APPENDIX C: ALF PAVEMENT RUT DEPTH DATA

1. Rut Depth Data

Tables 106 to 119 provide the rut depth data for each ALF pavement test. Both the raw data and the data from the Gauss-Newton model are provided. Figure 69 graphically shows the rut depths in the asphalt pavement layer, including confidence bands based on $\pm 2\sigma$ for the pavement tests at 58 °C. Figure 70 shows the rut depths in the asphalt pavement layer for the mixtures with unmodified binders at all pavement test temperatures. Figure 71 shows the rut depths in the asphalt pavement layer for the mixtures with modified binders at all pavement test temperatures.

2. Downward Only Rut Depth vs. Peak-to-Valley Rut Depth

The downward only rut depths using the survey rod and level and the peak-to-valley rut depths from the transverse profiles were compared to determine if they would provide the same conclusions regarding the relative rutting performances of the asphalt pavement layers. The downward only rut depth is the rut depth based on the original surface elevation of the pavement. The peak-to-valley rut depth is the rut depth that includes any uplift of mixture outside the wheelpath. The transverse profile data were extensive. However, these profiles alone could not be used to determine the rutting performances of the various asphalt mixtures because of the variable amount of rutting in the crushed aggregate base layer from test to test. The asphalt mixtures were compared using the data from the rod and level technique. These data were measured at only three locations. The usefulness of the transverse profiles was also diminished by the computer program used to obtain and store the data. Some of the profiles were not usable because of hardware and software problems.

The transverse profiles for each ALF test site were measured at eight stations during each distress survey. The profile was measured five times at each station and the data averaged. For each of the eight average profiles, the minimum value was considered the valley. The average of the two maximum values on each side of the wheelpath was considered the peak. Six of the eight profiles were used in the analysis. The profiles from the first and eighth stations were not used because these stations were not close to the pins used by the rod and level technique. The average transverse profiles for 14 test sites are shown in figures 72 to 85. The unit for the transverse points in these figures is inches, where 1 inch equals 25.4 mm.

Table 120 provides the wheel passes at total rut depth of 20 mm for the 14 test sites. The total rut depth is the rut depth from all pavement layers. The rankings provided by the two techniques are not identical, but they are close. The two sets of wheel passes provided an r^2 of 0.90. Table 120 shows that the number of wheel passes for lane 7, site 1 was higher using the peak-to-valley rut depth (10,650 vs. 11,030). This lane contained the Styrelf surface mixture. The wheel passes for the peak-to-valley rut depth should always be equal to or lower than the wheel passes for the downward only rut

depth. This discrepancy was attributed to the difference in the number of survey locations: three locations were used for the rod and level technique while six locations were used for the transverse profiles. Based on this finding, it is recommended that a minimum of six locations be used for the rod and level technique in future studies.

The two methods provided wheel passes for lane 5, site 1 that were not close to each other (6,070 vs. 1,910). This lane contained the AC-10 (PG 65) surface mixture. Differences in how the peaks developed in relationship to the valley was found to be the main reason for this. For example, figure 80 shows that there was a sharp increase in the heights of the peaks around 5,000 wheel passes, especially for the peak on the right side of the wheelpath. A reason for why this pavement deformed differently than the other pavements could not be established.

Figures 72, 73, 74, 76, and 77 show that the amount of uplift outside the wheelpath was very low for the pavements with the modified binders, even though the percent rut depth from viscous flow, which does not include the rut depth from densification, was significant in all five tests. The percent rut depth from viscous flow ranged from 45 to 75 percent. As expected, this percentage increased as the susceptibilities of the mixtures to rutting increased. Another observation was that when an asphalt pavement layer rutted quickly, the uplift outside the wheelpath started to occur at less than 100 ALF wheel passes. An example of this is shown in figure 85. This indicates that rutting from viscous flow and densification occurred at the same time.

Table 121 shows the wheel passes that provided a rut depth of 20 mm in the asphalt pavement layer. The amount of rutting in the lower layers was subtracted from the total rut depth provided by both the rod and level technique and the transverse profiles. The rutting in the lower layers was provided by the rod and level technique. The wheel passes were dissimilar for the three best performing pavements. The relationships between rut depth and wheel passes were relatively flat for these mixture at a rut depth of 20 mm. This meant that the error in the number of wheel passes was potentially very large. The two sets of wheel passes provided an r^2 of 0.96 without these three mixtures. The rankings also differed for Lane 5, site 1, containing the AC-10 (PG 65) surface mixture (21,720 vs. 3,780).

Table 122 shows the data for the Novophalt and Styrelf pavement tests at 58 and 70 °C. The Novophalt surface mixture performed better than the Styrelf surface mixture using both the downward only and the peak-to-valley rut depths. Therefore, the discrepancy between $G^*/\sin\delta$ and ALF pavement rutting performance was not related to the type of rut depth measurement.

The eight transverse profiles also provide longitudinal profiles with a distance of 1.2 m between the points. These data are not included in this report. The amount of variability in the longitudinal direction and the changes in this variability with wheel passes indicated that at least six locations should be used for the rod and level technique.

Table 106. Rut depth, lane 5 site 4 at 46 °C.

Passes	AC-10			
	Asphalt Layer, mm		Total, mm	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
10	1.8	3.1	1.8	2.6
100	4.1	4.9	4.2	4.9
500	6.5	6.9	6.8	7.7
1000	7.6	8.0	8.1	9.4
5000	11.7	11.1	15.0	14.8
10000	13.5	12.9	18.0	18.0
15000	14.5	14.0	20.2	20.1
25000	16.3	15.6	24.5	23.3
40000	18.1	17.2	27.9	26.5
50000	18.7	18.0	29.7	28.3
75000	19.2	19.6	31.8	31.7
100000	19.9	20.8	33.8	34.4
125000	20.8	21.8	34.6	36.6

Table 107. Rut depth, lane 3 site 3 at 46 °C.

Passes	AC-5			
	Asphalt Layer, mm		Total, mm	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
10	1.8	4.0	2.5	4.7
100	4.6	5.8	5.9	7.4
500	7.3	7.5	9.8	10.1
1000	8.4	8.4	11.3	11.5
5000	11.8	11.0	16.8	15.8
10000	13.3	12.3	19.4	18.1
15000	13.9	13.2	20.4	19.6
25000	15.3	14.3	22.7	21.7
50000	16.6	16.0	25.5	24.8
75000	17.4	17.1	26.6	26.9
100000	18.1	18.0	28.2	28.5
125000	18.6	18.6	29.4	29.7
150000	19.1	19.2	30.8	30.8
175000	19.4	19.7	31.8	31.8
200000	19.5	20.1	31.9	32.6
225000	20.1	20.5	33.2	33.4
250000	20.2	20.9	33.7	34.1

Table 108. Rut depth, lane 5 site 1 at 52 °C.

Passes	AC-10			
	Asphalt Layer, mm		Total, mm	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
1	0.1	1.0	0.1	0.8
10	1.3	2.0	1.4	1.9
100	4.3	4.0	4.7	4.5
500	7.5	6.5	8.7	8.0
5000	12.1	12.9	17.7	18.6
10000	16.2	15.9	24.1	24.0
15000	18.2	17.9	28.2	27.8
20000	19.7	19.5	30.7	30.9
25000	20.6	20.9	33.5	33.5

Table 109. Rut depth, lane 6 site 1 at 52 °C.

Passes	AC-20			
	Asphalt Layer, mm		Total, mm	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
1	0.1	2.0	0.2	2.0
10	2.0	3.2	2.2	3.4
100	4.9	4.9	5.3	5.8
500	6.1	6.7	7.7	8.5
5000	10.3	10.3	14.4	14.6
10000	12.6	11.8	18.2	17.2
15000	13.8	12.7	19.7	18.9
25000	14.6	14.0	21.9	21.3
40000	16.2	15.3	25.3	23.8
65000	17.1	16.8	27.7	26.7
90000	18.0	17.9	29.4	28.9
115000	19.0	18.8	31.1	30.6
140000	18.9	19.5	32.3	32.0
158300	19.3	19.9	32.4	33.0
165000	19.3	20.1	32.7	33.3
190000	20.1	20.6	34.1	34.4
215000	20.6	21.1	34.7	35.4

Table 110. Rut depth, lane 9 site 3 at 52 °C.

Passes	AC -5			
	Asphalt Layer, mm		Total, mm	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
10	5.1	4.1	4.9	3.2
100	7.8	8.2	8.2	7.9
1000	15.7	16.4	17.7	19.6
2500	21.7	21.6	29.0	28.2
3500	24.1	23.8	32.4	32.2

Table 111. Asphalt layer rut depth at 58° C, mm, raw data.

Passes	Lane number																
	9				5	10					7	8	11				12
	AC-5				AC-10	AC-20					Styrelf	Novophalt	AC-5 B				AC-20 B
	S1	S2	Avg.	S4	S2	S1	S2	Avg.	S3	S4	S2	S2	S1	S2	Avg.	S3	S1
0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0		0.0
1	0.2	0.2	0.2		0.2	1.9	0.6	1.3			0.2	0.2	-0.2	0.3	0.1		0.5
10	4.3	3.0	3.7	4.8	2.9	4.6	2.8	3.7	2.3	1.7	1.5	0.7	2.1	2.4	2.2	2.6	3.4
100	10.1	9.6	9.8	10.0	6.3	8.8	8.0	8.4	5.5	4.6	3.5	2.2	5.4	5.7	5.6	4.6	5.8
500	16.0	14.5	15.2	19.4	11.9	12.3	13.8	13.1	7.8	7.6	5.6	3.4	8.8	10.1	9.4	7.6	9.3
900				22.4													
1000	21.1	9.8	15.4		14.7	14.2	15.5	14.9	9.9	9.3	6.3	2.9	9.3	10.6	10.0	8.6	10.6
1500	23.5				NA												
2000	30.9	22.3	26.6		20.7									13.4			
3000					23.8	19.8							11.9	15.2	13.6		10.6
4000					27.4									16.9			
5000						27.2	27.4	27.3	16.5	14.0	7.1	2.9	13.6	18.1	16.0	11.3	14.4
7000						24.9							15.7				
10000						27.1	36.3	31.7	19.3	19.6	12.0	4.4	17.7	22.3	20.0	13.5	15.2
15000									19.9	20.7			20.8	23.6	22.2		
20000									22.7	22.3			21.6	24.1	22.9	16.7	
21000														25.0			
22000														24.6			
23000														24.3			
24000														24.9			
25000											14.3		23.4				
25100																	18.2
35500												5.8					
50000											16.6					19.0	20.6
60000																19.5	20.9
75000											17.0					20.2	21.2
82000																20.3	
85500												7.7					21.9
100000											16.9						
110500												7.6					
125000											17.6						22.9
135500												8.5					
150000											17.9						23.5
160500												8.9					
175000											18.2						
176735																	23.5
185500												9.2					
200000											18.1						24.1
208805												9.2					

Avg. = The average of sites 1 and 2.

Table 112. Asphalt layer rut depth at 58° C, mm, model data.

