

Part 3: Print Density Differences of First Generation Copies

Side-by-side Evaluation - In a side-by-side examination (at NARA) of the two "first generation" Secret Service copies and the Zapruder original, we observed a significant difference in the overall print density. (See Figure 3-9) The copy identified by NARA as Secret Service copy 1 is much darker than the original and Secret Service copy 2 is noticeably lighter. *Caution: Because of reproduction limitations, the Kodacolor photocopies tend to exaggerate the differences seen.*

In past discussions with Bruce Jamieson, his initial assumption was that all three copies were made with the same printer light and filter pack. The two copies identified by NARA as those received by Agent F.V. Sorrels challenge that assumption.

Image Characteristics of the Secret Service Copies:

- The two Secret Service copies are both on Kodachrome II Type A manufactured in 1963.
- Secret Service copy 2 has the Kodak Dallas Laboratory perforated identification 0186, confirming its first generation status.
- Both copies have good - comparable resolution.
- Both copies have image emulsion orientation to require viewing the film from the emulsion side, appropriate for first-generation contact prints made from the original. (The proper emulsion orientation for viewing the Kodachrome II reversal original is through the base.)
- Most likely, the original was rewound after each printing pass. The motorcade pictures do not have any image information printed between the perforations; therefore the printing orientation was the same for both copies. If the original was not rewound between printing passes the Secret Service copies were prints one and three.
- The hue of the 34 year-old prints is similar, which supports a hypothesis that the difference is primarily printer light intensity while maintaining the same filter pack.
- The difference in density is significant - more than one would expect from a printer operator trying to "bracket" a presumed correct exposure. However, it is possible that three different light levels were chosen - and that the copies Agent Sorrels received were the bracketed high and low and that Time-Life received the nominal. *(Examination of the Time-Life first generation print is needed: to*

confirm successive heads, or heads and tails printing orientation; and to compare the Time-Life print density to the Secret Service copies.)

The need for a comparative evaluation can be emphasized further as we note a comment on page 114 of Richard Trask's Book, *Pictures of the Pain*. There he relates to the research being done by author Josiah Thompson¹² as a consultant to LIFE; who noted in his screening of LIFE'S first generation copy of the Zapruder film, that it was "infinitely brighter and clearer" than the National Archives Copy.

Possible Scenarios - The density difference issue is perplexing and has been discussed with Bruce Jamieson, Motion Picture Laboratory management and printing personnel. Trying to place ourselves in the position of the JAMIESON film company in 1963, we hypothesized the following:

- a. They were faced with a significant time constraint - essentially immediate. This constraint precluded scene testing¹³ of the original to assess the ideal print density and filter pack.
 - b. The lab did not have 8mm perforated print stock on hand to permit using familiar materials. This mandated the use of 8mm Type A camera film as a print material (supplied by Kodak). The Type A camera film is both faster (ASA 40) and balanced for a higher color temperature (3400°K) than a typical print stock having a slower speed and a lower (neutral aim balance) color temperature of about 2800°K.
 - c. The lab consulted with Erwin "Pat" Pattist, Quality Control Supervisor of the Kodak Dallas Processing Laboratory, (possibly) to gain his assurance that the process was "in control" and his opinion about the selection of filter pack and printer light.
 - d. Handling of the films was complicated because Mr. Zapruder was present in the printing room while his original was being copied.
- Scenario 1 - If Mr. Zapruder had requested three "good" copies of his original, the prudent approach would be to print "one light", i.e. all three prints with the (same) best choice of filter pack and printer light setting. If this scenario was followed, Secret Service Copy 1 and Secret Service copy 2 should be a close match.

¹² *Six Seconds in Dallas, a Micro-study of the Kennedy Assassination*, Bernard Geis & Associates, 1967

¹³ Scene testing is a practical test of printing a few frames of the original onto a known print material to select the proper printing light setup.

