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White Paper

Return on Investment with Autodesk Revit

If you are a designer or CAD user in a business, the benefits of a new design system might seem obvious. It's faster. It offers tools for eliminating tedious tasks. You can do better work. But if you are the person responsible for the company finances, you don't care about fancy systems; you care about the bottom line. How much will the new system save? Will it increase shareholder value or the profitability of the firm? How long will it take to train the new users? Whether you hold the purse strings or are trying to convince the person holding the purse strings, you will need to come up with the answers to these questions.

This white paper explains the financial concept of return on investment (ROI) and shows you how to calculate the first-year ROI for a technology investment using an Autodesk® Revit® design system and data collected in a recent Autodesk survey as an example. This white paper also shows how ROI can pinpoint areas such as training and system cost where spending and savings make the most sense. A link to an interactive ROI calculator is included for your use at the end of this paper.

A Simple Formula

The concept behind ROI is simple. You get something back for what you put in. If you deposit $100 in a bank account and take out $105 a year later, that's a five percent return on investment. But an investment doesn't have to be in dollars. It can be in materials or assets, too. Imagine the hot water pipe in your house is leaking. A bucket under the leak measures the heat loss to be $5 a year. You pay a plumber $100 to fix the problem. That is also a five percent ROI.

$$\frac{\text{Earnings}}{\text{Investment or Cost}} = \text{ROI}$$

Calculating the ROI for a design system is a bit more complicated because of the many variables that come into play. You need to consider not only the cost of the system but also changes in user productivity. The diagram below illustrates what happens after a new system is purchased. If you follow the solid black curve, you will see that there is an immediate dip in productivity as the user gets up to speed with the new system. With time and training, productivity climbs back to where it was with the original system and eventually beyond as the new technology takes hold.

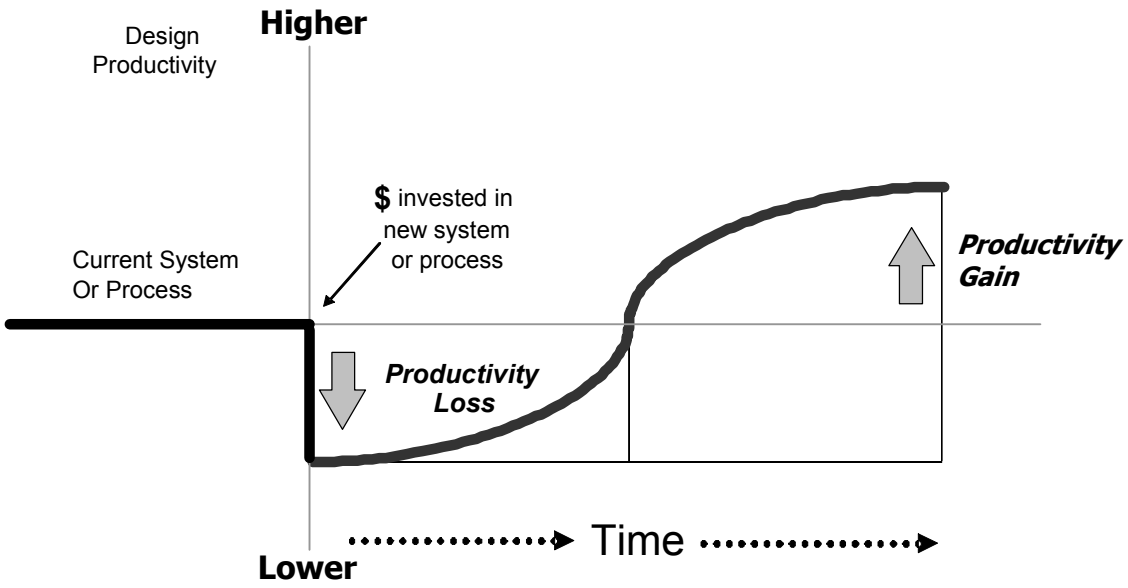

Figure 1. *Design investment and productivity curve. The dark bold line shows changes in productivity after the purchase of a new system. "Training time" is the time it takes a user to become as productive on the new system as on the old, shown here where the curve crosses the horizontal axis.*