Passes	Lane Number																
	9				5	10					7	8	11				12
	AC-5				AC-10	AC-20					Styrelf	Novophalt	AC-5 B				AC-20 B
	S1	S2	Avg.	S4	S2	S1	S2	Avg.	S3	S4	S2	S2	S1	S2	Avg.	S3	S1
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	1.4	1.1	1.3	2.1	0.9	2.4	1.9	2.2	1.5	1.1	1.5	0.6	1.2	1.9	1.6	2.0	2.9
10	3.5	3.3	3.4	4.6	2.4	4.4	3.8	4.1	2.8	2.3	2.5	1.0	2.4	3.5	3.0	3.2	4.4
100	8.7	9.4	9.1	10.5	6.1	8.2	7.5	7.9	5.3	4.5	4.0	1.6	4.7	6.3	5.6	5.2	6.5
500	16.5	19.6	18.1	18.5	11.6	12.7	12.1	12.5	8.3	7.4	5.6	2.4	7.5	9.5	8.6	7.3	8.7
1000	21.7	27.0	24.3	23.7	15.4	15.3	14.9	15.2	10.0	9.1	6.5	2.8	9.1	11.4	10.4	8.5	9.8
1500	25.5	32.5	28.9	27.4	18.2	17.0	16.8	17.0	11.1	10.3	7.1	3.0	10.3	12.6	11.6	9.2	10.5
2000	28.6	37.1	32.7	30.3	20.4	18.4	18.3	18.4	12.1	11.3	7.5	3.2	11.2	13.6	12.6	9.8	11.1
2730	32.4	42.8	37.4	33.8	23.2	20.0	20.0	20.1	13.1	12.4	8.0	3.5	12.2	14.7	13.7	10.4	11.7
3000	33.6	44.7	38.9	35.0	24.1	20.5	20.6	20.7	13.5	12.8	8.2	3.5	12.6	15.1	14.1	10.7	11.9
4000	37.7	51.0	44.1	38.7	27.1	22.1	22.4	22.4	14.6	13.9	8.7	3.8	13.6	16.2	15.2	11.3	12.5
5000	41.2	56.5	48.5	41.9	29.6	23.5	23.9	23.9	15.5	14.9	9.1	4.0	14.6	17.2	16.2	11.8	13.0
7000	47.1	65.9	56.0	47.2	34.0	25.7	26.4	26.2	17.0	16.5	9.7	4.3	16.0	18.8	17.7	12.7	13.8
10000	54.3	77.6	65.2	53.6	39.3	28.3	29.4	29.0	18.7	18.4	10.5	4.6	17.8	20.6	19.6	13.7	14.7
15000	63.8	93.5	77.6	61.9	46.3	31.5	33.1	32.5	20.9	20.8	11.4	5.1	20.0	22.8	21.9	14.9	15.8
20000	71.5	106.7	87.8	68.5	52.0	34.1	36.1	35.3	22.6	22.7	12.1	5.4	21.7	24.6	23.7	15.8	16.6
21000	72.9	109.1	89.7	69.7	53.1	34.5	36.6	35.8	22.9	23.0	12.3	5.5	22.0	24.9	24.0	16.0	16.7
22000	74.3	111.4	91.5	70.8	54.1	34.9	37.1	36.2	23.2	23.4	12.4	5.6	22.3	25.2	24.3	16.1	16.9
23000	75.6	113.7	93.2	72.0	55.0	35.4	37.6	36.7	23.5	23.7	12.5	5.6	22.6	25.5	24.6	16.3	17.0
24000	76.9	116.0	94.9	73.1	56.0	35.8	38.1	37.1	23.8	24.0	12.6	5.7	22.9	25.8	24.9	16.4	17.1
25000	78.2	118.2	96.6	74.1	56.9	36.2	38.5	37.6	24.1	24.3	12.7	5.7	23.2	26.0	25.1	16.6	17.3
25100	78.3	118.4	96.8	74.2	57.0	36.2	38.6	37.6	24.1	24.3	12.7	5.7	23.2	26.1	25.2	16.6	17.3
35500	89.9	138.8	112.3	83.9	65.7	39.7	42.8	41.5	26.5	27.0	13.7	6.2	25.7	28.5	27.7	17.8	18.4
50000	103.0	162.4	130.0	94.7	75.5	43.6	47.3	45.7	29.1	30.0	14.7	6.7	28.3	31.1	30.4	19.2	19.5
60000	110.8	176.6	140.6	101.1	81.2	45.7	50.0	48.1	30.6	31.7	15.2	7.0	29.9	32.6	31.9	19.9	20.1
75000	121.1	195.7	154.7	109.4	89.0	48.5	53.4	51.2	32.5	33.9	16.0	7.3	31.8	34.6	34.0	20.9	21.0
85500	127.5	207.8	163.6	114.6	93.8	50.3	55.5	53.1	33.7	35.3	16.4	7.6	33.1	35.8	35.2	21.4	21.4
100000	135.7	223.3	175.0	121.1	100.0	52.4	58.1	55.5	35.2	37.0	17.0	7.8	34.6	37.2	36.7	22.1	22.0
110500	141.2	233.7	182.7	125.5	104.1	53.9	59.8	57.1	36.1	38.1	17.3	8.0	35.6	38.2	37.7	22.6	22.4
125000	148.3	247.4	192.6	131.1	109.5	55.7	62.1	59.1	37.4	39.6	17.8	8.2	36.9	39.4	39.0	23.2	22.9
135500	153.2	256.7	199.3	134.9	113.1	56.9	63.6	60.5	38.2	40.6	18.1	8.4	37.8	40.3	39.9	23.6	23.3
150000	159.5	269.0	208.2	139.8	117.9	58.5	65.5	62.3	39.3	41.8	18.4	8.6	38.9	41.3	41.0	24.1	23.7
160500	163.9	277.4	214.3	143.2	121.1	59.5	66.8	63.5	40.0	42.7	18.7	8.7	39.7	42.1	41.8	24.4	24.0
175000	169.6	288.7	222.4	147.6	125.5	60.9	68.6	65.0	41.0	43.9	19.0	8.9	40.7	43.0	42.8	24.9	24.3
176735	170.3	290.0	223.4	148.2	126.0	61.1	68.8	65.2	41.1	44.0	19.1	8.9	40.8	43.1	42.9	24.9	24.4
185500	173.6	296.5	228.0	150.7	128.5	61.9	69.8	66.1	41.6	44.6	19.3	9.0	41.4	43.7	43.5	25.2	24.6
200000	178.9	306.9	235.5	154.8	132.5	63.1	71.3	67.5	42.5	45.7	19.6	9.2	42.3	44.5	44.4	25.6	24.9
208805	182.0	313.0	239.9	157.2	134.8	63.9	72.3	68.3	43.0	46.3	19.8	9.3	42.8	45.0	44.9	25.8	25.1
1000000	339.4	642.5	469.4	273.7	254.6	97.2	114.9	106.3	66.0	74.4	27.4	13.2	67.3	67.5	69.0	35.8	33.1

Avg. = The average of sites 1 and 2.

Table 113. Total rut depth at 58 °C, mm, raw data.

Passes	Lane Number																
	9				5	10					7	8	11				12
	AC-5				AC-10	AC-20					Styrelf	Novophalt	AC-5 B				AC-20 B
	S1	S2	Avg.	S4	S2	S1	S2	Avg.	S3	S4	S2	S2	S1	S2	Avg.	S3	S1
0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0		0.0
1	0.2	0.2	0.2		0.3	2.0	0.7	1.4			0.3	0.3	0.1	0.5	0.3		0.6
10	4.3	4.1	4.2	5.9	3.1	4.8	2.9	3.9	3.1	1.7	1.8	2.4	2.3	2.6	2.5	3.0	3.6
100	10.5	10.8	10.6	11.5	7.2	8.9	8.1	8.5	6.5	4.6	3.8	5.1	5.7	6.0	5.8	5.0	6.3
500	18.2	21.6	19.9	21.8	13.8	13.5	14.0	13.8	9.0	8.0	6.8	7.5	9.0	10.4	9.7	9.2	9.7
900				25.1													
1000	26.0	30.3	28.2		18.8	16.6	16.2	16.4	11.7	10.5	8.2	9.6	11.3	11.4	11.3	10.2	11.0
1500	31.6																
2000	41.5	40.1	40.8		25.5									14.2			
3000					29.8	22.7							16.3	16.5	16.4		11.0
4000					34.0									18.3			
5000						26.4	28.0	27.2	19.5	16.8	11.0	11.0	18.6	19.5	19.1	14.4	15.7
7000						29.2							21.4				
10000						32.8	36.9	34.8	23.7	22.6	18.1	15.2	23.9	24.4	24.1	18.0	17.3
15000									24.7	23.7			27.6	28.4	28.0		
20000									28.0	27.5			29.2	32.2		21.1	
21000														33.8			
22000														34.6			
23000														34.8			
24000														35.7			
25000											22.8	0.0	31.3				
25100																	21.0
35500												18.6					
50000											26.4					25.3	24.4
60000																26.3	25.3
75000											28.2					27.8	26.1
82000																27.8	
85500												22.3					27.2
100000											29.8						
110500												26.6					
125000											30.7						28.8
135500												29.1					
150000											31.2						29.7
160500												27.7					
175000											32.0						
176735																	30.0
185500												28.0					
200000											32.3						30.7
208805												29.3					

Avg. = The average of sites 1 and 2.

Table 114. Total rut depth at 58 °C, mm, model data.

Passes	Lane Number																
	9				5	10					7	8	11				12
	AC-5				AC-10	AC-20					Styrelf	Novophalt	AC-5 B				AC-20 B
	S1	S2	Avg.	S4	S2	S1	S2	Avg.	S3	S4	S2	S2	S1	S2	Avg.	S3	S1
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.8	1.4	1.1	2.6	1.0	2.3	1.6	1.9	1.7	1.0	1.6	1.6	1.2	1.0	1.1	2.0	2.5
10	2.6	3.9	3.3	5.6	2.7	4.4	3.4	4.0	3.2	2.2	2.8	2.8	2.6	2.2	2.4	3.5	4.0
100	8.4	10.7	9.9	12.2	7.1	8.6	7.6	8.2	6.2	4.7	5.1	4.8	5.4	5.0	5.2	6.0	6.5
500	19.1	21.9	21.2	21.0	14.0	13.7	13.1	13.6	9.8	8.0	7.6	7.1	9.1	8.8	9.0	8.7	9.1
1000	27.2	29.8	29.6	26.5	18.8	16.7	16.6	17.0	11.9	10.1	9.1	8.4	11.3	11.3	11.4	10.2	10.5
1500	33.5	35.7	35.8	30.4	22.3	18.8	19.1	19.3	13.3	11.5	10.0	9.2	12.9	13.0	13.1	11.2	11.4
2000	38.7	40.5	41.1	33.5	25.2	20.4	21.1	21.1	14.5	12.7	10.8	9.9	14.2	14.4	14.4	12.0	12.1
2730	45.4	46.5	47.7	37.2	28.7	22.3	23.5	23.3	15.8	14.0	11.7	10.6	15.6	16.1	16.0	12.9	12.9
3000	47.6	48.5	49.9	38.4	29.9	23.0	24.2	24.0	16.3	14.5	11.9	10.9	16.1	16.7	16.5	13.2	13.2
4000	55.1	55.1	57.2	42.3	33.8	25.0	26.7	26.3	17.6	15.9	12.8	11.6	17.7	18.5	18.2	14.1	14.0
5000	61.8	60.8	63.6	45.6	37.1	26.6	28.8	28.2	18.8	17.2	13.6	12.2	19.0	20.0	19.6	14.9	14.7
7000	73.3	70.6	74.6	51.1	42.8	29.3	32.4	31.3	20.7	19.2	14.8	13.3	21.1	22.5	22.0	16.1	15.7
10000	87.9	82.6	88.4	57.6	49.8	32.5	36.6	35.1	22.9	21.6	16.2	14.4	23.7	25.5	24.8	17.5	17.0
15000	108.0	98.9	107.2	66.1	59.2	36.6	42.0	39.9	25.7	24.7	17.9	15.9	27.0	29.5	28.4	19.2	18.5
20000	125.1	112.3	123.0	72.8	66.8	39.7	46.3	43.7	27.9	27.2	19.3	17.0	29.6	32.6	31.3	20.5	19.6
21000	128.2	114.8	125.9	74.0	68.2	40.3	47.1	44.3	28.3	27.6	19.5	17.2	30.0	33.2	31.8	20.7	19.8
22000	131.3	117.2	128.7	75.2	69.6	40.8	47.9	45.0	28.7	28.1	19.7	17.4	30.5	33.8	32.3	21.0	20.0
23000	134.3	119.5	131.4	76.3	70.9	41.4	48.6	45.6	29.1	28.5	20.0	17.6	30.9	34.3	32.8	21.2	20.2
24000	137.2	121.8	134.1	77.5	72.2	41.9	49.3	46.2	29.4	28.9	20.2	17.8	31.3	34.8	33.3	21.4	20.3
25000	140.1	124.0	136.8	78.5	73.5	42.4	50.0	46.8	29.8	29.3	20.4	17.9	31.8	35.3	33.7	21.6	20.5
25100	140.4	124.2	137.0	78.6	73.6	42.4	50.1	46.9	29.8	29.3	20.4	18.0	31.8	35.4	33.8	21.6	20.5
35500	167.5	144.9	161.6	88.4	85.2	46.9	56.4	52.3	32.9	32.9	22.3	19.5	35.5	40.0	38.0	23.4	22.1
50000	199.4	168.6	190.2	99.2	98.6	51.8	63.4	58.3	36.3	36.9	24.3	21.1	39.6	45.2	42.6	25.4	23.7
60000	218.8	182.8	207.5	105.5	106.5	54.6	67.5	61.7	38.2	39.2	25.4	22.1	42.0	48.2	45.3	26.5	24.6
75000	245.1	201.8	230.7	113.8	117.0	58.2	72.8	66.2	40.7	42.2	26.9	23.3	45.1	52.1	48.8	27.9	25.8
85500	262.0	213.8	245.6	118.9	123.7	60.5	76.2	69.0	42.3	44.0	27.8	24.0	47.1	54.6	51.0	28.8	26.5
100000	283.8	229.2	264.6	125.4	132.2	63.3	80.4	72.5	44.2	46.4	28.9	24.9	49.5	57.7	53.8	29.8	27.4
110500	298.6	239.6	277.5	129.7	137.9	65.1	83.2	74.9	45.5	47.9	29.7	25.5	51.1	59.8	55.7	30.5	28.0
125000	317.9	253.0	294.2	135.2	145.3	67.5	86.7	77.8	47.1	50.0	30.6	26.3	53.1	62.4	58.0	31.4	28.7
135500	331.2	262.2	305.8	139.0	150.4	69.1	89.2	79.8	48.2	51.3	31.2	26.8	54.5	64.3	59.6	32.0	29.2
150000	348.8	274.3	320.9	143.8	157.0	71.1	92.3	82.4	49.6	53.1	32.0	27.4	56.3	66.6	61.7	32.8	29.8
160500	361.0	282.6	331.4	147.1	161.6	72.5	94.5	84.2	50.6	54.3	32.6	27.9	57.6	68.2	63.1	33.3	30.2
175000	377.3	293.7	345.4	151.5	167.6	74.4	97.3	86.5	51.8	55.9	33.3	28.4	59.2	70.3	65.0	34.0	30.8
176735	379.2	295.0	347.0	152.0	168.3	74.6	97.6	86.8	52.0	56.0	33.4	28.5	59.4	70.6	65.2	34.1	30.8
185500	388.6	301.4	355.1	154.5	171.8	75.6	99.3	88.2	52.7	56.9	33.8	28.8	60.3	71.8	66.3	34.4	31.1
200000	403.8	311.6	368.0	158.5	177.4	77.3	101.9	90.3	53.8	58.4	34.4	29.4	61.8	73.8	68.0	35.1	31.6
208805	412.8	317.6	375.6	160.8	180.7	78.3	103.4	91.5	54.5	59.2	34.8	29.7	62.6	74.9	69.0	35.4	31.9
1000000	916.1	635.6	791.7	272.9	351.0	123.1	176.6	150.0	85.2	99.6	51.7	43.0	103.4	130.4	116.9	51.0	44.2

Avg. = The average of sites 1 and 2.