Zapruder 8mm Original Compared to Secret Service Copies

Made by the JAMIESON film company

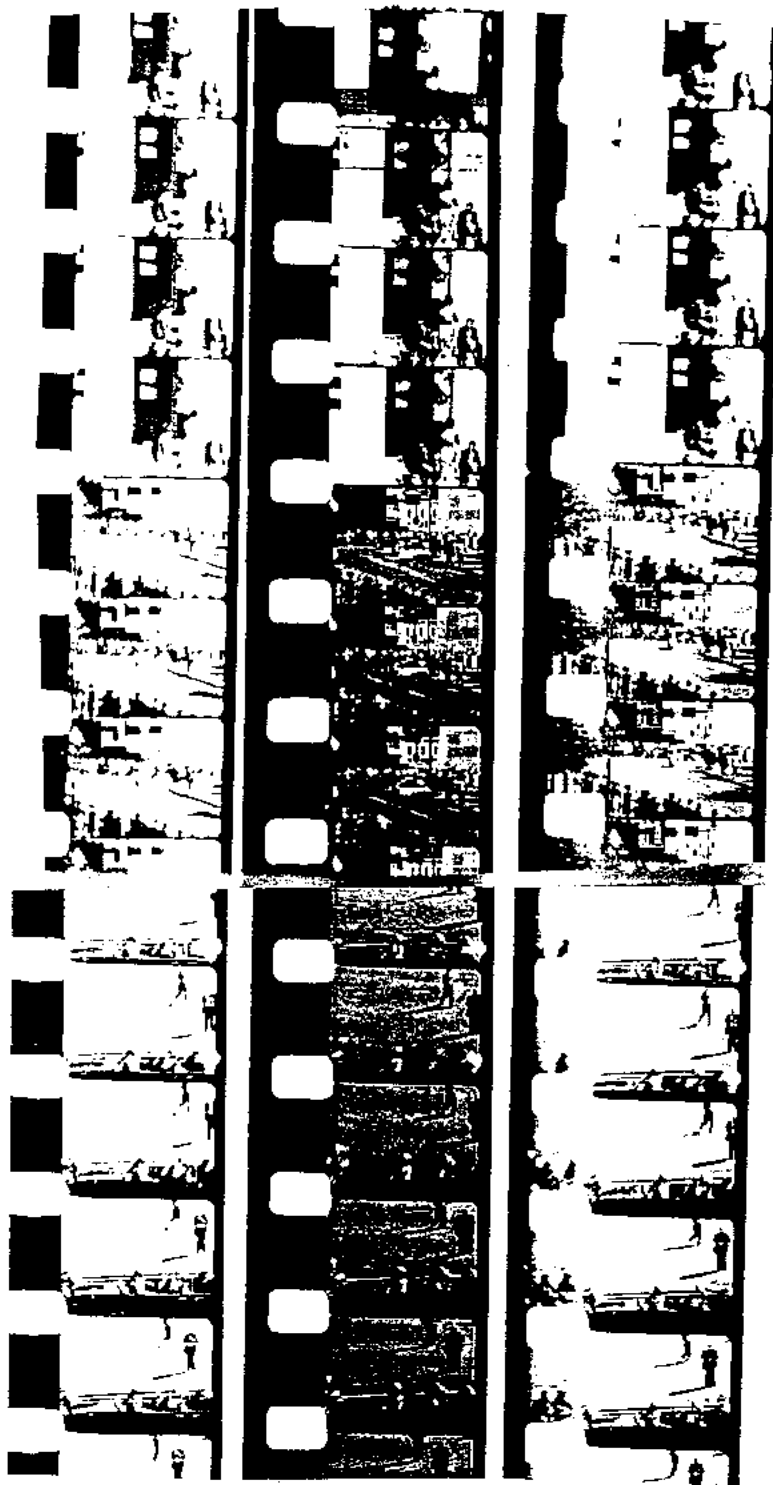


Figure 3-11 Three scenes of photocopies of Zapruder 8mm original in side-by-side comparison with first generation Secret Service copies 1 and 2 held by NARA . (Neg. 4527, frames 4A and 19A)
The original is on the right, Secret Service copy #1 is center and Secret Service copy #2 is left.

- Scenario 2 - If Mr. Zapruder had requested one "good" copy of his original, and provided three customer Type A film rolls for print stock to achieve this objective, a printer "light-bracketing" approach could have been considered. The procedure would be to select an aim printing light level for the first print and then possibly expose a half stop over and under for the second and third prints while maintaining the chosen filter pack. This scenario could be the basis of the density differences seen, especially if the Life Magazine copy density falls in-between the two Secret Service copies, and would be my personal best guess of what happened.

There is a need to reconcile the above hypotheses to the most probable scenario. In August 1998, the U.S. Justice Department requested that the LMH Company make available the LMH Company's first generation copy (formerly the "Life Magazine" first generation copy) for technical study and comparison alongside the Zapruder "Out-of-Camera" original, and Secret Service copies 1 and 2. [This First Generation Copy Identified by the ARRB Staff in April 1997, is labeled "Item No. 2" on the LMH inventory.]

Providing the Justice Department can persuade the LMH Co. to cooperate in this matter, it is recommended that the National Archives Motion Picture, Sound and Video Branch conduct a visual examination (and create a photographic record) of LMH Co., item No. 2, compared with the two Secret Service copies, and the Zapruder original for several matched scenes. Such a study would either provide support and corroboration for the present identification of these films as first generation copies (per Scenario 2), or would provide the basis for further study.

Part 4: Practical Printing Tests on the Model J

Our initial trials on Kodak's old Model J printer proved that we could not replicate JAMIESON's septum line characteristics and placement. However, we believed we could gain some awareness by the behavior of current Kodachrome through multiple generations of emulsion-to-emulsion contact printing. I wish to emphasize the simple goal of awareness rather than replication of printing technique and results. The reason is straightforward, the film and the processing characteristics for KODACHROME have evolved through the thirty-five years since the assassination.

Choice of Films: In Study 4, which follows, we ran several practical camera tests with the Bell & Howell 414PD camera, replicating most of the image characteristics of the Zapruder original. We were fortunate to find KODACHROME 25 Movie Film (daylight) 7267 to use as a camera taking film, and KODACHROME 40 Movie Film, Type A/7270, to use as a print stock. These films match in emulsion speed the KODACHROME II Daylight that Zapruder used in his camera and the KODACHROME II Type-A that the Dallas Processing Laboratory provided to make his copies at JAMIESON.

Our goal was to practically evaluate image resolution and image quality through three generations of printing. The purpose related to concerns, raised by some, that one of the Secret Service copies might have been a third generation contact print.

