Total Slack (Float) and the Critical Flag in Microsoft Project
Deciphering the Logic in Your Schedule

By Thomas Boyle, PE, PSP, PMP
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Introduction
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Abstract

• Complex sequencing logic can be difficult to extract and display in Microsoft Project, especially when deadlines, variable calendars, or resource leveling complicate Project’s Slack (Float) calculations.
• We wrote a Project Add-in to make it easier.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Agenda - Outline

- Background / Motivation
- Logic Tracing Features
- Limitations / Calculation Notes
- Some Real-World Examples
- Questions
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Background / Motivation

**History**
- MSP (DOS version) – 1984
- MSP (Windows version) – 1990
- Then
  - Focus on IT/Software Development
  - Multiple Smaller Projects – Competing for manpower
  - Low cost – limited functionality
  - Not taken seriously in other sectors
- Now (MSP 2013)
  - General-Purpose Project focus
  - All project sizes, client/server, master/sub-projects
  - Appears generally compliant with requirements for PDM/CPM
  - Improved functionality
  - Extremely large user base
  - Widely used in government and business, growing use in Construction.
  - Logic Output remains difficult (manual, click-intensive)
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule - Background / Motivation

- **History (to MSP2010)**
  - MSP Logic Input/Output
    - Input = Multiple Options
  - MSP Logic Input/Output
    - Output = ???
- **Task Inspector**
  - Local Driving Predecessor
  - Unreliable for non-FS drivers
- **Free Slack**
  - Distance from nearest local successor
  - No ID of driven successors
- **Total Slack**
  - Basis of "Critical" Flag
  - CPM Forward/Backward Pass + mods (Sparse docs.)
    - Loses significance w/ variable calendars and multiple Deadlines

### Additional Notes
- **Dependency (Predecessors) Object Form (R/W)**
- **Total Slack Field (RO)**
- **Free Slack Field (RO)**
- **Links (R/W)**
- **Dependency (Predecessors / Successors) Object Forms (R/W)**
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Background / Motivation

• **Needs**

For Complex Industrial / Construction Projects:

• Communication of the schedule plan:
  • Sequential logical relationships
  • Cascading consequences of delay/acceleration
  • Key milestones – ID and tracking

• Perform What-If Analyses

• Evaluate Schedule Disruptions

• Total Slack is not enough
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule - Background / Motivation

Needs – Why Total Slack is not enough

• Simplest Case (1980):
  • TS ~ “The amount of (working) time a task may slip without delaying the project.”
  • TS = Late Finish – Early Finish; TS = Late Start – Early Start
  • TS=0 → Critical Path; TS=1 → Near-Critical Path; etc.

• Complex Project (2015)
  • Working Time – i.e. Calendar – variations → TS changes along a single logical path.
    i.e. Critical Path ≠ (TS=0)
  • NLT Constraints and Deadlines affect Late dates ~→ sometimes TS<0.
    i.e. Critical Path ≠ (TS=0)
  • (Multiple) NLT Constraints and Deadlines → TS~ “The amount of time a task may slip without delaying ?????? (a constrained task somewhere, or the project finish.)”
    i.e. Critical Path = ????

• All Projects
  • TS ~ Task A → “project finish”.
  • TS says nothing re. Task A → Task B
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Background / Motivation

- **Needs**

  For a given task:
  - Which tasks are its predecessors? (The whole chain, not just the immediate dependencies.)
  - Which tasks are its successors?
  - Which predecessors are driving – i.e. effectively limiting the early start of – the task?
  - Which successor tasks are being driven by the task?
  - If a predecessor is NOT driving, how much may it slip before it becomes driving.
  - If a successor is NOT being driven, how much may the given task slip before it has an impact on the successor?
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Background / Motivation

