Kyocera FS-1800N and FS-3800TN

Kyocera FS-1800N

Pros Fast; very low lifetime cost.
Cons Output might degrade after 300,000 pages on the same drum.
Verdict A well-designed A4 monochrome printer with excellent economy.

Price as reviewed (ex. VAT) £749

KYOCERA'S FS-1800N IS THE LATEST offering from its FS series. It's designed for fast, economical A4 mono printing. However, some clever design from Porsche has resulted in a simple concept that enables you to 'mix and match' a wide range of add-ons and expand the system to suit your own requirements. The Ecosys printing system used helps keep running costs down, as only the toner needs replacing—the long life drum is guaranteed for three years or 300,000 pages. As a result, this printer heads our table for lowest cost of ownership.

The base unit comes with a 500-sheet paper tray and drop-down multimedia tray for labels, envelopes and transparencies up

▲ Kyocera FS-1800N

to 200gsm. A wide selection of optional fetures is also available. Paper storage can be increased by adding additional trays to give an extra capacity of 500 sheets for £240 (ex. VAT) and an optional duplex unit is offered

for double-sided printing (£285 ex. VAT), but you'll need some extra memory as well. You can also fit an IBM Microdrive for £369 (ex. VAT) and Kyocera has designed a bar code reader that can recover standard documents stored on the hard drive and print them without using a PC. Extra sorter/stacker units can be fitted—a 5 by 200-sheet collator is £429 (ex. VAT) and a 2,000-sheet output stacker is £630 (ex. VAT). There's also an optional printer base device that integrates all these features into one unit for £180 (ex. VAT).

Alongside the standard parallel and serial inputs, the network interface enables connection to 100Mbit/s Ethernet, Token Ring and fibre optic connection. This is a cleverly designed system that's very expandable and should be inexpensive to run.

Kyocera FS-3800TN

Pros Modular; quick; very expandable.
**Cons** The duplex unit is a bit awkward and restricts cable access.
Verdict If you intend to expand your printing requirements, then this should be able to cater for most things.

Price as reviewed (ex. VAT) £989

THE FS-3800TN FROM KYOCERA FOLlows the same concepts as the smaller FS-1800TN, but is designed for a higher throughput. To achieve this, Kyocera has used the powerful PowerPC 740 processor rather than the 405 found on the 1800 series. This was reflected in *PC Magazine* Labs' speed test results. Initial speed results were disappointing, due to the defective memory that was included with a small batch of the printers, but the problem was resolved by Kyocera quickly.

This version comes with the DU60 duplex unit, which adds to the height of an
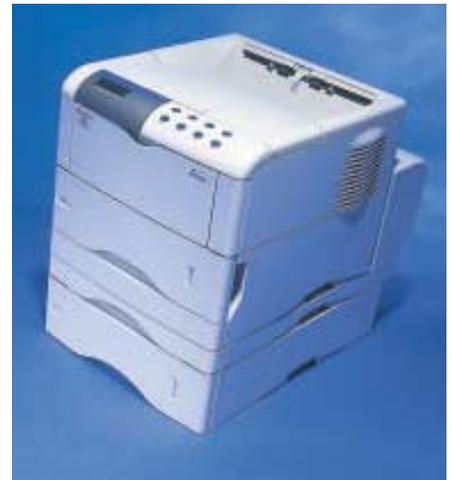
▲ Kyocera FS-3800TN

extra paper bin and extends at the rear. The only drawback is the positioning of the cables—the rear of the printer is obscured by the duplex unit and you have to drop down the cover to plug it in. Access to the print path is available from behind the duplex unit and at the front and top of the printer, so clearing jams shouldn't be hard.

Connectivity is the same as the FS-1800TN, with parallel and serial ports sitting alongside the 10/100Base-T port.

