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Witness: Daniel F. Meyer
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MISSOURI PUBLIC SERVICE COMMISSION

CASE NO.: ER-2009-0089

REBUTTAL TESTIMONY

OF

DANIEL F. MEYER

ON BEHALF OF

KANSAS CITY POWER & LIGHT COMPANY

Kansas City, Missouri
March 2009

"[redacted]**" Designates "Highly Confidential" Information Has Been Removed Pursuant To 4 CSR 240-2.135.**

REBUTTAL TESTIMONY

OF

DANIEL F. MEYER

Case No. ER-2009-0089

Q: Please state your name and address.

A: My name is Daniel F. Meyer. My address is 30 Sequoia, Lake Forest, Illinois.

Q: And by whom are you employed?

A: Meyer Construction Consulting. My services have been retained by Schiff Hardin LLP, ("Schiff") who is a consultant for Kansas City Power & Light Company ("KCP&L").

Q: How long have you worked with Schiff?

A: Since the early 1990s.

Q: What type of work have you done with Schiff since the early 1990s?

A: Primarily cost and cost analysis work, project oversight, some scheduling work, some litigation support, all in the construction industry and primarily in the power industry.

Q: Can you briefly describe your background in the construction industry?

A: I started in the industry at the age of 15, working as a laborer and a timekeeper. I received a Bachelor of Science in Civil Engineering from Ohio University in 1968. Immediately after college I started to work with Morrison-Knudsen Company, where I was employed from 1968 through 1983. In 1979, while at Morrison-Knudsen, I attended the program for management development at the Harvard Business School. At Morrison-Knudsen, I held various positions, including working as a shift engineer up through and including Vice President of Operations for the Heavy Construction Group. From 1983 to 1985, I was employed by Perini Corporation, and served as group Vice President of

Operations. Between 1985 and 1990, I worked for Paschen Contractors as a General Vice President. Beginning in 1990 through the present, I've had my own consulting business, Meyer Construction Consulting. Since 1990, I have sat on approximately 60 dispute review boards, where my role is to allocate costs between adverse parties, primarily in the construction industry. I also provide cost and schedule consulting in the construction and power industries as well as due diligence with respect to mergers and acquisitions in the construction industry. I am also currently on the board of directors of a national real estate developer. A copy of my resume is attached as Schedule DFM-4.

Q: What is the purpose of your testimony?

A: My testimony rebuts the positions taken by Mr. Dittmer on behalf of the Hospital Intervenors, Mr. Kumar on behalf of the U.S. Department of Energy, and Mr. Featherstone on behalf of the Commission's Staff concerning the cost of the Iatan 1 project and by inference the adequacy of KCP&L's management of the project. I also speak to Staff's incorrect in implication that because the cost of the project is in excess of KCP&L's preliminary control budget, that KCP&L was imprudent in its management of the project. Specifically, I discuss: (1) the development of KCP&L's control budget for the Unit 1 environmental upgrade and the construction of Unit 2 at the Iatan Generating Station ("Iatan Project"); (2) the cost reforecast process generally and KCP&L's 2008 cost reforecast; (3) KCP&L's external reporting and project controls systems and their effect on costs of the project; and (4) the balance of plant contracting methodology employed on the Iatan Project.

RESPONSE TO TESTIMONY OF KUMAR

Q: Are you familiar with the testimony of Jatinder Kumar in this case?

A: Yes.

Q: In reviewing Mr. Kumar's testimony, is there any evidence he cites relative to an allegation of imprudence?

A: No. Mr. Kumar cites no evidence of imprudence. Instead, Mr. Kumar simply states that the Commission should investigate the details and reasonableness of the increase in costs. This statement, by itself, does not suggest, much less establish imprudence on the part of KCP&L. Furthermore, as I testify, changes to the Control Budget and the process used for updating the Control Budget throughout the course of the Iatan Project, have been transparently reported and have followed industry standards.

DEVELOPMENT OF THE CONTROL BUDGET

Q: What was your first involvement in the vetting of the Iatan Project estimate?

A: I believe it was the first week of January 2006.

Q: What was Schiff's involvement with the development of the Iatan Project estimate in early 2006?

A: From January 2006 through late-April 2006, I, along with others from Schiff met with Burns & McDonnell's chief estimator at various intervals to review aspects of the cost estimate. Schiff was attempting to vet the underlying assumptions and basis for Burns & McDonnell's cost estimate.

Q: What was the status of the Iatan Project's estimate at that time?

A: KCP&L's Owner's Engineer, Burns & McDonnell was working to develop an "indicative estimate" for the Iatan Project. At that time, the basis for Burns & McDonnell's

indicative estimate was the high-level estimate it prepared as a part of the Project Definition Report ("PDR") in August of 2004. At the point that Schiff started its review of the Iatan estimate in early 2006, Burns & McDonnell's cost estimating group was utilizing the assumptions that were embedded in the PDR to match certain changes in the Project scope definition that had become evident by that time. As an example, as Company witness Chris Giles testified, the size of the proposed Iatan 2 boiler and the heat rate were both changed between the date of the PDR and early 2006, and the cost differences of those and other such items were expressed in Burns & McDonnell's reports on the estimate. Burns & McDonnell's initial reports of progress on the Iatan Project's estimate made specific reference to the PDR and how it had evolved over time.

Q: What is an "indicative estimate"?

A: An "indicative estimate," as this term was used by KCP&L, was intended to be a very rough cost projection used for budget and planning purposes when a project is in the early stages of concept development. In essence, it is an order-of-magnitude estimate that has an accuracy of -30% to +50%. Within the industry, developing an indicative estimate is a necessary first step in the development of a reliable control estimate.

Q: Are there accepted classifications for various types of estimates?

A: There are several ways to classify an estimate. The actual terms themselves can vary from project to project, but there is an accepted progression of the level of accuracy of a cost estimate as the project scope becomes more defined. The Association for the Advancement of Cost Engineers, also known as AACE International ("AACE"), which is an organization that acts as a clearinghouse for things related to cost in the construction industry, has developed a classification system that is widely referenced. This

classification system is described in an AACE paper entitled "Cost Engineering Terminology." (Schedule DFM-1)

AACE's cost estimate classification system ("AACE's Classification System") is based upon the level of project definition. As stated in the AACE paper: "The level of project definition defines maturity, or the extent and types of input information available to the estimating process. Such inputs include project scope definition, requirements documents, specifications, project plans, drawings, calculations, lessons learned from past projects, reconnaissance data, and other information that must be developed to define the project." AACE's Classification System has five different "classes" of estimates (Class 1 through Class 5). A Class 1 estimate is based upon a fully developed project definition, while a Class 5 estimate is based on very preliminary information, is often developed quickly, and as a result, is not generally very accurate.

Although AACE's Classification System defined above describes development stages of a cost estimate for a project from a conceptual to a very detailed stage, it is commonplace and acceptable for an estimate to mature more or less quickly based on available information and project particulars. For an owner, the two most important milestones to consider in this development cycle are at the conceptual phase and at the budgetary phase. An estimate in the conceptual phase allows corporate management to evaluate the feasibility of the project and to begin to evaluate strategically how to allocate resources. Under the AACE's Classification System, this estimate could typically either be a Class 5 or a Class 4 estimate. These types of estimates are not expected to be highly accurate; rather, they provide a cost order of magnitude for a project.

The second important milestone in the estimating process is to reach a level of accuracy so as to be able to set the budget for the project. This can occur when the information for the project allows the estimate to meet the definition of Class 3. A Class 3 estimate is typically used to monitor variations to the budget until it is replaced by more detailed estimates, although it is not uncommon for an owner to stop an estimate's development at a Class 3 estimate. The accuracy band around a Class 3 estimate is -15% to +30%.

Q: Did KCP&L follow the estimate progression as proposed by AACE's Classification System?

A: Yes.

Q: What was the state of the estimate for the Iatan Project at the time of your initial review in early 2006?

A: As stated above, KCP&L was developing what it called an "indicative estimate" during the first and second quarters of 2006.

Q: How would AACE classify this indicative estimate?

A: This indicative estimate was a Class 4 estimate under AACE's Classification System. As stated by the AACE, "Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges." Acceptable uses for a Class 4 estimate include determining the feasibility of the project, aiding in an evaluation of the project's concept, strategic planning, and in obtaining preliminary budget approval.

Q: Was it appropriate for KCP&L to have an indicative estimate for the Iatan Project as of the first half of 2006?

A: Yes. At that time, the Iatan Project was continuing to evolve. Engineering was in its

beginning stages, so it is expected that the project's estimate would have a wide band of accuracy. As I previously stated, the accuracy level of an indicative estimate is somewhere between -30% to +50%.

Q: When did Burns & McDonnell present the indicative estimate for Iatan Unit 1 to KCP&L?

A: The indicative estimate was first presented by Burns & McDonnell to KCP&L on May 15, 2006.

Q: What was the amount of that estimate?

A: Approximately $337 million. However, since that the indicative estimate has an accuracy level of between -30% to +50%, this estimate actually represents a possible range between $236 million and $505 million under AACE's Classification System.

Q: What was the next evolution of the Iatan cost estimate?

A: During the third and fourth quarters of 2006, Burns & McDonnell continued to refine the Project's estimate. Included in this effort was additional analysis, including a "Probabilistic Cost Estimate" that KCP&L engaged Burns & McDonnell to perform in order to help determine the likely overall project cost. Additionally, the project team continued to work with Burns & McDonnell to vet the information that served as the basis of the estimate. Burns & McDonnell provided updated estimate amounts in September 2006 and then again October 2006 as the Project's definition became more complete.

Q: What is a Probabilistic Cost Estimate ("PCE")?

A: Within the context of the Iatan Project, and starting from the base estimate, it is a statistical analysis that evaluates a series of probabilities which then yield indications of

likely cost. In a typical PCE, which is sometimes known as a Monte Carlo estimate, the data is processed by a computer in thousands of different iterations to determine a range of likely cost outcomes. Once this analysis is complete, the results yield a list of potential outcomes that could impact the project's cost. The most likely of those outcomes can be used for additional cost analysis and to develop contingency for the project.

Q: What was the amount of the Unit 1 estimate as of October 2006?

A: The amount of the October 2006 estimate ("October 2006 Estimate") was approximately $376 million.

Q: What Class is the October 2006 Estimate under AACE's Classification System?

A: I believe that the October 2006 Estimate would be classified as somewhere between a Class 4 and a Class 3 estimate. Class 3 estimates are usually prepared when the project definition is between 10% to 40% of the full or ultimate project definition. As stated by the AACE, "Class 3 estimates are typically prepared to support full project funding requests and become the first project phase 'control estimate' against which all actual costs and resources will be monitored for variations." I did not believe that the October 2006 Estimate had yet advanced to the Class 3 level (thus allowing KCP&L to set its baseline project budget) because not all of the available information that was used as the basis estimate had been adequately vetted by either KCP&L or Burns & McDonnell.

Q: What information required detailed vetting at this time?

A: Burns & McDonnell continued to update the project estimate as KCP&L entered into major procurement contracts and also to update balance of plant bulk quantities as additional information was developed. In early September, Schiff met with Burns & McDonnell's senior cost engineer to vet the updated cost estimate. At this meeting,

Schiff proposed a list of "drill-down" cost items. Schiff presented a list of approximately 34 items that Burns & McDonnell needed to check for quantity development, man-hour parameters and associated cost. Over the next several weeks, Burns & McDonnell reconciled the 34 drill-down items to the estimate database.

Q: What was Schiff's opinion of the process used by Burns & McDonnell to develop the estimate?

A: Based upon its meetings with Burns & McDonnell, Schiff believed that the methodology used in developing the estimate generally conformed to that typically seen in the construction industry. Also, as a part of the vetting process, Burns & McDonnell provided KCP&L the resumes of those personnel contributing to the development of the estimate. Burns & McDonnell's estimators appeared to be reasonably experienced and qualified to prepare the estimate.

Q: Did Schiff have any concerns with respect to the October 2006 Estimate?

A: Yes. We had some general concerns that there were areas of the October 2006 Estimate that still needed to be vetted. Additionally, Schiff reviewed the contingency in the Iatan 1 portion of the October 2006 Estimate, which was about **[redacted]**, or only about **[redacted]** of the total Iatan 1 estimated cost. Given the fact that the estimate was based upon engineering that was only 20-25% complete and the fact that the Iatan 1 project was a retrofit, the contingency in the October 2006 Estimate appeared to be low.

Q: Did you agree with Burns & McDonnell's assessment of the quality and accuracy of the cost estimate as of that time?

A: No. As I stated above, we did not think that the base cost estimate had been fully vetted

and appropriately understood. Furthermore, Burns & McDonnell was representing the estimate to be a "Definitive Estimate;" however, the design wasn't advanced to the point that the level of accuracy rose to such a level commensurate with a Definitive Estimate as that term is generally understood and accepted in the industry.

Q: What is a "Definitive Estimate"?

A: A Definitive Estimate is generally recognized in the industry as an estimate that is based upon a design that has progressed to the point that there is little or no ambiguity remaining in that design. Such an estimate typically contains verified quantities of work, so that the estimator can apply various productivity rates and unit costs to those quantities so as to develop a complete estimate. A Definitive Estimate would typically be based upon things like complete plot plans and elevations, final piping and instrument diagrams, equipment data sheets, foundation plans, complete specifications, building lay-outs, structural drawings, site definition and design, and quantities related to the balance of plant. The AACE has defined a "Definitive Estimate" as "An estimate prepared from very defined engineering data."

Q: Does AACE still use the term Definitive Estimate?

A: No. The AACE has advised that this term has been superseded by Recommended Practice No. 17R-97 "Cost Estimate Classification System" which I have outlined above. Under the AACE's current nomenclature, a Class 2 estimate would be approximately equal to what was once called a Definitive Estimate. It is still a term that is frequently used in the industry, however.

Q: In the fall of 2006, KCP&L used the term "Definitive Estimate" and then by December, when it set the control budget estimate, it changed the term to "Control Budget Estimate." Do you know why KCP&L made this change in its terminology?

A: It was on Schiff's advice. We did not believe that KCP&L was using the Definitive Estimate term correctly, especially given the fact that the Iatan Project was only about 20% to 25% engineered as of the end of 2006. More correctly characterized, at this time KCP&L really had a Class 3 estimate or "control estimate" that it used to set the budget for the project. As a result, KCP&L renamed the estimate issued in December 2006 as the Control Budget Estimate, a more accurate term based on the estimate's current state.

Q: What happened between October 2006 and December 2006 with respect to the Estimate?

A: The project team, Schiff and Burns & McDonnell continued to vet the estimate. Additionally, in October, it was determined that the cost estimate for Unit 2 was missing a significant amount of steel quantities for the turbine generator building. Burns & McDonnell started with Iatan Unit 1's as-built quantities for commodities and then scaled-up those quantities on a numerical basis for use on Unit 2. Generally speaking, when Burns & McDonnell utilized a scale-up of the existing Unit 1 for Unit 2 on a commodity basis, the measure of that scale-up was 20% to 25% to accommodate the new unit's larger size. As a result, KCP&L told Burns & McDonnell to reevaluate the entire estimate. Burns & McDonnell subsequently re-estimated all portions of the project: (1) that had not been purchased; (2) where the scope of any particular work package was influenced by commodities and/or quantities that could be at variance with the design concept; and (3) where there may have been scope variances between the estimate and

the design.

Q: How did Unit 1's cost estimate change from October to December 2006.

A: There was no change. Schiff and KCP&L were able to further vet the numbers to confirm that the estimate was a "Class 3" estimate, meaning that the budget for Unit 1 could be established.

Q: When was the estimate presented to the Executive Oversight Committee ("EOC")?

A: The estimate was presented to the EOC in November 2006 as the "Control Budget Estimate." It was approved by the Board of Directors in December 2006.

Q: What was the amount of that estimate?

A: Approximately $376 million.

Q: How accurate was that estimate?

A: As a Class 3 estimate, it had an accuracy level within the range of -15% to +30%.

Q: Would this estimate have been considered to be a Definitive Estimate as this term is commonly used in the industry?

A: No.

Q: Would it have been possible to have a Definitive Estimate for the Iatan Project by the end of 2006?

A: No. The design for the Iatan Project had not matured to a point to allow a Definitive Estimate until much later. Ultimately, the project team was able to refine the estimate through a reforecasting process that I will describe later, that achieved an estimate with a much higher level of accuracy in May 2008.

Q: Was it appropriate for KCP&L to set its budget in 2006 based upon an estimate with this level of accuracy?

A: Yes.

Q: How did you determine the maturity of the December 2006 estimate?

A: Schiff looked at several things in the December 2006 estimate. We looked at the pedigree of the original Burns & McDonnell estimate and, the various estimates that they had put together up to that time. We reviewed Burns & McDonnell's PCE analysis. We also reviewed the status of quantities that were available based upon the design status as it existed at that point in time.

Q: Approximately what percent of the Iatan 1 project was procured as of December 2006?

A: Approximately 70-80 percent. Most of the scope that had already been purchased for Iatan 1 was captured in the ALSTOM contract for the AQCS and SCR.

Q: Was it expected that the Control Budget Estimate would be revisited in the future?

A: Yes. From a cost management perspective, it is good practice to examine and update estimates and reforecast costs. In its simplest sense, a cost reforecast is an exercise that parties in the industry go through at some logical point in the project to revisit the budget and the efficacy of the budget amounts. As stated in The Comprehensive Energy Plan Construction Projects Cost Control System ("Cost Control System"), KCP&L was committed to continually monitoring the accumulation of actual costs compared to the Control Budget so as to determine if the initial assumptions in the project definition are still valid. Based upon this analysis, the project team would then prepare a new forecasted estimate at completion ("EAC").

THE COST REFORECAST

Q: Is there an authority that you would cite supporting the practice of reforecasting a project estimate?

A: It is a widespread industry practice to periodically reforecast project cost and those who fail to do so are generally regarded as imprudent. In supporting this opinion, I offer an article by John Rowe entitled "Construction Cost Contingency Tracking System." In this article, Mr. Rowe touches on the general subject matter of cost reforecasting and contingency drawdown. (Schedule DFM-2)

Q: Why would an owner reforecast its budget for a project?

A: Owners on multi-year projects need to review costs and cost trends to test whether original assumptions hold true over time. In the context of Iatan, which is a fast-track project, the budget was set before the completion of the design. As the design progressed toward completion, quantities and the scope of work became more defined and fixed. As that occurs, it is not unusual to have changes in cost. Thus, a cost reforecasting effort is necessary to revisit a budget for adequately including the cost trends that may have developed since the control budget was established.

Q: Do you recall at what point the Control Budget Estimate was revisited by KCP&L?

A: By the second quarter of 2007, it had become clear to the project team that the Unit 1 estimate required reforecasting. And that was brought to the attention of the EOC by the project team through some various "Risk and Opportunity" analyses that they had conducted by that time. Starting on June 15, 2007, the project team identified in its Iatan Status report that, "Iatan 1 may go over the allotted contingency depending on the outcome of potential drawdowns."

Q What were the Risk and Opportunity analyses that the project team generated?

A: During the course of the project, the project team members would identify areas of risk to the project that could potentially result in a draw on the project's contingency. The project team would also look for areas of opportunities to allow the project to save money. These risks and opportunities were tracked by the KCP&L Project Controls group.

Q: Who typically prepared the documents upon which the R&Os were based?

A: The majority of the R&Os were developed by KCP&L's lead engineers, though others on the project team also developed R&Os.

Q: Was there similar documentation for every R&O item on the project?

A: Yes.

Q: At what point did the KCP&L project team begin its reforecast of the Unit 1 budget?

