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Techniques that one may use for delay analysis have been examined twice in prior issues of the Revay Report. In both cases it was through the eyes of the analyst. This issue looks at current trends, but through the eyes of the courts. What type of analysis do courts prefer and why? A word of caution: the opinions expressed in this article are those of the author and anyone who intends to adopt them should do so only after seeking competent legal advice.

DELAY ANALYSIS REVISITED

by S.G. Revay

Construction projects, particularly complex ones, are seldom completed on the date originally specified in the contract. Some jobs, admittedly not too many, may be completed ahead of time. Most, however, are delayed for various reasons. The delays are at times acknowledged by the architect/engineer and the completion date is formally extended; in other cases, the issue is left unresolved and eventually forms the basis of a lengthy and expensive dispute, sometimes as the result of a disagreement on the question of entitlement, but in most cases due to the parties' inability (or unwillingness) to determine, or at times to apportion, the responsibility for the extended duration. One can readily measure the length of the overall delay by comparing the as-built duration with the contractual duration, but the question of who is responsible and for what portion of the overall delay is never easy to answer. The situation can, in fact, be so equivocal as to preclude precise determination altogether, and if that occurs, it may be abused by prejudiced owners.

Extension of Time Clauses

Today, most construction contracts contain extension of time clauses of some description. These clauses have various purposes:

1. to retain a defined time for completion;
2. to preserve the owner's right to liquidated damages in case of contractor-caused delay; and
3. to provide the contractor with relief from its strict duty to complete within the time specified by the contract as well as to provide it with monetary compensation in certain circumstances.

Extension of time clauses, therefore, provide protection to both the owner and the contractor making it that much harder to understand the apparent reluctance to approach the problem in a cooperative spirit.

Admittedly, there is a built-in bias in favour of the owners in most extension of time clauses, which could explain the hesitation of architects/engineers to deal with the requests of contractors. These clauses seldom, if ever, place time limits within which the architect/engineer must respond. In England, for instance, the architect/engineer may delay the response to the end of the project (*Amalgamated Building Contractors Ltd.* v. *Waltham Holy Cross U.D.C.*). By contrast in Australia, Mr. Justice Macfarlan found that the certifier was bound to give his decision promptly (*Perini Corporation* v. *Commonwealth of Australia*). In the U.S.A. failure to grant extension of time when the contractor's request is justified, coupled with pressure by the owner to finish on time, has been held as an order to accelerate (*Electronic & Missile Facilities Inc. ASBCA*).

The English view deserves some support; after all, contractors frequently argue, and often with justification, that the combined impact of successive occurrences (e.g. interruptions, changes, etc.) can be determined only upon the completion of the project. In a Canadian decision, the trial judge had this to say in this regard:

> "It would be clearly impossible to foresee with any accuracy what additional costs would be incurred by delay of other work as the result of undertaking the extras for which the price was submitted and approved, and it would appear that if any attempt had been made to include such consequential costs in tenders this would have been rejected as being too hypothetical and incapable of determination until the work was actually done."

On appeal to the Supreme Court, Mr. Justice Beetz, writing for the majority cited this statement with approval (*Corpex (1977) Inc.* v. *The Queen in Right of Canada*).

The same notion may support the architects'/engineers' hesitation to formalize the length of appropriate con-

tract extension. A further justification of such reluctance could be the expectation that the contractor may be able to mitigate the ultimate consequences. The obligation on the part of the contractor to mitigate the fiscal impact has long been recognized when quantifying delay damages, in fact the obligation to mitigate the delay by "best endeavours" (or something akin to it) is often called for in the contract. In one recent English decision, this obligation was described as follows:

> "The fundamental basis is thus compensation for pecuniary loss naturally flowing from the breach; but this first principle is qualified by a second, which imposes on a plaintiff the duty of taking all reasonable steps to mitigate the loss consequent on the breach, and debars him from claiming any part of the damage which is due to his neglect to take such steps."
>
> (*The Solholt (1983) 1 Lloyds Rep 605*)

A word of caution, although the above citations may tend to support delaying the damage quantification and for that matter also the determination of contract extension until the work is actually done, they offer no excuse for not dealing promptly with requests for time extensions arising out of individual causes, particularly because most extension of time clauses prescribe a relatively short period (e.g. 14 days) within which contractors must notify owners of anticipated or already ongoing delays. Non-compliance with the notice provisions could extinguish all the protections the contractor may have had. Canadian courts appear to view notice provisions strictly, although in one Canadian case Mr. Justice Wallace awarded compensation for delay even though the contractor's notice was faulty, reasoning as follows:

"GC 9.6 only bars a contractor's right to an extension of the contract. It does not refer to the obligation of the Hospital District to reimburse the contractor for any costs incurred by it as the result of the owner-caused delay as provided in GC 9.1" (*Pacific Coast Construction Co. Ltd.* v. *Greater Vancouver Regional Hospital District*).