Note: Contact printing, to maintain resolution, requires emulsion-to-emulsion contact at the printer sprocket. With reversal films therefore, proper subject image orientation is achieved when:

- | | |
|--------------------------------|---|
| A - Original | When viewing through the base side. |
| B - 1 st Generation | When viewing through the emulsion side. |
| C - 2 nd Generation | When viewing through the base side. |
| D - 3 rd Generation | When viewing through the emulsion side. |

We note that both Secret Service copies view the subject properly through the emulsion, indicating that they are either first or third generation.

Sensitometric Considerations: In Study 1, we found that Mr. Zapruder's camera film was manufactured in 1961, the year of the introduction for Kodachrome II. As a Kodachrome product engineer at that time, I recall that the first sixty emulsion batches we produced had lower contrast and longer exposure latitude than subsequent product. This occurred because the product was originally designated a movie film only and it wasn't until early 1962 that we also structured it to concurrently fulfill 35mm still camera needs.

The film was not designed as a camera film for commercial reproduction, but rather had proper visual contrast for direct viewing.¹⁴ When a camera film is reproduced onto a camera film, significant contrast builds up with an attendant loss of tonal range, often with significant shifts in color reproduction. (i.e. the films have been "asked" to do a job they were not designed to do.)

The 1963 film process combination had a greater opportunity to yield good quality than our practical test. The Secret Service copies attest to this fact. One of our limitations was that the Kodak Qualex Laboratory ceased processing Kodachrome Movie film in 1997, requiring us to use a test process yielding slightly different toe characteristics. Nonetheless, the concept of multiple generation printing could be demonstrated and we were able to derive two significant conclusions:

- We were very impressed at the tremendously effective retention of resolution through three generations of contact printing.
- By printing for aim or consistent density for the 11th step (of the sensitometric strip), we found significant loss of tonal reproduction in the lower scale and a blocking of image tone in the upper scale by the second generation. The third generation was completely unacceptable when compared to the first generation.

We doubt, therefore, that the Secret Service copies are first and third generation, but rather both are first generation with significant density differences as noted in Part 3.

A description of our printer test setup follows together with densitometer readings of the 7267 sensitometric strip, as the original,

¹⁴ Commercial camera films are designed low contrast so that when combined with a print film of proper contrast, the derived contrast of the resulting print is proper for viewing.

and readings of the resulting print-through sensitometric strips derived during the Model J printing at the selected light exposure level and filter pack.

In addition, the original sensitometric strip (the identical one spliced into the printing master) was reproduced with a sensitometer and the curves plotted (Status A densitometry) to provide a conceptual understanding of curve shape/tone reproduction changes when using a camera contrast film as a print medium. Included are:

Standard step-wedge exposed to KODACHROME 25 Day./7267
Resulting 7267 strip exposed to KODACHROME 40 Type A/7270
Resulting 7270 strip exposed to KODACHROME 40 Type A/7270

The sensitometric test represents a controlled printer test, but is two generations - sufficient to illustrate the build up of contrast and loss of tone scale. The results of the sensitometric print-throughs and the practical printer test print throughs can be interpreted from the data provided.

Comparison photos of a selected scene and a portion of the sensitometric strips that follow as Figure 3-12 are included for awareness only. (Copying and reproduction are not sufficiently controlled to permit visual analysis.)

Comparison of Original and Subsequent Generation Prints

A Selected Scene from the Model J Printer Test And the Sensitometric Strip and Print-throughs

CAUTION: The copying quality of the photographic reproduction does not permit a visual/analytical interpretation of the image or its tonal quality. See densitometric data for any analysis needed.

Print-Through Image Orientation: Left-to-Right, or Top-to-Bottom
ORIGINAL 7267 to 1ST GENERATION on 7270 to 2nd GEN. On 7270 to 3rd GEN on 7270