System cost, labor, training, and productivity changes are all accounted for in this formula for calculating the first-year ROI for an information technology investment:

$$\frac{\left(B - \left(\frac{B}{1+E}\right)\right) \times (12 - C)}{A + (B \times C \times D)} = \text{First Year ROI}$$

The formula has five variables:

A = cost of hardware and software (dollars)
B = monthly labor cost (dollars)
C = training time (months)
D = productivity lost during training (percentage)
E = productivity gain after training (percentage)

The denominator, which is the "investment" or "cost" part of the equation, includes the cost of the system (A) and the cost of the productivity lost, in terms of labor cost, as the user learns how to use the system. This second term is the product of the monthly labor cost (B) multiplied by months in training time (C) multiplied by productivity lost in training (D), therefore B x C x D. Throughout this paper "training time" refers not to the length of a training course, but to the time it takes a user to reach the same level of productivity experienced on the original system.

The numerator represents the "earnings" part of the equation and those earnings come from an increase in human productivity. The increase in average monthly productivity is represented in the left bracket ((B - (B / 1 + E). The right bracket (12 – C) is the number of months in a year (12) minus months in training (C). If the user needs three months to become as productive on the new system as on the old, then there are nine months left in the year to benefit from the productivity gains.

As an example of how productivity affects ROI, imagine the user is not more productive after training than before (E = 0). E equals zero. The entire left bracket would then be zero-ed out, resulting in a first year ROI of zero. On the other hand, if the user doubles his productivity after training (E = 1), than labor cost is cut in half ((B – B/2), and the ROI would be 100 percent. Productivity has a profound effect on ROI.

Some Real Numbers

Formulas are impressive but make more sense with real numbers. The numbers below will be used for the purposes of this white paper, but you can substitute your own in the ROI calculator provided at the end.

A = cost of hardware and software	$6,000
B = monthly labor cost	$4,200
C = training time	3 months
D = productivity loss during training	50%
E = productivity gain after training	25%

Following is an explanation of how each of the numbers was derived. Several came from data collected in a December 2003 Autodesk survey of Revit users (approximately 100 users provided responses to a survey invitation posted online).

Cost of hardware and software (A) — A Revit system (hardware and software) sells for around $6,000. This cost does not include training or support. It is simply a base system for the purposes of working the ROI formula.

Monthly labor cost (B) — In the design world there are several terms to describe labor costs. Direct Labor Cost is the hourly wage of an employee. Direct Personnel Expense (DPE) is the hourly wage plus another 30-40 percent to account for benefits and other employee-specific overhead. The billing rate is the Direct Labor Cost or the DPE marked up by a factor (often between two and three) to cover a company's overhead and profit margin. Because most project managers focus on DPE in their budgets as the managed cost, it makes sense to use this term for the ROI formula.

Now to figure out the monthly DPE for one person. A typical designer works an average of 147 billable hours per month, but not all that time is spent using Revit. As part of the 2003 survey, Revit users responded that on average they spent 35 percent of their time on design (*Figure 2*), 46 percent on documentation (*Figure 3*), 15 percent project on project management, and 3 percent on other tasks. In total, a typical Revit user spends 82 percent of his or her time, or 120 hours a month, on design and documentation, the two tasks where Revit is useful. At a reasonable DPE estimate of $35 an hour, that represents a monthly labor cost of $4,200.