A: In its most embryonic form, the reforecasting effort began in July of 2007 with initial work on the R&Os. The project team began assembling and tracking the information on which R&Os were written. As stated above, it appeared that Iatan 1's project's costs might well exceed the total of base amounts plus contingency.

Q: Why did the project team launch its cost reforecast effort in the Summer of 2007?

A: Shortly after the Control Budget Estimate was adopted in December 2006, Kiewit provided a proposal for the remaining balance of plant work which resulted in a series of vetting activities and presentations by Kiewit that stretched from April 16, 2007 to the end of third quarter of 2007. Because the majority of the work that had not yet been contracted on the project was contained in Kiewit's proposal, vetting of Kiewit's estimate

was tantamount to the vetting that one would perform in a cost reforecasting extract.

Q: When did the project team conclude its vetting of the Kiewit estimate?

A: The Kiewit estimate had been fully vetted by the end of September of 2007 and was used as a basis for Kiewit's contract, which was issued in early November of 2007. The cost reforecast for the remainder of the Iatan Project work came as a natural outgrowth of the Kiewit estimate vetting, and led the project team and Schiff to examine a number of other factors in the current cost estimate.

Q: What were some of those factors?

A: With respect to quantity, there was not a full agreement between Kiewit's electrical and mechanical quantities and those that Burns & McDonnell had derived in its design model. This issue required reconciliation.

Q: What happened next?

A: KCP&L initiated a full reforecast of the Unit 1 and 2 cost estimate in November 2007. Members of the KCP&L project controls team and Schiff engaged in a series of meetings with KCP&L's lead engineers to discuss the data that was required for developing a reasonable cost projection and the standards for documentation necessary to characterize the forecast as reasonably vetted.

Q: Was there a process created for the cost reforecast?

A: Yes, there was.

Q: And who created that process?

A: The KCP&L project controls group.

Q: Please describe the project cost reforecast process.

A: The cost reforecast process is described in the flow chart attached as Schedule DFM-3.

Basically, the process is described in five steps: (1) collect the input data that can drive cost; (2) prepare the preliminary cost forecast itself; (3) vet the cost forecast with the project's leadership team to assure buy-in of the prior two steps; (4) finally vet those costs with KCP&L's senior management; and (5) externally communicate the result.

Q: Did the Iatan Project team utilize this project cost reforecast process in performing the activities that are on the process diagram itself?

A: Yes.

Q: In your opinion, is the process described in the project cost reforecast process in keeping with industry practice?

A: Yes, it is. You might observe some other business entity using a slightly different name, but the process described generally conforms to the typical industry process for cost reforecasting.

Q: During the process of the Iatan Project's cost reforecast, was there a time that you and other members of the KCP&L staff met with the Staff of the Missouri Public Service Commission ("MPSC Staff") and other parties to the Regulatory Plan?

A: Yes. I met with the MPSC Staff and other parties to KCP&L's Regulatory Plan on March 12, 2008.

Q: Who was present at the meeting from KCP&L?

A: Company witnesses Bill Downey, Brent Davis, Kenneth Roberts and Chris Giles, the general counsel for KCP&L, Bill Riggins, and the project controls director for the Iatan Project, Terry Foster, among others.

Q: What did you present or comment upon at that meeting?

A: I mostly answered questions from the MPSC Staff, though I did help explain the cost

reforecasting flow chart discussed above, as well as describe standard practices in the industry applicable to cost reforecasting efforts.

Q: To your recollection, what was the focus of your presentation to the MPSC Staff and other parties in March 2008?

A: For the most part, the discussion in the meeting centered upon answering the MPSC Staff's questions regarding why KCP&L's reforecasted cost projection had not been completed and announced to the public by that date. I explained at that time that the process was in the "left side" of the flow chart, *i.e.,* the project team was still trying to gather information. I noted that until the information is gathered and the analysis and vetting completed, and the reanalysis that inevitably results from the vetting is also completed, it is not possible to offer up a number that would have any reasonable meaning.

Q: Was KCP&L's cost reforecast completed by March 12, 2008?

A: No, it was not complete at that time.

Q: As of March 12, 2008, what were the major activities that remained to be completed?

A: At that time, based on the process flow chart, the process was in "Prepare Preliminary Cost Reforecast" which had started January 23, 2008 with a projected finish of April 21, 2008. Therefore, the process was about halfway completed, and no vetting had occurred as yet.

Q: What were the major events that occurred after January 23, 2008 through April 21, 2008 that impacted the cost reforecast?

A: The two major events that drove the cost reforecast more than anything else were the

Tiger Team schedule reanalysis and the facilitation of commercial disputes with ALSTOM. Company witnesses William Downey and Kenneth Roberts testified as to both of these events.

Q: **By April 21, 2008, had all of the data necessary for review by the leadership team had been assembled?**

A: The information had been assembled but not fully vetted. The next step in the process was the vetting of that information by the leadership team.

Q: **Who was on the leadership team for the project at that time?**

A: Terry Foster, Steve Easley, Brent Davis, Steve Jones, Mike Hermsen and Denise Schumacher comprised the "Leadership Team."

Q: **How was that vetting done?**

A: That vetting was done in a round-table fashion. The Leadership Team members reviewed each item and the associated backup individually. The various analyses were prepared, reduced to writing and the Leadership Team was given the opportunity to voice its disagreement or its agreement.

Q: **How long did the vetting period last?**

A: Approximately a week.

Q: **At what point were the results of the cost reforecast presented to KCP&L's senior management?**

A: The results were presented in two phases. On April 25, 2008, the KCP&L project team presented its breakdown of the reforecasted budget to the EOC and to KCP&L's Chairman Mr. Chesser. The following week, on May 5, 2008, Schiff made its presentation to the same members of the EOC.

Q: Describe the process that Schiff used for final vetting of KCP&L's reforecasted Control Budget that was presented on April 25, 2008.

A: Schiff reviewed all aspects of the cost reforecast that the KCP&L project team had assembled, including the R&Os, change orders and allocations for remaining change orders, as well as the underlying documentation. We also performed a very detailed analysis with respect to what we felt would be reasonable to include in the forecast in terms of resolving both known and potential future disputes with the major contractors. We looked at the contingency amount, and we vetted the analysis performed by the project team. For each of the line items in the budget that had a new reforecasted amount, we established a "low," "high" and "use" number and totaling these three columns established a range from which we could judge the accuracy of the estimated items and ultimately gauge contingency. We concluded our review with an analysis of the contingency by looking at the reforecasted estimate in total and determining whether the contingency was sufficient to cover the remaining risks on the Project.

Q: Were there areas or specific line items in the Control Budget where your analysis yielded a different result than that of the KCP&L project team?

A: Yes, though you would expect that a separate vetting exercise would yield a different result. Where we disagreed, Schiff identified recommendations regarding adjustments that the project team could make if it chose to do so.

Q: What were the major elements that Schiff looked at in the vetting of the Iatan reforecasted estimate?

A: Our starting point was the last forecast and the assumptions that were used for its creation. We then looked at R&O items as a group of line items as well as individual

R&O items, and considered the trends that had been established on the Iatan Project thus far for scope changes. We also reviewed: (1) the current procurement status; (2) contractually-based potential bonuses for major contractors and Burns & McDonnell; and (3) potential future change orders and scope additions.

We also spent a considerable amount of time analyzing the contingency, which we grouped into three categories:

- Category 1 contingency was unique contractor cost additions, and the unique contractors were Kiewit, ALSTOM, and ASI. For Kiewit, the items reviewed included: materials; potential schedule compression; escalation; and the potential for subsistence payments, among other items. For ALSTOM, the Category 1 items included: a claim that it had made against KCP&L which we analyzed; and certain unique cost additions.
- Category 2 contingency consisted primarily of change orders. We analyzed each of the awarded construction contracts and the change orders associated with those. We also reviewed indirect contracts and design engineering, and examined the potential for cost increases for those two items.
- Category 3 contingency was basically unallocated, and that was made after full recognition of the level of detail, the veracity of the cost and the balance of the cost forecast. On the basis of this overall review, we derived an amount of what we believed was a reasonable amount of unallocated contingency for the Iatan Project.

Q: What was the total reforecasted amount for Iatan 1?

A: Approximately $484 million, excluding AFUDC. This number represents the entire construction cost, without regard to KCP&L's ownership percentage or jurisdiction.

Q: What level of accuracy is the reforecasted Unit 1 estimate?

A: I believe this was a Class 1 estimate. This is the estimate that I would consider to be a "Definitive Estimate" as that term is used and understood in the industry, and should be within a range of -10 to +15 percent.

Q: Why did the Control Budget Estimate increase from late 2006 to May 2008?

A: The main changes between the original Control Budget Estimate and the reforecasted Control Budget Estimate were due to: (1) design maturation; (2) pricing changes; and (3) plant optimization.

Q: What is design maturation?

A: On day one of the Iatan Project there was no design. Design of a project has to start somewhere, and it evolves over time. When the budget was established is December of 2006, the engineering completion was in the 20 percent range. As the Project's design further matured, an outgrowth of that is a different configuration with respect to certain aspects and thus different quantities resulted. As an example, quantities of electrical cable changed as the Project's design matured, and these changes are reflected in the difference in cost from 2006 to 2008.

Q: Why did changes to the Project's pricing occur?

A: In the construction industry material and equipment price escalations are not always predictable. Often the best you can do is make an educated guess, particularly in a heated market where scarcity of resources was a major issue. In addition, some of the Iatan

Project's suppliers included pricing escalation as part of their base contract, so that if prices increased, KCP&L was responsible for the difference. An example is the chimney liner, which is made from an alloy that escalated significantly in cost from the time KCP&L contracted with Pullman until the point Pullman purchased these materials.

Q: What are budgetary changes due to plant optimization?

A: As design matures and the project's scope is more in focus, owners often take the opportunity to maximize the overall performance of a project. In the case of Iatan 1, KCP&L chose to make logical additions to the scope for added platforms and stair towers that will aid the safe operation of the unit in the future.

Q: What were the most significant changes in scope to the Iatan 1 Project that were identified in the Iatan 1 Control Budget as a result of the reforecast in May 2008?

A: One scope addition was to add surface area to the existing Unit 1 economizer, to reduce the exit gas temperature into the new Unit 1 SCR. Another change that was required was the added cost for the substantial beef-up of the foundations beneath the existing Unit 1 air heater to accommodate additional structural loads that ALSTOM required in its ductwork from the economizer into the SCR. Other examples of scope adds include the dry flight conveyor and the rehabilitation of the existing coal yard and the Digital Control System.

Q: What was the additional cost of Iatan 1's new scope of the specific items referenced?

A: The additional cost was approximately **[redacted]**.

EXTERNAL REPORTING OF PROJECT COSTS

Q: Are you familiar with the cost portfolio that KCP&L was using for tracking the Iatan Project?

A: Yes.

Q: What is your opinion of KCP&L's cost portfolio?

A: The cost portfolio that KCP&L uses is often called a "cost reporting system." The cost portfolio contains the cost reporting information that is consistent with the industry at large. The cost portfolio is a summary level document, and it tracks all of the costs on the Project. The cost portfolio identifies major line items of work being done by the Iatan Project's various contractors and vendors. The information in the cost portfolio is tracked and updated; it has an actual cost tracking section of the report in which awarded costs, approved change orders, and commitments are tracked; and, it has a section that is allocated to the current cost reforecast. Viewed against what one would expect to see in the industry at large, the KCP&L cost portfolio contains the type of information that industry management generally uses on projects such as the Iatan Project.

Q: Are you familiar with KCP&L's Cost Control System?

A: Yes. In fact, I assisted with its preparation.

Q: Does KCP&L's Cost Control System conform to the standard in the industry?

A: Yes.

Q: Is the cost portfolio in conformance with KCP&L's cost control system document that was prepared in July of 2006?

A: Yes.

Q: Do you believe that the cost portfolio provides senior management with enough information upon which to make reasonable decisions relative to costs on the Iatan Project?

A: Yes. With the types of decisions that KCP&L's senior management is making, the necessary information is available, and to the extent that any particular decision might require additional information, that too is readily available.

Q: Are you aware of the method that the project team has used for informing the MPSC Staff of the cost of the Iatan 1 Project?

A: I have a general understanding that on a quarterly basis, KCP&L provides a written report to the MPSC Staff attaching an exhibit containing a snapshot of the Project's costs. This cost exhibit is consistent with the documentation that I see on a regular basis as I track costs on the Iatan Project. I also believe that the same or similar information is provided to KCP&L's partners for their monthly review of the Project's costs.

Q: What other information was provided to the MPSC on a quarterly basis relative to costs?

A: To my knowledge, the MPSC Staff also receives summary-level reports from the cost portfolio, as well as textual descriptions of events that bear on the Iatan Project's costs.

Q: In your opinion, has KCP&L provided the MPSC Staff with sufficient information on an ongoing basis regarding the costs for Iatan 1 for the MPSC Staff to understand the basis for the changes to the Control Budget Estimate?

A: Yes.

BALANCE OF PLANT CONTRACTING METHOD

Q: How would you define balance of plant work in the context of the Iatan Project?

A: On Unit 1, the balance of plant work would be all work exclusive of the Unit 1 work contained in ALSTOM's contract for the SCR and AQCS.

Q: What is a multi-prime contracting format?

A: A multi-prime contract format involves an owner retaining several separate contractors to perform various portions of the work. The owner either functions as the manager of the entire project or hires another contractor to do so. If the owner is the construction manager, the owner is responsible for all the coordination and has general management responsibilities associated with the site and the individual prime contractors.

Q: Are there certain risks that are inherent to multi-prime contracting?

A: Yes. The risk of coordination and construction management fall solely on the owner.

Q: In your opinion, in a multi-prime project where the owner acts as the construction manager, what is the likelihood that productivity issues could affect ultimate project costs and schedule?

A: It is more likely that productivity issues could affect the project costs and schedule under a multi-prime contract than where there is a single general contractor for several reasons. First, there are many competing contractors each using the same local labor pool, and those entities do not have to answer to one another. They are independent, they are not always consistent regarding how each entity addresses compensation, safety and scheduling, and this could result in a potential labor problem on the job. If there is a labor productivity issue on the project, a multi-prime site arrangement increases the risk because the project is subject to the varies of multiple parties' individual interests.

Nevertheless, an owner can control a multi-prime project through effective project management.

Q: Was KCP&L's senior management aware of these risks?

A: Yes. Schiff presented both the pros and cons of the multi-prime approach. In addition to the concerns discussed above, Schiff raised as an issue KCP&L's ability to assemble an adequate management staff to execute the Iatan Project in a multi-prime setting. Because KCP&L had been out of the power plant construction business for a long time, it did not have an experienced staff. Schiff discussed how difficult it would be for KCP&L to pull together an adequate management staff.

Q: Was part of the contingency in the original Control Budget Estimate developed to account for the risk of KCP&L managing a multi-prime work site itself?

A: Yes, that risk element was considered and included.

KIEWIT PROPOSAL FOR BALANCE OF PLANT WORK

Q: At what point did KCP&L become aware of Kiewit Industrial Construction's interest in the Iatan Project?

A: Kiewit unexpectedly contacted KCP&L in December 2006 regarding the balance of plant work for the Iatan Project.

Q: In what way was Kiewit's contact unexpected?

A: As Company witness Steven Jones testified, in the spring of 2006, KCP&L surveyed the balance of plant construction market, and determined that there was essentially no interest. The contractors with the ability to handle the balance of plant work had sufficient work back logs, and they were very busy in executing that work, thus they had little or no interest in bidding the Iatan work. KCP&L's market survey included Kiewit

who denied interest in the project at that time. Accordingly, when Kiewit approached KCP&L in December 2006, for the above reasons it was rather unexpected.

Q: Who were Kiewit's competitors in the utility construction industry?

A: Kiewit's competition includes Bechtel, Washington Group, Shaw and Black & Veatch.

Q: Do you know why KCP&L chose not to bid the balance of plant work in early 2007?

A: Company witness Steve Jones testified that KCP&L tried to find bidders, but the potential contractors declined interest just as they had during the market survey. In addition, to the time necessary to competitively bid the balance of plant work, on a Design-Bid-Build basis would most likely have required another 10 to 12 months. Due to KCP&L's belief that it was going to perform the balance of plant work on a multi-prime basis, the bid documents for the work had not yet been fully prepared. Therefore, additional time would have been required to prepare the drawings, prepare the specifications, issue a Request for Proposal, evaluate the bids and award the work.

Q: Had KCP&L chosen to competitively bid the balance of plant work at an earlier time, could the 10-12 month delay been avoided?

A: No, I don't think so. Engineering work takes time and there is little that can be done to compress it. Also, KCP&L was in the process of continually gathering market information, so in late 2006, as I testified to earlier, the entire construction market was overheated. One of the results of an overheated construction market is that companies build a large backlog of work. So KCP&L knew that it was a very thin market out there, and had it gone through the expense in an attempt to jump start the engineering for the balance of plant, it would have suffered on other fronts, namely, a shortage of bidders.

Q: Prior to its involvement with the Iatan Project, were you familiar with Kiewit and

its subsidiaries?

A: Yes. Kiewit is a Midwestern based company that is well known nationally and internationally within the construction industry.

Q: What is your opinion of Kiewit?

A: Kiewit is a very good company with a solid reputation. I have served on dispute review boards on Kiewit related projects.

Q: Do you know why Kiewit was suddenly interested in the work on the Iatan Project?

A: It is my understanding that Kiewit told KCP&L it had another powerhouse project that had been placed on hold, and the Iatan Project's timing was such that Kiewit saw it as an opportunity to put that crew to work. Company witness William Downey's rebuttal testimony describes the initial discussions with representatives from Kiewit at this time.

Q: At that time, what work was under contract for balance of plant for the Iatan Project?

A: The foundation and substructures and various general site work contracts as well as the engineered materials that had been purchased as of that time.

Q: Do you recall what Kiewit proposed for the Iatan Project?

A: On April 13, 2006, Kiewit submitted a price to KCP&L in the amount of about **[redacted]** That price included approximately **[redacted]** of work that KCP&L had already planned to procure, such as specialized equipment and services. Once that number was removed, Kiewit's proposal was approximately **[redacted]** for the balance of plant construction work.

Q: What presentations did Kiewit make to KCP&L senior management?

A: Kiewit made a series of presentations. As I recall, the first one was on April 16, 2007.

After Kiewit submitted its initial price in April of 2007, KCP&L, with help from Schiff began a vetting and estimate review process that continued through September of 2007. Kiewit was on the Project site performing walk-downs, and its team developed independent quantity estimates, and continually refined their estimate. One attractive part of Kiewit's proposal was that Kiewit performed internal cost estimates using its different internal operating groups. As a result, KCP&L felt it was receiving the benefit of competitive and check estimates provided by those different operating groups.

Q: What risks did Kiewit identify with the Iatan Project in its initial proposal?

A: Kiewit identified labor productivity, labor availability, schedule, and work quantities as major risks. One labor risk in particular that Kiewit identified was the potential of what we called a "CB4 affect" on the Iatan Project.

Q: What is CB4?

A: "CB4" is Council Bluffs Unit 4, which is a new coal fired project that was being built at that time in Council Bluffs, Iowa. It is general knowledge within the industry that CB4 suffered from run-away cost resulting primarily from low labor productivities. KCP&L was concerned about the effect of labor productivity on the Iatan Project.

Q: When was the CB4 project built?

A: My understanding is construction stretched from approximately 2005 to the end of last year, 2008.

Q: What is the proximity of CB4 to the Iatan Project?