Table 115. Rut depth, lane 6 site 2 at 64 °C.

Passes	AC-20			
	Asphalt Layer, mm		Total, mm	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
10	2.9	2.9	3.0	3.9
30	3.9	4.0	5.5	5.4
100	5.3	5.7	7.5	7.8
300	7.4	7.9	10.8	10.8
1000	12.3	11.3	16.2	15.4
3000	16.4	15.6	22.3	21.4
4000	16.8	17.0	23.0	23.3
5000	17.5	18.1	24.2	24.9
6000	18.5	19.1	25.5	26.3
8000	21.2	20.8	29.1	28.6

Table 116. Asphalt layer rut depth at 70 °C, mm.

Passes	Lane Number			
	7		8	
	Styrelf		Novophalt	
	Site 1		Site 1	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
1	0.8	3.0	1.4	2.3
10	2.5	4.3	3.5	3.4
100	6.3	6.4	5.6	5.0
500	8.7	8.3	7.7	6.6
1000	10.1	9.3	8.2	7.4
5000	13.6	12.2	9.1	9.8
10000	14.9	13.7	10.7	11.0
25000	17.0	15.9	11.3	12.8
50000	18.3	17.9	14.0	14.4
75000	18.6	19.1	15.3	15.5
100000	19.1	20.1	16.2	16.2
125000	19.7	20.8	18.3	16.9

Table 117. Total rut depth at 70 °C, mm.

Passes	Lane number			
	7		8	
	Styrelf		Novophalt	
	Site 1		Site 1	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
1	0.9	2.8	1.5	1.6
10	3.1	4.5	3.7	2.8
100	7.1	7.4	6.4	5.0
500	10.5	10.4	8.8	7.3
1000	12.2	12.1	10.1	8.7
5000	17.9	17.0	12.5	12.8
10000	20.1	19.7	13.9	15.2
25000	25.1	24.0	15.7	19.0
50000	28.8	27.8	21.2	22.5
75000	30.3	30.3	24.6	24.8
100000	31.3	32.2	26.9	26.6
125000	32.8	33.8	31.1	28.1

Table 118. Asphalt layer rut depth at 76 °C, mm.

Passes	Lane Number			
	7		8	
	Styrelf		Novophalt	
	Site 1		Site 2	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
10	2.8	4.0	2.7	2.6
100	5.4	5.8	4.6	3.8
500	7.4	7.5	5.8	5.0
1000	9.7	8.4	6.7	5.6
5000	11.5	10.8	7.6	7.3
10000	12.6	12.1	8.2	8.2
25000	13.6	14.0	8.9	9.6
50000	15.6	15.6	9.6	10.8
75000	16.5	16.6	9.9	11.6
100000	16.9	17.4	11.7	12.2
125000	17.3	18.0	12.4	12.6
150000	18.3	18.6	12.6	13.0
175000	18.9	19.0	13.3	13.4
200000	19.9	19.4	13.5	13.7
225000	20.7	19.8	13.6	13.9
250000			14.1	14.2
275000			14.8	14.4
300000			14.8	14.6
325000			14.9	14.8
350000			15.1	15.0
375000			15.5	15.2
400000			15.6	15.4
425000			16.4	15.5
450000			15.6	15.7
475000			15.7	15.8
500000			15.4	16.0
525000			15.6	16.1
550000			16.4	16.2
575000			16.1	16.3
600000			16.8	16.5
625000			16.9	16.6
650000			17.1	16.7
675000			17.2	16.8
700000			17.0	16.9

Table 119. Total rut depth at 76 °C, mm.

Passes	Lane Number			
	7		8	
	Styrelf		Novophalt	
	Site 1		Site 1	
	Raw	Model	Raw	Model
0	0.0	0.0	0.0	0.0
10	3.8	4.1	3.6	1.8
100	7.8	6.9	6.1	3.4
500	10.6	9.9	8.0	5.3
1000	12.8	11.6	8.5	6.4
5000	16.7	16.7	11.2	10.1
10000	18.5	19.5	12.2	12.2
25000	22.5	24.0	14.6	15.8
50000	28.7	28.1	16.8	19.2
75000	30.0	30.8	19.0	21.5
100000	32.4	32.9	22.6	23.3
125000	34.4	34.6	24.3	24.8
150000	36.2	36.0	25.7	26.1
175000	37.9	37.3	26.3	27.3
200000	38.4	38.4	27.9	28.3
225000	40.0	39.5	29.2	29.3
250000			30.5	30.2
275000			31.4	31.0
300000			31.4	31.7
325000			32.8	32.5
350000			33.0	33.1
375000			34.0	33.8
400000			34.2	34.4
425000			35.4	35.0
450000			35.5	35.6
475000			35.6	36.1
500000			35.8	36.6
525000			36.6	37.1
550000			37.7	37.6
575000			38.1	38.1
600000			39.4	38.5
625000			39.5	39.0
650000			39.4	39.4
675000			40.0	39.8
700000			40.6	40.2

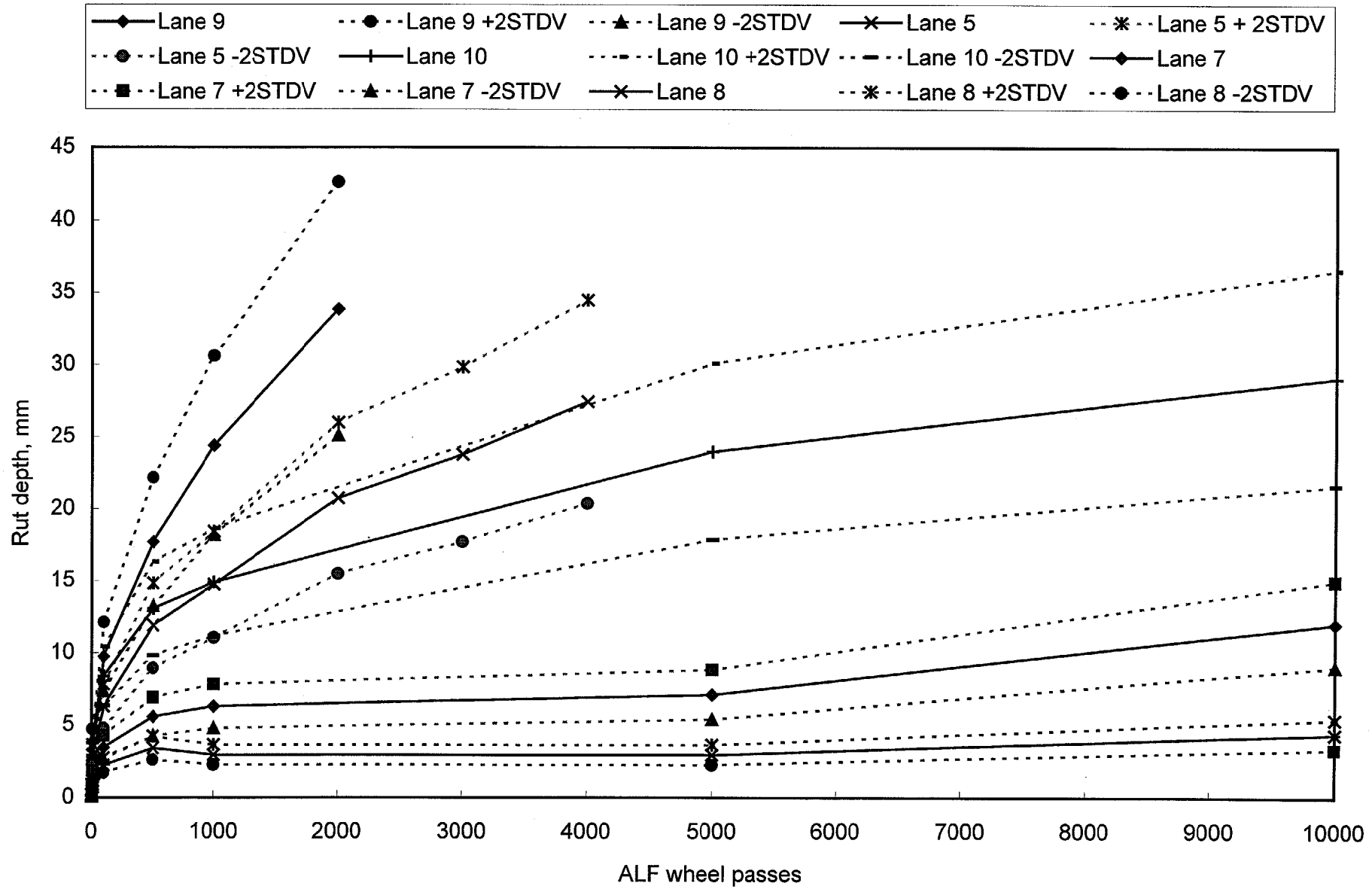

Figure 69. Rut depth ± two standard deviation (± 2STDV) at 58 °C.

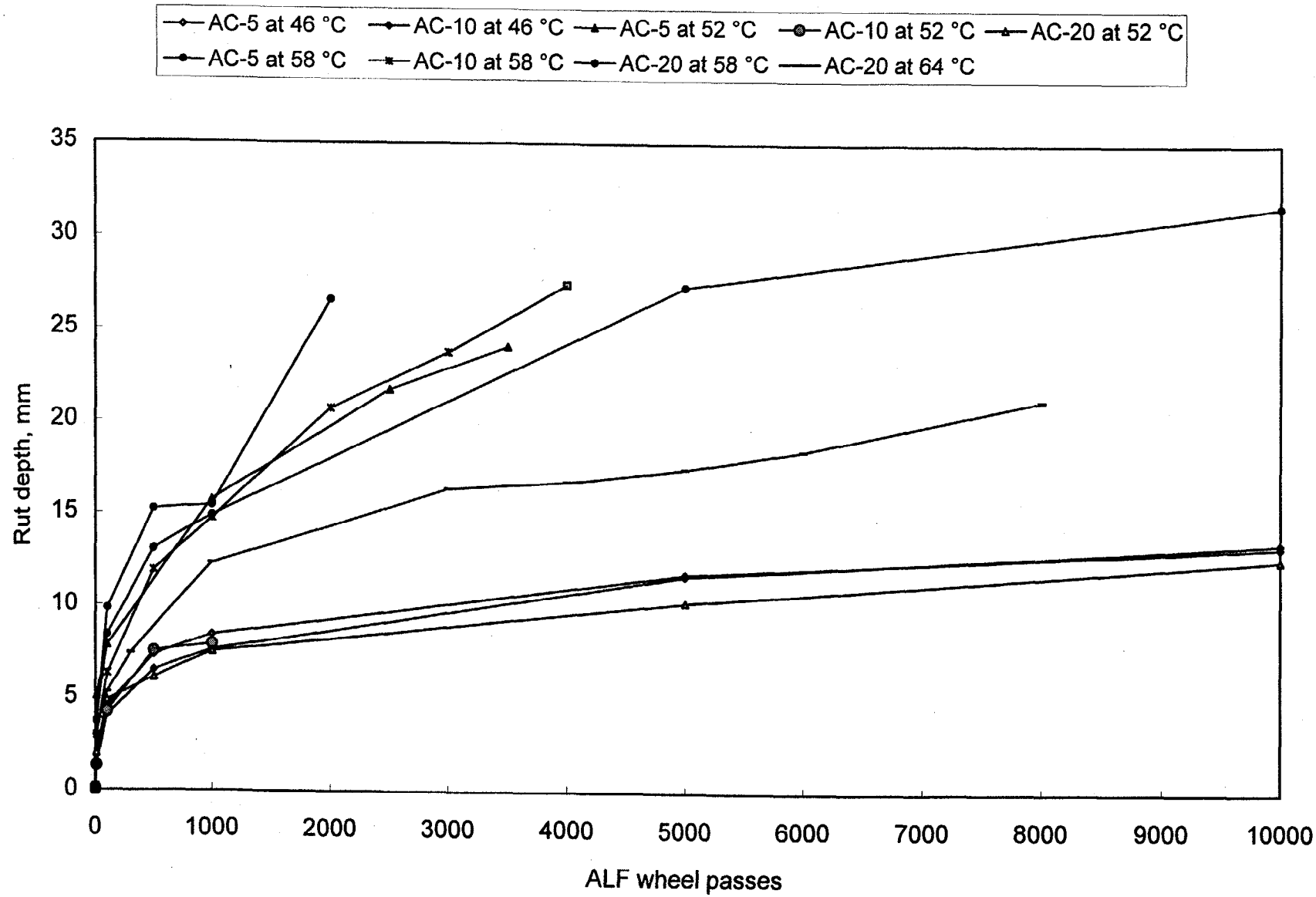

Figure 70. Measured rut depths in the asphalt pavement layer vs. ALF wheel passes.

