost	Pref.	Bin
Water	0000	WATER	27.50gal	3.67621		0.00		
Cement	0000	TYPE 3 East	01b	0.00000		0.00		
Cement	C-0001	TYPE 3 West	7291b	3.70713		0.00		
Aggregate	G-0004	SAND	11161b	6.74589		0.00		
Aggregate	G-0003	LIMESTONE	17521b	10.47177		0.00		
Admix	0000	PS1466	9.00oz/1001b	0.06852		0.00		
Admix	0000	VR10	81.00oz/yard	0.08459		0.00		

Mixer	Gain	Offset
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PROCESS	0.000000	0.000
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DATE: 8/1/2023

Mix Code **1P23MCP24A** Description **PCCP - Slip Form Paving**

Revision Number : 4 Creation Date 30 Jun 2023 Customer :

Plant : MANHATTAN BATCH PLANT Created By : charlesh Project :

Specifications

Consistence Class : 4.00 Max W/C : 0.45 Max Agg Size : 3/4
Strength Class : 4000 Min Cement : 564 lb Air Class : AIR ENTRAINED
Exposure Class :

Material Type	Material Code	Description	Source Supplier	Design Quantity	Specific Gravity	Volume ft3	
Cement	ASHGROVE1L	ASHGROVE TYPE 1L	Ash Grove Cement Co.-Chanute Plant	451 lb	3.07	2.35	
Fly Ash	TYPEFASH	ASHGROVE CLASS F FLY ASH	Ash Grove Cement Co.-Chanute Plant	113 lb	2.60	0.70	
Coarse Aggregate	MQCA-5	BAYER ZEANDALE ASTM 57/67 - CA5	Bayer Construction Co.-Zeandale Plant	1033 lb	2.60	6.37	
Fine Aggregate	KPSAND	MCM KP FINE AGGREGATE	Midwest Concrete Materials-Kaw Sand Plant	1918 lb	2.63	11.69	
Water	WATER	WATER	Midwest Concrete Materials-City Water	30.5 gal	1.00	4.08	
Admixture	A/E	GRACE AIR ENTRAINER	GCP Applied Technologies-GCP	5 lq oz	1.00	0.00	
Admixture	ADVA140	GRACE MID-RANGE WATER REDUCER	GCP Applied Technologies-GCP	28 lq oz	-	-	
				Air Content	6.50 %	--	1.75
				Yield	3770 lb	--	26.94

Design Properties

W/C Eq : 0.45 Density : 139.9 lb/ft3 Grading Specification :
Cement Eq : 564 lb Chloride/Cem : 0.00 % Actual Dmax : 0 mm
Cement Eq:lim : lb

Prepared By:

Engineer:

Chaz Hill

Wire Identification: Nucor 8.0-mm Wire with T4-Indent Style - VAE

Scan Date: 10/5/2021

Total Number
of Indents
Scanned
105

Indents in
Row 1
35

Indents in
Row 2
35

Indents in
Row 3
35

Orientation
(Degrees)

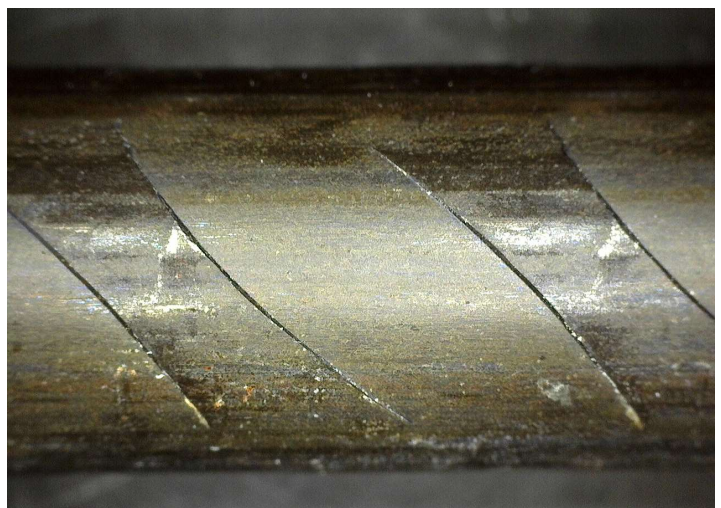
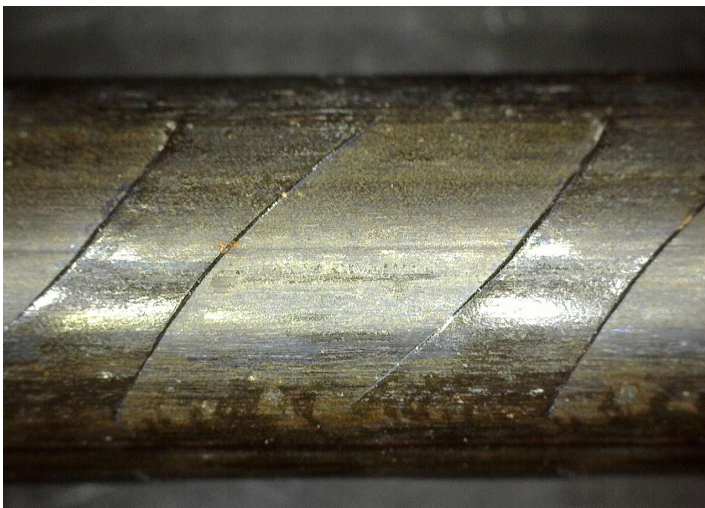
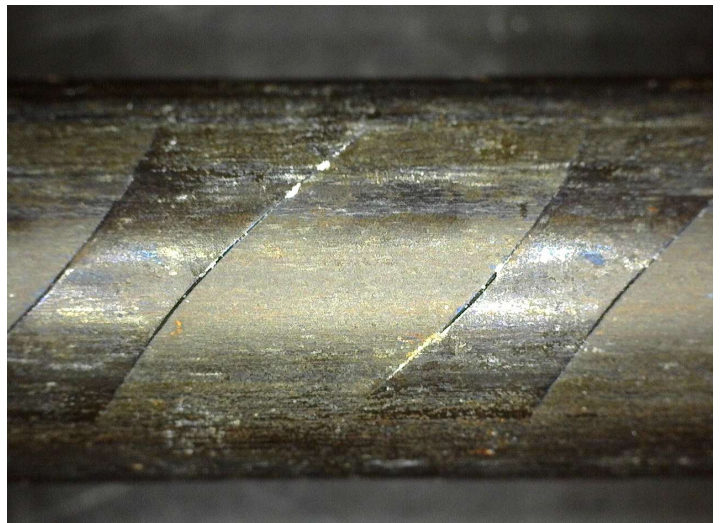
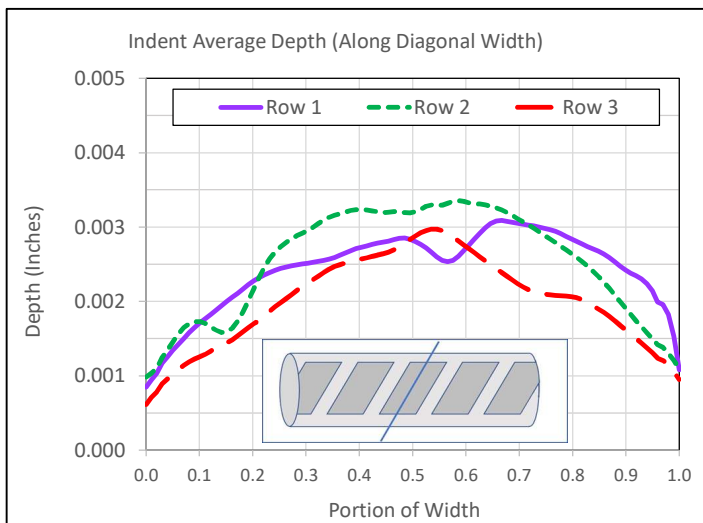
Row 1
-48.0

Row 2
48.6

Row 3
46.3

	Row 1			Row 2			Row 3		
	5 Percentile	Mean	95 Percentile	5 Percentile	Mean	95 Percentile	5 Percentile	Mean	95 Percentile
Indent Depth (inches)	0.00111	0.00242	0.00326	0.00112	0.00252	0.00353	0.00078	0.00200	0.00307
Indent Length (inches)	0.21573	0.23718	0.25590	0.21134	0.23562	0.25590	0.21747	0.24009	0.25591
Sidewall Angle Left (Degrees)	1.7	5.6	8.2	2.2	6.7	9.9	1.2	5.1	8.1
Sidewall Angle Right (Degrees)	2.5	6.5	9.1	1.8	6.4	9.4	1.2	4.8	7.5
Profile Area (square inches)	0.000227	0.000517	0.000721	0.000221	0.000538	0.000783	0.000161	0.000433	0.000685
Sidewall Length Left (inches)	0.01904	0.02693	0.03789	0.01565	0.02287	0.03155	0.01689	0.02481	0.03672
Sidewall Length Right (inches)	0.01635	0.02285	0.03154	0.01779	0.02614	0.03921	0.01726	0.02583	0.03339
Basin Length (inches)	0.16200	0.18406	0.20342	0.16094	0.18700	0.20506	0.16768	0.18937	0.20360
Indent Width (inches)	0.17929	0.18935	0.20430	0.19298	0.20201	0.21020	0.17968	0.19410	0.21379
Volume (cubic mm)	1.387	1.581	1.761	1.617	1.767	1.997	1.210	1.357	1.506
Indent Pitch (inches)	0.32009	0.32035	0.32047	0.31998	0.32015	0.32025	0.32016	0.32048	0.32102
Side Area Left (square inches)	0.00571	0.00677	0.00886	0.00564	0.00608	0.00676	0.00561	0.00657	0.00774
Right Side Area (square inches)	0.00512	0.00574	0.00668	0.00593	0.00693	0.00845	0.00577	0.00685	0.00826

Bite per Length (mm³/inch) = 2.73



Wire Identification: Nucor 8-mm Wire with T2-Indent Style - Target Depth 0.004"

Scan Date: 3/18/2021

Total Number
of Indents
Scanned
232

Indents in
Row 1
78

Indents in
Row 2
77

Indents in
Row 3
77

Orientation
(Degrees)

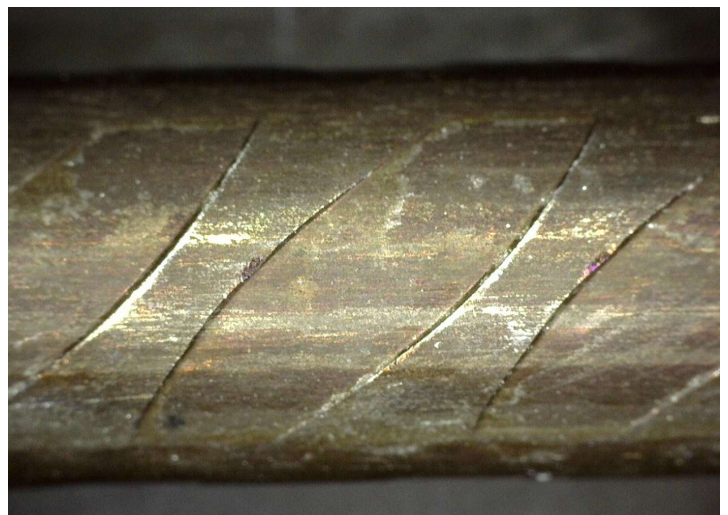
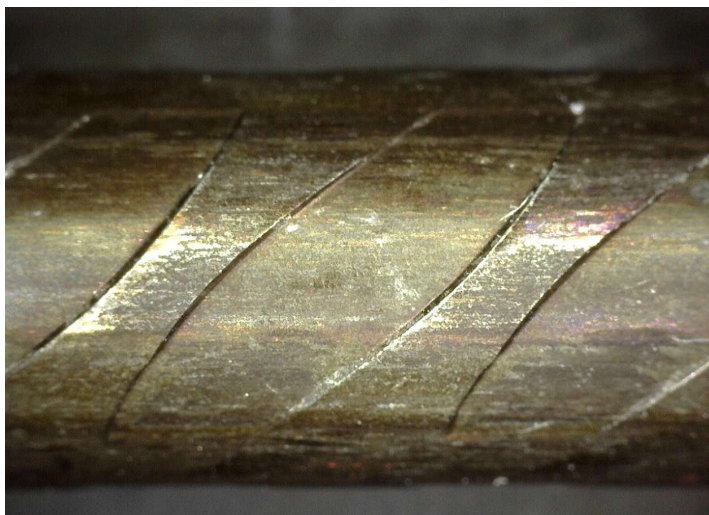
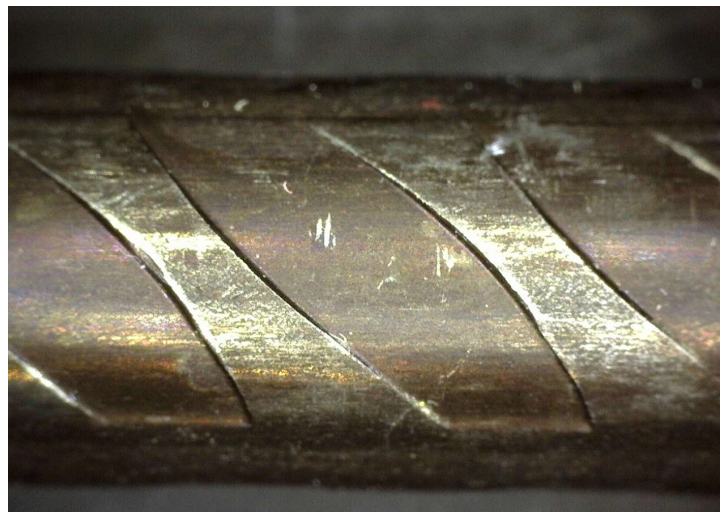
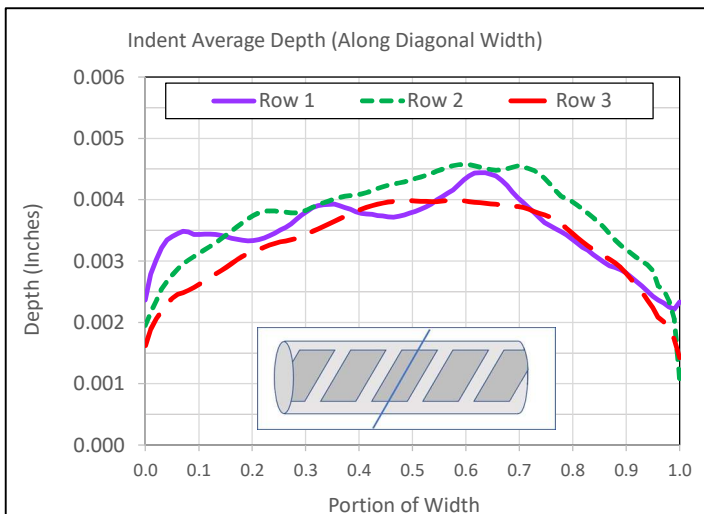
Row 1
-52.6

Row 2
52.4

Row 3
47.8

	5 Percentile	Row 1 Mean	95 Percentile	5 Percentile	Row 2 Mean	95 Percentile	5 Percentile	Row 3 Mean	95 Percentile
Indent Depth (inches)	0.00230	0.00353	0.00463	0.00241	0.00380	0.00480	0.00198	0.00333	0.00428
Indent Length (inches)	0.13715	0.16674	0.18863	0.13727	0.16448	0.18385	0.14083	0.16650	0.18574
Sidewall Angle Left (Degrees)	3.9	7.5	11.1	5.0	8.6	12.2	3.4	6.6	9.6
Sidewall Angle Right (Degrees)	5.2	9.0	13.9	4.8	8.7	11.5	3.8	7.9	11.9
Profile Area (square inches)	0.000283	0.000501	0.000711	0.000272	0.000536	0.000741	0.000229	0.000471	0.000668
Sidewall Length Left (inches)	0.01856	0.02894	0.04399	0.02084	0.02632	0.03446	0.02260	0.03010	0.04054
Sidewall Length Right (inches)	0.01621	0.02371	0.03126	0.02120	0.02575	0.03187	0.01833	0.02584	0.03532
Basin Length (inches)	0.08025	0.11286	0.13784	0.08404	0.11300	0.13729	0.07902	0.11112	0.13676
Indent Width (inches)	0.24383	0.25628	0.27093	0.26501	0.27726	0.28936	0.22204	0.23738	0.25111
Volume (cubic mm)	1.917	2.084	2.253	2.276	2.407	2.479	1.722	1.825	1.955
Indent Pitch (inches)	0.22294	0.22342	0.22445	0.22328	0.22394	0.22473	0.22394	0.22431	0.22521
Side Area Left (square inches)	0.00844	0.00924	0.01045	0.00850	0.00913	0.00950	0.00882	0.00953	0.01010
Right Side Area (square inches)	0.00670	0.00757	0.00844	0.00835	0.00892	0.00947	0.00747	0.00815	0.00872

Bite per Length (mm³/inch) = 7.91



APPENDIX B – KDOT Panel Calculations and Strain Compatibility

KDOT Prestressed Deck Panel Design:

Input: 7-Wire Strand - 8 ft

Total Finished Deck Slab Thickness	t_{total}	=	8 in
Prestressed Panel Thickness	t_{panel}	=	3 in
Girder Spacing (center to center of the web)	S	=	8 ft
Initial Prestressing Force Before Losses	P_i	=	-16.1 kip
Final Compression Strength of Cast in Place Slab	f_{pc_slab}	=	4 ksi
Final Compression Strength of Prestressed Panel	f_{pc_panel}	=	5 ksi
Initial Compression Strength of Prestressed Panel	f_{pci_panel}	=	4 ksi
Unit Weight of Concrete	W_c	=	150 pcf
Yield Strength of Plain Reinforcement	f_y	=	60 ksi
Yield Strength of Prestressed Strand	f_{py}	=	243 ksi
Ultimate Strength of Prestressed Strand	f_{pu}	=	270 ksi
Area of Prestressed Strand	A_{ps}	=	0.085 sq. in
Diameter of Prestressed Strand	d_{ps}	=	3/8 in
Modulus of the Prestressed Strand	E_p	=	28500 ksi
Effective Width for one Prestressed Strand	b	=	6 in
Width of the Pressed Girder Top Flange	$w_{topFlange}$	=	24 in
Average Humidity	H	=	65

Calculated Panel Span:

$$S_{panel} := S - (w_{topFlange} - 10 \cdot \text{in})$$

$$S_{panel} = 82 \text{ in}$$

Calculated Slab Thicknesses:

$$t_{slab} := t_{total} - t_{panel} \quad t_{structural} := t_{total} - 1 \cdot \text{in} \quad t_{slab_struct} := t_{structural} - t_{panel}$$

$$\begin{aligned} t_{slab} &= 5 \text{ in} \\ t_{structural} &= 7 \text{ in} \\ t_{slab_structural} &= 4 \text{ in} \end{aligned}$$

Calculated Modulus:

$$E_{ps} := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pc_panel}} \cdot ksi$$

$$E_c := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pc_slab}} \cdot ksi$$

$$E_{ct} := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pci_panel}} \cdot ksi$$

Eps = 4030.5 ksi
Ec = 3605.0 ksi
Ect = 3605.0 ksi

Allowable Prestressing Strand Stress before Losses:

$$f_{pi} := \frac{P_i}{A_{ps}} < -0.75 \cdot f_{pu}$$

fpi = -189.412 ksi
0.75 f_{pu} = -202.5 ksi

Check: OK

Unity: 0.935367

Article 5.9.5.2.3a Elastic Shortening:

$$f_{cgp} := \frac{P_i}{t_{panel} \cdot b}$$

$$\Delta f_{pES} := \frac{E_p}{E_{ct}} \cdot f_{cgp}$$

fcgp = -0.89444 ksi
Δf_{pES} = -7.0712 ksi

Article 5.9.5.3 Time Dependent Losses:

$$\gamma_h := 1.7 - 0.01 \cdot H \quad \gamma_{st} := \frac{5 \cdot ksi}{1 \cdot ksi + f_{pci_panel}}$$

$$\Delta f_{pLT} := 10.0 \cdot \frac{f_{pi} \cdot A_{ps}}{A_g} \cdot \gamma_h \cdot \gamma_{st} - 12.0 \cdot ksi \cdot \gamma_h \cdot \gamma_{st} - \Delta f_{pR}$$

Ag = 18 sq. in
γ_h = 1.05
γ_{st} = 1
Δf_{pR} = 2.4 ksi
Δf_{pLT} = -24.3917 ksi

Article 5.9.5.1 Loss of Prestress:

$$\Delta f_{pT} := \Delta f_{pES} + \Delta f_{pLT}$$

$$\Delta f_{pT} = -31.4629 \text{ ksi}$$

$$\frac{\Delta f_{pT}}{f_{pi}} = 16.61083 \%$$

Total Concrete Compressive Stress After Losses:

$$\sigma_{ps} := \frac{A_{ps} \cdot (f_{pi} - \Delta f_{pT})}{A_g}$$

$$\sigma_{ps} = -745.87 \text{ psi}$$

$$\sigma_{ps} > -0.45 \cdot f_{pc_panel}$$

$$0.45 f_{pc_panel} = -2250 \text{ psi}$$

Check : OK

Unity: 0.331498

Transformed Section Properties:

$$b_{eff} := \frac{E_c}{E_{ps}} \cdot b$$

$$b_{eff} = 5.366563 \text{ inches}$$

$$y_{bar} := \frac{\left(\frac{t_{panel}}{2} \right) \cdot (b \cdot t_{panel}) + \left(t_{panel} + \frac{t_{slab_struct}}{2} \right) \cdot (b_{eff} \cdot t_{slab_struct})}{(b_{eff} \cdot t_{slab_struct}) + (b \cdot t_{panel})}$$

$$y_{bar} = 3.403699 \text{ inches}$$

$$I_{total} := \frac{b}{12} \cdot t_{panel}^3 + \frac{b_{eff}}{12} \cdot t_{slab_struct}^3 + (b \cdot t_{panel}) \cdot \left(y_{bar} - \frac{t_{panel}}{2} \right)^2 + (b_{eff} \cdot t_{slab_struct}) \cdot \left(t_{panel} + \frac{t_{slab_struct}}{2} - y_{bar} \right)^2$$

$$I_{total} = 162.0547 \text{ in}^4$$

$$S_{comp} := \frac{I_{total}}{y_{bar}}$$

$$s_{comp} = 47.61135 \text{ in}^3$$

$$I_{panel} := \frac{1}{12} \cdot b \cdot t_{panel}^3$$

$$I_{panel} = 13.5 \text{ in}^4$$

$$S_{panel} := \frac{I_{panel}}{\frac{t_{panel}}{2}}$$

$$s_{panel} = 9 \text{ in}^3$$

Applied Loads:

$$S_{eff_Panel} := S_{panel} - 2 \cdot 5 \cdot \text{in} + 2 \cdot 1 \cdot \text{in}$$

$$S_{eff_Panel} = 74 \text{ inches}$$

$$S_{eff_Slab} := S - 2 \cdot \frac{W_{topFlange}}{3}$$

$$S_{eff_Slab} = 80 \text{ inches}$$

$$M_{DL_SelfWeight} := \frac{W_c \cdot b}{8} \cdot t_{panel} \cdot S_{eff_Panel}^2$$

$$M_{DL_SelfWeight} = 89.1276 \text{ ft} \cdot \text{lb}$$

$$M_{DL_Slab} := \frac{W_c \cdot b}{8} \cdot t_{slab} \cdot S_{eff_Panel}^2$$

$$M_{DL_Slab} = 148.546 \text{ ft} \cdot \text{lb}$$

$$M_{LL_Construction} := 50 \cdot \frac{\text{lbf}}{\text{ft}^2} \cdot \frac{b}{8} \cdot S_{eff_Panel}^2$$

$$M_{LL_Construction} = 118.8368 \text{ ft} \cdot \text{lb}$$

$$M_{DL_FWS} := 25 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{b}{10} \cdot S_{eff_Slab}^2$$

$$M_{DL_FWS} = 55.55556 \text{ ft} \cdot \text{lb}$$

OLD WAY FOR LL:

$$IMP = 1.3$$

$$M_{LL_old} := \frac{S_{eff_Slab} + 2 \cdot \text{ft}}{32} \cdot 16000 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{0.80}{12 \cdot \text{in}} \cdot b \cdot IMP$$

$$M_{LL_old} = 2253.333 \text{ ft} \cdot \text{lb}$$

From Appendix 4A the Positive Live Load Moment for the given Girder Spacing S is:

$$M_{A4_1} = 5690 \text{ ft} \cdot \text{lb}$$

$$M_{LL} := \frac{M_{A4_1}}{12 \cdot \text{in}} \cdot b$$

$$M_{LL} = 2845 \text{ ft} \cdot \text{lb}$$

$$\frac{M_{LL}}{M_{LL_old}} = 1.262574$$

Calculated Stresses at the Service III Level:

$$\gamma_{DL} = 1$$

$$\gamma_{LL} = 0.8$$

$$\sigma_{DL_Construction} := \gamma_{DL} \cdot \left(\frac{M_{DL_SelfWeight}}{S_{panel}} + \frac{M_{DL_Slab}}{S_{panel}} \right)$$

$$\sigma_{DL_Construction} = 316.8981 \text{ psi}$$

$$\sigma_{LL_Construction} := \gamma_{LL} \cdot \left(\frac{M_{LL_Construction}}{S_{panel}} \right)$$

$\sigma_{LL_Construction} =$ 126.7593 psi

$$\sigma_{Construction} := \sigma_{DL_Construction} + \sigma_{LL_Construction} + \sigma_{ps}$$

$\sigma_{Construction} =$ -302.212 psi

$$0.0948 \cdot \sqrt{f_{pci_panel}} \quad 189.6 \text{ psi}$$

$$\sigma_{Construction} < 0.0948 \cdot \sqrt{f_{pci_panel}}$$

Check: OK

Unity: -1.59395

Stress At Final Condition:

$$\sigma_{LL_Truck} := \gamma_{LL} \cdot \frac{M_{LL}}{S_{comp}}$$

$\sigma_{LL_Truck} =$ 573.6447 psi

$$\sigma_{DL_FWS} := \gamma_{DL} \cdot \frac{M_{DL_FWS}}{S_{comp}}$$

$\sigma_{DL_FWS} =$ 14.00226 psi

$$\sigma_{Final} := \sigma_{DL_Construction} + \sigma_{DL_FWS} + \sigma_{LL_Truck} + \sigma_{ps}$$

$\sigma_{Final} =$ 158.6753 psi

$$0.19 \cdot \sqrt{f_{pc_panel}} \quad 424.8529 \text{ psi}$$

$$\sigma_{Final} < 0.19 \cdot \sqrt{f_{pc_panel}}$$

Check: OK

Unity: 0.373483

Factored Moment at the Strength Level:

$$\gamma_{DC} = 1.25$$

$$\gamma_{DW} = 1.5$$

$$\gamma_{LL_FM} = 1.75$$

$$M_u := \gamma_{DC} \cdot M_{DL_SelfWeight} + \gamma_{DC} \cdot M_{DL_Slab} + \gamma_{DW} \cdot M_{DL_FWS} + \gamma_{LL} \cdot M_{LL}$$

$$M_u = 5359.175 \text{ lb}\cdot\text{ft}$$

Article 5.7.3.1 Stress in Prestressing Steel at Nominal Flexural Resistance:

$$L_{transfer} := 60 \cdot d_{ps}$$

$$L_{transfer} = 1.875 \text{ ft} \quad 22.5 \text{ inches}$$

$$f_{pe} := -(f_{pi} - \Delta f_{pT})$$

$$f_{pe} = 157.9489 \text{ ksi}$$

$$\frac{f_{pe}}{f_{pu}} > 0.5$$

$$f_{pe}/f_{pu} = 0.584996$$

$$\text{Check: OK}$$

$$\text{Unity: } 0.854707$$

$$\beta_1 = 0.85$$

$$k := 2 \cdot \left(1.04 - \frac{f_{py}}{f_{pu}} \right)$$

$$k = 0.28$$

$$d_p := t_{slab_struct} + \frac{t_{panel}}{2} - \frac{d_{ps}}{2}$$

$$d_p = 5.3125 \text{ inches}$$

$$c := \frac{A_{ps} \cdot f_{pu}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b + k \cdot A_{ps} \cdot \frac{f_{pu}}{d_p}}$$

c = 1.237223 inches

$$f_{ps} := f_{pu} \cdot \left(1 - k \cdot \frac{c}{d_p}\right)$$

f_{ps} = 252.3936 ksi

Article 5.11.4: Development of Prestressing Strand

κ = 1

$$L_d := \frac{\kappa \cdot \text{in}}{\text{ksi}} \cdot \left(f_{ps} - \frac{2}{3} \cdot f_{pe}\right)$$

L_d = 4.596698 ft 55.16037

x = 48 <- Panel Width/2 (inches)

$$f_p(x) := \begin{cases} \frac{f_{pe} \cdot x}{L_{transfer}} & \text{if } x < L_{transfer} \\ f_{pe} + \frac{x - L_{transfer}}{L_d - L_{transfer}} \cdot (f_{ps} - f_{pe}) & \text{else} \end{cases}$$

f_p(x) 231.6878 ksi 0.917962

$$c := \frac{A_{ps} \cdot f_{ps}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b}$$

c = 1.135724 inches

$$a := \beta_1 \cdot c$$

a = 0.965366 inches

Article 5.7.3.2: Flexural Resistance

$$\phi = 1$$

$$M_n := A_{ps} \cdot f_{ps} \cdot \left(d_p - \frac{a}{2} \right)$$

$$M_n = 7926.318 \text{ ft-lb}$$

$$M_r := \phi \cdot M_n$$

$$M_r = 7926.318 \text{ ft-lb}$$

$$M_r > M_u$$

Check: OK

Unity: 0.676124

Article 5.7.3.3.2: Minimum Reinforcement (Cracking Moment)

$$f_r := \frac{0.37}{\sqrt{ksi}} \cdot \sqrt{f_{pc_panel}} \cdot ksi$$

$$f_r = 827.3452 \text{ psi}$$

$$f_{cpe} := -\sigma_{ps}$$

$$f_{cpe} = 745.8698 \text{ psi}$$

$$M_{dnc} := M_{DL_SelfWeight} + M_{DL_Slab}$$

$$M_{dnc} = 237.6736 \text{ lb-ft}$$

$$M_{cr} := \min \left(s_{comp} \cdot (f_r + f_{cpe}) - M_{dnc} \cdot \left(\frac{s_{comp}}{s_{panel}} - 1 \right), s_{comp} \cdot f_r \right)$$

$$M_{cr} = 3282.585 \text{ lb-ft}$$

M_r

>

if $1.2 \cdot M_{cr} < 1.33 \cdot M_u$

$1.2 \cdot M_{cr}$

else

$1.33 \cdot M_u$

RHS = 3939.102 lb-ft

Check: OK

Unity: 0.496965

KDOT Prestressed Deck Panel Design:

Input: 7-Wire Strand - 6 ft

Total Finished Deck Slab Thickness	t_{total}	=	8 in
Prestressed Panel Thickness	t_{panel}	=	3 in
Girder Spacing (center to center of the web)	S	=	6 ft
Initial Prestressing Force Before Losses	P_i	=	-16.1 kip
Final Compression Strength of Cast in Place Slab	f_{pc_slab}	=	4 ksi
Final Compression Strength of Prestressed Panel	f_{pc_panel}	=	5 ksi
Initial Compression Strength of Prestressed Panel	f_{pci_panel}	=	4 ksi
Unit Weight of Concrete	W_c	=	150 pcf
Yield Strength of Plain Reinforcement	f_y	=	60 ksi
Yield Strength of Prestressed Strand	f_{py}	=	243 ksi
Ultimate Strength of Prestressed Strand	f_{pu}	=	270 ksi
Area of Prestressed Strand	A_{ps}	=	0.085 sq. in
Diameter of Prestressed Strand	d_{ps}	=	3/8 in
Modulus of the Prestressed Strand	E_p	=	28500 ksi
Effective Width for one Prestressed Strand	b	=	6 in
Width of the Pressed Girder Top Flange	$w_{topFlange}$	=	24 in
Average Humidity	H	=	65

Calculated Panel Span:

$$S_{panel} := S - (w_{topFlange} - 10 \cdot \text{in})$$

$$S_{panel} = 58 \text{ in}$$

Calculated Slab Thicknesses:

$$t_{slab} := t_{total} - t_{panel} \quad t_{structural} := t_{total} - 1 \cdot \text{in} \quad t_{slab_struct} := t_{structural} - t_{panel}$$

$$\begin{aligned} t_{slab} &= 5 \text{ in} \\ t_{structural} &= 7 \text{ in} \\ t_{slab_structural} &= 4 \text{ in} \end{aligned}$$

Calculated Modulus:

$$E_{ps} := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pc_panel}} \cdot ksi$$

$$E_c := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pc_slab}} \cdot ksi$$

$$E_{ct} := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pci_panel}} \cdot ksi$$

Eps = 4030.5 ksi

Ec = 3605.0 ksi

Ect = 3605.0 ksi

Allowable Prestressing Strand Stress before Losses:

$$f_{pi} := \frac{P_i}{A_{ps}} < -0.75 \cdot f_{pu}$$

fpi = -189.412 ksi

0.75 f_{pu} = -202.5 ksi

Check: OK

Unity: 0.935367

Article 5.9.5.2.3a Elastic Shortening:

$$f_{cgp} := \frac{P_i}{t_{panel} \cdot b}$$

$$\Delta f_{pES} := \frac{E_p}{E_{ct}} \cdot f_{cgp}$$

fcgp = -0.89444 ksi

Δf_{pES} = -7.0712 ksi

Article 5.9.5.3 Time Dependent Losses:

$$\gamma_h := 1.7 - 0.01 \cdot H \quad \gamma_{st} := \frac{5 \cdot ksi}{1 \cdot ksi + f_{pci_panel}}$$

$$\Delta f_{pLT} := 10.0 \cdot \frac{f_{pi} \cdot A_{ps}}{A_g} \cdot \gamma_h \cdot \gamma_{st} - 12.0 \cdot ksi \cdot \gamma_h \cdot \gamma_{st} - \Delta f_{pR}$$

Ag = 18 sq. in

γ_h = 1.05

γ_{st} = 1

Δf_{pR} = 2.4 ksi

Δf_{pLT} = -24.3917 ksi

Article 5.9.5.1 Loss of Prestress:

$$\Delta f_{pT} := \Delta f_{pES} + \Delta f_{pLT}$$

$$\Delta f_{pT} = -31.4629 \text{ ksi}$$

$$\frac{\Delta f_{pT}}{f_{pi}} = 16.61083 \%$$

Total Concrete Compressive Stress After Losses:

$$\sigma_{ps} := \frac{A_{ps} \cdot (f_{pi} - \Delta f_{pT})}{A_g}$$

$$\sigma_{ps} = -745.87 \text{ psi}$$

$$\sigma_{ps} > -0.45 \cdot f_{pc_panel}$$

$$0.45 f_{pc_panel} = -2250 \text{ psi}$$

Check : OK

Unity: 0.331498

Transformed Section Properties:

$$b_{eff} := \frac{E_c}{E_{ps}} \cdot b$$

$$b_{eff} = 5.366563 \text{ inches}$$

$$y_{bar} := \frac{\left(\frac{t_{panel}}{2} \right) \cdot (b \cdot t_{panel}) + \left(t_{panel} + \frac{t_{slab_struct}}{2} \right) \cdot (b_{eff} \cdot t_{slab_struct})}{(b_{eff} \cdot t_{slab_struct}) + (b \cdot t_{panel})}$$

$$y_{bar} = 3.403699 \text{ inches}$$

$$I_{total} := \frac{b}{12} \cdot t_{panel}^3 + \frac{b_{eff}}{12} \cdot t_{slab_struct}^3 + (b \cdot t_{panel}) \cdot \left(y_{bar} - \frac{t_{panel}}{2} \right)^2 + (b_{eff} \cdot t_{slab_struct}) \cdot \left(t_{panel} + \frac{t_{slab_struct}}{2} - y_{bar} \right)^2$$

$$I_{total} = 162.0547 \text{ in}^4$$

$$S_{comp} := \frac{I_{total}}{y_{bar}}$$

$$s_{comp} = 47.61135 \text{ in}^3$$

$$I_{panel} := \frac{1}{12} \cdot b \cdot t_{panel}^3$$

$$I_{panel} = 13.5 \text{ in}^4$$

$$S_{panel} := \frac{I_{panel}}{\frac{t_{panel}}{2}}$$

$$s_{panel} = 9 \text{ in}^3$$

Applied Loads:

$$S_{eff_Panel} := S_{panel} - 2 \cdot 5 \cdot \text{in} + 2 \cdot 1 \cdot \text{in}$$

$$S_{eff_Panel} = 50 \text{ inches}$$

$$S_{eff_Slab} := S - 2 \cdot \frac{W_{topFlange}}{3}$$

$$S_{eff_Slab} = 56 \text{ inches}$$

$$M_{DL_SelfWeight} := \frac{W_c \cdot b}{8} \cdot t_{panel} \cdot S_{eff_Panel}^2$$

$$M_{DL_SelfWeight} = 40.6901 \text{ ft} \cdot \text{lb}$$

$$M_{DL_Slab} := \frac{W_c \cdot b}{8} \cdot t_{slab} \cdot S_{eff_Panel}^2$$

$$M_{DL_Slab} = 67.81684 \text{ ft} \cdot \text{lb}$$

$$M_{LL_Construction} := 50 \cdot \frac{\text{lbf}}{\text{ft}^2} \cdot \frac{b}{8} \cdot S_{eff_Panel}^2$$

$$M_{LL_Construction} = 54.25347 \text{ ft} \cdot \text{lb}$$

$$M_{DL_FWS} := 25 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{b}{10} \cdot S_{eff_Slab}^2$$

$$M_{DL_FWS} = 27.22222 \text{ ft} \cdot \text{lb}$$

OLD WAY FOR LL:

$$IMP = 1.3$$

$$M_{LL_old} := \frac{S_{eff_Slab} + 2 \cdot \text{ft}}{32} \cdot 16000 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{0.80}{12 \cdot \text{in}} \cdot b \cdot IMP$$

$$M_{LL_old} = 1733.333 \text{ ft} \cdot \text{lb}$$

From Appendix 4A the Positive Live Load Moment for the given Girder Spacing S is:

$$M_{A4_1} = 5690 \text{ ft} \cdot \text{lb}$$

$$M_{LL} := \frac{M_{A4_1}}{12 \cdot \text{in}} \cdot b$$

$$M_{LL} = 2845 \text{ ft} \cdot \text{lb}$$

$$\frac{M_{LL}}{M_{LL_old}} = 1.641346$$

Calculated Stresses at the Service III Level:

$$\gamma_{DL} = 1$$

$$\gamma_{LL} = 0.8$$

$$\sigma_{DL_Construction} := \gamma_{DL} \cdot \left(\frac{M_{DL_SelfWeight}}{S_{panel}} + \frac{M_{DL_Slab}}{S_{panel}} \right)$$

$$\sigma_{DL_Construction} = 144.6759 \text{ psi}$$

$$\sigma_{LL_Construction} := \gamma_{LL} \cdot \left(\frac{M_{LL_Construction}}{S_{panel}} \right)$$

$$\sigma_{LL_Construction} = 57.87037 \text{ psi}$$

$$\sigma_{Construction} := \sigma_{DL_Construction} + \sigma_{LL_Construction} + \sigma_{ps}$$

$$\sigma_{Construction} = -543.323 \text{ psi}$$

$$0.0948 \cdot \sqrt{f_{pci_panel}} \quad 189.6 \text{ psi}$$

$$\sigma_{Construction} < 0.0948 \cdot \sqrt{f_{pci_panel}}$$

Check: OK

Unity: -2.86563

Stress At Final Condition:

$$\sigma_{LL_Truck} := \gamma_{LL} \cdot \frac{M_{LL}}{S_{comp}}$$

$$\sigma_{LL_Truck} = 573.6447 \text{ psi}$$

$$\sigma_{DL_FWS} := \gamma_{DL} \cdot \frac{M_{DL_FWS}}{S_{comp}}$$

$$\sigma_{DL_FWS} = 6.861109 \text{ psi}$$

$$\sigma_{Final} := \sigma_{DL_Construction} + \sigma_{DL_FWS} + \sigma_{LL_Truck} + \sigma_{ps}$$

$$\sigma_{Final} = -20.688 \text{ psi}$$

$$0.19 \cdot \sqrt{f_{pc_panel}} \quad 424.8529 \text{ psi}$$

$$\sigma_{Final} < 0.19 \cdot \sqrt{f_{pc_panel}}$$

Check: OK

Unity: -0.04869

Factored Moment at the Strength Level:

$$\gamma_{DC} = 1.25$$

$$\gamma_{DW} = 1.5$$

$$\gamma_{LL_FM} = 1.75$$

$$M_u := \gamma_{DC} \cdot M_{DL_SelfWeight} + \gamma_{DC} \cdot M_{DL_Slab} + \gamma_{DW} \cdot M_{DL_FWS} + \gamma_{LL} \cdot M_{LL}$$

$$M_u = 5155.217 \text{ lb}\cdot\text{ft}$$

Article 5.7.3.1 Stress in Prestressing Steel at Nominal Flexural Resistance:

$$L_{transfer} := 60 \cdot d_{ps}$$

$$L_{transfer} = 1.875 \text{ ft} \quad 22.5$$

$$f_{pe} := -(f_{pi} - \Delta f_{pT})$$

$$f_{pe} = 157.9489 \text{ ksi}$$

$$\frac{f_{pe}}{f_{pu}} > 0.5$$

$$f_{pe}/f_{pu} = 0.584996$$

$$\text{Check: OK}$$

$$\text{Unity: } 0.854707$$

$$\beta_1 = 0.85$$

$$k := 2 \cdot \left(1.04 - \frac{f_{py}}{f_{pu}} \right)$$

$$k = 0.28$$

$$d_p := t_{slab_struct} + \frac{t_{panel}}{2} - \frac{d_{ps}}{2}$$

$$d_p = 5.3125 \text{ inches}$$

$$c := \frac{A_{ps} \cdot f_{pu}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b + k \cdot A_{ps} \cdot \frac{f_{pu}}{d_p}}$$

c = 1.237223 inches

$$f_{ps} := f_{pu} \cdot \left(1 - k \cdot \frac{c}{d_p}\right)$$

f_{ps} = 252.3936 ksi

Article 5.11.4: Development of Prestressing Strand

κ = 1

$$L_d := \frac{\kappa \cdot \text{in}}{\text{ksi}} \cdot \left(f_{ps} - \frac{2}{3} \cdot f_{pe}\right)$$

L_d = 4.596698 ft 55.16037

x = 36 <- Panel Width/2 (inches)

$$f_p(x) := \begin{cases} \frac{f_{pe} \cdot x}{L_{transfer}} & \text{if } x < L_{transfer} \\ f_{pe} + \frac{x - L_{transfer}}{L_d - L_{transfer}} \cdot (f_{ps} - f_{pe}) & \text{else} \end{cases}$$

f_p(x) 196.9871 ksi 0.219524

$$c := \frac{A_{ps} \cdot f_{ps}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b}$$

c = 0.965623 inches

$$a := \beta_1 \cdot c$$

a = 0.82078 inches

Article 5.7.3.2: Flexural Resistance

$$\phi = 1$$

$$M_n := A_{ps} \cdot f_{ps} \cdot \left(d_p - \frac{a}{2} \right)$$

$$M_n = 6840.039 \text{ ft-lb}$$

$$M_r := \phi \cdot M_n$$

$$M_r = 6840.039 \text{ ft-lb}$$

$$M_r > M_u$$

Check: OK

Unity: 0.753682

Article 5.7.3.3.2: Minimum Reinforcement (Cracking Moment)

$$f_r := \frac{0.37}{\sqrt{ksi}} \cdot \sqrt{f_{pc_panel}} \cdot ksi$$

$$f_r = 827.3452 \text{ psi}$$

$$f_{cpe} := -\sigma_{ps}$$

$$f_{cpe} = 745.8698 \text{ psi}$$

$$M_{dnc} := M_{DL_SelfWeight} + M_{DL_Slab}$$

$$M_{dnc} = 108.5069 \text{ lb-ft}$$

$$M_{cr} := \min \left(s_{comp} \cdot (f_r + f_{cpe}) - M_{dnc} \cdot \left(\frac{s_{comp}}{s_{panel}} - 1 \right), s_{comp} \cdot f_r \right)$$

$$M_{cr} = 3282.585 \text{ lb-ft}$$

M_r

>

if $1.2 \cdot M_{cr} < 1.33 \cdot M_u$

$1.2 \cdot M_{cr}$

else

$1.33 \cdot M_u$

RHS = 3939.102 lb-ft

Check: OK

Unity: 0.575889

KDOT Prestressed Deck Panel Design:

Input: Indented Wire - 8 ft

Total Finished Deck Slab Thickness	t_{total}	=	8 in	
Prestressed Panel Thickness	t_{panel}	=	3 in	
Girder Spacing (center to center of the web)	S	=	8 ft	
Initial Prestressing Force Before Losses	P_i	=	-14.6 kip	
Final Compression Strength of Cast in Place Slab	f_{pc_slab}	=	4 ksi	
Final Compression Strength of Prestressed Panel	f_{pc_panel}	=	5 ksi	
Initial Compression Strength of Prestressed Panel	f_{pci_panel}	=	4 ksi	
Unit Weight of Concrete	W_c	=	150 pcf	
Yield Strength of Plain Reinforcement	f_y	=	60 ksi	
Yield Strength of Prestressed Strand	f_{py}	=	225 ksi	
Ultimate Strength of Prestressed Strand	f_{pu}	=	250 ksi	
Area of Prestressed Strand	A_{ps}	=	0.077912 sq. in	
Diameter of Prestressed Strand	d_{ps}	=	0.31496 in	(8 mm)
Modulus of the Prestressed Strand	E_p	=	28500 ksi	
Effective Width for one Prestressed Strand	b	=	6 in	
Width of the Pressed Girder Top Flange	$W_{topFlange}$	=	24 in	
Average Humidity	H	=	65	

Calculated Panel Span:

$$S_{panel} := S - (W_{topFlange} - 10 \cdot \text{in})$$

$$S_{panel} = 82 \text{ in}$$

Calculated Slab Thicknesses:

$$t_{slab} := t_{total} - t_{panel} \quad t_{structural} := t_{total} - 1 \cdot \text{in} \quad t_{slab_struct} := t_{structural} - t_{panel}$$

$$\begin{aligned} t_{slab} &= 5 \text{ in} \\ t_{structural} &= 7 \text{ in} \\ t_{slab_structural} &= 4 \text{ in} \end{aligned}$$

Calculated Modulus:

$$E_{ps} := \frac{57}{\sqrt{\text{psi}}} \cdot \sqrt{f_{pc_panel}} \cdot \text{ksi}$$

$$E_c := \frac{57}{\sqrt{\text{psi}}} \cdot \sqrt{f_{pc_slab}} \cdot \text{ksi}$$

$$E_{ct} := \frac{57}{\sqrt{\text{psi}}} \cdot \sqrt{f_{pci_panel}} \cdot \text{ksi}$$

Eps = 4030.5 ksi
Ec = 3605.0 ksi
Ect = 3605.0 ksi

Allowable Prestressing Strand Stress before Losses:

$$f_{pi} := \frac{P_i}{A_{ps}} < -0.75 \cdot f_{pu}$$

fpi = -187.392 ksi
0.75 f_{pu} = -187.5 ksi

Check: OK

Unity: 0.999423

Article 5.9.5.2.3a Elastic Shortening:

$$f_{cgp} := \frac{P_i}{t_{panel} \cdot b}$$

$$\Delta f_{pES} := \frac{E_p}{E_{ct}} \cdot f_{cgp}$$

fcgp = -0.81111 ksi
ΔfpES = -6.4124 ksi

Article 5.9.5.3 Time Dependent Losses:

$$\gamma_h := 1.7 - 0.01 \cdot H \quad \gamma_{st} := \frac{5 \cdot \text{ksi}}{1 \cdot \text{ksi} + f_{pci_panel}}$$

$$\Delta f_{pLT} := 10.0 \cdot \frac{f_{pi} \cdot A_{ps}}{A_g} \cdot \gamma_h \cdot \gamma_{st} - 12.0 \cdot \text{ksi} \cdot \gamma_h \cdot \gamma_{st} - \Delta f_{pR}$$

Ag = 18 sq. in
γ_h = 1.05
γ_{st} = 1
ΔfpR = 2.4 ksi
ΔfpLT = -23.5167 ksi

Article 5.9.5.1 Loss of Prestress:

$$\Delta f_{pT} := \Delta f_{pES} + \Delta f_{pLT}$$

$$\Delta f_{pT} = -29.9291 \text{ ksi}$$

$$\frac{\Delta f_{pT}}{f_{pi}} = 15.97139 \%$$

Total Concrete Compressive Stress After Losses:

$$\sigma_{ps} := \frac{A_{ps} \cdot (f_{pi} - \Delta f_{pT})}{A_g}$$

$$\sigma_{ps} = -681.565 \text{ psi}$$

$$\sigma_{ps} > -0.45 \cdot f_{pc_panel}$$

$$0.45 f_{pc_panel} = -2250 \text{ psi}$$

Check : OK

Unity: 0.302918

Transformed Section Properties:

$$b_{eff} := \frac{E_c}{E_{ps}} \cdot b$$

$$b_{eff} = 5.366563 \text{ inches}$$

$$y_{bar} := \frac{\left(\frac{t_{panel}}{2}\right) \cdot (b \cdot t_{panel}) + \left(t_{panel} + \frac{t_{slab_struct}}{2}\right) \cdot (b_{eff} \cdot t_{slab_struct})}{(b_{eff} \cdot t_{slab_struct}) + (b \cdot t_{panel})}$$

$$y_{bar} = 3.403699 \text{ inches}$$

$$I_{total} := \frac{b}{12} \cdot t_{panel}^3 + \frac{b_{eff}}{12} \cdot t_{slab_struct}^3 + (b \cdot t_{panel}) \cdot \left(y_{bar} - \frac{t_{panel}}{2}\right)^2 + (b_{eff} \cdot t_{slab_struct}) \cdot \left(t_{panel} + \frac{t_{slab_struct}}{2} - y_{bar}\right)^2$$

$$I_{total} = 162.0547 \text{ in}^4$$

$$S_{comp} := \frac{I_{total}}{y_{bar}}$$

$$s_{comp} = 47.61135 \text{ in}^3$$

$$I_{panel} := \frac{1}{12} \cdot b \cdot t_{panel}^3$$

$$I_{panel} = 13.5 \text{ in}^4$$

$$S_{panel} := \frac{I_{panel}}{\frac{t_{panel}}{2}}$$

$$s_{panel} = 9 \text{ in}^3$$

Applied Loads:

$$S_{eff_Panel} := S_{panel} - 2 \cdot 5 \cdot \text{in} + 2 \cdot 1 \cdot \text{in}$$

$$S_{eff_Panel} = 74 \text{ inches}$$

$$S_{eff_Slab} := S - 2 \cdot \frac{W_{topFlange}}{3}$$

$$S_{eff_Slab} = 80 \text{ inches}$$

$$M_{DL_SelfWeight} := \frac{W_c \cdot b}{8} \cdot t_{panel} \cdot S_{eff_Panel}^2$$

$$MDL_SelfWeight = 89.1276 \text{ ft} \cdot \text{lb}$$

$$M_{DL_Slab} := \frac{W_c \cdot b}{8} \cdot t_{slab} \cdot S_{eff_Panel}^2$$

$$MDL_Slab = 148.546 \text{ ft} \cdot \text{lb}$$

$$M_{LL_Construction} := 50 \cdot \frac{\text{lb}}{\text{ft}^2} \cdot \frac{b}{8} \cdot S_{eff_Panel}^2$$

$$M_{LL_Construction} = 118.8368 \text{ ft} \cdot \text{lb}$$

$$M_{DL_FWS} := 25 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{b}{10} \cdot S_{eff_Slab}^2$$

$$M_{DL_FWS} = 55.55556 \text{ ft} \cdot \text{lb}$$

OLD WAY FOR LL:

$$IMP = 1.3$$

$$M_{LL_old} := \frac{S_{eff_Slab} + 2 \cdot \text{ft}}{32} \cdot 16000 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{0.80}{12 \cdot \text{in}} \cdot b \cdot IMP$$

$$M_{LL_old} = 2253.333 \text{ ft} \cdot \text{lb}$$

From Appendix 4A the Positive Live Load Moment for the given Girder Spacing S is:

$$M_{A4_1} = 5690 \text{ ft} \cdot \text{lb}$$

$$M_{LL} := \frac{M_{A4_1}}{12 \cdot \text{in}} \cdot b$$

$$M_{LL} = 2845 \text{ ft} \cdot \text{lb}$$

$$\frac{M_{LL}}{M_{LL_old}} = 1.262574$$

Calculated Stresses at the Service III Level:

$$\gamma_{DL} = 1$$

$$\gamma_{LL} = 0.8$$

$$\sigma_{DL_Construction} := \gamma_{DL} \cdot \left(\frac{M_{DL_SelfWeight}}{S_{panel}} + \frac{M_{DL_Slab}}{S_{panel}} \right)$$

$$\sigma_{DL_Construction} = 316.8981 \text{ psi}$$

$$\sigma_{LL_Construction} := \gamma_{LL} \cdot \left(\frac{M_{LL_Construction}}{S_{panel}} \right)$$

$$\sigma_{LL_Construction} = 126.7593 \text{ psi}$$

$$\sigma_{Construction} := \sigma_{DL_Construction} + \sigma_{LL_Construction} + \sigma_{ps}$$

$$\sigma_{Construction} = -237.908 \text{ psi}$$

$$0.0948 \cdot \sqrt{f_{pci_panel}} \quad 189.6 \text{ psi}$$

$$\sigma_{Construction} < 0.0948 \cdot \sqrt{f_{pci_panel}}$$

Check: OK

Unity: -1.25479

Stress At Final Condition:

$$\sigma_{LL_Truck} := \gamma_{LL} \cdot \frac{M_{LL}}{S_{comp}}$$

$$\sigma_{LL_Truck} = 573.6447 \text{ psi}$$

$$\sigma_{DL_FWS} := \gamma_{DL} \cdot \frac{M_{DL_FWS}}{S_{comp}}$$

$$\sigma_{DL_FWS} = 14.00226 \text{ psi}$$

$$\sigma_{Final} := \sigma_{DL_Construction} + \sigma_{DL_FWS} + \sigma_{LL_Truck} + \sigma_{ps}$$

$$\sigma_{Final} = 222.9797 \text{ psi}$$

$$0.19 \cdot \sqrt{f_{pc_panel}} \quad 424.8529 \text{ psi}$$

$$\sigma_{Final} < 0.19 \cdot \sqrt{f_{pc_panel}}$$

Check: OK

Unity: 0.52484

Factored Moment at the Strength Level:

$$\gamma_{DC} = 1.25$$

$$\gamma_{DW} = 1.5$$

$$\gamma_{LL_FM} = 1.75$$

$$M_u := \gamma_{DC} \cdot M_{DL_SelfWeight} + \gamma_{DC} \cdot M_{DL_Slab} + \gamma_{DW} \cdot M_{DL_FWS} + \gamma_{LL} \cdot M_{LL}$$

$$M_u = 5359.175 \text{ lb}\cdot\text{ft}$$

Article 5.7.3.1 Stress in Prestressing Steel at Nominal Flexural Resistance:

$$f_{pe} := -(f_{pi} - \Delta f_{pT})$$

$$f_{pe} = 157.4627 \text{ ksi}$$

$$\frac{f_{pe}}{f_{pu}} > 0.5$$

$$f_{pe}/f_{pu} = 0.629851$$

$$\text{Check: OK}$$

$$\text{Unity: } 0.793839$$

$$\beta_1 = 0.85$$

$$k := 2 \cdot \left(1.04 - \frac{f_{py}}{f_{pu}} \right)$$

$$k = 0.28$$

$$d_p := t_{slab_struct} + \frac{t_{panel}}{2} - \frac{d_{ps}}{2}$$

$$d_p = 5.34252 \text{ inches}$$

$$c := \frac{A_{ps} \cdot f_{pu}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b + k \cdot A_{ps} \cdot \frac{f_{pu}}{d_p}}$$

c = 1.06084 inches

$$f_{ps} := f_{pu} \cdot \left(1 - k \cdot \frac{c}{d_p} \right)$$

fps = 236.1004 ksi

Article 5.11.4: Development of Prestressing Strand

$$c := \frac{A_{ps} \cdot f_{ps}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b}$$

c = 1.06084 inches

$$a := \beta_1 \cdot c$$

a = 0.901714 inches

Article 5.7.3.2: Flexural Resistance

ϕ = 1

$$M_n := A_{ps} \cdot f_{ps} \cdot \left(d_p - \frac{a}{2} \right)$$

Mn = 7498.5 ft-lb

$$M_r := \phi \cdot M_n$$

Mr = 7498.5 ft-lb

$$M_r > M_u$$

Check: OK

Unity: 0.7147

Article 5.7.3.3.2: Minimum Reinforcement (Cracking Moment)

$$f_r := \frac{0.37}{\sqrt{ksi}} \cdot \sqrt{f_{pc_panel} \cdot ksi}$$

fr = 827.3452 psi

$$f_{cpe} := -\sigma_{ps}$$

fcpe = 681.5654 psi

$$M_{dnc} := M_{DL_SelfWeight} + M_{DL_Slab}$$

Mdnc = 237.6736 lb-ft

$$M_{cr} := \min \left(s_{comp} \cdot (f_r + f_{cpe}) - M_{dnc} \cdot \left(\frac{s_{comp}}{s_{panel}} - 1 \right), s_{comp} \cdot f_r \right)$$