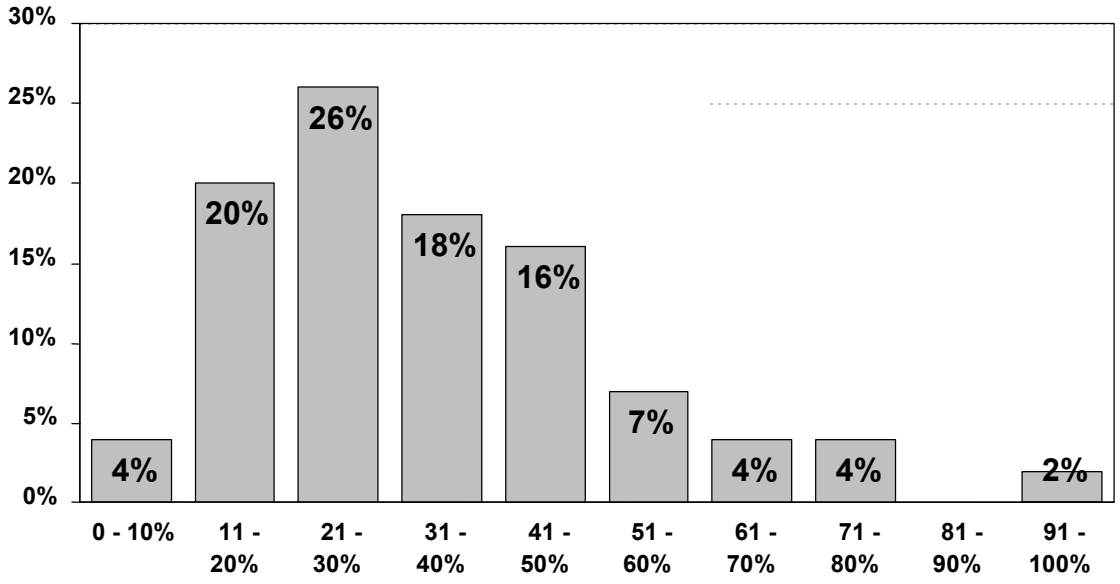

Figure 2. *Answers to the 2003 Revit survey question "What percentage of your time do you spend on concept and design development?" Answers averaged 35%.*

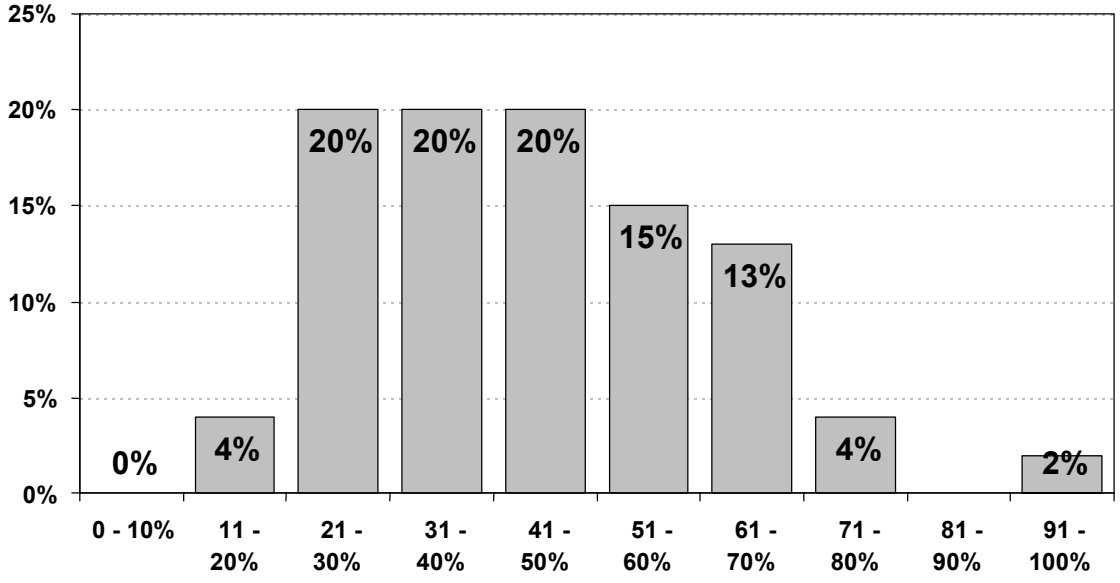

Figure 3. *Answers to the 2003 Revit survey question "What percentage of your time is typically spent on documentation?"*

	Hours per month	Time	DPE rate per hour	Monthly DPE cost
Design	52	35%	$35	$1,820
Documentation	68	46%	$35	$2,380
Project management	22	15%	$35	$770
All other tasks	5	3%	$35	$175
Total	**147**	**100%**		**$5,145**
Total for design and documentation	**120**	**82%**		**$4,200**

Training time (C) — According to the 2003 survey, Revit users reported that on average, it took them anywhere from one to six months to achieve the same productivity levels on Revit as with their old systems (*Figure 4*). A very conservative estimate is three months.

