

## STITCHING CALIBRATED IMAGES TOGETHER

While you do not need a medium- or large-format camera to capture shoe prints, you do need to capture your footwear impressions at the highest possible resolution. Capturing an overall footprint with a scale will produce an image that is typically less than half the resolution of the images created when you photograph the left and right portions of the footprint and separately. You still need the overall, full-length photograph of the shoe print or tire tread. This photograph provides the reference point for the position, size, or location of the impression.

To begin this process, you must first calibrate your images so that all of the images are scaled accurately for life-size output. Once you have the two partial shoeprint impressions calibrated, you can stitch them together for printing as well as for analysis.

### Step-by-step Instructions

1. Using the Crop tool, crop the image ensuring that the “marching ants” of the crop box go through the middle of the bar on the scale. (It is extremely important to ensure that the marching ants are parallel to the edge of the scale when cropping the image. If they are not parallel, move your cursor outside of the marching ants, then click and hold the left mouse button as you drag the cursor to rotate the crop box to make it parallel.)



Figure 1. Using the crop tool, you can identify a specific distance within an image, which is essential for calibrating images.

**NOTE:** For accurate scaling, ensure that the marching ants go directly through the center of the scale bar because the width of the scale bar can vary depending upon the resolution of the CCD, the size of the area captured, and so forth. For example, an individual scale bar can be 7 pixels wide or it can be 23 pixels wide. Therefore, by counting the exact number of pixels from the center of one scale bar to the center of another scale bar gives you a more accurate pixel count.

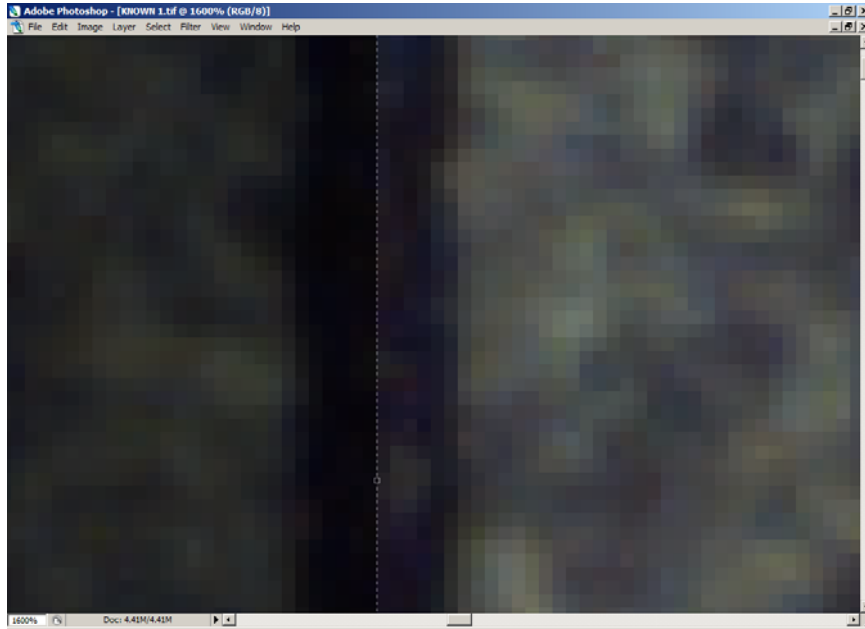


Figure 2. An enlarged scale bar; the width of this bar is 13 pixels wide.

2. From the Image menu, choose Image Size. The Image Size dialog box will be displayed on your screen.

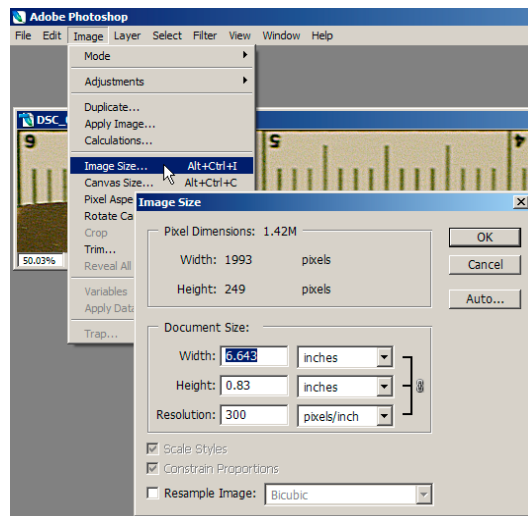


Figure 3. The image size dialog box is the key element for calibrating any image captured with a digital camera.

