

# Cost-Benefit Analysis

Scanning drawings to digital raster form is essential to realize any open archive benefits. The justification for scanning to a raster image can be easily made when looking at the value of managing the documents, savings in facilities costs, and improved document accessibility throughout the organization. These costs are often not easily measurable and can be staggering.

## Document Management Overview\*

1. 92% of Information is in manila folders
2. 80% of technical information is on paper and microfilm
3. The market for automated document management will reach \$3.7 billion by 1997\*\*
4. Document management is now the largest cost in organizations.
5. 7- 10 % of Fortune 1000 company revenues estimated at \$600 to \$800 billion are spent on document management.

\*estimated by Document Management Magazine

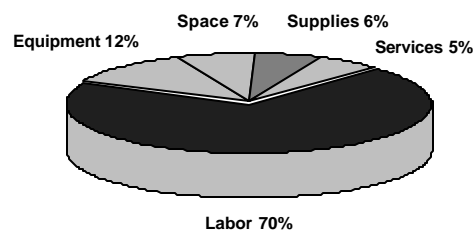
## Staggering Costs of Documents\*

- 4 Trillion documents are stored in US files
- Paper files are doubling every 3.5 years
- Average document is copied 19 times
- Each day, almost one billion photocopies are made
- Average worker has a 34 hour paper backlog
- Half of an office workers time is spent handling paper or data entry
- 50% of all projects are behind schedule

\* Source: AIIM, Forrester, Star Securities

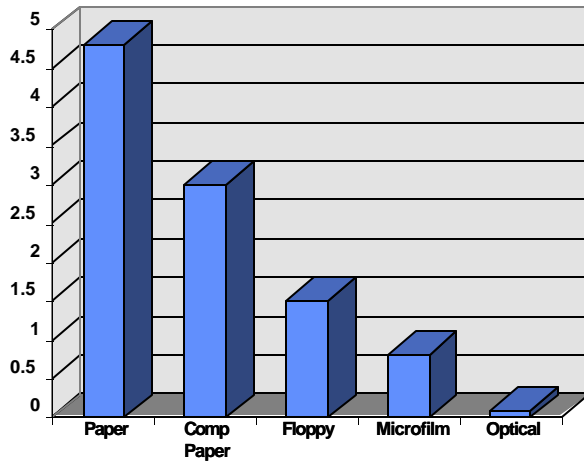
Considering that the amount of technical information grows exponentially throughout each successive phase of a product life cycle, the savings can easily accumulate. This can provide a substantial return for the maintenance, archiving, and revision of paper assets.

## Paper Costs



Source: U.S. Department of Labor

**Storage Cost per Megabyte**



## Document Management Costs

- Filing a document costs 25-30 cents per sheet
- 3-5% of an organization's documents are lost or misfiled
- Cost to recreate a misfiled document is \$120 and \$250
- 7.4% of an executive's time is spent looking for lost or misfiled documents
- Counting lost and misfiled documents, average cost shoots to \$20/document

Sources: AIIM, Computer World, Forrester

Document management costs are some of the more difficult company expenses to quantify, but they are very real and very expensive. Add together the financial considerations of the data from the diagrams above and it is easy to justify a hard look at scanning and electronic document management options. And this does not take into consideration the cost benefits that are derived from eliminating manual drawing revisions.

Creating an open environment for drawing archives requires a one-time cost for scanning paper drawings into an electronic environment. Once implemented, savings are realized throughout all phases of the product life cycle.

### Cost Benefit of Raster Based Engineering Change Order Cycles

A simple cost-benefit example in which a company has 100 drawings with 20 Engineering Change Order's (ECO) to perform each month can be used to illustrate raster-enabling cost savings. Various labor rates are used for each discipline. Actual numbers should be determined for individual organizations.