- Needs
For the Project as a whole:
  - What is the real “Critical Path” and how is this related to Project’s “Critical” task flag? (Is it related at all?)
  - What is the Longest Path – i.e. that group of logically connected activities that drive the overall project completion date?
  - What is the Critical/Longest Path for a project whose key milestone(s) don’t coincide with the end of the project schedule?
  - Identify and differentiate parallel critical paths and near critical paths?
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule - Background / Motivation

- **Available Tools**
  - Non-MSP Scheduling Tools (P6, Asta PowerProject, Spider, Safran, Deltek, Acumen Fuse, etc.)
  - MSP 2013 – Task Paths
  - PathsPro (http://www.projectprocorp.com/)
  - Driving Path Widget (http://www.projectwidgets.com/)
  - BPC Logic Filter (http://www.boyleprojectconsulting.com)
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

• Basic Features
  1. Simple Logic Tracer (Ancestors/Descendants)
  2. Counters/Limits/Controls
  3. Driving-Only (Relative Float=0)

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Predecessors</th>
<th>Rel. Float</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 day</td>
<td>18 Aug '15</td>
<td>18 Aug '15</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>2 days</td>
<td>18 Aug '15</td>
<td>19 Aug '15</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>3 days</td>
<td>18 Aug '15</td>
<td>20 Aug '15</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>4 days</td>
<td>18 Aug '15</td>
<td>21 Aug '15</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>5 days</td>
<td>18 Aug '15</td>
<td>24 Aug '15</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>0 days</td>
<td>24 Aug '15</td>
<td>24 Aug '15</td>
<td>1,2,3,4,5</td>
<td>0</td>
</tr>
</tbody>
</table>

Filter: Select Task Links: Drvrs+0dFF
Filter: Select Task Links(<1stp)

Only within 1 logical step of selected task.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

• Advanced Features
  4. Path Relative Float

Task9 Driving PathRelFlt=0
Task9 PathRelFlt=5
Task9 PathRelFlt=12
Task9 PathRelFlt=7
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

• **Special-Purpose Features**

  5. **Longest Path Filter**
     - Automatically Find Last Task(s)
     - Driving Predecessors

  6. **Near-Longest Path Filter**
     - Automatically Find Last Task(s)
     - Driving and Near Driving Predecessor Paths

  7. **Local Network Filter**
     - Dedicated Button
     - Limited steps from Selected Task
     - No Relative Float limits.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

• Professional Features

8. Target Task (Bounded Network)
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

- Professional Features

9. Cross-Project Links
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

- Professional Features
  10. Driving Path Drag
  - DRAG = Devaux’s Removed Activity Gauge
  - Total Project Acceleration to be achieved by removing a particular schedule component:
    - ~Task Remaining Duration (e.g. resource limitations)
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule  
- Logic Tracing Features

- **Professional Features**

  11. Bar Highlighting

  Bars show names and Relative Float of Related Tasks

  Bars in context of relative floats

  Color Codes for Driving, Near-Driving, and Non-Driving Task Bars
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule - Logic Tracing Features

• Professional Features

12. Resource Leveling

- Leveling Delay included in both FW and BW Passes
- Driving FS Links Inferred from Resource Analysis
- "Phantom Float" Removed from Logically Connected Tasks.
- Pre-Leveling Slack Values Preserved
- Slack Increased for Resource Drivers
- "Resource Constrained" Driving Path is Hidden
- Driving FS Links Inferred from Resource Analysis
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

bars for resource drivers are hatched with resources noted.
path relative float shown inside resource driver bars.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- Logic Tracing Features

• Feature Recap
  1. Simple Logic Tracer (Ancestors/Descendants)
  2. Counters/Limits/Controls
  3. Driving-Only (Relative Float=0)
  4. Path Relative Float
  5. Longest Path Filter
  6. Near Longest Path Filter
  7. Local Network Filter
  8. Target Task (Bounded Network)
  9. Cross-Project Links
  10. Driving Path Drag
  11. Bar Highlighting
  12. Resource Leveling Drivers
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- BPC Logic Filter Limitations/ Calculation Notes