A: It's within several hundred miles of the Iatan Project, but more importantly, the CB4 project drew from the same labor pool from which Iatan was drawing its craft workers. The project team, through Burns & McDonnell, had commissioned a labor analysis from

Schumacher Consulting, LLC, who in February 2006 produced the first in a series of reports. That initial 2006 report contained information regarding all competing projects in the midwest.

Q: What is Schumacher Consulting, LLC ("Schumacher")?

A: Schumacher is a consulting firm that specializes in analysis of construction labor. It was hired as a sub-consultant to Burns & McDonnell in early 2006.

Q: What were the issues addressed in Schumacher's 2006 report?

A: Schumacher raised a number of issues. We found Schumacher's comments to be most valuable in a section addressing "best practices." In that section, Schumacher discussed the critical factors impacting labor including detailed planning, timely delivery of materials and equipment, minimization of engineering changes, timely delivery of engineering drawings, contractor control of site labor, safety and quality. **[redacted]**.

This report also had a section entitled "manpower" in which Schumacher stated that the ability to attract skilled labor for the Iatan Project would be governed by the number of shifts that were worked because that represents premium money to the trades. Schumacher recommended **[redacted]**.

Q: Were any of Schumacher's conclusions used to formulate any portion of the control budget estimate in late 2006?

A: Yes. Schumacher's report influenced the estimating of the potential impact of labor productivity issues, as well as subsidy cost, daily per diems and other craft-related incentives.

Q: How did Kiewit's participation in the Iatan Project offset some of the labor risks that were being discussed in early 2007?

A: Kiewit's presence was able to offset or at least compensate for some of the things that Schumacher had pointed out in his report. Some of Schumacher's "best practices" are the very things that Kiewit is known for and for which it has a demonstrated track record in the industry and include: (1) detailed planning and scheduling—Kiewit is known for planning and in its specific proposal for the Iatan Project discussed at length the process it undertakes using "work packs" and daily work scripts for craft to maximize productivity; (2) Minimizing engineering changes—Kiewit's plan for the Iatan Project included measures to insure that engineering drawings are done timely and correctly; (3) Labor management—Kiewit is known for its ability to manage and get along with labor. Nationwide, Kiewit probably employs in excess of 60,000 craft people, so Kiewit is a significant labor market player. The unions know Kiewit and Kiewit knows the unions, so in regard to handling some of the issues looming at Iatan, Kiewit seemed to be a solution for mitigating the labor risks described in Schumacher's labor study.

Q: How did KCP&L vet Kiewit's estimate?

A: One of the goals in vetting the Kiewit estimate was to reconcile Kiewit's price with KCP&L's budget for the balance of plant work. As I indicated earlier, one of the reasons

for doing this was to confirm KCP&L's budget and the assumptions (*i.e.*, quantities) behind the budget estimate.

There were several meetings with Kiewit in regard to all aspects of their estimate. Subjects of discussion included clarifying the apparent differences between Kiewit's view of the electrical work scope and Burns & McDonnell's. Considerable time was spent on the issue of work quantities, and KCP&L had a series of meetings with Kiewit to reconcile the quantities that Kiewit had carried in its Iatan estimate with: (1) Kiewit's historical experience on other projects as factored into the quantities that were used at Iatan; and (2) the quantity information that KCP&L had received from Burns & McDonnell. KCP&L expended a great deal of effort over many months to get quantities vetted, reconciled and generally to the point that there was confidence in Kiewit's estimate.

Q: What was the result of the vetting of Kiewit's estimate?

A: KCP&L and Kiewit came to a mutual understanding and agreement on most of the quantity issues. As a further result of the vetting process, Kiewit adjusted its proposal, which ultimately pegged the cost of its work at about **[redacted]**

Q: What is the compensation structure in the contract between KCP&L and Kiewit?

A: The form of the Kiewit agreement is in essence a unit price contract with fixed fee. **[redacted]**

Q: How did Kiewit's price compare the KCP&L's budget for the Iatan Project as a whole?

A: Kiewit's price, which was tendered in April 2007, was roughly ** [redacted] ** than KCP&L's budget for the uncontracted balance of plant work. As a result, KCP&L evaluated its contingency related to the balance of plant work. The analysis found that there were items in the contingency which were derivative of the risks that Kiewit would be mitigating, and those contingency items were allocated to offset Kiewit's estimate.

Q: From that analysis, how much of the Iatan Project's contingency was derivative of Kiewit's estimate?

A: The portion of the contingency in the Control Budget Estimate of December 2006 which was allocated to Kiewit's work was ** [redacted] ** for the Iatan Project (Units 1 and 2). That more than balanced out the difference between Kiewit's price and KCP&L's budgeted price. There were also other potential savings that could be realized when comparing the Control Budget Estimate to the Kiewit estimate, including: (1) Kiewit had a different methodology of performing the barge facility work than what was embedded in the Control Budget Estimate; (2) KCP&L would be able to reduce its internal management expenses by approximately ** [redacted] ** from the staffing level necessary to manage a multi-prime; and (3) Kiewit had tendered some value engineering concepts for other scopes that had the potential of saving approximately ** [redacted] **

Q: What was Schiff's assessment of the value of the Kiewit proposal for the Iatan Project?

A: Schiff's view was that Kiewit's proposal and participation in the Iatan Project would significantly reduce the risk of performance of the balance of plant work. Schiff's view was shaped by: (1) Kiewit's demonstrated track record and expertise in the industry;

(2) Kiewit had a project management team available who was ready to hit the ground running; (3) Kiewit also had a track record of working with Burns & McDonnell on other projects; (4) Kiewit's plan to co-locate with Burns & McDonnell provided an opportunity to perform constructability reviews as engineering was being prepared; and (5) Kiewit is known throughout the industry as having good safety and quality programs, both of which result in lower project cost; (6) Kiewit had management expertise that would likely optimize its schedule adherence.

Q: Did KCP&L's senior management agree to contract with Kiewit based on its proposal and estimate?

A: Yes.

Q: Does that conclude your testimony?

A: Yes.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Kansas City Power & Light Company to Modify Its Tariff to Continue the Implementation of Its Regulatory Plan	)))	Case No. ER-2009-0089

AFFIDAVIT OF DANIEL F. MEYER

STATE OF ILLINOIS)
) ss
COOK COUNTY)

Daniel F. Meyer being first duly sworn on his oath, states:

1. My name is Daniel F. Meyer. I work for Meyer Construction Consulting.

2. Attached hereto and made a part hereof for all purposes is my Rebuttal Testimony on behalf of Kansas City Power & Light Company consisting of Thirty-five (35) pages, having been prepared in written form for introduction into evidence in the above-captioned docket.

3. I have knowledge of the matters set forth therein. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded, including any attachments thereto, are true and accurate to the best of my knowledge, information and belief.

Daniel F. Meyer

Subscribed and sworn before me this 11th day of March 2009.

Notary Public

My commission expires: 3/28/2010

"OFFICIAL SEAL"
Linda A. Kelly
Notary Public, State of Illinois
My Commission Exp. 03/28/2010

AACE International Recommended Practice No. 10S-90

COST ENGINEERING TERMINOLOGY

TCM Framework: General Reference

COST ENGINEERING TERMINOLOGY

TCM Framework: General Reference

January 26, 2009

Unless otherwise noted, all terms contained in this document have been developed by various AACE International technical committees, special interest groups, or project teams. All terms have been subject to a thorough review process, followed by approval by the AACE International Technical Board. Portions of this document have been incorporated into the American National Standards Institute's (ANSI) Standard No. Z94.x.

The **(mm/yy)** at the end of each definition, indicates the date adopted/revised.

ACCELERATION – Conduct by the owner or its agent (either in a directed or constructive manner) in which a contractor is required to complete performance of a contracted scope of work earlier than scheduled. A directed acceleration occurs when the owner formally directs such acceleration completion. A constructive acceleration generally occurs when a contractor is entitled to an excusable delay; the contractor requests a time extension from the owner; the owner declines to grant a time extension or grants one in an untimely manner; the owner or its agent either expressly orders completion within the original performance period or implies in a clear manner that timely completion within the original performance period is expected; and the contractor gives notice to the owner or its agent that the contractor considers this action an acceleration order. (6/07)

ACCEPT / ACCEPTANCE –
(1) The formal process of accepting delivery of a product or a deliverable.
(2) The act of taking custody based on satisfactory verification.
(3) The act of an authorized representative, for itself or as agent for another, assumes ownership of existing identified supplies tendered or approves specific services rendered as partial or complete performance of the contract. (6/07)

ACCEPTANCE, FINAL (PARTIAL) – The formal action by the owner accepting the work (or a specified part thereof), following written notice from the engineer that the work (or specified part thereof) has been completed and is acceptable subject to the provisions of the contract regarding acceptance. (11/90)

ACCEPTANCE CRITERIA – Implicit or explicit specifications that must be achieved for a product or service to be acceptable within the terms of the contract or agreement seeking its delivery. (8/07)

ACCESS TO THE WORK – The right of the contractor to ingress and egress, and to occupy the work site as required to reasonably perform the work described in the contract documents. An example of denial of access to the work would be on the segment of a sewer installation project where no easements or work limits are indicated, but the contractor is ordered, after contract award, to conduct operations within a narrow work corridor necessitating different or unanticipated construction methods (e.g., use of sheeting). (11/90)

ACCOUNTABILITY – Answerable, but not necessarily charged personally with doing the work. Accountability cannot be delegated but it can be shared. (11/90)

ACCOUNT CODE STRUCTURE – System used to assign summary numbers to elements of the work breakdown and account numbers to individual work packages. (11/90)

ACCOUNT NUMBER – An alphanumeric identification of a work package. An account number may be assigned to one or more activities. (6/07)

ACCOUNTS PAYABLE – The value of goods and services rendered on which payment has not yet been made. See: TAXES PAYABLE. (11/90)

ACCOUNTS RECEIVABLE – The value of goods shipped or services rendered to a customer on which payment has not yet been received. Usually includes an allowance for bad debts. (11/90)

ACTION – A measure taken or implemented that is intended to influence the course of the project. (6/07)

ACTION ITEM – Something agreed to be done as a meeting outcome and usually recorded in meeting minutes. (6/07)

ACTION PLAN–- A plan that describes what needs to be done and by when. Project plans are action plans. (6/07)

ACTIVITY – An operation or process consuming time and possibly resources (with the exception of dummy activities). 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. See: TASK. (6/07)

ACTIVITY ATTRIBUTES – Schedule-related characteristics and designations that uniquely describe a network activity. Attributes can include early and late start and finish dates; identification codes; resource assignments; predecessor and successor activities; and any other information that places the activity into accurate context of its place in the activity network. (8/07)

ACTIVITY BAR – A rectangle representing an activity on the bar chart. Its length is scaled according to the time scale. See: EARLY BAR. (6/07)

ACTIVITY CALENDAR – In computer scheduling, calendar that defines the working and non-working patterns applicable to an activity. The activity calendar is normally overridden by the project calendar. See: RESOURCE CALENDAR. (6/07)

ACTIVITY CODE – Alphanumeric designation system, with code(s) assigned to an activity to group or categorize its properties. Coding is used for detail and summary reporting purposes. Syn.: ACTIVITY IDENTIFIER. See: CODING; WORK BREAKDOWN STRUCTURE (WBS). (6/07)

ACTIVITY COST – The monetary amount expended to complete an activity. Depending upon the cost model and job cost system used, Activity cost may or may not include indirect costs (jobsite and home office) as well as direct costs. (6/07)

ACTIVITY DESCRIPTION – A unique activity name and word description, which generally defines the work to be accomplished which easily identifies an activity to any recipient of the schedule. (6/07)

ACTIVITY DEFINITION – Process of identifying specific activities that must be performed to produce project deliverables. [8] (6/07)

ACTIVITY DURATION –
(1) Length of time from start to finish of an activity, estimated or actual, in working or calendar time units.
(2) Best estimate of continuous time (hours, days, weeks, and months) needed to complete the work involved in an activity. This takes into consideration the nature of the work, and the resources needed to complete the task. Baseline activity duration development can become very complex when productivity impacts and nonstandard production rates must be utilized to meet the constraints of the project. See: DURATION. (6/07)

ACTIVITY DURATION ESTIMATING – Estimation of the number of work periods that will be needed to complete the activity. (6/07)

ACTIVITY IDENTIFIER – See: ACTIVITY CODE. (11/90)

ACTIVITY LIST – A table of scheduled activities listing their respective descriptions, unique identification codes, sufficiently detailed scopes, and predecessor and successor activities, so that the project team can readily discern the work of each activity and the project as a whole. (8/07)

ACTIVITY NUMBER – See: ACTIVITY CODE. (6/07)

ACTIVITY ON ARROW (AOA) – An activity network format. Schedule activities are represented by arrows and nodes are represented by circles. AOA networks require the use of “dummy” activities to properly model work flow. (6/07)

ACTIVITY ON NODE (AON) – An activity network format. Schedule activities are represented by boxes or bars and relationships are represented by arrows. Pure AON networks rely solely on finish-to-start relationships and do not employ the use of activity lags to model work flow. (6/07)

ACTIVITY RELATIONSHIP – Activity relationships determine how activities relate to one another and establish schedule logic. See: LOGIC. (6/07)

ACTIVITY SEQUENCING – The process of identifying and documenting dependencies among schedule activities. (6/07)

ACTIVITY SPLITTING – Dividing (i.e., splitting) an activity of stated scope, description and schedule into two or more activities which are rescoped and rescheduled. The sum of the split activities is normally the total of the original. See: HARD LOGIC; SOFT LOGIC. (11/90)

ACTIVITY STATUS – Information about the performance of an activity that is used to update schedule progress. Typical status information includes actual start and finish dates, percent complete, and remaining duration. This is information used to update the critical path method calculations periodically. (6/07)

ACTIVITY TIMES – Time information generated through the critical path method calculation that identifies the start and finish times for each activity in the network. (11/90)

ACTIVITY TYPE – Dictates calendar used in scheduling software for schedule calculations. Typical activity types are: independent, task, hammock, WBS, and milestone. (6/07)

ACTIVITY TOTAL SLACK – The latest allowable end time minus earliest allowable end time. The activity slack is always greater than or equal to the slack of the activity ending event. (11/90)

ACTS OF GOD –
(1) An extraordinary interruption by a natural cause, as a flood or earthquake, or the usual course of events that experience, foresight or care cannot reasonably foresee or prevent.
(2) An event in nature over which neither the owner nor the contractor has any control. (11/90)

ACTUAL [DURATION, START, FINISH, LOGIC, ETC.] – Schedule information that shows what has actually occurred. For example, the actual start date for a task is the day on which the task actually started, and its actual cost is the expenditures incurred spent up to the present. (6/07)

ACTUAL AND SCHEDULED PROGRESS – A comparison of the observable work done at a given time with the work planned up to that time. (6/07)

ACTUAL COMPLETION DATE – The calendar date on which an activity was completed. See: ACTUAL FINISH DATE. (11/90)

ACTUAL COSTS – The actual expenditures incurred by a program or project. (11/90)

ACTUAL COST OF WORK PERFORMED (ACWP) – The direct costs actually incurred and the direct costs actually recorded and assigned in accomplishing the work performed. These costs should reconcile with the contractor's incurred cost ledgers when they are audited by the client. (11/90)

ACTUAL COST OF WORK PERFORMED (ACWP) – In earned value management, a measure of the actual cost of the work performed as of a data date. See: BUDGETED COST OF WORK PERFORMED (BCWP); BUDGETED COST OF WORK SCXHEDULED (BCWS). (6/07)

ACTUAL FINISH DATE – Date when work on an activity is substantially complete. Activity substantial completion is when only minor or remedial work remains and successor activities may proceed without

hindrance from the predecessor's remaining work. It is not necessarily the last day work will be performed on that activity. The remaining duration of this activity is zero. (6/07)

ACTUAL START DATE – Date when work on an activity actually started with intention of completing activity within the planned duration. The actual start date is not necessarily the first date work was performed on that activity. Interim starts and stops for an activity may show the need for splitting the activity into component parts. (6/07)

ADDENDA – Written or graphic instruments issued prior to the date for opening of bids which may interpret or modify the bidding documents by additions, deletions, clarification, or corrections. (11/90)

ADJUSTED INTERNAL RATE-OF-RETURN (AIRR) – The compound rate of interest that, when used to discount the terminal values of costs and benefits of a project over a given study period, will make the costs equal the benefits when cash flows are reinvested at a specified rate. [1] (11/90)

ADM – See: ARROW DIAGRAMMING METHOD (ADM). (11/90)

ADMINISTRATIVE COST – See: GENERAL & ADMINISTRATIVE COSTS (G&A). (6/07)

AGENT – A person authorized to represent another (the principal) in some capacity. The agent can only act within this capacity or "scope of authority" to bind the principal. Agency agreements can be oral or in writing. (11/90)

AGGREGATE – A collection of items arbitrarily brought together as associated variables for analytical or comparative purposes. (11/90)

AGREEMENT – The written agreement between the owner and the contractor covering the work to be performed; other contract documents are attached to the agreement and made a part thereof as provided therein. (11/90)

ALLOCATED BASELINE – Requirements allocated to lower level system elements controlled by formal change control. (6/07)

ALLOCATED REQUIREMENTS – Requirements apportioned to the elements of a system by applying applicable knowledge and experience. Determination of allocated requirements is not as scientifically rigorous as determination of derived requirements. (6/07)

ALLOCATION –1) In planning and scheduling, the process of distributing or assigning work on an activity to specific resources. 2) In cost estimating and budgeting, the process of distributing or assigning cost of an item or activity (often an overhead or indirect cost) to specific cost or budget accounts. See: COST DISTRIBUTION. (6/07)

ALLOWANCES (ESTIMATING) – Resources included in estimates to cover the cost of known but undefined requirements for an individual activity, work item, account or sub-account. (6/07)

ALTERNATIVE DISPUTE RESOLUTION (ADR) – Any procedure or combination of procedures used to resolve issues in controversy without the need to resort to litigation. ADR typically includes assisted settlement negotiations, conciliation, facilitation, mediation, fact-finding, mini-trials, and arbitration. (6/07)

AMBIGUITY – An uncertainty in the meaning of provisions of a contract, document or specification. Mere disagreement about the meaning of a provision does not indicate an ambiguity. There must be genuine uncertainty of meaning based on logical interpretation of the language used in the contract. Generally, ambiguities in contracts are construed against the drafter of the agreement. (11/90)

AMENDMENT – A modification of the contract by a subsequent agreement. This does not change the entire existing contract but does alter the terms of the affected provisions or requirements. (11/90)

AMORTIZATION –
(1) As applied to a capitalized asset, the distribution of the initial cost by periodic charges to operations as in depreciation. Most properly applies to assets with indefinite life.
(2) The reduction of a debt by either periodic or irregular payments.
(3) A plan to pay off a financial obligation according to some prearranged schedule. (11/90)

ANALOGOUS CRITICAL PATH – The logic path determined by transferring the calculated critical path of the collapsed as-built onto the analogous logic path on the as-built schedule. The analogous critical path allows the analyst to reconcile the total difference in completion date between the collapsed state and the as-built state with the sum of the extracted delays, whole or in part, lying on the analogous path. (6/07)

ANALYSIS – The examination of a complex whole and the separation and identification of its constituent parts and their relationships. (11/90)

ANALYSIS (SCHEDULE VARIANCE) – Comparison of actual cost/schedule performance to that planned. This comparison includes identification of “potential change notices” and their cause. Derives from the monitoring of project expenditures, progress and performance. Requires application of independent review and creative thought processes to come up with a comprehensive understanding of how, why, and where project accounts are headed. Analysis should result in corrective action to offset/minimize any potential overruns and maximize any potential under runs. See: SCHEDULE VARIANCE. (6/07)

