**SHATTERING THE “WINDOWS SCHEDULE ANALYSIS” METHOD**

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There are nine principal, commonly utilized methods of performing forensic delay analysis on construction projects. These primary analysis techniques, listed in approximate order of complexity, include: Narrative, Bar Chart, Impacted As-Planned, Measured Mile, Update Review, As-Built Review, Collapsed As-Built, Multiple TIA (Also called Windows), and Contemporaneous. Some techniques are considered passive, that is, delays are determined through a study of the project schedule(s), while others are considered active. Active analyses involve the use of scheduling software and the preparation of one or more schedules to compare and contrast. Typically a “Baseline” schedule is compared to another identical schedule that has been modified to add or subtract CPM activities, which represent one or more delays. These nine methodologies run the entire spectrum of analysis, ranging from basic techniques through highly-detailed, intensive analyses. Consequently, the degree of acceptance in legal tribunals varies considerably among the techniques. Additionally, within each primary methodology exists numerous variations and sub-techniques of analysis. One in particular, the Summary Update Review Technique (SURT), which is a simplified version of the Update Review Technique mentioned above is the subject of this article.

Unfortunately, the industry has not established uniform terminology and criteria for many of these techniques, resulting in many analysts performing a lower form of analysis, but labeling it as a higher evaluation in order to gain credibility. Therefore, one must understand, in detail, the procedure actually used by the analyst to confirm what technique has in fact been employed. The Summary Update Review Technique (SURT) with increasing frequency is mislabeled as a higher form of evaluation – the “Windows Analysis.”

**Origins of the true “Windows Analysis”**

In the late 1980’s, many analysts incorrectly identified the true Contemporaneous Analysis Technique, developed by the Army Corps of Engineers (“COE”) in 1979, as a “Windows Analysis.” In the early 1990’s, a simplified version of the COE technique known as the Multiple Time Impact Analysis (“Multiple TIA”) approach began to be identified as the “Windows Analysis” technique. It is the authors’ opinion that the Multiple TIA technique is the methodology properly known as the “Windows Analysis.”

After 2000, however, another technique, which is a simplification of the Update Review Technique started to be presented as the “Windows Analysis” technique. This approach, which falls well below the Contemporaneous Analysis and the Multiple TIA techniques in terms of quality, accuracy and comprehensiveness, appears to be the most common approach being mislabeled with the title of “Windows Analysis” in today’s dispute resolution processes. As an attempt to reduce this obvious confusion in the industry, for the remainder of this article, the Multiple TIA approach will be referred to as the “MTIA” and the Simplified Update Review Technique will be referred to as the “SURT”.

Since both the MTIA and the SURT utilize periodic schedule updates created during the project, the remainder of this article will only be discussing methodologies whose analyses are based on schedule updates (i.e., the Contemporaneous Analysis, the Multiple TIA, the Update Review Technique and the SURT.[[1]](#footnote-1) Chart 1 provides a simplified illustration of the components for four of the more common schedule analysis techniques.



**Chart 1**

The Contemporaneous Analysis Technique is an active analysis approach using impact fragnets and three or more steps of analysis within each CPM update period. While the chart above only shows one step for the analysis and measurement of the effect of logic changes, this step can be broken into many steps to provide a more detailed analysis and allocation of delay and mitigation efforts within the single update period. The impacting step can also be subdivided to impact each potential impact separately. The MTIA is another active analysis approach that adds impact fragnets independently into individual CPM updates. This Windows Analysis approach, however, does not evaluate the effects of status or logic changes between updates as is done in the Contemporaneous Analysis approach. The Update Review technique is a passive analysis that includes a study of every CPM update created on the project (or at least every update in the pertinent period of time); however, the detail of the analysis varies greatly depending upon the analyst. Finally, the SURT groups several CPM update periods together prior to performing a study of some of the CPM updates created during the project.

