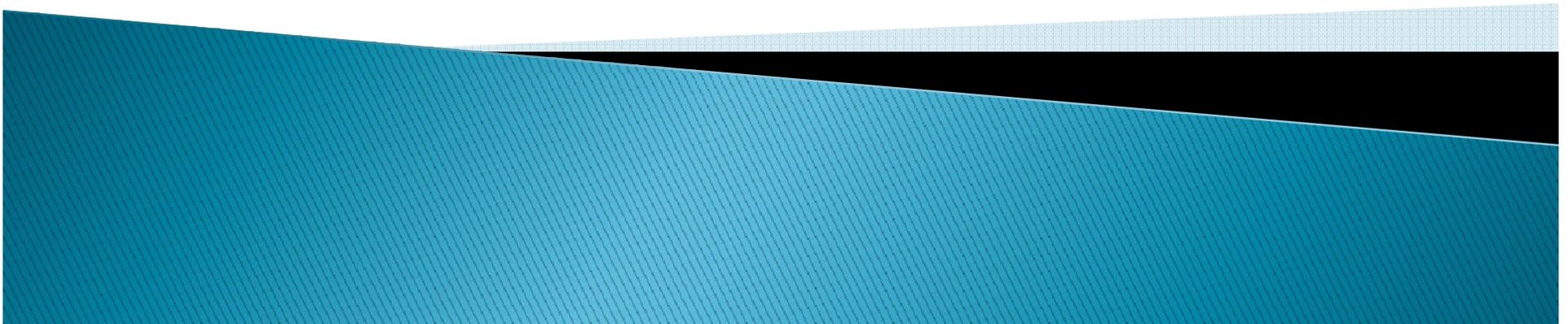




*Earned Value Management
Practitioners Symposium*

Understanding the DCMA 14 Point Assessment Metrics

Thursday, July 23, 2015
Janet Griskonis, PMP, EVP
LEIDOS

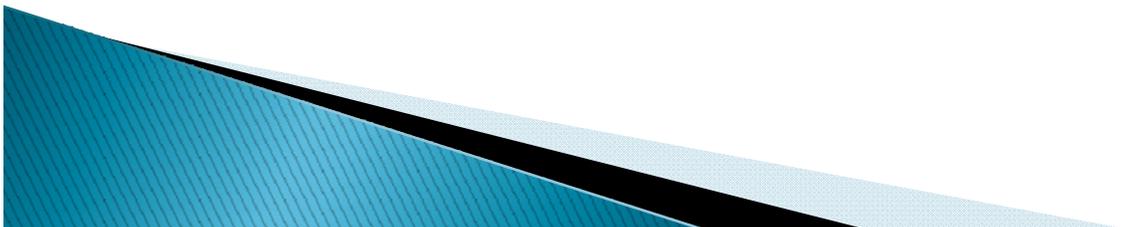


Background

- ▶ The DCMA 14-Point Schedule Metrics were developed to identify potential problem areas with a contractor's Integrated Master Schedule (IMS).
- ▶ The 14-Point schedule analysis should exclude:
 - Completed Tasks
 - LoE Tasks
 - Subprojects (called Summary Tasks in Microsoft Project)
 - Milestones
- ▶ These metrics provide the analyst with a framework for asking educated questions and performing follow-up research.

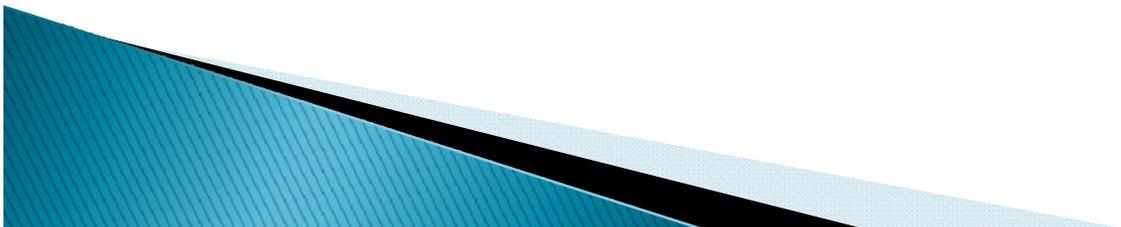
Mandate

- ▶ As of July 2012, PARCA has mandated the use of an Integrated Master Schedule for cost or incentive contracts/subcontracts and intra-government work agreements of at least \$20 million.
- ▶ IPMR – Format 6 Integrated Master Schedule



Available Tools

- ▶ Steelray Project Analyzer, Steelray Software,
<http://www.steelray.com>
- ▶ Acumen Fuse|Deltek,
www.deltek.com/products/ppm/schedule/acumen-fuse



Purpose

- ▶ To provide a consistent, agency-wide approach to schedule analysis.
- ▶ To provide a catalyst for constructive discussions between the contractor and DCMA.
- ▶ To provide a baseline for tracking IMS improvement over time.
- ▶ To utilize proven metrics that have been successfully implemented on several different programs.

DCMA 14-Point Assessment Checks

- ▶ Logic
- ▶ Leads
- ▶ Lags
- ▶ Relationship Types
- ▶ Hard Constraints
- ▶ High Float
- ▶ Negative Float
- ▶ High Duration
- ▶ Invalid Dates
- ▶ Resources
- ▶ Missed Tasks
- ▶ Critical Path Test
- ▶ Critical Path Length Index (CPLI)
- ▶ Baseline Execution Index (BEI)

Pre-Assessment Metrics

- ▶ **Total Tasks** – Lowest level tasks, excluding summary tasks, milestones, and LOE tasks.
- ▶ **Complete Tasks** – Of the Total Tasks, how many have been completed?
- ▶ **Incomplete Tasks** – Of the Total Tasks, how many are not completed?
- ▶ **Baseline Count** – Of the Total Tasks, how many were planned to be done by now?
- ▶ **BEI Baseline Count** – Baseline count plus tasks missing Baseline Finish Dates.
- ▶ **Relationship Count** – For the Incomplete Tasks, how many FS, FF, SS, and SF relationships are there.

