

# The Research of Map Spot Colors Digital Proofing in Commercial Prepress System

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## Abstract

*At present, many commercial prepress systems have the function of spot color proofing. However, there are still many problems when digital proofing system is used to simulate spot colors, great color difference is the severe one. In this article, a method of accurate color matching in map spot colors digital proofing is brought forward based on the analysis of the reasons that caused the huge color difference. According to the colorimetric values of the map spot colors, using the utmost color gamut of the digital proofing device, and making several effective corrections, the color difference between standard color values of map spot colors and the final digital proof is about 1. It shows that the accurate color matching of map spot colors in commercial prepress system is achieved.*

## 1 Introduction

The quality of digital proofing has been improving continually due to the revolution of digital proofing devices and the relevant color measuring devices. The average color differences between the sample of printing and that of digital proof can be nearly 1 or even less than 1 if using proper control methods. The color difference can not be perceived by human naked eyes if the value is nearly 1. Although the general digital proofing system will support spot colors, the matching result is not satisfied when proofing spot colors using present digital proofing system. The main problem is that the color difference is huge. Most digital proofing system can only accept spot colors, and actually the CMYK values are used to output. That explains why the color difference is huge, because the CMYK values are usually transformed according to a certain printing method with a narrower color gamut than spot colors.

How can the accurate color matching be achieved for spot colors by digital proofing in the proofing environment of commercial prepress system? In this paper, the limitations of digital proofing system used to output spot colors proof are analyzed. The data transforming and the stages controlling are effective. As a result, the final average color difference is nearly 1, it is sure that the project of spot color proofing is feasible and practical.

## 2. Problems on digital proofing system when outputting spot colors and the reasons

The files which describe the colors with L\*a\*b\* values are not always supported by all digital proofing system; most often files with CMYK color mode can only be accepted. The relevant

CMYK values of spot colors are often used when digital proofing, so huge color differences are produced.

### 2.1 Spot colors digital proofing using MetaDimension Color Proof Pro

18 basic colors of a color code for maps are selected to do the experiment. Among the 18 basic colors, some are spot colors and some are process colors, as they are all expressed by its L\*a\*b\* values and ignored the relevant CMYK values, so they are all considered as spot colors. In Photoshop, the 18 color patches are set with their L\*a\*b\* values, and then transformed to CMYK using the default color settings (U.S. Prepress color settings) and saved as Tiff file.

The device for digital proofing is HP Designjet 5500 with HP inks, Easicolor 517 digital proofing paper; the digital proofing software is Heidelberg Prinect MetaDimension Color Proof Pro (the same below). Digital proofing at this time will simulate CD 102 press. X-Rite 530 is used as color measurement instrument. The average color difference between the original colorimetric data and digital color proof of 18 color patches for maps is greater than 13.

### 2.2 The analysis of digital proofing

The average color difference is over 13. It is huge, of course. What caused such a huge color difference? The following reasons may be considered:

(1) When the Tiff file is transformed from L\*a\*b\* color mode to CMYK, some color patches that are out of color gamut of U.S. prepress default color settings offset from the original position. The average color differences between the original colorimetric values of the 18 color patches and the transformed ones based on the U.S. prepress default color settings is about 1.3, but the average color differences between the original colorimetric values of the 18 color patches and the transformed ones based on custom color settings is less than 0.2. In the custom color settings, the default CMYK color space is replaced by the ICC of HP Designjet 5500.

(2) In the digital proofing settings, the profiles of proofer and press are selected. When digital proofing, color space will be changed to the one of the press. But the color gamut of the 18 color patches is larger than the CD102 press, that's the main reason that caused the huge color difference.

(3) Of course, some color patches are still in the color gamut of the press after transformation. The ICC of the CD 102 press is not the one used to print the color code for maps, so color differences will produce. It needs certain corrections to achieve better matching result.

Based upon the above analysis, the accurate spot colors digital proofing scheme is formed: (1) Custom color settings in Photoshop, using the ICC profile of relevant digital proofer, in this

experiment, HP Designjet 5500. (2) Only device settings are set in the digital proofing software, use the greater color gamut of the proofer. (3) Several proofing corrections reach the accurate matching result.

### 3. Scheme of accurate color matching of spot colors proofing

#### 3.1 Custom color settings

The color gamut of U.S. prepress default color settings is smaller than that of the color patches for maps. In order to enlarge the color gamut, the ICC profile of HP Designjet 5500 is used during color setting in Photoshop. The colorimetric values of the original and the transformed with the custom color settings are almost the same. The average color difference is under 0.2.

In Photoshop, the CMYK working space is replaced by the ICC profile of HP Designjet 5500. Other settings remain the same as the U.S. prepress default color settings.

#### 3.2 Settings for digital proofing

In this experiment, only the device settings of output plan template in Heidelberg Prinect MetaDimension or Printready are needed, other parameters of digital proofing will leave unchecked or keep the default settings. Pay more attention to make sure that the “proof” settings must not be checked. Fig 3-1 shows the device settings of spot colors proofing output plan template.

