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R·I·T Printing Industry Center

Digital and Offset Print Quality Issues

Within the printing industry, quality is an important concept. However, quality assurance programs are not always in place to monitor print output when problems occur. Furthermore, with the myriad of printing technologies available for use today, problems may differ from process to process.

The purpose of this month's research monograph, *A Survey of Digital and Offset Print Quality Issues* (PICRM-2006-04), by Robert Chung, RIT School of Print Media professor, and graduate student Matthew Rees, is to compare and contrast the problems (demerits) that occur in digital and offset printing, while at the same time investigating the existence of demerit-based quality assurance programs within the print industry.

This project was prompted by input from the U.S. Government Printing Office (GPO) when it first became an industry partner of the Printing Industry Center in 2005. The GPO uses a quality assurance standard originally created for offset lithography when purchasing digital print. This standard, however, fails to address many of the print attributes common to digital print, such as background toning, banding, color variation, etc. As digital printing gains a larger portion of the print market share, the ability to express and quantify its quality becomes more important.

Offset Print Standards

Within the offset printing field, there are various understandings on how to deal with conformance. This situation developed in part because the maturity of offset technology has resulted in the development of many standards and industry-recognized practices. As shown in Table 1, these standards and practices give the printer great control over the measures used to prevent defects. Offset print standards also afford the printer a great deal of control over the conformance of materials before they enter the production process. These standards only fail in their ability to address the visual significance of any print defects.

Table 1. A list of applicable standards for offset lithographic printing - click to view image full size

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Material Conformance	ISO 1524	Provides procedures for measuring fineness of grind
	ISO 12644	Facilitates the measurement of viscosity
	ISO 12634	Allows for the measurement of ink tack
	ISO 2470	Enables the brightness of a substrate to be measured
	ISO 5626	Provides procedures for measuring folding endurance
	ISO 8254	Specifies how to measure the gloss of a substrate
	Ink Draw Down	Accommodates the preliminary evaluation of color properties
	ISO 2846	Specifies the color and transparency values for process colors
Process Control	ISO 12647	Defines tonal value increase and solid ink tolerances for a variety of paper grades

Digital Print Standards

Digital printing, when compared to offset printing, is a hands-off process. An offset press operator who has tested the inks and substrates can make modifications (e.g. by adding surfactants, defoamers, primers, etc., or adjusting plate pressure, press speed, ink coverage, etc.), either prior to a pressrun or on the fly, to make up for any problems that might occur on the press. On the flip side, most production digital printing processes depend on the use of certified paper to perform to their best capacity. Any adjustments that need to be made to the actual press require the intervention of technical support personnel other than the press operator.

While digital printing materials are not yet standardized, some work has been done exploring the impact that materials have on digital printing, with the intention of developing material standards. In a recent study, the print quality of digital and traditional technologies was compared subjectively and quantitatively. Two test images were printed using a variety of commercially available digital printing devices such as color copiers, ink jet printers, and liquid and toner based presses. The same two test images were also printed using flexographic and lithographic technology. The test images were produced on a variety of paper stocks ranging from uncoated to fully coated. International Color Consortium (ICC) profiles were created for each paper type and applied to each print. The results showed that offset print quality is still ahead of what is possible in digital technology, although the quality of offset printing is highly dependent on the substrate, whereas digital image quality is less dependent on the substrate. The study also exposed the two print attributes that were most influential on subjective print quality: mottle and micro gloss variation. In corresponding studies it has been verified that digital printing substrates are critical to the quality of the image; however, as stated above, there are currently no standards for testing digital printing substrates.

The eReview

The *eReview* is a monthly publication of the Printing

Findings

Based on the survey, three distinct groups of respondents were created. Tier 1 consisted of all respondents, Tier 2 consisted of respondents who provide both offset and digital print services, and Tier 3 consisted of respondents who provide both offset and digital print services and whose customers have formal quality requirements. The comparative results between these three groups are detailed below.

Print Demerits
There is little difference between companies whose customers have no formal quality requirements (CQL 1 & 2) and from those who have formal quality requirements (CQL 3), with regards to the frequency and severity of print demerits. Similarly, there is little difference in the top three offending print demerits. Color issues such as color varia¬tion and color non-uniformity are consistently ranked as the top print demerits for both frequency and severity. Color related print demerits also extend equally into each print¬ing process. Offset and digital printing process share reoccurring color problems.

Regardless of the CQL or printing process the foundation of a quality print is in part built from the customer-supplied files. From the open-ended responses, a typical comment relating to this issue was that “Usually the only problem with bad copy is what the customer has supplied to us and they know in bad out bad”. In one case, a company made mention that issues such as banding within their output could be attributed to the files provided by the customer.

Handling of Print Demerits
As seen from the data gathered, a large percentage of offset printers experiment to resolve frequent or severe print demerits on their own. This is reflected in the open-ended responses. The predominant comments throughout the responses indicate that those who are experimenting to resolve issues are doing so under an ISO or internal QA system. CQL 3 companies are more likely to have well defined SOP’s, are more likely to supply vendors with material specs, are more likely to monitor and measure their own process and are more likely to hold routine reviews of internal procedures. CQL 1 & 2 printers are much more likely to address problems with a vendor and less likely to experiment on their own to resolve issues, when compared to CQL 3 printers. Digital printers, as shown in the charts, follow the same suit with a greater percentage of CQL 3 printers experimenting to resolve issues when compared to CQL 1 & 2 printers. Formal QA procedures do not indicate that less problems occur, but indicate that time is saved by self experimentation.

Conclusions

The key findings of the survey can be summarized as such:

- The majority of the respondents (84% of the offset and 76% of the digital printing providers) indicated that the frequency of print demerits they experience is low.
- Less than 25% of the respondents using both digital and

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About the Center

Dedicated to the study of major business environment influences in the printing industry precipitated by new technologies and societal changes, the Printing Industry Center at RIT addresses the concerns of the printing industry through educational outreach and research initiatives.

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offset processes indicated that their customer quality requirements are documented. However, it was found that having formal procedures in place for expressing quality did not have an impact on the type of demerits occurring or on the frequency or severity of print demerits occurring.

- Color variation and color non-uniformity were found consistently to be in the top three most frequently occurring print demerits in both offset and digital printing processes.

- Print providers who offer both digital and offset processes and whose customers have formal quality requirements tend to solve print quality problems by experimenting on their own. Those print providers whose customers do not have formal quality requirements tend to take print quality related problems to their vendors.

- The root causes of print demerits are:

  – The open-system nature of offset printing technology. That is, print demerits are often the result of incompatible consumables, such as paper grades.

  – The closed-system nature of the digital printing technology. Digital print demerits are often the result of the workflow (i.e. customer-submitted files, the RIP, etc.), or the inherent noise of the digital printing engine (spatial non-uniformity and temporal consistency, etc.).

What has been established through this survey is that the majority of color-related problems found within offset printing can be attributed to the materials involved in producing the printed product, whereas with digital print, color-related demerits appear to stem from the inherent constraints of the technology. Since the offset printing industry has already at its disposal the tools for measuring and monitoring color-related print demerits, the path forward needs focus on how digital technology providers can address color-related print problems within their own proprietary devices. In addition, the path forward will also need to focus on what the printing industry as a whole will do to bring about standards and procedures for monitoring and measuring color within the digital printing environment.

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