One of the best features, common to both Kyocera models seen here, is the ability to store documents on an optional IBM Microdrive (£369 ex. VAT) and select products from a list with a bar code reader.
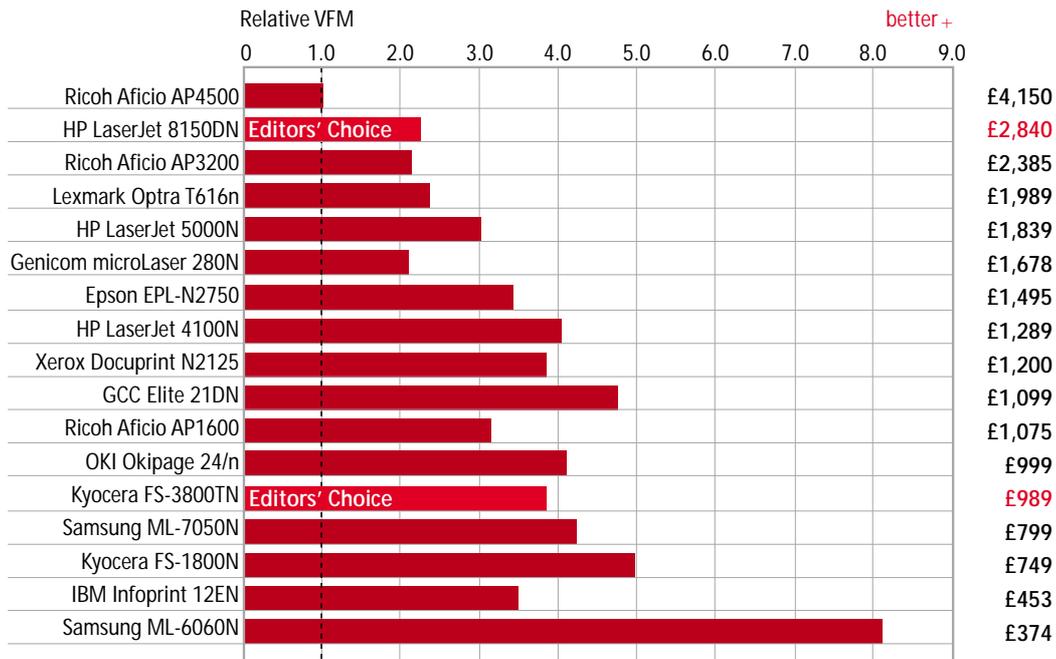
For the price, it's a very fast printer with good expandability options, all within a small footprint. In addition, Kyocera's extended life drum brings the total cost of ownership down to very low levels.
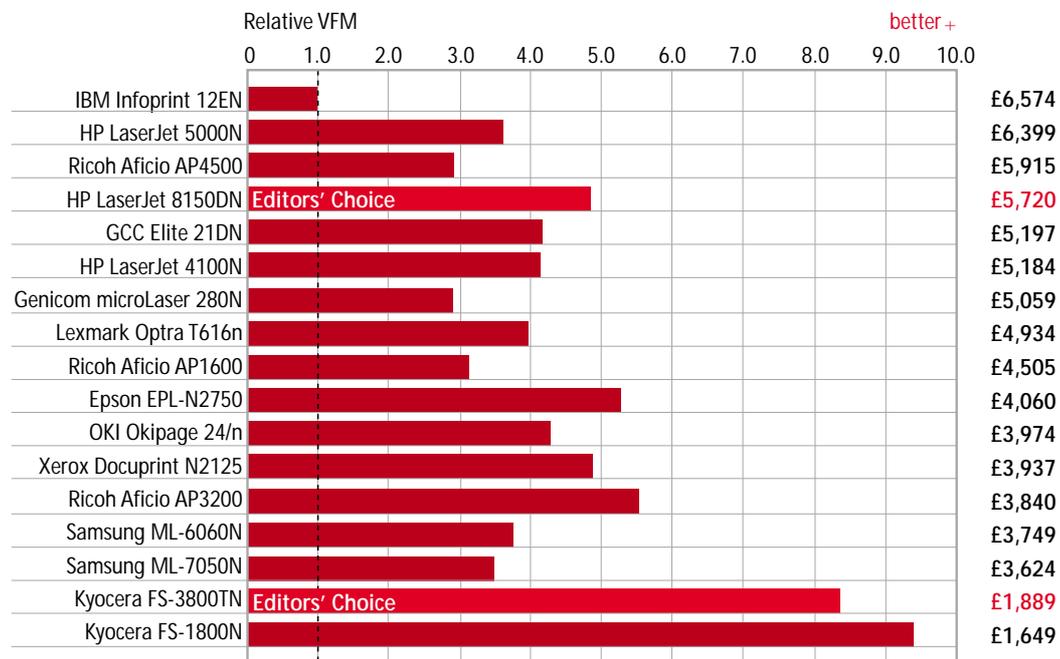
Value for Money | Mono printers—without cost of ownership

