



Understanding How to Use Level of Effort Activities

By Dan Stamness

TEPCO, LLC

www.tepco.us

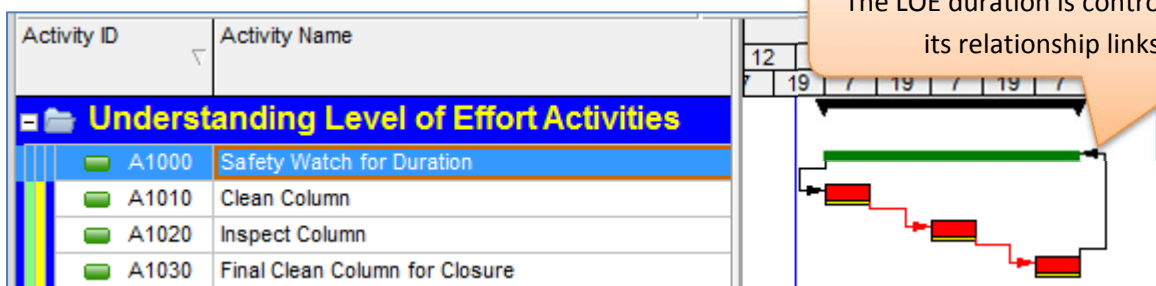
A Level of Effort activity duration is dependent on its predecessor and/or successor assignments. It basically contracts and expands based on what it is linked to. They can be useful for applying hours for overhead type of activities to a project or turnaround. A common use is to assign a safety watch or crane for the duration of a job, rather than assigning the safety watch or crane to each individual activity.

Things to note about a Level of Effort:

- Do not ignore them during update cycles! They should be managed by the TA scheduler just like milestones.
- You cannot assign constraints to them.
- They are not included in leveling.
- Start and Finish dates are calculated off of the LOE assigned activity calendar, not the calendars of the activities they are linked to. *For example, if the LOE calendar goes to 4pm on a particular day, but its driving successor goes to 5pm, the LOE will only schedule to 4pm regardless of the successor activity calendar.*

A level of effort activity is similar to, but different from a hammock activity:

- A level of effort activity uses its assigned calendar to summarize its dates. Hammocks are not scheduled using their own calendar.
- Any type of relationship can be assigned to a level of effort activity. Only a start-to-start and finish-to-finish relationship can be assigned to a hammock activity.
- A level of effort activity's duration is calculated from the earliest early start of its predecessors/successors (linked to the start end of the level of effort activity) to the latest early finish of its predecessors/successors (linked to the finish end of the level of effort activity).
- A hammock activity's duration is calculated from the earliest early start of its predecessors to the latest early finish of its successor activities.





Understanding How to Use Level of Effort Activities

Some schedulers tend to avoid the use of LOEs because of the inability to control their durations or update them properly. The intent of this document is to clarify all aspects of using Level of Effort activity types.

Level of Effort Duration Type

Although you can assign a Duration Type such as *Fixed Duration and Units/Time* or *Fixed Duration and Units*, **the duration is actually never fixed**, since its duration is controlled by the activities the LOE is linked to.

Since the duration is never fixed, you must have a clear understanding of how the Budgeted Units/Time and Total Units will react when the duration changes:

- **During Planning:** During the planning period, its best to use *Fixed Duration & Units/Time*. This ensures that the crew size (Budgeted Units/Time) you apply to the LOE stays constant. The total units will then increase and decrease as the duration flexes.
- **During Execution:** Once a plan is approved for execution, the duration of the LOE should now be defined. This means that the total hours are also defined based on the static crew size (Budgeted Units/Time) assigned. At this point you should change the duration type to *Fixed Duration & Units*. This ensures the total budgeted hours will not increase or decrease during execution, when the duration starts to contract and expand. **NOTE: Do not use Fixed Units, but rather Fixed Duration & Units. Otherwise the Units % Complete will not automatically update when performing progress entry.**

Also, this assumes that you have activated the setting in the project *Calculations* tab “*Recalculate Actual Units and Cost when duration % complete changes.*” This ensures that the Units % updates along with the Duration %