Metric #1 – Logic

▶ Metric Purpose:

- This metric identifies incomplete tasks with missing logic links.
- It helps identify how well or poorly is linked together.

▶ Calculation:

$$\text{Missing Logic \%} = \frac{\text{\# of tasks missing logic}}{\text{\# of incomplete tasks}} \times 100$$

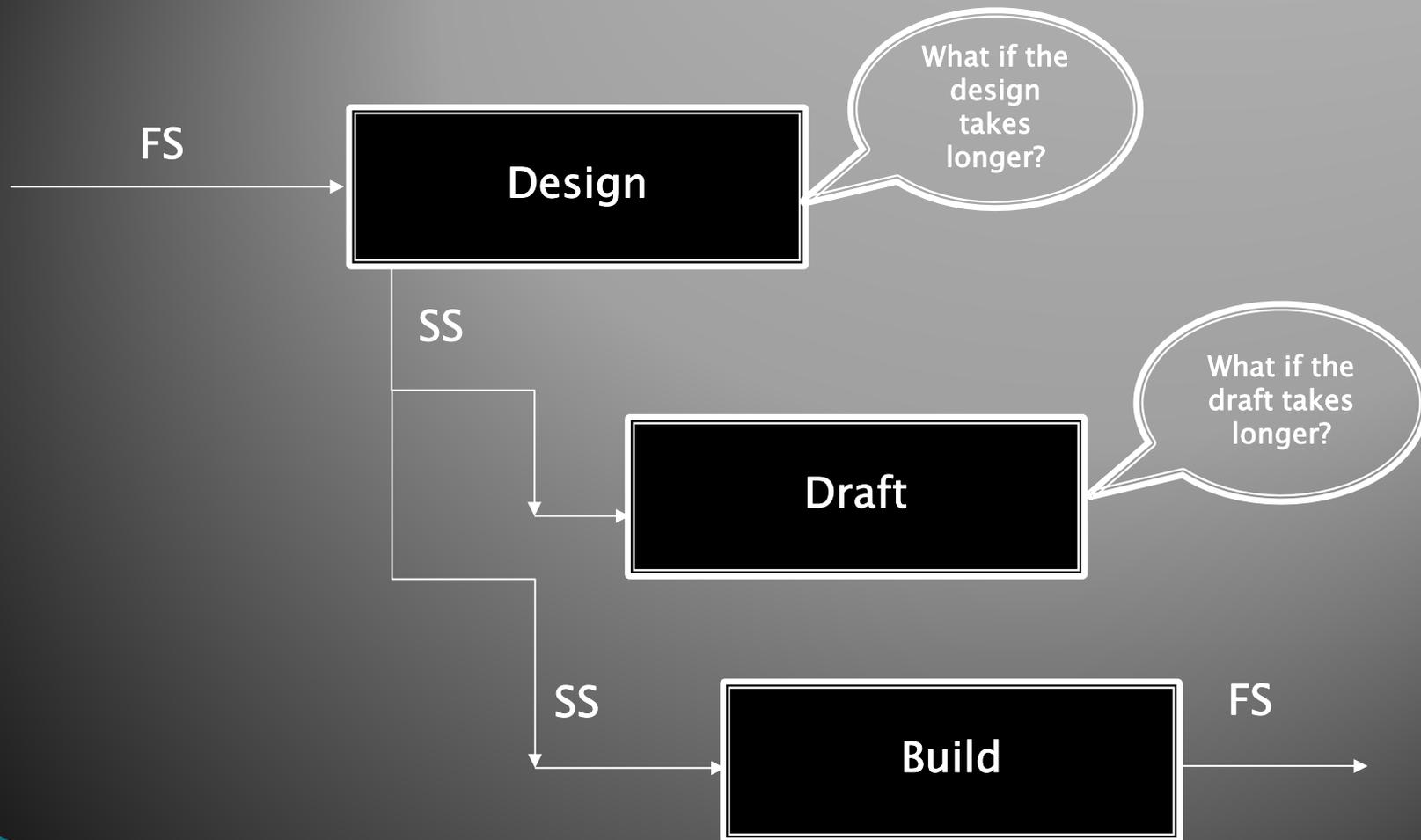
▶ Threshold:



Should not exceed 5%

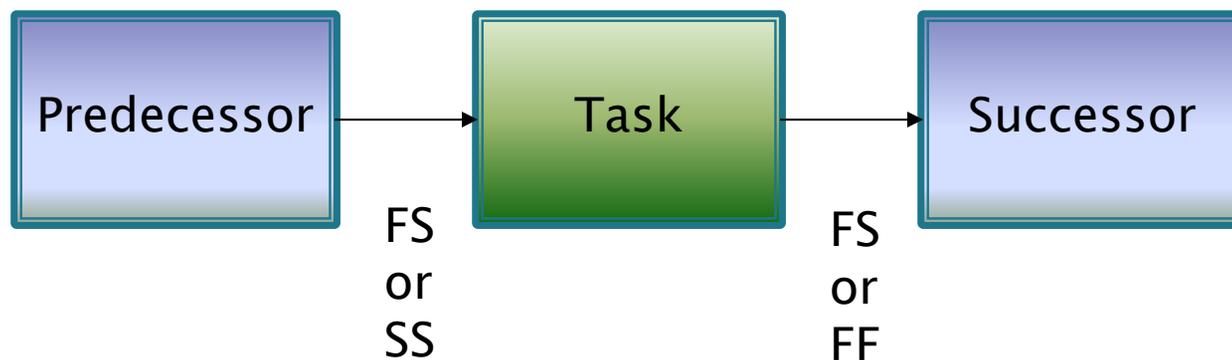


Example - Tasks without a Successor



Best Practice – Schedule Logic

- ▶ To avoid tasks without a predecessor or successor, also known as “dangling tasks,” each task should have:
 - At least FS or SS relationship as a predecessor
 - At least FS or FF relationship as a successor