3. Ensure that the Resample Image option is disabled. (There should not be a checkmark in the box to the left of this option and a bracket with a chain should be displayed on the right side of the Width, Height, and Resolution fields indicating that these three fields are linked. If set properly, when you change one option, the other options change automatically, thus keeping the appropriate size aspect ratio.)
4. Change the unit of measurement, if necessary. Be sure to verify that you are changing the appropriate physical dimension: width or height.
5. Highlight the width measurement, and type the appropriate distance. (In Figure 1, the width of the cropped portion of the image is 4 inches wide). As soon as you enter the appropriate width, the height and resolution fields change automatically as shown below.

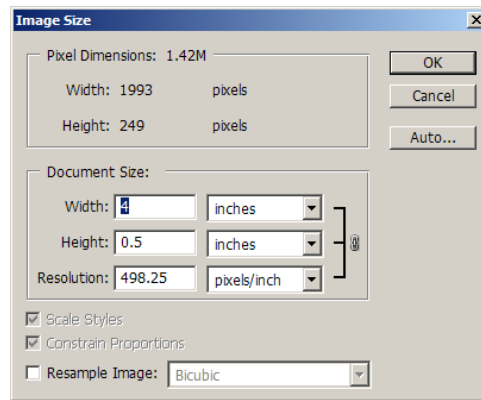


Figure 4. The image size dialog box is used for specifying the known distance as well as obtaining the resolution for that known distance.

6. Place your cursor over the resolution field and double click to highlight the contents of that field.
7. Copy the resolution value by either pressing Ctrl + C or clicking your right mouse button while the cursor is over the resolution field and choosing Copy from the list of options provided.
8. Click on Cancel or hit the Escape key to close the Image Size dialog box.
9. Restore the full, un-cropped image by choosing Step Backward from the Edit menu or press Ctrl + Alt + Z.
10. Once the full image is redisplayed on your screen, choose Image Size from the Image menu again.
11. When the Image Size dialog box is displayed again, ensure that the resample option is turned off. (There should not be a checkmark in the box to the left of this option and a bracket with a chain should be displayed on the right side of the Width, Height, and Resolution fields indicating that these three fields are linked.)
12. Place your cursor over the resolution field and double click to highlight the contents of that field.
13. Paste the resolution value obtained in step 6 above by either pressing Ctrl + P, or clicking your right mouse button while the cursor is over the resolution field and choosing Paste from the list of options provided.

14. Click OK and your image is now calibrated for accurate, 1:1 life-size output.

Repeat this process for each image that you must calibrate.

## **STITCHING THE IMAGES TOGETHER**

You must also be aware that while cameras are clinically clueless about the physical dimensions of the area that they capture, computers don't care about size either. They do, however, care about the number of pixels that are used to define a particular area. In other words, the computer only cares about the pixel per inch measurement, it doesn't care whether the image is one inch wide or two inches wide. It only cares that there are 1000 pixels per inch, and the one inch wide image contains 1000 pixels across the width of the image, and the two inch wide image contains 2000 pixels across the width of the image. If you attempted to place a one inch image that contains only 500 pixels across the width of the image onto the page with the image that contains 1000 pixels across the width of the image, the one-inch 500 pixel image would occupy only 500 pixels, which would measure only one-half inch instead of one inch.

In other words, for two or more images to maintain their one-to-one aspect ratio when they are placed together onto a single page, the resolution must be identical for those images regardless of the width or the height of the individual images.