• Dates
• Summary Tasks
• Inactive Tasks
• Manually-Scheduled Tasks
• Resource Leveling
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- BPC Logic Filter Limitations/ Calculation Notes

• **Dates**
  • BPC Logic Filter does not change the dates.
    • Running BPC Logic Filter after editing and before re-calculating the schedule will yield incorrect results.
  • Program mimics parts of forward and backward pass to compute path relative float, consistent w/ MSP behavior for task calendars, leads, lags.
    • Exception: use of task calendars for path relative float vs. total slack.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- BPC Logic Filter Limitations/Calculation Notes

• **Summary Tasks**
  • Program accounts for sequential logic through summary tasks.
  • Program ignores all parent/child inheritance logic. Schedules with the following characteristics may yield incorrect results:
    • Constraints on summary tasks
    • Manually Scheduled summary tasks
    • Actual-start entries on summary tasks
    • Predecessors or successors on summary tasks.
      • Exception: if all generations of subtasks (including sub-summaries) below the summary have no logic at all, then results may be correct. This condition seems rare in practice.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- BPC Logic Filter Limitations/ Calculation Notes

• Inactive Tasks
  • MSP 2010
    • Program ignores all inactive tasks.
    • Consistent with MSP 2010 behavior – inactive tasks are removed from logic.
  • MSP 2013
    • Program ignores all inactive tasks.
    • NOT-consistent with MSP 2013 behavior – inactive tasks are substituted with FS relationships (between all predecessors and all successors of the task) at run-time.
    • Future program upgrade is planned to address this condition.
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- BPC Logic Filter Limitations/ Calculation Notes

- Manual-Scheduling
  - Program ignores “Task Mode”
  - Program assumes all tasks are automatically scheduled
  - Logical conflicts due to manually scheduled tasks are ignored – presumed unreal.

<table>
<thead>
<tr>
<th>ID</th>
<th>Unique ID</th>
<th>Task Name</th>
<th>Start</th>
<th>Finish</th>
<th>Duration</th>
<th>Total Slack</th>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>8388611</td>
<td>Task13</td>
<td>16 Jun '15</td>
<td>29 Jun '15/10 days</td>
<td>-46 days</td>
<td>-46 days</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>5</td>
<td>8388612</td>
<td>Task14</td>
<td>30 Jun '15</td>
<td>13 Jul '15/10 days</td>
<td>-46 days</td>
<td>-46 days</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>8388613</td>
<td>Task15</td>
<td>14 Jul '15</td>
<td>27 Jul '15/10 days</td>
<td>-46 days</td>
<td>-46 days</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>8</td>
<td>8388614</td>
<td>Task16</td>
<td>28 Jul '15</td>
<td>10 Aug '15/10 days</td>
<td>20 days</td>
<td>20 days</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>8388846</td>
<td>Manual Test Task</td>
<td>01 Mar '15</td>
<td>30 May '15/67 days</td>
<td>61 days</td>
<td>61 days</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Total Slack and the Critical Flag; Deciphering the Logic in Your Schedule
- BPC Logic Filter Limitations/ Calculation Notes

• **Resource Leveling**
  • Program allows resource leveling regardless of checking resource drivers.
  • Leveling delays are noted/logged and deducted from relative float (Same as Project Total Slack Calc.)
  • When Checking Resource Drivers, driving relationships are based on timing only. MSP Leveling Heuristics are not analyzed or repeated.
  • Large resource pools distributed among many competing tasks will yield numerous parallel paths. In the absence of CPM logic, this is of dubious value.
Total Slack and the Critical Flag - TenSix Example
-Critical/Near Critical Paths

