

## CDR.06

# The As-Built Critical Path—Quest or Discovery?

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**ABSTRACT**—Good schedulers work hard to make their products accurately represent the anticipated sequence of work so managers can plan their resources, adjust for unanticipated events, and owners can anticipate project delivery. Among those sequences that interest schedulers the most is the critical path. Forensic schedulers work hard to explain why the projected sequence of work did NOT occur as planned. Those forensic schedulers are vitally interested in what judges sometimes call the “As-Built Critical Path” to help in that explanation, yet considerable debate exists concerning the very concept and existence of an “As-Built Critical Path.”

As this is a debate on the existence and character of the “As-Built Critical Path,” we have formatted the discussion as a series of questions or issues and then answered each from our respective positions. Jeff Ottesen argues that looking for the as-built critical path is like legendary quests that cannot succeed since the as-built critical path is illusionary. John Livengood knows that like adventures of discovery, the as-built critical path is difficult to find but rewarding when found. We will focus our debate on both the actual existence the “as-built critical path” and the semantics of such a concept.

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**Question 1: Is there agreement as to a definition of what a (prospective) critical path is in CPM analysis?**

**John:** I believe that there is agreement on the both the concept and definition of “critical path.” The following are several formulations of the definition:

**AACE International Recommended Practice No 10S-90 “Cost Engineering Terminology:”**

Critical Path—One or more sequences of activities with the least amount of total float activities running from the start event to the finish event in the schedule. It is the longest time path through the schedule [1].

**Fundamentals of Construction Law:** *The critical path is the longest chain of interrelated activities in time through the project from the beginning to the end* [10].

Continental Consolidated Corp.: *The CPM scheduling technique is one which requires a breakdown of the entire project into individual tasks and an analysis of the number of days required to perform each task. The analysis is then programmed into a computer which produces a chart showing the tasks and a line which controls the completion of the work. The line through the nodes, the junction points for completion of essential tasks is known as the critical path* [7].

Fortec Constructors v. United States: *If work on the critical path was delayed, then the eventual completion date of the project was delayed. Delay involving work not on the critical path generally [does not affect the] completion date of the project* [11].

**AACE International Recommended Practice—Forensic Schedule Analysis RP29R-03** does not contain a definition of critical path, but discusses many aspects of identification and calculation associated with the critical path. The *Recommended Practice* does say:

*At any given point in time on projects, certain work must be completed at that point in time so the completion of the project does not slip later in time. The industry calls this work, “critical work.” Project circumstances that delay critical work will extend the project duration. Critical delays are discrete, happen chronologically and accumulate to the overall project delay at project completion* [3].

These definitions reflect two different aspects of the critical path [12]. The first is the purely technical, computer-driven requirement that the activities be logically related in a manner that permits that relationship to be modeled. The second is the recognition that the primary characteristic of such a path, is that any delay to any activity on that path will result in a delay to project completion.

**Jeff:** I agree that prospectively there is agreement on both the concept and definition of “Critical Path.” I add, however, that the critical path is dynamic and therefore, changes over time.

**COMMENT:**

We both agree that the starting place for our search or quest is a definition of: (1) a critical path (Jeff) or (2) a prospective critical path (John). In this case we both agree on the definition.

**Question 2: Can there be a prospective critical path without a critical path method schedule?**

**Jeff:** Yes, however, identifying the real prospective critical path may be difficult or impossible. Several factors affect the practitioner's ability to identify the critical path in the absence of a CPM schedule, including:

- **Project Complexity:** Constructing a combined cycle power plant with multiple prime or subcontractors, for example, is much more complicated than constructing residential sidewalks, curbs and street gutters.
- **Number of Parties Involved** (e.g., subcontractors, vendors, etc.): If a single prime contractor is performing 100 percent of the work on a simple project, identifying the critical path without a schedule is more possible. When coordinating work with multiple prime contractors, subcontractors and vendors, however, the degree of uncertainty (i.e., the ability for each entity to perform its work scope within an expected and reasonable amount of time) increases significantly.
- **Unforeseeable Events:** Because conditions change, what may be the critical path now may not be true later. Example events include:
  - **Force Majeure Events:** Typically include: labor strikes, unusually severe weather conditions, or other natural disaster events labeled as "acts of God."
  - **Material Unavailability:** Unforeseeable, periodic shortages of materials can delay progress and cause delays that change a previously "defined" critical path. For example, a news article in 2004 reported cement shortages in the US caused by the construction of an Olympic events buildings in China [15]. Demand within the US during heavy construction periods also contributed to cement shortages [6].
  - **Poor Productivity:** Insufficient availability of skilled labor may delay work and cause a change to the critical path.

To draw an analogy, in "**Republic**," the philosopher Plato describes a world of the forms. The forms represent knowledge or rather, things as they really are which forms exist in an epistemological [17] plane. Plato argues that such knowledge is infallible. As people, however, we do not live in an epistemological plane, but instead we reside in an ontological [2] or metaphysical plane. Based upon our sensory traits we draw opinions and beliefs, but such opinions and beliefs are merely shadows of the forms, and that such beliefs and opinions are fallible [4].

A project team creates a CPM schedule that represents the beliefs and opinions based on their education and experience. Consequently, the CPM schedule is a model or likenesses of what the team believes are the activities, timing and sequence of work scope. As such, the CPM schedule is fallible. Only in an ideal world does the true, infallible CPM schedule exist. We will never be able to completely and accurately define and execute this schedule, but efforts to create a schedule that closely resembles the ideal are worthwhile and productive.

Optimally, a well designed and constructed CPM schedule represents the collective thoughts, experience and planning of many people. It is intended to project what will happen during execution of the contract's work scope. From it we derive an expected duration and sequencing of the project tasks, which have direct impacts on the overall project costs. Negotiations and key decisions made between

parties often center around the schedule, thus it is important that the best information be used and significant efforts made to set the schedule corresponding to an ideal set of circumstances.

**John:** Absolutely, there can be a prospective critical path, albeit imperfect, without a CPM schedule. While the term, “critical path” is clearly derived from the concept and practice of CPM scheduling, the concept that all projects have at least one series of activities that in the planning stage will determine the shortest period of time the project will need to be completed. In fact, we recognize that there are certain activities in our daily life that govern the time and sequence of events when we anticipate and achieve a particular goal. What event controls your departure to your work place in the morning? How fast you read the paper or how fast your child gets dressed in the morning? Many different situations, often beyond your control and only partially predictable are at play as real-life events unfold. One aspect of the concept that does need to be addressed is whether there can ever be a single, predictable, forward looking critical path for any endeavor. Since real events never precisely follow planned events, the idea of a fixed unitary critical path is an illusion [19]. However, simply because there is time lag between the measurement and projection of an event, that does not render the observation useless. Rather, it is useful within the parameters of daily life. In the same way, modeling future events is a reasonable representation of what could/should happen.

**COMMENT:** Again, we both agree that a CPM is not essential for there to be a critical path. We both also agree that planning for such a critical path is only a representation or an effort, that it is impossible to accurately predict the future. The quest or search is for the most accurate representation of that unachievable goal.

### **Question 3: Are there elements that make up a prospective critical path?**

**John:** I think there are four elements to a prospective critical path. These include the following.

- activities;
- functional relationships;
- continuous series of activities; and
- control of the completion date.

**Activities** or events may seem self-explanatory, it is possible to see that there are virtually an infinite number of possible activities for any project at one end of the spectrum, and only one activity at the other end [2].

**Functional relationships occur** between activities. The typical CPM relationships contains the following functional relationships, ‘finish-to-start’, ‘start-to-start’, ‘finish-to-finish’, ‘start-to-start with a lag,’ and perhaps a few others. While often thought of as time-related relationships, they are in fact functional, not temporal. Even the most evident of the time related logic relationships the ‘start-to-start with a lag,’ is a time approximation of a functional, work-rate related relationship.