### **Step-by-step Instructions**

#### *Defining Image Size (Resolution)*

1. You must first set the resolutions for both partial impressions to the same resolution. Using the calibrated resolution of both images, choose a common denominator by rounding the resolution for both images to the nearest 10, and then choose the highest resolution as the resolution for both images. For example, if the resolution of the left partial print is 532 PPI, round the resolution to 530. If the resolution of the right partial print is 489 PPI, round the resolution to 490. Since 530 PPI is the higher resolution, change the resolution for both images to 530.
2. Starting with the left partial print (click on the window containing the left portion of the footwear impression to make it the active window).
3. From the Image menu choose Image Size. When the Image Size dialog box appears, ensure that Resample is enabled (a check mark must appear in the option box to the left of Resample).
4. Highlight the contents of the Resolution field and enter the resolution identified in step 1 above.
5. Click OK to reset the image resolution for the left partial print.
6. Click on the window containing the right portion of the footwear impression to make it the active window.
7. From the Image menu choose Image Size. When the Image Size dialog box appears, ensure that Resample is enabled (a check mark must appear in the option box to the left of Resample).

8. Highlight the contents of the Resolution field and enter the resolution identified in step 1 above.
9. Click OK to reset the image resolution for the left partial print.

### ***Expanding the Canvas Size***

1. Click back on the image window that contains the left portion of the footwear impression.
2. From the Image menu, choose Canvas size. The Canvas Size dialog box will appear on your screen.

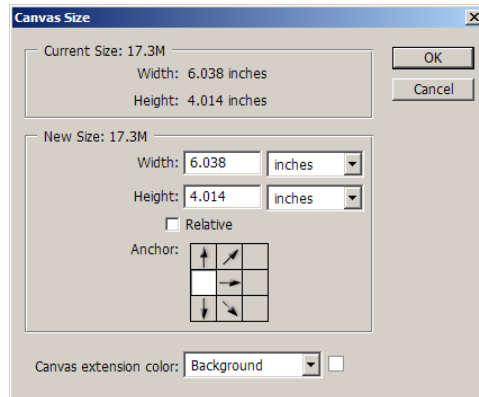


Figure 5. The canvas size dialog box makes room on the page for the additional portion of the foot print.

3. In the Anchor grid at the bottom of the Canvas Size dialog box, click the center box in the left column as shown above. When you change the width of the canvas, it will keep the left portion of the footwear impression on the left side of the image window, thus making room on the right side of the image window for the right portion of the impression.
4. Round the width value down to the nearest inch, and then double the width value. Enter this new width value for the new canvas size.
5. Round the height value down to the nearest inch, and then add two inches to the height value. Enter this new height value for the new canvas size.
6. Click OK to accept the new canvas size.
7. Once you accept the new canvas size, the image window will be resized. To display the new, full canvas on your screen, press Ctrl + 0 to fit the image on your screen.

### ***Merging the Images***

1. Activate the Move tool by typing the letter V or choosing the Move tool from the Photoshop Toolbar.
2. Click on the image window containing the right portion of the footwear impression.

3. Press and hold the shift key and move the cursor over the image, and then click and hold the left mouse button and drag the cursor onto the image window containing the left portion of the impression. Release the mouse button, and then release the shift key. (Do not release the shift key before releasing the mouse button).
4. After you have successfully moved a copy of the right portion of shoe print into the image window containing the left portion of the impression, close the image window containing only the right partial shoe print.
5. On the Layers palette of the remaining window, change the name of the background layer to **left impression** by double clicking on the Background layer in the Layers palette. A New Layer dialog box will appear on the screen. In the name text box, type **left impression** and then click OK.
6. Move the cursor directly on top of the words **Layer 1** on the Layers palette and double click the left mouse button. The words **Layer 1** will be highlighted. Type **right impression** and hit enter.
7. Use the move tool to position the right portion of the impression into its approximate location.
8. On the layers palette, reduce the opacity for the right impression to approximately 50% as shown below. This will enable you to see the background image while you are aligning the right portion of the impression to the left portion.

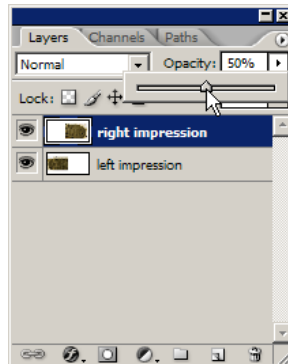


Figure 6. The opacity option on the Layers palette allows you to adjust the level of transparency for the overlaying image.