In England, lack of strict compliance with notice provisions does not appear to be fatal (*London Borough of Merton* v. *Stanley Hugh Leach Ltd.*). In the USA, oral notice was found to be satisfactory (*Hoel-Steffen Construction Co.* v. *United States*). In another case, it was found that an owner, if raising the defense of lack of formal written notice of delay, must demonstrate prejudice to succeed (*Appeal of C.H. Leavell & Co.*). In another case the court accepted monthly updates of the CPM schedules as evidence of notice of delay (*Vanderlinde Electric* v. *City of Rochester*).

Classes of Delay

Delay may result from shortcomings of the contractor or its subcontractors or suppliers, in which case the contractor is not entitled to a time extension and may have to accelerate at its own cost.

Delay could also result from so called "neutral events" (i.e. causes beyond the control of both parties). This class of delays usually entitles contractors to an extension of time but no compensation.

Finally there are delays for which the owner must assume responsibility pursuant to the terms of its contract. Unfortunately, these different classes of delays seldom occur uniquely by themselves. Owner-caused delays are often concurrent with either "neutral" (i.e. excusable) delays or perhaps with contractor-caused delays. This concurrency or overlap of delays of different origin makes delay analysis so complex. Mr. Justice Wallace, in the above referenced case described this problem in the following words:

"To reach any proper conclusion as to the costs from the delay one would be required to analyze the contractor's progress and determine to what extent the different causative factors, such as contractor-caused delays, unavoidable delays and owner-caused delay contributed to the overall delay experienced by the contractor."

Simply stated, Mr. Justice Wallace, as well as others of the judiciary before and after him, tends to limit contractors' entitlement to that length of time which is the difference between the actual contract duration and what the contract duration would have been but for the owner-caused and/or excusable delays.

A comparison between the contractor's as-built and as-planned schedules will seldom yield an acceptable answer. On short duration jobs, where the contractor performed according to its original schedule save and except for one single or relatively few interruptions for which the contractor is entitled to time extension, such a simplistic solution may suffice. Most projects, unfortunately, are much more involved.

Critical Path

A further complication results from the requirement that only delays on the so called critical path ought to be considered with respect to extension of time. In this respect, monetary compensation for interruption (i.e. delays) which did not cause time extension must be differentiated from delays that entitle the contractor to both extension of time and financial relief.

The above statement is not intended to reopen the debate about the ownership of float, but is simply a recognition that only events impacting on the critical path will extend the duration of the project. The problem is, however, that the critical path of a project seldom remains static and it may shift, perhaps several times during the project; that is, it is dynamic.

The critical path is defined by most experts as the longest continuous (i.e. uninterrupted) chain of activities. Although not a prerequisite it is nevertheless assumed that the activities on the critical path must follow each other in the same uninterrupted sequence as originally scheduled. By accepting this prerequisite, it is easy to understand that by delaying any activity on the critical path, one will similarly delay the overall project.

Unfortunately, critical paths, particularly those generated by sophisticated computer programs, often contain totally inconsequential activities which under no circumstances could affect the duration of the project, but were incorporated as the result of blind acceptance of the calculation by the computer. More importantly, critical path may shift by increasing the anticipated resources assigned to an activity on the critical path, or by experiencing better than anticipated productivity on a critical activity and thereby reducing the overall length of the heretofore longest chain. Alternatively a non-critical chain of activities may be rendered critical as the result of assigning a smaller than originally anticipated

crew, a lesser capacity equipment to one or more of its activities, by not being able to maintain the estimated productivity, or by delaying any of its activities.

CPM Scheduling

For CPM scheduling to be meaningful and acceptable for valid delay analysis the schedule must be kept current and must reflect both the delays as they occur and the then governing planning of the contractor (*Fortec Constructors* v. *United States*). Today, delay analysis based on CPM or network scheduling is preferred by the courts, as it ought to be, and is often demanded by architects/engineers during negotiations.