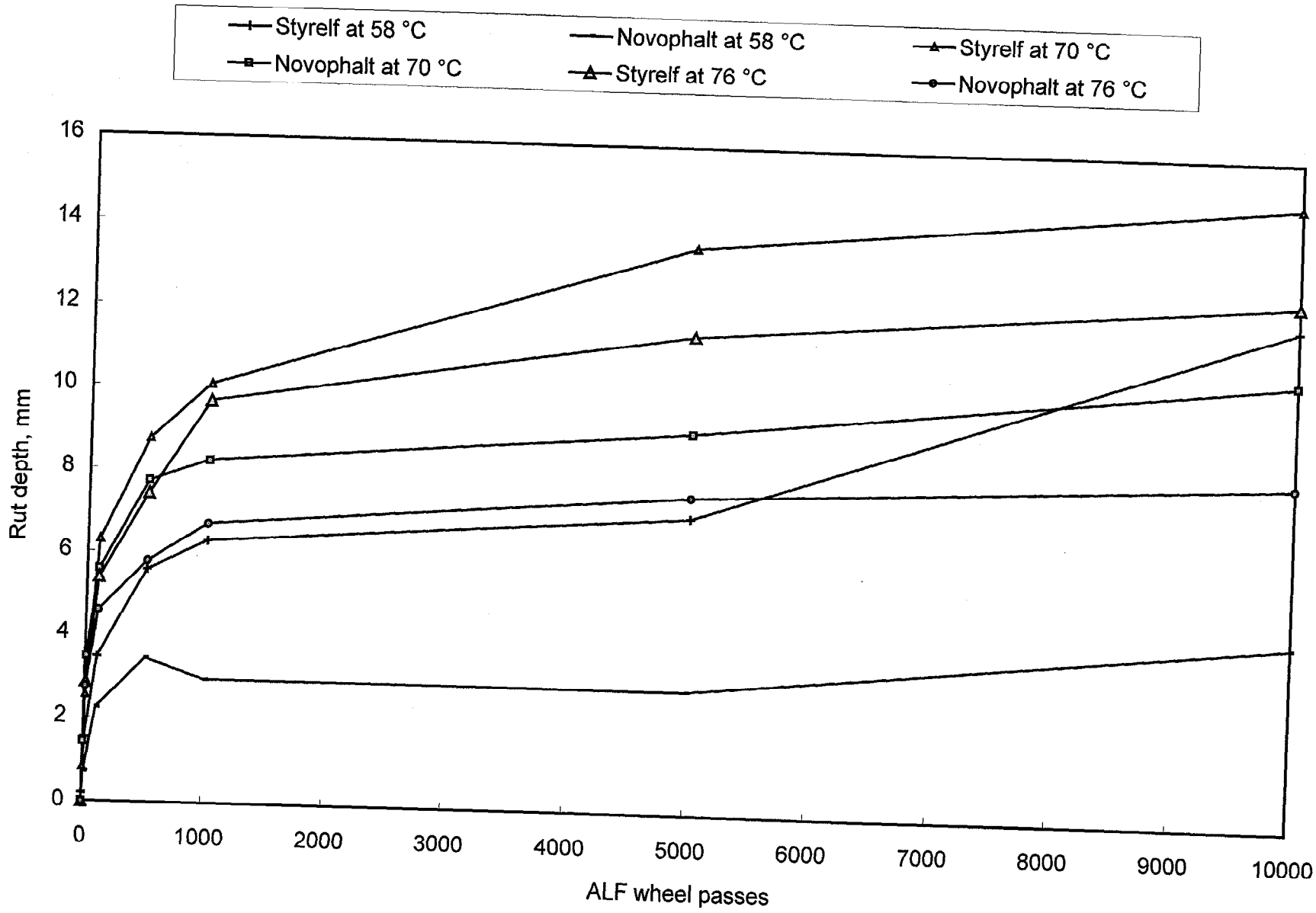

Figure 71. Measured rut depths in the asphalt pavement layer with modified binders vs. ALF wheel passes.

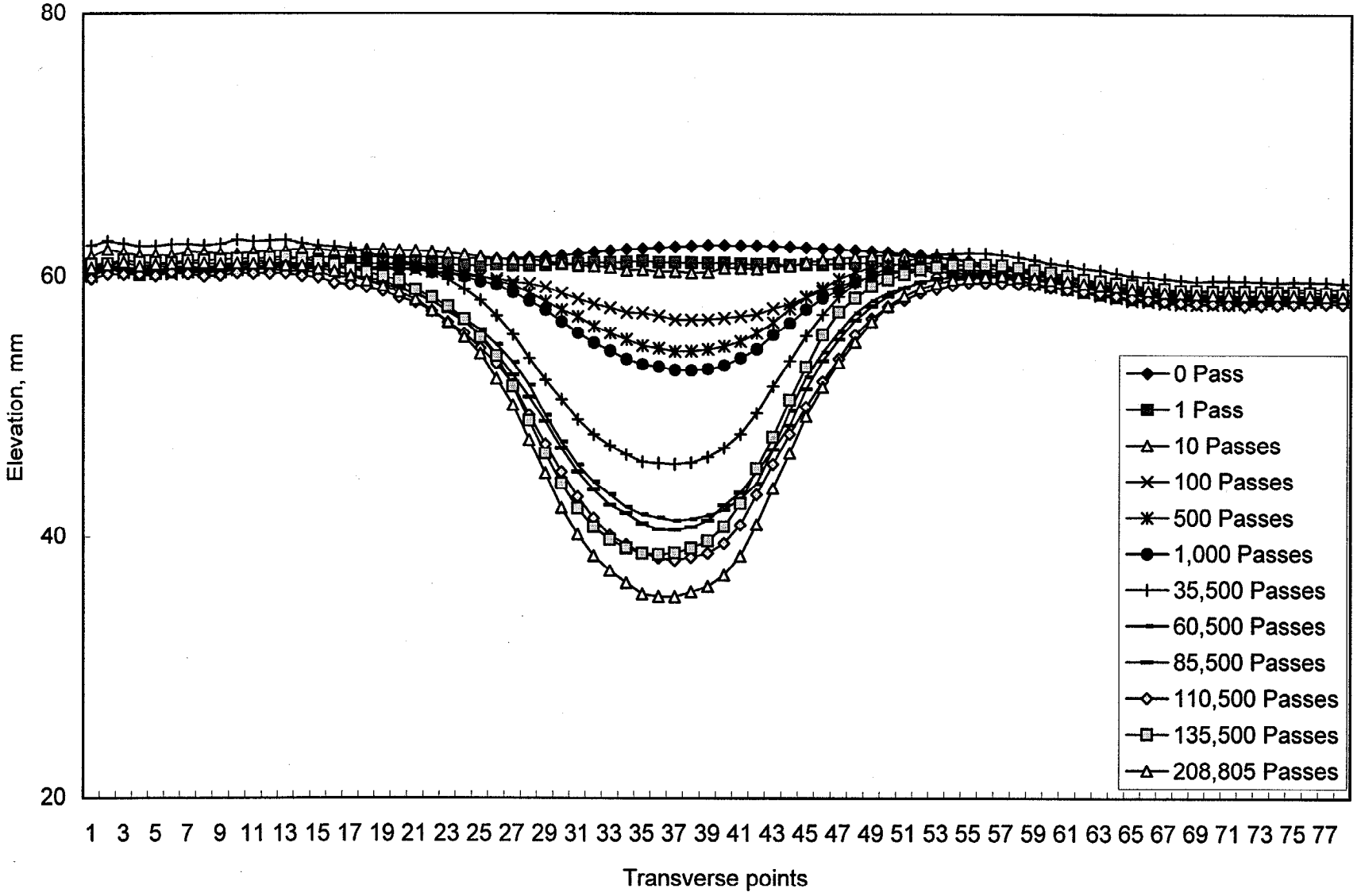

Figure 72. Transverse profiles for lane 8, site 2, Novophalt (PG 77) surface mixture at 58 °C.

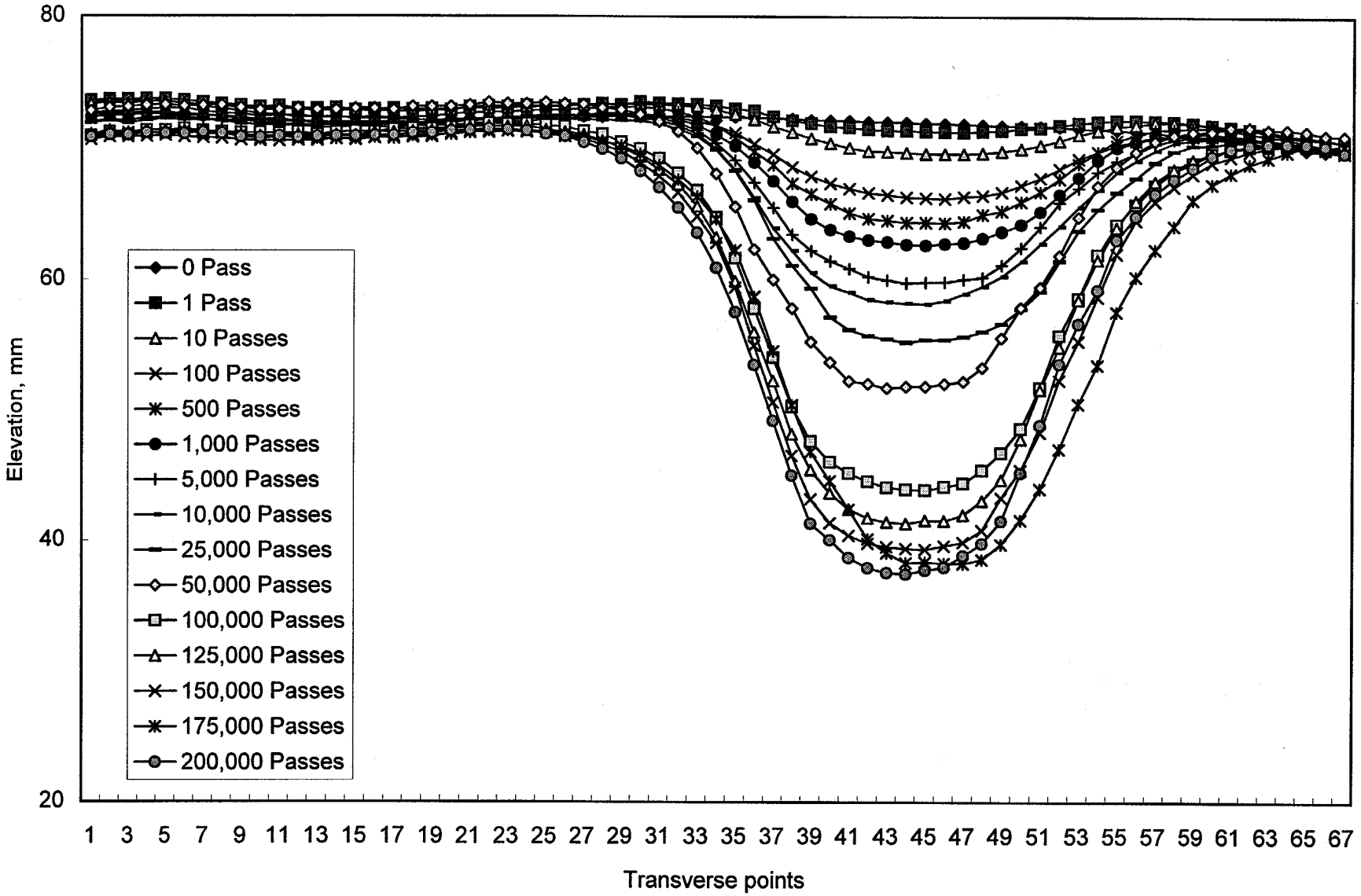

Figure 73. Transverse profiles for lane 8, site 1, Novophalt (PG 77) surface mixture at 70 °C.

