

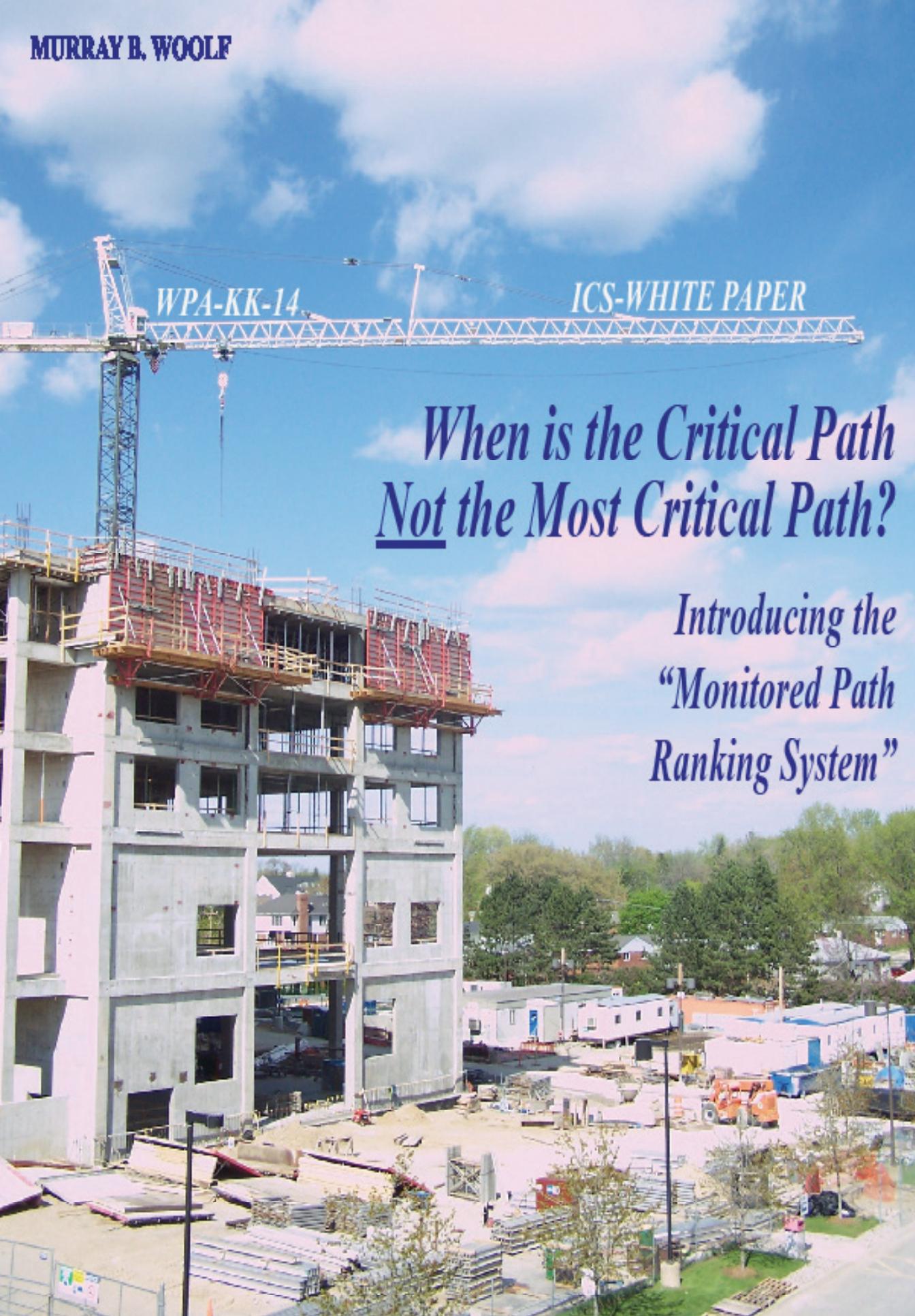
MURRAY B. WOOLF

WPA-KK-14

ICS-WHITE PAPER

# *When is the Critical Path Not the Most Critical Path?*

*Introducing the  
“Monitored Path  
Ranking System”*





# *When is the Critical Path NOT the Most Critical Path?*

## **Introducing the Monitored Path Ranking System and the Paramount Path**

*by Murray B. Woolf*

**ICS-Compendium White Paper WPA-KK-14**

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**Note:** This White Paper was designed to function as a stand-alone reference document. It presumes a minimum understanding of the basics of the Critical Path Method. If you do not feel that you have this level of understanding, or if you find the content of this White Paper a little “over your head,” you would quite likely receive great benefit from reading **CPM MECHANICS**.

**CPM MECHANICS** is Volume 1 of the ICS-Compendium\* and forms the basis for both the **DOMINANT PROJECT MANAGEMENT SERIES** and the **COGNITIVE PROJECT MANAGEMENT SERIES**. This White Paper is heavily referenced in **CPM MECHANICS**, and was written to serve as a supplement to that book.

To learn more about CPM Mechanics, we encourage you to investigate it at [www.CpmMechanics.com](http://www.CpmMechanics.com).

\* The ICS-Compendium is a five-year project that began in January 2011. The primary eight volumes are scheduled for issuance in six-month increments, starting with CPM Mechanics, which is already on bookshelves. Release Dates for the other volumes are posted at the ICS-Placement website. Simply go to [www.ics-placement.com](http://www.ics-placement.com).

**Note:** Words appearing in **bold font** are defined in the glossary at the end of the White Paper. You may wish to consult the ICS-Dictionary for additional terms not defined in the glossary.

**We wish to thank the following individuals for their tireless help in the development of this White Paper. Their advice and guidance was instrumental in achievement of this work product, so important to the Scheduling Community:**

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## *Table of Contents*

<b>I:</b>	<b>Defining Path, Critical, and Critical Path</b>	<b>6</b>
I.A:	Defining the Term, Path	7
I.A.1:	Definitional Criteria for the Term, Path	8
I.A.2:	Where Does an Activity Path Start and End?	8
I.A.3:	Defining an Activity Path's Secondary Terminology	11
I.A.3.a:	Defining the Term, Activity	11
I.A.3.b:	Defining the Term, Series of Activities	12
I.A.3.c:	Defining the Term, Open End Condition	13
I.A.3.d:	Defining the Terms, Path Start, Path Finish, and Path Ends	13
I.A.4:	Defining the Term, Activity Path	14
I.B:	Defining the Term, Critical	15
I.B.1:	“Critical” Must Mean More than Just Important or Essential	15
I.B.2:	“Critical,” as Used, is a Comparative Term	15
I.B.3:	Criticality: A Chicken or Egg Question	15
I.B.4:	Criticality Must Be Objectively, Not Subjectively, Derived	16
I.B.5:	Critical ... to What?	18
I.B.6:	Definitional Criteria for the Term, Critical	18
I.C:	Defining the Term, Critical Path	19
I.C.1:	Why Urgency Is NOT a Comparative Value	19
I.C.2:	No Silver Bullet: Rarely Just <i>One</i> Critical Path	22
I.C.3:	Definitional Criteria for the Term, <i>Critical Path</i>	22



## **ICS-Compendium: Project Management Critical Thinking**

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<b>II:</b>	<b>A New Paradigm for Ranking Path Urgency</b>	<b>23</b>
II.A:	Two Additional Definitional Criteria	24
II.A.1:	Singular Modifier is Inadequate	24
II.A.2:	Each Finish Date Constraint Has a <i>Set</i> of Affecting Paths	25
II.B:	Putting the Two Innovative Concepts Together	26
II.B.1:	Introducing the Monitored Path Ranking System	27
II.C:	Solving the “Critical Path” Definition Problem	28
II.C.1:	Advantages of Using the Monitored Path Ranking System	28
II.C.2:	Example of Using the Monitored Path Ranking System	29
II.D:	Conclusion	30
<b>III:</b>	<b>Definitions of Terms Used in this White Paper</b>	<b>32</b>



## *When is the Critical Path NOT the Most Critical Path?*

### *“Introducing the Monitored Path Ranking System and the Paramount Path”*

Today, more than fifty years after the Critical Path Method made its debut, there still is no universally accepted definition for the central term, **Critical Path**. Among the dozens of more obscure definitions, two conflicting theories dominate scheduling glossaries: the Longest Path interpretation and the Least Total Float Path interpretation.

- ☞ As this White Paper will expose in its opening pages, these two interpretations are deficient in three major ways:
- From a practical perspective, they are incompatible with one another.
  - From a value perspective, they both prove incapable of actually identifying the typical Schedule's several Critical Paths.
  - From a stability perspective, they are both based on a comparative platform that causes the Critical Path to shift and flicker uncontrollably with each corresponding change in Schedule content.

The problem goes much deeper than a lack of agreement on what should be the single determining factor when identifying a Schedule's Critical Path. A careful review of current scheduling literature shows that there is virtually no definition to be found for the underlying words “**Path**” or “Critical,” as standalone terms of significance in their own right.