Mcr = 3282.585 lb-ft

$$M_r > \begin{cases} \text{if } 1.2 \cdot M_{cr} < 1.33 \cdot M_u \\ \quad 1.2 \cdot M_{cr} \\ \text{else} \\ \quad 1.33 \cdot M_u \end{cases}$$

RHS = 3939.102 lb-ft

Check: OK

Unity: 0.525319

KDOT Prestressed Deck Panel Design:

Input: Indented Wire - 6 ft

Total Finished Deck Slab Thickness	t_{total}	=	8 in	
Prestressed Panel Thickness	t_{panel}	=	3 in	
Girder Spacing (center to center of the web)	S	=	6 ft	
Initial Prestressing Force Before Losses	P_i	=	-14.6 kip	
Final Compression Strength of Cast in Place Slab	f_{pc_slab}	=	4 ksi	
Final Compression Strength of Prestressed Panel	f_{pc_panel}	=	5 ksi	
Initial Compression Strength of Prestressed Panel	f_{pci_panel}	=	4 ksi	
Unit Weight of Concrete	W_c	=	150 pcf	
Yield Strength of Plain Reinforcement	f_y	=	60 ksi	
Yield Strength of Prestressed Strand	f_{py}	=	225 ksi	
Ultimate Strength of Prestressed Strand	f_{pu}	=	250 ksi	
Area of Prestressed Strand	A_{ps}	=	0.077912 sq. in	
Diameter of Prestressed Strand	d_{ps}	=	0.31496 in	(8 mm)
Modulus of the Prestressed Strand	E_p	=	28500 ksi	
Effective Width for one Prestressed Strand	b	=	6 in	
Width of the Pressed Girder Top Flange	$w_{topFlange}$	=	24 in	
Average Humidity	H	=	65	

Calculated Panel Span:

$$S_{panel} := S - (w_{topFlange} - 10 \cdot \text{in})$$

$$S_{panel} = 58 \text{ in}$$

Calculated Slab Thicknesses:

$$t_{slab} := t_{total} - t_{panel} \quad t_{structural} := t_{total} - 1 \cdot \text{in} \quad t_{slab_struct} := t_{structural} - t_{panel}$$

$$\begin{aligned} t_{slab} &= 5 \text{ in} \\ t_{structural} &= 7 \text{ in} \\ t_{slab_structural} &= 4 \text{ in} \end{aligned}$$

Calculated Modulus:

$$E_{ps} := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pc_panel}} \cdot ksi$$

$$E_c := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pc_slab}} \cdot ksi$$

$$E_{ct} := \frac{57}{\sqrt{psi}} \cdot \sqrt{f_{pci_panel}} \cdot ksi$$

Eps = 4030.5 ksi
Ec = 3605.0 ksi
Ect = 3605.0 ksi

Allowable Prestressing Strand Stress before Losses:

$$f_{pi} := \frac{P_i}{A_{ps}} < -0.75 \cdot f_{pu}$$

fpi = -187.392 ksi
0.75 f_{pu} = -202.5 ksi

Check: OK

Unity: 0.925391

Article 5.9.5.2.3a Elastic Shortening:

$$f_{cgp} := \frac{P_i}{t_{panel} \cdot b}$$

$$\Delta f_{pES} := \frac{E_p}{E_{ct}} \cdot f_{cgp}$$

fcgp = -0.81111 ksi
Δf_{pES} = -6.4124 ksi

Article 5.9.5.3 Time Dependent Losses:

$$\gamma_h := 1.7 - 0.01 \cdot H \quad \gamma_{st} := \frac{5 \cdot ksi}{1 \cdot ksi + f_{pci_panel}}$$

$$\Delta f_{pLT} := 10.0 \cdot \frac{f_{pi} \cdot A_{ps}}{A_g} \cdot \gamma_h \cdot \gamma_{st} - 12.0 \cdot ksi \cdot \gamma_h \cdot \gamma_{st} - \Delta f_{pR}$$

Ag = 18 sq. in
γ_h = 1.05
γ_{st} = 1
Δf_{pR} = 2.4 ksi
Δf_{pLT} = -23.5167 ksi

Article 5.9.5.1 Loss of Prestress:

$$\Delta f_{pT} := \Delta f_{pES} + \Delta f_{pLT}$$

$$\Delta f_{pT} = -29.9291 \text{ ksi}$$

$$\frac{\Delta f_{pT}}{f_{pi}} = 15.97139 \%$$

Total Concrete Compressive Stress After Losses:

$$\sigma_{ps} := \frac{A_{ps} \cdot (f_{pi} - \Delta f_{pT})}{A_g}$$

$$\sigma_{ps} = -681.565 \text{ psi}$$

$$\sigma_{ps} > -0.45 \cdot f_{pc_panel}$$

$$0.45 f_{pc_panel} = -2250 \text{ psi}$$

Check : OK

Unity: 0.302918

Transformed Section Properties:

$$b_{eff} := \frac{E_c}{E_{ps}} \cdot b$$

$$b_{eff} = 5.366563 \text{ inches}$$

$$y_{bar} := \frac{\left(\frac{t_{panel}}{2}\right) \cdot (b \cdot t_{panel}) + \left(t_{panel} + \frac{t_{slab_struct}}{2}\right) \cdot (b_{eff} \cdot t_{slab_struct})}{(b_{eff} \cdot t_{slab_struct}) + (b \cdot t_{panel})}$$

$$y_{bar} = 3.403699 \text{ inches}$$

$$I_{total} := \frac{b}{12} \cdot t_{panel}^3 + \frac{b_{eff}}{12} \cdot t_{slab_struct}^3 + (b \cdot t_{panel}) \cdot \left(y_{bar} - \frac{t_{panel}}{2}\right)^2 + (b_{eff} \cdot t_{slab_struct}) \cdot \left(t_{panel} + \frac{t_{slab_struct}}{2} - y_{bar}\right)^2$$

$$I_{total} = 162.0547 \text{ in}^4$$

$$S_{comp} := \frac{I_{total}}{y_{bar}}$$

$$s_{comp} = 47.61135 \text{ in}^3$$

$$I_{panel} := \frac{1}{12} \cdot b \cdot t_{panel}^3$$

$$I_{panel} = 13.5 \text{ in}^4$$

$$S_{panel} := \frac{I_{panel}}{\frac{t_{panel}}{2}}$$

$$s_{panel} = 9 \text{ in}^3$$

Applied Loads:

$$S_{eff_Panel} := S_{panel} - 2 \cdot 5 \cdot \text{in} + 2 \cdot 1 \cdot \text{in}$$

$$S_{eff_Panel} = 50 \text{ inches}$$

$$S_{eff_Slab} := S - 2 \cdot \frac{W_{topFlange}}{3}$$

$$S_{eff_Slab} = 56 \text{ inches}$$

$$M_{DL_SelfWeight} := \frac{W_c \cdot b}{8} \cdot t_{panel} \cdot S_{eff_Panel}^2$$

$$M_{DL_SelfWeight} = 40.6901 \text{ ft} \cdot \text{lb}$$

$$M_{DL_Slab} := \frac{W_c \cdot b}{8} \cdot t_{slab} \cdot S_{eff_Panel}^2$$

$$M_{DL_Slab} = 67.81684 \text{ ft} \cdot \text{lb}$$

$$M_{LL_Construction} := 50 \cdot \frac{\text{lbf}}{\text{ft}^2} \cdot \frac{b}{8} \cdot S_{eff_Panel}^2$$

$$M_{LL_Construction} = 54.25347 \text{ ft} \cdot \text{lb}$$

$$M_{DL_FWS} := 25 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{b}{10} \cdot S_{eff_Slab}^2$$

$$M_{DL_FWS} = 27.22222 \text{ ft} \cdot \text{lb}$$

OLD WAY FOR LL:

$$IMP = 1.3$$

$$M_{LL_old} := \frac{S_{eff_Slab} + 2 \cdot \text{ft}}{32} \cdot 16000 \cdot \frac{\text{lb} \cdot \text{ft}}{\text{ft}^2} \cdot \frac{0.80}{12 \cdot \text{in}} \cdot b \cdot IMP$$

$$M_{LL_old} = 1733.333 \text{ ft} \cdot \text{lb}$$

From Appendix 4A the Positive Live Load Moment for the given Girder Spacing S is:

$$M_{A4_1} = 5690 \text{ ft} \cdot \text{lb}$$

$$M_{LL} := \frac{M_{A4_1}}{12 \cdot \text{in}} \cdot b$$

$$M_{LL} = 2845 \text{ ft} \cdot \text{lb}$$

$$\frac{M_{LL}}{M_{LL_old}} = 1.641346$$

Calculated Stresses at the Service III Level:

$$\gamma_{DL} = 1$$

$$\gamma_{LL} = 0.8$$

$$\sigma_{DL_Construction} := \gamma_{DL} \cdot \left(\frac{M_{DL_SelfWeight}}{S_{panel}} + \frac{M_{DL_Slab}}{S_{panel}} \right)$$

$$\sigma_{DL_Construction} = 144.6759 \text{ psi}$$

$$\sigma_{LL_Construction} := \gamma_{LL} \cdot \left(\frac{M_{LL_Construction}}{S_{panel}} \right)$$

$\sigma_{LL_Construction} =$ 57.87037 psi

$$\sigma_{Construction} := \sigma_{DL_Construction} + \sigma_{LL_Construction} + \sigma_{ps}$$

$\sigma_{Construction} =$ -479.019 psi

$$0.0948 \cdot \sqrt{f_{pci_panel}} \quad 189.6 \text{ psi}$$

$$\sigma_{Construction} < 0.0948 \cdot \sqrt{f_{pci_panel}}$$

Check: OK

Unity: -2.52647

Stress At Final Condition:

$$\sigma_{LL_Truck} := \gamma_{LL} \cdot \frac{M_{LL}}{S_{comp}}$$

$\sigma_{LL_Truck} =$ 573.6447 psi

$$\sigma_{DL_FWS} := \gamma_{DL} \cdot \frac{M_{DL_FWS}}{S_{comp}}$$

$\sigma_{DL_FWS} =$ 6.861109 psi

$$\sigma_{Final} := \sigma_{DL_Construction} + \sigma_{DL_FWS} + \sigma_{LL_Truck} + \sigma_{ps}$$

$\sigma_{Final} =$ 43.61633 psi

$$0.19 \cdot \sqrt{f_{pc_panel}} \quad 424.8529 \text{ psi}$$

$$\sigma_{Final} < 0.19 \cdot \sqrt{f_{pc_panel}}$$

Check: OK

Unity: 0.102662

Factored Moment at the Strength Level:

$$\gamma_{DC} = 1.25$$

$$\gamma_{DW} = 1.5$$

$$\gamma_{LL_FM} = 1.75$$

$$M_u := \gamma_{DC} \cdot M_{DL_SelfWeight} + \gamma_{DC} \cdot M_{DL_Slab} + \gamma_{DW} \cdot M_{DL_FWS} + \gamma_{LL} \cdot M_{LL}$$

$$M_u = 5155.217 \text{ lb}\cdot\text{ft}$$

Article 5.7.3.1 Stress in Prestressing Steel at Nominal Flexural Resistance:

$$L_{transfer} := 60 \cdot d_{ps}$$

$$L_{transfer} = 1.574803 \text{ ft}$$

$$f_{pe} := -(f_{pi} - \Delta f_{pT})$$

$$f_{pe} = 157.4627 \text{ ksi}$$

$$\frac{f_{pe}}{f_{pu}} > 0.5$$

$$f_{pe}/f_{pu} = 0.629851$$

$$\text{Check: OK}$$

$$\text{Unity: } 0.793839$$

$$\beta_1 = 0.85$$

$$k := 2 \cdot \left(1.04 - \frac{f_{py}}{f_{pu}} \right)$$

$$k = 0.28$$

$$d_p := t_{slab_struct} + \frac{t_{panel}}{2} - \frac{d_{ps}}{2}$$

$$d_p = 5.34252 \text{ inches}$$

$$c := \frac{A_{ps} \cdot f_{pu}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b + k \cdot A_{ps} \cdot \frac{f_{pu}}{d_p}}$$

c = 1.06084 inches

$$f_{ps} := f_{pu} \cdot \left(1 - k \cdot \frac{c}{d_p} \right)$$

fps = 236.1004 ksi

Article 5.11.4: Development of Prestressing Strand

$$c := \frac{A_{ps} \cdot f_{ps}}{0.85 \cdot f_{pc_slab} \cdot \beta_1 \cdot b}$$

c = 1.06084 inches

$$a := \beta_1 \cdot c$$

a = 0.901714 inches

Article 5.7.3.2: Flexural Resistance

ϕ = 1

$$M_n := A_{ps} \cdot f_{ps} \cdot \left(d_p - \frac{a}{2} \right)$$

Mn = 7498.5 ft-lb

$$M_r := \phi \cdot M_n$$

Mr = 7498.5 ft-lb

$$M_r > M_u$$

Check: OK

Unity: 0.6875

Article 5.7.3.3.2: Minimum Reinforcement (Cracking Moment)

$$f_r := \frac{0.37}{\sqrt{ksi}} \cdot \sqrt{f_{pc_panel}} \cdot ksi$$

fr = 827.3452 psi

$$f_{cpe} := -\sigma_{ps}$$

fcpe = 681.5654 psi

$$M_{dnc} := M_{DL_SelfWeight} + M_{DL_Slab}$$

Mdnc = 108.5069 lb-ft

$$M_{cr} := \min \left(s_{comp} \cdot (f_r + f_{cpe}) - M_{dnc} \cdot \left(\frac{s_{comp}}{s_{panel}} - 1 \right), s_{comp} \cdot f_r \right)$$

Mcr = 3282.585 lb-ft

$$M_r > \begin{cases} \text{if } 1.2 \cdot M_{cr} < 1.33 \cdot M_u \\ \quad \parallel 1.2 \cdot M_{cr} \\ \text{else} \\ \quad \parallel 1.33 \cdot M_u \end{cases}$$

RHS = 3939.102 lb-ft

Check: OK

Unity: 0.525319

Strain Compatibility Input Data: 7-Wire Strand - 6 ft

Prestressed Section Properties

Area =	72 in ²	
b =	24 in	
h =	3 in	
I =	54 in ⁴	
y _b =	1.5 in	
w _{self} =	75 plf	
V/S =	1.333333 in	
w _{super dead} =	0 plf	
w _{live} =	0 plf	
Span =	5.5 ft	
Dist. From end to C. Brg.	0 in	
f' _{ci} =	4000 psi	
f' _c =	5000 psi	
Unit wt. of Concrete	145 lb/ft ³	
Strand Diameter	3/8 in	
E _p	28,500 ksi	
Initial Pull	189,411 psi	Override With
Initial Losses	10 %	10
Total Losses	16.61 %	16.61

Composite Section Properties

Is the Section Composite? (Y or N)	y
topping thickness =	5.5 in
topping width =	24 in
I _{composite} =	1228.25 in ⁴
(y _b) _{composite} =	2.75 in
w _{composite topping} =	75 plf
topping f' _c =	5000 psi
(h) _{composite} =	8.5
(β ₁) _{composite} =	0.80

E _{ci} =	3644 ksi	
E _c =	4074 ksi	
(y _t) _{nc} =	1.5 in	
(S _t) _{nc} =	36.0 in ³	
(S _b) _{nc} =	36.0 in ³	
(y _t) _{composite} =	5.75 in	
P _i =	57.96 kips	P _{jack} = 64.4
P _e =	53.70 kips	
f _{se} =	157.95 ksi	
w _u =	180 plf	
Transfer Length =	19.7 in	"=(f _{se} /3)d _b -overhang"
Development Length =	43.7 in	

Non-Composite Strength Calculation

f' _c =	5000	
β ₁ =	0.80	
comp. width =	24.0 in	
d _p =	1.50 in	
ρ _p =	0.009444	
f _{ps} =	221.81 psi	
a =	0.74 in	
Mn =	85 kip-in = 7.1 kip-ft	(based on ACI Equations)
φMn =	77 kip-in = 6.4 kip-ft	(based on ACI Equations)

Composite Strength Calculation

f' _c =	4700 psi	
β ₁ =	0.82	
comp. width =	24.0 in	
d _p =	7.00	
ρ _p =	0.002024	
f _{ps} =	259.67 psi	
a =	0.87 in	
Mn =	580 kip-in = 48.3 kip-ft	(based on ACI Equations)
φMn =	522 kip-in = 43.5 kip-ft	(based on ACI Equations)

Row #1	
# of Strands	4
Aps=	0.34 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #2	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #3	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in

Average e_{end}= 0 in

Average e_{mid}= 0 in

Total Aps=	0.340 in ²
Pe₁ =	53.70 kips
Pe₂ =	0.00 kips
Pe₃ =	0.00 kips
Total =	53.70 kips

E= 29,000 ksi
f_y= 60 ksi

Row #1		
Area=	1.24	in ²
depth=	2.75	in
Row #2		
Area=	0.00	in ²
depth=	0.00	in
Row #3		
Area=	0.00	in ²
depth=	0.00	in

		Transfer	0.1 L	0.2 L	0.3 L	0.4 L	0.5 L
	Dist. From Brg. (ft)	1.65	0.55	1.10	1.65	2.20	2.75
	Average e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	c (in)	1.78	1.78	1.78	1.78	1.78	1.78
	a (in)	1.45	1.45	1.45	1.45	1.45	1.45
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00554	0.00554	0.00554	0.00554	0.00554	0.00554
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.01449	0.01449	0.01449	0.01449	0.01449	0.01449
P/S Row #1	f _{ps} (ksi)	264.7	264.7	264.7	264.7	264.7	264.7
	Row 1 Tension (kips)	89.98	89.98	89.98	89.98	89.98	89.98
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.00895	0.00895	0.00895	0.00895	0.00895	0.00895
	f _{ps} (ksi)	249.5	249.5	249.5	249.5	249.5	249.5
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
P/S Row #2	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.00895	0.00895	0.00895	0.00895	0.00895	0.00895
	f _{ps} (ksi)	249.5	249.5	249.5	249.5	249.5	249.5
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
P/S Row #3	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.00895	0.00895	0.00895	0.00895	0.00895	0.00895
	f _{ps} (ksi)	249.5	249.5	249.5	249.5	249.5	249.5
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 1	depth (in)	2.75	2.75	2.75	2.75	2.75	2.75
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	0.00162	0.00162	0.00162	0.00162	0.00162	0.00162
	stress	47.1	47.1	47.1	47.1	47.1	47.1
	Row 1 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 1 Tension (kips)	58.36	58.36	58.36	58.36	58.36	58.36
Mild Steel 2	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 2 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 3	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 3 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression (kips)	148.35	148.35	148.35	148.35	148.35	148.35
	Tension (kips)	148.35	148.35	148.35	148.35	148.35	148.35
	C-T (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	M _n (kip-ft)	25.7	8.6	17.2	25.8	34.4	43.0
	ε _t	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	φ	0.90	0.90	0.90	0.90	0.90	0.90
	φM _n (kip-ft)	23.1	7.7	15.5	23.2	30.9	38.7
	Mu (kip-ft)	0.6	0.2	0.4	0.6	0.7	0.7
	Check Mu vs φMn						
	M _{cr}	42.1	45.2	43.4	42.1	41.3	41.0
	1.2*M _{cr}	50.5	54.2	52.0	50.5	49.5	49.2
	Check φMn > 1.2M _{cr}	X	X	X	X	X	X

Compatibility Input Data: 7-Wire Strand - 8 ft

Prestressed Section Properties

Area =	72 in ²	
b =	24 in	
h =	3 in	
I =	54 in ⁴	
y _b =	1.5 in	
w _{self} =	75 plf	
V/S =	1.333333 in	
w _{super dead} =	0 plf	
w _{live} =	0 plf	
Span =	7.5 ft	
Dist. From end to C. Brg.	0 in	
f' _{ci} =	4000 psi	
f' _c =	5000 psi	
Unit wt. of Concrete	145 lb/ft ³	
Strand Diameter	3/8 in	
E _p	28,500 ksi	
Initial Pull	189,411 psi	Override With
Initial Losses	10 %	10
Total Losses	16.61 %	16.61

Composite Section Properties

Is the Section Composite? (Y or N)	y
topping thickness =	5.5 in
topping width =	24 in
I _{composite} =	1228.25 in ⁴
(y _b) _{composite} =	2.75 in
w _{composite topping} =	75 plf
topping f' _c =	5000 psi
(h) _{composite} =	8.5
(β ₁) _{composite} =	0.80

E_{ci} = 3644 ksi

E_c = 4074 ksi

(y_t)_{nc} = 1.5 in

(S_t)_{nc} = 36.0 in³

(S_b)_{nc} = 36.0 in³

(y_t)_{composite} = 5.75 in

P_i = 57.96 kips

P_{jack} = 64.4

P_e = 53.70 kips

f_{se} = 157.95 ksi

23 w_u = 180 plf

Transfer Length = 19.7 in "(f_{se}/3)d_b -overhang"

Development Length = 43.7 in

Non-Composite Strength Calculation

f'_c = 5000

β₁ = 0.80

comp. width = 24.0 in

d_p = 1.50 in

ρ_p = 0.009444

f_{ps} = 221.81 psi

a = 0.74 in

M_n = 85 kip-in = 7.1 kip-ft (based on ACI Equations)

φM_n = 77 kip-in = 6.4 kip-ft (based on ACI Equations)

Composite Strength Calculation

f'_c = 4700 psi

β₁ = 0.82

comp. width = 24.0 in

d_p = 7.00

ρ_p = 0.002024

f_{ps} = 259.67 psi

a = 0.87 in

M_n = 580 kip-in = 48.3 kip-ft (based on ACI Equations)

φM_n = 522 kip-in = 43.5 kip-ft (based on ACI Equations)

Row #1	
# of Strands	4
Aps=	0.34 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #2	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #3	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in

Average e_{end}= 0 in

Average e_{mid}= 0 in

Total Aps=	0.340 in ²
Pe₁ =	53.70 kips
Pe₂ =	0.00 kips
Pe₃ =	0.00 kips
Total =	53.70 kips

E= 29,000 ksi
f_y= 60 ksi

Row #1		
Area=	1.24	in ²
depth=	2.75	in
Row #2		
Area=	0.00	in ²
depth=	0.00	in
Row #3		
Area=	0.00	in ²
depth=	0.00	in

		Transfer	0.1 L	0.2 L	0.3 L	0.4 L	0.5 L
	Dist. From Brg. (ft)	1.65	0.75	1.50	2.25	3.00	3.75
	Average e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	c (in)	1.78	1.78	1.78	1.78	1.78	1.78
	a (in)	1.45	1.45	1.45	1.45	1.45	1.45
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00554	0.00554	0.00554	0.00554	0.00554	0.00554
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.01449	0.01449	0.01449	0.01449	0.01449	0.01449
P/S Row #1	f _{ps} (ksi)	264.7	264.7	264.7	264.7	264.7	264.7
	Row 1 Tension (kips)	89.98	89.98	89.98	89.98	89.98	89.98
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.00895	0.00895	0.00895	0.00895	0.00895	0.00895
	f _{ps} (ksi)	249.5	249.5	249.5	249.5	249.5	249.5
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
P/S Row #2	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.00895	0.00895	0.00895	0.00895	0.00895	0.00895
	f _{ps} (ksi)	249.5	249.5	249.5	249.5	249.5	249.5
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
P/S Row #3	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
	strain3	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	total strain	0.00895	0.00895	0.00895	0.00895	0.00895	0.00895
	f _{ps} (ksi)	249.5	249.5	249.5	249.5	249.5	249.5
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 1	depth (in)	2.75	2.75	2.75	2.75	2.75	2.75
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	0.00162	0.00162	0.00162	0.00162	0.00162	0.00162
	stress	47.1	47.1	47.1	47.1	47.1	47.1
	Row 1 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 1 Tension (kips)	58.36	58.36	58.36	58.36	58.36	58.36
Mild Steel 2	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 2 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 3	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 3 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression (kips)	148.35	148.35	148.35	148.35	148.35	148.35
	Tension (kips)	148.35	148.35	148.35	148.35	148.35	148.35
	C-T (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	M _n (kip-ft)	25.7	11.7	23.4	35.1	46.9	56.9
	ε _t	0.00877	0.00877	0.00877	0.00877	0.00877	0.00877
	φ	0.90	0.90	0.90	0.90	0.90	0.90
	φM _n (kip-ft)	23.1	10.5	21.1	31.6	42.2	51.2
	Mu (kip-ft)	0.9	0.5	0.8	1.1	1.2	1.3
	Check Mu vs φMn						
	M _{cr}	39.3	43.2	39.8	37.4	36.0	35.5
	1.2*M _{cr}	47.1	51.8	47.8	44.9	43.1	42.6
	Check φMn > 1.2M _{cr}	X	X	X	X	X	

Strain Compatibility Input Data: Indented Wire - 6 ft**Prestressed Section Properties**

Area =	72	in ²	
b =	24	in	
h =	3	in	
I =	54	in ⁴	
y _b =	1.5	in	
w _{self} =	75	plf	
V/S =	1.333333	in	
w _{super dead} =	0	plf	
w _{live} =	0	plf	
Span =	5.5	ft	
Dist. From end to C. Brg.	0	in	
f' _{ci} =	4000	psi	
f' _c =	5000	psi	
Unit wt. of Concrete	145	lb/ft ³	
Strand Diameter	8mm	▼ in	
E _p	28,500	ksi	
Initial Pull	187,395	psi	Override With
Initial Losses	10	%	10
Total Losses	15.97	%	15.97

Composite Section Properties

Is the Section Composite? (Y or N)	y
topping thickness =	5.5 in
topping width =	24 in
I _{composite} =	1228.25 in ⁴
(y _b) _{composite} =	2.75 in
w _{composite topping} =	75 plf
topping f' _c =	5000 psi
(h) _{composite} =	8.5
(β ₁) _{composite} =	0.80

E_{ci} = 3644 ksi

E_c = 4074 ksi

(y_t)_{nc} = 1.5 in

(S_t)_{nc} = 36.0 in³

(S_b)_{nc} = 36.0 in³

(y_t)_{composite} = 5.75 in

P_i = 52.56 kips

P_{jack} = 58.4

P_e = 49.07 kips

f_{se} = 157.47 ksi

23 w_u = 180 plf

Transfer Length = 16.5 in "(f_{se}/3)d_b -overhang"

Development Length = 32.0 in

Non-Composite Strength Calculation

f'_c = 5000

β₁ = 0.80

comp. width = 24.0 in

d_p = 1.50 in

ρ_p = 0.008657

f_{ps} = 225.83 psi

a = 0.69 in

Mn = 81 kip-in = 6.8 kip-ft (based on ACI Equations)

φMn = 73 kip-in = 6.1 kip-ft (based on ACI Equations)

Composite Strength Calculation

f'_c = 4700 psi

β₁ = 0.82

comp. width = 24.0 in

d_p = 7.00

ρ_p = 0.001855

f_{ps} = 260.53 psi

a = 0.80 in

Mn = 536 kip-in = 44.7 kip-ft (based on ACI Equations)

φMn = 482 kip-in = 40.2 kip-ft (based on ACI Equations)

Row #1	
# of Strands	4
Aps=	0.31164 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #2	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #3	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in

Average e_{end}= 0 in

Average e_{mid}= 0 in

Total Aps=	0.312 in ²
Pe₁ =	49.07 kips
Pe₂ =	0.00 kips
Pe₃ =	0.00 kips
Total =	49.07 kips

E= 29,000 ksi
f_y= 60 ksi

Row #1		
Area=	1.24	in ²
depth=	2.75	in
Row #2		
Area=	0.00	in ²
depth=	0.00	in
Row #3		
Area=	0.00	in ²
depth=	0.00	in

		Transfer	0.1 L	0.2 L	0.3 L	0.4 L	0.5 L
P/S Row #1	Dist. From Brg. (ft)	1.38	0.55	1.10	1.65	2.20	2.75
	Average e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	c (in)	1.56	1.56	1.56	1.56	1.56	1.56
	a (in)	1.28	1.28	1.28	1.28	1.28	1.28
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00553	0.00553	0.00553	0.00553	0.00553	0.00553
	strain2	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017
	strain3	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	total strain	0.01612	0.01612	0.01612	0.01612	0.01612	0.01612
P/S Row #2	f _{ps} (ksi)	265.6	265.6	265.6	265.6	265.6	265.6
	Row 1 Tension (kips)	82.78	82.78	82.78	82.78	82.78	82.78
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017
	strain3	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	total strain	0.01059	0.01059	0.01059	0.01059	0.01059	0.01059
	f _{ps} (ksi)	258.9	258.9	258.9	258.9	258.9	258.9
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
P/S Row #3	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017
	strain3	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	total strain	0.01059	0.01059	0.01059	0.01059	0.01059	0.01059
	f _{ps} (ksi)	258.9	258.9	258.9	258.9	258.9	258.9
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 1	depth (in)	2.25	2.25	2.25	2.25	2.25	2.25
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	0.00131	0.00131	0.00131	0.00131	0.00131	0.00131
	stress	38.1	38.1	38.1	38.1	38.1	38.1
	Row 1 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 1 Tension (kips)	47.28	47.28	47.28	47.28	47.28	47.28
Mild Steel 2	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 2 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 3	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 3 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression (kips)	130.05	130.05	130.05	130.05	130.05	130.05
	Tension (kips)	130.05	130.05	130.05	130.05	130.05	130.05
	C-T (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	M _n (kip-ft)	26.0	10.4	20.7	31.1	41.4	50.2
	ε _t	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	φ	0.90	0.90	0.90	0.90	0.90	0.90
	φM _n (kip-ft)	23.4	9.3	18.7	28.0	37.3	45.2
	Mu (kip-ft)	0.5	0.2	0.4	0.6	0.7	0.7
	Check Mu vs φMn						
	M _{cr}	40.2	42.8	41.0	39.7	38.9	38.6
	1.2*M _{cr}	48.3	51.3	49.2	47.6	46.7	46.4
	Check φMn > 1.2M _{cr}	X	X	X	X	X	X

0.01042342

FALSE

FALSE

0.00131467

FALSE

FALSE

Strain Compatibility Input Data: Indented Wire - 8 ft**Prestressed Section Properties**

Area =	72	in ²	
b =	24	in	
h =	3	in	
I =	54	in ⁴	
y _b =	1.5	in	
w _{self} =	75	plf	
V/S =	1.333333	in	
w _{super dead} =	0	plf	
w _{live} =	0	plf	
Span =	5.5	ft	
Dist. From end to C. Brg.	0	in	
f' _{ci} =	4000	psi	
f' _c =	5000	psi	
Unit wt. of Concrete	145	lb/ft ³	
Strand Diameter	8mm	▼ in	
E _p	28,500	ksi	
Initial Pull	187,395	psi	Override With
Initial Losses	10	%	10
Total Losses	15.97	%	15.97

Composite Section Properties

Is the Section Composite? (Y or N)	y
topping thickness =	5.5 in
topping width =	24 in
I _{composite} =	1228.25 in ⁴
(y _b) _{composite} =	2.75 in
w _{composite topping} =	75 plf
topping f' _c =	5000 psi
(h) _{composite} =	8.5
(β ₁) _{composite} =	0.80

E_{ci} = 3644 ksi

E_c = 4074 ksi

(y_t)_{nc} = 1.5 in

(S_t)_{nc} = 36.0 in³

(S_b)_{nc} = 36.0 in³

(y_t)_{composite} = 5.75 in

P_i = 52.56 kips

P_{jack} = 58.4

P_e = 49.07 kips

f_{se} = 157.47 ksi

23 w_u = 180 plf

Transfer Length = 16.5 in "(f_{se}/3)d_b - overhang"

Development Length = 32.0 in

Non-Composite Strength Calculation

f'_c = 5000

β₁ = 0.80

comp. width = 24.0 in

d_p = 1.50 in

ρ_p = 0.008657

f_{ps} = 225.83 psi

a = 0.69 in

Mn = 81 kip-in = 6.8 kip-ft (based on ACI Equations)

φMn = 73 kip-in = 6.1 kip-ft (based on ACI Equations)

Composite Strength Calculation

f'_c = 4700 psi

β₁ = 0.82

comp. width = 24.0 in

d_p = 7.00

ρ_p = 0.001855

f_{ps} = 260.53 psi

a = 0.80 in

Mn = 536 kip-in = 44.7 kip-ft (based on ACI Equations)

φMn = 482 kip-in = 40.2 kip-ft (based on ACI Equations)

Row #1	
# of Strands	4
Aps=	0.31164 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #2	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in
Row #3	
# of Strands	0
Aps	0 in ²
e _{end} =	0 in
e _{mid} =	0 in

Average e_{end}= 0 in

Average e_{mid}= 0 in

Total Aps=	0.312 in ²
Pe₁ =	49.07 kips
Pe₂ =	0.00 kips
Pe₃ =	0.00 kips
Total =	49.07 kips

E= 29,000 ksi
f_y= 60 ksi

Row #1		
Area=	1.24	in ²
depth=	2.75	in
Row #2		
Area=	0.00	in ²
depth=	0.00	in
Row #3		
Area=	0.00	in ²
depth=	0.00	in

		Transfer	0.1 L	0.2 L	0.3 L	0.4 L	0.5 L
P/S Row #1	Dist. From Brg. (ft)	1.38	0.55	1.10	1.65	2.20	2.75
	Average e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	c (in)	1.56	1.56	1.56	1.56	1.56	1.56
	a (in)	1.28	1.28	1.28	1.28	1.28	1.28
	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00553	0.00553	0.00553	0.00553	0.00553	0.00553
	strain2	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017
	strain3	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	total strain	0.01612	0.01612	0.01612	0.01612	0.01612	0.01612
	f _{ps} (ksi)	265.6	265.6	265.6	265.6	265.6	265.6
	Row 1 Tension (kips)	82.78	82.78	82.78	82.78	82.78	82.78
P/S Row #2	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017
	strain3	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	total strain	0.01059	0.01059	0.01059	0.01059	0.01059	0.01059
	f _{ps} (ksi)	258.9	258.9	258.9	258.9	258.9	258.9
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
P/S Row #3	e (in)	0.00	0.00	0.00	0.00	0.00	0.00
	d _p (in)	7.00	7.00	7.00	7.00	7.00	7.00
	strain1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	strain2	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017
	strain3	0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
	total strain	0.01059	0.01059	0.01059	0.01059	0.01059	0.01059
	f _{ps} (ksi)	258.9	258.9	258.9	258.9	258.9	258.9
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 1	depth (in)	2.25	2.25	2.25	2.25	2.25	2.25
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	0.00131	0.00131	0.00131	0.00131	0.00131	0.00131
	stress	38.1	38.1	38.1	38.1	38.1	38.1
	Row 1 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 1 Tension (kips)	47.28	47.28	47.28	47.28	47.28	47.28
Mild Steel 2	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 2 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 2 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Mild Steel 3	depth (in)	0.00	0.00	0.00	0.00	0.00	0.00
	Compression Area (in ²)	0.00	0.00	0.00	0.00	0.00	0.00
	Area in Whitney Block	0.00	0.00	0.00	0.00	0.00	0.00
	strain	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300	-0.00300
	stress	-60.0	-60.0	-60.0	-60.0	-60.0	-60.0
	Row 3 Compression (kips)	0.00	0.00	0.00	0.00	0.00	0.00
	Row 3 Tension (kips)	0.00	0.00	0.00	0.00	0.00	0.00
Compression (kips)		130.05	130.05	130.05	130.05	130.05	130.05
Tension (kips)		130.05	130.05	130.05	130.05	130.05	130.05
C-T (kips)		0.00	0.00	0.00	0.00	0.00	0.00
M _n (kip-ft)		26.0	10.4	20.7	31.1	41.4	50.2
ε _t		0.01042	0.01042	0.01042	0.01042	0.01042	0.01042
φ		0.90	0.90	0.90	0.90	0.90	0.90
φM _n (kip-ft)		23.4	9.3	18.7	28.0	37.3	45.2
Mu (kip-ft)		0.5	0.2	0.4	0.6	0.7	0.7
Check Mu vs φMn							
M _{cr}		40.2	42.8	41.0	39.7	38.9	38.6
1.2*M _{cr}		48.3	51.3	49.2	47.6	46.7	46.4
Check φMn > 1.2M _{cr}		X	X	X	X	X	X

APPENDIX C – Transfer Length Data and Determinations

7-wire - 6 ft Panel Whittemore Data Points

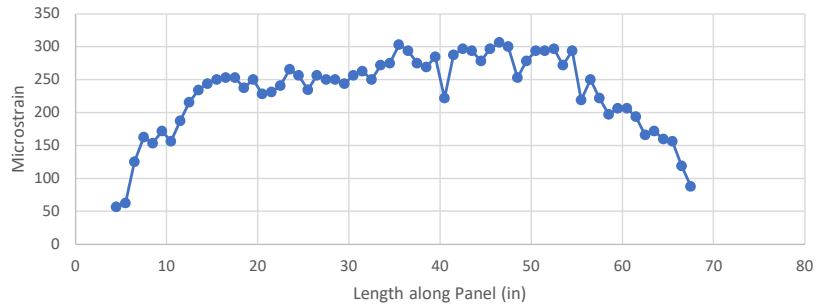
South	Initial 1	Initial 2	Difference	Average	Detensioning	21 day
1	0.00625	0.00635	1E-04	0.0063	0.00585	0.00265
2	0.0002	0.0003	0.0001	0.00025	-0.00025	-0.00335
3	0.0039	0.0041	0.0002	0.004	0.003	0
4	0.0049	0.00485	5E-05	0.004875	0.003575	0.0008
5	0.00115	0.0012	5E-05	0.001175	-0.00005	-0.00305
6	0.02875	0.0287	5E-05	0.028725	0.02735	0.0246
7	0.029	0.029	0	0.029	0.02775	0.0246
8	0.029	0.029	0	0.029	0.0275	0.02445
9	0.02905	0.029	5E-05	0.029025	0.0273	0.024425
10	0.029	0.029	0	0.029	0.02713	0.024275
11	0.029	0.0289	0.0001	0.02895	0.027	0.024225
12	0.02885	0.02895	1E-04	0.0289	0.0269	0.02375
13	0.029	0.02905	5E-05	0.029025	0.027	0.023675
14	0.0071	0.00695	0.00015	0.007025	0.005	0.001475
15	0.00505	0.00505	0	0.00505	0.00315	-0.0001
16	0.0018	0.0016	0.0002	0.0017	-0.0003	-0.0036
17	0.00455	0.0045	5E-05	0.004525	0.0027	-0.00075
18	0.0062	0.0062	0	0.0062	0.00435	0.00075
19	0.00875	0.0089	0.00015	0.008825	0.0069	0.00305
20	0.0106	0.01045	0.00015	0.010525	0.0084	0.00465
21	0.00115	0.00135	0.0002	0.00125	-0.0008	-0.00455
22	0.00375	0.0039	0.00015	0.003825	0.00195	-0.00235
23	0.00715	0.00715	0	0.00715	0.0051	0.001
24	0.009	0.009	0	0.009	0.007	0.00275
25	0.00555	0.00585	0.0003	0.0057	0.0037	-0.0004
26	0.00695	0.00675	0.0002	0.00685	0.0049	0.0005
27	-0.001	-0.001	0	-0.001	-0.00305	-0.0074
28	-0.0023	-0.0023	0	-0.0023	-0.0044	-0.0086
29	0.0041	0.004	0.0001	0.00405	0.00205	-0.0022
30	0.00365	0.0036	5E-05	0.003625	0.00145	-0.00275
31	0.004	0.0039	0.0001	0.00395	0.00175	-0.0025
32	0.0027	0.00245	0.00025	0.002575	0.00015	-0.0038
33	-0.001	-0.0012	0.0002	-0.0011	-0.00345	-0.007335
34	-0.00365	-0.00365	0	-0.00365	-0.00585	-0.00975
35	0.00325	0.00345	0.0002	0.00335	0.0012	-0.00295
36	0.00265	0.0027	5E-05	0.002675	0.0004	-0.0038
37	0.0051	0.00535	0.00025	0.005225	0.00345	-0.00085
38	0.00235	0.00215	0.0002	0.00225	-0.00005	-0.00415
39	0.00155	0.0013	0.00025	0.001425	-0.00095	-0.0051
40	0.00095	0.00085	0.0001	0.0009	-0.00145	-0.00565
41	0.00335	0.0033	5E-05	0.003325	0.0011	-0.003135
42	0.0013	0.00115	0.00015	0.001225	-0.00115	-0.00515
43	0.00615	0.00585	0.0003	0.006	0.00355	-0.0004
44	0.0035	0.0036	1E-04	0.00355	0.00115	-0.00255
45	0.0045	0.00455	5E-05	0.004525	0.0025	-0.00145
46	0.00625	0.0065	0.00025	0.006375	0.00415	0.0004
47	-0.00145	-0.00125	0.0002	-0.00135	-0.0037	-0.00715
48	0.0051	0.0051	0	0.0051	0.00275	-0.0006
49	0.0103	0.01035	5E-05	0.010325	0.00795	0.0049
50	0.0108	0.01075	5E-05	0.010775	0.0086	0.0053
51	0.0014	0.0014	0	0.0014	-0.00095	-0.00415
52	0.0059	0.006	0.0001	0.00595	0.0042	0.00135
53	0.00045	0.00045	0	0.00045	-0.00155	-0.0047
54	0.0073	0.00745	0.00015	0.007375	0.0056	0.00265
55	0.0075	0.00755	5E-05	0.007525	0.00595	0.0028
56	0.006	0.006	0	0.006	0.00435	0.0014
57	-0.0014	-0.0014	0	-0.0014	-0.00305	-0.00595
58	0.00195	0.00175	0.0002	0.00185	0.0003	-0.00255
59	0.00355	0.0038	0.00025	0.003675	0.00235	-0.0005
60	0.00245	0.0024	5E-05	0.002425	0.00105	-0.0017
61	0.00255	0.0025	5E-05	0.002525	0.00125	-0.0016
62	0.0031	0.0029	0.0002	0.003	0.00175	-0.001
63	0.00105	0.00105	0	0.00105	0.0001	-0.00255
64	0.0033	0.0032	1E-04	0.00325	0.00255	-0.0003

7-wire - 6 ft Panel Microstrain along Panel

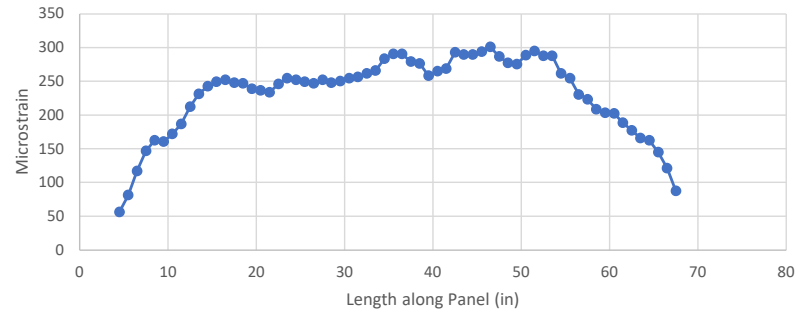
Detensioning			
Length	Delta	3 Pt Average	5 pt Average
4.5	56.25	56.25	56.25
5.5	62.5	81.25	81.25
6.5	125	116.6666667	111.875
7.5	162.5	146.875	135
8.5	153.125	162.5	153.75
9.5	171.875	160.4166667	166.25
10.5	156.25	171.875	176.875
11.5	187.5	186.4583333	193
12.5	215.625	212.2916667	207.375
13.5	233.75	231.0416667	226.125
14.5	243.75	242.5	239.25
15.5	250	248.9583333	246.75
16.5	253.125	252.0833333	247.5
17.5	253.125	247.9166667	248.75
18.5	237.5	246.875	244.375
19.5	250	238.5416667	240
20.5	228.125	236.4583333	237.5
21.5	231.25	233.3333333	243.125
22.5	240.625	245.8333333	244.375
23.5	265.625	254.1666667	245.625
24.5	256.25	252.0833333	250.625
25.5	234.375	248.9583333	252.5
26.5	256.25	246.875	249.375
27.5	250	252.0833333	246.875
28.5	250	247.9166667	251.25
29.5	243.75	250	252.5
30.5	256.25	254.1666667	252.5
31.5	262.5	256.25	256.875
32.5	250	261.4583333	263.125
33.5	271.875	265.625	272.5
34.5	275	283.3333333	278.75
35.5	303.125	290.625	283.75
36.5	293.75	290.625	283.125
37.5	275	279.1666667	285
38.5	268.75	276.0416667	268.75
39.5	284.375	258.3333333	267.5
40.5	221.875	264.5833333	271.875
41.5	287.5	268.75	276.875
42.5	296.875	292.7083333	275.625
43.5	293.75	289.5833333	290.625
44.5	278.125	289.5833333	294.375
45.5	296.875	293.75	295
46.5	306.25	301.0416667	286.875
47.5	300	286.4583333	286.875
48.5	253.125	277.0833333	286.25
49.5	278.125	275	283.75
50.5	293.75	288.5416667	283.125
51.5	293.75	294.7916667	286.875
52.5	296.875	287.5	290
53.5	271.875	287.5	275
54.5	293.75	261.4583333	266.25
55.5	218.75	254.1666667	251.25
56.5	250	230.2083333	236.25
57.5	221.875	222.9166667	218.75
58.5	196.875	208.3333333	216.25
59.5	206.25	203.125	205
60.5	206.25	202.0833333	193.75
61.5	193.75	188.5416667	188.75
62.5	165.625	177.0833333	179.375
63.5	171.875	165.625	169.375
64.5	159.375	162.5	154.375
65.5	156.25	144.7916667	138.75
66.5	118.75	120.8333333	120.8333333
67.5	87.5	87.5	87.5

21 Day			
Length	Delta	3 Pt Average	5 Pt Average
4.5	456.25	456.25	456.25
5.5	450	468.75	468.75
6.5	500	486.4583333	488.75
7.5	509.375	512.5	500.625
8.5	528.125	517.7083333	520.625
9.5	515.625	531.25	534.375
10.5	550	544.7916667	547.5
11.5	568.75	564.5833333	560
12.5	575	578.125	575
13.5	590.625	585.4166667	593.75
14.5	590.625	608.3333333	613.75
15.5	643.75	634.375	637.5
16.5	668.75	668.75	648.125
17.5	693.75	668.75	662.5
18.5	643.75	666.6666667	665.625
19.5	662.5	655.2083333	668.125
20.5	659.375	667.7083333	673.75
21.5	681.25	687.5	691.875
22.5	721.875	712.5	704.375
23.5	734.375	727.0833333	726.875
24.5	725	743.75	744.375
25.5	771.875	755.2083333	756.25
26.5	768.75	773.9583333	761.875
27.5	781.25	770.8333333	775.625
28.5	762.5	779.1666667	781.25
29.5	793.75	785.4166667	785
30.5	800	793.75	785
31.5	787.5	789.5833333	791.875
32.5	781.25	788.5416667	794.375
33.5	796.875	794.7916667	793.75
34.5	806.25	800	792.125
35.5	796.875	794.1666667	788.375
36.5	779.375	779.5833333	786.5
37.5	762.5	776.4583333	787.125
38.5	787.5	786.4583333	779.625
39.5	809.375	785.4166667	783.75
40.5	759.375	789.5833333	794.375
41.5	800	791.6666667	800.625
42.5	815.625	811.4583333	800.25
43.5	818.75	813.9583333	807.75
44.5	807.5	807.7083333	807.75
45.5	796.875	801.4583333	797.125
46.5	800	786.4583333	782.75
47.5	762.5	769.7916667	770.625
48.5	746.875	752.0833333	756.25
49.5	746.875	739.5833333	738.75
50.5	725	728.125	721.875
51.5	712.5	705.2083333	709.375
52.5	678.125	691.6666667	698.75
53.5	684.375	685.4166667	668.75
54.5	693.75	651.0416667	655
55.5	575	637.5	637.5
56.5	643.75	603.125	618.75
57.5	590.625	608.3333333	595
58.5	590.625	585.4166667	593.75
59.5	575	578.125	575
60.5	568.75	564.5833333	561.25
61.5	550	546.875	546.25
62.5	521.875	529.1666667	534.375
63.5	515.625	517.7083333	520.625
64.5	515.625	510.4166667	500.625
65.5	500	488.5416667	485
66.5	450	464.5833333	464.5833333
67.5	443.75	443.75	443.75

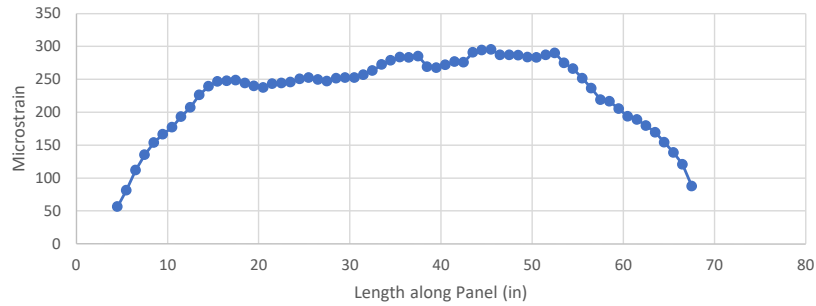
Pour 1 Detension- 6 ft Panel Raw Data



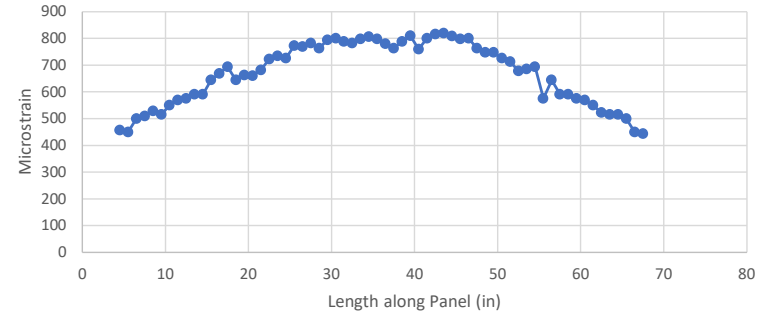
Pour 1 Detension- 6 ft Panel 3 Point Average



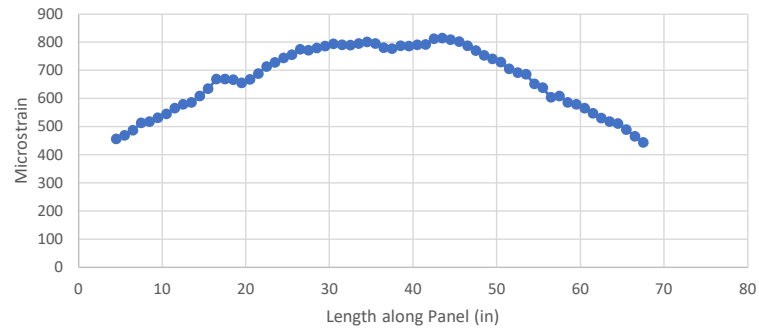
Pour 1 Detension - 6 ft Panel 5 Point Average