**Continuity** is understood to simply require that there be no periods of time where no work is performed and the sequence of activities goes from the commencement of the project to the completion. The exception is when such discontinuous periods are contractually required. Practically,

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this means that something happens at all times on the project (From a pure CPM scheduling perspective this continuity requirement disappears—replaced by the constraints associated with different calendars. However, even the CPM schedule uses different calendars, there is in effect a no-work activity inserted between the work activities.) [3, pgs 18-19]. If the owner declares no winter work may be performed from mid-December through the beginning of March, this no-work period is an ‘activity.’ One of the roles of early CPM scheduling was to eliminate or minimize unanticipated ‘no-work’ periods. (Some of these concepts have been identified in the **AACE International Recommended Practice** as being essential to the development of a suitable baseline schedule.) [3, pg. 18].

**Control of the Completion Date:** The fourth element of a critical path is that the time on that path controls the completion date. More commonly stated, any delay along the critical path will result in a delay in the project completion. This works in conjunction with the requirement of continuity since a discontinuous critical path would mean that a delay to an activity on that path might not result in a delay to the project. (It is recognized that multiple calendars may impact this concept.) Delay however is not a requirement for a critical path; just that if delay occurs and it delays the completion then the delay was on the critical path.

**Jeff:** I agree with the four items discussed above and with the addition of a fifth element: the consideration of available resources. A properly resource-loaded schedule is a form of “sanity check” to verify that the calculated critical path is attainable. For example, construction of a steel bridge pier only provides so many square feet of available work area for welders as the pier ascends upwards. Consequently, there are a fixed number of welders that can productively and safely work on the pier. Unrealistic durations that may exist in a schedule can be identified by performing a resource analysis. Unfortunately many CPM schedules are developed without obvious resource considerations. In essence, the schedule expert who develops the CPM hides the resource considerations either through simple use of past experience or through casual resource calculations. Without notated resource considerations, adjusting a schedule as real-time events unfold make that schedule more unreliable.

**COMMENT:** Again, we both agree that there are five elements that are essential to a critical path. It is the failure to completely meet these five elements that make the quest or search so elusive.

**Question 4: Actual work on activities often takes all the available time from early start to late finish. Doesn't that mean that all such activities are critical?**

**John:** *“Work expands so as to fill the time available for its completion”* [13]. Certainly contractors have taken this motto to heart. Since many projects have 75 percent of their activities with float or spare time for their completion, there is plenty of opportunity for the duration for these activities to grow from their original planned duration to something longer. In “CPM – speak”, the activities often expand to be performed from their early start through their late finish date. However, the application of Parkinson’s Law does not turn all of those activities where performance is extended, into simultaneous critical paths. If Parkinson’s Law was truly controlling the work flow in a project, then any delay on any activity would result in a delay to the project. This does happen, but not often. The reality is that contractors economize their work and after completing some significant percent of a task, often 90 percent, they move their work crews onto other activities – activities that are more critical. The next step in the logic of this theory is that since many activities finish on their “late dates” with virtually no float, those activities are essentially all critical, so they are all on the critical path

rendering the concept of a critical path irrelevant. The truth, however, is that many of these activities that expand to the full allowable time could and would be completed earlier if needed. The only reason they expand is that they are not needed to be completed any earlier.

I reject the concept that since many activities take until their late completion date to be finished, that there are multiple critical paths and, therefore, they are all on the as-built critical path. A more realistic understanding is that the as-built critical path should be on those activities that could not cost-effectively be completed earlier. At the same time, there are often multiple critical paths, any one of which, if delayed, would have affected the completion date of the project.