👉 **The Quagmire:** How then can we hope to fully understand the term Critical Path, if we do not first know how to spot *any* Path, or how to appreciate what should constitute Criticality?

This White Paper challenges **Dominant Project Management**<sup>[1]</sup> thinking by proposing a new way to understand and use the term, Critical Path. At stake is much more than a semantic discussion of terminology. Numerous surveys have confirmed that CPM Schedules are used for two over-arching reasons: to manage the Project and to resolve temporal disputes.

To support either use, however, the Critical Path must be identifiable in a consistent, objective, and defensible way.

- In the world of Construction Claims, methods for proving Delay, Acceleration, and Time Impact center on a Schedule's contemporaneous Critical Path.
- In Project Management, the main purpose of the Schedule is to help prioritize daily Activities, so that which is more "Critical" get the earliest and greatest attention.

### I: Defining Path, Critical, and Critical Path

Note that the word, Critical, is an adjective that characterizes the word Path. For instance, a *Critical* Path is distinguished from a Near-Critical or even Non-Critical Path. Because of its central importance, we will begin this White Paper by examining the root word, Path. For if we cannot agree on an Activity Path's composition, we certainly cannot agree on how to distinguish a Critical Path from its Near-Critical and Non-Critical cousins.

Accordingly, in this section we will provide a definition for the term, Activity Path,<sup>[2]</sup> and offer definitional criteria for the terms, Critical and Critical Path. In the second section, we will consider a new paradigm for understanding and evaluating the Activity Paths that terminate into **Deadline Milestones**.

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- 1 The term Dominant Project Management is used throughout the ICS-Compendium to refer to the broadest grouping of contemporary literature, dogma, standards, best practices, and other formal writings and teachings on Project Management topics and refers to today's "conventional wisdom" on Project Management matters. In contrast, **ICS-Compendium** advocates **Cognitive Project Management** as a superior alternative, designed specifically for Construction Project Management as practiced in North America.
  - 2 In so doing, we will also craft definitions for secondary terms that are used in the primary definitions.



## I.A: Defining the Term, Path

We begin by turning to Dictionary.com to gain a generic understanding of the word, path.<sup>[3]</sup>

- 🔍 Path: The route or course along which something travels or moves.
- 🔍 Path: A road, way, or track made for a particular purpose.

Unfortunately, these two general definitions provide little immediate help, although we will return to them shortly.

More useful, perhaps, is to picture a path through the woods, comprised of clearly-identifiable stepping stones, as shown in **Figure F001**. Surely the stepping stones are the *primary* element in the Path, but ...

- Would we consider such a Path as being comprised *only* of the stepping stones themselves?
- Or, does a Path *also include* other elements that surround the stepping stones: the cleared and leveled dirt between and alongside the stones; the green gravel and underlying vinyl barrier that keep grass and weeds from popping up between the stones; the guard rails that border the Path, or the trimmed edging and peripheral trees that define and shape the Path's curvaceous route?

To answer this, in **Figure F002** we recognize the same configuration of five stepping stones, but this time we see them in a field where they have just been excavated, and are about to be loaded onto a truck, headed for their ultimate destination – the Project job site. Without the surrounding leveled and cleared ground, gravel, railings, edging, and trees — the stones lose their context and no longer *appear* to us as being a Path. They are just a gathering of stones.



F001: An Obvious Path in the Woods



F002: Just So Many Stones

3 While throughout this White Paper we sometimes use the single word, Path, the full term is **Activity Path**. An Activity Path contains both Activities and the Performance Restrictions that link them.



### I.A.1: Definitional Criteria for the Term, Path

From this simple example we are able to identify three criteria that an adequate definition of the term, Path, at minimum would have to meet:

- Elements:** Our definition must list all primary and secondary elements that are to be found in an Activity Path. At a minimum it should mention Activities, the existence of Performance Restrictions, and Path Ends.
- Restrictive Nature of Relationships:** Our definition must not stop at just noting that Performance Restrictions exist between Activities. It should describe *how* the Activities are related. For instance, it should note that the Activities have an operational impact on one another, such that the performance of one Activity necessarily *restricts* or *impacts* the performance of one or more downstream Activities.
- Progressive Nature of the Path:** Finally, our definition should both acknowledge and clarify that an Activity Path contains Activities that, as they are performed, establish a gradual *progression* toward a common end point. As a logical extension of this thought, the Activities of a Path must necessarily spring from a common starting point.

In support of this third criterion, both Dictionary.com definitions seem to call for such a linkage between Path Start and Path Finish. While “made for a particular purpose” is perhaps a more emphatic wording than “along which something travels or moves,” both hint at an underlying purpose for the Path, and not just what particular elements might physically comprise such an Activity Path.

### I.A.2: Where Does an Activity Path Start and End?

Because we believe that the definition for the term, Activity Path, should make reference to a Path Start, as well as a Path Finish, we are faced with this difficult question: *Where does an Activity Path begin and end?* For if we cannot define an Activity Path’s starting and ending points, how can we possibly begin to define the term, Critical Path?

When you stop to think about it, in a CPM Logic Diagram there are only three possible Path Delineation Options for identifying what we call Path Ends:

- Open Ends Only Option:** We could say that an Activity Path's start or finish points are marked by the existence of **Open End Conditions**, which come in two varieties: **Unrestricted Start** and **Unrestricting Finish**.

Let us define these terms, pursuant to the ICS-Dictionary:



- ☛ **Unrestricted Start:** An Unrestricted Start is an Open End Condition where the start of a Subject Activity is not restricted on its start by any upstream Activities.
- ☛ **Unrestricting Finish:** An Unrestricting Finish is an Open End Condition where the finish of a Subject Activity is not restricting any downstream Activities.

☞ The word “only,” in the **OPEN ENDS ONLY OPTION**, means that if we were to adopt this option then **OPEN ENDS** alone would establish Path Ends. Date Constraints would have *no* bearing on where an Activity Path starts or ends.

- ☐ **Date Constraints Only Option :** We could say that a separate Activity Path begins with each distinct **Start Date Constraint**, and ends with each distinct a Finish Date Constraint.

- ☛ **Date Constraints:** Date Constraints are computational criteria for Calculated Dates that are superimposed on a given Activity, such that any Activity Path Segments (to which the Activity belongs) may be artificially accelerated, delayed, or fixed in time.

☞ Here again, the word “only” suggests that only Date Constraints would establish Path Ends. Open End Conditions would not be a defining factor.

☞ There is a correlation between a Finish Date Constraint and a Deadline Milestone, the latter being a real-life Project Execution Commitment, and the former being a Schedule-resident modeling technique. Since an Activity Path is a Schedule element, it ends at a Finish Date Constraint (also a Schedule element), as opposed to ending at a Deadline Milestone (which is *not* a Schedule element).

Throughout this White Paper, Activity Paths will commence and terminate at Date Constraints, not Release Milestones or Deadline Milestones. Occasionally, however, we may speak of an Activity Path “achieving” a Deadline Milestone when, technically, what we mean is that the Activity Path satisfies the Finish Date Constraint that correlates with the Deadline Milestone.

- ☐ **Total Float:** Finally, we could say that an Activity Path can only have one Total Float value across its entire length, and that Path Ends would be recognized by a change in Total Float values.



## ICS-Compendium: Project Management Critical Thinking

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We tested each of the three Options against a sample Logic Diagram, and then applied the two prevailing Critical Path definitions. What we found was that each Option introduced problems that were not immediately resolvable.

- ❑ **Problems with Open Ends Only Option:** When we applied the Open Ends Only Option to a Network Diagram that included a few scattered Date Constraints, we discovered that it allowed a single Activity Path to have multiple Total Float values along the way. Obviously this was a problem — for at least two important reasons:
  1. **Invalidates Prevailing Definitions:** The Longest Path would have more than one Total Float value.
    - If we stick with the Longest Path definition of a Critical Path, then which one of the various Total Float values do we assign to this “Critical” Path?
    - Yet, if we select the set of Activities having the Lowest Total Float among all Activities in the Activity Path spanning between Path Ends, such an Activity Path would not span the entire Schedule length!
  2. **To Which Element is Total Float Associated:** It further complicates our understanding of the term Critical Path when it confronts us with yet another troubling question: *with which Schedule element should the Total Float value be associated?*
    - The reason why this question is so troublesome is because we know that Total Float does not belong to a single Activity; we have consistently asserted that it belonged to the Activity Path. But if an Activity Path has more than one Total Value along its length (and, therefore, we cannot associate Total Float with either the Activity or the Activity Path), then with *which other* Schedule element *should* the Total Float value be associated? We can think of none.
- ❑ **Problems with Date Constraints Only Option:** This is the corollary to our criticism of the Open Ends Only Option, for if there happen to be multiple Start Date Constraints or multiple Finish Date Constraints in the Schedule, then once again this would break the correlation between the Longest Path and the Least Total Float Path.
- ❑ **Problems with Total Float Option:** The Total Float Option has two immediate drawbacks, and if we must find a way to address them, if we are to use this method of determining where an Activity Path starts and ends.
  1. **Total Float Can Change:** Total Float can change due to any number of factors, including Date Constraints, oscillating Path length, Software Settings, Work Performance Calendars, and even the choice of different Restriction



Linkages.<sup>[4]</sup>

With each new Schedule Edition,<sup>[5]</sup> a Schedule's Total Float values can be expected to change and with those changes the precise route and content of the Critical Path(s) would themselves flicker unpredictably. The resultant data instability would be as disruptive to intended Schedule usage as, for instance, having Activity Identifiers changing with each subsequent Schedule Edition.

