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TECHNICAL NOTE

ANALYSIS OF SENSITOMETRIC DATA FOR EARTH RESOURCES BLACK AND WHITE FILMS

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Technicolor Graphic Services, In

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BLACK AND WHITE FILMS

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ANALYSIS OF SENSITOMETRIC DATA FOR EARTH RESOURCES
BLACK AND WHITE FILMS

In order to relate the densities in a roll of duplicate imagery to the exposure on the original, it is necessary that the overall system response curve be generated. There are two methods of generating the system response curve. Both give equivalent results, but they vary in complexity.

A. 1. Plot (on D-log E paper) the density of the original versus the log exposure on the original.

2. Plot the density of the duplicate versus density of the original.

3. Read any density on duplicate; interpolate to get density on original. Once original density is determined, read log E from curve in Step 1.

B. 1. Plot (on D-log E paper) the density of the duplicate versus the log exposure on the original using the technique specified in Section 6.

2. Read any density on duplicate and interpolate to get log E from original.

Using the following set of data, these procedures can be easily illustrated:

Step #	Rel log E	Original Negative	Duplicate
1	0.00	0.14	2.70
2	0.15	0.15	2.69
3	0.30	0.17	2.66
4	0.45	0.20	2.60
5	0.60	0.25	2.50

Step #	Rel log E	Original Negative	Duplicate
6	0.75	0.34	2.30
7	0.90	0.45	2.07
8	1.05	0.59	1.63
9	1.20	0.73	1.11
10	1.35	0.87	0.72
11	1.50	1.01	0.44
12	1.65	1.16	0.30
13	1.80	1.31	0.24
14	1.95	1.47	0.22
15	2.10	1.59	0.21
16	2.25	1.73	0.20
17	2.40	1.84	0.20
18	2.55	1.93	0.20
19	2.70	2.02	0.20
20	2.85	2.07	0.20
21	3.00	2.13	0.20

It should be noted that the negative image of the original becomes a positive image in the duplicate.

Figure 1 is a graph of the density of the original negative as a function of the relative log exposure of the original.

Figure 2 is a plot of the density of the duplicate versus the density of the original.

Figure 3 is a plot of the density of the duplicate versus the relative log exposure of the original.