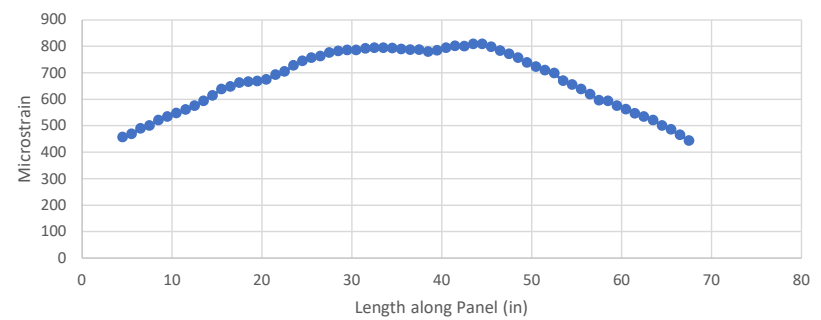
Pour 1 - 21 day - 6 ft Panel Raw



Pour 1 - 21 day - 6 ft Panel 3 Point Average



Pour 1 - 21 day - 6 ft Panel 5 Point Average



7-wire - 6 ft Panel Whittemore Data Points

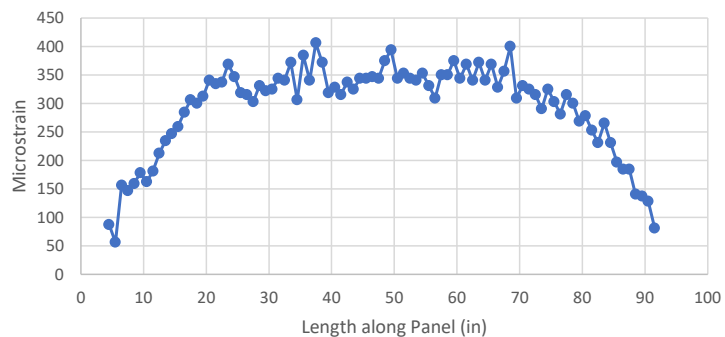
South	Initial 1	Initial 2	Difference	Average	Detensioning	21 day
1	0.00655	0.00655	0	0.00655	0.00585	0.0037
2	-0.00065	-0.00085	0.0002	-0.00075	-0.0012	-0.00455
3	0.0086	0.0085	1E-04	0.00855	0.0073	0.00515
4	0.0035	0.00355	5E-05	0.003525	0.00235	-0.0003
5	0.00365	0.0038	0.00015	0.003725	0.00245	-0.00025
6	0.00765	0.0077	5E-05	0.007675	0.00625	0.0037
7	0.006	0.006	0	0.006	0.0047	0.0019
8	0.0038	0.004	0.0002	0.0039	0.00245	-0.0003
9	0.00325	0.00335	0.0001	0.0033	0.0016	-0.00125
10	0.0027	0.00285	0.00015	0.002775	0.0009	-0.00195
11	0.0036	0.00365	5E-05	0.003625	0.00165	-0.0014
12	0.00625	0.0062	5E-05	0.006225	0.00415	0.0015
13	0.00735	0.0073	5E-05	0.007325	0.00505	0.00195
14	0.01055	0.01055	0	0.01055	0.0081	0.0049
15	0.01085	0.01085	0	0.01085	0.00845	0.0046
16	0.01075	0.01095	0.0002	0.01085	0.00835	0.00415
17	0.0097	0.00975	5E-05	0.009725	0.007	0.00325
18	0.01125	0.0113	5E-05	0.011275	0.0086	0.00505
19	0.0111	0.011	0.0001	0.01105	0.00835	0.004
20	0.0051	0.0051	0	0.0051	0.00215	-0.00225
21	0.00685	0.0069	5E-05	0.006875	0.0041	-0.00055
22	0.0033	0.0033	0	0.0033	0.00075	-0.00345
23	0.0078	0.00785	5E-05	0.007825	0.0053	0.0003
24	0.00745	0.0072	0.00025	0.007325	0.0049	0.00055
25	0.0036	0.0036	0	0.0036	0.00095	-0.0036
26	0.00965	0.0096	5E-05	0.009625	0.00705	0.0024
27	0.006	0.0059	0.0001	0.00595	0.00335	-0.00125
28	0.00595	0.00595	0	0.00595	0.0032	-0.00155
29	0.0052	0.00525	5E-05	0.005225	0.0025	-0.00235
30	0.00695	0.0074	0.00045	0.007175	0.0042	-0.0003
31	0.00545	0.00545	0	0.00545	0.003	-0.00175
32	0.00325	0.0032	5E-05	0.003225	0.00015	-0.00465
33	0.0086	0.00845	0.00015	0.008525	0.0058	0.00065
34	-0.00225	-0.00215	1E-04	-0.0022	-0.00545	-0.0098
35	-0.0029	-0.00265	0.00025	-0.00278	-0.00575	-0.0104
36	0.0026	0.0025	1E-04	0.00255	0	-0.0051
37	0.0036	0.00335	0.00025	0.003475	0.00085	-0.00425
38	0.0038	0.00365	0.00015	0.003725	0.0012	-0.00395
39	-0.00175	-0.00155	0.0002	-0.00165	-0.00435	-0.00935
40	0.00005	-0.00005	0.0001	0	-0.0026	-0.0077
41	-0.001	-0.001	0	-0.001	-0.00375	-0.00875
42	0.0027	0.0026	0.0001	0.00265	-0.0001	-0.0053
43	0.00765	0.0076	5E-05	0.007625	0.00485	-0.00025
44	0.0024	0.0024	0	0.0024	-0.00035	-0.0054
45	0.0061	0.0061	0	0.0061	0.0031	-0.002
46	0.0034	0.0035	0.0001	0.00345	0.0003	-0.00455
47	0.0052	0.0053	0.0001	0.00525	0.0025	-0.0027
48	0.00975	0.0098	5E-05	0.009775	0.00695	0.00185
49	0.00335	0.00325	0.0001	0.0033	0.00055	-0.0047
50	0.0085	0.00845	5E-05	0.008475	0.00575	0.0004
51	-0.00015	-0.0002	0.00005	-0.00018	-0.003	-0.00835
52	0.008	0.008	0	0.008	0.00535	-0.00015
53	-0.00175	-0.0018	5E-05	-0.00178	-0.00425	-0.0095
54	0.00615	0.00595	0.0002	0.00605	0.00325	-0.00215
55	0.0057	0.0055	0.0002	0.0056	0.0028	-0.0025
56	0.001	0.001	0	0.001	-0.002	-0.00735
57	0.006	0.0059	0.0001	0.00595	0.0032	-0.00195
58	0.00545	0.00545	0	0.00545	0.0025	-0.00275
59	0.0165	0.01675	0.00025	0.016625	0.0139	0.00875
60	0.00875	0.0085	0.00025	0.008625	0.00565	0.00055
61	0.01115	0.0113	0.00015	0.011225	0.0085	0.0034
62	0.0073	0.0073	0	0.0073	0.00435	-0.0009
63	0.0112	0.01135	0.00015	0.011275	0.00865	0.0036
64	0.00965	0.00935	0.0003	0.0095	0.00665	0.00215
65	0.0071	0.0073	0.0002	0.0072	0.004	-0.00045
66	0.0083	0.00825	5E-05	0.008275	0.0058	0.0012
67	0.00155	0.00165	0.0001	0.0016	-0.00105	-0.00545
68	0.00275	0.00265	1E-04	0.0027	0.0001	-0.00385
69	0.00195	0.0022	0.00025	0.002075	-0.00045	-0.00445
70	-0.00135	-0.0011	0.00025	-0.00123	-0.00355	-0.0073
71	0.005	0.0048	0.0002	0.0049	0.0023	-0.00135
72	0.0073	0.00735	5E-05	0.007325	0.0049	0.0014
73	0.0087	0.0086	1E-04	0.00865	0.0064	0.0031
74	0.00675	0.0066	0.00015	0.006675	0.00415	0.00085
75	0.0055	0.0054	1E-04	0.00545	0.00305	-0.0003
76	0.01045	0.01065	0.0002	0.01055	0.0084	0.0051
77	0.0093	0.00905	0.00025	0.009175	0.00695	0.00345
78	0.0106	0.01055	5E-05	0.010575	0.00855	0.0052
79	0.00405	0.00405	0	0.00405	0.0022	-0.00135
80	0.0025	0.00245	5E-05	0.002475	0.00035	-0.00305
81	0.0024	0.0021	0.0003	0.00225	0.0004	-0.003
82	0.0013	0.00125	5E-05	0.001275	-0.0003	-0.0033
83	0.0062	0.00595	0.00025	0.006075	0.0046	0.00155
84	0.0065	0.00635	0.00015	0.006425	0.00495	0.00205
85	0.00535	0.0053	5E-05	0.005325	0.0042	0.00125
86	0.00265	0.00265	0	0.00265	0.00155	-0.0012
87	0.0041	0.00405	5E-05	0.004075	0.00305	0.00145
88	0.00345	0.00355	0.0001	0.0035	0.00285	0.00035

7-wire - 8 ft Panel Microstrain along Panel

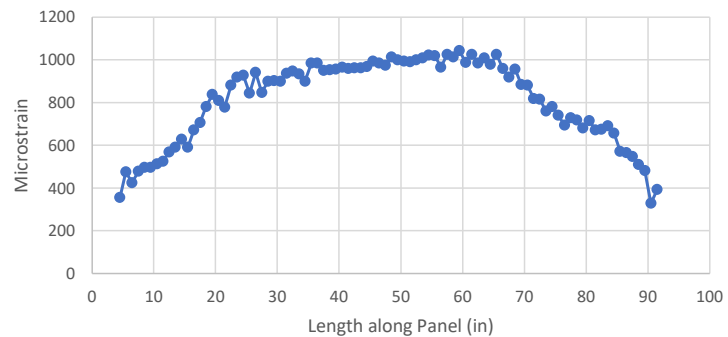
Detensioning			
Length	Delta	3 Pt Average	5 Pt Average
4.5	87.5	87.5	87.5
5.5	56.25	100	100
6.5	156.25	119.7916667	121.25
7.5	146.875	154.1666667	139.375
8.5	159.375	161.4583333	160.625
9.5	178.125	166.6666667	165.625
10.5	162.5	173.9583333	178.75
11.5	181.25	185.4166667	193.75
12.5	212.5	209.375	207.5
13.5	234.375	231.25	226.875
14.5	246.875	246.875	247.5
15.5	259.375	263.5416667	266.25
16.5	284.375	283.3333333	279.375
17.5	306.25	296.875	292.5
18.5	300	306.25	308.75
19.5	312.5	317.7083333	318.75
20.5	340.625	329.1666667	325
21.5	334.375	337.5	338.75
22.5	337.5	346.875	345.625
23.5	368.75	351.0416667	341.25
24.5	346.875	344.7916667	337.5
25.5	318.75	327.0833333	330.625
26.5	315.625	312.5	323.125
27.5	303.125	316.6666667	318.125
28.5	331.25	318.75	319.375
29.5	321.875	326.0416667	325
30.5	325	330.2083333	332.5
31.5	343.75	336.4583333	340.625
32.5	340.625	352.0833333	337.5
33.5	371.875	339.5833333	349.375
34.5	306.25	354.1666667	348.75
35.5	384.375	343.75	361.875
36.5	340.625	377.0833333	361.875
37.5	406.25	372.9166667	364.375
38.5	371.875	365.625	353.125
39.5	318.75	339.5833333	348.125
40.5	328.125	320.8333333	334.375
41.5	315.625	327.0833333	325
42.5	337.5	326.0416667	330
43.5	325	335.4166667	333.125
44.5	343.75	337.5	339.375
45.5	343.75	344.7916667	340.625
46.5	346.875	344.7916667	350.625
47.5	343.75	355.2083333	360.625
48.5	375	370.8333333	360.625
49.5	393.75	370.8333333	361.875
50.5	343.75	363.5416667	361.875
51.5	353.125	346.875	355
52.5	343.75	345.8333333	346.875
53.5	340.625	345.8333333	344.375
54.5	353.125	341.6666667	335.625
55.5	331.25	331.25	336.875
56.5	309.375	330.2083333	338.75
57.5	350	336.4583333	343.125
58.5	350	358.3333333	345.625
59.5	375	356.25	357.5
60.5	343.75	362.5	355.625
61.5	368.75	351.0416667	360
62.5	340.625	360.4166667	353.125
63.5	371.875	351.0416667	358.125
64.5	340.625	360.4166667	350
65.5	368.75	345.8333333	353.125
66.5	328.125	351.0416667	358.75
67.5	356.25	361.4583333	352.5
68.5	400	355.2083333	345
69.5	309.375	346.875	344.375
70.5	331.25	321.875	336.25
71.5	325	323.9583333	314.375
72.5	315.625	310.4166667	317.5
73.5	290.625	310.4166667	311.875
74.5	325	306.25	303.125
75.5	303.125	303.125	303.125
76.5	281.25	300	305
77.5	315.625	298.9583333	293.75
78.5	300	294.7916667	288.75
79.5	268.75	282.2916667	283.125
80.5	278.125	266.6666667	266.25
81.5	253.125	254.1666667	259.375
82.5	231.25	250	251.875
83.5	265.625	242.7083333	235.625
84.5	231.25	231.25	221.875
85.5	196.875	204.1666667	212.5
86.5	184.375	188.5416667	187.5
87.5	184.375	169.7916667	168.75
88.5	140.625	154.1666667	155
89.5	137.5	135.4166667	134.375
90.5	128.125	115.625	115.625
91.5	81.25	81.25	81.25

21 Day			
Length	Delta	3 Pt Average	5 Pt Average
4.5	356.25	356.25	356.25
5.5	475	418.75	418.75
6.5	425	459.375	446.25
7.5	478.125	466.6666667	474.375
8.5	496.875	490.625	481.875
9.5	496.875	502.0833333	501.875
10.5	512.5	511.4583333	520
11.5	525	535.4166667	538.75
12.5	568.75	561.4583333	565
13.5	590.625	595.8333333	580.625
14.5	628.125	603.125	610
15.5	590.625	630.2083333	637.5
16.5	671.875	656.25	675.625
17.5	706.25	719.7916667	717.5
18.5	781.25	775	761.25
19.5	837.5	809.375	782.5
20.5	809.375	808.3333333	817.5
21.5	778.125	822.9166667	845
22.5	881.25	859.375	863.125
23.5	918.75	909.375	870
24.5	928.125	896.875	902.5
25.5	843.75	904.1666667	895.625
26.5	940.625	877.0833333	891.875
27.5	846.875	895.8333333	886.875
28.5	900	883.3333333	898.125
29.5	903.125	901.0416667	897.5
30.5	900	913.5416667	917.5
31.5	937.5	928.125	924.375
32.5	946.875	939.5833333	923.75
33.5	934.375	927.0833333	940.625
34.5	900	939.5833333	950
35.5	984.375	956.25	950.625
36.5	984.375	972.9166667	954.375
37.5	950	962.5	965.625
38.5	953.125	953.125	961.875
39.5	956.25	958.3333333	956.875
40.5	965.625	960.4166667	959.375
41.5	959.375	962.5	961.25
42.5	962.5	961.4583333	963.75
43.5	962.5	964.5833333	969.375
44.5	968.75	975	974.375
45.5	993.75	982.2916667	976.875
46.5	984.375	984.375	986.875
47.5	975	990.625	993.125
48.5	1012.5	995.8333333	993.125
49.5	1000	1002.0833333	994.375
50.5	993.75	994.7916667	999.375
51.5	990.625	994.7916667	998.75
52.5	1000	1000	1003.125
53.5	1009.375	1010.416667	1008.125
54.5	1021.875	1016.666667	1003.125
55.5	1018.75	1002.0833333	1008.125
56.5	965.625	1003.125	1008.75
57.5	1025	1001.041667	1013.125
58.5	1012.5	1027.0833333	1006.875
59.5	1043.75	1014.5833333	1018.75
60.5	987.5	1018.75	1010.625
61.5	1025	998.9583333	1010
62.5	984.375	1006.25	996.875
63.5	1009.375	990.625	1004.375
64.5	978.125	1004.166667	991.25
65.5	1025	987.5	978.125
66.5	959.375	967.7083333	967.5
67.5	918.75	944.7916667	948.75
68.5	956.25	919.7916667	920
69.5	884.375	907.2916667	891.875
70.5	881.25	861.4583333	871.25
71.5	818.75	838.5416667	831.875
72.5	815.625	797.9166667	811.25
73.5	759.375	785.4166667	783.125
74.5	781.25	760.4166667	758.125
75.5	740.625	738.5416667	740.625
76.5	693.75	720.8333333	732.5
77.5	728.125	713.5416667	712.5
78.5	718.75	709.375	707.5
79.5	681.25	705.2083333	703.125
80.5	715.625	689.5833333	692.5
81.5	671.875	687.5	686.875
82.5	675	679.1666667	681.875
83.5	690.625	673.9583333	653.125
84.5	656.25	639.5833333	631.875
85.5	571.875	597.9166667	606.25
86.5	565.625	561.4583333	570
87.5	546.875	540.625	535
88.5	509.375	512.5	486.25
89.5	481.25	439.5833333	451.875
90.5	328.125	401.0416667	428.125
91.5	393.75	393.75	401.0416667

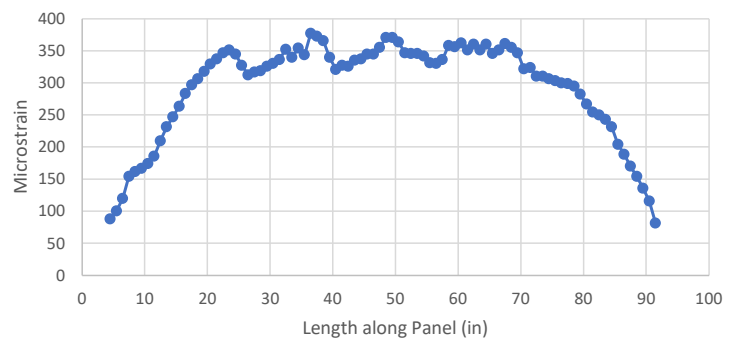
Pour 1 Detension - 8 ft Panel Raw



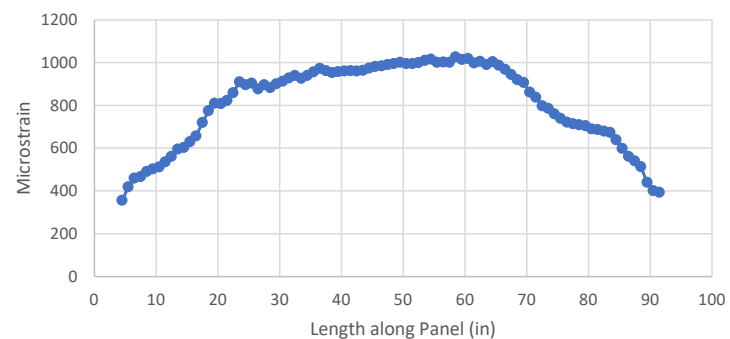
Pour 1 - 21 Day - 8 ft Panel Raw



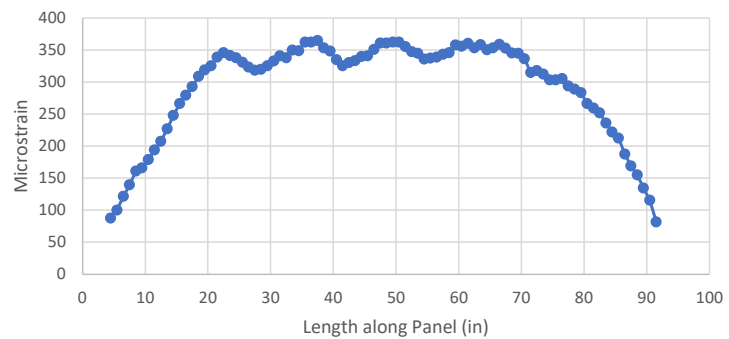
Pour 1 Detension - 8 ft Panel 3 Point Average



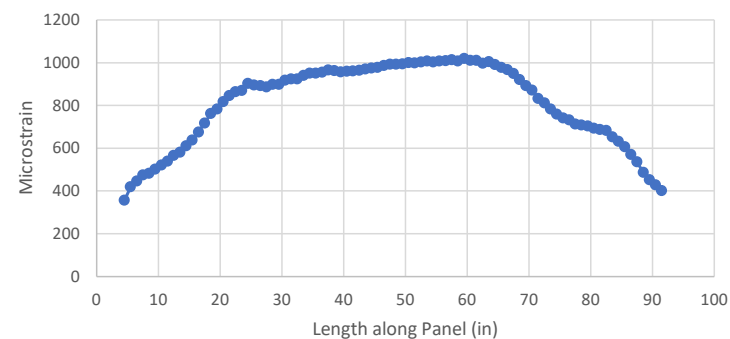
Pour 1 - 21 Day - 8 ft Panel 3 Point Average



Pour 1 Detension - 8 ft Panel 5 Point Average



Pour 1 - 21 Day - 8 ft Panel 5 Point Average



T4-VAE - 6 ft Panel Whittemore Data Points

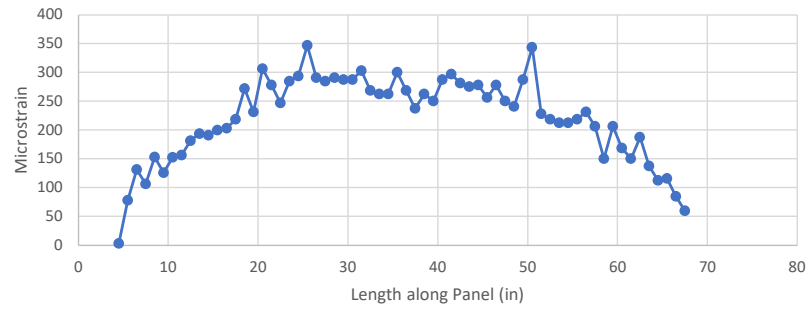
South	Initial 1	Initial 2	Difference	Average	Detensioning	21 day
1	-0.00155	-0.0015	5E-05	-0.001525	-0.00155	-0.0041
2	0.00565	0.0057	5E-05	0.005675	0.00505	0.0025
3	-0.00065	-0.00075	0.0001	-0.0007	-0.00175	-0.0037
4	0.00775	0.00775	0	0.00775	0.0069	0.004
5	0.00175	0.0017	5E-05	0.001725	0.0005	-0.002
6	0.02905	0.0289	0.00015	0.028975	0.02797	0.024925
7	0.02895	0.02885	1E-04	0.0289	0.02768	0.0248
8	0.029	0.0289	0.0001	0.02895	0.0277	0.0247
9	0.029	0.0289	0.0001	0.02895	0.0275	0.0247
10	0.0289	0.0289	0	0.0289	0.02735	0.02465
11	0.029	0.0289	0.0001	0.02895	0.027425	0.02425
12	0.0289	0.02885	5E-05	0.028875	0.02728	0.024175
13	0.029	0.02895	5E-05	0.028975	0.02735	0.024
14	0.00375	0.00365	1E-04	0.0037	0.00195	-0.001
15	0.006	0.00625	0.00025	0.006125	0.00395	0.00075
16	0.00715	0.00695	0.0002	0.00705	0.0052	0.0012
17	0.00185	0.00185	0	0.00185	-0.0006	-0.00365
18	0.00715	0.007	0.00015	0.007075	0.00485	0.0015
19	0.0069	0.00725	0.00035	0.007075	0.0051	0.0017
20	0.00735	0.0077	0.00035	0.007525	0.00525	0.0022
21	0.00205	0.00185	0.0002	0.00195	-0.0004	-0.0036
22	0.0036	0.00345	0.00015	0.003525	0.00075	-0.00235
23	0.00185	0.0018	5E-05	0.001825	-0.0005	-0.0047
24	0.0002	0.00005	0.00015	0.000125	-0.00215	-0.006
25	0.0081	0.00785	0.00025	0.007975	0.00565	0.002
26	0.0021	0.0022	0.0001	0.00215	-0.00015	-0.00425
27	-0.00475	-0.00505	0.0003	-0.0049	-0.0072	-0.0108
28	-0.00165	-0.0018	0.00015	-0.001725	-0.00415	-0.0078
29	0.00005	0.00015	0.0001	0.0001	-0.00205	-0.00555
30	0.00415	0.00435	0.0002	0.00425	0.00215	-0.00195
31	0.00175	0.00175	0	0.00175	-0.00035	-0.00395
32	0.0038	0.0035	0.0003	0.00365	0.00125	-0.0019
33	0.0002	0.0003	0.0001	0.00025	-0.0019	-0.00575
34	0.00305	0.00335	0.0003	0.0032	0.0013	-0.0027
35	0.00805	0.00815	1E-04	0.0081	0.006	0.00195
36	0.00695	0.00715	0.0002	0.00705	0.00505	0.0009
37	0.00805	0.00815	1E-04	0.0081	0.0058	0.00185
38	0.0003	0.00005	0.00025	0.000175	-0.0022	-0.00545
39	0.0032	0.0032	0	0.0032	0.00095	-0.00285
40	0.006	0.006	0	0.006	0.0038	-0.0002
41	0.0006	0.00065	0.00005	0.000625	-0.0016	-0.00565
42	0.0028	0.0031	0.0003	0.00295	0.0009	-0.0024
43	0.00615	0.0062	5E-05	0.006175	0.00395	0.0001
44	0.0011	0.0012	1E-04	0.00115	-0.00085	-0.00455
45	0.00325	0.0035	0.00025	0.003375	0.00145	-0.0027
46	0.0074	0.0073	0.0001	0.00735	0.00505	0.00155
47	0.00185	0.00195	1E-04	0.0019	-0.00085	-0.00315
48	0.0017	0.00175	5E-05	0.001725	-0.0001	-0.0038
49	0.00575	0.00545	0.0003	0.0056	0.00385	0.001
50	0.00325	0.00325	0	0.00325	0.00155	-0.00205
51	0.0061	0.0061	0	0.0061	0.0044	0.001
52	0.0066	0.0066	0	0.0066	0.00485	0.00155
53	0.0003	0	0.0003	0.00015	-0.0017	-0.004
54	0.0022	0.0022	0	0.0022	0.00055	-0.0025
55	0.0097	0.0097	0	0.0097	0.0085	0.00545
56	0.00705	0.00695	0.0001	0.007	0.00535	0.00275
57	0.00845	0.00835	1E-04	0.0084	0.00705	0.00415
58	0.0041	0.0041	0	0.0041	0.0029	0
59	-0.0024	-0.0025	0.0001	-0.00245	-0.00395	-0.0065
60	0.00295	0.00285	1E-04	0.0029	0.0018	-0.00095
61	0.01085	0.01085	0	0.01085	0.00995	0.0071
62	0.00925	0.0094	0.00015	0.009325	0.0084	0.00595
63	0.00225	0.0022	5E-05	0.002225	0.00155	-0.00135
64	0.00515	0.0051	5E-05	0.005125	0.00465	0.00185

T4-VAE - 6 ft Panel Microstrain along Panel

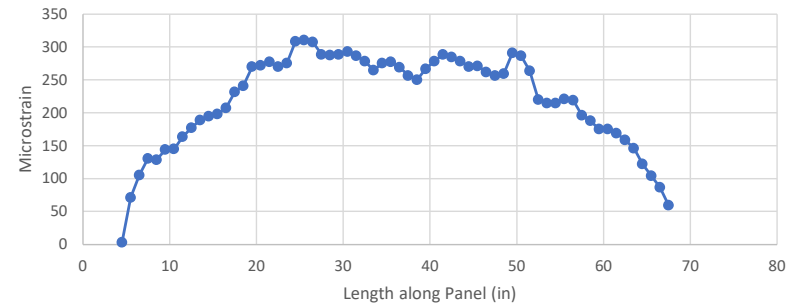
Detension			
Length	Delta	3 Pt Average	5 pt Average
4.5	3.125	3.125	3.125
5.5	78.125	70.83333333	70.83333333
6.5	131.25	105.2083333	94.375
7.5	106.25	130.2083333	118.875
8.5	153.125	128.3333333	133.75
9.5	125.625	143.75	138.75
10.5	152.5	144.7916667	153.75
11.5	156.25	163.3333333	161.875
12.5	181.25	177.0833333	174.875
13.5	193.75	188.5416667	184.25
14.5	190.625	194.5833333	193.625
15.5	199.375	197.7083333	201.125
16.5	203.125	207.0833333	216.75
17.5	218.75	231.25	224.875
18.5	271.875	240.625	246.25
19.5	231.25	269.7916667	261.25
20.5	306.25	271.875	266.875
21.5	278.125	277.0833333	269.375
22.5	246.875	269.7916667	281.875
23.5	284.375	275	290
24.5	293.75	308.3333333	292.5
25.5	346.875	310.4166667	300
26.5	290.625	307.2916667	301.25
27.5	284.375	288.5416667	300
28.5	290.625	287.5	288.125
29.5	287.5	288.5416667	290.625
30.5	287.5	292.7083333	287.5
31.5	303.125	286.4583333	281.875
32.5	268.75	278.125	276.875
33.5	262.5	264.5833333	279.375
34.5	262.5	275	272.5
35.5	300	277.0833333	266.25
36.5	268.75	268.75	266.25
37.5	237.5	256.25	263.75
38.5	262.5	250	261.25
39.5	250	266.6666667	266.875
40.5	287.5	278.125	275.625
41.5	296.875	288.5416667	278.125
42.5	281.25	284.375	283.75
43.5	275	278.125	277.5
44.5	278.125	269.7916667	273.75
45.5	256.25	270.8333333	267.5
46.5	278.125	261.4583333	260.625
47.5	250	256.25	262.5
48.5	240.625	259.375	280
49.5	287.5	290.625	270
50.5	343.75	286.4583333	263.75
51.5	228.125	263.5416667	258.125
52.5	218.75	219.7916667	243.125
53.5	212.5	214.5833333	218.125
54.5	212.5	214.5833333	218.75
55.5	218.75	220.8333333	216.25
56.5	231.25	218.75	203.75
57.5	206.25	195.8333333	202.5
58.5	150	187.5	192.5
59.5	206.25	175	176.25
60.5	168.75	175	172.5
61.5	150	168.75	170
62.5	187.5	158.3333333	151.25
63.5	137.5	145.8333333	140.625
64.5	112.5	121.875	127.5
65.5	115.625	104.1666667	101.875
66.5	84.375	86.45833333	83.33333333
67.5	59.375	59.375	59.375

21 Day			
Length	Delta	3 Pt Average	5 Pt Average
4.5	321.875	321.875	321.875
5.5	396.875	364.5833333	364.5833333
6.5	375	413.5416667	405.625
7.5	468.75	436.4583333	442.5
8.5	465.625	480.2083333	465.625
9.5	506.25	494.7916667	496.875
10.5	512.5	516.6666667	509.375
11.5	531.25	525	522.5
12.5	531.25	531.25	538.75
13.5	531.25	550	553.75
14.5	587.5	568.75	571.875
15.5	587.5	598.9583333	583.125
16.5	621.875	598.9583333	611.25
17.5	587.5	627.0833333	640
18.5	671.875	663.5416667	660
19.5	731.25	696.875	675
20.5	687.5	705.2083333	691.875
21.5	696.875	685.4166667	690.625
22.5	671.875	678.125	683.125
23.5	665.625	677.0833333	692.5
24.5	693.75	697.9166667	716.25
25.5	734.375	747.9166667	735
26.5	815.625	771.875	751.25
27.5	765.625	776.0416667	772.5
28.5	746.875	770.8333333	773.125
29.5	800	761.4583333	761.875
30.5	737.5	765.625	750
31.5	759.375	734.375	755.625
32.5	706.25	746.875	738.125
33.5	775	731.25	729.375
34.5	712.5	727.0833333	727.5
35.5	693.75	718.75	733.75
36.5	750	727.0833333	732.5
37.5	737.5	752.0833333	743.75
38.5	768.75	758.3333333	761.25
39.5	768.75	772.9166667	751.875
40.5	781.25	751.0416667	755.625
41.5	703.125	746.875	756.875
42.5	756.25	744.7916667	760
43.5	775	771.875	737.5
44.5	784.375	742.7083333	748.75
45.5	668.75	737.5	740
46.5	759.375	713.5416667	736.875
47.5	712.5	743.75	725
48.5	759.375	732.2916667	717.5
49.5	725	705.2083333	703.75
50.5	631.25	682.2916667	676.25
51.5	690.625	632.2916667	656.875
52.5	575	642.7083333	639.375
53.5	662.5	625	639.375
54.5	637.5	643.75	605
55.5	631.25	595.8333333	607.5
56.5	518.75	579.1666667	581.25
57.5	587.5	545.8333333	560
58.5	531.25	550	540
59.5	531.25	531.25	538.75
60.5	531.25	525	522.5
61.5	512.5	516.6666667	512.5
62.5	506.25	500	500
63.5	481.25	485.4166667	478.125
64.5	468.75	457.2916667	465
65.5	421.875	445.8333333	445.625
66.5	446.875	426.0416667	426.0416667
67.5	409.375	409.375	409.375

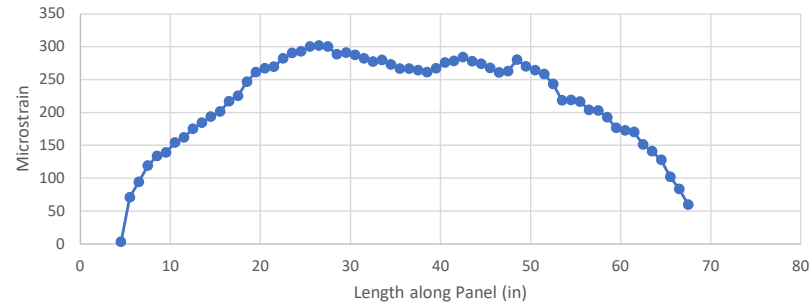
Pour 2 Detension - 6 ft Panel Raw



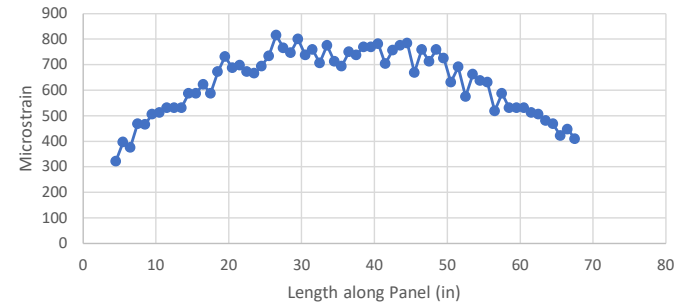
Pour 2 Detension - 6 ft Panel 3 Point Average



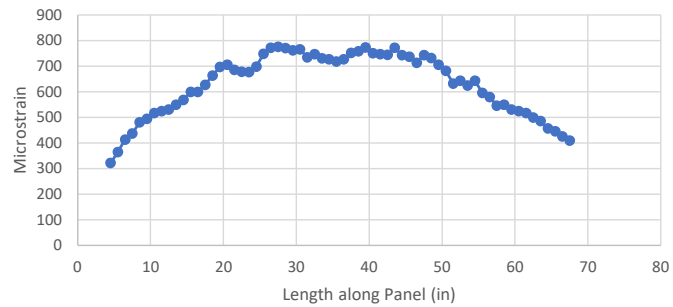
Pour 2 Detension - 6 ft Panel 5 Point Average



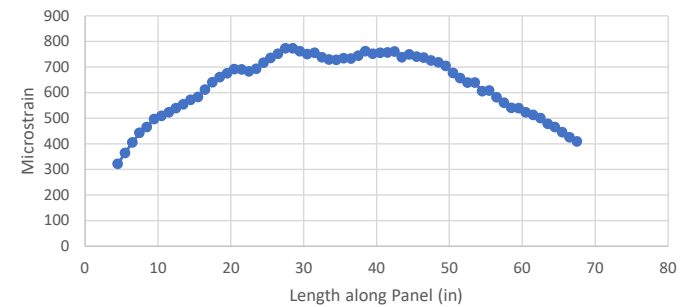
Pour 2 - 21 Day - 6 ft Panel Raw



Pour 2 - 21 Day - 6 ft Panel 3 Point Average



Pour 2 - 21 Day - 6 ft Panel 5 Point Average



T4-VAE - 8 ft Panel Whittemore Data Points

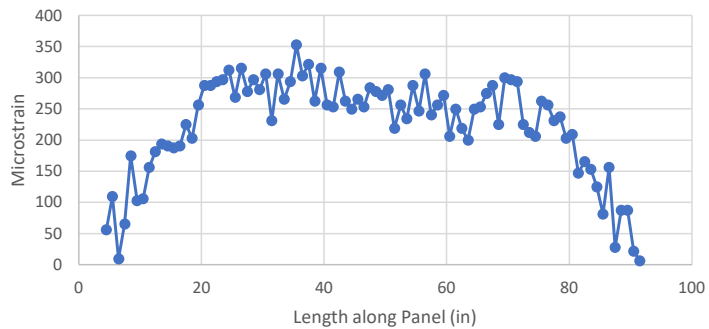
South	Initial 1	Initial 2	Difference	Average	Detensioning	21 day
1	0.00205	0.00175	0.0003	0.0019	0.00145	-0.00015
2	-0.00465	-0.0049	0.00025	-0.00478	-0.00565	-0.00725
3	0.0001	0.00015	0.00005	0.000125	0.00005	-0.002575
4	-0.0022	-0.00195	0.00025	-0.00208	-0.0026	-0.00495
5	0.0038	0.0037	1E-04	0.00375	0.00235	-0.0001
6	0.00225	0.0023	5E-05	0.002275	0.00145	-0.00105
7	-0.0015	-0.0014	0.0001	-0.00145	-0.0023	-0.0046
8	0.0036	0.0035	1E-04	0.00355	0.0023	-0.0004
9	0.0085	0.0083	0.0002	0.0084	0.00695	0.00345
10	0.0073	0.0073	0	0.0073	0.00575	0.0025
11	0.00825	0.0083	5E-05	0.008275	0.00675	0.00345
12	0.0035	0.0033	0.0002	0.0034	0.0019	-0.00085
13	0.0099	0.00965	0.00025	0.009775	0.00825	0.0051
14	0.00675	0.00655	0.0002	0.00665	0.00485	0.00195
15	0.009	0.00935	0.00035	0.009175	0.00755	0.004
16	0.0119	0.0121	0.0002	0.012	0.00995	0.00675
17	0.0053	0.0051	0.0002	0.0052	0.0029	0.0002
18	0.00785	0.00775	1E-04	0.0078	0.0055	0.0016
19	0.00305	0.00295	0.0001	0.003	0.00065	-0.00285
20	0.0068	0.00665	0.00015	0.006725	0.00435	-0.0001
21	0.00595	0.00585	0.0001	0.0059	0.0034	-0.0004
22	0.00155	0.00155	0	0.00155	-0.0006	-0.0048
23	0.00285	0.003	0.00015	0.002925	0.0004	-0.00415
24	0.0054	0.00545	5E-05	0.005425	0.0032	-0.0013
25	0.0034	0.00325	0.00015	0.003325	0.00095	-0.0033
26	0.00515	0.00545	0.0003	0.0053	0.00305	-0.0014
27	0.00605	0.00635	0.0003	0.0062	0.00375	-0.00085
28	0.0078	0.0068	0.001	0.0073	0.00545	0.0013
29	0.00615	0.00625	0.0001	0.0062	0.00375	-0.00105
30	0.0125	0.01245	5E-05	0.012475	0.01035	0.00645
31	0.009	0.0087	0.0003	0.00885	0.0065	0.00285
32	0.00215	0.0023	0.00015	0.002225	-0.0006	-0.0051
33	0.0057	0.00585	0.00015	0.005775	0.00335	-0.00125
34	0.00945	0.0093	0.00015	0.009375	0.0068	0.00215
35	0.00755	0.00755	0	0.00755	0.00545	0.00045
36	0.00785	0.008	0.00015	0.007925	0.0054	0.00075
37	0.00275	0.00265	1E-04	0.0027	0.00065	-0.0038
38	0.0036	0.00395	0.00035	0.003775	0.00175	-0.00305
39	0.00695	0.0071	0.00015	0.007025	0.00455	-0.00025
40	0.00935	0.00945	1E-04	0.0094	0.0073	0.00275
41	0.00955	0.00955	0	0.00955	0.00755	0.0038
42	0.00345	0.0036	0.00015	0.003525	0.0014	-0.0033
43	0.00235	0.0023	5E-05	0.002325	0.0003	-0.00415
44	-0.00105	-0.0007	0.00035	-0.00088	-0.00315	-0.0078
45	0.00515	0.0054	0.00025	0.005275	0.00305	-0.0013
46	0.00385	0.0041	0.00025	0.003975	0.0018	-0.00245
47	0.0022	0.0025	0.0003	0.00235	0.0001	-0.0044
48	-0.0051	-0.0049	0.0002	-0.005	-0.00675	-0.011
49	-0.0059	-0.0058	0.0001	-0.00585	-0.0079	-0.013
50	-0.00285	-0.0025	0.00035	-0.00268	-0.00455	-0.009
51	0.00275	0.00285	0.0001	0.0028	0.0005	-0.00415
52	0.00415	0.0044	0.00025	0.004275	0.0023	-0.0023
53	0.0047	0.0045	0.0002	0.0046	0.00215	-0.00195
54	-0.00085	-0.0008	5E-05	-0.00083	-0.00275	-0.0072
55	0.00015	0.00045	0.0003	0.0003	-0.00175	-0.0066
56	0.00785	0.008	0.00015	0.007925	0.00575	0.00155
57	0.009	0.0092	0.0002	0.0091	0.00745	0.00345
58	0.00885	0.00905	0.0002	0.00895	0.00695	0.0027
59	0.0091	0.0093	0.0002	0.0092	0.00745	0.00295
60	0.0036	0.0036	0	0.0036	0.002	-0.00215
61	0.0035	0.0037	0.0002	0.0036	0.0016	-0.0023
62	0.00955	0.0099	0.00035	0.009725	0.0077	0.00365
63	0.00845	0.00825	0.0002	0.00835	0.00615	0.00195
64	0.0027	0.0027	0	0.0027	0.0004	-0.0037
65	0.0082	0.008	0.0002	0.0081	0.0063	0.00235
66	0.00565	0.00565	0	0.00565	0.00325	-0.00085
67	-0.0027	-0.00245	0.00025	-0.00258	-0.00495	-0.009
68	0.0072	0.0073	0.0001	0.00725	0.0049	0.0014
69	0.0075	0.0076	0.0001	0.00755	0.00575	0.0012
70	0.00595	0.00615	0.0002	0.00605	0.00435	0
71	0.007	0.0068	0.0002	0.0069	0.00525	0.001
72	0.0148	0.015	0.0002	0.0149	0.0128	0.0089
73	0.0088	0.0088	0	0.0088	0.00675	0.0022
74	0.00825	0.00845	0.0002	0.00835	0.0065	0.0027
75	0.01335	0.01355	0.0002	0.01345	0.01155	0.0079
76	0.00565	0.0059	0.00025	0.005775	0.00415	0.00055
77	0.0083	0.00835	5E-05	0.008325	0.00665	0.0035
78	0.00355	0.0038	0.00025	0.003675	0.0025	-0.0009
79	0.007	0.00725	0.00025	0.007125	0.0058	0.00305
80	0.0025	0.00235	0.00015	0.002425	0.0012	-0.00175
81	0.0035	0.0037	0.0002	0.0036	0.0026	0.00005
82	0.00805	0.00785	0.0002	0.00795	0.0073	0.0045
83	0.0077	0.0075	0.0002	0.0076	0.00635	0.00295
84	0.00505	0.0047	0.00035	0.004875	0.00465	0.00185
85	0.0027	0.0026	0.0001	0.00265	0.00195	-0.0009
86	0.0059	0.0061	0.0002	0.006	0.0053	0.0025
87	0.00125	0.0015	0.00025	0.001375	0.0012	-0.00145
88	-0.00305	-0.00305	0	-0.00305	-0.0031	-0.00685

T4-VAE - 8 ft Panel Microstrain along Panel

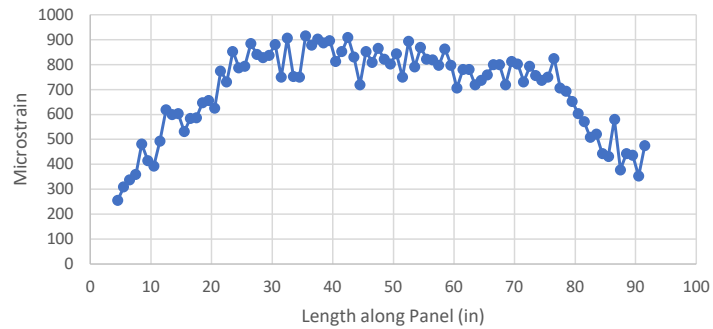
Detension				
Length	Delta	3 pt Average	5 pt Average	
4.5	56.25	56.25	56.25	
5.5	109.375	58.33333333	58.33333333	
6.5	9.375	61.45833333	83.125	
7.5	65.625	83.33333333	92.5	
8.5	175	114.5833333	91.875	
9.5	103.125	128.125	121.25	
10.5	106.25	121.875	144.375	
11.5	156.25	147.9166667	148.125	
12.5	181.25	177.0833333	165.625	
13.5	193.75	188.5416667	181.875	
14.5	190.625	190.625	188.75	
15.5	187.5	189.5833333	197.5	
16.5	190.625	201.0416667	199.375	
17.5	225	206.25	212.5	
18.5	203.125	228.125	232.5	
19.5	256.25	248.9583333	251.875	
20.5	287.5	277.0833333	265.625	
21.5	287.5	289.5833333	284.375	
22.5	293.75	292.7083333	295.625	
23.5	296.875	301.0416667	291.875	
24.5	312.5	292.7083333	297.5	
25.5	268.75	298.9583333	294.375	
26.5	315.625	287.5	294.375	
27.5	278.125	296.875	288.125	
28.5	296.875	285.4166667	295.625	
29.5	281.25	294.7916667	278.75	
30.5	306.25	272.9166667	284.375	
31.5	231.25	281.25	278.125	
32.5	306.25	267.7083333	280.625	
33.5	265.625	288.5416667	290	
34.5	293.75	304.1666667	304.375	
35.5	353.125	316.6666667	307.5	
36.5	303.125	326.0416667	306.875	
37.5	321.875	295.8333333	311.25	
38.5	262.5	300	291.875	
39.5	315.625	278.125	281.875	
40.5	256.25	275	279.375	
41.5	253.125	272.9166667	279.375	
42.5	309.375	275	266.25	
43.5	262.5	273.9583333	268.125	
44.5	250	259.375	268.125	
45.5	265.625	256.25	263.125	
46.5	253.125	267.7083333	266.25	
47.5	284.375	271.875	270.625	
48.5	278.125	278.125	273.75	
49.5	271.875	277.0833333	266.875	
50.5	281.25	257.2916667	261.25	
51.5	218.75	252.0833333	252.5	
52.5	256.25	236.4583333	255.625	
53.5	234.375	259.375	248.75	
54.5	287.5	256.25	266.25	
55.5	246.875	280.2083333	263.125	
56.5	306.25	264.5833333	267.5	
57.5	240.625	267.7083333	264.375	
58.5	256.25	256.25	256.25	
59.5	271.875	244.7916667	245	
60.5	206.25	242.7083333	240.625	
61.5	250	225	229.375	
62.5	218.75	222.9166667	225	
63.5	200	222.9166667	234.375	
64.5	250	234.375	239.375	
65.5	253.125	259.375	253.125	
66.5	275	271.875	258.125	
67.5	287.5	262.5	268.125	
68.5	225	270.8333333	276.875	
69.5	300	273.9583333	280.625	
70.5	296.875	296.875	268.125	
71.5	293.75	271.875	265.625	
72.5	225	243.75	246.875	
73.5	212.5	214.5833333	240	
74.5	206.25	227.0833333	232.5	
75.5	262.5	241.6666667	233.75	
76.5	256.25	250	238.75	
77.5	231.25	241.6666667	238.125	
78.5	237.5	223.9583333	227.5	
79.5	203.125	216.6666667	205.625	
80.5	209.375	186.4583333	192.5	
81.5	146.875	173.9583333	175.625	
82.5	165.625	155.2083333	160	
83.5	153.125	147.9166667	134.375	
84.5	125	119.7916667	136.25	
85.5	81.25	120.8333333	108.75	
86.5	156.25	88.54166667	95.625	
87.5	28.125	90.625	88.125	
88.5	87.5	67.70833333	76.25	
89.5	87.5	65.625	46.25	
90.5	21.875	38.54166667	38.54166667	
91.5	6.25	6.25	6.25	

21 Day				
Length	Delta	3 Pt Average	5 Pt Average	
4.5	256.25	256.25	256.25	
5.5	309.375	301.0416667	301.0416667	
6.5	337.5	335.4166667	348.75	
7.5	359.375	392.7083333	380.625	
8.5	481.25	418.75	397.5	
9.5	415.625	430.2083333	428.75	
10.5	393.75	434.375	480.625	
11.5	493.75	502.0833333	504.375	
12.5	618.75	570.8333333	541.875	
13.5	600	607.2916667	569.375	
14.5	603.125	578.125	587.5	
15.5	531.25	572.9166667	581.25	
16.5	584.375	567.7083333	590.625	
17.5	587.5	606.25	601.25	
18.5	646.875	630.2083333	620	
19.5	656.25	642.7083333	658.125	
20.5	625	685.4166667	686.875	
21.5	775	710.4166667	728.125	
22.5	731.25	786.4583333	754.375	
23.5	853.125	790.625	788.125	
24.5	787.5	811.4583333	810	
25.5	793.75	821.875	831.875	
26.5	884.375	839.5833333	826.875	
27.5	840.625	851.0416667	836.875	
28.5	828.125	835.4166667	854.375	
29.5	837.5	848.9583333	827.5	
30.5	881.25	822.9166667	840.625	
31.5	750	845.8333333	825.625	
32.5	906.25	803.125	808.125	
33.5	753.125	803.125	815	
34.5	750	806.25	840.625	
35.5	915.625	847.9166667	840	
36.5	878.125	898.9583333	866.875	
37.5	903.125	889.5833333	896.25	
38.5	887.5	895.8333333	875.625	
39.5	896.875	865.625	870.625	
40.5	812.5	854.1666667	871.875	
41.5	853.125	858.3333333	860.625	
42.5	909.375	864.5833333	825	
43.5	831.25	819.7916667	833.125	
44.5	718.75	801.0416667	824.375	
45.5	853.125	793.75	815.625	
46.5	809.375	842.7083333	813.75	
47.5	865.625	832.2916667	830.625	
48.5	821.875	830.2083333	828.75	
49.5	803.125	822.9166667	816.875	
50.5	843.75	798.9583333	822.5	
51.5	750	829.1666667	816.25	
52.5	893.75	811.4583333	829.375	
53.5	790.625	851.0416667	825	
54.5	868.75	827.0833333	838.75	
55.5	821.875	836.4583333	819.375	
56.5	818.75	812.5	833.75	
57.5	796.875	826.0416667	819.375	
58.5	862.5	818.75	796.25	
59.5	796.875	788.5416667	788.75	
60.5	706.25	761.4583333	785.625	
61.5	781.25	756.25	756.875	
62.5	781.25	760.4166667	745	
63.5	718.75	745.8333333	755.625	
64.5	737.5	738.5416667	759.375	
65.5	759.375	765.625	763.125	
66.5	800	786.4583333	763.125	
67.5	800	772.9166667	778.125	
68.5	718.75	777.0833333	786.875	
69.5	812.5	778.125	773.125	
70.5	803.125	782.2916667	771.875	
71.5	731.25	776.0416667	779.375	
72.5	793.75	760.4166667	764.375	
73.5	756.25	762.5	753.75	
74.5	737.5	747.9166667	772.5	
75.5	750	770.8333333	755	
76.5	825	760.4166667	742.5	
77.5	706.25	741.6666667	725.625	
78.5	693.75	684.375	696.25	
79.5	653.125	650	645.625	
80.5	603.125	609.375	606.25	
81.5	571.875	561.4583333	571.875	
82.5	509.375	534.375	530	
83.5	521.875	491.6666667	495.625	
84.5	443.75	465.625	497.5	
85.5	431.25	485.4166667	471.25	
86.5	581.25	463.5416667	455.625	
87.5	378.125	467.7083333	454.375	
88.5	443.75	419.7916667	438.75	
89.5	437.5	411.4583333	417.5	
90.5	353.125	421.875	421.875	
91.5	475	475	475	

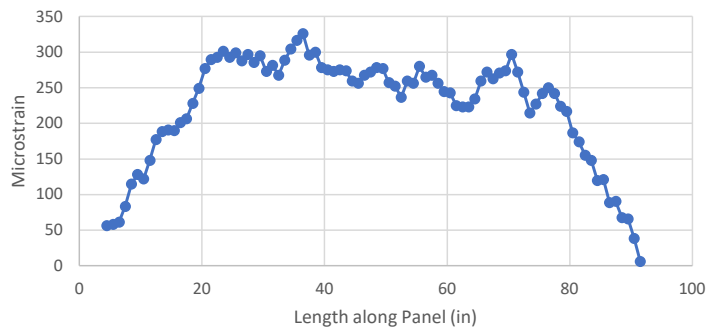
Pour 2 Detension - 8 ft Panel Raw



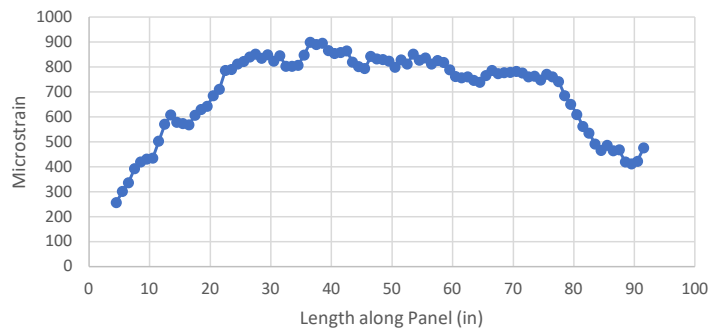
Pour 2 - 21 day - 8 ft Panel Raw



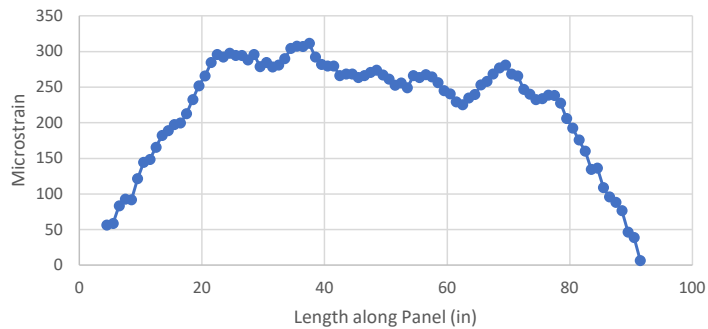
Pour 2 Detension - 8 ft Panel 3 Point Average



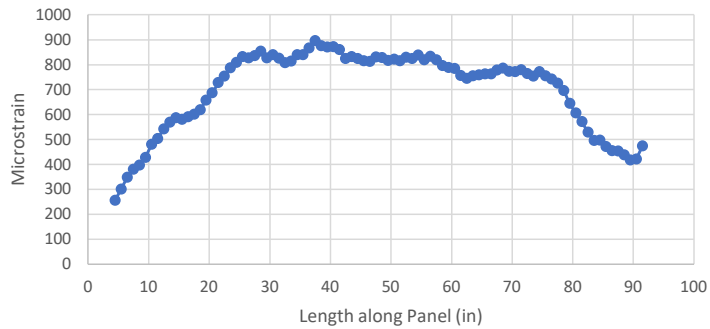
Pour 2 - 21 Day - 8 ft Panel 3 Point Average