<table>
<thead>
<tr>
<th>ID</th>
<th>Unique ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Total Slack</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Notice to Proceed</td>
<td>60 days</td>
<td>05-01-2015</td>
<td>20-04-2015</td>
<td>1.75 days</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Project Start</td>
<td>0 days</td>
<td>06-01-2015</td>
<td>05-01-2015</td>
<td>1.75 days</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Mobilize</td>
<td>10 days</td>
<td>07-01-2015</td>
<td>22-01-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>Set Foundations</td>
<td>9 days</td>
<td>26-02-2015</td>
<td>09-02-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>Dig Cable Trench</td>
<td>4 days</td>
<td>10-02-2015</td>
<td>15-02-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>14</td>
<td>11</td>
<td>Install Equipment</td>
<td>8 days</td>
<td>17-02-2015</td>
<td>25-02-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>17</td>
<td>14</td>
<td>Lay Control Cable</td>
<td>12 days</td>
<td>04-03-2015</td>
<td>24-03-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>21</td>
<td>18</td>
<td>Remove Equipment</td>
<td>5 days</td>
<td>25-03-2015</td>
<td>01-04-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>25</td>
<td>19</td>
<td>Substantial Completion</td>
<td>10 days</td>
<td>02-04-2015</td>
<td>20-04-2015</td>
<td>0 days</td>
</tr>
<tr>
<td>26</td>
<td>4</td>
<td>Project Complete</td>
<td>0 days</td>
<td>20-04-2015</td>
<td>20-04-2015</td>
<td>0 days</td>
</tr>
</tbody>
</table>

Alternate Calendar on Start Milestones

Std Project Calendar is 4d (M-Th)

Start Milestones are on Driving Path to Project Completion

Grading is 12d (not 4d) from Driving Path to Project Completion

Fence is 24d (not 4d) from Driving Path to Project Completion

Using Traditional Approach to Identify Critical/Near Critical Paths
Total Slack and the Critical Flag - Real World Example – Container Terminal - Critical/Near Critical Paths

Std Project Calendar is 5d (M-F).