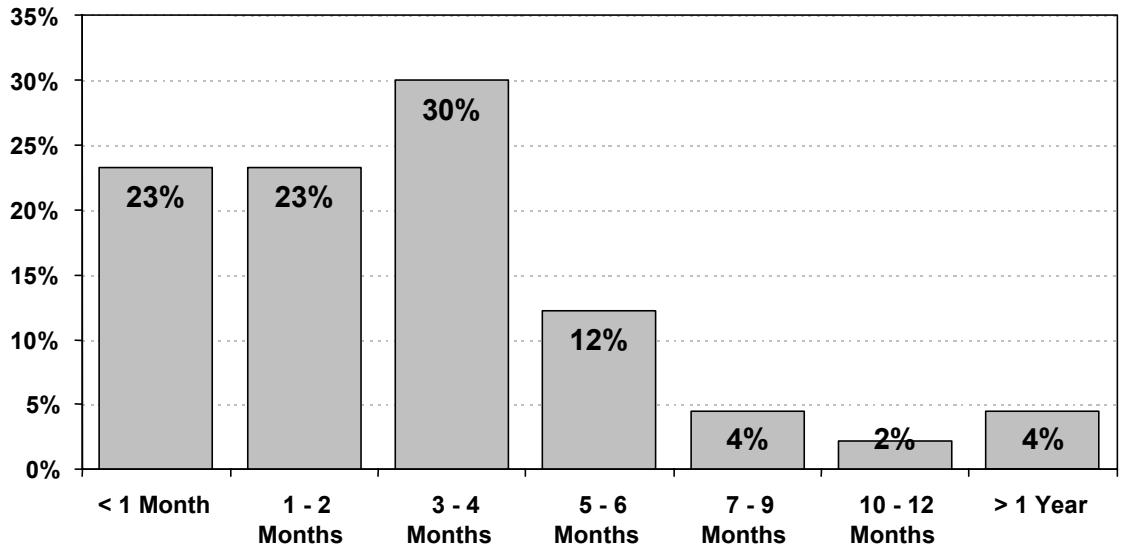

Figure 4. *Answers to the 2003 Revit survey question "How much time did it take you to get back to the same productivity you had with your previous software?" This is referred to as the "training time" or "training period."*

Productivity loss (D) — Users generally experience a dip in productivity as they get used to a new system. In the 2003 survey, Revit users reported that on average they experienced a 50 percent loss in productivity during their training time (*Figure 5*).