Pour 2 Detension - 8 ft Panel 5 Point Average



Pour 2 - 21 Day - 8 ft Panel 5 Point Average



T2-004 - 6 ft Panel Whittemore Data Points

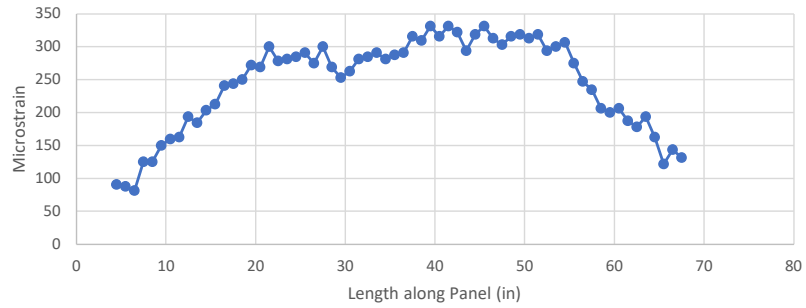
South	Initial 1	Initial 2	Difference	Average	Detensioning	21 day
1	0.00105	0.001	5E-05	0.001025	0.0003	-0.0026
2	0.00345	0.00365	0.0002	0.00355	0.00285	0.0003
3	0.0002	0.0002	0	0.0002	-0.00045	-0.0032
4	0.01155	0.01135	0.0002	0.01145	0.01045	0.00775
5	0.002	0.0022	0.0002	0.0021	0.0011	-0.00175
6	-0.00675	-0.00675	0	-0.00675	-0.00795	-0.01095
7	0.0025	0.00245	5E-05	0.002475	0.0012	-0.002
8	0.00565	0.00555	1E-04	0.0056	0.0043	0.0011
9	0.00075	0.00085	1E-04	0.0008	-0.00075	-0.004
10	0.0112	0.01135	0.00015	0.011275	0.0098	0.0065
11	0.00805	0.0082	0.00015	0.008125	0.0065	0.00305
12	0.00235	0.00245	1E-04	0.0024	0.0007	-0.0027
13	0.00845	0.0086	0.00015	0.008525	0.0066	0.00305
14	0.0101	0.01	1E-04	0.01005	0.0081	0.00445
15	0.00585	0.00585	0	0.00585	0.00385	0.00025
16	0.00115	0.0012	5E-05	0.001175	-0.001	-0.005
17	0.0058	0.0058	0	0.0058	0.00365	-0.00025
18	-0.00045	-0.00035	0.0001	-0.0004	-0.0028	-0.00685
19	0.002	0.00195	5E-05	0.001975	-0.00025	-0.00425
20	0.0008	0.0009	1E-04	0.00085	-0.0014	-0.00555
21	0.0032	0.00325	5E-05	0.003225	0.00095	-0.0036
22	0.0002	0.00025	0.00005	0.000225	-0.0021	-0.0064
23	0.00145	0.00145	0	0.00145	-0.00075	-0.0049
24	0.0053	0.0053	0	0.0053	0.0029	-0.0012
25	0.0073	0.0074	0.0001	0.00735	0.0052	0.001
26	-0.00095	-0.0008	0.00015	-0.000875	-0.0029	-0.00705
27	0.0053	0.00545	0.00015	0.005375	0.003275	-0.001
28	0.00785	0.00775	1E-04	0.0078	0.00555	0.0014
29	0.0062	0.00625	5E-05	0.006225	0.00395	-0.00035
30	0.00695	0.0071	0.00015	0.007025	0.0047	0.00055
31	0.0089	0.0088	1E-04	0.00885	0.0066	0.0025
32	0.0022	0.0022	0	0.0022	-0.0001	-0.0045
33	0.00045	0.0003	0.00015	0.000375	-0.00195	-0.006
34	0.00895	0.009	5E-05	0.008975	0.00645	0.00215
35	0.00225	0.0021	0.00015	0.002175	-0.0003	-0.00455
36	0.003	0.0029	0.0001	0.00295	0.0003	-0.0037
37	0.0001	0.00015	0.00005	0.000125	-0.0024	-0.00635
38	0.00205	0.00195	0.0001	0.002	-0.00065	-0.0048
39	0.0012	0.00105	0.00015	0.001125	-0.00145	-0.0055
40	0.00655	0.00675	0.0002	0.00665	0.0043	0.0002
41	0.00395	0.00385	0.0001	0.0039	0.00135	-0.0028
42	0.00265	0.00245	0.0002	0.00255	-0.0001	-0.0039
43	0.00175	0.00185	0.0001	0.0018	-0.0007	-0.00455
44	0.00045	0.0007	0.00025	0.000575	-0.00185	-0.005735
45	0.00365	0.0038	0.00015	0.003725	0.0012	-0.00255
46	0.00135	0.00145	1E-04	0.0014	-0.00115	-0.00495
47	0.00705	0.00695	0.0001	0.007	0.0045	0.00075
48	0.00225	0.00225	0	0.00225	-0.0003	-0.0041
49	0.005	0.0049	0.0001	0.00495	0.0026	-0.0012
50	0.004	0.0042	0.0002	0.0041	0.0017	-0.00205
51	0.00675	0.00695	0.0002	0.00685	0.0044	0.0008
52	0.02885	0.02885	0	0.02885	0.02665	0.023044
53	0.02885	0.0289	5E-05	0.028875	0.0269	0.023169
54	0.0289	0.02885	5E-05	0.028875	0.027	0.023457
55	0.0288	0.0288	0	0.0288	0.02715	0.0236
56	0.02895	0.02885	1E-04	0.0289	0.0273	0.02379
57	0.0289	0.02885	5E-05	0.028875	0.027225	0.023729
58	0.02895	0.02885	1E-04	0.0289	0.0274	0.023898
59	0.0289	0.02885	5E-05	0.028875	0.02745	0.024031
60	-0.00075	-0.00075	0	-0.00075	-0.0023	-0.00535
61	0.00695	0.00695	0	0.00695	0.00565	0.0025
62	-0.0001	-0.00005	0.00005	-0.000075	-0.00105	-0.00375
63	0.00305	0.00305	0	0.00305	0.0019	-0.00105
64	0.0048	0.0047	1E-04	0.00475	0.0037	0.00085

T2-004 - 6 ft Panel Microstrain along Panel

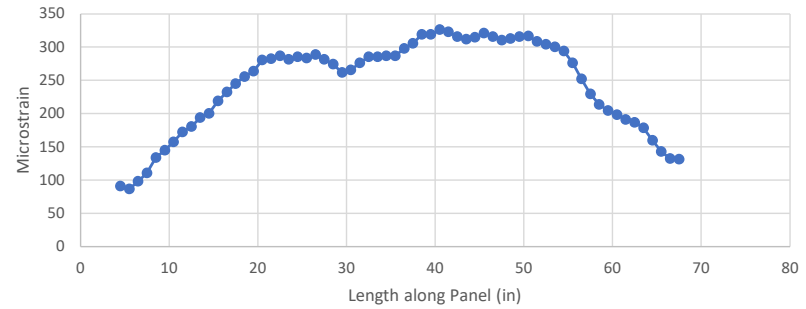
Detension			
Length	Delta	3 Point Average	5 Point Average
4.5	90.625	90.625	90.625
5.5	87.5	86.45833333	86.45833333
6.5	81.25	97.91666667	101.875
7.5	125	110.4166667	113.75
8.5	125	133.3333333	128.125
9.5	150	144.7916667	144.375
10.5	159.375	157.2916667	158.125
11.5	162.5	171.875	170
12.5	193.75	180.2083333	180.625
13.5	184.375	193.75	191.25
14.5	203.125	200	206.875
15.5	212.5	218.75	216.875
16.5	240.625	232.2916667	230
17.5	243.75	244.7916667	243.75
18.5	250	255.2083333	255
19.5	271.875	263.5416667	266.875
20.5	268.75	280.2083333	273.75
21.5	300	282.2916667	280
22.5	278.125	286.4583333	282.5
23.5	281.25	281.25	286.875
24.5	284.375	285.4166667	281.875
25.5	290.625	283.3333333	286.25
26.5	275	288.5416667	283.75
27.5	300	281.25	277.5
28.5	268.75	273.9583333	271.875
29.5	253.125	261.4583333	273.125
30.5	262.5	265.625	270
31.5	281.25	276.0416667	274.375
32.5	284.375	285.4166667	280
33.5	290.625	285.4166667	285
34.5	281.25	286.4583333	286.875
35.5	287.5	286.4583333	293.125
36.5	290.625	297.9166667	296.875
37.5	315.625	305.2083333	306.875
38.5	309.375	318.75	312.5
39.5	331.25	318.75	320.625
40.5	315.625	326.0416667	321.875
41.5	331.25	322.9166667	318.75
42.5	321.875	315.625	316.25
43.5	293.75	311.4583333	319.375
44.5	318.75	314.5833333	315.625
45.5	331.25	320.8333333	311.875
46.5	312.5	315.625	316.25
47.5	303.125	310.4166667	316.25
48.5	315.625	312.5	312.5
49.5	318.75	315.625	313.75
50.5	312.5	316.6666667	311.875
51.5	318.75	308.3333333	308.75
52.5	293.75	304.1666667	306.25
53.5	300	300	298.75
54.5	306.25	293.75	284.375
55.5	275	276.0416667	272.5
56.5	246.875	252.0833333	253.75
57.5	234.375	229.1666667	232.5
58.5	206.25	213.5416667	218.75
59.5	200	204.1666667	206.875
60.5	206.25	197.9166667	195.625
61.5	187.5	190.625	193.125
62.5	178.125	186.4583333	185.625
63.5	193.75	178.125	168.75
64.5	162.5	159.375	160
65.5	121.875	142.7083333	150.625
66.5	143.75	132.2916667	132.2916667
67.5	131.25	131.25	131.25

21 Day			
Length	Delta	3 Point Average	5 Point Average
4.5	453.125	453.125	453.125
5.5	406.25	428.125	428.125
6.5	425	431.25	445.625
7.5	462.5	456.25	460
8.5	481.25	489.5833333	490.625
9.5	525	521.875	518.125
10.5	559.375	548.9583333	545.625
11.5	562.5	573.9583333	568.75
12.5	600	586.4583333	590.625
13.5	596.875	610.4166667	606.25
14.5	634.375	622.9166667	630.625
15.5	637.5	652.0833333	650.625
16.5	684.375	673.9583333	671.25
17.5	700	694.7916667	698.75
18.5	700	723.9583333	722.5
19.5	771.875	742.7083333	746.875
20.5	756.25	778.125	762.5
21.5	806.25	780.2083333	782.5
22.5	778.125	794.7916667	798.75
23.5	800	810.4166667	813.125
24.5	853.125	827.0833333	810.625
25.5	828.125	825	817.5
26.5	793.75	811.4583333	816.25
27.5	812.5	800	800
28.5	793.75	792.7083333	793.75
29.5	771.875	787.5	795
30.5	796.875	789.5833333	796.875
31.5	800	806.25	800
32.5	821.875	810.4166667	804.375
33.5	809.375	808.3333333	812.5
34.5	793.75	813.5416667	811.875
35.5	837.5	809.375	818.125
36.5	796.875	829.1666667	824.375
37.5	853.125	830.2083333	831.875
38.5	840.625	841.6666667	826.25
39.5	831.25	827.0833333	836.875
40.5	809.375	830.2083333	831.875
41.5	850	829.1666667	825
42.5	828.125	828.125	826.25
43.5	806.25	823.9583333	825.625
44.5	837.5	816.6666667	814.375
45.5	806.25	812.5	806.5
46.5	793.75	796.25	802.125
47.5	788.75	788.9583333	793.375
48.5	784.375	788.9583333	788.375
49.5	793.75	786.4583333	788.375
50.5	781.25	789.5833333	784.375
51.5	793.75	781.25	781.25
52.5	768.75	777.0833333	773.75
53.5	768.75	764.5833333	762.65
54.5	756.25	750.25	746.55
55.5	725.75	731.75	728.25
56.5	713.25	705.4166667	704.5
57.5	677.25	680.1666667	681
58.5	650	655.3333333	664.5
59.5	638.75	644	646.9
60.5	643.25	635.75	632.55
61.5	625.25	624.6666667	617.55
62.5	605.5	601.9166667	601.05
63.5	575	578.9166667	564.275
64.5	556.25	530.2083333	541.725
65.5	459.375	509.375	518.125
66.5	512.5	486.4583333	486.4583333
67.5	487.5	487.5	487.5

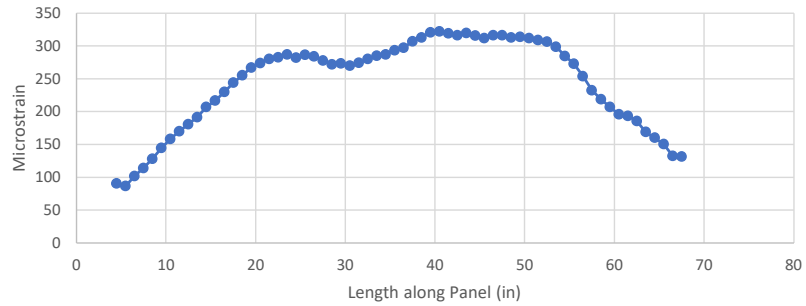
Pour 3 Detension - 6 ft Panel Raw



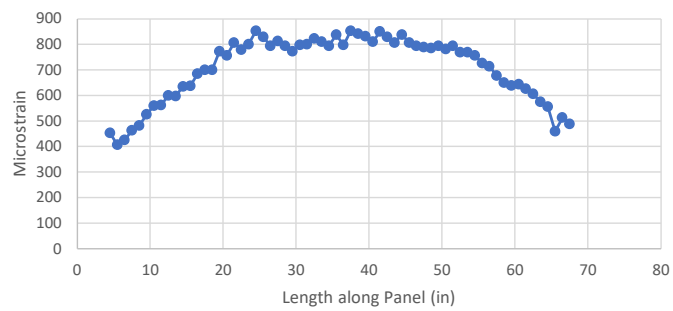
Pour 3 Detension - 6 ft Panel 3 Point Average



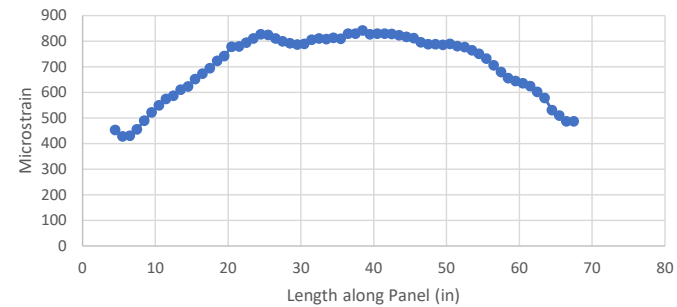
Pour 3 Detension - 6 ft Panel 5 Point Average



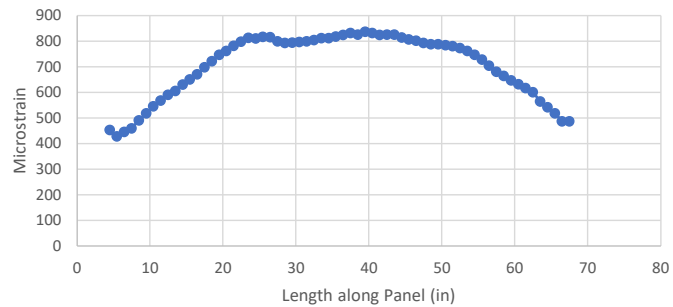
Pour 3 - 21 Day - 6 ft Panel Raw



Pour 3 - 21 Day - 6 ft Panel 3 Point Average



Pour 3 - 21 Day - 6 ft Panel 5 Point Average



T2-004 - 8 ft Panel Whittemore Data Points

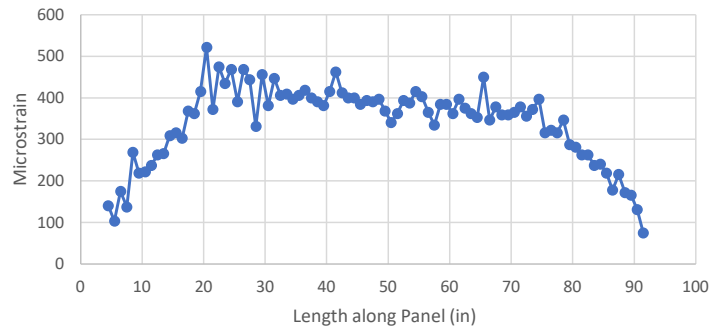
South	Initial 1	Initial 2	Difference	Average	Detensioning	21 day
1	-0.00015	-0.0003	0.00015	-0.00023	-0.00135	-0.00395
2	0.00125	0.0012	5E-05	0.001225	0.0004	-0.0023
3	0.00085	0.00055	0.0003	0.0007	-0.0007	-0.00365
4	0.0057	0.0062	0.0005	0.00595	0.00485	0.00195
5	0.00415	0.00405	0.0001	0.0041	0.00195	-0.00105
6	0.0039	0.0038	1E-04	0.00385	0.0021	-0.00115
7	0.0023	0.00235	5E-05	0.002325	0.00055	-0.0028
8	0.0052	0.0051	1E-04	0.00515	0.00325	-0.0001
9	0.01195	0.01215	0.0002	0.01205	0.00995	0.00655
10	0.00855	0.0086	5E-05	0.008575	0.00645	0.003
11	0.00825	0.0084	0.00015	0.008325	0.00585	0.0023
12	0.01035	0.0101	0.00025	0.010225	0.0077	0.004
13	0.01045	0.0105	5E-05	0.010475	0.00805	0.00435
14	0.00855	0.00825	0.0003	0.0084	0.00545	0.0014
15	0.00675	0.00675	0	0.00675	0.00385	0.00005
16	0.0085	0.00845	5E-05	0.008475	0.00515	0.0011
17	0.00305	0.003	5E-05	0.003025	-0.00115	-0.00525
18	0.00765	0.0077	5E-05	0.007675	0.0047	0.00045
19	0.0088	0.0086	0.0002	0.0087	0.0049	0.00095
20	0.0025	0.00255	5E-05	0.002525	-0.00095	-0.0053
21	0.0053	0.0053	0	0.0053	0.00155	-0.0028
22	0.0026	0.00255	5E-05	0.002575	-0.00055	-0.0052
23	0.0026	0.0025	1E-04	0.00255	-0.0012	-0.0058
24	0.00735	0.00735	0	0.00735	0.0038	-0.00065
25	0.00565	0.00585	0.0002	0.00575	0.0031	-0.00145
26	0.0043	0.0042	0.0001	0.00425	0.0006	-0.00375
27	-0.00095	-0.00085	0.0001	-0.0009	-0.00395	-0.00905
28	0.00775	0.0077	5E-05	0.007725	0.00415	-0.0003
29	0.0103	0.0102	1E-04	0.01025	0.007	0.0024
30	0.00675	0.0067	5E-05	0.006725	0.00345	-0.00115
31	0.0088	0.00905	0.00025	0.008925	0.00575	0.0014
32	0.0054	0.0053	0.0001	0.00535	0.0021	-0.0023
33	0.0114	0.0114	0	0.0114	0.00805	0.00355
34	0.00785	0.00795	0.0001	0.0079	0.0047	0.0003
35	0.009	0.00935	0.00035	0.009175	0.00605	0.00175
36	0.0052	0.0056	0.0004	0.0054	0.00235	-0.0023
37	0.0055	0.00545	5E-05	0.005475	0.00215	-0.0025
38	0.009	0.0089	1E-04	0.00895	0.00525	0.0011
39	0.00795	0.00775	0.0002	0.00785	0.00455	0
40	0.0099	0.0098	0.0001	0.00985	0.00665	0.0023
41	0.00095	0.00095	0	0.00095	-0.00225	-0.00655
42	0.00735	0.0072	0.00015	0.007275	0.0042	-0.00035
43	0.00195	0.00195	0	0.00195	-0.0012	-0.00565
44	0.00435	0.0042	0.00015	0.004275	0.00115	-0.0032
45	-0.00115	-0.0013	0.00015	-0.00123	-0.0044	-0.00845
46	0.00565	0.00585	0.0002	0.00575	0.0028	-0.00185
47	0.00395	0.0043	0.00035	0.004125	0.0014	-0.00325
48	-0.00665	-0.00645	0.0002	-0.00655	-0.00945	-0.0138
49	0.0024	0.0022	0.0002	0.0023	-0.00085	-0.0051
50	-0.00295	-0.00255	0.0004	-0.00275	-0.00585	-0.0101
51	0.00305	0.0029	0.00015	0.002975	-0.00035	-0.00435
52	0.00195	0.0019	5E-05	0.001925	-0.0013	-0.0054
53	0.0003	0.00045	0.00015	0.000375	-0.00255	-0.0068
54	-0.0003	-0.00085	0.00055	-0.00058	-0.00325	-0.0074
55	-0.0001	-0.00025	0.00015	-0.00018	-0.00325	-0.0075
56	0.01155	0.0115	5E-05	0.011525	0.00845	0.0045
57	0.0057	0.0059	0.0002	0.0058	0.0029	-0.0014
58	0.00785	0.0079	5E-05	0.007875	0.0047	0.0007
59	0.0077	0.00775	5E-05	0.007725	0.004725	0.00055
60	0.00355	0.00365	1E-04	0.0036	0.0007	-0.0031
61	0.01125	0.0112	5E-05	0.011225	0.0084	0.0043
62	0.00785	0.00785	0	0.00785	0.00425	0.00015
63	0.00955	0.0099	0.00035	0.009725	0.00695	0.00285
64	-0.0012	-0.00145	0.00025	-0.00133	-0.00435	-0.00845
65	0.0085	0.00825	0.00025	0.008375	0.0055	0.0016
66	0.0012	0.00135	0.00015	0.001275	-0.0016	-0.0059
67	0.0009	0.00055	0.00035	0.000725	-0.0022	-0.0061
68	0.00745	0.0073	0.00015	0.007375	0.00435	0.00015
69	0.00305	0.00305	0	0.00305	0.0002	-0.0036
70	0.0103	0.01045	0.00015	0.010375	0.0074	0.0038
71	0.0087	0.00855	0.00015	0.008625	0.00545	0.00215
72	0.0151	0.01525	0.00015	0.015175	0.01265	0.00895
73	0.0079	0.00785	5E-05	0.007875	0.0053	0.00165
74	0.01325	0.0134	0.00015	0.013325	0.0108	0.0072
75	0.01905	0.0189	0.00015	0.018975	0.0162	0.0129
76	0.01215	0.01215	0	0.01215	0.00985	0.0064
77	0.00825	0.00825	0	0.00825	0.006	0.0026
78	0.0039	0.0038	1E-04	0.00385	0.00175	-0.00175
79	0.00175	0.00165	0.0001	0.0017	-0.0004	-0.00375
80	0.0057	0.0057	0	0.0057	0.0038	0.0003
81	0.0036	0.00345	0.00015	0.003525	0.0016	-0.00175
82	0.00355	0.00355	0	0.00355	0.0018	-0.0013
83	0.001	0.00105	5E-05	0.001025	-0.0004	-0.00355
84	0.00145	0.0014	5E-05	0.001425	-0.0003	-0.00325
85	0.00785	0.0077	0.00015	0.007775	0.0064	0.0035
86	0.0033	0.00325	5E-05	0.003275	0.00195	-0.0008
87	0.0027	0.0025	0.0002	0.0026	0.00155	-0.0011
88	-0.00325	-0.00315	1E-04	-0.0032	-0.0038	-0.00685

T2-004 - 8 ft Panel Microstrain along Panel

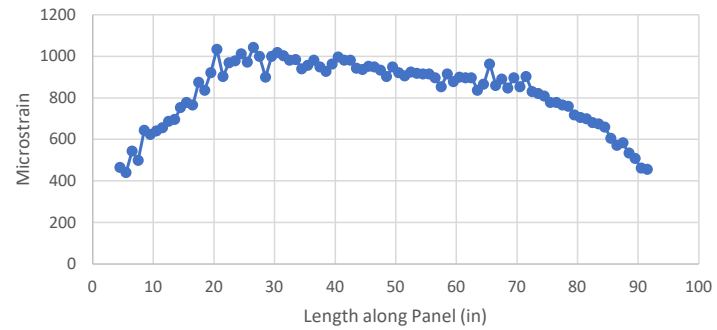
Detension			
Length	Delta	3 Point Average	5 Point Average
4.5	140.625	140.625	140.625
5.5	103.125	139.5833333	139.5833333
6.5	175	138.5416667	165
7.5	137.5	193.75	180.625
8.5	268.75	208.3333333	204.375
9.5	218.75	236.4583333	216.875
10.5	221.875	226.0416667	241.875
11.5	237.5	240.625	241.25
12.5	262.5	255.2083333	259.375
13.5	265.625	279.1666667	278.125
14.5	309.375	296.875	291.25
15.5	315.625	309.375	312.5
16.5	303.125	329.1666667	331.875
17.5	368.75	344.7916667	353.125
18.5	362.5	382.2916667	394.375
19.5	415.625	433.3333333	408.125
20.5	521.875	436.4583333	429.375
21.5	371.875	456.25	443.75
22.5	475	427.0833333	454.375
23.5	434.375	459.375	428.125
24.5	468.75	431.25	447.5
25.5	390.625	442.7083333	441.25
26.5	468.75	434.375	420.625
27.5	443.75	414.5833333	418.125
28.5	331.25	410.4166667	416.25
29.5	456.25	389.5833333	411.875
30.5	381.25	428.125	404.375
31.5	446.875	411.4583333	420
32.5	406.25	420.8333333	408.125
33.5	409.375	404.1666667	413.125
34.5	396.875	404.1666667	407.5
35.5	406.25	407.2916667	406.25
36.5	418.75	408.3333333	402.5
37.5	400	403.125	399.375
38.5	390.625	390.625	401.25
39.5	381.25	395.8333333	410
40.5	415.625	419.7916667	412.5
41.5	462.5	430.2083333	414.375
42.5	412.5	425	418.125
43.5	400	404.1666667	411.875
44.5	400	394.7916667	398.125
45.5	384.375	392.7083333	393.75
46.5	393.75	389.5833333	393.125
47.5	390.625	393.75	386.875
48.5	396.875	385.4166667	378.125
49.5	368.75	368.75	371.875
50.5	340.625	357.2916667	372.5
51.5	362.5	365.625	370.625
52.5	393.75	381.25	380
53.5	387.5	398.9583333	392.5
54.5	415.625	402.0833333	393.125
55.5	403.125	394.7916667	381.25
56.5	365.625	367.7083333	380.625
57.5	334.375	361.4583333	374.375
58.5	384.375	367.7083333	366.25
59.5	384.375	377.0833333	372.5
60.5	362.5	381.25	380.625
61.5	396.875	378.125	376.25
62.5	375	378.125	370
63.5	362.5	363.5416667	387.5
64.5	353.125	388.5416667	377.5
65.5	450	383.3333333	378.125
66.5	346.875	391.6666667	377.5
67.5	378.125	361.4583333	378.75
68.5	359.375	365.625	361.875
69.5	359.375	361.4583333	368.125
70.5	365.625	367.7083333	363.75
71.5	378.125	366.6666667	366.25
72.5	356.25	368.75	373.75
73.5	371.875	375	363.75
74.5	396.875	361.4583333	352.5
75.5	315.625	344.7916667	344.375
76.5	321.875	317.7083333	339.375
77.5	315.625	328.125	317.5
78.5	346.875	316.6666667	310.625
79.5	287.5	305.2083333	298.75
80.5	281.25	277.0833333	288.125
81.5	262.5	268.75	266.25
82.5	262.5	254.1666667	256.875
83.5	237.5	246.875	244.375
84.5	240.625	232.2916667	227.5
85.5	218.75	212.5	218.125
86.5	178.125	204.1666667	205
87.5	215.625	188.5416667	190
88.5	171.875	184.375	172.5
89.5	165.625	156.25	151.875
90.5	131.25	123.9583333	123.9583333
91.5	75	75	75

21 Day			
Length	Delta	3 Point Average	5 Point Average
4.5	465.625	465.625	465.625
5.5	440.625	483.3333333	483.3333333
6.5	543.75	494.7916667	518.75
7.5	500	562.5	550.625
8.5	643.75	589.5833333	590.625
9.5	625	636.4583333	613.125
10.5	640.625	640.625	650.625
11.5	656.25	661.4583333	661.25
12.5	687.5	680.2083333	686.875
13.5	696.875	712.5	714.375
14.5	753.125	742.7083333	736.25
15.5	778.125	765.625	773.75
16.5	765.625	806.25	801.875
17.5	875	826.0416667	835.625
18.5	837.5	878.125	886.875
19.5	921.875	931.25	914.375
20.5	1034.375	953.125	933.125
21.5	903.125	968.75	961.25
22.5	968.75	950	979.375
23.5	978.125	986.4583333	966.875
24.5	1012.5	987.5	995
25.5	971.875	1009.375	1001.25
26.5	1043.75	1005.208333	985.625
27.5	1000	981.25	983.125
28.5	900	966.6666667	992.5
29.5	1000	972.9166667	984.375
30.5	1018.75	1007.291667	980.625
31.5	1003.125	1001.041667	997.5
32.5	981.25	989.5833333	985.625
33.5	984.375	968.75	973.125
34.5	940.625	960.4166667	968.75
35.5	956.25	959.375	962.5
36.5	981.25	962.5	951.25
37.5	950	953.125	955.625
38.5	928.125	946.875	963.75
39.5	962.5	962.5	963.75
40.5	996.875	980.2083333	970
41.5	981.25	986.4583333	973.125
42.5	981.25	968.75	968.125
43.5	943.75	954.1666667	959.375
44.5	937.5	944.7916667	953.125
45.5	953.125	946.875	943.75
46.5	950	945.8333333	935.625
47.5	934.375	929.1666667	938.125
48.5	903.125	929.1666667	931.875
49.5	950	925	923.125
50.5	921.875	926.0416667	921.25
51.5	906.25	917.7083333	924.375
52.5	925	916.6666667	917.5
53.5	918.75	919.7916667	916.25
54.5	915.625	916.6666667	914.375
55.5	915.625	909.375	900
56.5	896.875	888.5416667	899.375
57.5	853.125	888.5416667	891.875
58.5	915.625	882.2916667	888.75
59.5	878.125	897.9166667	888.75
60.5	900	891.6666667	897.5
61.5	896.875	897.9166667	881.875
62.5	896.875	877.0833333	879.375
63.5	837.5	866.6666667	891.875
64.5	865.625	888.5416667	884.375
65.5	962.5	895.8333333	883.125
66.5	859.375	904.1666667	885
67.5	890.625	865.625	891.25
68.5	846.875	878.125	869.375
69.5	896.875	865.625	878.125
70.5	853.125	884.375	866.25
71.5	903.125	862.5	861.25
72.5	831.25	852.0833333	843.75
73.5	821.875	820.8333333	828.75
74.5	809.375	803.125	803.75
75.5	778.125	788.5416667	790.625
76.5	778.125	773.9583333	778.125
77.5	765.625	767.7083333	760
78.5	759.375	747.9166667	745.625
79.5	718.75	728.125	730
80.5	706.25	708.3333333	713.125
81.5	700	695.8333333	696.25
82.5	681.25	685.4166667	684.375
83.5	675	671.875	664.375
84.5	659.375	646.875	638.75
85.5	606.25	612.5	619.375
86.5	571.875	587.5	591.25
87.5	584.375	563.5416667	561.25
88.5	534.375	542.7083333	532.5
89.5	509.375	502.0833333	509.375
90.5	462.5	476.0416667	476.0416667
91.5	456.25	456.25	456.25

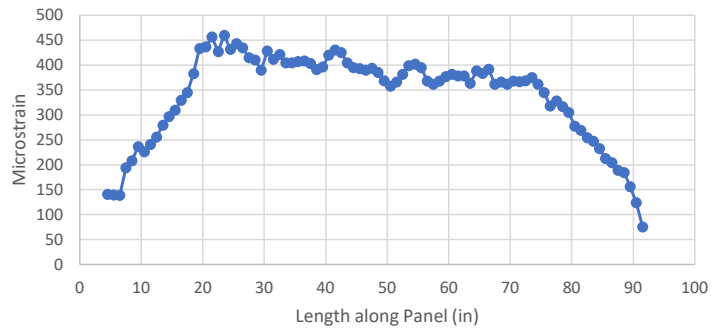
Pour 3 Detension - 8 ft Panel Raw



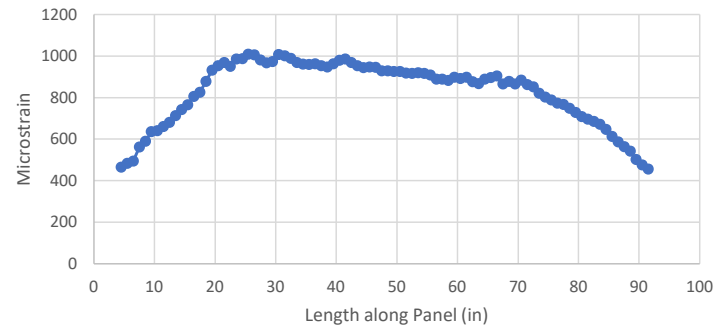
Pour 3 - 21 Day - 8 ft Panel Raw



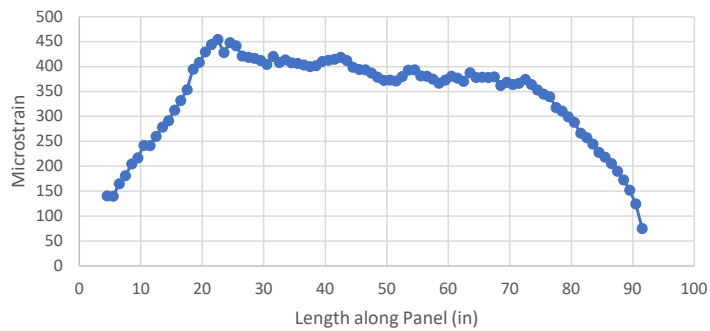
Pour 3 Detension - 8 ft Panel 3 Point Average



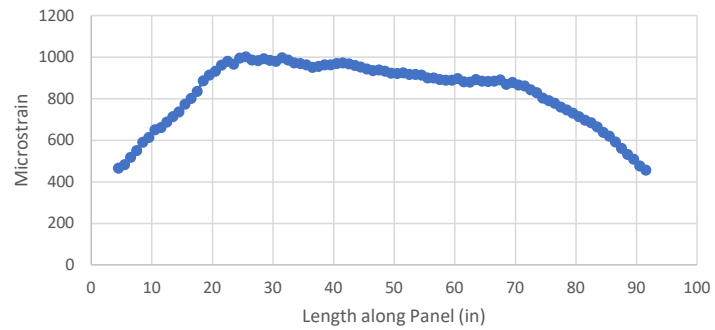
Pour 3 - 21 Day - 8 ft Panel 3 Point Average



Pour 3 Detension - 8 ft Panel 5 Point Average



Pour 3 - 21 Day - 8 ft Panel 5 Point Average



Detension		
Pour 1 Transfer Lengths		
	Z-L	95%
6 - S - R	14	14.22
6 - S - 3	14	14.34
6 - S - 5	14.2	14.94
6 - N - R	18.8	17.18
6 - N - 3	18.4	17.8
6 - N - 5	18.5	17.88
8 - S - R	20.1	19.88
8 - S - 3	20.4	20
8 - S - 5	20.5	20.11
8 - N - R	22.5	25.5
8 - N - 3	22.5	25.85
8 - N - 5	22	25.27
Average	18.825	19.41417

Detension		
Pour 2 Transfer Lengths		
	Z-L	95%
6 - S - R	21.7	20.08
6 - S - 3	21.2	20.721
6 - S - 5	21.2	21.72
6 - N - R	21.2	20.74
6 - N - 3	20.7	20.33
6 - N - 5	20.9	20.42
8 - S - R	21.8	20.01
8 - S - 3	21.8	20.32
8 - S - 5	21.8	20.84
8 - N - R	19.5	18.95
8 - N - 3	19.6	18.63
8 - N - 5	19.7	22.873
Average	20.925	20.4695

Detension		
Pour 3 Transfer Lengths		
	Z-L	95%
6 - S - R	20.2	19.29
6 - S - 3	20.2	19.72
6 - S - 5	20.3	19.61
6 - N - R	20.2	17.31
6 - N - 3	20.2	18.53
6 - N - 5	20.6	18.61
8 - S - R	19.9	19.11
8 - S - 3	20.1	18.75
8 - S - 5	20.1	18.52
8 - N - R	21.3	20.99
8 - N - 3	21.4	21.12
8 - N - 5	21.1	21.12
Average	20.46667	19.39

Average Transfer Lengths at Detension		
	Z-L Method	95% Method
7 Wire	18.83	19.41
T4VAE	20.93	20.47
T2004	20.47	19.39

21 Day		
Pour 1 Transfer Lengths		
	Z-L	95%
6 - S - R	18	22.37
6 - S - 3	17.9	22.69
6 - S - 5	17.8	22.92
6 - N - R	19.6	22.09
6 - N - 3	19.6	22.35
6 - N - 5	19.6	22.44
8 - S - R	25.1	22.98
8 - S - 3	25.2	23.31
8 - S - 5	25.2	24.41
8 - N - R	28	27.42
8 - N - 3	28	28.73
8 - N - 5	27.9	28.49
Average	22.65833	24.18333

21 Day		
Pour 2 Transfer Lengths		
	Z-L	95%
6 - S - R	20.1	18.91
6 - S - 3	20.3	19.67
6 - S - 5	20.4	23.76
6 - N - R	20.9	22.26
6 - N - 3	20.8	22.32
6 - N - 5	20.7	22.34
8 - S - R	25.9	23.08
8 - S - 3	25.7	24
8 - S - 5	25.7	24.06
8 - N - R	21.6	18.9
8 - N - 3	21.6	19.14
8 - N - 5	21.6	20.38
Average	22.10833	21.56833

21 Day		
Pour 3 Transfer Lengths		
	Z-L	95%
6 - S - R	19.8	19.4
6 - S - 3	19.6	20.06
6 - S - 5	19.6	20.49
6 - N - R	15.4	17.82
6 - N - 3	15.4	18.21
6 - N - 5	15.4	18.31
8 - S - R	19.6	19.5
8 - S - 3	19.6	19.32
8 - S - 5	19.5	19.82
8 - N - R	19.4	23.62
8 - N - 3	19.4	23.11
8 - N - 5	19.5	23.25
Average	18.51667	20.2425

Average Transfer Lengths at 21 Days		
	Z-L Method	95% Method
7 Wire	22.66	24.18
T4VAE	22.11	21.57
T2004	18.52	20.24

4.5 88
5.5 119
6.5 156
7.5 159
8.5 172
9.5 166
10.5 194
11.5 206
12.5 206
13.5 197
14.5 222
15.5 250
16.5 219
17.5 294
18.5 272
19.5 297
20.5 294
21.5 294
22.5 278
23.5 253
24.5 300
25.5 306
26.5 297
27.5 278
28.5 294
29.5 297
30.5 288
31.5 222
32.5 284
33.5 269
34.5 275
35.5 294

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

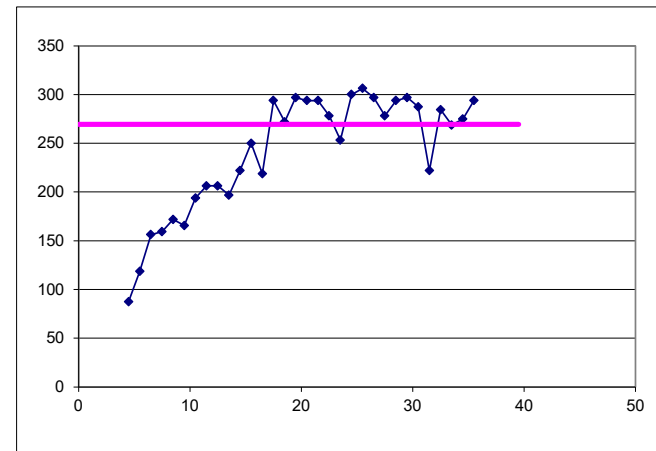
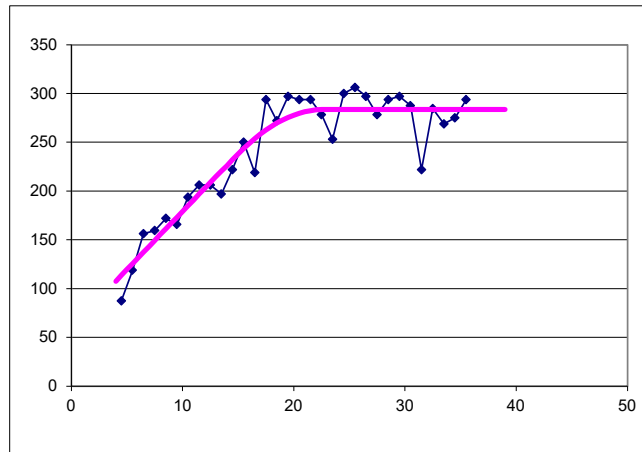
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 18.80
Estimated maxstrain= 283.67
Thermal strain= 60.00

Estimated transfer length= 17.18
Estimated maxstrain= 283.67
Thermal strain= 60.00

7 - Wire - 6 ft Panel - North - Raw - Detension



4.5 88
5.5 121
6.5 145
7.5 163
8.5 166
9.5 177
10.5 189
11.5 202
12.5 203
13.5 208
14.5 223
15.5 230
16.5 254
17.5 261
18.5 288
19.5 288
20.5 295
21.5 289
22.5 275
23.5 277
24.5 286
25.5 301
26.5 294
27.5 290
28.5 290
29.5 293
30.5 269
31.5 265
32.5 258
33.5 276
34.5 279
35.5 291

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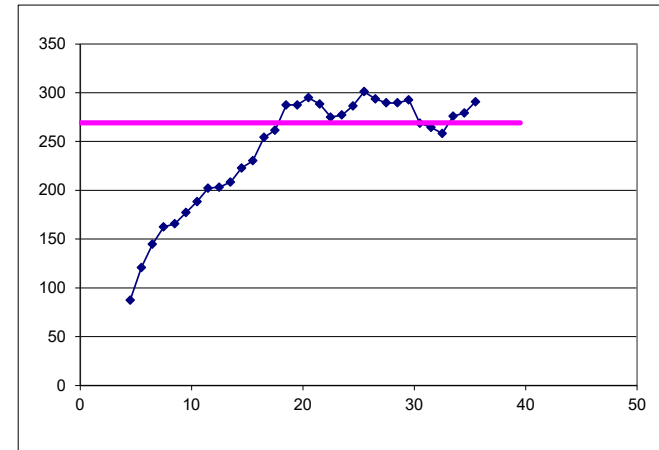
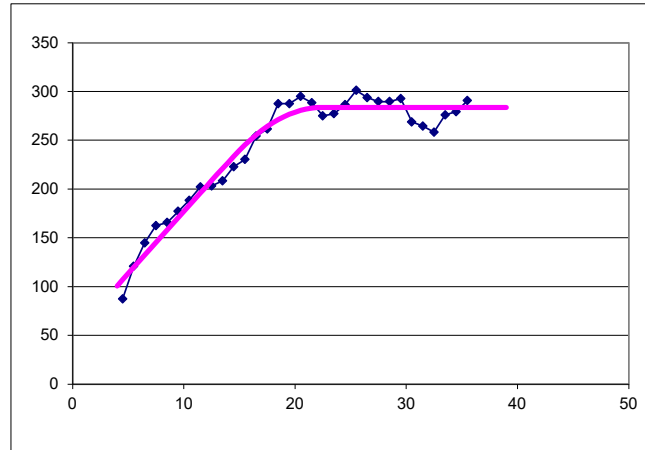
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 18.40
Estimated maxstrain= 283.52
Thermal strain= 50.00

Estimated transfer length= 17.80
Estimated maxstrain= 283.52
Thermal strain= 50.00

7 - Wire - 6 ft Panel - North - 3 point - Detension



4.5 88
5.5 118
6.5 136
7.5 154
8.5 168
9.5 179
10.5 187
11.5 196
12.5 205
13.5 213
14.5 224
15.5 235
16.5 251
17.5 264
18.5 277
19.5 284
20.5 287
21.5 285
22.5 284
23.5 286
24.5 287
25.5 290
26.5 292
27.5 293
28.5 287
29.5 281
30.5 275
31.5 272
32.5 269
33.5 274
34.5 279
35.5 284

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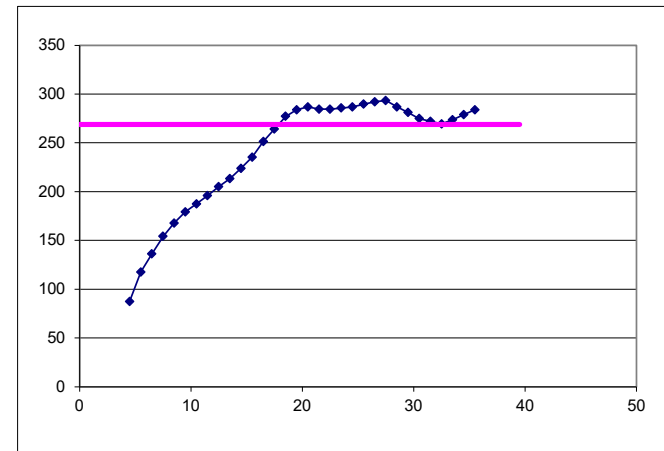
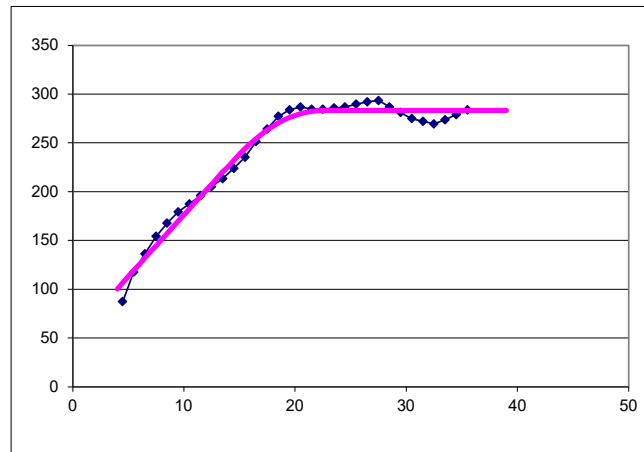
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 18.50
Estimated maxstrain= 283.18
Thermal strain= 50.00

Estimated transfer length= 17.88
Estimated maxstrain= 283.18
Thermal strain= 50.00

7 - Wire - 6 ft Panel - North - 5 point - Detension



4.5 56
5.5 63
6.5 125
7.5 163
8.5 153
9.5 172
10.5 156
11.5 188
12.5 216
13.5 234
14.5 244
15.5 250
16.5 253
17.5 253
18.5 238
19.5 250
20.5 228
21.5 231
22.5 241
23.5 266
24.5 256
25.5 234
26.5 256
27.5 250
28.5 250
29.5 244
30.5 256
31.5 263
32.5 250
33.5 272
34.5 275
35.5 303

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

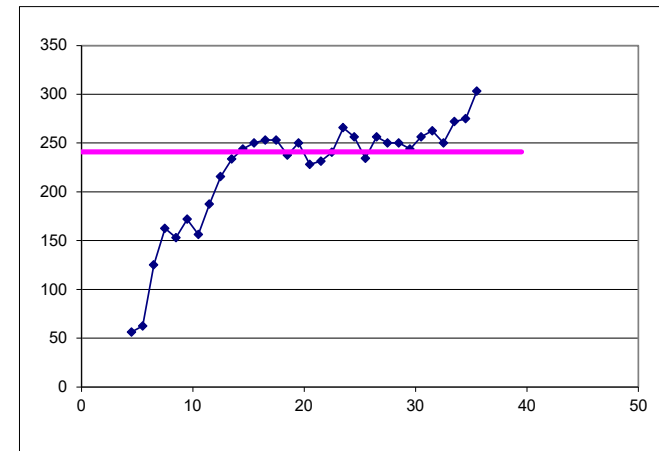
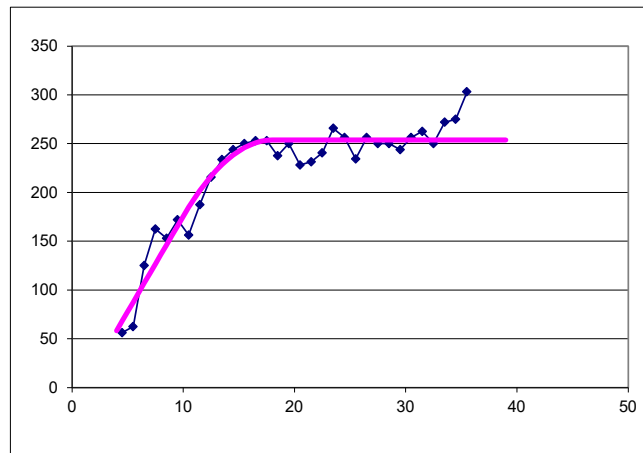
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 14.00
Estimated maxstrain= 253.65
Thermal strain= -20.00

Estimated transfer length= 14.22
Estimated maxstrain= 253.65
Thermal strain= -20.00

7 - Wire - 6 ft Panel - South - Raw - Detension



4.5 56
5.5 81
6.5 117
7.5 147
8.5 163
9.5 160
10.5 172
11.5 186
12.5 212
13.5 231
14.5 243
15.5 249
16.5 252
17.5 248
18.5 247
19.5 239
20.5 236
21.5 233
22.5 246
23.5 254
24.5 252
25.5 249
26.5 247
27.5 252
28.5 248
29.5 250
30.5 254
31.5 256
32.5 261
33.5 266
34.5 283
35.5 291

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

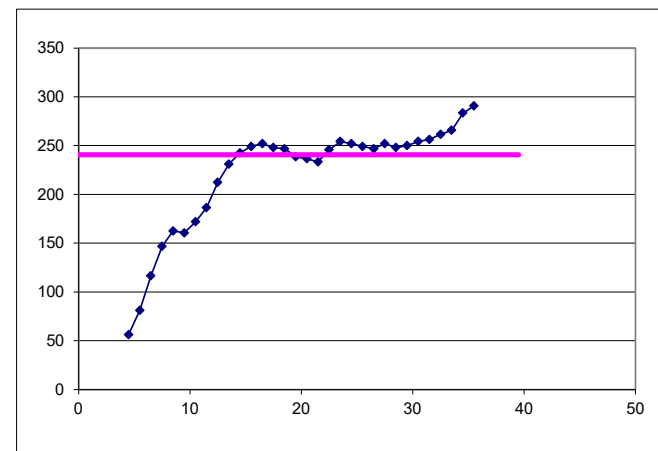
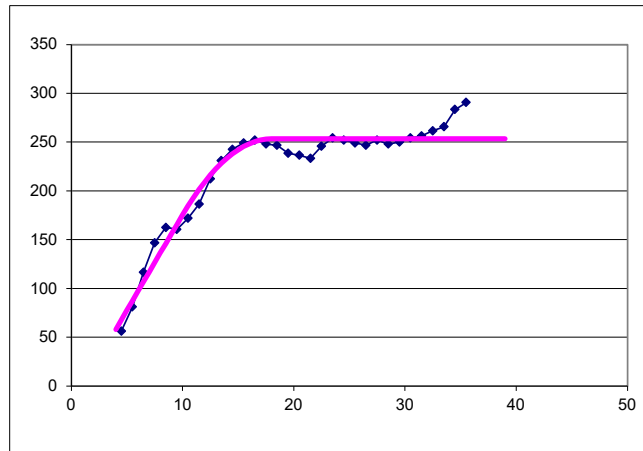
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 14.00
Estimated maxstrain= 253.35
Thermal strain= -20.00

Estimated transfer length= 14.34
Estimated maxstrain= 253.35
Thermal strain= -20.00

7 - Wire - 6 ft Panel - South - 3 Point - Detension



4.5 56
5.5 85
6.5 113
7.5 134
8.5 152
9.5 166
10.5 179
11.5 192
12.5 209
13.5 224
14.5 237
15.5 245
16.5 248
17.5 247
18.5 244
19.5 241
20.5 240
21.5 242
22.5 244
23.5 247
24.5 250
25.5 251
26.5 250
27.5 249
28.5 250
29.5 252
30.5 254
31.5 258
32.5 264
33.5 271
34.5 278
35.5 282

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

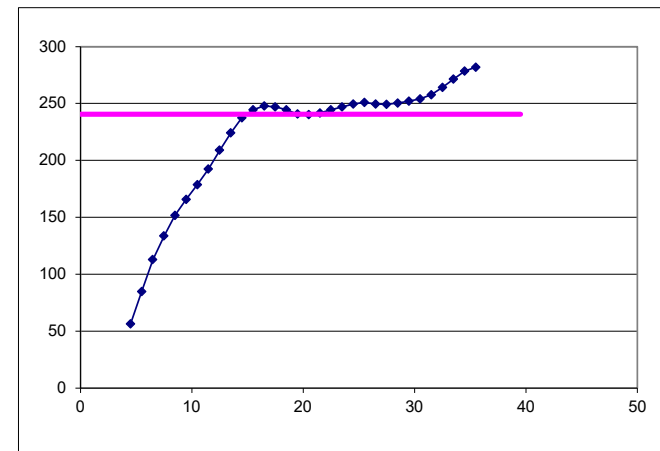
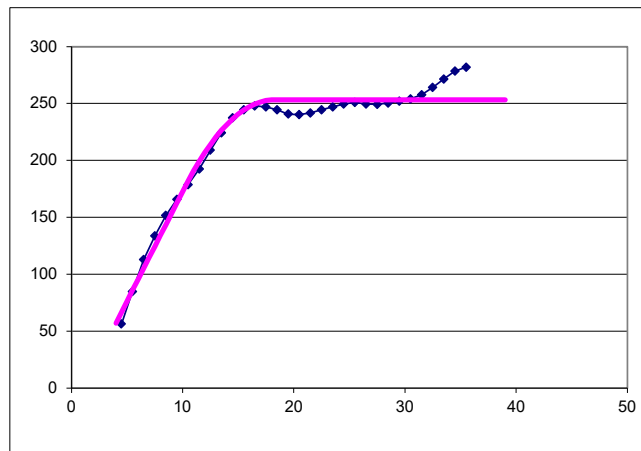
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 14.20
Estimated maxstrain= 253.17
Thermal strain= -20.00

Estimated transfer length= 14.94
Estimated maxstrain= 253.17
Thermal strain= -20.00