The screenshot shows a software interface with a tabbed menu at the top including 'General', 'Notebook', 'Budget Log', 'Spending Plan', 'Budget Summary', 'Dates', 'Funding', 'Codes', 'Defaults', 'Resources', 'Settings', and 'Calculations'. The 'Calculations' tab is active. On the left, the 'Activities' section has a 'Default Price / Unit for activities without resource or role Price / Units' field set to '\$0.00/h'. Below this are several checkboxes: 'Activity percent complete based on activity steps' (unchecked), 'Link Budget and At Completion for not started activities' (checked), 'Reset Original Duration and Units to Remaining' (unchecked), and 'Reset Remaining Duration and Units to Original' (checked). On the right, the 'Resource Assignments' section has a 'When updating Actual Units or' dropdown menu. Below it are three radio buttons: 'Add Actual to Remaining' (unchecked), 'Subtract Actual from Remaining' (checked), and 'Recalculate Actual Units and Cost when duration % complete changes' (checked). There are also two more checkboxes: 'Update units when costs change on resource assignments' (unchecked) and 'Link actual to date and actual this period units and costs' (checked). An orange callout box with the text 'Ensure this option is activated' points to the checked 'Recalculate Actual Units and Cost when duration % complete changes' option.



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Be aware that the *Remaining Units/Time* will now fluctuate (even to decimals or fractions) during execution when the duration of the LOE changes. This is okay, with the understanding that you do not want the total hours of the LOE to change. Typically any required changes to the LOE total hours should be managed through a change process. *An example of this is provided at the end of this document.*

Fixed Duration & Units vs. Fixed Units Example:

Here is an example containing two LOE activities. One is set to *Fixed Duration & Units* and the other is set to *Fixed Units*. Although the Duration % Complete automatically updated on both due to their predecessor activity being progressed, the LOE set with *Fixed Units* did not update the *Units % Complete, Earned Value Labor Units, or the Actual Labor Units*. *As stated earlier, use Fixed Duration & Units/Time on LOEs during planning. Use Fixed Duration and Units on LOEs during execution.*

Activity ID	Activity Name	Duration % Complete	Units % Complete	Earned Value Labor Units	Actual Labor Units	
Understanding Level of Effort Activities						
No TA_PHASE						
A1000	LOE - Fixed Duration and Units	33.33%	19.05%	40	40	
A1001	LOE - Fixed Units	33.33%	0%	0	0	
A1010	Clean Column	100%	100%	10	10	
A1020	Inspect Column	0%	0%	0	0	
A1030	Final Clean Column for Closure	0%	0%	0	0	

Units %, Earned Hours, and Actual Hours did not update.

The LOE set with the duration type of *Fixed Duration & Units* updated both the Duration % and Units %. Since the Units % updated, the Earned and Actual hours also calculated.

LOE Percent Complete Type

Although both the Duration % Complete and Units % Complete should automatically update on LOEs (*provided you are following the parameters noted above*), it's best to use a *Units percent complete* type on Level of Effort activities. Doing so ensures that the actual and earned hours on the LOE are calculated properly.

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LOE Relationship Links

Since a LOE duration is determined by the activities it is linked to, both the LOE start relationship link and the LOE finish relationship link are *technically* supposed to be predecessors, since realistically both the LOE start and finish are supposed to be driven by other activities. *We are noting this because you may encounter other P6 users that will argue this point.*

So *technically* the links for both the start and finish should be drawn up to the LOE, as shown in this example, indicating that the LOE duration is always driven by other activities:



The "Final Clean Column for Closure" relationship link drives the LOE finish date

The problem is that both links are predecessors to the LOE. That being said, there is not a successor assigned, which causes the P6 log file to flag the LOE as being open-ended:

Both links are predecessors

Activity ID	Activity Name	Relat	Lag
A1010	Clean Column	SS	
A1030	Final Clean Column for Closure	FF	

Successors

Activity ID	Activity Name	Relations	Lag	Critical
-------------	---------------	-----------	-----	----------

Errors:
Warnings:

```

Activities without predecessors.....1
Project:      LOE      Activity:      A1010      Clean Column
Activities without successors.....1
Project:      LOE      Activity:      A1000      Safety watch for Duration
  
```

The LOE is appearing in the schedule log as not having a successor.