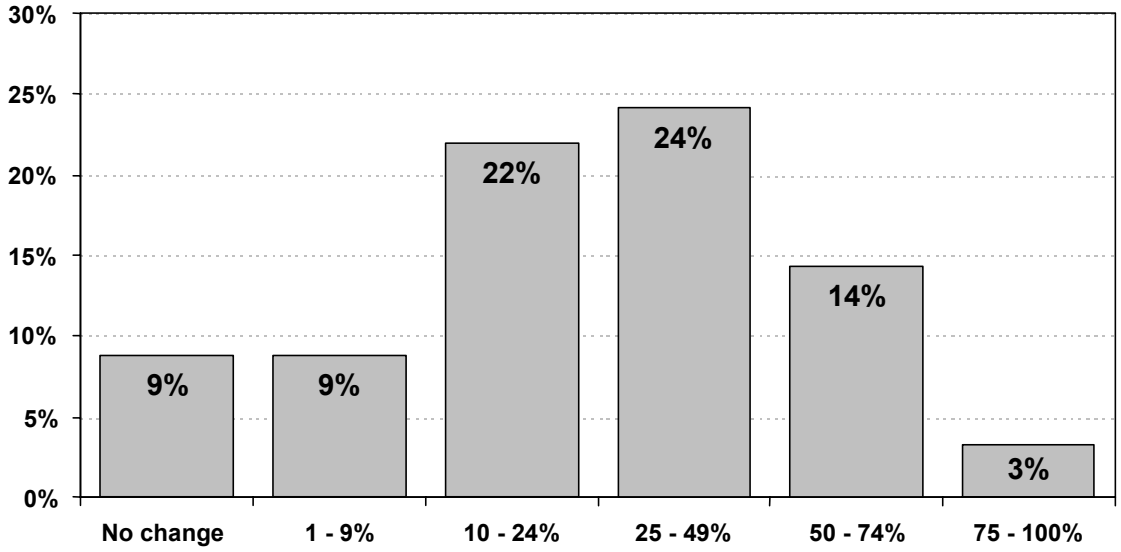

***Figure 5**. Answers to the 2003 Revit survey question "During your initial training period on Autodesk Revit, what was your estimated productivity loss?"*

Productivity gain (E) — Once the training period was complete and designers had gotten the hang of their new Revit systems, they generally reported that they were 25 to 100 percent more productive than they were on the old system (*Figure 6*) We will use 25 percent as a very conservative estimate for our example.

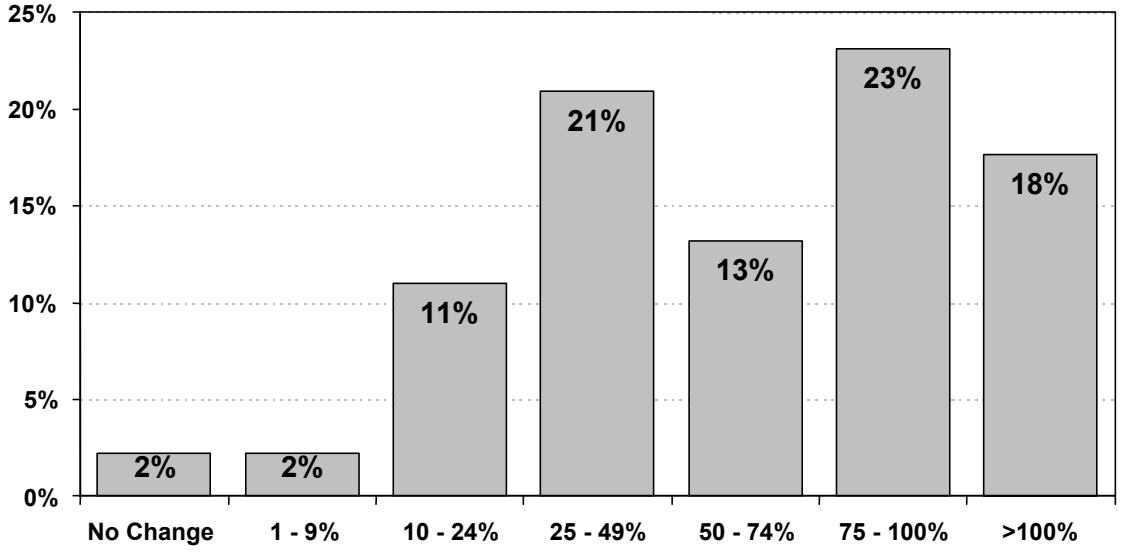

***Figure 6.** Answers to the 2003 Revit survey question "What change in productivity would you estimate you have now achieved by migrating to Autodesk Revit from your previous design software?"*

Now it's time to run the numbers. With the real numbers in place, the formula indicates that in its first year, a Revit design system offers a 61 percent return on investment. Here are the numbers again:

A = cost of hardware and software	$6,000
B = monthly labor cost	$4,200
C = training time	3 months
D = productivity loss during training	50%
E = productivity gain after training	25%

And here are the numbers in the formula:

$$\frac{\left(4{,}200 - \left(\frac{4{,}200}{1 + 25} \right) \right) \times (12 - 3)}{6{,}000 + (4{,}200 \times 3 \times 50)} = 61\%$$

Now imagine that the CFO of your company has five or ten million dollars of working capital sitting in a bank making only 3 percent interest, the equivalent of a 3 percent annual ROI. It is the CFO's job to find opportunities to grow the shareholder return, so with a 61 percent ROI, a new Revit design system is certainly worthy of consideration.