9. Temporarily turn off the tool bar and palettes by pressing the Tab key on your keyboard.
10. Maximize the image window inside the Photoshop window by clicking on the maximize button in upper left corner of the image window.
11. Fit the image to the window by pressing Ctrl + 0.
12. From the edit menu, choose Free Transform or press Ctrl + T.
13. Select a point that will be used for aligning the two images. Be sure to choose a point that is easily identifiable in area of overlap of both images.



14. With the cursor inside the transform box, line up the point in the right portion of the image to the same position (location) as the point in the left portion of the image as shown below.

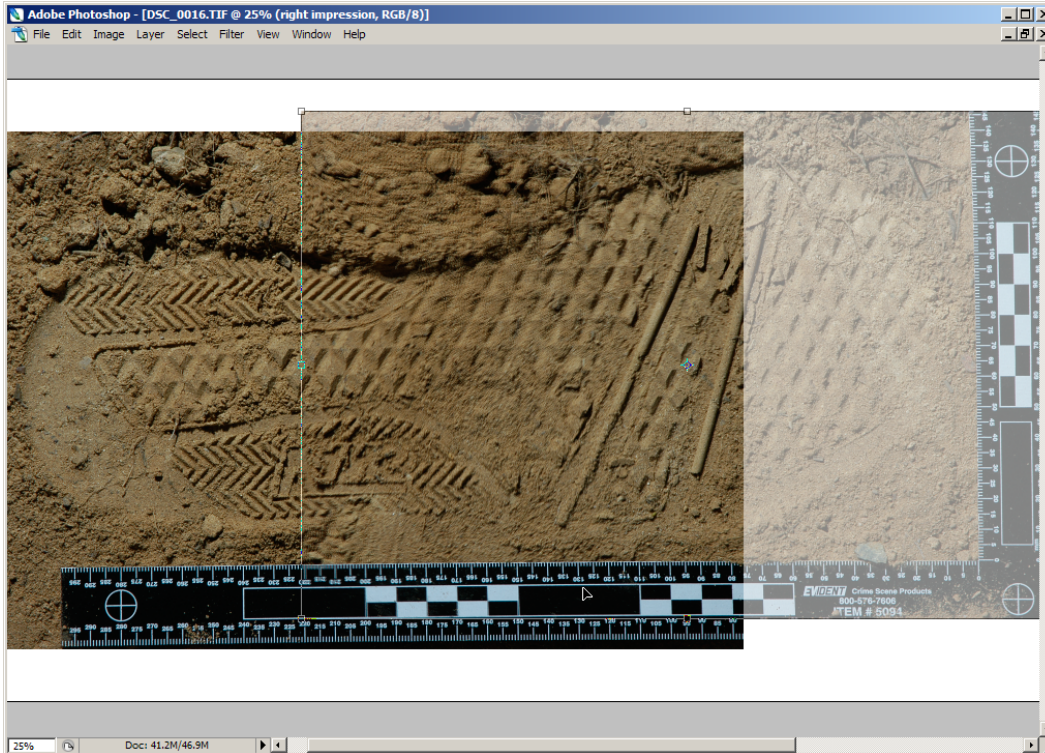


Figure 7. The Free Transform function allows you to rotate as well as move the overlaying image for a seamless, integrated image.

15. If necessary, move the cursor outside the Transform box (a two-headed cursor will appear when the cursor is outside the box). Click and hold down the left mouse button, and rotate the right portion of the impression until the corresponding characteristics of the impression are aligned to the same angle as the left impression (the corresponding characteristics should match up).

**NOTE:** You may also want to use the Zoom functions (Ctrl and plus key to zoom in and Ctrl and minus key to zoom out) to view the image more closely.

16. Hit Enter to complete the transform function and lock in the position of the right portion of the image.
17. From the tool bar, choose the Rectangular Marquee tool. On the Rectangular Marquee options bar, choose the New Selection option, then verify that Feather is set to a radius of 0 px (feathering must be disabled for this task), and Style should be set to Normal.