**Jeff:** I generally agree with John's position, but believe that the units used in the schedule affect results more than actual performance. For example, an electrician installs all wiring within an interior wall before leaving a work site. After the drywallers are finished, the electrician returns to test previously wired outlets. The wiring work may have taken four hours to complete, whereas the follow-up testing took less than one hour. Rarely does any construction CPM schedule record such activities in units of hours; they are usually recorded in days. The schedule here may show one day for both activities, or it may show one day to install the wiring and another to test. In either case, the actual time spent is not represented by the units used in the schedule.

If there is an as-built critical path, it must be based upon contemporaneous evaluation of the real-time schedule updates available to the parties. Even when this happens it can still only serve as a representation of the true critical path. For simple projects, that representation can closely approximate the true as-built critical path. For complex projects, however, the true as-built critical path cannot be known based on present analysis methodologies and the imperfect data that is commonplace in construction projects.

Those who claim to have found the as-built critical path must acknowledge they have introduced hindsight and bias, and have derived their results from incomplete or inconclusive data sets. Further, John's position generally assumes two elements that are not always true:

- That all contractors economize their work. This may be true if there are insufficient resources available and if the project is on schedule. When resources are spread too thin or the project is behind schedule, especially with the threat of liquidated damages, economy may be sacrificed just to get the work done to avoid liquidated damages.
- That the remaining 10 percent of work left undone by a contractor does not affect follow-on trades, or cause critical delay. What may be convenient or seemingly trivial to one contractor may have severe impacts to follow on trades. For example, steel members may be framed up and bolted together, but until plumbed and welded in place, placing a heavy load (such as a heavy piece of equipment) on the frame is unsafe and potentially destructive.

Thus, the analyst must consider not just a contractor's own work, but also the potential affect their work may have on other trades. Generally speaking, a contractor cares only about finishing its own work with little or no regard for the affect on others. Jeff and John agree that micro analyses of fragnets or other details of the schedule may be warranted to fully understand the interrelationships between various trades.

**COMMENT:** Both John and Jeff agree that generally work expands to fill the available time but that such expansion does not render those activities critical. At the same time, just as CPM schedules themselves, the models we use to describe and anticipate schedule behavior are to some degree inaccurate, contractors are not always perfect in their use of resources. Jeff and John's agreement underscores the impossibility of precisely predicting, or identifying after-the-fact criticality.

**Question 5: CPM methodology is forward looking it forecasts future events and the computer can only calculate a critical path to the right of the data dates? So how can CPM logic be used to the left of the data date?**

**Jeff: AACE International's RP 29R-03** states (in part),

*... [ T]he as-built critical path cannot be directly computed using CPM logic since networked computations that generate float values can be generated only to the future (right) of the data date. Because of this technical reason, the critical set of as-built activities is often called controlling activities as opposed to critical activities [3, pg. 21].*

Those who look to the left of the data date (i.e., to activities that have already been completed) in determining the as-built critical path, cannot do so without imposing their own subjectivity and judgments. The resulting as-built critical path then becomes a product of the analyst's interjected opinions, biases, and hindsight observations, regardless of how "objective" their intentions may be. Absent a purely mathematical calculation, such as is used when calculating the critical path, the term "controlling" is used for activities rather than "critical." Regardless of the semantics, as-built critical path practitioners portray their results as those key events that caused critical delay, or rather, those events that 'controlled' the overall project completion duration. They have no option but to apply their "looking to the left" results as if such events affected the project's duration while always "looking to the right" of the data date. Yet triers of fact repeatedly render decisions based on information known or what should have been known to the parties at the time a contract was executed. This premise holds that contemporaneous knowledge trumps hindsight knowledge because decisions are made based on information available and known to the parties at the time.

