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The DCM 14-point Schedule Assessment

The integrity of a Construction project schedule is one of the critical factors in achieving its success, and consequently, schedule quality control should be a regular process prior to releasing the schedule.

A very useful tool to check the quality of a schedule is the DCMA 14-Point Assessment, based on the framework developed by the Defense Contract Management Agency (DCMA) which provides a comprehensive review of the schedule and its elements. The 14-point assessment includes a review of the schedule logic, activity durations and resource loading, schedule risk analysis, and the accuracy of the cost and schedule baselines. The assessment also looks at the overall maturity of the schedule, including the accuracy of the schedule data, the use of earned value management, and the quality of the schedule reporting.

The DCM 14-point Schedule Assessment

The DCM 14-point Schedule Assessment considers 14 criteria, including schedule quality, schedule adherence, schedule accuracy, schedule performance, and scope management, helping schedulers to identify areas of improvement and to ensure that the project is running smoothly and on schedule.

The DCM 14-point Schedule Assessment are:

- **Logic**:
  DCM 14-point Schedule Assessment recommends that the percentage of tasks with no predecessors or successors should be minimized. It is recommended that this percentage does not exceed 5% of the total number of activities within the project.
- **Leads:**
  The leads value measures the percentage of tasks that have a negative lag between each other.
- **Lags:**
  This metric is the inverse of the previous point and quantifies the proportion of activities that exhibit a positive lag relationship.
- **Relationship Types:**
  The DCM 14-point schedule assessment recommends that 90% of the project schedule activities are of a *Finish-to-Start* type (*FS*).
- **Hard Constraints:**
  Hard Constraints are mandatories starts and Finishes.

- **High Float:**
  Percentage of tasks with a total float greater than 44 working days, that could be a consequence of incomplete activities.

- **Negative Float:**
  This measure is related with the "*Hard Constraints*" metric and offers the difference between the mandatory start or Finish and the current start or finish.

- **High Duration:**
  The DCM 14-point schedule assessment recommends that no task should last longer than 44 working days.

- **Invalid Dates:**
  This metric measures the invalid dates for tasks with actual start/finish date after the project status date, with start/finish date before project status date without an actual start/finish.

- **Resources:**
  The DCM 14-point schedule assessment recommends that all tasks in the project are resource-loaded.

- **Missed Tasks:**
  This point (also known as schedule adherence) measures the number of missing tasks according to the baseline and could indicate how well or badly the project schedule meets the baseline schedule.

- **Critical Path Test[1]:**
  This measure considers the integrity of the network logic. This is related to the Inverse criticality, detected for first time by Wiest (1981, Precedence diagramming method: Some unusual characteristics and their implications for project managers. Journal of Operations management, 1(3), 121-130.), in such way that increasing the duration of a critical activity, produces a reduction in the project makespan.

- **Critical Path Length Index (CPLI)**
  The $CPLI$ is a metric used to measure the relative efficiency to complete a milestone on time, and computed as follows:

$$CPLI = (CPL +/- Total\ Float) / CCPL$$

[1] Plexos Project PPM avoids the inverse criticality by considering activities as production processes (Ponz-Tienda et al.2015).

CPL is the critical path length in temporal units, and $CPLI$ values lower than 1 indicates that the program will not achieve its baseline completion date without corrective action.

- **Baseline Execution Index (BEI)**
  The BEI metric calculates the efficiency with which tasks have been accomplished when measured against the baseline tasks, and computed as follows:

$$BEI = \#finishedtasks \,/\, \#baselinedtasks$$

  When BEI is over 1.00, it usually means that the project team is performing ahead of schedule, while when it goes behind 1.00 it means the opposite.

The DCMA 14-Point Assessment checklist and its metrics are a very useful tool which offers the scheduler a way to objectively evaluate the quality of the schedule but satisfying these guidelines doesn't necessarily mean the schedule is realistic, feasible, and good quality schedule, specially I the AEC industry.

The Plexos Project schedule quality control.

AEC Industry, and construction project scheduling, is different, and consequently, the DCMA 14-Point Assessment could be difficult to apply, and some recommendations should be reconsidered.

Construction project scheduling must be faced as a production scheduling process, taking into account that the relationships between activities are usually production-based relationships, that must be overlapped (with start-to-start, finish-to-finish and start-to-finish relationships) to meet the efficiency in the internal and external production flows, as with new the new development algorithms with repetitive activities, also known as takt-planning (Figure 1 and Figure 2).

