

Identifying Manufacturing Variations in Computerized Stitching



Process Opportunity



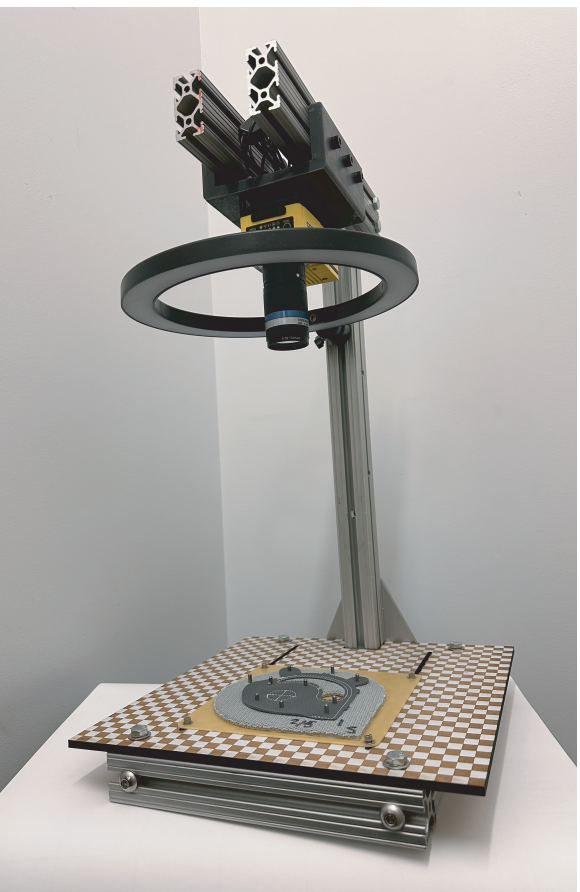
Quality at New Balance is of the utmost importance. Since the emergence of computerized stitching at New Balance in the 1990s, one concern has been the possibility of variations in stitching, specifically around stitch margin. If these variations occur, processes are required to ensure that the stitching is consistent before it is sent to distribution centers. Our team worked with the New Balance factory in Lawrence, MA to conduct tests of computerized stitching across several variables to determine the root cause of potential stitch margin variation.

Methodology

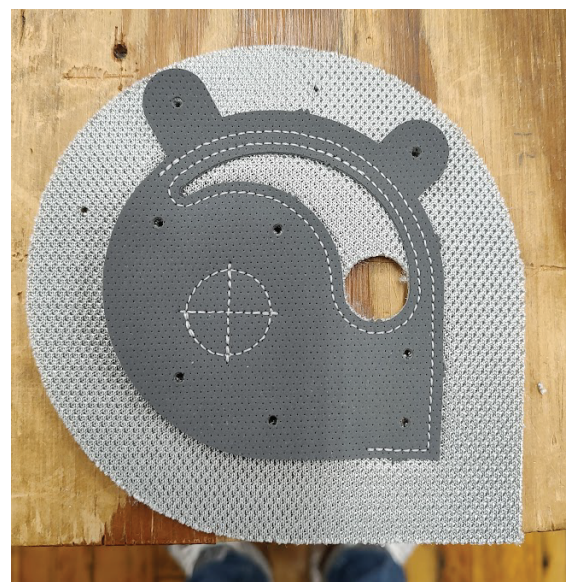
Variables Tested:

- | | |
|-------------------|---------------------|
| Pallet: | Material: |
| - Grip | - Leather Quality |
| - Pallet Material | - Material Layering |
| - Pin Placement | - Cutting Method |

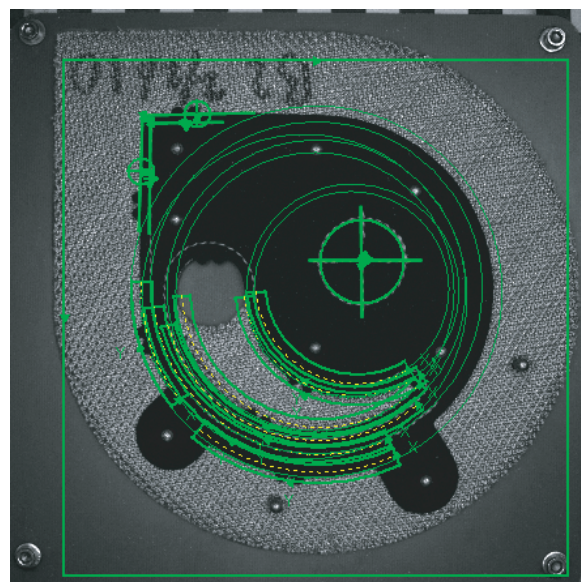
Our team developed a test piece to be used throughout all of our stitching tests that involved several different stitching geometries. With each test, a variable was changed. We constructed a machine vision camera setup with which we took photographs to measure geometry in software. We measured the distance from the stitch to the edge of the material at the location of six key geometries.



