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## StSI and RbSI Compared

*Two New Leaf Earned-Value Indexes Compared*

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### Introduction

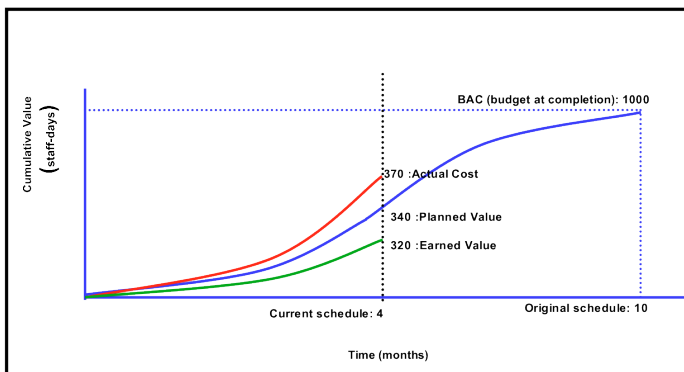
Two New Leaf white papers introduced and used two new earned-value indexes. In certain circumstances the two indexes appear to have the same value. The question arises, “Are the two indexes the same?” The answer turns out to be that they are equivalent. However, each index’s formula remains convenient in its own context and awkward in the other’s, so both should be continued.

*Note:* This white paper is intended as a sequel to two earlier white papers, *Earned Value: Ideas and Exercises*, where the Staffing-to-schedule Index (StSI) is used and *Earned-Value Benchmarks for Re-baselining Your Project* where the Re-baselined Staff Index (RbSI) is defined and used. If you have not read them, you may want to download them from New Leaf’s site and become familiar with them before continuing. We begin here with the simple example that first appeared in those earlier papers.

### A Simple Example

Figure 1 illustrates a project with an original cost, or Budget at Completion (BAC), of 1000 staff-days and an original schedule of 10 months. The calculations begin with the “s-curve” chart of information that shows the project’s planned value from start to end, and the two actual lines from the project start to the current date. One of the two “actual” lines depicts the actual cumulative cost to date, the other the actual cumulative earned value to date. The last bits of information in the graph are the present date and the planned value to date.

*Figure 1. A typical earned value chart*



*Figure 2. A typical project task list*

Task List					
Task name	Plan	Actual	Earned Value	Date completed	
				Planned	Actual
...					
MONTH 3	240	268	238		31-Mar
Pink	16	14	16	2-Apr	5-Apr
Violet	12	16	12	5-Apr	10-Apr
Red	18	22	18	5-Apr	8-Apr
Vermillion	8	10	8	15-Apr	20-Apr
Blue	18	24	18	20-Apr	18-Apr
Brown	8			22-Apr	
Green	10	16	10	22-Apr	28-Apr
Yellow	10			25-Apr	
MONTH 4	340	370	320		30-Apr
Brown*	*			22-Apr	
Yellow*	*			25-Apr	
Beige	2			2-May	
Apricot	2			5-May	
Pink	3			5-May	
...					

A summary of the facts:

1. Original project cost: 1000 staff-days
2. Original project schedule: 10 months
3. Planned value: 340 staff-days at 4 months
4. Actual cost: 370 staff-days
5. Earned value: 320 staff-days
6. Current monthly staff: 5 people

### The Staffing-to-schedule Index

At the end of the white paper, *Earned Value: Ideas and Exercises*, the Staffing-to-schedule Index was applied to the planned staff to produce an adjusted staff that would meet the original schedule while preserving the pattern of the original staffing histogram. The index itself was defined in an earlier New Leaf white paper entitled *The Remaining Work Index (RWI) and the Staffing-to-Schedule Index (StSI)*.

In the *Earned Value* paper, the simple example looked like this:

**To calculate the size of the adjusted staff needed to finish on time, follow these three steps:**

With a planned monthly staff = 5 people:

1. Remaining work index (RWI) = remaining planned work / remaining actual work

$$\begin{aligned}
 &= (1000 - 340) / (1000 - 320) \\
 &= 660 / 680 \\
 &= .97
 \end{aligned}$$

2. Staffing-to-Schedule Index (StSI) = Remaining Work Index \* CPI

$$= .97 * .86 = .84$$

3. Adjusted staff = Planned staff FTEs / StSI

$$= 5 / .84 = 6.0 \text{ staff FTEs}$$

## The Re-baselined Staffing Index

At the end of *Earned-Value Benchmarks for Re-baselining Your Project* the last step in re-baselining the project was to adjust all the remaining staffing to complete the project by the re-baselined date while preserving the adjusted pattern of the original staffing.

The simple example looked like this:

### **Rebaselined Staffing Index: the RbSI**

*Re-baselined staffing index* = (Original planned work remaining) /  
(Re-baselined planned work remaining)

$RbSI = (Original\ BAC - old\ current\ planned\ value) /$   
 $((Re-baselined\ cost\ BAC - new\ current\ planned\ value)$

$RbSI = (1000 - 340) / (1156 - 370) = 660 / 786 = .84$

As with the other earned-value indexes, you divide the original value by the index to arrive at the adjusted value:

### **Adjusting the Staffing Histogram with the RbSI to Get the Re-baselined Staffing Histogram**

*Original staffing histogram figure / RbSI = Re-baselined staffing histogram figure*  
 $5\ staff\ FTEs / .84 = 6.0\ staff\ FTEs$

## Two indexes compared

If we look carefully at our two examples, we will find that the StSI is exactly the same value as our RbSI. Is this a coincidence or do the two indexes have a lot in common? In order to find out, we will reduce each definition to a simple set of algebraic terms and compare them.

