

1. Finch Paper Digital Web XP
2. Georgia Pacific Spectrum Offset Smooth
3. Domtar Digital Opaque Plus

## Traditional Transaction Printing – Uncoated Paper Comparison

<b>Market</b>	Traditional Transaction Print
<b>Physical Coverage Estimate</b>	10-15%
<b>Total Ink Coverage Limit</b>	<200%
<b>Ink</b>	Dye
<b>OEM</b>	Canon Solutions America
<b>Machine</b>	ColorStream 3900
<b>Resolution</b>	600x600

### Key Performance Indicators (KPIs) tested for this market are:

- Process Color Optical Density
- Average Process Color Ink Strike
- Positive Small Text Raggedness – Black Text
- Reverse Small Text Raggedness – Black Text

## Summary

While Finch Paper Digital Web XP and Georgia Pacific Spectrum Offset Smooth scored equally on average optical density, Domtar Digital Opaque Plus received top scores in Visual Ink Strike as well as Positive and Reverse Small Black Text Raggedness.

Domtar Digital Opaque Plus showed the largest difference in a measurement of .06 OD in Magenta. Magenta's lower value will effect color values where magenta is required as compared to Finch Paper Digital Web XP and Georgia Pacific Spectrum Offset Smooth.

Overall, Domtar Digital Opaque Plus showed higher print quality values for the Traditional Transaction Printing Market compared to Finch Paper Digital Web XP and Georgia Pacific Spectrum Offset Smooth when using aqueous dye on the ColorStream 3900. Keep in mind that these results are only relevant to the ink and printer combination used and performance may be considerably different on another device, and particularly with ink formulation from a different OEM.

The visual results of aqueous ink jetted onto a page is highly dependent on the absorbency or drying factors of the substrate. Aqueous dyes and pigments dry in two ways, by evaporation from machine dryers and through absorption into the substrate. The rate of ink absorption is vital to achieve ink visual clarity, color darkness and color purity or color value.

Printed samples measured to create this report utilized best practices printing for speed and heat settings with customized linearization, color profiling and were dry for 24 hours prior to measurement. Please note print head health can also affect consistent solid ink density and is not addressed in this report.

Paper pricing was not a factor considered in this report and the relative gains from one paper to another should be evaluated in the context of current market paper pricing as well as relative ink consumption.

1. **Finch Paper Digital Web XP**
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## Process Color Ink Optical Density (OD)

Optical Density (OD) is a measurement of light absorbance (not to be confused with the absorbance of ink into the substrate.) Optical Density is measured using a spectrodensitometer and indicates the amount of light that absorbed by the ink as jetted onto the particular paper at 100% of each process color. OD is measured on a logarithmic scale where, for example:

- OD of 0 means that no light is absorbed and 100% of light is transmitted
- OD of 1 means that 90% of light is absorbed and 10% of light is transmitted
- OD of 2 means that 99% of light is absorbed and 1% of light is transmitted

In theory it is possible to create optical density approaching 1.5 with inkjet printers using only black ink on uncoated paper, but in practice a result of 1.0 is considered “acceptable” and any result greater than 1.10 is very dark and currently difficult to achieve on uncoated paper. There is a major difference between an Optical Density measurement of 1.0 and a result of 1.1, so pay close attention to the decimal points.

Higher OD values indicate that the jetted ink is drying quickly leaving the ink colorant closer to the paper surface and resulting in a darker color. Lower OD values indicate a faster migration of ink into the paper taking the colorant with it and therefore a lower or washed out color and a reduced color gamut. Faster migration into the paper can also affect visual show through which is addressed in this report.