In one U.S. case, the Board of Contract Appeals utilized a CPM schedule prepared after the project completion because the contractor's own schedule was insufficiently detailed. This was allowed only because the expert presented by the contractor was able to prove that the so generated CPM adopted all governing features of the as-planned barchart. (*Appeal of Blackhawk Heating and Plumbing Co.*). In other American cases, both the Federal court (*Natkin & Co.* v. *George A. Fuller Co.*) and the Board of Contract Appeals (*Appeal of Haas & Haynie Corp.*) refused to accept barcharts. In one other case the Board stated:

> "Since no interrelationship was shown as between the tasks the charts cannot show what project activities were dependent on the prior performance of the plaster and ceiling work, much less whether overall project completion was thereby affected. In short, the schedules were not prepared by the critical path method (CPM) and hence are not probative as to whether any particular activity or group of activities was on the critical path or constituted a pacing activity of the project."
>
> (*Appeal of Minmar Builders, Inc.*)

This was a 1972 decision and one cannot help wondering whether today, when both lawyers and courts have a much better understanding of the strengths and weaknesses of CPM, the need for CPM based delay analysis would be so uncompromising. It is suggested that slavish demand by architects/engineers, or by the courts for that matter, for a network (i.e. CPM) based delay analysis may not only be unjustified, but at times could be an outright penalty.

CPM scheduling is not always the preferred and perhaps not even the most suitable tool to manage a construction project. If it is not an essential tool for managing the project, then why would it be necessary to analyze the impact of certain unanticipated conditions or events that were encountered during the project? On linear jobs, such as installing "big inch" pipelines, perhaps even in tunnelling or on grassroots highway projects, depending on the nature of the undertaking (e.g. one cannot install the lining ahead of the tunnel boring machine, etc.), a CPM schedule is not any better, for instance, than a line-of-balance schedule. On many projects, a bar chart schedule can be as useful as a network schedule. During the finishing phase of many building projects, the critical path goes through resources, and sequencing of activities by and large becomes unrestricted. CPM is, however, the preferred tool where the proper sequencing of otherwise unrelated activities determines the ultimate duration and the financial outcome of the project, but not otherwise.

In one 1989 Canadian decision, Mr. Justice Dixon of the Alberta Court of Queen's Bench carried out an extensive delay analysis on the construction of a bridge in Calgary without the use of CPM based delay analysis (*Graham Construction & Engineering (1985) Ltd.* v. *Alberta*). His analysis clearly proved that as long as one is capable of determining the length of time which is the difference between the actual contract duration and what that duration would have been but for the owner-caused or excusable delays, the actual method used for such a determination is of little importance.

One should also keep in mind the principles reinforced in a 1975 decision of the Supreme Court of Canada where Mr. Justice Spence cited with approval the following statement from a 1915 Supreme Court decision:

> "It was clearly impossible under the facts of that case to estimate with anything approaching to mathematical accuracy the damages sustained by the plaintiffs, but it seems to me to be clearly laid down there by the learned judges that such an impossibility cannot "relieve the wrongdoer of the necessity of paying damages for his breach of contract" and that on the other hand the tribunal to estimate them whether jury or judge must under such circumstances do "the best it can" and its conclusion will not be set aside even if the amount of the verdict is a matter of guesswork."
>
> (*Penvidic Contracting Co.* v. *I.N.C.O.*)

CPM based delay analysis can at times be extremely expensive, particularly if the as-built schedule and perhaps even the periodic schedule updates have to be created in retrospect from available field records because the contractor failed to maintain proper progress control during the execution of the project.

One of the most powerful justifications forcing strict compliance with contractual notice provisions is its potential impact on the contractor's record keeping practices.

If the CPM is too expensive and barcharts are rejected by the courts, what then?

Progress Curves

First of all, one ought not to cast aside barcharts without giving them some consideration. They are easy to prepare and to comprehend. This, in turn, has led to their common acceptance and widespread use as a good form of communication. Unless the project is complex or the causes giving rise to the claim are truly concurrent, barcharts have been and can be used successfully for delay analysis, particularly if supplemented with progress curves. These curves are simple histograms depicting, for instance, both the planned and the actual progress of the project. The relationship of these two curves gives both a quick overview of the status of the job and the cumulative rate of progress. The slope (or trend) of the "actual" curve will highlight any gains or losses both in time and progress. This comparison can be broadened by adding the financial progress curve. A comparison between the actual or physical progress and the financial progress could yield the actually achieved productivity at given intervals.

