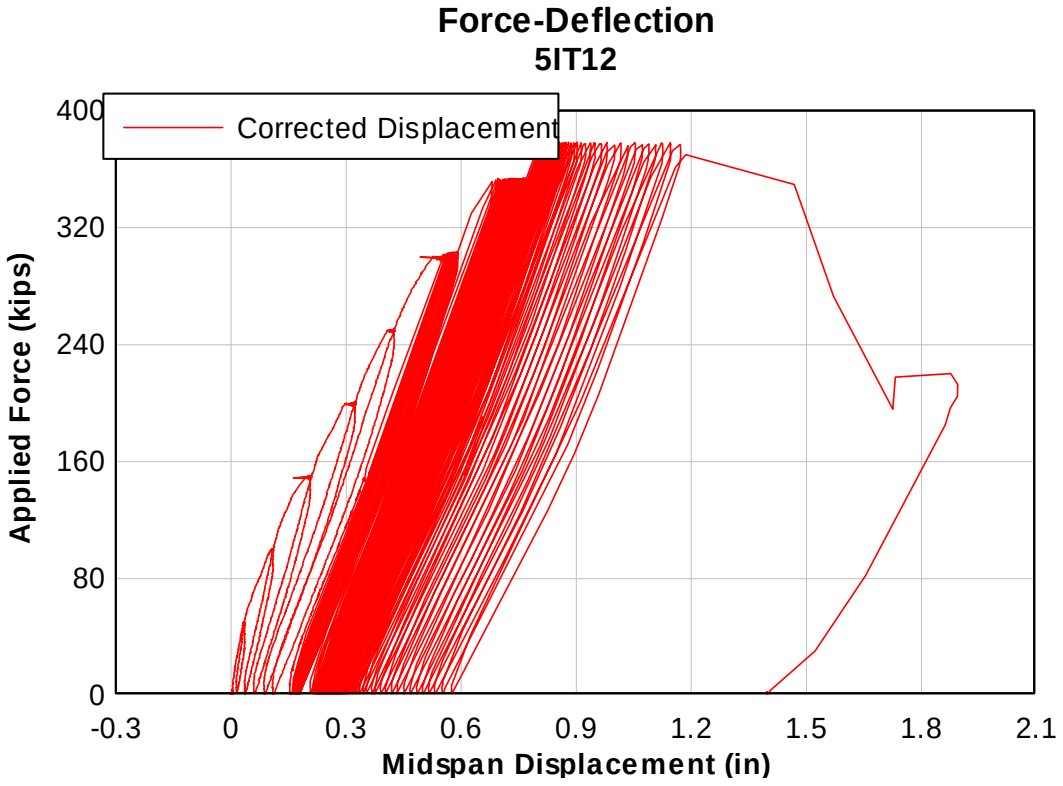
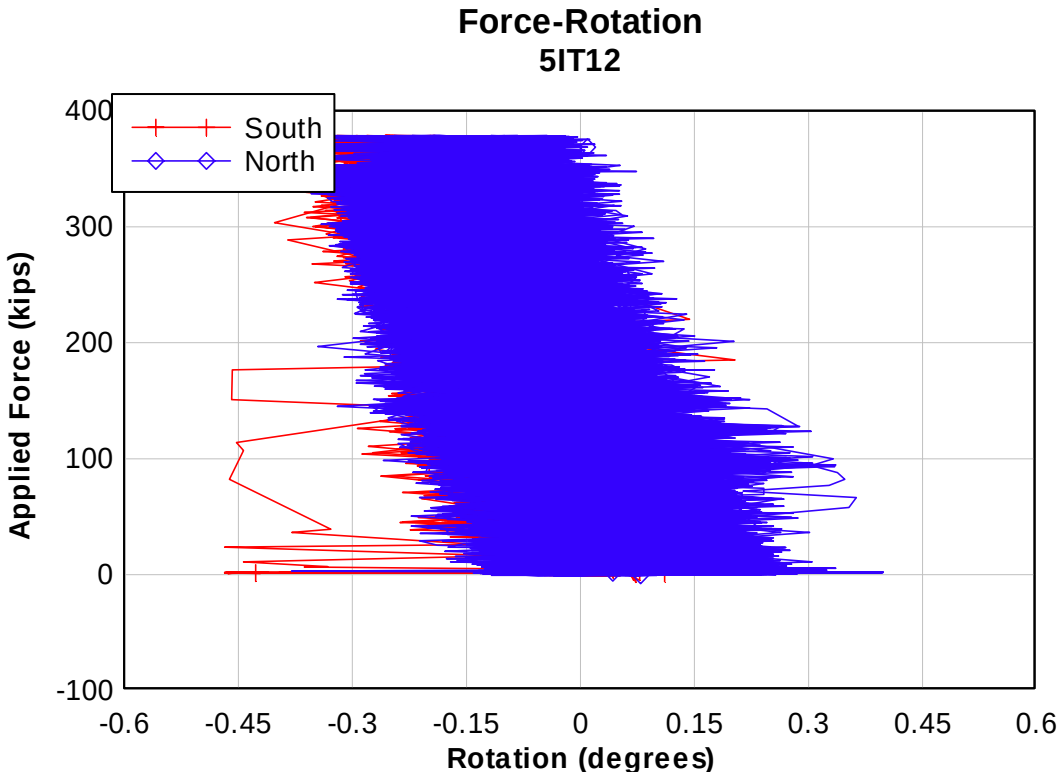
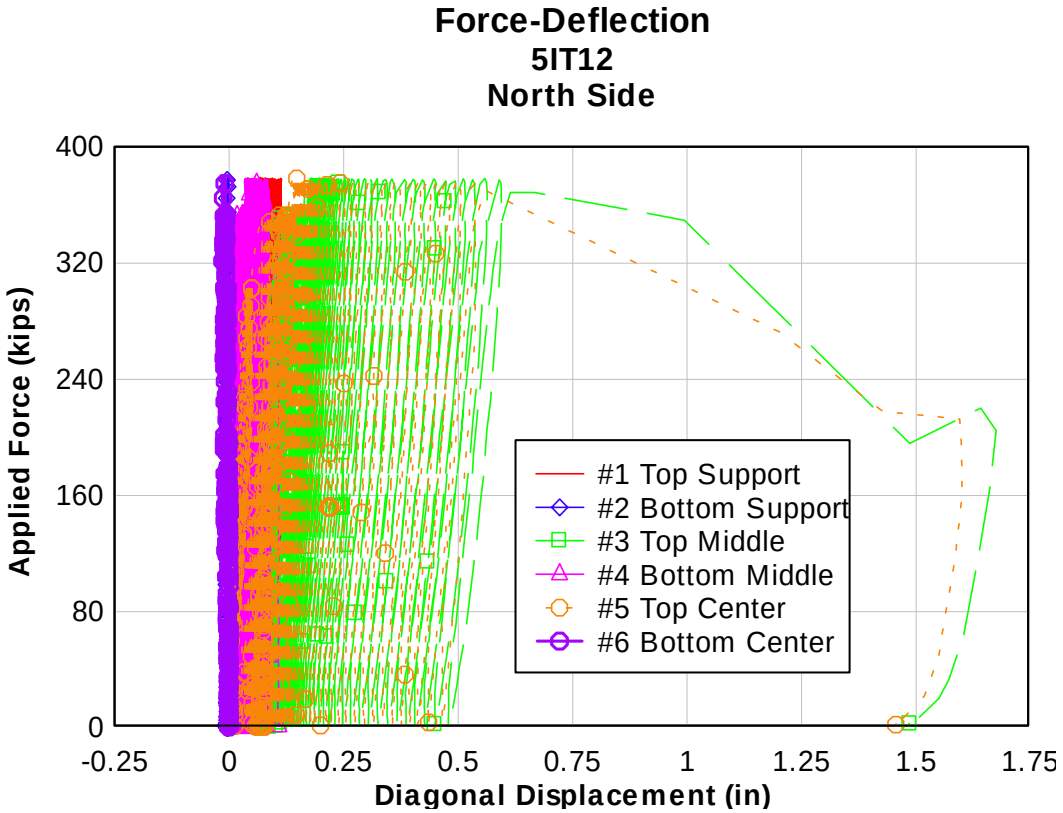
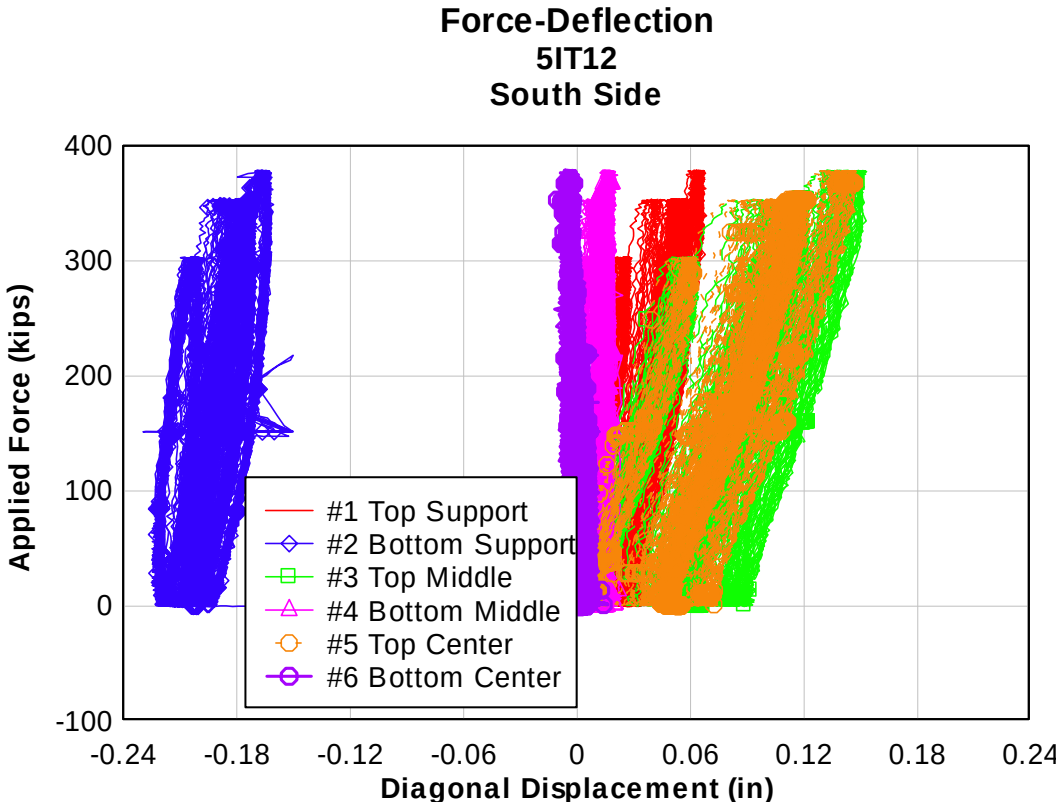
APPENDIX A5

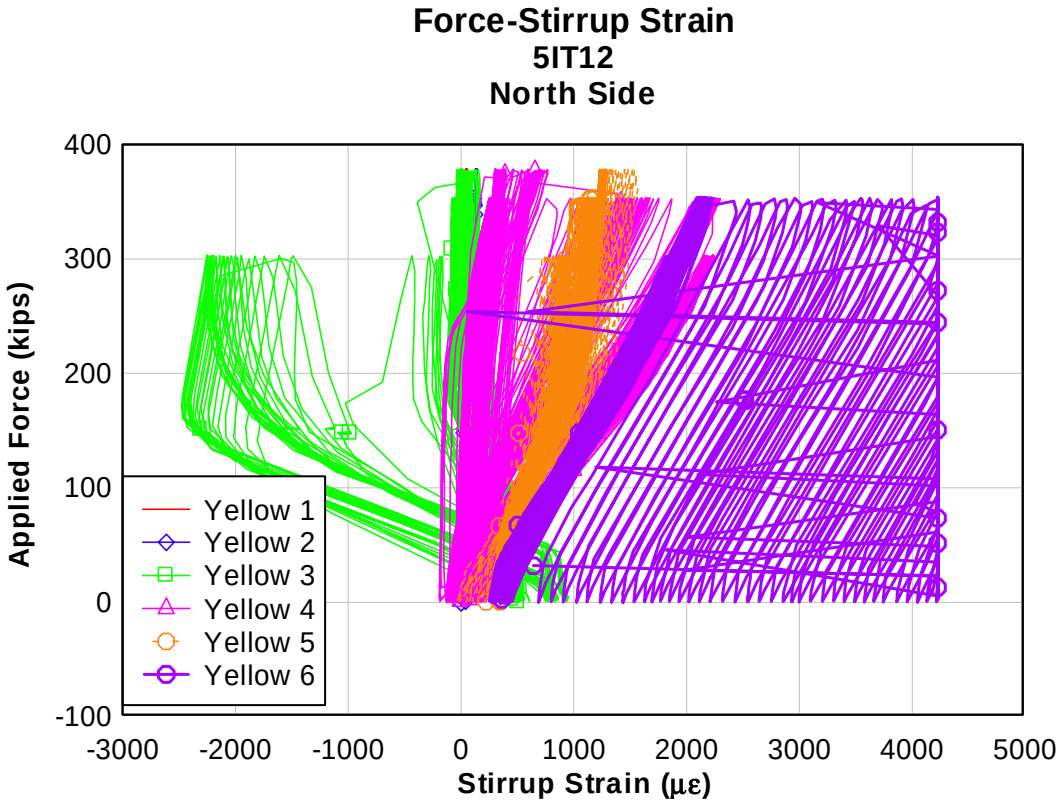
FORCE DEFLECTION

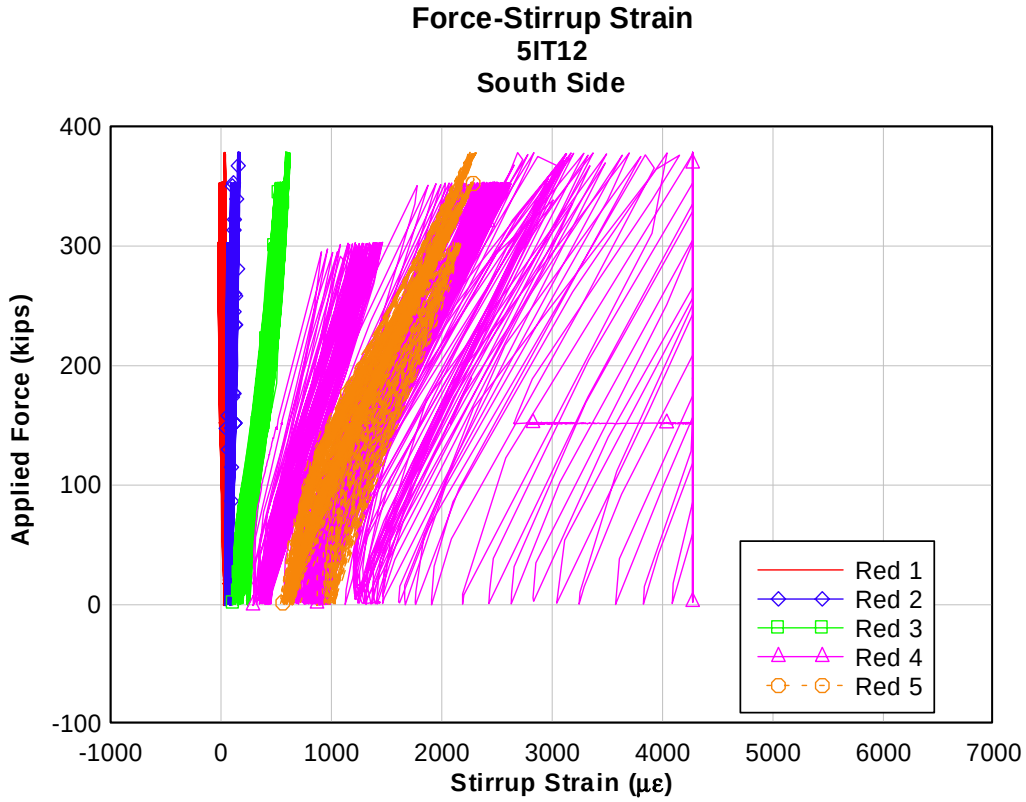

Force-Deflection
5IT12
Corrected Displacement
Applied Force (kips)
400
320
240
160
80
0
-0.3
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
Midspan Displacement (in)

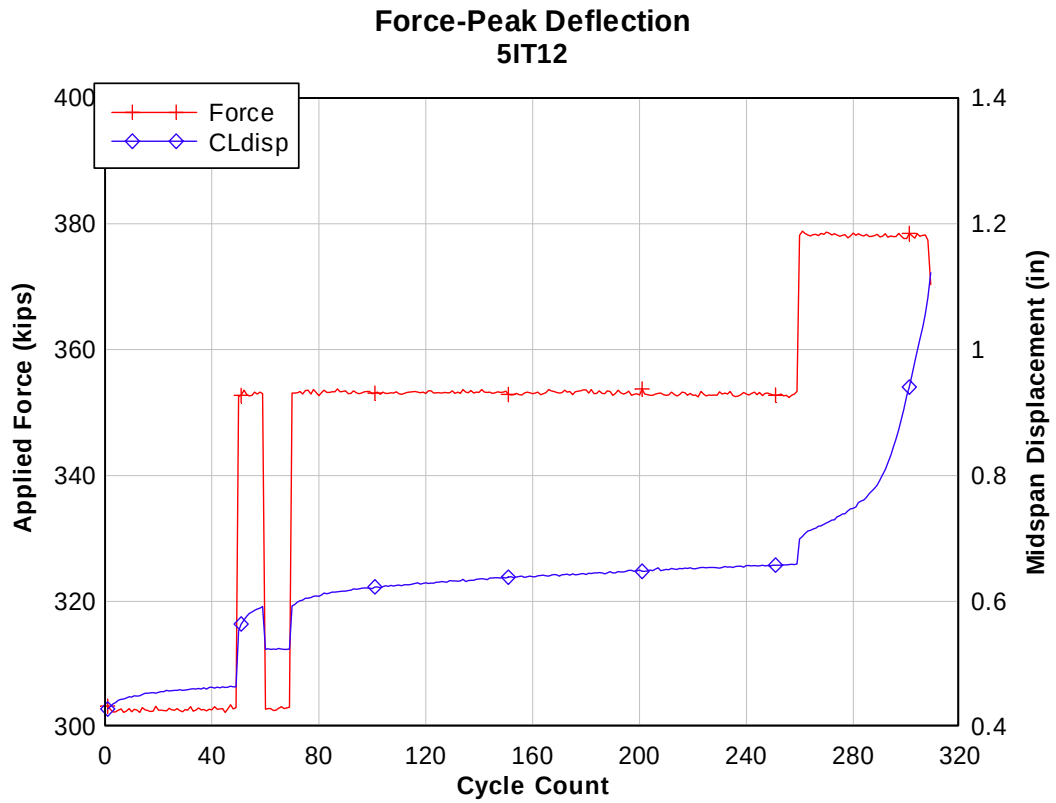

Force-Rotation
5IT12
South
North
Applied Force (kips)
400
300
200
100
0
-100
-0.6
-0.45
-0.3
-0.15
0
0.15
0.3
0.45
0.6
Rotation (degrees)

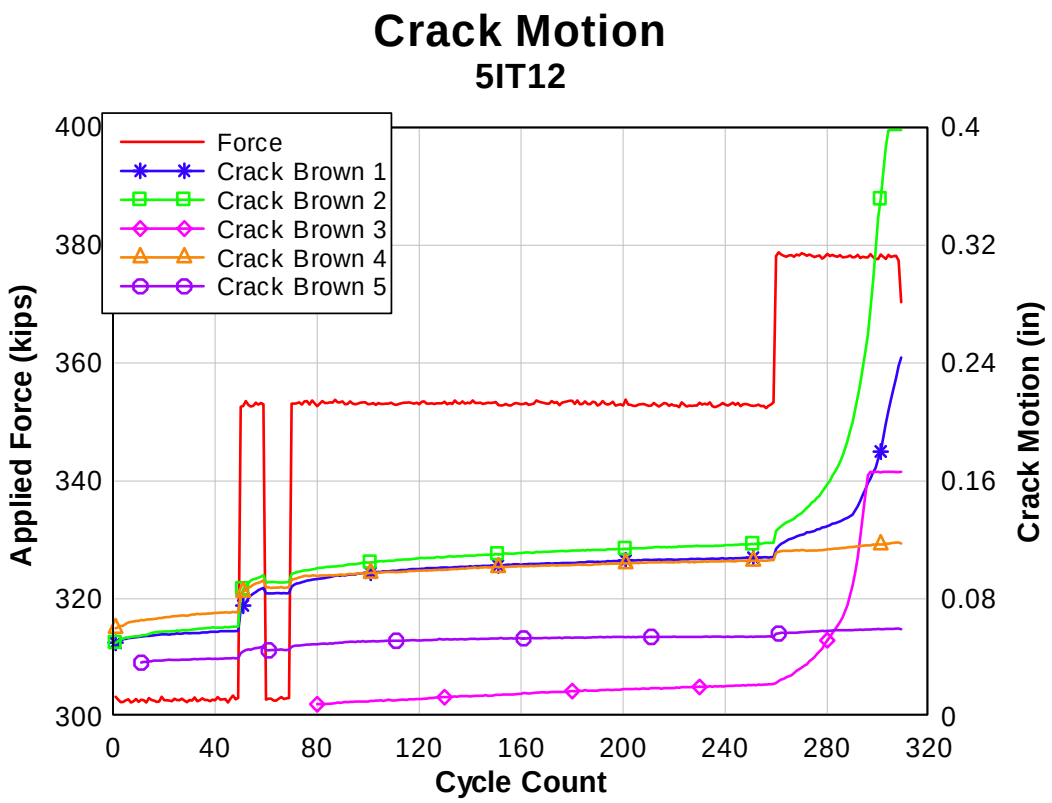

Force-Deflection
5IT12
North Side
Applied Force (kips)
Diagonal Displacement (in)
400
320
240
160
80
0
-0.25
0
0.25
0.5
0.75
1
1.25
1.5
1.75
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

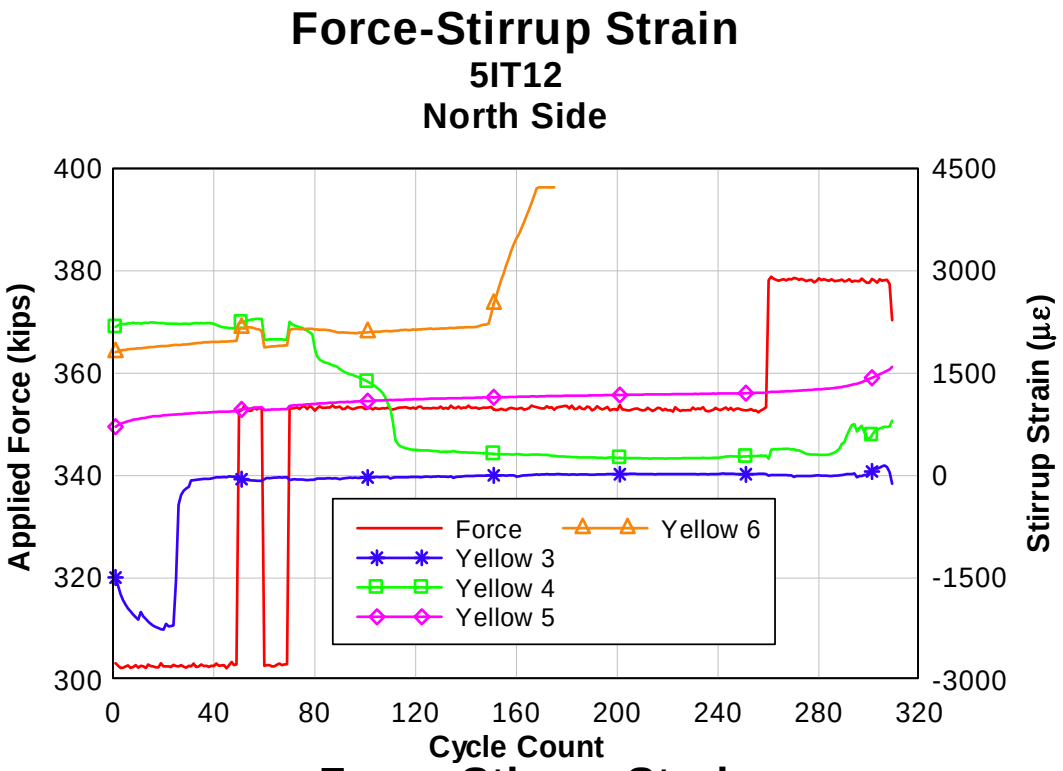

Force-Deflection
5IT12
South Side
Applied Force (kips)
Diagonal Displacement (in)
400
300
200
100
0
-100
-0.24
-0.18
-0.12
-0.06
0
0.06
0.12
0.18
0.24
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

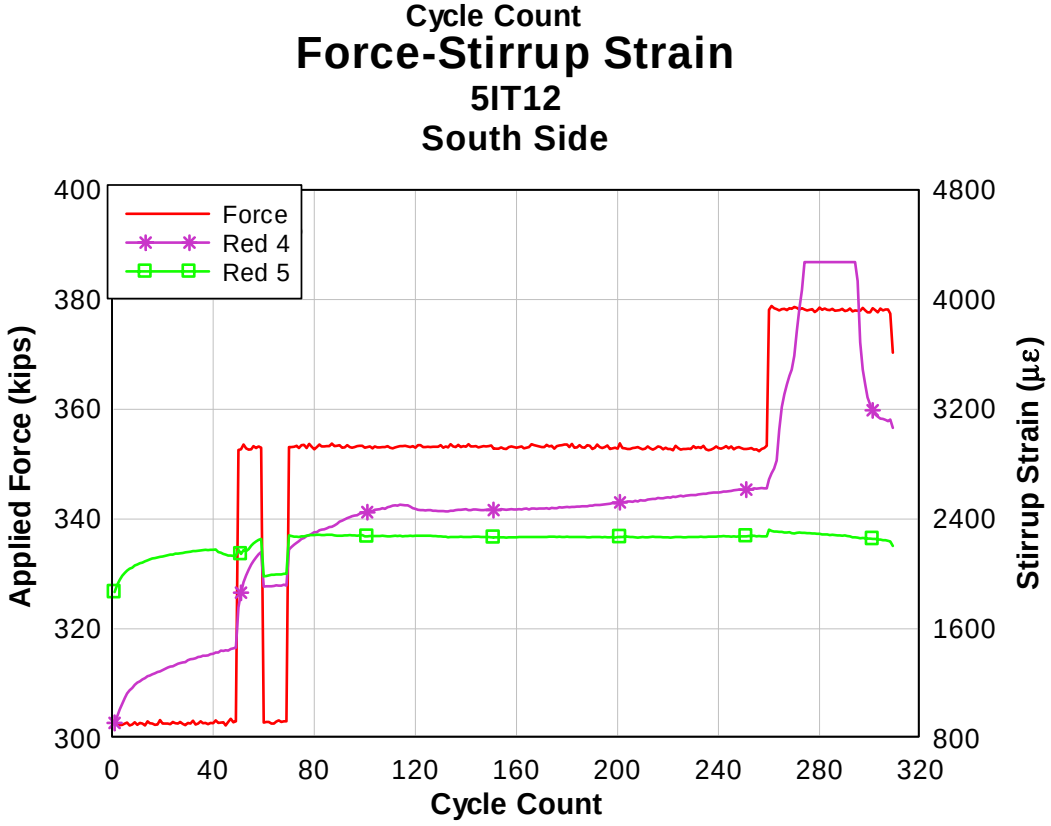

Force-Stirrup Strain
5IT12
North Side
Applied Force (kips)
Stirrup Strain (με)
400
300
200
100
0
-100
-3000
-2000
-1000
0
1000
2000
3000
4000
5000
Yellow 1
Yellow 2
Yellow 3
Yellow 4
Yellow 5
Yellow 6

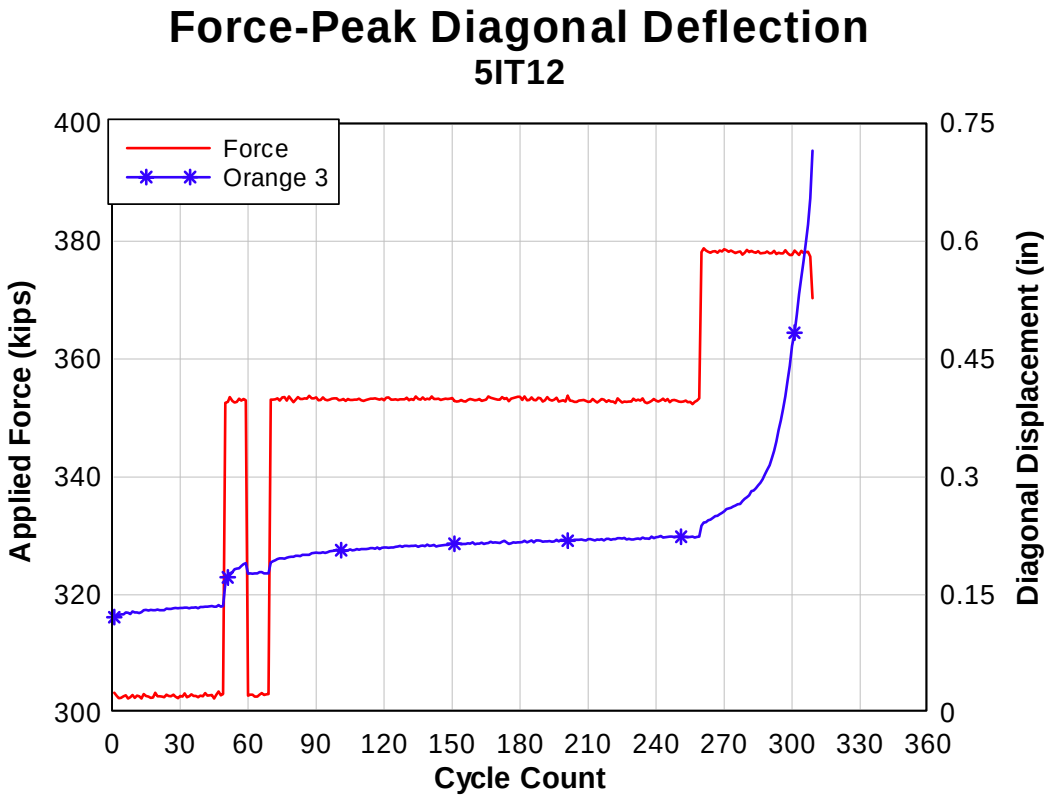

Force-Stirrup Strain
5IT12
South Side
Applied Force (kips)
Stirrup Strain (με)
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000
Red 1
Red 2
Red 3
Red 4
Red 5

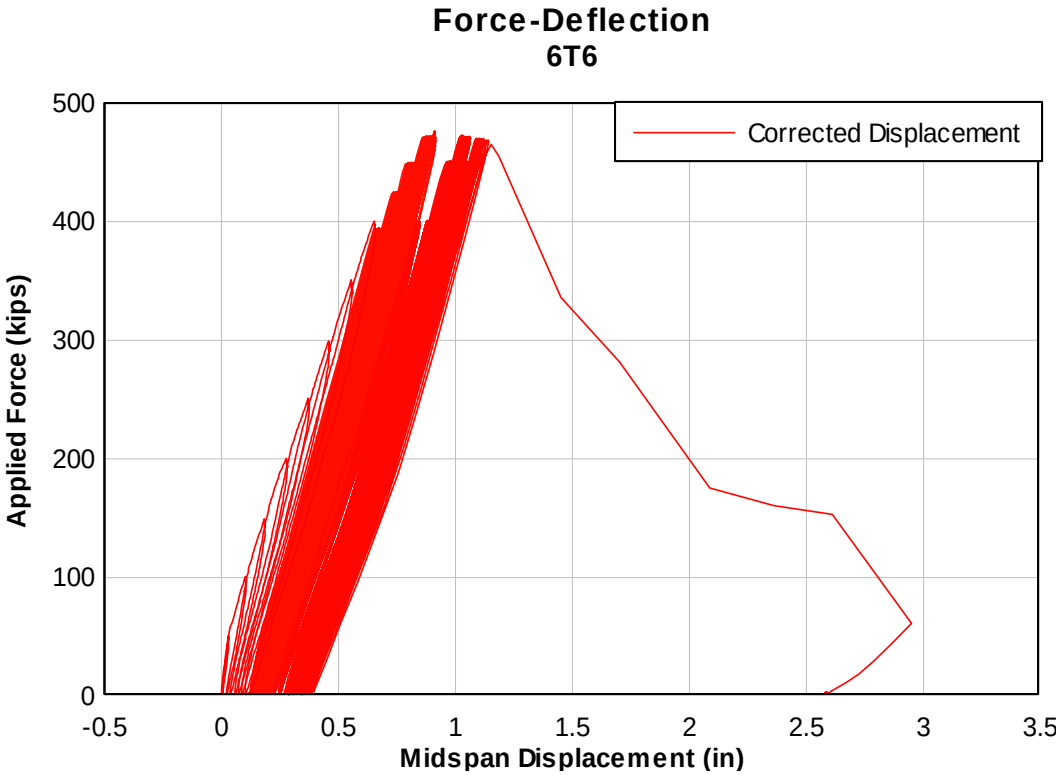

Force-Peak Deflection
5IT12
Force
CLdisp
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
400
380
360
340
320
300
1.4
1.2
1
0.8
0.6
0.4
0
40
80
120
160
200
240
280
320

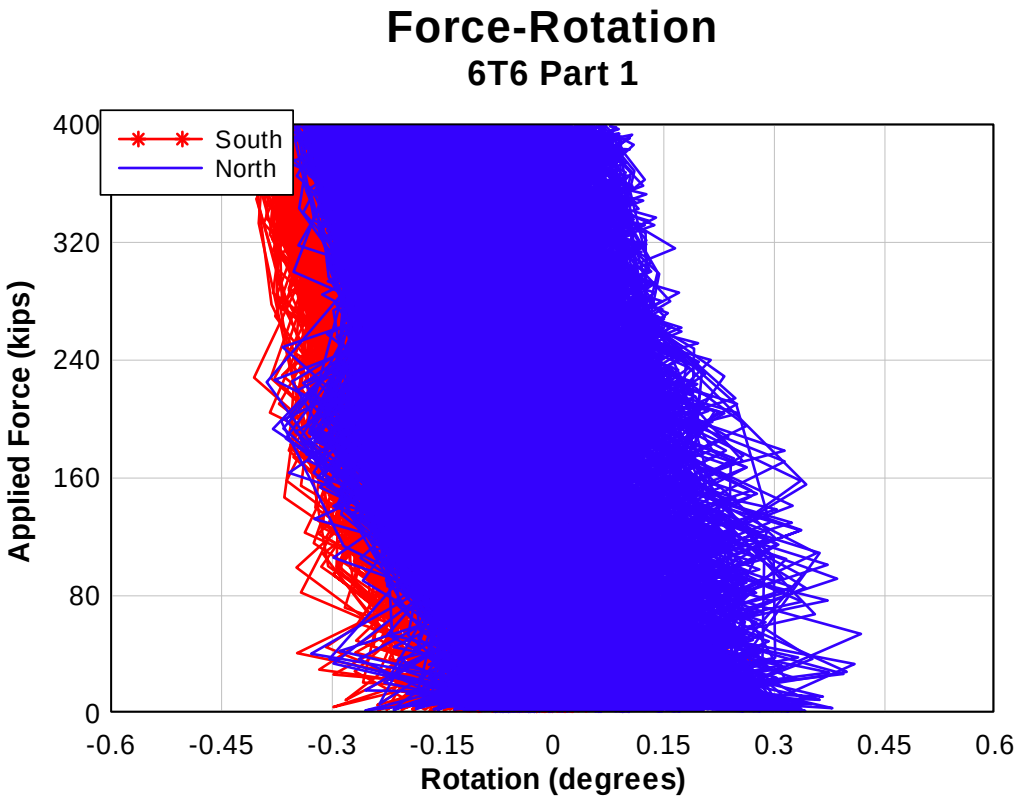

Crack Motion
5IT12
Force
Crack Brown 1
Crack Brown 2
Crack Brown 3
Crack Brown 4
Crack Brown 5
Applied Force (kips)
Crack Motion (in)
Cycle Count
400
380
360
340
320
300
0.4
0.32
0.24
0.16
0.08
0
0
40
80
120
160
200
240
280
320

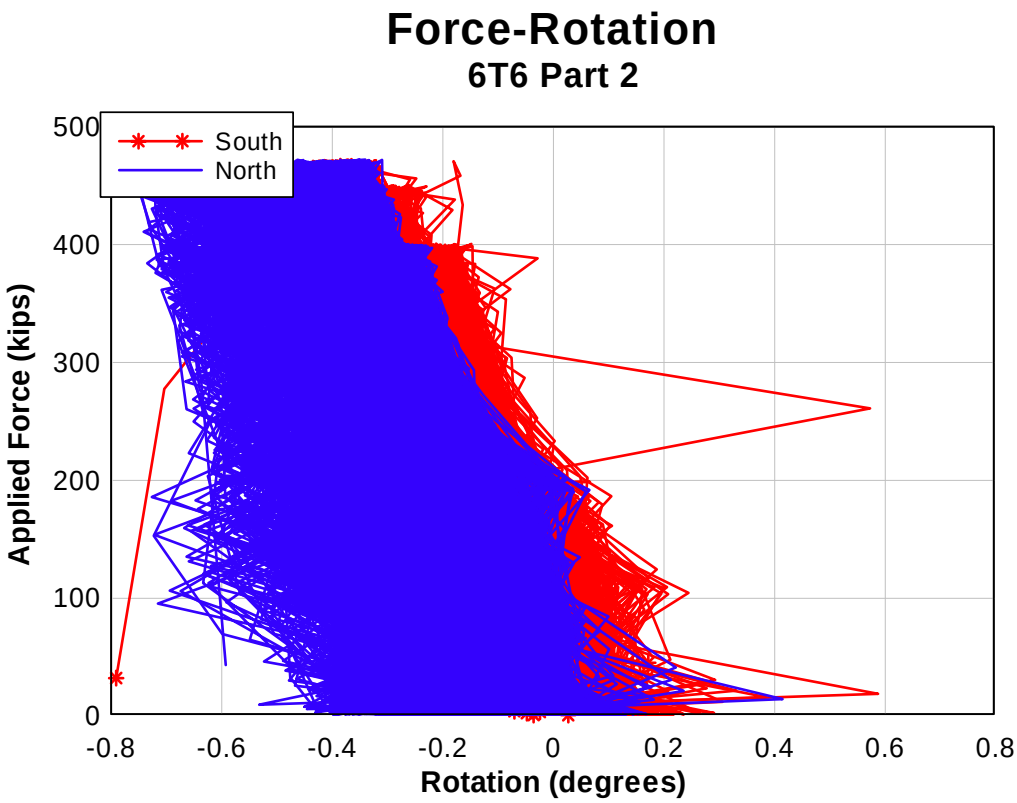

Force-Stirrup Strain
5IT12
North Side
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
Force
Yellow 3
Yellow 4
Yellow 5
Yellow 6
400
380
360
340
320
300
4500
3000
1500
0
-1500
-3000
0
40
80
120
160
200
240
280
320

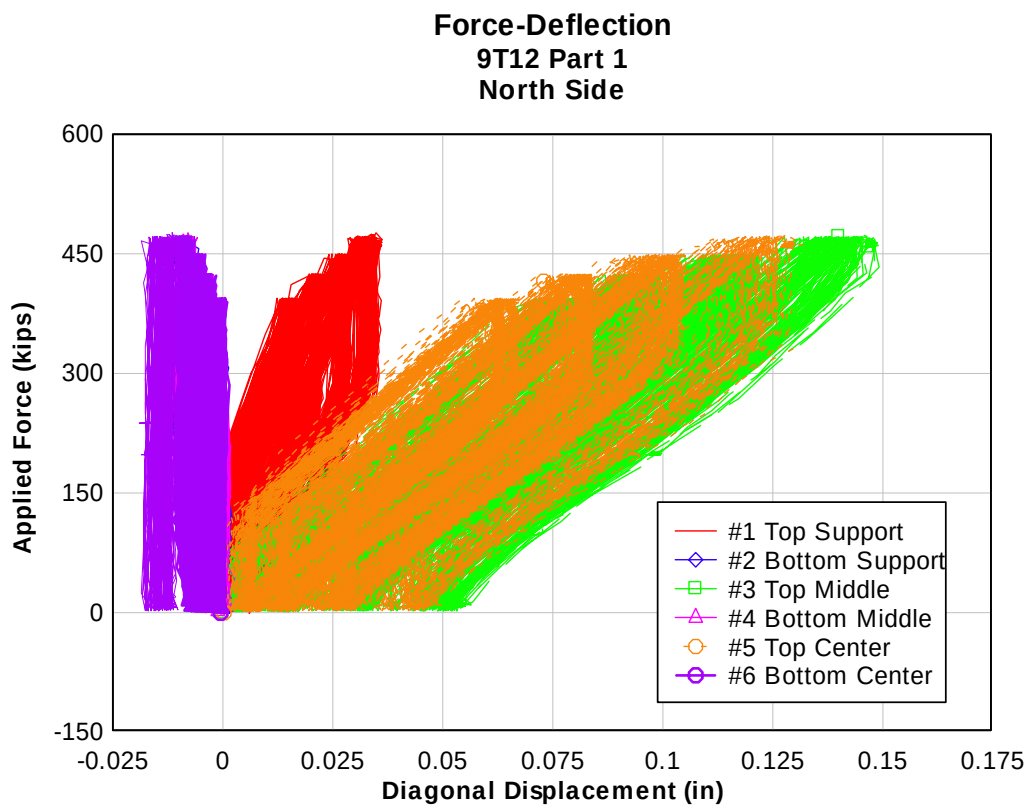

Force-Stirrup Strain
5IT12
South Side
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
Force
Red 4
Red 5
400
380
360
340
320
300
4800
4000
3200
2400
1600
800
0
40
80
120
160
200
240
280
320

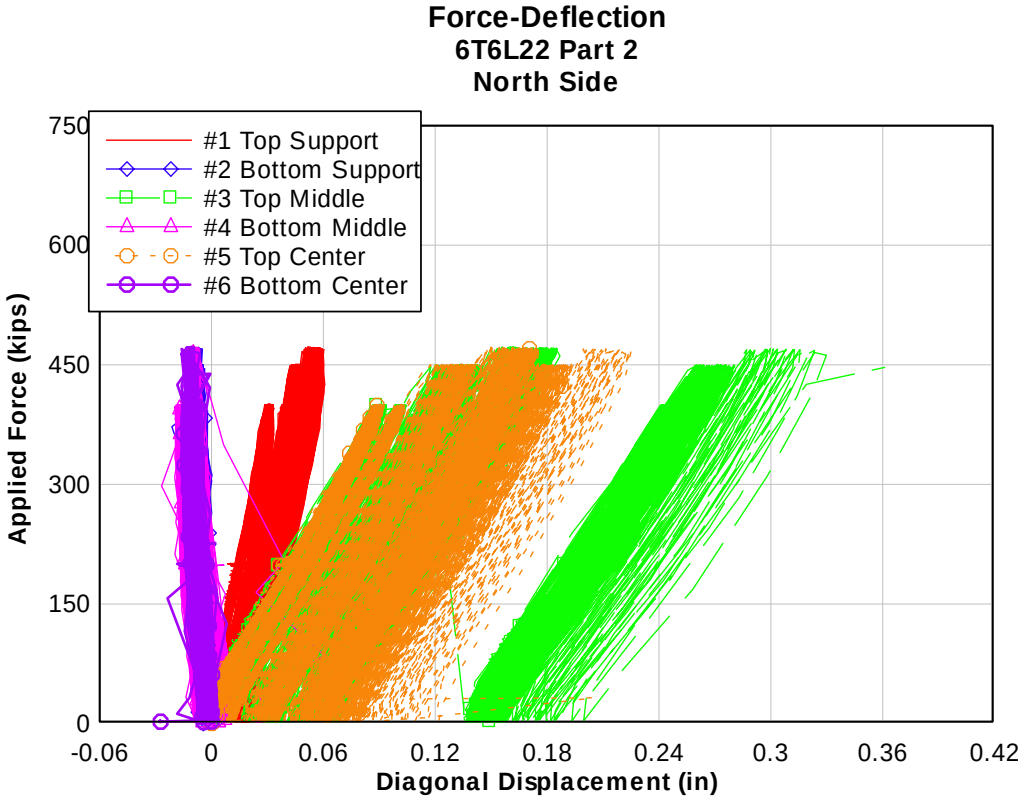

Force-Peak Diagonal Deflection
5IT12
Force
Orange 3
Applied Force (kips)
Diagonal Displacement (in)
Cycle Count
400
380
360
340
320
300
0.75
0.6
0.45
0.3
0.15
0
0
30
60
90
120
150
180
210
240
270
300
330
360

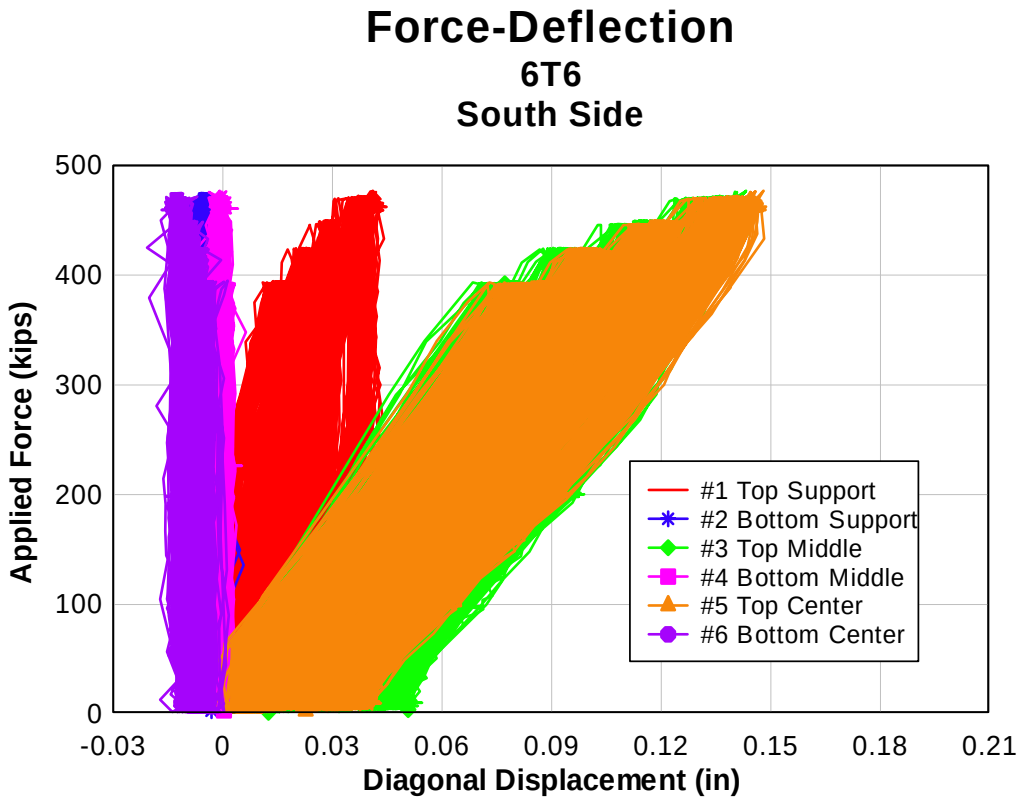

Force-Deflection
6T6
Corrected Displacement
Applied Force (kips)
Midspan Displacement (in)
500
400
300
200
100
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5

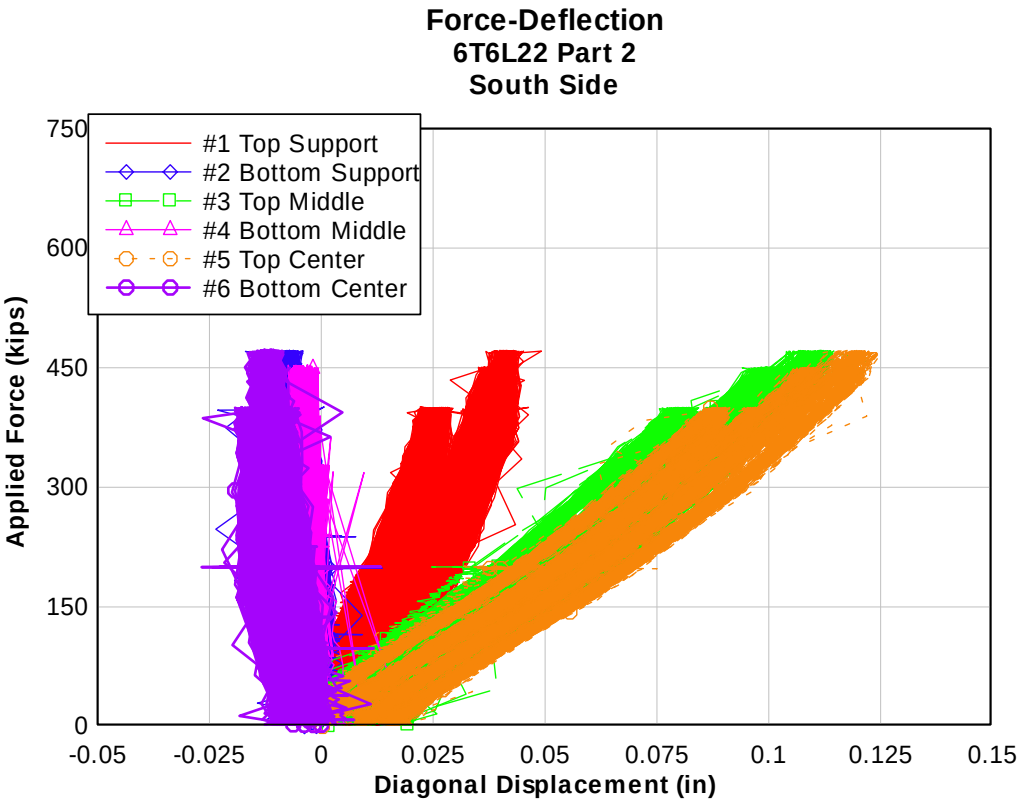

Force-Rotation
6T6 Part 1
South
North
Applied Force (kips)
Rotation (degrees)
400
320
240
160
80
0
-0.6
-0.45
-0.3
-0.15
0
0.15
0.3
0.45
0.6

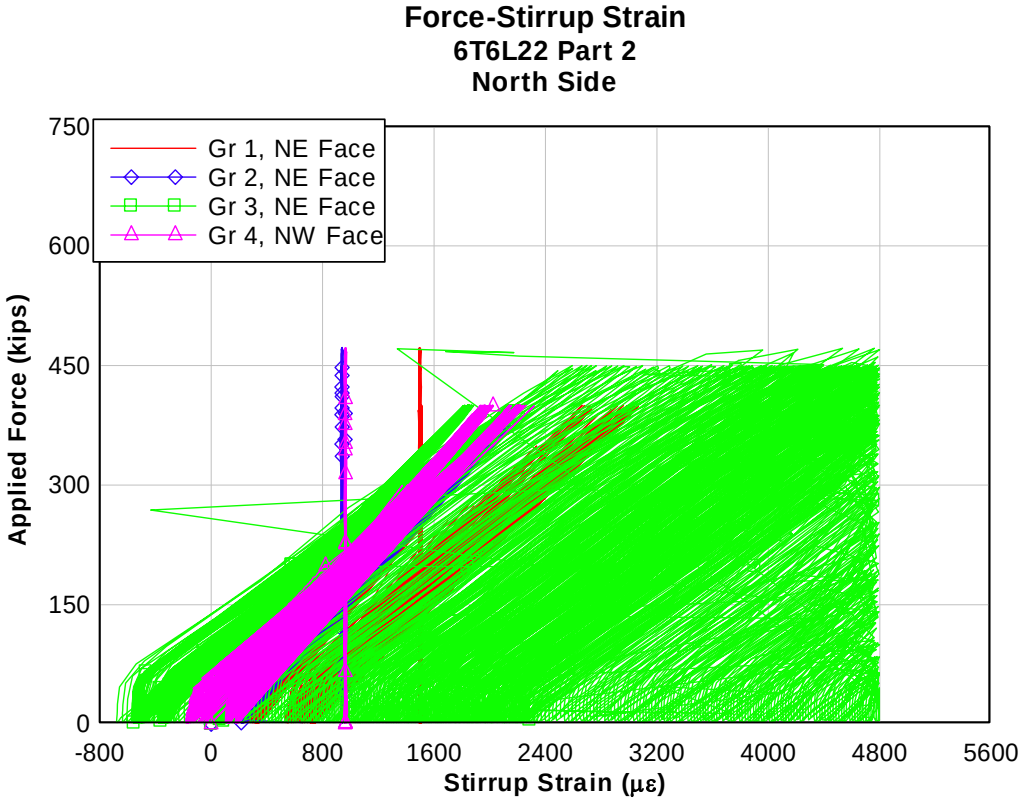

Force-Rotation
6T6 Part 2
South
North
Applied Force (kips)
Rotation (degrees)
500
400
300
200
100
0
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

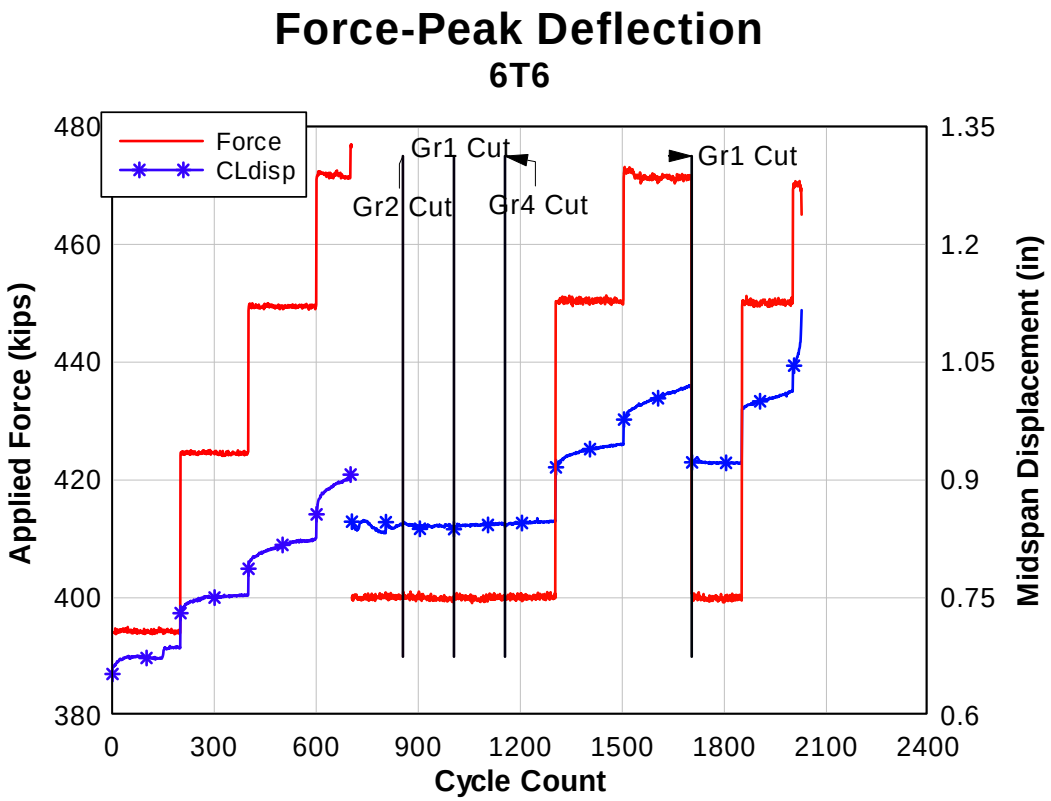

Force-Deflection
9T12 Part 1
North Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
Diagonal Displacement (in)
600
450
300
150
0
-150
-0.025
0
0.025
0.05
0.075
0.1
0.125
0.15
0.175

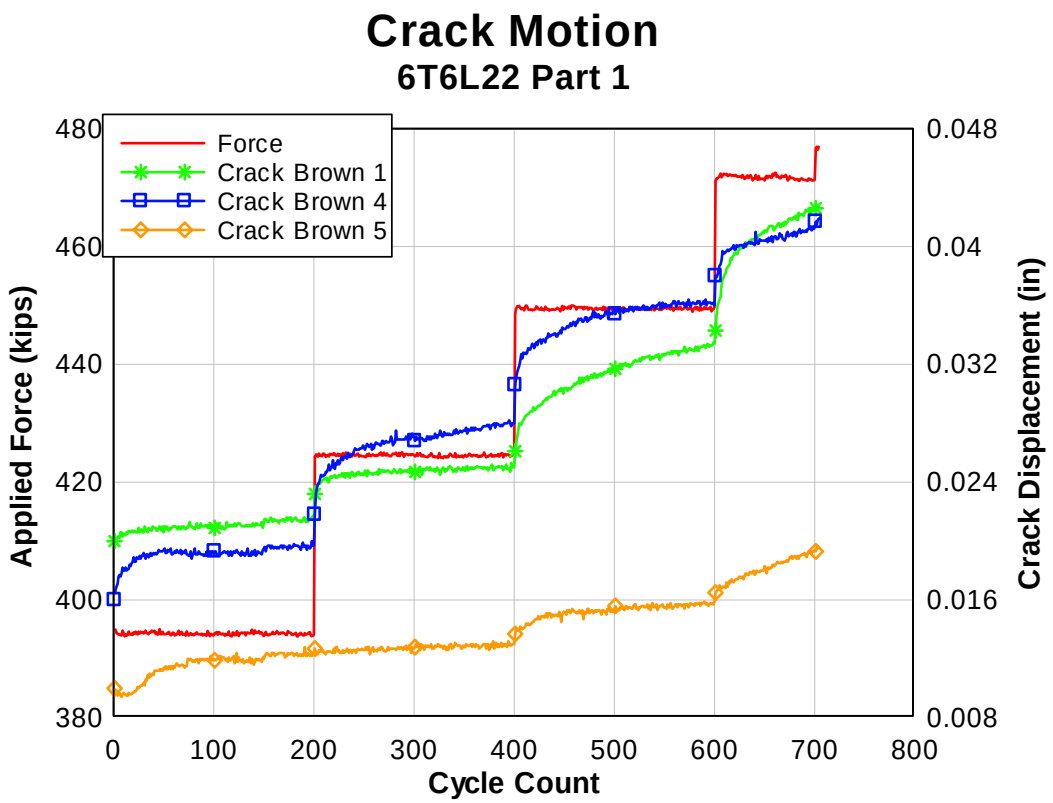

Force-Deflection
6T6L22 Part 2
North Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
Diagonal Displacement (in)
750
600
450
300
150
0
-0.06
0
0.06
0.12
0.18
0.24
0.3
0.36
0.42

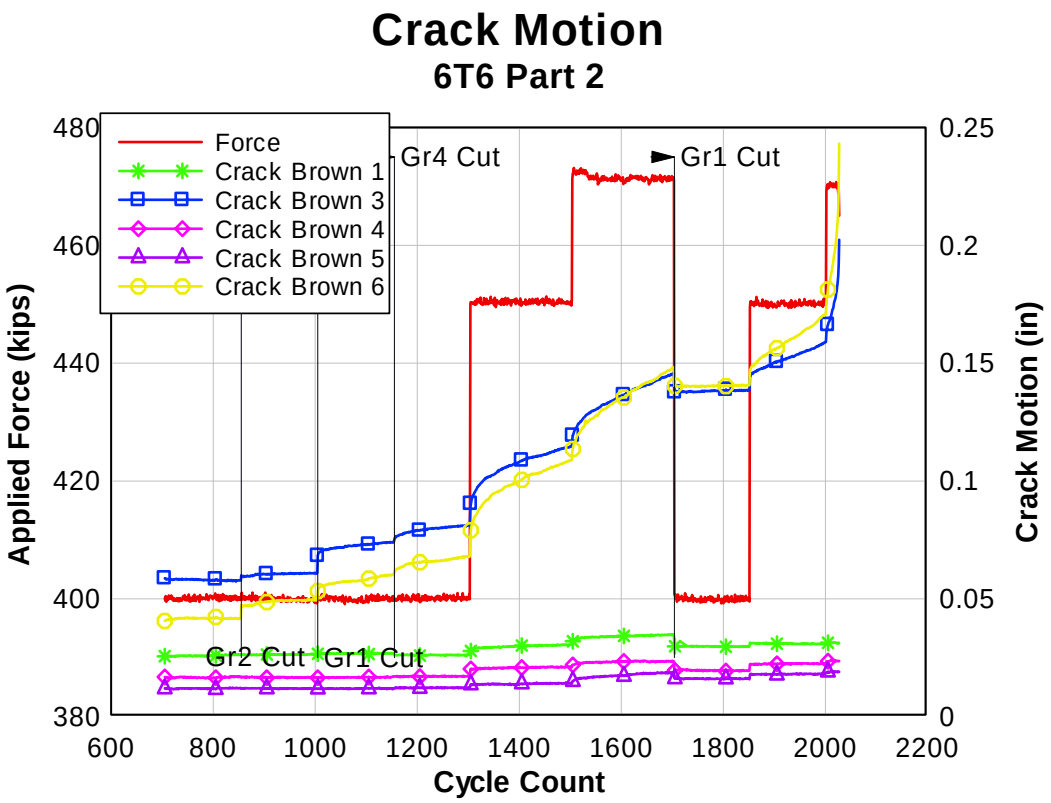

Force-Deflection
6T6
South Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
Diagonal Displacement (in)
500
400
300
200
100
0
-0.03
0
0.03
0.06
0.09
0.12
0.15
0.18
0.21

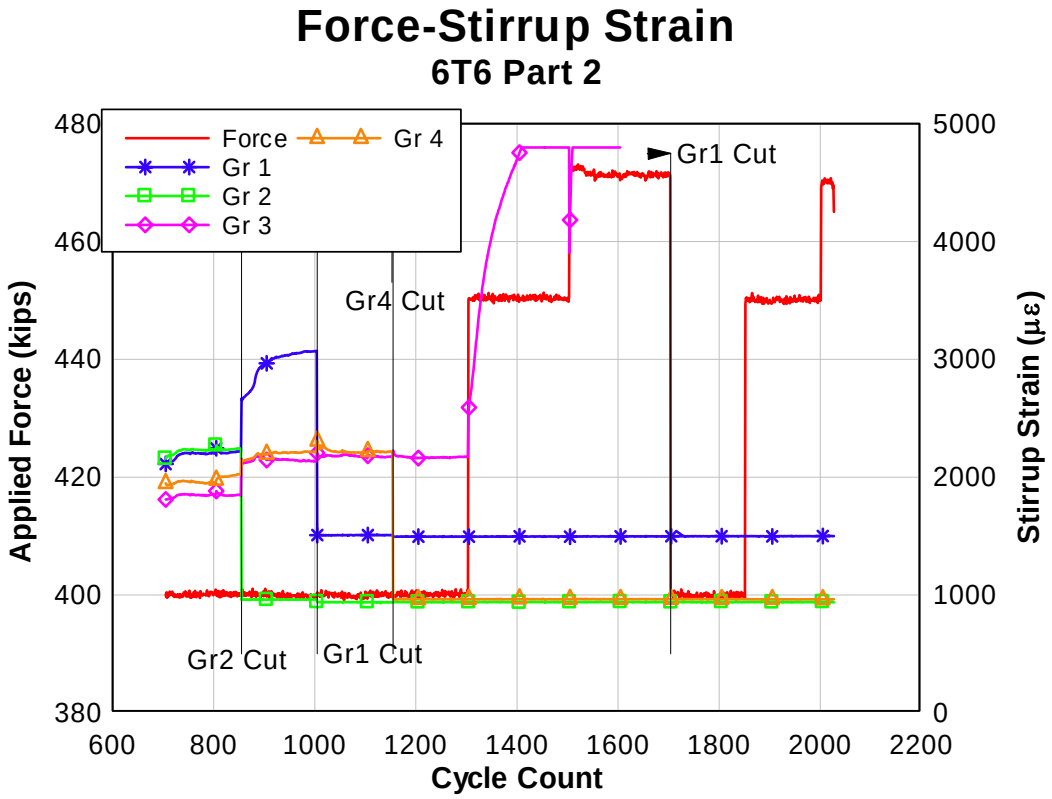

Force-Deflection
6T6L22 Part 2
South Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
750
600
450
300
150
0
-0.05
-0.025
0
0.025
0.05
0.075
0.1
0.125
0.15
Diagonal Displacement (in)

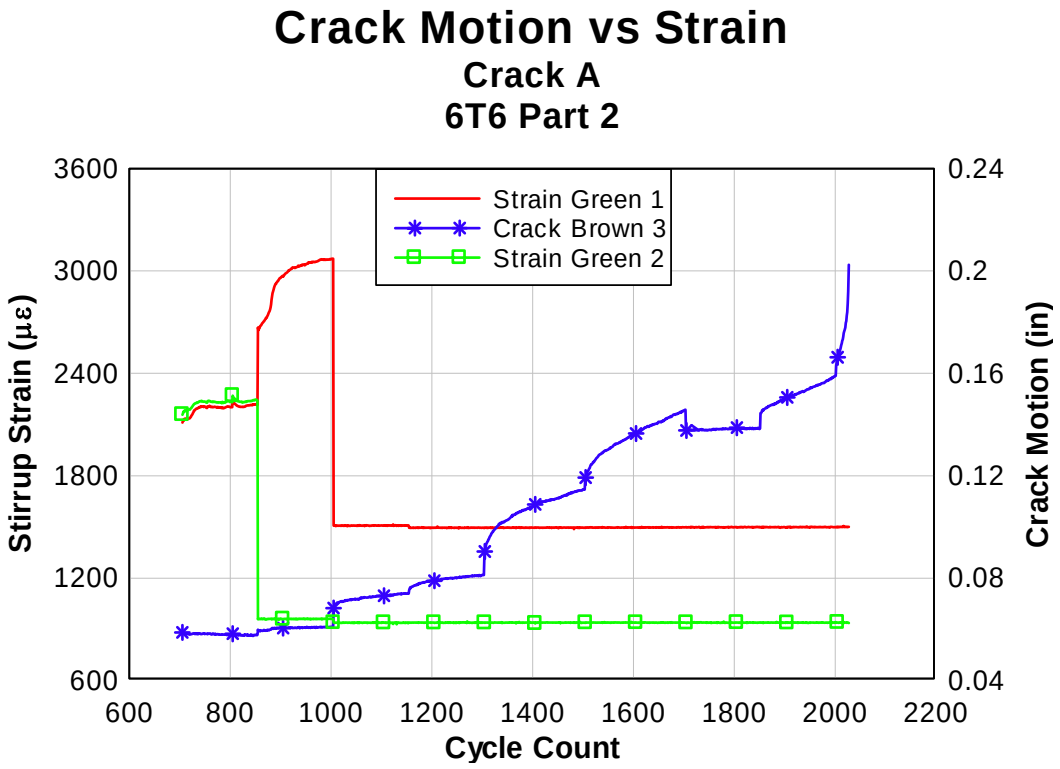

Force-Stirrup Strain
6T6L22 Part 2
North Side
Gr 1, NE Face
Gr 2, NE Face
Gr 3, NE Face
Gr 4, NW Face
Applied Force (kips)
750
600
450
300
150
0
-800
0
800
1600
2400
3200
4000
4800
5600
Stirrup Strain (με)

