# Scheduling Forensics

# Relationship Types and Out-of-Sequence Change Trending

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Pick a medium to large size completed construction project at random. Assemble the project schedule and all of its updates. Compile the out-of-sequence (OoS) and relationship type metrics. If you analyze the metrics, you'll almost always find two things: a) activities that were performed out of sequence, and b) a strong correlation between out-of-sequence change increasing over time, Start-to-Start and/or Finish-to-Finish relationship types trending up over time, and project cost overruns.

An activity OoS condition occurs when a successor activity's actual start and/or finish date violates any of the restrictions imposed upon it by relationships, or physical date/resource constraints. In a simple example if activity B has a Finish-to-Start Predecessor A with zero lag (FS=0) and activity B was progressed with an actual start date that occurred before activity A's actual finish date, then activity B is an Out-of-Sequence activity.

The reason an OoS condition occurs may be one or more of the following:

1. Bad or unrealistic planning which causes activities not to be performed according to plan.
2. Changed execution without being pre-modeled in the schedule, which in turn may be indicative of:
    a. Project team's inability to follow plan,
    b. Too many disruptions that are too frequent to plan around and reflect in a workable schedule, or
    c. Too many outstanding issues that create too much uncertainty to plan remainder of the work.
3. Schedule activities' scopes are vague or too general. When a schedule activity scope is vague, its actual start and finish dates are often hard to pin-point. When a schedule activity is too general, modeling its relationships is tricky and sloppy at best.

If modeling what actually happened on a project is necessary for the specific type forensic analysis being performed, then it becomes necessary to identify and remedy OoS activities.

Remedying OoS activities after the fact entails one or both of two methods, depending on the OoS condition(s):

1. Narrowing the scope of the activity in question by splitting it into two or more activities. That also requires adding relationships and changing some of the existing relationships to model actual progress or exact as-built sequence,
2. Changing types of relationships and their lags. Typically, a finish-to-start relationship with zero lag is replaced with a pair of start-to-start with some lag and a finish-to-finish with some lag.

In order to remedy OoS activities it is necessary to identify every OoS condition that occurred on the project, along with its type.

It is worth noting that the leading scheduling software does not adequately identify and list all OoS activities. P6, for instance, is content with listing only OoS activities that occur around the data date. If an OoS condition occurs in between two schedule updates data dates without either of the OoS-causing relationship activities touching or crossing the two data dates, then P6 calculation logs will not identify OoS conditions that may be associated with such activity.

An advanced forensic analysis software will be required to identify and trend OoS conditions and their types.

Trending OoS activities over the course of the project execution cycle is important for a first look at whether the project was executed substantially per plan, whether it only experienced periods of issues, or whether it was totally executed off-script. Such information allows the analyst to quickly focus on specific periods, or even specific types of operations, depending on the sophistication of the analysis filters.

Trending details of OoS conditions, such as identified specific period, types of operations, and/or types of OoS conditions may be crucial in helping the analyst establish tangible likely causes/effects of disruptions, delays, or concurrency.

The ability to trend relationship type changes is equally as important in completing the picture above. A graph that shows finish-to-start relationships decreasing while start-to-start and/or finish-to-finish relationships increasing is an indication of attempts to remedy OoS conditions as they occur, as the result of contract requirements or attempted best practice. While the attempts typically fail to capture all of the OoS conditions, as discussed above, the resultant relationship type changes tell an equally as compelling a story as not having remedied them. The idea is whether or not the OoS conditions are remedied, their occurrence trends how closely a project was executed according to plan, and if not when and possible how and why.