

As-Built Critical Paths
Fact or Fiction?

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There has recently been an upsurge in the application of forensic delay analyses relying simply on what has become known as an "As-Built Critical Path" - ABCP. Consequently, there has also been much debate between forensic analysts and site planners as to whether as-built critical paths truly exist.

The debate has been focused on the application of certain terms, most importantly "critical" and "path", and the method of determining what was actually critical to completion. To avoid confusion over the terms referred to in this update, I offer precise definitions to allow you to arrive at your own conclusion as to whether As-Built Critical Paths exist or not.

As-built programme - The record of the history of the construction project in the form of a programme. The as-built programme does not necessarily have any logic links...

Critical path - The sequence of activities through a project network from start to finish, the sum of whose durations determines the overall project duration. There may be more than one critical path depending on workflow logic. A delay to progress of any activity on the critical path will, without acceleration or re-sequencing, cause the overall project duration to be extended, and is therefore referred to as a 'critical delay.'

Critical path analysis (CPA) and critical path method (CPM) - The critical path analysis or method is the process of deducing the critical activities in a programme by tracing the logical sequence of tasks that directly affect the date of project completion...

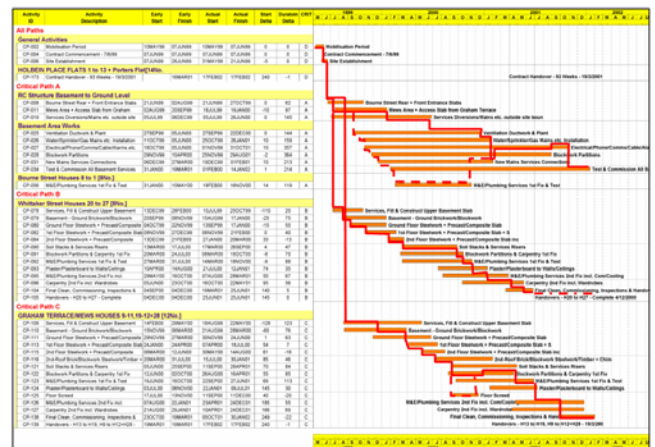
These definitions were extracted from the Protocol on Delay and Disruption published by the SCL. Despite ongoing debate over the Protocol's recommendations, I believe it is agreed by many that the definitions provided were helpful. They will also assist in defining and understanding the ABCP method of analysis.

"Critical Path Analysis" is clearly a process of deduction. It does not require one to "push a button" and does not rely on computer software of any kind to determine where the path flows through the works. The path is dependent on the facts and finding it requires a developed understanding of resource deployment, structural dependencies, changed intentions, unforeseen events, etc. This aspect of deduction is where "planners" and "analysts" part ways, and is fundamental to the debate. Computers provide great assistance in Critical Path Analysis, especially on projects with thousands of tasks. However, CPA was possible before the advent of the PC and the same process of logical deduction is possible today, without the use of programming software.

Retrospectively deducing which activities "directly affect the date of project completion" is required with any form of delay analysis and establishing an As-Built programme should be possible as a factual matter of record. The real difficulty is in determining where the critical path flows on any given day and progressively to completion. Before one attempts to find the elusive ABCP, there are some basic tenets that must be accepted for the process to be effective.

- b. The ABCP may shift to unrelated tasks - if unforeseen events occur (un-planned-shift), or if acceleration re-sequencing is imposed (planned-shift).
- c. There can be more than one ABCP.
- d. An ABCP should be determined to each section/area of work completed later than the contract completion date to identify both concurrent causes of delay and / or disruption to potentially critical tasks.
- e. The as-built critical path might be (and usually is) different than the as-planned critical path.
- f. The sum of as-planned durations for the activities on the ABCP may be less than the original contract time for performance (i.e. these activities would have had float in the as-planned programme.)
- g. An ABCP does not determine liability for delay (ABCP's illustrate "Effect" not "Cause")
- h. The forensic planner will need knowledge of the facts and experience with the relevant technique and methods of construction to arrive at a reliable assessment of the as-built critical path
- i. ABCP's are transparent and, if necessary, are easily corrected if further information is later made available.

With that said - it may not be possible for parties to agree to an ABCP, for many reasons. However, if the critical path is the sequence of activities which "determines the overall project duration" then this must hold true not only in the as-planned state, but also in the as-built state. On large projects with multiple discrete 'sections' there should arguably be an ABCP determined to each and every section that was completed later than the original contract completion date. The number of as-built critical paths will increase with the size, complexity or geographical spread of a project. For example, the figure below demonstrates three concurrent critical paths (A, B, and C) superimposed onto an as-built programme. (Note: the programme has been summarized and filtered to include only critical activities for this illustration).



The logic for shifting from one activity to the next is where both judgement and analysis of all available facts is required. This will include meeting minutes, site diaries, photographs and any and all contemporaneous documents that are available.

Assessing the over-run against any one activity may require breaking the project down into Windows. By assessing how long an activity or group of activities should have taken one can then compare this to the actual duration for the same scope of work.

