Image analysis

The tender corners are essentially vertical and parallel in this image, so there is no significant keystoning. Further, the bottom edge of the tender is straight, so there is no significant pincushioning. In this limit, an increment of horizontal displacement in the object plane, dx', is related to a displacement in the image plane, dx, by

$$dx' = dx\,\frac{\Delta y(x_0)}{\Delta y(x)} = dx\,\frac{\Delta y_0}{\Delta y_0 - \alpha(x - x_0)} \tag{1}$$

where $\Delta y(x)$ is the vertical separation between the top and bottom edges of the tender at position x in the image plane, $\Delta y(x_0) \equiv \Delta y_0 = 79$ is the separation at the front corner (position x_0), and $\alpha = (79 - 62)/124 = 0.137$ is the rate at which the red line converge in the image plane. This relation has the property that the increment of distance in the object plane increases as the vertical separation decreases, to account for the fact that the rear of the tender is further away from the viewer than the front.

The accumulated distance between any two vertical lines in the object plane, x_1 and x_2, can be obtained by integration,

$$\Delta x' = \int_{x_1'}^{x_2'} dx' = \int_{x_1}^{x_2} dx\,\frac{\Delta y_0}{\Delta y_0 - \alpha x} \tag{2}$$

$$= \frac{\Delta y_0}{\alpha}\left(\ln|\Delta y_0 - \alpha x_1| - \ln|\Delta y_0 - \alpha x_2|\right). \tag{3}$$

For the left panel we have $x_1 = 0, x_2 = 60$, so

$$\Delta x_{\text{left}} = \frac{79}{0.137}\left(\ln|79| - \ln|79 - 0.137 \cdot 60|\right) \tag{4}$$

$$= 576 \cdot (4.369 - 4.259) = 63.4 \tag{5}$$

For the right panel we have $x_1 = 81, x_2 = 124$, so

$$\Delta x_{\text{right}} = \frac{79}{0.137}\left(\ln|79 - 0.137 \cdot 81| - \ln|79 - 0.137 \cdot 124|\right) \tag{6}$$

$$= 576 \cdot (4.218 - 4.127) = 52.4 \tag{7}$$