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Regardless of the technical concept that LOE's must be driven by predecessor links to define both the start and finish dates of the LOE, we at TEPCO recommend a simplistic approach to ensure there is both a predecessor and successor on the LOE:

The screenshot shows the Primavera P6 interface. The top pane displays a Gantt chart for the month of October. Activity A1000, 'Safety Watch for Duration', is highlighted in blue. Below the chart, the 'Predecessors' and 'Successors' tables are visible. A callout bubble points to the relationship between A1000 and A1030.

Activity ID	Activity Name	Relat	L
A1010	Clean Column	SS	

Activity ID	Activity Name	Relations	Lag	Critical
A1030	Final Clean Column for Closure	FF	0	<input type="checkbox"/>

This relationship has been tied as a Finish-to-Finish from the LOE, opposite of the previous example

This resolves the LOE being flagged as not having a successor in the schedule log, and does not adversely affect the LOE duration in any way:

```
Errors:
-----
warnings:
-----
Activities without predecessors.....1
Project: LOE Activity: A1010 Clean Column

Activities without successors.....1
Project: LOE Activity: A1030 Final Clean column for closure

Data Date.....0
```

The LOE is no longer appearing as not having a successor in the schedule log



Understanding How to Use Level of Effort Activities

Updating Progress on LOEs

Updating a LOE tends to cause the greatest confusion. A LOE is NOT a summary activity, although many schedulers like to call it one. The only summarizing attribute of the LOE is the start and finish date. Nothing else summarizes to it.

The Duration % Complete and Units % Complete *should* automatically update on the LOE. This should not be considered summarization either. It is simply updating the percent based on its own duration, although since it is linked and driven by other activities, it can appear to look like a summary. Some environments use them to simply summarize durations, similar to what WBS (or activity code) grouping bands can do.

So when the driving activities are updated, the LOE start date will automatically update to follow its earliest started predecessor.

In this example, activity A1010 has been updated to 100% and the data date has been moved forward 1 day. Both the Duration and Units % Complete on the LOE have updated.

Activity ID	Activity Name	Duration % Complete	Units % Complete	Activity % Complete	BL Hours	Actual Hours	Earned Hours				
								Mon 13 19	Tue 14 19	Wed 15 19	
Understanding Level of Effort											
A1000	Safety Watch for Duration	33.33%	33.33%	33.33%	90.00	30.00	30.00				
A1010	Clean Column	100%	100%	100%	10.00	10.00	10.00				
A1020	Inspect Column	0%	0%	0%	10.00	0.00	0.00				
A1030	Final Clean Column for Closure	0%	0%	0%	10.00	0.00	0.00				

Earned vs. Actual Hours

Since we typically do not enter true actual hours into P6 based on timesheets, we ensure the project setting is activated to *Recalculate Actual Units and Cost when duration % complete changes* within the projects details *Calculations* tab. This ensures the *Actual Units* automatically update when we enter *Duration % Complete* or *Remaining Duration*. This gives us the ability to pulled *Earned Hours* from resource assignments by utilizing the *Actual Units* fields as earned units. (A separate white paper has been written on this.)

As a precaution, it's always good to compare the *Actual Units* field to the *Earned Units* field prior to running management reports. If the two fields are not the same, something is out of sync. Your S-Curve reports will most likely be skewed as well.



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9 times out of 10 it's a Level of Effort activity causing the problem. This can happen when the Duration % Complete and Units % Complete fields are not the same on the LOE. This can be very apparent when you have LOE's with a high amount of manhours.

The cause of the two percent fields becoming out of sync is not always clear. It could be the manner in which activities are updated. Or it could be when there are multiple resource assignments on a single LOE. P6 Version 8 seems to calculate the fields in this aspect better than previous versions. ***This issue is very common in P6 Version 6.2.***

Here is an example of what you might encounter. Notice how the Units % Complete does not match the Duration % Complete. Also, the Actual Hours do not match the Earned Hours.