- Using this option, the Activity Path would no longer necessarily correlate with *any* particular Finish Date Constraint.

### I.A.3: Defining an Activity Path's Secondary Terminology

Realizing that none of the three Path Delineation Options came without serious complications, the ICS-Compendium Development Team returned to definitional criteria derived from the stepping stones example. Specifically, we agreed among ourselves that a useful definition of the term, Activity Path, should minimally:

- List all primary/secondary Schedule elements found in an Activity Path.
- Describe *how* Activities are related; i.e., that Activities have an operational impact and restrictive influence upon one another.
- Acknowledge the progressive nature of Work performance that is reflected in an Activity Path.
- Confirm that each Activity Path has a distinct Path Start and Path Finish.

Our solution was to very carefully craft definitions for secondary terms that ultimately would be used in our definition of the primary term, Activity Path. These secondary terms included: Activity, series of Activities, Path Ends, Path Start, and Path Finish.

#### I.A.3.a: Defining the Term, Activity

We begin our development of a definition for an Activity Path by citing the ICS-Dictionary definition of the term, **Activity**:

☛ **Activity:** The most basic building block of a Project Schedule, an Activity represents a discrete portion of the overall Scope of Work to be performed through **Project Execution**, with support from **Project Administration**. Resident in a CPM Network Diagram, an Activity is an artificial representation of its real life

- 4 Restriction linkages is the Cognitive Project Management substitute term for relationship or dependency type. The four CPM Restriction Linkages are: **Default Restriction** (Finish-to-Start), **Start Restriction** (Start-to-Start), **Finish Restriction** (Finish-to-Finish), and **Holdback Restriction** (Start-to-Finish).
- 5 Cognitive Project Management substitute term for Dominant Project Management's **Schedule Update**.



## ICS-Compendium: Project Management Critical Thinking

counterpart, a Project Execution Action. The dimensions of a single Activity's included Work Scope are circumscribed by the Activity Description and Activity Duration, as well as the corresponding Action's location, complexity, performers, and other limiting factors.

As the definition clarifies, the Activity is the most basic building block of a Network Diagram and, therefore, of a Project Schedule. It contains an Activity Description, which clarifies the Scope of Work of the corresponding Project Action (that the Activity seeks to model). It also includes an Activity Duration, which represents the amount of time required by the Activity's performers to accomplish the Scope of Work of the Activity.

### I.A.3.b: Defining the Term, Series of Activities

With an Activity defined, we can now define a Series of Activities, as follows:

☛ **Series of Activities:** A Series of Activities is a unique arrangement of Activities in temporal progression, such that each Activity has one Restricting Activity before it and one Restricted Activity after it.

There are a couple of important requirements for a combination of Activities to qualify as a *series*:

**Must Be Progressively Related:** The Activities must be progressively related to one another. In **Cognitive Project Management** jargon, the Activities must share a Progressive Relationship. According to the ICS-Dictionary:

☛ **Progressive Relationship:** A Progressive Relationship exists between two Activities that are linked together by way of Performance Restrictions (and possibly additional intervening Activities). In a Progressive Relationship, the timing of a downstream Activity is or will be affected by the timely performance of one or more upstream Activities.

☛ These Performance Restrictions reflect the progressive nature of Activity interdependency, such that the Work of the Activities build upon one another in a *progressive* manner, so that the ultimate Work of the Project is achieved by each Activity's efforts being the underlying basis for the Work of its downstream counterpart Activities.

**Relationship is Temporal:** The Activities must have a temporal connection to one another. That is, the timing of a downstream Activity must be affected by the timing of Activities that come before it.



- One Activity On Either Side:** Each Activity in a Series of Activities can have only *one* Activity before it, or *one* Activity after it (except for the first and last Activities in the Series).
- Restrictive Influence:** The performance of the Subject Activity must be restricted by the Activity immediately before it (Restricting Activity), and it must in turn restrict the performance of the Activity immediate after it (Restricted Activity).

### **I.A.3.c: Defining the Term, Open End Condition**

Back on page 9 we introduced the terms Unrestricted Start and Unrestricting Finish. These are the two ways that an Activity Path can have what Dominant Project Management calls an Open End. Cognitive Project Management defines an Open End Condition this way:

**🔍 Open End Condition:** In a Progressively-related Network Diagram, an Open End Condition refers to a break in sequential Logic whereby a Subject Activity is either not restricted on its start by any upstream Activities or, conversely, its own finish is not restricting any downstream Activities.

Another way to think of an Open End Condition is to view it as a *missing link* condition. Imagine, while tracing your family ancestry, you encounter a distant relative for whom no parental information can be found! You would come to a screeching halt in your research.

The same situation applies when we are performing Forward Pass Date Calculations and we encounter an Activity whose start does not appear to be restricted by any other Activity. Just as problematic to a Backward Pass would be an Activity that does not seem to “*have to finish.*” That is, no other Activity seems to be waiting on the completion of the Subject Activity.

### **I.A.3.d: Defining the Terms, Path Start, Path Finish, and Path Ends**

Armed with working definitions for the above terms (Activities, Series of Activities, and Open End Condition) we are now able to establish the precise meaning of three additional terms that will be essential to our understanding of the ultimate term, Activity Path.

The first to cite from the ICS-Dictionary is Path Start, which helps us to know how to spot the start of Activity Path.



☛ **Path Start:** In a Progressively-Related Network Diagram the term, Path Start, refers to an Activity that marks the beginning of an Activity Path. To qualify as a Path Start, an Activity must either be bound by a Start Date Constraint or suffer from an Open End Condition known as Unrestricted Start. In an Unrestricted Start Condition, the start of a Subject Activity is not restricted by any upstream Activities.

The counterpart to Path Start is Path Finish, which we define this way:

☛ **Path Finish:** In a Progressively-Related Network Diagram the term, Path Finish, refers to an Activity that marks the end of an Activity Path. To qualify as a Path Finish, an Activity must either be bound by a Finish Date Constraint or suffer an Open End Condition known as Unrestricting Finish. In an Unrestricting Finish Condition, the finish of a Subject Activity does not itself restrict any downstream Activities.

Of course, both Path Start and Path Finish are collectively called Path Ends:

☛ **Path Ends:** The term, Path Ends, refers to the Point of Origin and Point of Termination of an Activity Path. The two Path Ends are Path Start and Path Finish.

### I.A.4: Defining the Term, Activity Path

At last we are able to construct a definition for the term, Activity Path (Path, for short). And thanks to the preciseness of the above terms (for Activity, Series of Activities, Path Start, and Path Finish) our definition of the term Activity Path is remarkably simple:

☛ **Activity Path:** In a CPM Network Diagram, an Activity Path is a unique Series of Activities that spans from Path Start to Path Finish.

At this point, this definition should be fairly self-explanatory. The only detail we wish to point out is the inclusion of one special word. “Unique” is injected into the definition in order to force the establishment of distinctly different Activity Paths for each unique Series of Activities that may happen to span between the same Path Start and Path Finish.



## I.B: Defining the Term, Critical

Now we turn our attention to the word, Critical.

### I.B.1: “Critical” Must Mean More than Just Important or Essential

Based on how the term Critical Path is routinely used, the word Critical cannot merely mean *important* or *essential*, because every Activity in a Schedule is important or essential to the completion of the Project.<sup>[6]</sup> As a modifier, the word Critical implies a degree of *urgency* to be associated with particular Activities. This is how the word is used throughout the Dominant Project Management world.

### I.B.2: “Critical,” as Used, is a Comparative Term

We also note that the word Critical, as used in Dominant Project Management jargon, is a *comparative* one and can be translated to mean *most critical*. In fact, quite often the complete expression is more along the lines of “*the Critical Path*,” as if to say that one Activity Path is preeminently more critical than any others.

Additionally, the two predominant formulas for identifying a Critical Path also use *comparative* terms: *Longest Path*, and *Least Total Float path*. Thus, the criticality of one path is almost always compared to the lesser criticality of others paths: that is, one Activity Path is *longer* than all others, or one Activity Path has *lesser* Total Float than all others.

### I.B.3: Criticality: A Chicken or Egg Question

Esoterically, we must consider whether an Activity Path gets its Criticality from the Activities that reside on it — or, in the inverse, whether the Activity gets its Criticality from the Activity Path on which it resides.

**Activity Criticality Makes No Sense:** An Activity Path cannot obtain its Criticality from the Activities that reside on it, because there is no independent basis for establishing Criticality for a single Activity. As support for this statement, consider that *both* of the two prevailing definitions of a Critical Path determine Path Criticality at the Path level, not the Activity level.