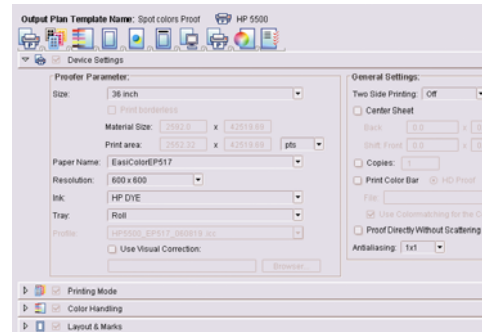


Figure 3-1 Device settings of spot colors proof output plan template

#### 3.3 First correction for spot colors proofing

After finishing the above steps of settings, now it is time to do the first digital proofing for the 18 color patches. X-Rite 530 is used to measure the colorimetric values of the digital proof of 18 color patches. According to the measuring data and original ones, the first correction data will get. The colorimetric data of the first proof and the first correction data are shown in Table 3-1. The first proof is only get by series settings of the proofing environment, the average color difference declines from 13 to 8. With the first correction, we will soon get a more satisfied result.

Table 3-1 Measuring colorimetric data of the first proof and the first correction data

Name	Standard			Measured			Color differences	First correction data		
	L*	a*	b*	L*	a*	b*		L*	a*	b*
Yellow	85	-5	84	78.04	-4.9	74.86	11.48874	92	-5	93
Peach red	52	66	-10	47.06	63.14	-14.25	7.116579	57	69	-6
Sky blue	56	-30	-39	50.86	-27.61	-40.29	5.813416	61	-32	-38
Light yellow	88	-10	75	80.96	-10.07	66.02	11.41082	95	-10	84
Magenta	52	59	-4	47.06	56.37	-8.1	6.937615	57	62	0
Peacock blue	57	-33	-36	51.13	-31.26	-37.41	6.282722	63	-35	-35
Bright red	52	61	25	46.77	58.24	20.03	7.724727	57	64	30
Orange yellow	71	39	63	64.1	35.93	56.05	10.2634	78	42	70
Black	30	1	1	25.42	-0.07	-1.81	5.478814	35	2	3
Topographic brown	67	12	35	60.31	11.64	28.92	9.047215	74	12	41
Topographic blue	63	-25	-34	56.83	-23.13	-35.72	6.672646	69	-27	-32
Topographic green	71	-46	38	63.59	-44.08	30.56	10.67465	78	-48	45
Light brown	80	11	47	73.44	9.77	40.99	8.981459	87	12	53
Red brown	61	37	38	55.08	34.95	32.77	8.160993	67	39	43
Green	67	-48	36	60.15	-45.18	27.56	11.2298	74	-51	45
Purple gray	63	5	-15	56.88	5.27	-18.43	7.02084	69	5	-12
Purple	46	43	-16	40.77	42.82	-18.38	5.748887	51	43	-14
Blue gray	53	-10	0	47.28	-9.89	-3.45	6.680793	59	-10	3
						Average	8.151896			

### 3.4 Second correction for spot colors proofing

Based on the first correction data, renew the Tiff file in Photoshop, and then output digital proof for the second time. The

colorimetric data of the second proof and the second correction data are shown in Table 3-2. The average color difference is dropped to nearly 2. The result is good enough.

**Table 3-2 Colorimetric data of the second proof and the second correction data**

Name	Standard			Measured			Color differences	Second correction data		
	L	a*	b*	L	a*	b*		L*	a*	b*
Yellow	85	-5	84	85.24	-5.33	80.06	3.961073	92	-5	97
Peach red	52	66	-10	50.94	65.75	-9.75	1.117408	58	69	-6
Sky blue	56	-30	-39	54.9	-29.52	-40.43	1.866896	62	-32	-37
Light yellow	88	-10	75	86.63	-9.12	73.99	1.91609	96	-11	85
Magenta	52	59	-4	51.56	58.9	-3.08	1.024695	57	62	-1
Peacock blue	57	-33	-36	56.26	-32.02	-38.03	2.37253	64	-36	-33
Bright red	52	61	25	50.71	60.72	24.95	1.320984	58	64	30
Orange yellow	71	39	63	65.34	35.3	59.73	7.511225	84	46	73
Black	30	1	1	29.36	1.46	-0.46	1.659156	36	2	4
Topographic brown	67	12	35	67.89	10.33	35.88	2.08696	73	14	40
Topographic blue	63	-25	-34	62.17	-24.42	-34.87	1.334991	69	-28	-31
Topographic green	71	-46	38	71.46	-44.93	38.4	1.231463	78	-49	45
Light brown	80	11	47	78.45	10.23	45.71	2.158588	89	13	54
Red brown	61	37	38	60.35	37.45	36.82	1.420352	68	39	44
Green	67	-48	36	67.17	-49.42	37.1	1.804245	74	-50	44
Purple gray	63	5	-15	63.44	5.14	-14.66	0.573411	69	5	-12
Purple	46	43	-16	45.11	42.41	-16.26	1.099	52	44	-14
Blue gray	53	-10	0	52.23	-10.05	-1.41	1.607327	59	-10	4
						Average	2.003688			

### 3.5 Third correction for spot colors proofing

Based on the second correction data, renew the Tiff file in Photoshop, and then output digital proof for the third time. Measure the colorimetric data and then create the third correction data. The average color difference reaches 1.5. The data table is omitted here because of the limited space.

