

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*

John M. Nevison, PMP

Introduction

Frequently, part way through a project, the team will discover that things have not been going exactly according to plan. The deliverables have not all been completed on schedule, a major milestone may have slipped, the people working on the project are not the ones envisioned in the plan, and extra work has already been done to keep the project from falling further behind.

While the solutions can be as varied as the project's problems, a common solution is to exert more effort and try to complete the full project on the originally scheduled date. The original staff looks forward to working longer hours and often, extra staff is hired. The original plan usually varies its level of staffing to conform to variations in the level of work and if extra staff is going to be useful, it needs to roughly preserve the shape of the original staffing plan.

In the small project in the example below, the shape of the staffing profile might not appear to be an important factor. In most departments, however, the project staffers are in high demand and are simultaneously scheduled on multiple projects. It is of the utmost importance to make adjustments to each project in the way that causes the least disruption to the other projects underway. Preserving the shape of the staffing profile increases the likelihood that the extra staff will come on board at the right time, will be used in the best manner, and will minimize the disruptions to other projects.

So the question arises, "How do you add sufficient staff to recover the original schedule while preserving the shape of the original staffing plan?"

A Simple Example

The answer to this common question is that we will use New Leaf's Remaining Work Index (RWI) and New Leaf's Staffing to Schedule Index (StSI), two handy ratios that simplify some tedious calculations. In order to understand what the RWI and the StSI are and how we can use them, let's look at a simple example.

Here's a project plan for a seven-month project that will involve 18 staff-months of effort:

Month	Staff
1	1.0
2	2.0
3	3.0
4	4.0
5	4.0
6	2.0
7	2.0

7 Total months, the schedule in months
18 Total staff-months, the budget

While the actual plan probably details the work in staff-hour units, the effort in the table has been summarized in staff-month units to keep the example easy to understand. Notice how the work grows from 1 staff-month the first month to 4 staff-months for the fourth and fifth months, and finally tapers off to 2 staff-months for the sixth and seventh months.

At the end of the fourth month the details on the project looked like this:

To Date:
4 Project is now at end of this month
10.0 Planed Value to Date
11.0 Actual Cost to Date
9.0 Earned Value to Date
0.82 Cost Perf. Index (CPI)
0.90 Schedule Perf. Index (SPI)
22.0 Est. Cost at Complete (Original Budget / CPI)
7.8 Est. Schedule at Complete (Original Schedule / SPI)

We now see that the project at the end of four months is not going according to plan. The amount of work that was planned to have been completed at this point was 10 staff-months of work. The amount of work that has actually occurred is 11 staff-months, but the earned value of the work completed is only 9 staff months. We can make a rough prediction that if the remaining work is similar to the completed work, the project will cost 22 staff-months (not the planned 18) and be finished in 7.8 months (not the planned 7). The question now becomes “What are the adjusted staffing requirements?”

At this point we will make a few simplifying assumptions. (After we arrive at an answer we can revisit the assumptions and see how to modify our initial results if some of the assumptions are not true.) Our assumptions are:

- All activities that have been begun have been completed—there are no partially completed activities
- Every person in the department is capable of doing every activity on the project
- Every activity can be “crashed” by adding additional labor
- People can schedule their time in hours, so that fractional staff-months of work are possible answers to our question
- Increased numbers of people will work together as efficiently as the originally planned team

Again the question is “How much staff should you add to meet the original schedule while preserving the *shape* of the original staffing plan?”

Three Attempts

Here is a first attempt at a solution:

TOTAL METHOD (Forgetting CPI)
9.0 Remaining work (Budget - Earned Value to Date)
3.0 / Remaining months
3.0 = Staff needed next month (Assumes a level staffing to the end of the project)

Our first attempt started with 9 staff-months of remaining work, divided it by the remaining 3 months, and settled on 3 staffers each month for the next three months. However, this attempt did not include any consideration of the Cost Performance Index’s fall from 1.0 to .82. Our lower CPI tells us that we should remember that we are not as efficient as we originally planned to be.

A second attempt at a solution:

TOTAL METHOD
9.0 Remaining work
3.0 / Remaining months
0.82 / CPI
3.7 = Staff needed next month (Assumes a level staffing to the end of the project)

Our second attempt started with 9 staff-months of remaining work, divided it by the remaining 3 months, then divided again by the .82 CPI to get a staffing level of a 3.7. However, this second attempt assumes that we will level-staff the project for the next three months. It disregards the 4-2-2 the shape of the original staffing plan.