But not only large companies benefit from this formula. Small companies, like the many architectural firms that use Revit, can use it to demonstrate how they plan to repay a bank loan. Even if your company is not borrowing money for such an investment, sound financial planning involves answering the same kinds of questions a bank officer would ask. This is where the power of this ROI formula, supported by data, comes in.

Some Variables Weigh More

On of the questions you may be asked is, how does each variable affect ROI? In order to examine the variables independently, it's important to run a sensitivity test. By varying the range of each variable and plugging the numbers on the long and short end of the range back into the formula, you can measure that variable's effect on ROI. In looking at the results below, remember that the ROI was originally 61 percent.

Variable	Range	Impact on ROI
A (system cost)	$4,000 ←$6,000→ $8000	72 – 50%
B (monthly DPE)	$8,400 ←4,200→ $2,100	81 – 50%
C (training time)	1 mo. ←3 mos.→ 6 mos.	83 – 40%
D (productivity loss)	25% ←50%→ 100%	115 – 25%
E (productivity gain)	50% ←25%→ 0%	102 – 0%

By plotting the numbers above on a graph, it's easier to see the impact each variable has on ROI. The steeper the line, the greater the impact.

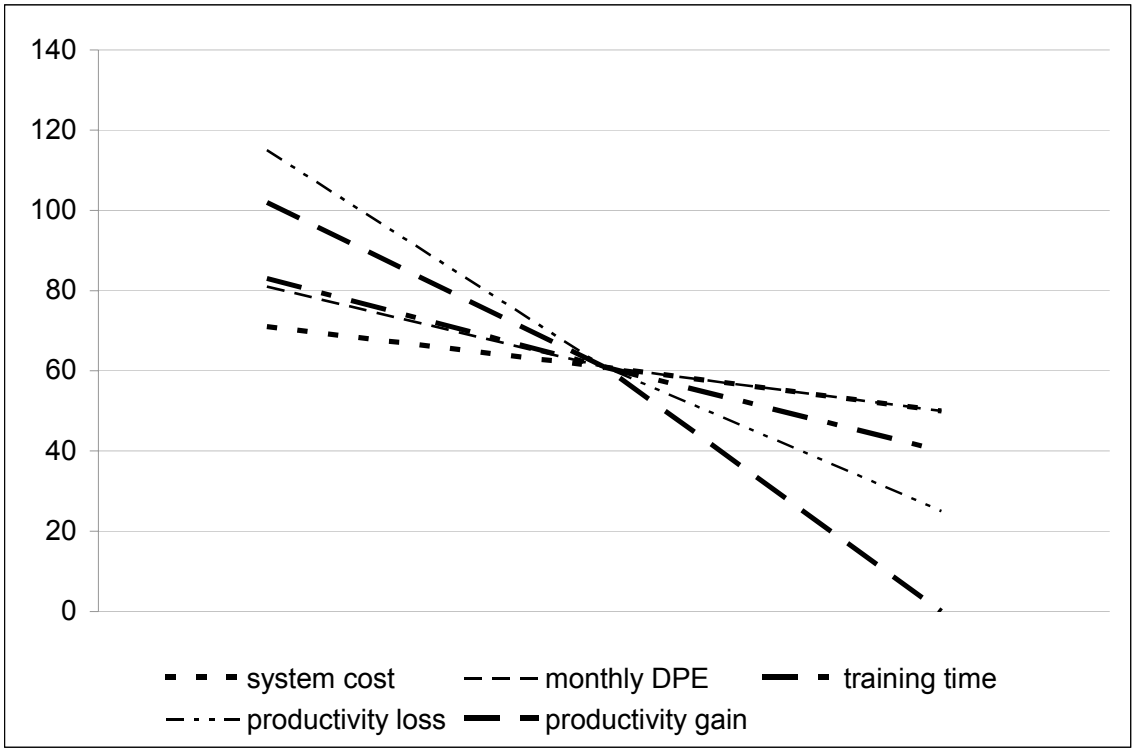

Figure 7. *Comparable impact of variables on ROI. Productivity gain and loss are the steepest lines and have the greatest effect on ROI.*

Productivity gain and productivity loss have the steepest slopes and therefore, the greatest impact on ROI. Training time and monthly DPE are tied at third and fourth, and the variable that has the least effect on ROI is system cost. Yet the majority of the time people go to buy a new system, they focus on system cost with little attention given to people costs.

A Closer Look at System Cost

How much does system cost really matter? A bare bones system costing around $6,000 has a 61 percent first-year ROI. But what happens if you run the numbers on a $10,000