**John:** Important ideas and concepts often get expanded from an original application to a new application because they help us understand that new application Architecture has a long history of meaning the design and organization of buildings. Yet the term architecture is now applied to computer organization and function. This is because the concept of a system of relationships between components is applicable to both building architecture and now computer architecture. Critical path is such an idea. The concept of series of logically related activities that control the overall duration of task sets is applicable both to series of activities modeled in a computer and to those with a more prosaic application. Thus the concept of the critical path now conveys a meaning, and is commonly understood to mean any series of activities for which any delay on one of the activities will result in a project delay. But, the activities no longer need to be logically connected *prospectively*. This is clearly seen in the very dynamic nature of a CPM. A traditional CPM does not anticipate differing site conditions. Such conditions are not logically related to the work, are likely to delay project completion. For example, after the event's occurrence, it is possible to see the logical connection between the excavation activities and the differing site condition. It is this inability to identify the logic before the event that distinguishes the prospective (more traditional) critical path from the retrospective critical path.

But unanticipated events are not the only types of logic that are generally unrecognized at the planning stage. Despite the significant complexity of modern CPM schedules, they usually stylize the relationships between activities while failing to fully quantify most relationships. Sometimes activities start before they are intended to – indicating the functional relationship reflected in the computer model was only approximate. Most activities have hidden constraints, usually manpower and the ever-present management dependent functional relationship. The management component of activities relationships usually only becomes evident when acceleration is required and more management is required. It is also seen where there is insufficient management resulting in poor coordination.

I agree with Jeff that schedule delay analysts do interject “subjective” beliefs into a retrospective identification of an as-built critical path. (The *Recommended Practice* acknowledges that forensic schedule delay analysis is both an art and a science and that it is impossible to completely remove subjectivity.) [3, pg 8]. The original scheduling expert uses his or her best knowledge in creating the schedule – therefore making it “subjective” and the scheduling expert updates schedules with their “subjective” belief on the status of activities and possible modifications of logic. The only non-subjective aspect of CPM scheduling is the computer calculation. This is why a human intelligently reviews the result of a CPM computer run to assure that it makes sense and avoids the prospective critical path going through the erection of the flagpole.

Jeff is also correct in stating that triers of fact do rely on what was known and when it was known during a project, rather than theoretical constructs [16]. Since all schedules are imperfect in both creation and updating, as Jeff previously discussed, it is important that the forensic schedule expert be able to explain how those real-world events affected the project rather than simply relying on the CPM math. Thus a forensic “as-built critical path” reflects, to the best of the expert’s ability what was known and what actually happened as a result of that knowledge. That expert makes judgments based on the record and his/her experience, not just what the CPM schedule showed. The following excerpt from *Cogefar-Impresit USA, Inc.*, illustrates that CPMs are not enough:

*... Cogefar’s expert on scheduling conducted a review of the entire building construction [through a detailed examination of all available material]. The project was then reconstructed on an as-built basis. [The expert] thereby determined the actual, as-built, critical path of the project. He then compared this result with the as-planned schedule submitted by Cogefar and approved by FBOP at the outset of the project. ... [The Government’s scheduling expert] used a contemporaneous time frame analysis to evaluate delay at the time of the event based on two successive schedule updates. [The government’s expert] used Cogefar’s schedule to determine the critical path. ... However [the expert] did not use the logic changes made by Cogefar subsequent to the September 11, 1992 schedule because of the FBOP’s failure to approve the changes. A use of a different logic can result in a different critical path. ... [We] find the analysis of [Cogefar’s scheduling expert] to be a more reliable indication of the delay caused to the project as a result of the various events that occurred. [The Expert’s] more thorough review looked at actual events to plot the critical path [9].*

**COMMENT:** Here we disagree on important elements of CPM analysis. John believes that expert opinion, also called “subjectivity” is an essential part of CPM scheduling, whether to the right of the data date or the left. Jeff believes that that subjectivity cannot be minimized sufficiently when applied to the left of the data date, while recognizing there is always imperfection even to the right of the data

date. The quest (Jeff) or search (John) for the as-built critical path to the left of the data date is either impossible (Jeff) or difficult (John).