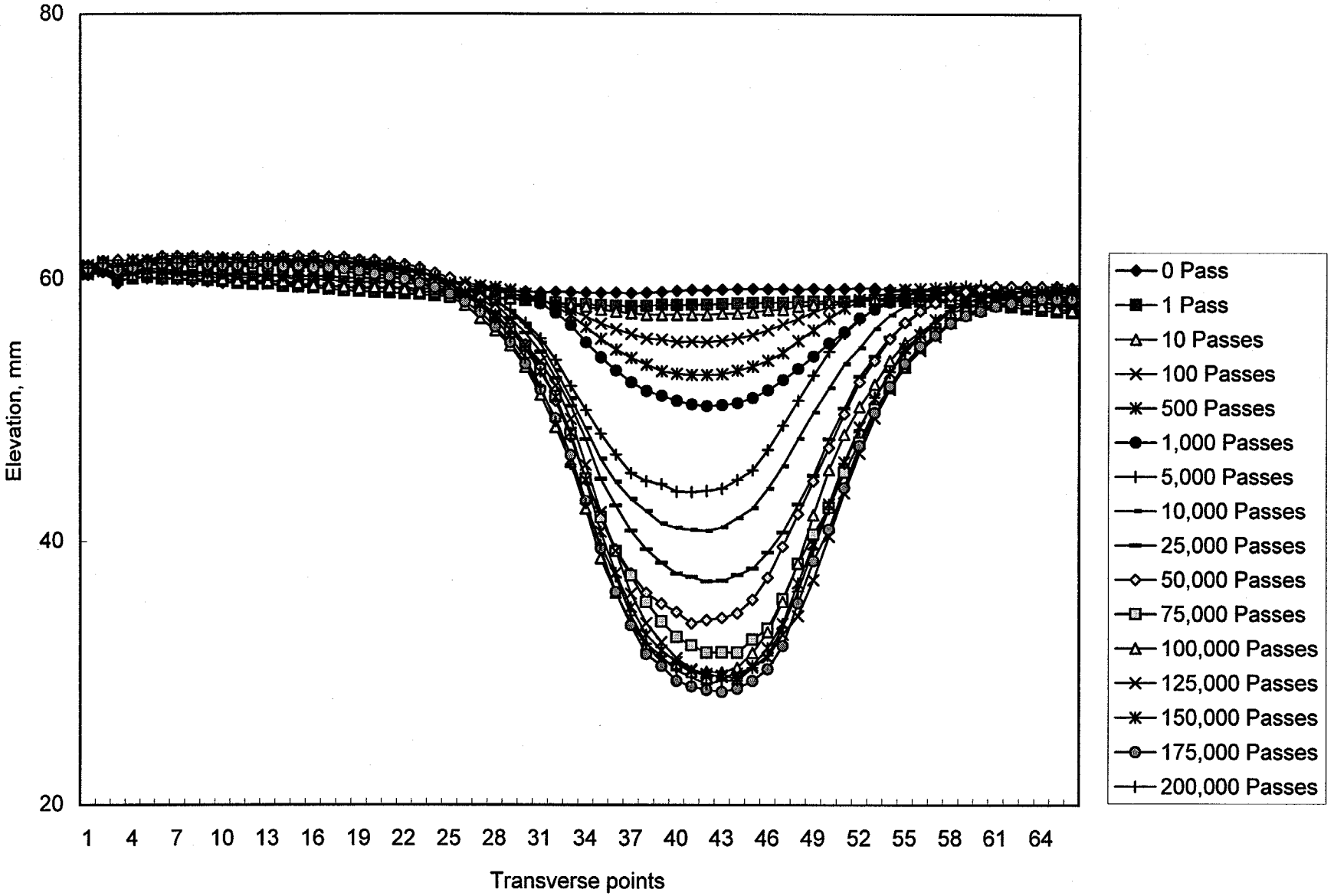

Figure 74. Transverse profiles for lane 7, site 2, Styrelf (PG 88) surface mixture at 58 °C.

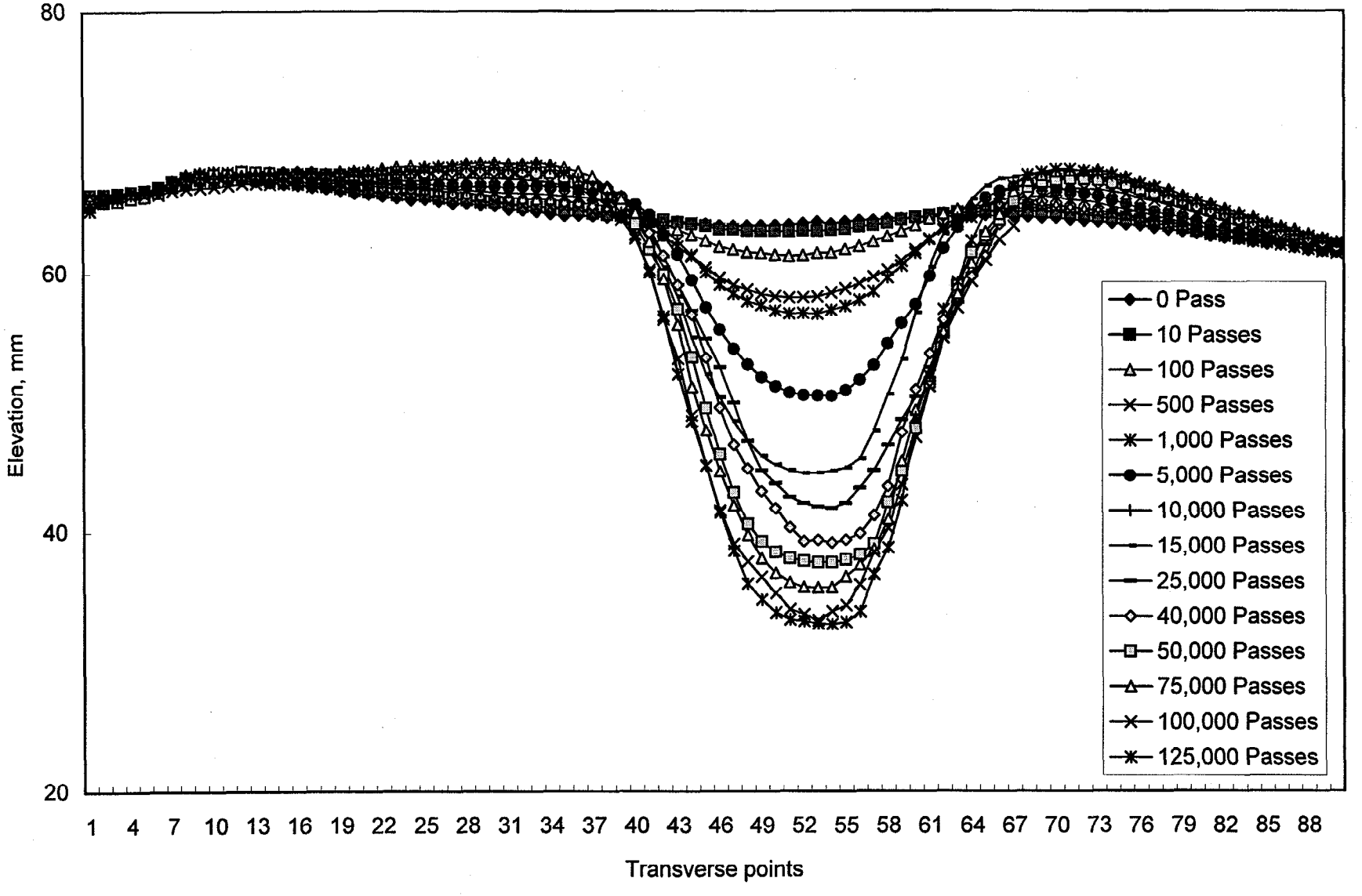

Figure 75. Transverse profiles for lane 5, site 4, AC-10 (PG 65) surface mixture at 46 °C.

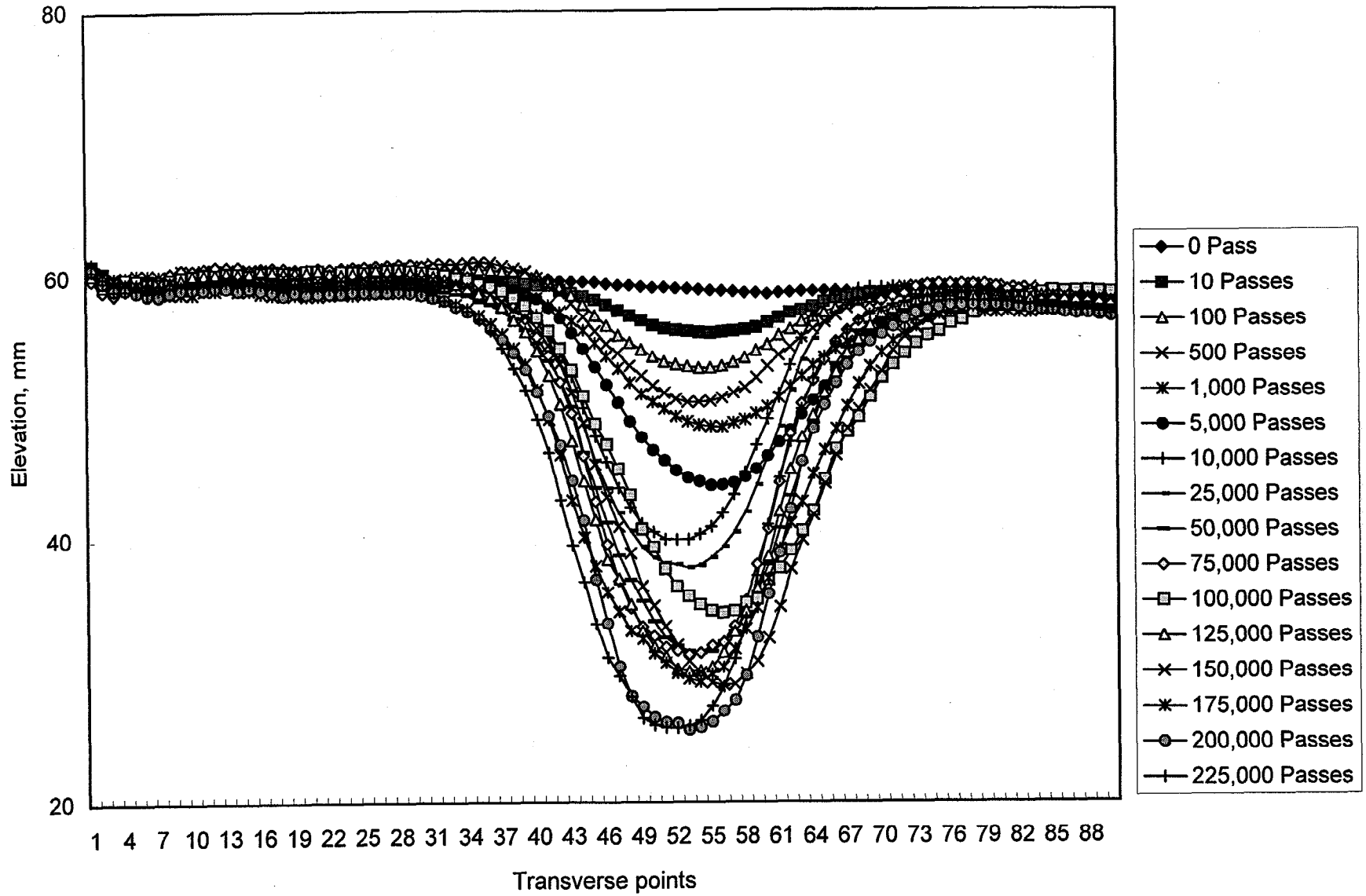

Figure 76. Transverse profiles for lane 7, site 3, Styrelf (PG 88) surface mixture at 76 °C.