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Total Slack</th>
<th>Task Calendar</th>
</tr>
</thead>
<tbody>
<tr>
<td>257 Stage 1 Grading</td>
<td>59 days</td>
<td>24 Nov '07</td>
<td>21 Jan '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>274 Stage 3 Grading</td>
<td>70 days</td>
<td>22 Jan '08</td>
<td>31 Mar '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>297 Stage 4 Storage Yard Grading</td>
<td>52 days</td>
<td>01 Apr '08</td>
<td>22 May '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>300 Stage 4 - Construct Sanitary Sewer</td>
<td>10 days</td>
<td>23 May '08</td>
<td>01 Jun '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>301 Stage 4 - Construct Piped Utilities (W, F, FM)</td>
<td>40 days</td>
<td>02 Jun '08</td>
<td>11 Jul '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>302 Stage 4 - Construct Electrical Duct Banks &amp; Structures</td>
<td>120 days</td>
<td>23 Apr '08</td>
<td>20 Aug '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>303 Stage 4 - Pull/Connect Power Distribution Cabling to Substations/Poles</td>
<td>100 days</td>
<td>23 May '08</td>
<td>30 Aug '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>304 Stage 4 - Yard Lightpoles installed and connected</td>
<td>0 days</td>
<td>30 Aug '08</td>
<td>30 Aug '08</td>
<td>-4 days</td>
<td></td>
</tr>
<tr>
<td>306 Marine/Gate Dry Run Ops #1</td>
<td>5 days</td>
<td>02 Sep '08</td>
<td>09 Sep '08</td>
<td>-3 days</td>
<td></td>
</tr>
<tr>
<td>307 Marine/Gate Dry Run Ops #2</td>
<td>5 days</td>
<td>09 Sep '08</td>
<td>15 Sep '08</td>
<td>-3 days</td>
<td></td>
</tr>
<tr>
<td>316 IT Systems Ready for Gate Opening</td>
<td>0 days</td>
<td>22 Sep '08</td>
<td>22 Sep '08</td>
<td>-3 days</td>
<td></td>
</tr>
<tr>
<td>327 Gate Opening for Exports</td>
<td>0 days</td>
<td>22 Sep '08</td>
<td>22 Sep '08</td>
<td>-3 days</td>
<td></td>
</tr>
<tr>
<td>333 First Commercial Lift (2 STS)</td>
<td>0 days</td>
<td>02 Oct '08</td>
<td>02 Oct '08</td>
<td>-3 days</td>
<td></td>
</tr>
<tr>
<td>280 Uplands - Roadability Bldg/Canopy U/G Utilities, Flnks, Slabs</td>
<td>40 days</td>
<td>29 Jan '08</td>
<td>08 Mar '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>281 Uplands - Erect and Finish Roadability Bldg/Canopy</td>
<td>136 days</td>
<td>09 Mar '08</td>
<td>22 Jul '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>282 Uplands - CMS - Roadability Canopy Handover for Components Installation</td>
<td>0 days</td>
<td>22 Jul '08</td>
<td>22 Jul '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>284 Uplands - Outgate Lanes/Canopy U/G Utilities, Flnks, Slabs</td>
<td>45 days</td>
<td>29 Jan '08</td>
<td>13 Mar '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>285 Uplands - Erect and Finish Outgate Lanes/Canopy</td>
<td>131 days</td>
<td>14 Mar '08</td>
<td>22 Jul '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>341 IMS - Outgate Lane Canopy Canopy Handover for Components Installation</td>
<td>0 days</td>
<td>22 Jul '08</td>
<td>22 Jul '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>342 Install/Connect/Test Gate Components at Portals and Gates</td>
<td>28 days</td>
<td>26 Aug '08</td>
<td>26 Aug '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>343 Gate System validation testing - IG/OG Portals</td>
<td>20 days</td>
<td>06 Aug '08</td>
<td>03 Sep '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>344 Gate Components ready for commissioning phase-in</td>
<td>10 days</td>
<td>10 Sep '08</td>
<td>10 Sep '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>345 Gate Operations Integration/Testing</td>
<td>20 days</td>
<td>21 Aug '08</td>
<td>18 Sep '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>346 IT Systems Ready for integrated Ops Testing</td>
<td>0 days</td>
<td>27 Aug '08</td>
<td>27 Aug '08</td>
<td>-1 day</td>
<td></td>
</tr>
<tr>
<td>354 South Storage Yard - Finish Grading and Base</td>
<td>39 days</td>
<td>12 May '08</td>
<td>19 Jun '08</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>355 South Storage Yard - Base paving - RCC</td>
<td>58 days</td>
<td>09 Jun '08</td>
<td>05 Aug '08</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>356 South Storage Yard - Finish Paving and Stripping, signs, misc.</td>
<td>37 days</td>
<td>21 Jul '08</td>
<td>26 Aug '08</td>
<td>0 days</td>
<td></td>
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<tr>
<td>357 Stage 5 North Storage Yard Grading</td>
<td>52 days</td>
<td>23 May '08</td>
<td>13 Jul '08</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>358 Stage 5 - Construct Stormwater Drainage Structures &amp; Piping</td>
<td>52 days</td>
<td>05 Jul '08</td>
<td>25 Aug '08</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>359 Stage 5 - Construct Piped Utilities (W, F, FM)</td>
<td>8 days</td>
<td>26 Aug '08</td>
<td>02 Sep '08</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>360 Stage 5 - Construct Electrical Duct Banks &amp; Structures</td>
<td>170 days</td>
<td>03 Sep '08</td>
<td>19 Feb '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>361 North Storage Yard - Finish Grading and Base</td>
<td>70 days</td>
<td>03 Oct '08</td>
<td>11 Dec '08</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>362 North Storage Yard - Base paving - RCC</td>
<td>70 days</td>
<td>12 Dec '08</td>
<td>12 Feb '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>363 North Storage Yard - Finish Paving and Stripping, signs, misc.</td>
<td>40 days</td>
<td>20 Feb '09</td>
<td>31 Mar '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>364 Perimeter Fence Installation - Final</td>
<td>20 days</td>
<td>30 Mar '09</td>
<td>19 Apr '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>365 CMS - Northern Storage Yard Substantially Complete</td>
<td>0 days</td>
<td>31 Mar '09</td>
<td>31 Mar '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>366 CMS - Yard/Gate Construction Complete</td>
<td>0 days</td>
<td>30 Apr '09</td>
<td>30 Apr '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>367 Completion of Civil Works</td>
<td>0 days</td>
<td>30 Apr '09</td>
<td>30 Apr '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>368 Terminal Full Operation</td>
<td>0 days</td>
<td>28 May '09</td>
<td>28 May '09</td>
<td>0 days</td>
<td></td>
</tr>
<tr>
<td>369 Project End</td>
<td>0 days</td>
<td>28 May '09</td>
<td>28 May '09</td>
<td>0 days</td>
<td></td>
</tr>
</tbody>
</table>
Total Slack and the Critical Flag
- Real World Example – Container Terminal
- Critical/Near Critical Paths