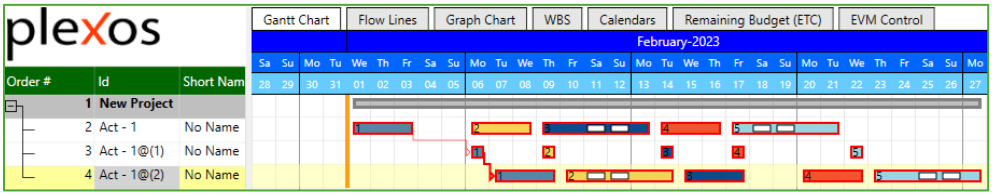

Figure 1 Takt planning with Plexos Project PPM

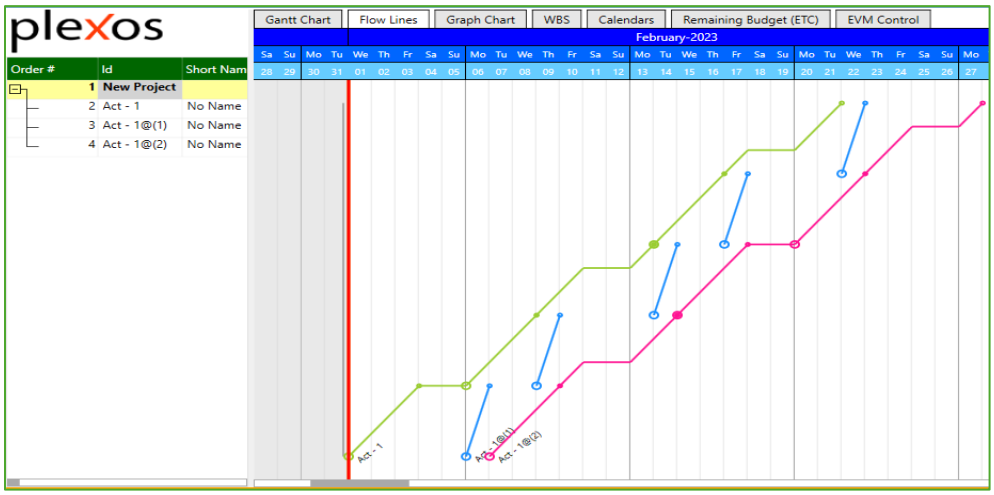

Figure 2 Flow lines with Plexos Project PPM

Another critical point is the rescheduling of the project through the different control points during the project execution, and if the activities are rescheduled according to the real advance of the project (Figure 3).

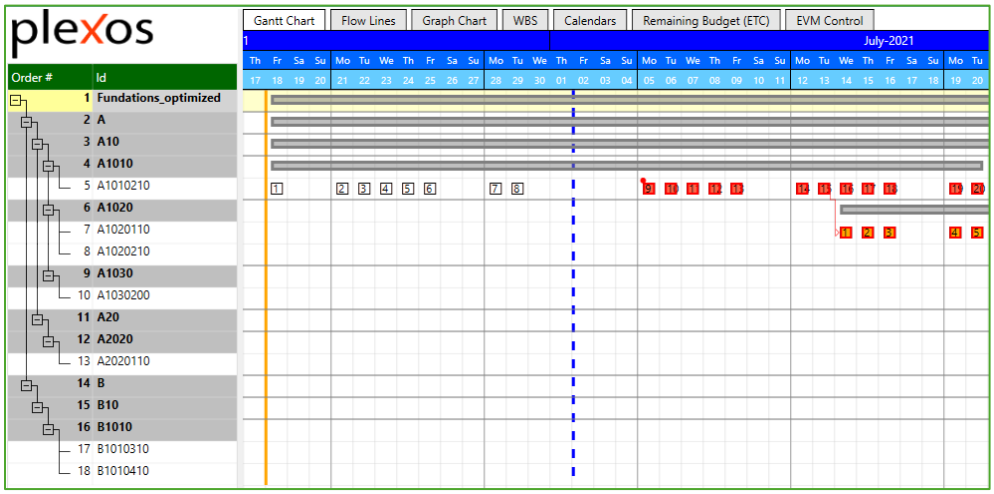

Figure 3 Correct control with Plexos Project PPM

In this line, with the aim of providing the schedulers a tool for analyzing the quality of the schedule in construction projects, Plexos computes some network (Figure 4), project and control metrics, but without advising about the goodness of the values that depend on the scheduler's criterion.