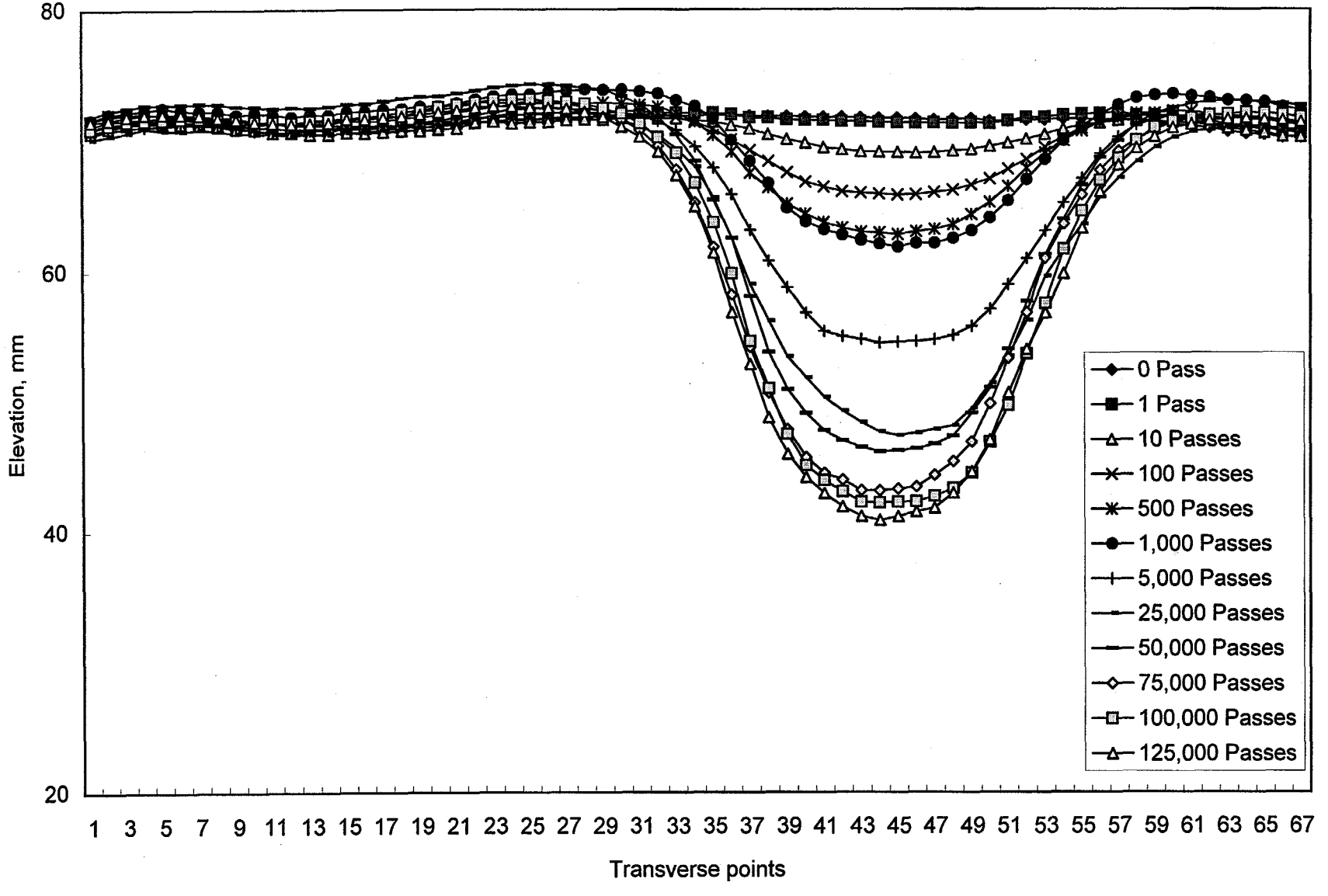

Figure 77. Transverse profiles for lane 7, site 1, Styrelf (PG 88) surface mixture at 70 °C.

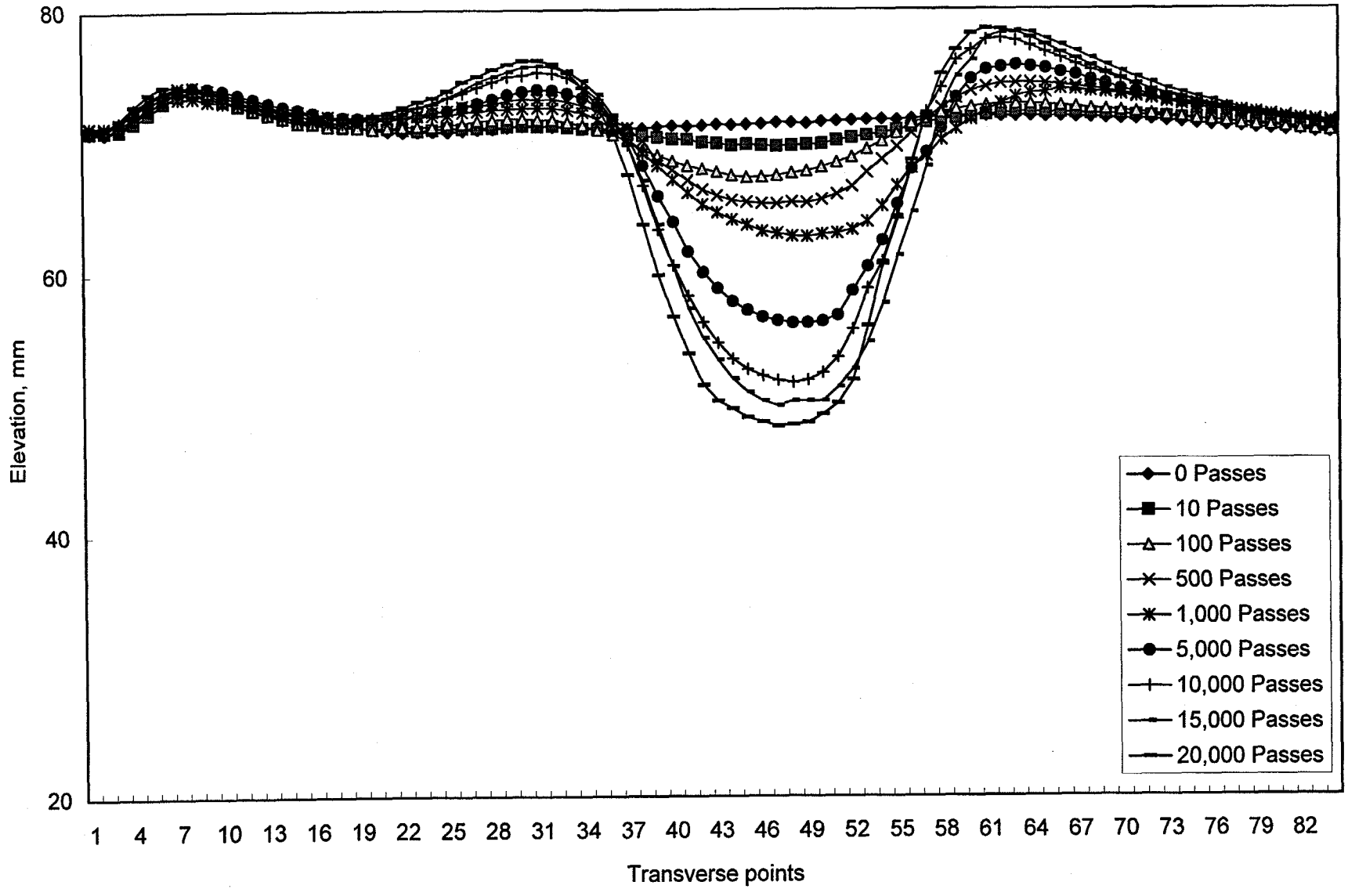

Figure 78. Transverse profiles for lane 10, site 4, AC-20 (PG 70) surface mixture at 58 °C.

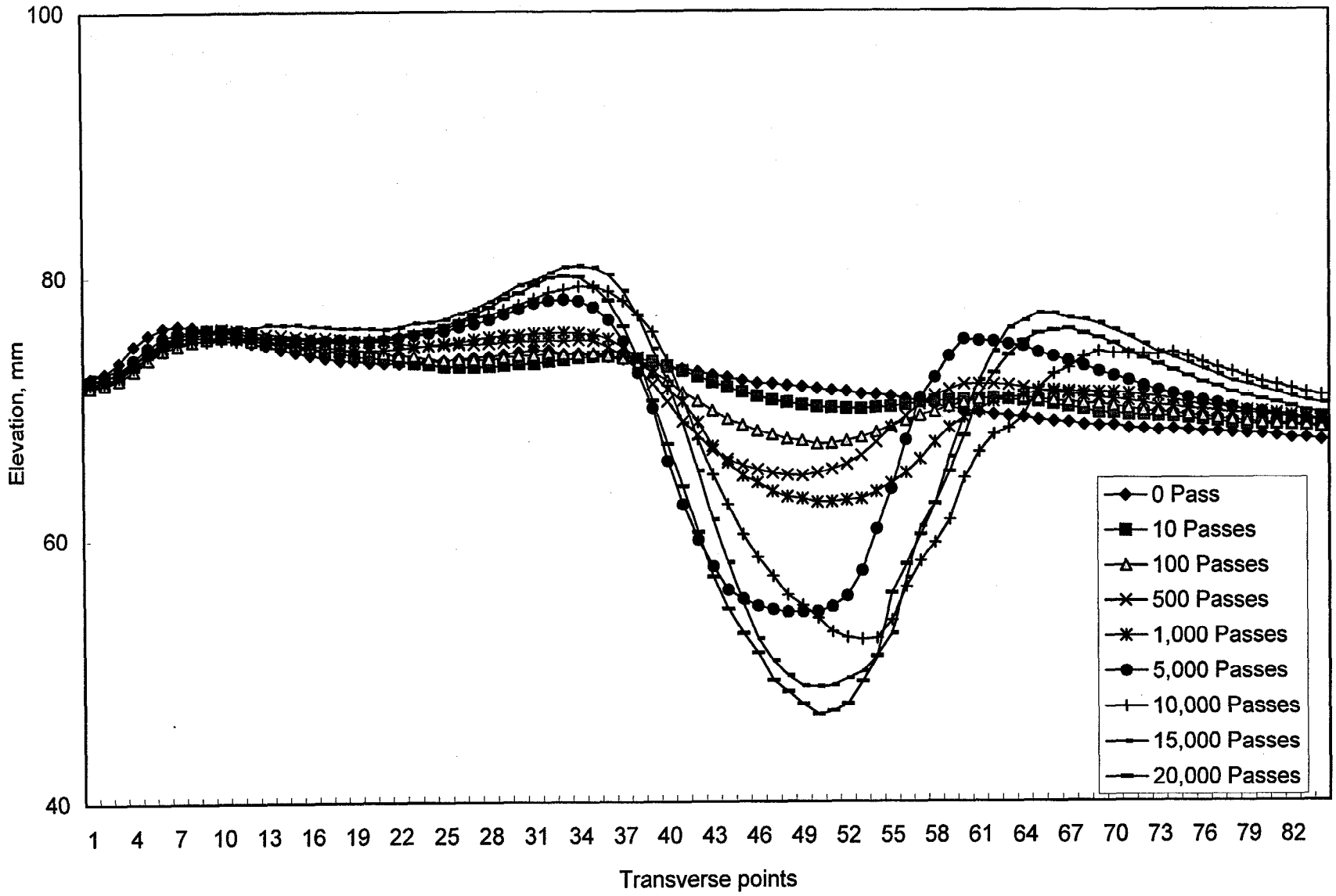

Figure 79. Transverse profiles for lane 10, site 3, AC-20 (PG 70) surface mixture at 58 °C.