Our third attempt will introduce a couple of new concepts, including the New Leaf’s Staffing to Schedule Index (StSI):

<p>STAFFING TO SCHEDULE METHOD (Preserves the original shape of the staffing)</p> <p>8.0 Remaining work planned (Budget - Planned Value to Date)</p> <p>9.0 / Remaining work (Budget - Earned Value to Date)</p> <p>0.89 = Remaining Work Index (RWI)</p> <p>0.82 x CPI</p> <p>0.73 = Staffing to Schedule Index (StSI)</p> <p>4.0 Next month's originally planned staff</p> <p>0.73 / Staffing to Schedule Index (StSI)</p> <p>5.5 = Staff needed next month</p>
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The third attempt begins by creating the New Leaf's Remaining Work Index (RWI) by dividing the remaining work by the planned remaining work. Because the RWI has fallen from 1.0 to .89 we know we are behind in our work and that we have extra work remaining to be completed by our deadline.

In addition to having extra work to do, we are also less productive than planned because our CPI has fallen from 1.0 to .82. The product of the RWI x CPI gives us .73, the Staffing to Schedule Index (StSI). The StSI is the measure of how much we should increase the pattern of our staffing if we wish to meet our original schedule and *preserve the shape of the original staffing plan*. Next month's staffing level should be 5.5.

Two New Indexes

New Leaf's two new indexes are defined as:

- Remaining Work Index (RWI) is the (Remaining Planned Work) / (Remaining Actual Work), or the (Budget – Planned Value to Date) / (Budget – Earned Value to Date)
- The Staffing to Schedule Index (StSI) is the Cost Performance Index (CPI) x the Remaining Work Index (RWI)

Both of these new indexes work in the familiar ways of the traditional earned-value indexes of CPI and SPI. For both the RWI and the StSI:

- an index of 1.0 means all is well (or at least, all is going according to plan)
- an index *less than 1.0* means things are behind plan
- an index *greater than 1.0* means things are ahead of plan.

Final Check

In order to be sure that the StSI calculation really works, let's compare our second and third attempts to adjust our staffing:

Original planned work				
	Month		Staff	
		1	1.0	
		2	2.0	
		3	3.0	
		4	4.0	
Current measures				
		10.0	Planned Value to Date	
		11.0	Actual Cost to Date	
		9.0	Earned Value to Date	
Forecasted staffing				
		-----	Staff	-----
		Orig.	Total	Staffng to Schedule
	Month	Plan	Method	Method
	5	4.0	3.67	5.50
	6	2.0	3.67	2.75
	7	2.0	3.67	2.75
	Total work remaining	8.0	11.0	11.0

We see that while two methods correctly calculate the 11 staff-months of total work remaining, the “Total Method” failed to preserve the 4-2-2 staffing shape of the last three months while the Staffing to Schedule Index method *proportionately adjusts the staffing* and preserves the shape of the original staffing plan, 5.50 – 2.75 – 2.75.

Assumptions Revisited

Our assumptions were:

- All activities that have been begun have been completed—there are no partially completed activities
- Every person in the department is capable of doing every activity on the project
- Every activity can be “crashed” by adding additional labor
- People can schedule their time in hours, so that fractional staff-months of work are possible answers to our question
- Increased numbers of people will work together as efficiently as the originally planned team

The first assumption that there were no partially completed activities allowed us to be sure that our calculations were precise. Small amounts of incomplete work do not adversely affect earned-value calculations in real projects. If a large amount of incomplete work exists, assigning “partial credit” can usually correct the problem.

[1]

The second assumption that every staffer can do every task made it easy for us to focus on a simple calculation. In most projects we will have to spend some time matching the right talent to each task. So we should probably add a little “matching” effort to our 11-staff-month forecast.

The third assumption that every activity can be “crashed” is probably not true. Nine people cannot have a baby in one month. Some activities cannot be compressed. If we are late starting an activity that is not compressible and is on the critical path, our schedule will slip no matter how many extra staffers we apply to the project.

The fourth assumption that people can schedule their time in hours is true of most white-collar projects.

The fifth assumption that increased numbers of people will work together as efficiently as the originally planned team is rarely true. To the extent that new people are

- hard to find right away;
- need time to adjust to the work [2];
- may not be as individually productive as the original team members;
- may make the expanded team a little less efficient [3];

the estimated 22 staff-months should be increased. The actual staffing for each month might be “rounded up” to the next whole person. So when our assumptions are modified to conform to reality, our calculated staffing of $5.50 - 2.75 - 2.75$ (total of 11) may become real hiring of $6 - 3 - 3$ (total of 12).

Conclusion

We have seen how to combine the CPI from traditional earned-value analysis, with the new New Leaf’s Remaining Work Index (RWI) to create the New Leaf’s Staffing to Schedule Index (StSI). As with the familiar CPI and SPI, for both the RWI and the StSI an index of 1.0 means all is well (or at least, all is going according to plan). An index *less than 1.0* means things are behind plan; an index *greater than 1.0* means things are ahead of plan.