#### Cost benefit comparison of raster enabled ECO process.

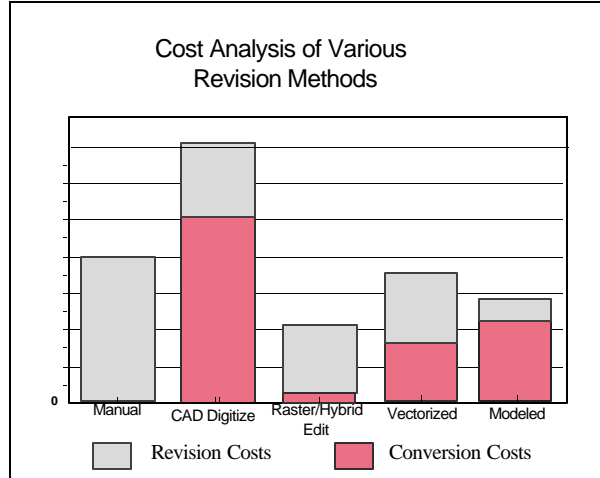
Action	Times Per Month	Manual minutes	Raster Enabled	Burdened Rate	Savings
Find a Drawing	100	1	.05	\$50	\$4,750
Find related ECO	20	1	.05	\$50	\$950
Approve ECO	20	4	.5	\$50	\$3,500
Update to Rev B	20	3	.1	\$50	\$2,900
Confirm Changes	20	1	.1	\$50	\$900
Distribute Latest Revision	20	3	.1	\$25	\$1,450
				Monthly Savings	\$14,450 month

## Raster Editing/Digitizing/Vectorization Cost Analysis

With reduced labor costs and improved usage of CAD, the benefits of revising drawings electronically are clear. What may not be clear is the trade-off between investing in the upfront vectorizing to raw vector CAD, converting to intelligent variational models, or taking advantage of a lower cost hybrid raster CAD system.

**Revision Life-Cycle Cost Savings.** The costs associated with revising drawings are dependent on the method and solution used. The methods evaluated here include manual, CAD digitize, hybrid raster CAD, full vectorization, or conversion to intelligent models.

Costs are incurred with each individual revision and include the cost associated with capturing the document to a digital form unless the manual method was used. Therefore, the true cost is calculated by combining the labor rate and the projected time spent on each revision plus the digital transformation expense.



The key driver for determining the cost benefit is the labor savings realized for each method. Any drawing will realize a unique labor savings based on the drawing's quality and the revision method used.

	Capture cost	Revision
Manual	n/a	\$400
Digitize in CAD	\$520	\$200
Hybrid	\$25	\$200
R2V	\$250	\$200

In an article first appearing in Document Management Magazine, the inherent cost to recreate and revise a complex drawing, using each of these methods were compared. This

comparison considered both the initial capture time, various labor rates, and the time associated with making revisions to the drawing once it had been captured. The results are shown above.

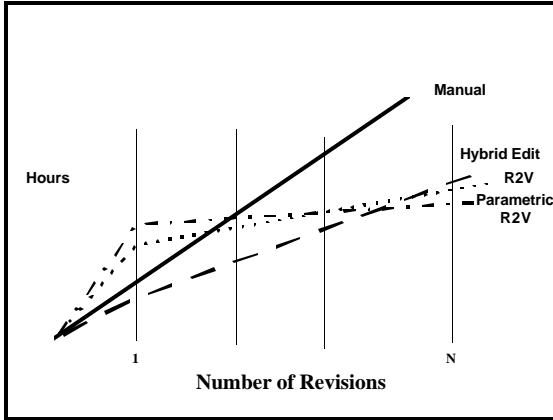
The hybrid Raster/CAD approach, which eliminates the redraw, clean up, and verification process, offers the greatest immediate cost benefit for the first revision.

**Life Cycle Savings.** Most drawings realize frequent revisions throughout their active life. A look at a cost benefit analysis throughout that life can also be identified by Figure 4. The break-even points for the four primary methods can be determined.

A break even analysis can help you understand what method is best for you. The first point is when the hybrid raster CAD approach becomes beneficial over manual methods (n2) and is usually attained with the first revision. This is due to the tremendous savings attained with a hybrid raster CAD systems as it allows the modification of old drawings as if they have CAD intelli-

gence. These raster CAD systems can move, copy, or add selected raster entities fast and accurately with raster snapping features.