For example, if the physical progress curve rises more slowly than both the planned and financial curves, the job is behind schedule even though more than the anticipated resources have

probably been mobilized, e.g. some unanticipated condition or event was delaying the job. If the barchart is kept up to date (i.e. not only the planned but also the actual progress is shown), it should point out the activity or activities causing the delay. At this point, the history of the job (i.e. as developed from daily reports, minutes of meetings, correspondence, drawing transmittals, etc.) should help to establish the cause as well as the responsibility for the delay.

On complex jobs, the same analysis ought to be repeated for all major trades. By comparing the relationship of the planned curves of two or three immediately preceding as well as proceeding trades with the actual progress curves of the same trades, one could readily identify the trade causing the delay. If the actual progress curve of the guilty trade is annotated with relevant excerpts from the project history, one could identify both the cause and the duration of the delay.

Another possible step is to superimpose either the dates when approved for construction drawings were issued or when shopdrawings were approved on the actual progress curve of the suspected trade. The combinations of these comparisons are numerous, but nevertheless not very expensive. The data required for such an undertaking is usually available even on jobs where record keeping leaves a lot to be desired. Based on the author's experience, such an exercise should be the first step even on large, complex projects where network-based delay analysis is unavoidable, because it will highlight the most likely time frame and the trades that require in-depth analysis.

The line-of-balance method of scheduling and consequently the commensurate delay analysis is quite similar to the previously described analysis of the progress curves with one difference: in the case of line-of-balance schedules one would be analyzing activities as opposed to trades. The use of this type of scheduling is restricted, as was mentioned earlier, to linear and repetitive operations. In analyzing line-of-balance schedules, one ought to follow the same steps described above. Simply stated, one is to compare trends in the progress and in the separation in time between preceding and/or proceeding activities. In this type of scheduling, the critical path, if it can be called that, is represented by the combined total duration of all separation between proceeding activities.

Dynamic Scheduling

There can be no escape, however, from the need for CPM based delay analysis on long duration jobs and/or on jobs where concurrency of causes are suspected. CPM scheduling, if properly prepared, is an analytical tool which is why it is so popular for delay analysis. Its usefulness, however, does not depend on the relative sophistication of the computer program or on the power of the computer used to generate it, but rather on the reliability of the source documents supporting it, as well as on the degree of accuracy with which it represents the evolution of the project (See: *Weaver-Baily Contractors, Inc.*).

It may not be frivolous to state: "Not necessarily CPM, but CPM if necessary". However, one ought to enlarge this statement by adding: not just any CPM schedule, but only one that was properly prepared and was kept current throughout the project.

For a CPM schedule to respond to the needs of a project or construction manager with a view to allowing him to react in a timely and cost effective manner to any unanticipated condition or event, it must be dynamic (i.e. kept current) as opposed to being static. At the same time, only a dynamic schedule will satisfy the prerequisites set down by Mr. Justice Wallace in the above referenced decision, that is **"... to analyze the contractor's progress and determine to what extent the different causation factors, such as contractor-caused delays, unavoidable delays and owner-caused delays contributed to the overall delay experienced by the contractor"**.

Not every schedule kept by contractors meets the above prerequisites though, admittedly, more do today than ten years ago. The problem does not always rest with the contractors' inability or unwillingness, at times it is the result of impractical specifications. A specifier who demands that no scheduled activity have more than seven days' duration does not understand the difference in purpose and characteristics between master schedules and look-ahead schedules. A network containing three or four thousand activities, as a schedule probably would be if complying with the seven days ground rule, cannot be updated meaningfully on a monthly basis. The contractor, accordingly, will either pay lip service only to the scheduling requirements, or will stop producing updates altogether. In both cases the project will suffer, with a secondary impact being that the contractor may not be able to support a delay claim, should it decide to assert one at the end of the project.

There have been a chain of decisions by American tribunals over the years pointing out the pitfalls of improper CPM based scheduling and/or delay analysis. In *Continental Consolidated Corp.* it was the Army Corps of Engineers who put forward a CPM based analysis in its defense. The Board of Contract Appeals rejected the defense because adequate time extension was not granted in a timely manner. Accordingly, the projected completion date used by the Army to order acceleration was based on distorted and invalid facts.

In *J.A. Jones Construction Co.*, the Board found that because the schedule was not updated to give effect to recognized time extensions, one could not determine whether certain activities were on or behind schedule.