### 3.6 Final output of spot colors proofing

Based on the third correction data, renew the Tiff file in Photoshop, then output digital proof for the fourth time and this is also the last time for the spot colors proofing. The colorimetric data of the final proof is shown in Table 3-3. The average color difference reaches 1.1.

**Table 3-3 Colorimetric data of the final proof and the color differences**

Name	Standard			Measured			Color differences
	L*	a*	b*	L*	a*	b*	
Yellow	85	-5	84	85.39	-4.38	84.22	0.764788
Peach red	52	66	-10	52.34	66.19	-10.49	0.625939
Sky blue	56	-30	-39	55.5	-29.57	-39.28	0.71645
Light yellow	88	-10	75	88.12	-9.95	73.03	1.974285
Magenta	52	59	-4	52.3	59.65	-4.07	0.719305
Peacock blue	57	-33	-36	57.41	-33.11	-36.12	0.441135
Bright red	52	61	25	51.89	61.65	23.68	1.475466
Orange yellow	71	39	63	67.49	34.83	62.38	5.485745

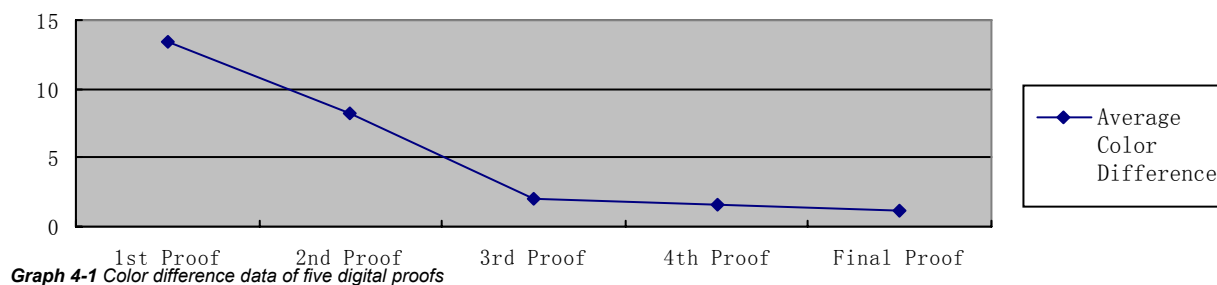
Black	30	1	1	29.57	-0.04	-0.24	1.674545
Topographic brown	67	12	35	66.68	12.47	35.51	0.763806
Topographic blue	63	-25	-34	62.08	-24.69	-34.22	0.99544
Topographic green	71	-46	38	71.5	-46.29	38.95	1.112025
Light brown	80	11	47	79.76	11.21	46.06	0.992623
Red brown	61	37	38	60.71	37.12	37.84	0.352278
Green	67	-48	36	67.19	-47.76	35.93	0.314006
Purple gray	63	5	-15	62.59	4.95	-15.15	0.439431
Purple	46	43	-16	45.12	42.9	-15.93	0.888426
Blue gray	53	-10	0	53.2	-10.02	-0.25	0.32078
						Average	1.114248

#### 4. Conclusion and further research work

The average color difference is getting smaller and smaller, it proves that the analysis of all the reasons caused the huge color differences at the very first digital proofing is right, and it also

proves the feasibility and practicability of the experiment methods used to output spot colors digital proof.

After several corrections, the average color difference declined from 13 at the very beginning to nearly 1 at the final time, the color difference data is shown in the following line graph, Graph 4-1.



Further research works are as follows:

1. Establish the transformation model for spot colors proofing to meet the demand of all other spot colors proofing.
2. Verify the matching effect of spot colors proofing by proofing Pantone spot colors.

#### References:

- [1] MetaDimension Color Proof Pro User's Guide, Edition 09/2004, Heidelberg.

- [2] MeatDimension Proofing Engine Manger User's Guide, Edition 09/2004, Heidelberg, pg. 4-1~7.
- [3] Prinect MetaDimension 6 User's Guide, Edition 01/2006, Heidelberg, pg. 8-11~17.
- [4] Prinect Printready System 3 User's Guide, Edition 04/2006, Heidelberg.

#### Author Biography

Liu Shide received his BS in printing mechanical engineering from Beijing Institute of Graphic Communications (1988) and his MS in printing technology from Zhengzhou Institute of Surveying and Mapping (1998). He has worked in the Institute of Surveying and Mapping since 1988. His work has focused on the prepress technology in the graphic arts education, and he is an associate professor in this area.