- ❑ **Using the Longest Path Definition of Critical Path:** The Longest Path approach involves the addition of Activity Durations along each different Path, in order to determine which Path is in fact the *longest*. Hence, it is the sum of multiple Activity Durations that determine an individual Activity Path's length. Until each Path is

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6 If the Activity were not important or essential, it would not be in the Schedule.



## ICS-Compendium: Project Management Critical Thinking

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so "measured" and until all Paths are compared, one is simply unable to know *which* Path is the Critical Path. Only after one Path is deemed to be the *longest*, are Activities resident on that Path deemed to be Critical.

- ❑ **Using the Least Total Float Path Definition of Critical Path:** The Least Total Float approach to determining the Critical Path also depends on aggregation of Activity-level data. In order to find the Activity Path bearing the *Least* Total Float, each Activity Path must first be measured to determine its particular Total Float value. Since Total Float is the difference between Earliest Dates and Latest Dates, a prerequisite to determining the Total Float of any single Path is the determination of Earliest and Latest Dates.

This is accomplished through Forward Pass and Backward Pass Processes, respectfully. Those arithmetic processes entail adding up Activity Durations. Once again, an individual Path's collective Total Float value is based on the cumulative Durations of Activities resident on the Path.

If you are still not convinced, then consider that the behavior of Total Float consumption is entirely Path-centric. Both Forward Pass and Backward Pass Date Calculations, which yield Earliest Dates and Latest Dates, are performed across the full length of Activity Paths. Equally convincing, a change in any single Activity Duration will change the Total Float values for all Activities on the Path upon which the Activity resides.

**Path Criticality Make Perfect Sense:** Total Float, then, *must be* a group possession, (a Path value) and not the sole attribute of any single or particular Activity. Our conclusion, therefore, is that Activities assume the Criticality of the Activity Paths on which they reside.

But there is a major problem with this conclusion! Since it is common for an Activity to reside on more than one Activity Path, *which* Total Float value should we assign to an Activity when each distinct Activity Path on which the Activity resides reports a different Total Float value? This is a *very* common situation in Critical Path Method Schedules. Before we can answer the question, we must consider the implications of a comparatively-oriented value.

### I.B.4: Criticality Must Be Objectively, Not Subjectively, Derived

From all of the above we see that adoption of a *comparative* basis for Critical Path identification is fraught with problems. For the term to have any reliable meaning at all, Criticality must be objectively, and not subjectively, derived. Dictionary.com defines "subjective," as:



- ☛ **Subjective:** Existing in the mind; belonging to the thinking subject rather than to the object of thought (as opposed to objective).
- ☛ **Subjective:** Relating to or of the nature of an object as it is known in the mind as distinct from a thing in itself

As we sat and talked about it, we realized that the two Dominant Project Management definitions of the term Critical Path have three weaknesses in common:

- A subjective understanding of the concept of Criticality.
- Contradictory viewpoints on how to identify a Critical Path.
- Confusion as to where Criticality is rooted: in the Activity Path or in the Activity itself.

Once we rejected the use of comparison to spot a Critical Path, we were faced with establishing a replacement basis for identifying *that Activity Path(s) most worthy of Project Management's highest attention during Project Execution*. We set up three guidelines for development of this new basis for identifying a Critical Path:

1. It must not be predicated on any comparative scale.
2. It must be measurable. As a likely extension of the first bullet, it would most likely be based on a numerical or statistical range that is calculated from within the Activity Path.
3. It must be an objective, not subjective, value. That is, this measurable value must exist independent of the conditions outside of the Activity Path.

For example, in weather reporting a Tropical Storm is recognized when winds are recorded between 39 and 73 miles per hour. Higher winds upgrade a storm to Hurricane status. Lower winds would reduce the storm to Tropical Depression status. Notice how each storm can be classified on its own merits, and how its ranking is not contingent on how other storms around it may be rated.

Now imagine what would happen if we were to replace the three separate terms (Tropical Depression, Tropical Storm, and Hurricane) ... with, say, one word! For instance, “dangerous.” How meaningful or useful would weather reports be if:

- The storm with the highest winds was classified as “dangerous?”
- The storm with the second highest winds was classified as “near-dangerous?”
- The storm with the third highest winds was considered “not dangerous?”



### I.B.5: Critical ... to What?

The term Critical has a general meaning that we all understand. Dictionary.com well captures this general meaning:

- 👁️ **Critical:** Urgently needed
- 👁️ **Critical:** Of or forming a crisis; crucial; decisive

Even with these definitions we are left to agree on the basis for determining what is “urgently needed,” why it is “urgently needed” or warrants being considered “crucial,” or how to recognize an impending “crisis.”

In Dominant Project Management's use of the term Critical Path, the assumption has always been that temporal outcome is the one and only criterion for determining Criticality. Whether we use the Longest Path or the Least Total Float Path basis for Critical Path identification, the ultimate foundation is either Activity Durations and Calculated Dates (respectively) and at its logical end, the delay or acceleration of some downstream Deadline Milestone.

Is temporal outcome the most important criterion for establishing Criticality? Is it the *only* criterion for establishing Criticality? To be sure, on Projects where the Owner deems *timely completion* to be a higher priority than any other Project success criterion (e.g., cost, quality, functionality, beneficial use, etc.), defining Criticality in terms of temporal outcome makes perfect sense.

But even on such a Project, how we can decide which variable(s) are the best predictive indicators of likely temporal outcome? Under Dominant Project Management, Total Float is the chosen variable. Indeed, it is the only variable. Cognitive Project Management suggests that there are other — quite a few, in fact — variables that can and should be used to measure and report criticality beyond either Total Float or Activity Durations. But such a discussion exceeds the scope of this particular White Paper.

We will close this topic by simply noting, for the record, that even if a particular Activity Path is found to be Critical to the *timely completion* of some important temporal outcome, a comprehensive Project Management system should take care not to adopt too narrow of a use of the term, Critical.

### I.B.6: Definitional Criteria for the Term, Critical

- 👁️ **Note:** As you shall soon read, Cognitive Project Management advocates replacing the singular term, Critical Path, with a *set* of precisely defined terms in its place. For this reason, we find little value in spending great energy crafting a carefully worded definition for the word, Critical, when we do not intend



to use it in the current manner that Dominant Project Management uses the expression, Critical Path.

That said, we can however establish a few criteria for defining the word, Critical, should its definition be desired by others. Here are our suggestions:

- The term Critical cannot simply mean “important” or “essential,” as every Activity in the Schedule is important and essential to the Project’s full and timely completion.
- For an Activity Path to be Critical, it must be the predominant influence upon, and directly related to, some *specific* Project objective.
- An Activity Path does not get its Criticality from the Activities that reside upon it. Rather, an Activity derives its Criticality from the Path (or Paths) upon which it resides.
- To be useful or meaningful, Criticality must be objectively determined, must be measurable, will most likely be numerically based, and must not be comparative.

### **I.C: Defining the Term, Critical Path**

Now we can examine the term, Critical Path, in the context of its most common usage and separate from our earlier understanding of the foundational terms, Critical and Path.

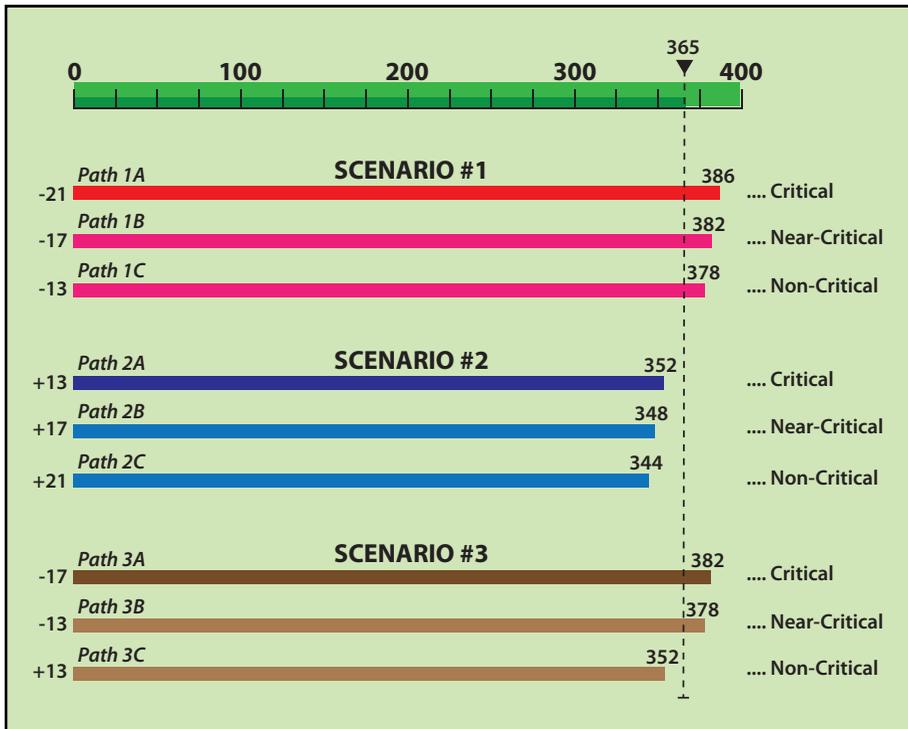
Immediately we appreciate that the intent behind the term, as it is used in scheduling circles, is to deem one particular Activity Path as being (the most) “critical,” *as compared to* all other paths in the Schedule -- that is, the most important to downstream temporal outcomes.