system? This top-of-the-line system comes with all the amenities. An Autodesk reseller installs it, sets up an efficient subdirectory structure, customizes office templates, and configures work sets for that important first project. It also includes a one week training course and full-service maintenance with phone and on-site support to keep you up and running.

These added benefits affect other variables. Training time drops from three to two months, and productivity loss drops from 50 to 25 percent. As a result, the first-year ROI is *116 percent*, a figure that could easily justify the additional $4,000.

	Minimum cost system	**Maximum productivity system**
Basic Hardware	$1,000	$1,000
Hardware upgrades	0	1,000
Revit software	5,000	5,000
Third party software	0	0
Installation & configuration	0	200
Training	0	2,000
Phone support	0	300
On-site support	0	500
Total system cost	**$6,000**	**$10,000**

Training time	3 months	2 months
Productivity loss	50%	25%
Productivity gain	25%	50%
Monthly DPE	$4,200	$4,200
1st year ROI	**61%**	**116%**

Early Training Counts

It should be clear by now that productivity counts big. And one tool for increasing productivity is training. Data collected from a 1993 Autodesk® survey of AutoCAD® users indicates that the earlier you start training, the better, and that the productivity benefits of early training are both immediate and long term. The results of that survey can easily be extended to users of any design software, including Revit.

Here are the details: The 1993 survey grouped AutoCAD users into those who received training and those who did not. Both groups experienced an immediate drop in productivity when they switched to AutoCAD, but the similarities stop there. Untrained users

experienced a 40 percent drop in productivity and it took them 11 long months to crawl back to parity. In contrast, trained users experienced a 55 percent drop in productivity (they were off-site during training) but climbed back to parity in only four months. What's more, two years later, while the untrained users were only 125 percent more productive on AutoCAD than they had been on their old systems, the trained users were a whopping 177 percent more productive (*Figure 8*).