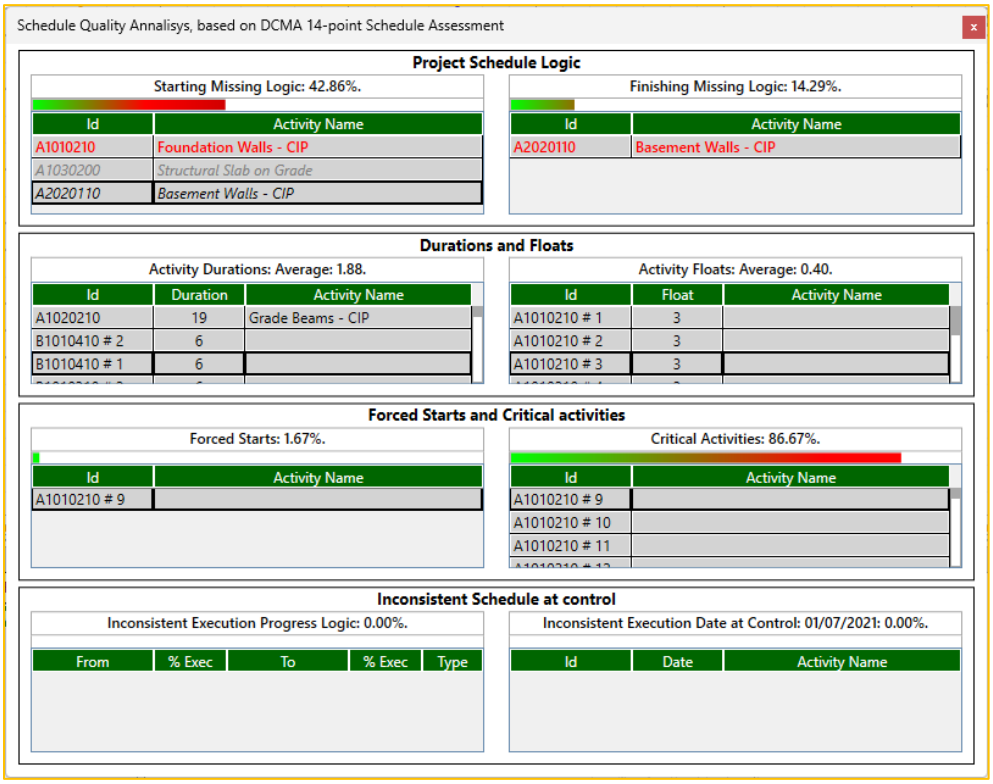

Figure 4 Schedule Quality analysis by Plexos

The metrics analyzed by Plexos are organized in four sets:

- Project Schedule Logic.
- Durations and floats
- Forced starts and critical activities.
- Inconsistent schedule at control.

Project Schedule Logic

Project Schedule Logic metrics assesses the topological logic of the project schedule. The key metrics within this category include the prevalence of starting and finishing missing logic.

Starting missing logic.

This metric compute and identify the activities, and percentage, that don't have a relationship related to its starting.

Plexos differentiates between activities without a starting relationship, and totally free starting date (highlighted in red), and activities without a starting relationship but with its starting date conditioned by a finishing relationship (in gray and italics) (Figure 5).

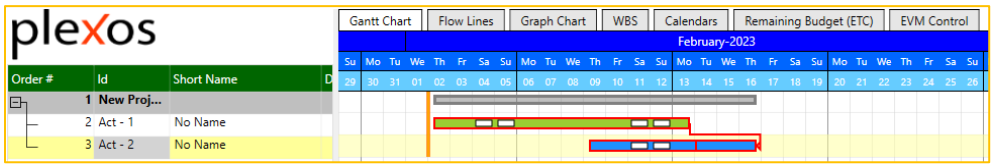

Figure 5 Starting missing logic but conditioned by a finishing relationship

Finishing missing logic.

This metric differs from the previous one by considering the network logic that determines the finishing of the activities.

Durations and floats

Analyzes the consistency of durations and floats of the activities of the project. The metrics analyzed in this set are the activity durations and floats.

Activity durations.

This metric analyzes the variability of the durations of the project activities, ordered in the grid, showing the average duration.

Activity Floats.

As in the activity durations, this metric analyzes the variability of the floats of the project activities, ordered in the grid, and showing the average float.

Forced starts and critical activities

This set of metrics are related to forced starting dates, and the criticality of the activities.

Forced Starts.

Compute the quantity of activities subject to mandatory start dates and the average number of activities within the project.

Critical Activities.

This metric highlights the proportion of critical activities within the overall project. It serves as a crucial indicator of project risk, with higher values signifying a greater likelihood of project delays. However, it's important to acknowledge that the Architecture, Engineering, and Construction (AEC) industry often exhibits a high degree of criticality across its activities.

Inconsistent schedule at control.

Analyzes inconsistencies in the progress of the activities at the last control.

Inconsistent execution progress logic.

This metric shows the activities have been started without considering the restrictions imposed by its predecessor activities.

In the example offered in Figure 6, Act–2 has started without considering that needs 5 executed days of Act-1, imposed by the relationship between them. The metric is alerting that Act–1 has a 30% executed, and Act–2 a 10%, violating the imposed start-to-start (SS) relationship. View Figure 7for a finish-to-finish case.