#### **I.C.1: Why Urgency Is NOT a Comparative Value**

And, therein, we come face-to-face with why the overall meaning of the term Critical Path is so often and so easily misunderstood — and why there is so much confusion and debate in Project Time Management circles as to what the Critical Path actually is.

Simply stated, in order to be useful at all an actionable condition must not be described in *comparative* terms. That is, a condition upon which we can take preemptive or mitigating actions is not a condition that suddenly appears or disappears simply because of the arrival or departure of other surrounding conditions of greater or lesser urgency.

To fully appreciate the ridiculousness of a *comparative* measure of urgency, let us consider three different SCENARIOS, as shown in **Figure F003**.



F003: The Comparative Meaning of the "Critical" Path

All three SCENARIOS assume the same Schedule details:

- Project Length: 365 calendar days
- Schedule Size: 100 Activities
- Critical Path: 20 Activities
- Work Calendar: Seven-Day Workweek

Now, here are the details about each SCENARIO.

- Scenario #1:** The Project is seriously behind Schedule. The longest three Paths all bear significant *negative* Total Float:
  - Path 1A Length = 386 days; Total Float = TF -21
  - Path 1B Length = 382 days; Total Float = TF -17
  - Path 1C Length = 378 days; Total Float = TF -13
- Scenario #2:** The Project is impressively ahead of Schedule. The longest three Paths all bear significant *positive* Total Float:

## WPA-KK-14 When is the Critical Path is Not the Most Critical Path?



- Path 2A Length = 352 days; Total Float = TF +13
  - Path 2B Length = 348 days; Total Float = TF +17
  - Path 2C Length = 344 days; Total Float = TF +21
- ☐ Scenario #3: The Project is behind Schedule, but not quite as badly as SCENARIO #1. Two of the longest Paths show high *negative* Total Float, while the third longest Path has *positive* Total Float.
- Path 3A Length = 382 days; Total Float = TF -17
  - Path 3B Length = 378 days; Total Float = TF -13
  - Path 3C Length = 352 days; Total Float = TF +13

Applying either the Longest Path or Least Total Float Path definition to SCENARIO #1, we are quick to recognize PATH #1A as *the* Critical Path because the Activity Path is both the *longest* and the one with the *least* Total Float.

But a contradiction lies within:

- ☐ If we take the words *longest* and *least* literally, then the other two Activity Paths, although both significantly behind Schedule, would *not* be considered critical,<sup>[7]</sup> but instead only Near Critical. For example, PATH 1B with a length of 382 days is *not* the Longest Path and with Total Float of TF -17 is also *not* the Least Total Float Path. Thus, it cannot be *the* Critical Path.
- ☐ Yet, in SCENARIO #3, PATH 3A, which has the same length and same Total Float as PATH 1B, is considered to be *the* Critical Path simply because in SCENARIO #3 it is the Longest Path, as well as the one with the Least Total Float. Obviously, this definition makes no sense!

We can see this same contradiction even more starkly when we compare PATH 2A with PATH 3C. In SCENARIO #2, PATH 2A, with positive Total Float of TF +13, is deemed Critical because it is the Longest Path and has the least Total Float. Yet, in SCENARIO #3, PATH 3C (having the *same* length and Total Float) is *not* critical, because it is neither the Longest Path nor the Least Total Float Path.

A splash of common sense jolts us back to reality. How can a path that is 17 days *behind* Schedule not be considered Critical, while a Path that is 13 days *ahead of* Schedule is considered Critical? Surely there is something fundamentally wrong with these two dominant definitions of what is considered to be a Critical Path!

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7 For there can only be one Critical Path — one longest Path, or one Path with the least Total Float.



### I.C.2: No Silver Bullet: Rarely Just *One* Critical Path

In addition to the *comparative* nature of these definitions being inherently flawed, there is another equally important observation to be made from the above examination. Whether Least Total Float Path or Longest Path, there is a fallacy in presupposing that there can only be *one* Critical Path per Project Schedule.<sup>[8]</sup>

Today, most Schedules incorporate more than one Deadline Milestones. Yet both the Longest Path and Least Total Float Path definitions continue to speak in terms of there being only *one* Deadline Milestone, such as **PROJECT COMPLETION**. As we confirmed in our discussion of Activity Paths, the introduction of multiple Date Constraints<sup>[9]</sup> invalidates both the Longest Path and Least Total Float Path definitions of the term Critical Path, as long as those definitions speak only in terms of a single, Deadline Milestone.

### I.C.3: Definitional Criteria for the Term, *Critical Path*

As we noted previously about the term, critical, Cognitive Project Management advocates replacement of the singular term, Critical Path, with a set of precisely defined terms in its place. However, since this White Paper is intended to assist and inform those who practice Project Time Management according to Dominant Project Management principles, we will venture to provide useful definitional criteria for the term, Critical Path:

- Should Not Be Comparative:** Whatever the basis for determining the Critical Path, it should not be comparative. That one Activity Path is longer or shorter than another – or that it has Total Float greater or lesser than another – does not help us understand what is truly most critical with respect to the timely achievement of one or more downstream Deadline Milestones.
- May Be More Than One Critical Path:** The notion of *one* Critical Path (whether the Longest Path or the Least Total Float Path) is a theoretical concept, but rarely the case in real life. Most Projects work toward multiple Deadline Milestones, and their Schedules use Finish Date Constraints to lock in the Latest Finish for each such Deadline Milestone.

Each of these Finish Date Constraints is capable of overriding Latest Dates that would otherwise be calculated through a Backward Pass originating from other downstream Finish Date Constraints. The result is a separate set of Latest Dates and resultant Total Float values, that correlate directly with each separate Finish

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8 We say this, even if we set aside the occasional condition where there happen to be two or more paths of the same length and, thus, the same Total Float terminating at the same Finish Date Constraint.

9 Both Start Date Constraints and Finish Date Constraints.



Date Constraint.

- ❑ **Longest Path Basis is Flawed:** The Longest Path basis for determining the Critical Path is flawed due to the common use of multiple Finish Date Constraints. From a practical standpoint, the prolific use of Date Constraints cannot be mandated out of existence, and their presence is likely to only increase in the future.<sup>[10]</sup>

☞ Cognitive Project Management, disagreeing with Dominant Project Management, actually encourages the discrete and responsible use of Date Constraints as a practical and effective way to simulate Project Management intentions and their likely consequences.

- ❑ **Least Total Float Path Basis is Flawed:** The Least Total Float Path basis for determining the Critical Path is also flawed in that it necessarily ignores all but the Path with the least Total Float. When multiple Paths are behind Schedule (bearing negative Total Float), the Least Total Float Path interpretation describes all but this one Activity Path as being something other than Critical.

If we reserve the term Critical Path for the Activity Path with the least Total Float, then we are forced to find other words to describe other Paths that might have frightfully negative Total Float values. One popular term that is in wide use is Near-Critical Path. But what is Near-Critical about an Activity Path that is many *weeks* behind Schedule (negative Total Float of **TF -17**)?

## II: **A New Paradigm for Ranking Path Urgency**

The first half of this White Paper identified important definitional criteria for defining the terms Path, Critical, and Critical Path. These definitional criteria are intended to assist those who might boldly undertake the much needed challenge of crafting a new set of terms to represent and communicate discrete degrees of temporal urgency among the many Activity Paths that transect every Project Schedule.

The purpose of this White Paper is not to actually wordsmith a new definition of the term, Critical Path. One reason for not doing so is that this White Paper concludes that

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10 A third Activity Path delineation that has emerged in recent years is called the Driving Path. While there are formulaic variations among its adherents, in a nutshell the Driving Path is found by essentially ignoring the presence or effects of Date Constraints and, nonetheless, tracing the Longest Path from Schedule start to Schedule end. As such, the Driving Path is not a Critical Path definition, but rather an alternative to the Critical Path, as determined by the two prevailing definitions. The Driving Path is fraught with the same deficiencies noted above for the Longest Path – the most glaring being that the Driving Path would have multiple Total Float values along its length.



a single term, Critical Path, is woefully inadequate when in most Schedules there are multiple Activity Paths that have the potential to impact multiple downstream Finish Date Constraints.

Second, the impetus for this White Paper is a sincere desire to help lay the groundwork for an effort by others to develop a set of terms that meet the intended uses behind the currently inadequate single term, Critical Path.

### II.A: Two Additional Definitional Criteria

Before we introduce a new paradigm for measuring and ranking the varying degrees of Activity Path importance to downstream Finish Date Constraints, let us first consider two final points not covered in the previous discussion, but that should be factored into any fresh attempt to redefine or even replace the term, Critical Path.