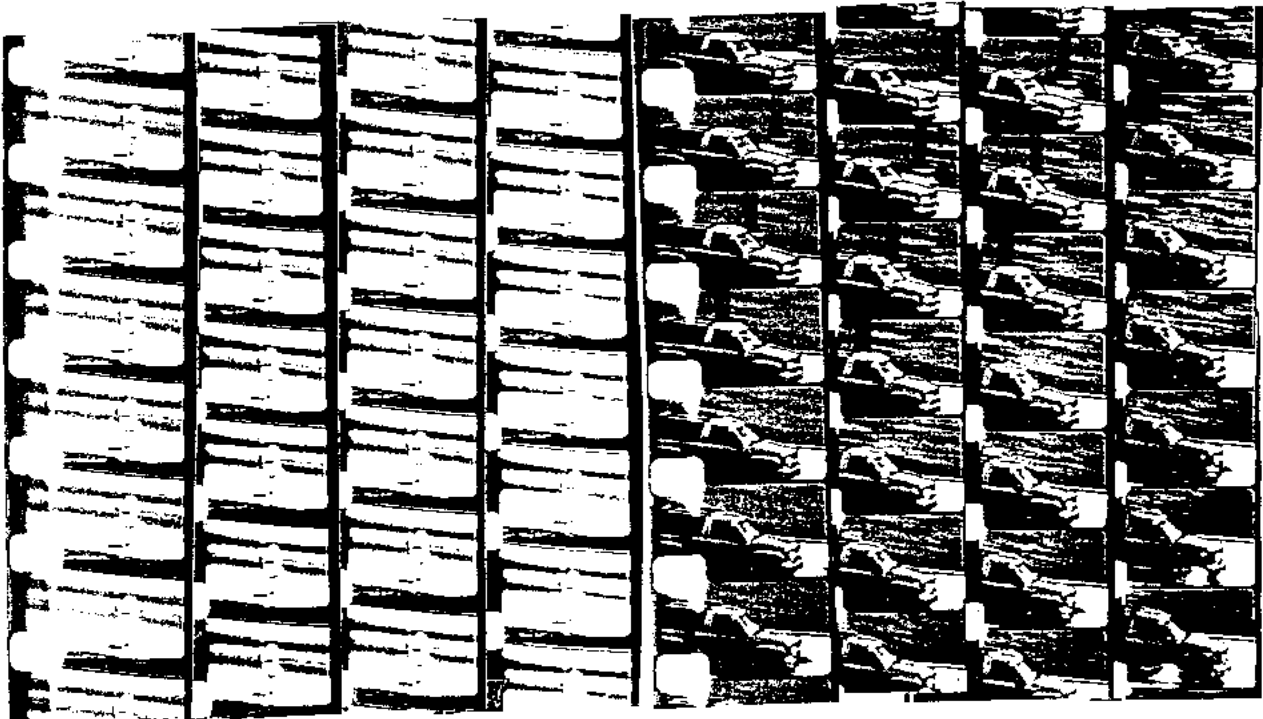
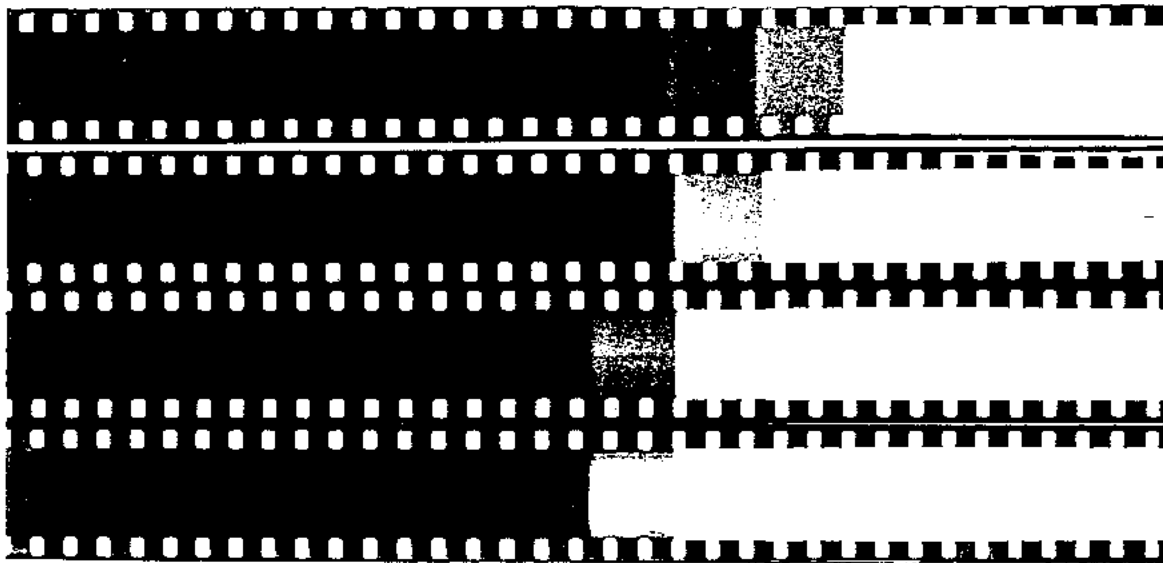


Figure 3-12

B&H Model J Printer Test Setup

Using R. Zavada's B&H 414PD Camera Test Films

Goal

Design a test to use Kodak's old B&H Model J printer to determine if this equipment will approximate or replicate the septum line of the NARA copies of the Zapruder film. (See text.)

Makeup of Printing Master Roll

The printing master roll will be made up of selected scenes taken as camera tests with B&H 414PD 8mm Cameras. (Note: the 8mm film from the tests has not been split and is in 16mm width)

Content of Printing Master

1. Heads Leader
2. Scene of Dealey Plaza from Camera Test 1. (approx. 4ft.).
3. Scene of 17% Gray wall - Inf. focus/Zoom WA to Tele, Camera Test 2 (approx. 4ft.).
4. Scene of focus test charts -- Inf. focus/Zoom WA to Tele, Camera Test 3 (approx. 4ft.).
5. Sensitometric strip from camera test film material 7267.
6. Tails Leader

Splicing - Simple and reliable - tape splices are OK.

Cleaning and Lubrication - Yes

Caution

Because 8mm perforation pitch product may be interspliced with 16mm perforation pitch leader, it is important to ensure splicing will allow transition of 8mm to 16mm splices to 16mm sprockets. A pre print run through a synchronizer should confirm proper splice pitch.

Print Stock

KODACHROME 40 Movie Film, Type A/7270 (ISO-40 3400K) Perforated 8mm

Printing

- Initial test - one-to-three passes to confirm filter pack and printer light.
- 13. After successful test -- establish optimum density and adjust filter pack.