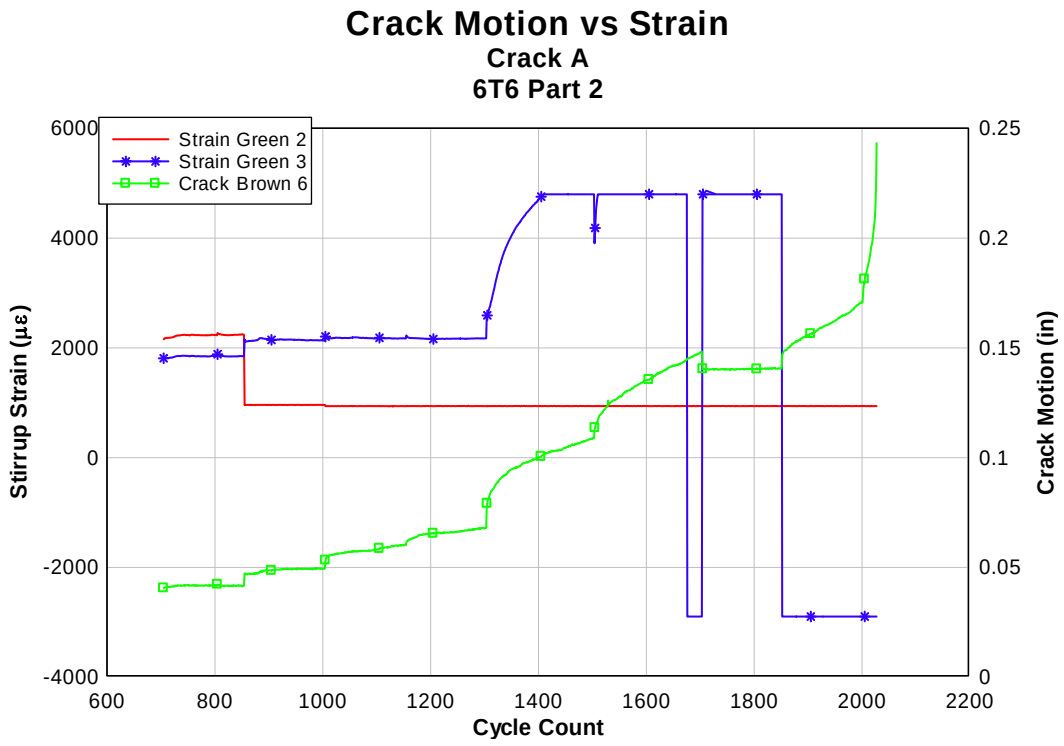

Force-Peak Deflection
6T6
Force
CLdisp
Gr1 Cut
Gr2 Cut
Gr4 Cut
Gr1 Cut
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
480
460
440
420
400
380
1.35
1.2
1.05
0.9
0.75
0.6
0
300
600
900
1200
1500
1800
2100
2400

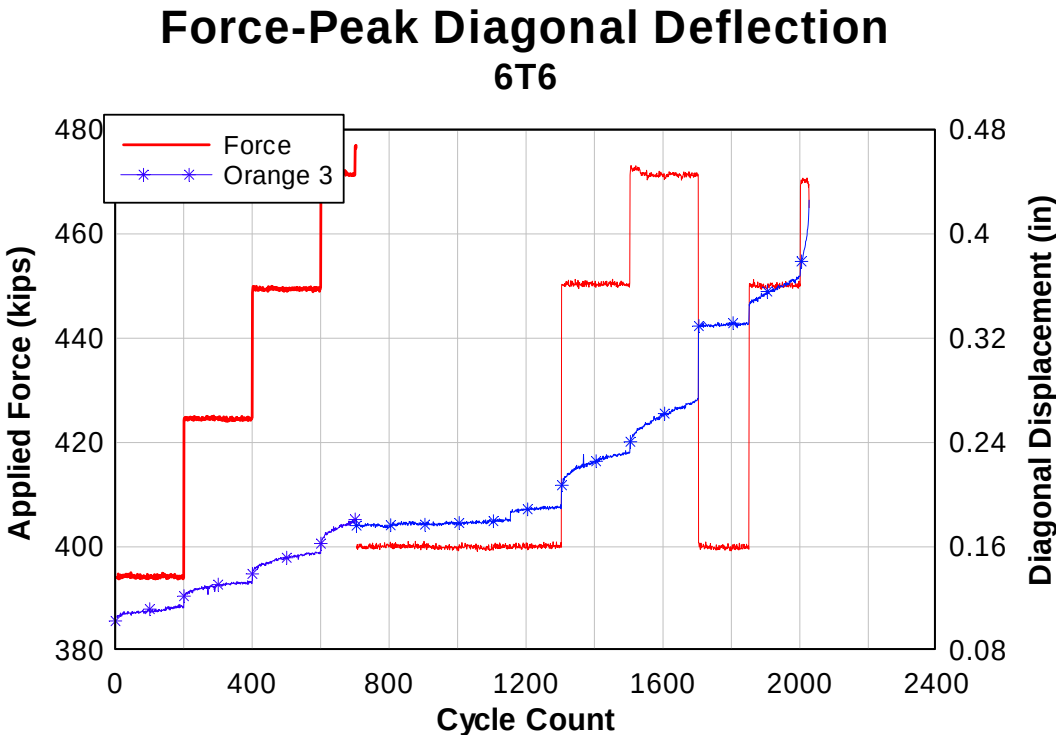

Crack Motion
6T6L22 Part 1
Force
Crack Brown 1
Crack Brown 4
Crack Brown 5
Applied Force (kips)
Crack Displacement (in)
Cycle Count
480
460
440
420
400
380
0.048
0.04
0.032
0.024
0.016
0.008
0
100
200
300
400
500
600
700
800

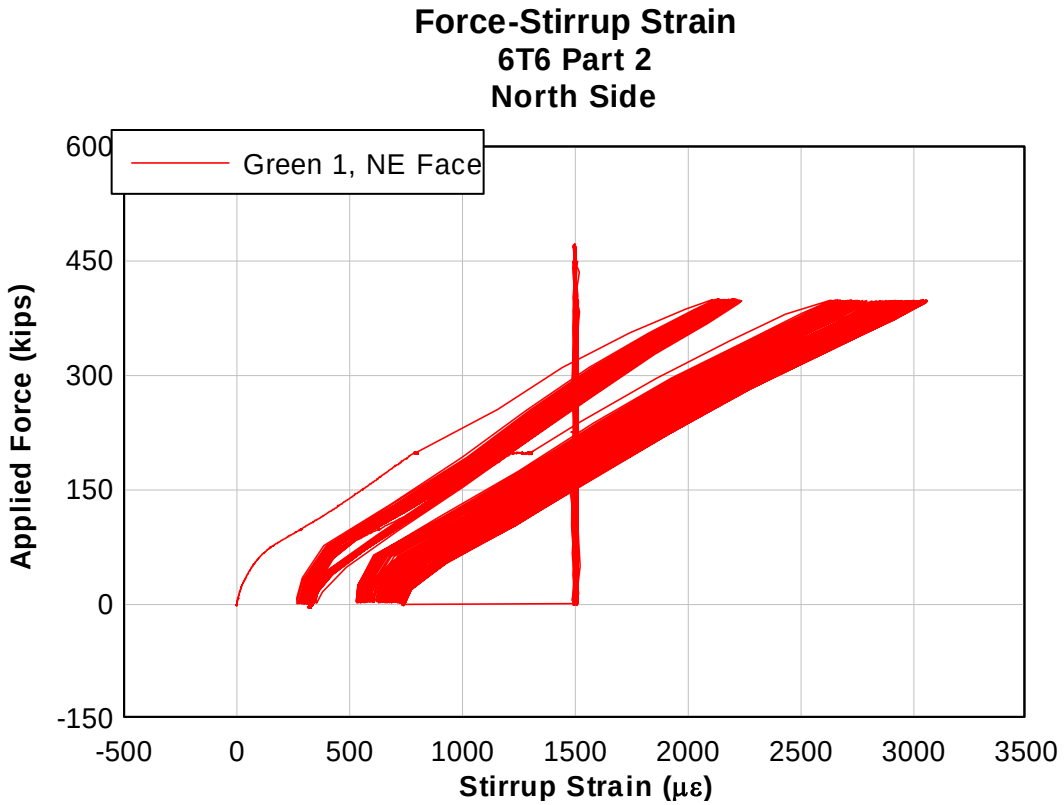

Crack Motion
6T6 Part 2
Force
Crack Brown 1
Crack Brown 3
Crack Brown 4
Crack Brown 5
Crack Brown 6
Gr4 Cut
Gr1 Cut
Gr2 Cut
Gr1 Cut
Applied Force (kips)
Crack Motion (in)
Cycle Count
480
460
440
420
400
380
0.25
0.2
0.15
0.1
0.05
0
600
800
1000
1200
1400
1600
1800
2000
2200

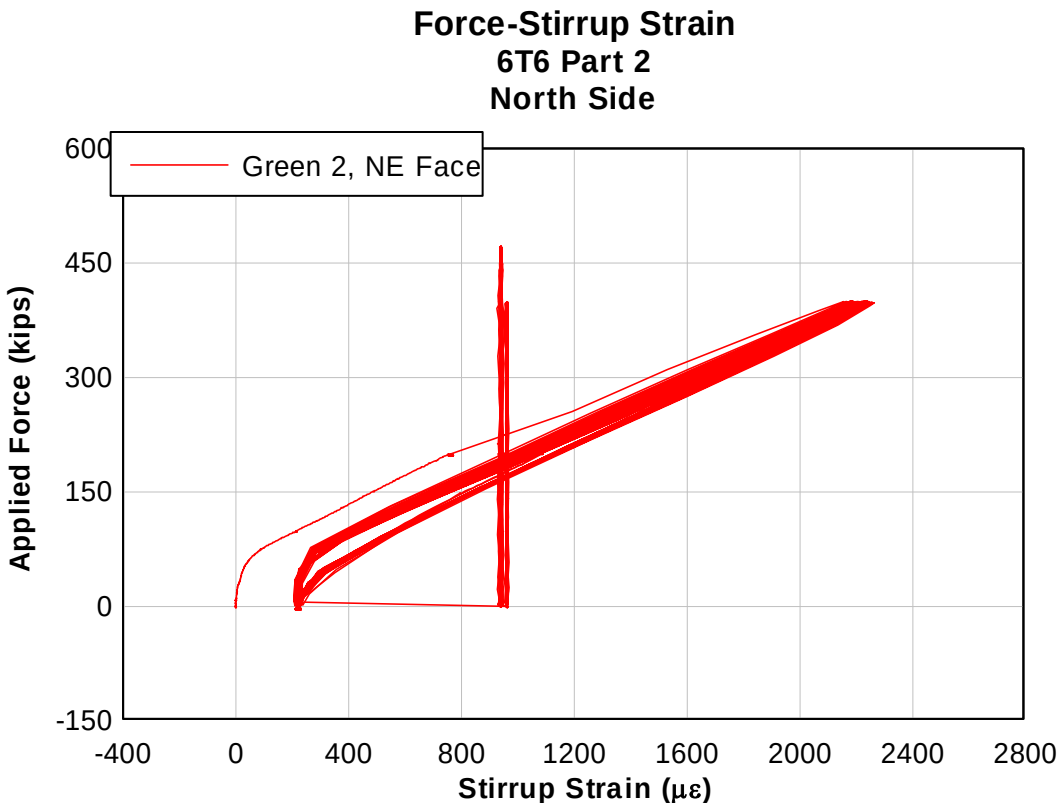

Force-Stirrup Strain
6T6 Part 2
Force
Gr 4
Gr 1
Gr 2
Gr 3
Gr1 Cut
Gr4 Cut
Gr2 Cut
Gr1 Cut
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
480
460
440
420
400
380
5000
4000
3000
2000
1000
0
600
800
1000
1200
1400
1600
1800
2000
2200

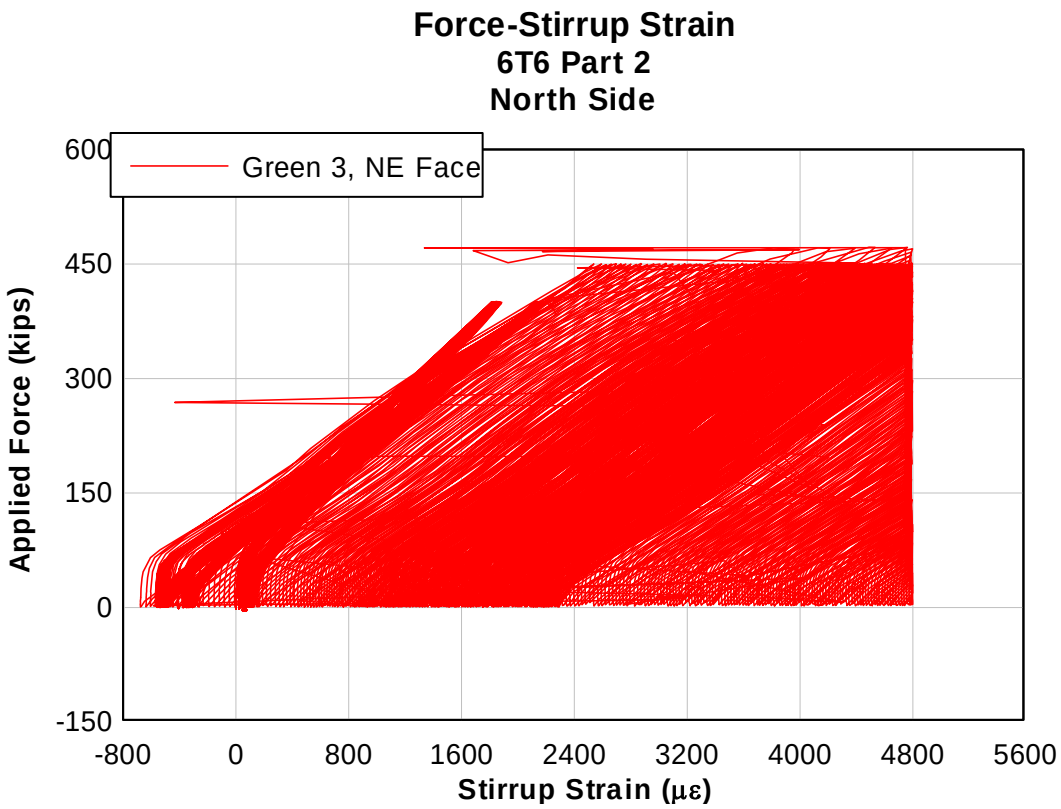

Crack Motion vs Strain
Crack A
6T6 Part 2
Strain Green 1
Crack Brown 3
Strain Green 2
Stirrup Strain (με)
Crack Motion (in)
Cycle Count
3600
3000
2400
1800
1200
600
0.24
0.2
0.16
0.12
0.08
0.04
600
800
1000
1200
1400
1600
1800
2000
2200

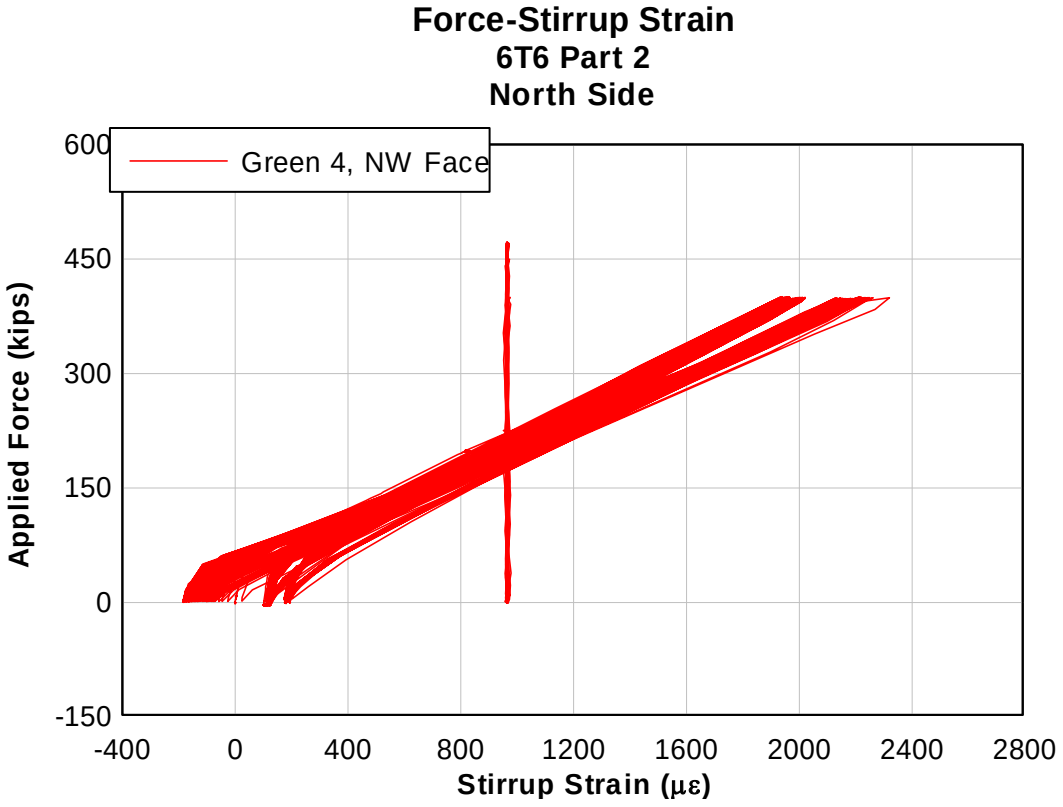

Crack Motion vs Strain
Crack A
6T6 Part 2
Strain Green 2
Strain Green 3
Crack Brown 6
Stirrup Strain (με)
Crack Motion (in)
Cycle Count
6000
4000
2000
0
-2000
-4000
0.25
0.2
0.15
0.1
0.05
0
600
800
1000
1200
1400
1600
1800
2000
2200

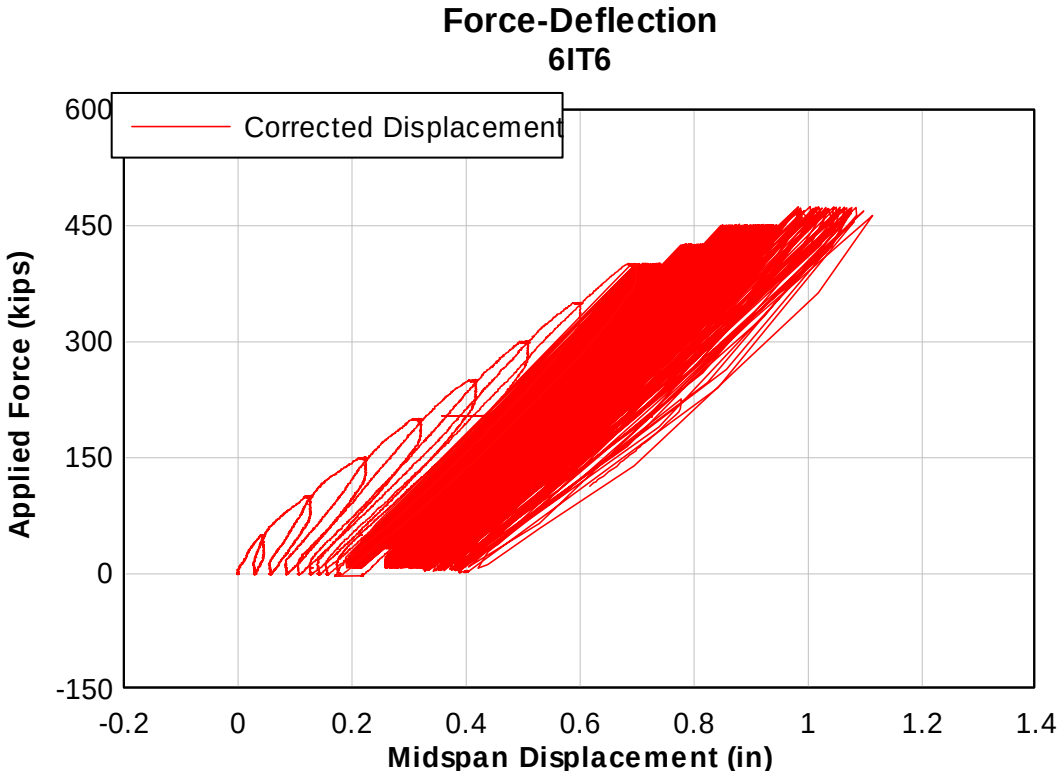

Force-Peak Diagonal Deflection
6T6
Force
Orange 3
Applied Force (kips)
Diagonal Displacement (in)
Cycle Count
480
460
440
420
400
380
0.48
0.4
0.32
0.24
0.16
0.08
0
400
800
1200
1600
2000
2400

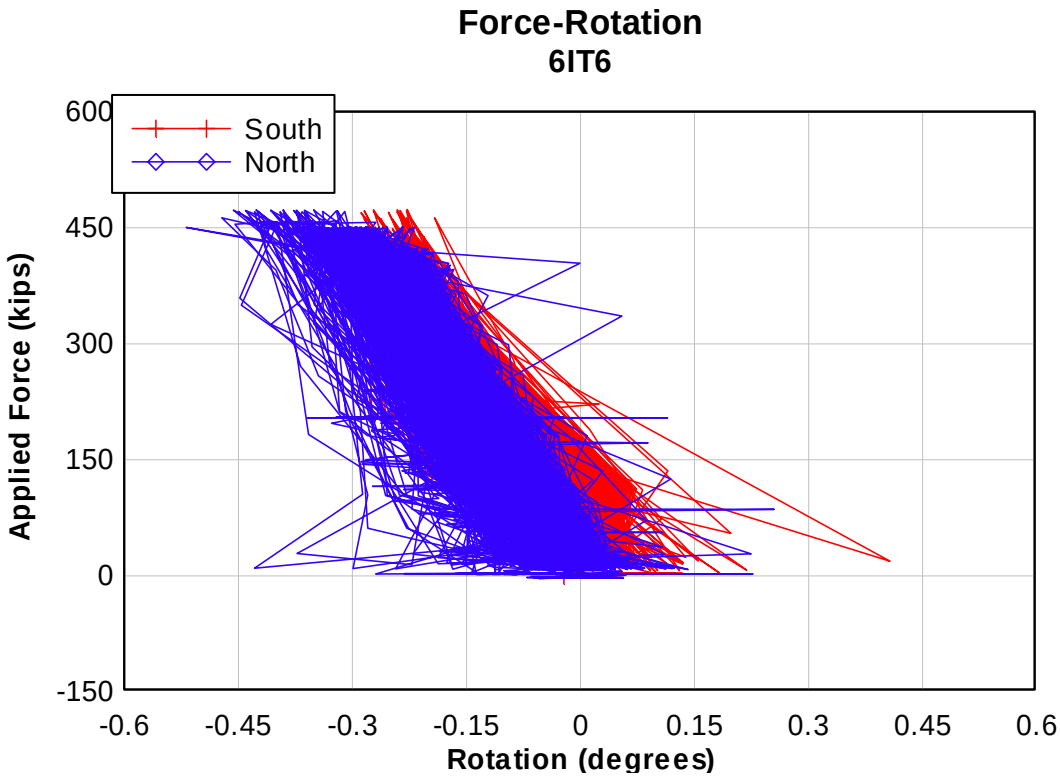

Force-Stirrup Strain
6T6 Part 2
North Side
Green 1, NE Face
Applied Force (kips)
Stirrup Strain (με)
600
450
300
150
0
-150
-500
0
500
1000
1500
2000
2500
3000
3500

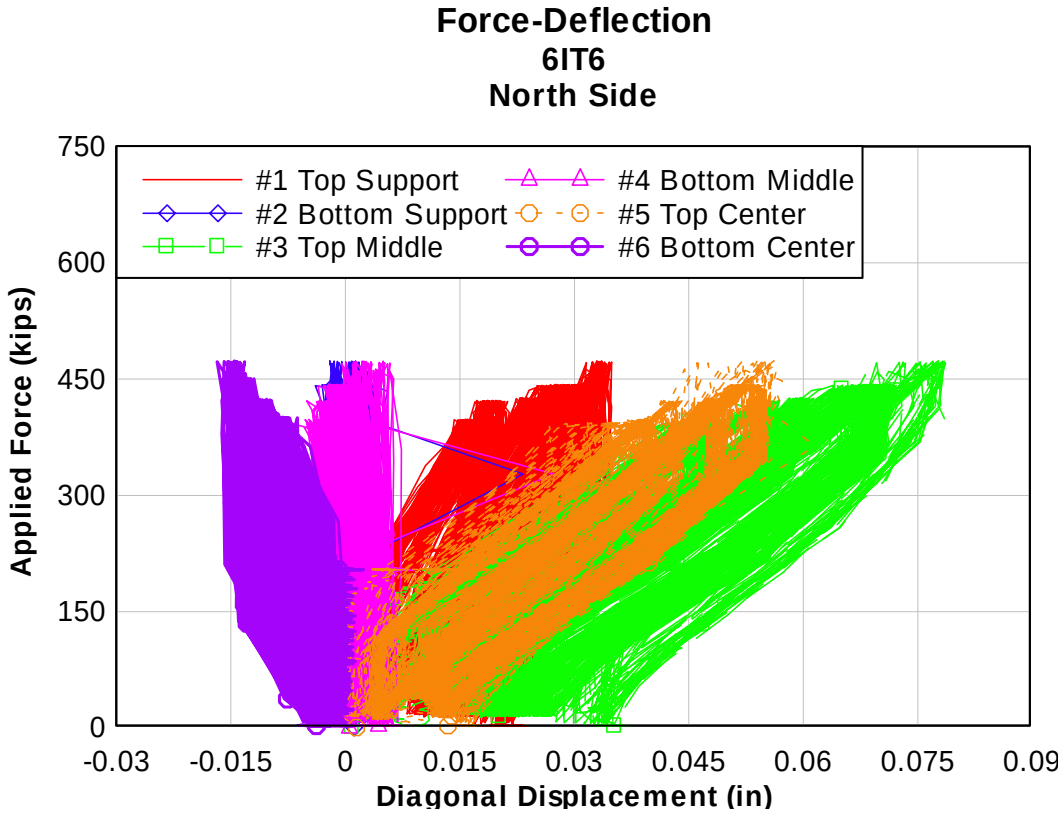

Force-Stirrup Strain
6T6 Part 2
North Side
Green 2, NE Face
Applied Force (kips)
600
450
300
150
0
-150
-400
0
400
800
1200
1600
2000
2400
2800
Stirrup Strain (με)

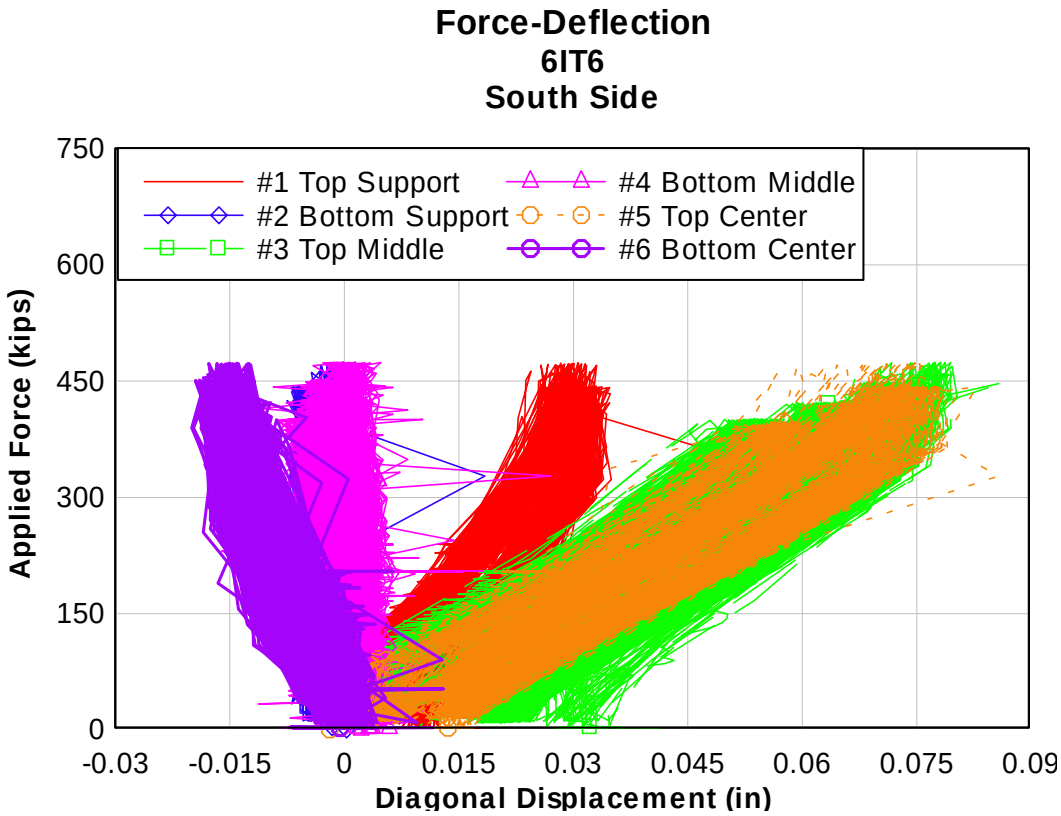

Force-Stirrup Strain
6T6 Part 2
North Side
Green 3, NE Face
Applied Force (kips)
600
450
300
150
0
-150
-800
0
800
1600
2400
3200
4000
4800
5600
Stirrup Strain (με)

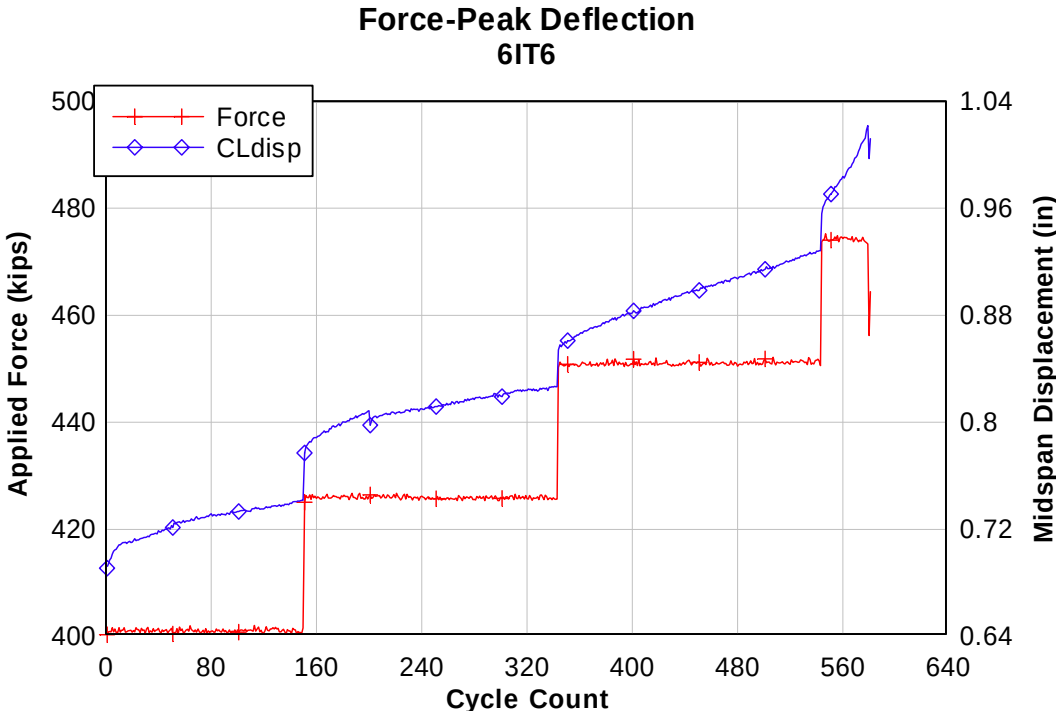

Force-Stirrup Strain
6T6 Part 2
North Side
Green 4, NW Face
Applied Force (kips)
600
450
300
150
0
-150
-400
0
400
800
1200
1600
2000
2400
2800
Stirrup Strain (με)

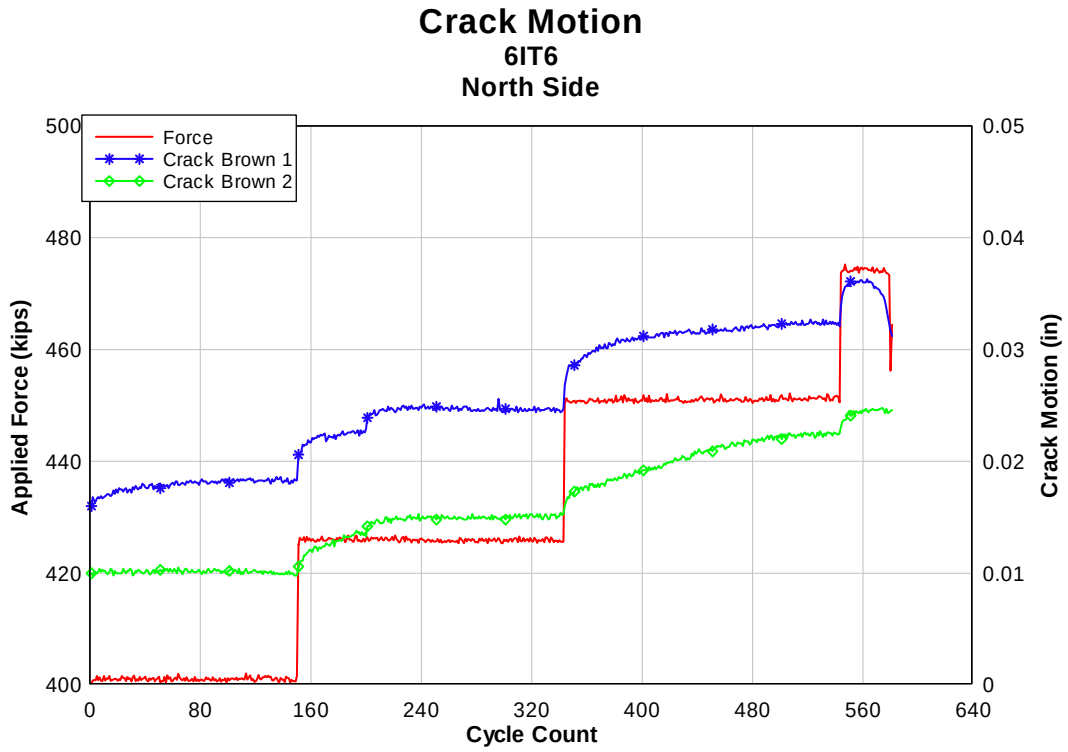

Force-Deflection
6IT6
Corrected Displacement
Applied Force (kips)
600
450
300
150
0
-150
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Midspan Displacement (in)

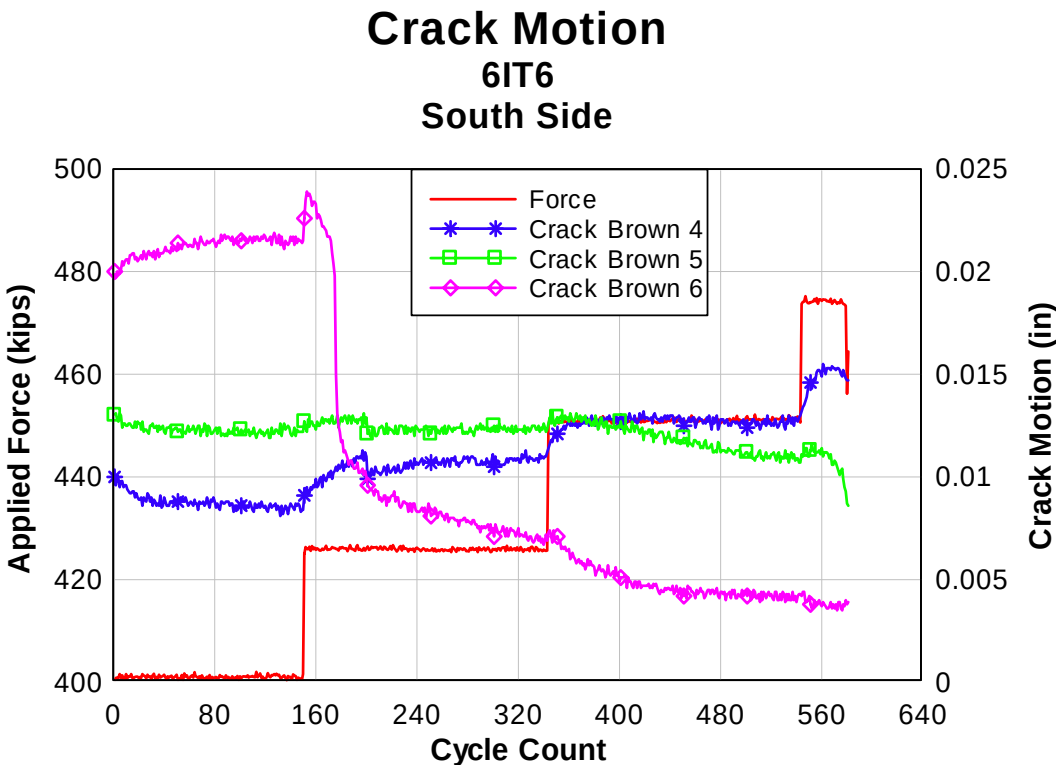

Force-Rotation
6IT6
South
North
Applied Force (kips)
600
450
300
150
0
-150
-0.6
-0.45
-0.3
-0.15
0
0.15
0.3
0.45
0.6
Rotation (degrees)

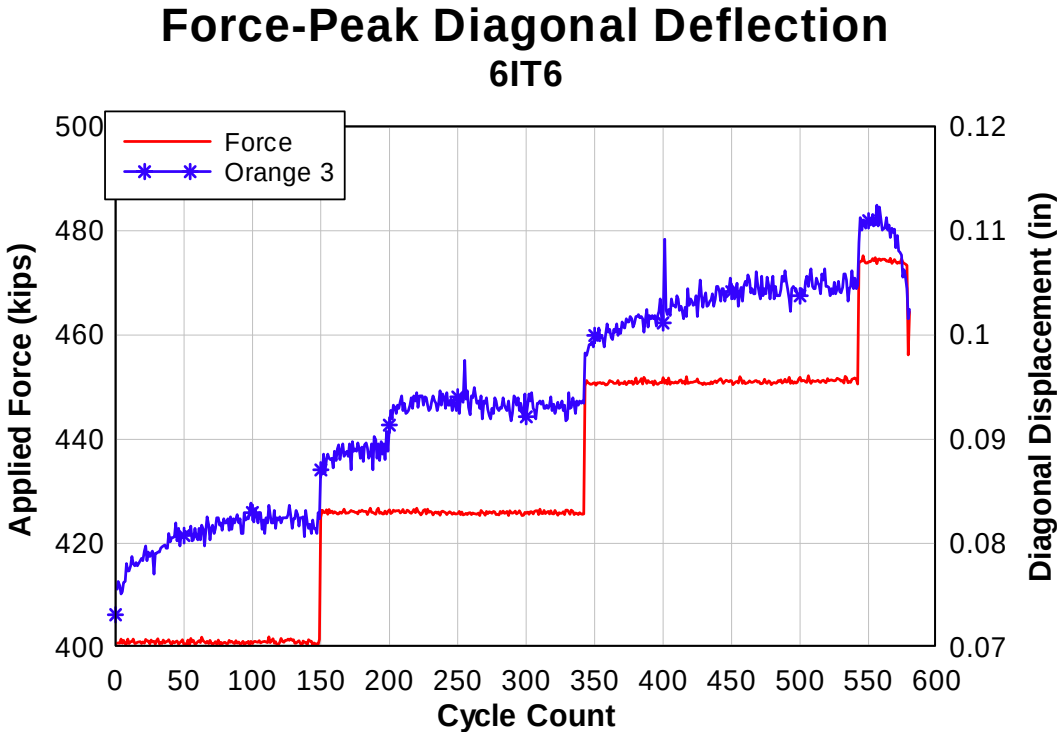

Force-Deflection
6IT6
North Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
750
600
450
300
150
0
-0.03
-0.015
0
0.015
0.03
0.045
0.06
0.075
0.09
Diagonal Displacement (in)

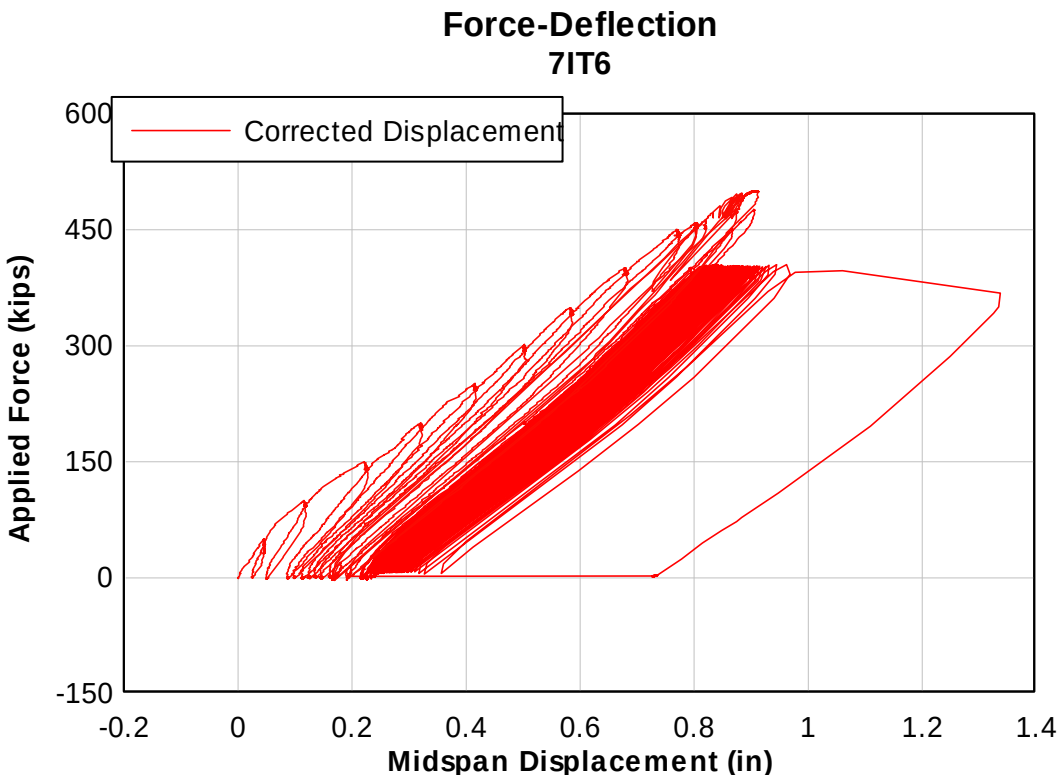

Force-Deflection
6IT6
South Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
750
600
450
300
150
0
-0.03
-0.015
0
0.015
0.03
0.045
0.06
0.075
0.09
Diagonal Displacement (in)

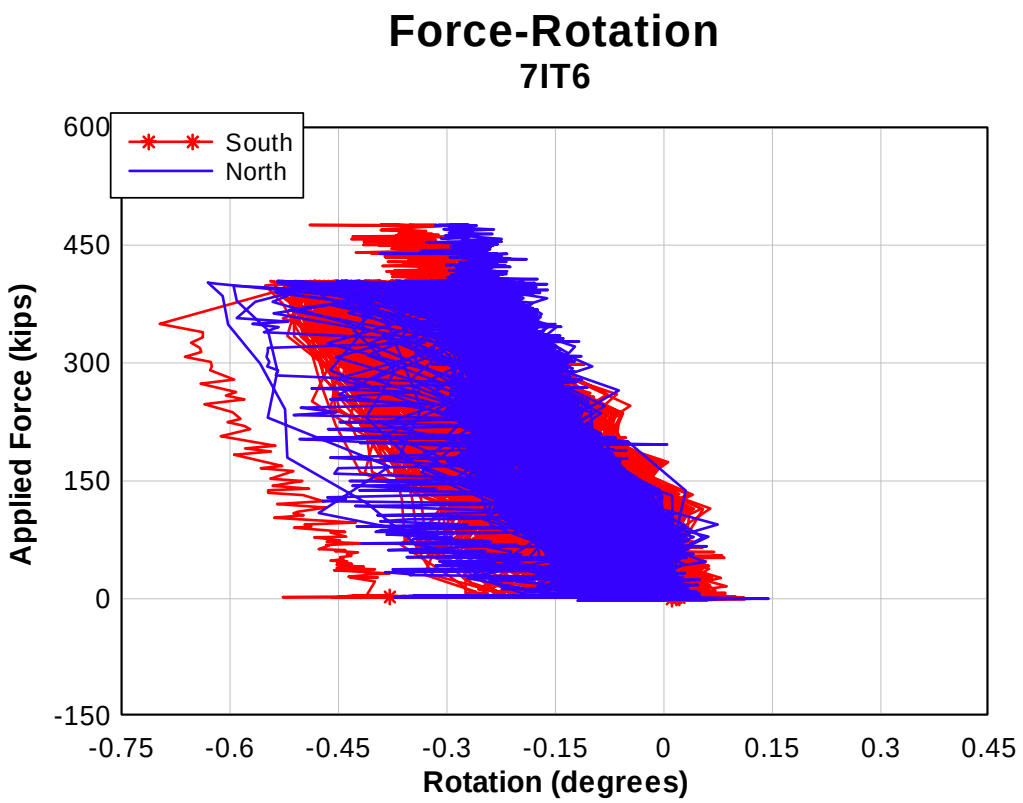

Force-Peak Deflection
6IT6
Force
CLdisp
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
500
480
460
440
420
400
1.04
0.96
0.88
0.8
0.72
0.64
0
80
160
240
320
400
480
560
640

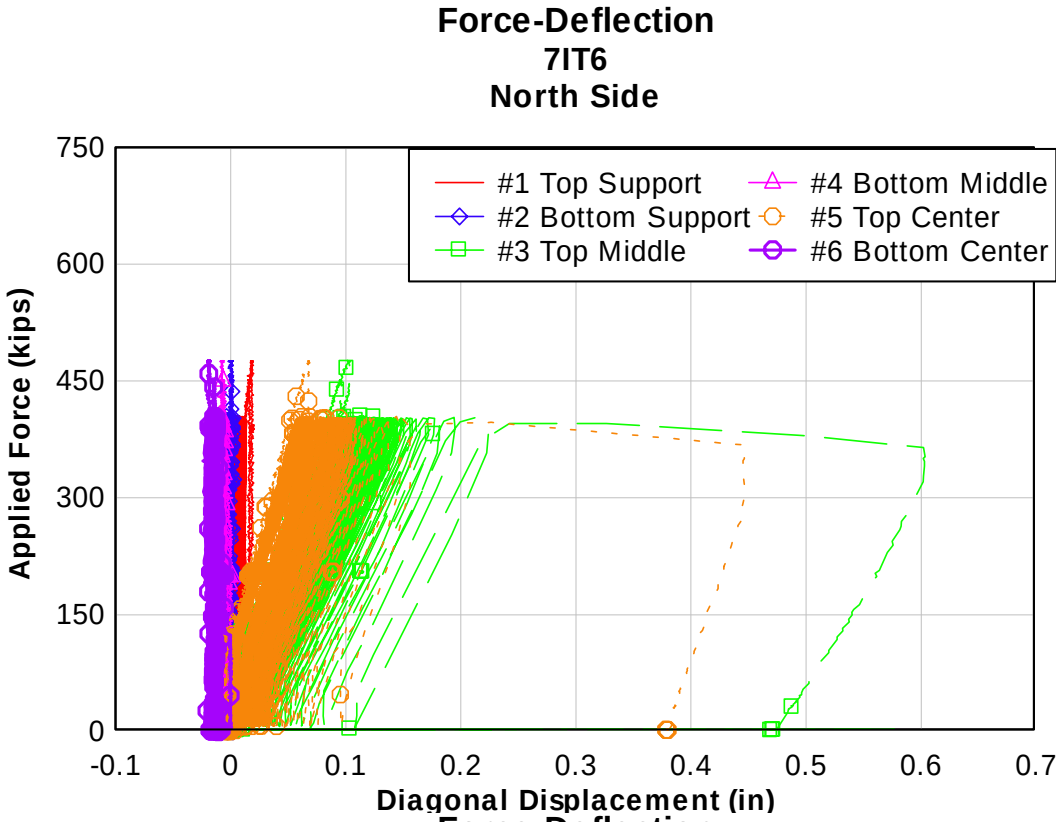

Crack Motion
6IT6
North Side
Force
Crack Brown 1
Crack Brown 2
Applied Force (kips)
Crack Motion (in)
Cycle Count
500
480
460
440
420
400
0.05
0.04
0.03
0.02
0.01
0
0
80
160
240
320
400
480
560
640

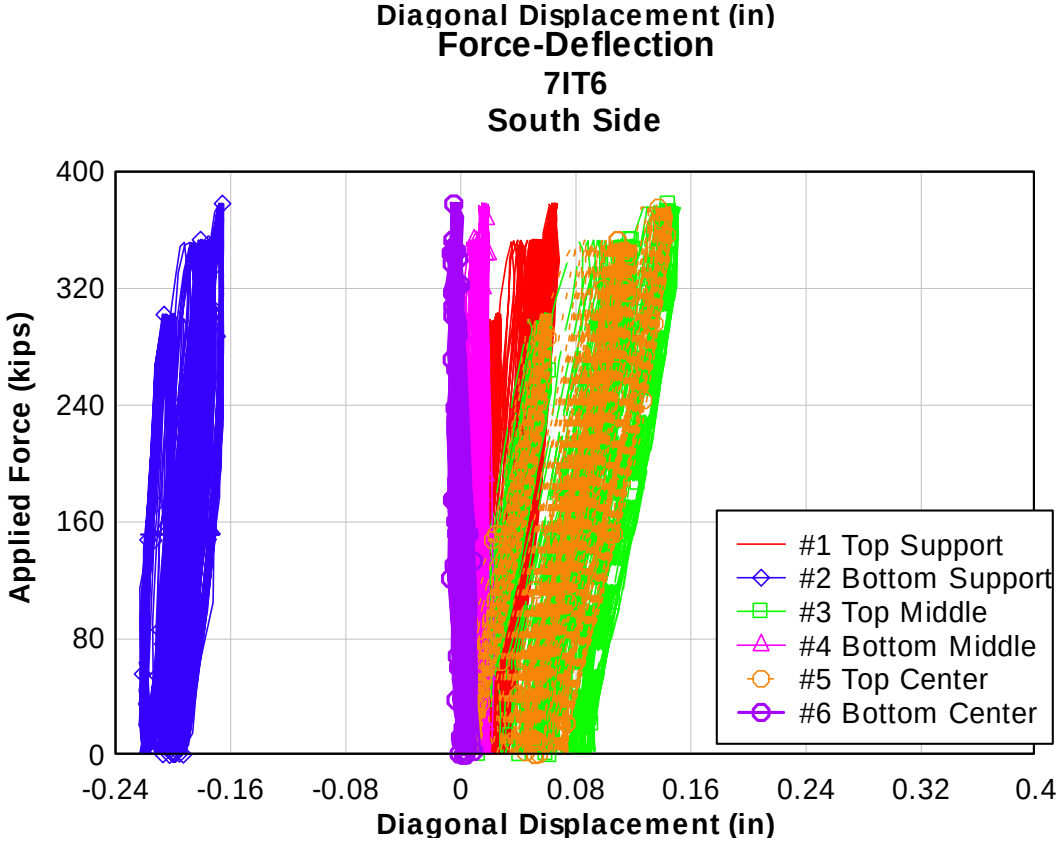

Crack Motion
6IT6
South Side
Force
Crack Brown 4
Crack Brown 5
Crack Brown 6
Applied Force (kips)
Crack Motion (in)
Cycle Count
500
480
460
440
420
400
0.025
0.02
0.015
0.01
0.005
0
0
80
160
240
320
400
480
560
640

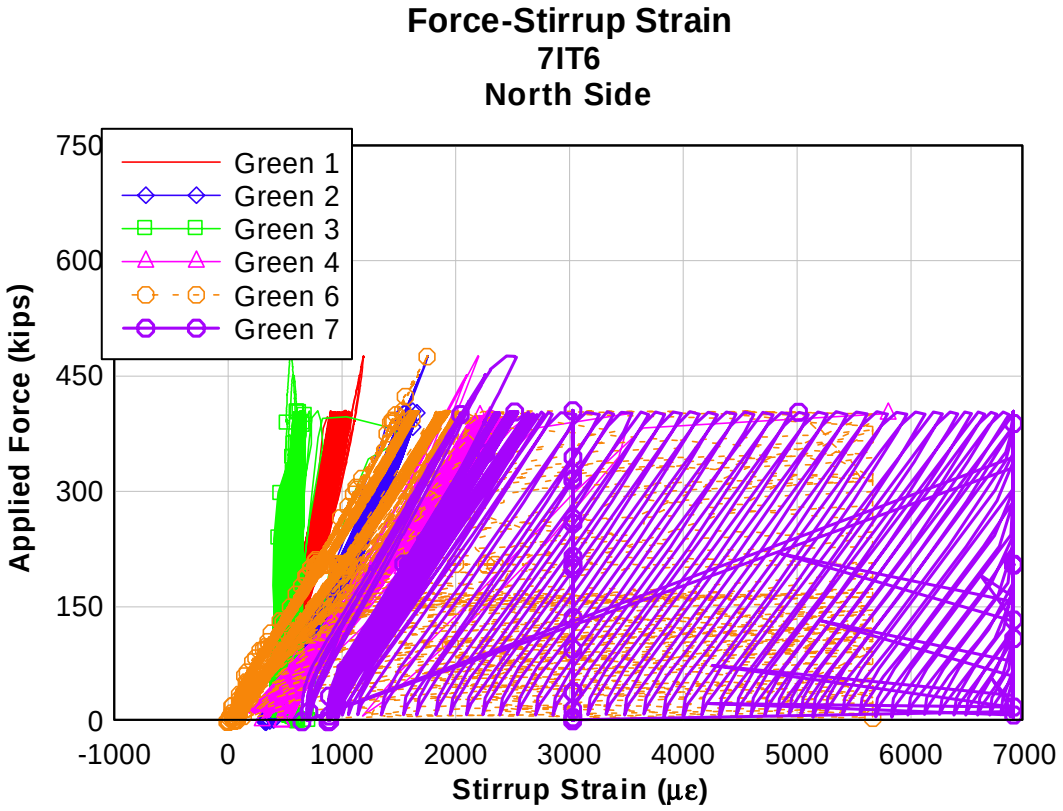

Force-Peak Diagonal Deflection
6IT6
Force
Orange 3
Applied Force (kips)
Diagonal Displacement (in)
Cycle Count
500
480
460
440
420
400
0.12
0.11
0.1
0.09
0.08
0.07
0
50
100
150
200
250
300
350
400
450
500
550
600

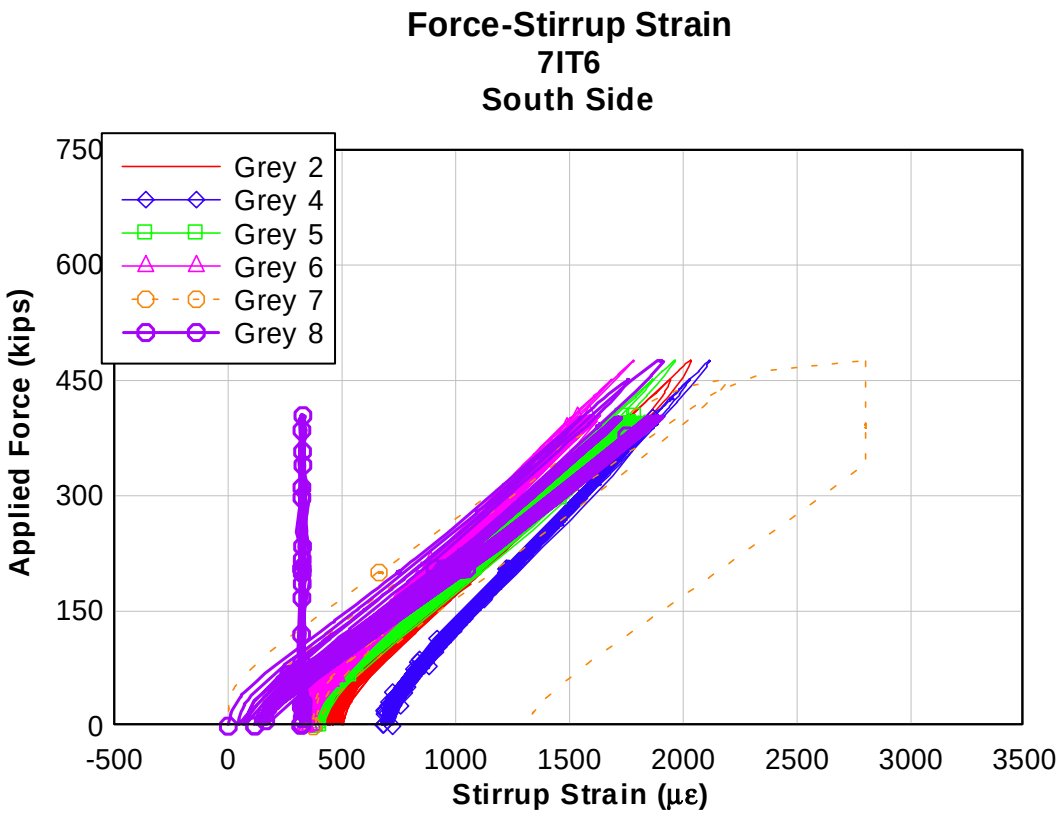

Force-Deflection
7IT6
Corrected Displacement
Applied Force (kips)
600
450
300
150
0
-150
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Midspan Displacement (in)

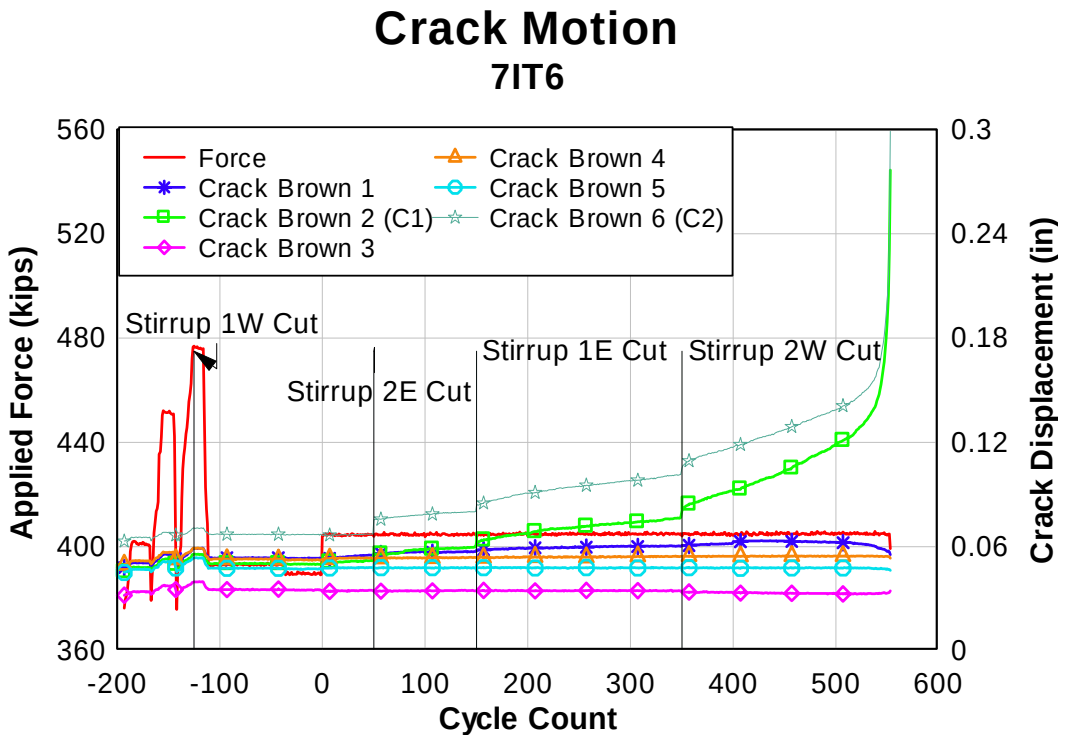

Force-Rotation
7IT6
South
North
Applied Force (kips)
600
450
300
150
0
-150
-0.75
-0.6
-0.45
-0.3
-0.15
0
0.15
0.3
0.45
Rotation (degrees)

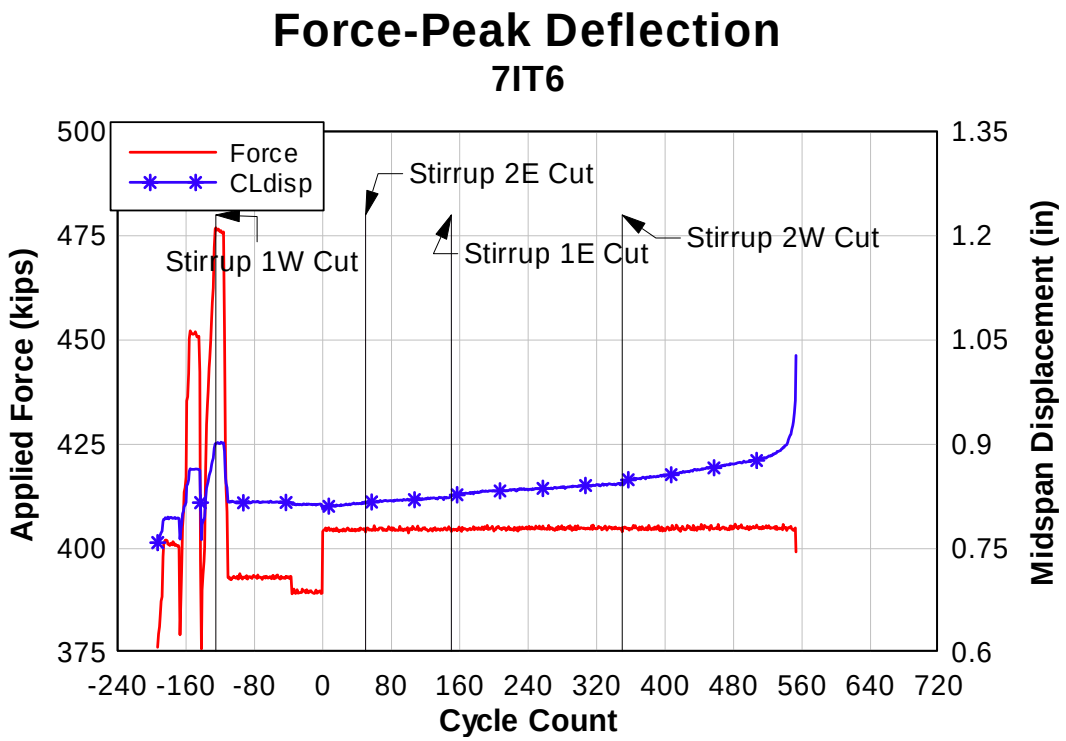

Force-Deflection
7IT6
North Side
Applied Force (kips)
Diagonal Displacement (in)
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
750
600
450
300
150
0
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

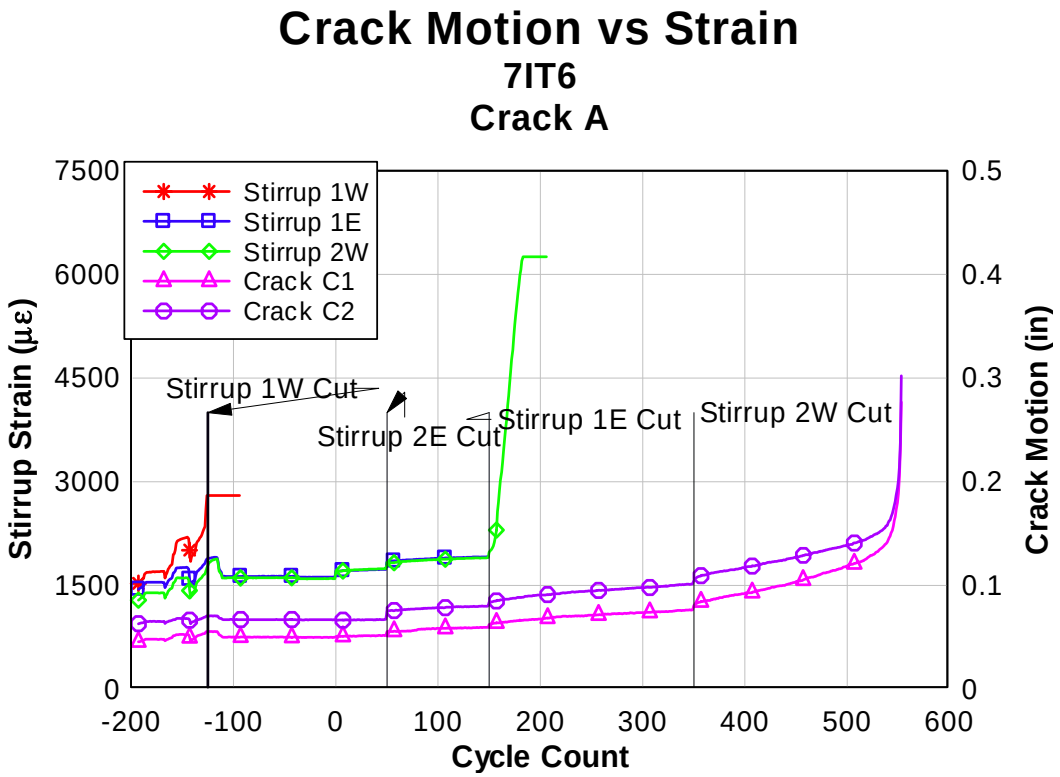

Force-Deflection
7IT6
South Side
Applied Force (kips)
Diagonal Displacement (in)
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
400
320
240
160
80
0
-0.24
-0.16
-0.08
0
0.08
0.16
0.24
0.32
0.4