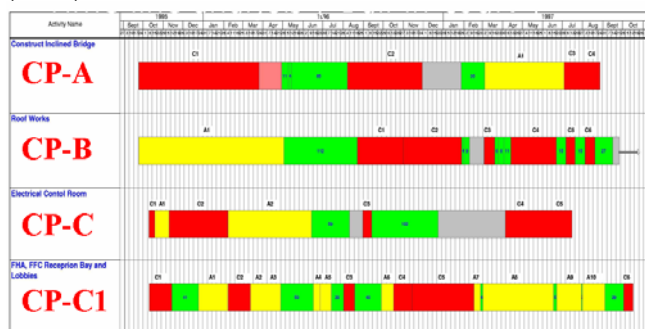
- a. Activities on the ABCP are not necessarily critical throughout their entire duration.

1. What if there is no As-Planned Programme?

Without an as-planned programme it is difficult to compare the as-built duration for any specific task to an equivalent as-planned allowance. Even without the APP it will still be possible to assess what activities were critical to completion and which events determined the commencement of each critical activity. The process required working initially, in reverse from the completion date of each relevant section backwards, through the programme, to commencement. By assessing which activities were critical to completion and determining which task or event allowed each activity to commence, one should be able to determine an initial ABCP from which to interrogate the documents and site personnel with first-hand knowledge of the events to identify any refinement or adjustments required.

By repeating this process for each delayed section this will allow the identification of concurrent delays along multiple critical paths. Further, as illustrated on the previous page, there may be "near" critical paths that require assessment in parallel with these three concurrent critical paths to ensure all possible concurrent delays, excusable and culpable are considered.

Once the ABCP's are identified an entitlement model can be developed (see illustration below), identifying when culpable delay was being experienced (red), when excusable delay was being experienced (yellow) and when work was proceeding as planned (Green).



The above example illustrates where delays could be identified, but liability could not, (grey).

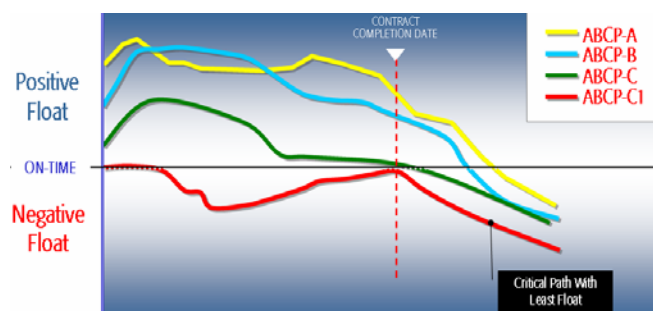
2. What if there is an As-Planned Programme?

When there is an as-planned programme available (assuming that programme was accepted and was reasonable), the initial stage of assessing the as-built critical path is similar to that just described. The APP assists in understating the intended relationship and dependencies between tasks. Although the planned logic may have been flawed and the as-built sequence may have changed from what was intended, the real benefit in having an APP is that it removes the need to assess how much time should have been allowed for any particular task. With a side-by-side comparison of what was intended vs. what actually happened one can discretely identify each over-run (or under-run) experienced along each ABCP. This provides even more transparency to the third party decision maker when deciding which over-runs establish entitlement to EOT and which represent culpable delay. When concurrent ABCPs are identified, as

illustrated above, this provides invaluable assistance in determining compensation for loss & expense or prolongation.

3. What if there is an As-Planned Programme and frequent updates of that programme?

With frequently updated programmes assessing the ABCP is easier, and less subjective, but requires the same scrutiny and understanding of the facts to ensure any obvious programming errors are routed out and addressed. By mapping the float values for each task from update-to-update, on a progressive and forward looking basis, you can determine which activities were critical to completion (at the time) and how much float deterioration occurred in each interval between progress updates. By mapping the float in this way, many trends can be established, both on and off the critical path. Most importantly, the calculations establishing the ABCP are readily supportable and rely on what was reported by the contractor at the time, which is a good starting point from which to establish an initial ABCP. A typical "float mapping" exercise is provided below to illustrate the progressive float deterioration along four concurrent ABCPs.



With the application of common sense and professional judgment the parties should be able to agree fair and reasonable EOT entitlement. Otherwise, it will be a matter for a tribunal. I have found the above approach to be effective in enabling parties to avoid post-contract disputes as well as assist tribunals in deciding EOT entitlement on projects ranging in size from £90K to £400M.

There's no doubt As-Built Critical Paths are 'Old School'. As with any method of analysis there are pitfalls and this approach may not be appropriate in every case. ABCP's are often applied in conjunction with Time Impact or other forms of deterministic, quantitative delay analysis. Used in this way, ABCPs are a powerful way to demonstrate, and quantify, successful acceleration or mitigation when project completion would have been much later otherwise.

Either way, it is important to be aware that ABCP's exist, are readily supportable, and are here to stay. Like believing in Santa Claus - and the ability of arbitrators, judges and adjudicators to distinguish fact from fiction - it's safer to be a believer...

...just in case!

Feel free to contact the author if you have any feedback or comments or would like more information regarding the topics addressed in this update. Additional information can be obtained from www.keane-associates.com.

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