1st Printer Test

Evaluated the printer. Last use estimated to be in excess of 10 years. Located all controls and made two dry runs. Located edge print light source - independent of printed area light source.

Had to make guess of first trial printer pack.

- Assumed Printer Lamp operating at 90% of rated voltage would be about 2950°K
- Selected Wratten 82C filter to raise color temperature to about 3400°K
- Maintained 0.80 ND and Wratten 2B of previous filter pack
- Maintained two 2"X2" clear glass

Edge Print Light

Located a "voltage variac" power source for the independent edge print light. Even after setting to maximum of 40 units at stop, visually noticed that the edge print light was significantly warmer than the printer image light. (This was done when the printer light was set to sound track only to simplify viewing – Subsequently measured with photometer and Color Temperature meter!)

Test Run

After two trial thread-ups, master and raw stock were threaded per standard B&H Model J procedures - except that the Kodak printer had been modified with a plush pad to provide improved original to print contact. After test runs, Printer set-up was :

Printer Lamp voltage -- 85v

Edge print light setting -- 40units

Filter pack – Wratten 2B, 82C, 20CC Magenta, 20+5CC Red

Printer light aperture diaphragm -- 13 (mid-range)

Image aperture setting: Picture Only

Results

We noted that the printer sprocket had a thickness equivalent to the sprocket tooth width. This result required refurbishing the light pipe light source to determine if repositioning would improve the light penetration from the edge of the film into the area between the perforations.

Repeat Test

A repeat test was tried after refurbishing the edge print light pipe. No improvement was noted, the width of the root circle of the printing sprocket prevented light from reaching between the perforations. Our experiment failed to replicate JAMIESON'S septum line.

Modified Simple Multiple Generation Printing Test

As long as we had refurbished the printer, we believed it prudent to continue with a simple multiple generation contact-printing test to gain an appreciation of the challenge of the users of Secret Service copies to replicate their first generation copies. We therefore printed two additional generations without the edge printing light and with the aperture set to "picture only". See text and densitometry for analysis of results.

Practical Printer Test, Kodak Model J Printer – Densitometer Tape Data

Note Printing Goal was to closely match the 11th step Density Value of Original in Print-Through(s) – See Text
 Status "A" filter readings. r = Red, g = Green, b = Blue. Decimal point follows first digit, e.g. r0112 = 0.112 density Red

ORIGINAL 7267 Sens. Strip	7267 printed to 7270 (1 st gen.)	7270 (1 st) printed to 7270 (2 nd gen.)	7270 (2 nd) printed to 7270 (3 rd gen.)
r0112 g0135 b0146	r0116 g0177 b0185	r0117 g0186 b0197	r0114 g0178 b0188
r0176 g0167 b0187	r0125 g0186 b0197	r0119 g0188 b0201	r0114 g0179 b0190
r0288 g0234 b0253	r0144 g0199 b0215	r0122 g0191 b0205	r0115 g0183 b0194
r0430 g0357 b0347	r0187 g0227 b0239	r0127 g0198 b0217	r0117 g0182 b0196
r0621 g0535 b0482	r0254 g0302 b0308	r0137 g0215 b0239	r0116 g0184 b0200
r0846 g0712 b0631	r0389 g0433 b0405	r0167 g0263 b0282	r0122 g0194 b0209
r1106 g0898 b0802	r0637 g0646 b0569	r0262 g0395 b0374	r0132 g0227 b0240
r1375 g1121 b1012	r1015 g0917 b0802	r0544 g0673 b0576	r0185 g0349 b0328
r1671 g1336 b1235	r1495 g1222 b1100	r1233 g1076 b0952	r0709 g0795 b0665
r2037 g1580 b1506	r2184 g1640 b1551	r2360 g1690 b1616	r2522 g1749 b1632
r2443 g1846 b1817	r2917 g2072 b2070	r3597 g2615 b2607	r3828 g3355 b2982
r2843 g2146 b2132	r3554 g2662 b2632	r3841 g3542 b3061	r3894 g3756 b3145
r3237 g2513 b2455	r3797 g3336 b2965	r3864 g3711 b3123	r3898 g3737 b3136
r3497 g2879 b2729	r3865 g3635 b3084	r3859 g3718 b3125	r3890 g3734 b3140
r3662 g3217 b2930	r3878 g3697 b3112	r3853 g3717 b3147	r3878 g3733 b3146
r3749 g3443 b3052	r3881 g3715 b3124	r3933 g3724 b3130	r3888 g3727 b3124
r3793 g3551 b3097	r3889 g3706 b3124	r3887 g3711 b3122	r3886 g3754 b3143
r3811 g3620 b3136	r3901 g3703 b3129	r3868 g3599 b3119	r3901 g3742 b3142
r3816 g3652 b3182	r3884 g3709 b3116	r3977 g3725 b3131	r3886 g3731 b3132
r3846 g3682 b3175	r3885 g3701 b3115		r3883 g3719 b3136