#### II.A.1: Singular Modifier is Inadequate

Reasonable minds will readily agree that, even in a purely theoretical setting, it is rarely if ever the case that one Activity Path is Critical while all others are *not* critical at all.<sup>[11]</sup> Today, we are just as uncertain as to what constitutes a Near-Critical Activity Path as we are unclear about the meaning of the mother term, Critical Path. For this reason, we invite the reader to shake off the decades-old way of thinking about the mythical Critical Path and consider replacing it with a completely new and utterly logical alternative.

It's all about our initial mind-set. The current school of thought has us staring at a Schedule and immediately trying to find the Critical Path. Even though the Schedule often contains multiple **Finish Date Constraints**, Dominant Project Management "Best Practices" continue to have us searching for one special, magical Activity Path.

As a practical alternative (to pursuing the impossible), how about this approach? We suggest that, when we examine a Schedule, with the intent of recognizing areas of Criticality, the target for our *initial gaze* ought be the *various* Finish Date Constraints, and that we should work backwards from there.

That is, we would:

- Identify All Paths:** Identify all of the Activity Paths that feed into a given Finish Date Constraint. This, in itself, would be a major improvement over Dominant Project Management thinking, in that we would be acknowledging that there are, in fact, many Activity Paths that feed into a single Finish Date Constraint.

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11 Historically speaking, in response to this realization, the term Near-Critical was coined.



- ❑ **Rank Each Path:** Proceed to rank each Activity Path as to the extent to which it actually or potentially impacts that particular Finish Date Constraint. This ranking would be performed against a pre-defined, standardized set of ranking criteria.

With this approach, there would be one or more essential Activity Paths that affect *each* Finish Date Constraint. We could then use the word Critical to refer to a specific, pre-defined level of real impact to a given Finish Date Constraint, instead of it being a comparative word meant to point out the *longest* or *least float* difference with other Activity Paths.

The conventional wisdom, that there is some magical Critical Path, lacks wisdom altogether. Imagine being asked to take a highlighter and mark up a large city map in order to show the *Best Route*! We would have a host of questions before we could perform this assignment. A *Best Route* toward one destination, and from one starting point, may not be the *Best Route* for any another destination. It depends on where you are headed – and where you are starting from.

And it also depends on how one defines the word, “best.” Does *best* refer to the most scenic route? The shortest route? The fastest route?

If we recall the original intention behind having a measure of Activity Path Criticality, to provide Project Management with an objective sense of priorities and urgency, then wouldn't the Project Team be better served by a *set* of modifiers that reflect *degrees* of such Criticality, than by one singular term that changes with the wind?

In meteorology, the public may be issued a tornado **Watch**, **Warning**, or **Alert**. In the field of medicine, a patient's medical condition may be reported as **Good**, **Stable**, **Poor**, **Acute**, **Severe**, **Intensive**, **Critical**, or **Terminal**. By using a set of terms that have been pre-defined to stand for specific degrees of importance, storms (or Activity Paths) can be ranked independent of one another, and against a standard that can be compared apples-to-apples.

### II.A.2: Each Finish Date Constraint Has a Set of Affecting Paths

We know that each Finish Date Constraint launches a separate Backward Pass, which in turn generates a different set of Latest Dates and accordant Total Float values.<sup>[12]</sup>

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12 At first, this sentence may seem difficult to understand, or even appear as incorrect. We submit that the discomfort with this sentence most likely stems from the reader's complete indoctrination into, and acceptance of, the comparative nature of the Critical Path term, and its underlying statistical basis, the equally comparative Total Float value.

Confirming this, consider the rules of Forward Pass and Backward Pass date calculations, which have us comparing all possible calculated date options and then choosing the latest date among the choices (in the case of a Forward Pass), or the earliest date among the choices (in the case of a Backward Pass). When different Activity Paths converge, they bring with them different Earliest Dates and Latest Dates – proof that Activity Paths do indeed overlap one another.



Therefore, each Finish Date Constraint is affected by one or more Activity Paths, each with its own Path-long Total Float value. And since an Activity has the ability to reside on multiple Activity Paths simultaneously, an Activity can, and quite often does, affect one or more Finish Date Constraints.

**II.B: Putting the Two Innovative Concepts Together**

If we combine these two concepts, that a singular modifier (“Critical”) is inadequate and that each Finish Date Constraint is likely affected by *multiple* Activity Paths feeding into it, then we arrive at the following suggestions with respect to labeling the Activity Paths that actually or potentially affect a given Finish Date Constraint:

- All Activity Paths Should Be Identified and Monitored:** For each separate Finish Date Constraint, we should be identify and monitor *all* Activity Paths that pose a potential or real threat to a particular Finish Date Constraint. Each of these would be called a Monitored Path.
- Reference the Deadline Milestone:** The label we assign to an Activity Path should make reference to the Deadline Milestone that corresponds to the Finish Date Constraint into which the Activity Path feeds. Examples would include **BUILDING DRY-IN PATH** OR **SUBSTANTIAL COMPLETION PATH**.
- Express Degree of Urgency:** Every Activity Path should be characterized as to the *degree* to which it threatens, or has the potential to threaten, the timely achievement of a downstream Deadline Milestone.

MONITORED PATH RANKING SYSTEM									
PATH CATEGORY	IMPACT POTENTIAL	From To		PROJECT LENGTH 120 Work Days		PROJECT LENGTH 240 Work Days		PROJECT LENGTH 360 Work Days	
		% of PROJECT LENGTH		From To	From To	From To	From To		
				TOTAL FLOAT RANGE	TOTAL FLOAT RANGE	TOTAL FLOAT RANGE	TOTAL FLOAT RANGE	TOTAL FLOAT RANGE	TOTAL FLOAT RANGE
<b>CRITICAL PATHS</b>	Unrecoverable Path	-51%	Or Worse	-61	Or Worse	-121	Or Worse	-182	Or Worse
	Ominous Path	-35%	-50%	-42	-60	-83	-120	-124	-180
	Grave Path	-21%	-34%	-26	-41	-50	-82	-75	-123
	Significant Path	-9%	-20%	-11	-25	-21	-49	-31	-74
<b>WATCH PATHS</b>	Moderate Path	-4%	-8%	-5	-10	-9	-20	-14	-30
	Limited Path	0%	-3%	-1	-4	-1	-8	-1	-13
	Probable Path	+3%	0%	+4	0	+8	0	+13	0
	Possible Path	+8%	+4%	10	5	20	9	30	14
<b>FREE PATHS</b>	Free Paths	Or Better	+9%	Or Better	11	Or Better	21	Or Better	31

**F004: Monitored Path Ranking System**



## II.B.1: Introducing the Monitored Path Ranking System

**Figure F004** presents a set of labels that can be used to reflect an Activity Path's threat level with respect to timely achievement of a given Finish Date Constraint. This table comes from the Monitored Path Ranking System recommended by Cognitive Project Management, as a way to express the relative urgency of one or more Activity Paths that feed into a given Finish Date Constraint.

**Figure F004** is included in this White Paper as an example of how a ranking system differs from the current single modifier approach used by Dominant Project Management. A complete discussion of the Monitored Path Ranking System is provided in another ICS-White Paper. However, in order for the reader of this book to get a general sense of how the Monitored Path Ranking System works, here are ICS-Dictionary definitions for the three primary Activity Path Ranking Classes, as well as the Paramount Path:

- ☛ **Critical Path Class (Path Ranking):** Under the Monitored Path Ranking System, Activity Paths are ranked according to their potential threat to the timely completion of downstream Deadline Milestones. Ranked Paths are further classified by levels of threat severity, Critical Paths being the most severe. The Critical Path Class includes Unrecoverable, Ominous, Grave, and Significant Paths. Activity Paths within the Critical Path Class pose a real and extreme threat to the timely completion of one or more Deadline Milestones, and require urgent, substantive, and deliberate Project Management response in order to reverse, mitigate, or eliminate the impending impact.
- ☛ **Watch Path Class (Path Ranking):** Under the Monitored Path Ranking System, Activity Paths are ranked according to their potential threat to the timely completion of downstream Deadline Milestones. Ranked Paths are further classified by levels of threat severity, Watch Paths falling between Critical Paths and Free Paths. The Watch Path Class includes Moderate, Limited, Probable, and Possible Paths. Activity Paths within the Watch Path Class pose a potential or easily reversible threat to the timely completion of one or more Deadline Milestones, and warrants close and special monitoring and control in order to reverse, mitigate, or eliminate the likely impact.
- ☛ **Free Path Class (Path Ranking):** Under the Monitored Path Ranking System, Activity Paths are ranked according to their potential threat to the timely completion of downstream Deadline Milestones. Ranked Paths are further classified by levels of threat severity, Free Paths being the least severe. Activity Paths within the Free Path Class include any Activity Path that, based on indicators such as Total Float or Path Segment Volume, pose no real or potential threat to any Deadline



Milestones, and require no special monitoring and control, beyond that provided by normal work Activity supervision and oversight.