AND RELATIONSHIP – Logical relationship between two or more activities that converges on or diverges from an event. The “and” relationship indicates that every one of the activities has to be undertaken. (6/07)

ANNUAL VALUE – A uniform annual amount equivalent to the project costs or benefits taking into account the time value of money throughout the study period. Syn.: ANNUAL WORTH; EQUIVALENT UNIFORM ANNUAL VALUE. See: AVERAGE ANNUAL COST. [1] (11/90)

ANNUAL WORTH – See: ANNUAL VALUE. [1] (11/90)

ANNUALLY RECURRING COSTS – Those costs that are incurred in a regular pattern each year. (6/07)

ANNUITY –
(1) An amount of money payable to a beneficiary at regular intervals for a prescribed period of time out of a fund reserved for that purpose.
(2) A series of equal payments occurring at equal periods of time. (11/90)

ANTICIPATORY BREACH – A specific refusal by the contractor to perform within the terms of the contract documents before performance is due; or a clear indication that the contractor is unable or unwilling to perform. (11/90)

APPLICATION AREA – Projects sharing specialized components that logically segregate work by product or production technology or by user. (8/07)

APPLICATION FOR PAYMENT – The form furnished by the owner or the engineer which is to be used by the contractor in requesting progress or final payments and which shall contain an affidavit, if required, in the general or supplementary conditions. The application for payment includes all supporting documentation as required by the contract documents. (11/90)

APPORTIONED EFFORT (AE) – Effort that is not readily divisible into short-span, discrete work packages, but that is related proportionally to the measured effort. (8/07)

APPROVE – To accept as technically satisfactory by person or persons in authority. The approval may still require confirmation by someone else at a higher level of authority for legal or commercial considerations. (11/90)

ARBITRATION – A method for the resolution of disputes by an informal tribunal in which a neutral person or persons with specialized knowledge in the field in question renders a decision on the dispute. An arbitrator may grant any award which is deemed to be just and equitable after having afforded each party full and equal opportunity for the presentation of the case. Arbitration does not strictly follow the rules of evidence and discovery procedures found in litigation. Arbitration may be conducted under the auspices of an organization (e.g., the American Arbitration Association) which is available as a vehicle for conducting arbitration. (11/90)

ARROW – The graphic representation of activities in ADM network. One arrow represents one activity. The tail of the arrow represents the start of the activity. The head of arrow represents the finish. The arrow is not a vector quantity and is not drawn to scale. A solid line is used for actual activities and a dashed line for dummies. It is uniquely defined by two events. (6/07)

ARROW DIAGRAM – A network (logic diagram) on which the activities are represented by arrows between event nodes. (11/90)

ARROW DIAGRAMMING METHOD (ADM) – A method of constructing a logical network of activities using arrows to represent the activities and connecting those head-to-tail. This diagramming method shows the sequence, predecessor and successor relationships of the activities. (11/90)

ARTIFACT (PLANNING)– A piece of information that is produced, modified, or used by a process, defines an area of responsibility, and is subject to version control. An artifact can be a model, a model element, or a document. A document can enclose other documents. (6/07)

AS-BUILT SCHEDULE – Historical project record showing actual start and finish dates for work performed. Generally, shows logic used in the sequence of construction, along with actual start and finish dates. (6/07)

AS-PLANNED SCHEDULE – The plan or baseline schedule the contractor developed to estimate / bid / contract to perform the work. The as-planned schedule incorporates planned production rates, work calendars, resource availability, logic ties, constraints and activity durations to meet contract requirements and contractor needs or desires. (6/07)

AS-LATE-AS-POSSIBLE (ALAP) – An activity for which the scheduling application sets the early dates as late as possible without delaying the early dates of any successor. (6/07)

AS-OF DATE – See: DATA DATE. (6/07)

AS-SOON-AS-POSSIBLE (ASAP) – An activity for which the scheduling application sets the early dates to be as soon as possible. This is the default activity type in most project management systems. (6/07)

ASSETS – Anything owned that has a monetary value, e.g., property, both real and personal, including notes, accounts and accrued earnings or revenues receivable and cash or its equivalent. Assets may be subdivided into current, fixed, etc. Property: real, i.e. physical; or intangible, i.e. knowledge, systems, or practices. Assets are created through the investment of resources in projects. (6/07)

ASSET LIFE CYCLE – Syn.: ECONOMIC LIFE (CYCLE). (6/07)

ASSESSED VALUE – That value entered on the official assessor's records as the value of the property applicable in determining the amount of taxes to be assessed against that property. (11/90)

ATTRIBUTE – In the context of asset or project planning, a characteristic or property which is appraised in terms of whether it does or does not exist, (e.g., go or not-go) with respect to a given requirement. (6/07)

AUDIT – In the context of asset or project performance assessment, a formal, independent examination with intent to verify conformance with established requirements through surveillance and inspection. They may be either internal or external. (6/07)

AUTHORITY –
(1) Power of influence, either granted to or developed by individuals, that leads to others doing what those individuals direct.
(2) Formal conferment of such influence through an instrument such as a project charter. [8] (6/07)

AUTHORIZE – Give final approval; a person who can authorize something is vested with authority to give final endorsement and which requires no further approval or agreement. [8] (6/07)

AUTHORIZED WORK – An effort that has been approved by higher authority and may or may not be definitive. (6/07)

AVERAGE ANNUAL COST – The conversion, by an interest rate and present worth technique, of all capital and operating costs to a series of equivalent equal annual costs. As a system for comparing proposal investments, it requires assumption of a specific minimum acceptable interest rate. (11/90)

AVERAGE-INTEREST METHOD – A method of computing required return on investment based on the average book value of the asset during its life or during a specified study period. (11/90)

AVOIDANCE (RISK)– Risk response strategy that eliminates the threat or opportunity of a specific risk event, usually by eliminating its potential cause. See: ACCEPT / ACCEPTANCE; MITIGATION. [8] (6/07)

BACKCHARGE – Cost of corrective action taken by the purchaser, chargeable to supplier by contract terms. (6/07)

BACKUP – Supporting documents for an estimate or schedule including detailed calculations, descriptions of data sources, and comments on the quality of the data. (11/90)

BACKWARD PASS – Network schedule calculation that determines the latest each activity in the network may start (LS) and finish (LF) and still maintain the minimum overall duration of the project as calculated by the forward pass. It counts backward toward the beginning of the schedule to determine the last possible start and finish dates for each activity that will not delay project completion. See: FORWARD PASS. (6/07)

BAR CHART – Graphic representation of a project that includes the activities that makes up the project and placed on a time scale. Bar charts are time scaled, show activity number, description, duration, start and finish dates, and an overall sequencing of the flow of work. Bar charts do not generally include the logic ties between activities. Syn.: GANTT CHART. (6/07)

BASE DATE – Syn.: BASE TIME. [1] (11/90)

BASE PERIOD (OF A GIVEN PRICE INDEX) – Period for which prices serve as a reference for current period prices; in other words, the period for which an index is defined as 100 (if expressed in percentage form) or as 1 (if expressed in ratio form). (11/90)

BASE POINT FOR ESCALATION – Cost index value for a specific month or an average of several months that is used as a basis for calculating escalation. (11/90)

BASE TIME – The date to which all future and past benefits and costs are converted when a present value method is used (usually the beginning of the study period). Syn.: BASE DATE. [1] (11/90)

BASELINE –
(1) In project control, the reference plans in which cost, schedule, scope and other project performance criteria are documented and against which performance measures are assessed and changes noted.
(2) The budget and schedule that represent approved scope of work and work plan. Identifiable plans, defined by data bases approved by project management and client management, to achieve selected project objectives. It becomes basis for measuring progress and performance and is baseline for identifying cost and schedule deviations. Syn.: CONTROL BASELINE. (1/03)

BASELINE SCHEDULE –
(1) A fixed project schedule that is the standard by which project performance is measured. The current schedule is copied into the baseline schedule that remains frozen until it is reset. Resetting the baseline is done when the scope of the project has been changed significantly, for example after a negotiated change. At that point, the original or current baseline becomes invalid and should not be compared with the current schedule.
(2) Version of schedule that reflects all formally authorized scope and schedule changes. [9] (6/07)

BASIS – Written documentation that describes how an estimate, schedule, or other plan component was developed and defines the information used in support of development. A basis document commonly includes, but is not limited to, a description of the scope included, methodologies used, references and defining deliverables used, assumptions and exclusions made, clarifications, adjustments, and some indication of the level of uncertainty. (6/07)

BATTERY LIMIT – Comprises one or more geographic boundaries, imaginary or real, enclosing a plant or unit being engineered and/or erected, established for the purpose of providing a means of specifically identifying certain portions of the plant, related groups of equipment, or associated facilities. It generally refers to the processing area and includes all the process equipment, and excludes such other facilities as storage, utilities, administration buildings, or auxiliary facilities. The scope included within a battery limit must be well-defined so that all personnel will clearly understand it. On drawings, this is often referred to in the phrase: inside/outside battery limits or ISBL/OSBL. See: OFFSITES. (6/07)

BEGINNING EVENT – An event that signifies the beginning of an activity. Syn.: PREDECESSOR EVENT; PRECEDING EVENT; STARTING EVENT. (11/90)

BEGINNING NETWORK EVENT – The event that signifies the beginning of a network (or subnet). (11/90)

BEGINNING (START) NODE OF NETWORK (ADM) – A node at which no activities end, but one or more activities begin. (11/90)

BENCHMARKING – A measurement and analysis process that compares practices, processes, and relevant measures to those of a selected basis of comparison (i.e., the benchmark) with the goal of improving performance. The comparison basis includes internal or external competitive or best practices, processes or measures. Examples of measures include estimated costs, actual costs, schedule durations, resource quantities, etc. (1/03)

BENEFICIAL OCCUPANCY – Use of a building, structure, or facility by the owner for its intended purpose (functionally complete), although other contract work, nonessential to the function of the occupied section, remains to be completed. See: SUBSTANTIAL COMPLETION. (11/90)

BENEFIT COST ANALYSIS – A method of evaluating projects or investments by comparing the present value or annual value of expected benefits to the present value or annual value of expected costs. [1] (11/90)

BENEFIT-TO-COST RATIO (BCR) – Benefits divided by costs, where both are discounted to a present value or equivalent uniform annual value. [1] (11/90)

BEST PRACTICES – Practical techniques gained from experience that have been shown to produce best results. (6/07)

BIASES – Lack of objectivity based on the enterprise's or individual's position or perspective. Systematic and predictable relationships between a person's opinion or statement and his/her underlying knowledge or circumstances. Note: There may be "system biases" as well as "individual biases". (6/07)

BID – To submit a price for services; a proposition either verbal or written, for doing work and for supplying materials and/or equipment. (11/90)

BID BOND – See: BOND, BID. (6/07)

BIDDER – The individual, partnership, or corporation, or combination thereof, acting directly or through an authorized representative, formally submitting a bid directly to the owner, as distinct from a sub-bidder, who submits a bid to a bidder. (11/90)

BID SECURITY – Security is provided in connection with the submittal of a bid to guarantee that the bidder, if awarded or offered the contract, will execute the contract and perform the work. The requirements for the bid security are usually designated in a specific section of the bidding documents. The bid security is payable to the owner (usually around 5% of the total bid price) in the form of either a certified or bank check or a bid bond issued by a surety satisfactory to the owner. The bid security of the successful bidder is usually retained until the bidder has executed the agreement and furnished the required contract security, whereupon the bid security is returned. Bid security of the other bidders is returned after the bid opening. (11/90)

BID SHOPPING – An effort by a prime contractor to reduce the prices quoted by subcontractors and/or suppliers, by providing the bid price to other subcontractors or suppliers in an attempt to get the other subcontractors or suppliers to underbid the original price quoted. The reverse of this situation is when subcontractors try to get a better price out of a prime contractor. This is known as bid peddling. (11/90)

BIDDING DOCUMENTS – The advertisement for bids, instructions to bidders, information available to bidders, bid form with all attachments, and proposed contract documents (including all addenda issued prior to receipt of bids). (11/90)

BIDDING REQUIREMENTS – The advertisement for bids, instructions to bidders, supplementary instructions and all attachments therein, information to bidders and all attachments therein, and bid form and all attachments therein. (11/90)

BILL OF MATERIALS (BOM) –
(1) Set of physical elements required to build a project.
(2) Hierarchical view of the physical assemblies, subassemblies, and components needed to fabricate a manufacturing product.
(3) Descriptive and quantitative list of materials, supplies, parts, and components required to produce a designated complete end item of materials, assembly, or subassembly. See: BILL OF QUANTITITES (BOQ) [8] (6/07)

BILL OF QUANTITIES (BOQ) − Descriptive and quantitative list of materials, supplies, parts, and components required to produce a designated complete end item of materials, assembly, or

subassembly. Typically includes a description of the associated “method of measurement”. See: BILL OF MATERIALS (BOM); METHOD OF MEASUREMENT. (6/07)

BLANKET BOND – A bond covering a group of persons, articles, or properties. (11/90)

BOND, BID – A bond that guarantees the bidder will enter into a contract on the basis of the bid. (6/07)

BOND, PAYMENT – A bond that is executed in connection with a contract and which secures the payment of all persons supplying labor and material in the prosecution of the work provided for in the contract. (11/90)

BOND, PERFORMANCE – A bond that is executed in connection with a contract and which secures or guarantees the completion, performance and fulfillment of all the work, undertakings, covenants, terms, conditions, and agreements contained in the contract. (6/07)

BONDS – Instruments of security furnished by the contractor and/or surety in accordance with the contract documents. The term contract security refers to the payment bond, performance bond and those other instruments of security required in the contract documents. (11/90)

BONUS-PENALTY – A contractual arrangement between a client and a contractor wherein the contractor is provided a bonus, usually a fixed sum of money, for each day the project is completed ahead of a specified schedule and/or below a specified cost, and agrees to pay a similar penalty for each day of completion after the schedule date or over a specified cost up to a specified maximum either way. The penalty situation is sometimes referred to as liquidated damages. (11/90)

BOOK VALUE (NET) –
(1) Current investment value on the books calculated as original value less depreciated accruals.
(2) New asset value for accounting use.
(3) The value of an outstanding share of stock of a corporation at any one time, determined by the number of shares of that class outstanding. (11/90)

BRAINSTORMING – Process in which a group of people, selected for their creativity and knowledge, are brought together to seek solutions to particular problems or simply to find better ways of meeting objectives. Suggestions, however outlandish, are encouraged and pursued during a creativity session. From this, many ideas, some entirely new, are brought forward for analysis and ranking. (6/07)

BREACH OF CONTRACT – Failure, by either the owner or the contractor, without legal excuse, to perform any work or duty owed to the other person. (11/90)

BREAKDOWN STRUCTURE – A hierarchical structure by which project elements are broken down, or decomposed. See: ORGANIZATIONAL BREAKDOWN STRUCTURE (OBS); WORK BREAKDOWN STRUCTURE (WBS); COST BREAKDOWN STRUCTURE (CBS). (6/07)

BREAKEVEN CHART – A graphic representation of the relation between total income and total costs for various levels of production and sales indicating areas of profit and loss. (11/90)

BREAKEVEN POINT –
(1) In business operations, the rate of operations output, or sales at which income is sufficient to equal operating costs or operating cost plus additional obligations that may be specified.
(2) The operating condition, such as output, at which two alternatives are equal in economy.
(3) The percentage of capacity operation of a manufacturing plant at which income will just cover expenses. (11/90)

BREAKOUT SCHEDULE – Jobsite schedule, generally in bar chart form, used to communicate day-to-day activities to all working levels on the project as directed by construction manager. Detail information

with regard to equipment use, bulk material requirements, and craft skills distribution, as well as the work to be accomplished, forms content of schedule. Issued on a weekly basis with a two to three-week look ahead from the issue date. (6/07)

BUDGET – A planned allocation of resources. The planned cost of needed materials is usually subdivided into quantity required and unit cost. The planned cost of labor is usually subdivided into the workhours required and the wage rate (plus fringe benefits and taxes). (11/90)

BUDGETED COST OF WORK PERFORMED (BCWP) –Measure of the amount of money budgeted to complete the actual work performed as of the data date. Represents the value of work performed, rather than the cost of the actual work performed. In current earned value management system usage, it is referred to as “earned value” or EV. Syn.: EARNED VALUE (EV). (6/07)

BUDGET ESTIMATE – A budget estimate is prepared with the use of flow sheets, layouts, and equipment details. (This term is superceded by Recommended Practice No. 17R-97 “Cost Estimate Classification System”.) (6/07)

BUDGETED COST OF WORK SCHEDULED (BCWS) – Measure of the amount of money budgeted to complete the scheduled work as of the data date. In current Earned Value Management System usage, it is referred to as “planned value” or PV. Syn.: PLANNED VALUE (PV). (6/07)

BUDGETING – A process used to allocate the estimated cost of resources into cost accounts (i.e., the cost budget) against which cost performance will be measured and assessed. Budgeting often considers time-phasing in relation to a schedule and/or time-based financial requirements and constraints. (1/03)

BULK MATERIAL – Material bought in lots. These items can be purchased from a standard catalog description and are bought in quantity for distribution as required. Examples are pipe (non-spooled), conduit, fittings, and wire. (11/90)

BURDEN – In construction, the cost of maintaining an office with staff other than operating personnel. Includes also federal, state and local taxes, fringe benefits and other union contract obligations. In manufacturing, burden sometimes denotes overhead. (11/90)

BURDEN OF PROOF – The necessity of proving the facts in a dispute on an issue raised between the owner and the contractor. In a claim situation, the burden of proof is always on the person filing the claim. This is true whether the contractor is claiming against the owner, or the owner is making a claim against the contractor. (11/90)

BURN RATE – Rate at which resources such as funds or man-hours are or were being expended on a project. (6/07)

BUSINESS PLANNING – The determination of financial, production and sales goals of a business organization; and the identification of resources, methods, and procedures required to achieve the established objectives within specified budgets and timetables. (11/90)

BUSINESS CASE – Defines a project’s or other investment’s justification for business decision making purposes. Depending upon the business’ decision making criteria, it typically includes an outline of objectives, deliverables, time, cost, technical, safety, quality and other attributes in respect to how the project or investment addresses the objectives and requirements of the business. May include information on project risks (either threats or opportunities), competitive impact, resource requirements, organizational impacts, key performance indicators (particularly profitability) and critical success factors. (6/07)

CALCULATE SCHEDULE – A modeling process that defines all critical activities and individual activity scheduling data. The process applied in most scheduling software calculates the start and finish dates of

activities in two passes. The first pass calculates early start and finish dates from the earliest start date forward. The second pass calculates the late start and finish activities from the latest finish date backwards. The difference between the pairs of start and finish dates for each task is the float or slack time for the task. See: FLOAT. (6/07)

CALENDAR – Defined work periods and holidays that determine when project activities may be scheduled. Multiple calendars may be used for different activities, which allows for more accurate modeling of the project work plan. E.g., 5-day work week calendar vs. 7-day work week. See: GLOBAL CALENDAR; CALENDAR UNIT. (6/07)

CALENDAR RANGE – Span of the calendar from calendar start through end date. The calendar start date is unit number one. The calendar range is usually expressed in years. (11/90)

CALENDAR UNIT – The smallest common / standard unit of time used in a particular calendar for scheduling an activity or a project. Calendar units are generally in hours, days, or weeks, but can also be shifts or even minutes. See: CALENDAR; TIME UNIT. (6/07)