Similarly, in *Ballenger Corp.*, the Department of Transportation Board of Contract Appeals found that if the schedule is not kept up-to-date in a consistent and accurate manner it is of little use to measure delays.

There appears to be no recent Canadian decisions on the point, which is that much more surprising because CPM was already used by Canadian Courts for delay analysis in 1971 in *Vermont Construction Inc.* et *Sa Majesté la Reine.*

Other CPM related American decisions of interest are the following:

In *Youngdale and Sons Construction Co., Inc.* v. *United States*, a Federal court refused to consider CPM schedules prepared by a scheduling consultant retained by the contractor because the schedules were not properly based on contemporaneous project records and failed to establish a causal connection.

In *Bell Coatings, Inc.* the Corps of Engineers Board of Contract Appeals denied a claim for government interference with scheduled early completion because the contractor was unable to

prove that its intended completion date would have been achievable.

In *Coffey Construction Co., Inc.*, the Veterans Administration Board of Contract Appeals stated that because no contemporaneous CPM updates had been run during the currency of the project, only self-serving, after-the-fact schedules had been offered in evidence and delays were caused by both parties, neither party had the right to enforce its remedy for late completion.

In *D.E.W., Inc.*, the Armed Services Board of Contract Appeals stated that in order to establish entitlement to a time extension, appellant must show that the overall project was delayed. Appellant did not meet this burden of proof, because according to the project CPM schedule it was obvious that the activity which was delayed by the government was never on the critical path either originally or as delayed.

In *Pioneer Enterprises, Inc.*, the Armed Services Board of Contract Appeals ruled that the contractor failed to prove its delay claim using a computerized scheduling program. When asserting its delay claim, the contractor filed an as-built schedule generated by the Primavera software which showed all work delayed by the tie-in problem. But the Board found that the as-built schedule ignored the fact that the contractor could have mitigated the delay by proceeding with other activities (i.e. by changing the sequencing and accordingly shifting the critical path).

In *Harrison Western Corp and Franki-Denys* the Corps of Engineers Board of Contract Appeals ruled that a contract clause governing the use of CPM schedules did not allow the contractor to establish compensable delay at the time of the delay incident. The contractor still had to prove delay in the overall completion of the project. The Board further stated that the CPM schedules were intended to be administrative tools to enable parties to monitor work progress, but the schedules did not establish automatic entitlement to delay damages. The contractor still had to prove that the delay in question (changed soil condition in this case) had caused the late completion of the entire project. In fact, the schedules relied on by the contractor during the trial made no such showing.

The next decision highlights the recognition by tribunals that critical path may shift. In *Titan Mountain States Construction Corporation* the Board found that although the activities impacted by the changes were not originally on the critical path, they became critical because the length of delay occasioned by the changes exceeded the total available float. Accordingly, the Board ruled in favour of the contractor.

Disputes usually get much more murky when either party argues concurrency. In *Williams Entreprises, Inc.* v. *Strait Manufacturing and Welding, Inc.*, the structural steel subcontractor, who was held responsible for the collapse of the steel structure, argued that the delay on the part of the owner in approving the precast concrete shop-drawings was concurrent with the delay caused by the collapse and re-erection. The re-erection was completed on January 30, 1985, which was the date when the installation of the precast concrete cladding started. The steel fabricator argued that precast cladding would not have been ready before January 30 even if the steel erection had been completed on October 16, 1984, as scheduled. Extensive factual and expert testimony was presented during the trial, including evidence with respect to the progress of manufacturing the precast panels. Eventually the court found that the evidence presented by Williams failed to support the contention that the late approval of precast shopdrawings delayed overall completion, because some of the precast panels were ready and awaiting installation as of November 7, 1984, although all of the panels were not ready before January 14, 1985. To complicate matters, the approval for the shopdrawings of the precast panels was withdrawn by the architect on November 26. In making his findings, the judge apparently was influenced by three facts:

1. The collapse occurred on September 25, 1984, and there was no possibility of precast erection until the replacement steel was fabricated and erected.
2. The steel fabricator failed to call as witnesses any officials from the precast manufacturer or subpoena its company records.
3. Given the magnitude of the disruption caused by the steel collapse, the court hesitated to reconstruct in retrospect what might have happened had the collapse not occurred.

As a point of precision, no delay was assessed against Williams prior to November 8, 1984.