7 - Wire - 6 ft Panel - South - 5 Point - Detension

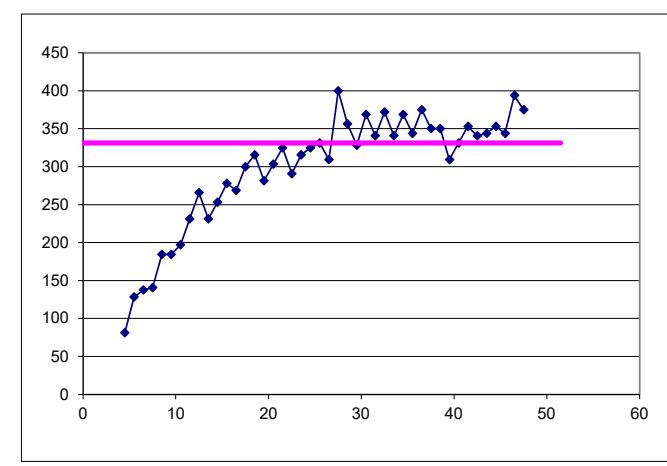
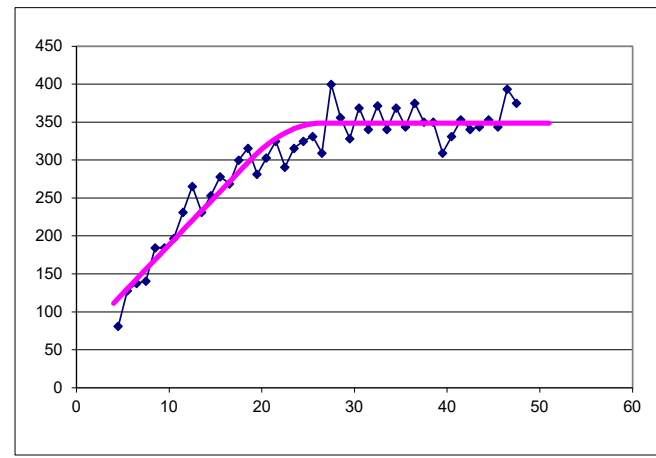


4.5 81
5.5 128
6.5 138
7.5 141
8.5 184
9.5 184
10.5 197
11.5 231
12.5 266
13.5 231
14.5 253
15.5 278
16.5 269
17.5 300
18.5 316
19.5 281
20.5 303
21.5 325
22.5 291
23.5 316
24.5 325
25.5 331
26.5 309
27.5 400
28.5 356
29.5 328
30.5 369
31.5 341
32.5 372
33.5 341
34.5 369
35.5 344
36.5 375
37.5 350
38.5 350
39.5 309
40.5 331
41.5 353
42.5 341
43.5 344
44.5 353
45.5 344
46.5 394
47.5 375

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length=	8	Estimated transfer length=	22.50	Estimated transfer length=	25.50
Upper thermal strain allowed=	200	Estimated maxstrain=	348.67	Estimated maxstrain=	348.67
Lower thermal strain allowed=	-200	Thermal strain=	60.00	Thermal strain=	60.00

7 - Wire - 8 ft Panel - North - Raw - Detension



4.5 81
5.5 116
6.5 135
7.5 154
8.5 170
9.5 189
10.5 204
11.5 231
12.5 243
13.5 250
14.5 254
15.5 267
16.5 282
17.5 295
18.5 299
19.5 300
20.5 303
21.5 306
22.5 310
23.5 310
24.5 324
25.5 322
26.5 347
27.5 355
28.5 361
29.5 351
30.5 346
31.5 360
32.5 351
33.5 360
34.5 351
35.5 363
36.5 356
37.5 358
38.5 336
39.5 330
40.5 331
41.5 342
42.5 346
43.5 346
44.5 347
45.5 364
46.5 371
47.5 371

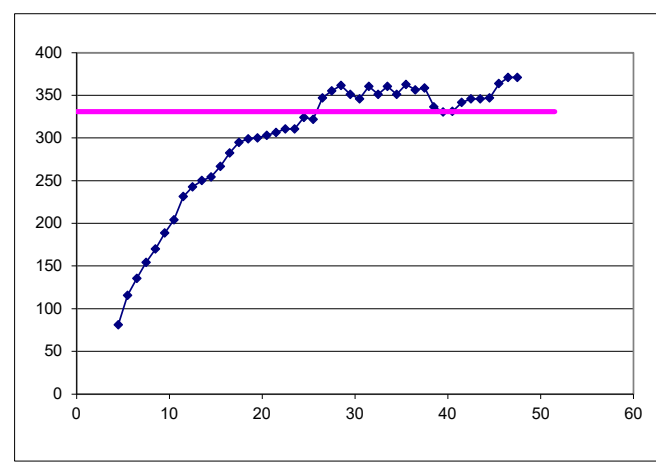
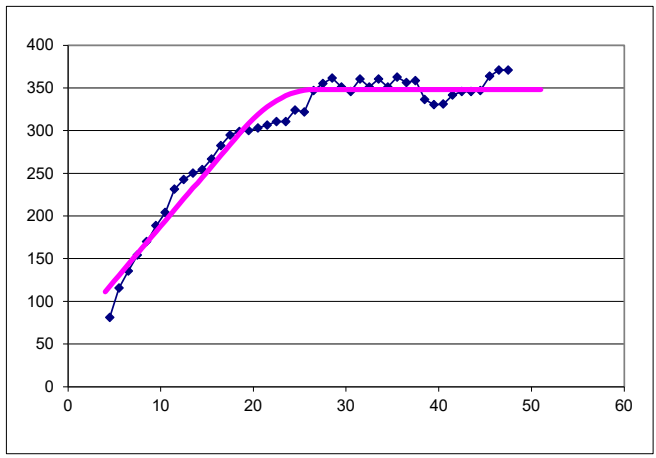
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length=	22.50
Estimated maxstrain=	348.16
Thermal strain=	60.00

Estimated transfer length=	25.85
Estimated maxstrain=	348.16
Thermal strain=	60.00

7 - Wire - 8 ft Panel - 3 Point - Raw - Detension



4.5 81
5.5 111
6.5 131
7.5 153
8.5 170
9.5 190
10.5 207
11.5 223
12.5 236
13.5 249
14.5 259
15.5 270
16.5 279
17.5 289
18.5 296
19.5 301
20.5 304
21.5 306
22.5 311
23.5 315
24.5 323
25.5 332
26.5 342
27.5 347
28.5 352
29.5 355
30.5 354
31.5 354
32.5 354
33.5 357
34.5 356
35.5 358
36.5 353
37.5 349
38.5 343
39.5 340
40.5 337
41.5 339
42.5 342
43.5 349
44.5 355
45.5 360
46.5 361
47.5 361

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

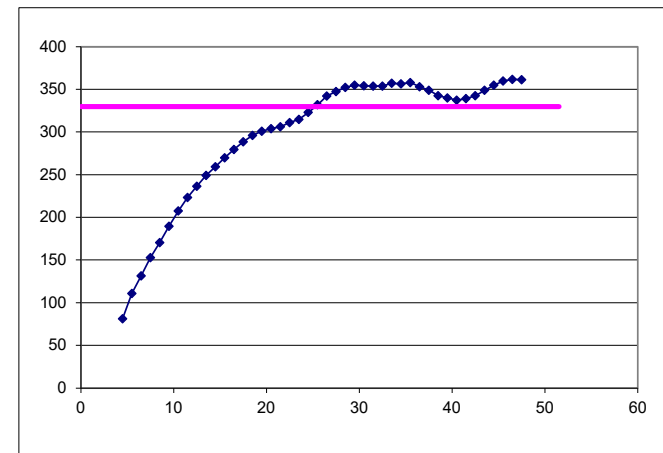
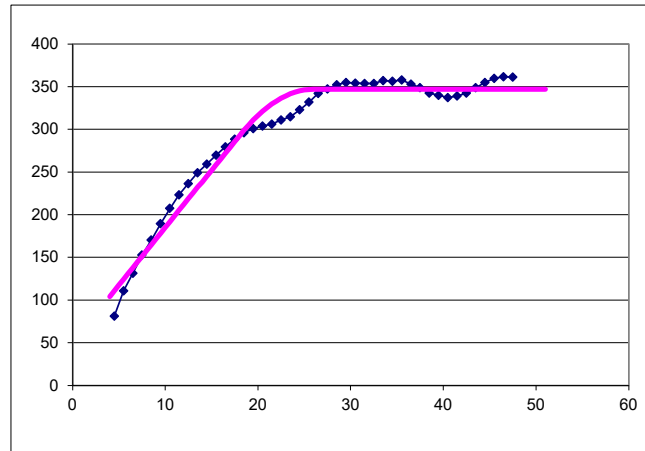
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 22.00
Estimated maxstrain= 346.95
Thermal strain= 50.00

Estimated transfer length= 25.27
Estimated maxstrain= 346.95
Thermal strain= 50.00

7 - Wire - 8 ft Panel - North - 5 point - Detension



4.5 88
5.5 56
6.5 156
7.5 147
8.5 159
9.5 178
10.5 163
11.5 181
12.5 213
13.5 234
14.5 247
15.5 259
16.5 284
17.5 306
18.5 300
19.5 313
20.5 341
21.5 334
22.5 338
23.5 369
24.5 347
25.5 319
26.5 316
27.5 303
28.5 331
29.5 322
30.5 325
31.5 344
32.5 341
33.5 372
34.5 306
35.5 384
36.5 341
37.5 406
38.5 372
39.5 319
40.5 328
41.5 316
42.5 338
43.5 325
44.5 344
45.5 344
46.5 347
47.5 344

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

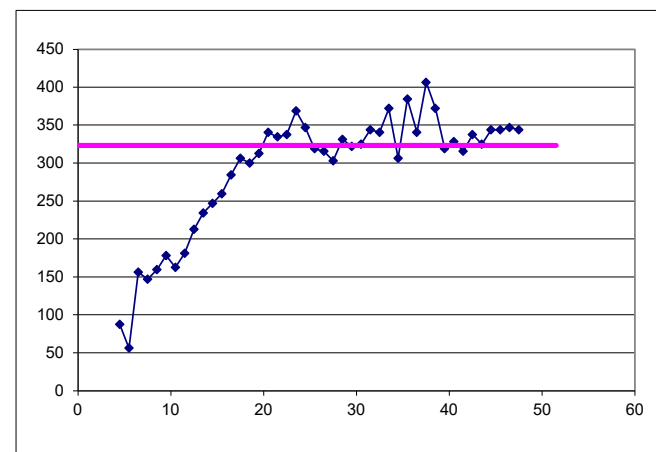
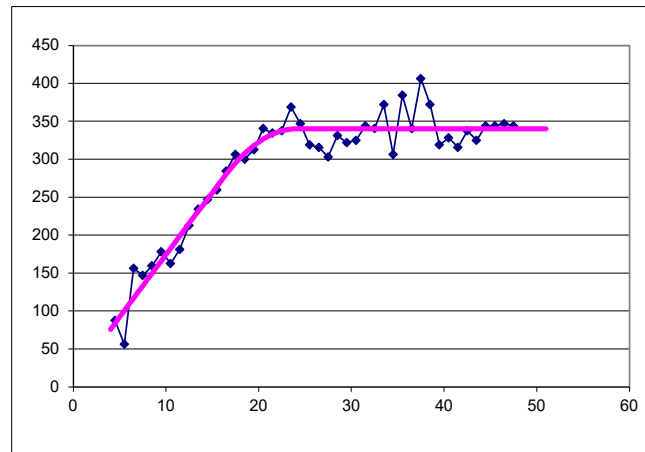
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.10
Estimated maxstrain= 340.19
Thermal strain= 10.00

Estimated transfer length= 19.88
Estimated maxstrain= 340.19
Thermal strain= 10.00

7 - Wire - 8 ft Panel - South - Raw - Detension



4.5 88
5.5 100
6.5 120
7.5 154
8.5 161
9.5 167
10.5 174
11.5 185
12.5 209
13.5 231
14.5 247
15.5 264
16.5 283
17.5 297
18.5 306
19.5 318
20.5 329
21.5 338
22.5 347
23.5 351
24.5 345
25.5 327
26.5 313
27.5 317
28.5 319
29.5 326
30.5 330
31.5 336
32.5 352
33.5 340
34.5 354
35.5 344
36.5 377
37.5 373
38.5 366
39.5 340
40.5 321
41.5 327
42.5 326
43.5 335
44.5 338
45.5 345
46.5 345
47.5 355

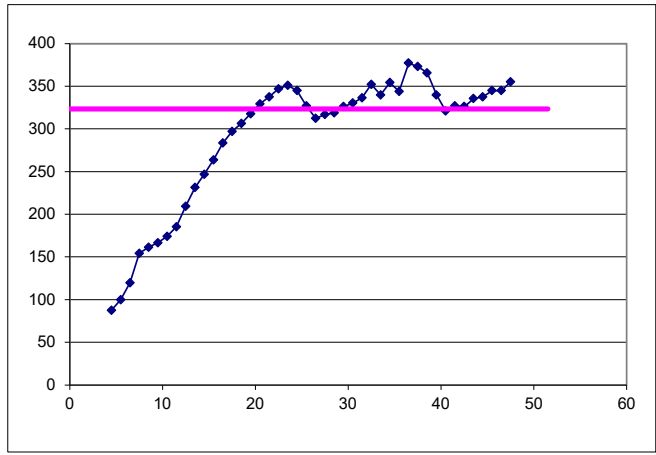
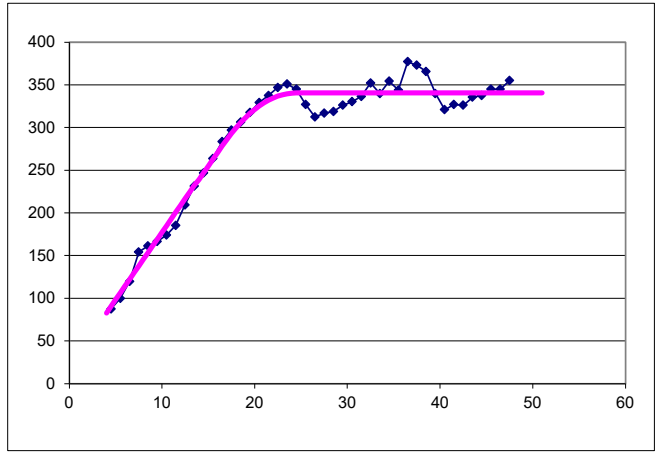
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.40
Estimated maxstrain= 340.45
Thermal strain= 20.00

Estimated transfer length= 20.00
Estimated maxstrain= 340.45
Thermal strain= 20.00

7 - Wire - 8 ft Panel - South - 3 point - Detension



4.5 88
5.5 102
6.5 125
7.5 140
8.5 155
9.5 168
10.5 179
11.5 193
12.5 209
13.5 227
14.5 247
15.5 264
16.5 279
17.5 294
18.5 307
19.5 318
20.5 328
21.5 336
22.5 342
23.5 341
24.5 336
25.5 330
26.5 324
27.5 320
28.5 321
29.5 326
30.5 333
31.5 337
32.5 343
33.5 345
34.5 353
35.5 358
36.5 363
37.5 360
38.5 355
39.5 345
40.5 336
41.5 330
42.5 329
43.5 334
44.5 338
45.5 344
46.5 351
47.5 357

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

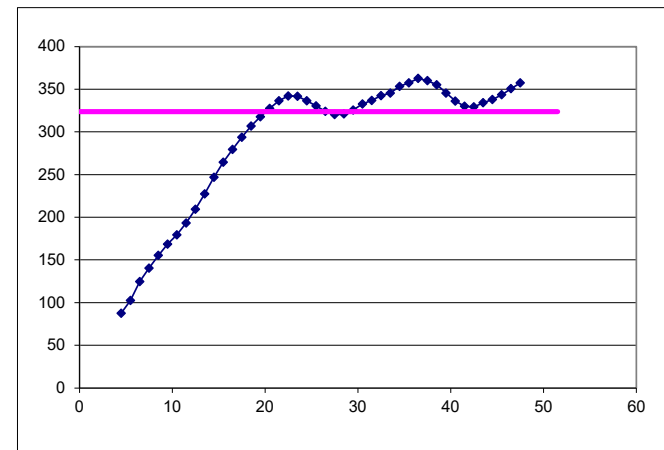
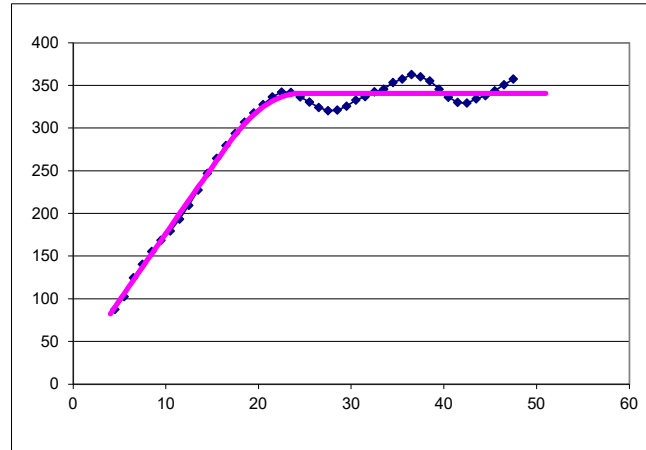
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.50
Estimated maxstrain= 340.63
Thermal strain= 20.00

Estimated transfer length= 20.11
Estimated maxstrain= 340.63
Thermal strain= 20.00

7 - Wire - 8 ft Panel - South - 5 point - Detension



4.5 444
5.5 450
6.5 500
7.5 516
8.5 516
9.5 522
10.5 550
11.5 569
12.5 575
13.5 591
14.5 591
15.5 644
16.5 575
17.5 694
18.5 684
19.5 678
20.5 713
21.5 725
22.5 747
23.5 747
24.5 763
25.5 800
26.5 797
27.5 808
28.5 819
29.5 816
30.5 800
31.5 759
32.5 809
33.5 788
34.5 763
35.5 780

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

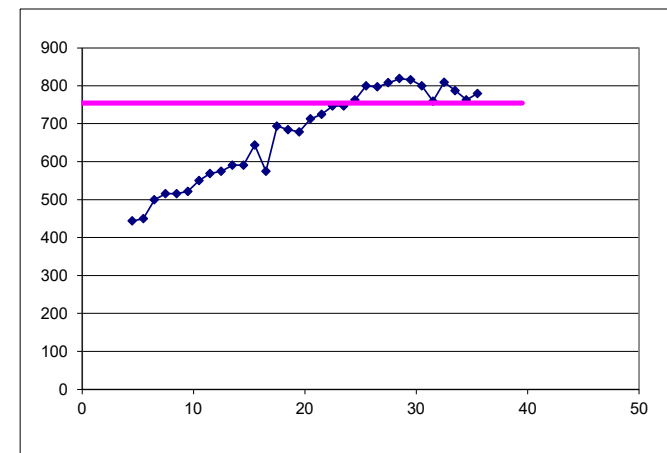
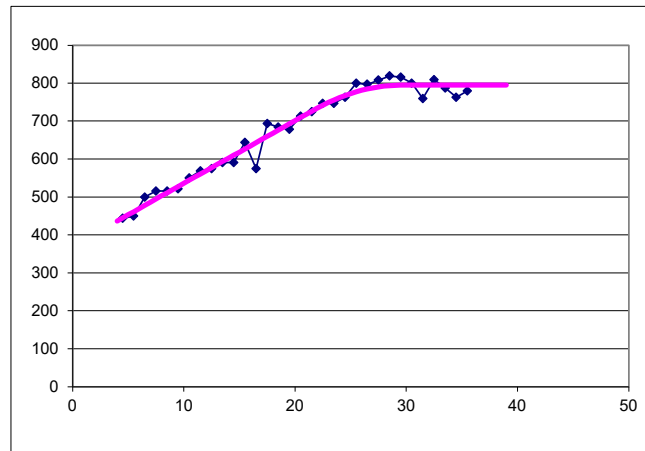
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 25.60
Estimated maxstrain= 794.78
Thermal strain= 370.00

Estimated transfer length= 24.02
Estimated maxstrain= 794.78
Thermal strain= 370.00

7 - Wire - 6 ft Panel - North - Raw - 21 Day



4.5 444
5.5 465
6.5 489
7.5 510
8.5 518
9.5 529
10.5 547
11.5 565
12.5 578
13.5 585
14.5 608
15.5 603
16.5 638
17.5 651
18.5 685
19.5 692
20.5 705
21.5 728
22.5 740
23.5 752
24.5 770
25.5 786
26.5 802
27.5 808
28.5 814
29.5 811
30.5 792
31.5 790
32.5 785
33.5 786
34.5 777
35.5 780

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

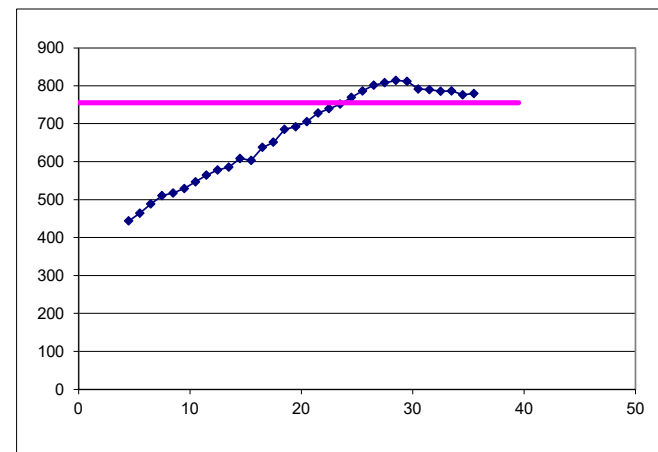
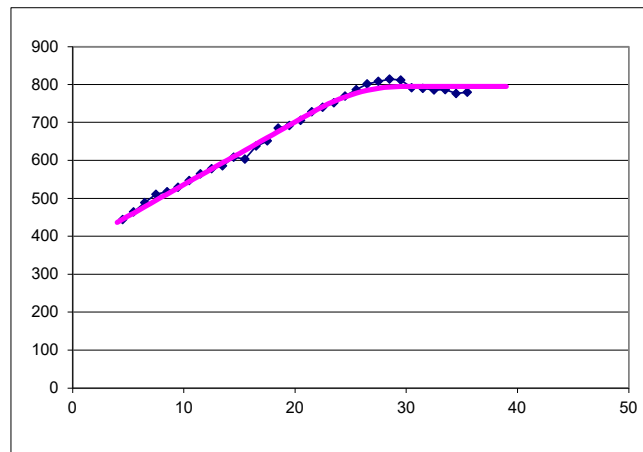
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 25.60
Estimated maxstrain= 794.83
Thermal strain= 370.00

Estimated transfer length= 23.67
Estimated maxstrain= 794.83
Thermal strain= 370.00

7 - Wire - 6 ft Panel - North - 3 point - 21 Day



4.5 444
5.5 465
6.5 485
7.5 501
8.5 521
9.5 534
10.5 546
11.5 561
12.5 575
13.5 594
14.5 595
15.5 619
16.5 638
17.5 655
18.5 669
19.5 699
20.5 709
21.5 722
22.5 739
23.5 756
24.5 771
25.5 783
26.5 797
27.5 808
28.5 808
29.5 800
30.5 801
31.5 794
32.5 784
33.5 780
34.5 787
35.5 787

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

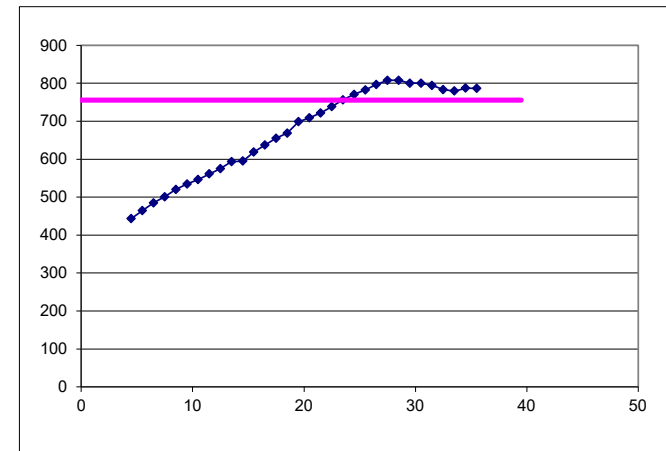
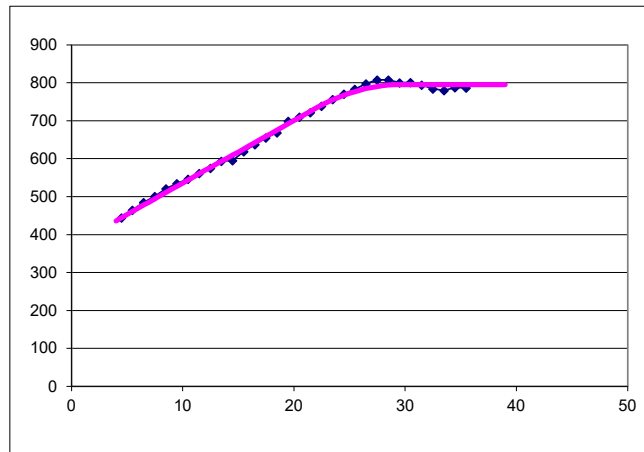
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 25.70
Estimated maxstrain= 795.46
Thermal strain= 370.00

Estimated transfer length= 23.47
Estimated maxstrain= 795.46
Thermal strain= 370.00

7 - Wire - 6 ft Panel - North - 5 point - 21 Day



4.5 444
5.5 449
6.5 494
7.5 509
8.5 516
9.5 522
10.5 549
11.5 568
12.5 574
13.5 590
14.5 590
15.5 643
16.5 575
17.5 628
18.5 644
19.5 663
20.5 659
21.5 681
22.5 722
23.5 734
24.5 725
25.5 772
26.5 769
27.5 781
28.5 763
29.5 794
30.5 800
31.5 788
32.5 781
33.5 797
34.5 806
35.5 797

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

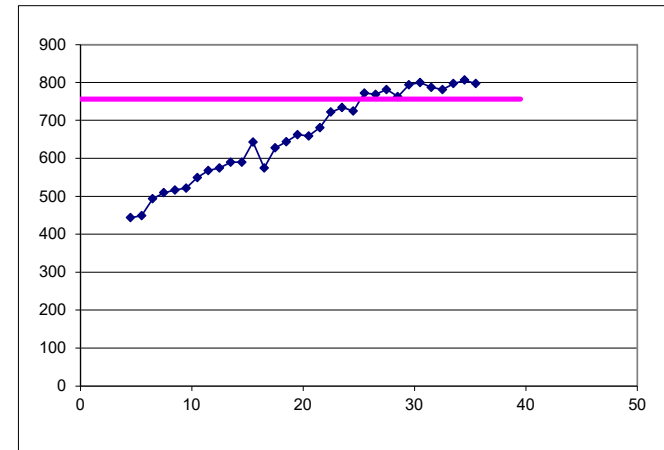
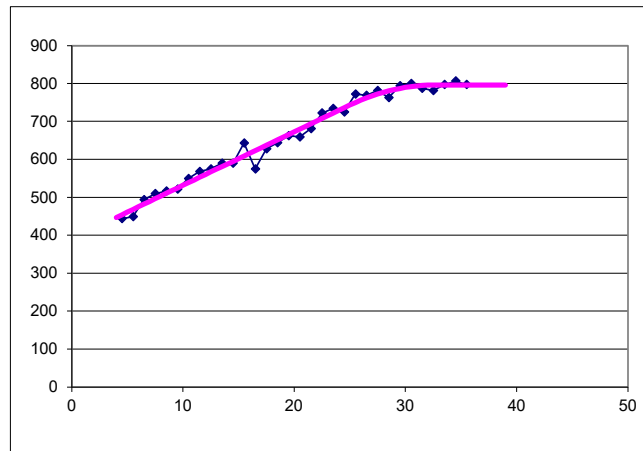
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 28.70
Estimated maxstrain= 796.13
Thermal strain= 390.00

Estimated transfer length= 25.17
Estimated maxstrain= 796.13
Thermal strain= 390.00

7 - Wire - 6 ft Panel - South - Raw - 21 Day



4.5 444
5.5 462
6.5 484
7.5 506
8.5 516
9.5 529
10.5 546
11.5 564
12.5 578
13.5 585
14.5 608
15.5 603
16.5 615
17.5 616
18.5 645
19.5 655
20.5 668
21.5 688
22.5 713
23.5 727
24.5 744
25.5 755
26.5 774
27.5 771
28.5 779
29.5 785
30.5 794
31.5 790
32.5 789
33.5 795
34.5 800
35.5 794

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

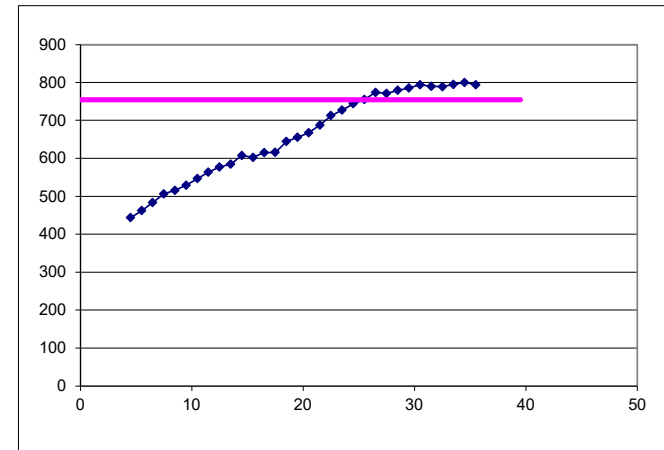
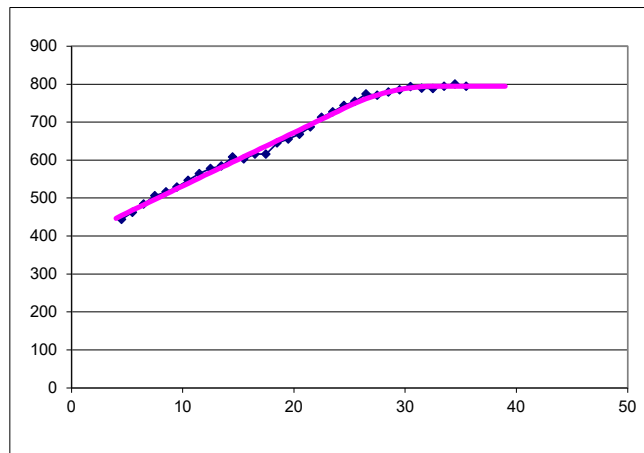
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 28.60
Estimated maxstrain= 794.74
Thermal strain= 390.00

Estimated transfer length= 25.48
Estimated maxstrain= 794.74
Thermal strain= 390.00

7 - Wire - 6 ft Panel - South - 3 point - 21 Day



4.5 444
5.5 462
6.5 482
7.5 498
8.5 518
9.5 533
10.5 546
11.5 561
12.5 574
13.5 593
14.5 595
15.5 605
16.5 616
17.5 631
18.5 634
19.5 655
20.5 674
21.5 692
22.5 704
23.5 727
24.5 744
25.5 756
26.5 762
27.5 776
28.5 781
29.5 785
30.5 785
31.5 792
32.5 794
33.5 794
34.5 792
35.5 788

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

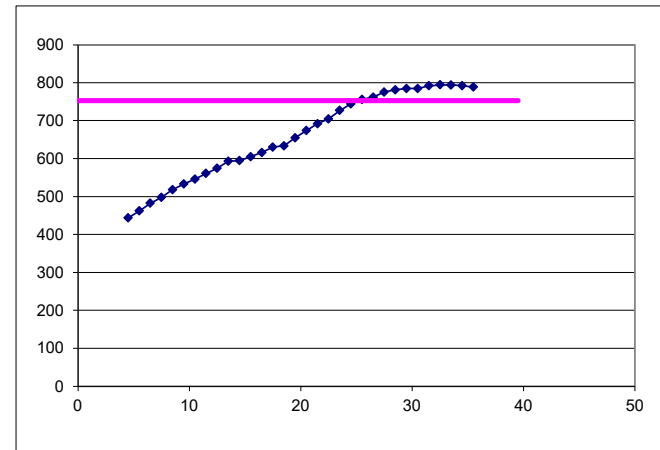
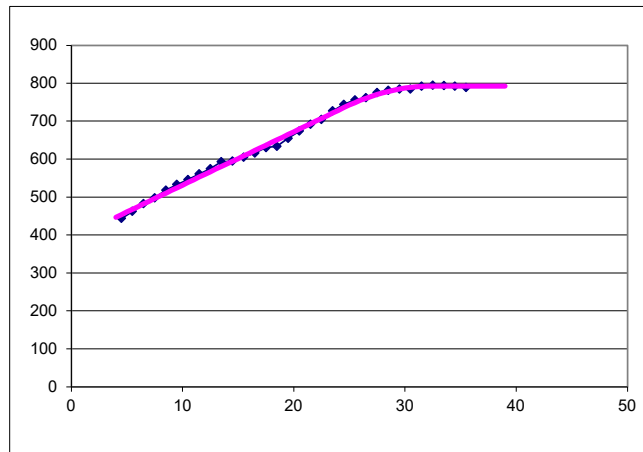
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 28.50
Estimated maxstrain= 792.73
Thermal strain= 390.00

Estimated transfer length= 25.23
Estimated maxstrain= 792.73
Thermal strain= 390.00

7 - Wire - 6 ft Panel - South - 5 point - 21 Day



4.5 394
5.5 328
6.5 481
7.5 509
8.5 547
9.5 566
10.5 572
11.5 656
12.5 691
13.5 681
14.5 672
15.5 716
16.5 681
17.5 719
18.5 728
19.5 694
20.5 741
21.5 781
22.5 759
23.5 816
24.5 819
25.5 881
26.5 884
27.5 956
28.5 919
29.5 959
30.5 1025
31.5 978
32.5 1009
33.5 984
34.5 1025
35.5 988
36.5 1044
37.5 1013
38.5 1025
39.5 966
40.5 1019
41.5 1022
42.5 1009
43.5 1000
44.5 991
45.5 994
46.5 1000
47.5 1013

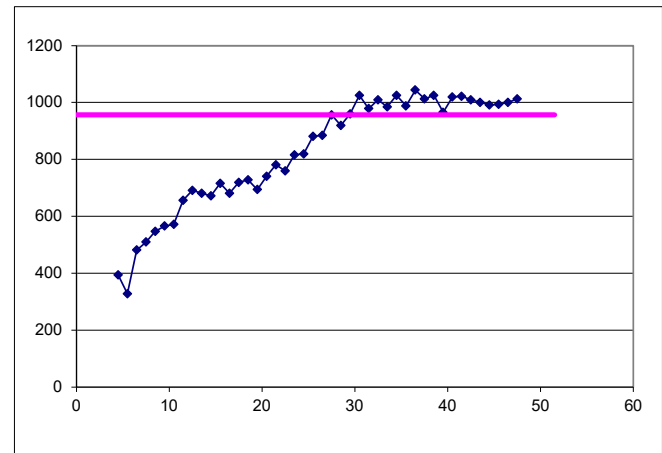
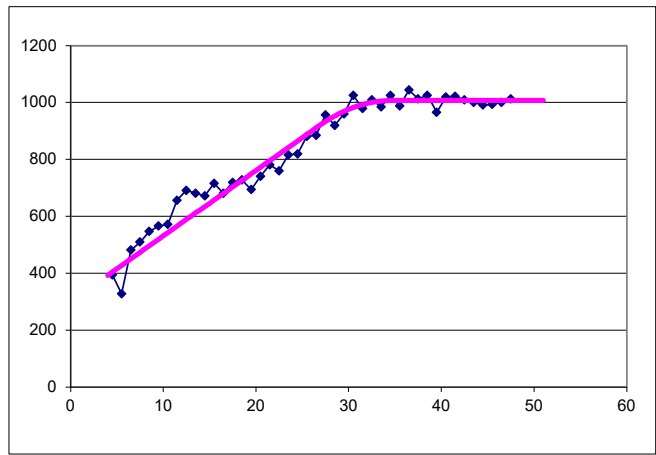
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 30.60
Estimated maxstrain= 1006.76
Thermal strain= 300.00

Estimated transfer length= 29.43
Estimated maxstrain= 1006.76
Thermal strain= 300.00

7 - Wire - 8 ft Panel - North - Raw - 21 Day



4.5 394
5.5 401
6.5 440
7.5 513
8.5 541
9.5 561
10.5 598
11.5 640
12.5 676
13.5 681
14.5 690
15.5 690
16.5 705
17.5 709
18.5 714
19.5 721
20.5 739
21.5 760
22.5 785
23.5 798
24.5 839
25.5 861
26.5 907
27.5 920
28.5 945
29.5 968
30.5 988
31.5 1004
32.5 991
33.5 1006
34.5 999
35.5 1019
36.5 1015
37.5 1027
38.5 1001
39.5 1003
40.5 1002
41.5 1017
42.5 1010
43.5 1000
44.5 995
45.5 995
46.5 1002
47.5 996

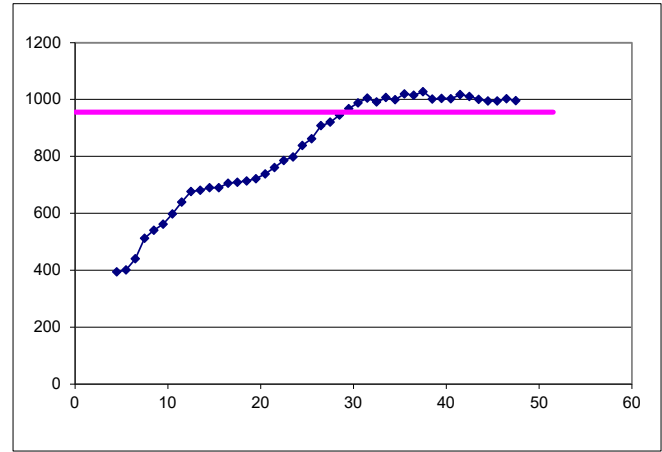
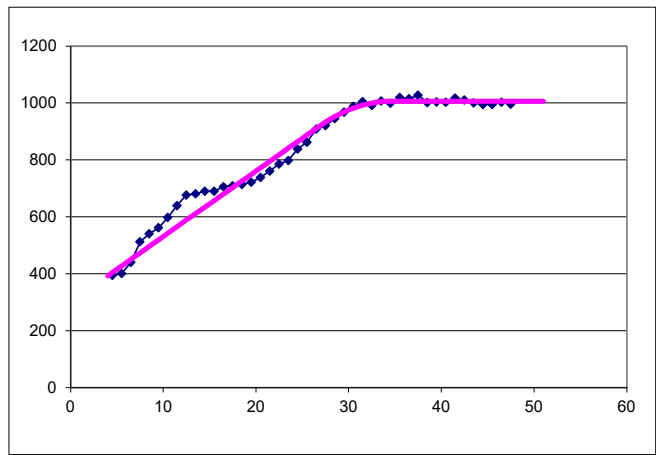
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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 30.60
Estimated maxstrain= 1006.19
Thermal strain= 300.00

Estimated transfer length= 28.98
Estimated maxstrain= 1006.19
Thermal strain= 300.00

7 - Wire - 8 ft Panel - North - 3 point - 21 Day



4.5 394
5.5 401
6.5 452
7.5 486
8.5 535
9.5 570
10.5 606
11.5 633
12.5 654
13.5 683
14.5 688
15.5 694
16.5 703
17.5 708
18.5 713
19.5 733
20.5 741
21.5 758
22.5 783
23.5 811
24.5 832
25.5 871
26.5 892
27.5 920
28.5 949
29.5 968
30.5 978
31.5 991
32.5 1004
33.5 997
34.5 1010
35.5 1011
36.5 1019
37.5 1007
38.5 1013
39.5 1009
40.5 1008
41.5 1003
42.5 1008
43.5 1003
44.5 999
45.5 999
46.5 994
47.5 993

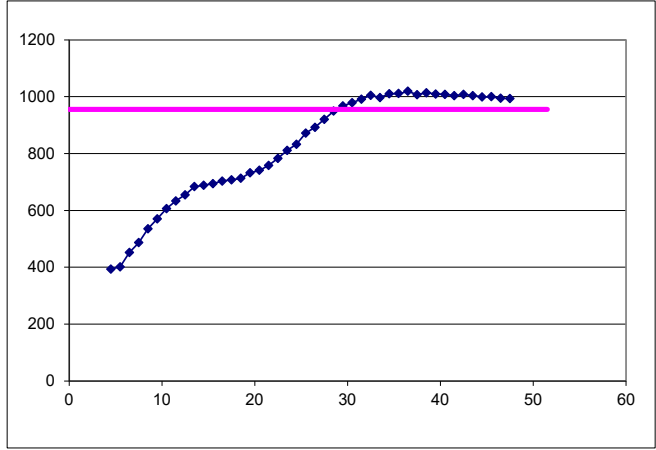
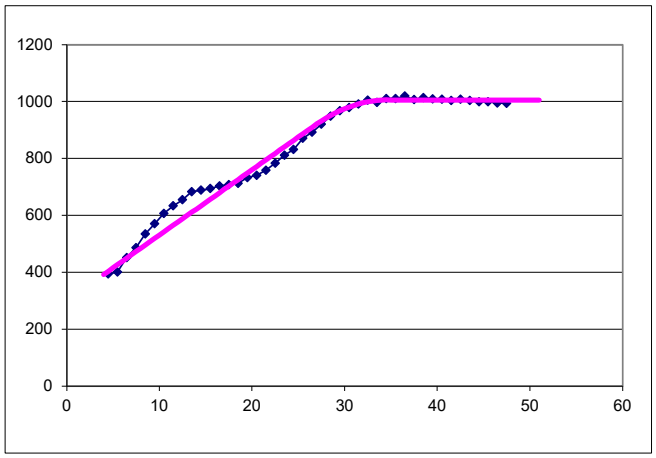
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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 30.60
Estimated maxstrain= 1005.30
Thermal strain= 300.00

Estimated transfer length= 28.84
Estimated maxstrain= 1005.30
Thermal strain= 300.00

7 - Wire - 8 ft Panel - North - 5 point - 21 Day



4.5 356
5.5 475
6.5 425
7.5 478
8.5 497
9.5 497
10.5 513
11.5 525
12.5 569
13.5 591
14.5 628
15.5 591
16.5 672
17.5 706
18.5 781
19.5 838
20.5 809
21.5 778
22.5 881
23.5 919
24.5 928
25.5 844
26.5 941
27.5 847
28.5 900
29.5 903
30.5 900
31.5 938
32.5 947
33.5 934
34.5 900
35.5 984
36.5 984
37.5 950
38.5 953
39.5 956
40.5 966
41.5 959
42.5 963
43.5 963
44.5 969
45.5 994
46.5 984
47.5 975

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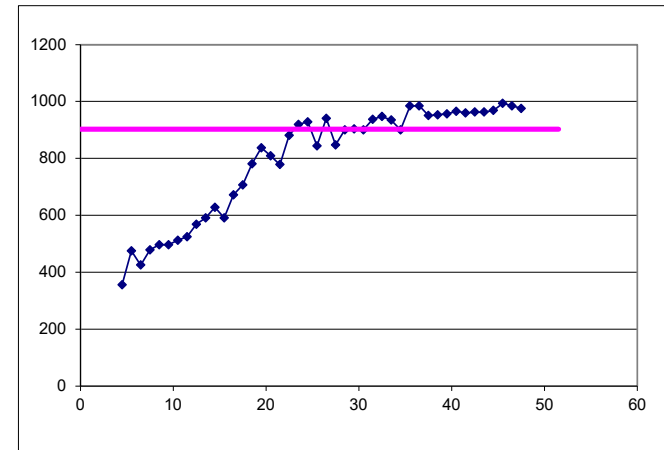
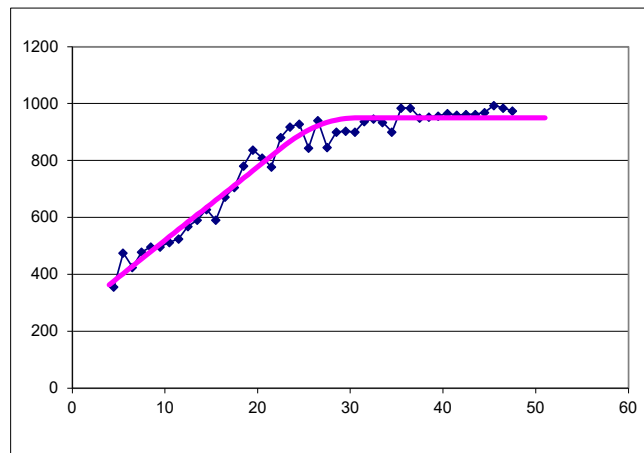
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 26.60
Estimated maxstrain= 949.86
Thermal strain= 260.00

Estimated transfer length= 23.06
Estimated maxstrain= 949.86
Thermal strain= 260.00

7 - Wire - 8 ft Panel - South - Raw - 21 Day



4.5 356
5.5 419
6.5 459
7.5 467
8.5 491
9.5 502
10.5 511
11.5 535
12.5 561
13.5 596
14.5 603
15.5 630
16.5 656
17.5 720
18.5 775
19.5 809
20.5 808
21.5 823
22.5 859
23.5 909
24.5 897
25.5 904
26.5 877
27.5 896
28.5 883
29.5 901
30.5 914
31.5 928
32.5 940
33.5 927
34.5 940
35.5 956
36.5 973
37.5 963
38.5 953
39.5 958
40.5 960
41.5 963
42.5 961
43.5 965
44.5 975
45.5 982
46.5 984
47.5 991

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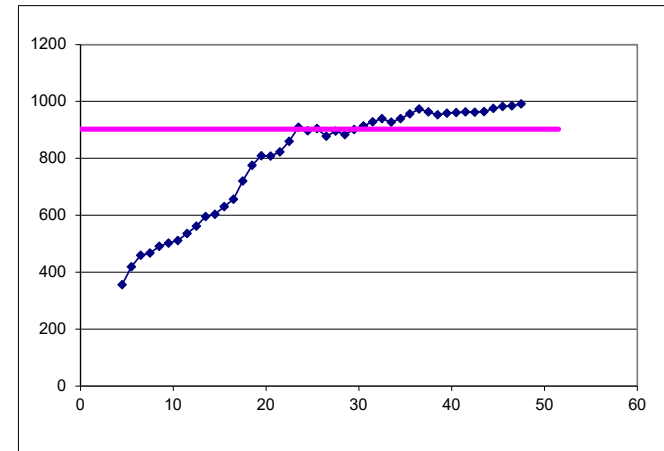
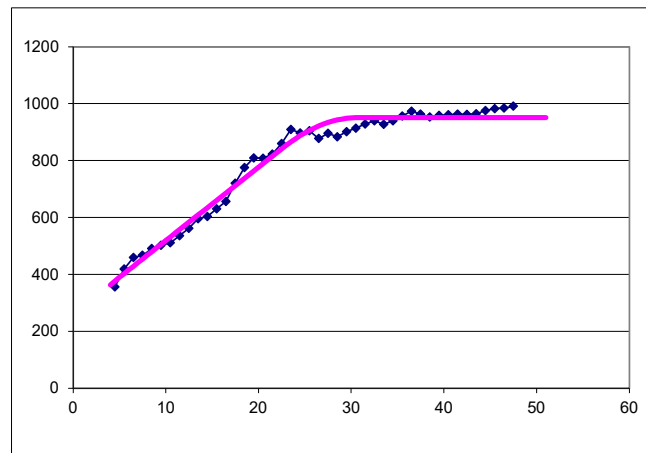
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 26.70
Estimated maxstrain= 950.59
Thermal strain= 260.00

Estimated transfer length= 23.37
Estimated maxstrain= 950.59
Thermal strain= 260.00

7 - Wire - 8 ft Panel - South - 3 point - 21 Day



4.5 356
5.5 419
6.5 446
7.5 474
8.5 482
9.5 502
10.5 520
11.5 539
12.5 565
13.5 581
14.5 610
15.5 638
16.5 676
17.5 718
18.5 761
19.5 783
20.5 818
21.5 845
22.5 863
23.5 870
24.5 903
25.5 896
26.5 892
27.5 887
28.5 898
29.5 898
30.5 918
31.5 924
32.5 924
33.5 941
34.5 950
35.5 951
36.5 954
37.5 966
38.5 962
39.5 957
40.5 959
41.5 961
42.5 964
43.5 969
44.5 974
45.5 977
46.5 987
47.5 993

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

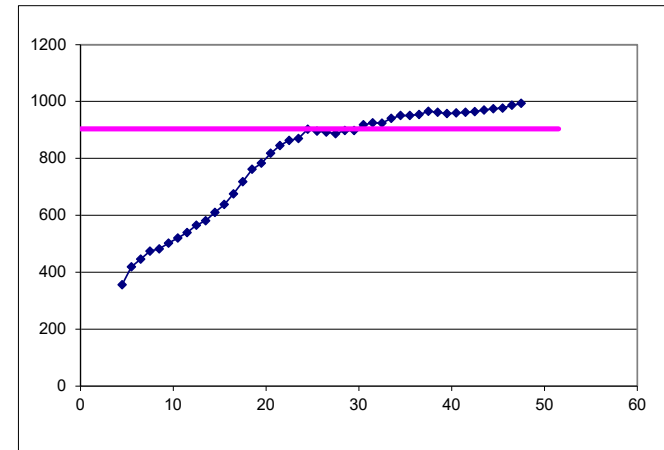
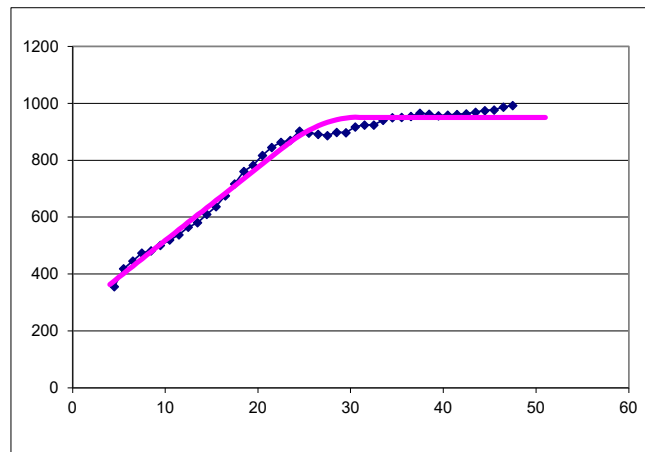
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 26.80
Estimated maxstrain= 951.00
Thermal strain= 260.00

Estimated transfer length= 29.80
Estimated maxstrain= 951.00
Thermal strain= 260.00

7 - Wire - 8 ft Panel - South - 5 point - 21 Day



4.5 59
5.5 84
6.5 116
7.5 113
8.5 138
9.5 188
10.5 150
11.5 169
12.5 206
13.5 150
14.5 206
15.5 231
16.5 219
17.5 213
18.5 213
19.5 219
20.5 228
21.5 344
22.5 288
23.5 241
24.5 250
25.5 278
26.5 256
27.5 278
28.5 275
29.5 281
30.5 297
31.5 288
32.5 250
33.5 263
34.5 238
35.5 269

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

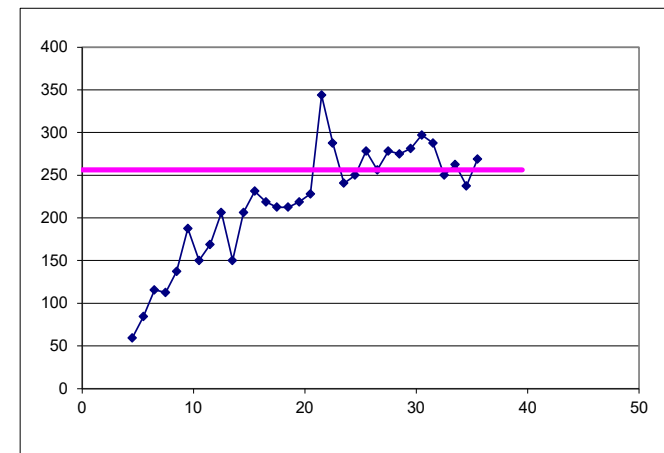
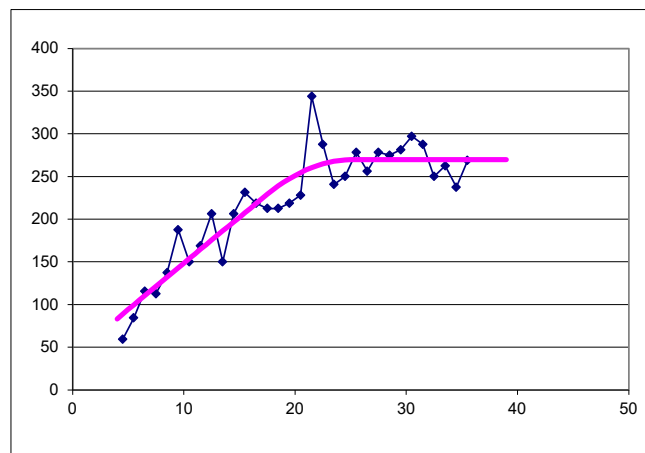
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.20
Estimated maxstrain= 269.79
Thermal strain= 40.00

Estimated transfer length= 20.74
Estimated maxstrain= 269.79
Thermal strain= 40.00

T4 - VAE - 6 ft Panel - North - Raw - Detension



4.5 59
5.5 86
6.5 104
7.5 122
8.5 146
9.5 158
10.5 169
11.5 175
12.5 175
13.5 188
14.5 196
15.5 219
16.5 221
17.5 215
18.5 215
19.5 220
20.5 264
21.5 286
22.5 291
23.5 259
24.5 256
25.5 261
26.5 271
27.5 270
28.5 278
29.5 284
30.5 289
31.5 278
32.5 267
33.5 250
34.5 256
35.5 269

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

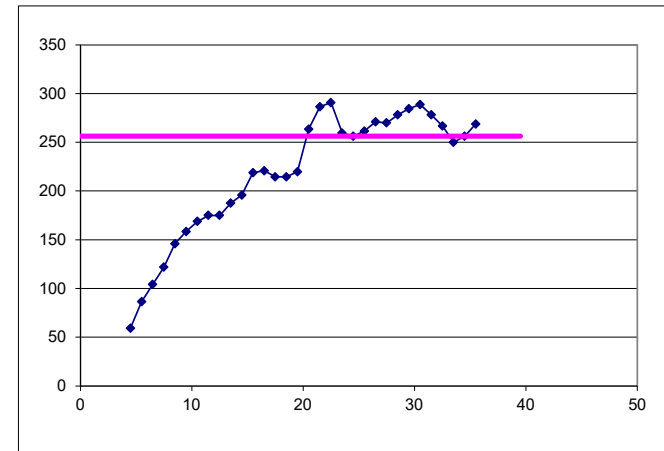
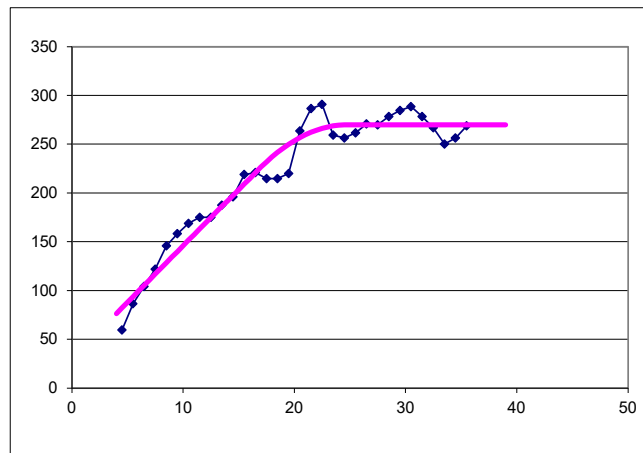
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.70
Estimated maxstrain= 269.80
Thermal strain= 30.00