Activity ID	Activity Name	Duration % Complete	Units % Complete	Activity % Complete	BL Hours	Actual Hours	Earned Hours
Understanding Level of Effort							
A1000	Safety Watch for Duration	33.33%	28%	28%	90.00	30.00	25.20
A1010	Clean Column	100%	100%	100%	10.00	10.00	10.00
A1020	Inspect Column	0%	0%	0%	10.00	0.00	0.00
A1030	Final Clean Column for Closure	0%	0%	0%	10.00	0.00	0.00

Percent fields do not match.

Actual and Earned are not in sync

This is a simple example, so we could just manually change the Units % Complete field to 33.33%. However, if you have an LOE with numerous resources and high hours, this may be more difficult to make them match exactly. The P6 percent fields only show 2 decimal places, so it's quite possible that the *Duration % Complete* is rounding in the background.

Fortunately there is a very easy fix that can be used at any time and does not take any manual calculations. The *Update Progress* tool in P6 will automatically resolved the problem for us, and should fix it right down to a fraction of a percent.

- 1) Use Ctrl-Click to select the LOE activities that are out of sync
- 2) Go to *Tools, Update Progress*
- 3) Select the option *Selected Activities Only* and click *Apply*
- 4) Schedule (F9) the project. (NOTE: The *Duration % Complete* field may have changed when you performed the update progress. You MUST reschedule to correct it.)

Activity ID	Activity Name	Duration % Complete	Units % Complete	Activity % Complete	BL Hours	Actual Hours	Earned Hours
Understanding Level of Effort							
A1000	Safety Watch for Duration	33.33%	33.33%	33.33%	90.00	30.00	30.00
A1010	Clean Column	100%	100%	100%	10.00	10.00	10.00
A1020	Inspect Column	0%	0%	0%	10.00	0.00	0.00
A1030	Final Clean Column for Closure	0%	0%	0%	10.00	0.00	0.00



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Make Update Progress tool in P6 Part of your Standard Update Process for LOEs:

Since the *Update Progress* tool resolves the issue, you could add this procedure into your normal updating routine. Simply update your activities as normal, move the data date ahead, ensure no actuals are ahead of the data date, and then use the *Update Progress* tool on all LOEs. Re-updating an already progressed LOE via *Update Progress* does not hurt anything. So you could apply a LOE filter and just update them all!

Change Requests and LOEs

If a job containing an LOE increases in duration, this causes the duration of the LOE to increase. The total hours will not increase since the LOE is set to *Fixed Duration & Units*. An increase in job duration could be due to:

- Discovery work added to the plan
- Weather or Ops delays
- Poor productivity from the primary resources
- Etc...

In this example, it's determined that a change management activity will need to be added to the column for weld repairs. When added into the activity sequence, the LOE duration now increases. In this case, the added work should go through change management approval before adding the activity. However, will the added activity contain the extra Safety Watch hours? If you do this, the LOE will also be running over the top of it, causing the Safety Watch histogram to exceed limits. (Sometimes referred to as "double dipping".) It's best to add the extra Safety Watch hours to the existing LOE. This is commonly overlooked.

Activity ID	Activity Name	Duration % Complete	Units % Complete	Activity % Complete	BL Hours	Actual Hours	Earned Hours
Understanding Level of Effort							
A1000	Safety Watch for Duration	30%	30%	30%	90.00	27.00	27.00
A1010	Clean Column	100%	100%	100%	10.00	10.00	10.00
A1020	Inspect Column	0%	0%	0%	10.00	0.00	0.00
DWR100	Discovery Work - Weld Repairs	0%	0%	0%	0.00	0.00	0.00
A1030	Final Clean Column for Closure	0%	0%	0%	10.00	0.00	0.00

The safety watch is required during the weld repairs. Were hours added to the LOE to compensate for this as well?

Another situation that may result in added hours for the Safety Watch is a basic over run of job duration. In this case the turnaround manager may want to submit a change request towards the end of the turnaround to compensate for the increased usage of the Safety Watch resources.