**Question 6: This argument sounds a lot like a simple matter of semantics. Is not the term “controlling path” sufficient?**

**John:** “Semantics” have important implications. Just as we insist our children not swear because, among other reasons, such language hides more subtle meanings, or teach them that the word “like” need not be used as a modifier for all statements, the term “critical path” has both cache and a distinct meaning. While the **Recommended Practice for Forensic Schedule Analysis (29R-03)** seems to indicate that “controlling path” is the proper technical term, [3, pg. 21] the document refers to both the “as-built critical path” and the “controlling path” with frequency. (The **2009 Recommended Practice** uses “controlling path” 13 times, and “as-built critical path” 37 times). I believe that use of the term “as-built critical path” deepens understanding of the concept.

To further clarify of these concepts, I propose the following definitions:

**Prospective Critical Path:** *The critical path is the logically related continuous sequence of activities that describes the shortest overall period of time for the completion of a project and for which if any activity in that sequence is delayed, the overall completion duration will be delayed by that same amount.*

**As-Built Critical Path:** *The as-built critical path is the continuous series of chronological activities for which if any activity in that sequence was or could have been delayed, the overall completion date was or would have been delayed by that same amount.*

The recognition that there are separate definitions for critical path and as-built critical path will greatly assist the profession of forensic schedule delay analysis. It is important that the term “critical path” is used in both definitions because while the two are calculated differently, they describe the same underlying idea – that any delay along that path will extend project completion. They both describe the activities that are critical to project completion. The use of separate definitions assists the planning and scheduling professionals as well as the forensic schedule delay analysis profession in at least two ways:

First, the construction public, including: contractors, engineers, owners and attorneys, generally understand the idea of a critical path, regardless of whether it is prospective or retrospective. Forensic schedule experts only add to the confusion by avoiding the use of the term “critical path” in the retrospective situation. For example, in a recent US Federal Claims Court decision, the Court recognized the as-built critical path as a method to compare projected and actual construction activity: [The expert] prepared a critical path method schedule delay analysis, in which he reviewed the as-planned schedule, schedule updates, progress payments and other project documentation in order to construct an as-built schedule. [The expert] identified the critical path on the as-built schedule, compared it to the critical path on the as-planned schedule, and analyzed “where activities may have been performed in the same time as was originally planned, may have been performed in a shorter time that originally planned, or may have been performed in a longer time than originally planned [14].

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Second, most contracts provide that time extensions or delay damages can only be awarded for actual delay to the critical path. Since a typical CPM critical path is entirely prospective, it cannot by definition have actual delay. On the other hand, an as-built critical path will reflected delays on a critical path which I would interpret as “actual” or as-built [4].

*The reason that the determination of the critical path is crucial to the calculation of delay damages is that only construction work on the critical path had an impact upon the time in which the project was completed [11].*

**Jeff:** I object to use of the term “controlling path” because it implies reduced significance of concurrent paths, which when all float is eroded thereon, also contribute to critical delay. A similar term frequently used is “driving path,” which has the same effect on lessening importance of concurrent delayed paths. Because many instances of case law recognize literal concurrency when evaluating critical delay and require evaluation of concurrent delay when addressing compensable delay damages, performing an analysis that yields a single “controlling path” is insufficient to also address literal concurrency of delaying events. A contrived as-built critical path inherently is merely a reflection of the analyst’s perceived controlling path for the project.

**COMMENT:** John and Jeff agree that damages only apply for delay to the critical path. However, John believes that an as-built critical path is sufficient to prove such compensability and that the identification of the as-built critical path can, if properly performed identify concurrency. Jeff holds that an as-built critical path fails to adequately consider concurrent delays.

### **Final Words**

**John:** There is such a thing as an “as-built critical path,” it exists in ALL projects, but admittedly may not be readily identifiable. The job of the forensic schedule expert is to “discover” that as-built critical path. Projects that never had a CPM developed still have a *continuous series of chronological activities for which if any activity in that sequence was or could have been delayed, the overall completion date was or would have been delayed by that same amount.* Identification of that as-built critical path is easier if proper CPM schedules were maintained through the project. Neither the limitations of the scheduling software nor the tendency for activities to expand to consume available time preclude the conclusion that there is an “As-Built Critical Path.” It is a journey full of discovery.