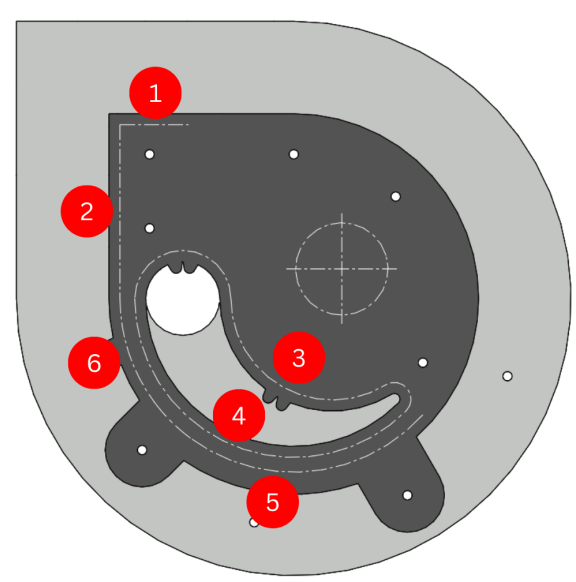
Camera setup for photographing test pieces



Developed test piece used for all tests



Cognex machine vision software used to accurately measure pieces

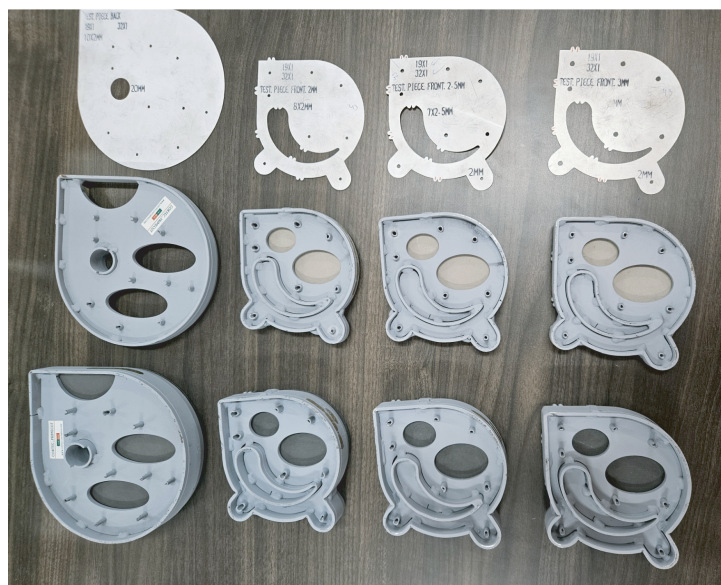


Location of each measure point

Stitching Process



990v6 Shoe Top Assembly created in the stitching process



Dies used to cut fabric for stitching



Pallets used to accurately load fabric into the stitching machines



Operators load fabric into the stitching pallet

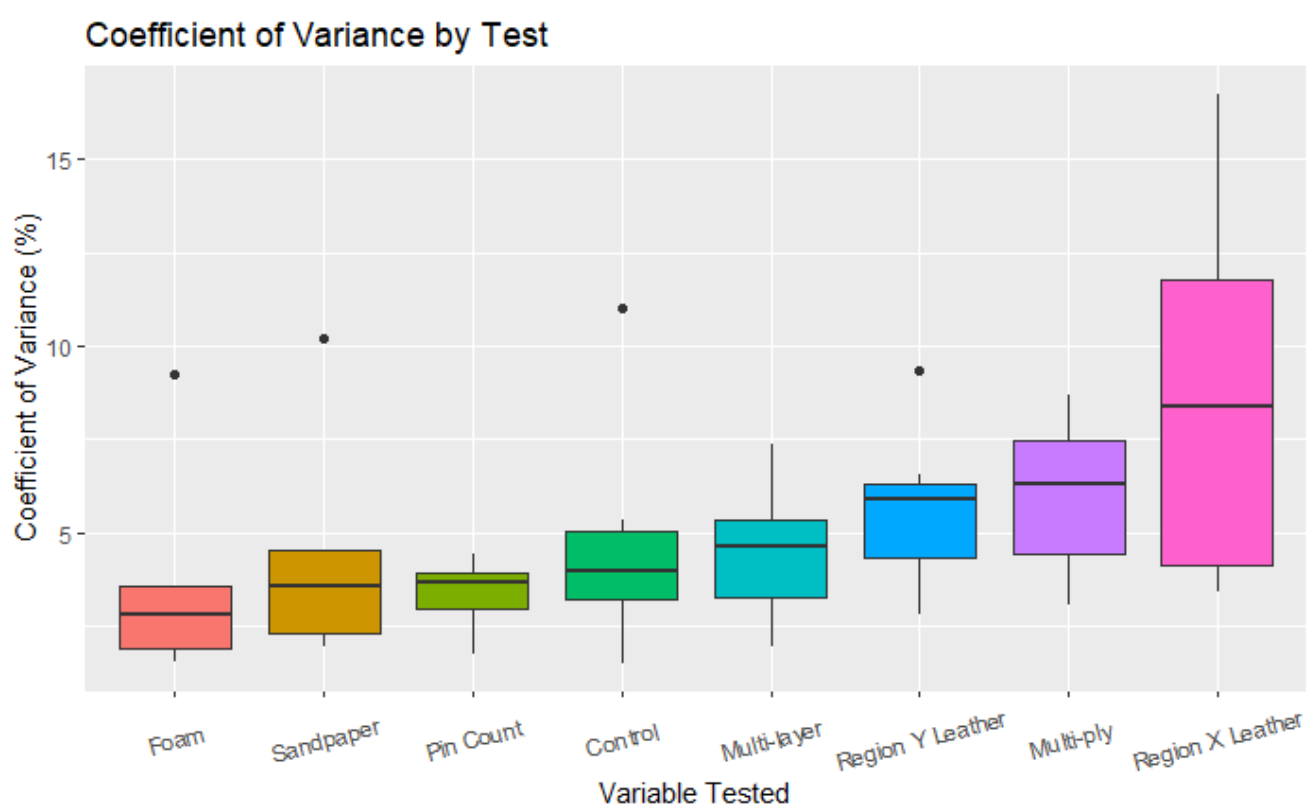


The machine stitches the fabric together along set paths

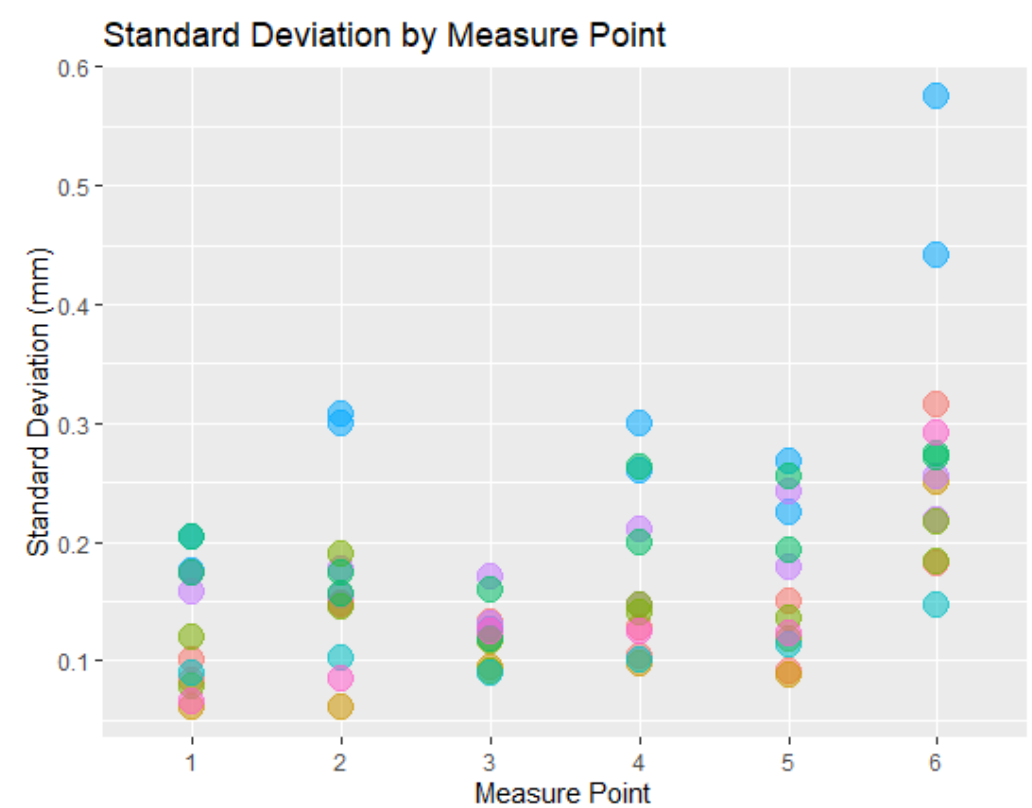
New Balance shoes are manufactured in a complex multi-step process. We stepped in at a specific step in the process involving the computerized stitching of each unique shoe piece into a completed flat pattern which then gets folded into the standard shoe shape. This process first involves cutting the pieces of fabric from large stacked sheets with multi-ply die cutting. These pieces are loaded onto a pallet and placed on pins to keep the fabric from moving during the stitching process. Finally, the stitching machine picks up the loaded pallet and stitches the fabric on predetermined paths. This process is completed several times per minute to ensure high volume production.