In *Ealahan Electric Company, Inc.*, the Department of Transportation Board of Contract Appeals considered the arguments asserted in the Williams case and eventually ruled that the contractor is entitled to a time extension for government-caused delays although it also had delayed performance, because such delays had occurred in a different time period than the government-caused delays. But the contractor was entitled to a time extension only from the date the first change impacted its performance, to the day the final change was completed. Because there was overlap in the periods of time during which the changes were performed, the Board did not simply add up the time taken for each change in determining the amount of delay attributable to these changes. In this decision, the Board followed the rule accepted today by most tribunals, that responsibility for delays caused by different parties may be apportioned as long as it can be done in an objective manner, as was done in the above case. In *Fairweather* v. *Wandsworth*, one English court examined the implication of "dominant" delay and arrived at the same conclusion as stated above.

In *Weaver-Baily Contractors Inc.* v. *The United States*, the court made a number of determinations concerning CPM scheduling, including a very clear description of what a CPM schedule should be. One may be justified to cite two statements by the court:

> "The court heard foundational testimony on the power of Mr. Berkley's [the expert presented by the Army] computer and the program he used in performing his critical path analysis. While the court appreciates the value of computers in making complex tasks simpler, it must be remembered that a computer-generated analysis is no better than the data which is entered into the computer", — and
>
> "Moreover, the conclusions Mr. Berkley draws from his critical path analysis reflect a misunderstanding of the concept of float time.
>
> To reiterate, a critical path activity is one which, if allowed to grow in duration at all, will cause the overall

time required to complete the project to increase. By contrast, an activity with float time may grow in duration up to a certain point without an adverse impact on the time required to complete the project."

Snapshot Analysis

Finally, in *Gulf Contracting, Inc.*, the Armed Services Board of Contract Appeals describes the delay analysis by the expert presented by the Corps of Engineers (i.e. the winning side), as follows:

> "The adjusted schedules were prepared by starting with the reasonable as-planned schedule and chronologically incorporating the time impacts, which occurred during the project, into this schedule. Once a time impact was identified, the original schedule dates were revised to create an adjusted schedule incorporating the time impact. The adjusted schedule was then revised to incorporate the next chronological time impact. In this way, each of the five controlling time impacts has been incorporated into the schedule as it occurred."

The method used by the above expert closely resembles the principles advocated in the Modification Impact Evaluation Guide, published in July, 1979, by the Office of the Chief of Engineers, Department of the Army, but is done in retrospect whereas the Guide specified contemporaneous application. When done contemporaneously, the schedule employed to project the impact of a delay would be the then current schedule, whereas the expert of the above case apparently used an adjusted version of the same schedule (i.e. apparently without giving recognition to potential mitigation or changes in sequencing), perhaps because there were no schedule updates that coincided with the dates used for the analysis. Unfortunately, this is a common problem analysts face daily.

The principle advocated by the above referenced Guide, as promising as it appears in theory, has severe practical limitations especially on projects with a multitude of changes and other interferences. One simply cannot justify repeating the same exercise on a daily or even on a weekly basis. The solution, which eventually evolved from the above referenced method, is to carry out the analysis at predetermined intervals, e.g. from one to six months apart depending on the nature of the job and the number of changes introduced.

If doing it in retrospect, as analysts are usually called upon to do, the date of such an analysis ideally ought to coincide with the dates when the schedule was updated.

This method of delay analysis, which is known as either "window analysis" or "snapshot analysis" is now the preferred procedure. It was described by the author in an article entitled: "Time Extension in Construction Contracts" published in Vol. 6 of the Construction Law Reports in 1984. Admittedly, the process today is much better developed than it was in 1984.

In some circumstances, particularly in respect of projects where the critical path is less likely to shift back and forth, the so called "but for" or "collapsing" method may yield a more readily understandable answer. In that method, the analyst extracts from the as-built schedule the duration of either all of the owner-caused delays or alternately all of the contractor-caused delays. Although the "but for" schedules are much easier to comprehend, they often have to be supported by the snapshot technique to be acceptable.

As can be seen, delay analysis is not a well established scientific process. What is and is not acceptable under given circumstances can only be judged by the treatment delay claims have received from the courts, which has been continuously changing, and quite rapidly in the United States. Procedures such as the so called "Entitlement" or "Impacted As-Planned" method which were in favour during the late 70's and early 80's are no longer acceptable, simply because the procedure is not dynamic. At the same time, one must realize that even the currently preferred techniques are not without shortcomings and further evolution of delay analysis is to be expected.

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