WHITE PAPER

spencerLAB DIGITAL COLOR LABORATORY

Comparative Print Quality and Ink Usage Study

HP Designjet Z5400, Designjet Z6200, and Designjet Z3200 vs. Canon imagePROGRAF iPF8400S, iPF8400 and Epson Stylus Pro 9890

The *spencerLAB* DIGITAL COLOR LABORATORY has conducted an independent evaluation of *Print Quality* and *Ink Usage-based Running Cost* for several Hewlett-Packard large format printers and competitive devices, including the 8-color Canon imagePROGRAF iPF8400S and Epson Stylus Pro 9890, and the 12-color Canon imagePROGRAF iPF8400, in multiple applications (see Test Matrix).

Key Findings

- **The HP Designjet Z5400 provided the Most Cost-Effective option**

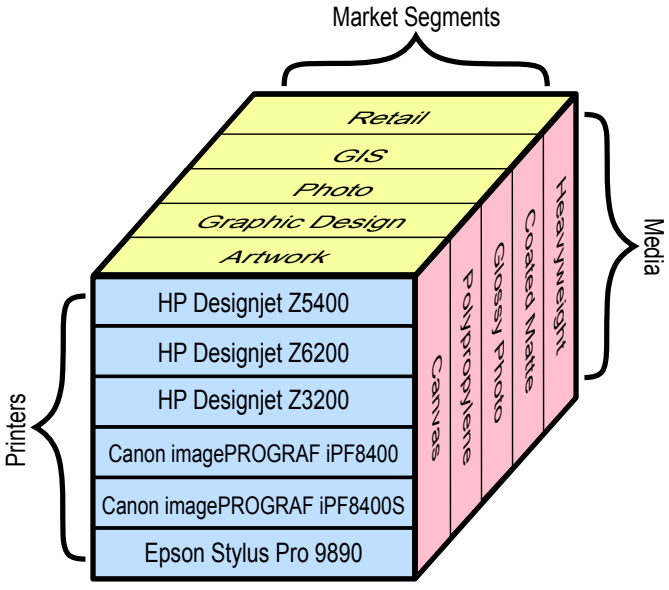
  When compared with the 8- and 12-color competitive printers, the 6-color Z5400 provided overall lowest Ink Usage Cost while rendering adequate Print Quality for the majority of market segment applications tested

- **The HP Designjet Z3200 provided the Highest Print Quality option**

  The 12-color HP Designjet Z3200 provided the best overall Print Quality, rendering the largest Gamut Volume on all tested media types, sometimes even at a lower cost than the competitive 8- and 12-color printers

- **The HP Designjet Z6200 provided the best balance of Cost-Effectiveness and Print Quality**

  The 8-color HP Designjet Z6200 provided comparable or better Print Quality than the competitive 8- and 12-color printers, at a lower Ink Usage Cost



Test Matrix

The *spencerLAB* DIGITAL COLOR LABORATORY, a division of Spencer & Associates Publishing, Ltd., is an independent test laboratory with a broad base of industry clients. Although this independent comparative study was commissioned by Hewlett-Packard Company, *SpencerLAB* believes these results maintain its reputation for the integrity of its procedures and analyses. Results stated herein are based upon direct testing by *spencerLAB* of actual products believed to be representative.

Retail: Heavyweight

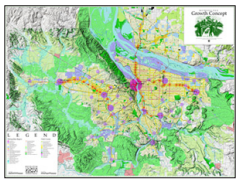

GIS: Coated Matte


Photo: Glossy Photo


Graphic Design: Polypropylene


Artwork: Canvas

Application Representative Test Files and Media Types

Test Results

Print Quality and Ink Usage Costs

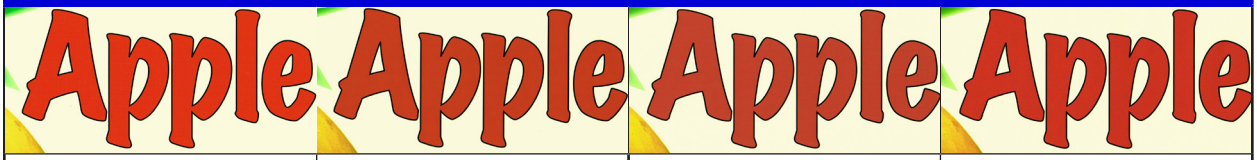
The 12-color HP Designjet Z3200 rendered the largest Gamut Volume. The 6-color HP Designjet Z5400 rendered a smaller Gamut Volume in comparison with competitive 8- and 12-color printers.