Relative VFM   better +

Printer	VFM Score	Price
Ricoh Aficio AP4500		£4,150
HP LaserJet 8150DN — Editors' Choice		£2,840
Ricoh Aficio AP3200		£2,385
Lexmark Optra T616n		£1,989
HP LaserJet 5000N		£1,839
Genicom microLaser 280N		£1,678
Epson EPL-N2750		£1,495
HP LaserJet 4100N		£1,289
Xerox Docuprint N2125		£1,200
GCC Elite 21DN		£1,099
Ricoh Aficio AP1600		£1,075
OKI Okipage 24/n		£999
Kyocera FS-3800TN — Editors' Choice		£989
Samsung ML-7050N		£799
Kyocera FS-1800N		£749
IBM Infoprint 12EN		£453
Samsung ML-6060N		£374

To illustrate the considerable difference that running costs can make to the total cost of ownership (TCO) of a printer, we printed two versions of the VFM graph. In the first, the VFM calculations use just the printer's purchase price, while in the second it's based on the purchase price, plus the total consumable cost to print 300,000 pages. For monochrome printers, our VFM for purchase price only is driven by cost. You have to pay a lot more for small increases in performance or print quality.

Value for Money | Mono printers—with cost of ownership

Relative VFM   better +

Printer	VFM Score	Price
IBM Infoprint 12EN		£6,574
HP LaserJet 5000N		£6,399
Ricoh Aficio AP4500		£5,915
HP LaserJet 8150DN — Editors' Choice		£5,720
GCC Elite 21DN		£5,197
HP LaserJet 4100N		£5,184
Genicom microLaser 280N		£5,059
Lexmark Optra T616n		£4,934
Ricoh Aficio AP1600		£4,505
Epson EPL-N2750		£4,060
OKI Okipage 24/n		£3,974
Xerox Docuprint N2125		£3,937
Ricoh Aficio AP3200		£3,840
Samsung ML-6060N		£3,749
Samsung ML-7050N		£3,624
Kyocera FS-3800TN — Editors' Choice		£1,889
Kyocera FS-1800N		£1,649

Compared to our monochrome printer VFM without the total cost of ownership, our VFM including the TCO, brings things into perspective. The effect of expenditure falls because the printers that cost less to purchase are relatively more expensive to run. Here our VFM is dominated almost equally by print quality and throughput performance. High consumable costs mean the IBM Infoprint 12EN gets the poorest VFM score. Best value by a clear margin goes to the two Kyocera printers.

How to use the VFM chart This chart shows our assessment of the relative value for money for each of the products in this review. Longer bars represent better value for money. Products are sorted by price, with the highest price at the top. Where products have the same price, they are shown in alphabetical order. The relative VFM scores are calculated by adding each product's relative performance and features scores (normalised to the lowest-scoring product in each case), and dividing the total by its relative price. The resulting raw VFM scores are then made relative to the lowest-scoring product. To use the graph, first see which products fall within your chosen price range, by looking at the column of prices on the right. The best value product within that range is then the one with the longest bar. For performance scores see the Overall Performance graph in the *PC Magazine* Labs report on page 112. For features scores see the Features Table on page 120 for monochrome and page 124 for colour. Prices quoted are correct as of 16/2/01.

PC MAGAZINE LABS

Total cost of ownership and operator interventions

There are many costs associated with running a printer—the purchase price is only part of the story.