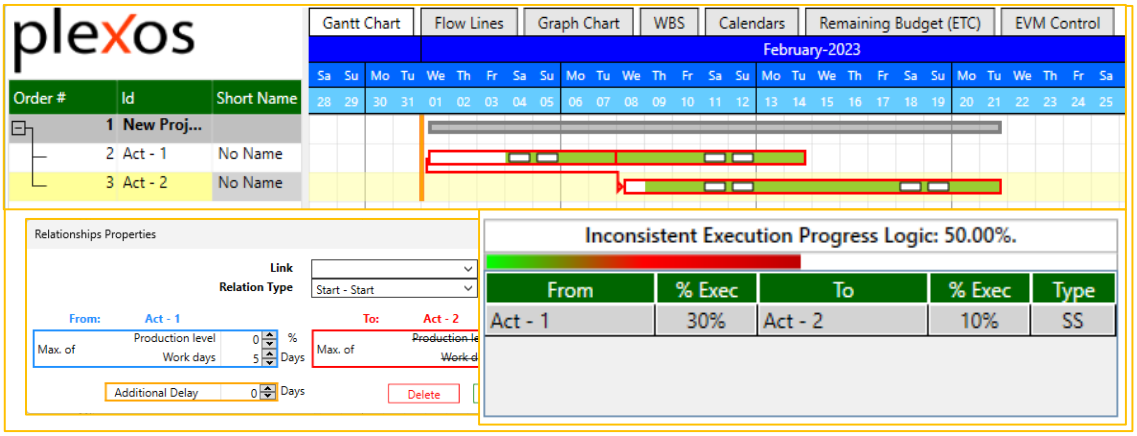

Figure 6 Inconsistent execution progress logic with start-to-start relationship

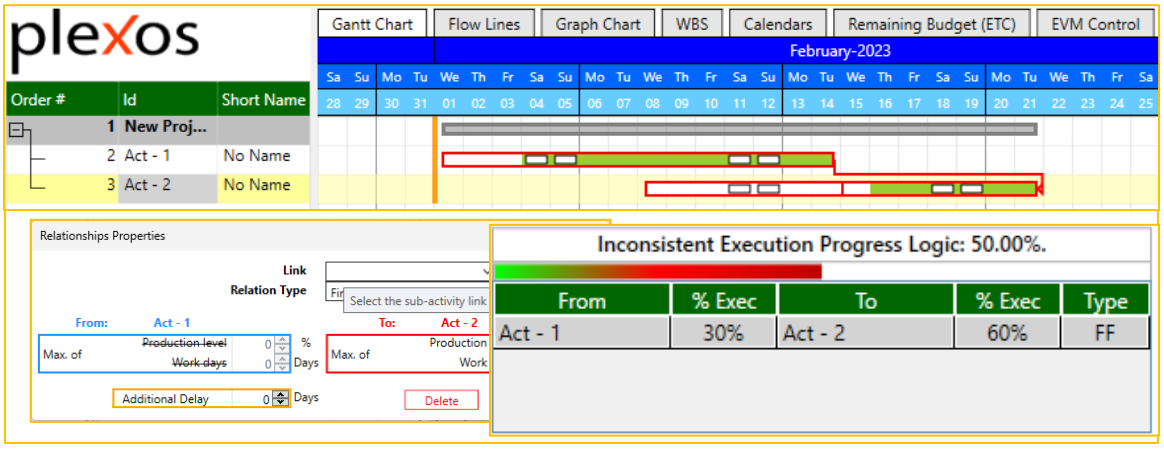

Figure 7 Inconsistent execution progress logic with finish-to-finish relationship

Inconsistent execution date at control.

Shows the activities where progress doesn't match with the control date, as in Figure 8

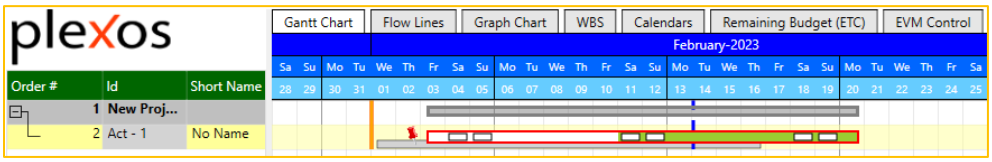

Figure 8 Inconsistent execution date at control

Conclusions.

This technical report presents and analyzes several metrics derived from the DCMA 14-Point Assessment, adapted by Plexos Project PPM, for evaluating schedule quality.

These metrics aim to guide the identification of potential errors and inconsistencies in project scheduling and control, rather than dictating rigid acceptance criteria. The quality of a construction schedule ultimately depends on the scheduler's professional judgment and experience.

While these metrics offer valuable insights and can assist schedulers in identifying areas for improvement and developing more accurate schedules, they should not be considered a substitute for the expertise and knowledge of experienced practitioners in creating feasible and realistic project plans.

References.

Wiest, J. D. (1981). Precedence diagramming method: Some unusual characteristics and their implications for project managers. Journal of Operations management, 1(3), 121-130.

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