Estimated transfer length= 20.33
Estimated maxstrain= 269.80
Thermal strain= 30.00

T4 - VAE - 6 ft Panel - North - 3 point - Detension



4.5 59
5.5 83
6.5 102
7.5 128
8.5 141
9.5 151
10.5 170
11.5 173
12.5 176
13.5 193
14.5 203
15.5 204
16.5 216
17.5 219
18.5 218
19.5 243
20.5 258
21.5 264
22.5 270
23.5 280
24.5 263
25.5 261
26.5 268
27.5 274
28.5 278
29.5 284
30.5 278
31.5 276
32.5 267
33.5 261
34.5 264
35.5 266

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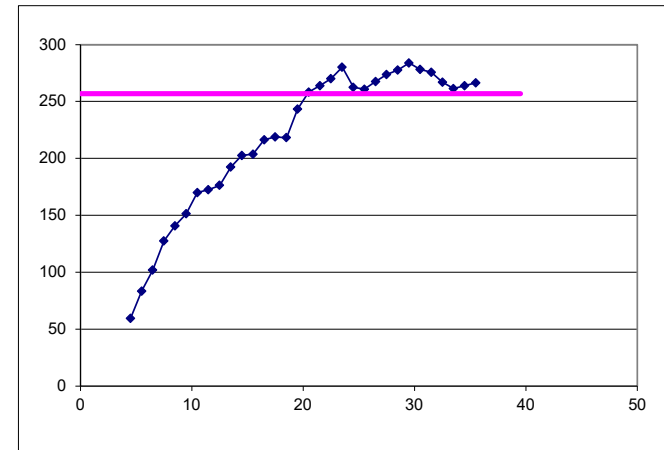
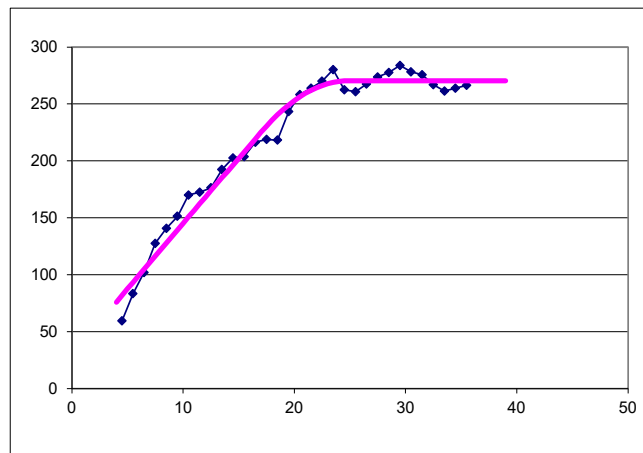
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.90
Estimated maxstrain= 270.41
Thermal strain= 30.00

Estimated transfer length= 20.42
Estimated maxstrain= 270.41
Thermal strain= 30.00

T4 - VAE - 6 ft Panel - North - 5 point - Detension



4.5 3
5.5 78
6.5 131
7.5 106
8.5 153
9.5 126
10.5 153
11.5 156
12.5 181
13.5 194
14.5 191
15.5 199
16.5 203
17.5 219
18.5 272
19.5 231
20.5 306
21.5 278
22.5 247
23.5 284
24.5 294
25.5 347
26.5 291
27.5 284
28.5 291
29.5 288
30.5 288
31.5 303
32.5 269
33.5 263
34.5 263
35.5 300

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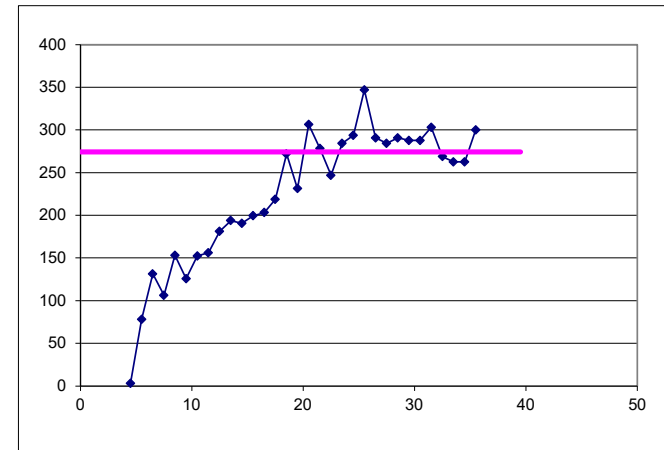
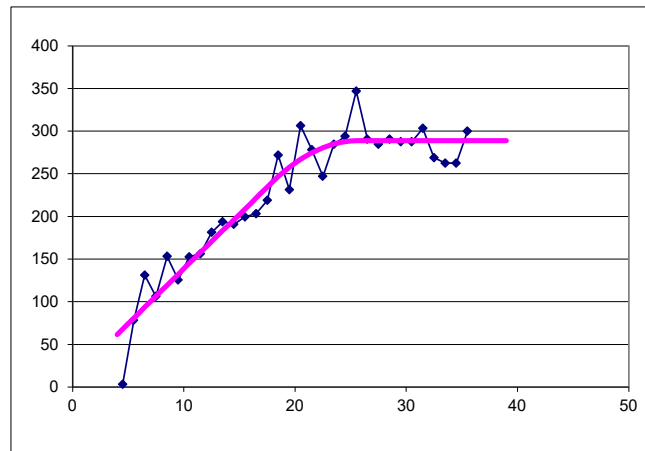
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.70
Estimated maxstrain= 288.90
Thermal strain= 10.00

Estimated transfer length= 20.08
Estimated maxstrain= 288.90
Thermal strain= 10.00

T4 - VAE - 6 ft Panel - South - Raw - Detension



4.5 3
5.5 71
6.5 105
7.5 130
8.5 128
9.5 144
10.5 145
11.5 163
12.5 177
13.5 189
14.5 195
15.5 198
16.5 207
17.5 231
18.5 241
19.5 270
20.5 272
21.5 277
22.5 270
23.5 275
24.5 308
25.5 310
26.5 307
27.5 289
28.5 288
29.5 289
30.5 293
31.5 286
32.5 278
33.5 265
34.5 275
35.5 277

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

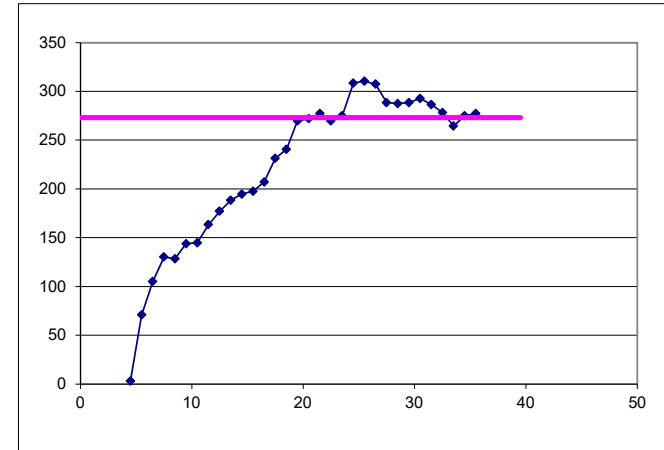
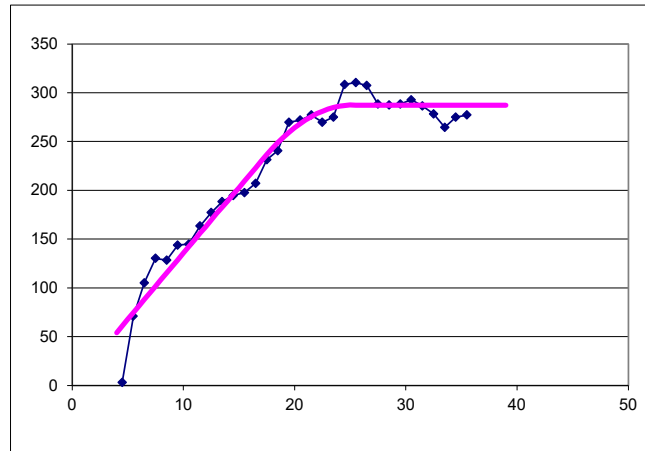
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.20
Estimated maxstrain= 287.39
Thermal strain= 0.00

Estimated transfer length= 20.72
Estimated maxstrain= 287.39
Thermal strain= 0.00

T4 - VAE - 6 ft Panel - South - 3 point - Detension



4.5 3
5.5 71
6.5 94
7.5 119
8.5 134
9.5 139
10.5 154
11.5 162
12.5 175
13.5 184
14.5 194
15.5 201
16.5 217
17.5 225
18.5 246
19.5 261
20.5 267
21.5 269
22.5 282
23.5 290
24.5 293
25.5 300
26.5 301
27.5 300
28.5 288
29.5 291
30.5 288
31.5 282
32.5 277
33.5 279
34.5 273
35.5 266

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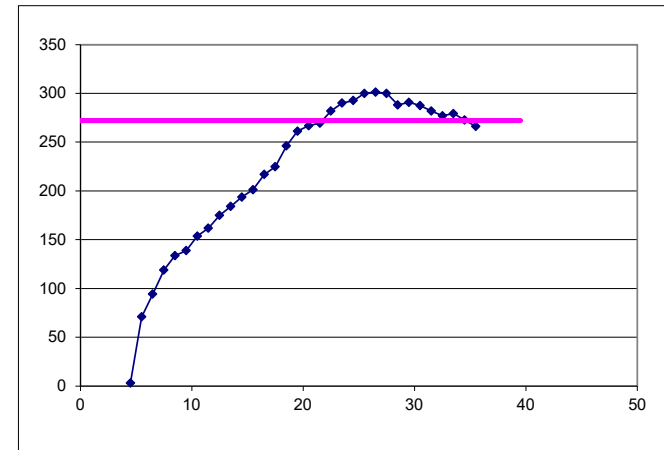
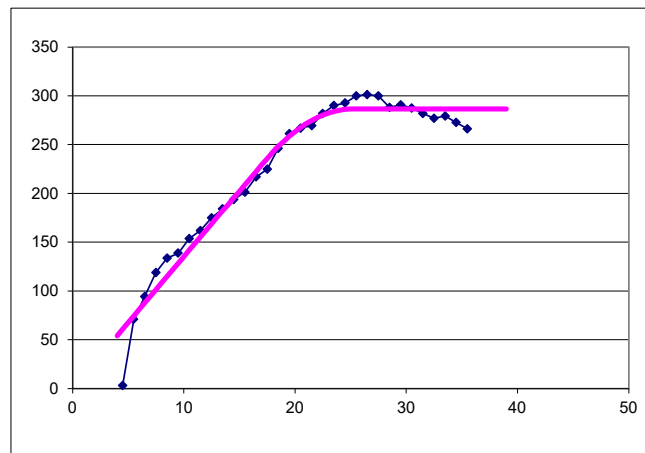
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.20
Estimated maxstrain= 286.48
Thermal strain= 0.00

Estimated transfer length= 21.72
Estimated maxstrain= 286.48
Thermal strain= 0.00

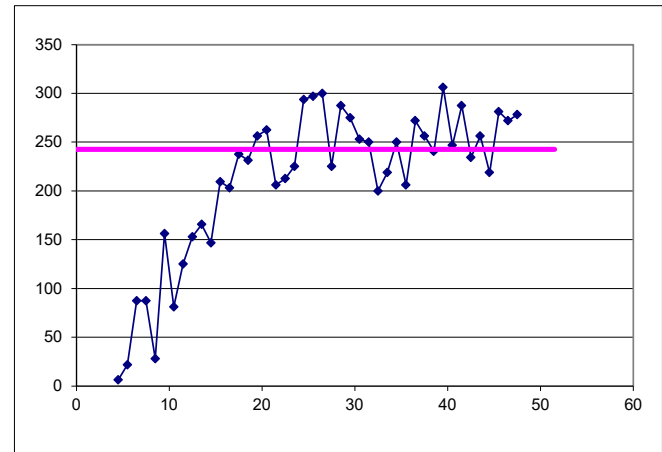
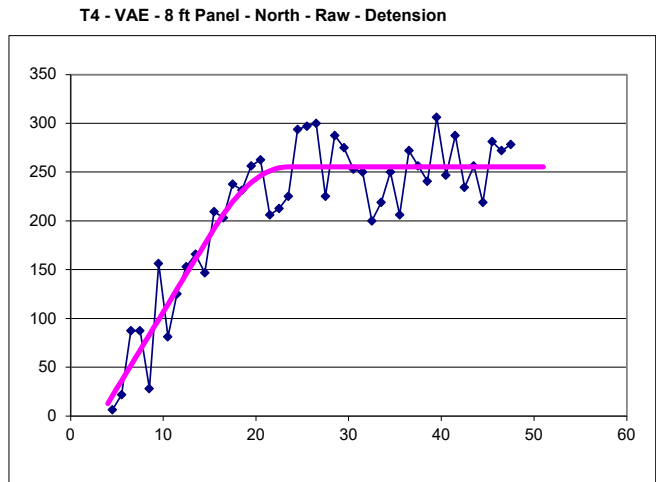
T4 - VAE - 6 ft Panel - South - 5 point - Detension



4.5	6
5.5	22
6.5	88
7.5	88
8.5	28
9.5	156
10.5	81
11.5	125
12.5	153
13.5	166
14.5	147
15.5	209
16.5	203
17.5	238
18.5	231
19.5	256
20.5	263
21.5	206
22.5	213
23.5	225
24.5	294
25.5	297
26.5	300
27.5	225
28.5	288
29.5	275
30.5	253
31.5	250
32.5	200
33.5	219
34.5	250
35.5	206
36.5	272
37.5	256
38.5	241
39.5	306
40.5	247
41.5	288
42.5	234
43.5	256
44.5	219
45.5	281
46.5	272
47.5	278

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 LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length=	8	Estimated transfer length=	19.50	Estimated transfer length=	18.95
Upper thermal strain allowed=	200	Estimated maxstrain=	255.31	Estimated maxstrain=	255.31
Lower thermal strain allowed=	-200	Thermal strain=	-50.00	Thermal strain=	-50.00

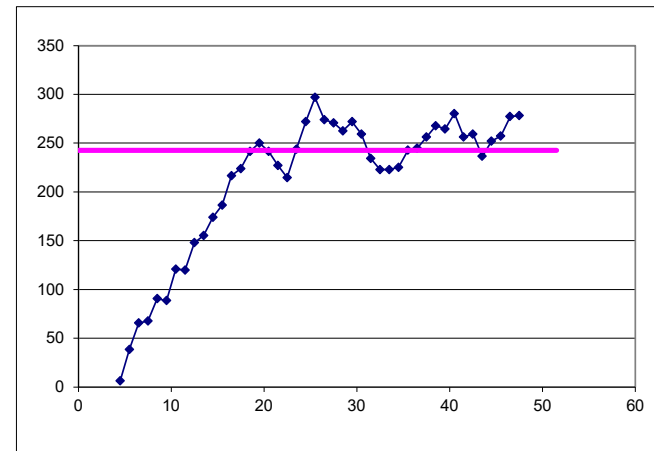
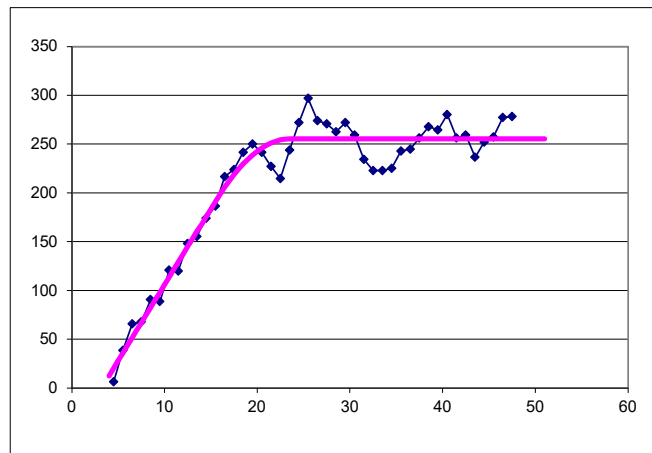


4.5 6
5.5 39
6.5 66
7.5 68
8.5 91
9.5 89
10.5 121
11.5 120
12.5 148
13.5 155
14.5 174
15.5 186
16.5 217
17.5 224
18.5 242
19.5 250
20.5 242
21.5 227
22.5 215
23.5 244
24.5 272
25.5 297
26.5 274
27.5 271
28.5 263
29.5 272
30.5 259
31.5 234
32.5 223
33.5 223
34.5 225
35.5 243
36.5 245
37.5 256
38.5 268
39.5 265
40.5 280
41.5 256
42.5 259
43.5 236
44.5 252
45.5 257
46.5 277
47.5 278

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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length=	8	Estimated transfer length=	19.60	Estimated transfer length=	18.63
Upper thermal strain allowed=	200	Estimated maxstrain=	255.51	Estimated maxstrain=	255.51
Lower thermal strain allowed=	-200	Thermal strain=	-50.00	Thermal strain=	-50.00

T4 - VAE - 8 ft Panel - North - 3 point - Detension



4.5	6
5.5	39
6.5	46
7.5	76
8.5	88
9.5	96
10.5	109
11.5	136
12.5	134
13.5	160
14.5	176
15.5	193
16.5	206
17.5	228
18.5	238
19.5	239
20.5	234
21.5	233
22.5	240
23.5	247
24.5	266
25.5	268
26.5	281
27.5	277
28.5	268
29.5	258
30.5	253
31.5	239
32.5	234
33.5	225
34.5	229
35.5	241
36.5	245
37.5	256
38.5	264
39.5	268
40.5	263
41.5	266
42.5	249
43.5	256
44.5	253
45.5	261
46.5	267
47.5	274

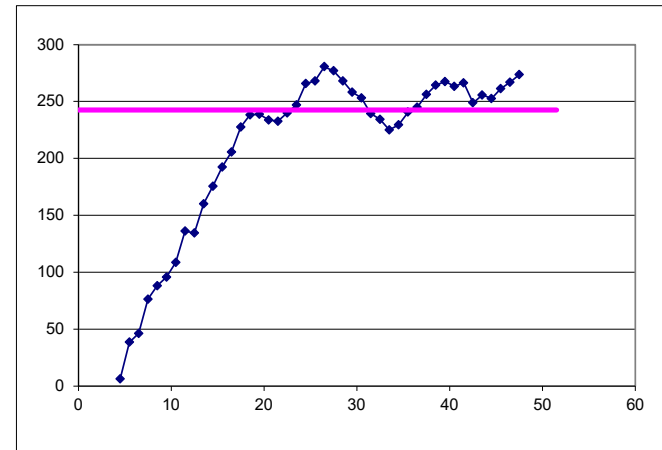
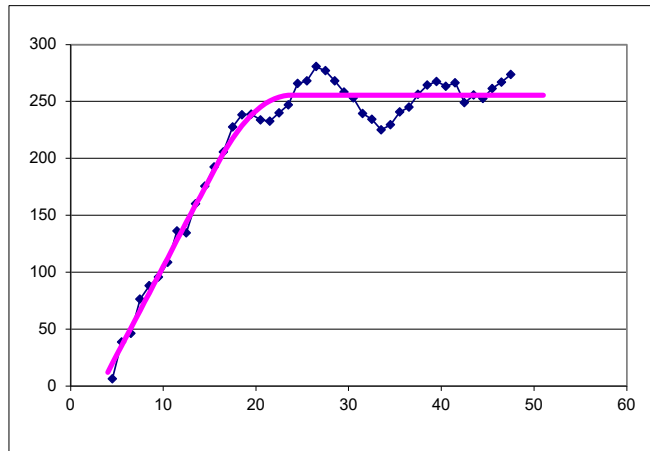
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
 LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
 Upper thermal strain allowed= 200
 Lower thermal strain allowed= -200

Estimated transfer length= 19.70
 Estimated maxstrain= 255.34
 Thermal strain= -50.00

Estimated transfer length= 22.87
 Estimated maxstrain= 255.34
 Thermal strain= -50.00

T4 - VAE - 8 ft Panel - North - 5 point - Detension



4.5 56
5.5 109
6.5 9
7.5 66
8.5 175
9.5 103
10.5 106
11.5 156
12.5 181
13.5 194
14.5 191
15.5 188
16.5 191
17.5 225
18.5 203
19.5 256
20.5 288
21.5 288
22.5 294
23.5 297
24.5 313
25.5 269
26.5 316
27.5 278
28.5 297
29.5 281
30.5 306
31.5 231
32.5 306
33.5 266
34.5 294
35.5 353
36.5 303
37.5 322
38.5 263
39.5 316
40.5 256
41.5 253
42.5 309
43.5 263
44.5 250
45.5 266
46.5 253
47.5 284

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

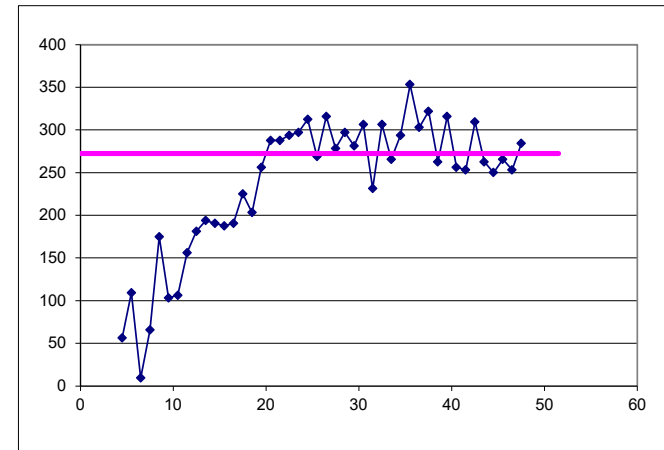
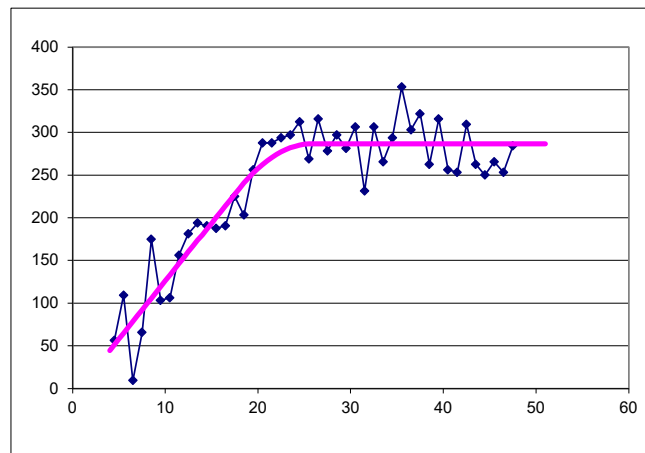
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.80
Estimated maxstrain= 286.64
Thermal strain= -10.00

Estimated transfer length= 20.01
Estimated maxstrain= 286.64
Thermal strain= -10.00

T4 - VAE - 8 ft Panel - South - Raw - Detension



4.5 56
5.5 58
6.5 61
7.5 83
8.5 115
9.5 128
10.5 122
11.5 148
12.5 177
13.5 189
14.5 191
15.5 190
16.5 201
17.5 206
18.5 228
19.5 249
20.5 277
21.5 290
22.5 293
23.5 301
24.5 293
25.5 299
26.5 288
27.5 297
28.5 285
29.5 295
30.5 273
31.5 281
32.5 268
33.5 289
34.5 304
35.5 317
36.5 326
37.5 296
38.5 300
39.5 278
40.5 275
41.5 273
42.5 275
43.5 274
44.5 259
45.5 256
46.5 268
47.5 272

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

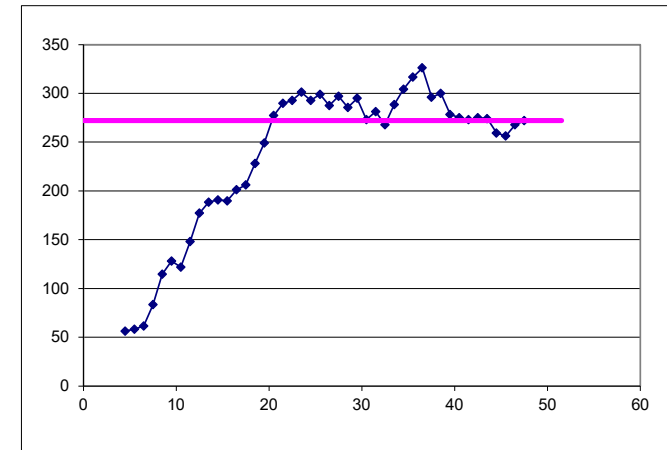
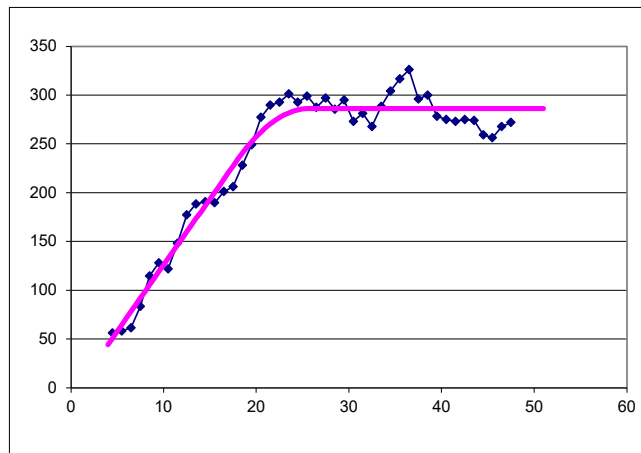
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.80
Estimated maxstrain= 286.36
Thermal strain= -10.00

Estimated transfer length= 20.32
Estimated maxstrain= 286.36
Thermal strain= -10.00

T4 - VAE - 8 ft Panel - South - 3 point - Detension



4.5 56
5.5 58
6.5 83
7.5 93
8.5 92
9.5 121
10.5 144
11.5 148
12.5 166
13.5 182
14.5 189
15.5 198
16.5 199
17.5 213
18.5 233
19.5 252
20.5 266
21.5 284
22.5 296
23.5 292
24.5 298
25.5 294
26.5 294
27.5 288
28.5 296
29.5 279
30.5 284
31.5 278
32.5 281
33.5 290
34.5 304
35.5 308
36.5 307
37.5 311
38.5 292
39.5 282
40.5 279
41.5 279
42.5 266
43.5 268
44.5 268
45.5 263
46.5 266
47.5 271

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

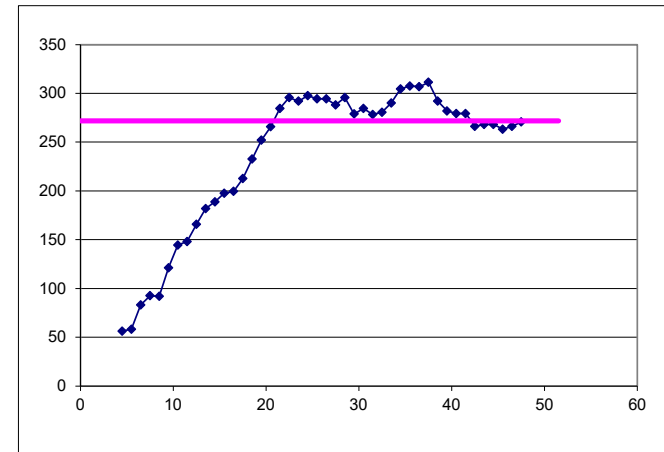
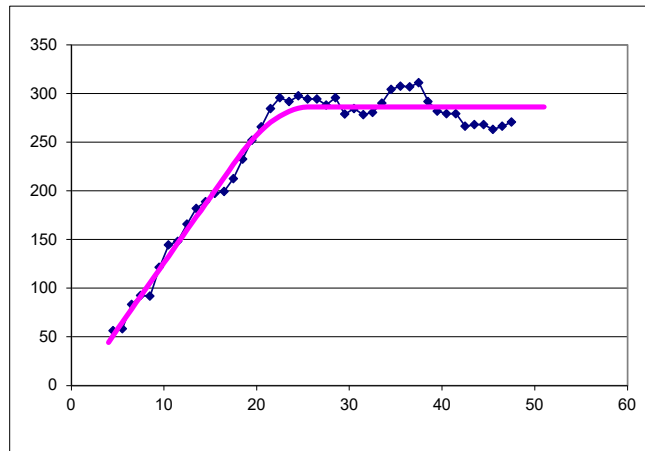
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.80
Estimated maxstrain= 286.30
Thermal strain= -10.00

Estimated transfer length= 20.84
Estimated maxstrain= 286.30
Thermal strain= -10.00

T4 - VAE - 8 ft Panel - South - 5 point - Detension



4.5 409
5.5 447
6.5 422
7.5 469
8.5 481
9.5 506
10.5 513
11.5 531
12.5 531
13.5 531
14.5 588
15.5 519
16.5 631
17.5 638
18.5 663
19.5 575
20.5 691
21.5 631
22.5 725
23.5 759
24.5 713
25.5 759
26.5 669
27.5 784
28.5 775
29.5 756
30.5 703
31.5 781
32.5 769
33.5 769
34.5 738
35.5 750

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

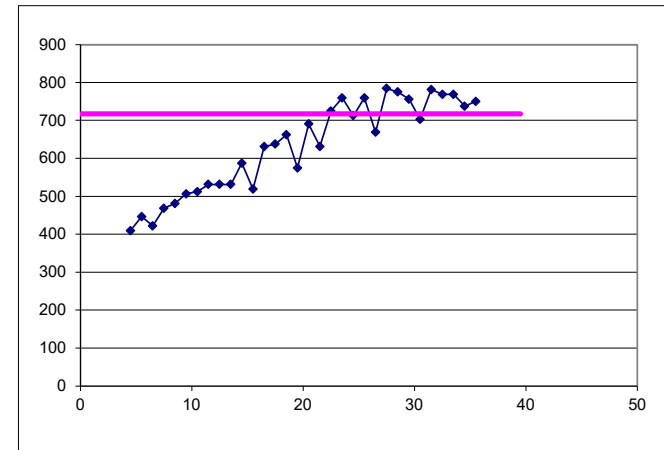
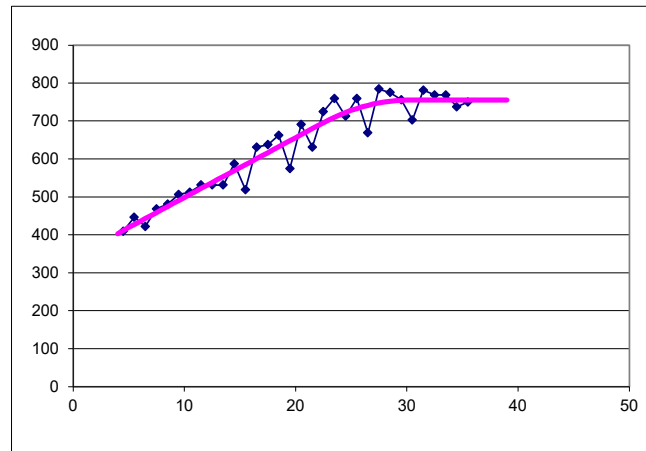
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 26.20
Estimated maxstrain= 755.13
Thermal strain= 340.00

Estimated transfer length= 22.42
Estimated maxstrain= 755.13
Thermal strain= 340.00

T4 - VAE - 6 ft Panel - North - Raw - 21 days



4.5 409
5.5 426
6.5 446
7.5 457
8.5 485
9.5 500
10.5 517
11.5 525
12.5 531
13.5 550
14.5 546
15.5 579
16.5 596
17.5 644
18.5 625
19.5 643
20.5 632
21.5 682
22.5 705
23.5 732
24.5 744
25.5 714
26.5 738
27.5 743
28.5 772
29.5 745
30.5 747
31.5 751
32.5 773
33.5 758
34.5 752
35.5 727

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

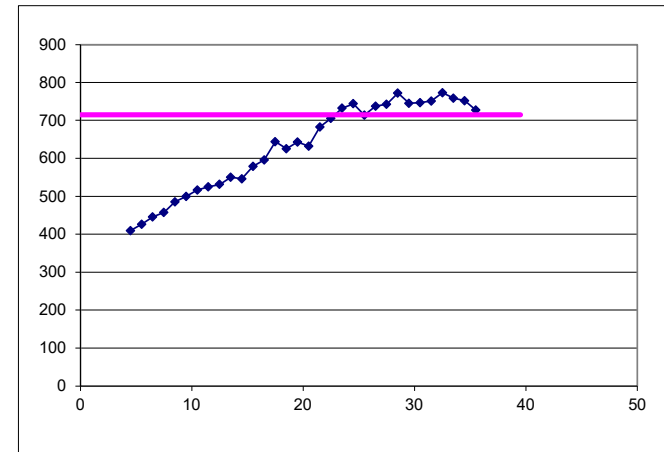
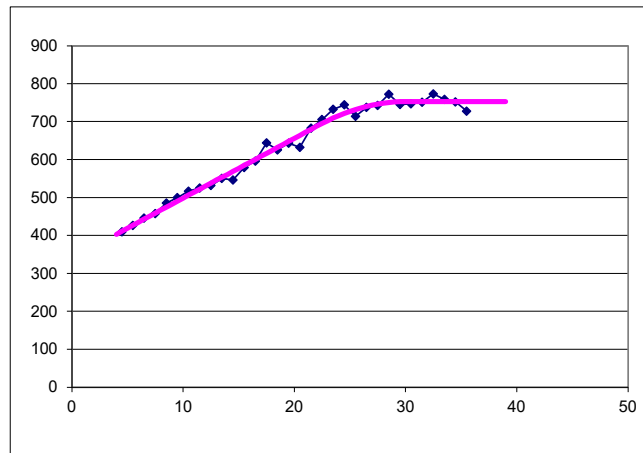
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 26.10
Estimated maxstrain= 753.01
Thermal strain= 340.00

Estimated transfer length= 22.87
Estimated maxstrain= 753.01
Thermal strain= 340.00

T4 - VAE - 6 ft Panel - North - 3 point - 21 days



4.5 409
5.5 426
6.5 446
7.5 465
8.5 478
9.5 500
10.5 513
11.5 523
12.5 539
13.5 540
14.5 560
15.5 581
16.5 608
17.5 605
18.5 639
19.5 639
20.5 657
21.5 676
22.5 704
23.5 718
24.5 725
25.5 737
26.5 740
27.5 749
28.5 738
29.5 760
30.5 757
31.5 756
32.5 752
33.5 761
34.5 744
35.5 733

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

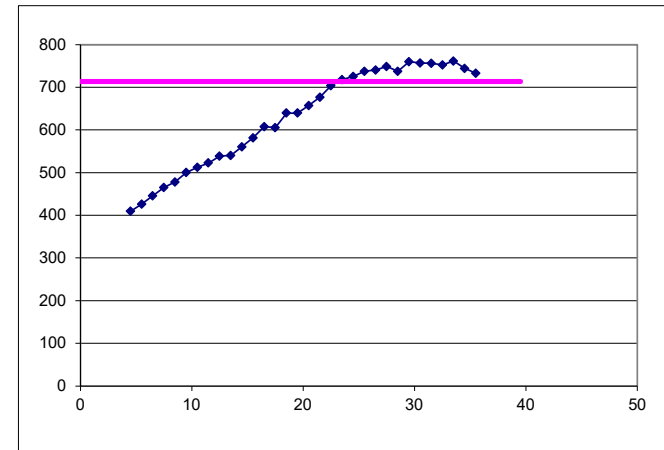
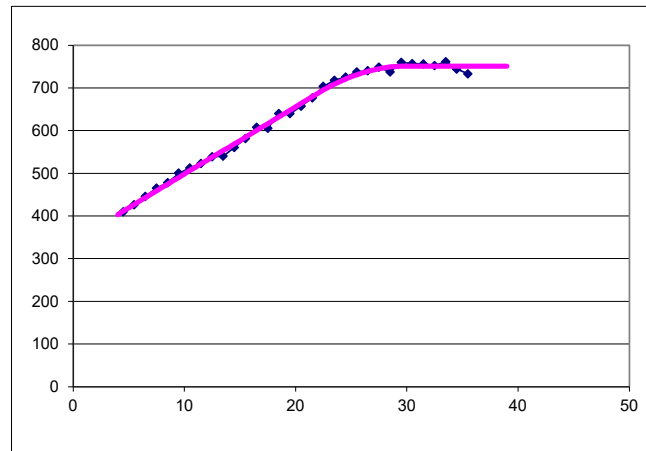
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 26.00
Estimated maxstrain= 751.26
Thermal strain= 340.00

Estimated transfer length= 23.22
Estimated maxstrain= 751.26
Thermal strain= 340.00

T4 - VAE - 6 ft Panel - North - 5 point - 21 days



4.5 322
5.5 397
6.5 375
7.5 469
8.5 466
9.5 505
10.5 544
11.5 574
12.5 621
13.5 642
14.5 666
15.5 618
16.5 741
17.5 775
18.5 672
19.5 731
20.5 688
21.5 697
22.5 672
23.5 666
24.5 694
25.5 734
26.5 816
27.5 766
28.5 747
29.5 800
30.5 738
31.5 759
32.5 706
33.5 775
34.5 713
35.5 694

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

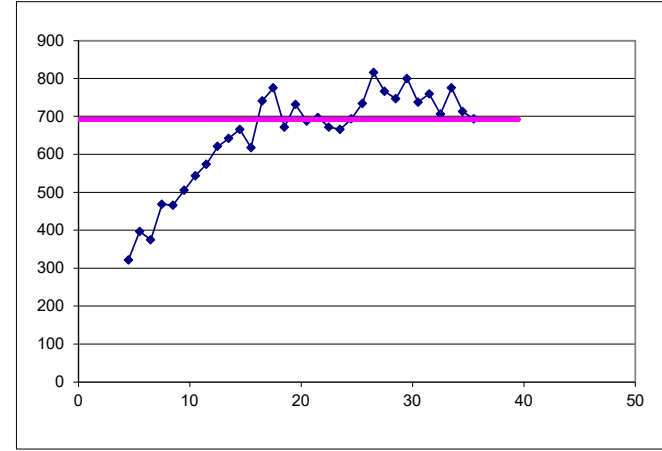
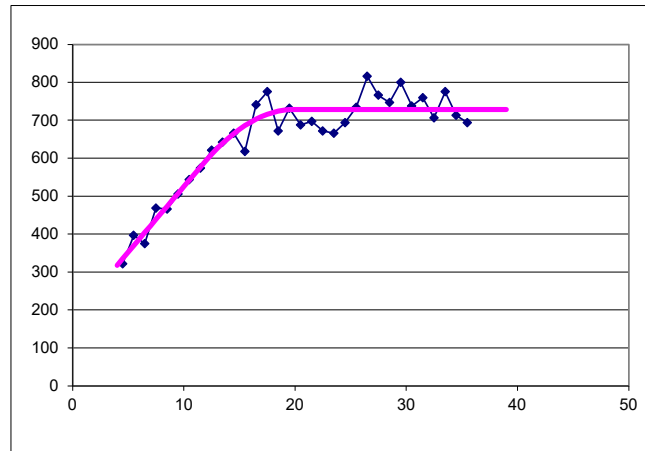
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 15.90
Estimated maxstrain= 728.39
Thermal strain= 180.00

Estimated transfer length= 16.11
Estimated maxstrain= 728.39
Thermal strain= 180.00

T4 - VAE - 6 ft Panel - South - Raw - 21 days



4.5 322
5.5 365
6.5 414
7.5 436
8.5 480
9.5 505
10.5 541
11.5 580
12.5 612
13.5 643
14.5 642
15.5 675
16.5 711
17.5 729
18.5 726
19.5 697
20.5 705
21.5 685
22.5 678
23.5 677
24.5 698
25.5 748
26.5 772
27.5 776
28.5 771
29.5 761
30.5 766
31.5 734
32.5 747
33.5 731
34.5 727
35.5 719

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

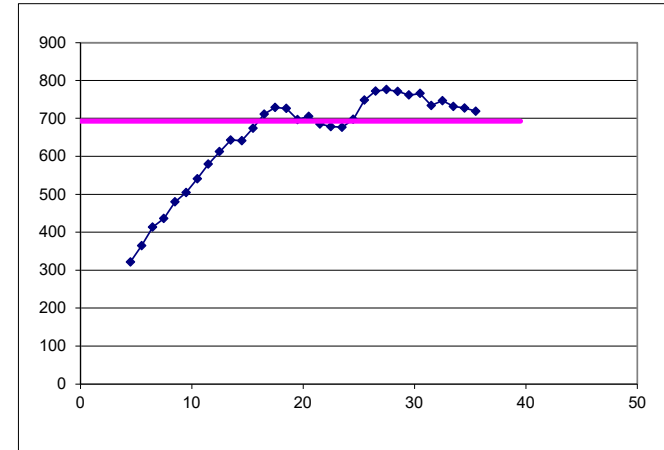
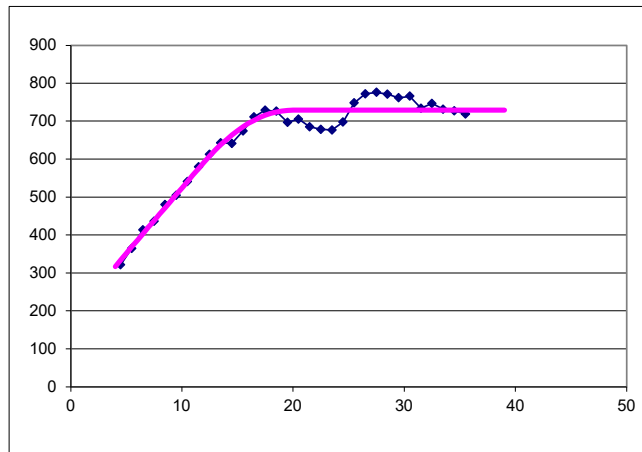
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 16.00
Estimated maxstrain= 729.26
Thermal strain= 180.00

Estimated transfer length= 16.00
Estimated maxstrain= 729.26
Thermal strain= 180.00

T4 - VAE - 6 ft Panel - South - 3 point - 21 days



4.5 322
5.5 365
6.5 406
7.5 442
8.5 472
9.5 511
10.5 542
11.5 577
12.5 609
13.5 624
14.5 657
15.5 688
16.5 694
17.5 707
18.5 721
19.5 713
20.5 692
21.5 691
22.5 683
23.5 693
24.5 716
25.5 735
26.5 751
27.5 773
28.5 773
29.5 762
30.5 750
31.5 756
32.5 738
33.5 729
34.5 728
35.5 734

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

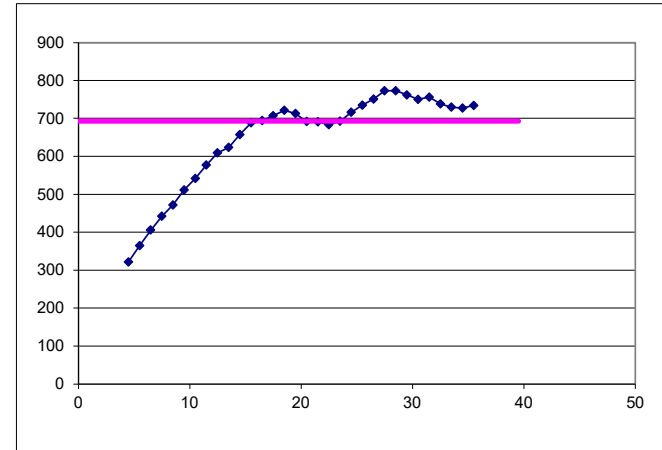
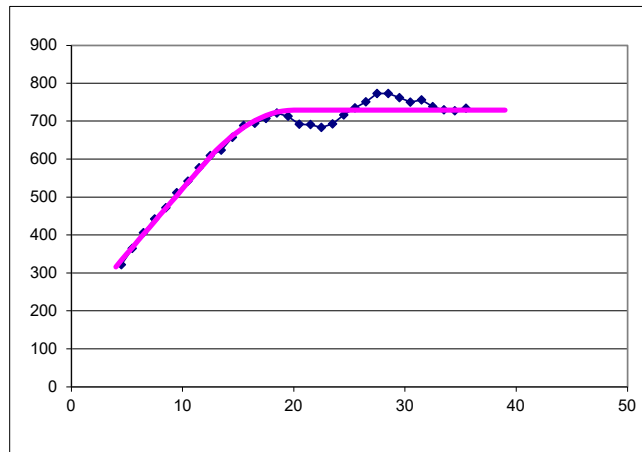
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= **16.10**
Estimated maxstrain= **729.41**
Thermal strain= **180.00**

Estimated transfer length= **16.31**
Estimated maxstrain= **729.41**
Thermal strain= **180.00**

T4 - VAE - 6 ft Panel - South - 5 point - 21 days



4.5 475
5.5 353
6.5 438
7.5 444
8.5 378
9.5 581
10.5 431
11.5 444
12.5 522
13.5 509
14.5 572
15.5 603
16.5 653
17.5 694
18.5 706
19.5 825
20.5 625
21.5 575
22.5 606
23.5 794
24.5 731
25.5 803
26.5 813
27.5 719
28.5 800
29.5 800
30.5 759
31.5 738
32.5 719
33.5 781
34.5 781
35.5 706
36.5 797
37.5 863
38.5 797
39.5 819
40.5 822
41.5 869
42.5 791
43.5 894
44.5 750
45.5 844
46.5 803
47.5 822

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

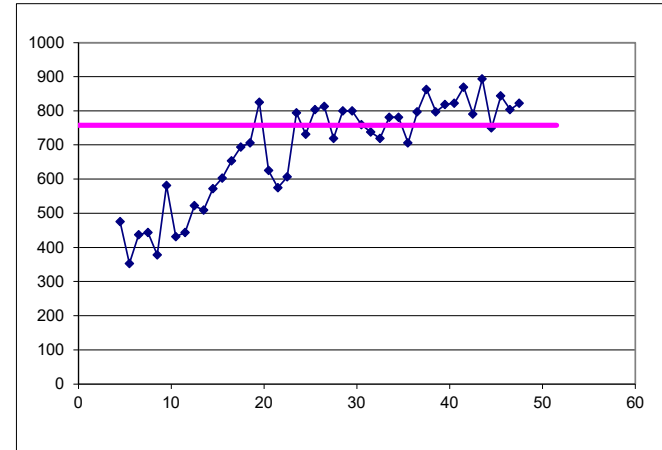
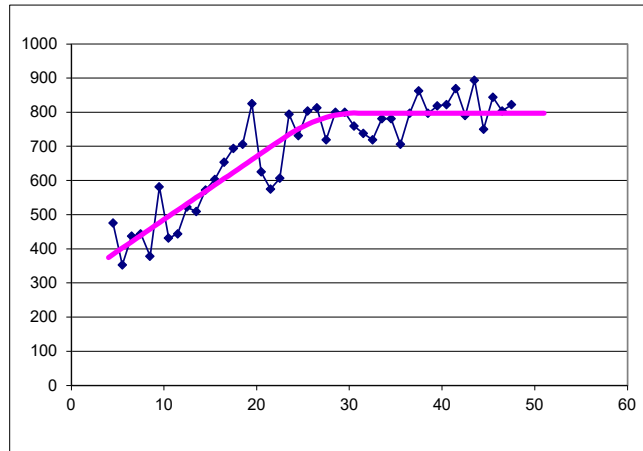
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 26.80
Estimated maxstrain= 797.59
Thermal strain= 300.00

Estimated transfer length= 18.93
Estimated maxstrain= 797.59
Thermal strain= 300.00

T4 - VAE - 8 ft Panel - North - Raw - 21 days



4.5 475
5.5 422
6.5 411
7.5 420
8.5 468
9.5 464
10.5 485
11.5 466
12.5 492
13.5 534
14.5 561
15.5 609
16.5 650
17.5 684
18.5 742
19.5 719
20.5 675
21.5 602
22.5 658
23.5 710
24.5 776
25.5 782
26.5 778
27.5 777
28.5 773
29.5 786
30.5 766
31.5 739
32.5 746
33.5 760
34.5 756
35.5 761
36.5 789
37.5 819
38.5 826
39.5 813
40.5 836
41.5 827
42.5 851
43.5 811
44.5 829
45.5 799
46.5 823
47.5 830

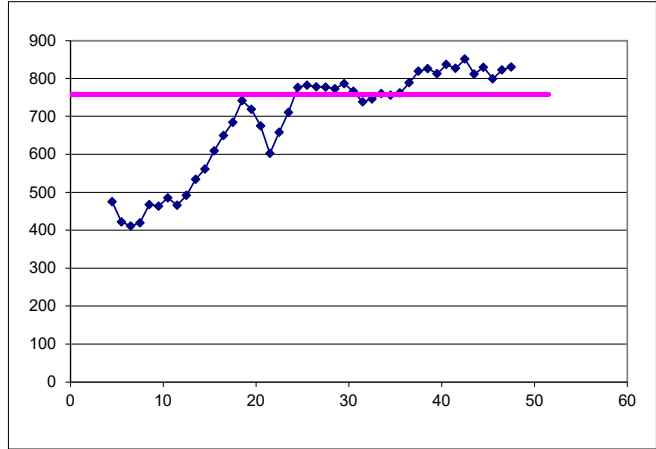
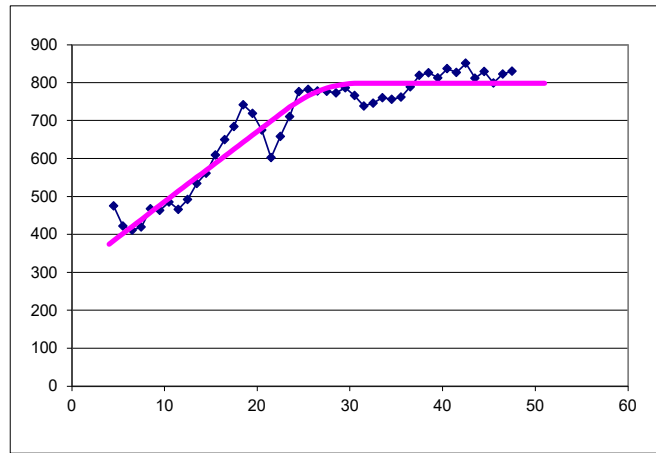
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length=	26.80
Estimated maxstrain=	798.18
Thermal strain=	300.00

Estimated transfer length=	24.23
Estimated maxstrain=	798.18
Thermal strain=	300.00

T4 - VAE - 8 ft Panel - North - 3 point - 21 days



4.5 475
5.5 422
6.5 418
7.5 439
8.5 454
9.5 456
10.5 471
11.5 498
12.5 496
13.5 530
14.5 572
15.5 606
16.5 646
17.5 696
18.5 701
19.5 685
20.5 668
21.5 685
22.5 666
23.5 702
24.5 749
25.5 772
26.5 773
27.5 787
28.5 778
29.5 763
30.5 763
31.5 759
32.5 756
33.5 745
34.5 757
35.5 786
36.5 789
37.5 796
38.5 819
39.5 834
40.5 819
41.5 839
42.5 825
43.5 829
44.5 816
45.5 823
46.5 817
47.5 829

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

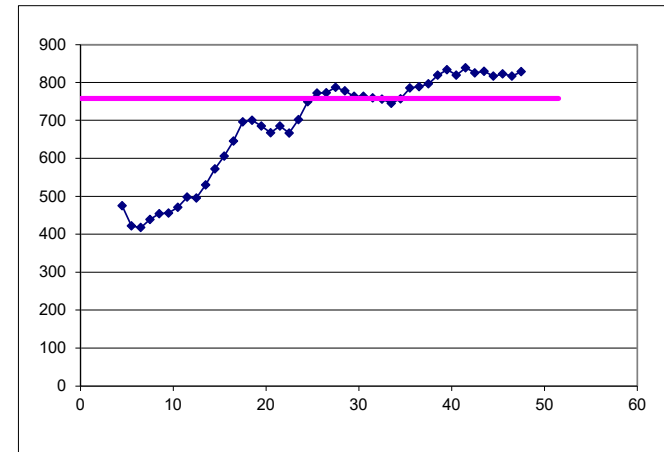
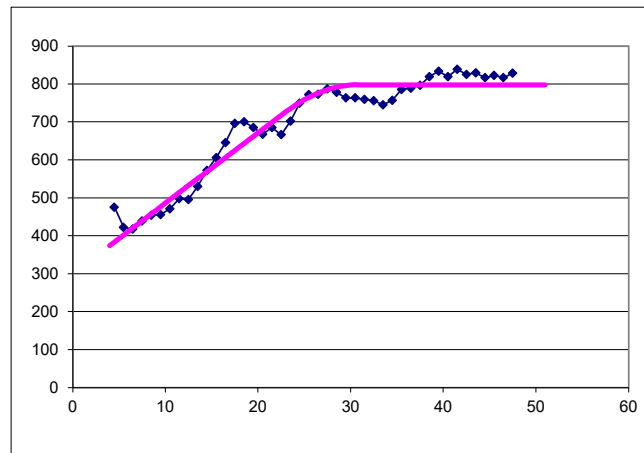
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 300
Lower thermal strain allowed= -300

Estimated transfer length= 26.80
Estimated maxstrain= 798.03
Thermal strain= 300.00

Estimated transfer length= 24.89
Estimated maxstrain= 798.03
Thermal strain= 300.00

T4 - VAE - 8 ft Panel - North - 5 point - 21 days



4.5 256
5.5 309
6.5 338
7.5 359
8.5 481
9.5 416
10.5 394
11.5 494
12.5 619
13.5 600
14.5 603
15.5 531
16.5 584
17.5 588
18.5 647
19.5 656
20.5 625
21.5 775
22.5 731
23.5 853
24.5 788
25.5 794
26.5 884
27.5 841
28.5 828
29.5 838
30.5 881
31.5 750
32.5 906
33.5 753
34.5 750
35.5 916
36.5 878
37.5 903
38.5 888
39.5 897
40.5 813
41.5 853
42.5 909
43.5 831
44.5 719
45.5 853
46.5 809
47.5 866