**Figure 1 – Process Color Ink Optical Density Measures**

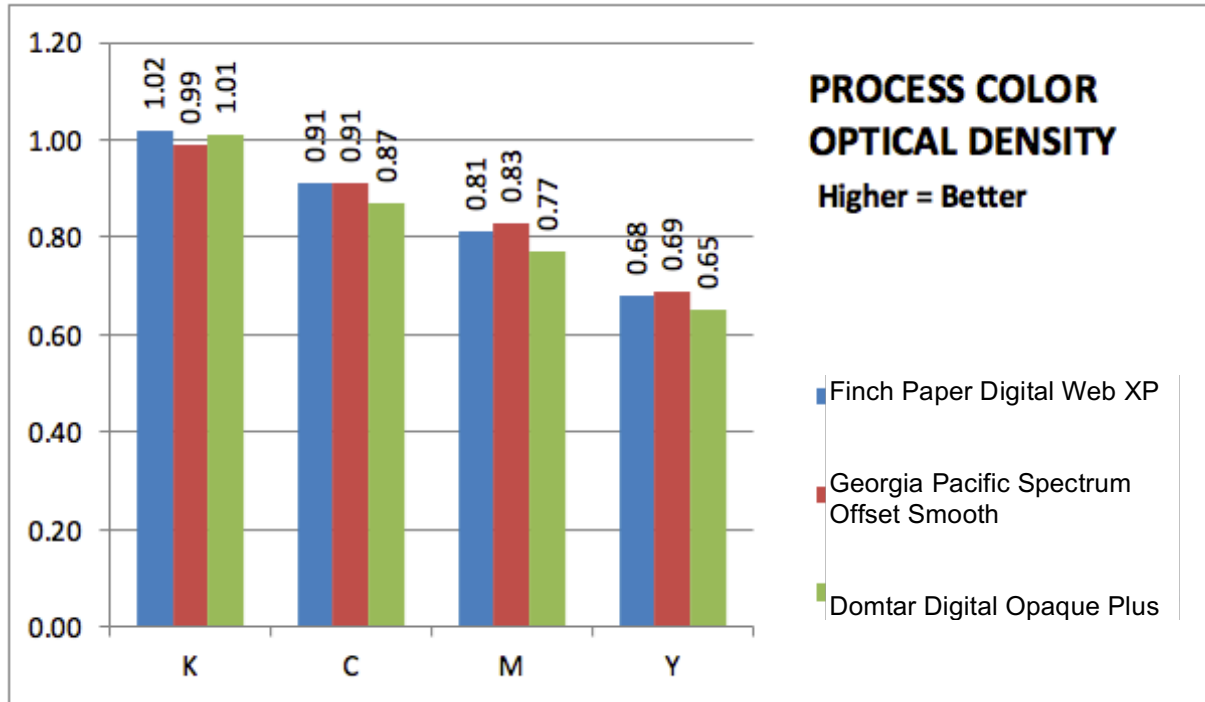
1. Finch Paper Digital Web XP 24# Bond/90gsm		2. Georgia Pacific Spectrum Offset Smooth 24# Bond/90gsm		3. Domtar Digital Opaque Plus 24# Bond/90gsm	
	Density (OD) >		Density (OD) >		Density (OD) >
K	1.02	K	0.99	K	1.01
C	0.91	C	0.91	C	0.87
M	0.81	M	0.83	M	0.77
Y	0.68	Y	0.69	Y	0.65
<b>Average</b>	<b>0.86</b>	<b>Average</b>	<b>0.86</b>	<b>Average</b>	<b>0.83</b>

*Measurements conducted with Xrite 500 series Spectrodensitometer, Absolute, Status T*

Papers included:

1. Finch Paper Digital Web XP
2. Georgia Pacific Spectrum Offset Smooth
3. Domtar Digital Opaque Plus

Figure 2 – Graphical Comparison of Process Color Ink Optical Density Measures



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## Visual Ink Strike

Visual Ink Strike, also called Strike Through, measures the visibility of printing on the reverse side of a sheet of paper due to excessive ink penetration through the paper. Ink Strike can be affected by ink volume and varying paper composition, such as paper weight, porosity and opacity (Show Through). Ink Strike values are measured as the difference in Lightness (L\*) between printed vs. unprinted areas of media on reverse side for each 100% primary process color. Measured process colors were averaged to achieve a combined value of Visual Ink Strike.

Lower values represent a lesser visual appearance of ink through the sheet. Higher numbers represent a darker visual appearance.