Results

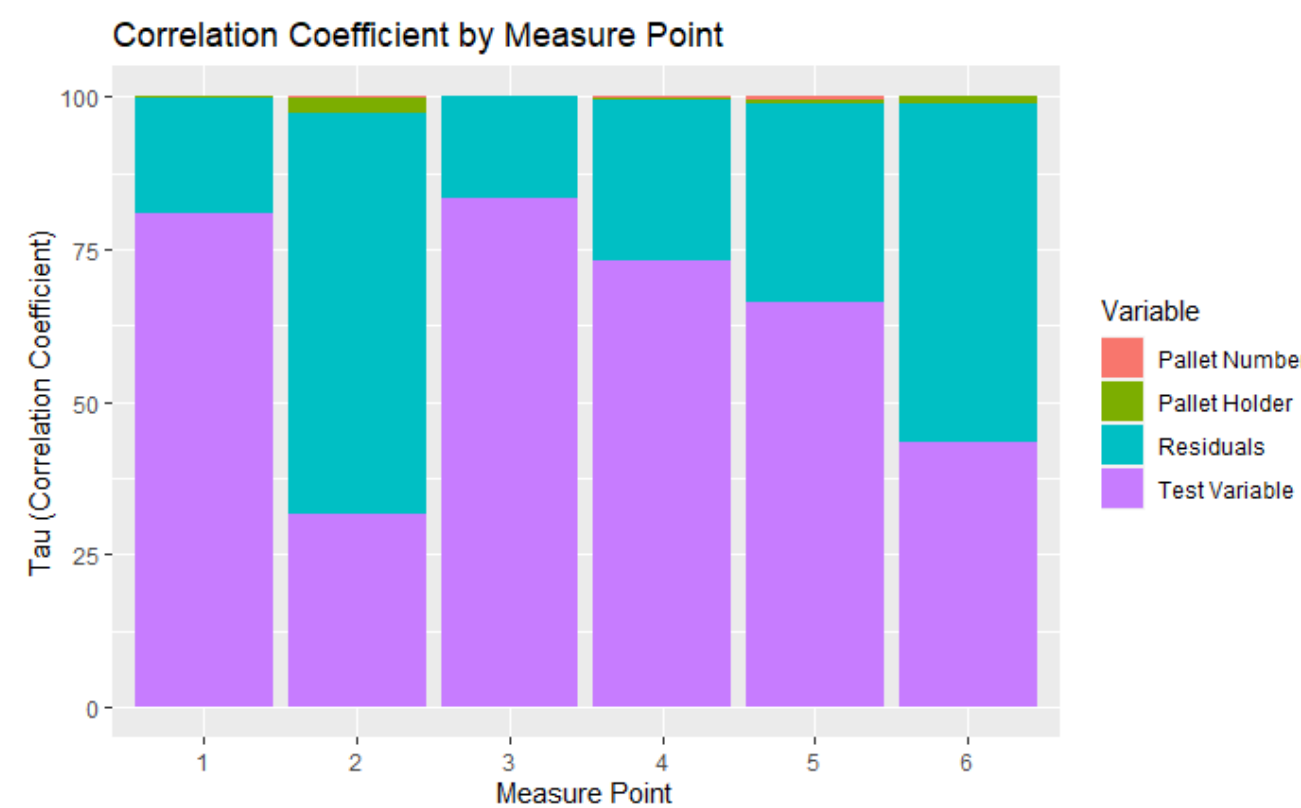
In the analysis of our multiple trials and variables we came to a few conclusions. A potentially significant source of variation we found was how the shoe materials were held down in the machines. Some added aids (foam hold-downs and sandpaper) lowered the stitch margin variation on the test pieces. We also found that leather quality had a significant impact on inconsistencies, with leather taken from a first region of the hide (region X) causing far more variation than leather taken from a second region of the hide (region Y). The standard method of cutting material (six ply cuts with a die) produced far greater variation than the control, suggesting a change in cutting practice may improve variation.



Coefficient of variance of each variable tested



Standard deviation of each test variable across each measure point



Percent impact of test variables and pallets on variation by measure point



Lily Dao



Lauren Armstrong



Bryce Ferguson



Diana Garcia



Diego Riverbay

Olin Advisor:
Lawrence Neeley

New Balance Liaisons:
Kelly Goldfarb
Sarah Mendelowitz
David Sullivan