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

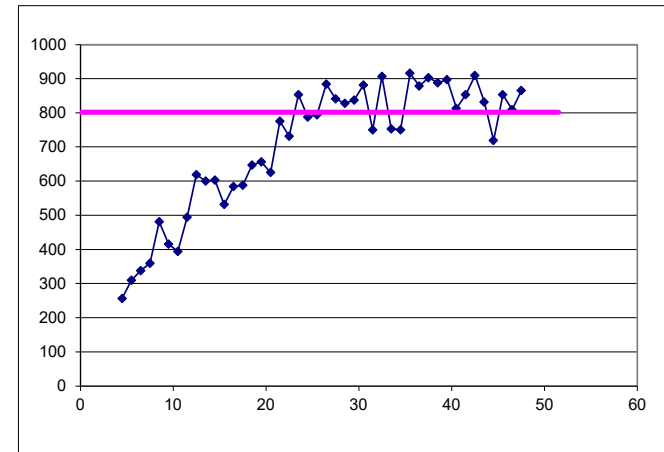
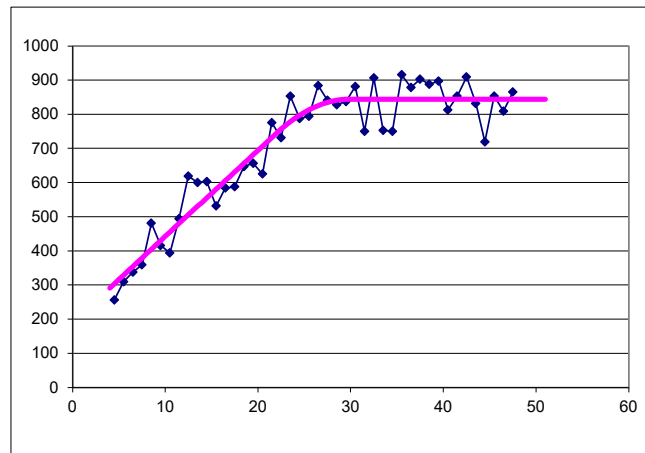
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 25.90
Estimated maxstrain= 844.18
Thermal strain= 190.00

Estimated transfer length= 23.08
Estimated maxstrain= 844.18
Thermal strain= 190.00

T4 - VAE - 8 ft Panel - South - Raw - 21 days



4.5 256
5.5 301
6.5 335
7.5 393
8.5 419
9.5 430
10.5 434
11.5 502
12.5 571
13.5 607
14.5 578
15.5 573
16.5 568
17.5 606
18.5 630
19.5 643
20.5 685
21.5 710
22.5 786
23.5 791
24.5 811
25.5 822
26.5 840
27.5 851
28.5 835
29.5 849
30.5 823
31.5 846
32.5 803
33.5 803
34.5 806
35.5 848
36.5 899
37.5 890
38.5 896
39.5 866
40.5 854
41.5 858
42.5 865
43.5 820
44.5 801
45.5 794
46.5 843
47.5 832

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

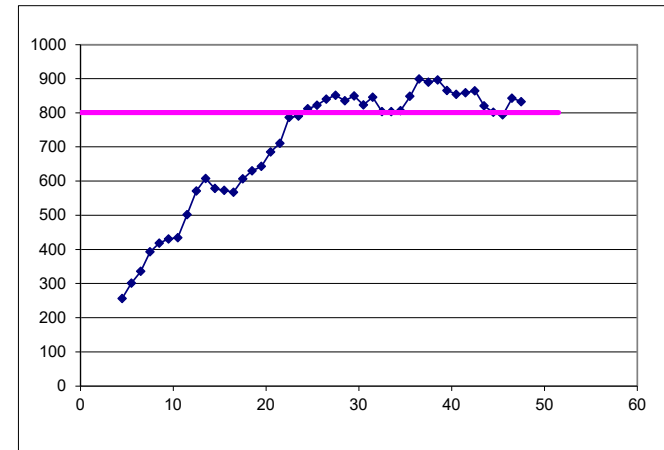
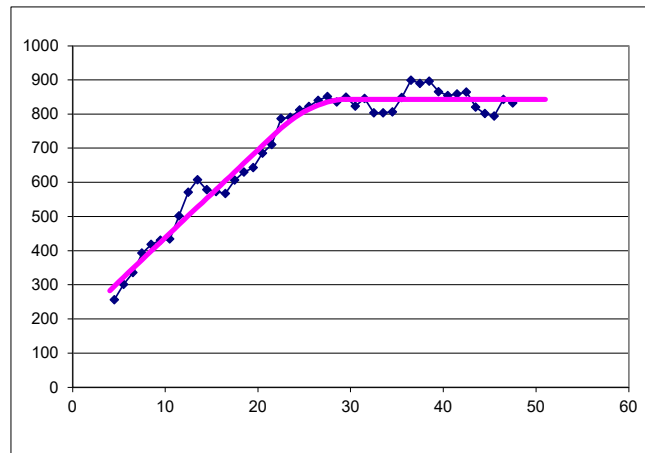
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 25.70
Estimated maxstrain= 843.30
Thermal strain= 180.00

Estimated transfer length= 24.00
Estimated maxstrain= 843.30
Thermal strain= 180.00

T4 - VAE - 8 ft Panel - South - 3 point - 21 days



4.5 256
5.5 301
6.5 349
7.5 381
8.5 398
9.5 429
10.5 481
11.5 504
12.5 542
13.5 569
14.5 588
15.5 581
16.5 591
17.5 601
18.5 620
19.5 658
20.5 687
21.5 728
22.5 754
23.5 788
24.5 810
25.5 832
26.5 827
27.5 837
28.5 854
29.5 828
30.5 841
31.5 826
32.5 808
33.5 815
34.5 841
35.5 840
36.5 867
37.5 896
38.5 876
39.5 871
40.5 872
41.5 861
42.5 825
43.5 833
44.5 824
45.5 816
46.5 814
47.5 831

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

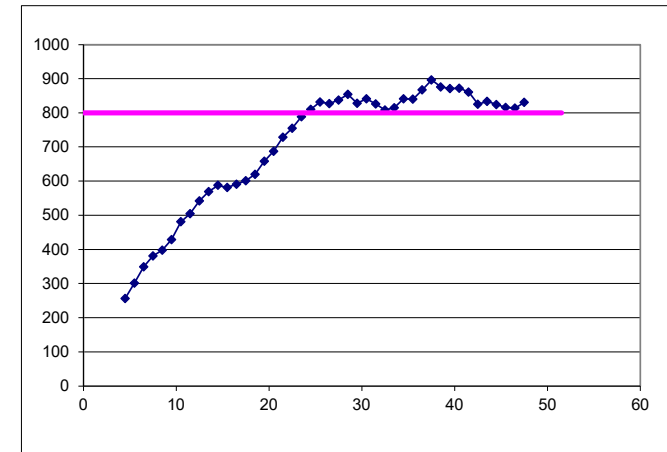
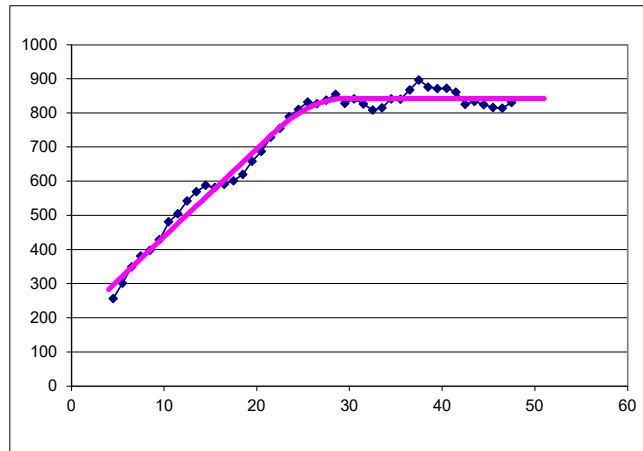
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 25.70
Estimated maxstrain= 842.57
Thermal strain= 180.00

Estimated transfer length= 24.06
Estimated maxstrain= 842.57
Thermal strain= 180.00

T4 - VAE - 8 ft Panel - South - 5 point - 21 days



4.5 131
5.5 144
6.5 122
7.5 163
8.5 194
9.5 178
10.5 188
11.5 206
12.5 200
13.5 206
14.5 234
15.5 247
16.5 275
17.5 306
18.5 300
19.5 294
20.5 319
21.5 313
22.5 319
23.5 316
24.5 303
25.5 313
26.5 331
27.5 319
28.5 294
29.5 322
30.5 331
31.5 316
32.5 331
33.5 309
34.5 316
35.5 291

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

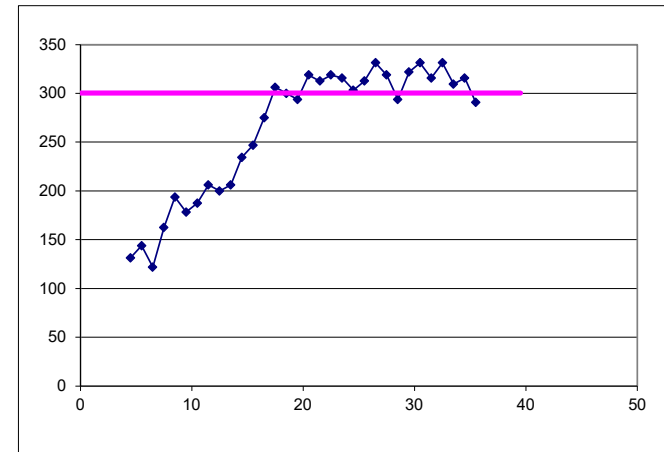
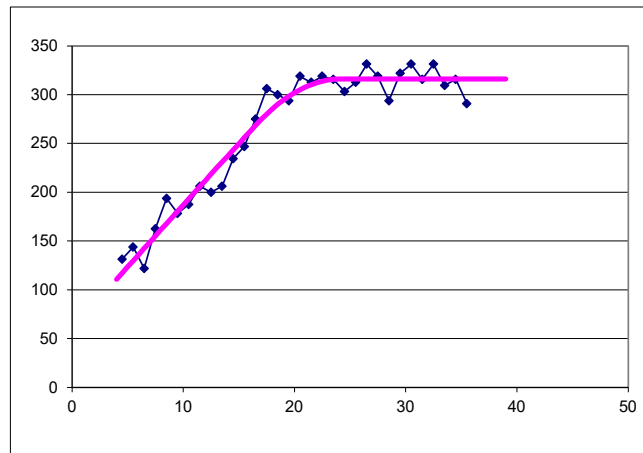
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.20
Estimated maxstrain= 316.14
Thermal strain= 60.00

Estimated transfer length= 17.31
Estimated maxstrain= 316.14
Thermal strain= 60.00

T2 - 004 - 6 ft Panel - North - Raw - Detension



4.5 131
5.5 132
6.5 143
7.5 159
8.5 178
9.5 186
10.5 191
11.5 198
12.5 204
13.5 214
14.5 229
15.5 252
16.5 276
17.5 294
18.5 300
19.5 304
20.5 308
21.5 317
22.5 316
23.5 313
24.5 310
25.5 316
26.5 321
27.5 315
28.5 311
29.5 316
30.5 323
31.5 326
32.5 319
33.5 319
34.5 305
35.5 298

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

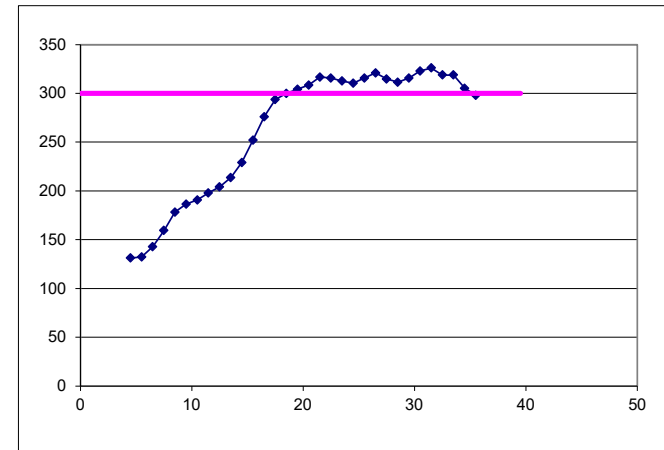
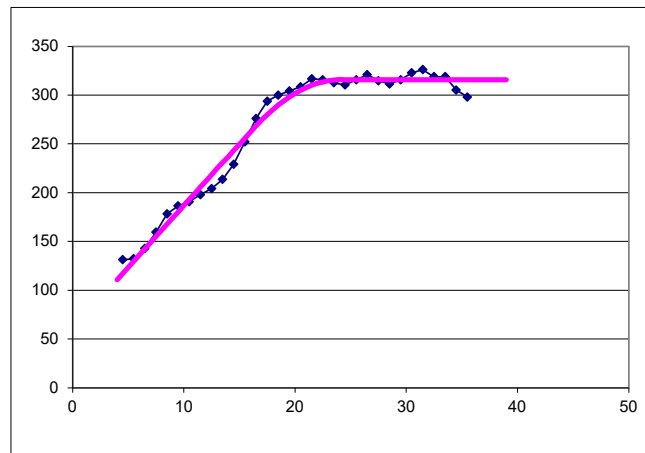
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.20
Estimated maxstrain= 315.92
Thermal strain= 60.00

Estimated transfer length= 18.53
Estimated maxstrain= 315.92
Thermal strain= 60.00

T2 - 004 - 6 ft Panel - North - 3 point - Detension



4.5 131
5.5 132
6.5 151
7.5 160
8.5 169
9.5 186
10.5 193
11.5 196
12.5 207
13.5 219
14.5 233
15.5 254
16.5 273
17.5 284
18.5 299
19.5 306
20.5 309
21.5 312
22.5 314
23.5 313
24.5 316
25.5 316
26.5 312
27.5 316
28.5 319
29.5 316
30.5 319
31.5 322
32.5 321
33.5 313
34.5 307
35.5 297

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

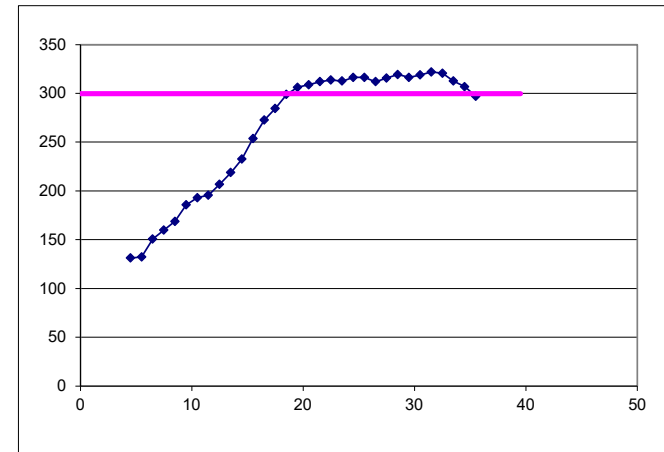
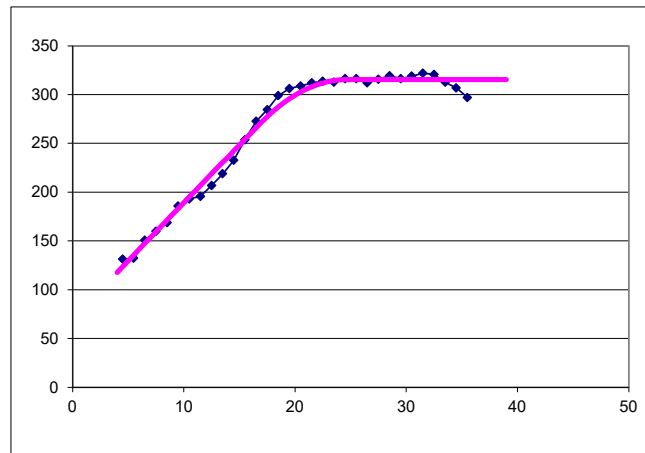
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.60
Estimated maxstrain= 315.32
Thermal strain= 70.00

Estimated transfer length= 18.61
Estimated maxstrain= 315.32
Thermal strain= 70.00

T2 - 004 - 6 ft Panel - North - 5 point - Detension



4.5 91
5.5 88
6.5 81
7.5 125
8.5 125
9.5 150
10.5 159
11.5 163
12.5 194
13.5 184
14.5 203
15.5 213
16.5 241
17.5 244
18.5 250
19.5 272
20.5 269
21.5 300
22.5 278
23.5 281
24.5 284
25.5 291
26.5 275
27.5 300
28.5 269
29.5 253
30.5 263
31.5 281
32.5 284
33.5 291
34.5 281
35.5 288

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

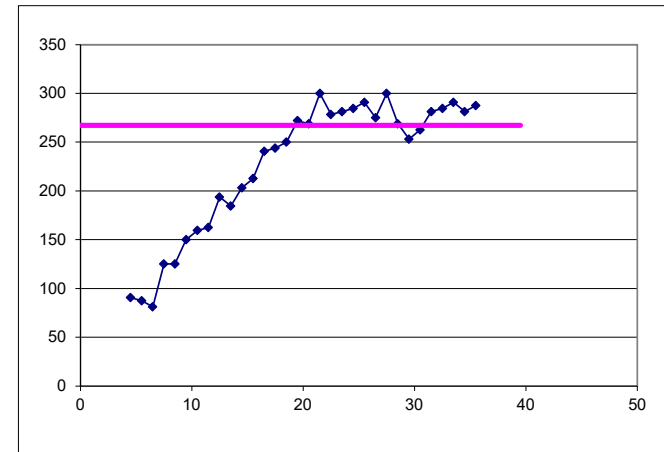
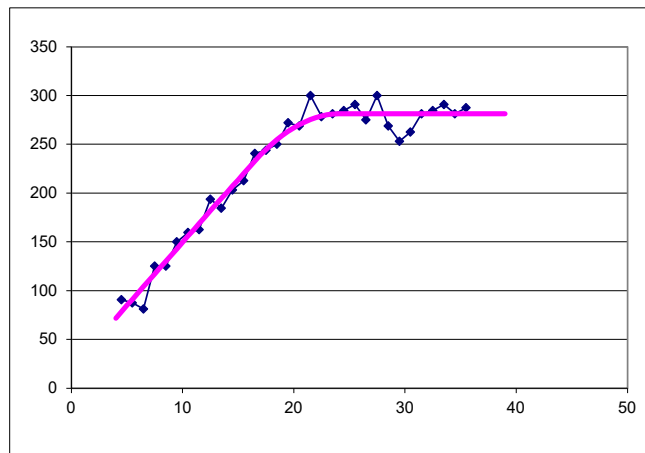
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.20
Estimated maxstrain= 281.40
Thermal strain= 20.00

Estimated transfer length= 19.29
Estimated maxstrain= 281.40
Thermal strain= 20.00

T2 - 004 - 6 ft Panel - South - Raw - Detension



4.5 91
5.5 86
6.5 98
7.5 110
8.5 133
9.5 145
10.5 157
11.5 172
12.5 180
13.5 194
14.5 200
15.5 219
16.5 232
17.5 245
18.5 255
19.5 264
20.5 280
21.5 282
22.5 286
23.5 281
24.5 285
25.5 283
26.5 289
27.5 281
28.5 274
29.5 261
30.5 266
31.5 276
32.5 285
33.5 285
34.5 286
35.5 286

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

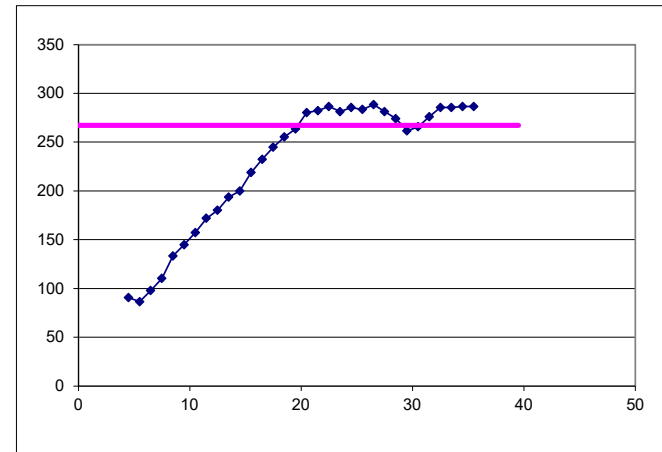
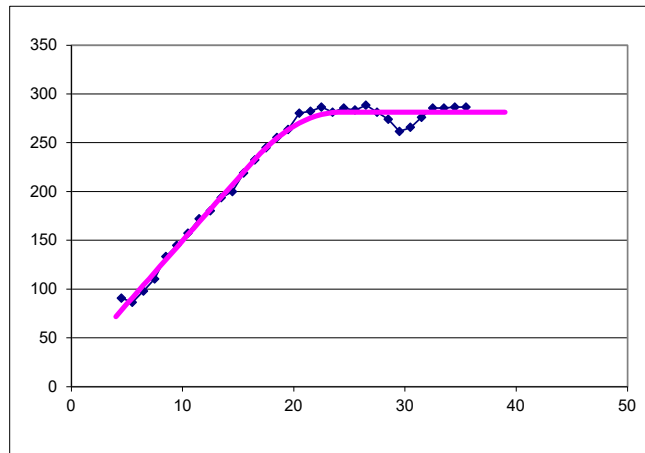
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.20
Estimated maxstrain= 281.33
Thermal strain= 20.00

Estimated transfer length= 19.72
Estimated maxstrain= 281.33
Thermal strain= 20.00

T2 - 004 - 6 ft Panel - South - 3 point - Detension



4.5 91
5.5 86
6.5 102
7.5 114
8.5 128
9.5 144
10.5 158
11.5 170
12.5 181
13.5 191
14.5 207
15.5 217
16.5 230
17.5 244
18.5 255
19.5 267
20.5 274
21.5 280
22.5 283
23.5 287
24.5 282
25.5 286
26.5 284
27.5 278
28.5 272
29.5 273
30.5 270
31.5 274
32.5 280
33.5 285
34.5 287
35.5 293

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

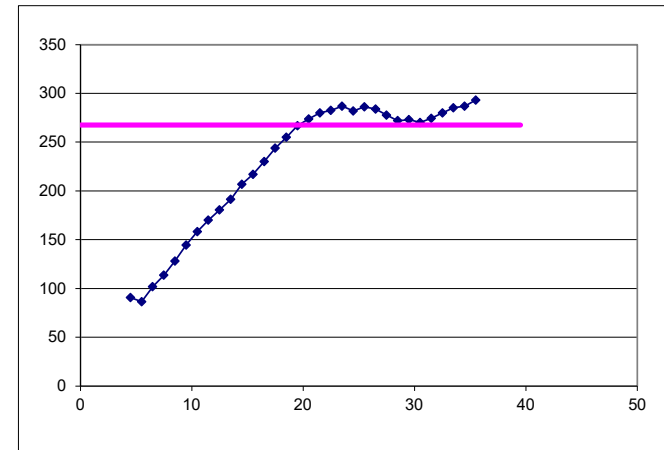
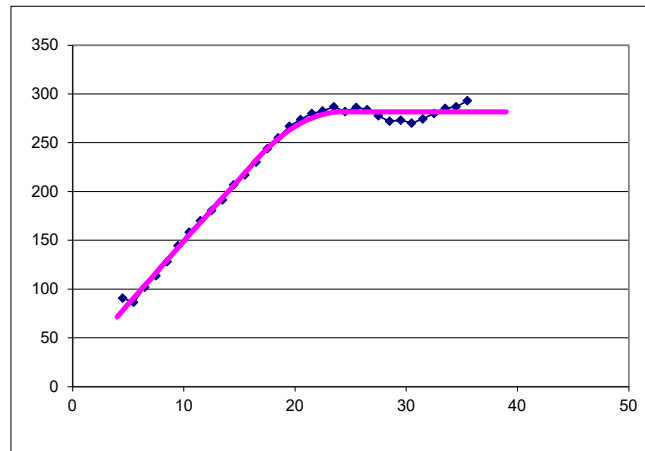
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.30
Estimated maxstrain= 281.68
Thermal strain= 20.00

Estimated transfer length= 19.61
Estimated maxstrain= 281.68
Thermal strain= 20.00

T2 - 004 - 6 ft Panel - South - 5 point - Detension



4.5 75
5.5 131
6.5 166
7.5 172
8.5 216
9.5 178
10.5 219
11.5 241
12.5 238
13.5 263
14.5 263
15.5 281
16.5 288
17.5 347
18.5 316
19.5 322
20.5 316
21.5 397
22.5 372
23.5 356
24.5 378
25.5 366
26.5 359
27.5 359
28.5 378
29.5 347
30.5 450
31.5 353
32.5 363
33.5 375
34.5 397
35.5 363
36.5 384
37.5 384
38.5 306
39.5 366
40.5 403
41.5 416
42.5 369
43.5 394
44.5 363
45.5 341
46.5 369
47.5 397

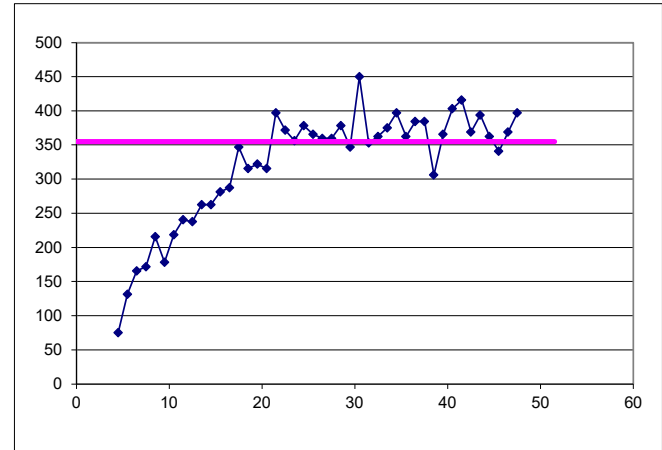
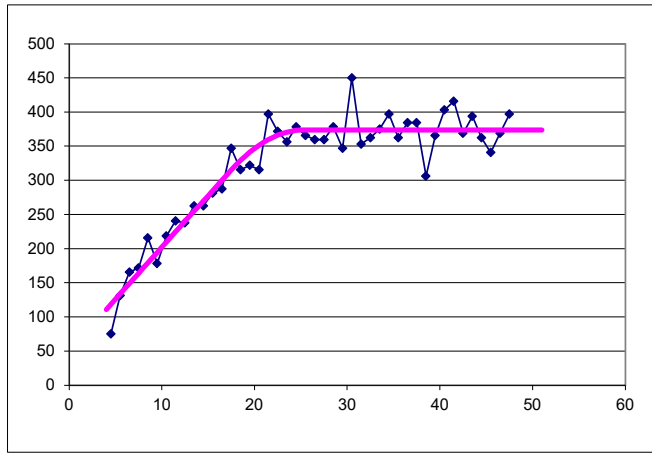
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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.30
Estimated maxstrain= 373.73
Thermal strain= 50.00

Estimated transfer length= 20.99
Estimated maxstrain= 373.73
Thermal strain= 50.00

T2 - 004 - 8 ft Panel - North - Raw - Detension



4.5 75
5.5 124
6.5 156
7.5 184
8.5 189
9.5 204
10.5 213
11.5 232
12.5 247
13.5 254
14.5 269
15.5 277
16.5 305
17.5 317
18.5 328
19.5 318
20.5 345
21.5 361
22.5 375
23.5 369
24.5 367
25.5 368
26.5 361
27.5 366
28.5 361
29.5 392
30.5 383
31.5 389
32.5 364
33.5 378
34.5 378
35.5 381
36.5 377
37.5 358
38.5 352
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40.5 395
41.5 396
42.5 393
43.5 375
44.5 366
45.5 357
46.5 369
47.5 385

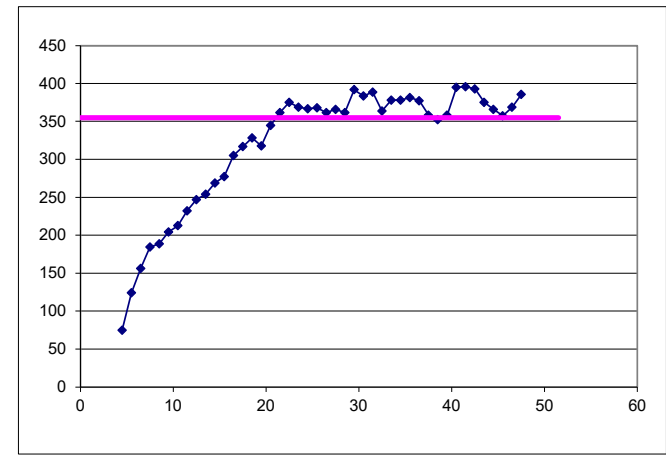
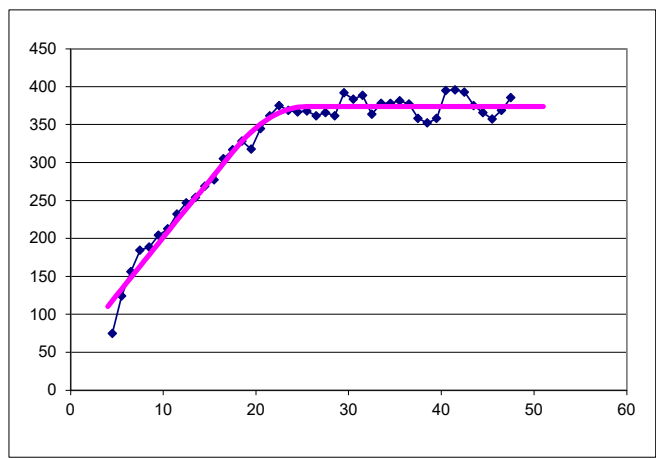
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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length=	21.40
Estimated maxstrain=	373.74
Thermal strain=	50.00

Estimated transfer length=	21.12
Estimated maxstrain=	373.74
Thermal strain=	50.00

T2 - 004 - 8 ft Panel - North - 3 point - Detension



4.5 75
5.5 124
6.5 152
7.5 173
8.5 190
9.5 205
10.5 218
11.5 228
12.5 244
13.5 257
14.5 266
15.5 288
16.5 299
17.5 311
18.5 318
19.5 339
20.5 344
21.5 353
22.5 364
23.5 374
24.5 366
25.5 364
26.5 368
27.5 362
28.5 379
29.5 378
30.5 378
31.5 378
32.5 388
33.5 370
34.5 376
35.5 381
36.5 367
37.5 361
38.5 369
39.5 375
40.5 372
41.5 389
42.5 389
43.5 376
44.5 367
45.5 373
46.5 372
47.5 378

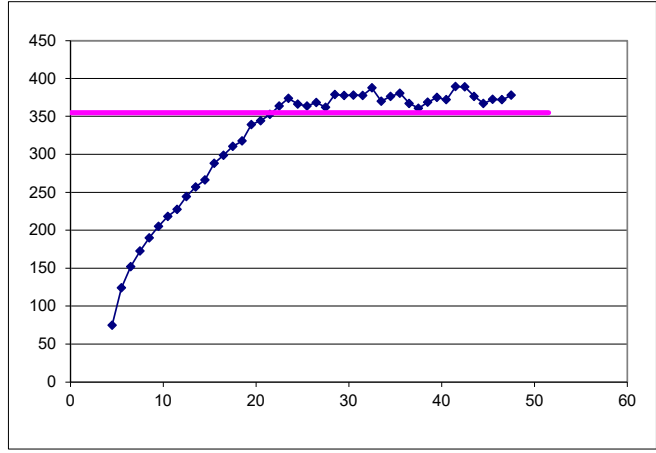
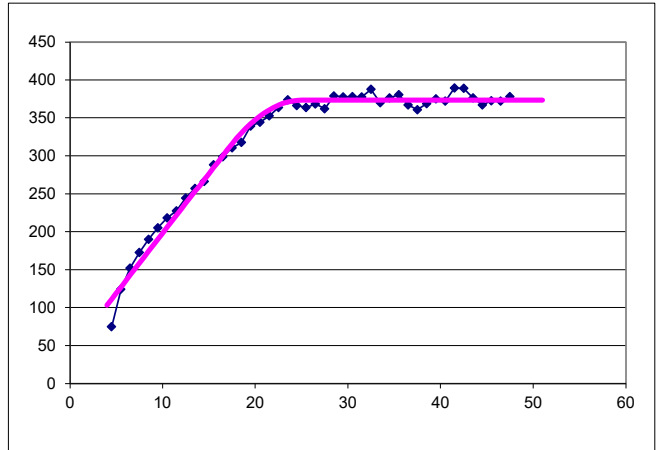
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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 21.10
Estimated maxstrain= 373.53
Thermal strain= 40.00

Estimated transfer length= 21.12
Estimated maxstrain= 373.74
Thermal strain= 50.00

T2 - 004 - 8 ft Panel - North - 5 point - Detension



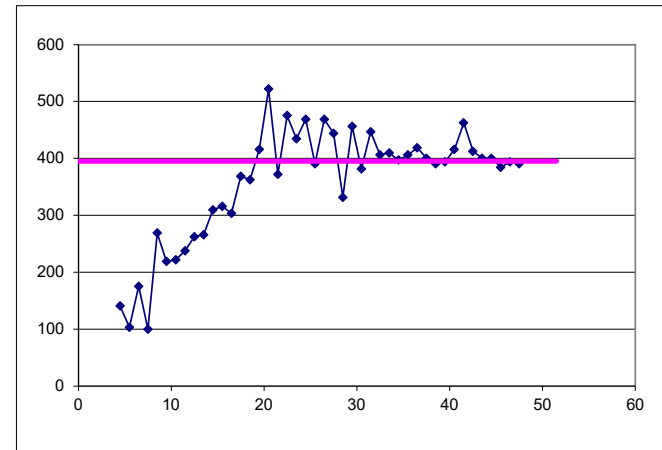
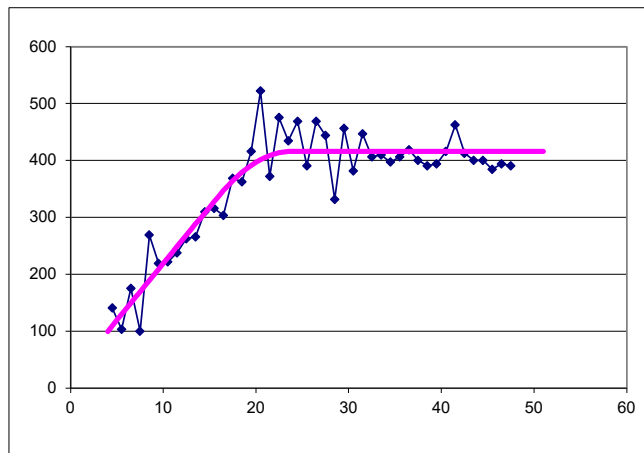
4.5 141
5.5 103
6.5 175
7.5 100
8.5 269
9.5 219
10.5 222
11.5 238
12.5 263
13.5 266
14.5 309
15.5 316
16.5 303
17.5 369
18.5 363
19.5 416
20.5 522
21.5 372
22.5 475
23.5 434
24.5 469
25.5 391
26.5 469
27.5 444
28.5 331
29.5 456
30.5 381
31.5 447
32.5 406
33.5 409
34.5 397
35.5 406
36.5 419
37.5 400
38.5 391
39.5 394
40.5 416
41.5 463
42.5 413
43.5 400
44.5 400
45.5 384
46.5 394
47.5 391

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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length=	8	Estimated transfer length=	19.90
Upper thermal strain allowed=	200	Estimated maxstrain=	415.95
Lower thermal strain allowed=	-200	Thermal strain=	20.00

Estimated transfer length=	19.11
Estimated maxstrain=	415.95
Thermal strain=	20.00

T2 - 004 - 8 ft Panel - South - Raw - Detension



4.5 141
5.5 140
6.5 126
7.5 181
8.5 196
9.5 236
10.5 226
11.5 241
12.5 255
13.5 279
14.5 297
15.5 309
16.5 329
17.5 345
18.5 382
19.5 433
20.5 436
21.5 456
22.5 427
23.5 459
24.5 431
25.5 443
26.5 434
27.5 415
28.5 410
29.5 390
30.5 428
31.5 411
32.5 421
33.5 404
34.5 404
35.5 407
36.5 408
37.5 403
38.5 395
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42.5 425
43.5 404
44.5 395
45.5 393
46.5 390
47.5 394

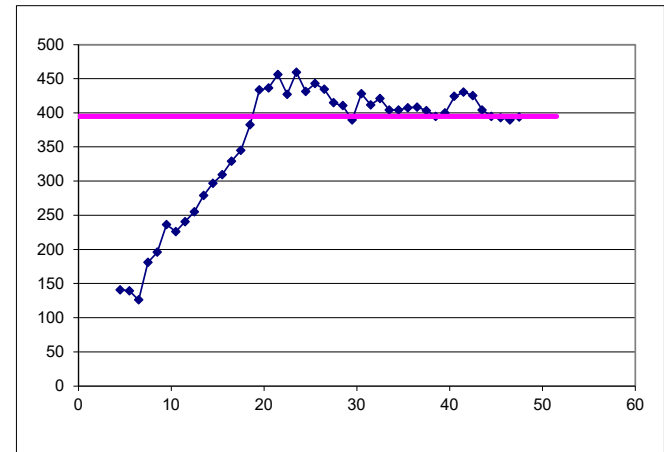
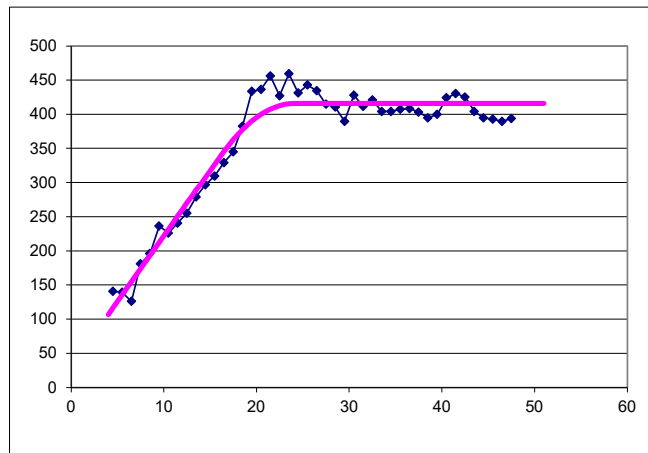
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LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 200
Lower thermal strain allowed= -200

Estimated transfer length= 20.10
Estimated maxstrain= 415.79
Thermal strain= 30.00

Estimated transfer length= 18.75
Estimated maxstrain= 415.79
Thermal strain= 30.00

T2 - 004 - 8 ft Panel - South - 3 point - Detension

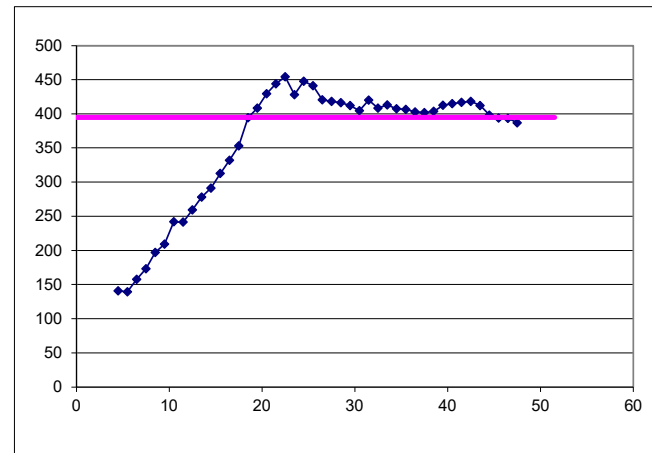
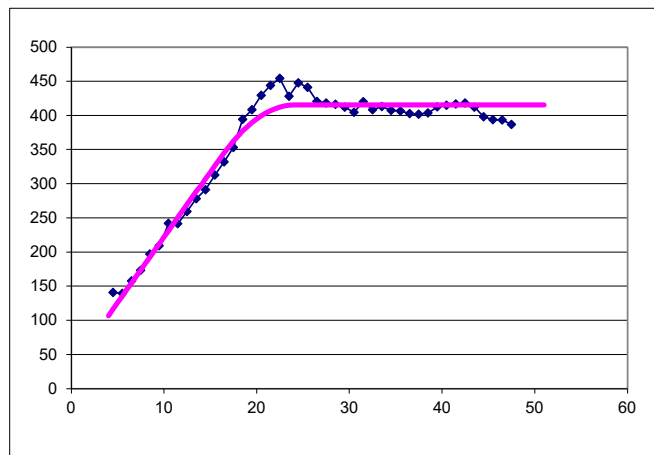


4.5 141
5.5 140
6.5 158
7.5 173
8.5 197
9.5 209
10.5 242
11.5 241
12.5 259
13.5 278
14.5 291
15.5 313
16.5 332
17.5 353
18.5 394
19.5 408
20.5 429
21.5 444
22.5 454
23.5 428
24.5 448
25.5 441
26.5 421
27.5 418
28.5 416
29.5 412
30.5 404
31.5 420
32.5 408
33.5 413
34.5 408
35.5 406
36.5 403
37.5 402
38.5 404
39.5 413
40.5 415
41.5 417
42.5 418
43.5 412
44.5 398
45.5 394
46.5 393
47.5 387

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length=	8	Estimated transfer length=	20.10	Estimated transfer length=	18.52
Upper thermal strain allowed=	200	Estimated maxstrain=	415.42	Estimated maxstrain=	415.42
Lower thermal strain allowed=	-200	Thermal strain=	30.00	Thermal strain=	30.00

T2 - 004 - 8 ft Panel - South - 5 point - Detension



4.5 488
5.5 513
6.5 459
7.5 556
8.5 575
9.5 606
10.5 625
11.5 643
12.5 639
13.5 650
14.5 677
15.5 713
16.5 726
17.5 756
18.5 769
19.5 769
20.5 794
21.5 781
22.5 794
23.5 784
24.5 789
25.5 794
26.5 806
27.5 838
28.5 806
29.5 828
30.5 850
31.5 809
32.5 831
33.5 841
34.5 853
35.5 797

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

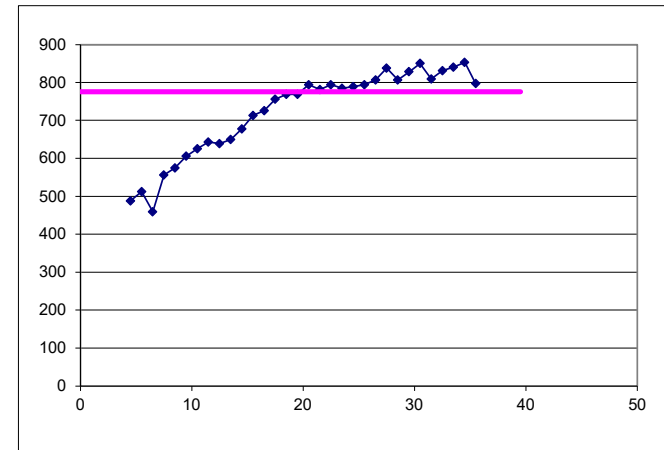
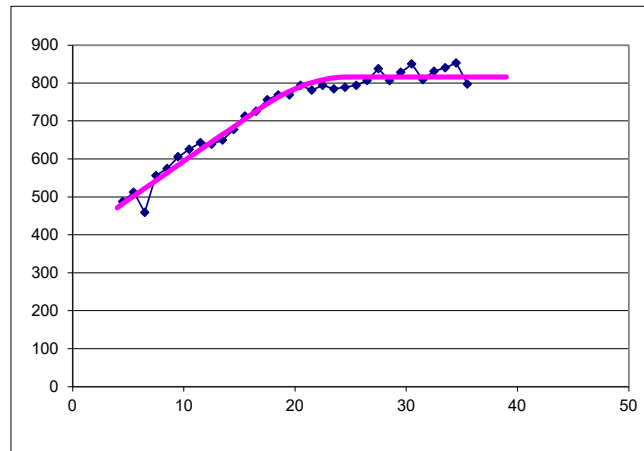
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 20.90
Estimated maxstrain= 816.17
Thermal strain= 390.00

Estimated transfer length= 19.76
Estimated maxstrain= 816.17
Thermal strain= 390.00

T2 - 004 - 6 ft Panel - North - Raw - 21 Day



4.5 488
5.5 486
6.5 509
7.5 530
8.5 579
9.5 602
10.5 625
11.5 636
12.5 644
13.5 655
14.5 680
15.5 705
16.5 732
17.5 750
18.5 765
19.5 777
20.5 781
21.5 790
22.5 786
23.5 789
24.5 789
25.5 796
26.5 813
27.5 817
28.5 824
29.5 828
30.5 829
31.5 830
32.5 827
33.5 842
34.5 830
35.5 829

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

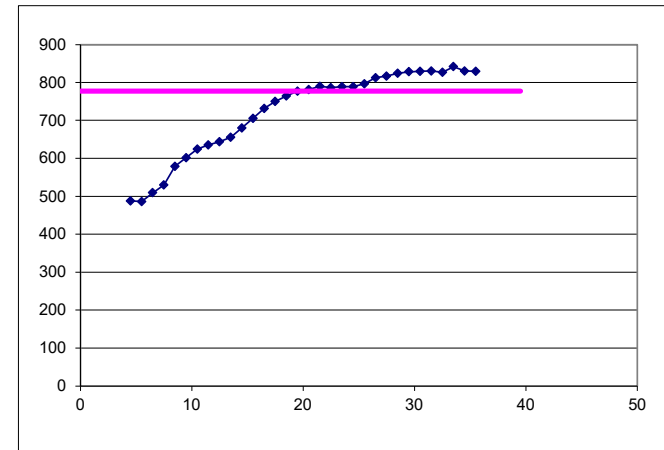
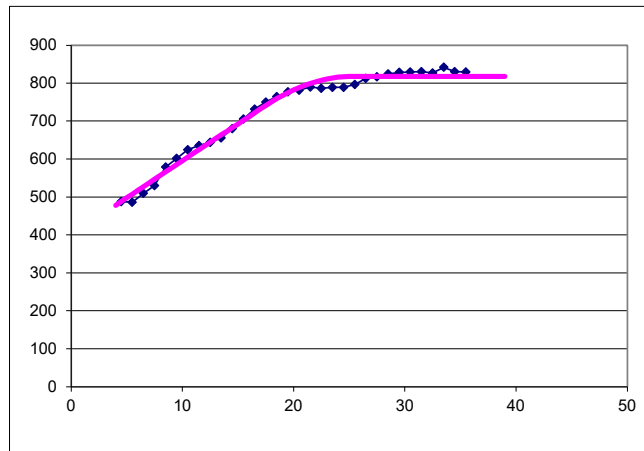
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 21.40
Estimated maxstrain= 818.15
Thermal strain= 400.00

Estimated transfer length= 19.54
Estimated maxstrain= 818.15
Thermal strain= 400.00

T2 - 004 - 6 ft Panel - North - 3 point - 21 Day



4.5 488
5.5 486
6.5 518
7.5 542
8.5 564
9.5 601
10.5 618
11.5 633
12.5 647
13.5 665
14.5 681
15.5 705
16.5 728
17.5 747
18.5 763
19.5 774
20.5 781
21.5 784
22.5 788
23.5 788
24.5 793
25.5 802
26.5 807
27.5 814
28.5 826
29.5 826
30.5 825
31.5 832
32.5 837
33.5 826
34.5 832
35.5 824

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

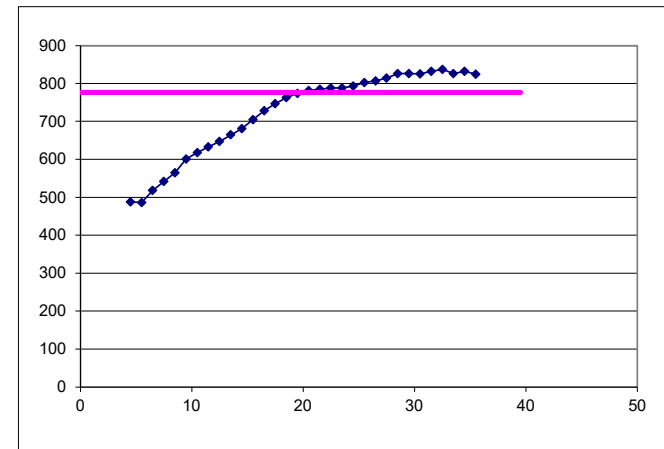
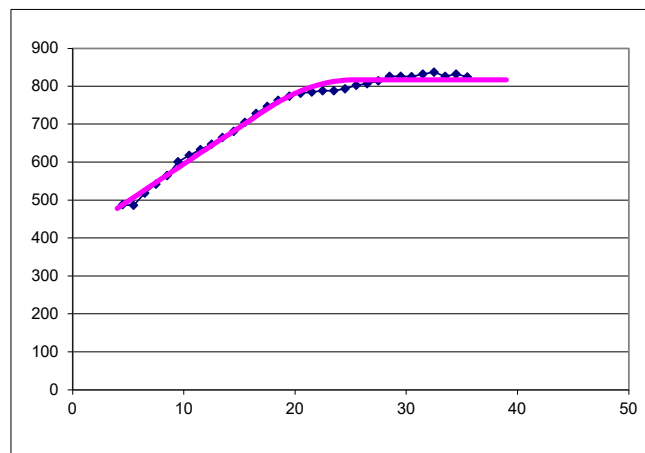
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 21.40
Estimated maxstrain= 817.17
Thermal strain= 400.00

Estimated transfer length= 19.84
Estimated maxstrain= 817.17
Thermal strain= 400.00

T2 - 004 - 6 ft Panel - North - 5 point - 21 Day



4.5 453
5.5 406
6.5 425
7.5 463
8.5 481
9.5 525
10.5 559
11.5 563
12.5 600
13.5 597
14.5 634
15.5 638
16.5 684
17.5 700
18.5 700
19.5 772
20.5 756
21.5 806
22.5 778
23.5 800
24.5 853
25.5 828
26.5 794
27.5 813
28.5 794
29.5 772
30.5 797
31.5 800
32.5 822
33.5 809
34.5 794
35.5 838

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

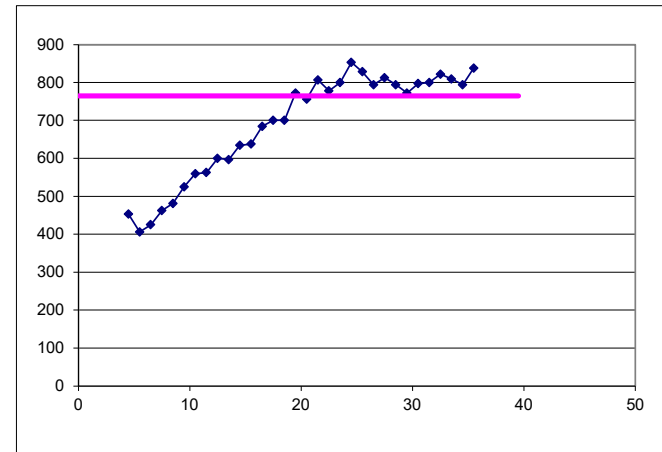
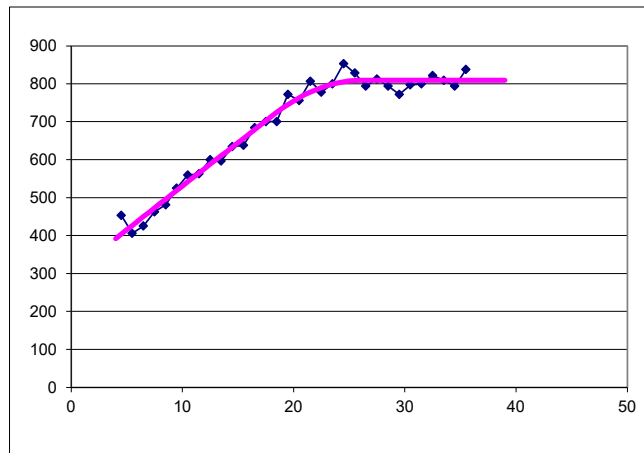
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 22.10
Estimated maxstrain= 809.06
Thermal strain= 300.00

Estimated transfer length= 19.40
Estimated maxstrain= 804.98
Thermal strain= 200.00

T2 - 004 - 6 ft Panel - South - Raw - 21 Day



4.5 453
5.5 428
6.5 431
7.5 456
8.5 490
9.5 522
10.5 549
11.5 574
12.5 586
13.5 610
14.5 623
15.5 652
16.5 674
17.5 695
18.5 724
19.5 743
20.5 778
21.5 780
22.5 795
23.5 810
24.5 827
25.5 825
26.5 811
27.5 800
28.5 793
29.5 788
30.5 790
31.5 806
32.5 810
33.5 808
34.5 814
35.5 809

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

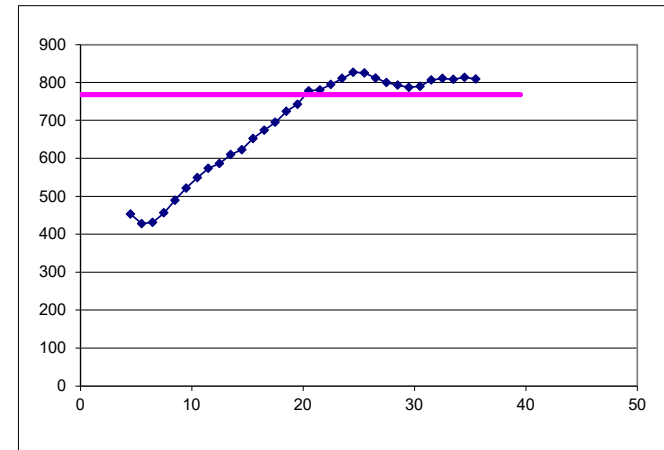
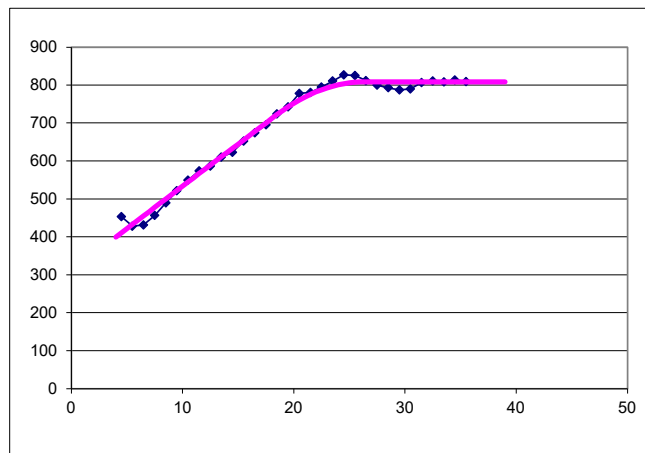
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 22.30
Estimated maxstrain= 808.23
Thermal strain= 310.00

Estimated transfer length= 20.21
Estimated maxstrain= 808.23
Thermal strain= 310.00

T2 - 004 - 6 ft Panel - South - 3 point - 21 Day



4.5 453
5.5 428
6.5 446
7.5 460
8.5 491
9.5 518
10.5 546
11.5 569
12.5 591
13.5 606
14.5 631
15.5 651
16.5 671
17.5 699
18.5 723
19.5 747
20.5 763
21.5 783
22.5 799
23.5 813
24.5 811
25.5 818
26.5 816
27.5 800
28.5 794
29.5 795
30.5 797
31.5 800
32.5 804
33.5 813
34.5 812
35.5 818