**NOTE:** You may need to refit the image to the window to see the full image. In addition, you may want to turn off the background image (heel portion of the impression for easier viewing). To turn off the left impression layer, click the eye in the visibility panel of the Layers palette for the bottom layer.

18. On the layers palette, return the opacity for the right impression to 100%. This will enable you to see the foreground image while you are clipping the right portion of the impression.
19. Position the marquee tool at the top of the canvas in the middle of the area of overlap.

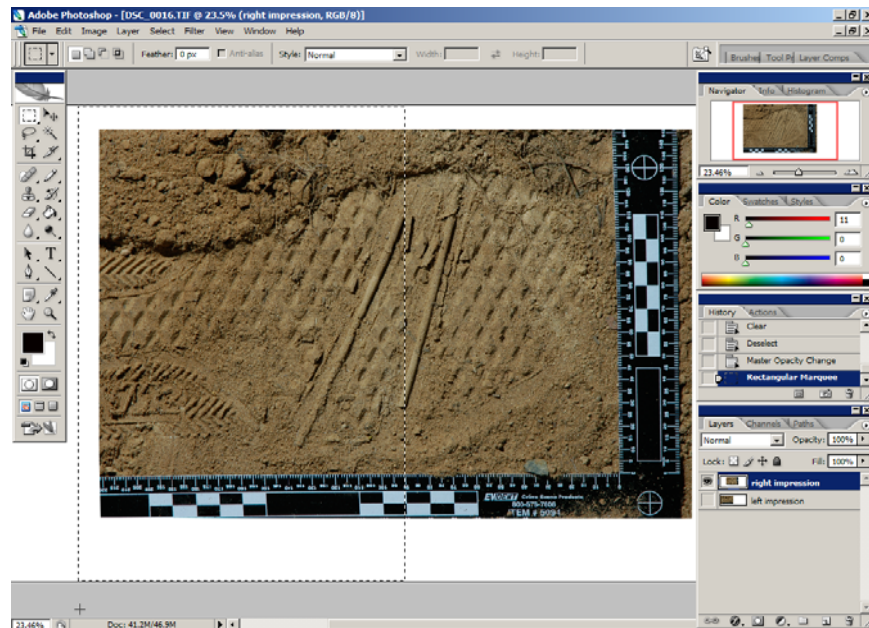


Figure 8. Using the Marquee tool, you can isolate the overlapping edge of the top layer and feather the edge for a seamless view of the composite image.

20. Click and hold the left mouse button and drag the cursor to the bottom of the canvas and beyond the left edge of the top layer.
21. From the Select menu, choose Feather. When the Feather Selection dialog box appears, set the feather radius to somewhere between 25 (for lower resolution images) and 35 (for higher resolution images).
22. Press the delete key on your keyboard. This will eliminate the unused portion of the overlap and will feather the left edge of the top layer (the right portion of the image) so that the top layer will blend into the bottom layer.
23. Turn off the marching ants by choosing Select from the menu bar, and choosing Deselect. You may also press Ctrl + D to turn off the marching ants.
24. Turn on the visibility option for the left impression by clicking the blank space in the visibility panel of the Layers palette for the bottom layer.



25. If you have followed these steps and had photographed your impressions properly, you will not be able to identify where one image stops and one image ends.



Figure 9. The feathered edge of the top (overlying) image makes the blending of the two, high resolution images appear seamless.

26. The final step is to crop the composite image and eliminate any unnecessary part of the image.
27. From the tool bar, choose the Crop tool or simply type the letter C.
28. Select the image area that you want to keep as shown below. Be sure to eliminate any portion of the image where the two layers do not match.



Figure 10. Cropping the composite image eliminates any of the unnecessary image area.

29. Then hit enter to complete the crop process.

You will then be left with a final, high-resolution composite image as shown below. Be sure to save this final image. You can also print this image on a high resolution printer, such as the Epson PhotoStylus R1900 inkjet printer.



Figure 11. The cropped composite image provides a seamless, high resolution image that is better for image analysis and identification.