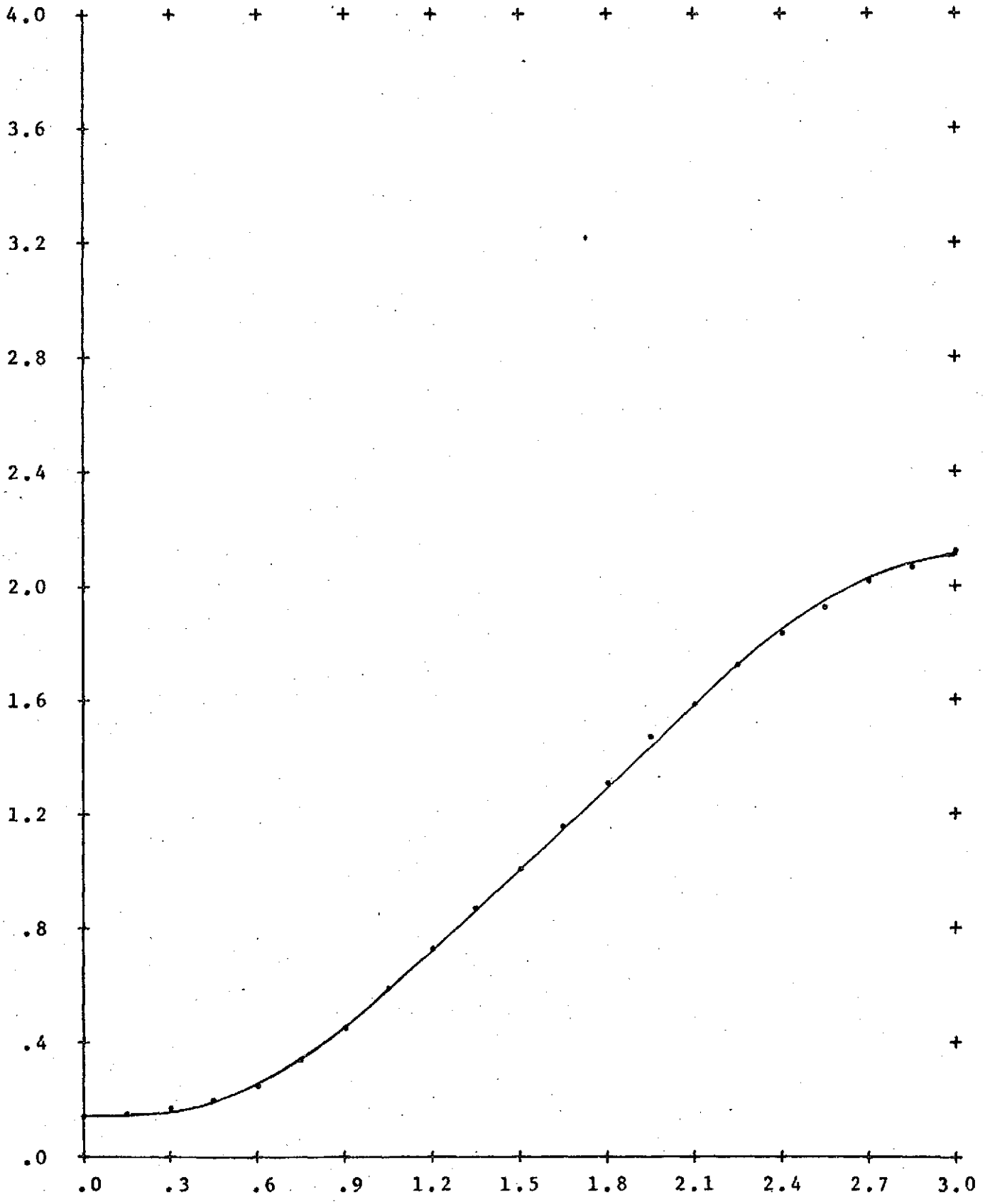

FIGURE 1. Density of Original Versus Relative Log Exposure of Original.