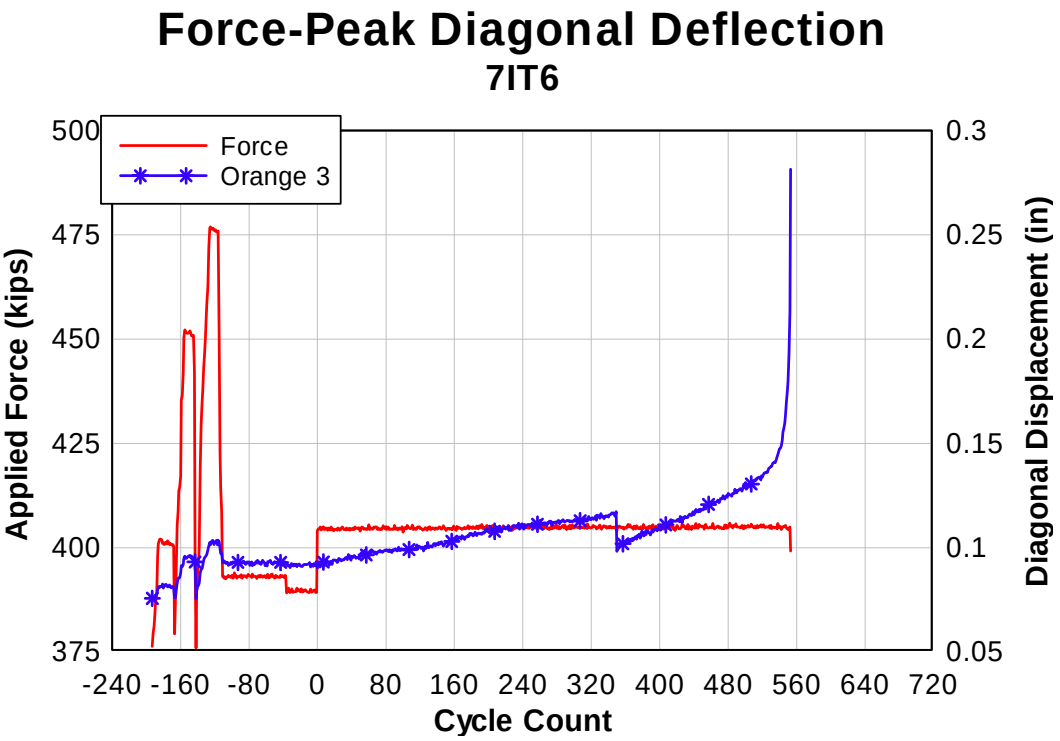

Force-Stirrup Strain
7IT6
North Side
Green 1
Green 2
Green 3
Green 4
Green 6
Green 7
Applied Force (kips)
Stirrup Strain (με)
750
600
450
300
150
0
-1000
0
1000
2000
3000
4000
5000
6000
7000


Force-Stirrup Strain
7IT6
South Side
Grey 2
Grey 4
Grey 5
Grey 6
Grey 7
Grey 8
Applied Force (kips)
Stirrup Strain (με)
750
600
450
300
150
0
-500
0
500
1000
1500
2000
2500
3000
3500

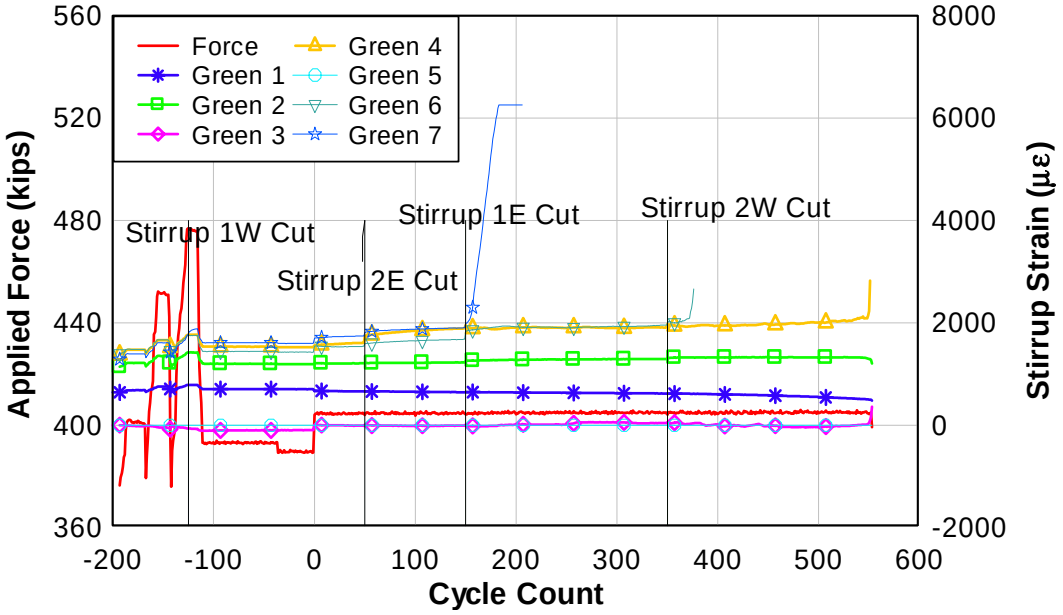

Crack Motion
7IT6
Force
Crack Brown 1
Crack Brown 2 (C1)
Crack Brown 3
Crack Brown 4
Crack Brown 5
Crack Brown 6 (C2)
Stirrup 1W Cut
Stirrup 2E Cut
Stirrup 1E Cut
Stirrup 2W Cut
Applied Force (kips)
Crack Displacement (in)
Cycle Count
560
520
480
440
400
360
0.3
0.24
0.18
0.12
0.06
0
-200
-100
0
100
200
300
400
500
600


Force-Peak Deflection
7IT6
Force
CLdisp
Stirrup 2E Cut
Stirrup 1W Cut
Stirrup 1E Cut
Stirrup 2W Cut
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
500
475
450
425
400
375
1.35
1.2
1.05
0.9
0.75
0.6
-240
-160
-80
0
80
160
240
320
400
480
560
640
720

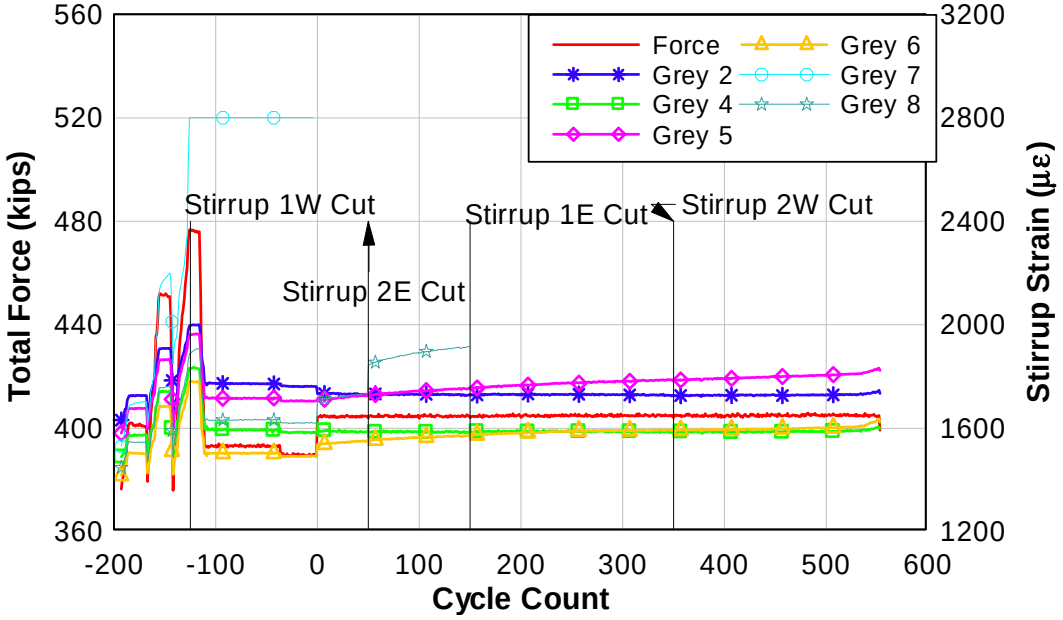

Crack Motion vs Strain
7IT6
Crack A
Stirrup 1W
Stirrup 1E
Stirrup 2W
Crack C1
Crack C2
Stirrup 1W Cut
Stirrup 2E Cut
Stirrup 1E Cut
Stirrup 2W Cut
Stirrup Strain (με)
Crack Motion (in)
Cycle Count
7500
6000
4500
3000
1500
0
0.5
0.4
0.3
0.2
0.1
0
-200
-100
0
100
200
300
400
500
600

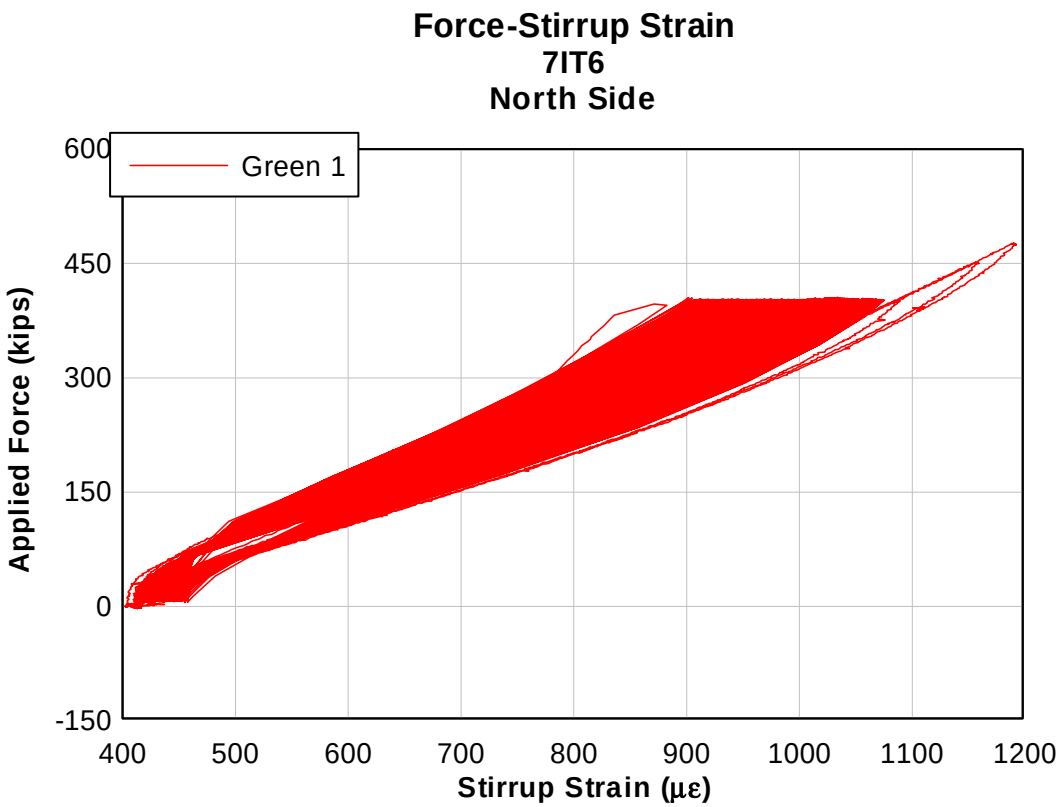

Force-Peak Diagonal Deflection
7IT6
Force
Orange 3
Applied Force (kips)
Diagonal Displacement (in)
Cycle Count
500
475
450
425
400
375
0.3
0.25
0.2
0.15
0.1
0.05
-240
-160
-80
0
80
160
240
320
400
480
560
640
720

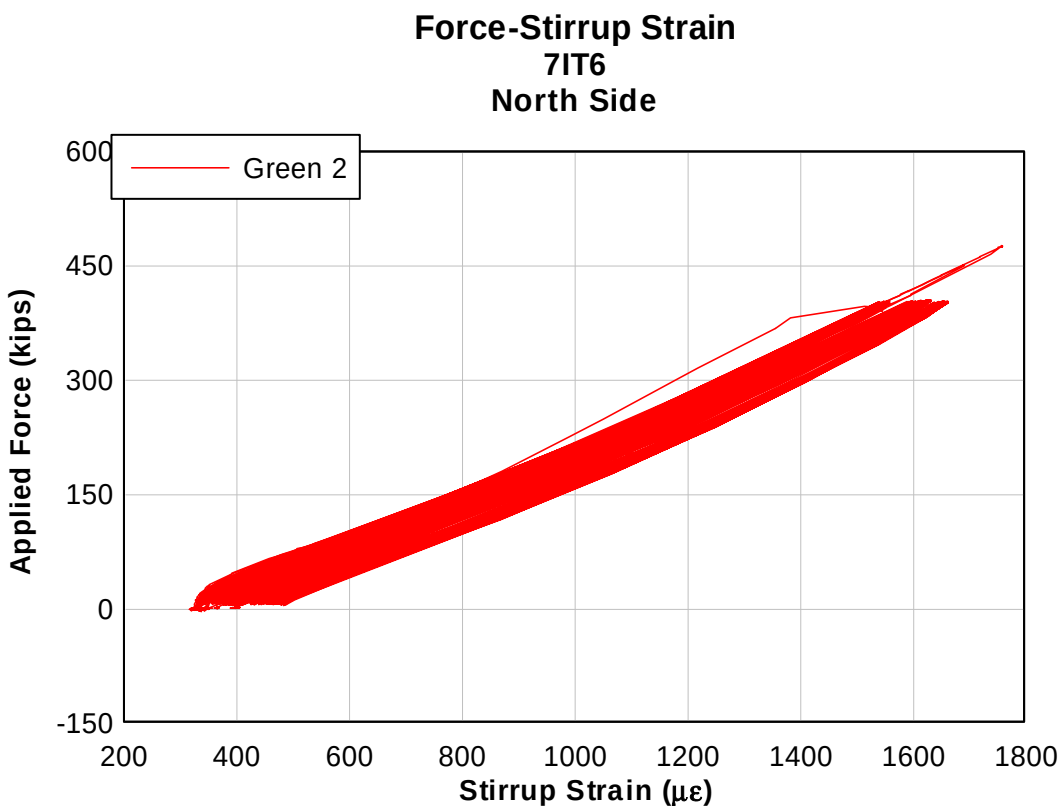
Force-Stirrup Strain
7IT6
North Side

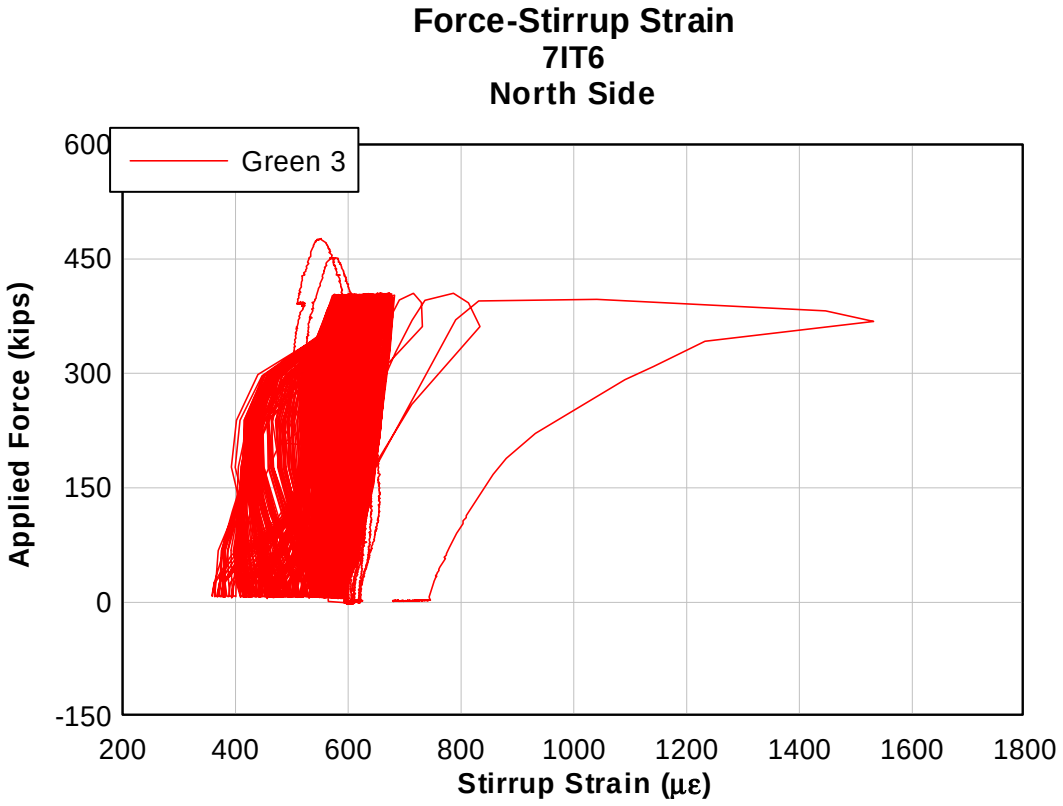


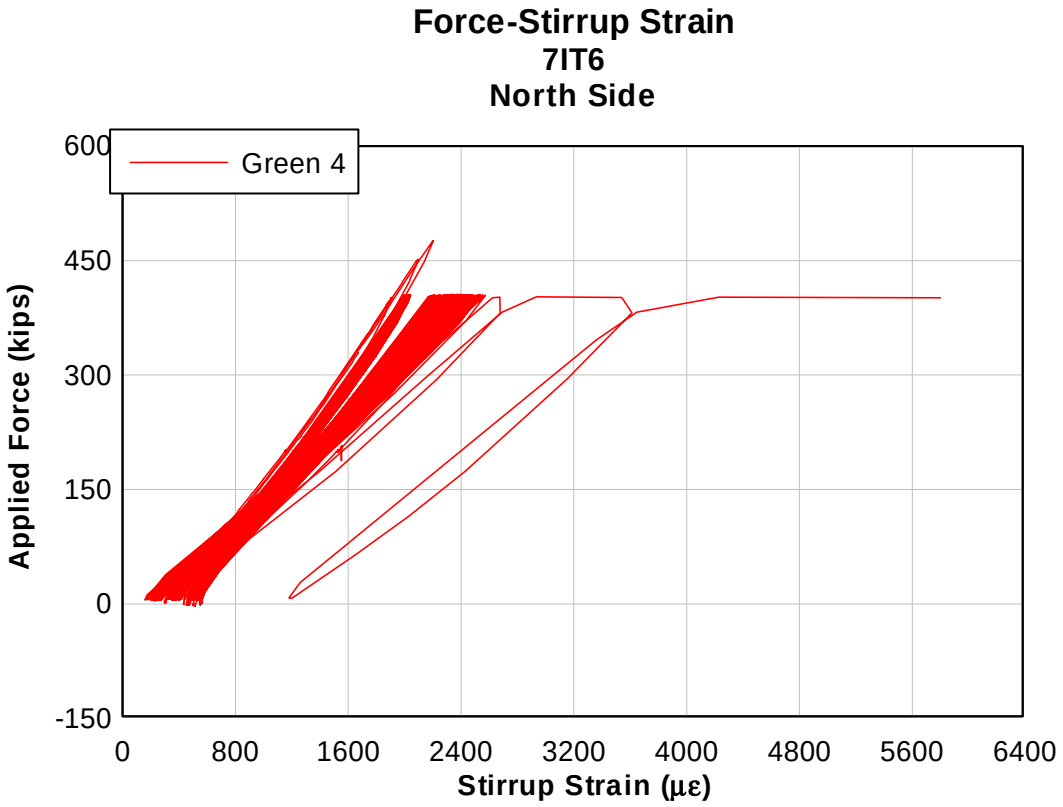
Force-Stirrup Strain
7IT6
South Side

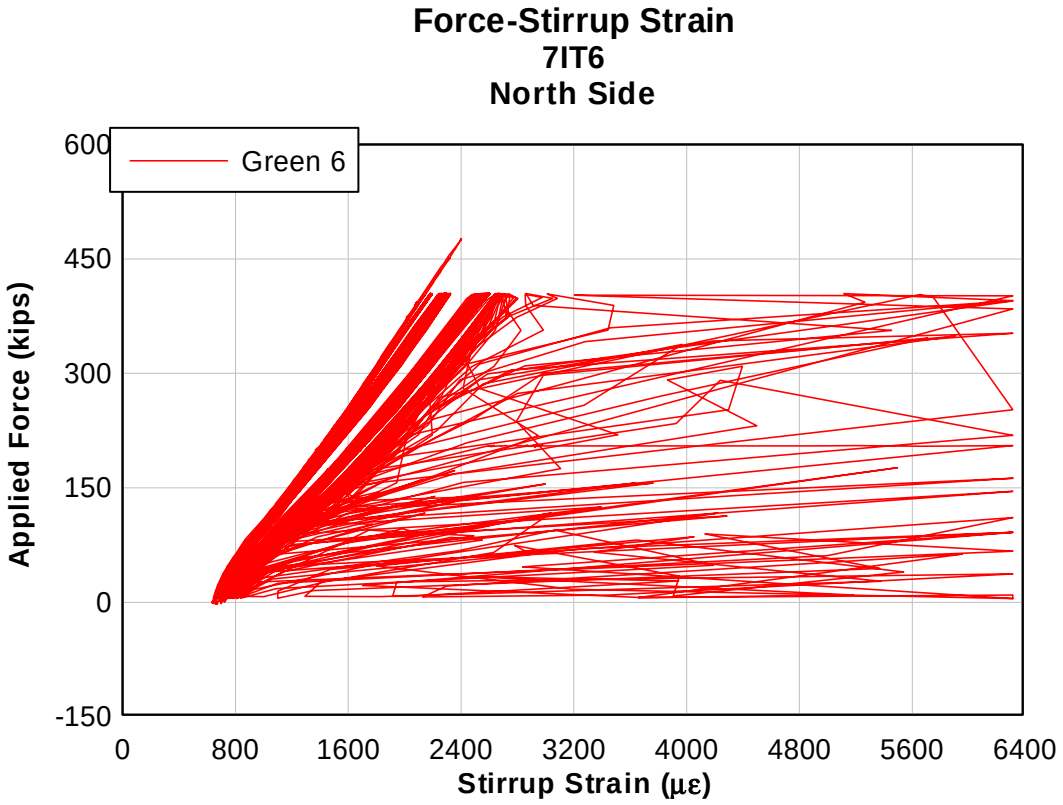


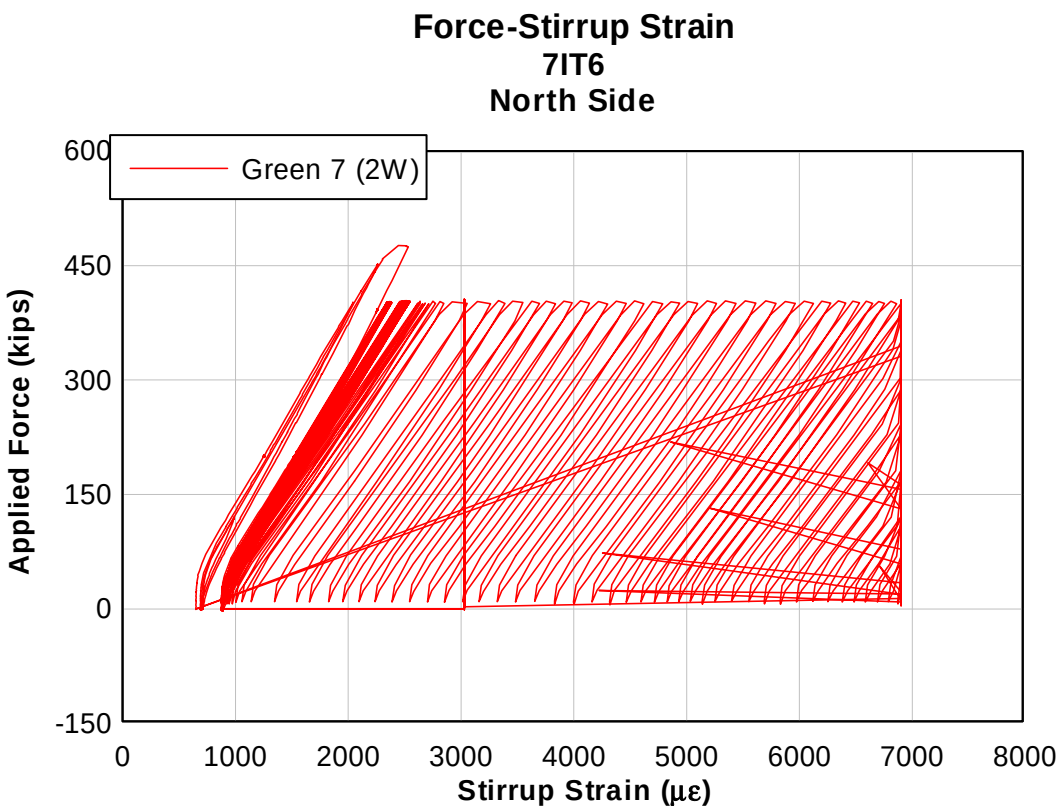

Force-Stirrup Strain
7IT6
North Side
Green 1
Applied Force (kips)
600
450
300
150
0
-150
400
500
600
700
800
900
1000
1100
1200
Stirrup Strain (με)

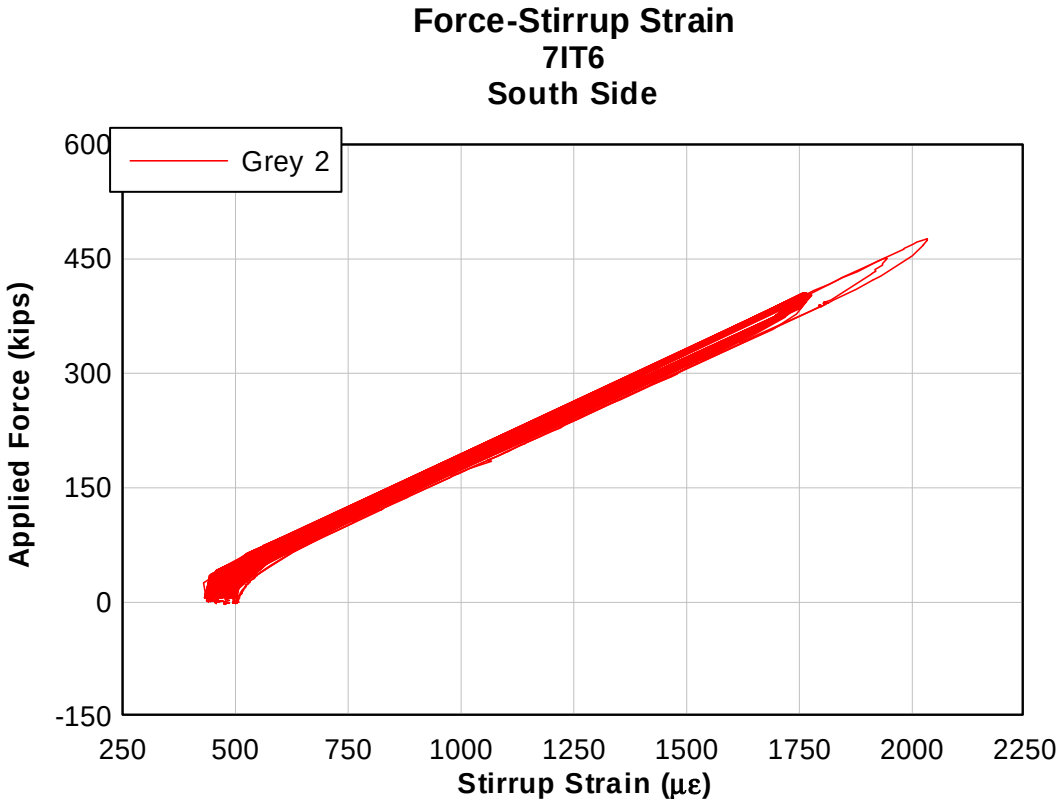

Force-Stirrup Strain
7IT6
North Side
Green 2
Applied Force (kips)
600
450
300
150
0
-150
200
400
600
800
1000
1200
1400
1600
1800
Stirrup Strain (με)

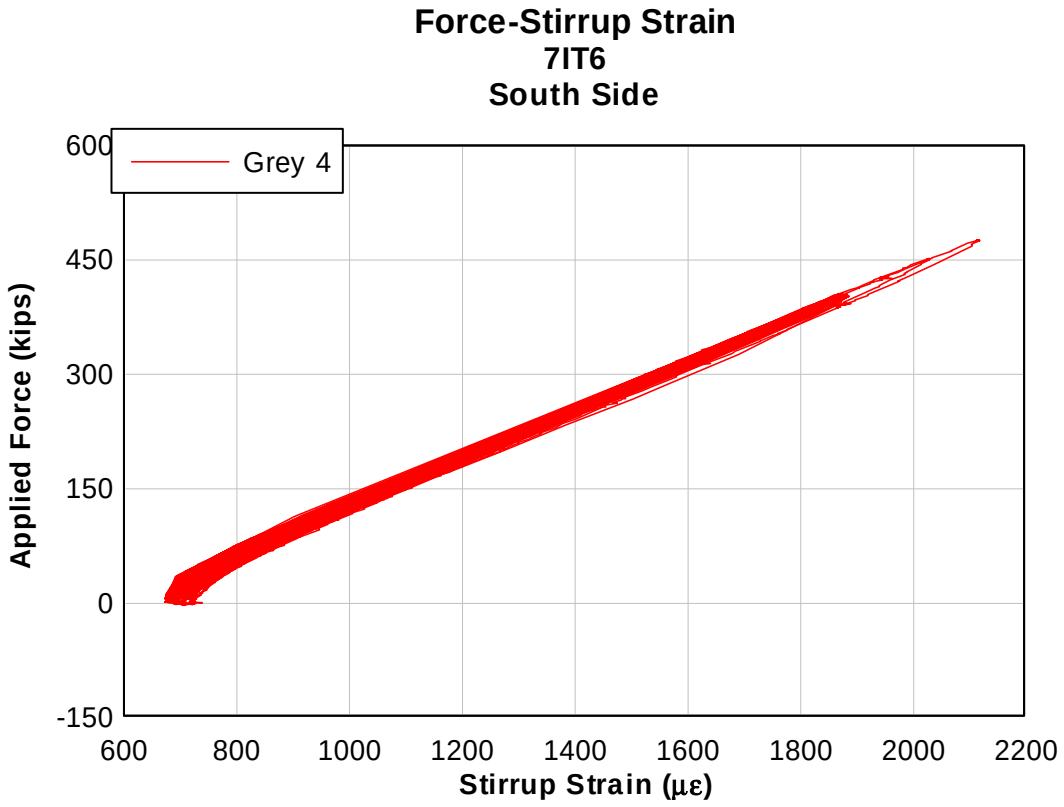

Force-Stirrup Strain
7IT6
North Side
Green 3
Applied Force (kips)
600
450
300
150
0
-150
200
400
600
800
1000
1200
1400
1600
1800
Stirrup Strain (με)

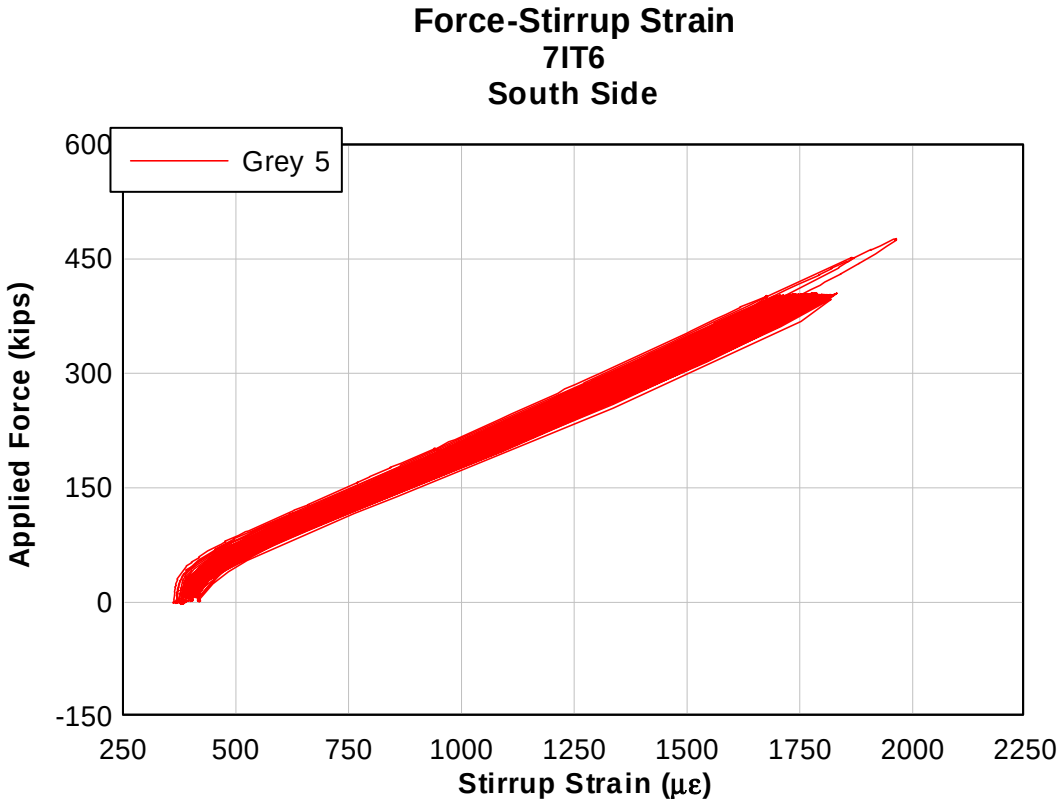

Force-Stirrup Strain
7IT6
North Side
Green 4
Applied Force (kips)
600
450
300
150
0
-150
0
800
1600
2400
3200
4000
4800
5600
6400
Stirrup Strain (με)

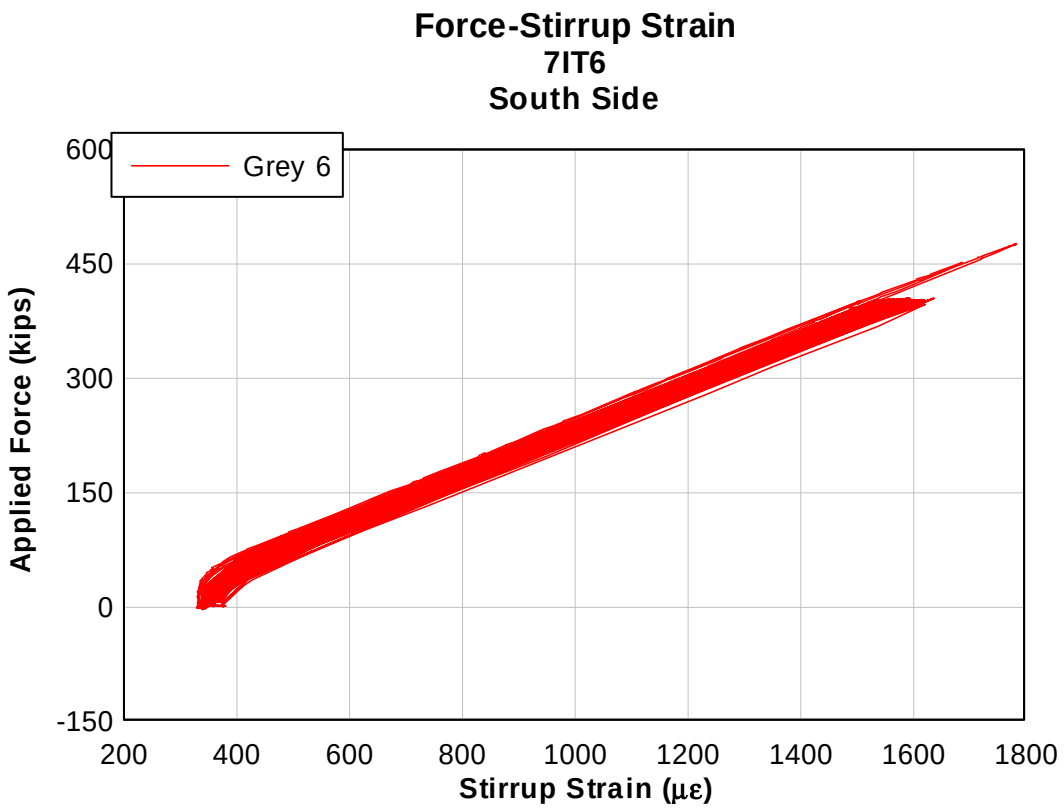

Force-Stirrup Strain
7IT6
North Side
Green 6
Applied Force (kips)
600
450
300
150
0
-150
0
800
1600
2400
3200
4000
4800
5600
6400
Stirrup Strain (με)

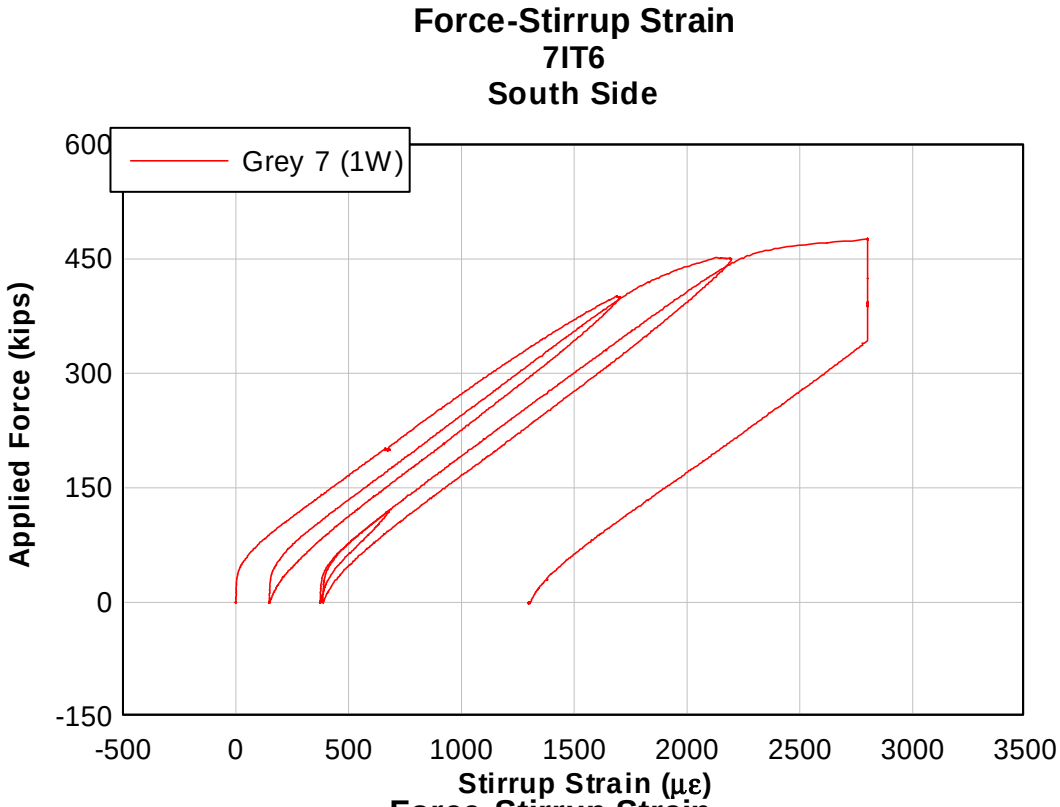

Force-Stirrup Strain
7IT6
North Side
Green 7 (2W)
Applied Force (kips)
600
450
300
150
0
-150
0
1000
2000
3000
4000
5000
6000
7000
8000
Stirrup Strain (με)

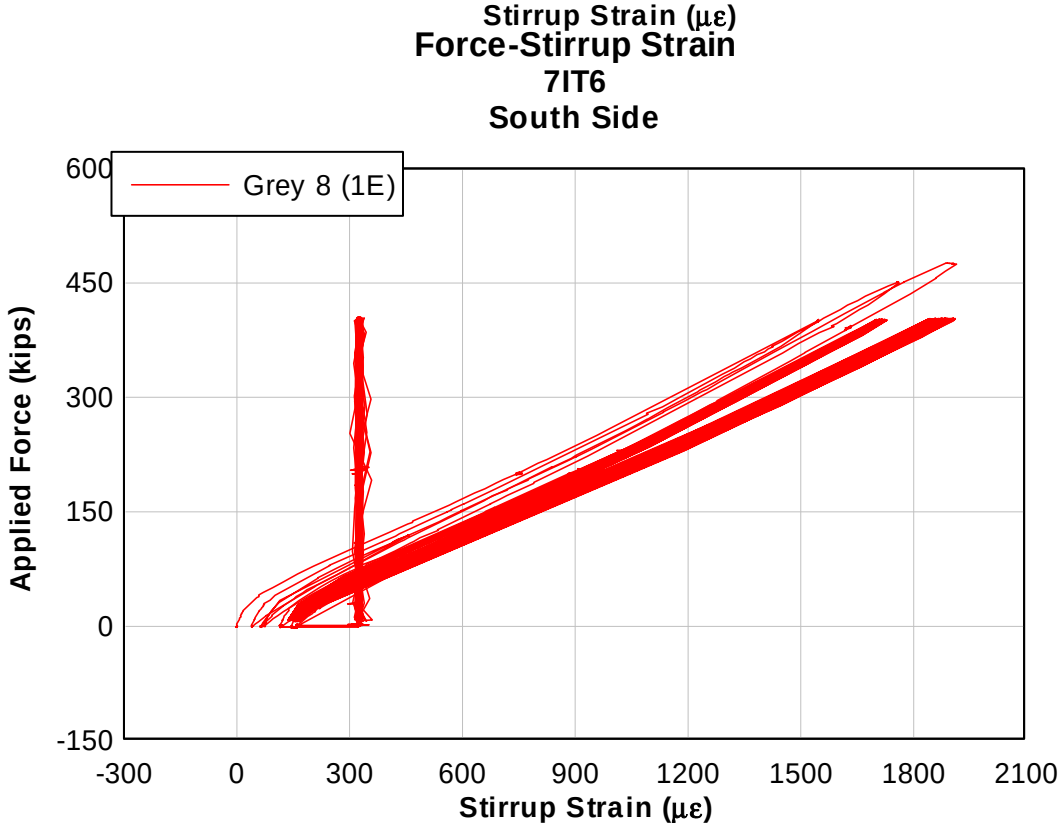

Force-Stirrup Strain
7IT6
South Side
Grey 2
Applied Force (kips)
600
450
300
150
0
-150
250
500
750
1000
1250
1500
1750
2000
2250
Stirrup Strain (με)

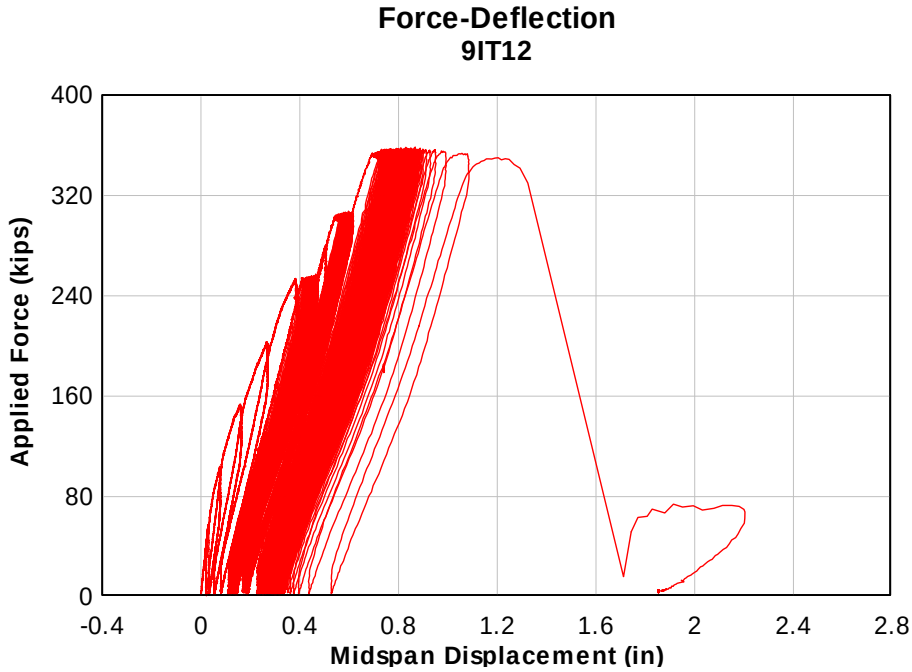

Force-Stirrup Strain
7IT6
South Side
Grey 4
Applied Force (kips)
600
450
300
150
0
-150
600
800
1000
1200
1400
1600
1800
2000
2200
Stirrup Strain (με)

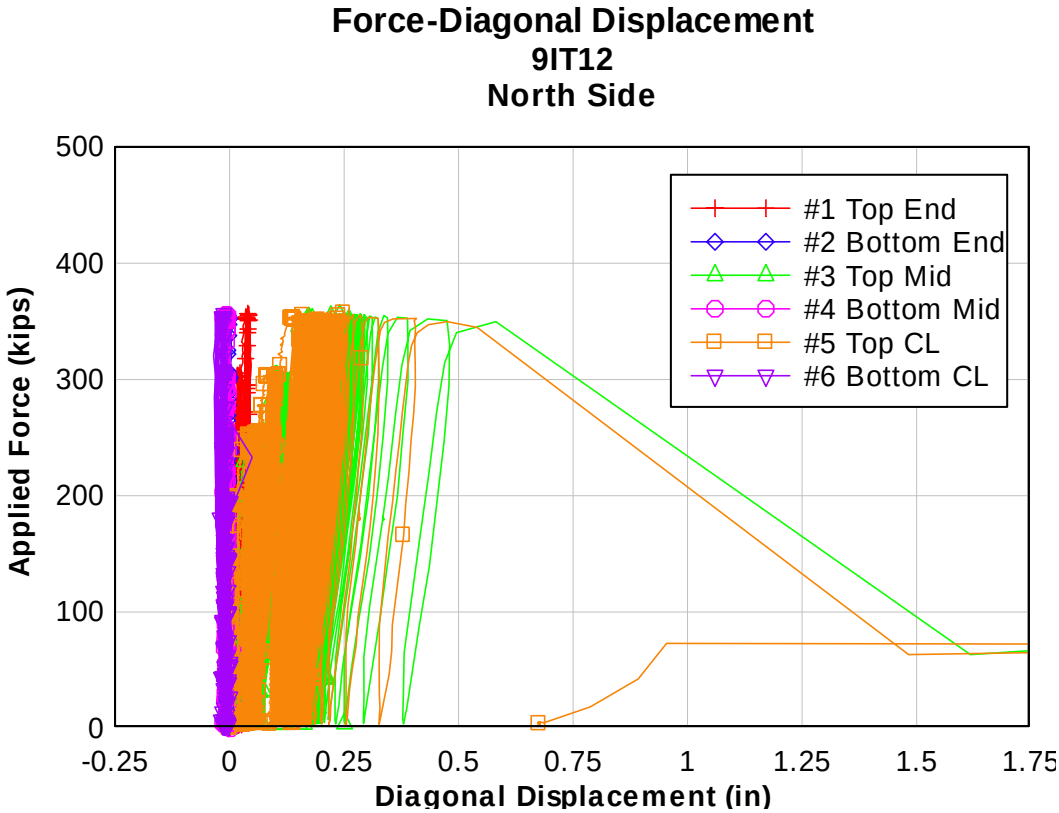

Force-Stirrup Strain
7IT6
South Side
Grey 5
Applied Force (kips)
600
450
300
150
0
-150
250
500
750
1000
1250
1500
1750
2000
2250
Stirrup Strain (με)

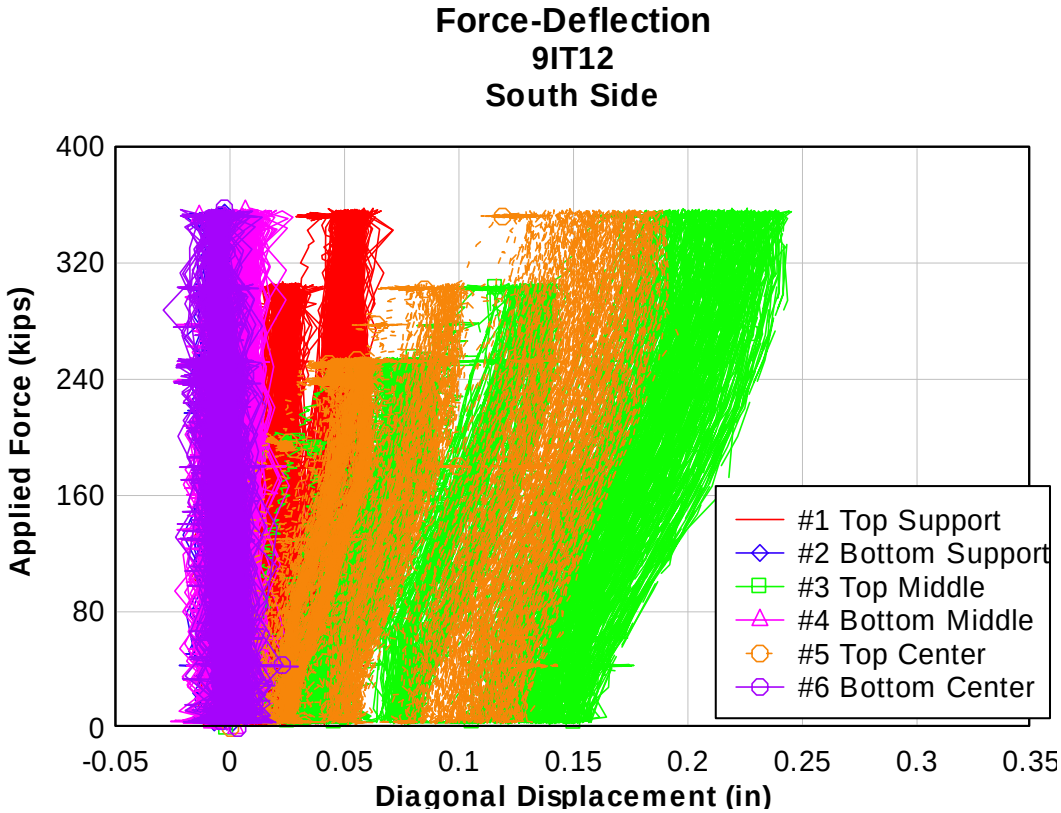

Force-Stirrup Strain
7IT6
South Side
Grey 6
Applied Force (kips)
600
450
300
150
0
-150
200
400
600
800
1000
1200
1400
1600
1800
Stirrup Strain (με)

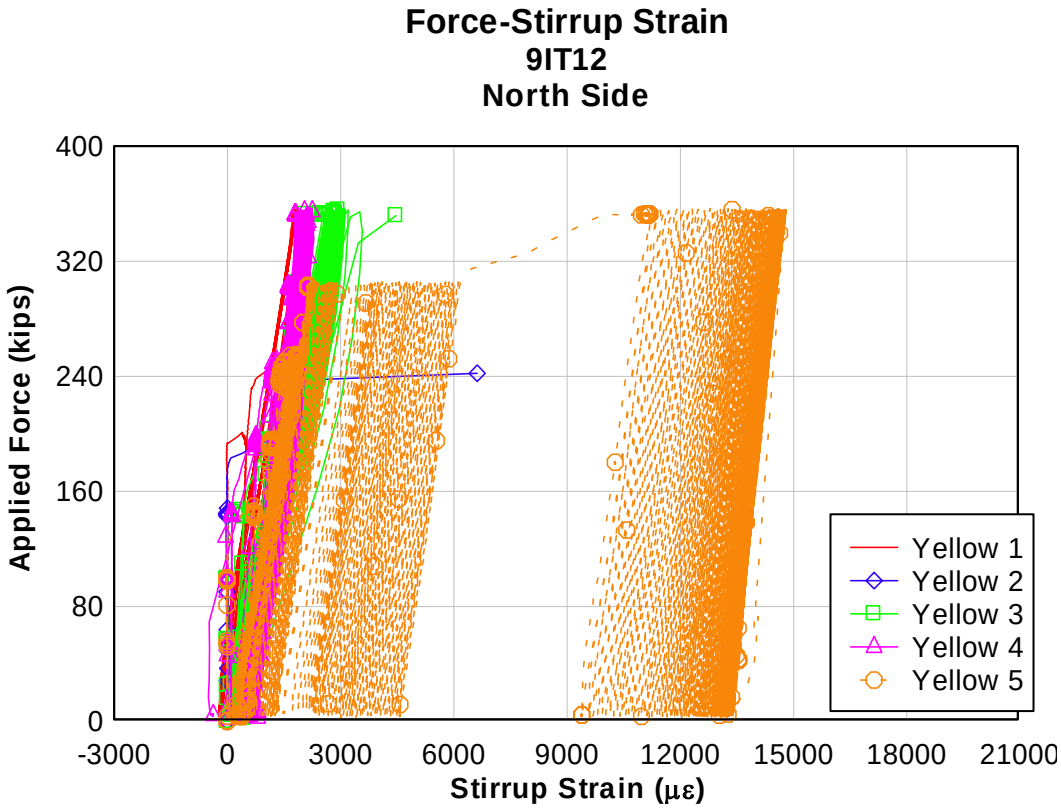

Force-Stirrup Strain
7IT6
South Side
Grey 7 (1W)
Applied Force (kips)
600
450
300
150
0
-150
-500
0
500
1000
1500
2000
2500
3000
3500
Stirrup Strain (με)

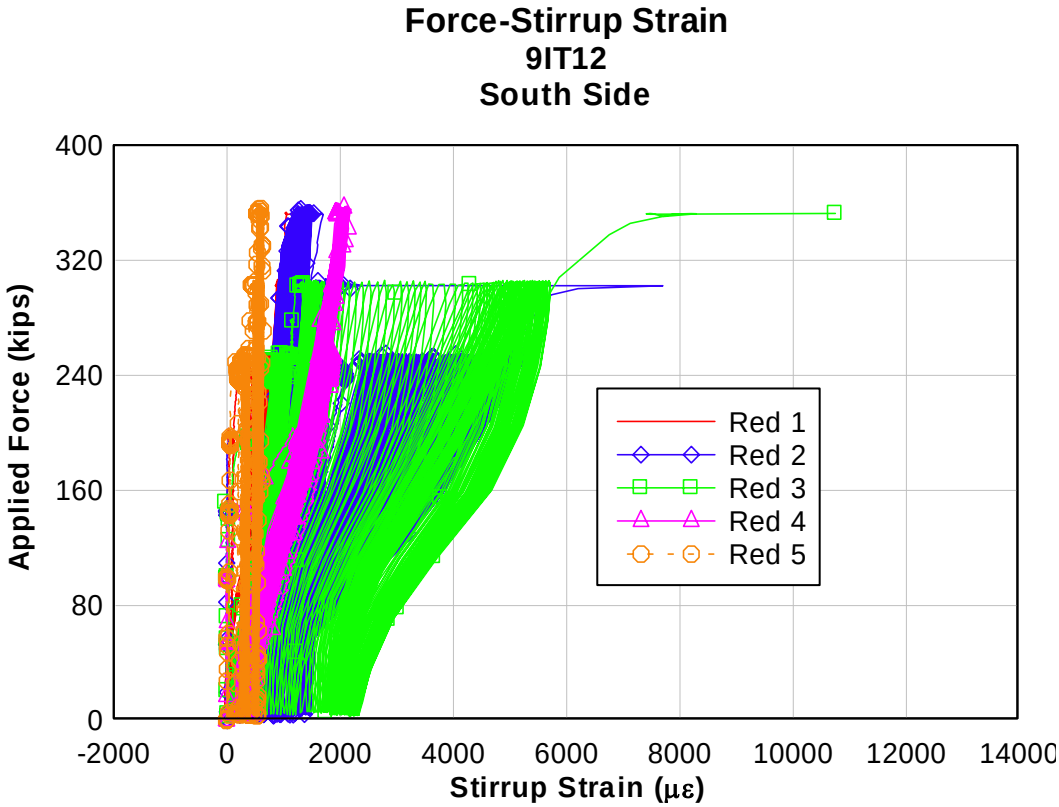

Force-Stirrup Strain
7IT6
South Side
Grey 8 (1E)
Applied Force (kips)
600
450
300
150
0
-150
-300
0
300
600
900
1200
1500
1800
2100
Stirrup Strain (με)

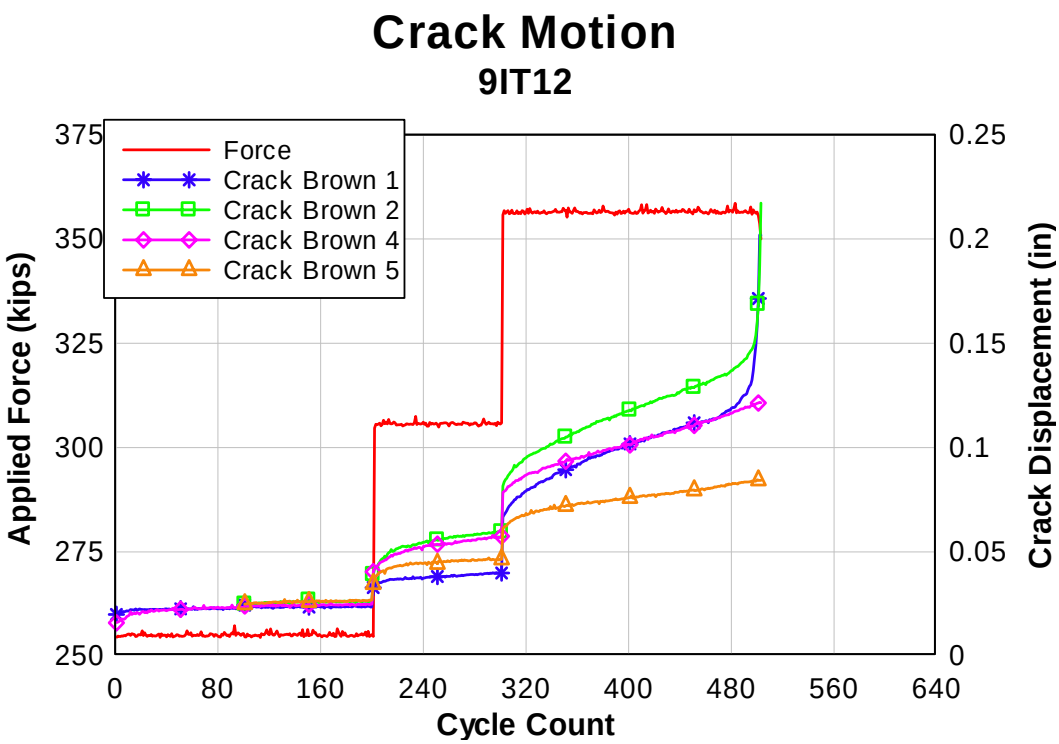

Force-Deflection
9IT12
Applied Force (kips)
400
320
240
160
80
0
-0.4
0
0.4
0.8
1.2
1.6
2
2.4
2.8
Midspan Displacement (in)

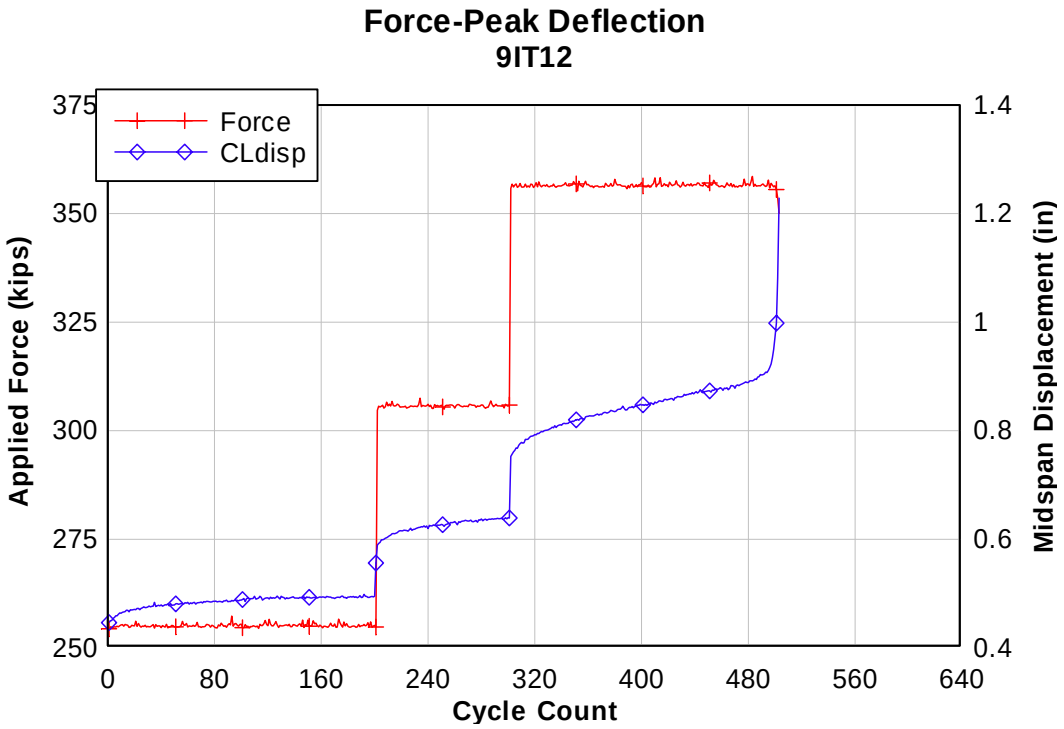

Force-Diagonal Displacement
9IT12
North Side
Applied Force (kips)
500
400
300
200
100
0
-0.25
0
0.25
0.5
0.75
1
1.25
1.5
1.75
Diagonal Displacement (in)
#1 Top End
#2 Bottom End
#3 Top Mid
#4 Bottom Mid
#5 Top CL
#6 Bottom CL

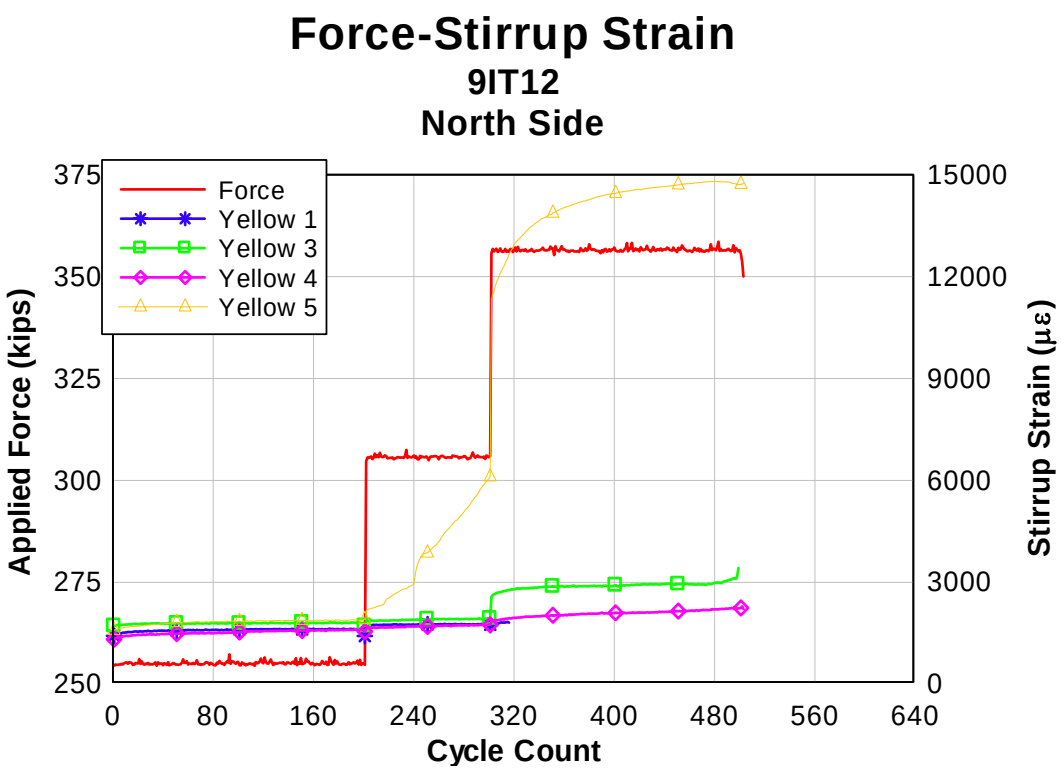

Force-Deflection
9IT12
South Side
Applied Force (kips)
Diagonal Displacement (in)
400
320
240
160
80
0
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