CALENDAR START DATE – The date assigned to the first unit of the defined calendar; the first day of the schedule. (11/90)

CAPACITY (UTILIZATION) FACTOR – In manufacturing or production practice, 1) The ratio of average load to maximum capacity. 2) The ratio between average load and the rated capacity of the apparatus. 3) The ratio of the average actual use to the rated available capacity. (6/07)

CAPACITY FACTOR – In cost estimating, an exponential factor used in the capacity factor method. Syn.: SCALING FACTOR. See: CAPACITY FACTOR METHOD. (6/07)

CAPACITY FACTOR METHOD − A cost estimating method in which the cost of a new facility is derived from the cost of a similar item or facility of a known, but usually different capacity. In this method, the ratio of costs between two similar facilities is equal to the ratio of their capacities taken to an exponential factor (i.e., the scaling, or capacity factor). See: SCALING FACTOR. (6/07)

CAPACITY UTILIZATION FACTOR − Syn.: CAPACITY FACTOR. (6/07)

CAPITAL, DIRECT – See: DIRECT COSTS. (11/90)

CAPITAL, FIXED – The total original value of physical facilities which are not carried as a current expense on the books of account and for which depreciation is allowed by the Federal Government. It includes plant equipment, building, furniture and fixtures, and transportation equipment used directly in the production of a product or service. It includes all costs incident to getting the property in place and in operating condition, including legal costs, purchased patents, and paid-up licenses. Land, which is not depreciable, is often included. Characteristically it cannot be converted readily into cash. (11/90)

CAPITAL, INDIRECT – See: INDIRECT COSTS. [1] (11/90)

CAPITAL, OPERATING – Capital associated with process facilities inside battery limits. (11/90)

CAPITAL BUDGETING – A systematic procedure for classifying, evaluating, and ranking proposed capital expenditures for the purpose of comparison and selection, combined with the analysis of the financing requirements. (11/90)

CAPITAL PROJECT – A project in which the cost of the end result or product is capitalized (i.e., cost will be depreciated). The product is usually a physical asset such as property, real estate or infrastructure, but may include other assets that are depreciable. (6/07)

CAPITAL RECOVERY –
(1) Charging periodically to operations amounts that will ultimately equal the amount of capital expenditure.
(2) The replacement of the original cost of an asset plus interest.
(3) The process of regaining the net investment in a project by means of revenue in excess of the costs from the project. (Usually implies amortization of principal plus interest on the diminishing, unrecovered balance.) See: AMORTIZATION; DEPLETION; DEPRECIATION. (11/90)

CAPITAL RECOVERY FACTOR – A factor used to calculate the sum of money required at the end of each of a series of periods to regain the net investment of a project plus the compounded interest on the unrecovered balance. (11/90)

CAPITAL, SUSTAINING – The fixed capital requirements to: 1) Maintain the competitive position of a project throughout its commercial life by improving product quality, related services, safety, or economy; or, 2) Required to replace facilities which wear out before the end of the project life. (11/90)

CAPITAL, TOTAL – Sum of fixed and working capital. (11/90)

CAPITAL, VENTURE – Capital invested in technology or markets new at least to the particular organization. (11/90)

CAPITAL, WORKING – The funds in addition to fixed capital and land investment which a company must contribute to the project (excluding startup expense) to get the project started and meet subsequent obligations as they come due. Working capital includes inventories, cash and accounts receivable minus accounts payable. Characteristically, these funds can be converted readily into cash. Working capital is normally assumed recovered at the end of the project. (11/90)

CAPITALIZED COST –
(1) The present worth of a uniform series of periodic costs that continue for an indefinitely long time (hypothetically infinite).
(2) The value at the purchase date of the asset of all expenditures to be made in reference to this asset over an indefinite period of time. This cost can also be regarded as the sum of capital which, if invested in a fund earning a stipulated interest rate, will be sufficient to provide for all payments required to maintain the asset in perpetual service. (11/90)

CARDS-ON-THE-WALL PLANNING – A planning technique in which team members interact to create a project strategy, tactical approach, and resulting network by locating and interconnecting task cards using walls as the work space. The wall data are transferred into a computer model for scheduling, critical path analysis and iteration. (6/07)

CASH COSTS – Total cost excluding capital and depreciation spent on a regular basis over a period of time, usually one year. Cash costs consist of manufacturing cost and other expenses such as transportation cost, selling expense, research and development cost or corporate administrative expense. (11/90)

CASH FLOW – Inflow and outflow of funds within a project. A time-based record of income and expenditures, often presented graphically. (6/07)

CASH FLOW (NET) – The net flow of funds into or out of a project. The sum, in any time period, of all cash receipts, expenses, and investments. Also called cash proceeds or cash generated. The stream of monetary values—costs and benefits—resulting from a project investment. [1] (6/07)

CASH FLOW MANAGEMENT – The planning of project expenditures relative to income or authorized funding in such a way as to minimize the carrying cost of the financing for the project or keep within the

constraints of a time-phased budget. This maybe achieved by accelerating or delaying some activities, but at the risk of ineffective performance, late completion and consequent increased cost. (6/07)

CASH RETURN, PERCENT OF TOTAL CAPITAL – Ratio of average depreciation plus average profit, to total fixed and working capital, for a year of capacity sales. Under certain limited conditions, this figure closely approximates that calculated by profitability index techniques where it is defined as the difference, in any time period, between revenues and all cash expenses, including taxes. (11/90)

CAUSATION – An explanation or description of the facts and circumstances that produce a result, the cause and effect for which the contractor claims entitlement to compensation from the owner under the contract. (11/90)

CERTAINTY – Unquestionable. Free of doubt. No risk involved. (6/07)

CHAIN – A series of elements joined together in sequence, such as a logical series of activities or occurrences. (6/07)

CHAIN INDEX – An index which globally measures the price change of a range of commodities. (11/90)

CHANGE – Alteration or variation to a scope of work and/or the schedule for completing the work. (11/90)

CHANGE, CARDINAL – Work that is beyond the scope of that specified in the contract and consequently unauthorized. The basic tests for a cardinal change are whether the type of work was within the contemplation of the parties when they entered into the contract and whether the job as modified is still the same basic job. (11/90)

CHANGE, CONSTRUCTIVE – An act or failure to act by the owner or the engineer that is not a directed change, but which has the effect of requiring the contractor to accomplish work different from that required by the existing contract documents. (11/90)

CHANGE, UNILATERAL – See: MODIFICATION, UNILATERAL. (11/90)

CHANGE CONTROL -
(1) Process of accepting or rejecting changes to the project's baselines. Lack of change control is one of the most common causes of scope creep.
(2) Process of implementing procedures that ensure that proposed changes are properly assessed and, if approved, incorporated into the project plan. Uncontrolled changes are one of the most common causes of delay and failure.
(3) Risk abatement process of accepting or rejecting changes to the project's baselines, based on predetermined criteria or "trigger points." See: CHANGE MANAGEMENT. (6/07)

CHANGE DOCUMENTATION/LOG – Records of changes proposed, accepted and rejected. (6/07)

CHANGE IN SCOPE – A change in the defined deliverables or resources used to provide them. (6/07)

CHANGE IN SEQUENCE – A change in the order of work initially specified or planned by the contractor. If this change is ordered by the owner and results in additional cost to the contractor, the contractor may be entitled to recovery under the changes clause. (11/90)

CHANGE MANAGEMENT – The formal process through which changes to the project plan are identified, assessed, reviewed, approved and introduced. (6/07)

CHANGE ORDER – A document requesting and/or authorizing a scope and/or baseline change or correction. 1) From the owner's perspective, it is an agreement between the project team and higher

authority approving a change in the project control baseline. 2) From a contractor's perspective, it is an agreement between the owner and the contractor to compensate for a change in scope or other conditions of a contract. It must be approved by both the client and the contractor before it becomes a legal change to the contract. (6/07)

CHANGED CONDITIONS – See: DIFFERING SITE CONDITIONS. (11/90)

CHART OF ACCOUNTS – Syn.: CODE OF ACCOUNTS (COA). (11/90)

CHILD – A lower-level element in a hierarchical structure. See: PARENT. (6/07)

CHILD ACTIVITY – Subordinate task belonging to a 'parent' task existing at a higher level in the work breakdown structure. (6/07)

CLAIM – A demand or assertion of rights by one party against another for damages sustained under the terms of a legally binding contract. Damages might include money, time, or other compensation to make the claimant whole. (8/07)

CLIENT –
(1) Party to a contract who commissions the work. On capital projects, may also be referred to as the "owner".
(2) Customer, principal, owner, promoter, buyer, or end user of the product or service created by the project. [8] (6/07)

CLOSEOUT – The completion of project work. The phase at the end of a project lifecycle just before the operations begins. (6/07)

CODE – A referencing system typically applied to the elements of work and cost breakdown structures. (6/07)

CODE OF ACCOUNTS (COA) – A systematic coding structure for organizing and managing scope, asset, cost, resource, work, and schedule activity information. A COA is essentially an index to facilitate finding, sorting, compiling, summarizing, or otherwise managing information that the code is tied to. A complete code of accounts includes definitions of the content of each account. Syn.: CHART OF ACCOUNTS. See: COST CODES. (6/07)

CODING – The process of applying a code. See: ACTIVITY CODE; CODE OF ACCOUNTS (COA). (6/07)

COMMISSIONING – Activities performed to substantiate the capabilities of individual units and systems to function as designed. May include performance tests on mechanical equipment, water washing, flushing and drying of equipment and piping, control systems operability checks, checking of safety and fire protection devices, and operation of systems on inert fluids. Commissioning normally follows mechanical completion and ends with initial operation or startup. See: STARTUP. (6/07)

COMMITTED COST – A cost which has not yet been paid, but an agreement, such as a purchase order or contract, has been made that the cost will be incurred. See: COMMITMENTS. (6/07)

COMMITMENTS – The sum of all financial obligations made, including incurred costs and expenditures as well as obligations, which will not be performed until later. (11/90)

COMMODITY – In price index nomenclature, a good and sometimes a service. (11/90)

COMPANY – Term used primarily to refer to a business first party, the purpose of which is to supply a product or service. In a capital project, typically refers to the contractor who is performing services for an owner or client. (6/07)

COMPLETED ACTIVITY – An activity with an actual completion date and remaining duration of zero. An activity that is finished, ended and / or concluded in accordance with requirements. (6/07)

COMPLETION (CONTRACT) - When the entire work has been performed to the requirements of the contract, except for those items arising from the provisions of warranty, and is so certified. (6/07)

COMPLETION DATE (PLANNED) – The calculated date for completion derived from estimating, planning and risk evaluation taking into account contingencies for identified risks. (6/07)

COMPOSITE PRICE INDEX – An index which globally measures the price change of a range of commodities. (11/90)

COMPOUND AMOUNT – The future worth of a sum invested (or loaned) at compound interest. (11/90)

COMPOUND AMOUNT FACTOR –
(1) The function of interest rate and time that determines the compound amount from a stated initial sum.
(2) A factor which when multiplied by the single sum or uniform series of payments will give the future worth at compound interest of such single sum or series. (11/90)

COMPOUND INTEREST –
(1) The type of interest that is periodically added to the amount of investment (or loan) so that subsequent interest is based on the cumulative amount.
(2) The interest charges under the condition that interest is charged on any previous interest earned in any time period, as well as on the principal. (11/90)

COMPOUND RISK – A risk made up of a number of interrelated risks. (6/07)

COMPOUNDING, CONTINUOUS –
(1) A compound interest situation in which the compounding period is zero and the number of periods infinitely great. A mathematical concept that is practical for dealing with frequent compounding and small interest rates.
(2) A mathematical procedure for evaluating compound interest factors based on a continuous interest function rather than discrete interest periods. (11/90)

COMPOUNDING PERIOD – The time interval between dates at which interest is paid and added to the amount of an investment or loan. Designates frequency of compounding. (11/90)

CONCEPT DEFINITION DOCUMENT – A document describing the concept selected for development and the results of investigating alternative system concepts. It is used to derive the system specifications and the statement of work. Syn.: SYSTEM CONCEPT DOCUMENT. (6/07)

CONCEPT PHASE – First phase of a project in which need is examined, alternatives are assessed, the goals and objectives of the project are established and a sponsor is identified. (6/07)

CONCEPTUAL ESTIMATE – An estimate made in the concept phase without the benefit of detailed engineering data. (This term is superceded by Recommended Practice No. 17R-97 “Cost Estimate Classification System”.) (6/07)

CONCEPTUAL SCHEDULE – Similar to a proposal schedule except it is usually time-scaled and developed from the abstract or conceptual design of the project. Used primarily to give the client a general idea of the project scope and on overview of activities. (6/07)

CONCURRENCY – Degree to which independent activities may be, or are performed at the same time (fully or partially). Degree to which phases, stages, or activities may be overlapped. (6/07)

CONCURRENT ACTIVITIES – Independent activities that may be, or are performed at the same time (fully or partially). (6/07)

CONCURRENT DELAY –
(1) Two or more delays that take place or overlap during the same period, either of which occurring alone would have affected the ultimate completion date. In practice, it can be difficult to apportion damages when the concurrent delays are due to the owner and contractor respectively.
(2) Concurrent delays occur when there are two or more independent causes of delay during the same time period. The “same” time period from which concurrency is measured, however, is not always literally within the exact period of time. For delays to be considered concurrent, most courts do not require that the period of concurrent delay precisely match. The period of “concurrency” of the delays can be related by circumstances, even though the circumstances may not have occurred during exactly the same time of period. [10]
(3) True concurrent delay is the occurrence of two or more delay events at the same time, one an employer risk event, the other a contractor risk event and the effects of which are felt at the same time. The term ‘concurrent delay’ is often used to describe the situation where two or more delay events arise at different times, but the effects of them are felt (in whole or in part) at the same time. To avoid confusion, this is more correctly termed the ‘concurrent effect’ of sequential delay events. [12]
(4) Concurrent delay occurs when both the owner and contractor delay the project or when either party delays the project during an excusable but non-compensable delay (e.g., abnormal weather). The delays need not occur simultaneously but can be on two parallel critical path chains. [13]
(5) The condition where another delay-activity independent of the subject delay is affecting the ultimate completion of the chain of activities. (6/07)

CONDITION (UNCERTAIN) – Any specific identifiable circumstance (such as the rate of inflation or the quality of labor available) that might affect the outcome of the project. See: EVENT. (6/07)

CONDITIONAL RISK – Risk that occurs under certain conditions or is accepted provided that certain conditions are met. (6/07)

CONFIDENCE LEVEL – The probability: 1) That results will be equal to or more favorable than the amount estimated or quoted; or 2) That the decision made will achieve the desired results; or 3) That the stated conclusion is true. Note: Confidence level may also be expressed as "equal to or less favorable". If that is the case, it should so be noted. Without such a note, the definition shown is assumed. (6/07)

CONFIGURATION – A collection of an item's descriptive and governing characteristics, which can be expressed: 1) In functional terms, i.e. what performance the item is expected to achieve; and 2) In physical terms, i.e. what the item should look like and consist of when it is completed. (6/07)

CONFIGURATION CONTROL – A system of procedures that monitors emerging project scope against the scope baseline. Requires documentation and management approval on any change to the baseline. (6/07)

CONFIGURATION MANAGEMENT – Technical and administrative activities concerned with the creation, maintenance and controlled change of configuration throughout the life of the product. Configuration management is an integral part of life-cycle management. (6/07)

CONFLICT – Two or more parties having differing interests or perspectives that require resolution to achieve project goals. The state that exists when two groups have goals that will affect each other differently. (6/07)

CONFLICT IN PLANS AND SPECIFICATIONS – Statements or meanings in the contract documents (including drawings and specifications) that cannot be reconciled by reasonable interpretation on the part of the contractor and which may require the owner to provide an interpretation between alternatives. (11/90)

CONFLICT MANAGEMENT – Handling of conflicts between project participants or groups in order to create optimal project results. (6/07)

CONSENT OF SURETY – An acknowledgement by a surety that its bond, given in connection with a contract, continues to apply to the contract as modified; or, at the end of a contract, permission from the surety to release all retainage to the contractor. (11/90)

CONSTANT BASKET – A set of goods and services with quantities fixed in relation to a given time period, used for computing composite price indexes. (11/90)

CONSTANT BASKET PRICE INDEX – A price index which measures price changes by comparing the expenditures necessary to provide the same set of goods and services at different points in time. (11/90)

CONSTANT DOLLARS – Dollars of uniform purchasing power exclusive of general inflation or deflation. Constant dollars are tied to a reference year. [1] (11/90)

CONSTANT UTILITY PRICE INDEX – A composite price index which measures price changes by comparing the expenditures necessary to provide substantially equivalent sets of goods and services at different points in time. (11/90)

CONSTRAINT – Any factor that affects when an activity can be scheduled. A restriction imposed on the start, finish or duration of an activity. The external factor may be resources, such as labor, cost or equipment, or, it can be a physical event that must be completed prior to the activity being restrained. Constraints are used to reflect project requirements more accurately. Examples of date constraints are: Start-no-earlier-than, finish-no-later-than, mandatory start, and as-late-as-possible. Syn.: RESTRAINT. (6/07)

CONSTRAINT DATE – See: PLUG DATE. (11/90)

CONSTRUCTABILITY –
(1) A system (process) for achieving optimum integration of construction knowledge in the construction process, balancing various project and environmental constraints to achieve maximization of project goals and performance. [6]
(2) Derived from early detailed construction planning that allows engineering and procurement to be scheduled to support construction in accordance with the overall optimized project schedule. [5]
(3) The extent to which the design of a structure or system facilitates ease of construction, subject to the overall requirements for the completed form. The optimum use of construction knowledge and experience in planning, engineering, procurement and field operations to achieve the overall objective. (6/07)

CONSTRUCTION COST – The sum of all costs, direct and indirect, inherent in converting a design plan for material and equipment into a project ready for start-up, but not necessarily in production operation; the sum of field labor, supervision, administration, tools, field office expense, materials, equipment, and subcontracts. (6/07)

CONSTRUCTION MANAGEMENT –
(1) Project management as applied to construction.
(2) A professional service that applies to effective management techniques to the planning, design, and construction of a project from inception to completion for the purpose of controlling time, cost, and quality, as defined by the Construction Management Association of America (CMAA). (6/07)

CONSTRUCTION PROGRESS – Construction progress is monitored and reported as percent complete. Actual work units completed are measured against the planned work units for each applicable account in the bill of materials or quantities. Usually reported against individual accounts by area and total project, and summarized by area and total project. (6/07)

CONSTRUCTION PROGRESS REPORT – A report that informs management of overall construction progress (physical percent complete), costs, performance and manpower at a specific reporting cut-off date. Typically includes major accomplishments, objectives for the upcoming report period, areas of concern, and other pertinent information necessary for management and control. (6/07)

CONSTRUCTIVE ACCELERATION – An owner's action or inaction, in absence of a specific direction to accelerate, that results in the contractor accelerating its work to maintain scheduled completion date(s). Case law has identified five elements normally required to establish a claim for constructive acceleration and include: 1) An excusable delay must exist; 2) Timely notice of the delay and a proper request for a time extension must have been given; 3) The time extension must have been postponed or refused; 4) Owner must have ordered (either by coercion, direction or some other manner) the project completed within its original performance period; and 5) Contractor must actually accelerate its performance, thereby incurring excess costs. (6/07)

CONSTRUCTIVE CHANGE – An owner's action or inaction that impacts the contractor's working conditions and constitutes an unauthorized modification of contract intent. (6/07)

CONSTRUCTIVE DELAY – An act or omission by the owner or its agent, which in fact delays completion of the work. (6/07)

CONSUMABLE RESOURCE – A type of resource that remains available until consumed (for example, a material). (6/07)

CONSUMABLES – Supplies and materials used up during construction. Includes utilities, fuels and lubricants, welding supplies, worker's supplies, medical supplies, etc. (11/90)

CONSUMERS PRICE INDEX (CPI) – A measure of time-to-time fluctuations in the price of a quantitatively constant market basket of goods and services, selected as representative of a special level of living. (11/90)

CONTINGENCY – An amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs. Typically estimated using statistical analysis or judgment based on past asset or project experience. Contingency usually excludes: 1) Major scope changes such as changes in end product specification, capacities, building sizes, and location of the asset or project; 2) Extraordinary events such as major strikes and natural disasters; 3) Management reserves; and 4) Escalation and currency effects. Some of the items, conditions, or events for which the state, occurrence, and/or effect is uncertain include, but are not limited to, planning and estimating errors and omissions, minor price fluctuations (other than general escalation), design developments and changes within the scope, and variations in market and environmental conditions. Contingency is generally included in most estimates, and is expected to be expended. See: MANAGEMENT RESERVE. (1/04)

CONTRACT – Legal agreement between two or more parties, which may be of the types enumerated below:

1. In cost plus contracts the contractor agrees to furnish to the client services and material at actual cost, plus an agreed upon fee for these services. This type of contract is employed most often when the scope of services to be provided is not well defined.

a. COST PLUS PERCENTAGE BURDEN AND FEE - the client will pay all costs as defined in the terms of the contract, plus "burden and fee" at a specified percent of the labor costs which the client is paying for directly. This type of contract generally is used for engineering services. In contracts with some governmental agencies, burden items are included in indirect cost.

b. COST PLUS FIXED FEE - the client pays costs as defined in the contract document. Burden on reimbursable technical labor cost is considered in this case as part of cost. In addition to the costs and burden, the client also pays a fixed amount as the contractor's "fee".

c. COST PLUS FIXED SUM - the client will pay costs defined by contract plus a fixed sum which will cover "non-reimbursable" costs and provide for a fee. This type of contract is used in lieu of a cost plus fixed fee contract where the client wishes to have the contractor assume some of the risk for items which would be reimbursable under a cost plus fixed fee type of contract.

d. COST PLUS PERCENTAGE FEE - the client pays all costs, plus a percentage for the use of the contractor's organization.