Std Project Calendar is 5d (M-F).

Longest Path Filter = Driving Path to Project Completion

TS = -4
>> Constraint on other path

No Slack Jumps at Calendar Changes => Mixed-Calendar links are on weekdays.
Total Slack and the Critical Flag
- Real World Example – Container Terminal
- Critical/Near Critical Paths

Task Logic Tracer -> Driving Path & Near Driving Paths to Project End
Total Slack and the Critical Flag
- Real World Example – Container Terminal
- Critical/Near Critical Paths

"Drag" is limited by first Near Critical Path (17d)

Task Logic Tracer -> Drag on Driving Path to Project End

Task Durations not on CP: “Drag” = 0
Total Slack and the Critical Flag
- Real World Example – Container Terminal
- Critical/Near Critical Paths

Task Logic Tracer -> Driving Path & Near Driving Paths to Key Milestone

Std Project Calendar is 5d (M-F).
Total Slack and the Critical Flag
- Real World Example – Container Terminal
- Critical/Near Critical Paths

“Drag” Limited by Parallel Logic Path (2d)

Driven Finish + Driving Start: “Negative Drag”

What About Cranes?

Task Logic Tracer → Driving Path Drag ~ Potential Acceleration
Total Slack and the Critical Flag
- Real World Example – Container Terminal
- Bounded Analysis – Major Equipment

All Logical Connections Between STS Crane Fabrication and Terminal First Commercial Lift.

Conclusion: Crane Erection/Testing & Transport may be delayed 53 days without delaying milestone.
# Total Slack and the Critical Flag