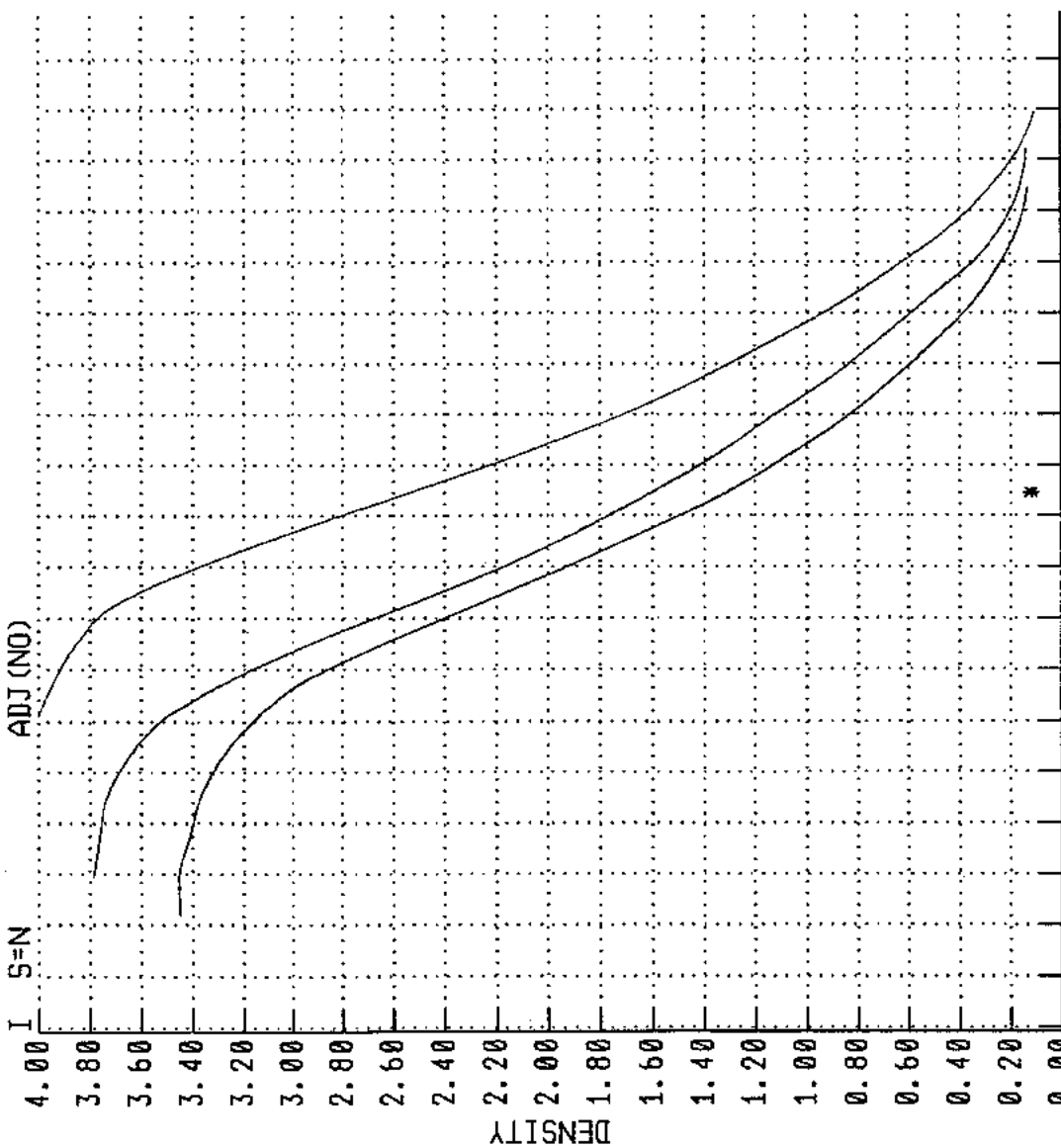
11th
Step

Sensitometric Data for EkCo B&H Model J Printer Tests
 KODACHROME 25 Movie Film (Daylight) 7267 exposed to Standard Step Tablet
 Densitometry is Status A Left Curve is BLUE, Center is GREEN, and Right is RED

- STUDY 3 - 31 R. J. Zavada, Sept. 1998

7267 4411 044
 BSC AA 8635623
 T90 NORMAL MA 00022
 1/25 SEC DAY 5

STEP	RED	GREEN	BLUE
1	4.047	3.785	3.448
2	4.030	3.761	3.451
3	4.031	3.736	3.410
4	4.010	3.658	3.372
5	3.946	3.533	3.294
6	3.858	3.284	3.170
7	3.717	2.951	2.973
8	3.398	2.564	2.655
9	2.984	2.189	2.298
10	2.536	1.874	1.945
11	2.115	1.599	1.618
12	1.731	1.348	1.308
13	1.414	1.132	1.065
14	1.133	.909	.838
15	.864	.719	.655
16	.633	.537	.495
17	.430	.356	.348
18	.282	.233	.243
19	.169	.164	.168
20	.107	.135	.132



ADJ (NO)
 I S=N
 DENSITY
 *
 CALC 01/20/98 13:16 LOG H (REF -0.7100) BTCH# F38794
 USER 571976 LIM 1 DISPLCMNT 0.150 0.000 -0.150
 STRIP CT 01/00
 NLR577
 TL: 4 ANFP
 MAG 1.000