☛ **Paramount Path:** Within the Monitored Path Ranking System, the one Activity Path that most influences the timely achievement of a downstream corresponding Deadline Milestone is known as the Paramount Path. A Paramount Path can belong to any of the three Path Ranking Classes: Critical, Watch, or Free. Of all of the Activity Paths feeding into a given Deadline Milestone, the Paramount Path is the Activity Path bearing the Least Total Float. Since each Deadline Milestone in a Schedule has at least one Paramount Path, a Project Schedule will minimally have as many different Paramount Paths as there are Deadline Milestones. Paramount Path is the term that Cognitive Project Management uses to represent the same Least Total Float Path that Dominant Project Management calls a Critical Path. The biggest difference, of course, is that Dominant Project Management insists that a Schedule can have only one Critical Path, even if it contains multiple Deadline Milestones.

### II.C: Solving the “Critical Path” Definition Problem

The labels, percentages, and ranges appearing in the Monitored Path Ranking System table ([Figure F004](#)) are merely an example of how the problem of Activity Path Criticality might be differently solved. To be sure, the Monitored Path Ranking System eliminates the deficiencies posed by the Longest Path and Least Total Float Path definitions, which are only practical for Projects that have but one Deadline Milestone. And how often is that the case?

#### II.C.1: Advantages of Using the Monitored Path Ranking System

A few obvious advantages gained by a Monitored Path Ranking System are:

- ☐ **Eliminated Single Word:** We are no longer limited to a single word (“Critical”) to describe all Activity Paths that are not Non-Critical. We can use different words to describe increasing degrees of potential or actual threat to the timely achievement of one *or more* specific Deadline Milestones.
- ☐ **Labels Not Comparative:** The new Activity Path labels (e.g. Ominous Path, Moderate Path, etc.) are not comparative to one another. Instead, they describe the extent of the potential or real threat to a Finish Date Constraint that a particular Activity Path poses *as measured against a fixed set of ranking criteria*.
- ☐ **Critical Path Has Stable Meaning:** The term Critical Path now refers to a Class of real



impacts, ranging from Significant Threat to Unrecoverable Threat. Alternatively, other Activity Paths, ranging from Possible Threat to Moderate Threat, are classified as Watch Paths.

## II.C.2: Example of Using the Monitored Path Ranking System

How would we use this set of labels in combination with specific Finish Date Constraints? A sample **NARRATIVE REPORT** might read as follows:

### **Project Substantial Completion Milestone, Confidence Level**

The Project's **SUBSTANTIAL COMPLETION** Milestone is in serious jeopardy with the presence of six Critical Paths, as follows. Confidence in achieving this Deadline Milestone in a timely manner is all but gone.

- One Ominous Path: Passing through Electrical activities on the fourth floor, poses the greatest threat to this Deadline Milestone, with a Total Float value of **TF -87**.
- Two Grave Paths: Both passing through Civil activities on the second and third floors, further threaten this Deadline Milestone's timely completion. These paths carry Total Float values of **TF -52** and **TF -61**.
- Three Significant Paths: Passing through various Mechanical activities in the penthouse and boiler room, also threaten this Deadline Milestone's timely completion. The Total Float values for these paths are: **TF -27**, **TF -29**, and **TF -31**.

### **Building Dry-In Completion Milestone, Confidence Level**

The Project's **BUILDING DRY-IN** Milestone is in fairly good shape, with only three Watch Paths (one Moderate Path and two Probable Paths), as follows. Confidence in achieving this Deadline Milestone in a timely manner is guarded, but optimistic.

- One Moderate Path: Running through exterior window walls on the sixth floor, with a Total Float value of **TF -9**. While this is a negative Total Float value, it is entirely recoverable, and efforts are underway to reverse the impact of this Activity Path on the **BUILDING DRY-IN** Milestone.
- Two Watch Paths: Hold the possibility (but not immediate real threat) of negatively impacting the **BUILDING DRY-IN** Milestone. Because these are Monitored Path, they will remain under the watchful eye of the Project Team.

### **Project Final Completion Milestone, Confidence Level**

The Project's **FINAL COMPLETION** Milestone has no Critical Paths or Watch Paths leading to it. Instead, the five Free Paths that lead to it all enjoy significant positive Total Float. Confidence in achieving this Deadline Milestone in a timely manner is quite high.



### Overall Project, Confidence Level

The following table identifies nine Deadline Milestones and shows 113 Monitored Path that are being tracked against their corresponding Finish Date Constraints. Despite 13 Critical Paths and 35 Watch Paths among the 113 Monitored Path, confidence in the Project completing on time, and the vast majority of interim deadlines being met, remains fairly high.

Date constraint	Critical Paths	Watch Paths	Free Paths	Total
Earthwork Complete	0	2	4	6
Demolition Complete	1	0	4	5
Phase I Complete	1	5	1	7
Building Dry-In Achieved	0	3	7	10
Phase II Complete	1	5	11	17
Permanent Power Achieved	2	4	6	12
Phase III Complete	2	8	14	24
Substantial Complete	6	8	15	29
Final Complete	0	0	3	3
Overall Project	13	35	65	113

### II.D: Conclusion

Abiding by Dominant Project Management recommendations, the use of a singular term, Critical Path, to represent all Activity Paths in the Schedule that are not Non-Critical is confusing, misleading, and fairly useless.

- Critical is Comparative Term:** The word Critical, as it is commonly employed, is used in a *comparative* way, thereby creating conditions where Activity Paths with *positive* Total Float may be deemed Critical, while Activity Paths with *negative* Total Float may be considered Not Critical. This is backwards!
- More than One Critical Path:** Dominant Project Management insists that there is only one Critical Path (e.g., “*the* Critical Path), even though the Schedule may contain multiple Finish Date Constraints.
- Prevailing Definitions Have Limited Relevance:** The two most predominant formulaic bases for the identification of the Critical Path (the Longest Path, and the Least Float Total Path) are both inadequate in a multi-deadline Schedule environment.
- One Starting and Finishing Activity per Schedule:** Dominant Project Management also insists that, in order to be considered a “good” Schedule, there must only be *one* starting



Activity and *one* ending Activity, despite overwhelming evidence from the field of practice that Schedules routinely incorporate multiple Date Constraints. This requirement, not to have any Open End Conditions, has encouraged the often random tying of Activities to adjacent Activities, merely to conform to this "Standard of Practice."

So, we return to the title of this paper, which is: *when is the Critical Path not the most Critical Path?* Our answer: What do you mean by "Critical?"

Until the Dominant Project Management community reaches agreement on the meaning of that one eight-letter word, Critical, we cannot answer the above, or any other, questions that concern the use of the term, Critical Path.

Until a reasonable level of global consensus is reached, one can only expect continued and increased confusion about the Critical Path Method, its processes, its work products, its conclusions, and – most of all – its professional credibility. This White Paper urges the leadership of the Project Time Management discipline, with Dominant Project Management, to commission and conduct a comprehensive study of this important topic.

Meanwhile, for its part, Cognitive Project Management recommends adoption of the Monitored Path Ranking System. This refreshing improvement over the current system offers these immediate advantages:

- Every Finish Date Constraint is being monitored; not just the last Finish Date Constraint, the one that corresponds to the final Deadline Milestone, **PROJECT COMPLETE**.
- All Activity Paths leading to each Finish Date Constraint are being monitored; not just the one with the least Total Float or the one that appears to be the longest Activity Path.
- Every Activity Path is measured and ranked according to a pre-defined scale that is equally applied to all Activity Paths in the Schedule. This provides for apples-to-apples comparisons across all Finish Date Constraints, across multiple Schedule Editions, and even across different Projects.
- Since all Activity Paths that are linked to a given Finish Date Constraint are monitored and scored statistically, it is possible to compute an Achievement Probability Value for each Deadline Milestone.
- By tracking a *set* of Achievement Probability Values for a single Finish Date Constraint, one can obtain a far better understanding regarding the effects of work progress on a given Deadline Milestone across time.
- By comparing Achievement Probability Values across Deadline Milestones, it is possible to compute an overall *Project* Achievement Probability Value.



- ❑ By comparing Achievement Probability Values across Finish Date Constraints, Project Management can easily recognize where managerial attention is most urgently needed. For instance, Project Achievement Probability Values can be compared across Projects within a Program (portfolio of Projects).
- ❑ Because Activity Path labeling is no longer subjective or comparative, Activity Path ranking will remain more stable, less fluctuating.
- ❑ Since every Activity Path will be recognized by a single Total Float value associated with it, Activities that reside on multiple Activity Paths will now be able to report the multiple Total Float values available to them.<sup>[13]</sup>

### III: Definitions of Terms Used in this White Paper

The following definitions, for technical or unusual terms used in this White Paper, are excerpted from the ICS-Dictionary. You may wish to consult the ICS-Dictionary for additional terms not defined in the following glossary.