PRINTERS ARE OFTEN SOLD AS cheaply as possible, with most of the profits being made on consumables. Inkjet printers are the best examples of this practice, but even workgroup devices have hidden costs. Many vendors buy in print engines from external sources and modify them for their own product. This results in printers from different manufacturers that are physically identical. Even so, it's common for these vendors to sell their own consumables at different prices.

Compare the total cost of ownership of the Samsung ML-6060N and IBM's Infoprint 12EN, for example. They're based on the same engine, yet a 6,000-page toner cartridge for the Infoprint costs nearly double that of the same consumable for the ML-6060N. If you assume a printer lifetime of around 300,000 pages, you'll be paying around £3,000 more to run the Infoprint.

Unfortunately in cases such as these, although the toner cartridges would easily fit into either printer, they're been 'keyed' with plastic notches that only allow them to be fitted into the correct device. Sometimes there's a good reason for this, especially in colour printers—using the wrong toner could play havoc with the internal colour management and what's actually inside different manufacturer's toner cartridges isn't necessarily identical or of similar quality.

For monochrome printing, we've included all the colour and monochrome printers in the same graph. If you buy a colour workgroup printer, it's also likely you'll be printing a large quantity of black and white pages, particularly if it's a replacement for a monochrome model. With one notable exception, colour printers are more expensive to run. Xerox's Phaser 850DX costs less per monochrome page than any other printer in this round-up, but only because that Xerox makes no charge for black ink. It wants potential customers to see the 850DX as a cost-effective replacement for a monochrome unit that can bring the benefit of colour when needed at minimal extra cost. However, there's still some cost associated with printing monochrome pages—although the black ink is free, there's a maintenance kit that must be replaced every 45,000 pages priced at £99 (ex. VAT).
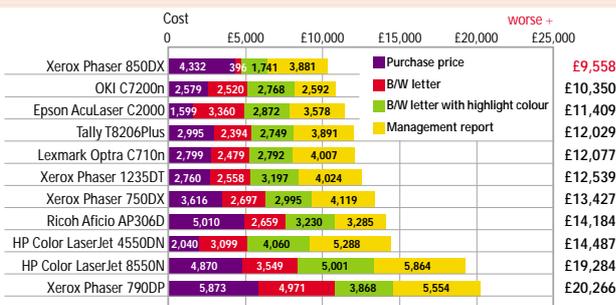
Counting the cost

It's easy to overlook the cost of consumables, but they make up over half the printer's cost. Items such as maintenance kits, drums and fusers, however, are easy to overlook. Some items are listed as 'maintenance

items' and were therefore left off our list, even though they have a projected lifetime that falls within our 300,000-page limit. The excellent value afforded by Kyocera's FS-3800TN and FS-1800N is due thanks to the cheapest toner of any manufacturer—with the exception of the Xerox Phaser 850DX—and free drum replacements after 300,000 pages. If you're going to make heavy use of your printer, these models will be cheaper to run than anything else and you should take this into consideration when comparing them to the IBM Infoprint 12EN and Samsung ML-6060N.

For colour printing, HP's LaserJet 4550DN is the most expensive A4 printer to run. Although its purchase price is reasonable, it's likely that you'll spend more on consumables than you saved in buying it. Of the three colour A3 printers here, Ricoh's Aficio AP306D is to be commended for its low running costs.

Xerox's Phaser 1235DT and OKI's C7200n are based on the same OKI-built engine, but the Xerox consumables cost much more. OKI also rates its drum life at 30,000 pages, compared to the 22,000 offered by the Xerox.

Cheapest to run, although the most expensive to buy, is the colour-capable Xerox Phaser 850DX, thanks to its free black ink.
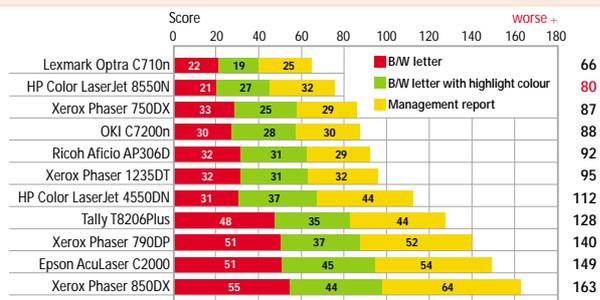
Operator interventions