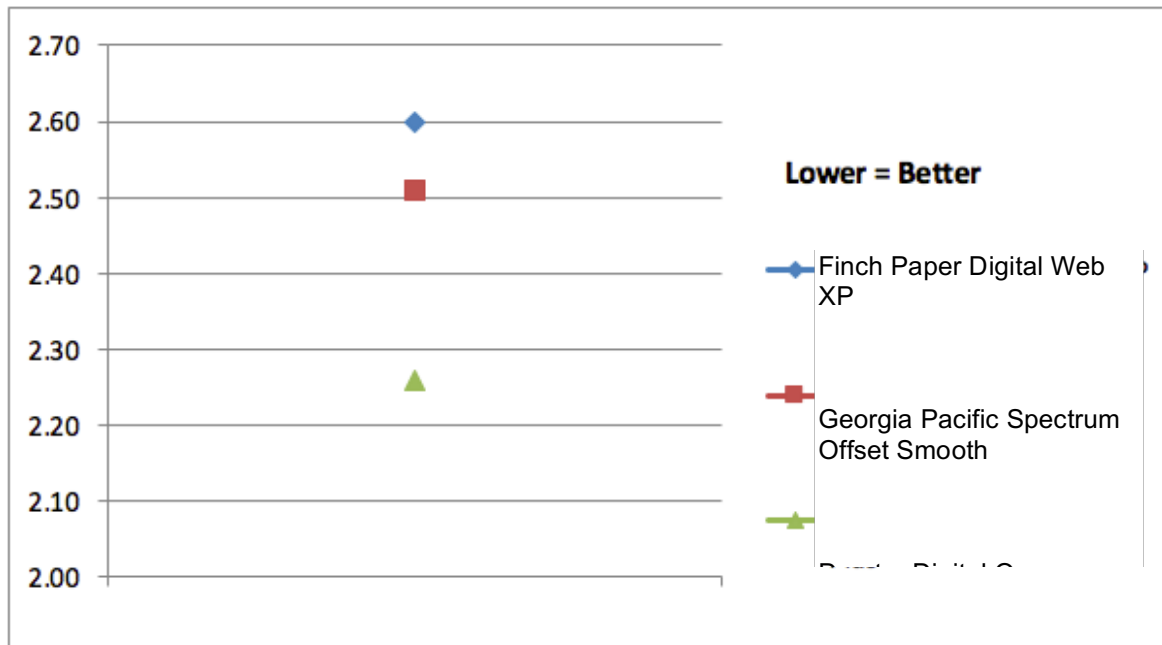
**Figure 3 – Visual Ink Strike values for 100% Process Color**

Although Ink Strike acceptability is somewhat subjective, Ink Strike values for transactional applications in production are generally <3.0.

AVG	1. Finch Paper Digital Web XP 24# Bond/90gsm	2. Georgia Pacific Spectrum Offset Smooth 24# Bond/90gsm	3. Domtar Digital Opaque Plus 24# Bond/90gsm
Printed/Unprinted L* difference <	2.6	2.51	2.26

*Measurements conducted with Xrite 500 series Spectrodensitometer, Absolute, Status T*

**Figure 4 - Graphical comparison of Visual Ink Strike**



Papers included:

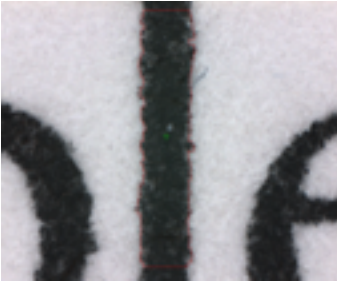


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## Positive Small Black Text Raggedness

Positive Text Raggedness measures the effect of ink following a paper's fiber formation on the readability of text. The ink flow can result in a feathering or ragged effect to the edges of the text. Raggedness affects the perception of text sharpness. Because the porosity and formation of a paper can vary within a sheet, it is important to capture the length of the worst case leading or trailing edge Raggedness to capture the largest deviation value of the measured area. Black text edge raggedness values are measured in microns ( $\mu\text{m}$ ). A lower Raggedness value indicates sharper text and edge clarity. Higher values represent a rougher edge which can cause clarity and legibility issues.