The two examples below use the following form for their “proofs”:

### **Statement**

= <reason to transform statement into next statement >

### **Next statement**

Staffing-to-schedule Index (StSI) is the index that will adjust the original staffing histogram to achieve the full plan on the original schedule and preserve the shape of the staffing histogram.

= <Using New Leaf's definition of StSI>

Remaining Work Index \* CPI

= <Using New Leaf's definition of Remaining Work Index>

(Remaining planned work / remaining actual work) \* CPI

= <Using earned-value definitions>

((Original budget at completion (BAC) – current planned value) /

(Original budget at completion (BAC) – current earned value)) \* CPI

= <Using the definition of CPI>

((Original budget at completion (BAC) – current planned value) /

(Original budget at completion (BAC) – current earned value)) \* (Earned Value / Actual Cost)

= <Algebraic substitution using:  $b = BAC$ ,  $x = Actual\ Cost$ ,  $y = Planned\ Value$ ,  $z = Earned\ Value$ >

$((b - y) / (b - z)) * (z / x)$

Re-baselined staffing index (RbSI) is the index to adjust the original histogram's re-baselined pattern in a way that achieves the re-baselined cost in the re-baselined schedule.

$$\begin{aligned}
 &= \text{<Using New Leaf's definition for the RbSI>} \\
 &= \text{(Original planned work remaining) / (Re-baselined planned work remaining)} \\
 &= \text{<Using earned-value definitions>} \\
 &= \text{(Original BAC – old current planned value) / (Re-baselined cost BAC – re-baselined current planned value)} \\
 &= \text{<Algebraic substitution using } b = \text{BAC, } x = \text{Actual Cost, } y = \text{Planned Value,} \\
 &\quad \text{and definitions for re-baselining from the article, Earned-Value Benchmarks for Re-} \\
 &\quad \text{baselining Your Project>} \\
 &= (b - y) / (\text{old-typical-variance-EAC} - \text{old current actual cost}) \\
 &= \text{<Definition of (typical) EAC>} \\
 &= (b - y) / ((\text{BAC} / \text{CPI}) - \text{old current actual cost}) \\
 &= \text{<Algebraic substitution using: } b = \text{BAC, } x = \text{Actual Cost, } y = \text{Planned Value, } z = \text{Earned Value} \\
 &\quad \text{and Definition of CPI>} \\
 &= (b - y) / (b / (z/x) - x) \\
 &= \text{<algebra part one>} \\
 &= (b - y) / ((b*x / z) - x) \\
 &= \text{<algebra part two>} \\
 &= (b - y) / (x*(b/z) - x) \\
 &= \text{<algebra part three>} \\
 &= (b - y) / ((b/z) - 1) * x) \\
 &= \text{<algebra part four>} \\
 &= (b - y) / ((b - z) * x / z) \\
 &= \text{<algebra part five>} \\
 &= ((b - y) / (b - z)) * (z / x)
 \end{aligned}$$

This formula for the SbSI is the same as the StSI. So using the assumptions in the two “proofs,” the two New Leaf indexes are equivalent. In the simple example:

$$\begin{aligned}
 \text{RbSI} &= (1000 - 340) / (1156 - 370) = 660 / 786 = .84 \\
 \text{StSi} &= (1000 - 340) / (1000 - 320) * \text{CPI} = 660 / 680 * (320 / 370) = .97 * .86 = .84
 \end{aligned}$$

The re-baseline and the original plan both have 5.0 planned staff in the next month so the staffing adjustment in both cases is:

$$5.0 \text{ staff FTEs} / .84 = 6.0 \text{ staff FTEs}$$

The above argument was for the common (and conservative) earned-value case where the current cost variance was assumed to be *typical*. In the rare cases when the current cost variance is *atypical*, then the CPI in the Staffing-to-schedule Index becomes 1.0, and the EAC in the Re-baselined Staff Index becomes (BAC – CV). The two indexes remain equivalent. The reader may verify that both indexes work out to be (b – y) / (b – z).

### **Conclusion: Two Convenient Uses**

One might conclude that we want to throw away one of the indexes if they are the same. However, conceptual clarity argues for keeping *both* indexes. Each index's definition makes sense in the context where it is used. Each definition employs the terms that are immediately at hand when their slightly different staffing questions arise.

Each index — with its independent definition — continues to serve a useful purpose in its own context.

### **Further Reading**

If you want to see what it's like to use the basic earned-value tools on a real project you may want to read Mark Durrenberger's *An Earned Value Tutorial*.

If you would like more details on the RWI and the StSI, read John Nevison's *The Remaining Work Index (RWI) and the Staffing-to-Schedule Index (StSI): How to use New Leaf's new indexes to adjust staffing and make your schedule*.

If you want to try your hand at calculating basic earned-value figures and other project metrics (including the StSI), read John Nevison's *Earned Value: Ideas and Exercises*.

If you want to see the original use and definition of the SbSI, read John Nevison's *Earned-Value Benchmarks for Re-baselining Your Project: Handy benchmarks to help you re-baseline the project*.

All four articles are available on New Leaf's web site ([www.NewLeafPM.com](http://www.NewLeafPM.com)) and **all can be studied to earn additional PDUs**.

### **About the Author**

**John M. (Jack) Nevison**, PMP is the author of six books and numerous articles on computing and management. During the course of his business career, Nevison has built and sold two businesses, managed projects, managed project managers, and served as both an internal and external consultant to Fortune 100 companies. He is past president of the Mass Bay Chapter of the Project Management Institute (PMI®), a past president of the Greater Boston Chapter of the Association for Computing Machinery (ACM), a certified Project Management Professional (PMP), and a Phi Beta Kappa graduate of Dartmouth.

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