Another hidden cost of running a printer is the burden of supporting it, which can be alleviated by good management software and features like email notification. However, there are some things that

Total cost of ownership—colour

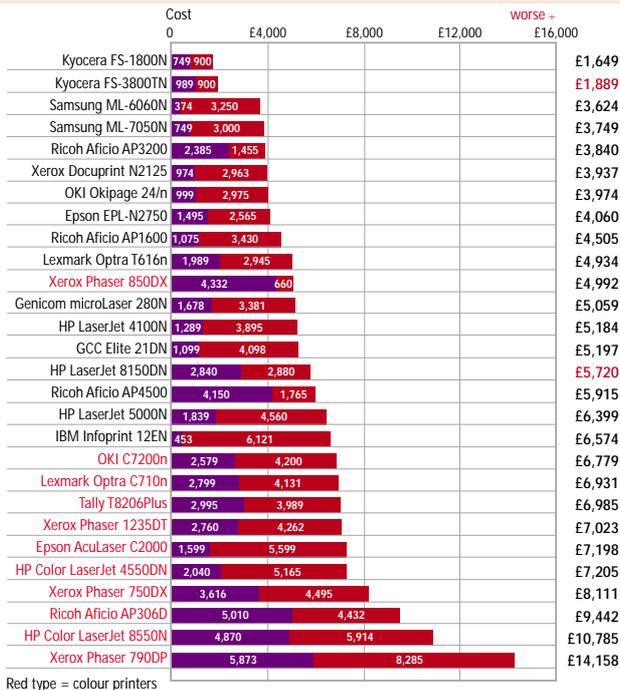| Printer	Purchase price	B/W letter	B/W letter with highlight colour	Management report	Total
Xerox Phaser 850DX	4,332	396	1,741	3,881	£9,558
OKI C7200n	2,579	2,520	2,768	2,592	£10,350
Epson AcuLaser C2000	1,599	3,360	2,872	3,578	£11,409
Tally T8206Plus	2,995	2,394	2,749	3,891	£12,029
Lexmark Optra C710n	2,799	2,479	2,792	4,007	£12,077
Xerox Phaser 1235DT	2,760	2,558	3,197	4,024	£12,539
Xerox Phaser 750DX	3,616	2,697	2,995	4,119	£13,427
Ricoh Aficio AP306D	5,010	2,659	3,230	3,285	£14,184
HP Color LaserJet 4550DN	2,040	3,099	4,060	5,288	£14,487
HP Color LaserJet 8550N	4,870	3,549	5,001	5,864	£19,284
Xerox Phaser 790DP	5,873	4,971	3,868	5,554	£20,266

▲ **Total cost of ownership—colour** We've assessed the cost of ownership based on printing a mixture of different types of document—details can be found in the analysis. A3 printers are more expensive to run, with the exception of Ricoh's Aficio AP306D. The Xerox Phaser 850DX is the cheapest to run, despite its high purchase price. The HP LaserJet 4550DN has the lowest price, but its consumables give it the highest cost of ownership.

Interventions per 300,000 pages—colour

Printer	B/W letter	B/W letter with highlight colour	Management report	Score
Lexmark Optra C710n	22	19	25	66
HP Color LaserJet 8550N	21	27	32	80
Xerox Phaser 750DX	33	25	29	87
OKI C7200n	30	28	30	88
Ricoh Aficio AP306D	32	31	29	92
Xerox Phaser 1235DT	32	31	32	95
HP Color LaserJet 4550DN	31	37	44	112
Tally T8206Plus	48	35	44	128
Xerox Phaser 790DP	51	37	52	140
Epson AcuLaser C2000	51	45	54	149
Xerox Phaser 850DX	55	44	64	163

▲ **Interventions per 300,000 pages—colour** The Xerox Phaser 850DX again requires the most interventions, closely followed by the Epson AcuLaser C2000 and Xerox Phaser 790DP. The 790DP uses higher capacity colour toner cartridges than monochrome ones, reducing the number of interventions when printing colour pages. Lexmark's Optra C710n uses long-life consumables.