**Summary Description of the SURT analysis (Improperly called Windows)**

The SURT method starts with the analyst dividing the total project duration into a small number of time periods, called “windows”. On a two or three year project, the analyst typically selects five to seven “window” periods, each four to eight months long, within which the analysis is structured. The analyst then uses the CPM updates generated during the project to determine the projected completion date of the project at the beginning and end of each “window”. The change in projected completion dates from the beginning to the end of each “window” reflects the number of days lost or gained during that period. The Update Review Technique studies the projected project completion date from every CPM schedule update (typically monthly) not just a selected portion of those updates, which is why this technique is appropriately called the Summary Update Review Technique (SURT). Finally, the analyst assigns responsibility for those delays found to an issue and/or the party the analyst believes is responsible for the delay. In some instances, the delay measured within a single window will be allocated to two or more issues. Unfortunately, however, all assignments of responsibility under this SURT methodology are purely subjective in nature, a weakness discussed in more detail later in this article.

**A More Detailed Description of the SURT methodology**

Reviewing the steps of the SURT analysis in detail assists with understanding the areas where this technique is subject to manipulation by the analyst.

**First Step**

The first step in the SURT analysis is to select the number of windows to be used and their corresponding start and end dates. Ideally, based on knowledge of the issues being claimed, the analyst determines which points in time will provide the most precise measurements of delay. For example, if the earliest claimed delays occurred during the foundation work, the first window might start with the baseline schedule and end on the date of the first available CPM update that is just beyond when the foundation work was completed. If another delay issue involved the roofing, the analyst might select the date of the first available CPM update that is just before the roofing work began as the date for the start of another window. If the final inspection by code enforcement authorities caused problems with obtaining a Certificate of Substantial Completion, the analyst might select the substantial completion date as the end date for the final window.

Chart 2 shows a typical selection of “Windows” for a two year project. Note that the length of each window should be catered to the delay issues being analyzed.



**Chart 2**

For this type of analysis, it is generally accepted practice for the selection of window start dates to occur just prior to the start of a delay event, and window end dates to occur just after the cessation of the delay. Since the windows are linked together, that exact selection is not always possible without additional windows being identified, though the dates on which CPM updates are performed rarely line up precisely with the events believed to impact the project. Since one of the major attractions of the SURT methodology is its simplicity, additional windows increase the level of effort required (and the cost) for the analysis.

Analysts sometimes select window start and end dates based on other criteria, which may or may not be a valid consideration. These other criteria include only using CPM updates that were “accepted” by the owner during the project, or using selected start or finish dates for individual activities from the baseline schedule. These alternate criteria are fertile grounds for abuse by analysts seeking to push delays (or mitigation) into a different window in an attempt to create a result favoring their client. The reasoning for the selection of the specific window start and finish dates is rarely explained by the analyst in their narrative report and must be extracted through some type of interview (e.g. deposition).

Similarly, when an analyst who performed a SURT analysis is asked why he or she did not perform the full Update Review analysis, the typical response is that the SURT methodology provides a better summary and a simplification of the process. The information not considered, or perhaps hidden, in that simplification process is what should concern all parties involved.

**Second Step**

The second step in the SURT process is to identify the projected substantial completion date for the start and end of each window using the corresponding CPM update that was developed during the project. The differential between the projected substantial completion date at the beginning of a window and the projected substantial completion date at the end of a window determines the *net* amount of time that was lost (or gained) during that period.

For example, if the CPM update at the beginning of a window starting on January 1, 2008 projects a substantial completion date of October 1, 2009, and the CPM update at the end of the same window, say April 1, 2008, reflects a substantial completion date of November 5, 2010, then the net delay during that three month period totals thirty-five calendar days. Note that some windows may not reflect any delays and, occasionally, the selected window might indicate mitigation or acceleration of previous delays.

Chart 3 below is an expanded version of Chart 2 (SURT window selection), which now identifies the specific issues being analyzed, the calendar days lost during each window and the cumulative days lost as the project progressed.