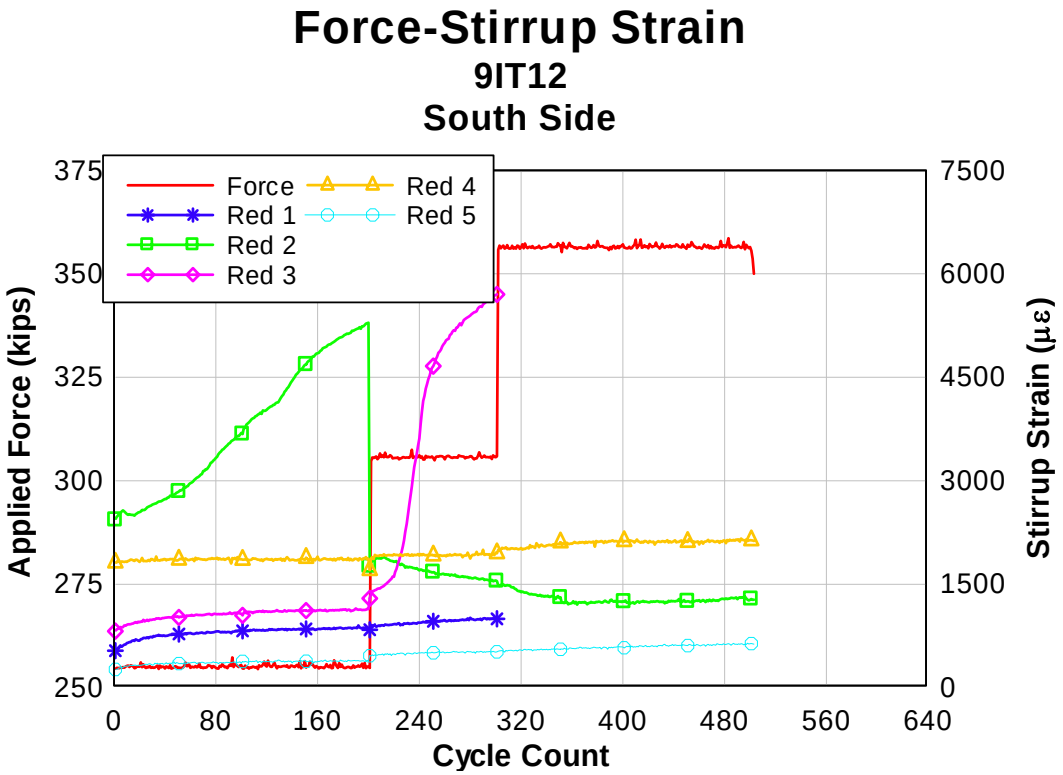

Force-Stirrup Strain
9IT12
North Side
Applied Force (kips)
Stirrup Strain (με)
400
320
240
160
80
0
-3000
0
3000
6000
9000
12000
15000
18000
21000
Yellow 1
Yellow 2
Yellow 3
Yellow 4
Yellow 5

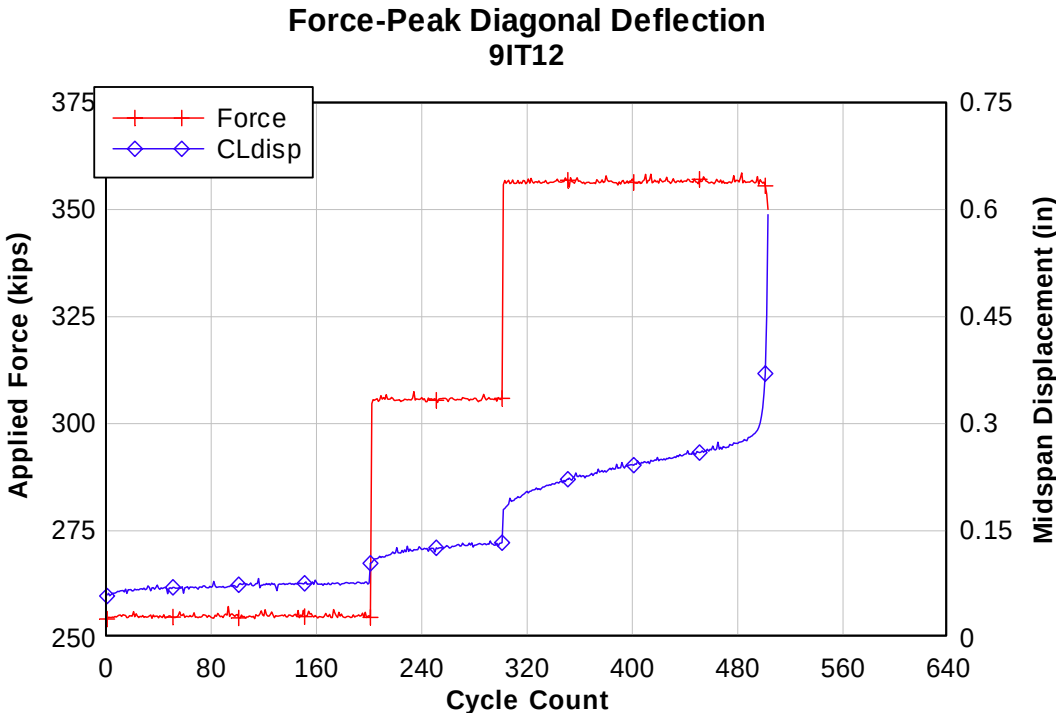

Force-Stirrup Strain
9IT12
South Side
Applied Force (kips)
Stirrup Strain (με)
Red 1
Red 2
Red 3
Red 4
Red 5
400
320
240
160
80
0
-2000
0
2000
4000
6000
8000
10000
12000
14000

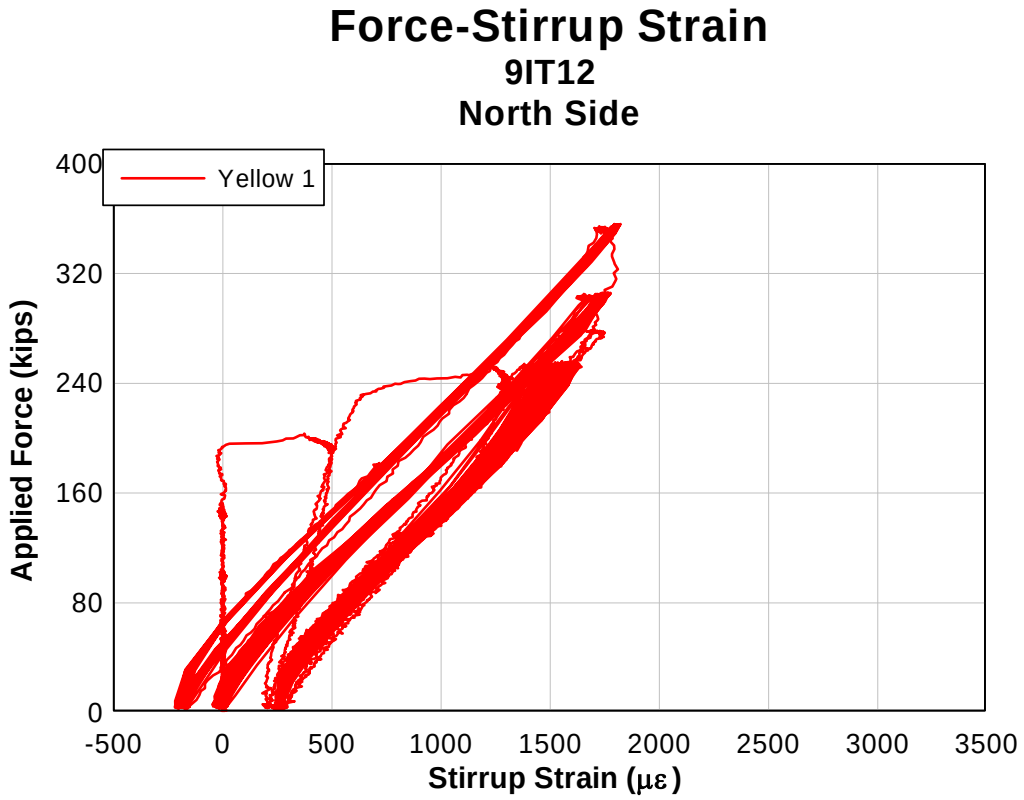

Crack Motion
9IT12
Force
Crack Brown 1
Crack Brown 2
Crack Brown 4
Crack Brown 5
Applied Force (kips)
Crack Displacement (in)
Cycle Count
375
350
325
300
275
250
0.25
0.2
0.15
0.1
0.05
0
0
80
160
240
320
400
480
560
640

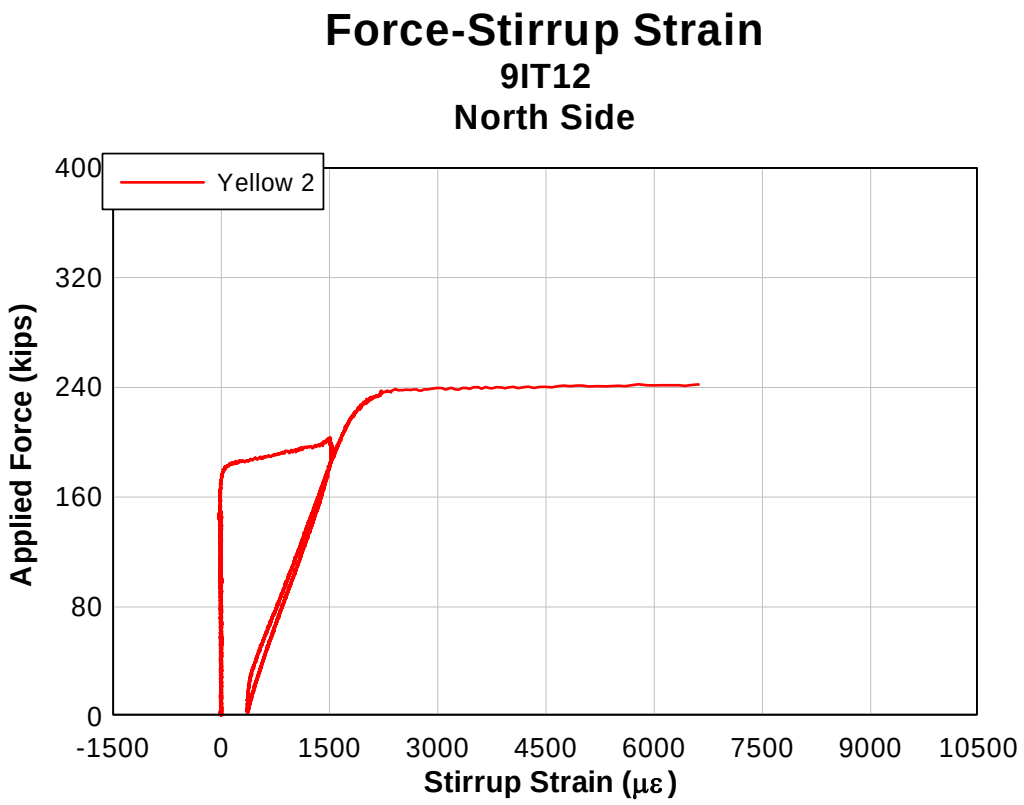

Force-Peak Deflection
9IT12
Force
CLdisp
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
375
350
325
300
275
250
1.4
1.2
1
0.8
0.6
0.4
0
80
160
240
320
400
480
560
640

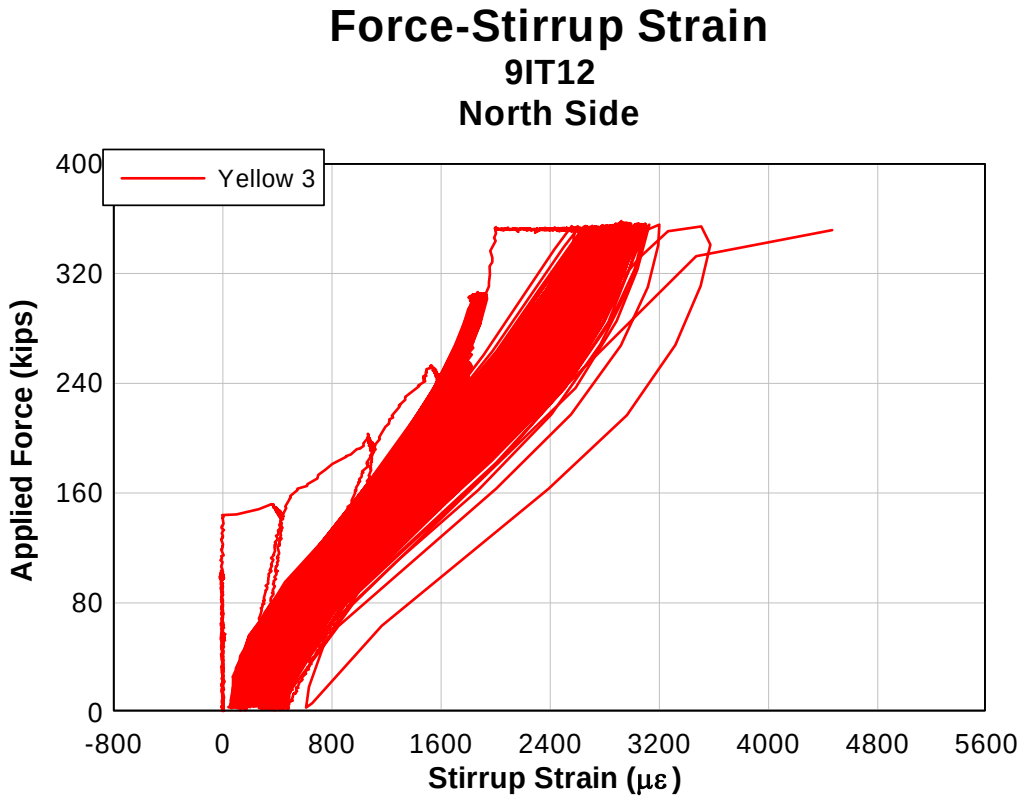

Force-Stirrup Strain
9IT12
North Side
Force
Yellow 1
Yellow 3
Yellow 4
Yellow 5
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
375
350
325
300
275
250
15000
12000
9000
6000
3000
0
0
80
160
240
320
400
480
560
640

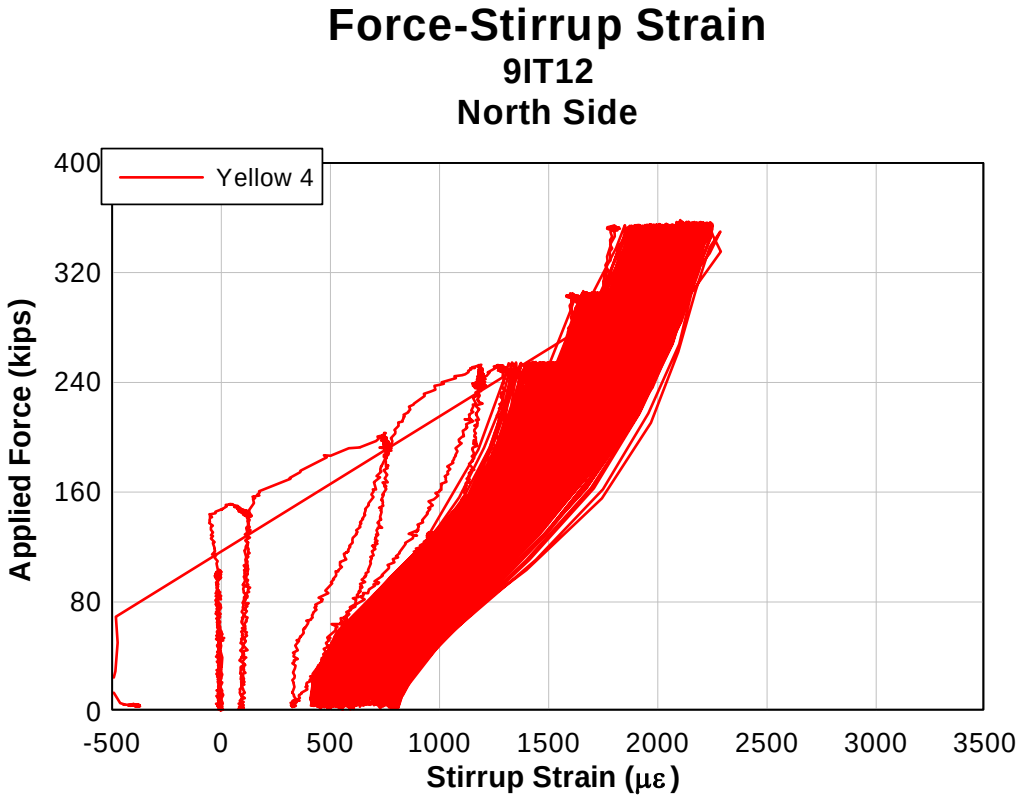

Force-Stirrup Strain
9IT12
South Side
Force
Red 1
Red 2
Red 3
Red 4
Red 5
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
375
350
325
300
275
250
7500
6000
4500
3000
1500
0
0
80
160
240
320
400
480
560
640

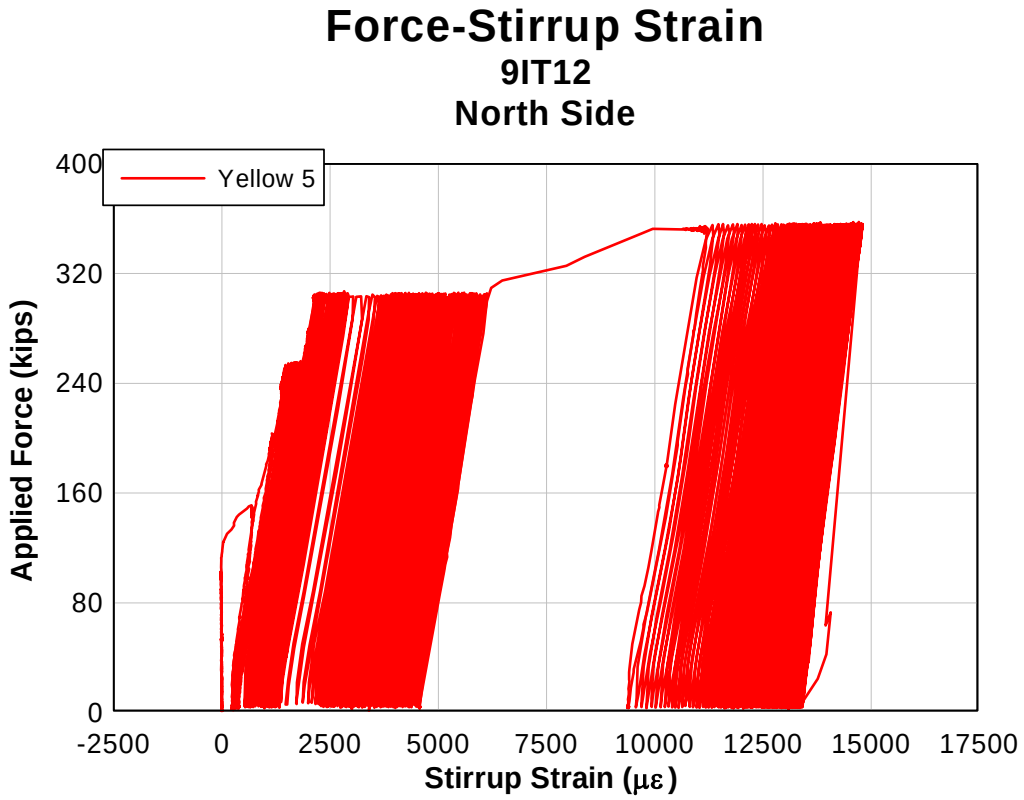

Force-Peak Diagonal Deflection
9IT12
Force
CLdisp
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
375
350
325
300
275
250
0.75
0.6
0.45
0.3
0.15
0
0
80
160
240
320
400
480
560
640

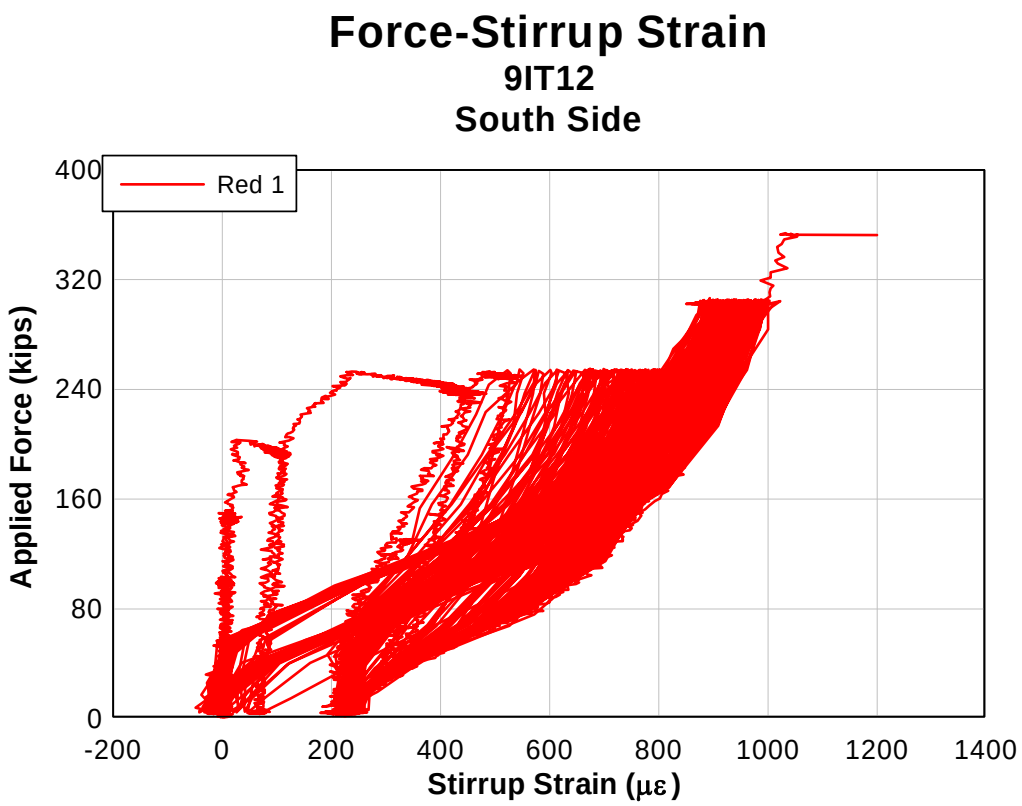

Force-Stirrup Strain
9IT12
North Side
Yellow 1
Applied Force (kips)
400
320
240
160
80
0
-500
0
500
1000
1500
2000
2500
3000
3500
Stirrup Strain (με)

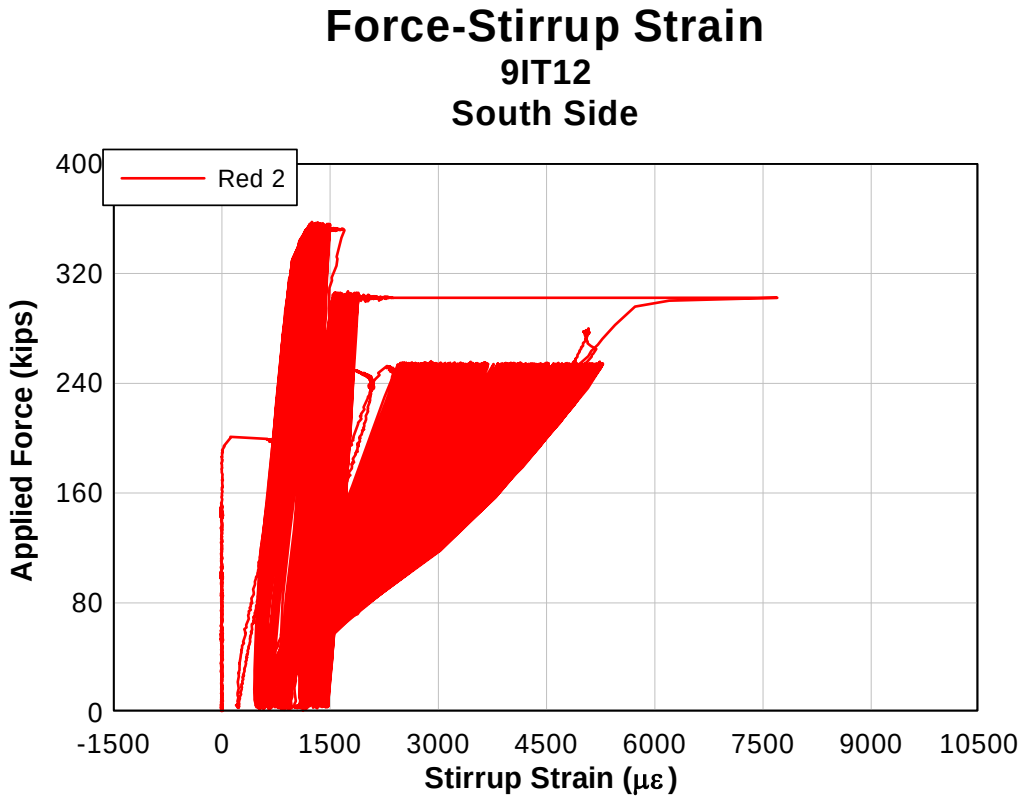

Force-Stirrup Strain
9IT12
North Side
Yellow 2
Applied Force (kips)
400
320
240
160
80
0
-1500
0
1500
3000
4500
6000
7500
9000
10500
Stirrup Strain (με)

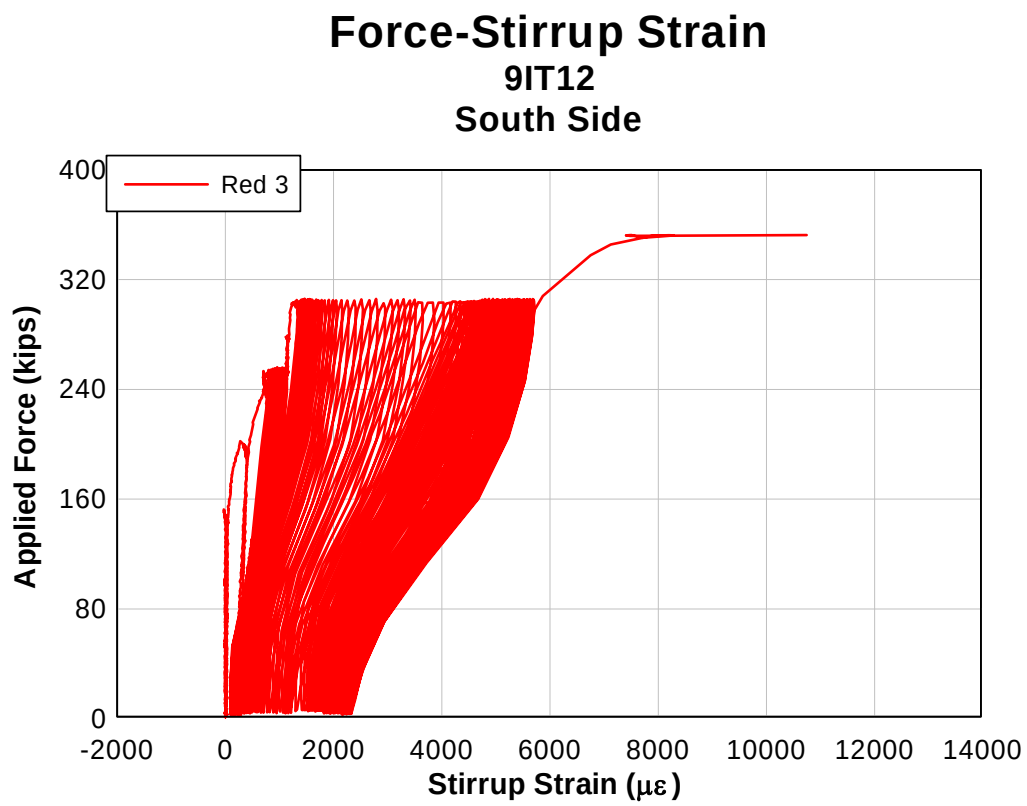

Force-Stirrup Strain
9IT12
North Side
Yellow 3
Applied Force (kips)
400
320
240
160
80
0
-800
0
800
1600
2400
3200
4000
4800
5600
Stirrup Strain (με)

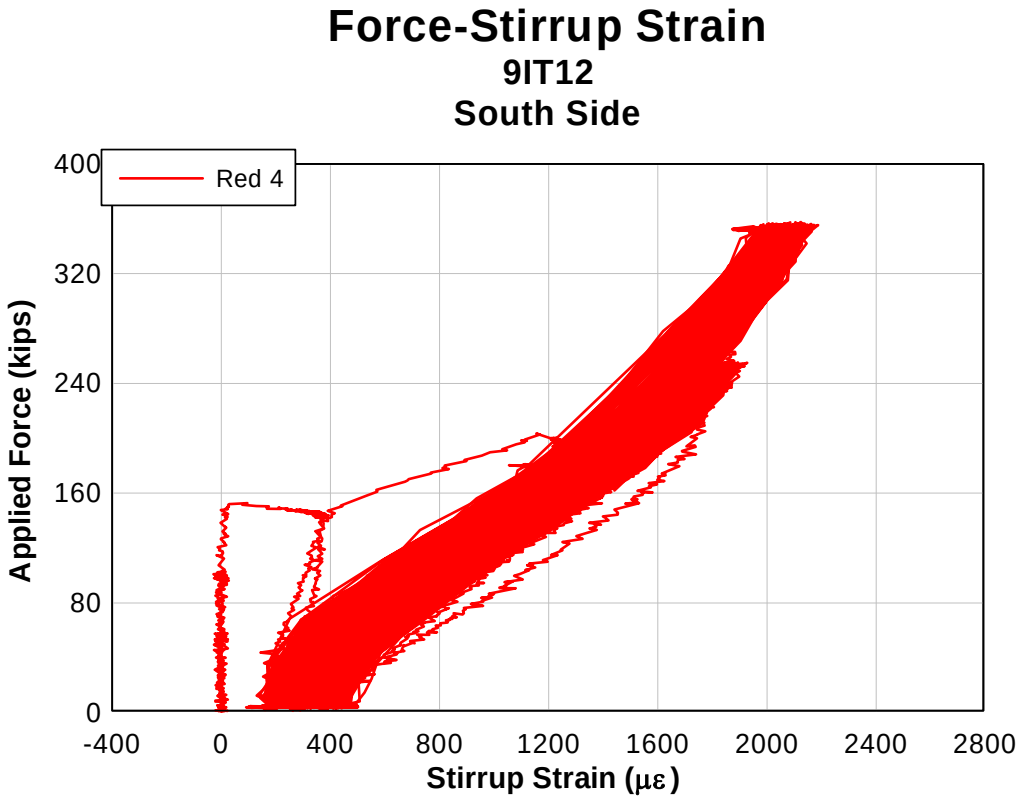

Force-Stirrup Strain
9IT12
North Side
Yellow 4
Applied Force (kips)
400
320
240
160
80
0
-500
0
500
1000
1500
2000
2500
3000
3500
Stirrup Strain (με)

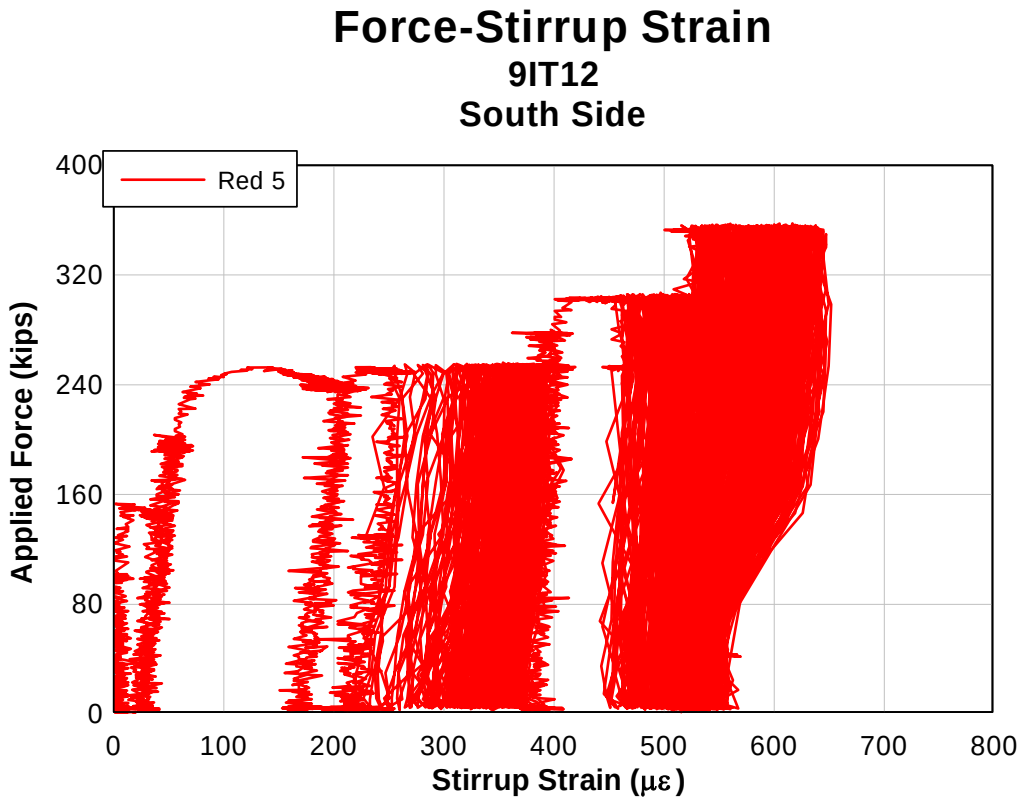

Force-Stirrup Strain
9IT12
North Side
Yellow 5
Applied Force (kips)
400
320
240
160
80
0
-2500
0
2500
5000
7500
10000
12500
15000
17500
Stirrup Strain (με)

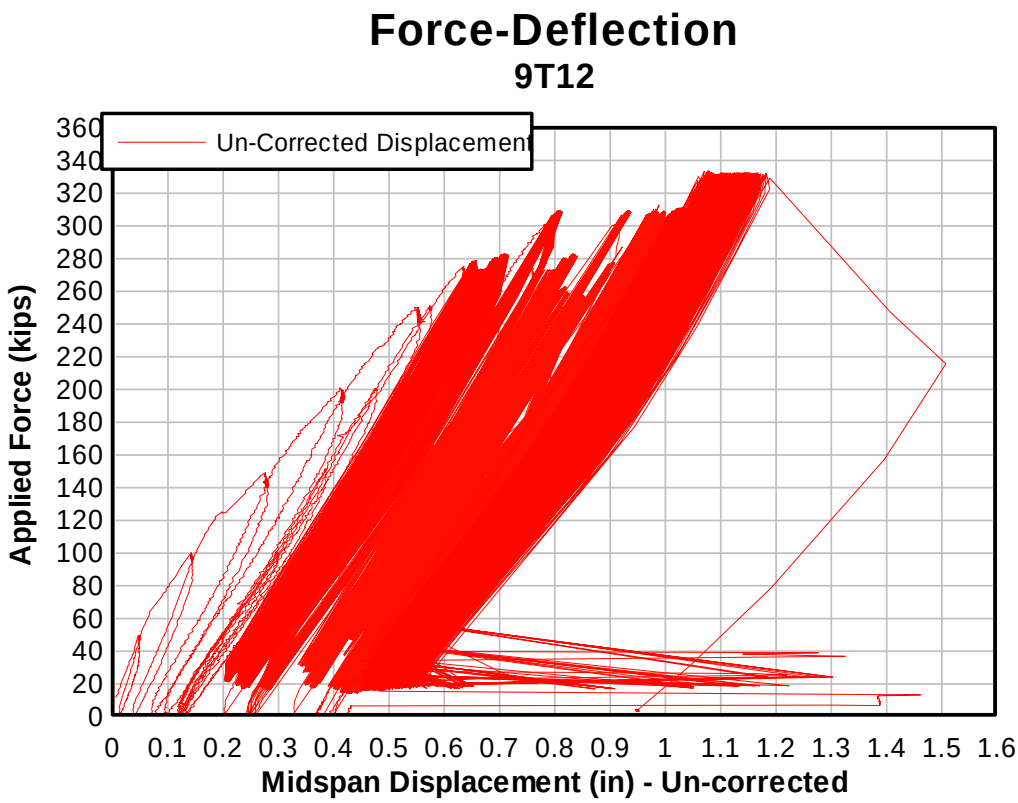

Force-Stirrup Strain
9IT12
South Side
Red 1
Applied Force (kips)
400
320
240
160
80
0
-200
0
200
400
600
800
1000
1200
1400
Stirrup Strain (με)

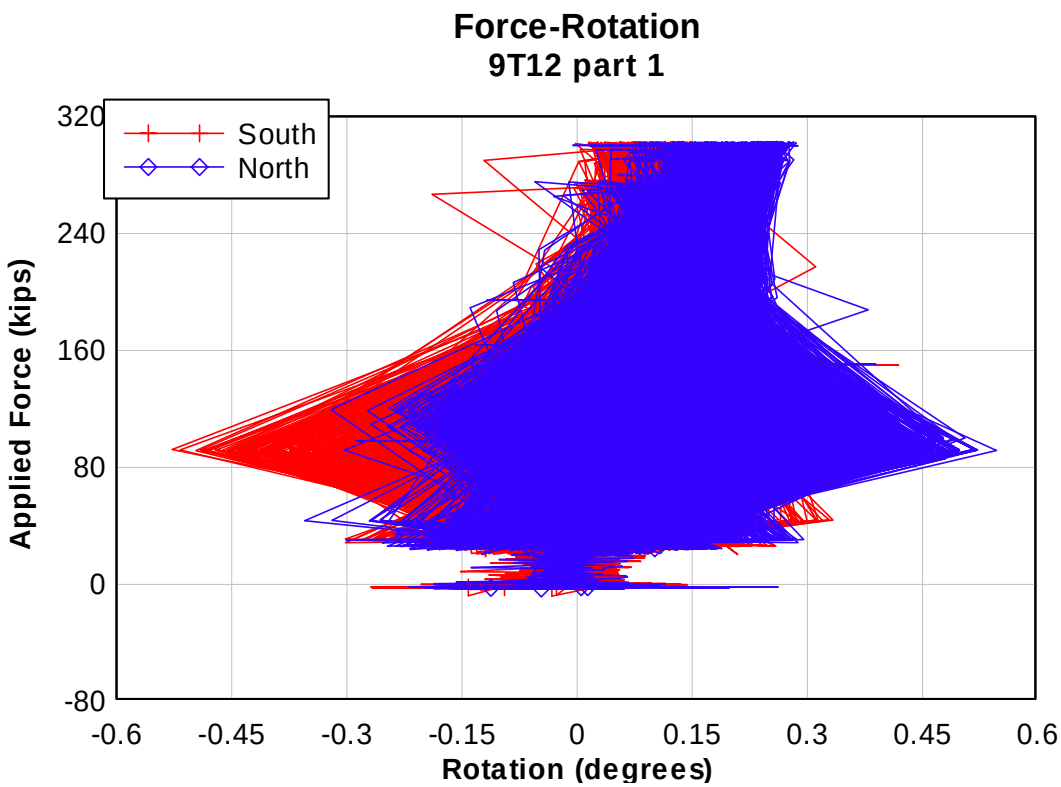

Force-Stirrup Strain
9IT12
South Side
Red 2
Applied Force (kips)
400
320
240
160
80
0
-1500
0
1500
3000
4500
6000
7500
9000
10500
Stirrup Strain (με)

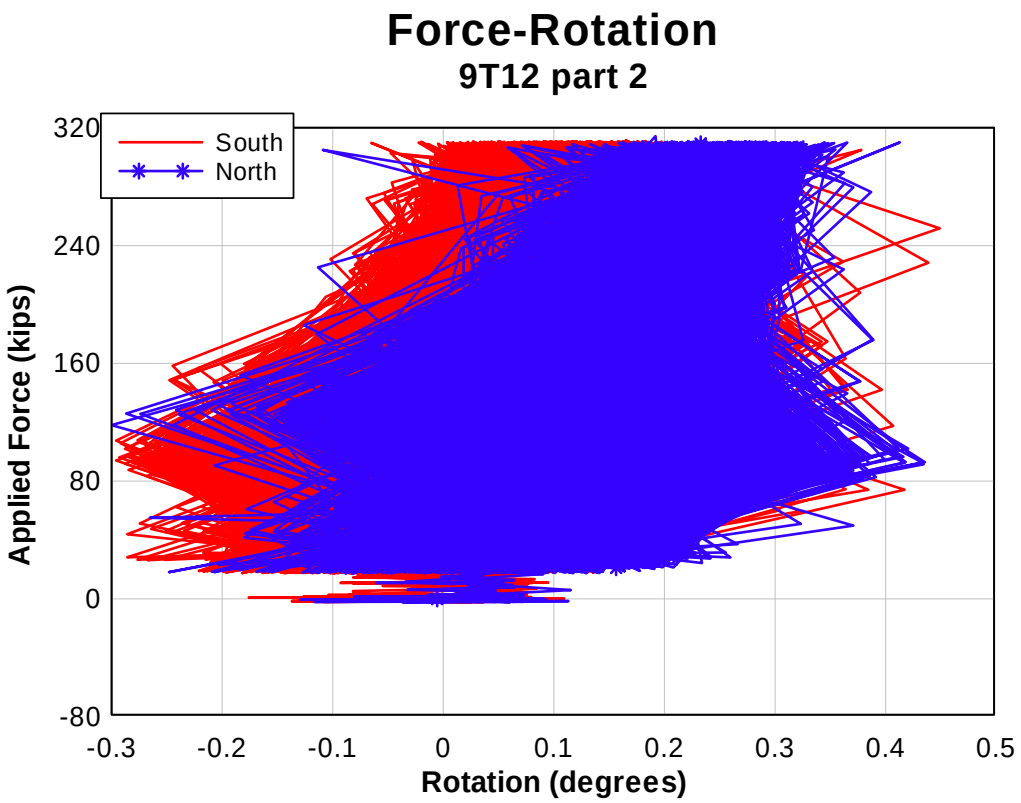

Force-Stirrup Strain
9IT12
South Side
Red 3
Applied Force (kips)
400
320
240
160
80
0
-2000
0
2000
4000
6000
8000
10000
12000
14000
Stirrup Strain (με)

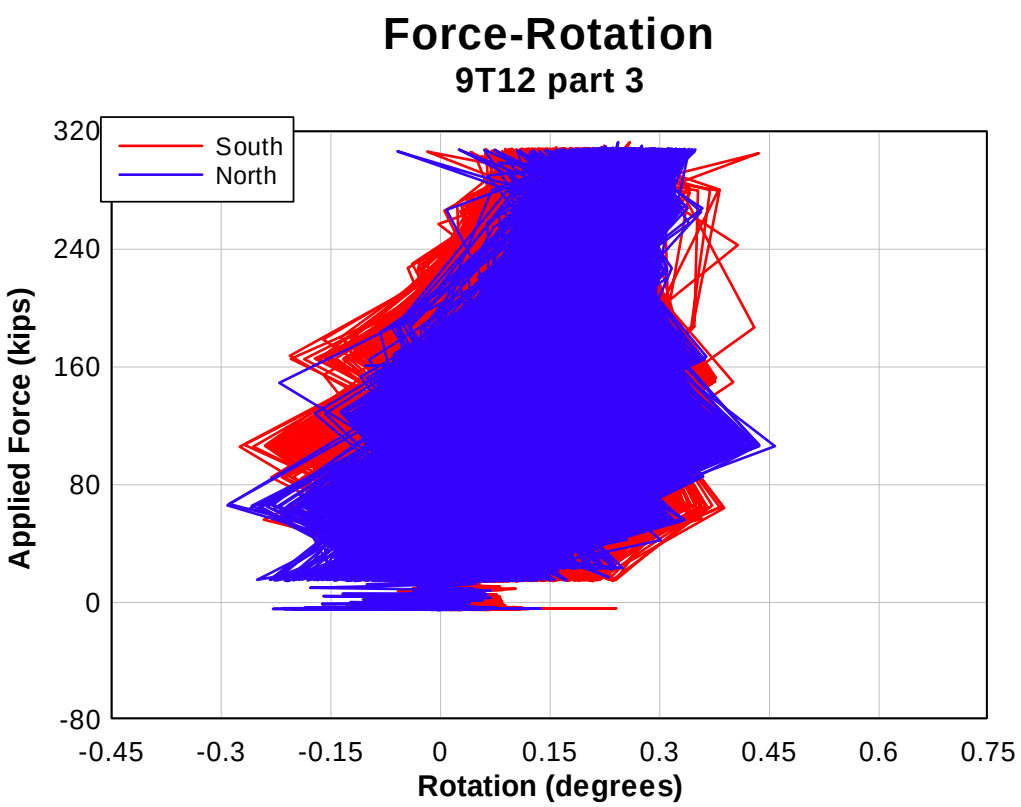

Force-Stirrup Strain
9IT12
South Side
Red 4
Applied Force (kips)
Stirrup Strain (με)
400
320
240
160
80
0
-400
0
400
800
1200
1600
2000
2400
2800

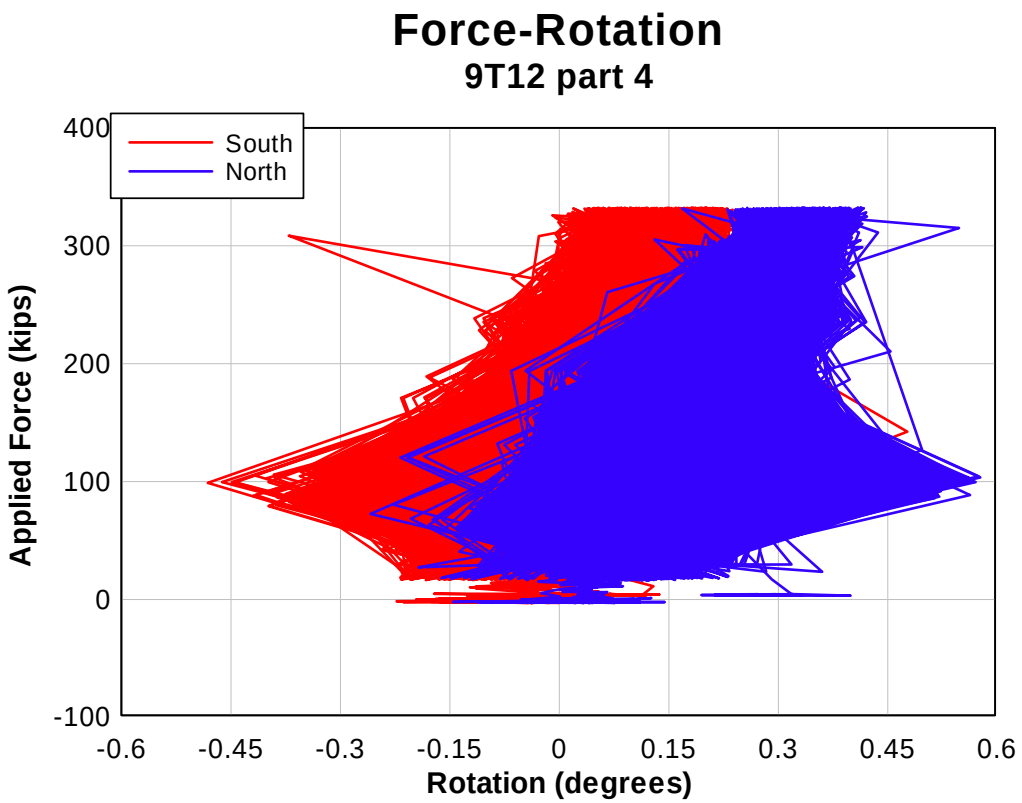

Force-Stirrup Strain
9IT12
South Side
Red 5
Applied Force (kips)
Stirrup Strain (με)
400
320
240
160
80
0
0
100
200
300
400
500
600
700
800

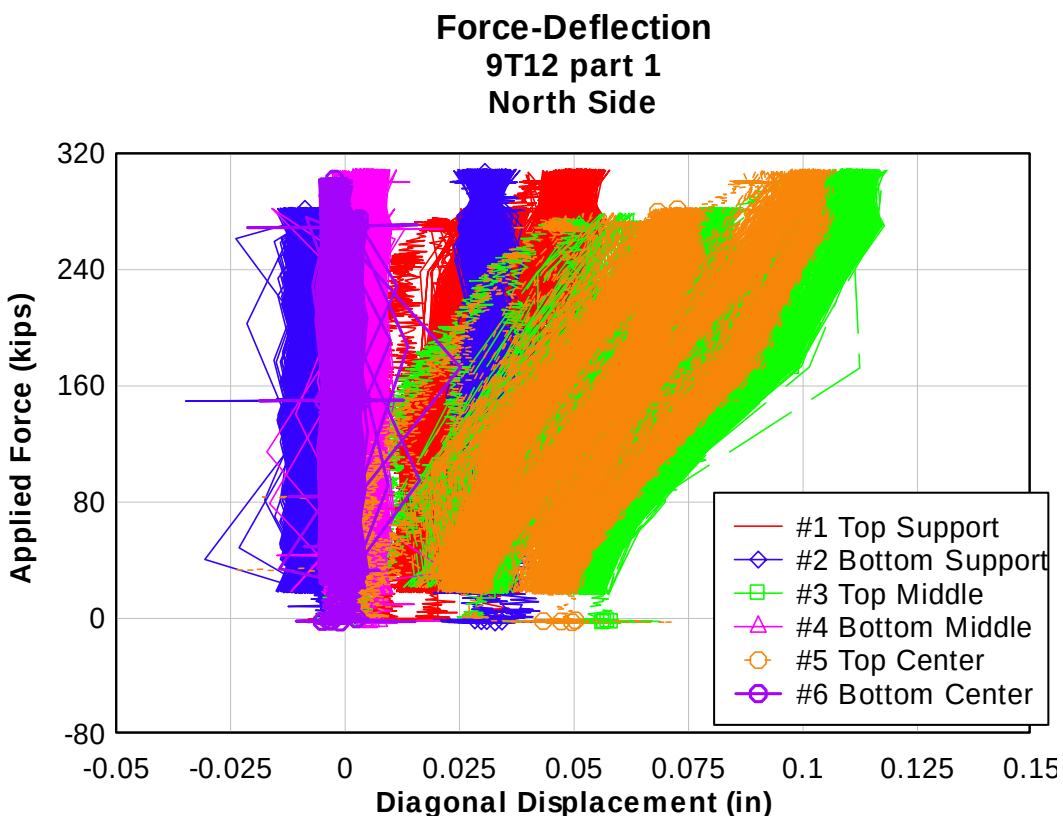

Force-Deflection
9T12
Un-Corrected Displacement
Applied Force (kips)
Midspan Displacement (in) - Un-corrected
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6

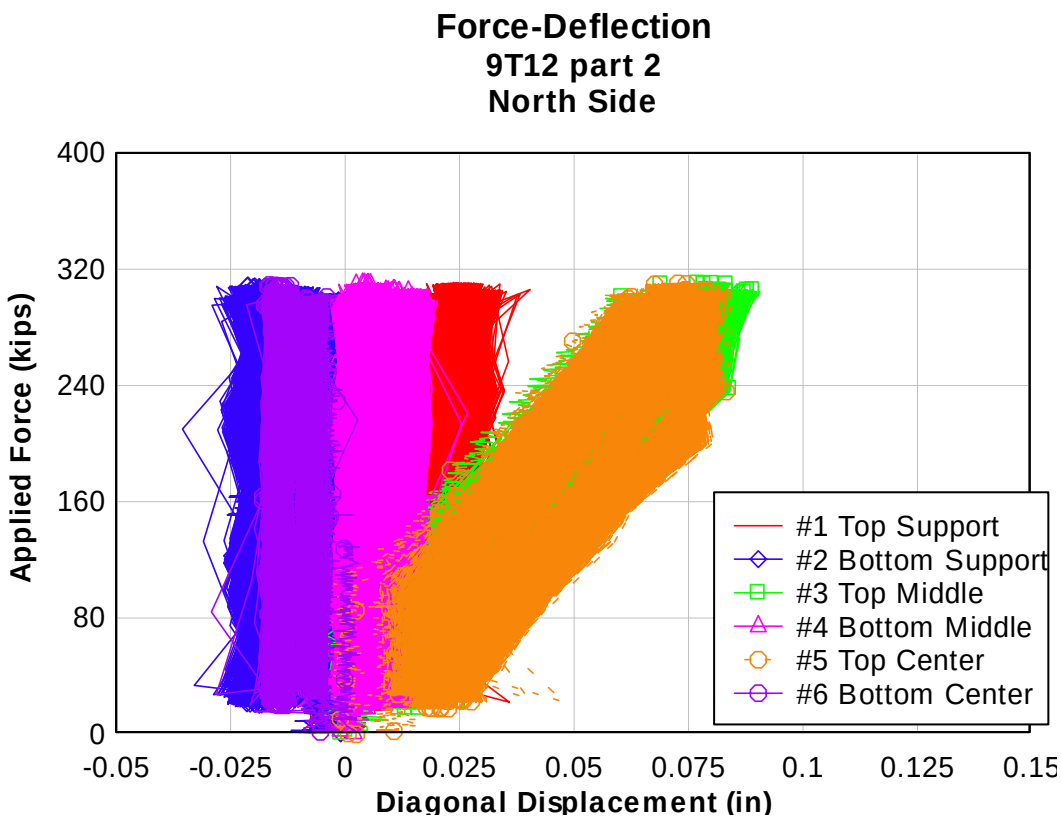

Force-Rotation
9T12 part 1
South
North
Applied Force (kips)
Rotation (degrees)
-80
0
80
160
240
320
-0.6 -0.45 -0.3 -0.15 0 0.15 0.3 0.45 0.6

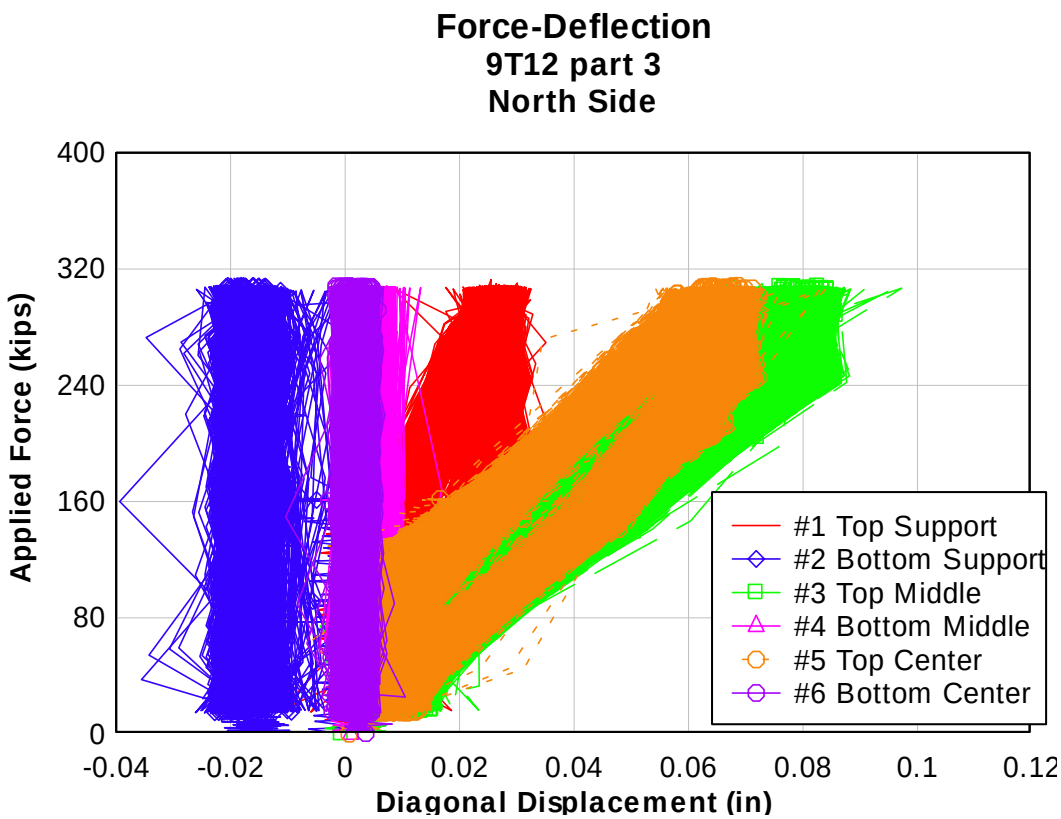

Force-Rotation
9T12 part 2
South
North
Applied Force (kips)
320
240
160
80
0
-80
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
Rotation (degrees)

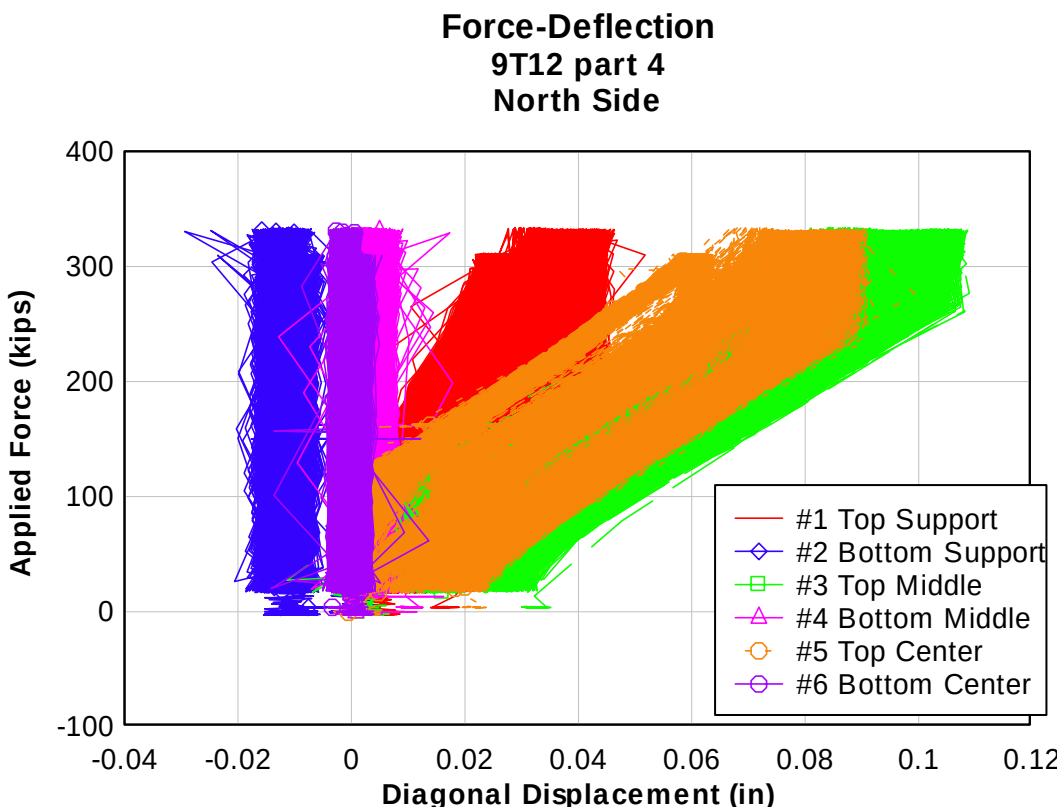

Force-Rotation
9T12 part 3
South
North
Applied Force (kips)
320
240
160
80
0
-80
-0.45
-0.3
-0.15
0
0.15
0.3
0.45
0.6
0.75
Rotation (degrees)

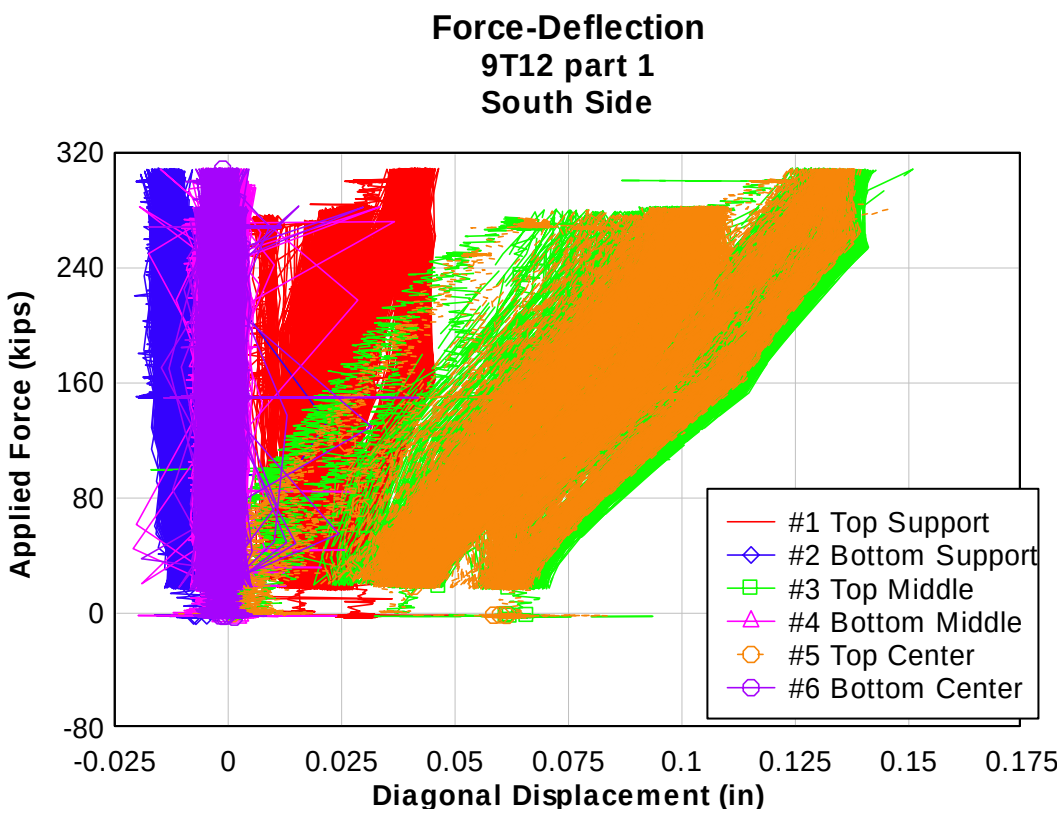

Force-Rotation
9T12 part 4
South
North
Applied Force (kips)
400
300
200
100
0
-100
-0.6
-0.45
-0.3
-0.15
0
0.15
0.3
0.45
0.6
Rotation (degrees)

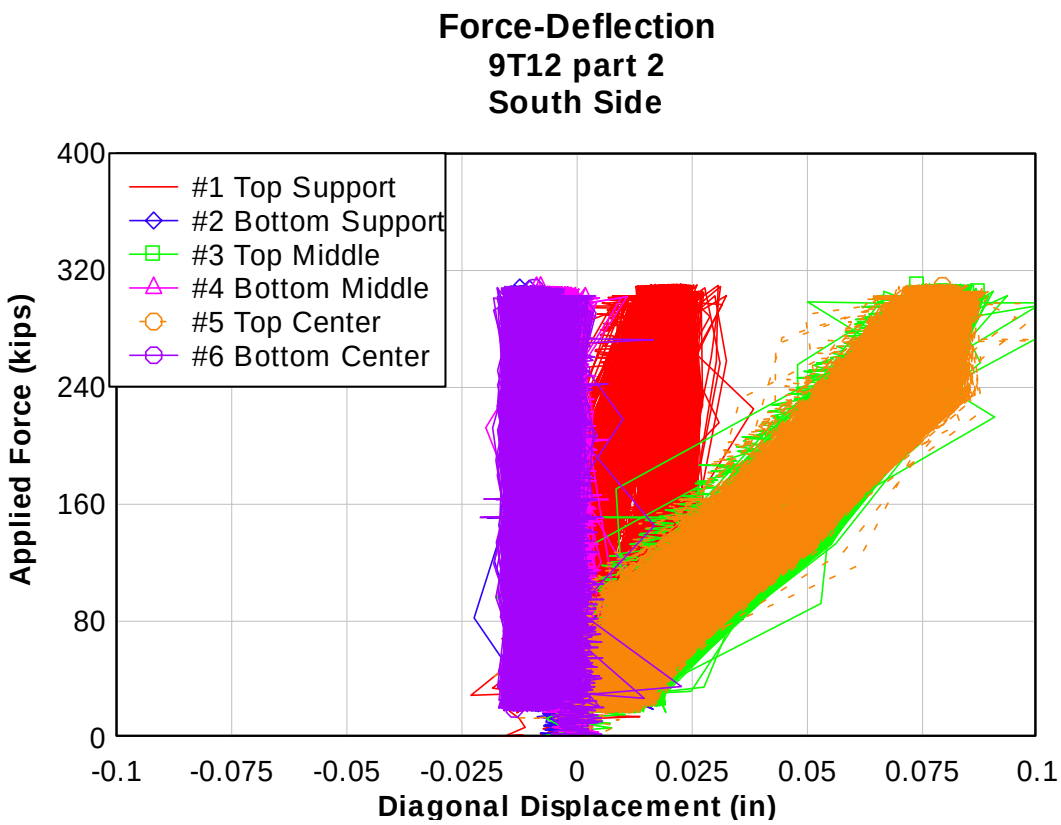

Force-Deflection
9T12 part 1
North Side
Applied Force (kips)
320
240
160
80
0
-80
-0.05
-0.025
0
0.025
0.05
0.075
0.1
0.125
0.15
Diagonal Displacement (in)
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