Total cost of ownership—monochrome

Printer	Purchase	Running	Total
Kyocera FS-1800N	749	900	£1,649
Kyocera FS-3800TN	989	900	£1,889
Samsung ML-6060N	374	3,250	£3,624
Samsung ML-7050N	749	3,000	£3,749
Ricoh Aficio AP3200	2,385	1,455	£3,840
Xerox Docuprint N2125	974	2,963	£3,937
OKI Okipage 24/n	999	2,975	£3,974
Epson EPL-N2750	1,495	2,565	£4,060
Ricoh Aficio AP1600	1,075	3,430	£4,505
Lexmark Optra T616n	1,989	2,945	£4,934
Xerox Phaser 850DX	4,332	660	£4,992
Genicom microLaser 280N	1,678	3,381	£5,059
HP LaserJet 4100N	1,289	3,895	£5,184
GCC Elite 21DN	1,099	4,098	£5,197
HP LaserJet 8150DN	2,840	2,880	£5,720
Ricoh Aficio AP4500	4,150	1,765	£5,915
HP LaserJet 5000N	1,839	4,560	£6,399
IBM Infoprint 12EN	453	6,121	£6,574
OKI C7200n	2,579	4,200	£6,779
Lexmark Optra C710n	2,799	4,131	£6,931
Tally T8206Plus	2,995	3,989	£6,985
Xerox Phaser 1235DT	2,760	4,262	£7,023
Epson AcuLaser C2000	1,599	5,599	£7,198
HP Color LaserJet 4550DN	2,040	5,165	£7,205
Xerox Phaser 750DX	3,616	4,495	£8,111
Ricoh Aficio AP306D	5,010	4,432	£9,442
HP Color LaserJet 8550DN	4,870	5,914	£10,785
Xerox Phaser 790DP	5,873	8,285	£14,158

Cost axis: 0 £4,000 £8,000 £12,000 £16,000 — worse +

Red type = colour printers

Interventions per 300,000 pages—monochrome

Printer	Score
Lexmark Optra T616n	13
HP LaserJet 8150DN — Editors' Choice	15
Kyocera FS-1800N	16
Kyocera FS-3800TN — Editors' Choice	16
Genicom microLaser 280N	19
Epson EPL-N2750	20
Ricoh Aficio AP4500	22
Xerox Docuprint N2125	23
GCC Elite 21DN	24
HP LaserJet 4100N	30
HP LaserJet 5000N	30
Ricoh Aficio AP3200	30
HP Color LaserJet 8550N	36
Lexmark Optra C710n	36
Samsung ML-7050N	37
Ricoh Aficio AP1600	42
IBM Infoprint 12EN	50
OKI C7200n	50
Samsung ML-6060N	50
HP Color LaserJet 4550DN	51
Ricoh Aficio AP306D	53
Xerox Phaser 1235DT	54
Xerox Phaser 750DX	55
OKI Okipage 24/n	60
Tally T8206Plus	81
Epson AcuLaser C2000	84
Xerox Phaser 790DP	85
Xerox Phaser 850DX	91

Score axis: 0 20 40 60 80 100 — worse +

Red type = colour printers

▲ **Total cost of ownership—monochrome** By combining the purchase price with the cost of running the printer, we've calculated the total cost of owning a printer over 300,000 pages. Both colour and monochrome printers are included in this graph, which is based on printing monochrome pages only. The bars are split between purchase price and running costs.

▲ **Interventions per 300,000 pages—monochrome** Both the colour and monochrome printers feature here—the colour devices printed in monochrome only. The colour printers generally require more interventions, due to their engine complexity. Worst performer of all the monochrome printers is the OKI Okipage 24/n, which uses low-capacity toner cartridges.

can't be dealt with remotely. When your toner runs out, for example, someone will have to physically attend to the printer. Small toner cartridges might be easy to handle and cost less per item, but you'll need to change them more often. If you're in a small workgroup, then a cartridge will last longer and you might prefer the convenience of

being able to buy a replacement more cheaply than a bigger cartridge.