Metric #2 – Leads

▶ Metric Purpose:

- This metric identifies the number of links with a lead (negative lag) in predecessor relationships for incomplete tasks.
- The use of leads distorts the total float in the schedule may cause resource conflicts.
- Per the IMS Data Item Description (DID), negative time is not demonstrable and should not be encouraged.

▶ Calculation:

$$\text{Leads \%} = \frac{\text{\# of logic links with leads}}{\text{\# of logic links}} \times 100$$

▶ Threshold:

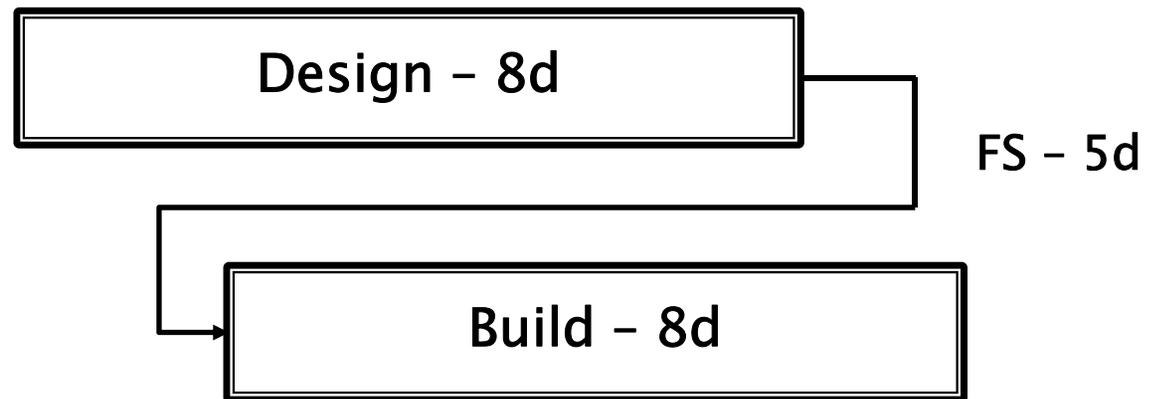
- Leads should not be used; therefore, the goal for this metric is “0.”

Example – “Lead” relationship

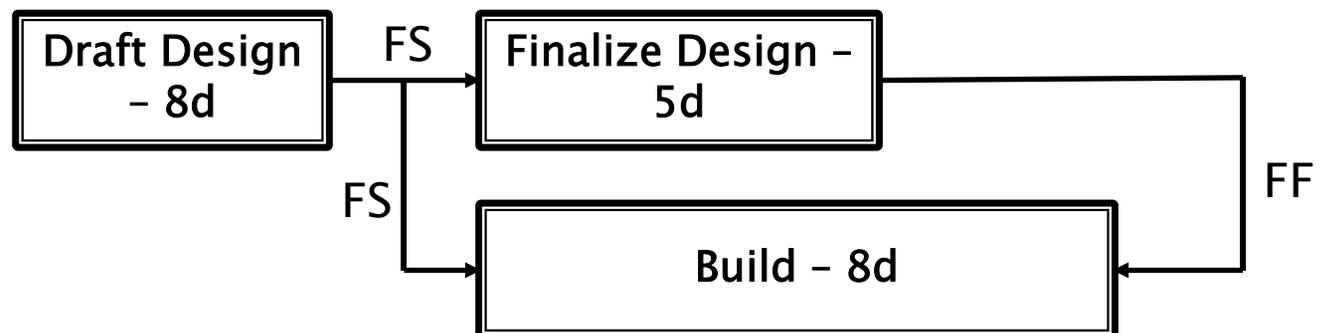
The intention of leads is to put you ahead of schedule, but at what risk?

Finish to Start (Lead)

Example

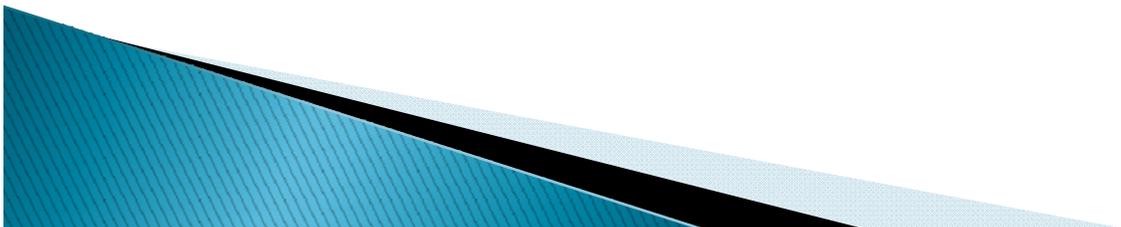


Better Example



Best Practice – Leads

- ▶ If some event in the predecessor task is the “criteria” to begin the successor task, consider breaking the predecessor into two discrete tasks.



Metric #3 – Lags

▶ Metric Purpose:

- This metric represents the number of lags in predecessor logic relationships for incomplete tasks.
- The critical path and any subsequent analysis can be adversely affected by using lags.
- Per the IMS Data Item Description (DID), lag should not be used to manipulate float/slack or to restrain the schedule.