### Figure 5 – Positive Small Black Text Raggedness

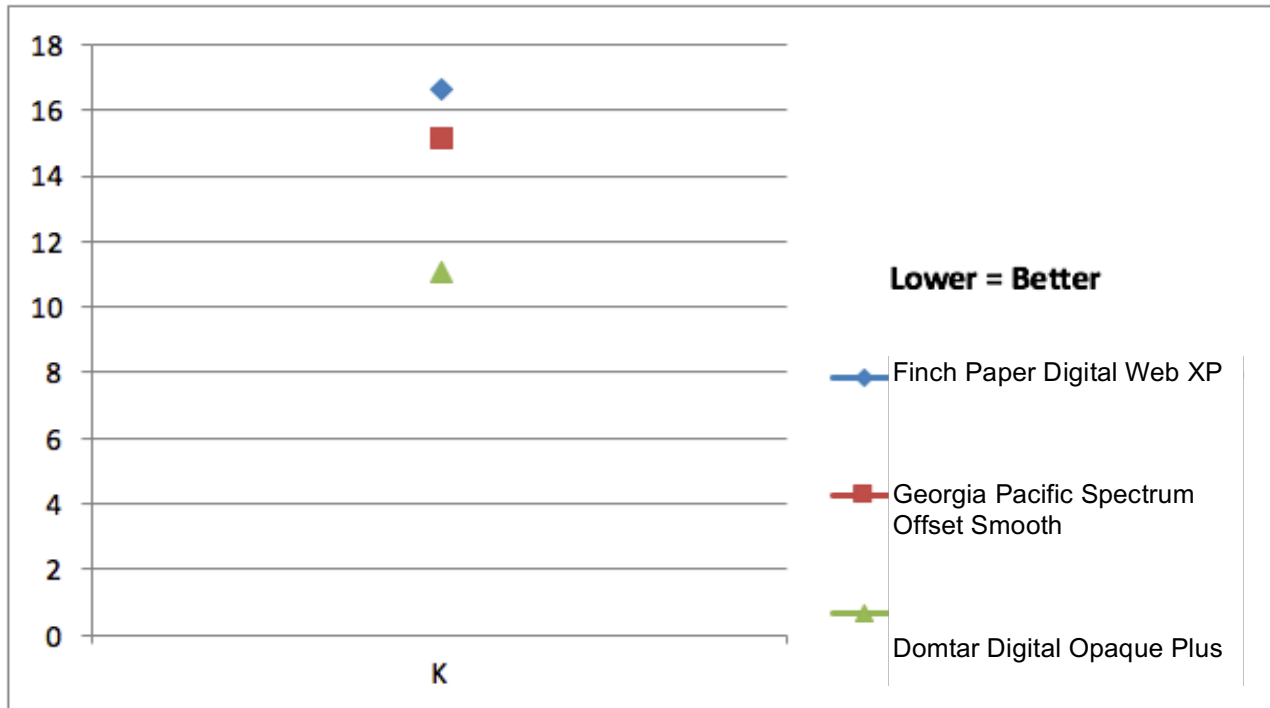
Acceptable Raggedness measures are subjective but, values for the Traditional Transaction Printing market are typically less than  $<18.0$ .

1. Finch Paper Digital Web XP 24# Bond/90gsm	2. Georgia Pacific Spectrum Offset Smooth 24# Bond/90gsm	3. Domtar Digital Opaque Plus 24# Bond/90gsm
>	>	>
16.62 $\mu\text{m}$	15.17 $\mu\text{m}$	11.09 $\mu\text{m}$
		

Measured QEA Pias II - High Res Magnification

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Figure 6 - Graphical Comparison of Positive Small Black Text Raggedness



### Reverse Small Black Text Raggedness

Reverse Text Raggedness measures the same effect as Positive Text Raggedness but using text that is “knocked out” of a solid color allowing paper “white” text to show through. (Sometimes referred to as reverse or inverse printing) It measures the effect of ink following a paper’s fiber formation on the readability of text. The ink flow can result in a feathering or ragged effect to the edges of the text and “fill in” the reversed area representing each letter. Raggedness affects the perception of text sharpness. Because the porosity and formation of a paper can vary within a sheet, it is important to capture the length of the worst case leading or trailing edge Raggedness to capture the largest deviation value of the measured area. Reverse Black Text Raggedness values are measured in microns ( $\mu\text{m}$ ).