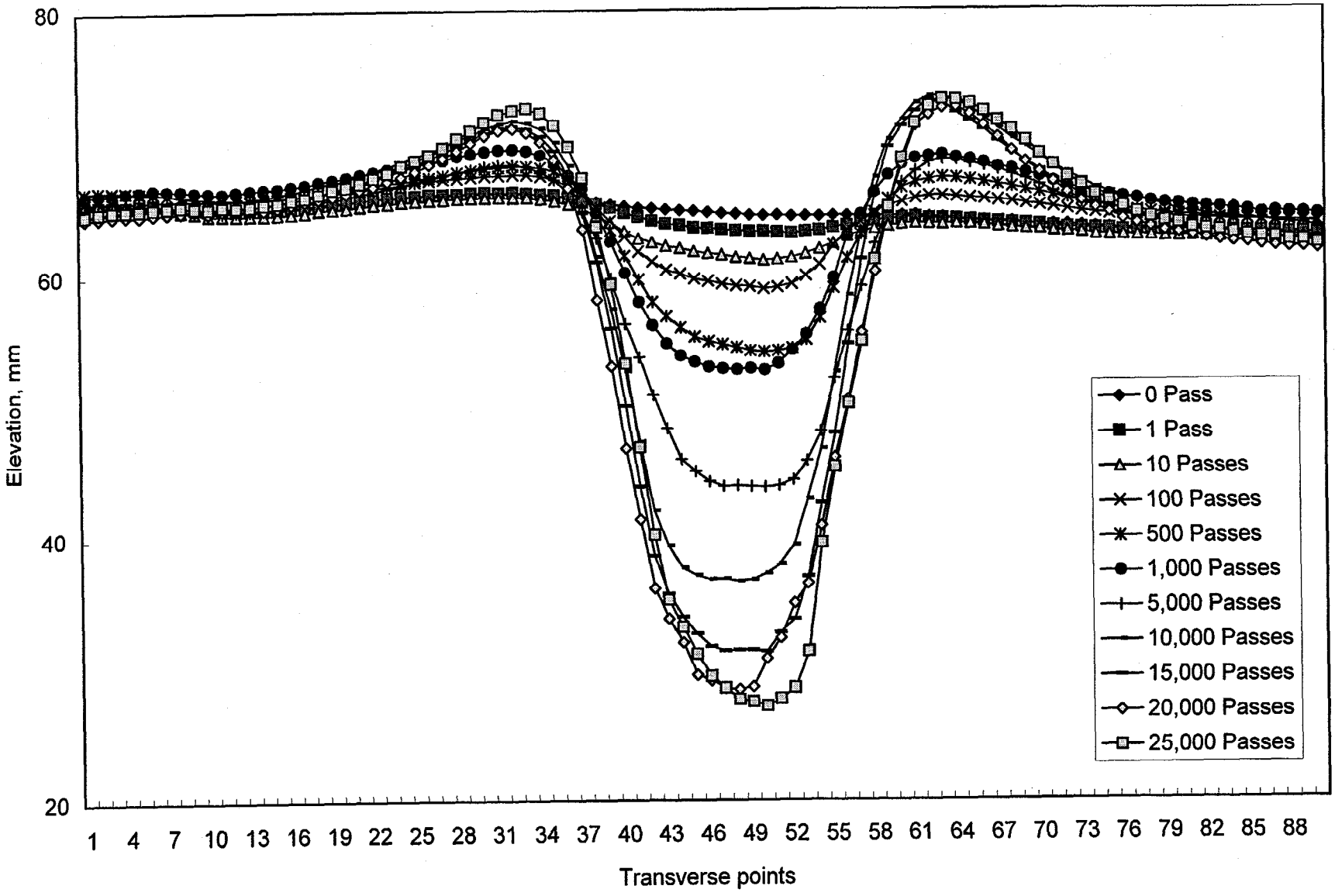

Figure 80. Transverse profiles for lane 5, site 1, AC-10 (PG 65) surface mixture at 52 °C.

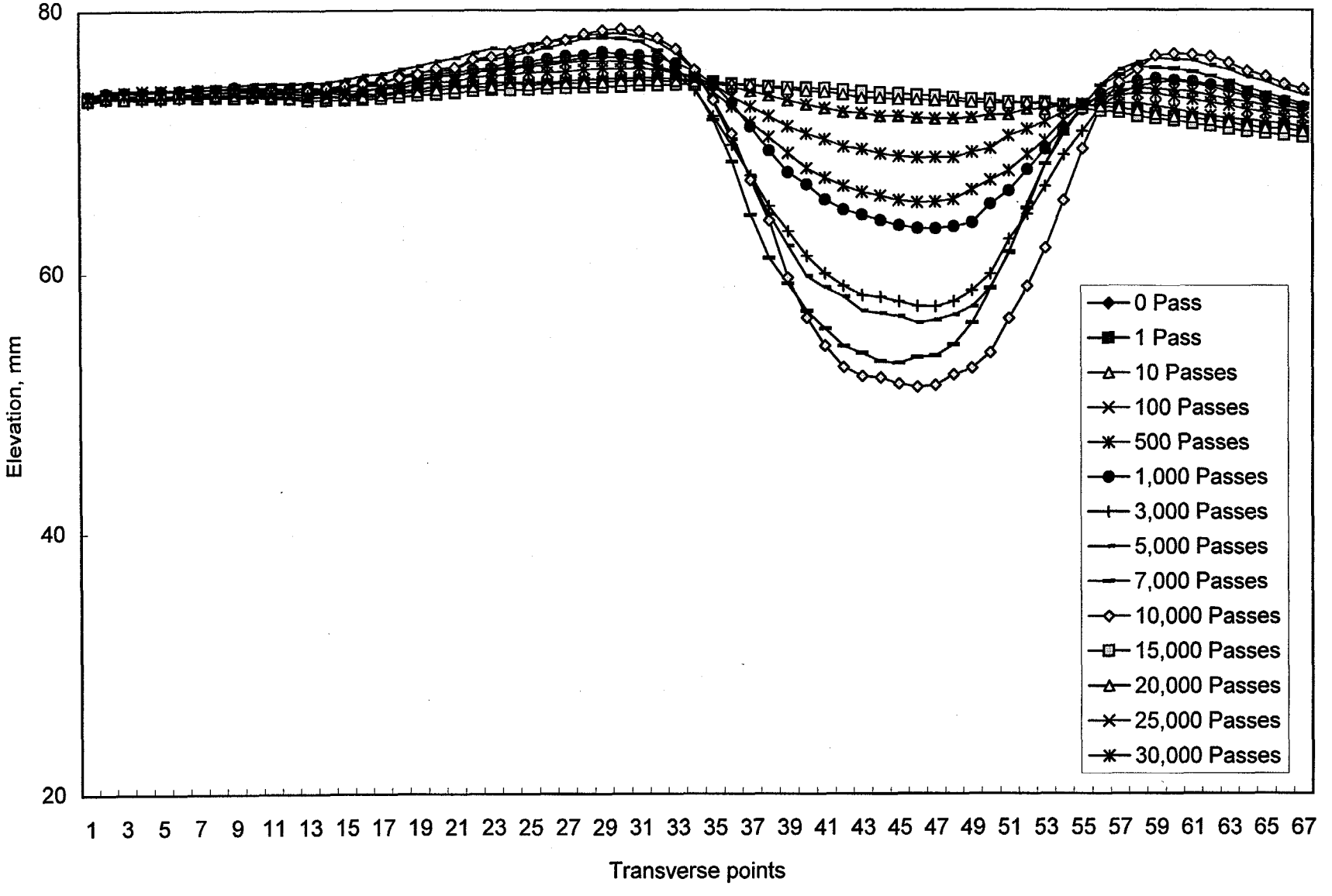

Figure 81. Transverse profiles for lane 11, site 1, AC-5 (PG 59) base mixture at 58 °C.

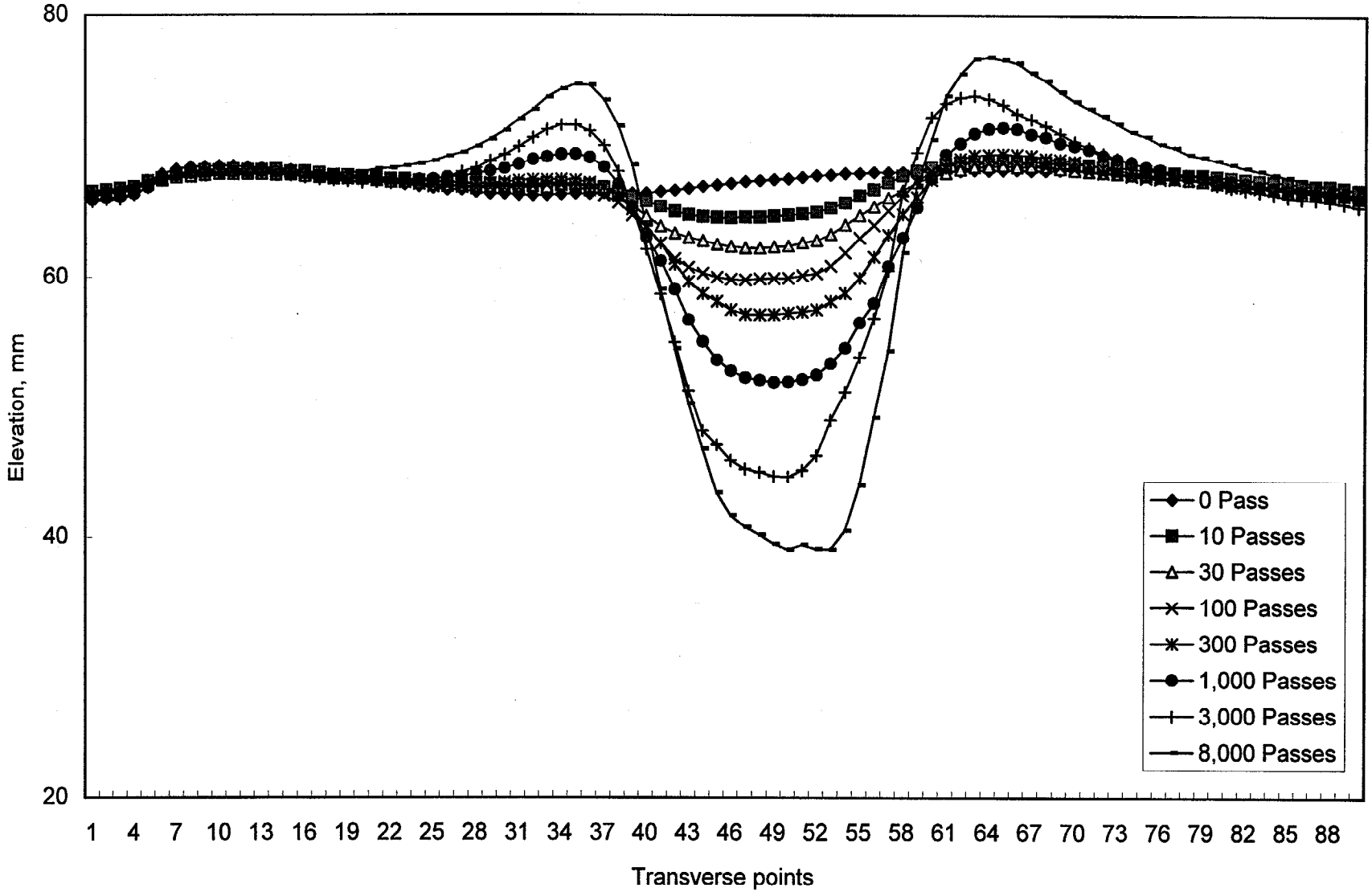

Figure 82. Transverse profiles for lane 6, site 2, AC-20 (PG 70) surface mixture at 64 °C.

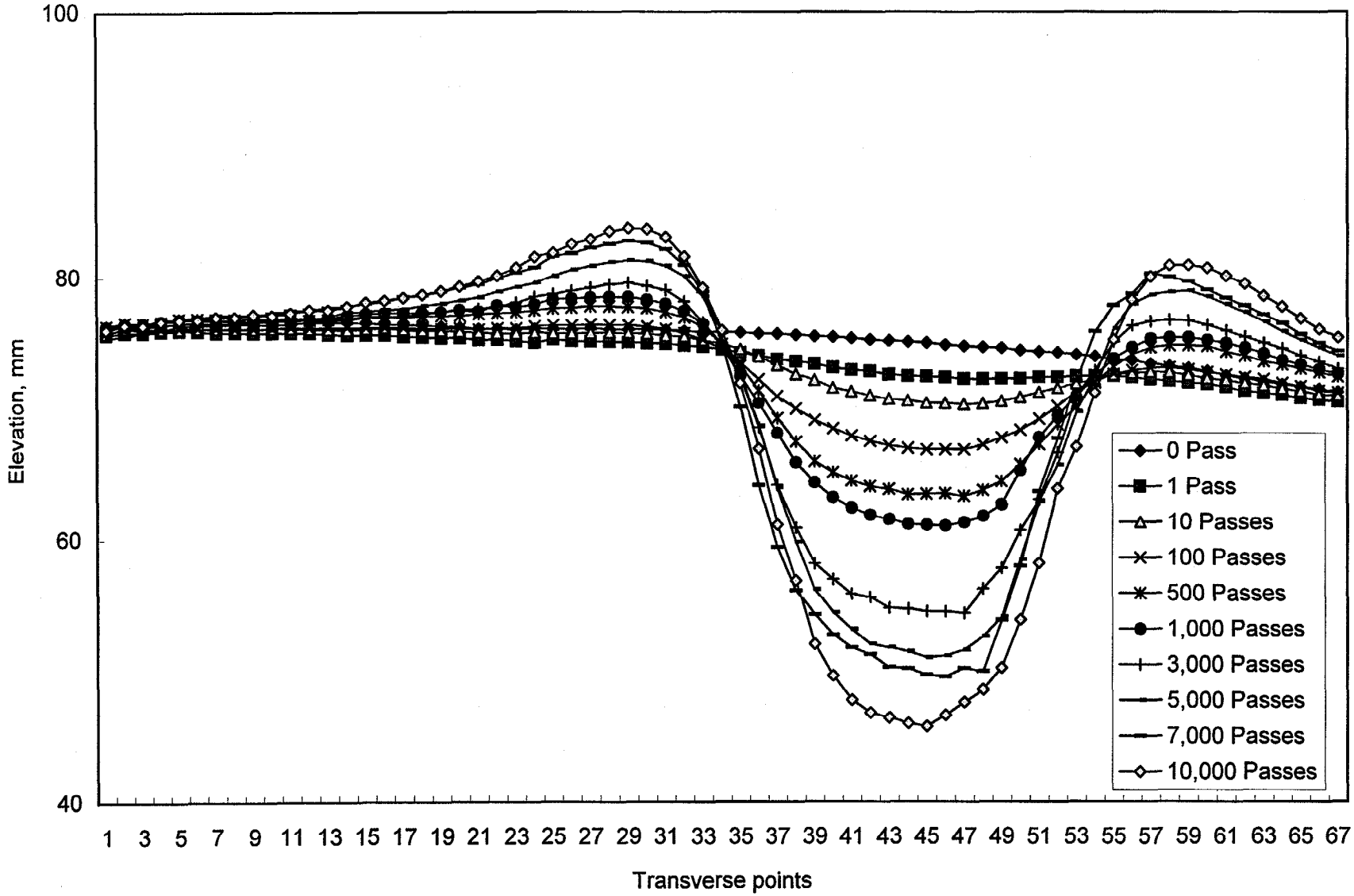

Figure 83. Transverse profiles for lane 10, site 1, AC-20 (PG 70) surface mixture at 58 °C.