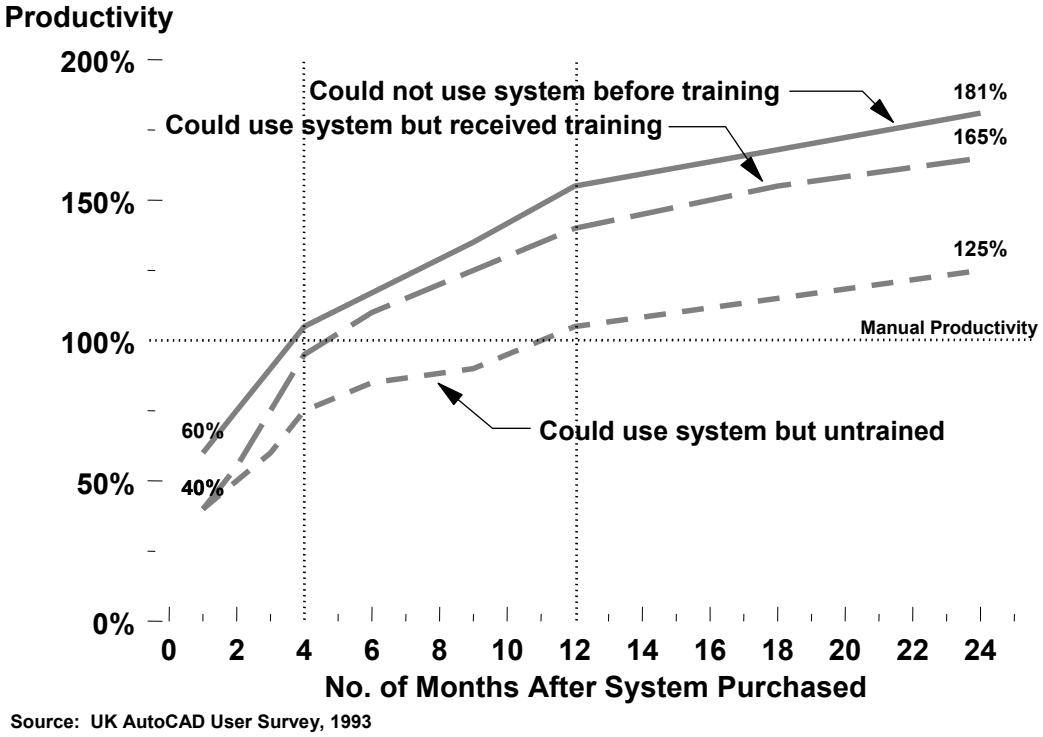

Figure 8. *Productivity analysis, trained vs. untrained users (solid and short-dashed lines). Also including data from originally untrained but experienced users (middle, long-dashed line) who received update training. Those trained on the system immediately are more productive on the system indefinitely. Self-taught users are never as productive, even after receiving training.*

The data indicates that not only is there an initial difference between trained and untrained users, but that that difference actually increases over time. What's more, untrained users never actually catch up in terms of the productivity of the trained user. Trained users remain 50 percent more productive than untrained users. Imagine trying to compete with a company that is 50 percent more productive than you?

The survey also broke the users down by: how many were not able to use the system before training, how many could use the system but still received training, and how many could use the system but remained untrained (*Figure 8*). The results showed that the most productive users were the ones who were trained from the get-go (top, solid line) even if they didn't know how to use the system beforehand. The ones who got training at some point after their initial purchase (bottom, short-dashed line) did well but never quite caught

up to the others. And the people who got no professional training (middle, long-dashed line) were less productive than either of the other two groups.

The data also indicated that the critical period for training was one or two months after introduction to the package. If you wait longer than two months and try to learn on your own, bad habits become too ingrained and can result in long-term handicaps.

Another way to measure the benefits of training is with the ROI formula. Simply substitute system cost (A) for the cost of a one-week training course ($2,000 for training, travel, and lodging). Of course, some of the other variables need adjustment as well. Productivity loss (D) during training is 100 percent due to time away from the office. And productivity gain (E) after training is a very conservative 10 percent. With these numbers, the ROI comes to 147 percent, dramatic enough to convince anyone of the importance of training.

A = cost of training class	$2,000
B = monthly DPE	4,200
C = training time	0.25 months
D = productivity loss (during training)	100%
E = productivity gain (after training)	10%
ROI for Revit training class:	**147%**

Conclusion

You now understand the financial concept of return on investment and have learned how to calculate the first-year ROI for a technology investment. You have also seen how investing in higher quality hardware and training can improve your ROI.

The ROI formula is a powerful tool for analyzing an Autodesk Revit or any design system investment. It allows you to resolve budget issues faster and clearly demonstrates that the richest investments are in the tools that enable people to do their best work.

To find out more about the Autodesk Revit building design and documentation system, visit us on the web at http://www.autodesk.com/revit. There, you will find an interactive ROI calculator worksheet with this white paper under **Features & Specifications** > **White Papers**, if it did not download automatically with this paper.

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