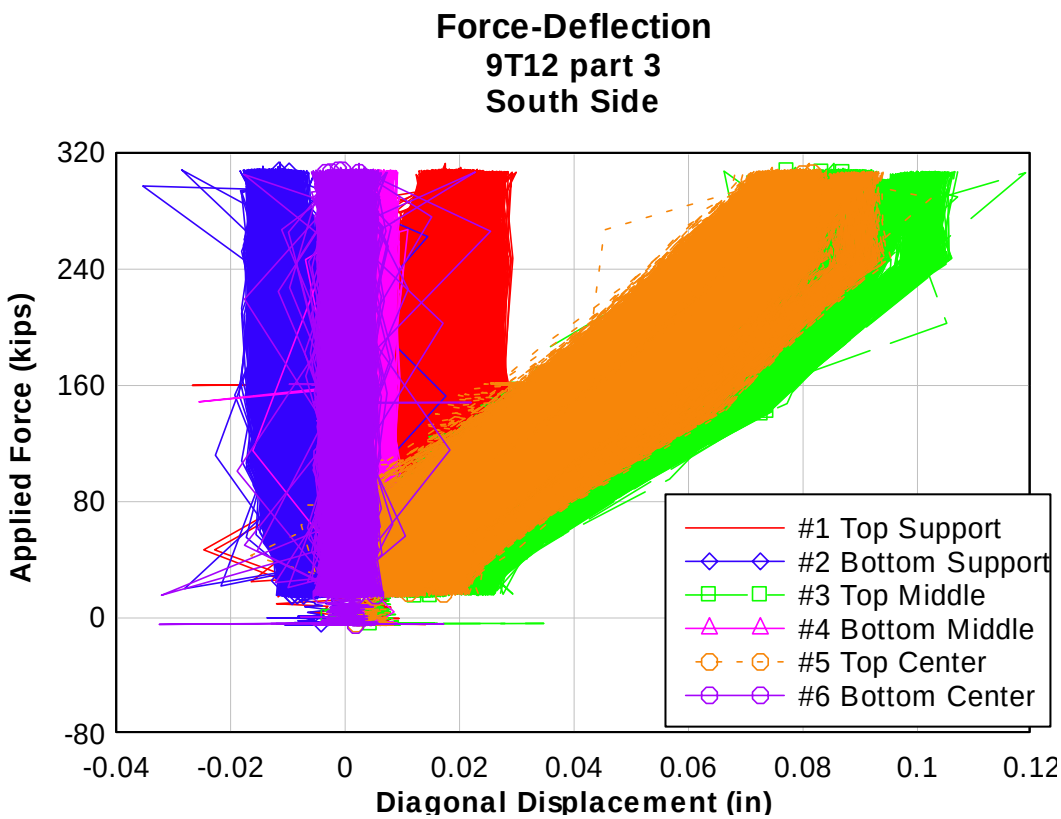

Force-Deflection
9T12 part 2
North Side
Applied Force (kips)
Diagonal Displacement (in)
400
320
240
160
80
0
-0.05
-0.025
0
0.025
0.05
0.075
0.1
0.125
0.15
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

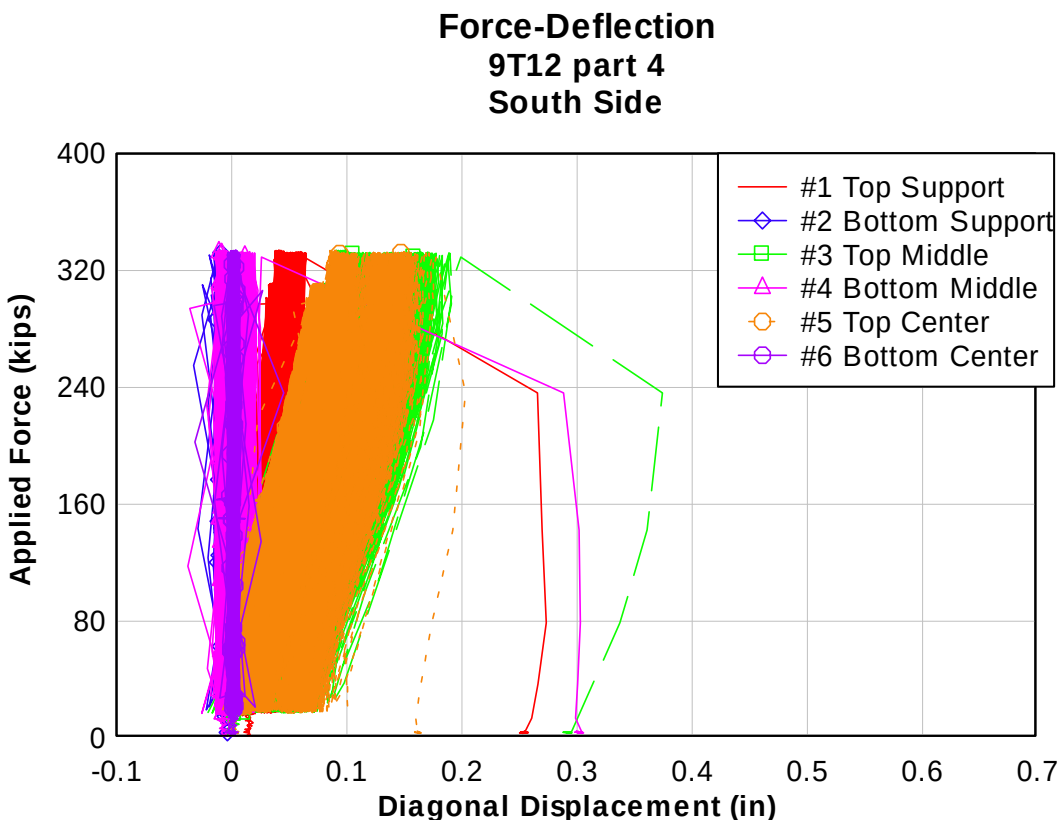

Force-Deflection
9T12 part 3
North Side
Applied Force (kips)
Diagonal Displacement (in)
400
320
240
160
80
0
-0.04
-0.02
0
0.02
0.04
0.06
0.08
0.1
0.12
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

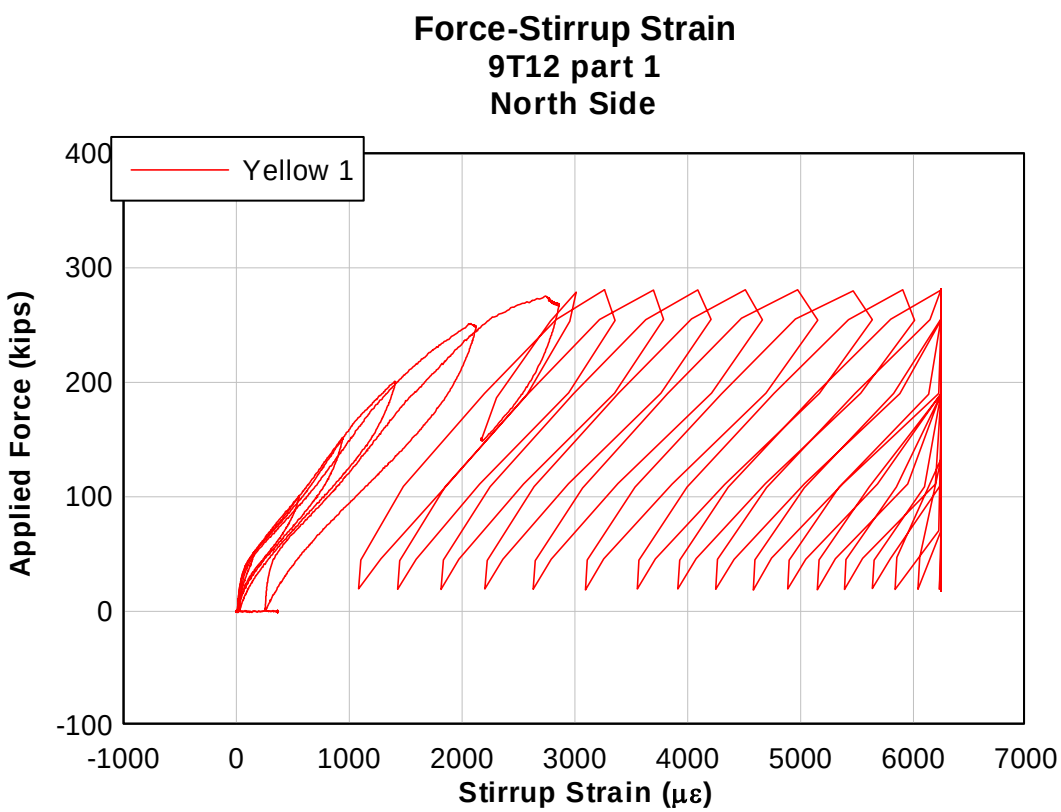

Force-Deflection
9T12 part 4
North Side
Applied Force (kips)
Diagonal Displacement (in)
400
300
200
100
0
-100
-0.04
-0.02
0
0.02
0.04
0.06
0.08
0.1
0.12
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

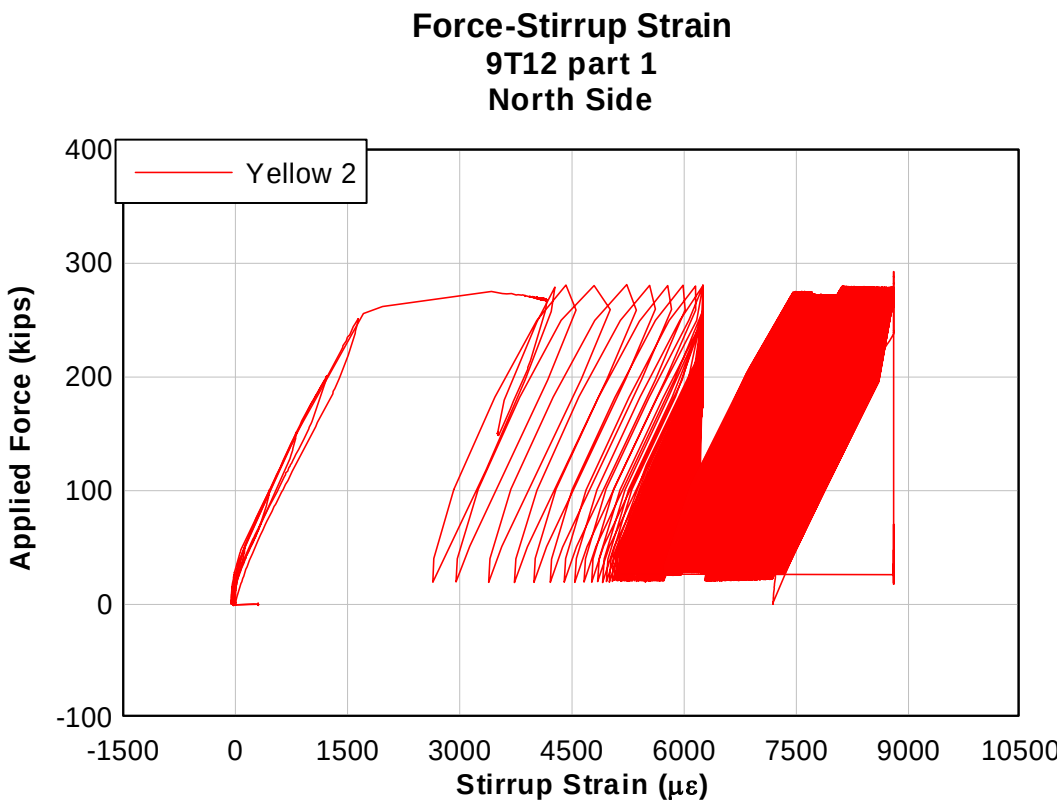

Force-Deflection
9T12 part 1
South Side
Applied Force (kips)
Diagonal Displacement (in)
320
240
160
80
0
-80
-0.025
0
0.025
0.05
0.075
0.1
0.125
0.15
0.175
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center

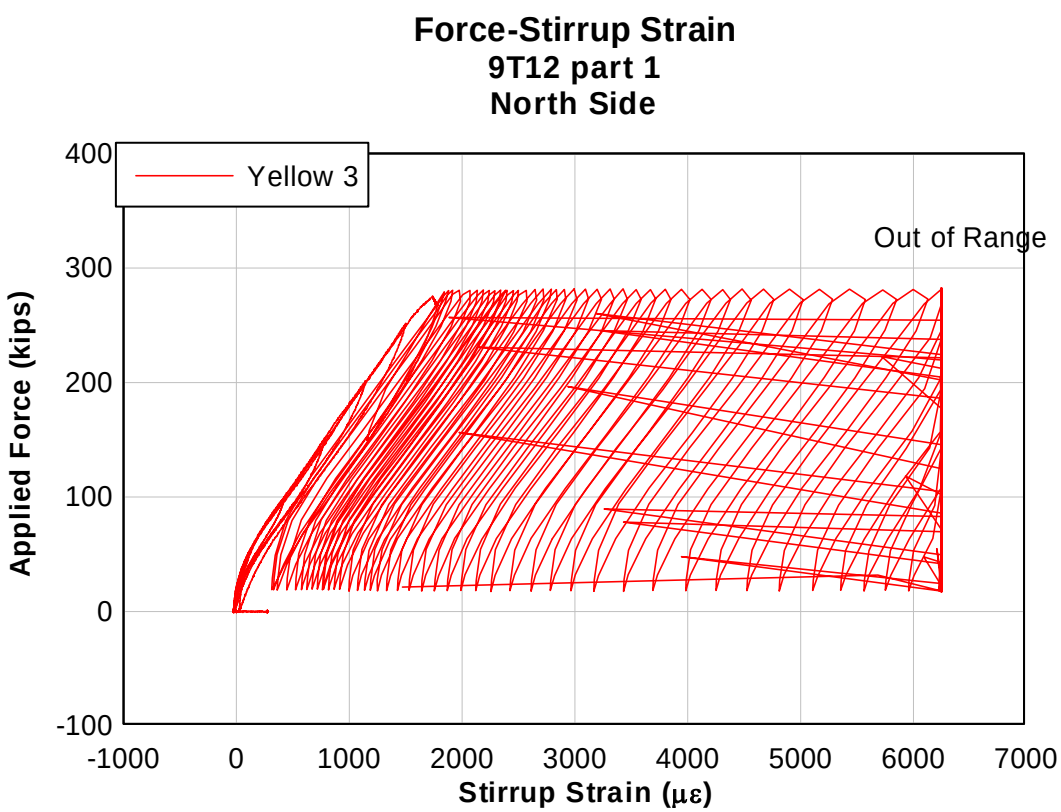

Force-Deflection
9T12 part 2
South Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
Diagonal Displacement (in)
400
320
240
160
80
0
-0.1
-0.075
-0.05
-0.025
0
0.025
0.05
0.075
0.1

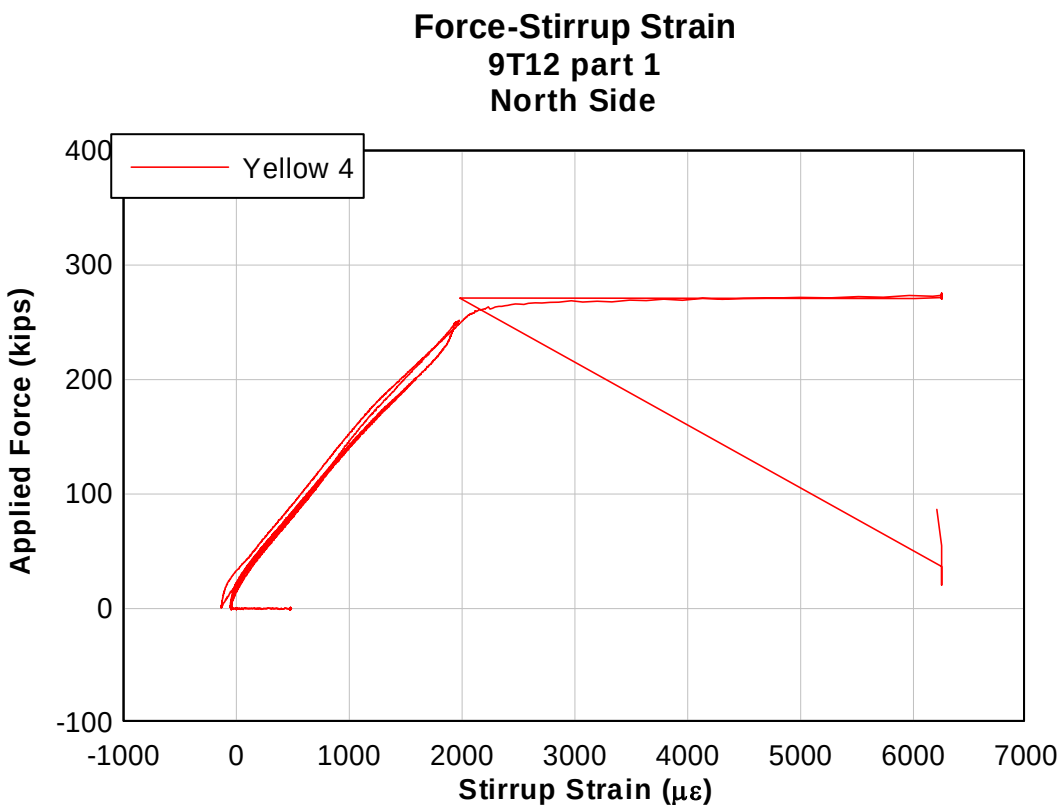

Force-Deflection
9T12 part 3
South Side
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
Applied Force (kips)
Diagonal Displacement (in)
320
240
160
80
0
-80
-0.04
-0.02
0
0.02
0.04
0.06
0.08
0.1
0.12

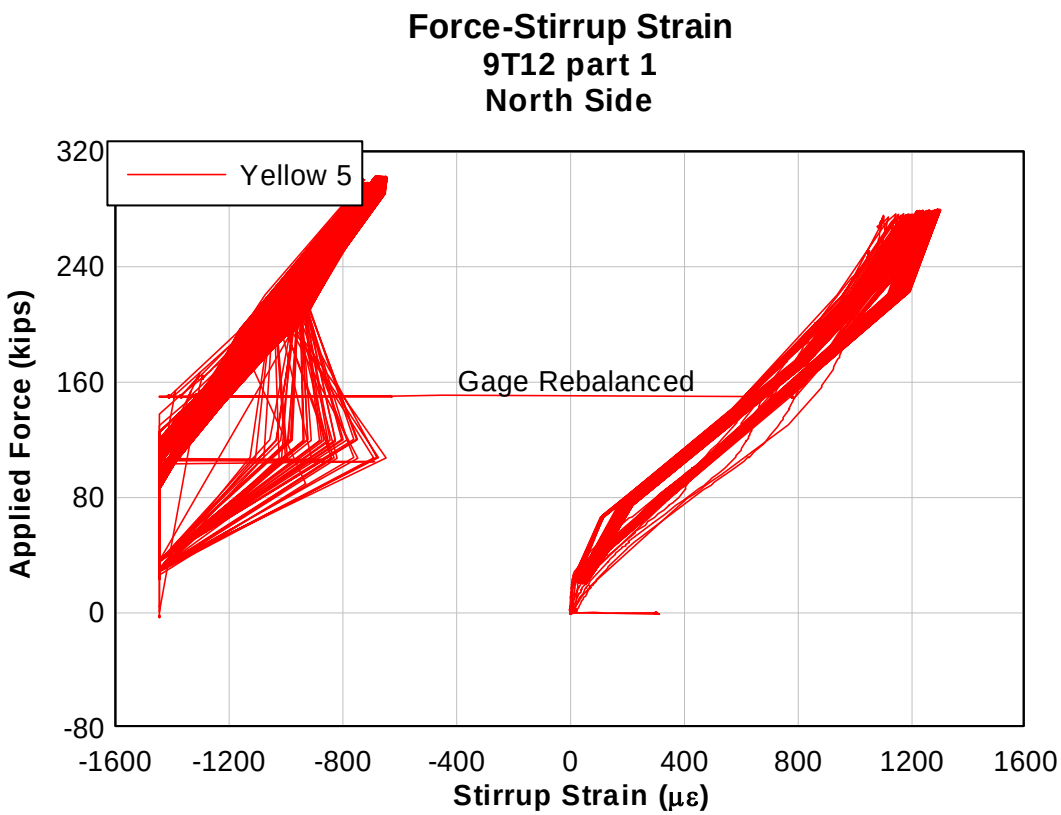

Force-Deflection
9T12 part 4
South Side
Applied Force (kips)
Diagonal Displacement (in)
#1 Top Support
#2 Bottom Support
#3 Top Middle
#4 Bottom Middle
#5 Top Center
#6 Bottom Center
400
320
240
160
80
0
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

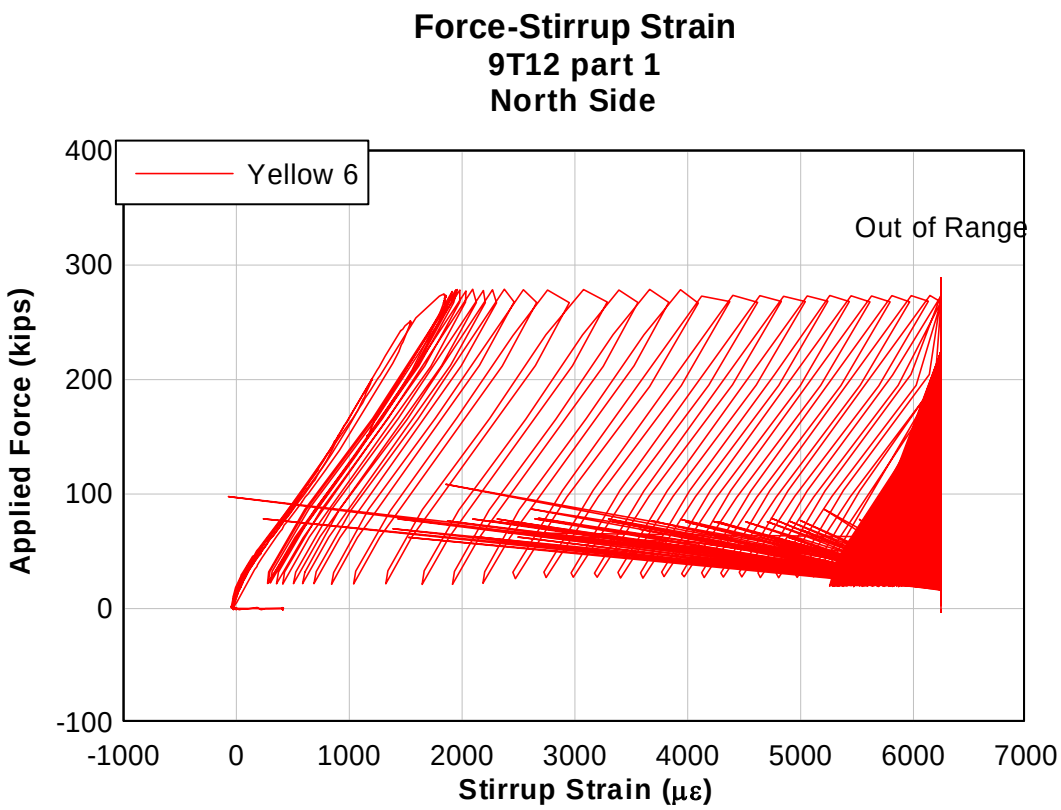

Force-Stirrup Strain
9T12 part 1
North Side
Applied Force (kips)
Stirrup Strain (με)
Yellow 1
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000

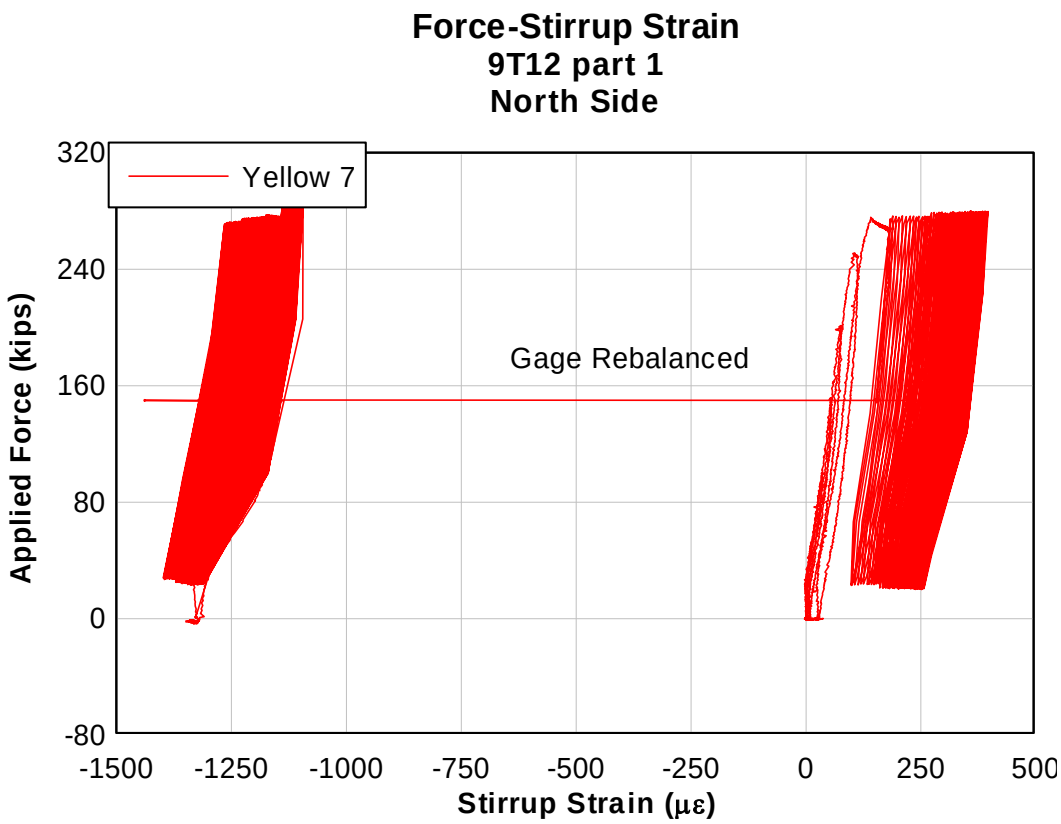

Force-Stirrup Strain
9T12 part 1
North Side
Yellow 2
Applied Force (kips)
400
300
200
100
0
-100
-1500
0
1500
3000
4500
6000
7500
9000
10500
Stirrup Strain (με)

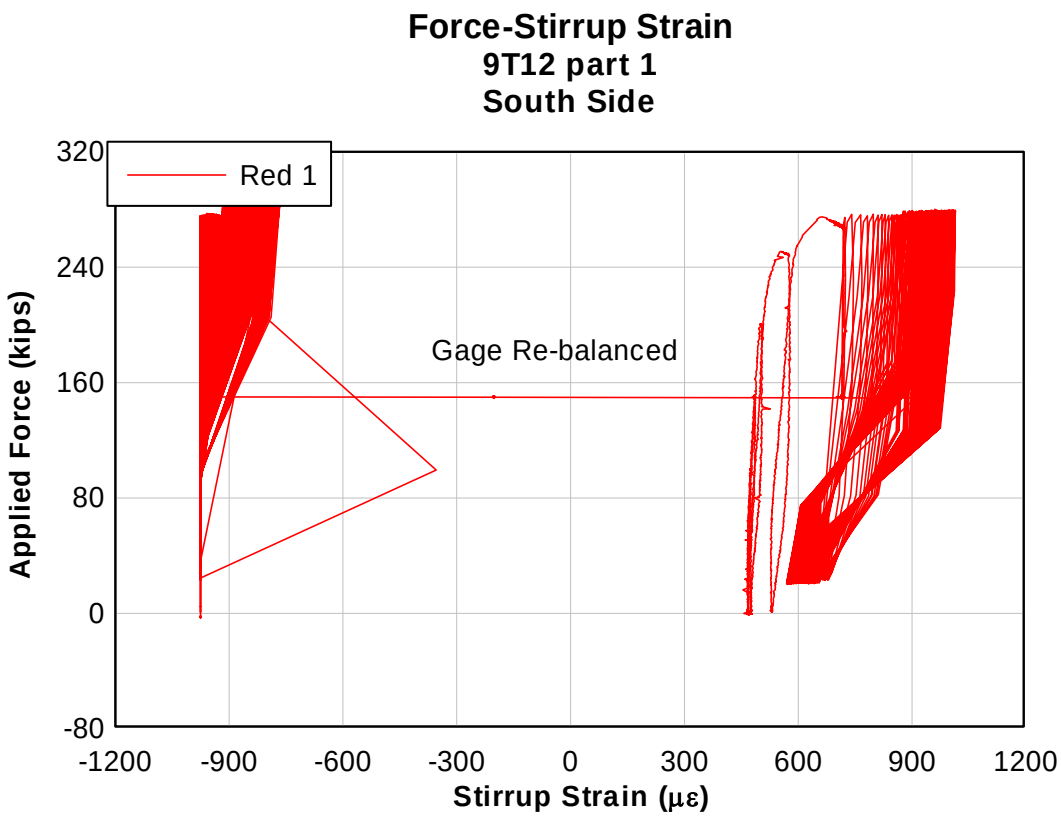

Force-Stirrup Strain
9T12 part 1
North Side
Yellow 3
Out of Range
Applied Force (kips)
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000
Stirrup Strain (με)

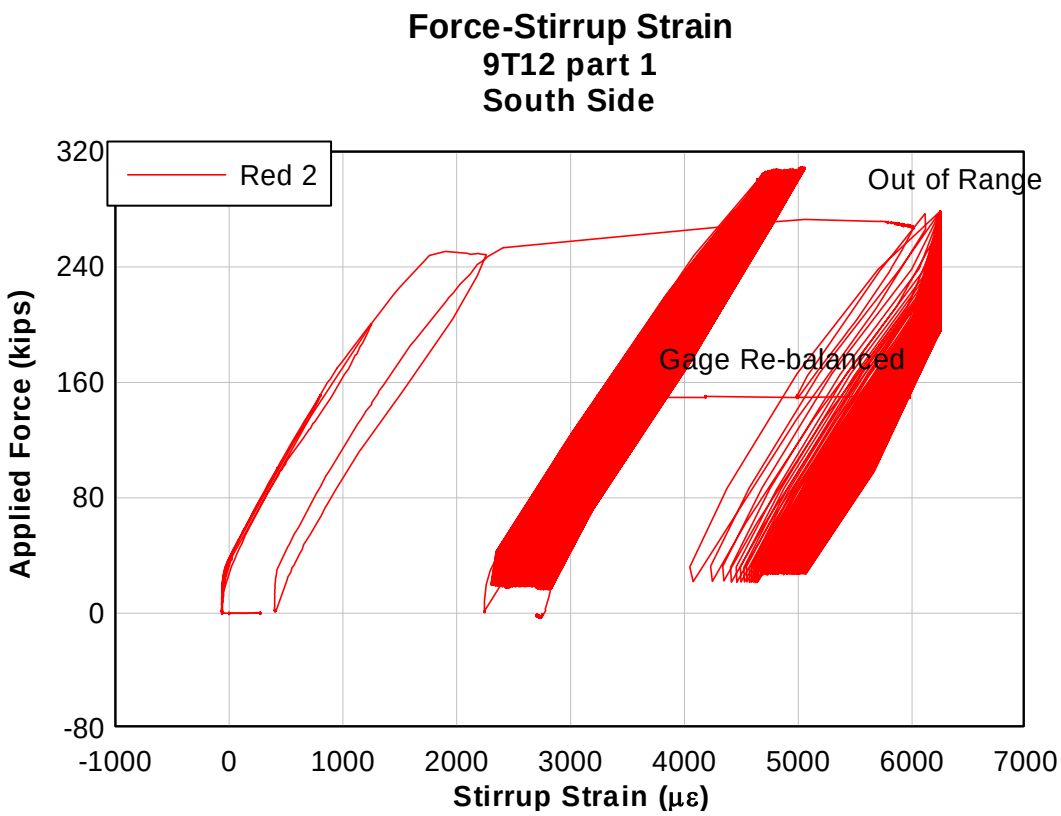

Force-Stirrup Strain
9T12 part 1
North Side
Yellow 4
Applied Force (kips)
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000
Stirrup Strain (με)

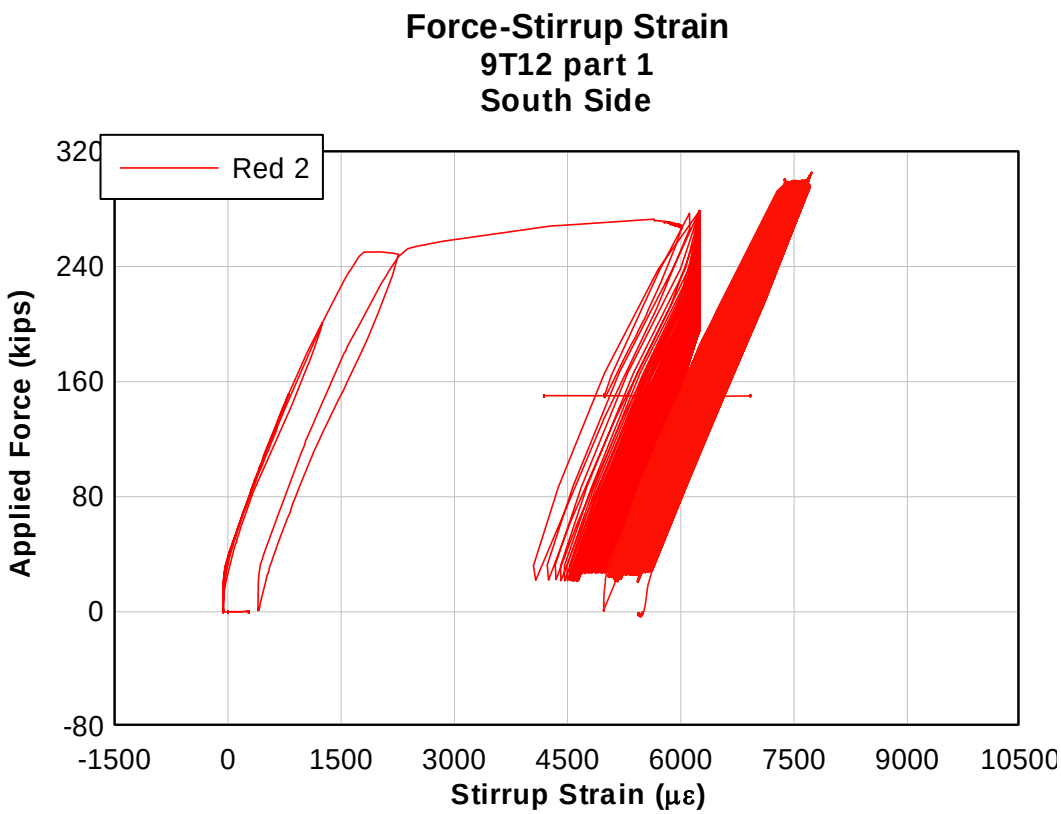

Force-Stirrup Strain
9T12 part 1
North Side
Yellow 5
Gage Rebalanced
Applied Force (kips)
320
240
160
80
0
-80
-1600
-1200
-800
-400
0
400
800
1200
1600
Stirrup Strain (με)

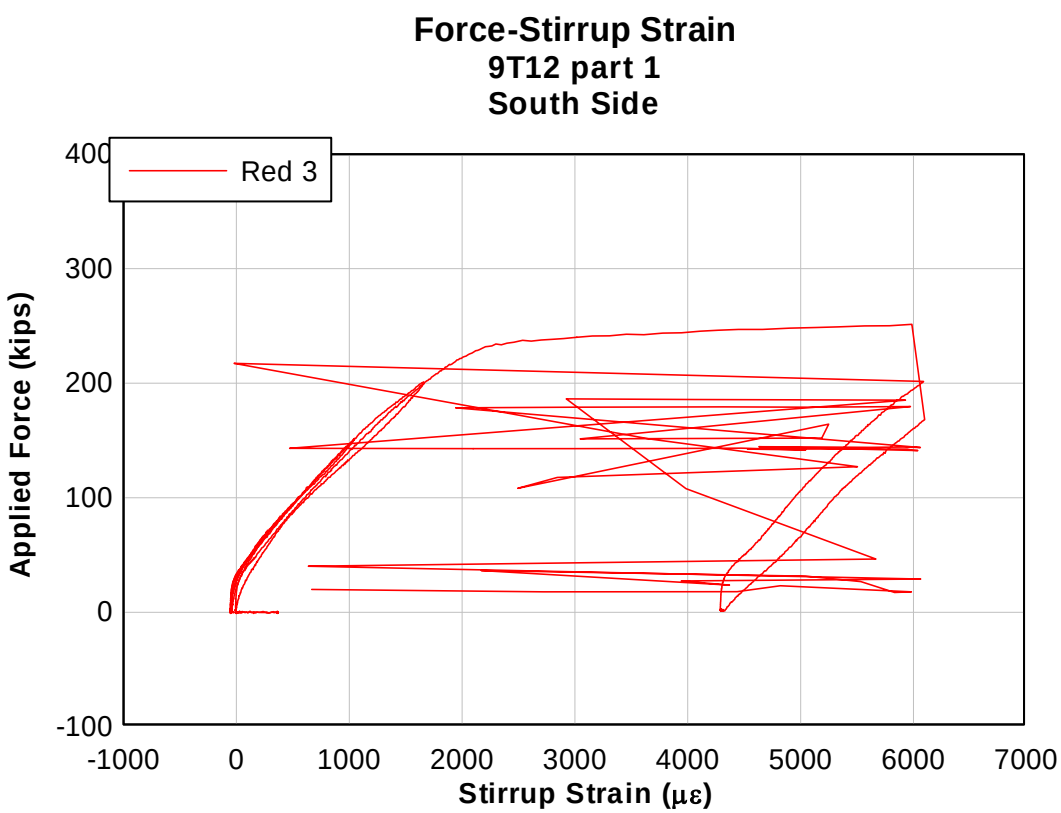

Force-Stirrup Strain
9T12 part 1
North Side
Yellow 6
Out of Range
Applied Force (kips)
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000
Stirrup Strain (με)

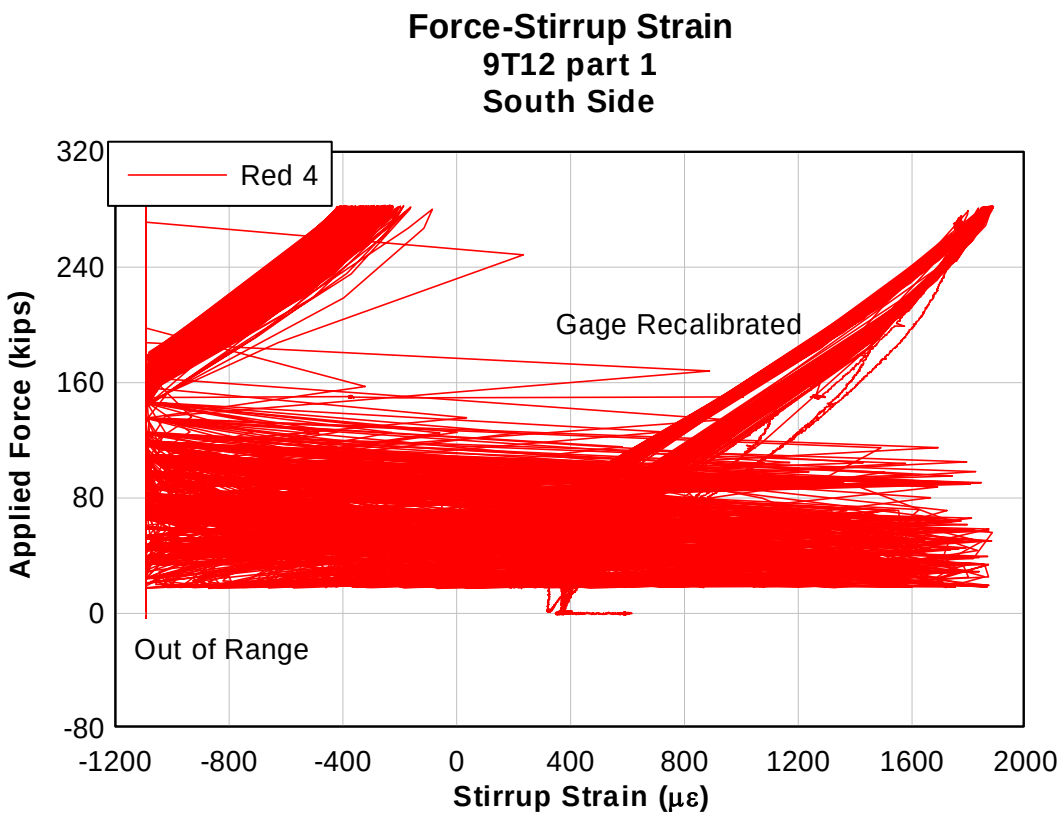

Force-Stirrup Strain
9T12 part 1
North Side
Yellow 7
Gage Rebalanced
Applied Force (kips)
320
240
160
80
0
-80
-1500
-1250
-1000
-750
-500
-250
0
250
500
Stirrup Strain (με)

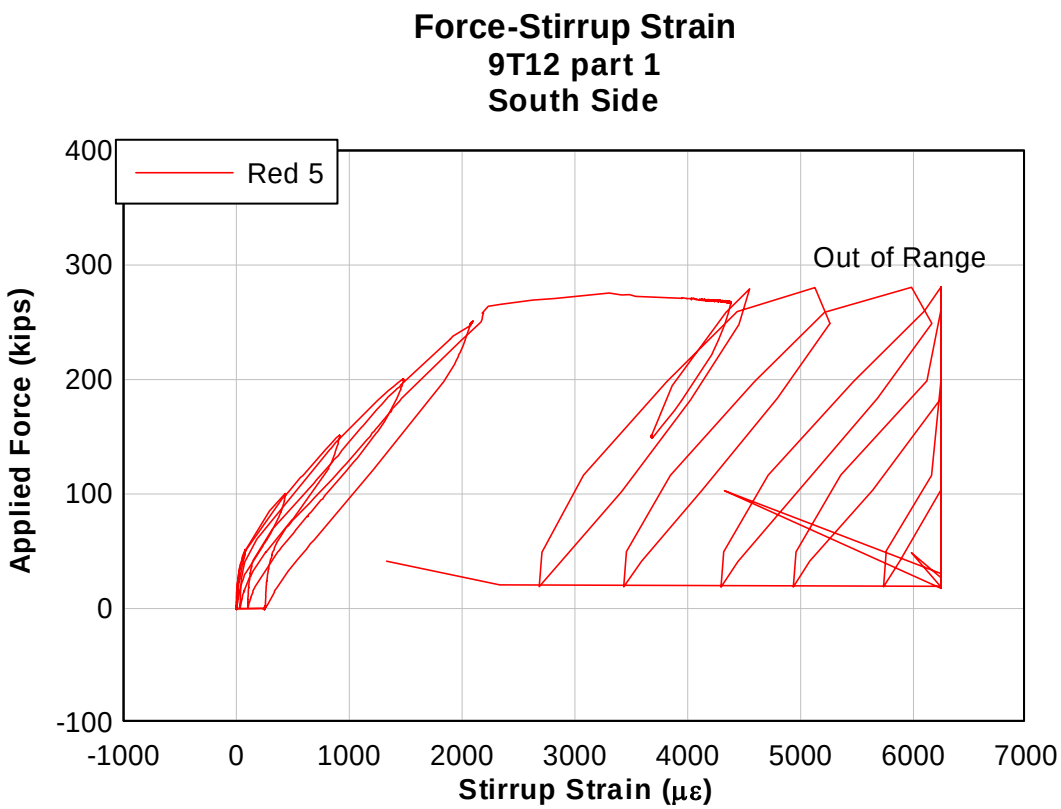

Force-Stirrup Strain
9T12 part 1
South Side
Red 1
Gage Re-balanced
Applied Force (kips)
320
240
160
80
0
-80
-1200
-900
-600
-300
0
300
600
900
1200
Stirrup Strain (με)

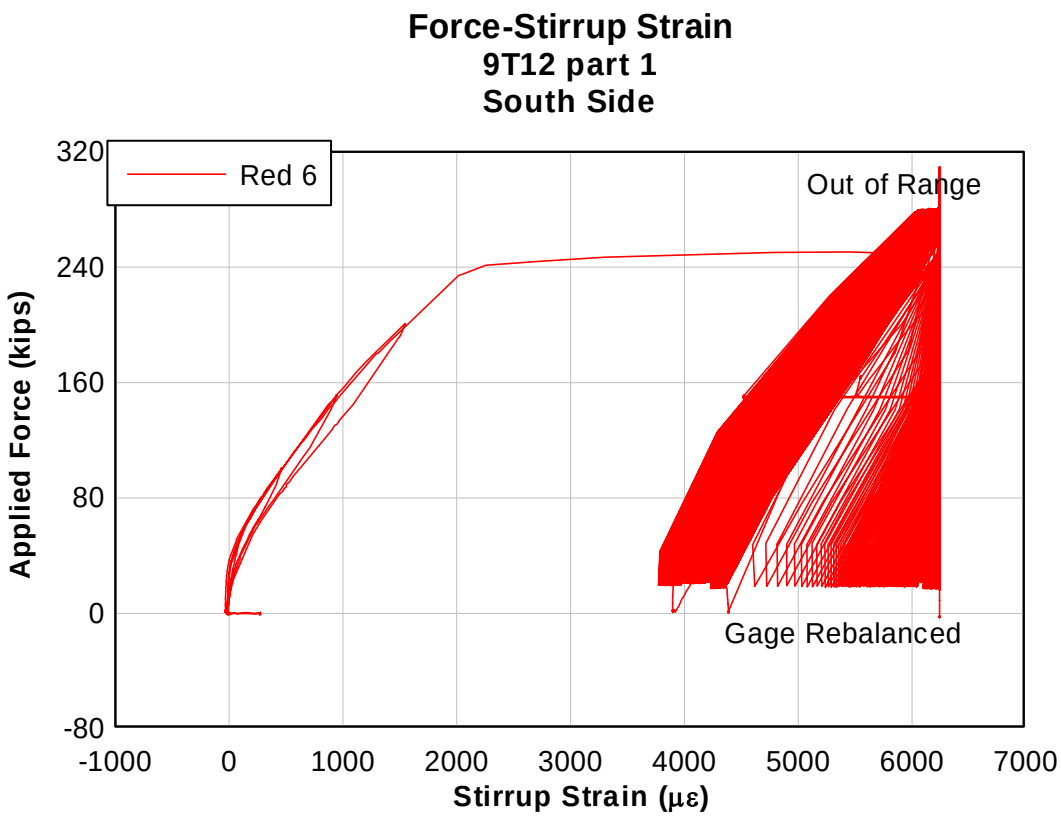

Force-Stirrup Strain
9T12 part 1
South Side
Red 2
Out of Range
Gage Re-balanced
Applied Force (kips)
320
240
160
80
0
-80
-1000
0
1000
2000
3000
4000
5000
6000
7000
Stirrup Strain (με)

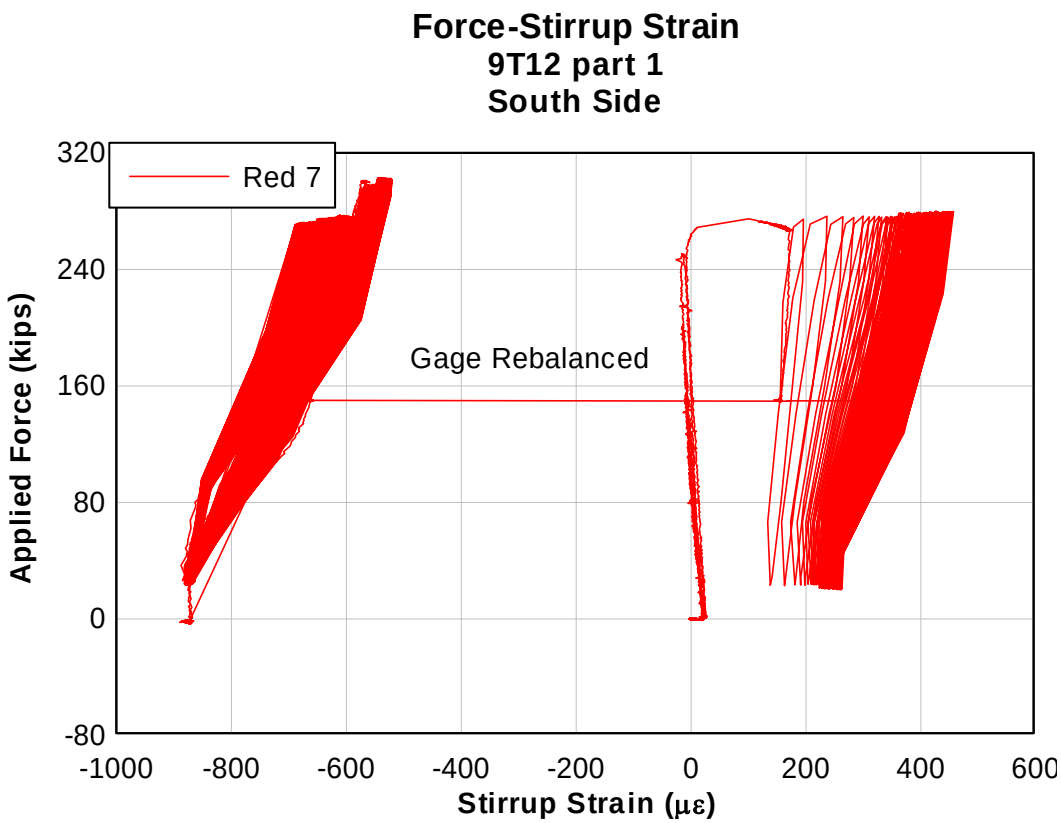

Force-Stirrup Strain
9T12 part 1
South Side
Red 2
Applied Force (kips)
320
240
160
80
0
-80
-1500
0
1500
3000
4500
6000
7500
9000
10500
Stirrup Strain (με)

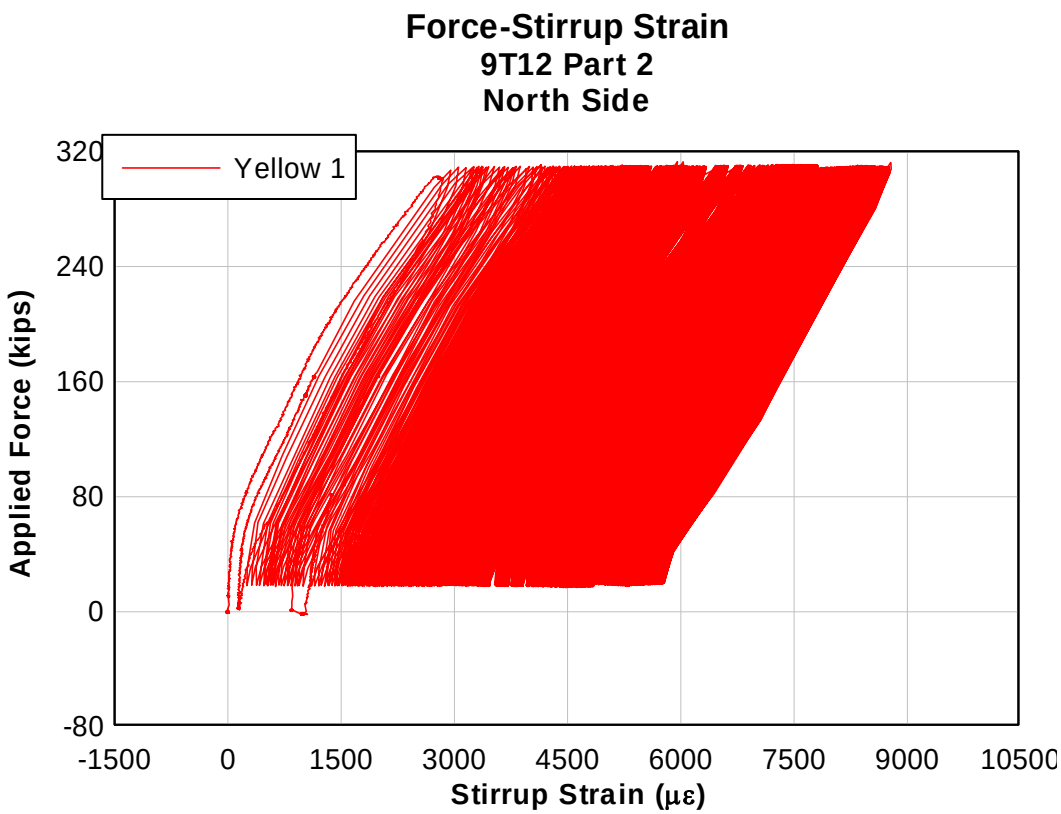

Force-Stirrup Strain
9T12 part 1
South Side
Red 3
Applied Force (kips)
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000
Stirrup Strain (με)

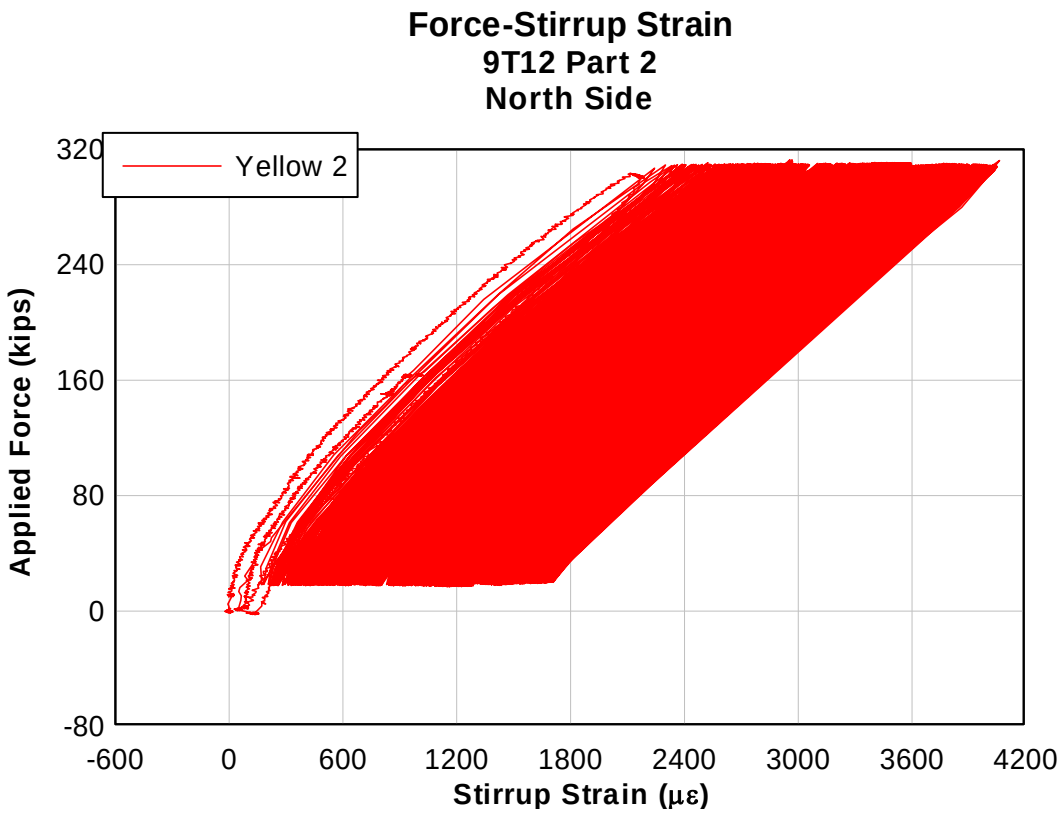

Force-Stirrup Strain
9T12 part 1
South Side
Red 4
Gage Recalibrated
Out of Range
Applied Force (kips)
Stirrup Strain (με)
320
240
160
80
0
-80
-1200
-800
-400
0
400
800
1200
1600
2000

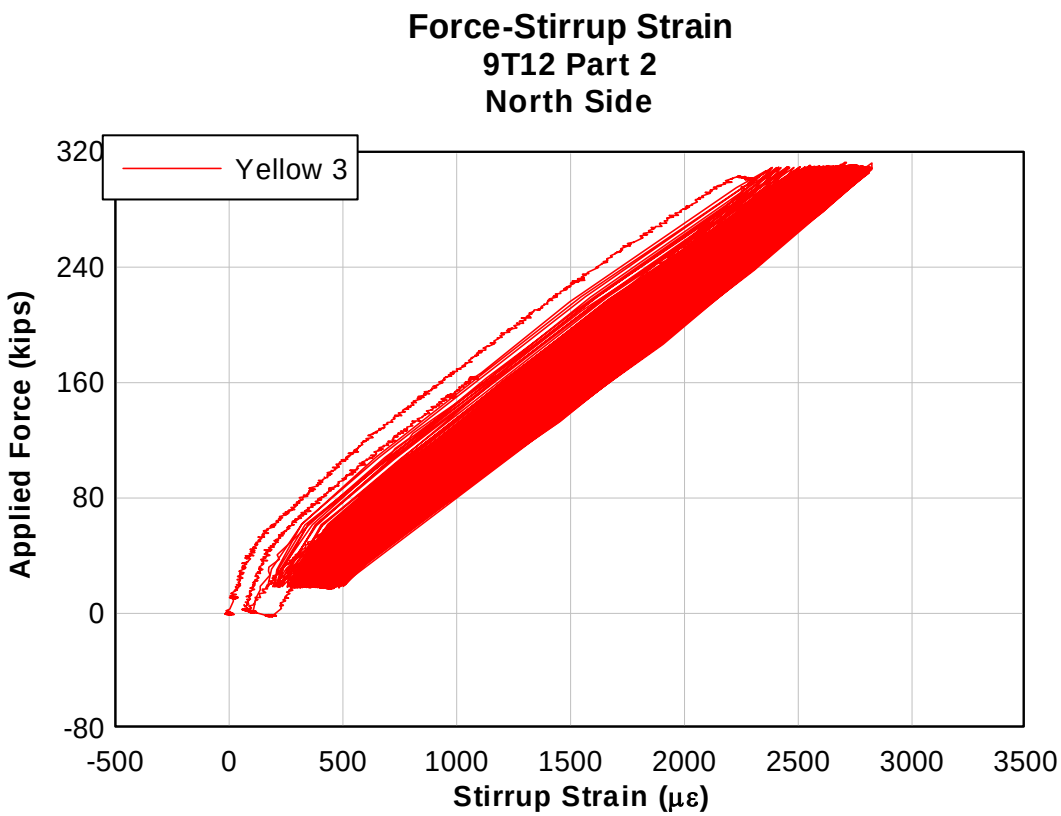

Force-Stirrup Strain
9T12 part 1
South Side
Red 5
Out of Range
Applied Force (kips)
Stirrup Strain (με)
400
300
200
100
0
-100
-1000
0
1000
2000
3000
4000
5000
6000
7000

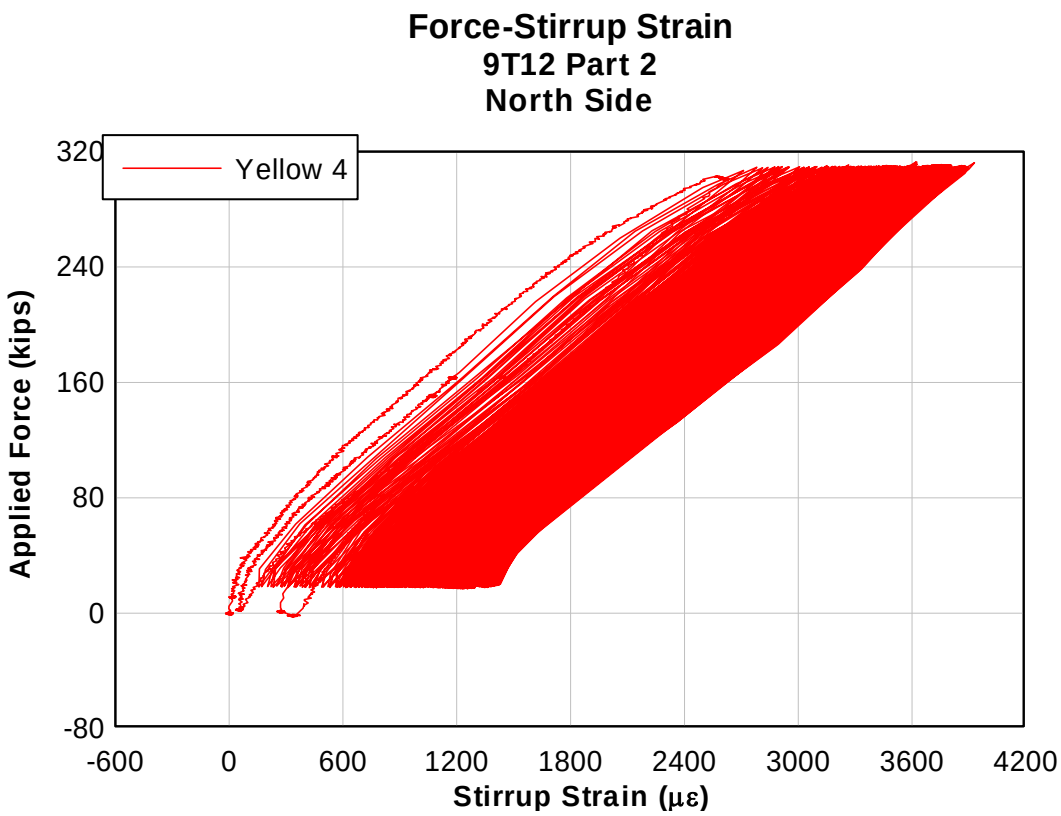

Force-Stirrup Strain
9T12 part 1
South Side
Red 6
Out of Range
Gage Rebalanced
Applied Force (kips)
Stirrup Strain (με)
320
240
160
80
0
-80
-1000
0
1000
2000
3000
4000
5000
6000
7000

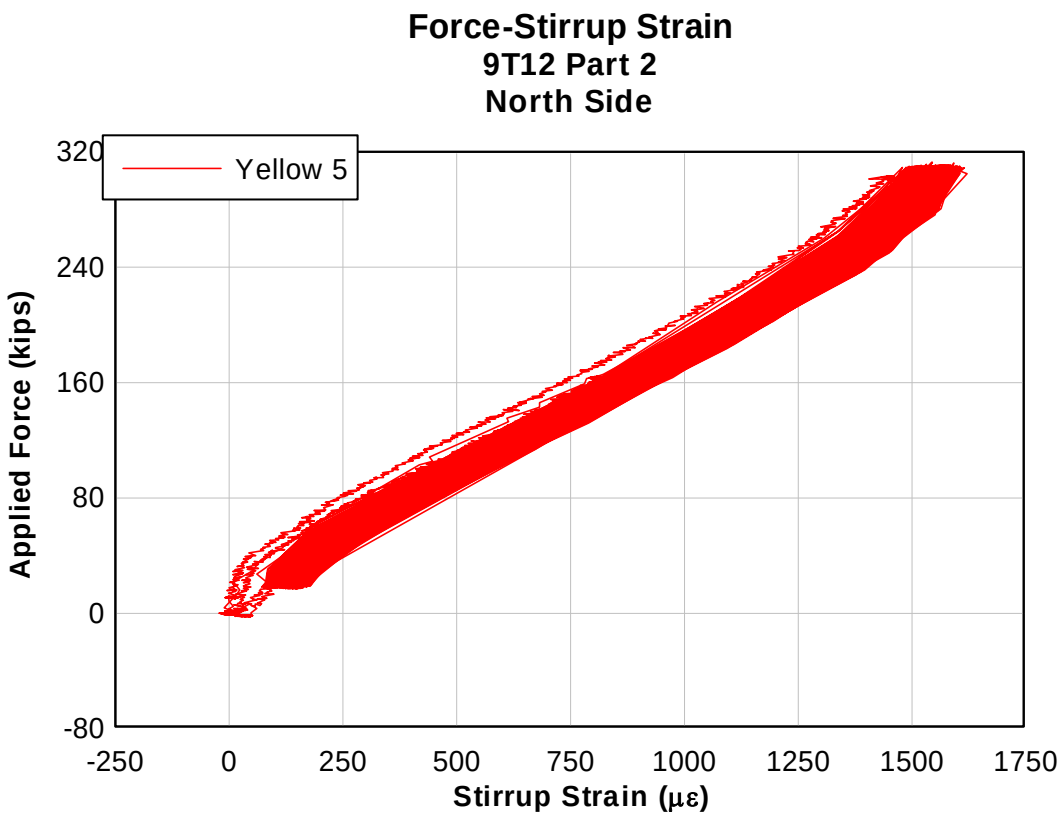

Force-Stirrup Strain
9T12 part 1
South Side
Red 7
Gage Rebalanced
Applied Force (kips)
Stirrup Strain (με)
320
240
160
80
0
-80
-1000
-800
-600
-400
-200
0
200
400
600

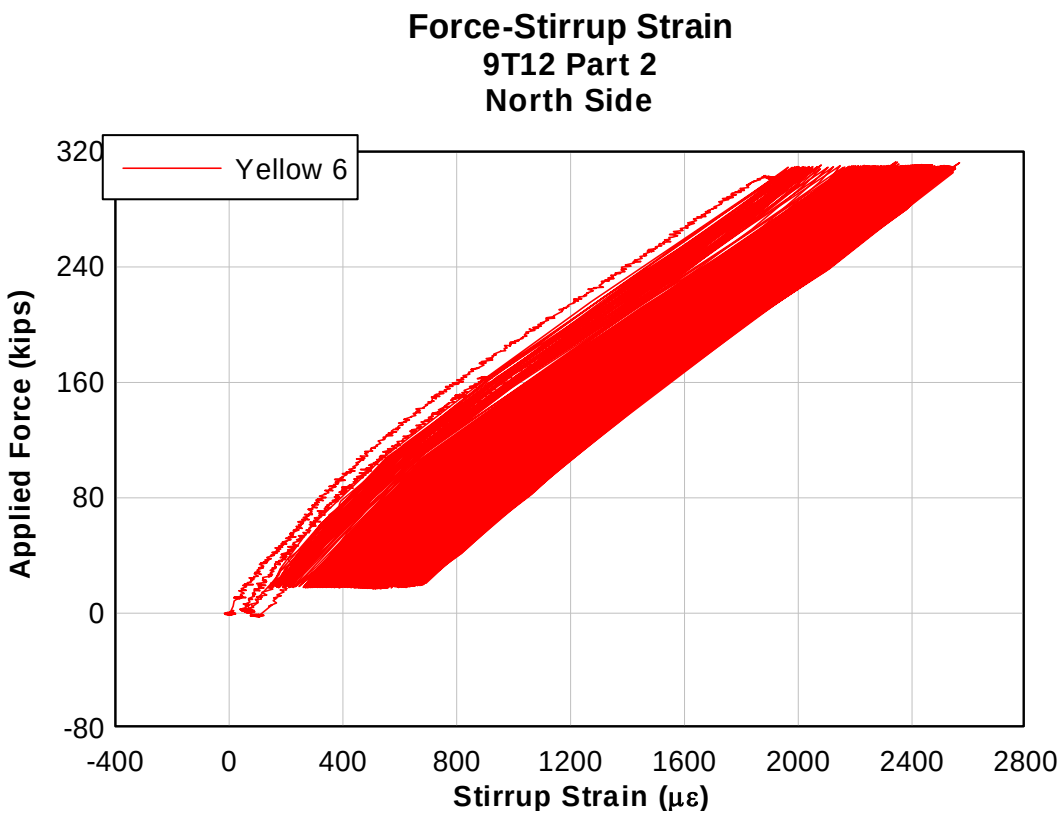

Force-Stirrup Strain
9T12 Part 2
North Side
Yellow 1
Applied Force (kips)
320
240
160
80
0
-80
-1500
0
1500
3000
4500
6000
7500
9000
10500
Stirrup Strain (με)