Results are noted in the following sections by market application segment.

Retail Market Application

Retail applications, such as store signage, are typically printed on Heavyweight paper and are designed to promote products or sales for a short period of time. Both the HP Designjet Z6200 and the HP Designjet Z3200 output exhibited good color saturation and vibrance. All three HP Designjet printers rendered better or comparable Black Density than the competitive printers. These are useful attributes in Retail applications as they help to draw consumer attention to the signage.

Retail: Heavyweight Paper†



HP Designjet Z3200 Most Vibrant	Canon 8400	Canon 8400S	Epson 9890

Ink Usage Cost of the HP Designjet Z5400 ($0.24/ft²)* was the lowest, with prints as much as 51% less expensive than competitors' prints. Cost-effectiveness would be attractive for users who are looking for economical prints for a short-term Retail application.

Market Segment (Paper Type)	HP			12-Color Canon 8400	8-Color Canon 8400S	8-Color Epson 9890
	# of Colors	Model	Cost	Cost	Cost	Cost
Retail (Heavyweight)	6-Color	**Z5400**	**$0.24**	$0.41 HP is 41% less	$0.50 HP is 51% less	$0.42 HP is 43% less
	8-Color	**Z6200**	**$0.31**	$0.41 HP is 26% less	$0.50 HP is 39% less	$0.42 HP is 28% less
	12-Color	**Z3200**	**$0.41**	$0.41 HP is equal	$0.50 HP is 17% less	$0.42 HP is 2% less

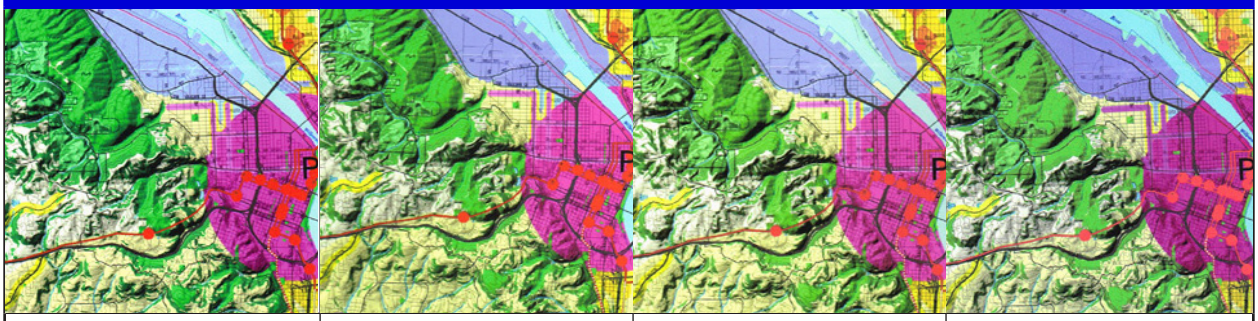
* Ink Usage Cost includes cost of ink only; results were similar with cost of media included.

The HP Designjet Z6200 delivered prints of good Print Quality at low Ink Usage Cost ($0.31/ft^2), up to 39% less expensive than the competitors, providing the best combination of Quality and Cost.

GIS Market Application

GIS applications include maps and line drawings that are typically printed on Coated Matte paper. The HP Designjet Z3200 exhibited high saturation and good color differentiation. All three HP Designjet printers rendered better or comparable Black Density than the competitive printers. These attributes are beneficial when printing topographical maps where shading in complex detail areas defines spatial information.

GIS: Coated Matte Paper†



HP Designjet Z3200 High Saturation and Good Color Differentiation	Canon 8400	Canon 8400S	Epson 9890

Ink Usage Costs of the HP Designjet Z5400 and HP Designjet Z6200 were equal ($0.17/ft^2) and the lowest among all printers, with output up to 73% less expensive than the competitors. The HP Designjet Z6200 delivered overall good Print Quality at low Ink Usage Cost, offering a good balance between the two.