▶ Calculation:

$$\text{Lags \%} = \frac{\# \text{ of logic links with lags}}{\# \text{ of logic links}} \times 100$$

▶ Threshold:

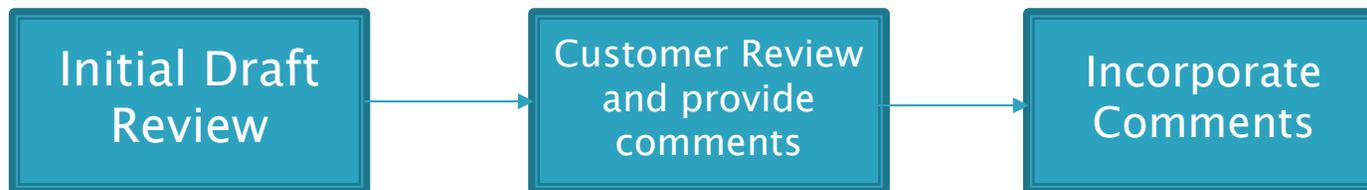
- Lags should not exceed 5%

Example – “Lag” relationship



Best Practice – Lags

- ▶ If the lag represents some effort or activity, consider inserting a task to close the gap.



Metric #4 – Relationship Types

▶ Metric Purpose:

- The metric provides a count of incomplete tasks containing each type of logic link.

▶ Calculation:

$$\% \text{ of FS Relationship Types} = \frac{\# \text{ of logic links with FS Relationships}}{\# \text{ of logic links}} \times 100$$

▶ Threshold:

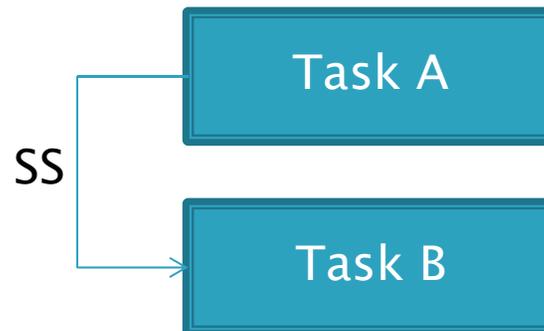
- **Finish to Start (FS)** – should account for 90% of the relationships used.
- **Start to Finish (SF)** – should only be used very rarely and with detailed justification.

Example of Relationship Types

- ▶ **Finish to Start:** Once the predecessor finishes the successor can start.

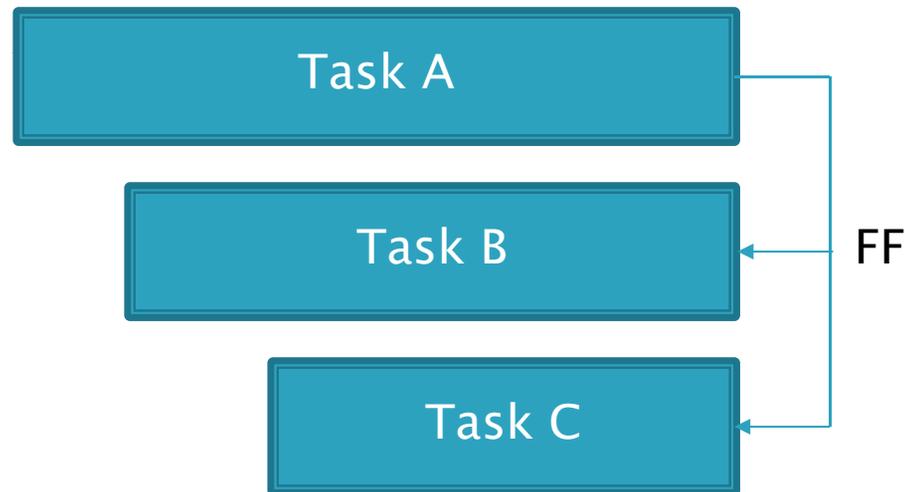


- **Start to Start:** Until the predecessor starts, the successor can not start.



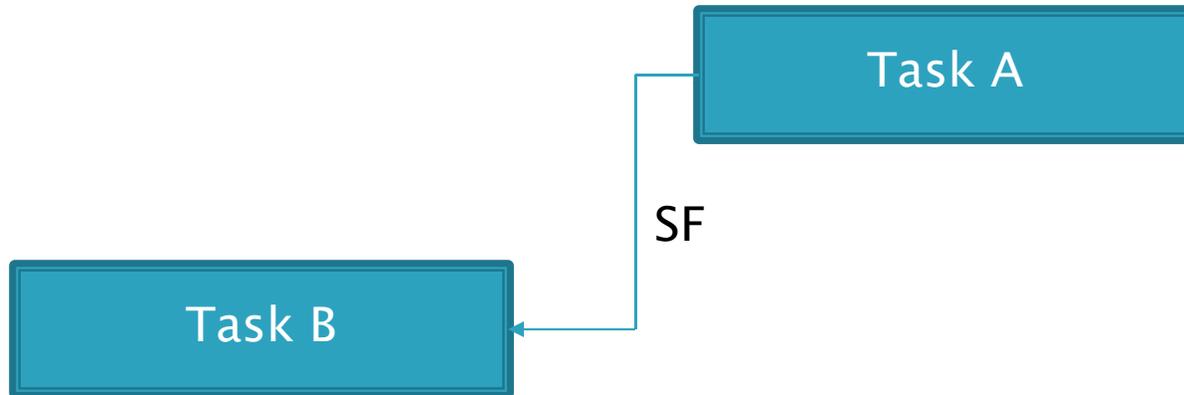
Example of Relationship Types (continued)

- ▶ **Finish to Finish:** You must wait for predecessor to finish before the successor can finish.