**Chart 3**

**Third Step**

The analyst performs the third step of a SURT analysis by “studying” some or all of the CPM updates between the window start and end dates. The analyst “extracts” the cause(s) of delay during the period in question. Unfortunately, this part of the analysis is rarely shown or described in the analyst’s report, and there is little (if any) evidence of how the “extraction” of causes was performed. The lack of transparency greatly hinders the ability of another expert to replicate the “analysis”. This undisclosed and highly-subjective extraction process is what has led many industry participants to characterize SURT analyses as “Black Box” analyses. The lack of quantitative analysis effectively allows the schedule analyst to arrive at whatever conclusions he or she desires, taking substantial liberties with the “facts” along the way. While the claimed delays may seem superficially logical and may, in some cases, relate well to the project records, there is no positive or empirical link between the claimed cause of the delay and the extension of the project’s substantial completion date.

When the analyst is questioned, the most common explanation of how the “extraction” process was performed is that the analyst compared the planned duration of selected activities within the CPM update to the “actual” duration for the same activities. The “actual” durations may come from the actual start and finish dates recorded in the CPM updates or they may come from project records such as daily logs. Those that reflect longer “actual” durations are assessed with the delay. This assessment, however, may or may not be limited to the critical path, which further expands the substantial subjectivity inherent in a SURT analysis. Moreover, in situations where concurrent delays are alleged, there is no empirical calculation made to determine whether each impact actually delayed the project or the extent of the delay caused by that impact. Accordingly, when questioned, SURT analysts typically explain that they “studied” the project record and “based on their experience,” they “know” which issue(s) actually caused a delay and the number of days each issue delayed the project. This qualitative process, through which delay causes and allocations are subjectively identified, derived and “measured/allocated”, represents the most fertile ground for manipulation by the SURT analyst.

Practically, one should consider that when comparing planned durations to actual durations on a project that has been delayed, it is not uncommon to find that over 80% of the actual durations exceed the planned durations in the baseline schedule. This is due mostly to the reality that work activities overlap each other in actual construction more than what is typically shown in the CPM schedule’s logic and, once a delay is encountered, work on non-critical activities is often paced by the contractor. Having as many as 80% of the activities available for assigning blame for delays makes it easy for the analyst to cherry-pick the activities that support his or her client’s position. However, a direct causal link between the claimed cause of the delay and the extended duration of the project has not been demonstrated through any quantitative analysis.

**Final Step**

The final step of a SURT analysis typically involves summarizing the allocation of delay among the various “causes”.



**Chart 4**

For presentation purposes, these simplistic conclusions are typically paired with artful and creative graphics, which lend themselves to portraying the analysis as being comprehensive, factually-based, plausible and fair. As in most construction disputes, however, the devil is in the details.

**Positive Attributes of the SURT Methodology**

A SURT analysis is neither difficult nor time consuming to perform. The speed and low cost of this analysis contribute to its attractiveness. The way this technique simplifies the entire construction project also makes it easy to explain and understand, and conducive to graphical presentation. From a practical perspective, the simplicity of analysis can make it more difficult to disprove, without performing a more sophisticated and quantitatively-based analysis. The SURT methodology can provide preliminary delay information, which if performed properly, may be used effectively to focus additional research and delay analysis efforts in certain time periods of the project. However, it is the authors’ opinion that only in extremely rare instances would this technique be suitable as a primary form of analysis for reaching conclusions about the cause(s) and measurement of delays.

**Negative Attributes of the SURT Methodology**

Fundamentally, the SURT methodology fails to provide a positive causal link between an event and a delay to project completion. Only the schedule analyst’s testimony can attempt to bridge that causation gap. In most active forms of schedule analysis (SURT is a passive methodology), a fragnet representing an impact to the schedule is added to a copy of the CPM update created just prior to the start of the claimed delay. If this fragnet’s impact extends the substantial completion date, then there is direct demonstration of the causal link between the event and the project delay. The SURT analysis does not provide this direct proof. Instead, the analyst has an activity that took longer than planned and an alleged delay issue. Except in rare instances, there is no proof that the alleged delay actually caused the activity to take longer. The subcontractor who was responsible for that activity may have been waiting on an answer from the owner, could have been busy on another project or could have been pacing. In short, there potentially are a lot of plausible reasons for the extended duration of that activity. Additionally, the activity in question might be on the critical path for some, but not all, of the CPM updates generated during that period. Does that mean it is critical for the entire window? How does that affect the evaluation? The answers to these questions will vary substantially with the analyst performing the analysis.