2. Fixed price types of contract are ones wherein a contractor agrees to furnish services and material at a specified price, possibly with a mutually agreed upon escalation clause. This type of contract is most often employed when the scope of services to be provided is well defined.

a. LUMP SUM - contractor agrees to perform all services as specified by the contract for a fixed amount. A variation of this type may include a turn-key arrangement where the contractor guarantees quality, quantity and yield on a process plant or other installation.

b. UNIT PRICE - contractor will be paid at an agreed upon unit rate for services performed. For example, technical work-hours will be paid for at the unit price agreed upon. Often field work is assigned to a subcontractor by the prime contractor on a unit price basis.

c. GUARANTEED MAXIMUM (TARGET PRICE) - a contractor agrees to perform all services as defined in the contract document guaranteeing that the total cost to the client will not exceed a stipulated maximum figure. Quite often, these types of contracts will contain special share-of-the-saving arrangements to provide incentive to the contractor to minimize costs below the stipulated maximum.

d. BONUS-PENALTY - a special contractual arrangement usually between a client and a contractor wherein the contractor is guaranteed a bonus, usually a fixed sum of money, for each day the project is completed ahead of a specified schedule and/or below a specified cost, and agrees to pay a similar penalty for each day of completion after the schedule date or over a specified cost up to a specified maximum either way. The penalty situation is sometimes referred to as liquidated damages. (11/90)

CONTRACT CHANGE – An authorized modification to terms of a contract. May involve, but is not limited to: 1) A change in the volume or conditions of the work involved; 2) The number of units to be produced; 3) The quality of the work or units; 4) The time for delivery; and/or 5) The consequent cost involved. (6/07)

CONTRACT COMPLETION DATE – The date established in the contract for completion of all or specified portions of the work. This date may be expressed as a calendar date or as a number of days after the date for commencement of the contract time is issued. (11/90)

CONTRACT DATES – The start, intermediate, or final dates specified in the contract that impact the project schedule. See: SCHEDULED DATES. (6/07)

CONTRACT DOCUMENTS – The agreement, addenda (which pertain to the contract documents), contractor's bid (including documentation accompanying the bid and any post-bid documentation submitted prior to the notice of award) when attached as an exhibit to the agreement, the bonds, the general conditions, the supplementary conditions, the specifications and the drawings as the same are more specifically identified in the agreement, together with all amendments, modifications and supplements issued pursuant to the general conditions on or after the effective date of the agreement. (11/90)

CONTRACT MASTER SCHEDULE – The management summary schedule that shows the overall plan for the total contract. (6/07)

CONTRACT PLAN – The conditions, methods, schedule, etc. for carrying out the work of the contract as agreed between the parties at the time of signing the contract. (6/07)

CONTRACT PRICE – The monies payable by the owner to the contractor under the contract documents as stated in the agreement. (11/90)

CONTRACT "READ AS A WHOLE" – Reading an entire contract document, instead of reading each clause in the contract in isolation. If a clause is ambiguous and can be interpreted in more than one way, the meaning that conforms to the rest of the document is usually the accepted meaning. (11/90)

CONTRACT TIME – The number of days within which, or the dates by which, the work, or any specified part thereof, is to be completed. (11/90)

CONTRACT WORK BREAKDOWN STRUCTURE (CWBS) – A work breakdown structure of the products or services to be furnished under contract. It is comprised of selected PWBS (program / project WBS) elements specified in the contractual document and the contractor's lower level extensions of those elements. [7] (10/06)

CONTRACTOR –
(1) A business entity that enters into contracts to provide goods or services to another party.
(2) A person or organization that undertakes responsibility for the performance of a contract. One that agrees to furnish materials or perform services at a specified price. (6/07)

CONTROL –
(1) Management action, either preplanned to achieve the desired result or taken as a corrective measure prompted by the monitoring process.
(2) To take timely corrective action. Control occurs only if monitoring and forecasting activities indicate an undesirable final result is likely to occur and that a different final result is possible.
(3) Process of comparing actual performance with planned performance, analyzing the differences, and taking the appropriate corrective action. (6/07)

CONTROL ACCOUNT (CA) – A management control point where earned value measurement takes place. Syn.: COST ACCOUNT. (6/07)

CONTROL AND COORDINATION – Control is the process of developing targets and plans; measuring actual performance and comparing it against planned performance and taking the steps to correct the situation. Coordination is the act of ensuring that work is being carried out in different organizations and places to fit together effectively in time, content and cost in order to achieve the project objectives effectively. (6/07)

CONTROL BASELINE – See: BASELINE (6/07)

CONTROL GATE – A major project milestone at which the project client has the opportunity to exercise a 'go/no-go' decision upon continuation into the succeeding phase. (6/07)

CONTROLLING PATH – An alternate term used in place of 'as-built critical path' in order to technically preserve the use of the term critical path to denote only to activity paths identified by float calculation using early and late dates. By definition, as-built activities do not have early and late dates. (6/07)

CONTROLLING RELATIONSHIP – In planning and scheduling, the predecessor activity logic tie to an activity, with multiple predecessors, which "controls" or "drives" that activity and establishes it's latest early finish. (6/07)

CORRECTION PERIOD – The period of time within which the contractor shall promptly, without cost to the owner and in accordance with the owner's written instructions, either correct defective work, or if it has been rejected by the owner, remove it from the site and replace it with non-defective work, pursuant to the general conditions. (11/90)

COST – In project control and accounting, it is the amount measured in money, cash expended or liability incurred, in consideration of goods and/or services received. From a total cost management perspective, cost may include any investment of resources in strategic assets including time, monetary, human, and physical resources. (1/02)

COST ACCOUNT – Syn.: CONTROL ACCOUNT (CA). (6/07)

COST ACCOUNTING – The historical reporting of actual and/or committed disbursements (costs and expenditures) on a project. Costs are denoted and segregated within cost codes that are defined in a chart of accounts. In project control practice, cost accounting provides the measure of cost commitment and/or expenditure that can be compared to the measure of physical completion (or earned value) of an account. (1/03)

COST ANALYSIS – A historical and/or predictive method of ascertaining for what purpose expenditures on a project were made and utilizing this information to project the cost of a project as well as costs of future projects. The analysis may also include application of escalation, cost differentials between various localities, types of buildings, types of projects, and time of year. (11/90)

COST/SCHEDULE CONTROL SYSTEM CRITERIA (C/SCSC) – A standard method of earned value management used on US Government projects. C/SCSC combined time and cost measures to better measure performance in an integrated way. This standard was superceded by a government earned value management system (EVMS) standard. (6/07)

COST APPROACH – One of the three approaches in the appraisal process. Underlying the theory of the cost approach is the principle of substitution, which suggests that no rational person will pay more for a property than the amount with which he/she can obtain, by purchase of a site and construction of a building without undue delay, a property of equal desirability and utility. (11/90)

COST AT COMPLETION (CAC) – The amount an activity or group of activities will cost when it has been completed. It is the sum of the cost expended to date and the estimated cost to complete. See: INDICATED TOTAL COST. (6/07)

COST AVOIDANCE – An action taken in the present designed to decrease costs in the future. (6/07)

COST BASELINE – A time-phased budget used to measure and monitor cost performance. It is developed by summing estimated costs by period and is usually displayed in the form of an S-curve. See: BASELINE. (6/07)

COST BREAKDOWN STRUCTURE (CBS) –

(1) A hierarchical structure that divides budgeted resources into elements of costs, typically labor, materials and other direct costs. The lowest level, when assigned responsibility, typically defines a cost center.
(2) Hierarchical breakdown of a project into cost elements or cost categories. See: COST CENTER; COST CATEGORY. (6/07)

COST CATEGORY – A specifically defined division in a system of classification for estimated and/or expended money for which costs are to be summarized. (6/07)

COST CENTER – The smallest unit of activity or area of responsibility against which costs are accumulated; defined sections in the corporate system, representing units of responsibility as well as accounting units. (6/07)

COST CODES – Codes allocated to items or activities that allow costs to be consolidated according to the elements of the coding structure. See: CODE OF ACCOUNTS (COA); CHART OF ACCOUNTS. (6/07)

COST CONTROL – The application of procedures to monitor expenditures and performance against progress of projects or manufacturing operations; to measure variance from authorized budgets and allow effective action to be taken to achieve minimum costs. (11/90)

COST CONTROL SYSTEM – Any system of managing costs within the bounds of budgets or standards based upon work actually performed. Cost control is typically performed at designated levels in the work breakdown structure. (6/07)

COST CURVE – A graph that plots cumulative cost (e.g., planned, expended, incurred, etc) against a time scale. See: CASH FLOW. (6/07)

COST DISTRIBUTION – Distribution or allocation of overhead (indirect) costs on some logical basis, e.g., the time or cost of all associated direct cost activities. See: ALLOCATION. (6/07)

COST ENGINEER – An engineer whose judgment and experience are utilized in the application of scientific principles and techniques to problems of estimation; cost control; business planning and management science; profitability analysis; project management; and planning and scheduling. (11/90)

COST ESTIMATE – A prediction of quantities, cost, and/or price of resources required by the scope of an asset investment option, activity, or project. As a prediction, an estimate must address risks and uncertainties. Estimates are used primarily as inputs for budgeting, cost or value analysis, decision making in business, asset and project planning, or for project cost and schedule control processes. Cost estimates are determined using experience and calculating and forecasting the future cost of resources, methods, and management within a scheduled time frame. See: COST ESTIMATE CLASSIFICATION SYSTEM. (6/07)

COST ESTIMATE CATEGORY – Syn.: COST ESTIMATE CLASSIFICATION SYSTEM. (1/04)

COST ESTIMATE CLASS – Syn.: COST ESTIMATE CLASSIFICATION SYSTEM. (1/04)

COST ESTIMATE CLASSIFICATION SYSTEM – There are numerous characteristics that can be used to categorize project cost estimate types. Some of these characteristics are: degree of project definition, end usage of the estimate, estimating methodology, and the effort and time needed to prepare the estimate. The primary characteristic used to define the classification category is the degree of project definition -- the level of project definition determines the estimate class. The other characteristics are considered secondary.

The level of project definition defines maturity, or the extent and types of input information available to the estimating process. Such inputs include project scope definition, requirements documents, specifications, project plans, drawings, calculations, lessons learned from past projects, reconnaissance data, and other information that must be developed to define the project. Each industry will have a typical set of defining deliverables that are used to support the type of estimates used in that industry. The set of deliverables becomes more definitive and complete as the level of project definition (e.g., project engineering) progresses.

For projects, the estimate class designations that follow below are labeled Class 1, 2, 3, 4, and 5. A Class 5 estimate is based upon the lowest level of project definition, and a Class 1 estimate is closest to full project definition and maturity. This "countdown" approach considers that estimating is a process whereby successive estimates are prepared until a final estimate closes the process.

CLASS 5 ESTIMATE
(Typical level of project definition required: >0% to 2% of full project definition.)
Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systemic manner. Class 5 estimates, due to the requirements of end use, may be prepared within a very limited amount of time and with little effort expended. Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc.

CLASS 4 ESTIMATE
(Typical level of project definition required: 1% to 15% of full project definition.)
Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage.

CLASS 3 ESTIMATE
(Typical level of project definition required: 10% to 40% of full project definition.)
Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, and/or funding. Class 3 estimates are typically prepared to support full project funding requests, and become the first of the project phase "control estimate" against which all actual costs and resources will be monitored for variations to the budget. They are used as the project budget until replaced by more detailed estimates. In many owner organizations, a Class 3 estimate may be the last estimate required and could well form the only basis for cost/schedule control.

CLASS 2 ESTIMATE
(Typical level of project definition required: 30% to 70% of full project definition.)
Class 2 estimates are generally prepared to form a detailed control baseline against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the "bid" estimate to establish contract value. Class 2 estimates are typically prepared as the detailed control baseline against which all actual costs and resources will now be monitored for variations to the budget, and form a part of the change/variation control program.

CLASS 1 ESTIMATE
(Typical level of project definition required: 50% to 100% of full project definition.)
Class 1 estimates are generally prepared for discrete parts or sections of the total project rather than generating this level of detail for the entire project. The parts of the project estimated at this level of detail will typically be used by subcontractors for bids, or by owners for check estimates. The updated

estimate is often referred to as the current control estimate and becomes the new baseline for cost/schedule control of the project. Class 1 estimates may be prepared for parts of the project to comprise a fair price estimate or bid check estimate to compare against a contractor's bid estimate, or to evaluate/dispute claims. Class 1 estimates are typically prepared to form a current control estimate to be used as the final control baseline against which all actual costs and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution.

Syn.: COST ESTIMATE TYPE, COST ESTIMATE CLASS, COST ESTIMATE CATEGORY. See: AACE Recommended Practices No. 17R-97 "Cost Estimate Classification System" and No. 18R-97 "Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries". (1/04)

COST ESTIMATE TYPE – Syn.: COST ESTIMATE CLASSIFICATION SYSTEM. (1/04)

COST ESTIMATING – A predictive process used to quantify, cost, and price the resources required by the scope of an asset investment option, activity, or project. As a predictive process, estimating must address risks and uncertainties. The outputs of estimating are used primarily as inputs for budgeting, cost or value analysis, decision making in business, asset and project planning, or for project cost and schedule control processes.

As applied in the project engineering and construction industry, cost estimating is the determination of quantity and the predicting and forecasting, within a defined scope, of the costs required to construct and equip a facility. Costs are determined utilizing experience and calculating and forecasting the future cost of resources, methods, and management within a scheduled time frame. Included in these costs are assessments and an evaluation of risks. (1/03)

COST ESTIMATING RELATIONSHIP (CER) – In estimating, an algorithm or formula that is used to perform the costing operation. CERs show some resource (e.g., cost, quantity, or time) as a function of one or more parameters that quantify scope, execution strategies, or other defining elements. A CER may be formulated in a manner that, in addition to providing the most likely resource value, also provides a probability distribution for the resource value. Cost estimating relationships may be used in either definitive or parametric estimating methods. See: DEFINITIVE ESTIMATE; PARAMETRIC ESTIMATE. (1/03)

COST INDEX – A number which relates the cost of an item at a specific time to the corresponding cost at some specified prior time. See: PRICE INDEX. (6/07)

COST LOADING – In planning and scheduling, assigning an estimated or actual cost to an activity. The estimated cost may be only direct costs, or may include indirect costs. However, the CPM (critical path method) must be developed using only one cost loading method. (6/07)

COST OF CAPITAL – A term, usually used in capital budgeting, to express as an interest rate percentage the overall estimated cost of investment capital at a given point in time, including both equity and borrowed funds. (11/90)

COST OF LOST BUSINESS ADVANTAGE – The cost associated with loss of repeat business and/or the loss of business due to required resources and costs. (11/90)

COST OF OWNERSHIP – The cost of operations, maintenance, follow-on logistical support, and end item and associated support systems. See: OPERATING COST. [3] (11/90)

COST OF QUALITY –

(1) Consists of the sum of those costs associated with: (a) Cost of quality conformance; (b) Cost of quality nonconformance; and (c) Cost of lost business advantage.
(2) Cost incurred or expended to ensure quality, including those associated with the cost of conformance and nonconformance. [8] (6/07)

COST OF QUALITY CONFORMANCE – The cost associated with the quality management activities of appraisal, training, and prevention. (11/90)

COST OF QUALITY NONCONFORMANCE – The cost associated with deviations involving rework and/or the provision of deliverables that are more than required. (11/90)

COST PERFORMANCE INDEX / INDICATOR (CPI) – The ratio of earned value to actual costs (CPI = BCWP/ACWP). A value greater than 1 indicates that costs are running under budget. A value less than 1 indicates that costs are running over budget. Often used to predict magnitude of a possible cost overrun by dividing it into the original cost estimate (original cost estimate / CPI = projected cost at completion). (6/07)

COST TO COMPLETE – The amount that an in-progress activity or group of activities will cost to complete. (6/07)

COST VALUE – See: FUNCTIONAL WORTH. (11/90)

COST VARIANCE – The difference between the earned value and actual cost. Cost variance (CV) = budgeted cost of work performed (BCWP) - actual cost of work performed (ACWP). A negative cost variance indicates that the activity(ies) is running over budget. (6/07)

COST-OF-LIVING INDEX – In modern usage, a price index based on a constant utility concept as opposed to a constant basket concept. (11/90)

COSTING –
(1) The application of cost and resources to a quantified scope.
(2) The translation of quantified scope information into expressions of the cost and resources required through the use of cost estimating relationships (CERs).
(3) A process of determining actual costs from actual expenditures. The way costs are estimated and the way money is spent are rarely the same, making it necessary to analyze and redistribute actual expenditures to arrive at cost data that is useful for future estimating purposes. See: COST ESTIMATING RELATIONSHIP (CER); NORMALIZATION. (6/07)

COSTING, ACTIVITY BASED (ABC) – Costing in a way that the costs budgeted to an account truly represent all the resources consumed by the activity or item represented in the account. (1/03)

CPM – See: CRITICAL PATH METHOD (CPM). (6/07)

CRASH COSTS – The cost of reducing an activity to its crash duration. (6/07)

CRASH DURATION – When needing to shorten a network critical path, activities may be 'crashed'. This represents drastic action to reduce the duration of a critical activity and should only taken in exceptional circumstances due to a dramatic increase in resource consumption. (6/07)