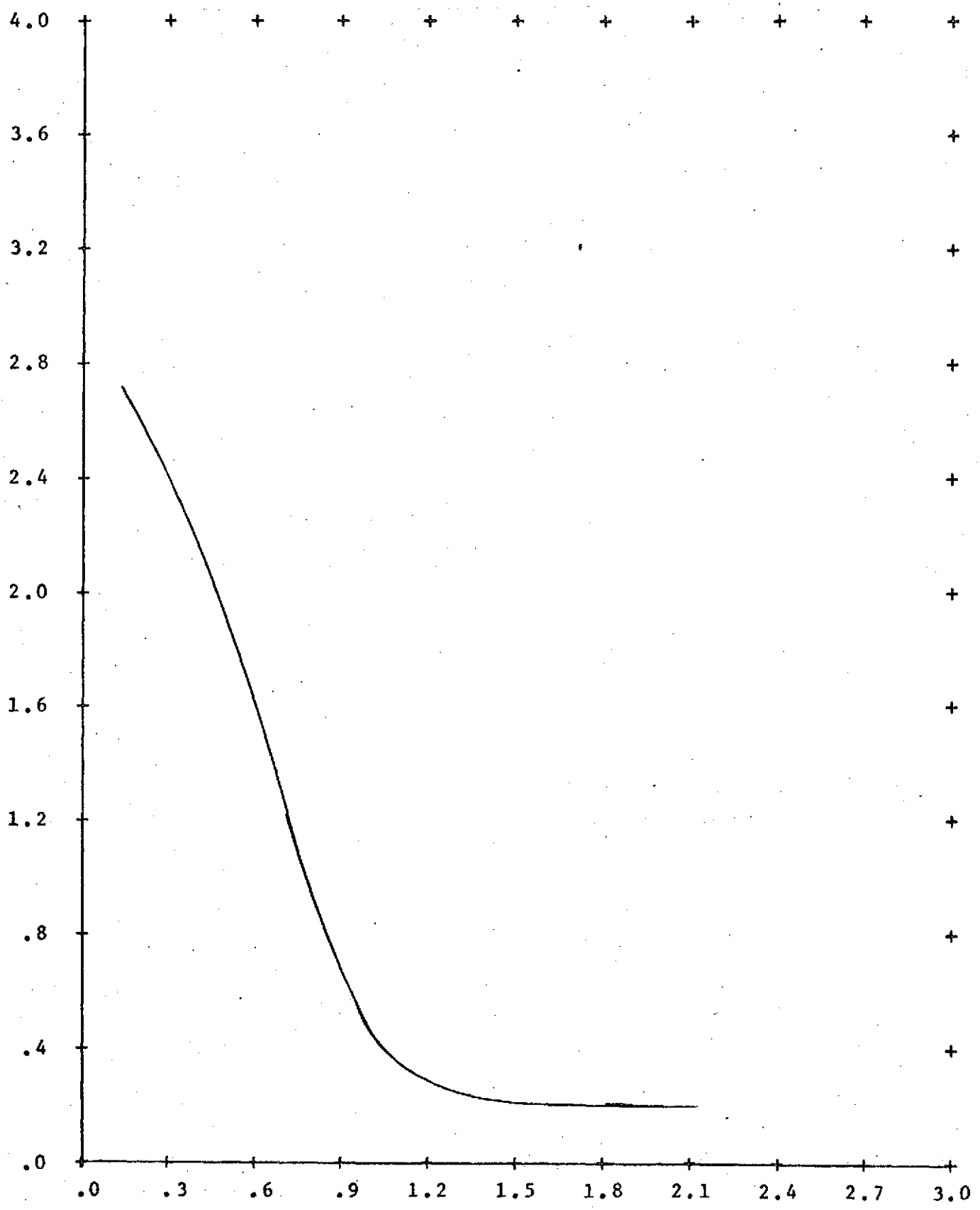

FIGURE 2. Density of Duplicate Versus Density of Original

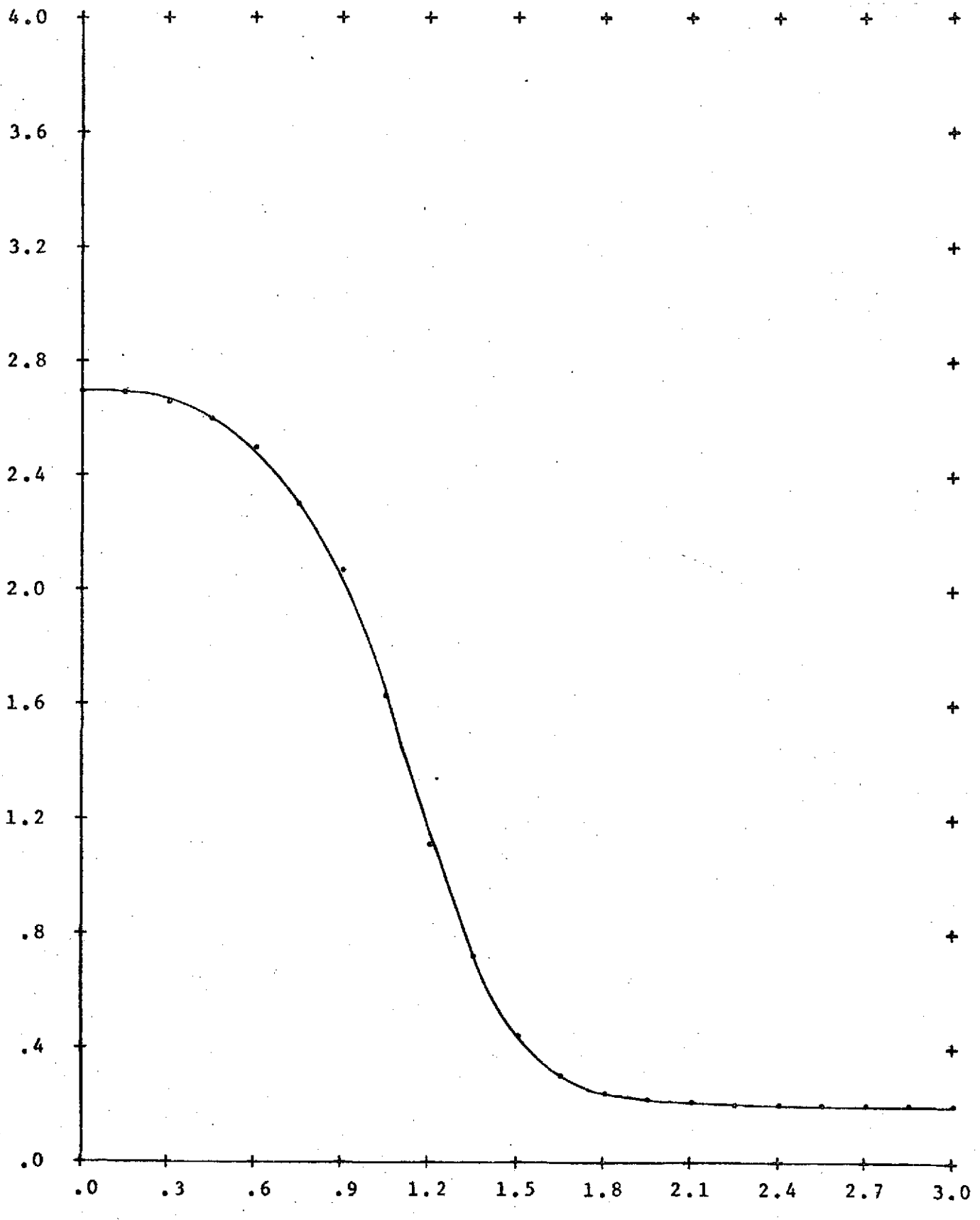

FIGURE 3. Density of Duplicate Versus Relative Log Exposure of Original

Following the procedure outlined in A, requires multiple interpolations using Figures 1 and 2. This is the more complicated procedure.

The procedure specified in B, produces Figure 3 which is the overall system response curve. Figure 3 may also be generated using Figures 1 and 2. When this method is used, the result is a tone reproduction cycle drawing.

NOTE: To obtain absolute log exposure values from relative log exposure values, it is necessary to know the absolute value for the relative log exposure origin.

TONE REPRODUCTION CYCLE

The four-quadrant tone-reproduction cycle shown in the accompanying figure gives a graphic illustration of the procedures outlined above.

Quadrant I is used only as a linear transfer curve in this diagram. In a normal tone-reproduction cycle, this quadrant would contain the flare curve of the camera (and/or atmosphere).

Equivalent answers are obtained for the overall system response curve by:

1. Going through quadrants II and III and plotting duplicate densities against original densities to produce the duplicate response curve.

2. Plotting the duplicate densities against the original log exposures. The steps are essentially 0.15 log exposure increments.

It can be seen from the figure that these two procedures give equivalent results, but obviously procedure #2 is far simpler. It requires no knowledge of the original sensitometric response or the response of the duplicating material.

Example:

If a density of 1.00 is read from the duplicate, the relative log exposure by either method is 1.22. Absolute log exposure is found by adding the values supplied with the film (absolute log E at relative log E of 0.0) to the relative log exposure.

Step No.	Relative Log E	Original Negative	Duplicate
1	0.00	0.14	2.70
2	0.15	0.15	2.69
3	0.30	0.17	2.66
4	0.45	0.20	2.60
5	0.60	0.25	2.50
6	0.75	0.34	2.30
7	0.90	0.45	2.07
8	1.05	0.59	1.63
9	1.20	0.73	1.11

Step No.	Relative Log. E	Original Negative	Duplicate
10	1.35	0.87	0.72
11	1.50	1.01	0.44
12	1.65	1.16	0.30
13	1.80	1.31	0.24
14	1.95	1.47	0.22
15	2.10	1.59	0.21
16	2.25	1.73	0.20
17	2.40	1.84	0.20
18	2.55	1.93	0.20
19	2.70	2.02	0.20
20	2.85	2.07	0.20
21	3.00	2.13	0.20

NEGATIVE/POSITIVE TONE REPRODUCTION CYCLE