The SURT analysis is very easy to manipulate to provide results in favor of the client being served. As will be discussed below, the selection of the windows provides the analyst with multiple opportunities to skew the results in favor of their client.

The SURT methodology does not perform well when there are multiple delays within a single window; nor does it identify or segregate the mitigation efforts performed by either party. In most circumstances, the SURT analysis completely overlooks mitigation efforts. These mitigation efforts are most commonly performed by the contractor. The SURT methodology is only capable of identifying the *net* delay encountered during a window, *after* any mitigation efforts offset the delays. This characteristic tends to make the SURT methodology attractive to consultants representing the entity defending against a claimed delay. Conversely, when a SURT analysis is used by a consultant working for the party pursuing a delay claim, the same netting process can be used to cover up the contractor’s lack of performance delays or to commingle them with delays.

Finally, the SURT methodology has great difficulty dealing with, and measuring the effect of, logic changes that are so prevalent in today’s CPM updates. Often, these logic changes reflect a contractor’s efforts to mitigate previous delays. The SURT analysis almost always subsumes these mitigation efforts (either inherently or by the analyst’s selection / manipulation of window dates) within the same window as the delays that made the mitigation efforts necessary, thereby minimizing the net delay.

**Shattering the SURT (Windows) Methodology**

Uncovering intentional or accidental manipulation of the SURT methodology is relatively straightforward. The initial step of the investigation is the development of a portion of an Update Review Schedule analysis, using all of the CPM updates generated for the project. The full Update Review technique is performed the same way the SURT analysis is performed; however, the analyst looks at every CPM update, typically around twenty CPM updates for a two year project, instead of summarizing the review process into six or seven windows. While the full Update Review technique suffers from some of the same inadequacies as the SURT methodology, it provides more detail and reduces, but does not eliminate, the ability of the analyst to “bury” certain delays, lack of progress delays, and mitigation efforts within other delay issues.

The extraction of the projected substantial completion date from each CPM update provides the basis for Chart 5 below. This process will identify any CPM updates that reflect mitigation efforts. It would be an unusual project where no CPM update during the entire project reflected an improvement in the projected substantial completion date.



**Chart 5**

In this hypothetical, CPM updates 5, 6, 10, 11, 12, 13, 18 and 20 all show delay mitigation, whereas only window 5 (*see* Chart 3) in the SURT analysis shows any mitigation. This example demonstrates how the SURT methodology can be manipulated to “cherry-pick” dates for the start and end dates of windows, thereby commingling mitigation with delays. The minimization of mitigation credit is obtained by the selection of window timeframes. Moreover, the fewer windows selected, the easier it is to bury mitigation efforts by offsetting them against delay issues.[[2]](#footnote-2)

The SURT methodology is predicated on the assumption that all delays will show up in the CPM updates as delays to the projected substantial completion date. Additionally, unless a more detailed analysis is performed, the result of this analysis technique is that if a delay has been mitigated or overcome by rescheduling or adding resources, then the delay effectively did not occur. A simple example illustrates this fundamental flaw in the SURT methodology.

Every morning a person gets ready for work, leaves the house at 7:20 a.m. and walks ten minutes to a bus stop. The bus picks him up at 7:30 a.m. and takes him to work. One day, just as he is leaving at 7:20 a.m., he notices that the dog has knocked over the trash can and spread its contents across the floor. He spends four minutes picking up the trash and putting it in the garbage can. He then runs to the bus stop, in six minutes flat, arriving just in time.

In this hypothetical, the question is – since he arrived at the bus stop on time, did a delay occur? Of course a delay occurred – the dog caused a four minute delay. With substantial effort (running to the bus stop), the four minute delay was fully mitigated, resulting in no net delay. While the effect of the impact was ultimately eliminated, there were two different events that occurred – a four minute delay and affirmative mitigation to overcome the delay. If one only looks at the schedule just before this person leaves the house at 7:20 and then when the bus picks him/her up at 7:30, the delay and mitigation will be completely missed.

