

GoX Studio Insole Testing for Mechanical Durability and Accuracy

GRF estimate from GoX Studio Insole vs. Instrumented Treadmill in Gate Lab, November 2018

Mechanical Stability: Output signal comparison at 0 vs. 500,000 cycles, October 2018

GRF Calculations

A preliminary algorithm for generating GRF values from the insole sensors has been developed for walking at 0.9m/s. The algorithm filters the data, combines signals, and applies an equation to generate peak GRF forces that fall within 4% of the actual values. Table 1 shows GRF values generated by the algorithm compared to actual GRF values recorded from the Gait Lab treadmill, Chart 1 shows a graph of the GRF values generated from GoX Insole and Chart 2 is the same step data recorded by the treadmill.

	Insole GRF		Treadmill GRF		Comparison	
	Heel Strike	Push-Off	Heel Strike	Push-Off	% Diff Heel	% Diff Push Off
Sample 1	1042	875	1028	908	1.36%	3.63%
Sample 2	986	871	1000	862	1.40%	1.04%
Sample 3	1007	889	1000	903	0.70%	1.55%
Sample 4	1035	961	1028	980	0.68%	1.94%
Sample 5	1020	945	1029	912	0.87%	3.62%
Average	1018	908.2	1017	913	0.10%	0.53%

Table 1. Insole GRF vs Treadmill GRF



Chart 1. GoX Insole GRF

Chart 2. Treadmill GRF

Fatigue Testing

Fatigue testing on GoX insole was completed for 500,000 steps. The results show that the insole design is robust enough to handle the 500,000 steps with only slight changes in signal response. Table 2 shows the actuated/non-actuated values for the insole at key points during the test, and a brief analysis of the data and Chart 3 shows the insole response at the key points overlaid.

	Average Peak	% Diff From Start	Average Low	Range	% Change From Start	% Change After "Break-In"
0 Steps	152.98	0.00%	16.176	136.80	0.00%	N/A
100k Steps	156.78	2.48%	50.242	106.53	22.12%	0.00%
200k Steps	156.64	2.39%	56.104	100.53	26.51%	5.63%
300k Steps	156.70	2.43%	59.155	97.54	28.70%	8.44%
400k Steps	156.68	2.42%	50.609	106.07	22.46%	0.44%
500k Steps	156.78	2.48%	55.005	101.77	25.61%	4.47%
STDEV	1.53		15.90	14.41		

Table 2. 500k Fatigue Testing Results

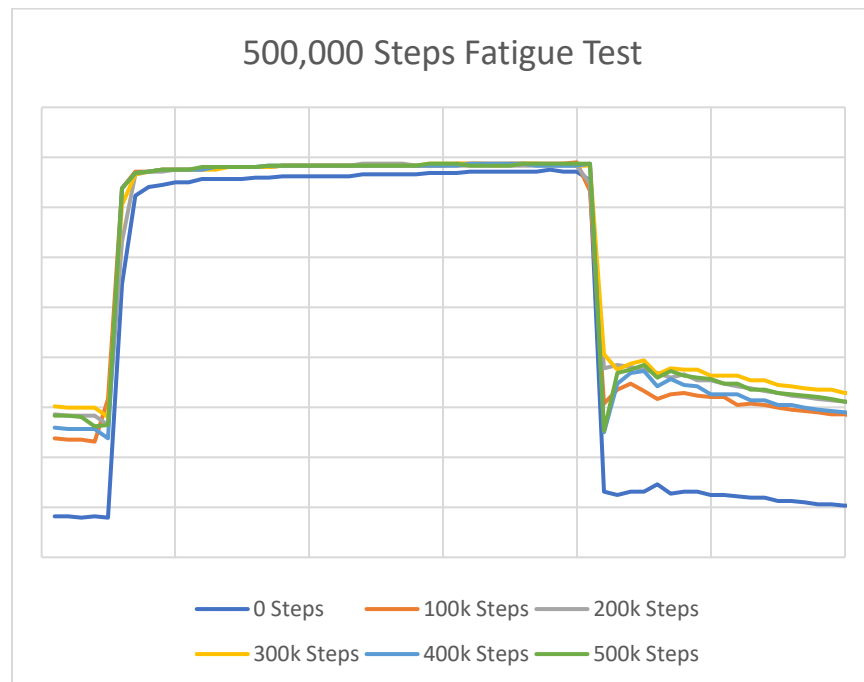


Chart 3. 500k Fatigue Testing Results

Results show that after a break-in period, which occurs quickly, the insole maintains a steady response, only deviating by 4.47% after 500,000 steps. Even looking at the insole response before break-in, the response changes by 25.61%, which may seem high however the insole can lose up to 50% of its range before the signals produced become unusable.