**Jeff:** The as-built critical path is based on theory that only a single, driving critical path exists on any given day for the project, which theory incorrectly ignores literal concurrency as recognized by US case law. Because all CPM schedules are fallible, identification of the as-built critical path using the logic from such schedules frequently equates to a “garbage in, garbage out” exercise. Further, creating an as-built critical path requires use of hindsight which increases the analyzer’s reliance on subjectivity and potential for bias. Project scheduling is a quest requiring constant adjustment – a quest that gets close to what actually happens but can never become an objective as-built critical path.

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2. **AACE International Recommended Practice No 10S-90 “Cost Engineering Terminology,”** AACE International, Morgantown, WV, 2004. A related definition is: *ACTIVITY – An operation or process consuming time and possibly resources. An activity is an element of work that must be performed in order to complete a project. An activity consumes time, and may have resources associated with it. Activities must be measurable and controllable. An activity may include one or more tasks.* AACE International Recommended Practice No 10S-90 “Cost Engineering Terminology”, AACE International, Morgantown, WV, 2004.
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4. Barba E., G. Lare and R. Lowe, “*View From Across the Pond: An American Perspective on the Society of Construction Law’s Delay and Disruption Protocol,*” **The Construction Lawyer**, No. 27, Vol. 1, Winter 2007, Page 23.
5. Cohen, S. Marc. “*Forms as Objects of Knowledge: Rep. 476-480,*” University of Washington Lecture Notes, 7-Nov-06. Mr. Cohen explains, *The distinction between knowledge and belief is crucial for Plato - without it, he would not have his main support for the theory of Forms. That he continues to have this concern (after the Republic) is made clear in this passage in the Timaeus (51d): ‘If understanding and true opinions are distinct, then these “by themselves” things definitely exist - these Forms, the objects not of our sense perception but of our understanding only. But if - as some people think - true opinion does not differ in any way from understanding, then all the things we perceive through our bodily senses must be assumed to be the most stable things there are. But we do have to speak of understanding and true opinion as distinct, of course, because we can come to have one without the other, and the one is not like the other . . . Since these things are so we must agree that (i) that which keeps its own form unchangingly, which has not been brought into being and is not destroyed, which neither receives into itself anything else from anywhere else, nor itself enters into anything else anywhere, is one thing. It is invisible - it cannot be perceived by the senses at all, and it is the role of understanding to study it. (ii) The second thing is that which shares the other’s name and resembles it. This thing can be perceived by the senses, and it has been begotten.*

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*It is constantly borne along, now coming into being in a certain place and perishing out of it. It is apprehended by opinion, which involves sense perception.*

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7. Continental Consolidated Corp., ENGBCA NOs. 2743, 2766, BCA Para 6624 (1967).
8. D'Onofrio, R. "Can There Be Float on the Critical Path?," **ABA Newsletter, Under Construction**, Vol. 11, No. 3, August 2009, Page 1.
9. DOTCAB No. 2721, 97-2 BCA Para 29,188 (1997) at 145,201.
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15. **The [Cincinnati] Enquirer**, "Concrete Shortage Begins to Harden," July 14, 2004, Page D-3.
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17. www.dictionary.com defines "epistemological" as "a branch of philosophy that investigates the origin, nature, methods, and limits of human knowledge."
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19. Zack, James G., CFCC. In an email communication with John Livengood, dated 10-Jul-09, James Zack, Executive Director, Corporate Claims Management, Fluor Corporation, wrote: *I still feel that the idea of a single critical path determining the outcome of the job is a fallacy. We all know, and acknowledge, that the critical path is a dynamic, living creature. It is subject to change on a routine basis depending upon what is happening on the project. The concept of the critical path (like the underlying premise of a TIA) is that it is a prospective prediction of those events driving the end date of the project*



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