- 🔑 **Activity:** The most basic building block of a Project Schedule, an Activity represents a discrete portion of the overall Scope of Work to be performed through Project Execution, with support from Project Administration. Resident in a CPM Network Diagram, an Activity is an artificial representation of its real life counterpart, a Project Execution Action. The dimensions of a single Activity's included Work Scope are circumscribed by the Activity Description and Activity Duration, as well as the corresponding Action's location, complexity, performers, and other limiting factors.
- 🔑 **Activity Path:** In a CPM Network Diagram, an Activity Path is a unique Series of Activities that spans from Path Start to Path Finish.
- 🔑 **Cognitive Project Management:** The ICS-Compendium advocates Cognitive Project Management as a superior alternative, designed specifically for Construction Project Management as practiced in North America. Conversely, the ICS-Compendium uses the term Dominant Project Management to refer to the broadest grouping of contemporary literature, dogma, standards, best practices, and other formal writings and teachings on Project Management topics. In a word, Dominant Project Management refers to today's "conventional wisdom" on Project Management topics.

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13 Activities have always had multiple Total Float values, but under the Dominant Project Management model, of Project Time Management, only the lowest/least Total Float has been acknowledged.



- ☛ **Critical Path:** In principle, as Dominant Project Management explains it, the Critical Path is that string of logically-tied Activities that has the greatest potential or actual influence on the timely completion of a downstream Finish Milestone. In practice, however, definitions among the most respected Project Time Management authorities differ widely on what constitutes a Critical Path.
- ☛ **Deadline Milestone:** A Deadline Milestone is an Anchored Finish Milestone that reflects a formal Project Execution Commitment to complete one or more Work Elements by a specific future date. A Substantial Completion date is an example of a Deadline Milestone.
- ☛ **Default Restriction:** A Performance Restriction in which the commencement of a Restricted Activity is constrained by the prior completion of the Restricting Activity. The extent of a Default Restriction is expressed as a Restriction Delay, an amount of Time by which the start of the Restricted Activity is constrained by the completion of the Restricting Activity. According to Cognitive Project Management, the Restriction Delay of a Default Restriction represents a passage of time. The Default Restriction corresponds to the Finish-to-Start Relationship Type of Dominant Project Management. Its Restriction Abbreviation is "FS."
- ☛ **Dominant Project Management:** The term Dominant Project Management is used throughout the ICS-Compendium to refer to the broadest grouping of contemporary literature, dogma, standards, best practices, and other formal writings and teachings on Project Management topics. In a word, Dominant Project Management refers to today's "conventional wisdom" on Project Management topics. In contrast, the ICS-Compendium advocates Cognitive Project Management as a superior alternative, designed specifically for Construction Project Management as practiced in North America.
- ☛ **Finish Date Constraint:** A Finish Date Constraint establishes the latest that an Activity can finish. The Finish Date Constraint corresponds to a Finish-No-Later-Than (FNLT) Software Setting. A Finish Date Constraint constitutes a Path Finish and, as a result, its effect is that if the Finish Date Constraint advances the Path Finish Activity (Deadline Milestone), it necessarily advances the entire Activity Path that it terminates. In the inverse, if the Finish Date Constraint recedes and allows the Path Finish Activity to finish later, the performance urgency for the entire upstream Activity Path is correspondingly eased.
- ☛ **Finish Restriction:** A Performance Restriction in which the completion of a Restricted Activity is constrained by the prior completion of its Restricting Activity. The extent of a Finish Restriction is expressed as a Restriction Delay, an amount of



## ***ICS-Compendium: Project Management Critical Thinking***

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time required by the Restricted Activity to perform the final portion of its work. According to Cognitive Project Management, the Restriction Delay of a Finish Restriction represents work performance time (contained in the duration of the Restricted Activity) — as opposed to the mere passage of time. The Finish Restriction corresponds to the Finish-to-Finish Relationship Type of Dominant Project Management. Its Restriction Abbreviation is "FF."

- ☛ **Holdback Restriction:** The Holdback Restriction corresponds to the Start-to-Finish Relationship Type of Dominant Project Management. Its Restriction Abbreviation is "SF." Throughout Dominant Project Management circles there is no consistent or universal understanding as to how this Performance Restriction works. As best as we can tell, a Holdback Restriction seems to be a hybrid combination of both a Start Restriction and a Finish Restriction. That is, in a Holdback Restriction, a final portion of the Restricted Activity cannot be performed until the Restricting Activity has both commenced and progressed to a certain extent. While Cognitive Project Management does not encourage the use of the Holdback Restriction, it provides a name for it (Holdback Restriction) in the interest of thoroughness.
- ☛ **ICS-Compendium:** A ten-volume set of books that provide a comprehensive treatment of Project Time Management for the Construction Industry. The first four volumes, further designated as the Dominant Project Management Series, fully discuss Project Time Management as currently practiced in Construction Project Management. The next four volumes, dubbed the Cognitive Project Management Series, comprehensively explain the innovations in and improvements to Project Time Management as offered by Cognitive Project Management. The final two volumes contain general reference information, including the ICS-Dictionary, and ground-breaking ICS-White Papers.
- ☛ **Open End Condition:** In a Progressively-related Network Diagram, an Open End Condition refers to a break in sequential Logic whereby a Subject Activity is either not restricted on its start by any upstream Activities or, conversely, its own finish is not restricting any downstream Activities.
- ☛ **Path Ends:** The term, Path Ends, refers to the Point of Origin and Point of Termination of an Activity Path. The two Path Ends are Path Start and Path Finish.
- ☛ **Path Finish:** In a Progressively-Related Network Diagram the term, Path Finish, refers to an Activity that marks the end of an Activity Path. To qualify as a Path Finish, an Activity must either be bound by a Finish Date Constraint or suffer an Open End Condition known as Unrestricting Finish. In an Unrestricting Finish Condition, the finish of a Subject Activity does not itself restrict any downstream



Activities.

- ☛ **Path Start:** In a Progressively-Related Network Diagram the term, Path Start, refers to an Activity that marks the beginning of an Activity Path. To qualify as a Path Start, an Activity must either be bound by a Start Date Constraint or suffer from an Open End Condition known as Unrestricted Start. In an Unrestricted Start Condition, the start of a Subject Activity is not restricted by any upstream Activities.
- ☛ **Progressive Relationship:** A Progressive Relationship exists between two Activities that are linked together by way of Performance Restrictions (and possibly additional intervening Activities). In a Progressive Relationship, the timing of a downstream Activity is or will be affected by the timely performance of one or more upstream Activities.
- ☛ **Project Administration:** One of four Project Management Domains within the Cognitive Project Management model, Project Administration provides the capacity for Project Execution, by supplying the necessary resources and operating conditions.
- ☛ **Project Execution:** One of four Project Management Domains within the Cognitive Project Management model, Project Execution is where the rubber meets the road. This is the Project Management Domain where the work of the Project is performed. The Project Executor is Cognitive Project Management's title for the role more commonly known as General Superintendent.
- ☛ **Series of Activities:** A Series of Activities is a unique arrangement of Activities in temporal progression, such that each Activity has one Restricting Activity before it and one Restricted Activity after it.
- ☛ **Start Date Constraint:** A Start Date Constraint establishes the earliest that an Activity can start. The Start Date Constraint corresponds to a Start-No-Earlier-Than (SNET) Software Setting. A Start Date Constraint constitutes a Path Start and, as a result, its effect is that if the Start Date Constraint delays the Path Start Activity, it delays the entire Activity Path, correspondingly. In the inverse, if the Start Date Constraint allows for an advanced start to the Path Start Activity, the probability of timely completion of the downstream Activity Path is correspondingly improved.
- ☛ **Start Restriction:** A Performance Restriction in which the commencement of a Restricted Activity is constrained by both (a) the commencement and (b) partial performance of a Restricting Activity. The extent of a Start Restriction is expressed as a Restriction Delay, an amount of time required by the Restricting Activity to perform an opening portion of its work as a prerequisite to commencement of the



## ***ICS-Compendium: Project Management Critical Thinking***

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Restricted Activity. According to Cognitive Project Management, the Restriction Delay of a Start Restriction represents work performance time (contained in the duration of the Restricting Activity) — as opposed to the mere passage of time. The Start Restriction corresponds to the Start-to-Start Relationship Type of Dominant Project Management. Its Restriction Abbreviation is "SS."

- ☛ **Schedule Update:** As used throughout Dominant Project Management, the term Schedule Update describes both a work product and a Project Time Management process. A Baseline Schedule, which is a virgin Project Schedule on a yet-to-be-performed Project, contains no actualized or historical data. However, once the Project has commenced, there is informational need in “updating” the Baseline Schedule to reflect any what has transpired “to date” (up to the Data Date). Captured information includes actual Work Performance, actual Work conditions, changes in Work objectives, and so forth.
- ☛ **Unrestricted Start:** An Unrestricted Start is an Open End Condition where the start of a Subject Activity is not restricted on its start by any upstream Activities.
- ☛ **Unrestricting Finish:** An Unrestricting Finish is an Open End Condition where the finish of a Subject Activity is not restricting any downstream Activities.