CRASHING – Action to decrease the duration of an activity or project by increasing the expenditure of resources. (6/07)

CREW HOUR – An hour of effort for a crew of workers. For example, if a crew has 2 workers, a crew hour includes 2 labor hours. (6/07)

CREW RATE – Labor cost per crew hour for a given crew. The labor cost may include only wages or wages plus benefits, burdens, and other markups. The labor cost may also include an allowance for the costs of tools and equipment used by the crew in performance of their work. See: LABOR COST. (6/07)

CRITICAL ACTIVITY – An activity on the project's critical path. A delay to a critical activity causes a corresponding delay in the completion of the project. Although some activities are "critical," in the dictionary sense, without being on the critical path, this meaning is seldom used in the project context. (6/07)

CRITICAL CHAIN – That set of tasks which determines the overall duration of a project, after considering resource capacity. It is typically regarded as the constraint or leverage point of a project. (6/07)

CRITICAL CHAIN METHOD – Differentiated from the critical path method, this project planning and management technique considers resources that constrain the work, not only the precedence of activities. The method determines the longest-duration sequence of resource-constrained activities through a project network—thus, the shortest-possible project duration—the critical chain. Algorithms for application of the method are both deterministic and stochastic. Time buffers are included to protect completion dates and provide adequate solutions, since contingency is removed from durations of individual activities. (8/07)

CRITICAL PATH – The longest continuous chain of activities (may be more than one path) which establishes the minimum overall project duration. A slippage or delay in completion of any activity by one time period will extend final completion correspondingly. The critical path by definition has no "float." See: LONGEST PATH. (6/07)

CRITICAL PATH ANALYSIS – Procedure for calculating the critical path and floats in a network. (6/07)

CRITICAL PATH METHOD (CPM) –
(1) Technique used to predict project duration by analyzing which sequence of activities has least amount of scheduling flexibility. Early dates are figured by a forward pass using a specific start date and late dates are figured by using a backward pass starting from a completion date.
(2) Network scheduling using activity durations and logic ties between activities to model the plan to execute the work. CPM scheduling is the method of choice for managing projects of long duration, complex technical integration, or the need to coordinate fast or early completion of the work. (6/07)

CRITICAL RELATIONSHIP – A driving relationship between two critical activities, thus defining which activity influences the final completion of the project. (6/07)

CRITICAL SEQUENCE – Sequence of activities having zero float after resource limits are taken into account in calculating float. (6/07)

CRITICAL SEQUENCE ANALYSIS – A process of calculating a critical sequence of activities while taking into account resource limits that reflects an activity's flexibility. (6/07)

CRITICAL TASK – A task that must finish on time for the entire project to finish on time. If a critical task is delayed, the project completion date is also delayed. A critical task has zero slack time. A series of critical tasks make up the project's critical path. (6/07)

CRITICALITY – A measure of the significance or impact of failure of a product, process, or service to meet established requirements. (11/90)

CRITICALITY INDEX – In planning and scheduling, a measure of how often an activity appears on the critical path during a Monte Carlo simulation. (6/07)

CRUDE MATERIALS – Includes products entering the market for the first time which have not been fabricated or manufactured but will be processed before becoming finished goods (e.g., steel scrap, wheat, raw cotton). Syn.: RAW MATERIALS. (11/90)

CURRENT COST ACCOUNTING (CCA) – a methodology prescribed by the Financial Accounting Board to compute and report financial activities in constant dollars. (11/90)

CURRENT DATE LINE – A vertical line in a Gantt chart, resource graph, or other charts with dates on one axis, indicating the current date. (6/07)

CURRENT DOLLARS – Dollars of purchasing power in which actual prices are stated, including inflation or deflation. In the absence of inflation or deflation, current dollars equal constant dollars. [1] (11/90)

CURRENT FINISH DATE – The current estimate of the calendar date when an activity will be completed. (6/07)

CURRENT PERIOD (OF A GIVEN PRICE INDEX) – Period for which prices are compared to the base period prices. (11/90)

CURRENT SCHEDULE – Schedule update, which reflects actual progress to date, plus forecast progress going forward and is accepted / used for monitoring and controlling the work. (6/07)

CURRENT START DATE – The current estimate of the calendar date when an activity will begin. (6/07)

CURRENT STATUS – In project control, a report that compares actual progress with planned progress as of the last reporting date. (6/07)

CUSTOM IN THE INDUSTRY – An established practice in a particular industry in the general area. It may be used to show the practice to be followed in a particular circumstance. (11/90)

CUSTOMER – The ultimate consumer, user, client, beneficiary or second party who will be responsible for acceptance of the project's deliverables. (6/07)

CUSTOMER FURNISHED EQUIPMENT (CFE) – Equipment provided to the contractor doing the project by the customer for the project and typically specified in the contract. Also referred to as owner furnished material/equipment (OFM/OFE). (6/07)

CUTOFF DATE – The ending date in a reporting period. (6/07)

CYCLE TIME – The time duration that it takes to create a deliverable. Includes time for both direct effort on the deliverable and time spent on other activities, projects or processes that intentionally or unintentionally add to the duration. (6/07)

DAMAGES, ACTUAL – The increased cost to one party resulting from another party's acts or omissions affecting the contract but not incorporated into a contract modification. (11/90)

DAMAGES, LIQUIDATED – An amount of money stated in the contract as being the liability of a contractor for failure to complete the work by the designated time(s). Liquidated damages ordinarily stop at the point of substantial completion of the project or beneficial occupancy by the owner. Also can apply to contract defined output performance. (6/07)

DAMAGES, RIPPLE – See: IMPACT COST. (11/90)

DANGLE – An activity in a network that has neither predecessors nor successors. (6/07)

DATA DATE –
(1) The date on which the schedule has been updated to reflect actual progress (percent complete, remaining durations, new activities and changed logic, etc. input into schedule) and projects a new completion date.
(2) The calendar date that separates actual (historical) data from scheduled data. Scheduling software uses the data date to base its network calculations.
See: STATUS DATE; TIME-NOW; PROGRESS DATE (6/07)

DATE CONSTRAINT – A fixed date imposed on an activity to force it to start or finish by or on a certain date in a schedule model. A date constraint overrides the logic of the schedule and can, if improperly used, caused unintended results. (6/07)

DATE FOR THE COMMENCEMENT OF THE CONTRACT TIME – The date when the contract time commences to run and on which the contractor shall start to perform the contractor's obligations under the contract documents. (11/90)

DATE OF ACCEPTANCE – Date on which the client agrees to final acceptance of the project. Commitments against the authorized funds usually cease at this time. This is an event. See: DELIVERY (6/07)

DAY WORK ACCOUNT – A method of payment for work not included in the scope of the contract that the construction contractor is obliged to perform at the request or direction of the owner or its agent. Generally, such day work account is paid for on unit-price or cost-plus terms. (6/07)

DECELERATION – The opposite of acceleration. A direction, either expressed or implied, to slow down job progress. (11/90)

DECISION EVENT – State in the progress of a project when a decision is required before the start of any succeeding activity. The decision determines which of a number of alternative paths is to be followed. (6/07)

DECISION MODEL – A quantitative model that that provides a base methodology that supports objective, consistent and appropriate decision making by an organization considering all agreed model inputs and outputs. See: DECISION POLICY. (6/07)

DECISION POLICY – Definitive position of an organization on how investment or project decisions will be made. Establishes the basis for decision models. Provides a basis for consistent and appropriate decision making and defines authority and accountability within the organization. See: POLICY. (6/07)

DECISION TREE – A graphical representation of the decision process. Sequential decisions are drawn in the form of branches of a tree, stemming from an initial decision point and extending all the way to final outcomes. Each path through branches of the tree represents a separate series of decisions and probabilistic events. (6/07)

DECISIONS UNDER CERTAINTY – Simple decisions that assume complete information and no uncertainty connected with the analysis of the decisions. (11/90)

DECISIONS UNDER RISK – A decision problem in which the analyst elects to consider several possible futures, the probabilities of which can be estimated. (11/90)

DECISIONS UNDER UNCERTAINTY – A decision for which the analyst elects to consider several possible futures, the probabilities of which cannot be estimated. (11/90)

DECLINING BALANCE DEPRECIATION – Method of computing depreciation in which the annual charge is a fixed percentage of the depreciated book value at the beginning of the year to which the depreciation applies. Syn.: PERCENT ON DIMINISHING VALUE. (11/90)

DECOMPOSITION – Separation of the scope of work and requirements into smaller, component packages, so that work effort can be more effectively monitored and controlled. (8/07)

DE-ESCALATE – A method to convert present-day costs or costs of any point in time to costs at some previous date via applicable indexes. (11/90)

DEFECT – A deviation of a severity sufficient to require corrective action. (11/90)

DEFECTIVE – An adjective which, when modifying the work, refers to work that is unsatisfactory, faulty or deficient, or does not conform to the contract documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the contract documents, or has been damaged prior to the engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by the owner at substantial completion in accordance with the contract documents). (11/90)

DEFECTIVE SPECIFICATIONS – Specifications and/or drawings which contain errors, omissions, and/or conflicts, which affect or prevent the contractor's performance of the work. (11/90)

DEFECT, LATENT – A defect in the work which cannot be observed by reasonable inspection. (11/90)

DEFECT, PATENT – A defect in the work which can be observed by reasonable inspection. (11/90)

DEFINITION (PROJECT) – Process of quantifying performance and interface requirements during system decomposition and elaboration phase of a project. See: LIFE CYCLE – PROJECT LIFE CYCLE. (6/07)

DEFINITION PHASE – An early phase in the project life cycle when the scope is defined. Syn.: PLANNING PHASE; DEVELOPMENT PHASE; FRONT END (6/07)

DEFINITIVE ESTIMATE –
(1) In estimating practice, describes estimating algorithms or cost estimating relationships that are not highly probabilistic in nature (i.e., the parameters or quantification inputs to the algorithm tend to be conclusive or definitive representations of the scope). Typical definitive estimate algorithms include, but are not limited to, detailed unit and line-item cost techniques (i.e., each specific quantified item is listed and costed separately).
(2) An estimate prepared from very defined engineering data. For construction, the engineering data includes as a minimum, nearly complete plot plans and elevations, piping and instrument diagrams, one-line electrical diagrams, equipment data sheets and quotations, structural sketches, soil data and sketches of major foundations, building sketches and a complete set of specifications. This category of estimate covers all types, from the minimum described above, to the maximum definitive type, which would be made from “approved for construction” drawings and specifications. (This term is superceded by Recommended Practice No. 17R-97 “Cost Estimate Classification System”.) (6/07)

DEFLATION – An absolute price decline for a commodity; also, an operation by means of which a current dollar value series is transformed into a constant dollar value series (i.e., is expressed in "real" terms using appropriate price indexes as deflators). (11/90)

DELAY – To cause the work or some portion of the work to start or be completed later than planned or later than scheduled. (4/04)

DELAY, COMPENSABLE –
(1) Delays that are caused by the owner's actions or inactions. Contractor is entitled to a time extension

and damage compensation for extra costs associated with the delay.
(2) If the delay is deemed compensable the party will be entitled to additional compensation for the costs of delay, as well as additional time for contract performance. However, it is possible for a delay to be compensable without extending the contract performance time. Generally speaking, a delay that could have been avoided by due care of one party is compensable to the innocent party suffering injury or damage as a result of the delay's impact. [10]
(3) A contractor is entitled to recover for delay costs and a time extension provided that three conditions are satisfied: 1) The delay is caused by the owner or is within the owner's control; 2) The delay results in additional costs to the contractor; and 3) The contractor has not assumed the risk of delay. Because this entitlement is implied in every contract, it does not need to be expressly stated in the contract. [11] (6/07)

DELAY, CONCURRENT – Two or more delays in the same time frame or which have an independent effect on the end date. The owner/engineer and the contractor may each be responsible for delay in completing the work. This may bar either party from assessing damage against the other. This may also refer to two or more delays by the same party during a single time period. (11/90)

DELAY, EXCUSABLE – Any delay beyond the control and without the fault or negligence of the contractor or the owner, caused by events or circumstances such as, but not limited to, acts of God or of the public enemy, acts of interveners, acts of government other than the owner, fires, floods, epidemics, quarantine restrictions, freight embargoes, hurricanes, tornadoes, labor disputes, etc. Generally, a delay caused by an excusable delay to another contractor is compensable when the contract documents specifically void recovery of delay costs. (11/90)

DELAY, INEXCUSABLE – Any delay caused by events or circumstances within the control of the contractor, such as inadequate crewing, slow submittals, etc, which might have been avoided by the exercise of care, prudence, foresight, or diligence on the part of the contractor. (11/90)

DELAY, NONPREJUDICIAL – Any delay impacting a portion of the work within the available total float or slack time, and not necessarily preventing completion of the work within the contract time. (11/90)

DELAY, PACING –
(1) Deceleration of the project work, by one of the parties to the contract, due to a delay to the end date of the project caused by the other party, so as to maintain steady progress with the revised overall project schedule.
(2) A delay resulting from a conscious and contemporaneous decision to pace progress of an activity against another activity experiencing delay due to an independent cause.
(3) The consumption of float created by another delay, in performing work on an activity not directly dependent on the progress of the work experiencing the other delay. (6/07)

DELAY, PARENT – The alleged owner-caused delay that created or increased the relative total float consumed by the pacing delay. The parent delay must start or exist prior to the pacing delay. Also the parent delay must be on the critical path or have a lower float value than the paced activity prior to pacing. (6/07)

DELAY, PREJUDICIAL – Any excusable or compensable delay impacting the work and exceeding the total float available in the progress schedule, thus preventing completion of the work within the contract time unless the work is accelerated. (11/90)

DELAYING RESOURCE – In resource planning and scheduling, inadequate availability of one or more resources may require that completion of an activity be delayed beyond the date on which it could otherwise be completed. The delaying resource is the first resource on an activity that causes the activity to be delayed. (6/07)

DELIVERABLE –

(1) A report or product of one or more tasks that satisfy one or more objectives and must be delivered to satisfy contractual requirements.
(2) Another name for products, services, processes, or plans created as a result of doing a project. A project typically has interim as well as final deliverables (6/07)

DELIVERY – Transfer or handover of a product from one party to another. Syn.: TURNOVER. (6/07)

DELPHI TECHNIQUE – A forecasting technique that seeks expert consensus by sharing their opinions with each other anonymously after each round of forecasts. Based on the array of anonymous expert opinions then shared, panel participants rethink and reforecast for the next round. When forecasts are congruent or nearly so, the forecasting process is complete. (8/07)

DEMAND FACTOR –
(1) The ratio of the maximum instantaneous production rate to the production rate for which the equipment was designed.
(2) The ratio between the maximum power demand and the total connected load of the system. (11/90)

DEMING CYCLE – Syn.: PLAN-DO-CHECK-ACT (PDCA) CYCLE. (6/07)

DEMOGRAPHIC INDEX – Cost indexes developed to deal with geographic cost differences. (11/90)

DEMURRAGE – A charge made on cars, vehicles, or vessels held by or for consignor or consignee for loading or unloading, for forwarding directions or for any other purpose. (11/90)

DEPENDENCIES – Relationships between products or tasks. For example, one product may be made up of several other 'dependent' products or a task may not begin until a 'dependent' task is complete. See: RELATIONSHIP. (6/07)

DEPENDENCY – A relation between activities, such that one requires input from the other. (6/07)

DEPLETION –
(1) A form of capital recovery applicable to extractive property (e.g., mines). Depletion can be on a unit-of-output basis related to original or current appraisal of extent and value of the deposit. (Known as percentage depletion.)
(2) Lessening of the value of an asset due to a decrease in the quantity available. Depletion is similar to depreciation except that it refers to such natural resources as coal, oil, and timber in forests. (11/90)

DEPRECIATED BOOK VALUE – The first cost of the capitalized asset minus the accumulation of annual depreciation cost charges. (11/90)

DEPRECIATION –
(1) Decline in value of a capitalized asset.
(2) A form of capital recovery applicable to a property with a life span of more than one year, in which an appropriate portion of the asset's value is periodically charged to current operations. (11/90)

DESCRIPTIVE – Portrayal of content in words, either orally or written. When applied to instructions, implies information concerning how something is to be done, rather than step by step details of what is to be done, i.e. prescriptive. (6/07)

DESIGN & DEVELOPMENT PHASE – Definition phase in a generic project life cycle that encompasses detailed technical, commercial and organizational decisions. There is often substantial opportunity to optimize these decisions without expenditure of significant resources by modeling, prototyping and testing. Management approval gates are necessary where major decisions will be made. In some industries, this phase is dealt with as two separate phases with a management gate between the two. This allows design to be matured before approval is given for significant resource expenditure on full

design/development. Equally, the gate may be required before major procurement decisions and commitments are made after initial design but prior to full design/development. See: DEFINITION PHASE. (6/07)

DESIGN DEVELOPMENT – Process of identifying and verifying technical solutions to meet requirements of conceptual design. Takes conceptual design to next level of detail, but not as detailed as the detailed design stage. Depending on size and nature of project, it may be a separate stage in the project life cycle. (6/07)

DESIGN REVIEW – A formal, documented, comprehensive and systematic examination of a design to evaluate design requirements and capability of the design to meet these requirements and to identify problems and propose solutions. (6/07)

DESIRABLE LOGIC – Network logic that is desirable for the contractor (but not necessarily for the client), based on some preference or advantage. Desirable logic may impose unnecessary conditions that preclude an optimum solution. See: IRREFUTABLE LOGIC; PREFERENTIAL LOGIC. (6/07)

DETAILED ENGINEERING – The detailed design, drafting, engineering, and other related services necessary to purchase equipment and materials and construct a facility. (11/90)

DETAILED REQUIREMENT – A requirement that describes the specific function that a particular product provides at a level of detail sufficient to support execution of the work. [8] (6/07)

DETAIL(ED) SCHEDULE –
(1) A schedule used to communicate the day-to-day activities to working levels on the project. The detailed schedule would typically cover activities up to at least the next major milestone. The detailed schedule supports and is consistent with the master schedule.
(2) A schedule, which displays the lowest level of detail necessary to control the project through job completion. The intent of this schedule is to finalize remaining requirements for the total project. (6/07)

DETERMINISTIC NETWORK / MODEL –
(1) A network with no facilities to accommodate probabilistic dependencies. Precedence networks are said to be deterministic.
(2) A deterministic model, as opposed to a stochastic model, contains no random elements and for which, therefore, the future course of the system is determined by its state at present (and/or in the past). (6/07)

DEVELOPMENT – Process of working out and extending theoretical, practical, and/or useful application of an idea, concept, or preliminary design. (6/07)

DEVELOPMENT COSTS – Those costs specific to a project, either capital or expense items, which occur prior to commercial sales and which are necessary in determining the potential of that project for consideration and eventual promotion. Major cost areas include process, product, and market research and development. (11/90)

DEVELOPMENT PHASE – Syn.: DEFINITION PHASE. (6/07)

DEVIATION –
(1) A departure from established requirements. Deviations occur when the work product either fails to meet or unnecessarily exceeds the requirements. The change (positive or negative) may be considered potential or it may already be in the process of actually occurring. The deviation is used to provide a detailed description and detailed estimate (or ROM estimate) of change impacts that are the result of design developments, productivity, omissions, errors, price fluctuation, supplier changes, etc., or anything else that changes the forecast cost and schedules. Deviations are documented by project controls and communicated to the project manager. A deviation provides the project team with an opportunity to

mitigate an adverse impact or to optimize the outcome and is used primarily as a communication tool. Note: Deviation as used herein refers to a single point variance. Trend refers to a pattern of a data group. (2) In systems engineering, a deviation in the work product may be classified as an imperfection, nonconformance, or defect. (6/07)