The next break even is attained when conversion to full CAD begins its cost benefits over the manual process. This point is highly dependent on image quality, operator training, and tools used.



It can be reached in as few as 1-3 revisions.

A final break even is realized between the hybrid raster CAD approach and converting to full vector CAD. This is where selective conversion tools have a significant place allowing companies to incrementally convert to CAD as changes become necessary.

Cost justification for the various technologies described here is most measurable when based on labor savings in the revision process and improved information access and management.

### Payback and ROI

An estimate of the payback period can be found by dividing the net investment in capture equipment and costs by the annual savings. The return on investment is the annual savings divided by the net investment.

An example could be if a company has 500 active drawings and makes an average of 2 revisions (taking 3.5 hours to complete each) per year per drawing. The drafting burden rate is \$35/hour. That adds up to  $(500 \times 3.5 \text{ hrs} \times \$35/\text{hr} \times 2)$  \$122,500 per year on drawing revisions.

We can examine this same situation using the hybrid raster editing approach without conversion. Handling, scan time, and enhancement will take about 10 minutes, the burdened operator charge is \$70 including equipment amortization resulting in capture costs of  $(500 \times 10/60 \text{ hrs} \times \$70/\text{hr})$  \$5,834. There is no vectorization or clean-up time and revisions take 30 minute per drawing. Revision costs associated with this approach are  $(500 \times 30/60 \text{ hrs} \times \$70/\text{hr} \times 2 \text{ revs} = \$35,000)$ . This is calculated using \$70/hour including the hardware & software costs for a fully burdened CAD operator. This adds up to a potential savings of **\$81,666 per year**.

This example can also be calculated using the vectorization approach. Scan time and burden costs remain the same (\$5,834). Typical conversion time (capture costs) for a large portion of the drawing would take approximately 15 minutes for initial vectorization and 1.5 hours for post processing and QA/clean-up, resulting in a cost of  $(500 \times 1.75 \text{ hrs} @\$70/\text{hr} = \$61,250)$ . Revision time is reduced to half an hour as CAD functionality would mainly be used  $(500 \times .5 \text{ hrs} \times \$70/\text{hr} \times 2 \text{ revs} = \$35,000)$ . This adds up to \$102,084 -- **a potential savings of \$20,416** after two revisions. Now that the drawings are fully in CAD, all future revisions would add up to greater savings.

If the total system costs \$30,000 (scanner and software) per year, these examples have a technical payback time of just a few months and the investment is easily justifiable.

Keep in mind that although the payback and ROI figures will vary, the cost of manual revisions are already being realized and will only increase.

## Intangible benefits

The direct benefits of integrating paper within EDM/PDM and CAD are based on labor savings in the revision cycle. However, there are many intangible benefits which include:

### Market/Lead Time Benefits

- Manufacturing companies often survive based on getting quality products to market sooner than its competition. Doing so helps increase mind share and hence market share.
- Project oriented companies, such as utility and construction companies develop a product at a greater scale. Contracts are awarded based on accurate and detailed proposals which must include cost and time estimates. A paper-enabled and intelligent modeling system at the front end yields faster design times and more accurate bidding efforts.

### CAD System Benefits:

- An increase in the value of CAD by eliminating its use for tedious redraw. CAD can now be used for productive design and analysis functions.
- A common electronic database.
- Reduced retrieval and print times for documents with a document management solution.
- Improved information flow with workflow and E-mail tools.
- Improved conformance to the ISO 9000 or OSHA regulations by instituting better document control procedures.
- Increased value of paper drawings through integration with CAD and EDM/PDM tools.
- Fewer lost, damaged, and misfiled documents.
- Immediate availability of accurate information.
- Streamlining of the change process.
- Increased quality.

**Business Reinvestment.** Companies already spend 7-10% of their expenditures on manual document management processes. A business reinvestment strategy involving the technology presented here can help reduce the incurred costs of managing, revising, and distributing information.