Market Segment (Paper Type)	HP			12-Color Canon 8400	8-Color Canon 8400S	8-Color Epson 9890
	# of Colors	Model	Cost	Cost	Cost	Cost
GIS (Coated Matte)	6-Color	Z5400	$0.17	$0.65 HP is 73% less	$0.45 HP is 62% less	$0.31 HP is 45% less
	8-Color	Z6200	$0.17	$0.65 HP is 73% less	$0.45 HP is 62% less	$0.31 HP is 44% less
	12-Color	Z3200	$0.27	$0.65 HP is 58% less	$0.45 HP is 40% less	$0.31 HP is 13% less

Photo Market Application

Photo applications include printing of keepsake images, such as those taken on a vacation or a "wow" landscape shot, on Glossy Photo paper. The HP Designjet Z3200 rendered the best overall Print Quality with high color saturation, good color depth and detail, attributes key to the photographic market.

Photo: Glossy Photo Paper†

HP Designjet Z3200 Good Color Depth & Detail	Canon 8400	Canon 8400S	Epson 9890

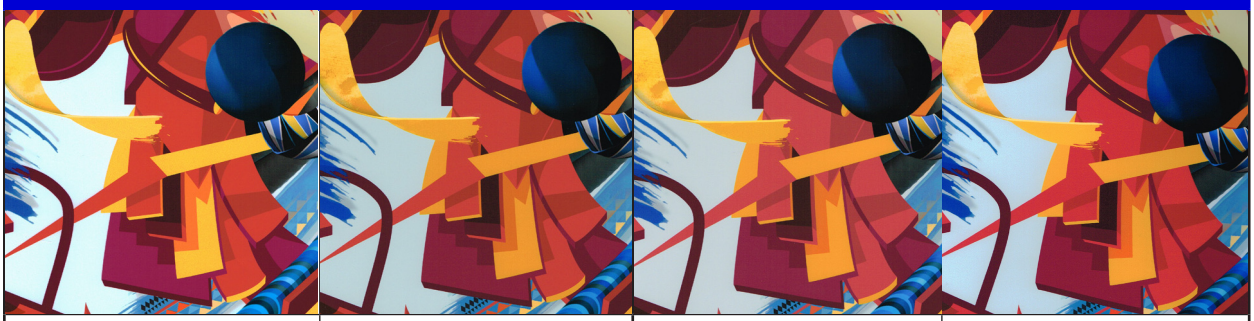
The HP Designjet Z5400 Ink Usage Cost ($0.40/ft^2) was the lowest, with photo output up to 74% less expensive than the competitors' costs. The HP Designjet Z6200 ($0.58/ft^2), with photo output up to 62% less expensive than its competitors, again provided the best solution for Quality with Cost-effectiveness.

Market Segment (Paper Type)	HP			12-Color Canon 8400	8-Color Canon 8400S	8-Color Epson 9890
	# of Colors	Model	Cost	Cost	Cost	Cost
Photo (Glossy Photo)	6-Color	Z5400	$0.40	$1.55 HP is 74% less	$0.87 HP is 54% less	$0.66 HP is 39% less
	8-Color	Z6200	$0.58	$1.55 HP is 62% less	$0.87 HP is 33% less	$0.66 HP is 11% less
	12-Color	Z3200	$0.95	$1.55 HP is 39% less	$0.87 HP is 8% more	$0.66 HP is 44% more

Graphic Design Market Application

Graphic Design applications include posters or banners for use in exhibits, trade shows, etc., often printed on Polypropylene media. Again, the HP Designjet Z3200 output, with well-balanced saturation and color vibrance, good color differentiation and contrast, provided the best overall Print Quality. Graphic Design posters typically involve solid, saturated, vibrant colors, essential for the artist's design. These are to be reproduced in print; the ability of a printer to render shades of colors enhances detailed and distinguished design.

Graphic Design: Polypropylene Media†



HP Designjet Z3200 Best balance of Vibrance and Contrast	Canon 8400	Canon 8400S	Epson 9890

Ink Usage Cost of the HP Designjet Z5400 ($0.30/ft²) was the lowest, with output cost up to 71% less than competitors. This lower cost would be attractive for users who are looking for economical prints, such as for use as trade show signs with limited display life.