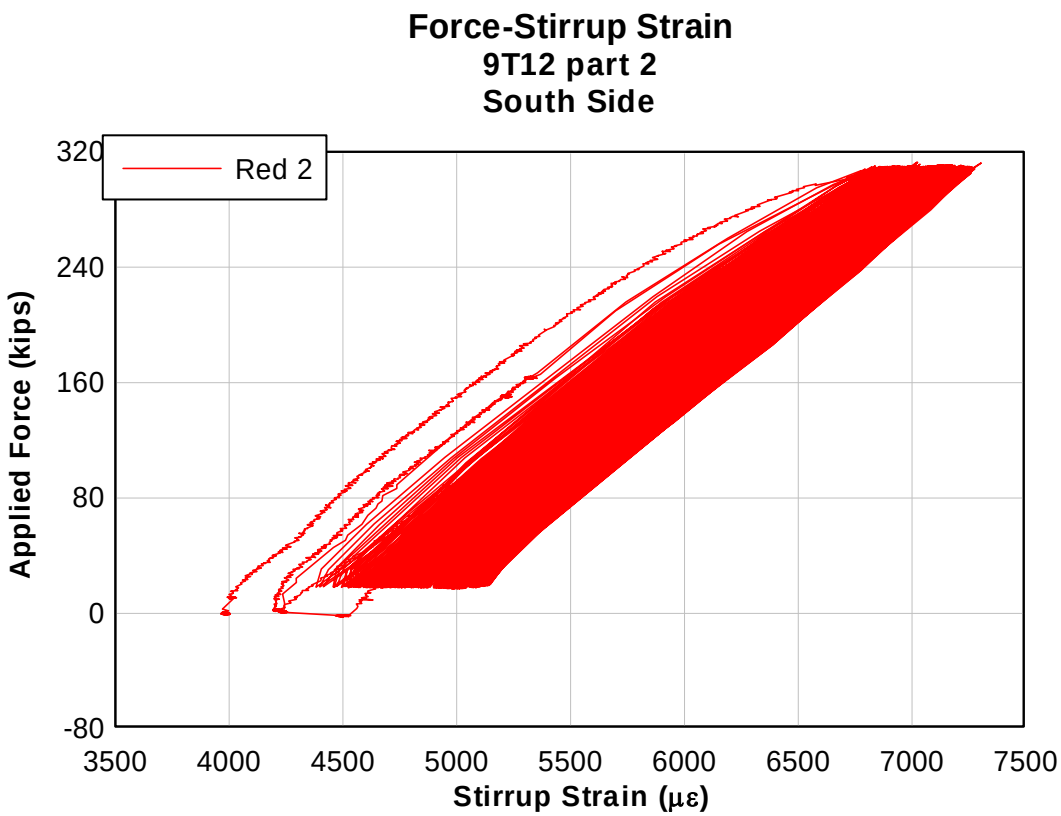

Force-Stirrup Strain
9T12 Part 2
North Side
Yellow 2
Applied Force (kips)
320
240
160
80
0
-80
-600
0
600
1200
1800
2400
3000
3600
4200
Stirrup Strain (με)

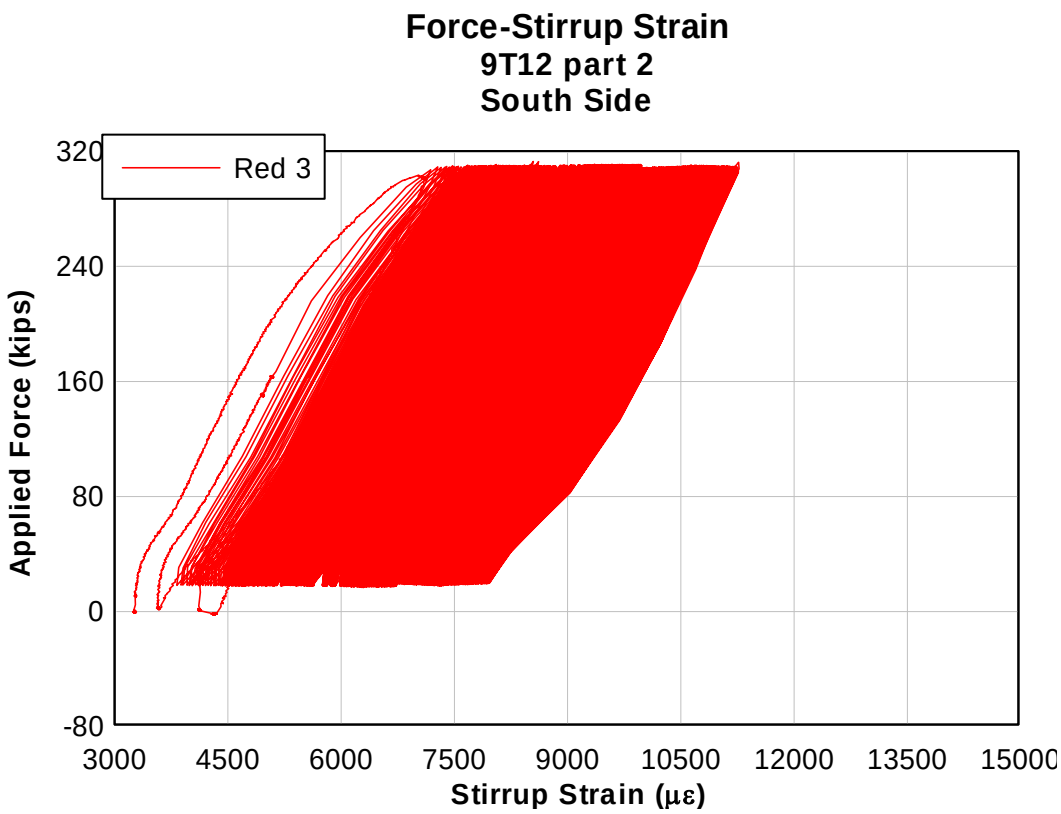

Force-Stirrup Strain
9T12 Part 2
North Side
Yellow 3
Applied Force (kips)
320
240
160
80
0
-80
-500
0
500
1000
1500
2000
2500
3000
3500
Stirrup Strain (με)

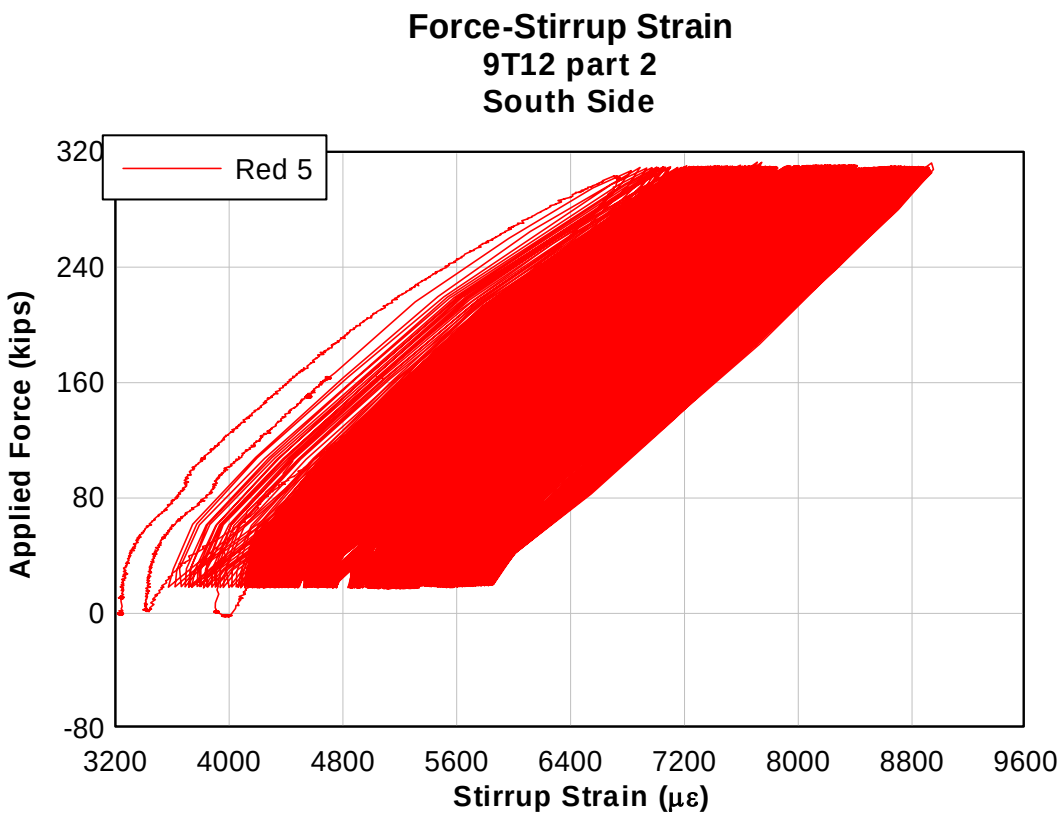

Force-Stirrup Strain
9T12 Part 2
North Side
Yellow 4
Applied Force (kips)
320
240
160
80
0
-80
-600
0
600
1200
1800
2400
3000
3600
4200
Stirrup Strain (με)

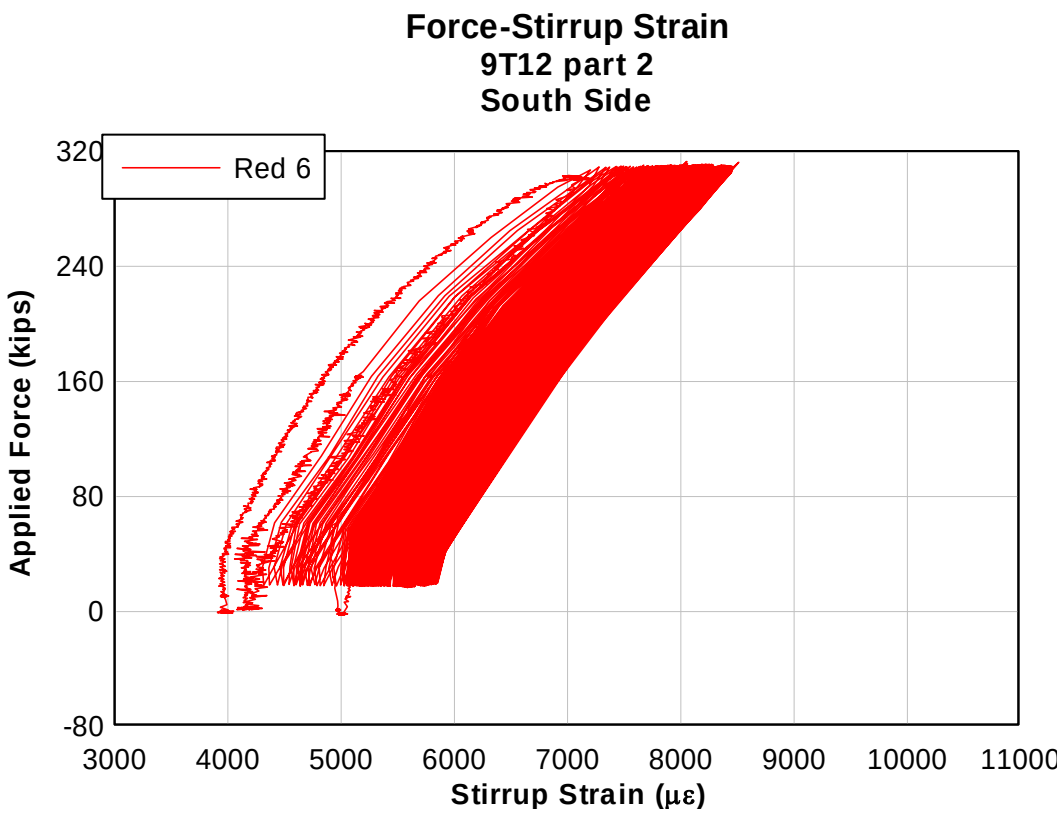

Force-Stirrup Strain
9T12 Part 2
North Side
Yellow 5
Applied Force (kips)
320
240
160
80
0
-80
-250
0
250
500
750
1000
1250
1500
1750
Stirrup Strain (με)

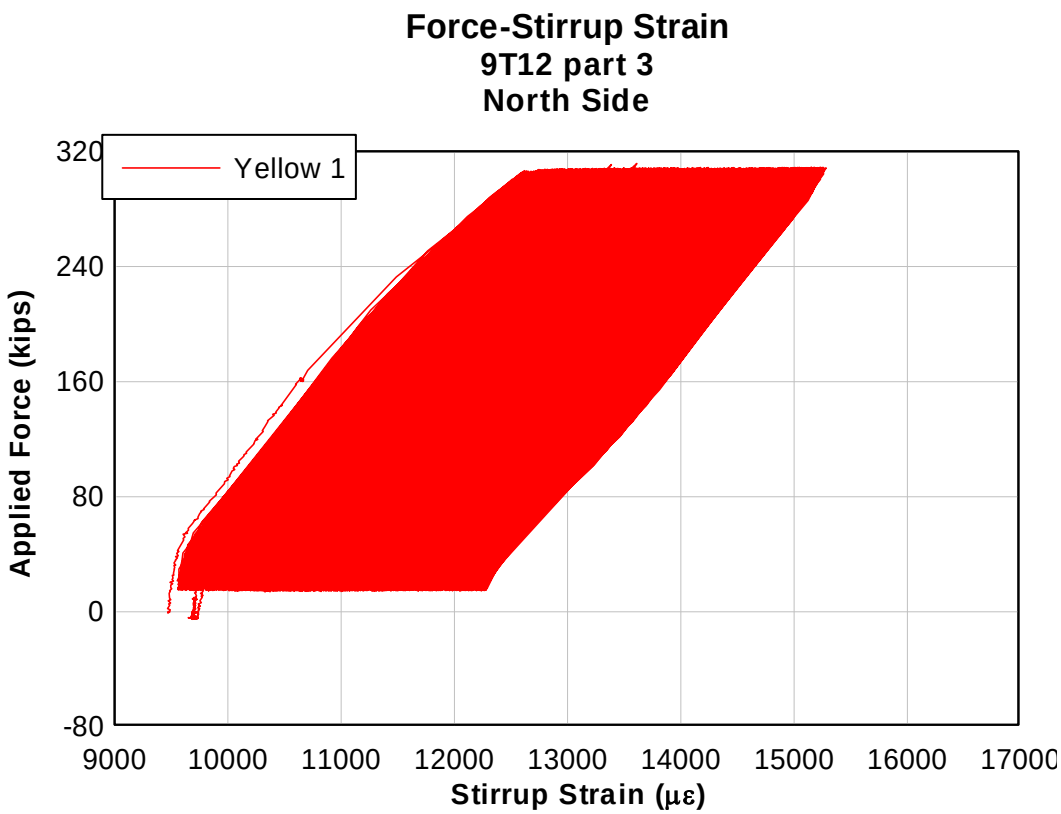

Force-Stirrup Strain
9T12 Part 2
North Side
Yellow 6
Applied Force (kips)
320
240
160
80
0
-80
-400
0
400
800
1200
1600
2000
2400
2800
Stirrup Strain (με)

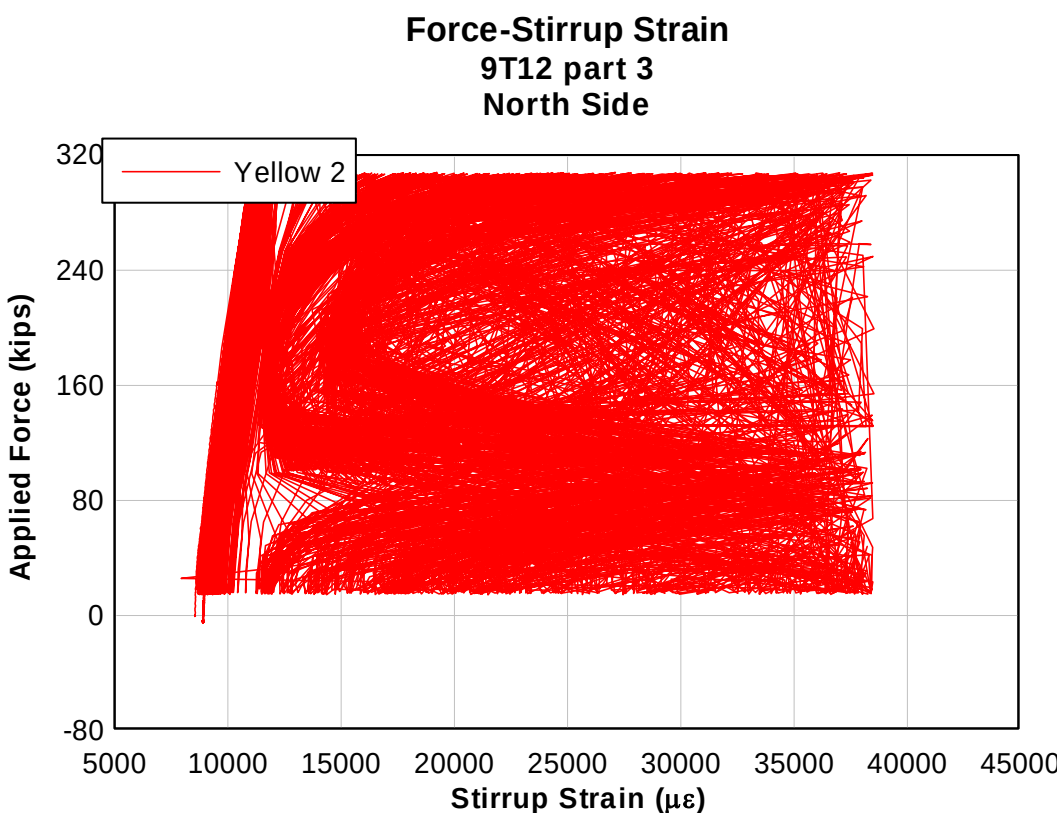

Force-Stirrup Strain
9T12 part 2
South Side
Red 2
Applied Force (kips)
320
240
160
80
0
-80
3500
4000
4500
5000
5500
6000
6500
7000
7500
Stirrup Strain (με)

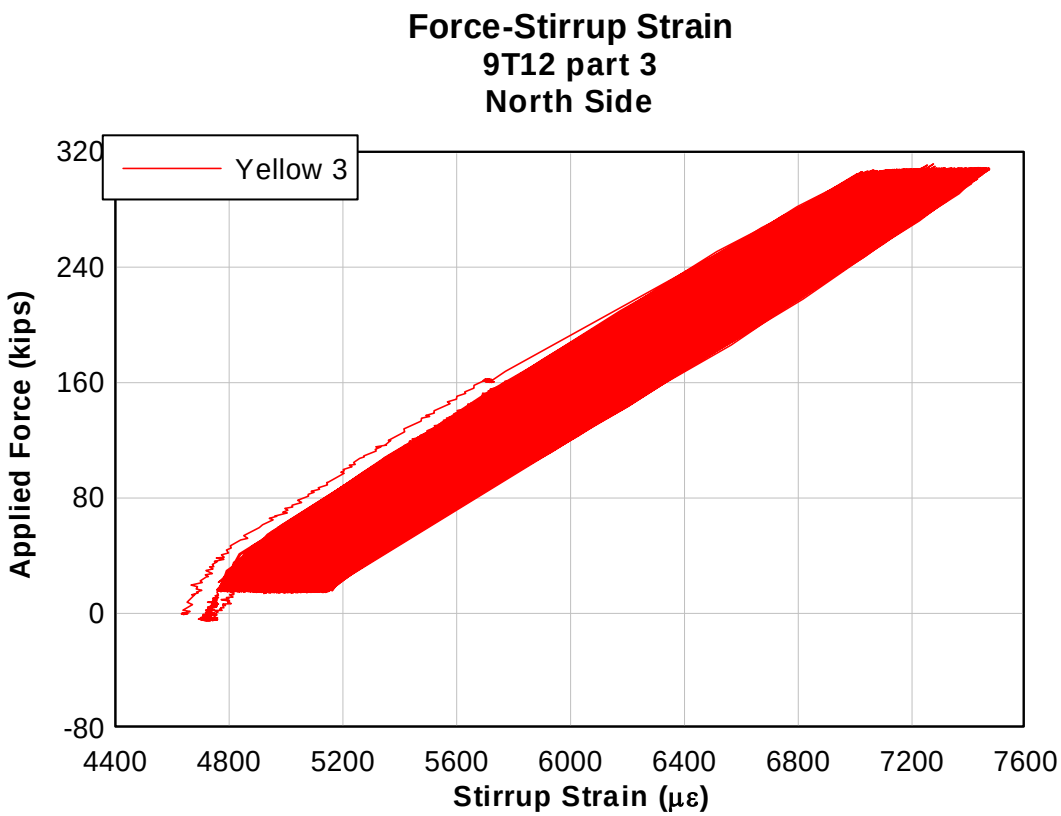

Force-Stirrup Strain
9T12 part 2
South Side
Red 3
Applied Force (kips)
320
240
160
80
0
-80
3000
4500
6000
7500
9000
10500
12000
13500
15000
Stirrup Strain (με)

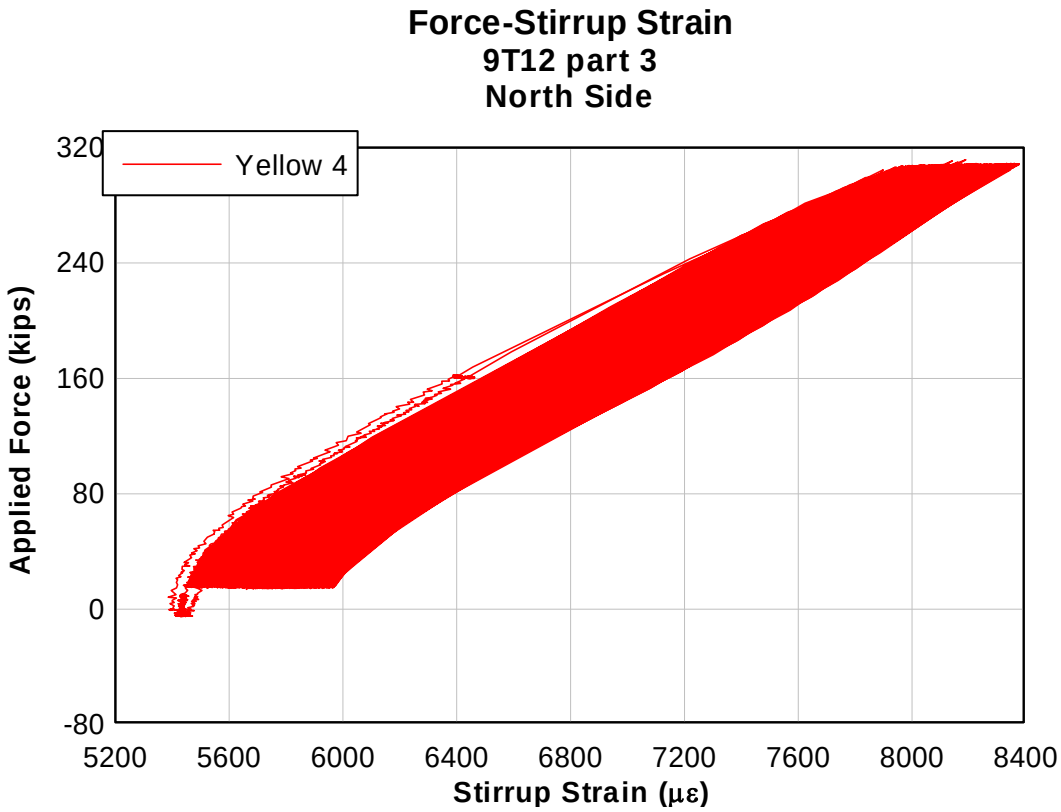

Force-Stirrup Strain
9T12 part 2
South Side
Red 5
Applied Force (kips)
320
240
160
80
0
-80
3200
4000
4800
5600
6400
7200
8000
8800
9600
Stirrup Strain (με)

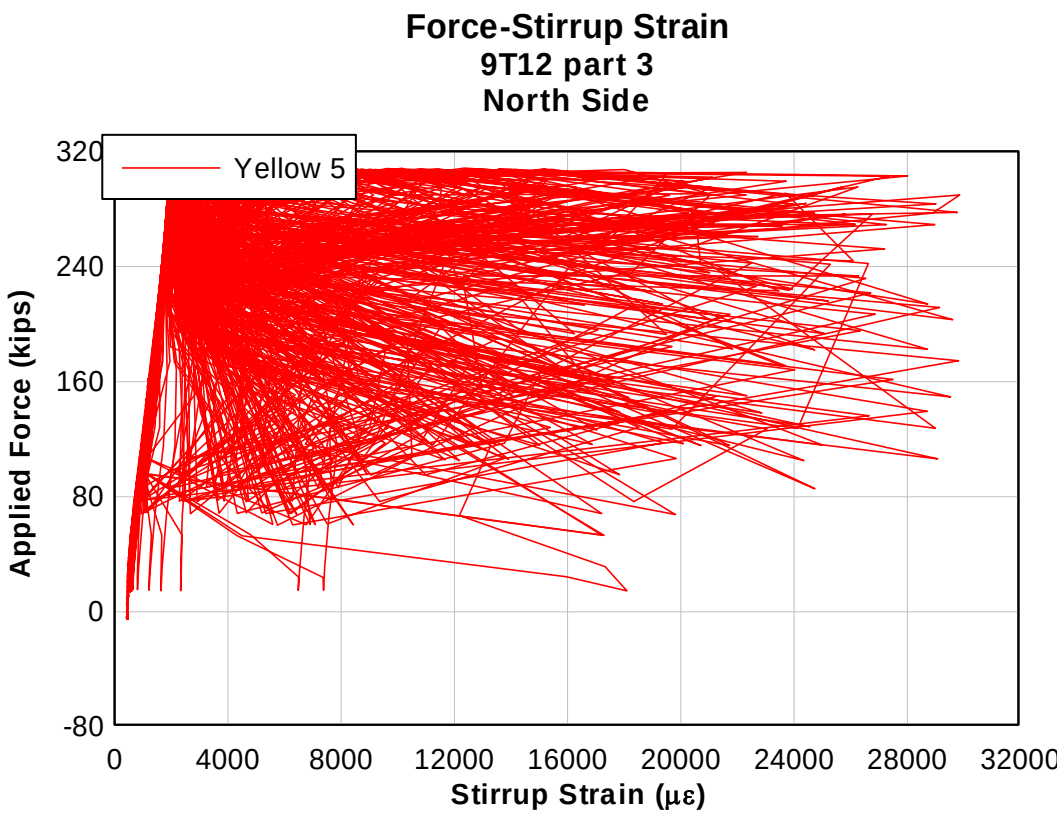

Force-Stirrup Strain
9T12 part 2
South Side
Red 6
Applied Force (kips)
320
240
160
80
0
-80
3000
4000
5000
6000
7000
8000
9000
10000
11000
Stirrup Strain (με)

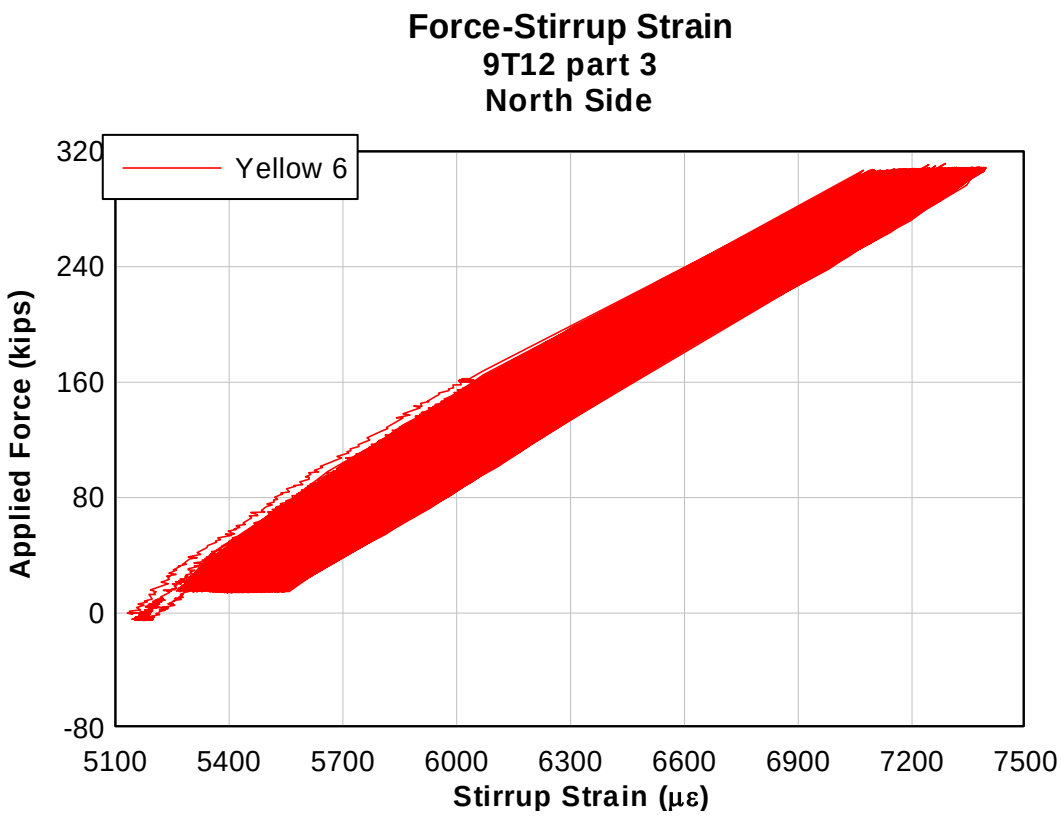

Force-Stirrup Strain
9T12 part 3
North Side
Yellow 1
Applied Force (kips)
320
240
160
80
0
-80
9000
10000
11000
12000
13000
14000
15000
16000
17000
Stirrup Strain (με)

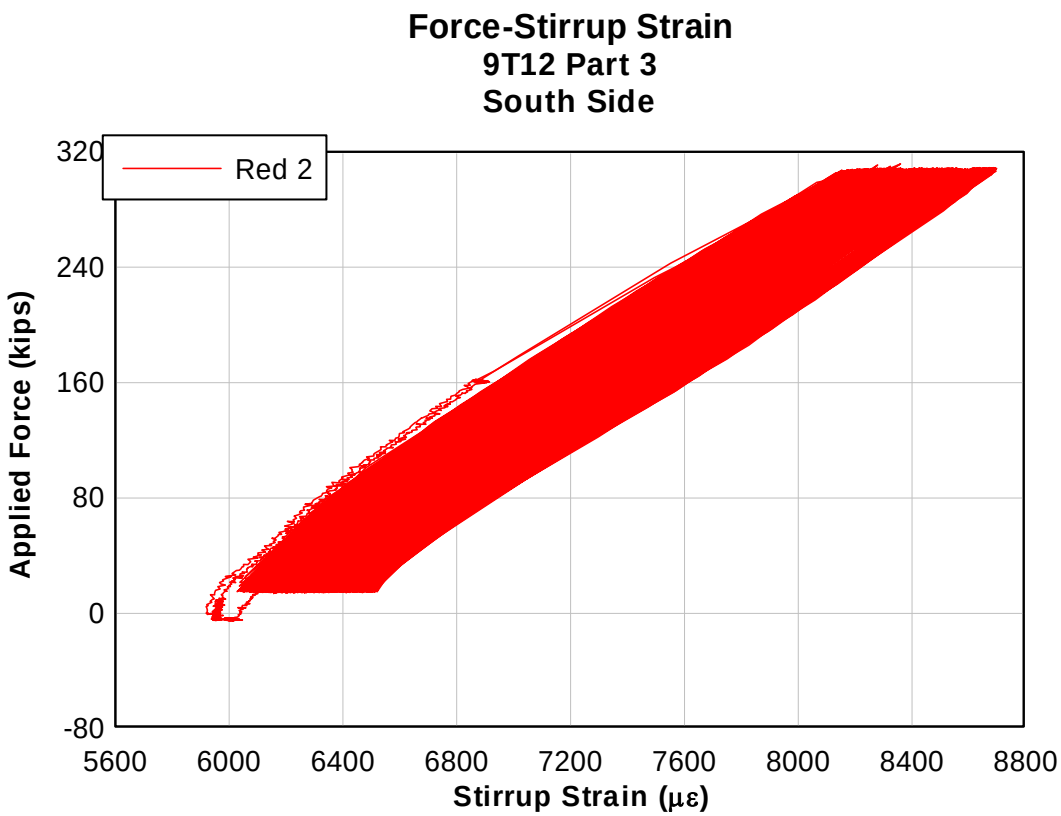

Force-Stirrup Strain
9T12 part 3
North Side
Yellow 2
Applied Force (kips)
320
240
160
80
0
-80
5000
10000
15000
20000
25000
30000
35000
40000
45000
Stirrup Strain (με)

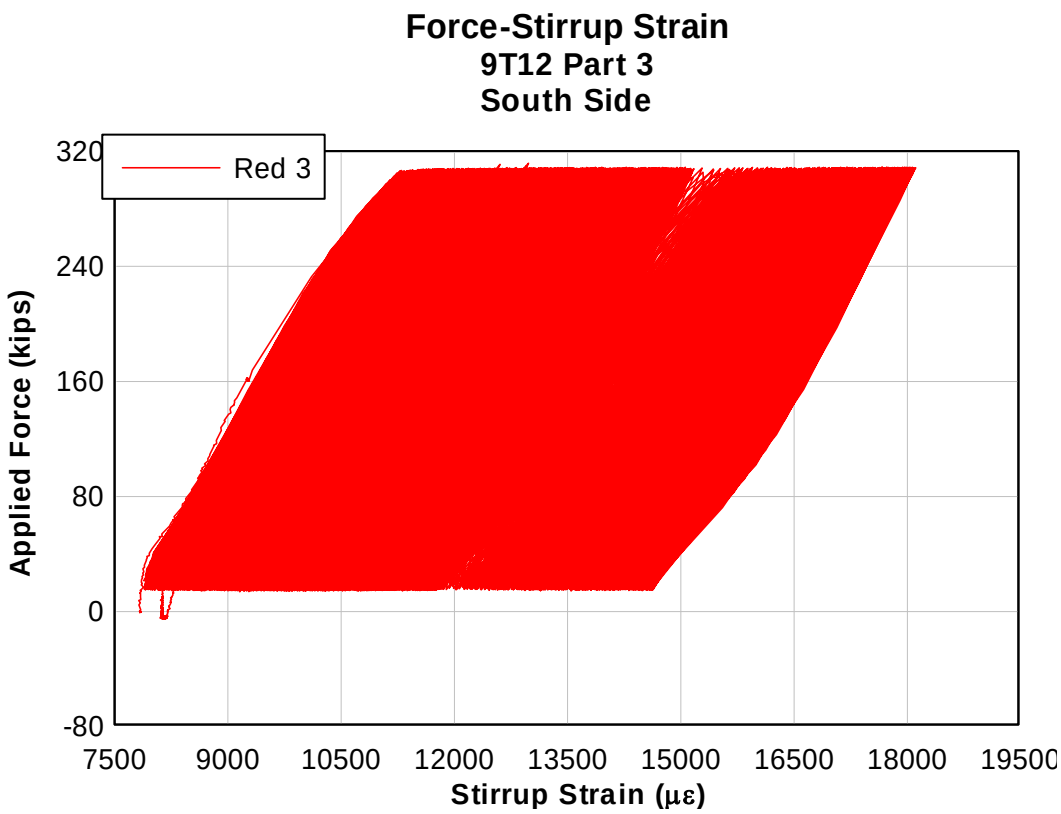

Force-Stirrup Strain
9T12 part 3
North Side
Yellow 3
Applied Force (kips)
320
240
160
80
0
-80
4400
4800
5200
5600
6000
6400
6800
7200
7600
Stirrup Strain (με)

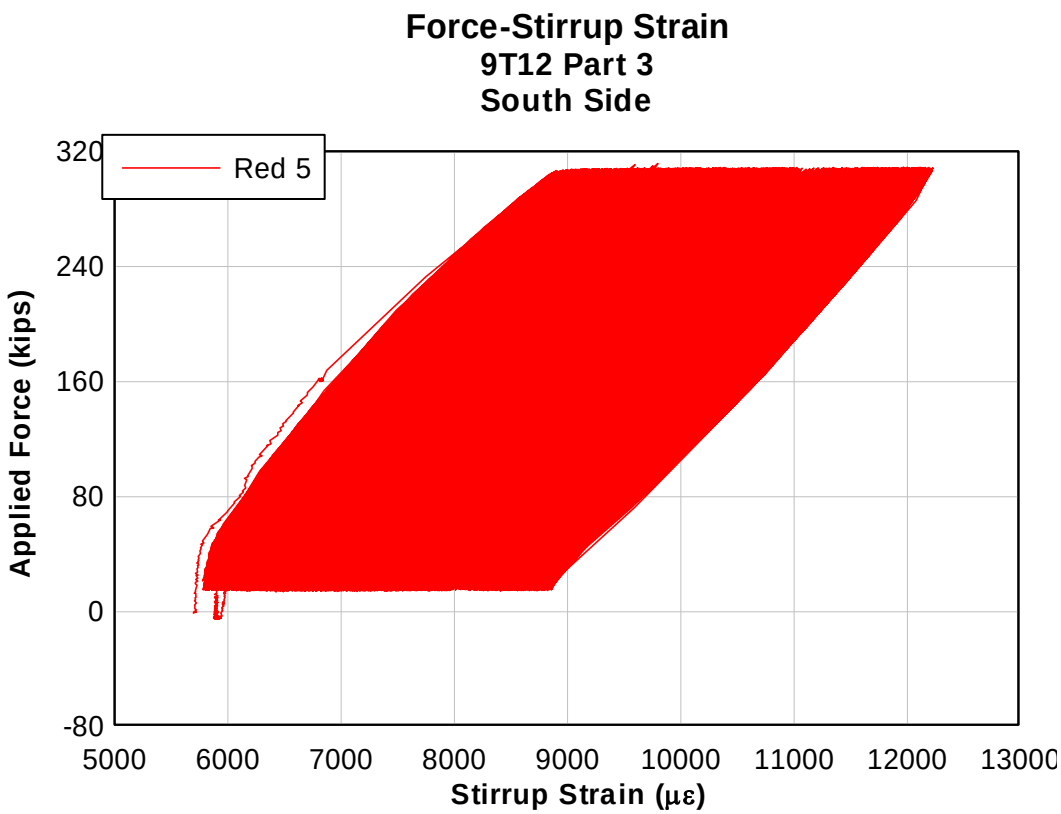

Force-Stirrup Strain
9T12 part 3
North Side
Yellow 4
Applied Force (kips)
320
240
160
80
0
-80
5200
5600
6000
6400
6800
7200
7600
8000
8400
Stirrup Strain (με)

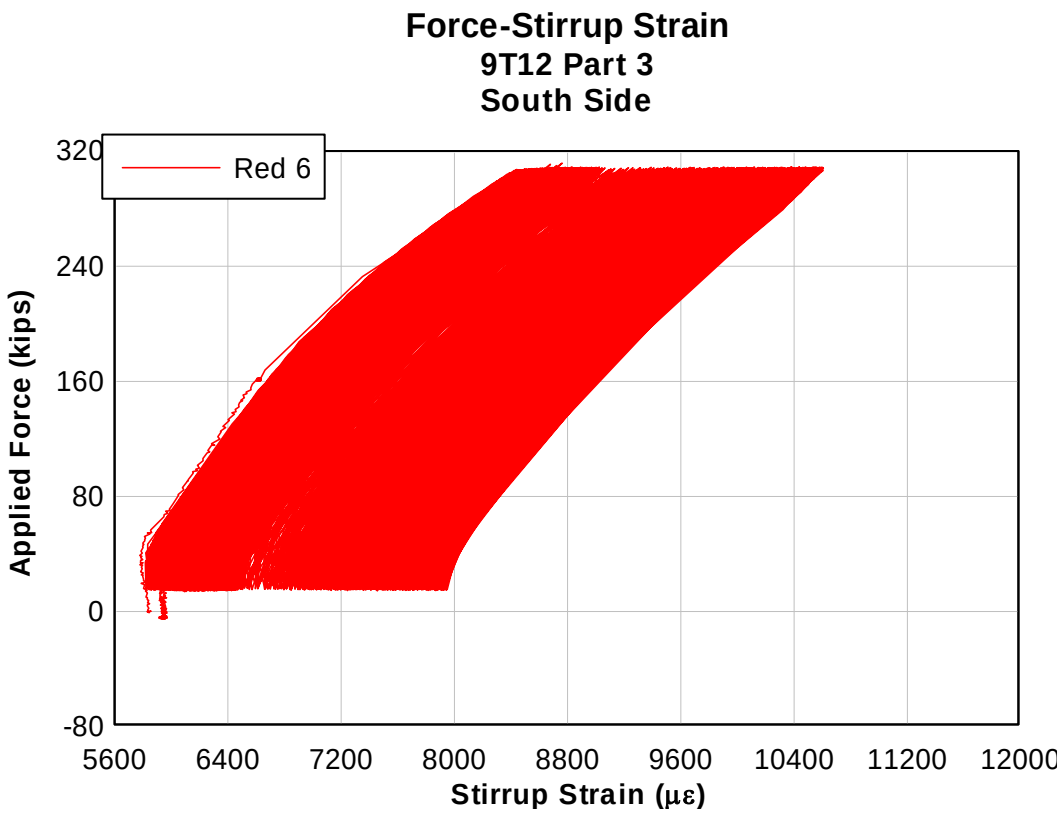

Force-Stirrup Strain
9T12 part 3
North Side
Yellow 5
Applied Force (kips)
320
240
160
80
0
-80
0
4000
8000
12000
16000
20000
24000
28000
32000
Stirrup Strain (με)

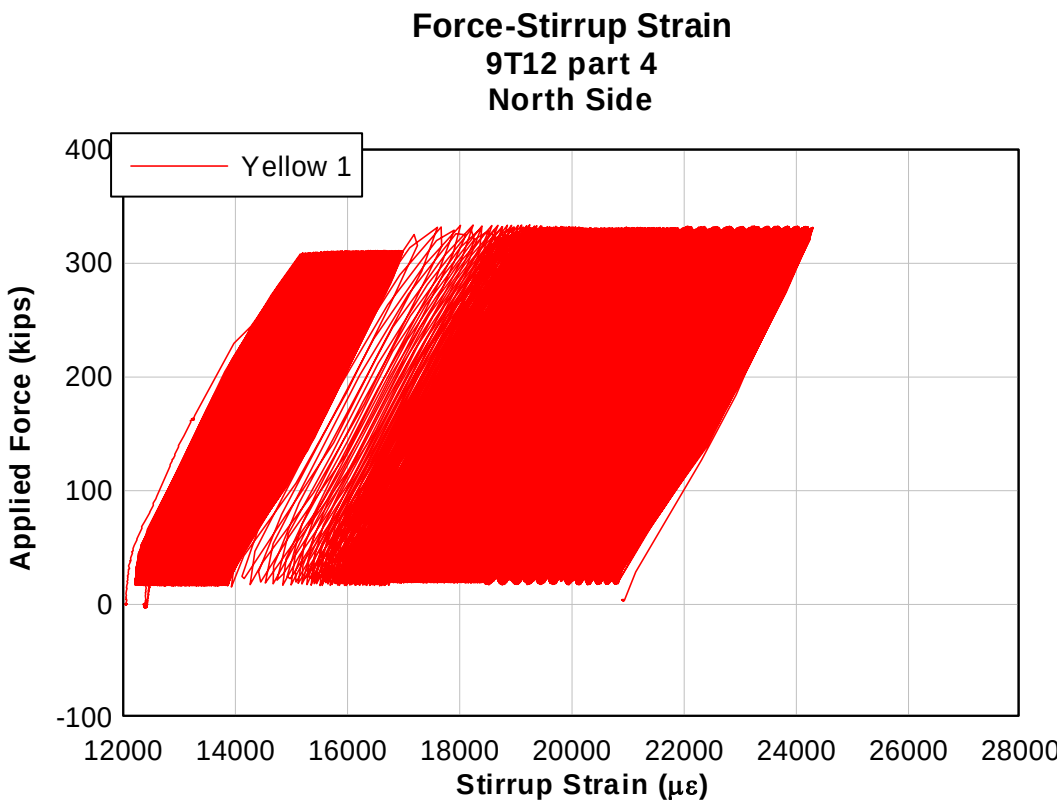

Force-Stirrup Strain
9T12 part 3
North Side
Yellow 6
Applied Force (kips)
320
240
160
80
0
-80
5100
5400
5700
6000
6300
6600
6900
7200
7500
Stirrup Strain (με)

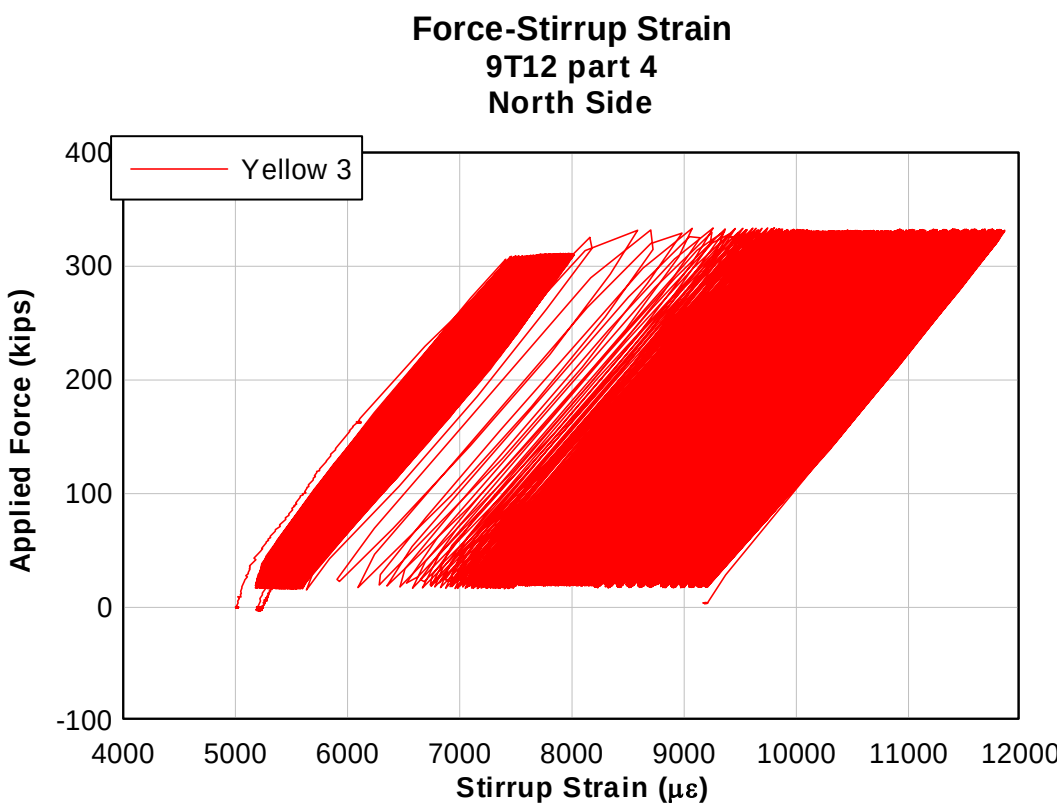

Force-Stirrup Strain
9T12 Part 3
South Side
Red 2
Applied Force (kips)
320
240
160
80
0
-80
5600
6000
6400
6800
7200
7600
8000
8400
8800
Stirrup Strain (με)

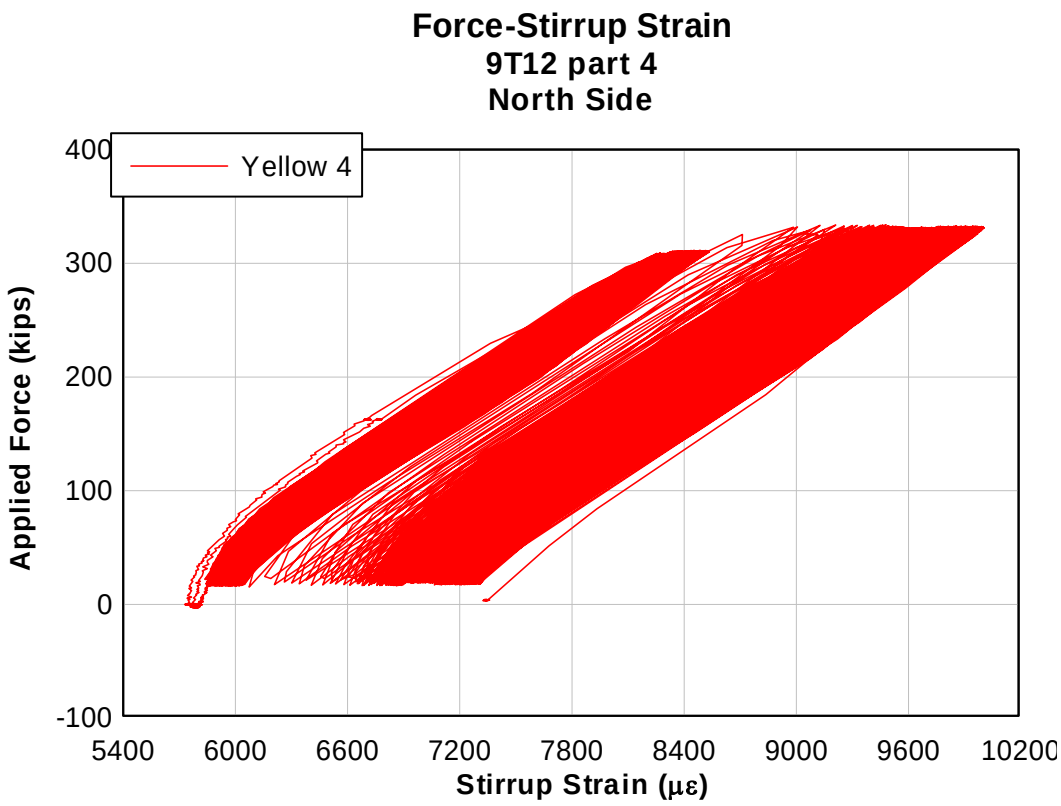

Force-Stirrup Strain
9T12 Part 3
South Side
Red 3
Applied Force (kips)
320
240
160
80
0
-80
7500
9000
10500
12000
13500
15000
16500
18000
19500
Stirrup Strain (με)

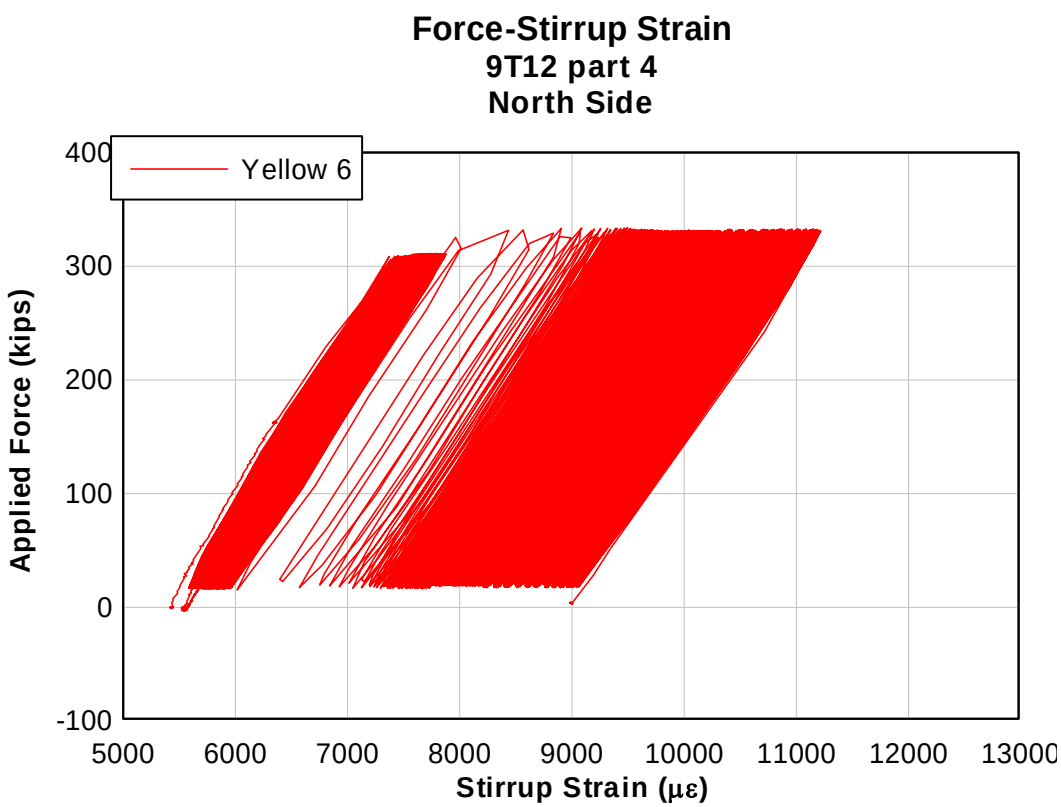

Force-Stirrup Strain
9T12 Part 3
South Side
Red 5
Applied Force (kips)
320
240
160
80
0
-80
5000
6000
7000
8000
9000
10000
11000
12000
13000
Stirrup Strain (με)

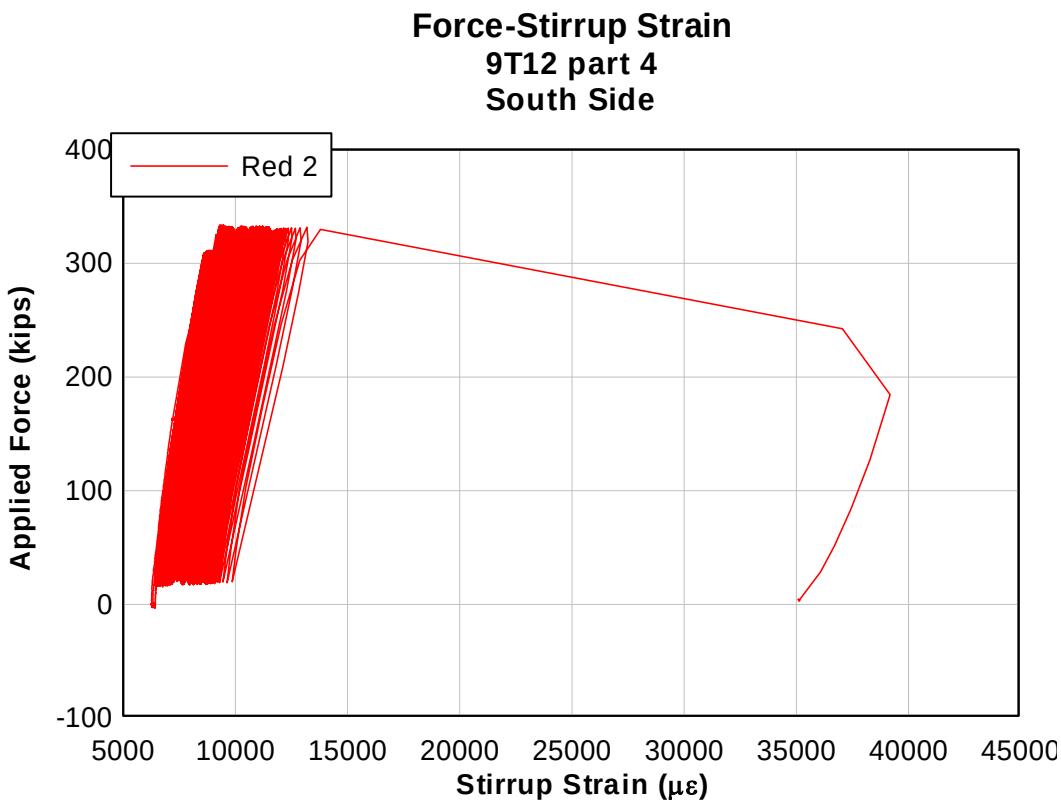

Force-Stirrup Strain
9T12 Part 3
South Side
Red 6
Applied Force (kips)
320
240
160
80
0
-80
5600
6400
7200
8000
8800
9600
10400
11200
12000
Stirrup Strain (με)

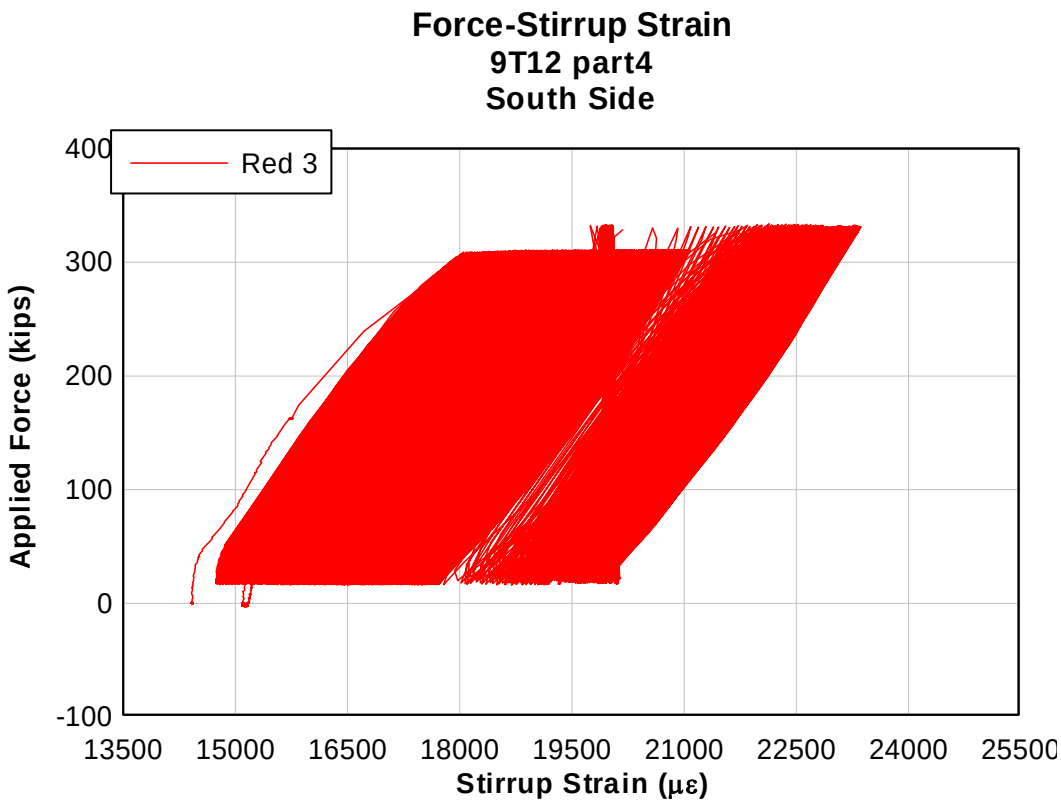

Force-Stirrup Strain
9T12 part 4
North Side
Yellow 1
Applied Force (kips)
400
300
200
100
0
-100
12000
14000
16000
18000
20000
22000
24000
26000
28000
Stirrup Strain (με)

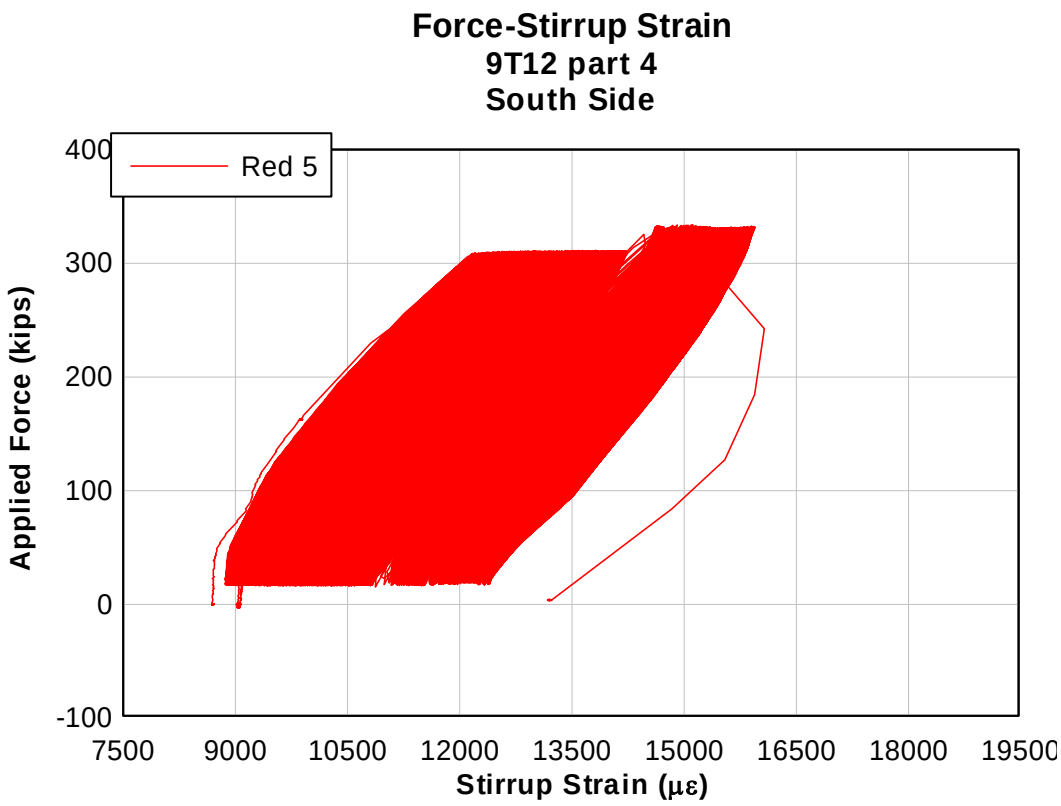

Force-Stirrup Strain
9T12 part 4
North Side
Yellow 3
Applied Force (kips)
400
300
200
100
0
-100
4000
5000
6000
7000
8000
9000
10000
11000
12000
Stirrup Strain (με)

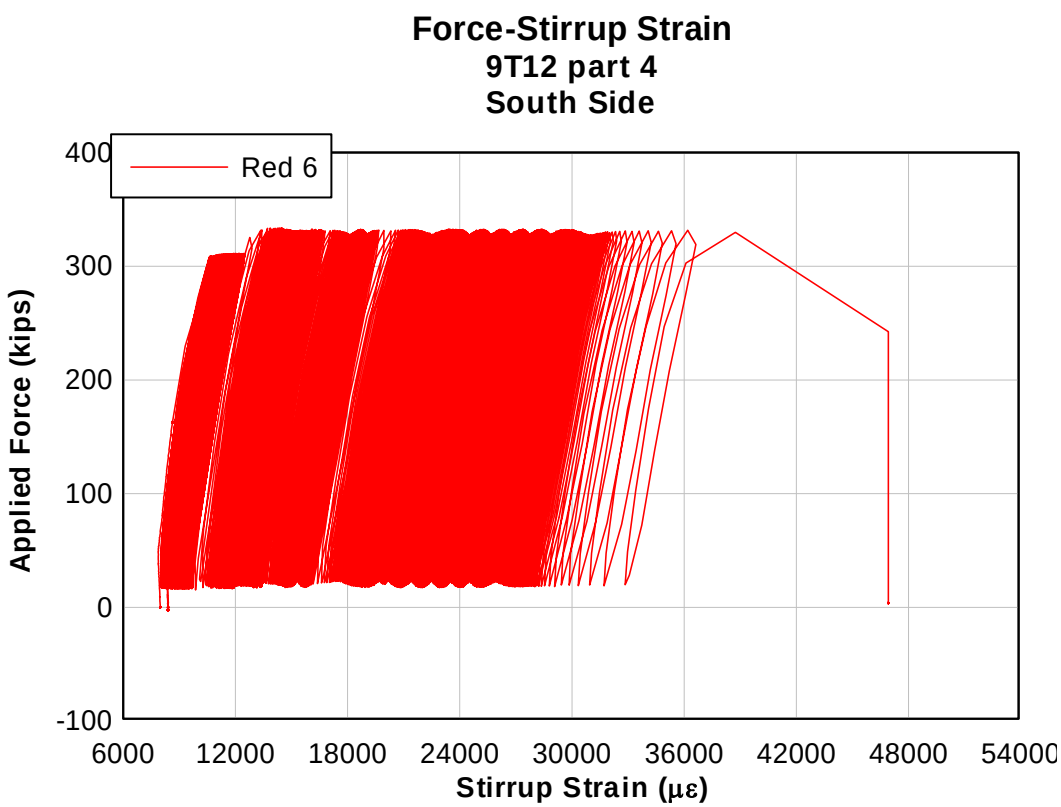

Force-Stirrup Strain
9T12 part 4
North Side
Yellow 4
Applied Force (kips)
400
300
200
100
0
-100
5400
6000
6600
7200
7800
8400
9000
9600
10200
Stirrup Strain (με)