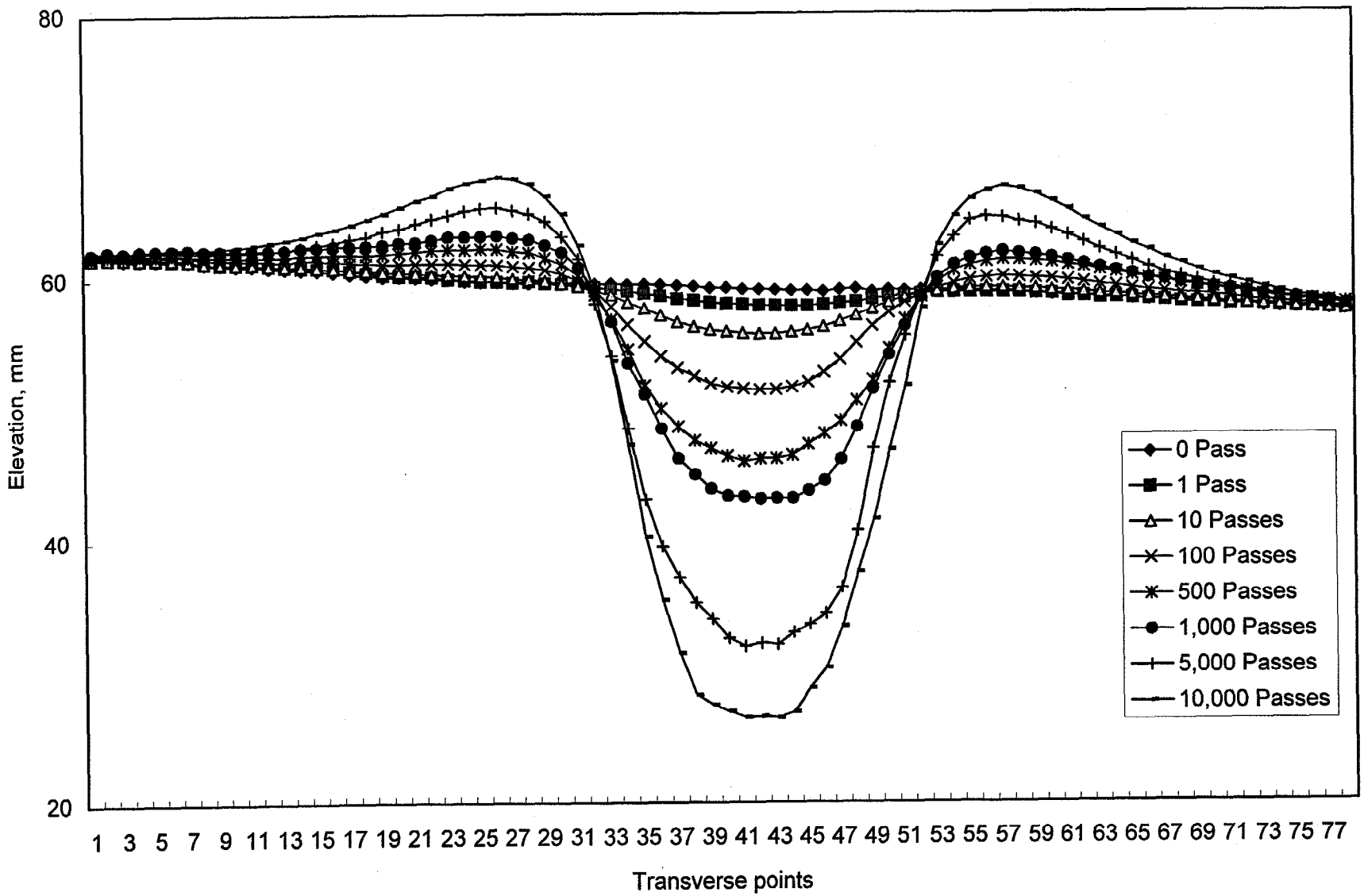

Figure 84. Transverse profiles for lane 10, site 2, AC-20 (PG 70) surface mixture at 58 °C.

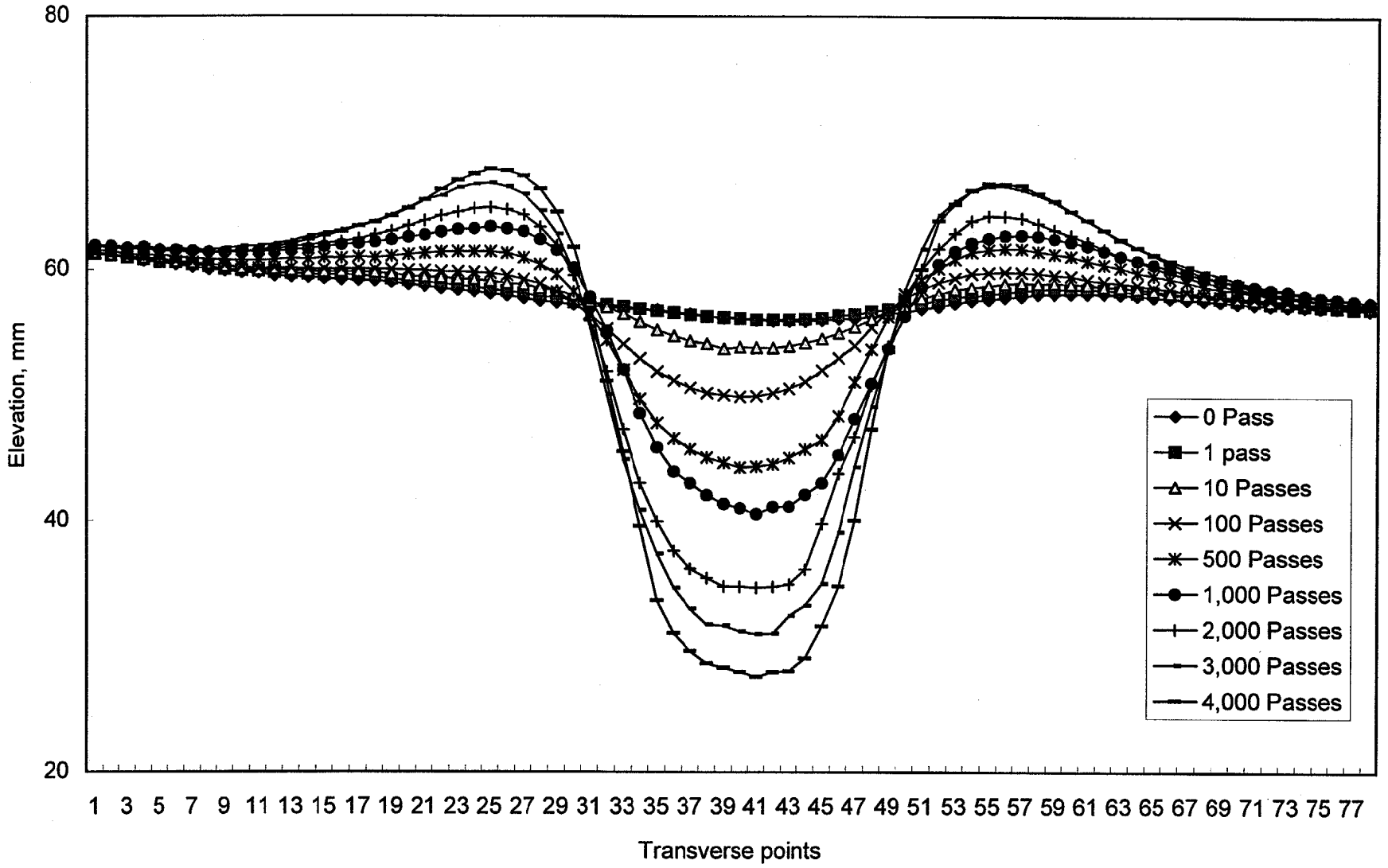

Figure 85. Transverse profiles for lane 5, site 2, AC-10 (PG 65) surface mixture at 58 °C.

Table 120. ALF wheel passes at failure based on the downward only total rut depth and the peak-to-valley total rut depth.

Lane & Site	Binder	Binder PG Grade	Test Temp °C	ALF Wheel Passes and Ranking at a 20-mm Downward Only Total Rut Depth		ALF Wheel Passes and Ranking at a 20-mm Peak-to-Valley Total Rut Depth	
L8 S2	Novophalt	77	58	39,600	1	55,260	1
L8 S1	Novophalt	77	70	30,840	2	27,420	2
L7 S2	Styrelf	88	58	23,160	3	16,660	3
L5 S4	AC-10	65	46	14,650	4	9,390	5
L7 S3	Styrelf	88	76	11,160	5	8,430	6
L7 S1	Styrelf	88	70	10,650	6	11,030	4
L10 S4	AC-20	70	58	7,930	7	4,880	7
L10 S3	AC-20	70	58	6,210	8	3,800	9
L5 S1	AC-10	65	52	6,070	9	1,910	10
L11 S1	AC-5 Base	59	58	5,900	10	4,090	8
L6 S2	AC-20	70	64	2,410	11	1,210	12
L10 S1	AC-20	70	58	1,860	12	1,510	11
L10 S2	AC-20	70	58	1,710	13	966	13
L5 S2	AC-10	65	58	1,160	14	544	14

Table 121. ALF wheel passes at failure based on the downward only rut depth and the peak-to-valley rut depth in the asphalt pavement layer alone.

Lane & Site	Binder	Binder PG Grade	Test Temp °C	ALF Wheel Passes and Ranking at a 20-mm Downward Only Rut Depth in the Asphalt Pavement Layer		ALF Wheel Passes and Ranking at a 20-mm Peak-to-Valley Rut Depth in the Asphalt Pavement Layer	
L8 S2	Novophalt	77	58	6,000,000	1	>9,000,000	1
L8 S1	Novophalt	77	70	340,000	2	268,000	3
L7 S3	Styrelf	88	76	236,000	3	528.000	2
L7 S2	Styrelf	88	58	220,000	4	225,000	4
L7 S1	Styrelf	88	70	98,300	5	113,000	5
L5 S4	AC-10	65	46	82,920	6	43,560	6
L5 S1	AC-10	65	52	21,720	7	3,780	10
L11 S1	AC-5 Base	59	58	15,000	8	9,950	7
L10 S4	AC-20	70	58	13,180	9	7,430	8
L10 S3	AC-20	70	58	12,720	10	6,560	9
L6 S2	AC-20	70	64	7,000	11	2,490	11
L10 S1	AC-20	70	58	2,740	12	1,950	12
L10 S2	AC-20	70	58	2,720	13	1,030	13
L5 S2	AC-10	65	58	1,900	14	800	14

Table 122. ALF wheel passes at failure for the Novophalt and Styrelf surface mixtures.

Lane & Site	Binder	Binder PG Grade	Test Temp °C	Downward Only Total Rut Depth		Peak-to-Valley Total Rut Depth	
L8 S1	Novophalt	77	70	30,840	1	27,420	1
L7 S1	Styrelf	88	70	10,650	2	11,030	2
L8 S2	Novophalt	77	58	39,600	1	55,260	1
L7 S2	Styrelf	88	58	23,160	2	16,660	2
				Downward Only Rut Depth in the Asphalt Pavement Layer		Peak-to-Valley Rut Depth in the Asphalt Pavement Layer	
L8 S1	Novophalt	77	70	340,000	1	268,000	1
L7 S1	Styrelf	88	70	98,300	2	113,000	2
L8 S2	Novophalt	77	58	6,000,000	1	>9,000,000	1
L7 S2	Styrelf	88	58	220,000	2	225,000	2