The lower the Raggedness value the sharper the text and edge clarity becomes. Lower values represent a rougher edge which can cause knocked out text to become thinner. This plugging effect significantly impacts text clarity and legibility. When focusing on reversed text our eye picks up more of the visual raggedness of the surrounding color than with positive text, thus requiring a lower acceptance value.

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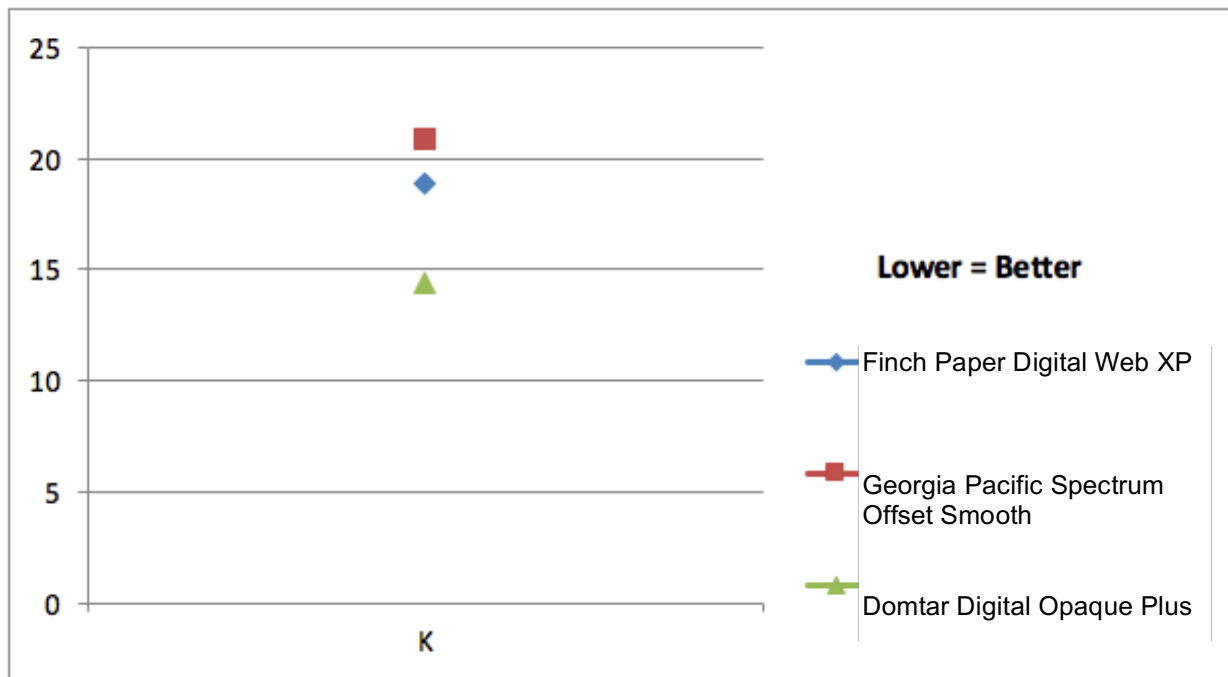
**Figure 7 – Reverse Small Black Text Raggedness**

Reverse Small Black Text Raggedness acceptability values for the Traditional Transaction Printing market are typically <15.0.

1. Finch Paper Digital Web XP 24# Bond/90gsm	2. Georgia Pacific Spectrum Offset Smooth 24# Bond/ 90gsm	3. Domtar Digital Opaque Plus 24# Bond/90gsm
>	>	>
18.85 $\mu$ m	20.87 $\mu$ m	14.42 $\mu$ m



**Figure 8 - Graphical Comparison of Reverse Small Black Text Raggedness**



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