The HP Designjet Z6200 ($0.38/ft²), with output up to 64% less expensive than the competitors, provided the best balance between Quality and Cost-effectiveness.

Market Segment (Paper Type)	HP			12-Color Canon 8400	8-Color Canon 8400S	8-Color Epson 9890
	# of Colors	Model	Cost	Cost	Cost	Cost
Graphic Design (Polypropylene)	6-Color	**Z5400**	**$0.30**	$1.05 HP is 71% less	$0.61 HP is 51% less	$0.34 HP is 12% less
	8-Color	**Z6200**	**$0.38**	$1.05 HP is 64% less	$0.61 HP is 38% less	$0.34 HP is 10% more
	12-Color	**Z3200**	**$0.54**	$1.05 HP is 49% less	$0.61 HP is 12% less	$0.34 HP is 57% more

Artwork Market Application

Artwork applications include printing of special moment pictures such as wedding photos, artistic reproductions, etc., on Canvas media to maintain the artistic sense. All three HP Designjet printers rendered better or comparable Black Density than the competitive printers. The HP Designjet Z3200 output with high saturation, vibrance, and good detail rendition provided the best overall Print Quality for this application.

Artwork: Canvas Media†

HP Designjet Z3200 High Saturation and Vibrance	Canon 8400	Canon 8400S	Epson 9890

Ink Usage Cost of the HP Designjet Z5400 ($0.25/ft²) was the lowest, with output up to 86% less expensive than the competitors. The HP Designjet Z6200 ($0.26/ft²) with output up to 85% less expensive than the competitors, provided the best balance of Quality and Cost-effectiveness.

Market Segment (Paper Type)	HP			12-Color Canon 8400	8-Color Canon 8400S	8-Color Epson 9890
	# of Colors	Model	Cost	Cost	Cost	Cost
Artwork (Canvas)	6-Color	**Z5400**	**$0.25**	$1.75 HP is 86% less	$0.68 HP is 63% less	$0.77 HP is 68% less
	8-Color	**Z6200**	**$0.26**	$1.75 HP is 85% less	$0.68 HP is 62% less	$0.77 HP is 67% less
	12-Color	**Z3200**	**$0.42**	$1.75 HP is 76% less	$0.68 HP is 38% less	$0.77 HP is 46% less

Methodology

Representative Test Files, for each of the five (5) application types, were selected from the *spencerLAB* PRINTER TEST SUITE, supplemented by HP. Comparable application-appropriate media available from each manufacturer was used for printing; third-party media was used when comparable OEM media was not available from the manufacturer.

For each application, five copies of the associated test file were printed on the application-appropriate media. All cartridges were weighed before and after each trial. Special procedures were followed when testing the Canon cartridges to account for its unique ink sub-tank system. All printing was done from Mac OS X 10.9.2 using the latest printer firmware and driver versions. All printing, measurements, and analyses were performed by *spencerLAB*. Application-specific Print Quality analysis was performed by a panel of three *spencerLAB* experts. The color management settings were set to 'LET PRINTER DETERMINE COLORS' and comparable print quality modes, appropriate for each media type, were used.

Black Density (L*, D50/2°) measurements were taken using a calibrated X-Rite 939 spectrophotometer. Color measurements were taken using an X-Rite i1 iSis spectrophotometer; ICC profiles were created using the i1 Profiler software and the Gamut Volumes were measured using the ColorThink Pro software. The X-Rite TC9.18 RGB test target was used for all Color Gamut Volumes, except on the HP Designjet Z3200 (CMYK printer) which used IT8.7-3 CMYK test target. One unit of each competitive printer was used in testing, and was assumed to be representative for analysis. Printer maintenance (calibration, printhead cleaning, alignment, etc.) was performed on all devices prior to testing.

†SCANS ZOOMED TO SHOW DETAIL.

IMAGES MAY NOT BE ACCURATELY REPRODUCED WHEN PRINTED FROM THIS REPORT; IMAGES BEST VIEWED ON SCREEN.

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The *spencerLAB* Digital Color Laboratory

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