One key to shattering the SURT analysis is to perform more detailed analyses to identify and quantify any mitigation efforts, which the SURT analyst conveniently absorbed into the windows that contained his or her client’s delay issues. Researching the project record – to determine the action that resulted in mitigation or “recovery” of time – is fundamental. Mitigation efforts can arise in many forms, such as working hard to make better-than-planned progress, modifying schedule logic to reflect a change in sequence for future work that shortened the total time required to complete the project, or adding resources (e.g., overtime, or additional shifts, crews and/or equipment). Similarly, it is possible that the mitigation was due to an owner action, such as agreeing to pay for overtime, relaxing a specification, or deleting contract work, among others. Identifying and quantifying these types of mitigation can undermine the credibility of the SURT analyst’s entire evaluation.

Another area where performing even a modestly more sophisticated analysis (such as the full Update Review technique) can provide evidence of shortcomings in the SURT analysis is to identify whether there are any significant delay issues that the SURT analyst failed to include / evaluate. Under the SURT methodology, the analyst will commonly claim that he or she did not have to perform an analysis of a particular delay because it occurred during a window when no time was lost. Obviously, windows where “no time was lost” are fertile ground for identifying mitigation efforts, though potential delays missed or discounted within windows where other delays are assessed should not be ignored. When a new delay is presented, the analyst will often claim that the issue was considered, but it did not contribute to the delays in that window. Left to the highly-subjective SURT methodology, the issue can then devolve to a shouting match, resolved by the fact-finder having to choose which analyst is more credible. More detailed analysis can often disprove the SURT analyst’s argument.

Furthering the hypothetical example used above, Chart 6 is a more detailed version of the delay summary, adding impacts and mitigation efforts the SURT analyst omitted.



**Chart 6**

Chart 6 recalculates the delay allocation provided by performing a complete Update Review technique, which adds enlightening detail to the SURT analysis. As can be seen from Chart 7 below, the added details provide a very different picture of the project delay issues.



**Chart 7**

**Reflection**

The demonstration above shows that, with a relatively small effort, the SURT (Improperly identified as “Windows”) technique can be undermined. While far beyond the context of this article, a Contemporaneous Analysis, with its ability to separately identify and measure every delay, mitigation, lack of progress delay, and acceleration effort within each CPM Update period, would dramatically demonstrate the inadequacies of the SURT analysis. The complexity of the issues and the claimed costs of delay must be considered when selecting a technique to disprove/refute the SURT analysis.

**Conclusion**

When confronted with an evaluation labeled as a “Windows Analysis,” one cannot assume that it represents the detailed analysis properly bearing this title. Increasingly, evaluations labeled as a “Windows Analysis” are merely a very rudimentary analysis technique – the SURT analysis, which is highly-subjective in nature and does not provide positive causal links between an event and a project completion delay. Understanding precisely what form of analysis was performed is essential to evaluating what further analysis is necessary to establish the causation and quantification of delay. While it would be unfair to simply presume that a SURT analysis has been manipulated, the “Black Box” nature of this technique and the numerous ways in which it can readily be manipulated require careful scrutiny.

The viability of a SURT analysis can be tested by several different forensic techniques, ranging from performing a complete Update Review analysis to performing a proper Windows Analysis (Multiple TIA technique) or a Contemporaneous Analysis (which provides the most comprehensive and detailed evaluation / results). These more detailed techniques can identify whether mitigation or other delays have been overlooked or ignored, which would destroy the credibility of the SURT analysis.

1. Other analysis techniques that either do not involve active analysis or do not utilize periodic schedule updates are not discussed further in this article (e.g. Narrative, Bar Chart, Impacted As-Planned, Measured Mile, As-Built Review, Collapsed As-Built. [↑](#footnote-ref-1)
2. While it is possible for delays and mitigation to occur within the same CPM update, there is only one forensic schedule analysis technique – the Contemporaneous Analysis method – that is capable of identifying, segregating and quantifying these offsetting events in a single CPM update period. [↑](#footnote-ref-2)