Example of Relationship Types (continued)

- ▶ **Start to Finish:** You must wait for predecessor to finish before the successor can finish.



Metric #5 – Hard Constraints

▶ Metric Purpose:

- This is the count of incomplete tasks with hard constraints in use.
- Using Hard Constraints [Must-Finish-On (MFO), Must-Start-On (MSO), Start-No-Later-Than (SNLT), & Finish-No-Later-Than (FNLT) may prevent tasks from being moved by their dependencies, and therefore, prevent the schedule from being logic driven.
- Soft constraints such as As-Soon-As-Possible (ASAP), Start-No-Earlier-Than (SNET), and Finish-No-Earlier-Than (FNET) enable the schedule to be logic driven.
- Field typically used in Microsoft Project is “Constraint Date.”

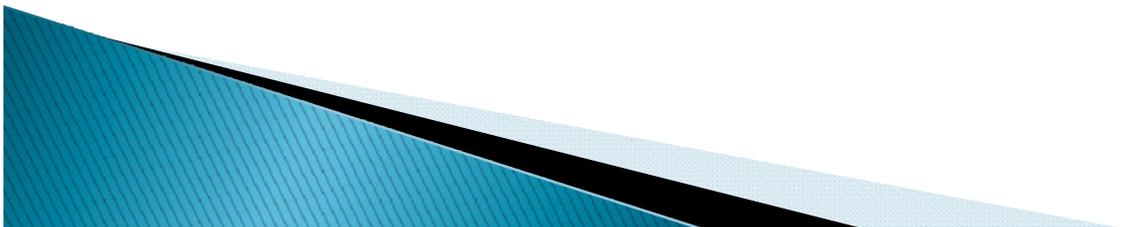
Metric #5 – Hard Constraints

▶ Calculation:

$$\text{Hard Constraint \%} = \frac{\text{Total \# of incomplete tasks with hard constraints}}{\text{Total \# of incomplete tasks}} \times 100$$

▶ Threshold:

- The number of tasks with hard constraints should not exceed 5%.



Example – Hard Constraint

Hard Constraint indicator

The screenshot displays the Microsoft Project interface. The Gantt chart shows a task named 'Interface A' with a duration of 5 days, starting on Monday, 7/20/15, and ending on Friday, 7/24/15. The Task Information dialog box is open, showing the 'General' tab. The 'Constraint type' is set to 'Start No Earlier Than' and the 'Constraint date' is 'Mon 7/20/15'. A white arrow points from the text 'Hard Constraint indicator' to the 'Start No Earlier Than' dropdown menu.

Task Name	Duration	Start	Finish
Master Project Schedule	50 days	Wed 7/15/15	Tue 9/22/15
Interface A	5 days	Mon 7/20/15	Fri 7/24/15
Interface B	10 days	Wed 7/15/15	Tue 7/28/15
Interface C	10 days	Wed 7/29/15	Tue 8/11/15
Interface D	10 days	Wed 8/12/15	Tue 8/25/15
Interface E	10 days	Wed 8/26/15	Tue 9/8/15
Interface F	10 days	Wed 9/9/15	Tue 9/22/15

Best Practice – Hard Constraints

- ▶ Avoid hard constraint dates unless absolutely needed.
 - This tends to break the schedule logic and interferes with downstream critical path analysis.
- ▶ Consider using the “deadlines” capability in MS Project as a way of modeling target dates.
 - Allows the task to slip to the right if the predecessor’s slip.
 - Does not disrupt the logical flow of the schedule
 - Highlights negative float/slack if the deadlines is at risk.

Metric #6 – High Float

▶ Metric Purpose:

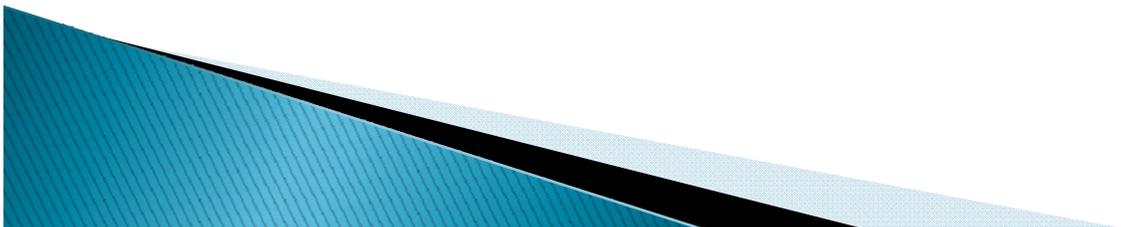
- An incomplete task with total float greater than 44 working days (2 months) is counted in this metric.
- A task with total float over 44 working days may be a result of missing predecessors and/or successors.

▶ Calculation:

$$\text{High Float \%} = \frac{\text{Total \# of incomplete tasks with high float}}{\text{Total \# of incomplete tasks}} \times 100$$

▶ Threshold:

- If the percentage of tasks with excessive total float exceeds 5%, the network may be unstable and may not be logic driven.