## Real World Example – Industrial EPC (4 Plants)

### Check for Missing Logic in Defined Scope

<table>
<thead>
<tr>
<th>Nom de la tâche</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Predecessors</th>
<th>Total Slack</th>
<th>Section1 STOC?</th>
<th>DPC Relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>757</td>
<td>626 days</td>
<td>24 Dec '07</td>
<td>04 May '10</td>
<td></td>
<td>0 days</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>756</td>
<td>594 days</td>
<td>24 Dec '07</td>
<td>30 Mar '10</td>
<td></td>
<td>26 days</td>
<td>No</td>
<td></td>
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<tr>
<td>759</td>
<td>116 days</td>
<td>24 Dec '07</td>
<td>02 Jun '08</td>
<td></td>
<td>213 days</td>
<td>No</td>
<td></td>
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<tr>
<td>760</td>
<td>0 days</td>
<td>24 Dec '07</td>
<td>24 Dec '07</td>
<td></td>
<td>213 days</td>
<td>Yes</td>
<td>1-Predecessors of Selected Task</td>
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<tr>
<td>761</td>
<td>0 days</td>
<td>14 Jan '08</td>
<td>14 Jan '08</td>
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<td>257 days</td>
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<td>762</td>
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<td>03 Mar '08</td>
<td></td>
<td>325 days</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>763</td>
<td>0 days</td>
<td>03 Mar '08</td>
<td>03 Mar '08</td>
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<td>0 days</td>
<td>Yes</td>
<td>1-Predecessors of Selected Task</td>
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<tr>
<td>764</td>
<td>0 days</td>
<td>02 Jun '08</td>
<td>02 Jun '08</td>
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<td>1-Predecessors of Selected Task</td>
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<tr>
<td>765</td>
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<td>15 Aug '09</td>
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<td>165 days</td>
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<tr>
<td>766</td>
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<td>15 Jun '08</td>
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<td>1-Predecessors of Selected Task</td>
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<tr>
<td>767</td>
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<td>07 Jul '08</td>
<td>10 Jun '09</td>
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<td>212 days</td>
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<td>768</td>
<td>55 days</td>
<td>07 Jul '08</td>
<td>19 Sep '09</td>
<td>766FS+15 days</td>
<td>212 days</td>
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<td>769</td>
<td>100 days</td>
<td>22 Sep '08</td>
<td>05 Feb '09</td>
<td>766FS+20 days</td>
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<tr>
<td>770</td>
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<td>1-Predecessors of Selected Task</td>
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<tr>
<td>771</td>
<td>125 days</td>
<td>18 Aug '08</td>
<td>05 Feb '09</td>
<td>766,720,700,761</td>
<td>252 days</td>
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<td>772</td>
<td>75 days</td>
<td>15 Sep '08</td>
<td>25 Dec '08</td>
<td>766,821</td>
<td>300 days</td>
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<td>773</td>
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<td>29 Sep '08</td>
<td>22 May '09</td>
<td>766FS+75 days</td>
<td>166 days</td>
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<td>774</td>
<td>100 days</td>
<td>15 Oct '08</td>
<td>27 Feb '09</td>
<td>766FS+75 days</td>
<td>249 days</td>
<td>Yes</td>
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<tr>
<td>775</td>
<td>150 days</td>
<td>15 Oct '08</td>
<td>22 May '09</td>
<td>766,622</td>
<td>166 days</td>
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<tr>
<td>776</td>
<td>100 days</td>
<td>15 Oct '08</td>
<td>22 May '09</td>
<td>766,622</td>
<td>166 days</td>
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<tr>
<td>777</td>
<td>152 days</td>
<td>03 Nov '08</td>
<td>29 May '09</td>
<td>766FS+100 days</td>
<td>165 days</td>
<td>Yes</td>
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</tr>
<tr>
<td>778</td>
<td>75 days</td>
<td>03 Nov '08</td>
<td>12 Feb '09</td>
<td>766FS+100 days</td>
<td>262 days</td>
<td>Yes</td>
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<tr>
<td>779</td>
<td>75 days</td>
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<td>08 Jan '09</td>
<td>702FS+25 days</td>
<td>329 days</td>
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<tr>
<td>780</td>
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<td>09 Jan '09</td>
<td>01 Apr '09</td>
<td>700FS+150 days</td>
<td>222 days</td>
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<tr>
<td>781</td>
<td>146 days</td>
<td>13 Nov '08</td>
<td>02 Jun '09</td>
<td>766FS+75 days</td>
<td>178 days</td>
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<tr>
<td>782</td>
<td>105 days</td>
<td>10 Jan '09</td>
<td>10 Jun '09</td>
<td>700,629,706,630</td>
<td>157 days</td>
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</tr>
<tr>
<td>783</td>
<td>0 days</td>
<td>10 Jun '09</td>
<td>10 Jun '09</td>
<td>782,768,769,770</td>
<td>219 days</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Total Slack and the Critical Flag

Conclusion

“I didn’t write BPC Logic Filter to overcome all the shortcomings of MSP; rather I wrote it to extract and present the logic-related information that is already there but which MSP does not show. In this case - as in most - it tells a more complete story than Total Slack alone.”

• Questions?