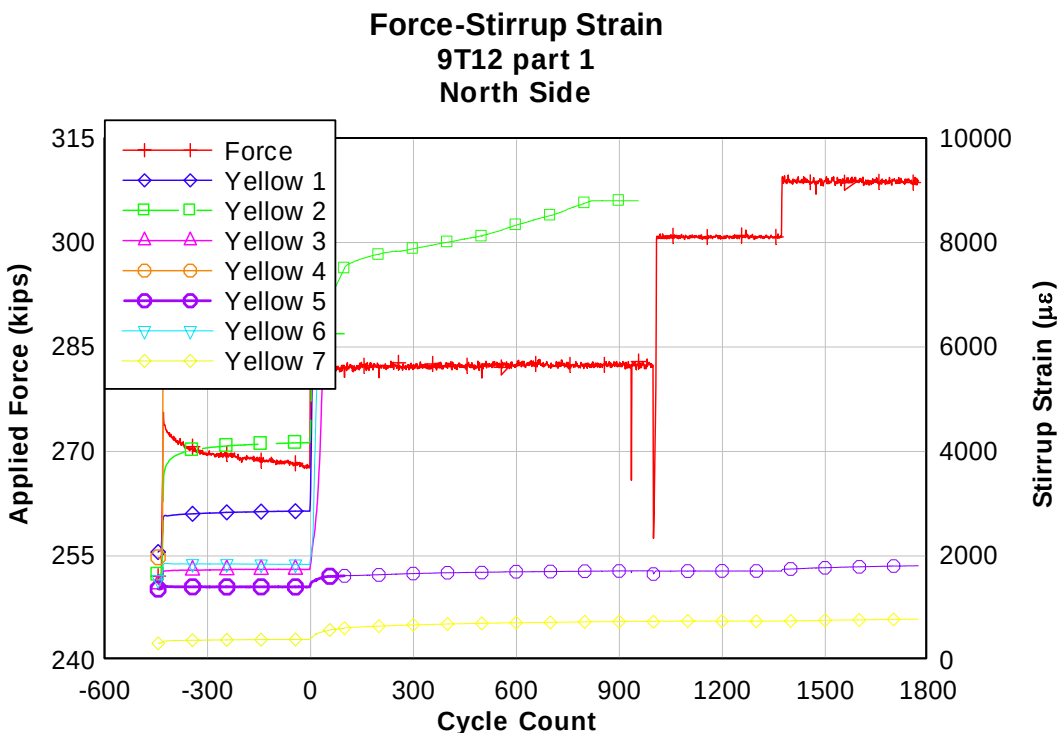

Force-Stirrup Strain
9T12 part 4
North Side
Yellow 6
Applied Force (kips)
400
300
200
100
0
-100
5000
6000
7000
8000
9000
10000
11000
12000
13000
Stirrup Strain (με)

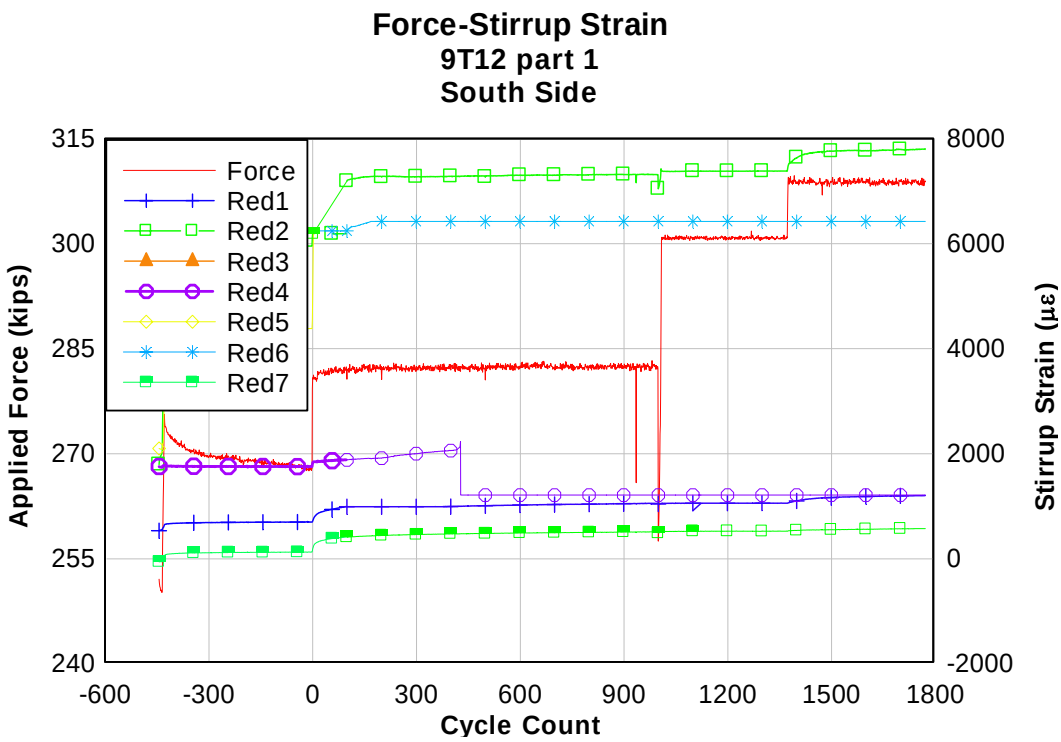

Force-Stirrup Strain
9T12 part 4
South Side
Red 2
Applied Force (kips)
400
300
200
100
0
-100
5000
10000
15000
20000
25000
30000
35000
40000
45000
Stirrup Strain (με)

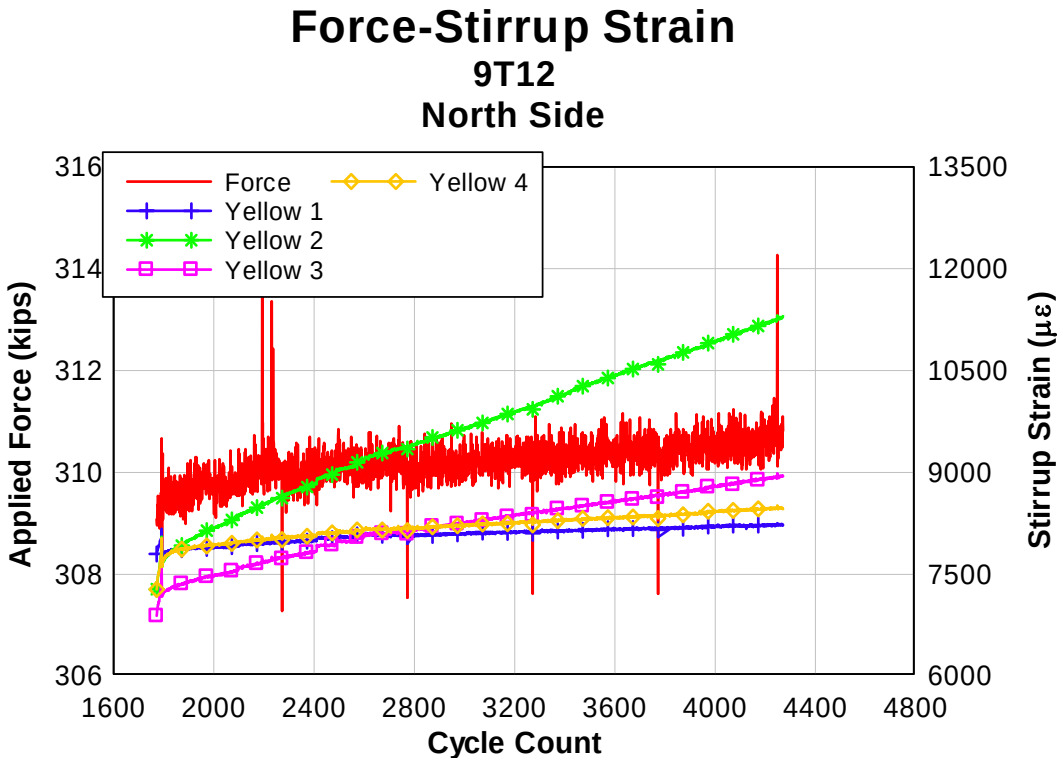

Force-Stirrup Strain
9T12 part4
South Side
Red 3
Applied Force (kips)
400
300
200
100
0
-100
13500
15000
16500
18000
19500
21000
22500
24000
25500
Stirrup Strain (με)

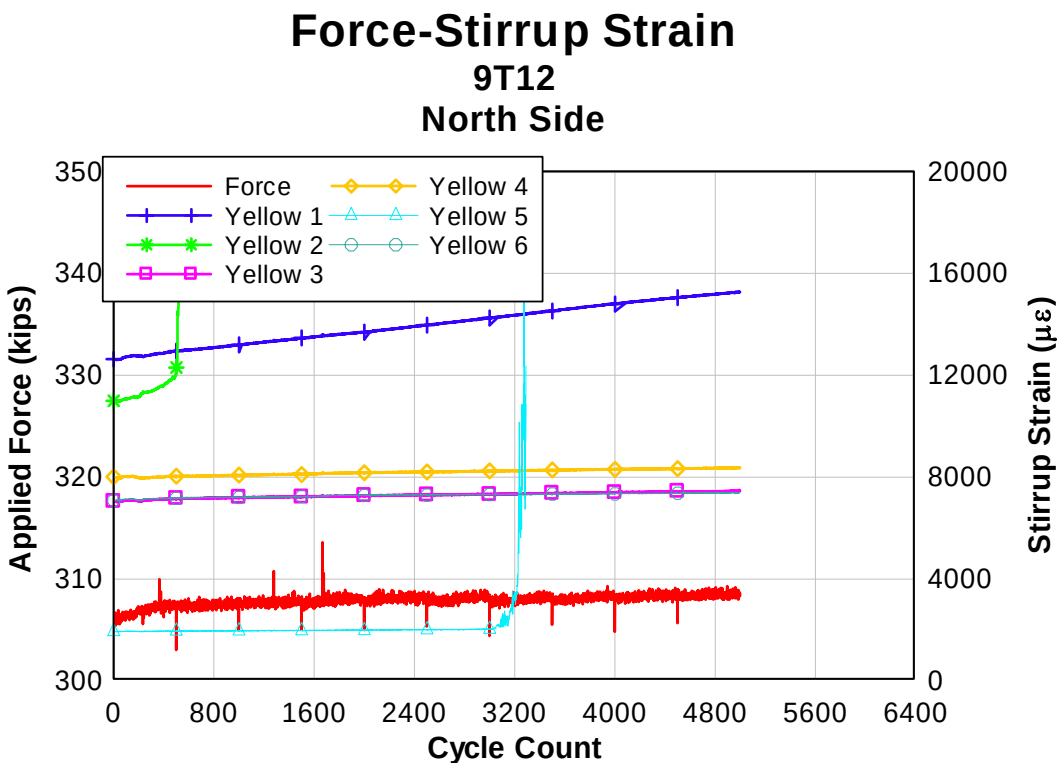

Force-Stirrup Strain
9T12 part 4
South Side
Red 5
Applied Force (kips)
400
300
200
100
0
-100
7500
9000
10500
12000
13500
15000
16500
18000
19500
Stirrup Strain (με)

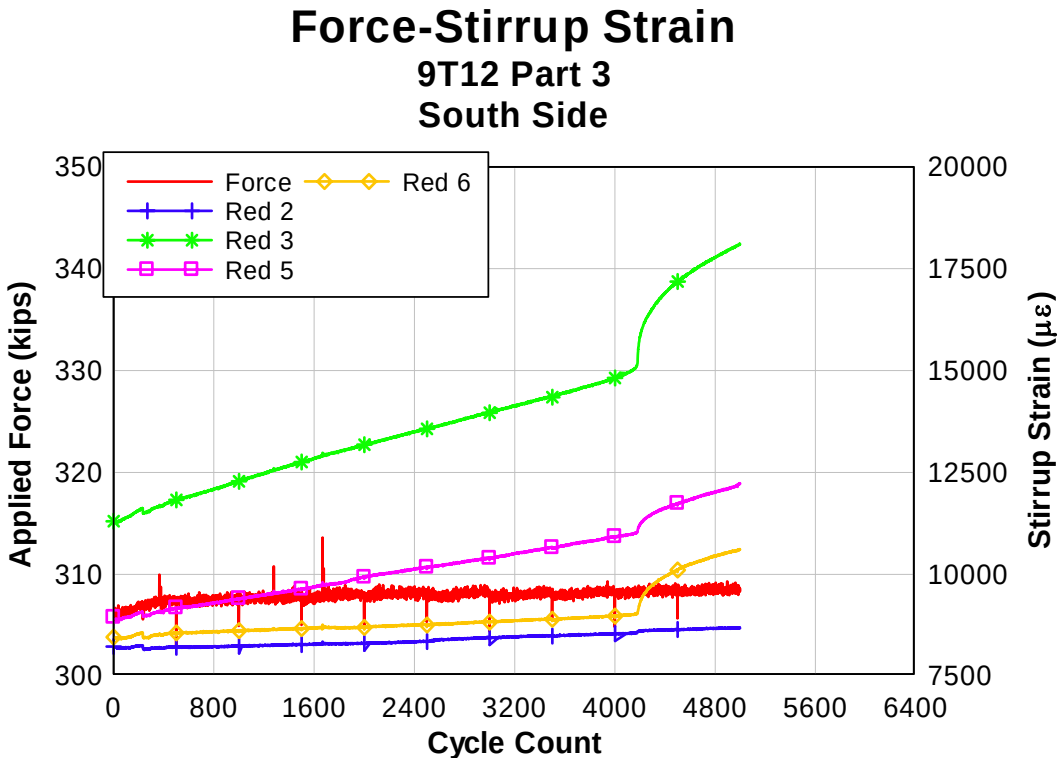

Force-Stirrup Strain
9T12 part 4
South Side
Red 6
Applied Force (kips)
400
300
200
100
0
-100
6000
12000
18000
24000
30000
36000
42000
48000
54000
Stirrup Strain (με)

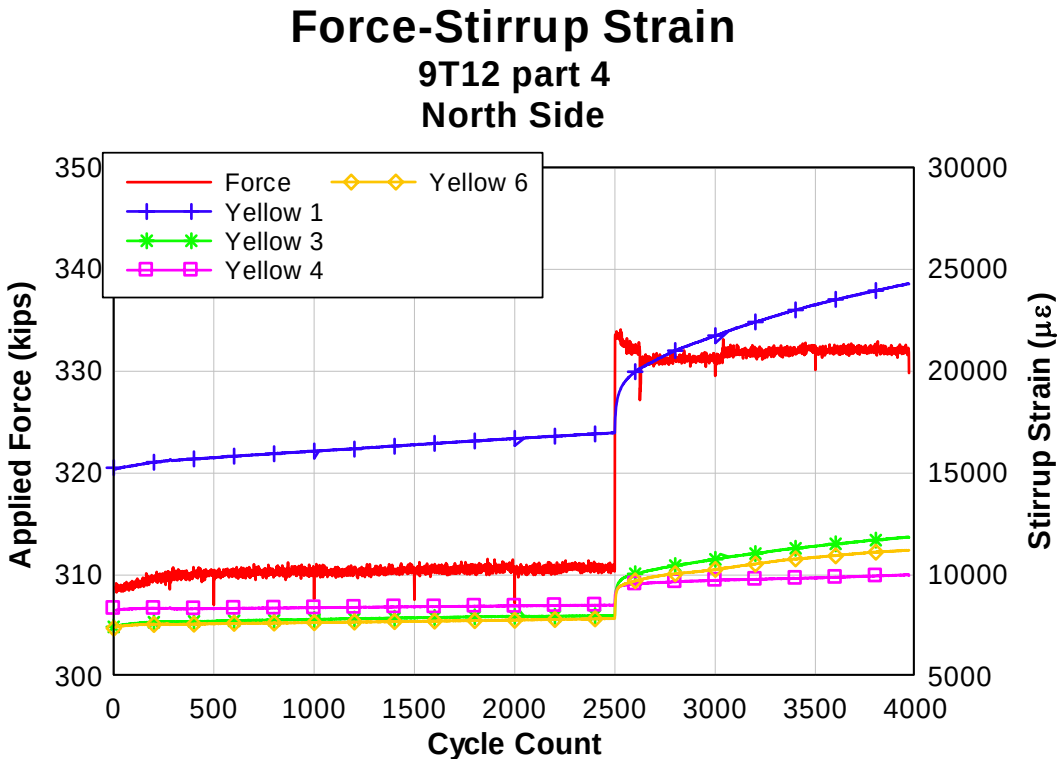

Force-Stirrup Strain
9T12 part 1
North Side
Force
Yellow 1
Yellow 2
Yellow 3
Yellow 4
Yellow 5
Yellow 6
Yellow 7
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
315
300
285
270
255
240
10000
8000
6000
4000
2000
0
-600
-300
0
300
600
900
1200
1500
1800

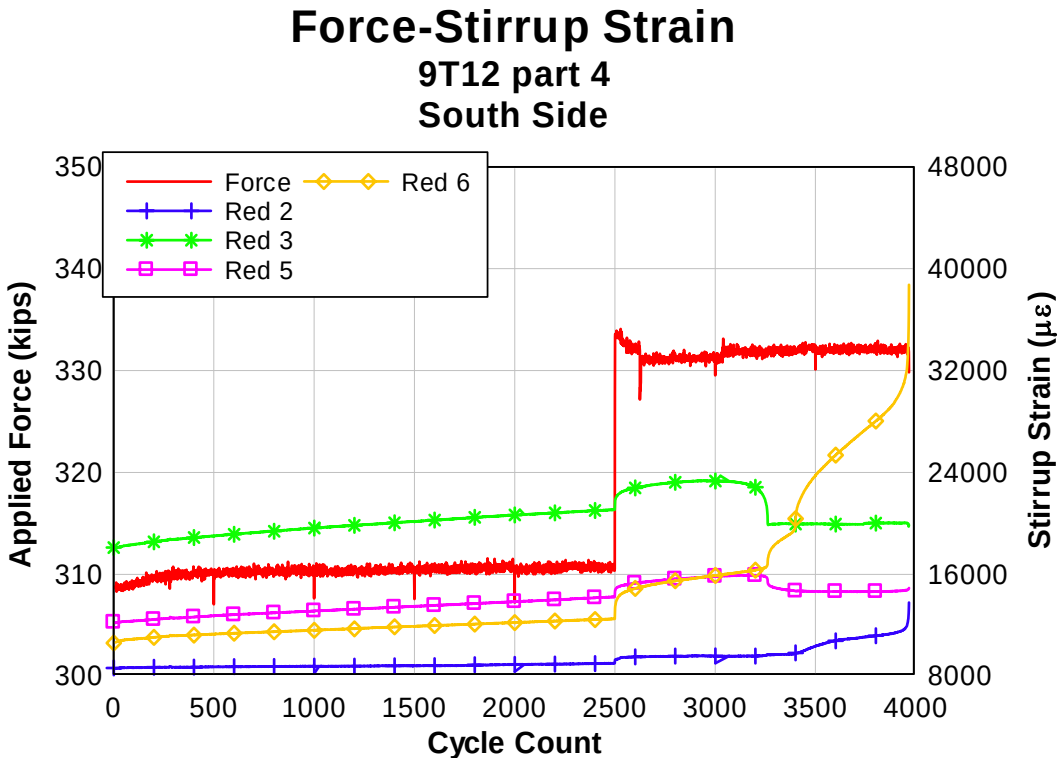

Force-Stirrup Strain
9T12 part 1
South Side
Force
Red1
Red2
Red3
Red4
Red5
Red6
Red7
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
315
300
285
270
255
240
8000
6000
4000
2000
0
-2000
-600
-300
0
300
600
900
1200
1500
1800

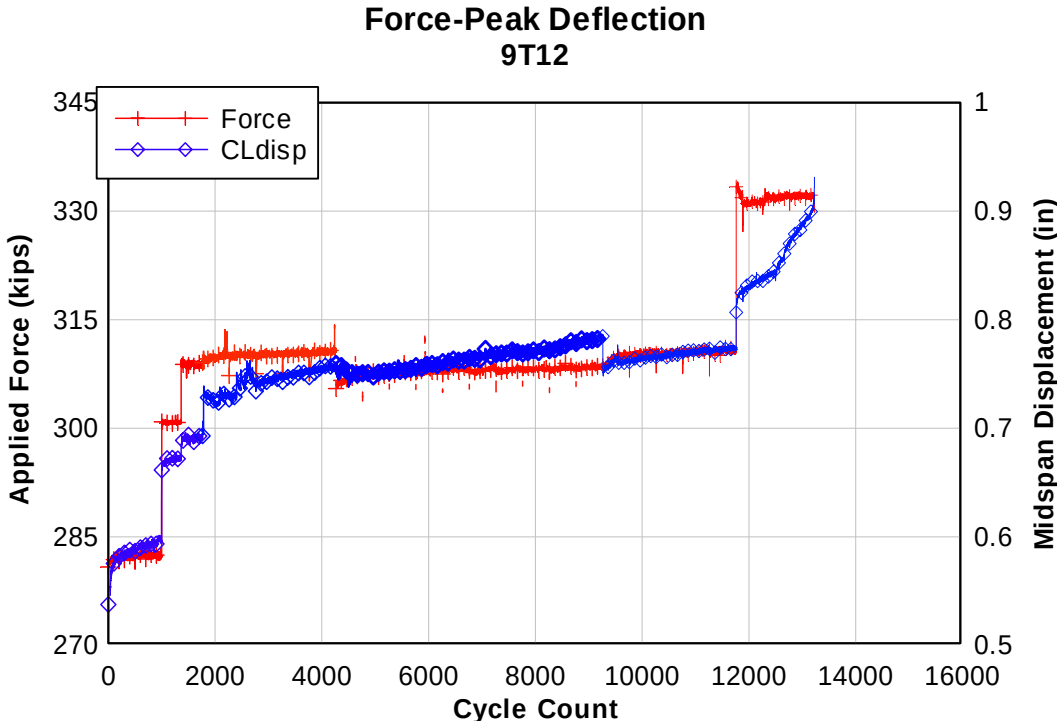

Force-Stirrup Strain
9T12
North Side
Force
Yellow 1
Yellow 2
Yellow 3
Yellow 4
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
316
314
312
310
308
306
13500
12000
10500
9000
7500
6000
1600
2000
2400
2800
3200
3600
4000
4400
4800

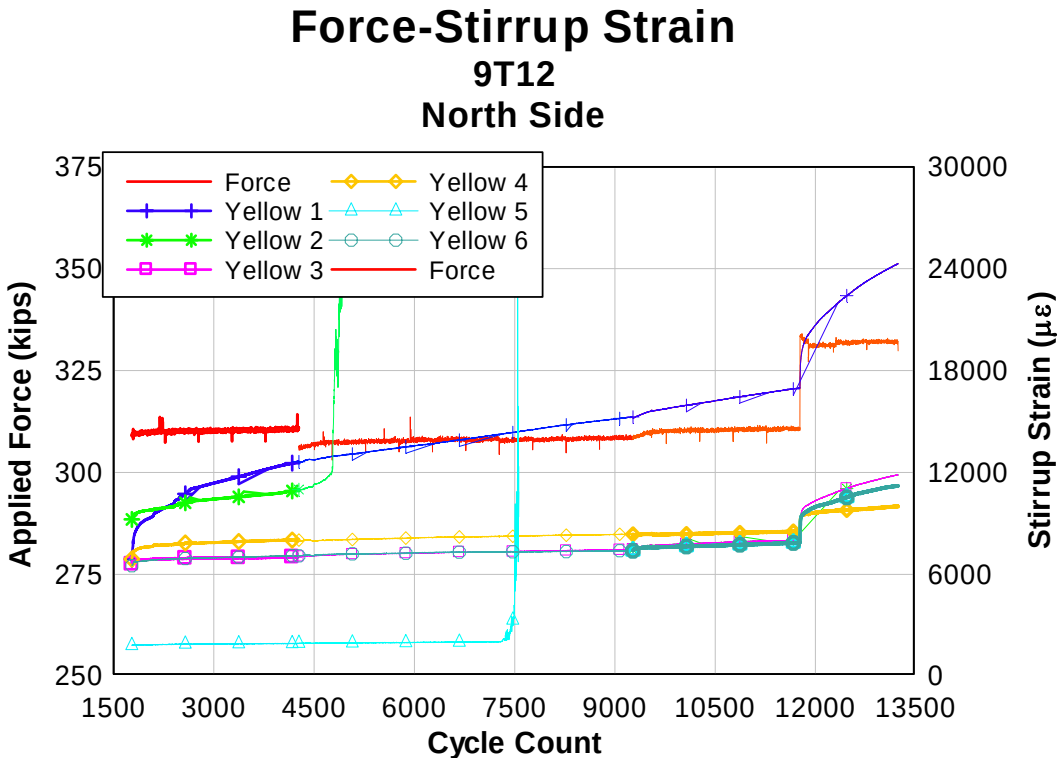

Force-Stirrup Strain
9T12
North Side
Force
Yellow 1
Yellow 2
Yellow 3
Yellow 4
Yellow 5
Yellow 6
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
350
340
330
320
310
300
20000
16000
12000
8000
4000
0
0
800
1600
2400
3200
4000
4800
5600
6400

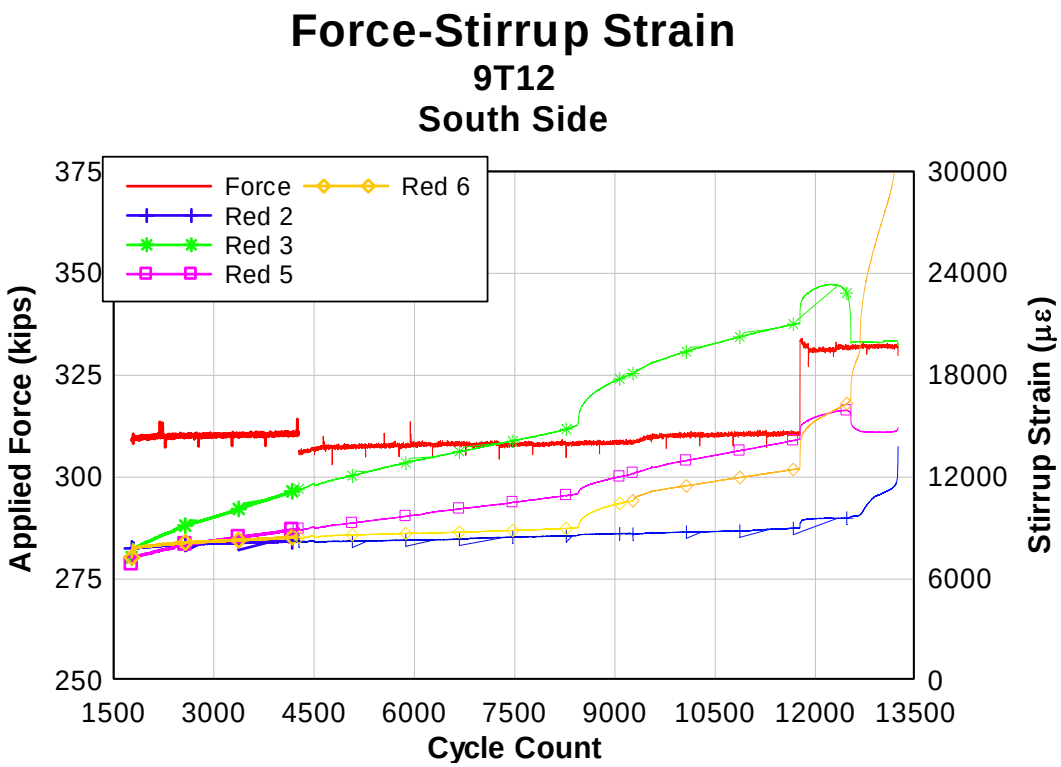

Force-Stirrup Strain
9T12 Part 3
South Side
Force
Red 2
Red 3
Red 5
Red 6
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
350
340
330
320
310
300
20000
17500
15000
12500
10000
7500
0
800
1600
2400
3200
4000
4800
5600
6400

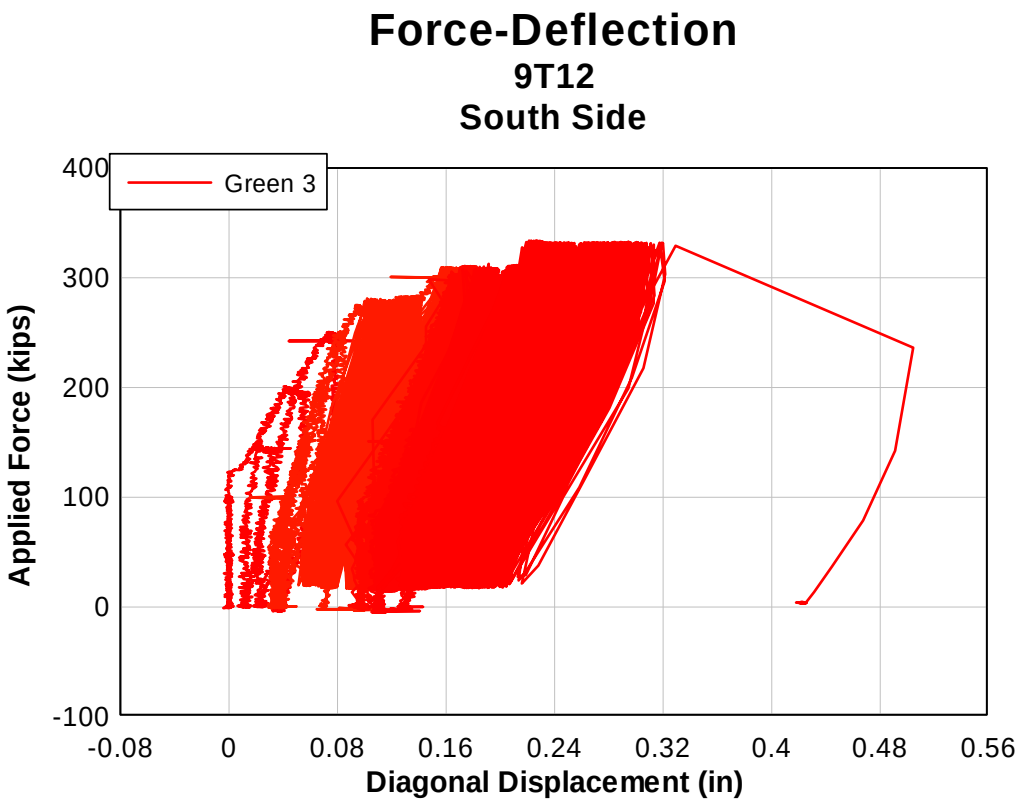

Force-Stirrup Strain
9T12 part 4
North Side
Force
Yellow 1
Yellow 3
Yellow 4
Yellow 6
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
350
340
330
320
310
300
30000
25000
20000
15000
10000
5000
0
500
1000
1500
2000
2500
3000
3500
4000

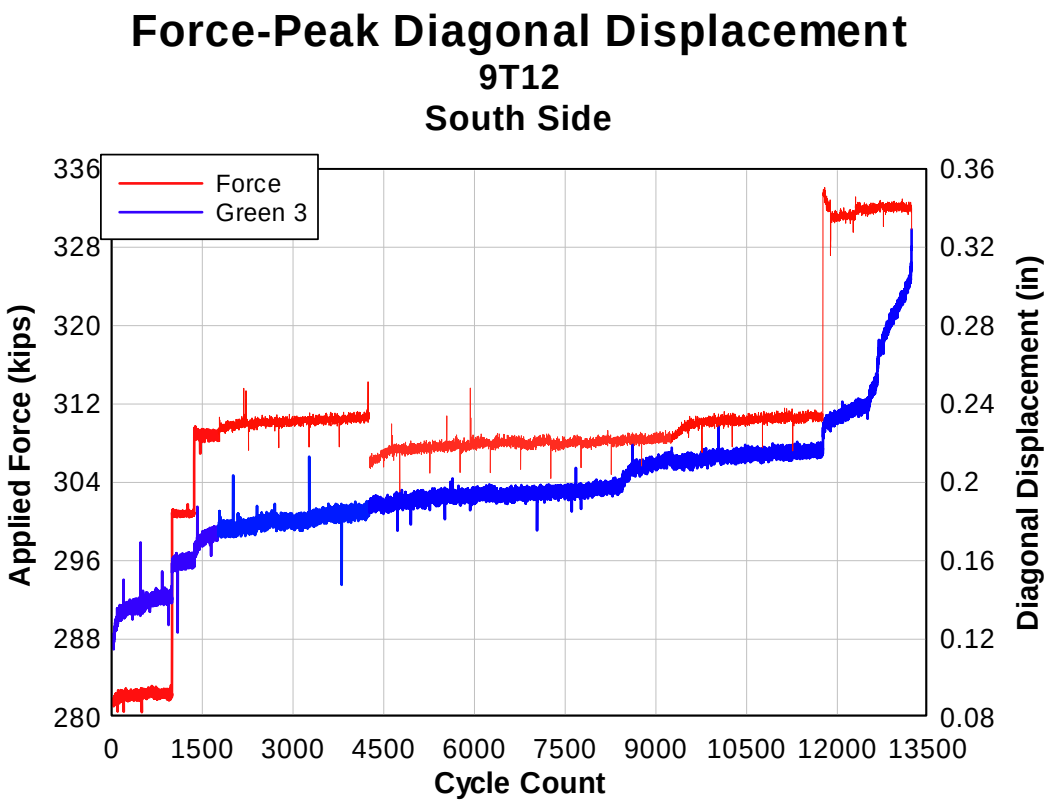

Force-Stirrup Strain
9T12 part 4
South Side
Force
Red 2
Red 3
Red 5
Red 6
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
350
340
330
320
310
300
48000
40000
32000
24000
16000
8000
0
500
1000
1500
2000
2500
3000
3500
4000

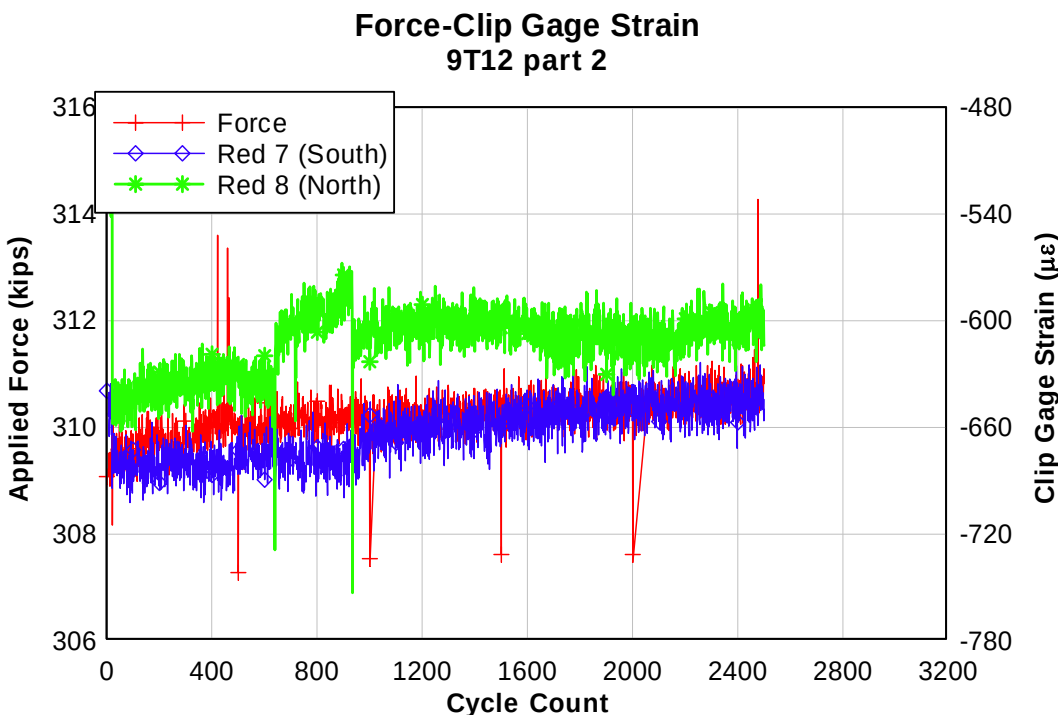

Force-Peak Deflection
9T12
Force
CLdisp
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
345
330
315
300
285
270
1
0.9
0.8
0.7
0.6
0.5
0
2000
4000
6000
8000
10000
12000
14000
16000

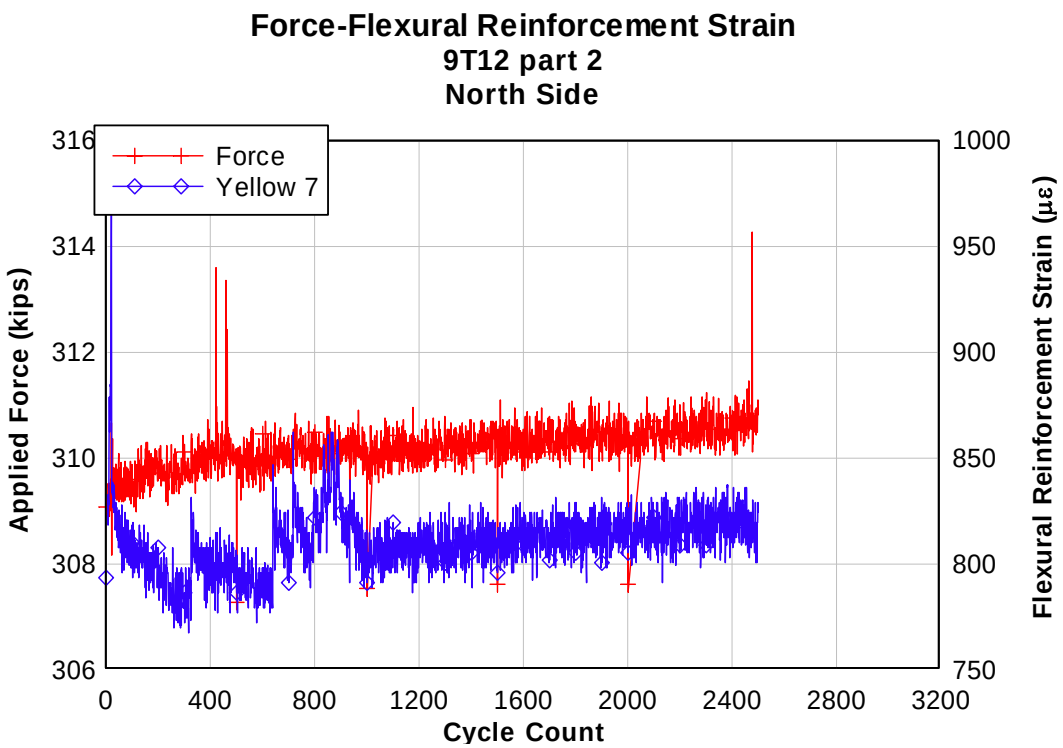

Force-Stirrup Strain
9T12
North Side
Force
Yellow 1
Yellow 2
Yellow 3
Yellow 4
Yellow 5
Yellow 6
Force
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
375
350
325
300
275
250
30000
24000
18000
12000
6000
0
1500
3000
4500
6000
7500
9000
10500
12000
13500

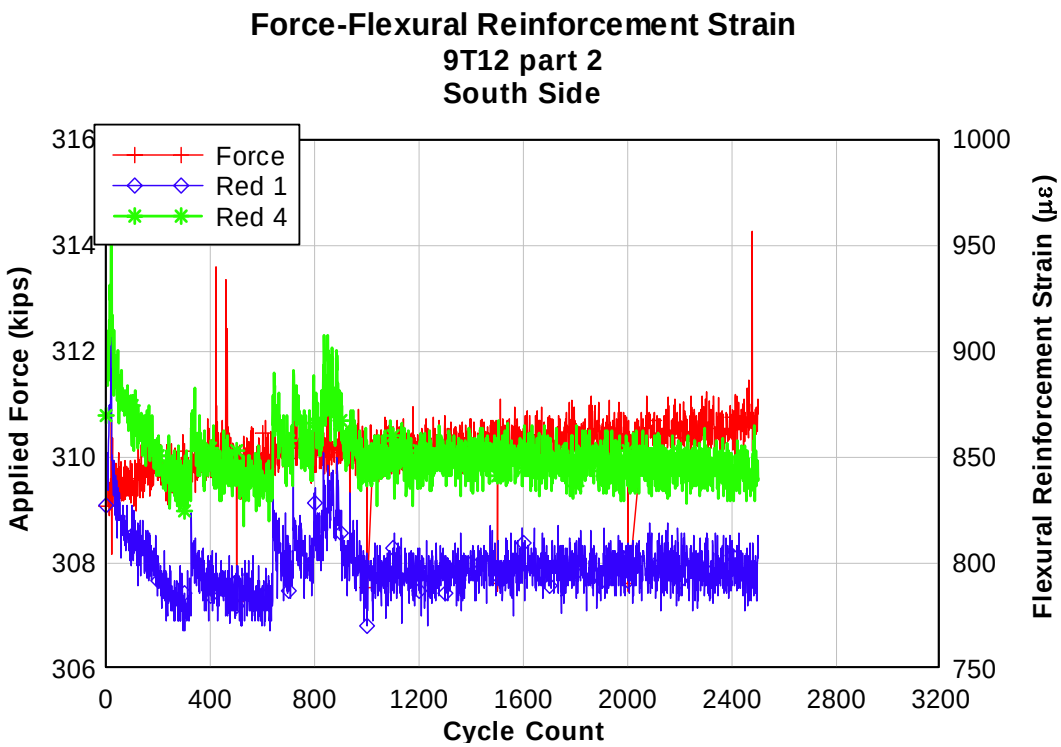

Force-Stirrup Strain
9T12
South Side
Force
Red 2
Red 3
Red 5
Red 6
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
375
350
325
300
275
250
30000
24000
18000
12000
6000
0
1500
3000
4500
6000
7500
9000
10500
12000
13500

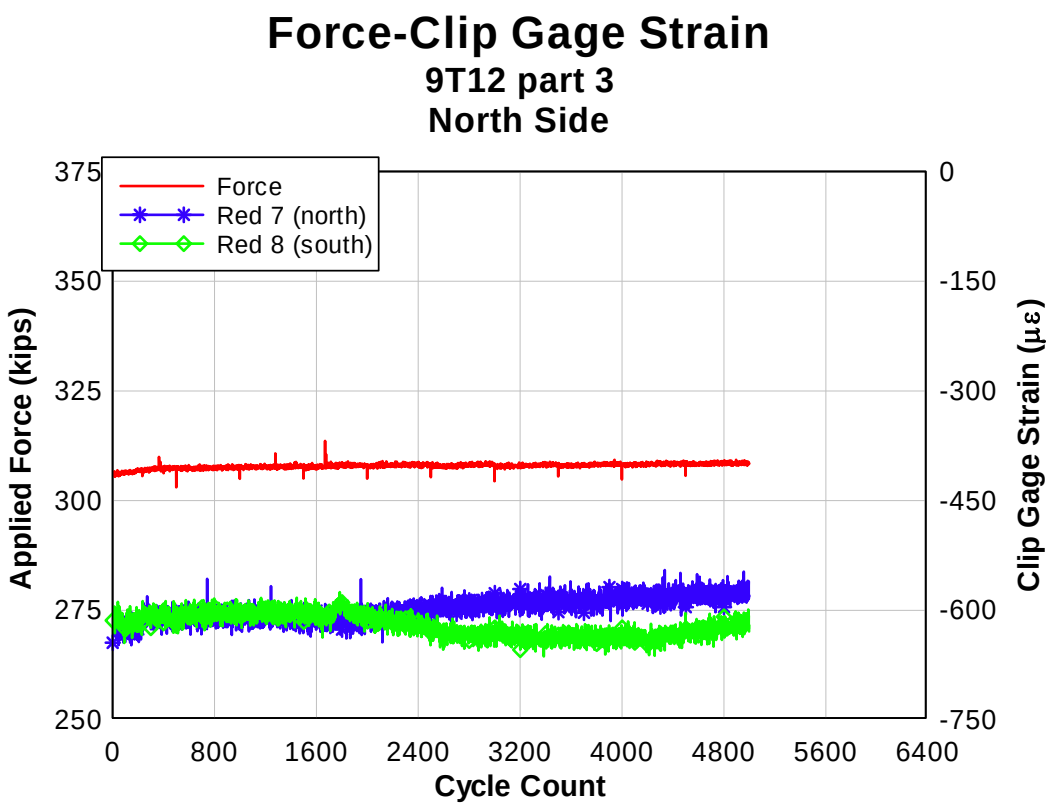

Force-Deflection
9T12
South Side
Green 3
Applied Force (kips)
400
300
200
100
0
-100
-0.08
0
0.08
0.16
0.24
0.32
0.4
0.48
0.56
Diagonal Displacement (in)

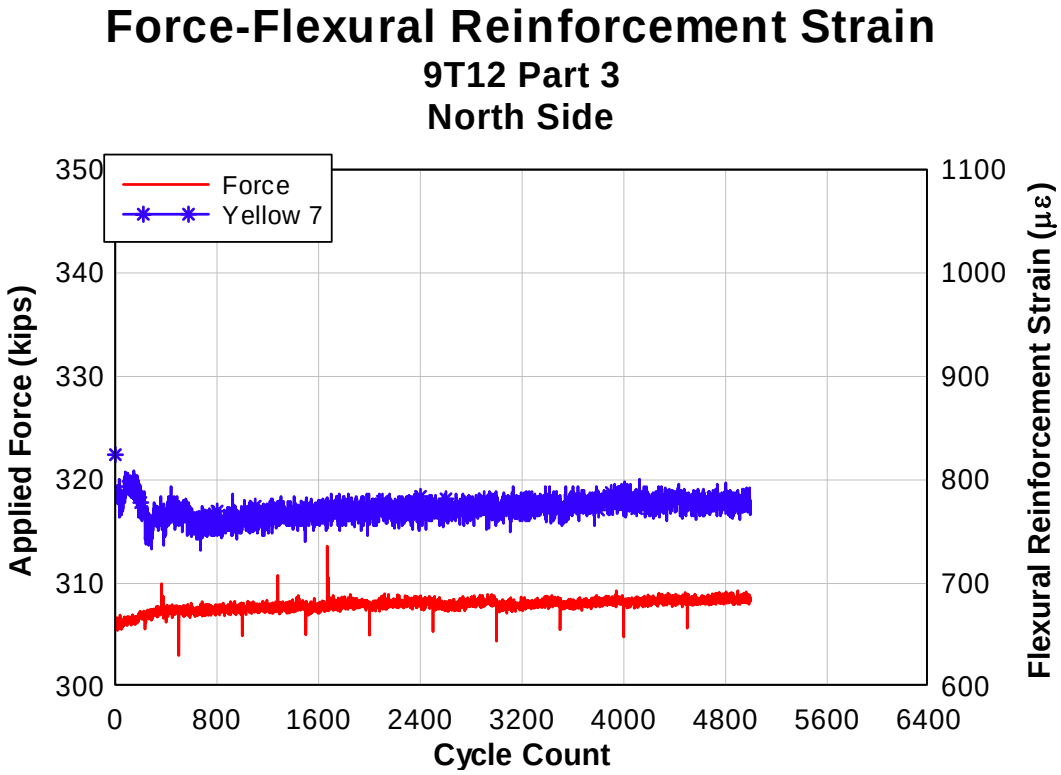

Force-Peak Diagonal Displacement
9T12
South Side
Force
Green 3
Applied Force (kips)
336
328
320
312
304
296
288
280
Diagonal Displacement (in)
0.36
0.32
0.28
0.24
0.2
0.16
0.12
0.08
0
1500
3000
4500
6000
7500
9000
10500
12000
13500
Cycle Count

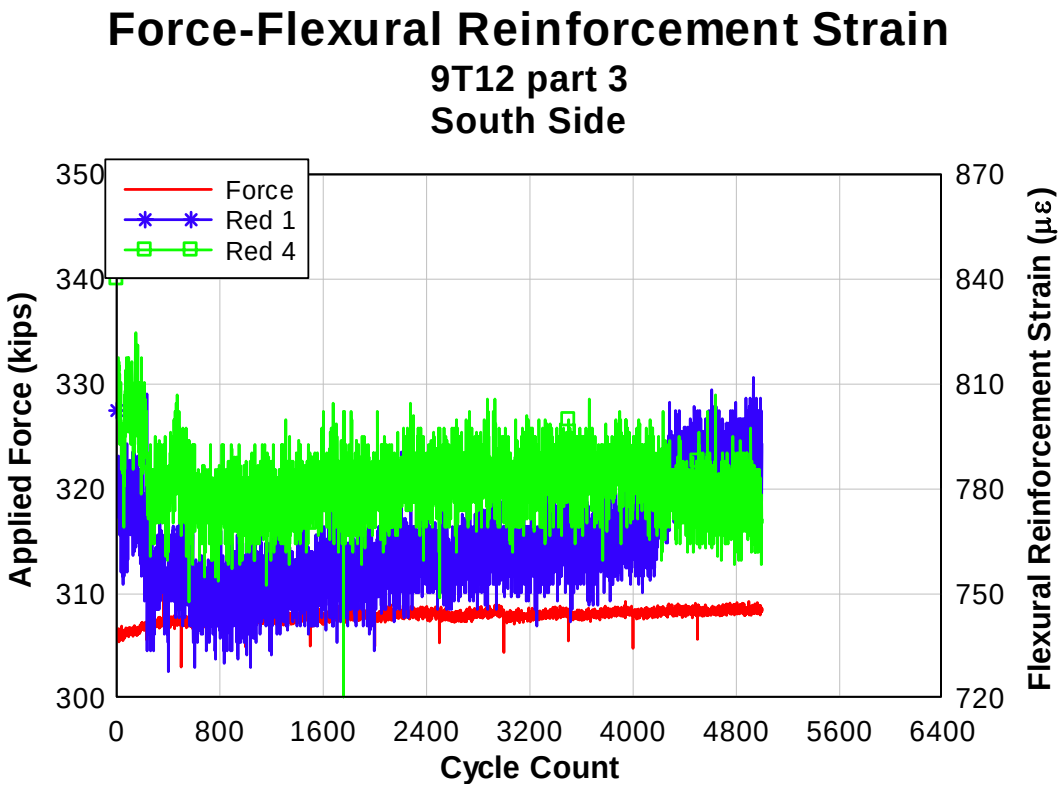

Force-Clip Gage Strain
9T12 part 2
Force
Red 7 (South)
Red 8 (North)
Applied Force (kips)
Clip Gage Strain (με)
Cycle Count
316
314
312
310
308
306
-480
-540
-600
-660
-720
-780
0
400
800
1200
1600
2000
2400
2800
3200

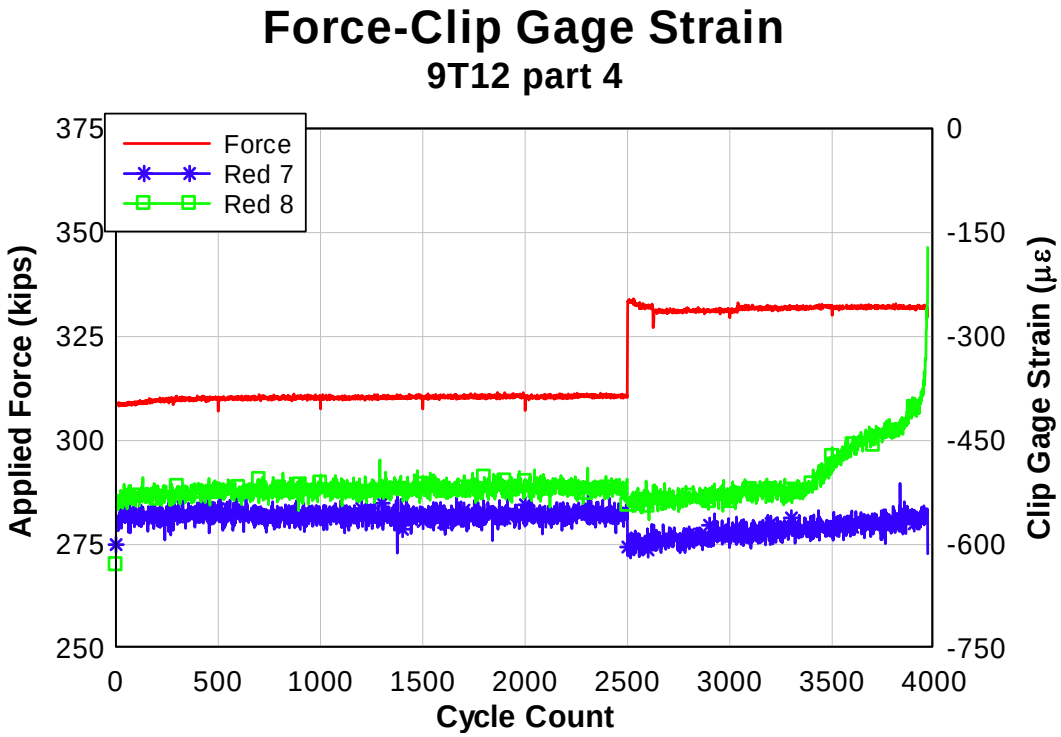

Force-Flexural Reinforcement Strain
9T12 part 2
North Side
Force
Yellow 7
Applied Force (kips)
Flexural Reinforcement Strain (με)
Cycle Count
316
314
312
310
308
306
1000
950
900
850
800
750
0
400
800
1200
1600
2000
2400
2800
3200

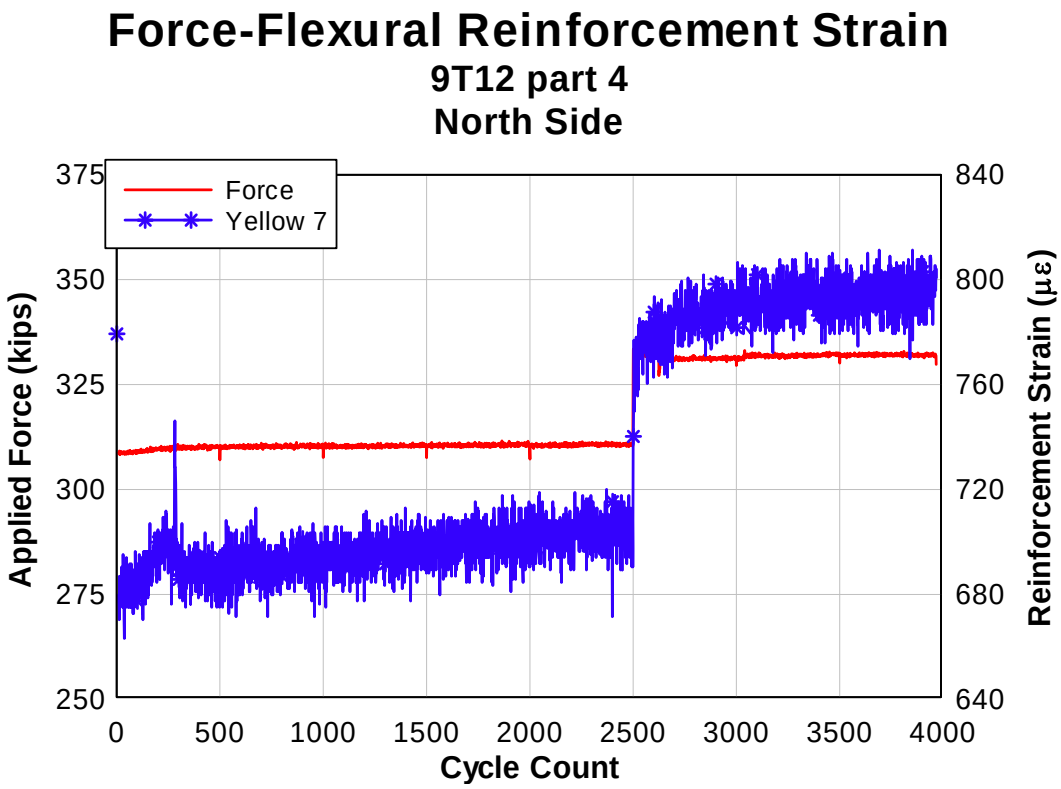

Force-Flexural Reinforcement Strain
9T12 part 2
South Side
Force
Red 1
Red 4
Applied Force (kips)
Flexural Reinforcement Strain (με)
Cycle Count
316
314
312
310
308
306
1000
950
900
850
800
750
0
400
800
1200
1600
2000
2400
2800
3200


Force-Clip Gage Strain
9T12 part 3
North Side
Force
Red 7 (north)
Red 8 (south)
Applied Force (kips)
Clip Gage Strain (με)
Cycle Count
375
350
325
300
275
250
0
-150
-300
-450
-600
-750
0
800
1600
2400
3200
4000
4800
5600
6400

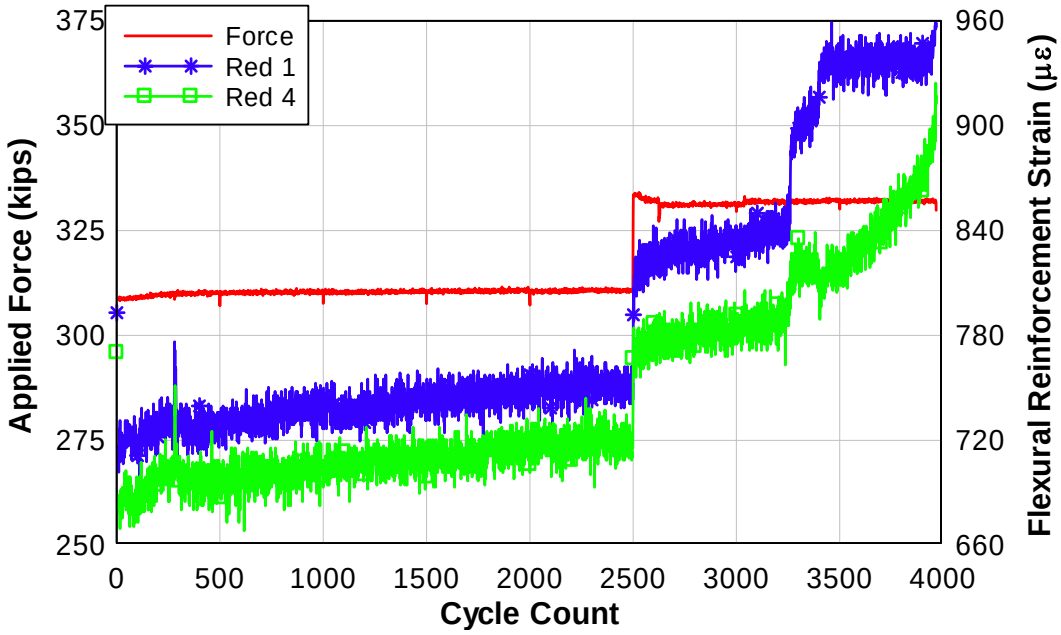

Force-Flexural Reinforcement Strain
9T12 Part 3
North Side
Force
Yellow 7
Applied Force (kips)
Flexural Reinforcement Strain (με)
Cycle Count
350
340
330
320
310
300
1100
1000
900
800
700
600
0
800
1600
2400
3200
4000
4800
5600
6400


Force-Flexural Reinforcement Strain
9T12 part 3
South Side
Force
Red 1
Red 4
Applied Force (kips)
Flexural Reinforcement Strain (με)
Cycle Count
350
340
330
320
310
300
870
840
810
780
750
720
0
800
1600
2400
3200
4000
4800
5600
6400

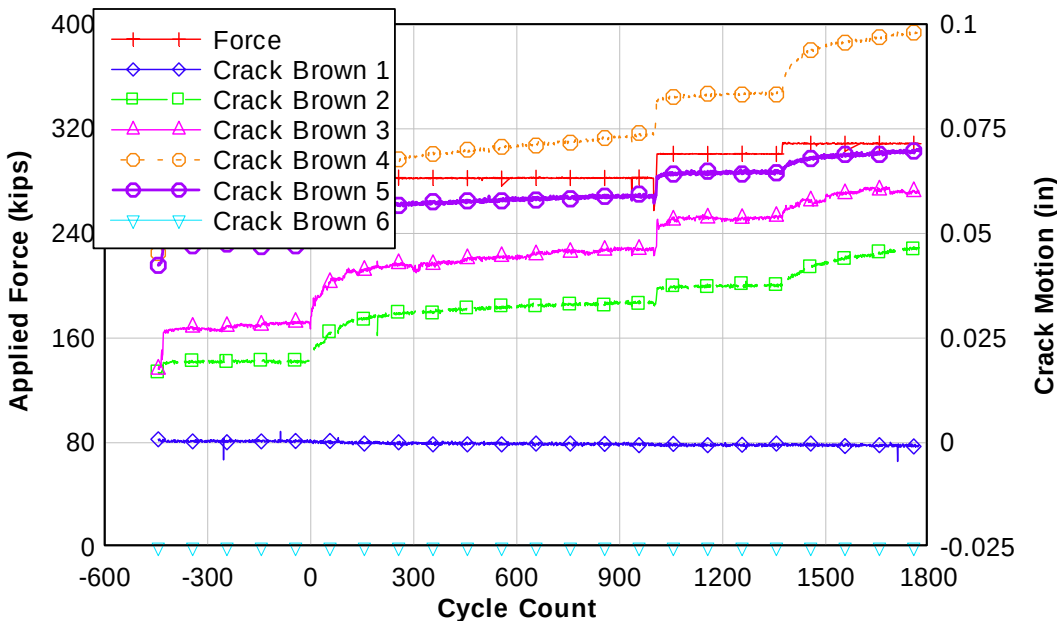

Force-Clip Gage Strain
9T12 part 4
Force
Red 7
Red 8
Applied Force (kips)
Clip Gage Strain (με)
Cycle Count
375
350
325
300
275
250
0
-150
-300
-450
-600
-750
0
500
1000
1500
2000
2500
3000
3500
4000

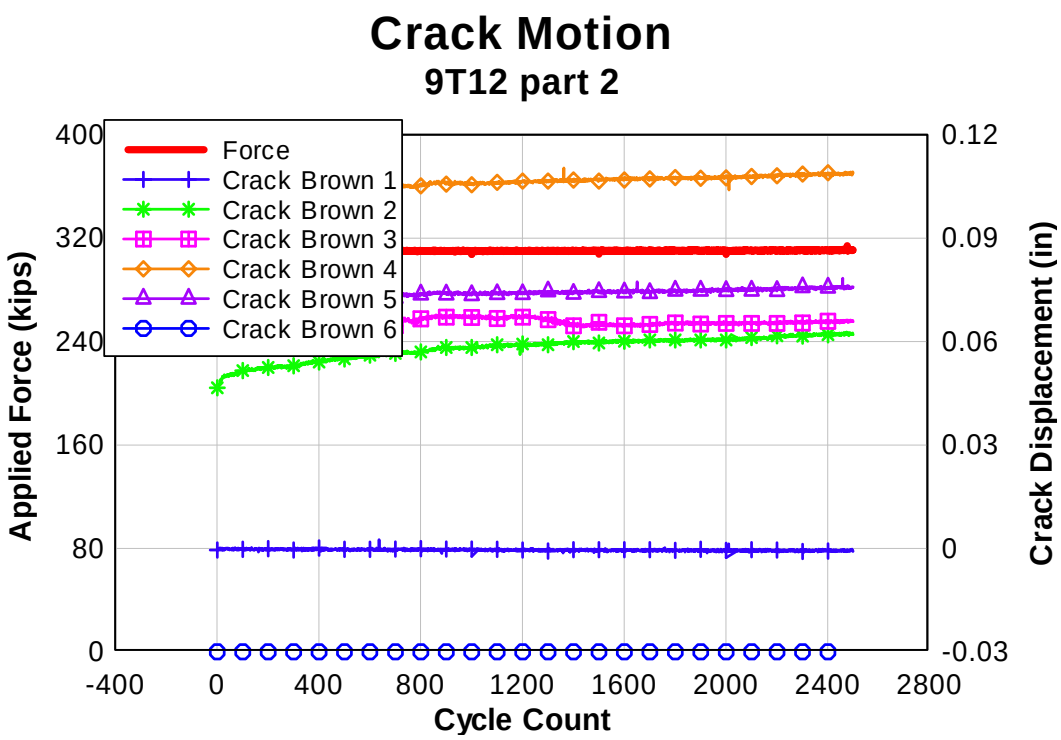

Force-Flexural Reinforcement Strain
9T12 part 4
North Side
Force
Yellow 7
Applied Force (kips)
Reinforcement Strain (με)
Cycle Count
375
350
325
300
275
250
840
800
760
720
680
640
0
500
1000
1500
2000
2500
3000
3500
4000

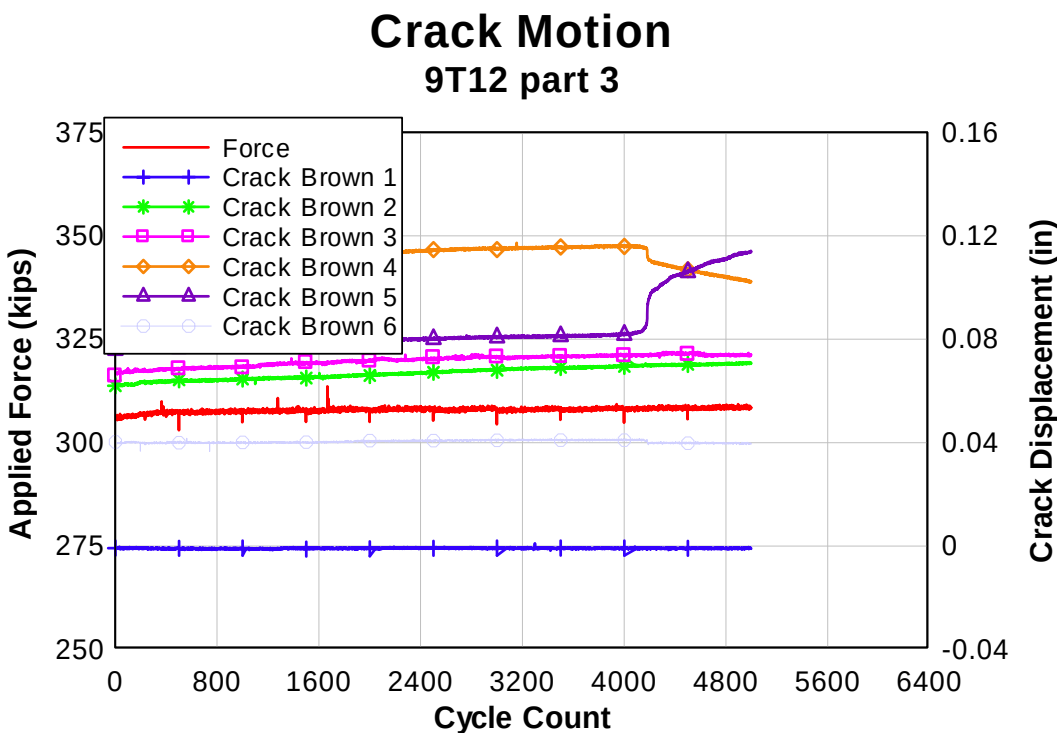
Force-Flexural Reinforcement Strain
9T12 part 4
South Side