Unsurprisingly, colour printers require more interventions, due to the larger number of consumables. One exception is Xerox's Phaser 850DX. Although it requires the most interventions of all, it's unique in that the solid ink can be topped-up, so you don't have to wait for the

printer to run out before you can add more.

For monochrome printing, the Xerox Phaser 790DP, Epson AcuLaser C2000 and Tally T8206Plus stand out as requiring more interventions than the rest of the field. Of these, the 790DP is aimed more at lower volume users, but this is offset by the fact that it's an A3 printer used for printing graphically inten-

sive pages that will require more toner.

When printing in colour, the AcuLaser C2000 starts to require more attention than the 790DP. This is due to the fact that the 790DP uses higher capacity colour cartridges than monochrome ones. However, the AcuLaser remains far cheaper to run.

PAUL MONCKTON

OUR RESULTS ARE ALL BASED ON the manufacturers' claimed lifetimes and prices for all consumables. The lifetime of the most obvious consumable, toner, is usually rated as a number of pages for five per cent coverage of a piece of A4 paper. Pages with more than five per cent coverage use more toner; sparsely printed pages use less. From the manufacturers' quoted figures, we worked out the cost of one per cent coverage of a page and then multiplied that figure by whatever amount was necessary to match our target page.
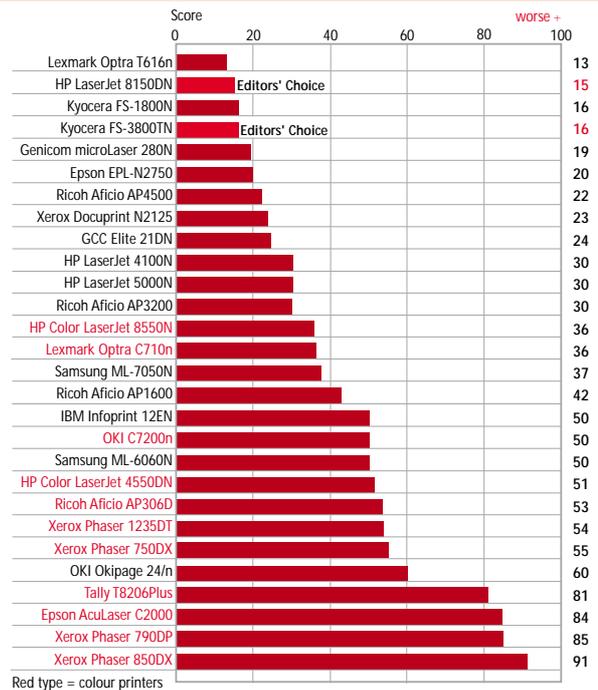
Obviously, the amount of toner you use depends on what you print. We chose three typical types of page

you might see printed in an office. First, there's the standard black and white letter, based on a five per cent coverage of black. Our results for the monochrome printers are based on printing only this kind of document.

For the colour printers, we added two more document types. The first is similar to our black and white letter, but with the addition of some highlight colour, such as a company letterhead with a logo. This document used five per cent black and a total of five per cent colour.

The third type made heavier use of colour and is more likely to be the kind of document for which you'd purchase a colour printer—to print

reports with charts, for example. This document combined five per cent black with 20 per cent colour per page. The colour printers' results were calculated based on printing a mix of 60 per cent black and white letters, 25 per cent letters with colour highlights and 15 per cent management reports.

Other consumables aren't dependent on the amount of coverage. The drum and fuser will be used regardless. Moreover, a colour printer will probably use the drum four times per page—once for each colour of toner. The final fusing process occurs only after all the toner is on the page and, therefore, occurs once per cycle.

Taking into account the number of cycles per page, per item and the rated life of these, we can calculate their cost for each page.

Our total cost of ownership figures combine the initial purchase price of a printer with the total cost of printing 300,000 pages using the calculations above. The number of interventions is calculated on the basis of one intervention per consumable item replaced, using the same profile as above.

In some cases, vendors offer optional low- and high-capacity versions of certain consumables. We picked the high-capacity versions.