Example – High Float

Primary reason for High Float/Total Slack is there is no predecessor or successor

Task Name	Duration	Start	Finish	Predecessors	Successors	Total Slack
Master Project Schedule	50 days	Wed 7/15/15	Tue 9/22/15			0 days
Interface A	5 days	Wed 7/15/15	Tue 7/21/15			45 days
Interface B	10 days	Wed 7/15/15	Tue 7/28/15		4	0 days
Interface C	10 days	Wed 7/29/15	Tue 8/11/15	3	5	0 days
Interface D	10 days	Wed 8/12/15	Tue 8/25/15	4	6	0 days
Interface E	10 days	Wed 8/26/15	Tue 9/8/15	5	7	0 days
Interface F	10 days	Wed 9/9/15	Tue 9/22/15	6		0 days

Best Practice – High Float

- ▶ Develop views or filters in Microsoft Project to highlight excessive total float.
- ▶ If present, review the schedule dependency logic to ensure that the predecessor/successor relationships are defined thoroughly.
- ▶ Check to see if there are missing successor relationships.
- ▶ Ask yourself, “Are the task durations realistic and attainable?”

Metric # 7 – Negative Float

▶ Metric Purpose:

- An incomplete task with total float less than 0 working days is included in this metric.
- It helps identify tasks that are delaying completion of one or more milestones.
- Tasks with negative float should have an explanation and corrective action plan to mitigate the negative float.

▶ Calculation:

$$\text{Negative Float \%} = \frac{\text{Total \# of incomplete tasks with negative float}}{\text{Total \# of incomplete tasks}} \times 100$$

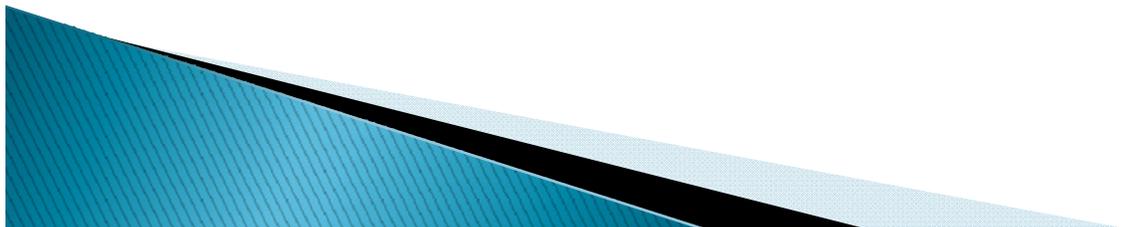
▶ Threshold:

- Ideally there should not be any negative float in the schedule.



Best Practices – Negative Float

- ▶ Develop views or filters to highlight negative total slack and review often.
- ▶ Negative float (total slack in MS Project) sometimes illustrates that hard constraint dates have been applied to the schedule.
 - Try to minimize hard constraints to allow the logic to flow smoothly.
 - Use “deadlines” instead of constraint dates.
- ▶ Negative float indicates that some key target dates is no longer viable with the schedule as planned.
- ▶ Update the schedule dependencies/logic or work plan to minimize negative slack.



Metric #8 – High Duration

▶ Metric Purpose:

- An incomplete task with a baseline duration greater than 44 working days (2 months), and has a baseline start date with the detail planning period or rolling wave is included in this metric.
- It helps to determine whether or not a task can be broken into two or more discrete tasks rather than one.
- It also makes tasks more manageable; which provides better insight into cost and schedule performance.

▶ **Calculation:**

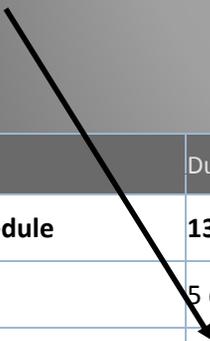
$$\text{High Duration \%} = \frac{\text{Total \# of incomplete tasks with high duration}}{\text{Total \# of incomplete tasks}} \times 100$$

▶ Threshold:

- The number tasks with high duration should not exceed 5%.

Example of High Duration

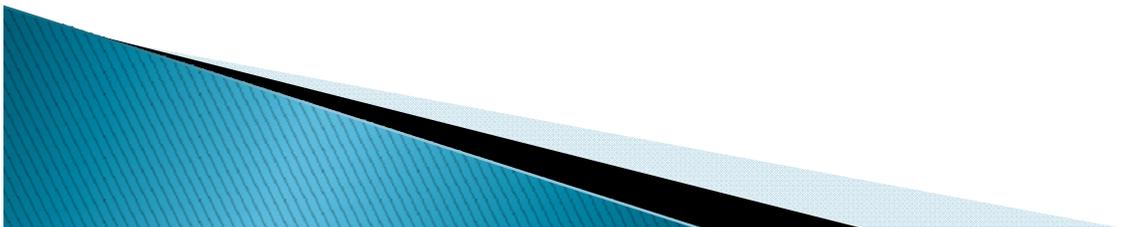
Does Interface B need to be broken down into two tasks to better manage?



Task Name	Duration	Start	Finish	Resource Names
Master Project Schedule	130 days	Wed 7/15/15	Tue 1/12/16	
Interface A	5 days	Mon 7/20/15	Fri 7/24/15	Test Engineer
Interface B	50 days	Wed 7/15/15	Tue 9/22/15	Chief Test Engineer
Interface C	40 days	Wed 9/23/15	Tue 11/17/15	Test Engineer
Interface D	20 days	Wed 11/18/15	Tue 12/15/15	Test Analyst
Interface E	15 days	Wed 12/16/15	Tue 1/5/16	Jr. Tester
Interface F	5 days	Wed 1/6/16	Tue 1/12/16	Sr. Tester

Best Practices – High Duration

- ▶ There are some disadvantages to High Duration:
 - It can make discreet progress measurement more difficult.
 - It could lead to complex logic (for example, “negative” lag.)
 - It will distort the critical path.
- ▶ Consider breaking the high duration tasks into shorter, more measureable tasks.
- ▶ Use rolling wave planning and planning packages to represent future effort where is it not yet practical to define discrete work packages.