Sensitometric Data for EkCo B&H Model J Printer Tests

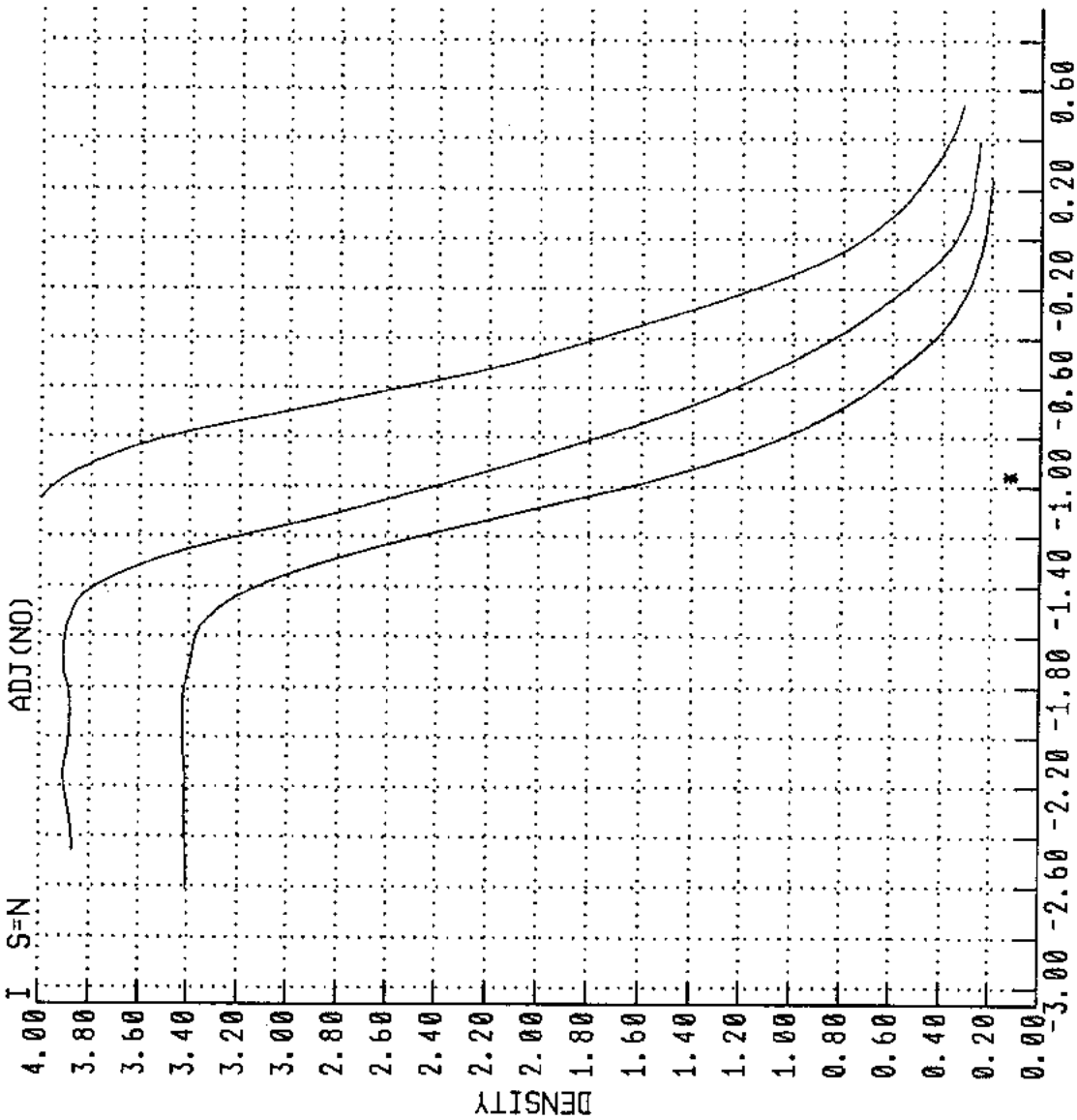
KODACHROME 40 Movie Film Type A 7270 exposed to 7267 as the Step Tablet

Densitometry is Status A Left Curve is BLUE, Center is GREEN, and Right is RED

- STUDY 3 - 32 R. J. Zavada, Sept. 1998

7270 2462 031 7267
 MISC AA 8651141
 T90 NORMAL MA 00015
 1/50 SEC FLD 2

STEP	RED	GREEN	BLUE
1	4.108	3.869	3.407
2	4.103	3.882	3.410
3	4.094	3.904	3.417
4	4.089	3.885	3.414
5	4.104	3.879	3.426
6	4.094	3.906	3.425
7	4.105	3.892	3.395
8	4.097	3.793	3.352
9	4.042	3.425	3.145
10	3.890	2.809	2.699
11	3.517	2.271	2.091
12	2.822	1.792	1.496
13	2.134	1.373	1.059
14	1.644	1.040	.763
15	1.184	.770	.554
16	.816	.562	.396
17	.602	.392	.301
18	.472	.303	.247
19	.376	.271	.218
20	.320	.251	.199