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

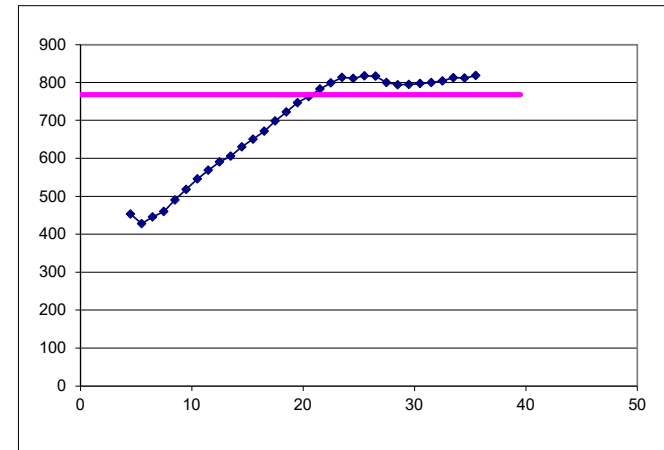
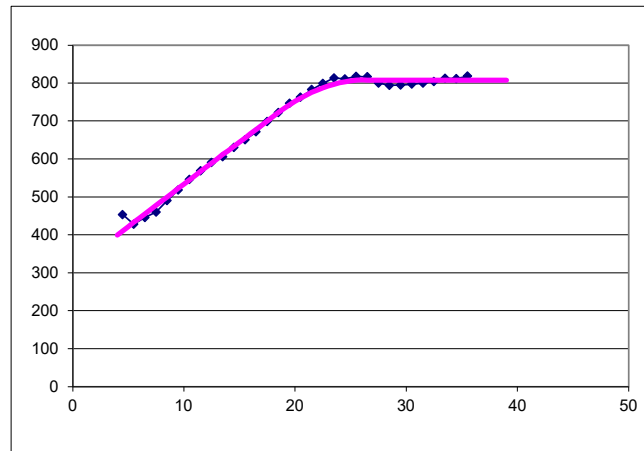
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 22.30
Estimated maxstrain= 808.11
Thermal strain= 310.00

Estimated transfer length= 20.76
Estimated maxstrain= 808.11
Thermal strain= 310.00

T2 - 004 - 6 ft Panel - South - 5 point - 21 Day



4.5 456
5.5 463
6.5 509
7.5 534
8.5 584
9.5 572
10.5 606
11.5 659
12.5 675
13.5 681
14.5 700
15.5 706
16.5 719
17.5 759
18.5 766
19.5 778
20.5 778
21.5 809
22.5 822
23.5 831
24.5 903
25.5 853
26.5 897
27.5 847
28.5 891
29.5 859
30.5 963
31.5 866
32.5 838
33.5 897
34.5 897
35.5 900
36.5 878
37.5 916
38.5 853
39.5 897
40.5 916
41.5 916
42.5 919
43.5 925
44.5 906
45.5 922
46.5 950
47.5 903

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

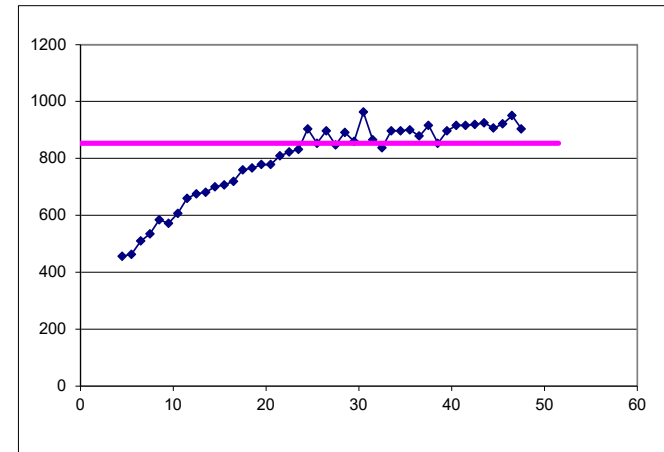
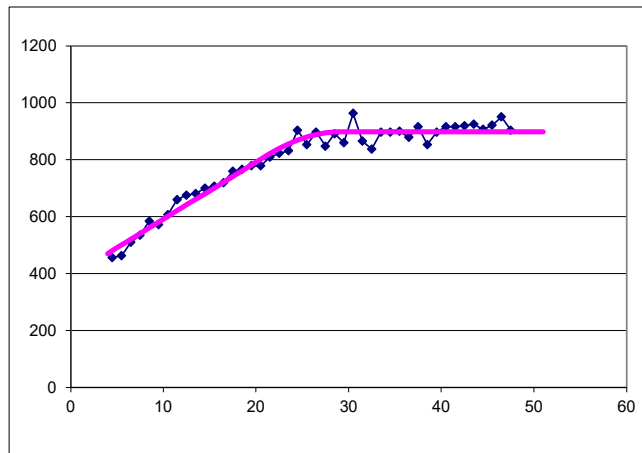
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 25.30
Estimated maxstrain= 898.33
Thermal strain= 390.00

Estimated transfer length= 23.81
Estimated maxstrain= 898.33
Thermal strain= 390.00

T2 - 004 - 8 ft Panel - North - Raw - 21 Day



4.5 456
5.5 476
6.5 502
7.5 543
8.5 564
9.5 588
10.5 613
11.5 647
12.5 672
13.5 685
14.5 696
15.5 708
16.5 728
17.5 748
18.5 768
19.5 774
20.5 789
21.5 803
22.5 821
23.5 852
24.5 863
25.5 884
26.5 866
27.5 878
28.5 866
29.5 904
30.5 896
31.5 889
32.5 867
33.5 877
34.5 898
35.5 892
36.5 898
37.5 882
38.5 889
39.5 889
40.5 909
41.5 917
42.5 920
43.5 917
44.5 918
45.5 926
46.5 925
47.5 929

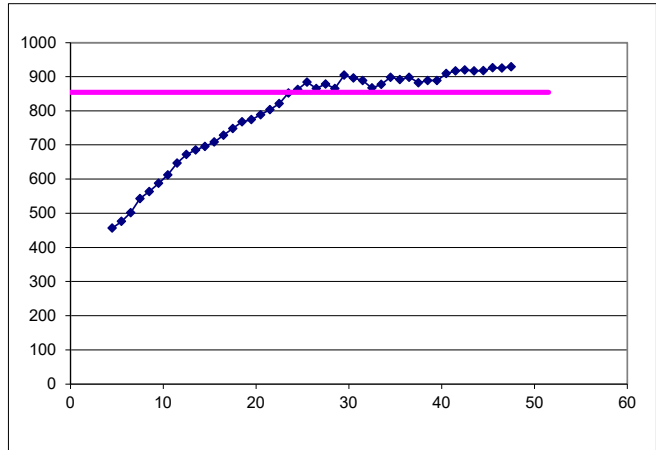
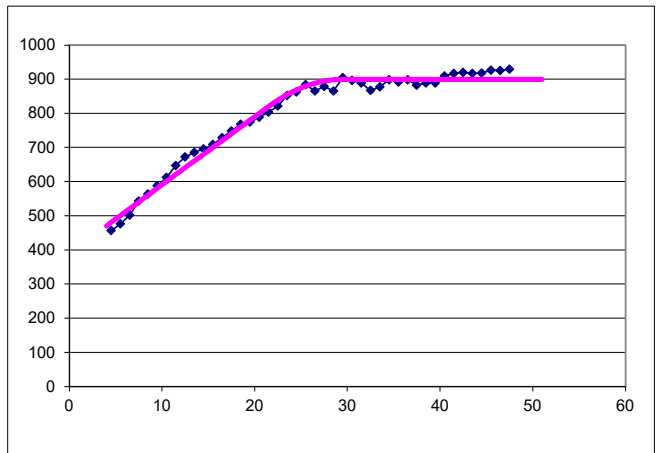
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 25.40
Estimated maxstrain= 899.02
Thermal strain= 390.00

Estimated transfer length= 23.69
Estimated maxstrain= 899.02
Thermal strain= 390.00

T2 - 004 - 8 ft Panel - North - 3 point - 21 Day



4.5 456
5.5 476
6.5 509
7.5 533
8.5 561
9.5 591
10.5 619
11.5 639
12.5 664
13.5 684
14.5 696
15.5 713
16.5 730
17.5 746
18.5 760
19.5 778
20.5 791
21.5 804
22.5 829
23.5 844
24.5 861
25.5 866
26.5 878
27.5 869
28.5 891
29.5 885
30.5 883
31.5 884
32.5 892
33.5 879
34.5 882
35.5 898
36.5 889
37.5 889
38.5 892
39.5 899
40.5 900
41.5 914
42.5 916
43.5 918
44.5 924
45.5 921
46.5 923
47.5 932

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

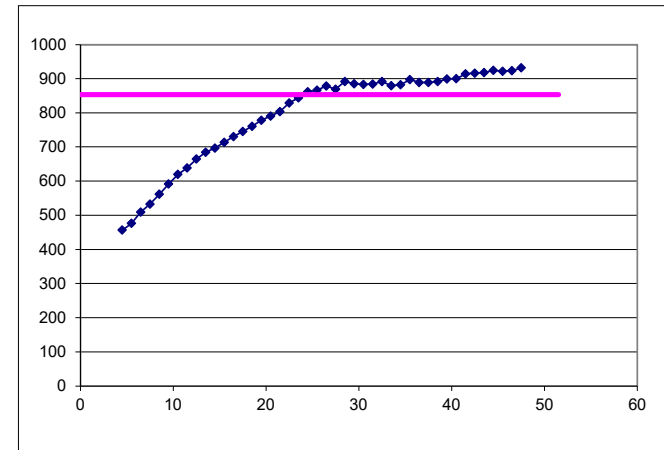
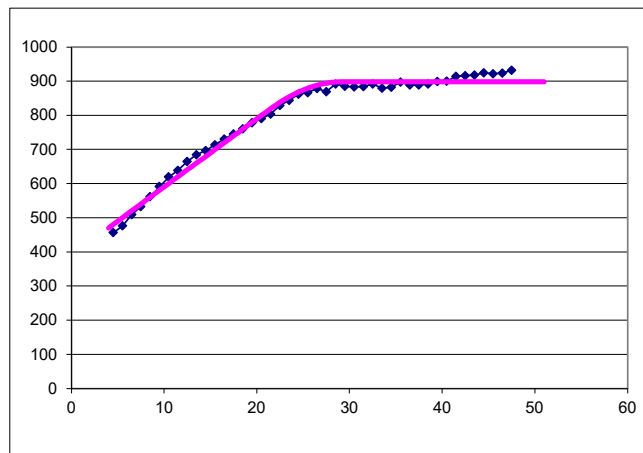
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 25.40
Estimated maxstrain= 898.63
Thermal strain= 390.00

Estimated transfer length= 24.07
Estimated maxstrain= 898.63
Thermal strain= 390.00

T2 - 004 - 8 ft Panel - North - 5 point - 21 Day



4.5 466
5.5 441
6.5 544
7.5 500
8.5 644
9.5 625
10.5 641
11.5 656
12.5 688
13.5 697
14.5 753
15.5 778
16.5 766
17.5 875
18.5 838
19.5 922
20.5 1034
21.5 903
22.5 969
23.5 978
24.5 1013
25.5 972
26.5 1044
27.5 1000
28.5 900
29.5 1000
30.5 1019
31.5 1003
32.5 981
33.5 984
34.5 941
35.5 956
36.5 981
37.5 950
38.5 928
39.5 963
40.5 997
41.5 981
42.5 981
43.5 944
44.5 938
45.5 953
46.5 950
47.5 934

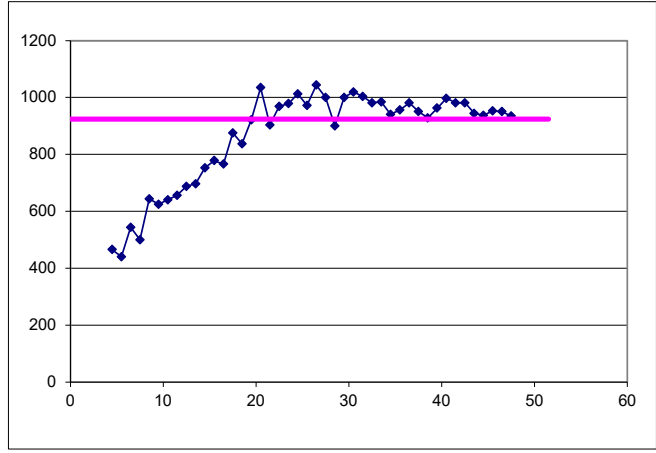
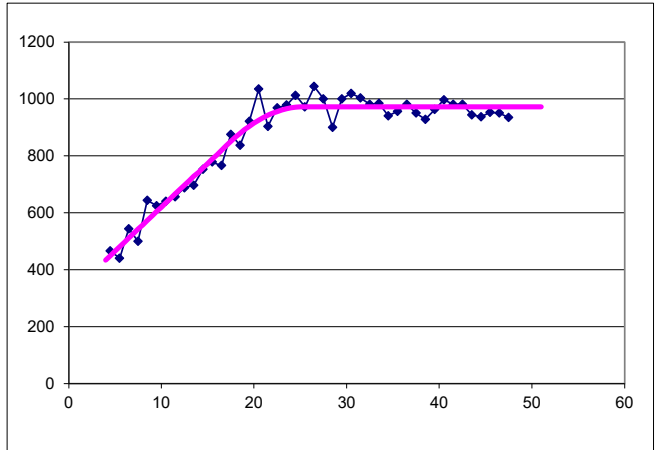
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 21.40
Estimated maxstrain= 972.54
Thermal strain= 310.00

Estimated transfer length= 19.52
Estimated maxstrain= 972.54
Thermal strain= 310.00

T2 - 004 - 8 ft Panel - South - Raw - 21 Day



4.5 466
5.5 483
6.5 495
7.5 563
8.5 590
9.5 636
10.5 641
11.5 661
12.5 680
13.5 713
14.5 743
15.5 766
16.5 806
17.5 826
18.5 878
19.5 931
20.5 953
21.5 969
22.5 950
23.5 986
24.5 988
25.5 1009
26.5 1005
27.5 981
28.5 967
29.5 973
30.5 1007
31.5 1001
32.5 990
33.5 969
34.5 960
35.5 959
36.5 963
37.5 953
38.5 947
39.5 963
40.5 980
41.5 986
42.5 969
43.5 954
44.5 945
45.5 947
46.5 946
47.5 929

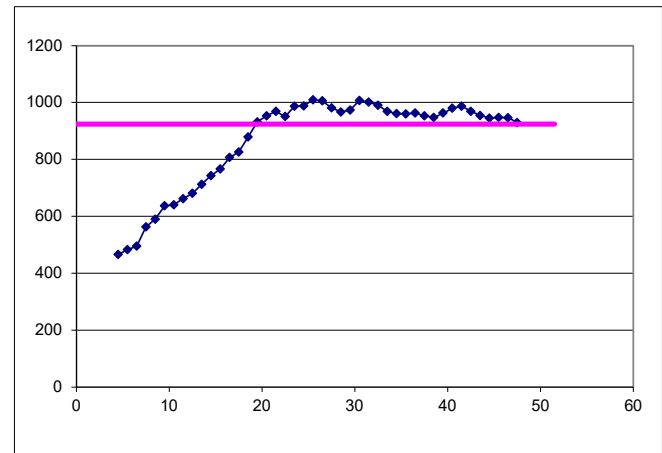
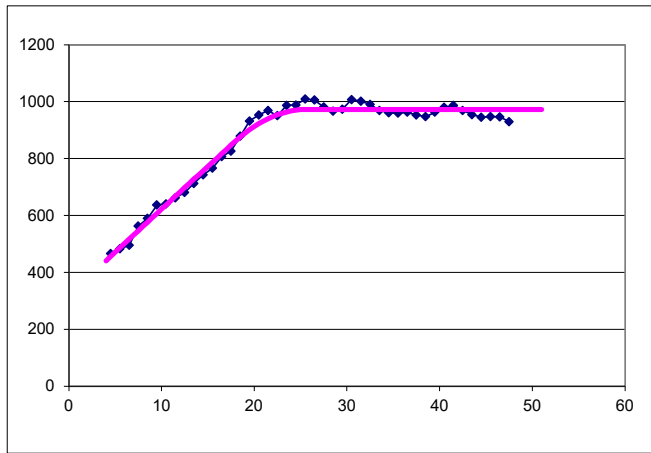
This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

Estimated transfer length= 21.60
Estimated maxstrain= 972.33
Thermal strain= 320.00

Estimated transfer length= 19.36
Estimated maxstrain= 972.33
Thermal strain= 320.00

T2 - 004 - 8 ft Panel - South - 3 point - 21 Day



4.5 466
5.5 483
6.5 519
7.5 551
8.5 591
9.5 613
10.5 651
11.5 661
12.5 687
13.5 714
14.5 736
15.5 774
16.5 802
17.5 836
18.5 887
19.5 914
20.5 933
21.5 961
22.5 979
23.5 967
24.5 995
25.5 1001
26.5 986
27.5 983
28.5 993
29.5 984
30.5 981
31.5 998
32.5 986
33.5 973
34.5 969
35.5 963
36.5 951
37.5 956
38.5 964
39.5 964
40.5 970
41.5 973
42.5 968
43.5 959
44.5 953
45.5 944
46.5 936
47.5 938

This Excel macro is programmed by Weixin Zhao (wzh3939@ksu.edu) to estimate the transfer length of pre-tensioned concrete member. The algorithm is based on Zhao-lee method.

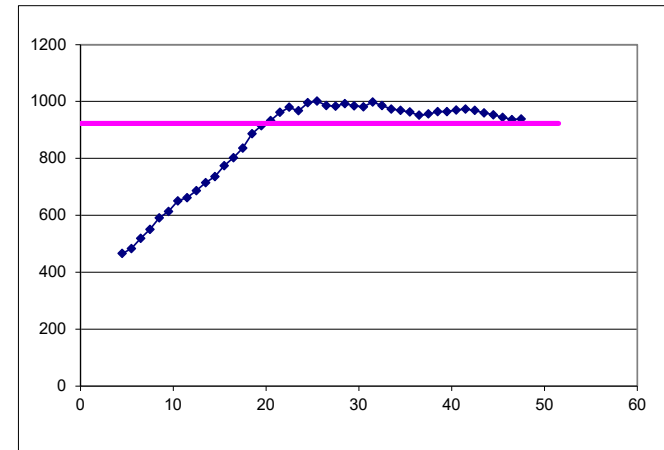
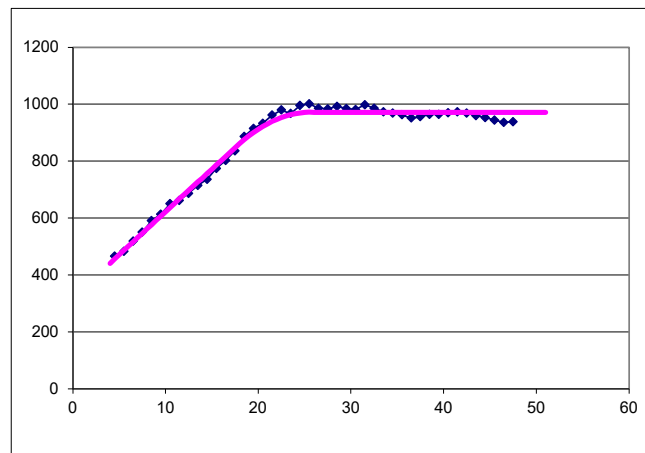
LICENSE: Free. HOW TO USE: Put the raw strain data (unsmoothed) in Column A and Column B. Input gauge length at Cell E9. Click the button.

Gauge Length= 8
Upper thermal strain allowed= 400
Lower thermal strain allowed= -400

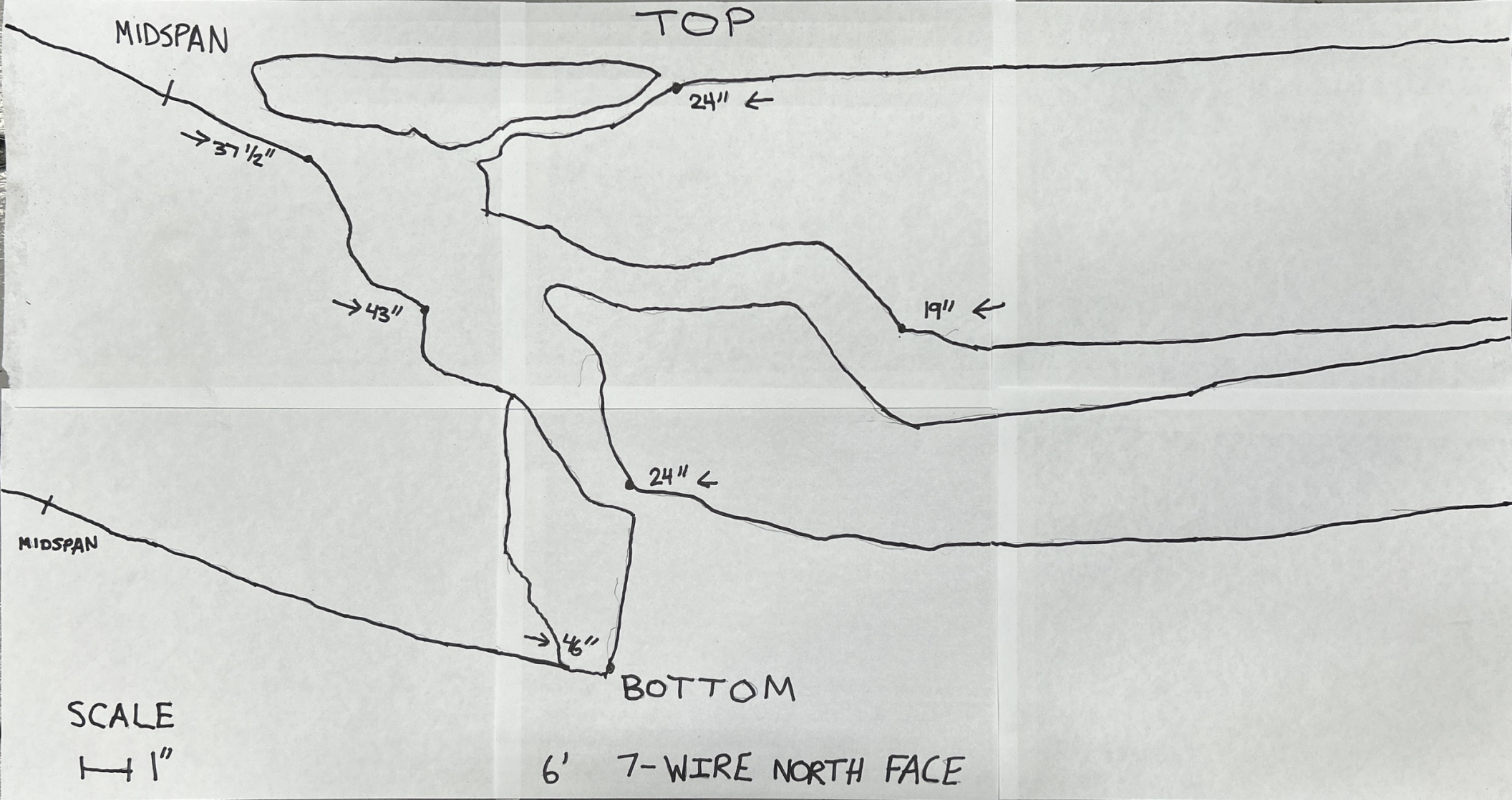
Estimated transfer length= 21.60
Estimated maxstrain= 971.73
Thermal strain= 320.00

Estimated transfer length= 19.97
Estimated maxstrain= 971.73
Thermal strain= 320.00

T2 - 004 - 8 ft Panel - South - 5 point - 21 Day



APPENDIX D – Crack Drawings and Concrete Compressive Strengths



TOP

→ 26"

35"
←

→ 18.5"

15.5"

MIDSPAN

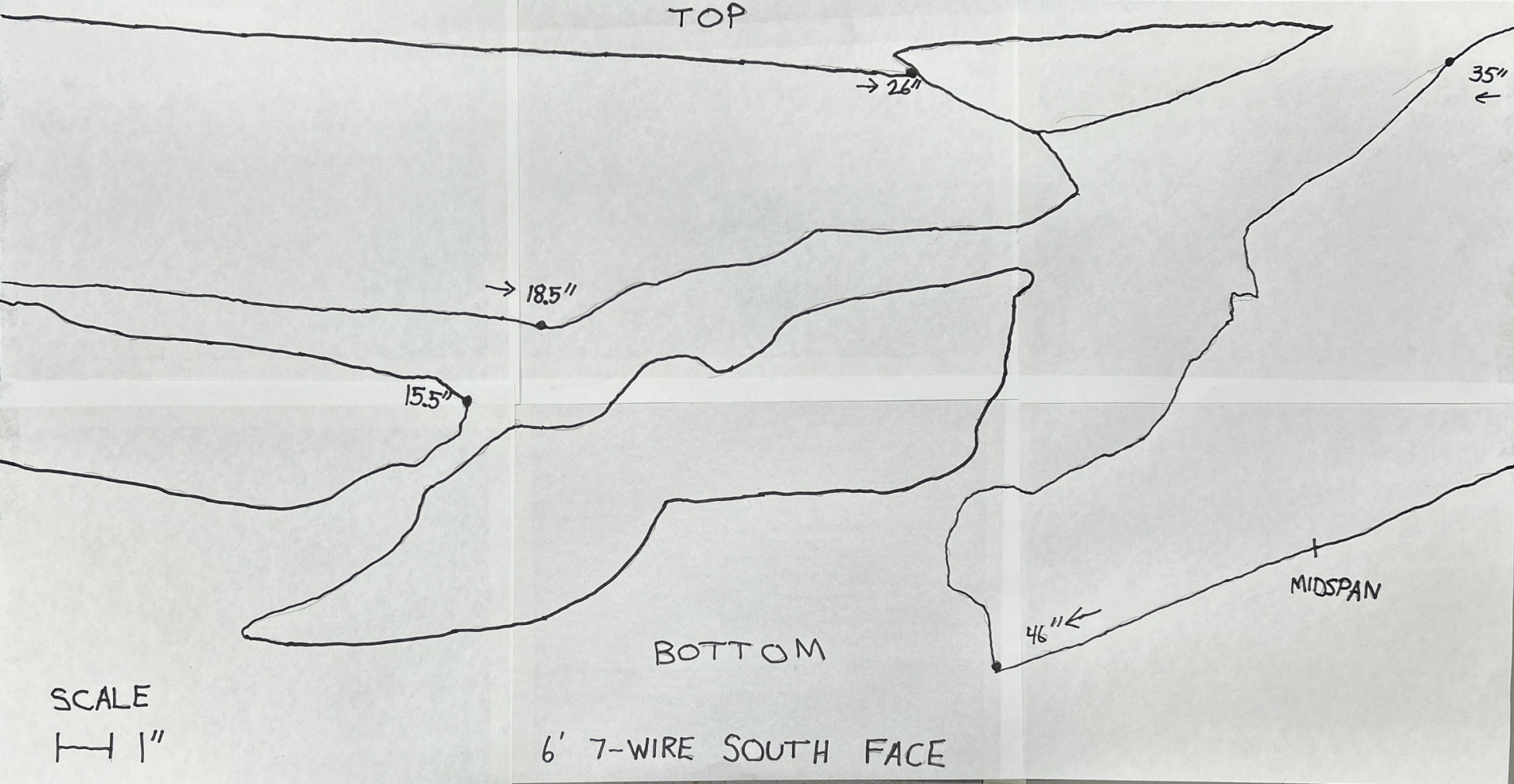
46"←

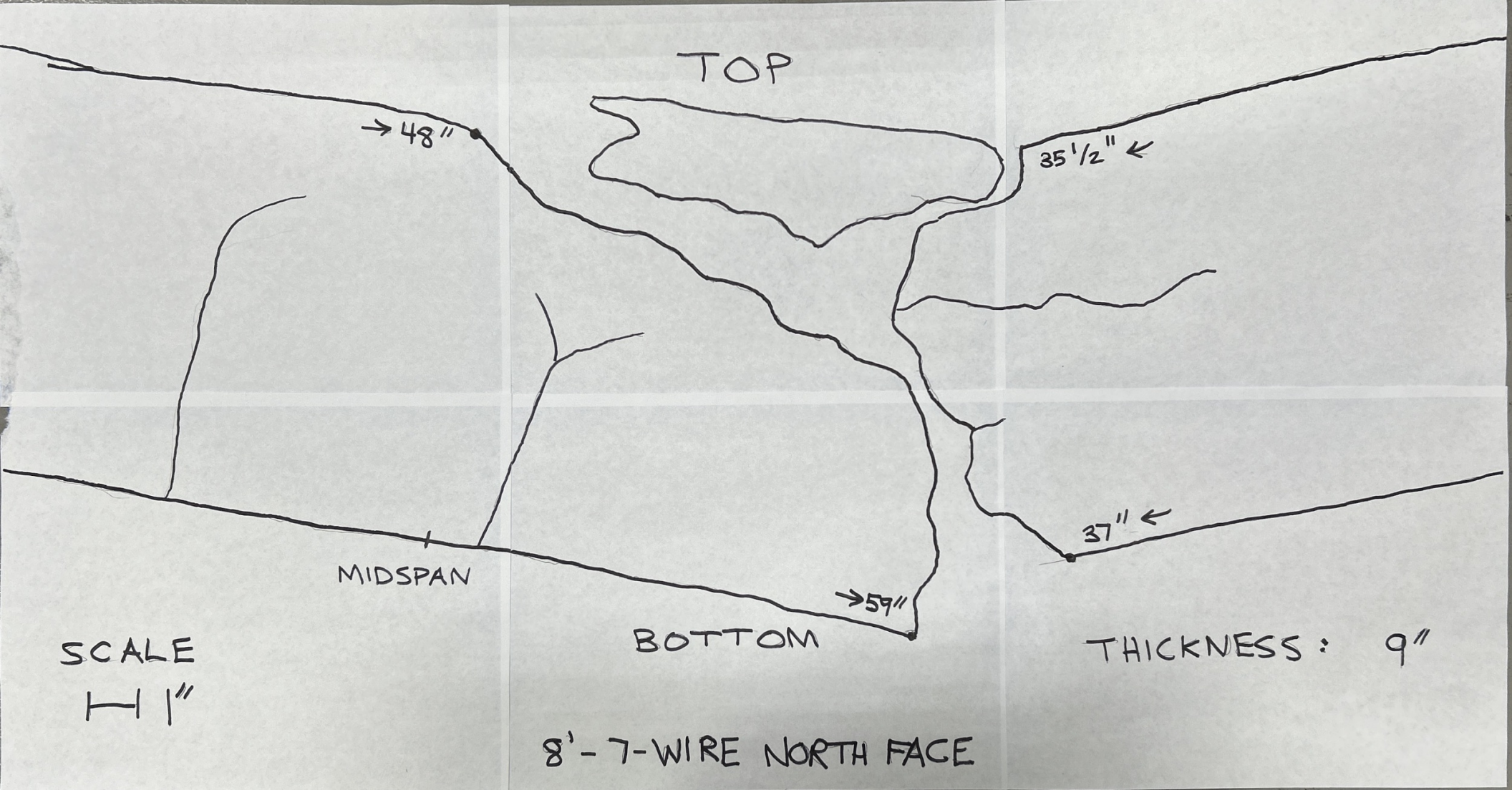
BOTTOM

SCALE

1"

6' 7-WIRE SOUTH FACE





TOP

$\rightarrow 48''$

$35\frac{1}{2}'' \leftarrow$

MIDSPAN

$\rightarrow 59''$

$37'' \leftarrow$

BOTTOM

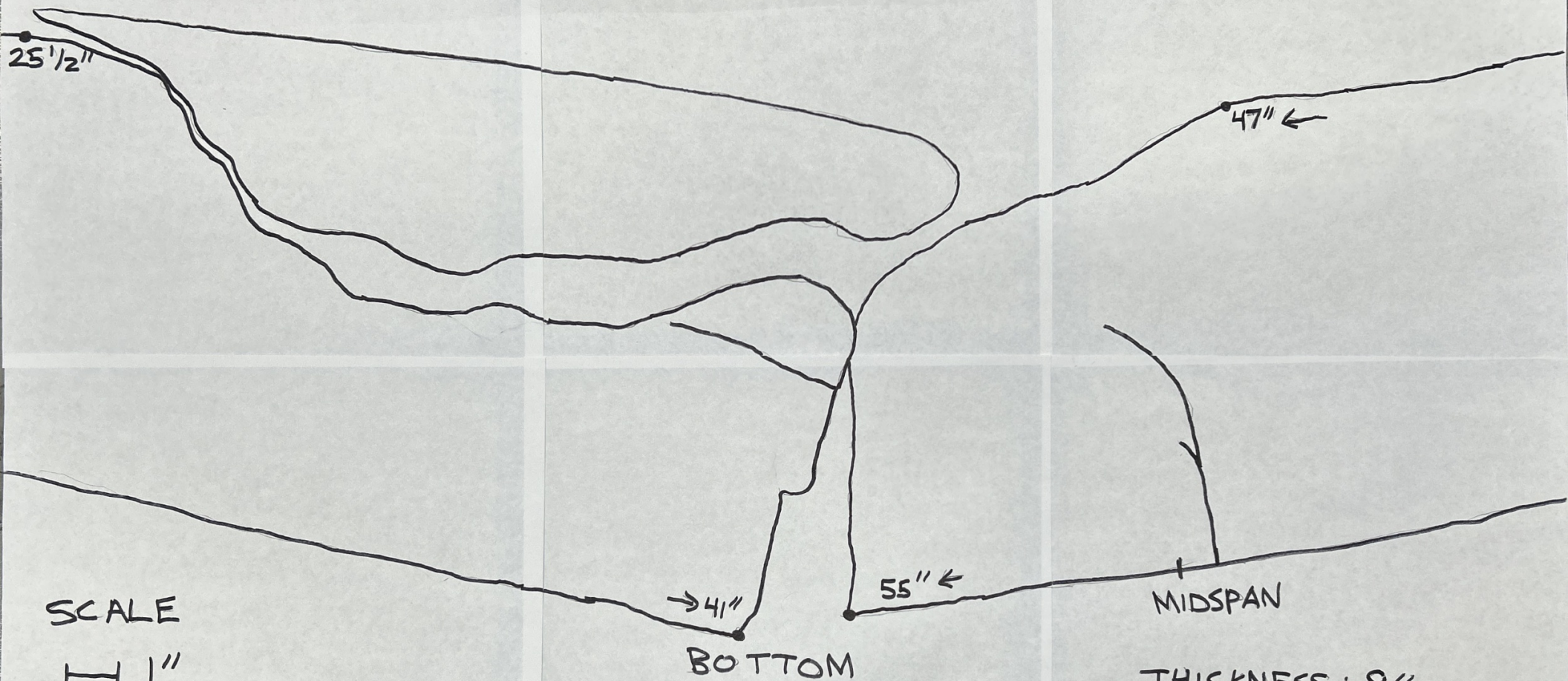
SCALE

1" = 1'

THICKNESS: 9"

8' - 7-WIRE NORTH FACE

TOP



SCALE

$1''$

BOTTOM

MIDSPAN

THICKNESS: 9''

8'-7-WIRE SOUTH FACE

TOP

→30"

40" ←

→29"

41.5" ←

MIDSPAN

SCALE

1"

BOTTOM

6'-T4VAE NORTH FACE



TOP

→ 28.5"

← 29"

MIDSPAN

→ 42"

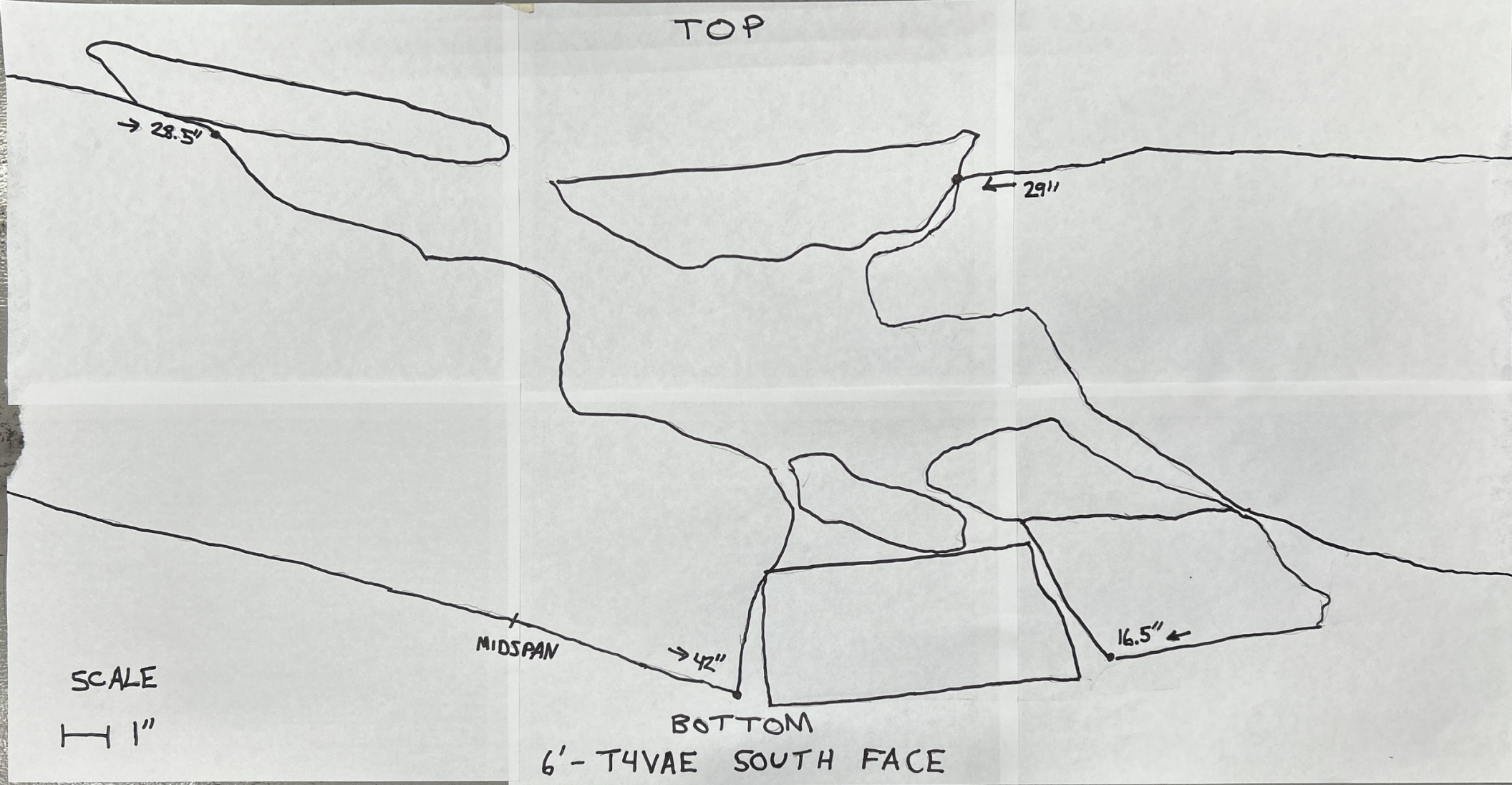
← 16.5"

BOTTOM

6'-T4VAE SOUTH FACE

SCALE

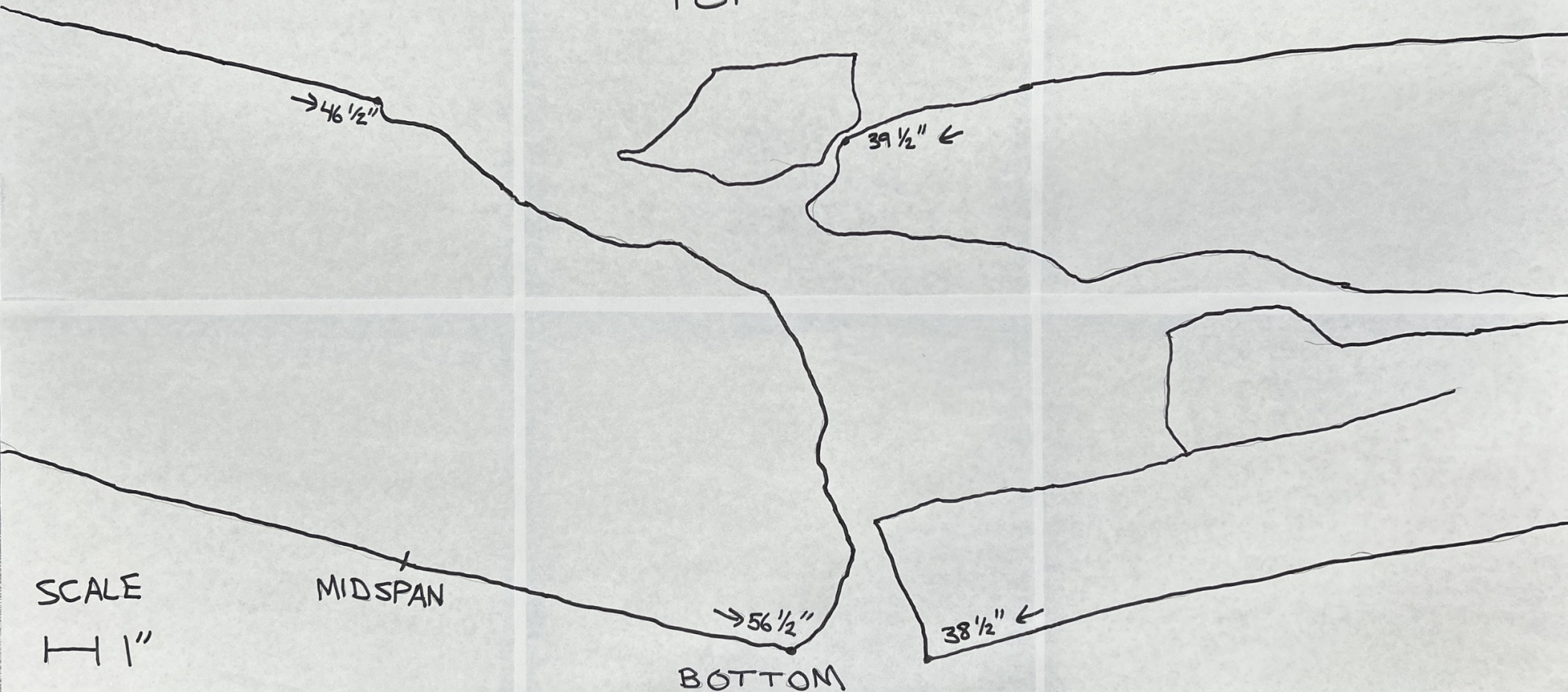
H 1"



8' - T4VAE NORTH FACE

THICKNESS: $8\frac{3}{4}"$

TOP



8' - T4VAE - SOUTH FACE

TOP

→ 37"

49" ←

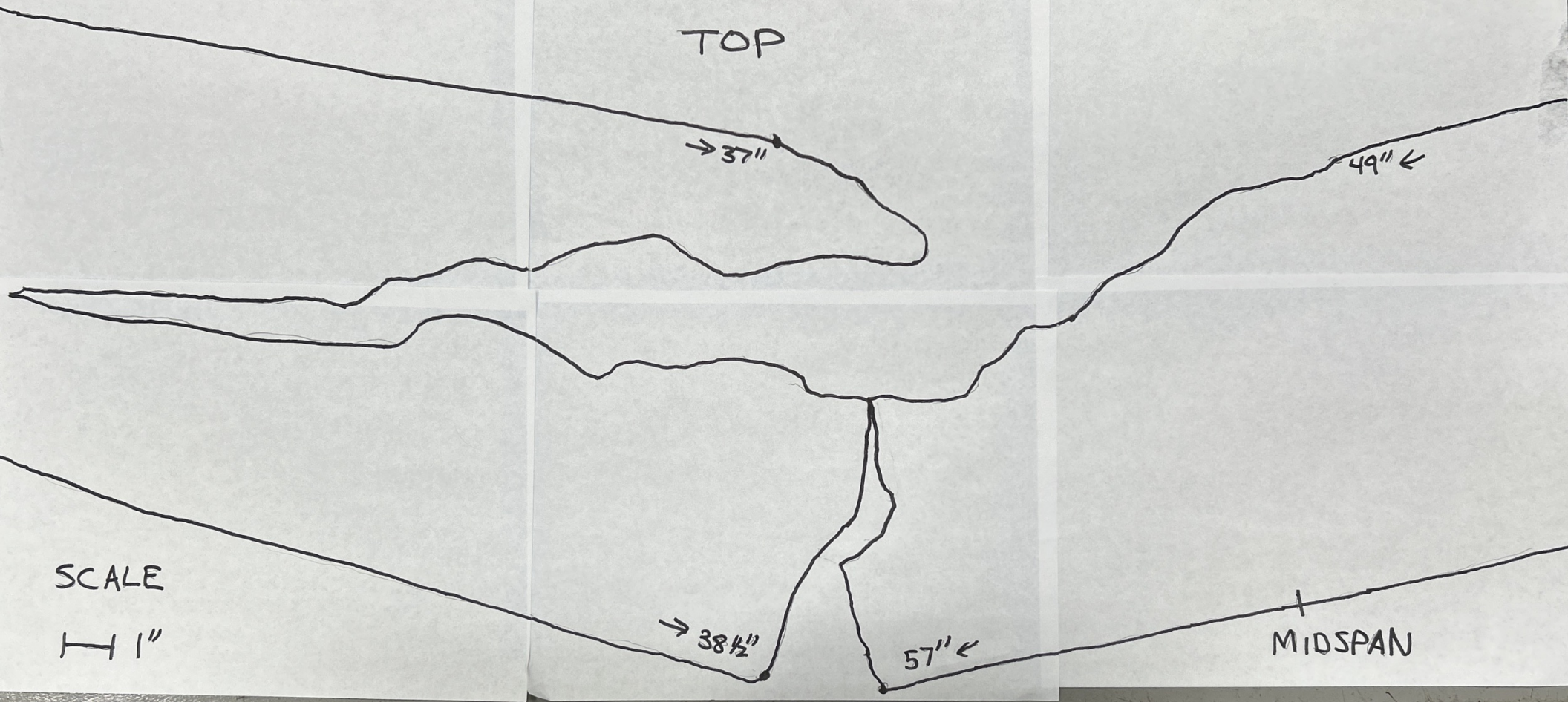
SCALE

1" = 1'

→ 38½"

57" ←

MIDSPAN



TOP

25" →

← 37"

← 34½"

29¾" →

← 42¾"

← 53⅛"

BOTTOM

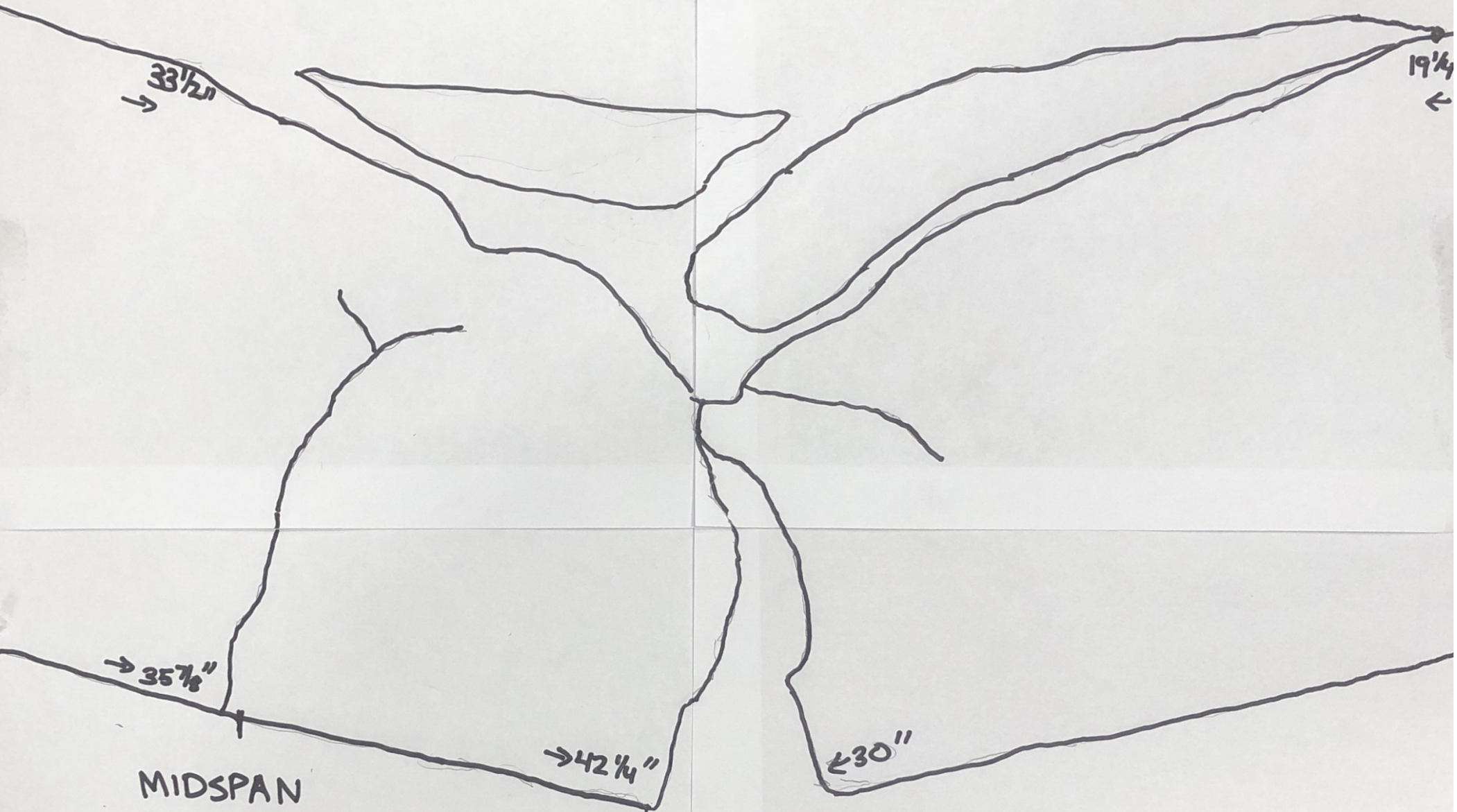
MIDSPAN

SCALE



6' T2004 NORTH FACE

TOP



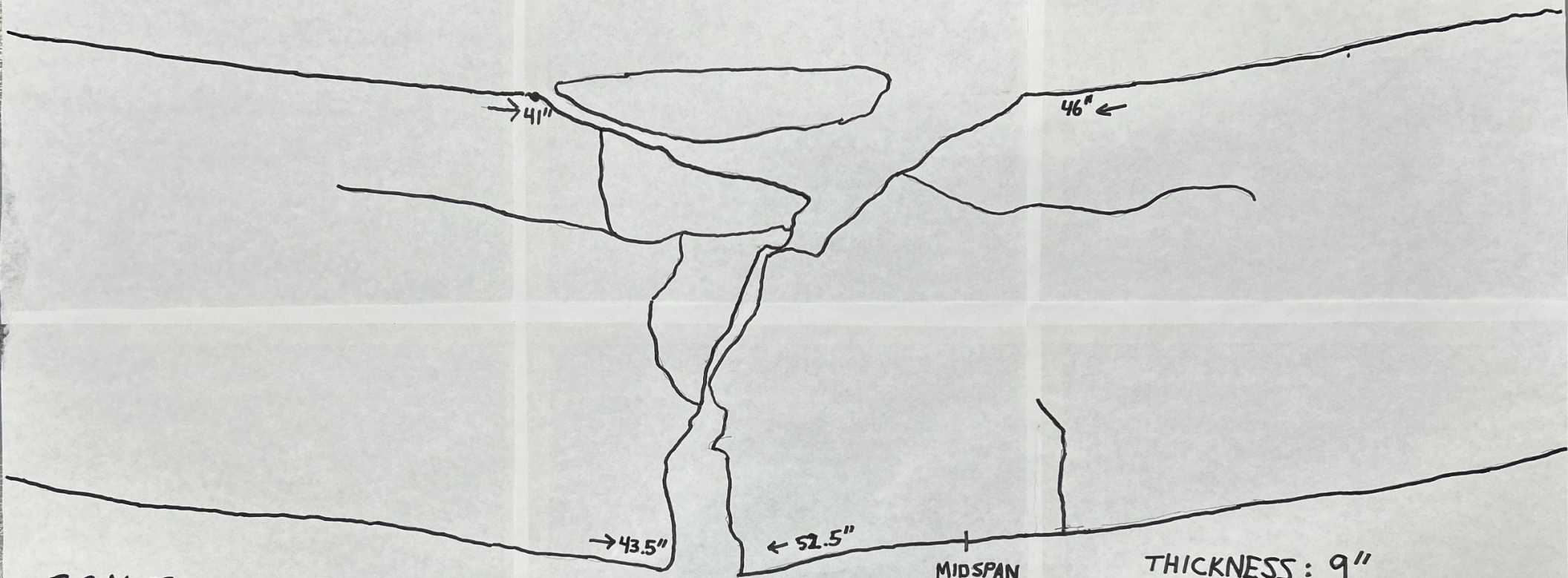
MIDSPAN

BOTTOM

1"
|
|

6' T2004 SOUTH FACE

TOP



SCALE

H 1"

BOTTOM

MIDSPAN

THICKNESS: 9"

8' - T2004 NORTH FACE

TOP

→ 46.5"

40.5" ←

MIDSPAN

→ 51.5"

44.5" ←

BOTTOM

SCALE

1" = 1'

THICKNESS : 9"

8' - T2004 SOUTH FACE

Pour 1 - 7 Wire Strand		
Cylinder	Strength (psi)	Day
1-1	4465	Detension
1-2	5192	Detension
1-3	8732	7 days
1-4	10877	7 days
1-5	9994	28 days
1-6	11657	28 days
1-7	10672	28 days
1-8	11216	28 days
1-9	10944	28 days
1-10	9728	28 days

Pour 2 - T4-VAE		
Cylinder	Strength (psi)	Day
2-1	4365	Detension
2-2	4478	Detension
2-3	10052	7 days
2-4	11527	7 days
2-5	10106	28 days
2-6	11784	28 days
2-7	11586	28 days
2-8	10111	28 days
2-9	10698	28 days
2-10	10405	28 days

Pour 3 - T2-004		
Cylinder	Strength (psi)	Day
3-1	4684	Detension
3-2	4579	Detension
3-3	11754	7 days
3-4	11552	7 days
3-5	12070	28 days
3-6	11600	28 days
3-7	10031	28 days
3-8	11392	28 days
3-9	11888	28 days
3-10	12435	28 days

Topping Pour		
Cylinder	Strength (psi)	Day
T-1	5186	28 days
T-2	5389	28 days
T-3	5457	28 days
T-4	4730	28 days
T-5	5478	28 days
T-6	5291	28 days
T-7	4522	28 days
T-8	5399	28 days
T-9	4569	28 days
T-10	4322	28 days
T-11	4881	28 days
T-12	4993	28 days

Average Compressive Strength			
	Detension (psi)	7 Day (psi)	28 Day (psi)
Pour 1 - 7 Wire Strand	4829	9805	10702
Pour 2 - T4-VAE	4422	10790	10782
Pour 3 - T2-004	4632	11653	11569
Cast-in-Place Topping	-	-	5018