Metric #9 – Invalid Dates

▶ Metric Purpose:

- Incomplete tasks that have a forecast start/finish prior to the IMS status date, or has an actual start/finish date beyond the IMS status date are included in this metric.
- A task should have forecast start and forecast finish dates in the future relative to the status date of the IMS (i.e., if the IMS status date is 7/15/15, the forecast date should be on or after 7/15/15).
- A task should not have an actual start or actual finish date that is in the future relative to the status date of the IMS (i.e., if the IMS status date is 7/15/15, the actual start or finish date should be on or before 7/15/15 and not after 7/15/15).
- To fix in Microsoft Project, you need to reschedule the incomplete work and the dates will be updated.

▶ Threshold:

- There shouldn't be any invalid dates in the schedule.

Metric #10 – Resources

▶ Metric Purpose:

- This metric provides verification that all tasks with durations greater than zero have dollars or hours assigned.
- The IMS DID (DI-MGMT-81650) does not require the contractor to load resources directly into the schedule.

▶ Calculation:

- If the contractor does resource load their schedule,

$$\text{Missing Resource \%} = \frac{\text{Total \# of incomplete tasks with missing resource}}{\text{Total \# of incomplete tasks}} \times 100$$

▶ Threshold:

- All incomplete tasks should have resources.

Metric #11 – Missed Tasks

▶ Metric Purpose:

- A task is included in this metric if it is supposed to be completed already (baseline finish date on or before the status date) and the actual finish date or forecast finish date (early finish date) is after the baseline finish date or the Finish Variance (Early Finish minus Baseline Finish) is greater than “0.”
- This metric helps identify how well or poorly the schedule is meeting the baseline plan.

▶ **Calculation:**
$$\% = \frac{\text{\# of Incomplete tasks with missed Baseline Finish}}{\text{\# of incomplete tasks}} \times 100$$

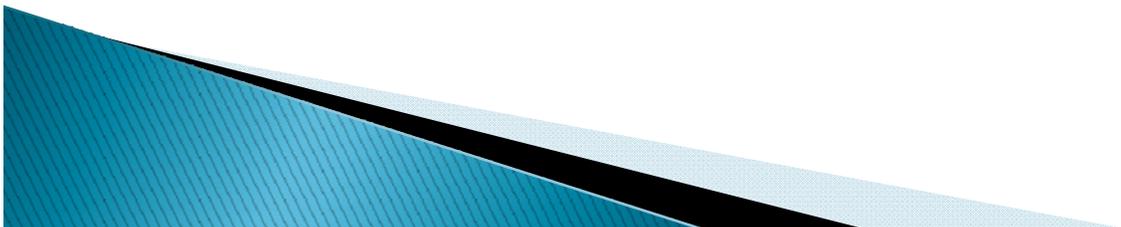
▶ Threshold:

- The number of missed tasks should not exceed 5%.



Best Practices – Missed Tasks

- ▶ Develop views or filters in MS Project to highlight discrete tasks with a baseline finish date prior to the status date and which also have a forecasted finish date after the baseline finish date.
- ▶ To mitigate, develop corrective action plans.



Metric #12 – Critical Path Test

▶ Metric Purpose:

- The purpose is to test the integrity of the overall network logic and, in particular, the critical path.
- If the project completion date (or other milestone) is not delayed in direct proportion (assuming zero float) to the amount of the intentional slip that is introduced into the schedule as part of this test, then there is broken logic somewhere in the network.
- Broken logic is a result of missing predecessors and/or successors on tasks where they are needed.
- The IMS passes the critical path test if the project completion dates (or other milestone) show a negative total float number or a revised Early Finish date that is in direct proportion (assuming zero float) to the amount of intentional slip applied.

▶ Calculation:

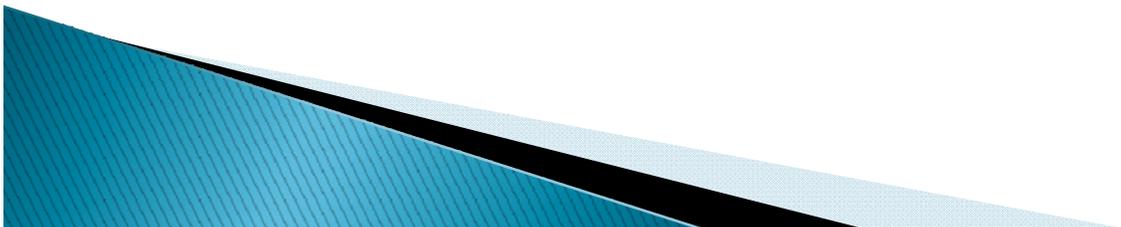
- Add 400 days to the remaining duration of an open task on the critical path. Once done, does the project completion task slack (float) become the same amount?

▶ Threshold:

- Pass/Fail Only

Best Practice – Critical Path Test

- ▶ Incomplete logic is usually a result of missing predecessor and/or successors.
- ▶ Develop views or filters in MS Project to identify tasks with missing predecessors and successors.



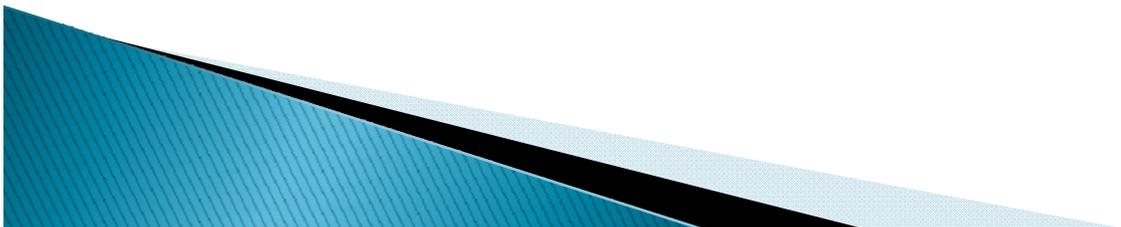
Metric #13 – Critical Path Length Index (CPLI)

▶ Metric Purpose:

- The CPLI is a measure of the efficiency required to complete a milestone on time.
- It measures Critical Path *realism* relative to the baselined finish date, when constrained.
- The CPLI is a measure of the relative achievability of the critical path.