The StSI allows us to preserve the shape of the original plan’s staffing profile by *proportionately adjusting it*. This proportional adjustment increases the likelihood that precious staff-hours will be efficiently used on the adjusted project and decreases unnecessary disturbances to the other critical projects that the staff is working on.

These calculations, modified by a realistic assessment of our initial assumptions, allow us to make a realistic effort to add staff and recover our original schedule.

Notes

1. While not taking partial credit is strongly advocated as a “best practice,” an example of taking partial credit is also illustrated in Durrenberger (June, 2003).
2. The concept of up-to-speed time is thoroughly explored in Nevison (Spring, 1994) and Nevison (June, 1994).
3. The idea of expanded teams becoming inefficient led to the title idea in Fred Brook’s *The Mythical Man Month*. This reference is both highly entertaining and a wonderful source of genuine wisdom about software engineering projects. Some of the “combinatorial” inefficiency that Brooks discusses is probably really “learning curve” effects that Nevison (June, 1994) explores.

References

- Brooks, Frederick P, Jr., (1995). *The Mythical Man Month: Essays on Software Engineering, 2nd Edition*, Reading, MA: Addison-Wesley Publishing Company.
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- Nevison, John M., (Spring, 1994), “Up to Speed: The Cost of Learning on a White-Collar Project,” *Project Management Journal*, Project Management Institute, Vol. XXV, No. 2, pp. 11-15.
- Nevison, John M., (June, 1994), “What Can We Learn About Learning on Projects?”, *PMNetwork*, Project Management Institute, pp. 6-8.

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 a 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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PDU Questions: Staffing-to-Schedule Index (StSI)

(\$9.95, 1 PDU)

1. What does RWI stand for?
 - a. Reserved work indicator
 - b. Remaining work index
 - c. Resource waiting indicator
 - d. All of the above.
2. What does StSI stand for?
 - a. Staffing-to-schedule indicator
 - b. Standard schedule index
 - c. Staffing-and-scheduling index
 - d. Staffing-to-schedule index
3. Preserving the staffing profile of a project is important because:
 - a. Each project should disrupt other projects as little as possible
 - b. Staffers are in high demand and are scheduled to perform parallel activities
 - c. A stable staffing profile increases the likelihood that the staff will arrive at the right time
 - d. All of the above
4. Which is *not* a method described in the article?
 - a. Total method (forgetting CPI)
 - b. Total method (using CPI)
 - c. Staffing-to-schedule method
 - d. Calculated guess method
5. The RWI is equal to:
 - a. $(\text{Remaining Planned Work}) / (\text{Remaining Actual Work})$
 - b. $(\text{Budget} - \text{Planned Value to Date}) / (\text{Earned Value to Date} - \text{Budget})$
 - c. $(\text{Budget} - \text{Planned Value to Date}) / (\text{Budget} - \text{Earned Value to Date})$
 - d. Both a and c
6. The StSI is equal to:
 - a. $(\text{Cost Performance Index (CPI)}) \times (\text{Remaining Work Index (RWI)})$
 - b. $(\text{Schedule Performance Index (SPI)}) \times (\text{Remaining Work Index (RWI)})$
 - c. $(\text{Cost Performance Index (CPI)}) \times (\text{Schedule Performance Index (SPI)})$
 - d. None of the above
7. For all four indexes (CPI, SPI, RWI, and StSI):
 - a. Exactly 1.0 means things are on plan
 - b. Less than 1.0 means things are behind plan
 - c. Greater than 1.0 means things are ahead of plan
 - d. All of the above
8. Which of the following is *not* an assumption in solving the puzzle?
 - a. The CPI is stable at this point in the project
 - b. There are no partially completed activities
 - c. Every activity can be shortened by adding additional labor
 - d. People schedule their time in staff-days

9. Which of the assumptions is *most likely* to be true?
- The CPI is stable at this point in the project
 - There are no partially completed activities
 - Every activity can be shortened by adding additional labor
 - All staffers are capable of doing every activity on the project
10. Which is *not* true?
- The StSI allows us to preserve the shape of the staffing profile
 - The StSI depends on the RWI and the CPI
 - Both the StSI and the RWI are ratios that say similar things about the relationship between the actual project and the planned project
 - The RWI is difficult to calculate
11. The correct staffing in Month 5 of the puzzle is:
- 4.00
 - 3.67
 - 5.50
 - 5.75

Staffing-to-Schedule Index (StSI)

\$9.95 for 1 PDU

If you score 70% or more correct answers, a PDU certificate will be e-mailed to you. These PDUs count as "Category 3: PMI/R.E.P. Educational Activities" and are not limited for CCR/PMP recertification purposes. To receive your PDUs, please fill in the information below (✓ fields are required).

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