CALC 01/20/98 13:30 LOG H (REF -0.9600) BTCH#
 USER 571976 LIM 1 DISPLCMT 0.150 0.000 -0.150

STRIP CT 01/00

NLR577 MAG 1.000
 7267 USED FOR STEP TABLET TL: L ANFP

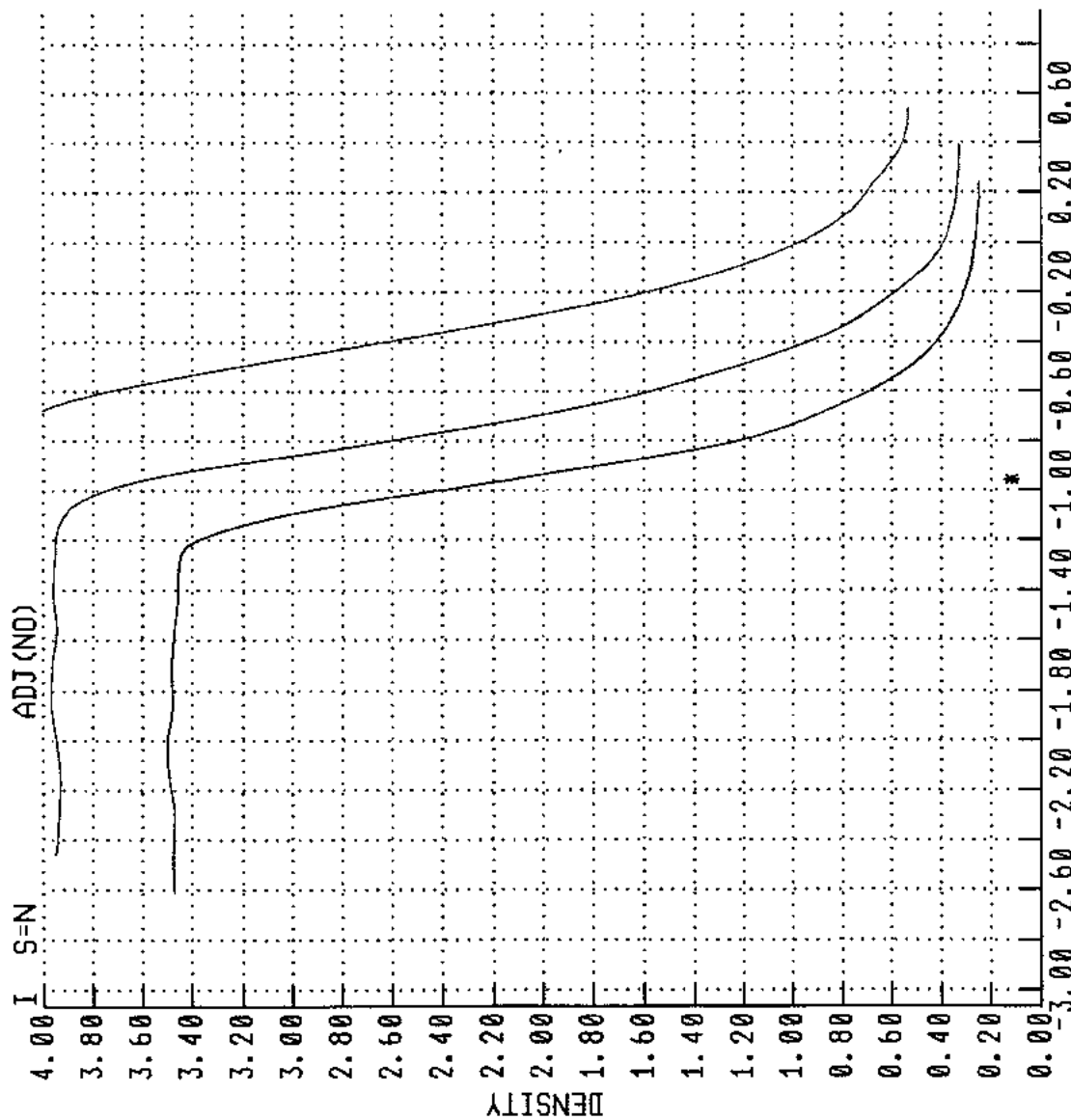
Sensitometric Data for EkCo B&H Model J Printer Tests

KODACHROME 40 Movie Film Type A 7270 exposed to 7270 as the Step Tablet

Densitometry is Status A Left Curve is BLUE, Center is GREEN, and Right is RED

-STUDY 3- 33 R. J. Zavada, Sept. 1998

7270 2462 031 7270
 BSC AA 8652930
 T90 NORMAL MA 00015
 1/50 SEC FLD 2



STEP	RED	GREEN	BLUE
1	4.139	3.947	3.469
2	4.158	3.935	3.474
3	4.137	3.930	3.468
4	4.150	3.943	3.488
5	4.137	3.965	3.496
6	4.155	3.963	3.477
7	4.155	3.943	3.478
8	4.164	3.958	3.469
9	4.147	3.951	3.453
10	4.164	3.920	3.444
11	4.130	3.600	3.071
12	3.959	2.668	2.138
13	3.273	1.814	1.255
14	2.399	1.259	.815
15	1.624	.839	.533
16	1.113	.593	.387
17	.809	.424	.309
18	.667	.356	.271
19	.557	.331	.253
20	.530	.325	.246

CALC 01/22/98 14:21 LOG H (REF -0.9600) BTCH#
 USER 571976 LIM 1 DISPLCMNT 0.150 0.000 -0.150
 STRIP CT 01/00 RR
 NLR577
 MAG 1.000
 GJ0: SMOOTHING DISABLED: ACT RCD