▶ Calculation:

$$\text{Critical Path Length Index (CPLI)} = \frac{\text{Critical Path Length (CPL)} + \text{Total Float (TF)}}{\text{Critical Path Length (CPL)}}$$



Metric #13 – Critical Path Length Index (CPLI) (continued)

▶ Indicators:

- A CPLI of 1.00 means that the program must accomplish one day's worth of work for every day that passes.
- A CPLI less than 1.00 means that the program schedule is inefficient with regard to meeting the baseline date of the milestone (i.e., going to finish late).
- A CPLI greater than 1.00 means the program is running efficiently with regard to meeting the baseline date of the milestone (i.e., going to finish early.)
- The CPLI is an indicator of efficiency relating to tasks on a milestone's critical path (not to other tasks with the schedule).

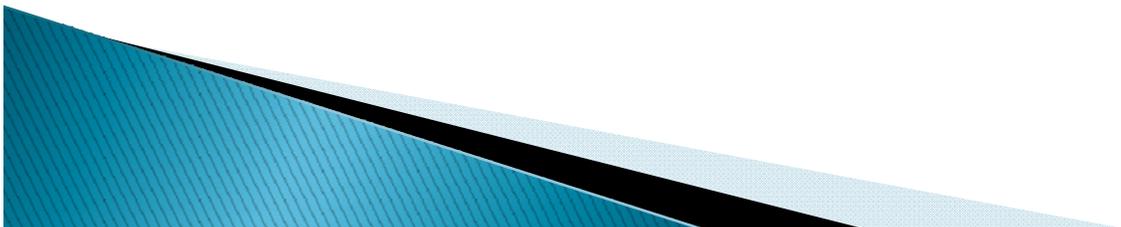
▶ Threshold:

- A CPLI less than 0.95 should be considered a flag and requires further investigation.



Best Practice – CPLI

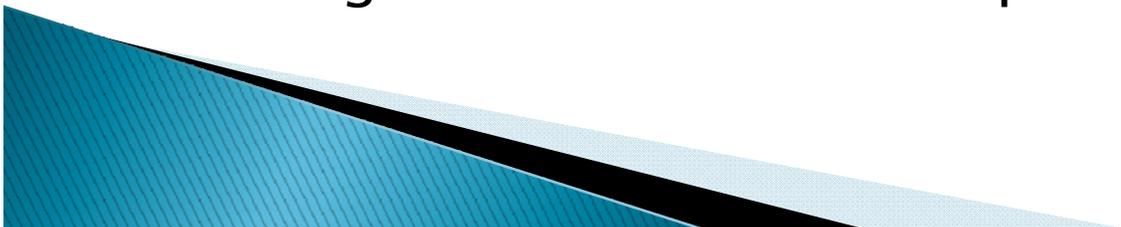
- ▶ Make sure the schedule is able to pass the critical path test (Metric #12) and conforms to enough other schedule metrics to demonstrate *realism*.



Metric #14 – Baseline Execution Index (BEI)

▶ Metric Purpose:

- The BEI metric is an IMS-based metric that calculates the efficiency with which tasks have been accomplished when measured against the baseline tasks.
- Similar to the Earned Value schedule performance Index as it compares the number of completed activities to date to the number of tasks planned to be completed by the project status date.
- BEI does provide insight into tasks completed early or late (before or after the baseline finish date), as long as the task was completed prior to time now.



Metric #14 – Baseline Execution Index (BEI) (continued)

▶ Calculation

$$BEI_{cum} = \frac{\text{Total \# of Tasks Complete}}{\text{Total \# of Tasks Completed Before Now} + \text{Total \# of Tasks Missing Baseline Finish Date}}$$

▶ Indicators:

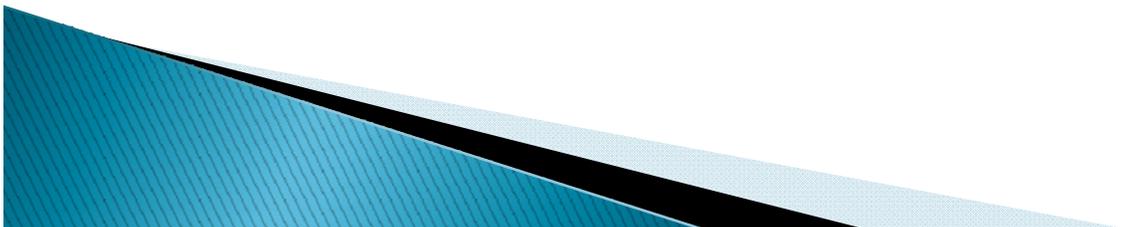
- If you complete more tasks than planned, then the BEI will be higher than 1.00 reflecting a higher task throughput than planned.
- Tasks missing baseline finish dates are included in the denominator.

▶ Threshold:

- A BEI less than 0.95 should be considered a flag and requires additional investigation.

Best Practices – BEI

- ▶ In MS Project, you will need to develop filters and/or views to identify tasks that have a Baseline Finish date within 60 days or less of the Project Status Date.
- ▶ Then create a filter of the above tasks to identify any with forecast finish dates later than their baseline finish.
 - Do you need to mitigate?
 - If there is adequate total float, a corrective action plan may not be needed.



Questions?