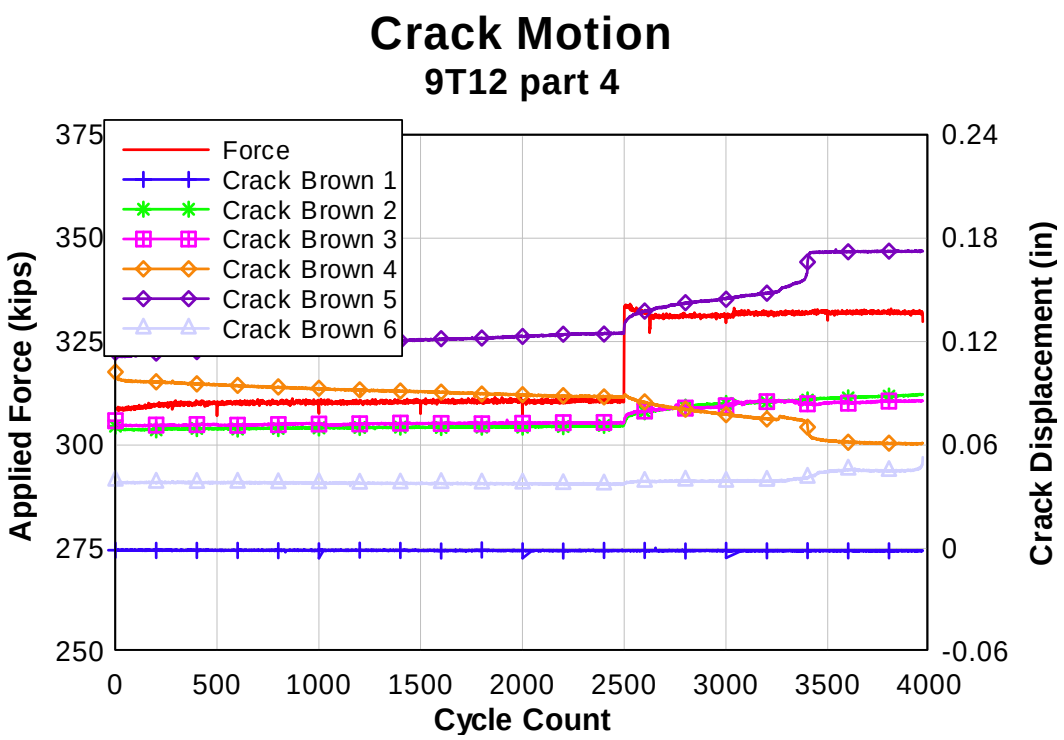


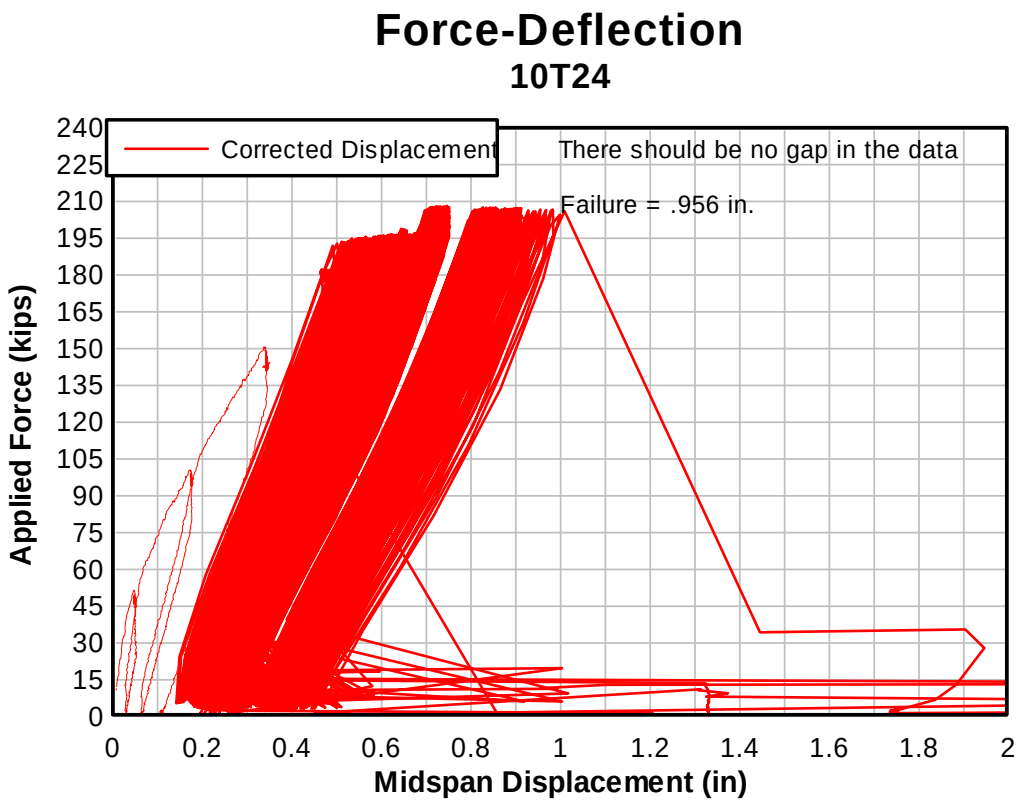
Crack Motion
9T12 part 1

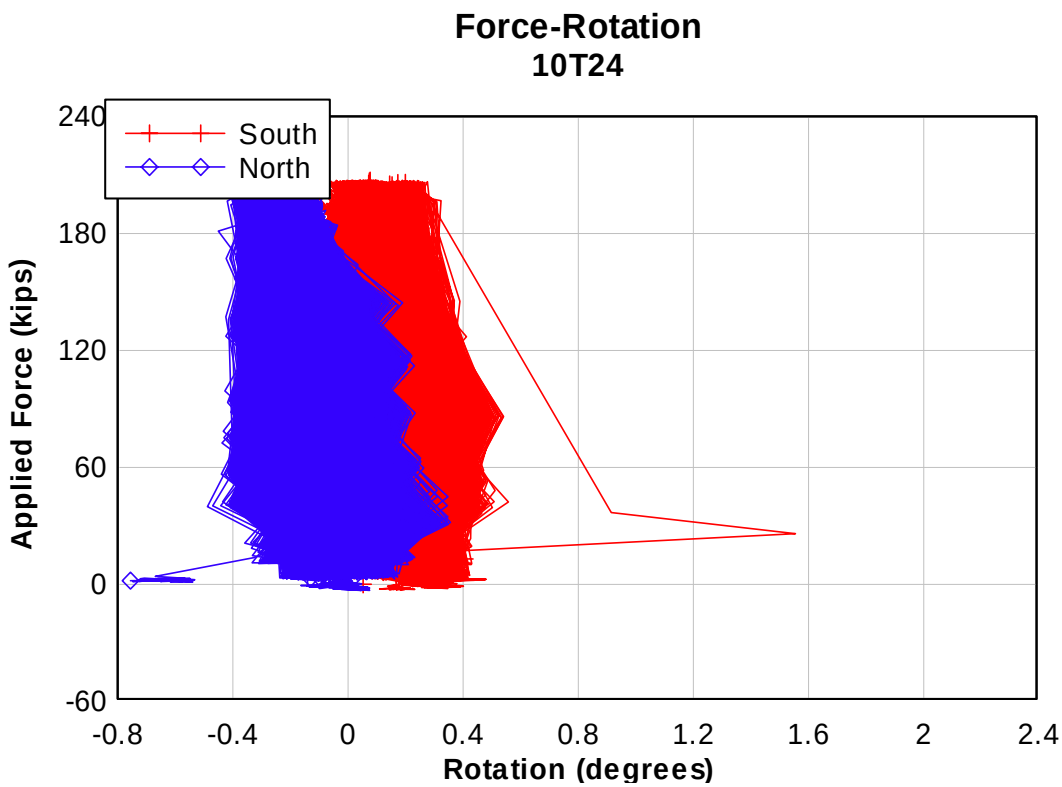


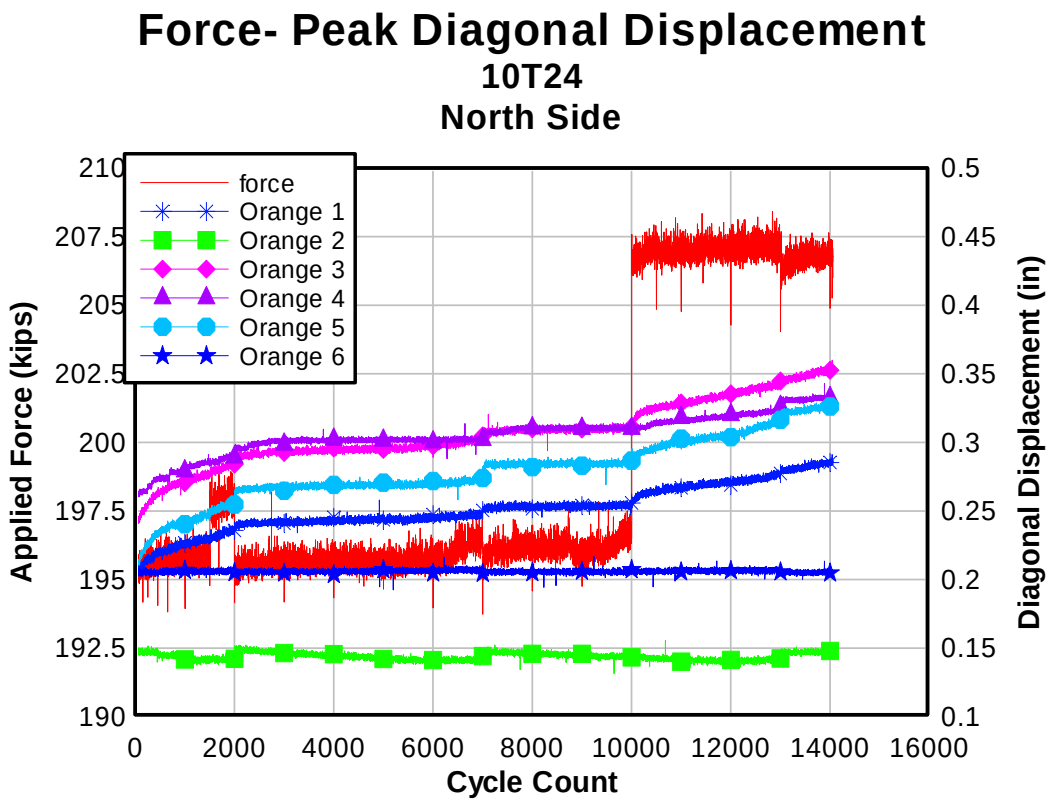

Crack Motion
9T12 part 2
Force
Crack Brown 1
Crack Brown 2
Crack Brown 3
Crack Brown 4
Crack Brown 5
Crack Brown 6
Applied Force (kips)
Crack Displacement (in)
Cycle Count
400
320
240
160
80
0
0.12
0.09
0.06
0.03
0
-0.03
-400
0
400
800
1200
1600
2000
2400
2800

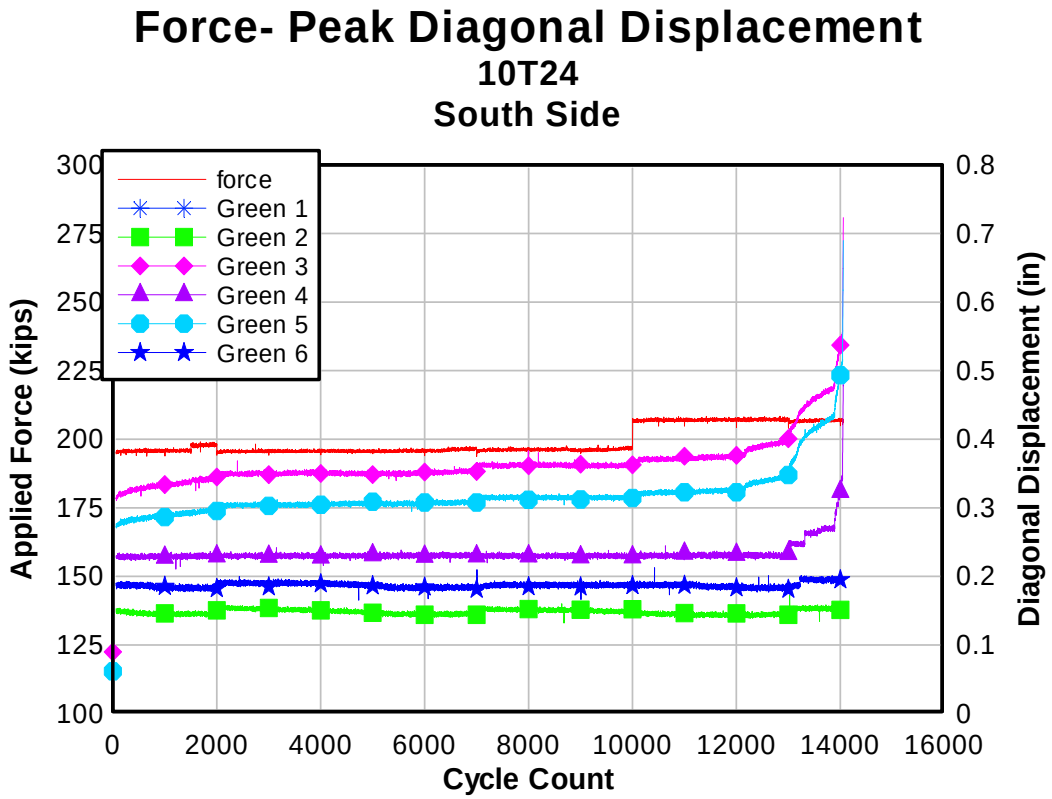

Crack Motion
9T12 part 3
Force
Crack Brown 1
Crack Brown 2
Crack Brown 3
Crack Brown 4
Crack Brown 5
Crack Brown 6
Applied Force (kips)
Crack Displacement (in)
Cycle Count
375
350
325
300
275
250
0.16
0.12
0.08
0.04
0
-0.04
0
800
1600
2400
3200
4000
4800
5600
6400

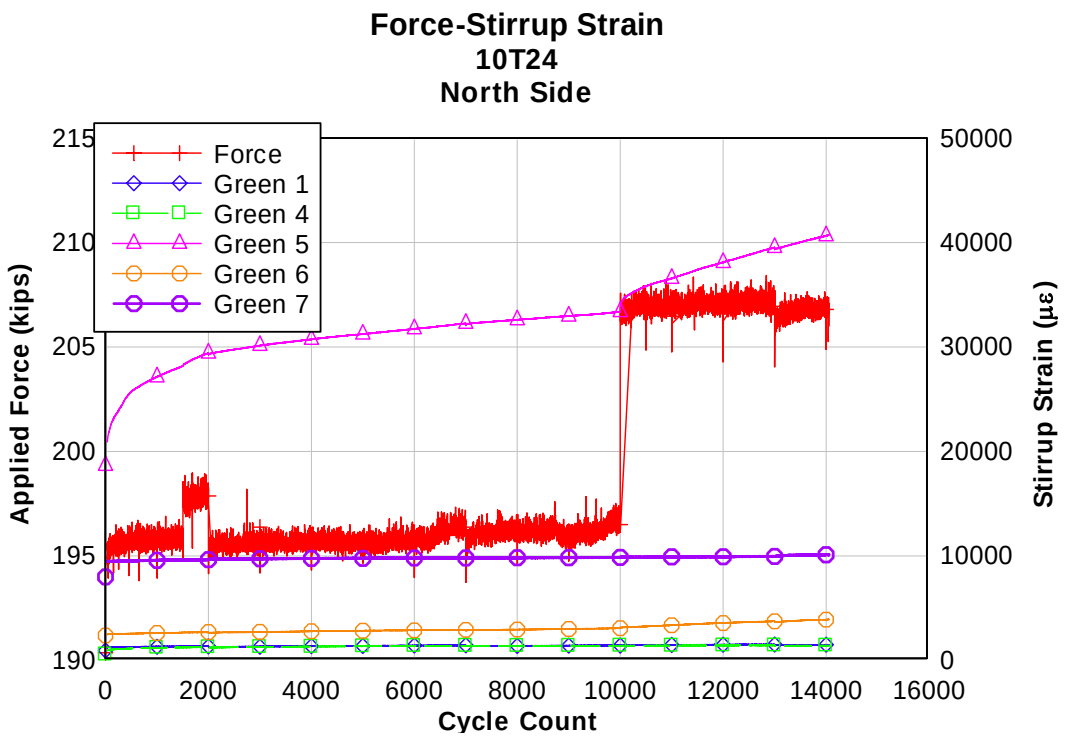

Crack Motion
9T12 part 4
Force
Crack Brown 1
Crack Brown 2
Crack Brown 3
Crack Brown 4
Crack Brown 5
Crack Brown 6
Applied Force (kips)
Crack Displacement (in)
Cycle Count
375
350
325
300
275
250
0.24
0.18
0.12
0.06
0
-0.06
0
500
1000
1500
2000
2500
3000
3500
4000

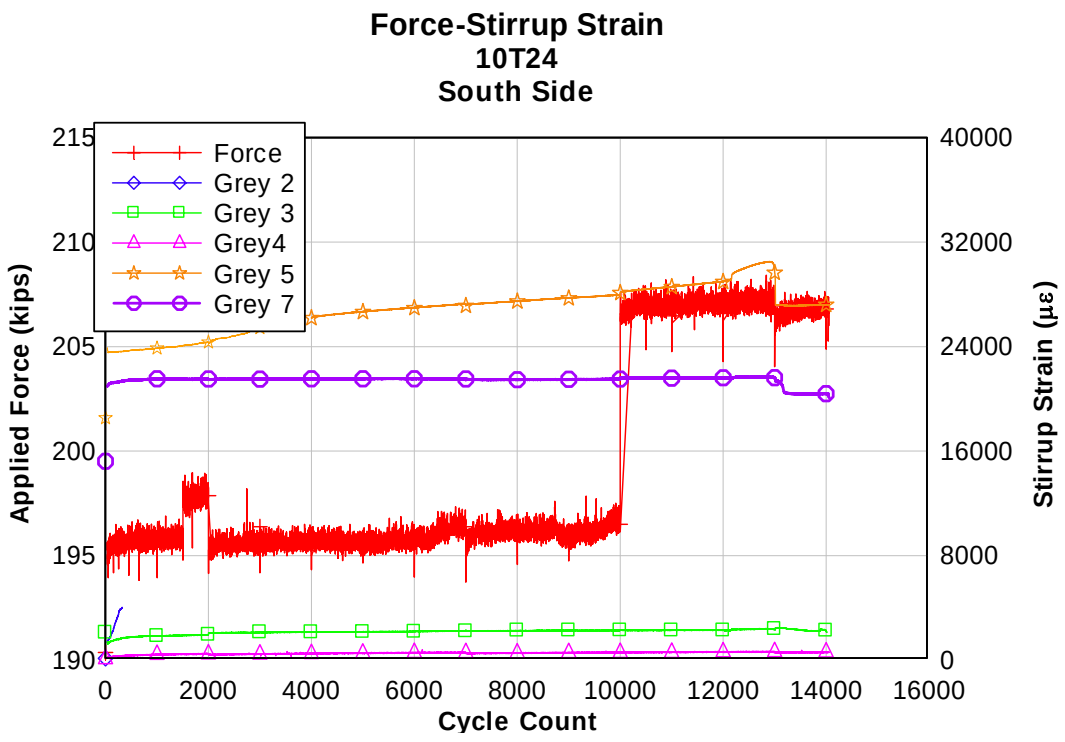

Force-Deflection
10T24
Corrected Displacement
There should be no gap in the data
Failure = .956 in.
Applied Force (kips)
Midspan Displacement (in)
240
225
210
195
180
165
150
135
120
105
90
75
60
45
30
15
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

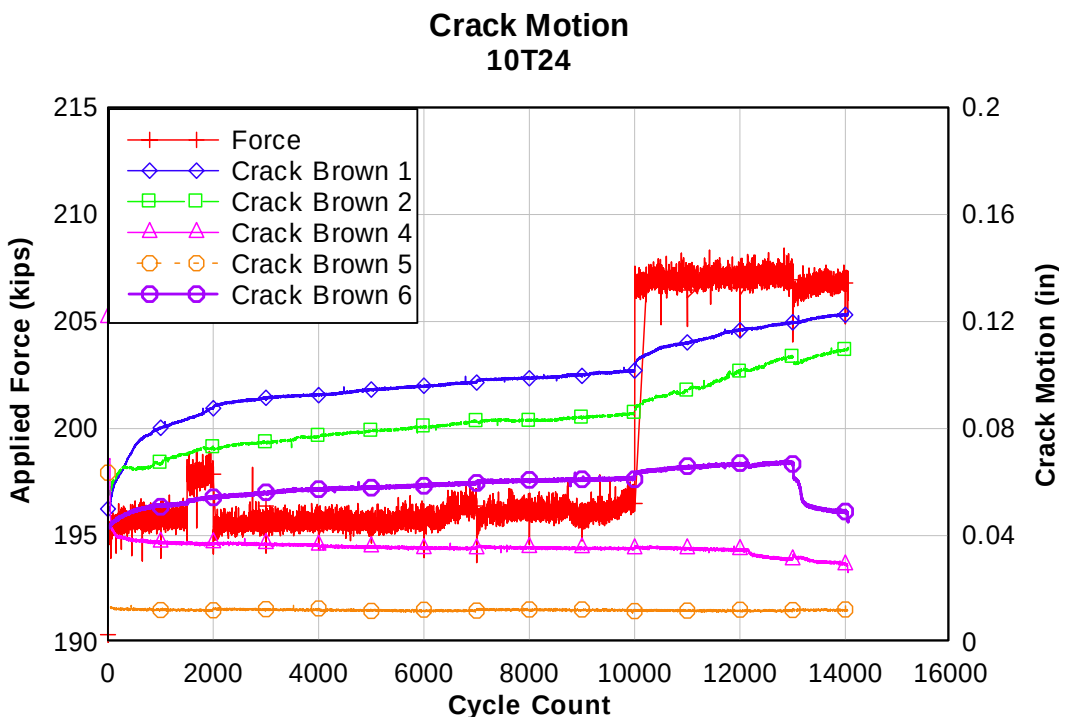

Force-Rotation
10T24
South
North
Applied Force (kips)
Rotation (degrees)
240
180
120
60
0
-60
-0.8
-0.4
0
0.4
0.8
1.2
1.6
2
2.4

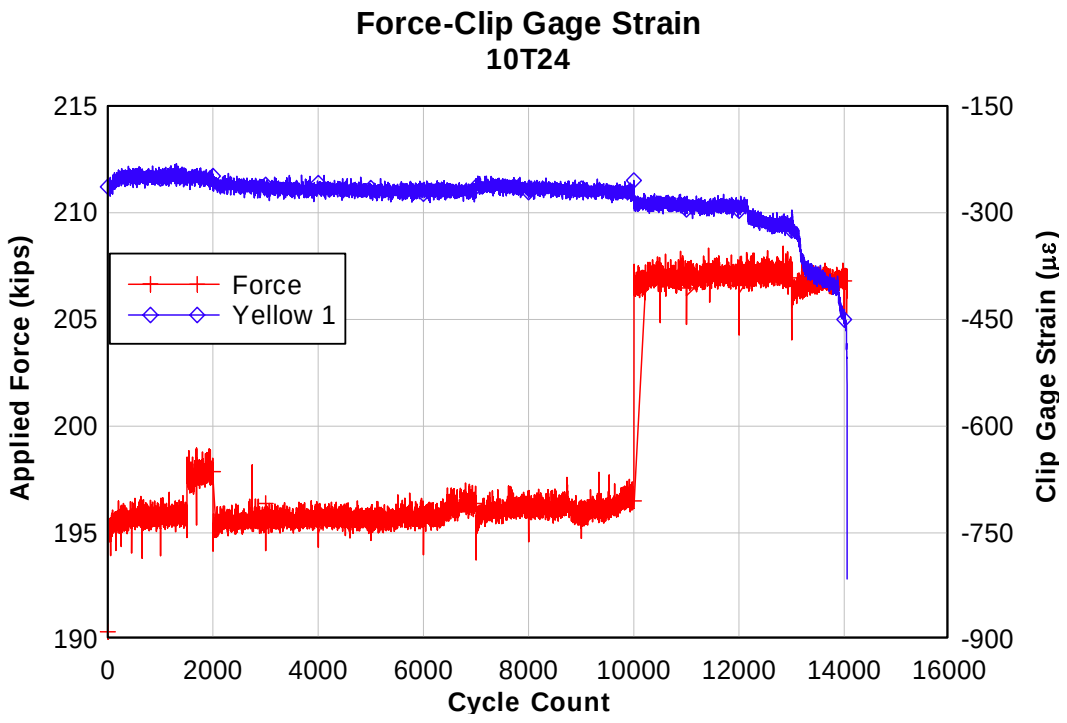

Force- Peak Diagonal Displacement
10T24
North Side
force
Orange 1
Orange 2
Orange 3
Orange 4
Orange 5
Orange 6
Applied Force (kips)
Diagonal Displacement (in)
Cycle Count
210
207.5
205
202.5
200
197.5
195
192.5
190
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0
2000
4000
6000
8000
10000
12000
14000
16000

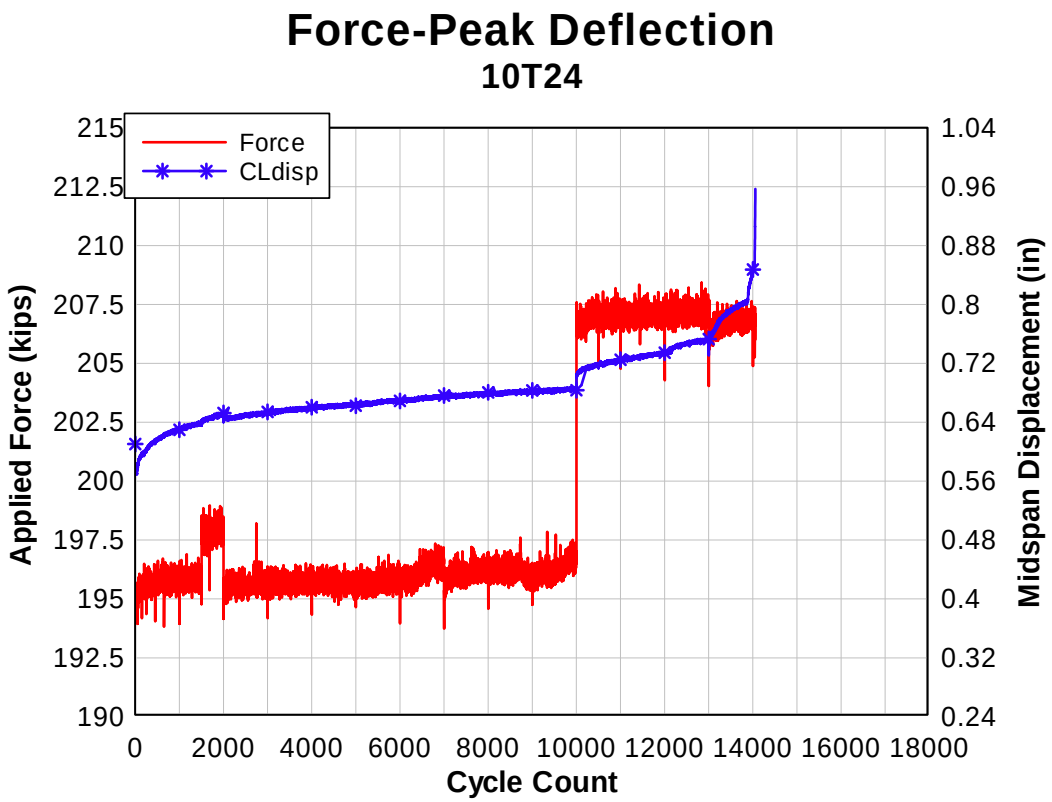

Force- Peak Diagonal Displacement
10T24
South Side
force
Green 1
Green 2
Green 3
Green 4
Green 5
Green 6
Applied Force (kips)
Diagonal Displacement (in)
Cycle Count
300
275
250
225
200
175
150
125
100
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2000
4000
6000
8000
10000
12000
14000
16000

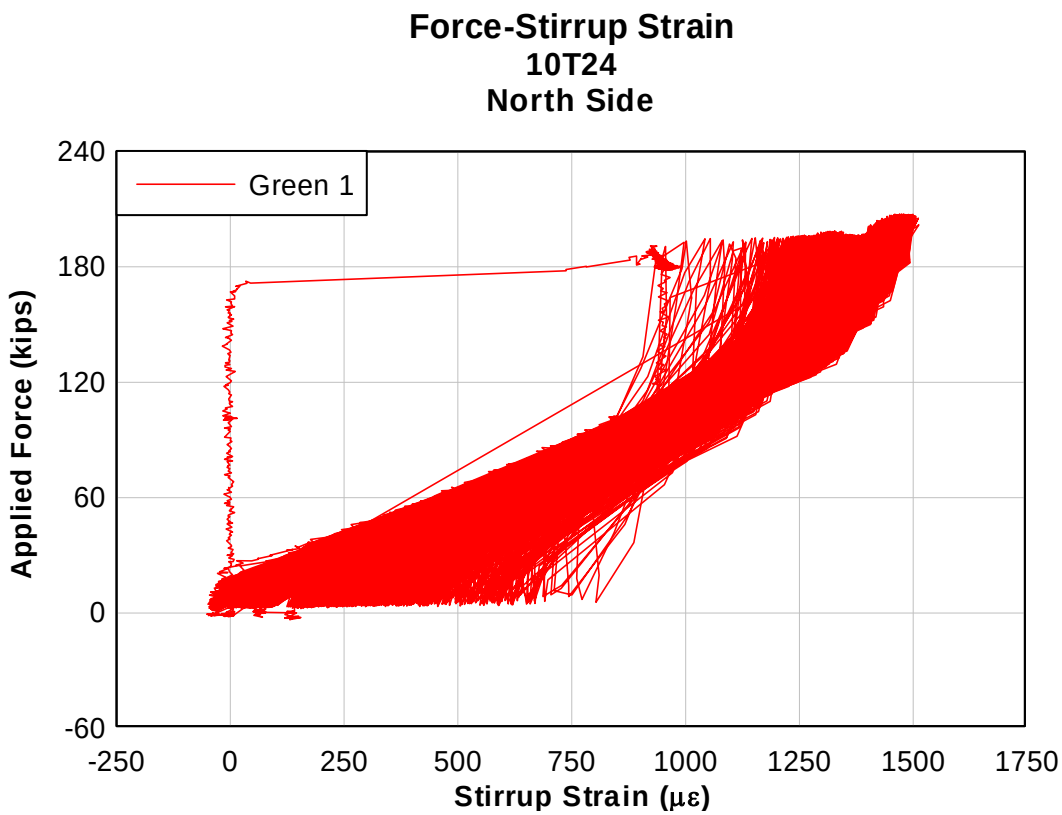

Force-Stirrup Strain
10T24
North Side
Force
Green 1
Green 4
Green 5
Green 6
Green 7
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
215
210
205
200
195
190
50000
40000
30000
20000
10000
0
0
2000
4000
6000
8000
10000
12000
14000
16000

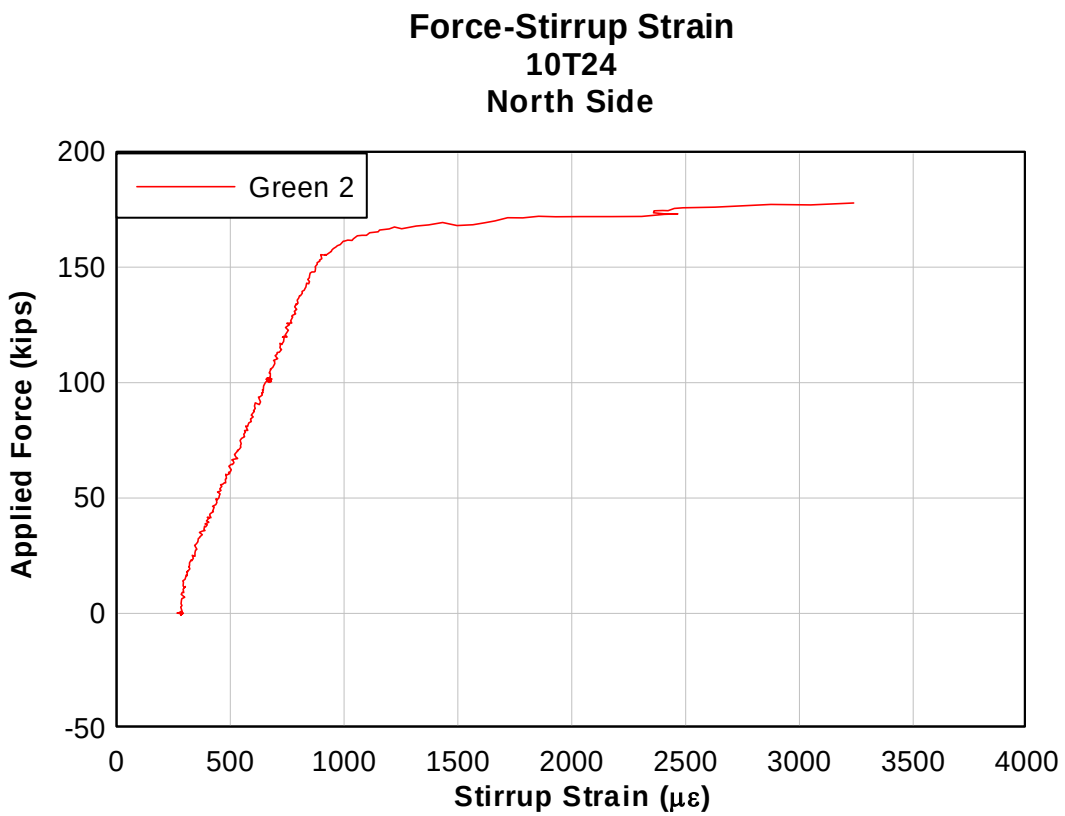

Force-Stirrup Strain
10T24
South Side
Force
Grey 2
Grey 3
Grey4
Grey 5
Grey 7
Applied Force (kips)
Stirrup Strain (με)
Cycle Count
215
210
205
200
195
190
40000
32000
24000
16000
8000
0
0
2000
4000
6000
8000
10000
12000
14000
16000

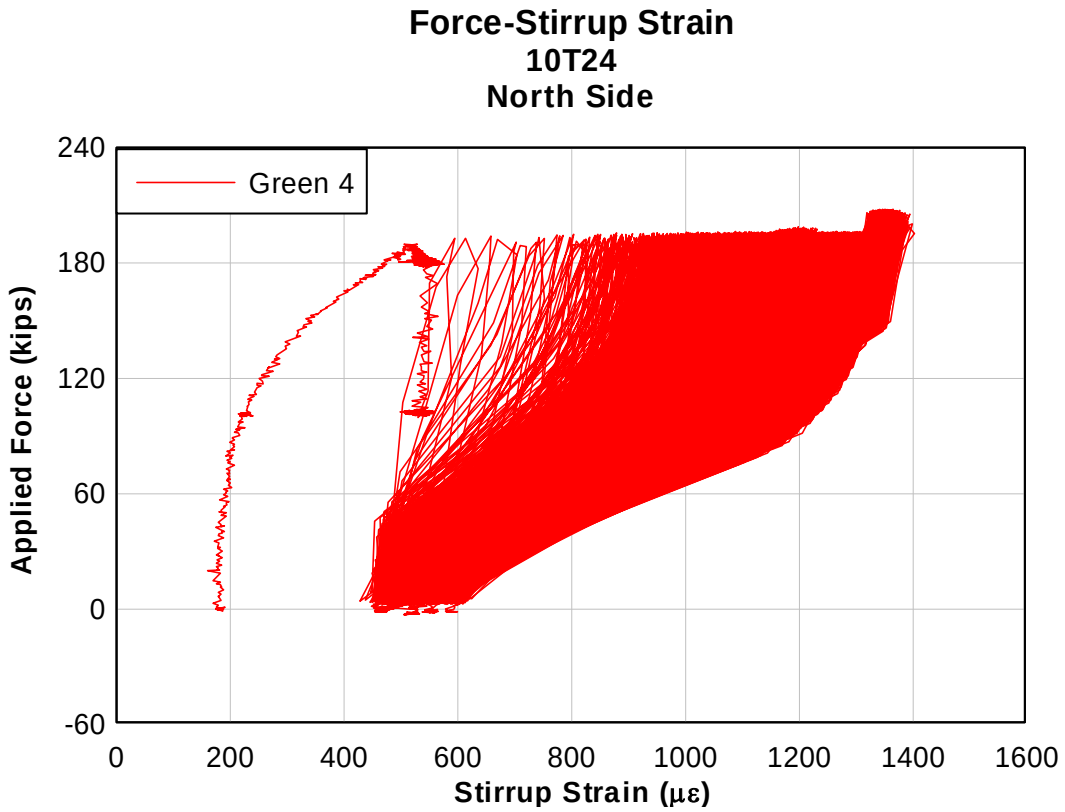

Crack Motion
10T24
Force
Crack Brown 1
Crack Brown 2
Crack Brown 4
Crack Brown 5
Crack Brown 6
Applied Force (kips)
Crack Motion (in)
Cycle Count
215
210
205
200
195
190
0.2
0.16
0.12
0.08
0.04
0
0
2000
4000
6000
8000
10000
12000
14000
16000

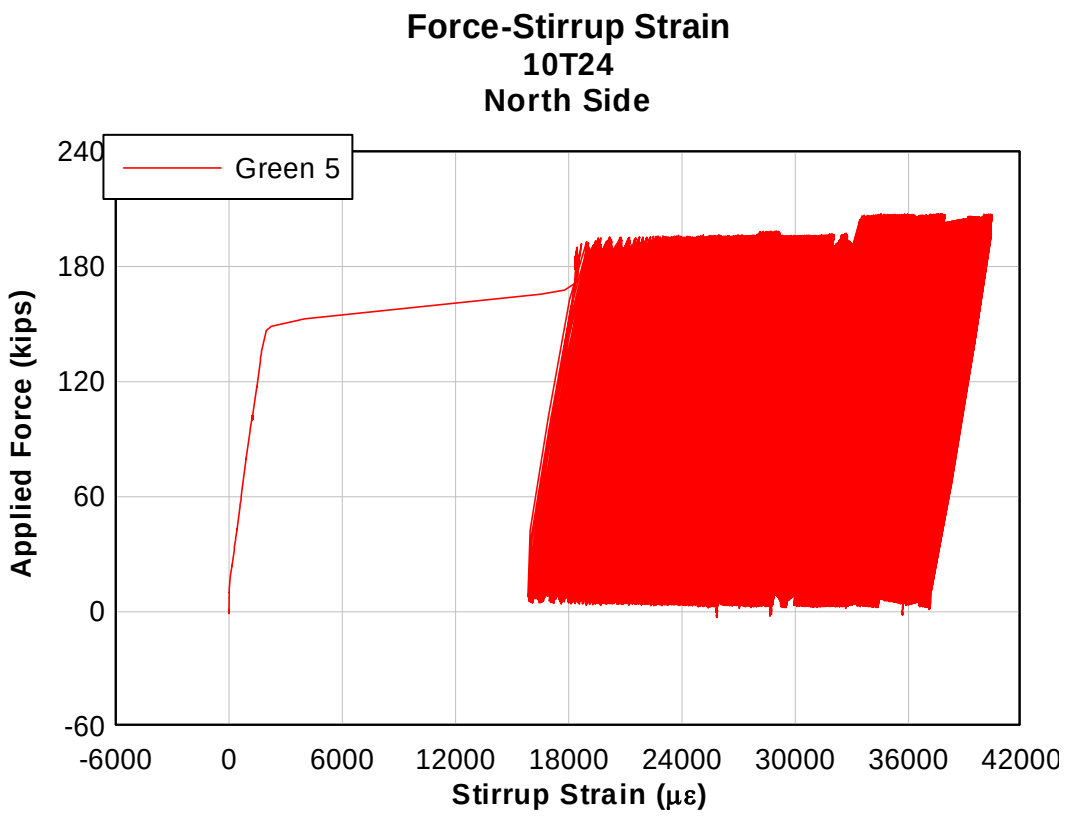

Force-Clip Gage Strain
10T24
Force
Yellow 1
Applied Force (kips)
Clip Gage Strain (με)
Cycle Count
215
210
205
200
195
190
-150
-300
-450
-600
-750
-900
0
2000
4000
6000
8000
10000
12000
14000
16000

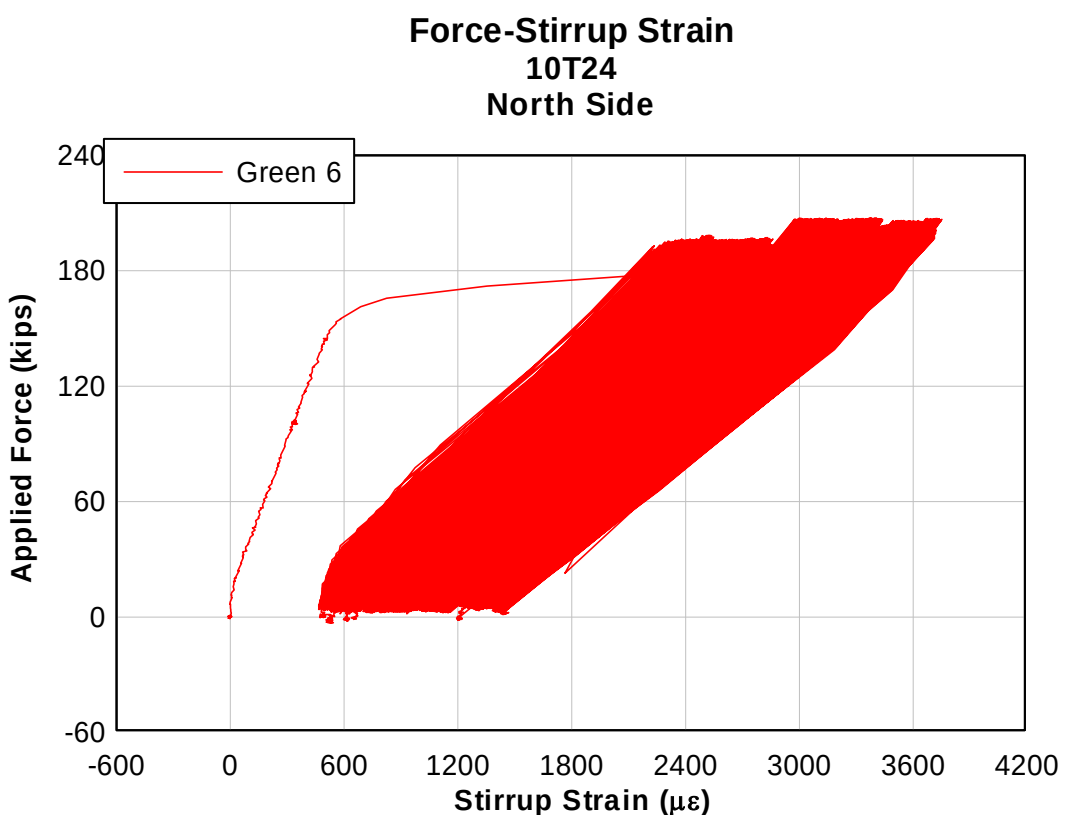

Force-Peak Deflection
10T24
Force
CLdisp
Applied Force (kips)
Midspan Displacement (in)
Cycle Count
215
212.5
210
207.5
205
202.5
200
197.5
195
192.5
190
1.04
0.96
0.88
0.8
0.72
0.64
0.56
0.48
0.4
0.32
0.24
0
2000
4000
6000
8000
10000
12000
14000
16000
18000

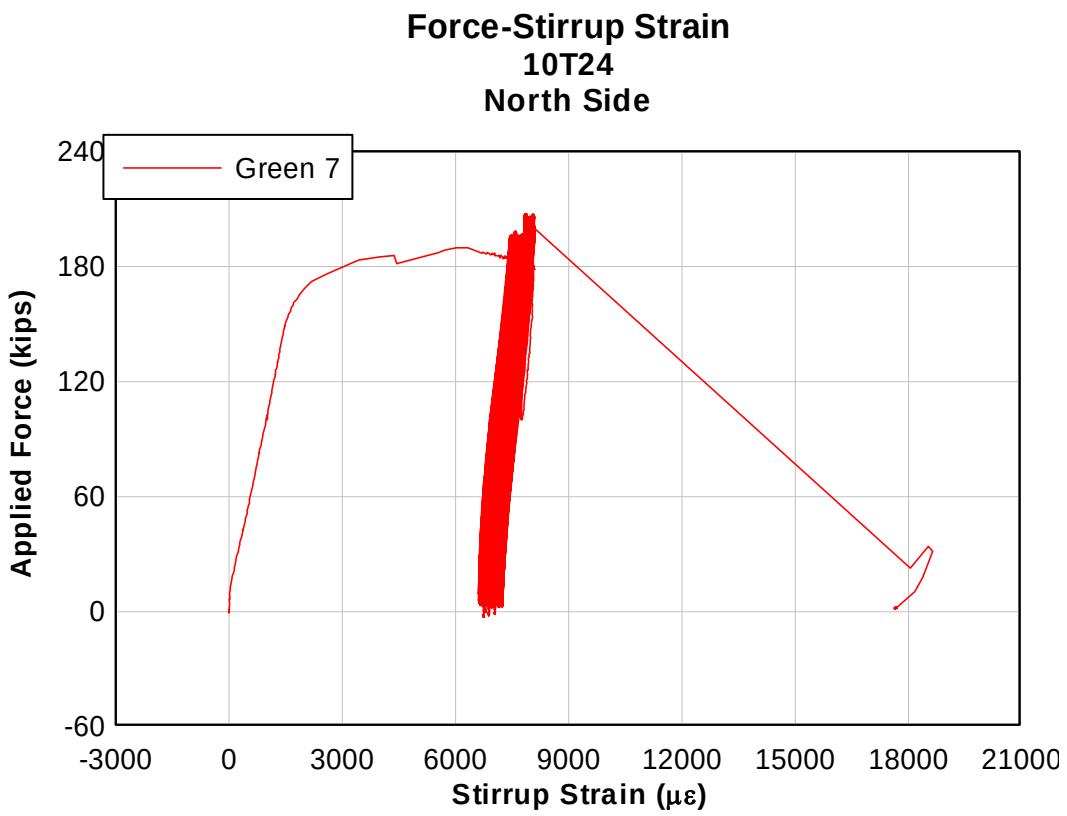

Force-Stirrup Strain
10T24
North Side
Green 1
Applied Force (kips)
Stirrup Strain (με)
240
180
120
60
0
-60
-250
0
250
500
750
1000
1250
1500
1750

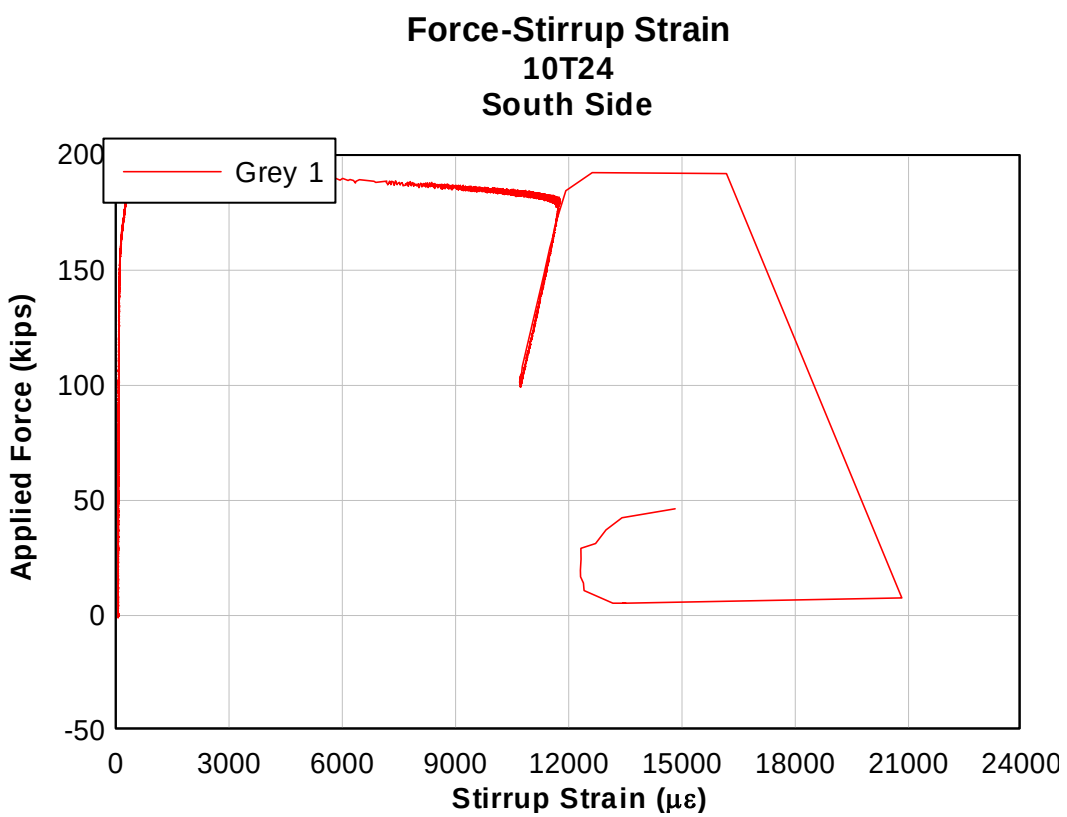

Force-Stirrup Strain
10T24
North Side
Green 2
Applied Force (kips)
Stirrup Strain (με)
200
150
100
50
0
-50
0
500
1000
1500
2000
2500
3000
3500
4000

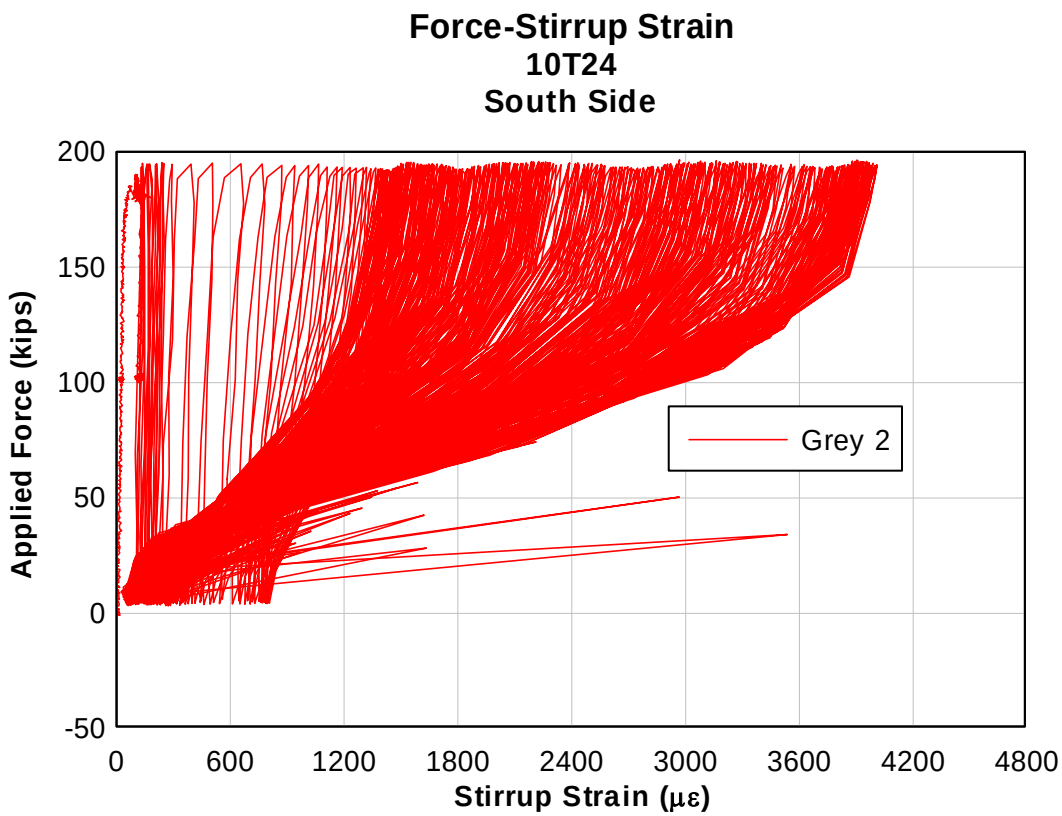

Force-Stirrup Strain
10T24
North Side
Green 4
Applied Force (kips)
Stirrup Strain (με)
240
180
120
60
0
-60
0
200
400
600
800
1000
1200
1400
1600

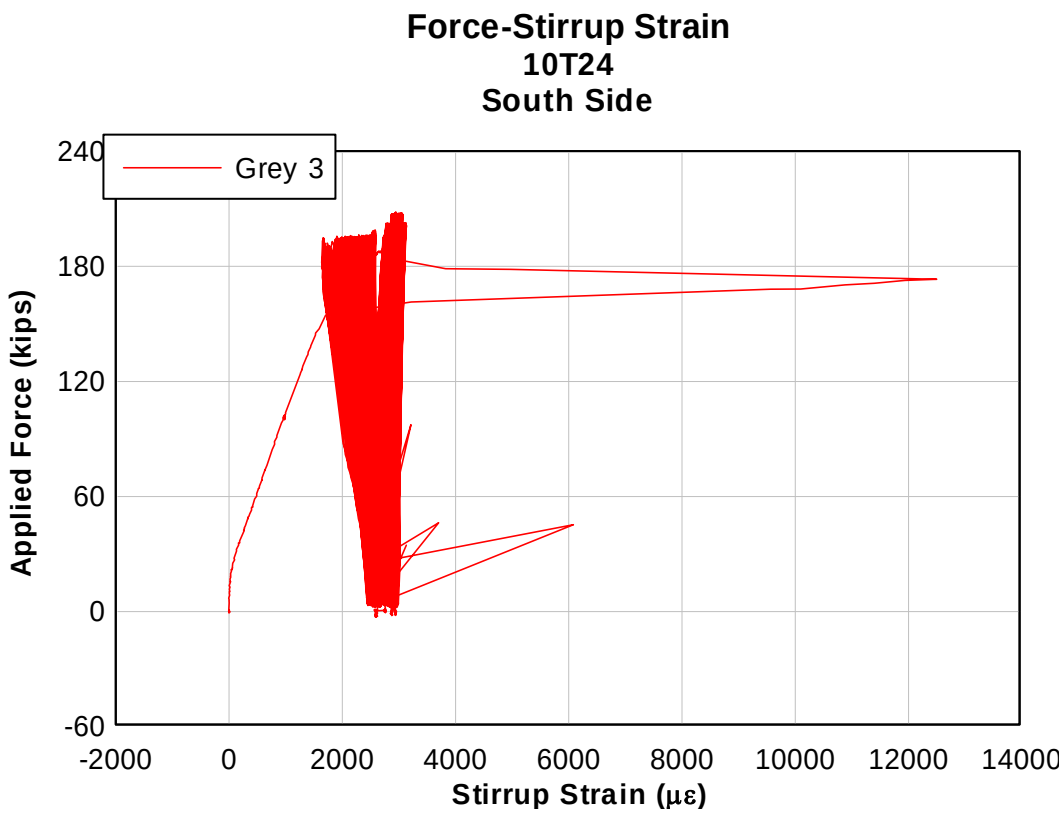

Force-Stirrup Strain
10T24
North Side
Green 5
Applied Force (kips)
240
180
120
60
0
-60
-6000
0
6000
12000
18000
24000
30000
36000
42000
Stirrup Strain (με)

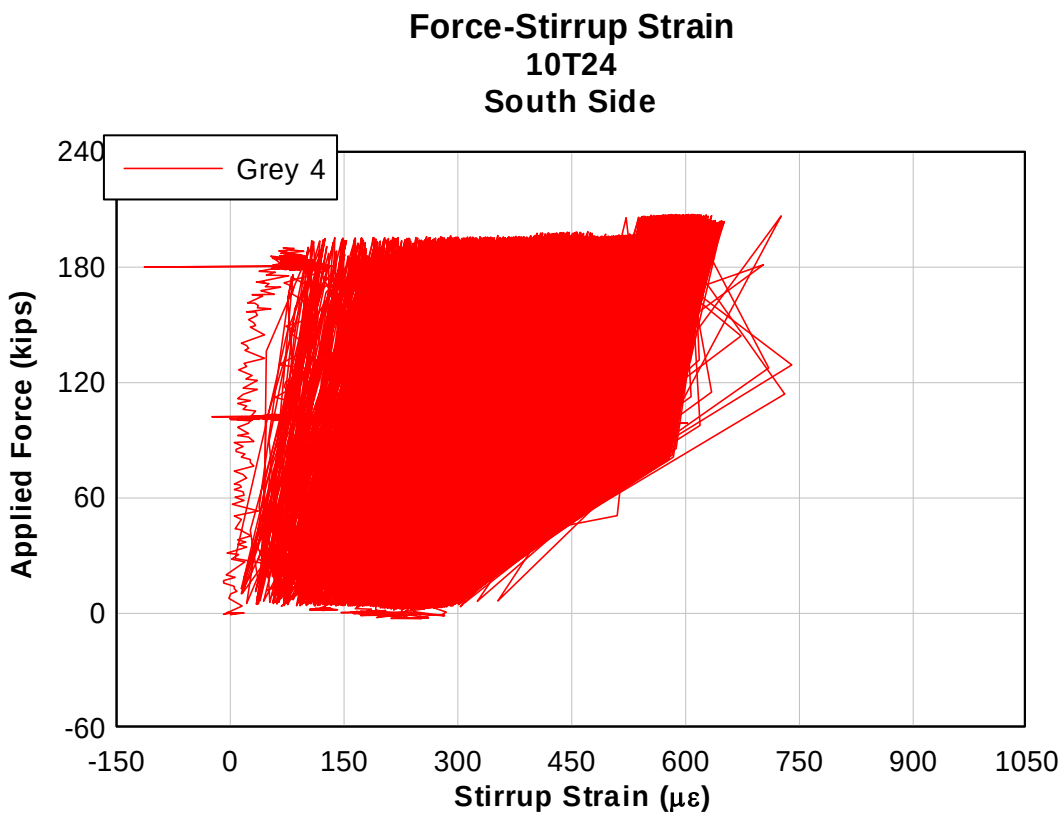

Force-Stirrup Strain
10T24
North Side
Green 6
Applied Force (kips)
240
180
120
60
0
-60
-600
0
600
1200
1800
2400
3000
3600
4200
Stirrup Strain (με)

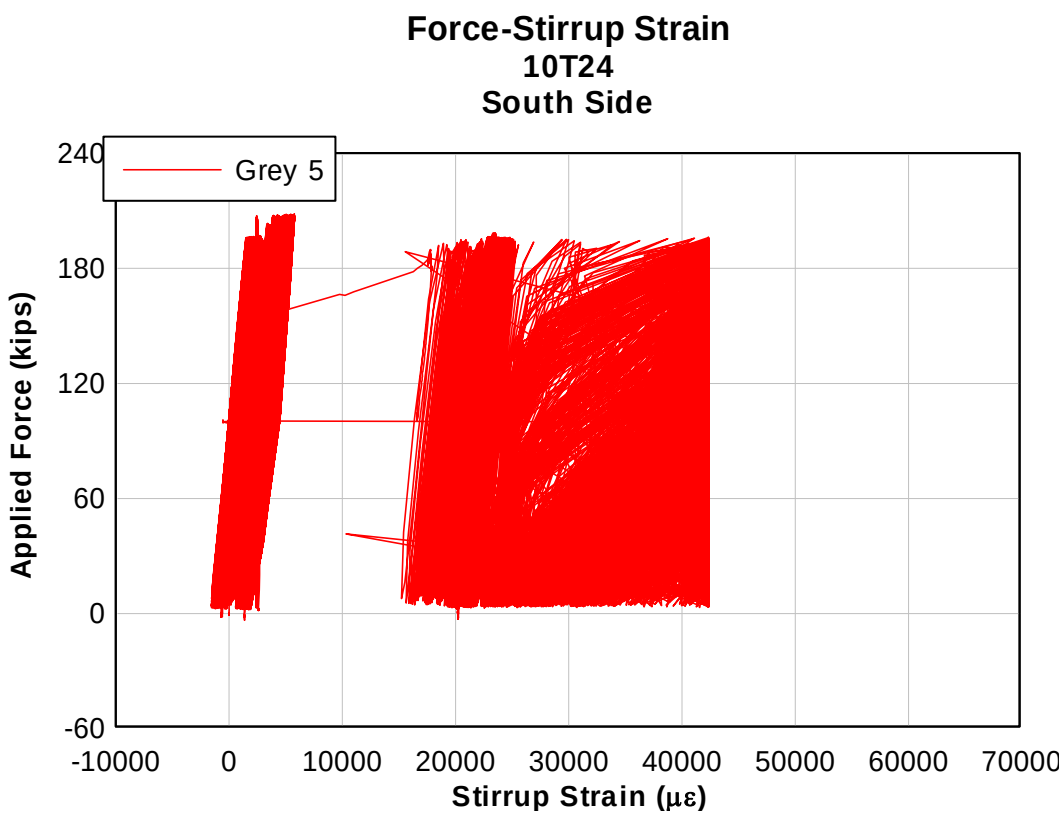

Force-Stirrup Strain
10T24
North Side
Green 7
Applied Force (kips)
240
180
120
60
0
-60
-3000
0
3000
6000
9000
12000
15000
18000
21000
Stirrup Strain (με)

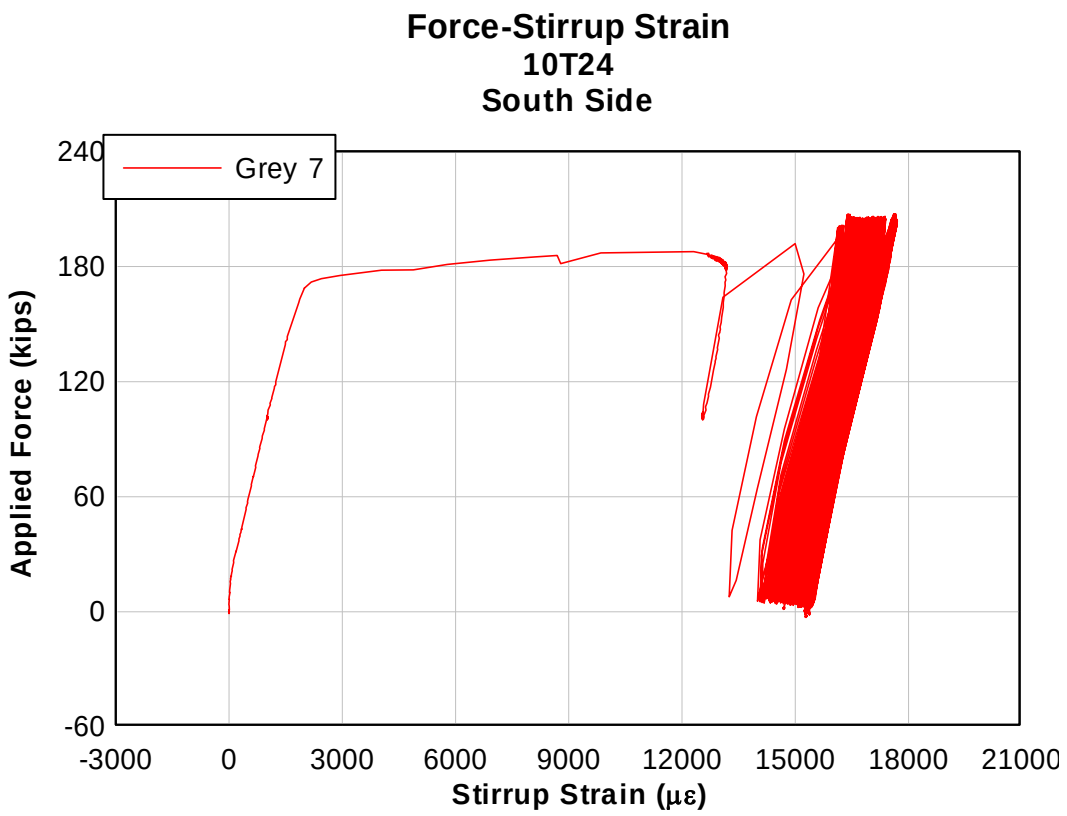

Force-Stirrup Strain
10T24
South Side
Grey 1
Applied Force (kips)
200
150
100
50
0
-50
0
3000
6000
9000
12000
15000
18000
21000
24000
Stirrup Strain (με)


Force-Stirrup Strain
10T24
South Side
Applied Force (kips)
Stirrup Strain (με)
Grey 2
200
150
100
50
0
-50
0
600
1200
1800
2400
3000
3600
4200
4800


Force-Stirrup Strain
10T24
South Side
Applied Force (kips)
Stirrup Strain (με)
Grey 3
240
180
120
60
0
-60
-2000
0
2000
4000
6000
8000
10000
12000
14000


Force-Stirrup Strain
10T24
South Side
Grey 4
Applied Force (kips)
240
180
120
60
0
-60
-150
0
150
300
450
600
750
900
1050
Stirrup Strain (με)


Force-Stirrup Strain
10T24
South Side
Grey 5
Applied Force (kips)
240
180
120
60
0
-60
-10000
0
10000
20000
30000
40000
50000
60000
70000
Stirrup Strain (με)


Force-Stirrup Strain
10T24
South Side
Grey 7
Applied Force (kips)
240
180
120
60
0
-60
-3000
0
3000
6000
9000
12000
15000
18000
21000
Stirrup Strain (με)