DEVIATION COSTS – The sum of those costs, including consequential costs such as schedule impact, associated with the rejection or rework of a product, process, or service due to a departure from established requirements. Also may include the cost associated with the provision of deliverables that are more than required. (11/90)

DIAGRAMMING (SCHEDULE) – See: SCHEDULING. (6/07)

DIFFERENTIAL PRICE ESCALATION RATE – The expected percent difference between the rate of increase assumed for a given item of cost (such as energy), and the general rate of inflation. [1] (11/90)

DIFFERING SITE CONDITIONS – Subsurface or latent physical conditions at the site differing materially from those conditions indicated in the contract documents or unknown physical conditions at the site, of an unusual nature, differing materially from conditions normally encountered and generally recognized as inherent in work of the nature provided for in the contract. (11/90)

DIRECT COSTS – Costs of completing work that are directly attributable to its performance and are necessary for its completion. 1) In construction: the cost of installed equipment, material, labor and supervision directly or immediately involved in the physical construction of the permanent facility. 2) In manufacturing, service, and other non-construction industries: the portion of operating costs that is readily assignable to a specific product or process area. (6/07)

DIRECT PACING – When the paced event has a logical relationship to the parent delay. (6/07)

DISCIPLINE –
(1) Area of technical expertise or specialty. [8]
(2) A discrete area of study and endeavor where only specialized education and experience enable the full comprehension of the content of the subject matter and its appropriate application. (8/07)

DISCONTINUOUS ACTIVITY – An activity in which the interval between start and finish dates is allowed to exceed its duration in order to satisfy start-to-start and finish-to-finish relationships with other activities. (6/07)

DISCOUNTED CASH FLOW –
(1) The present worth of a sequence in time of sums of money when the sequence is considered as a flow of cash into and/or out of an economic unit.
(2) An investment analysis which compares the present worth of projected receipts and disbursements occurring at designated future times in order to estimate the rate of return from the investment or project. Also called discounted cash flow rate of return, interest rate of return, internal rate of return, investor's method or profitability index. (11/90)

DISCOUNTED PAYBACK PERIOD (DPB) – The time required for the cumulative benefits from an investment to pay back the investment cost and other accrued costs considering the time value of money. [1] (11/90)

DISCOUNT FACTOR – A multiplicative number (calculated from a discount formula for a given discount rate and interest period) that is used to convert costs and benefits occurring at different times to a common time. [1] (11/90)

DISCOUNTING – A technique for converting cash flows that occur over time to equivalent amounts at a common time. [1] (11/90)

DISCOUNT RATE – The rate of interest reflecting the investor's time value of money, used to determine discount factors for converting benefits and costs occurring at different times to a base time. The discount rate may be expressed as nominal or real. [1] (11/90)

DISCRETE EFFORT – Tasks that have a specific measurable end product or end result. Discrete tasks are ideal for earned value measurement. See: WORK PACKAGE. (6/07)

DISCRETE MILESTONE – A milestone that has a definite scheduled occurrence. (6/07)

DISCRETE TASK – A measurable activity with an output. (6/07)

DISCRETIONARY DEPENDENCY – Dependency defined by preference, rather than necessity. These are typically employed in preferential or soft logic. (6/07)

DISINFLATION – A downward trend in inflation rates, effected by weak or declining demand. It may well portend deflation. (11/90)

DISPATCHING – The selecting and sequence of jobs to be run at individual work stations and the assignment of these jobs to workers. In many companies, dispatching is done by the actual shop line supervisor, set-up worker or lead worker. A dispatcher is usually a representative of the production control department which handles this job assignment task. (11/90)

DISPUTE – A disagreement between the owner and the contractor as to a question of fact or contract interpretation which cannot be resolved to the mutual satisfaction of the parties. (11/90)

DISRUPTION – An interference (action or event) with the orderly progress of a project or activity(ies). Disruption has been described as the effect of change on unchanged work and manifests itself primarily as adverse labor productivity impacts. If such disruption is caused by owner or engineer action (or failure to act), the contractor may be entitled to recover any resulting costs. See: RIPPLE EFFECT. (6/07)

DISTRIBUTABLES – The portion of a project’s cost that can not be associated with any specific direct account. In construction, this includes the field non-manual staff, field office, office supplies, temporary construction, utilities, small tools, construction equipment, weather protection, snow removal, lost time, labor burden, etc. When completion cost reports are prepared, the distributable costs may be distributed across the direct accounts for fixed asset accounting. See: INDIRECT COSTS. (6/07)

DOCUMENT –
(1) (*noun*) Words or images assembled for a communicative purpose within a bounded physical medium—typically on sheets of paper or in digital memory files.
(2) (*verb*) To record communications, events, actions, or circumstances within a bounded physical medium. (8/07)

DRAWINGS, PLANS – The drawings, plans or reproductions thereof, which show location, character, dimensions, and details of the work to be performed and which are referred to in the contract documents. (11/90)

DRIVING RELATIONSHIP – A relationship between two activities in which the start or completion of the predecessor activity determines the early dates for the successor activity with multiple predecessors. See: FREE FLOAT. (6/07)

DRIVING ACTIVITY – The predecessor activity(ies) that determines another activity's early start. (6/07)

DUMMY ACTIVITY – Used only in activity on arrow (AOA) networks to create logic relationships between activities denoting a dependency, but not an action. Dummies are “activities” with zero duration, but are not milestones. Dummy activities are typically drawn as dotted lines. (6/07)

DUMMY START ACTIVITY – An activity entered into the network for the sole purpose of creating a single start for the network. (11/90)

DURABLE GOODS – Generally, any producer or consumer goods whose continuous serviceability is likely to exceed three years (e.g., trucks, furniture). (11/90)

DURATION – The amount of time estimated to complete an activity in the time scale used in the schedule (hours, days, weeks, etc.). Planned production rates and available resources will define the duration used in a given schedule. The following four types of duration are used: 1) Original duration: Duration input by the planner; 2) Current duration: Duration based on latest progress date for in-progress activities. Calculated rate of progress provides a new completion estimate; 3) Actual duration: Duration based on activity's actual start and actual finish. Applies only to completed activities; and 4) Remaining duration: The expected time required to complete an activity. It is calculated as the difference between the data date and the expected finish date for in-progress activities. (Equal to the original duration for non-progressed activities. Equal to zero for completed activities.) See: ACTIVITY DURATION; CYCLE TIME. (6/07)

DURATION COMPRESSION – Shortening project schedule without reducing project scope. Duration compression is not always possible and often requires an increase in project cost. See: CRASHING; FAST-TRACK(ING). (8/07)

EARLIEST EXPECTED COMPLETION DATE – The earliest calendar date on which the completion of an activity work package or summary item occurs. [4] (11/90)

EARLY BAR – An activity bar shown on the bar chart starting at the earliest date its predecessors’ completion will allow it to begin. (6/07)

EARLY DATES – Calculated in the forward pass of time analysis, early dates are the earliest dates on which an activity can start and finish. (6/07)

EARLY EVENT TIME (EV) – The earliest time at which an event may occur. (11/90)

EARLY FINISH (EF) – The earliest date or time an activity may finish as calculated by the schedule during the forward pass. Equal to the early start of the activity plus its remaining duration. (6/07)

EARLY START TIME (ES) – the earliest time any activity may begin as logically constrained by the network for a specific work schedule. (11/90)

EARLY START (ES) – The earliest date or time an activity may start as calculated by the schedule during the forward pass. (6/07)

EARLY WORK SCHEDULE – Predicated on the parameters established by the proposal schedule and any negotiated changes, the early work schedule defines reportable pieces of work within major areas. The format is developed into a logic network including engineering drawings, bid inquiries, purchase orders, and equipment deliveries, and can be displayed as a time-phased network. The detail of this schedule concentrates on projected engineering construction issue drawings released and equipment deliveries. The activities of the early part of construction are more defined than in the proposal or milestone schedule. (11/90)

EARNED HOURS (EH) – The time in standard hours credited as a result of the completion of a given task or a group of tasks. (6/07)

EARNED VALUE (EV) – Measure of the value of work performed so far. Earned value uses original estimates and progress-to-date to show whether the actual costs incurred are on budget and whether the tasks are ahead or behind the baseline plan. The budgeted cost of work performed (BCWP). The “value” of the work earned at the date of analysis (data date). Represents the actual value of work performed, rather than the actual cost of the work performed. In comparison to planned value (PV), provides a measure of performance taking into account both time and cost expended. See: PLANNED VALUE (PV). (6/07)

EARNED VALUE CONCEPT – In general (non-EVMS) terms, the objective measurement at any time of work accomplished (performed) in terms of budgets planned for that work, and the use of these data to indicate contract cost and schedule performance. (6/07)

EARNED VALUE MANAGEMENT [SYSTEM] (EVM[S]) – A project progress control system that integrates work scope and resources to enable objective comparison of the earned value to the actual cost and the planned schedule of the project. (8/07)

EARNED VALUE REPORTS – Cost and schedule performance reports that are part of the performance measurement system. These reports make use of the earned value concept of measuring work accomplishment. (11/90)

EARNINGS VALUE – The present worth of an income producer's probable future net earnings, as prognosticated on the basis of recent and present expense and earnings and the business outlook. (11/90)

ECONOMIC EVALUATION METHODS – A set of economic analysis techniques that considers all relevant costs associated with a project investment during its study period, comprising such techniques as life-cycle cost, benefit-to-cost ratio, savings-to-investment ratio, internal rate of return, and net savings. [1] (11/90)

ECONOMIC LIFE (CYCLE)– That period of time over which an investment is considered to be the least-cost alternative for meeting a particular objective. Syn.: ASSET LIFE CYCLE. [1] (11/90)

ECONOMIC RETURN – The profit derived from a project or business enterprise without consideration of obligations to financial contributors and claims of others based on profit. (11/90)

ECONOMIC VALUE – The value of property in view of all its expected economic uses, as distinct from its value in view of any particular use. Also, economic value reflects the importance of a property as an economic means to an end, rather than as an end in itself. (11/90)

ECONOMY – The cost or profit situation regarding a practical enterprise or project as in economy study, engineering economy, and project economy. (11/90)

EFFECTIVE DATE OF THE AGREEMENT – The date indicated in the agreement on which it becomes effective, but if no such date is indicated, the date on which the agreement is signed and delivered by the last of the two parties to sign and deliver. (11/90)

EFFECTIVE INTEREST – The true value of interest rate computed by equations for compound interest rate for a 1-year period. (11/90)

EFFICIENCY – Syn.: PRODUCTIVITY. (6/07)

EFFICIENCY FACTOR – A measure of overall performance used in a work measurement system. It is calculated by dividing the standard time to perform the work by the actual time. (6/07)

EFFORT – The number of labor units necessary to complete work. Effort is usually expressed in staff hours, staff days or staff weeks and should not be confused with duration. (6/07)

EFFORT REMAINING – Estimate of effort remaining to complete an activity. A far more useful measure of progress than percentage complete. (6/07)

EFFORT-DRIVEN ACTIVITY – An effort-drive activity provides the option to determine activity duration through resource usage. The resource requiring the greatest time to complete the specified amount of work on the activity will determine its duration. (6/07)

EIGHTY-HOUR RULE – Method of breaking down each project activity or task into work packages that require no more than 80 hours of effort to complete. [8] (6/07)

EIGHTY-TWENTY RULE (PARETO'S LAW) – A statistical principle named after Italian economist Vilfredo Pareto, who observed that 80% of income in Italy went to 20% of the population. In Cost Management, it is commonly used to describe the situation where a small subset of cost items, activities, and so on, are the source of most of the total cost, duration, etc. (6/07)

ELEMENTARY COMMODITY GROUPS (ELEMENTARY GROUPS) – The lowest level of goods and services for which a consistent set of value weights is available. (11/90)

END ACTIVITY – An activity with no logical successors. (6/07)

END EVENT (OF A PROJECT) – Event with preceding, but no succeeding activities. There may be more than one end event. (6/07)

END ITEM – A final combination of end products components, parts or materials that is ready for its intended use. See: DELIVERABLE; PRODUCT. [7] (6/07)

ENDING NODE OF NETWORK (ADM) – A node where no activities begin, but one or more activities end. (11/90)

END NETWORK EVENT – The event that signifies the end of a network. (11/90)

ENDOWMENT – A fund established for the support of some project or succession of donations or financial obligations. (11/90)

ENGINEER (IN CONTRACTS) – The individual, partnership, corporation, joint venture, or any combination thereof, named as the engineer in the agreement who will have the rights and authority assigned to the engineer in the contract documents. The term "the engineer" means the engineer or the engineer's authorized representative. (11/90)

ENGINEERING CHANGE NOTICE (ECN) – The formal release of an engineering change. (6/07)

ENGINEERING CHANGE PROPOSAL (ECP) – A proposal submitted by the seller in response to a buyer request for an ECP to change the existing contract effort. Only the buyer can initiate the request for an engineering change proposal. This activity is usually preceded by a request for change. The user, buyer, or the seller can initiate a request for change to the contract. It is an exploratory activity. (6/07)

ENGINEERING CHANGE REQUEST (ECR) – Request to consider a technical change to the technical baseline submitted to client or its agent. (6/07)

ENGINEERED ITEMS – Items that are purchased to be used for a particular purpose and are engineered to unique specifications, as opposed to commodity materials. This typically includes tagged items and materials that require detailed engineering data sheets. (6/07)

ENTERPRISE –
(1) A business organization involved in economic activity and taking risks for purposes of profit.
(2) In total cost management, any endeavor, business, government, group, individual or other entity that owns, controls, or operates strategic assets. (6/07)

ENTERPRISE PROJECT MANAGEMENT – Application of project management discipline throughout an enterprise. A concept based on principle that prosperity depends on adding value to business, and that value is added by systematically implementing new projects, i.e. projects of all types across the organization. (6/07)

ENTERPRISE RESOURCE PLANNING (ERP) – Program/project resource planning of activities, supported by multi-module application software and processes to help an enterprise manage key parts of its business which may include product planning, maintaining inventories, supply chain processes, providing customer services, human resources planning, etc. It may include other system involving any kind of resource consumption that can benefit from integration of information across many functional areas. (6/07)

EQUITABLE ADJUSTMENT – A contract adjustment in price or time under, certain contract clauses, or both, to compensate the contractor expense incurred due to actions of the owner or to compensate the owner for contract reductions. An equitable adjustment includes an allowance for profit. Certain contract clauses provided for adjustments, excluding profit, and are not considered “equitable adjustments.” (6/07)

EQUIVALENT SETS OF COMMODITIES – Sets of commodities which provide the same total satisfaction to a given group of consumers (without necessarily being identical). (11/90)

EQUIVALENT UNIFORM ANNUAL VALUE – Syn.: ANNUAL VALUE. [1] (11/90)

ERRORS AND OMISSIONS – Deficiencies, usually in design or drafting, in the plans and specifications that must be corrected in order for the facility to operate properly. Errors in plans and specifications are normally items that are shown incorrectly, while omissions are normally items that are not shown at all. (11/90)

ESCALATION – The provision in actual or estimated costs for an increase in the cost of equipment, material, labor, etc., over that specified in the purchase order or contract due to continuing price level changes over time. Inflation may be a component of escalation, but non-monetary policy influences, such as supply-and-demand, are often components. (8/07)

ESCALATOR CLAUSE – Clause contained in collective agreements or purchase orders, providing for an automatic price adjustment based on changes in specified indices. (6/07)

ESTEEM VALUE – See: FUNCTIONAL WORTH. (11/90)

ESTIMATE –
(1) A prediction or forecast of the resources (i.e., time, cost, materials, etc) required to achieve or obtain an agreed upon scope (i.e., for an investment, activity, project, etc.).
(2) In cost estimating, a compilation of all the probable costs of the elements of a project or effort included within an agreed upon scope. See: FORECAST (6/07)

ESTIMATE BACKUP – Basic data, project objectives, scope, drawings, quotes, estimating data, qualifications and assumptions used in preparing the estimate and supporting the basis. (6/07)

ESTIMATE, COST – See: COST ESTIMATE; COST ESTIMATE CLASSIFICATION SYSTEM. (1/04)

ESTIMATE AT COMPLETION (EAC) – An estimate of the total cost an activity or group of activities will accumulate upon final completion. (6/07)

ESTIMATE TO COMPLETE (ETC) –
(1) In general terms, the estimated resources (i.e., work hours, costs, time, and/or materials) required to complete a scope of work.
(2) In earned value management, an estimate of the remaining costs required to complete an activity or group of activities. Typically, ETC = EAC - ACWP, is the estimated cost to complete the project or program under discussion. (8/07)

ESTIMATED COMPLETION DATE – The predicted date at which all requirements for a defined task will be completed. (6/07)

EVENT –
(1) A point in time when certain conditions have been fulfilled, such as the start or completion of one or more activities. Graphically, it is represented by a node. An event occurs only when all work preceding it has been completed. It has zero duration.
(2) In risk management, any specific identifiable action (such as a large government project being started in the same labor area as your project) or an act of nature that might happen and that (if it does happen) could affect the outcome of the project. See: MILESTONE EVENT; CONDITION (UNCERTAIN). (6/07)

EVENT NAME – An alphanumeric description of an event. [4] (11/90)

EVENT NUMBER – A numerical description of an event for computation and identification. (11/90)

EVENT ORIENTED – Planning approach focusing on events rather than activities. (6/07)

EVENT SLACK – The difference between the latest allowable date and the earliest date for an event. (11/90)

EVENT TIMES – Time information generated through the network analysis calculation, which identifies the start and finish times for each event in the network. (11/90)

EXCEPTION REPORT – A report that lists exceptions to the expected norm as progress and forecast information is compared against the plan. (6/07)

EXCEPTIONS – Those occurrences that cause deviation from a plan, such as issues, change requests and risks. Exceptions can also refer to items that the cost variance and schedule variance exceed predefined thresholds. (6/07)

EXCHANGE VALUE – See: FUNCTIONAL WORTH. (11/90)

EXCLUSIVE OR RELATIONSHIP – Logical relationship indicating that only one of the possible activities can be undertaken. (6/07)

EXCUSABLE COMPENSABLE DELAYS – Delays that are caused by the owner's actions or inactions. Contractor is entitled to a time extension and damage compensation for extra costs associated with the delay. See: EXCUSABLE DELAYS; EXCUSABLE NON-COMPENSABLE DELAYS; NON-EXCUSABLE DELAYS; CONCURRENT DELAYS. (6/07)

EXCUSABLE DELAYS – Delays not attributable to contractor's action or inactions. Excusable delays when founded, entitle contractor to a time extension if the completion date is affected. See: EXCUSABLE COMPENSABLE DELAYS; EXCUSABLE NON-COMPENSABLE DELAYS; NON-EXCUSABLE DELAYS; CONCURRENT DELAYS. (6/07)

EXCUSABLE NON-COMPENSABLE DELAYS – Delays that are neither contractor's nor owner's fault. The contractor is entitled to a time extension but not to damage compensation. Non-excusable delays, i.e. delays that are caused by the contractor's or its subcontractor's actions or inactions. Consequently, the contractor is not entitled to a time extension or delay damages. On the other hand, owner may be entitled to liquidated or other damages. See: EXCUSABLE DELAYS; EXCUSABLE COMPENSABLE DELAYS; NON-EXCUSABLE DELAYS; CONCURRENT DELAYS. (6/07)

EXECUTE / EXECUTING – Accomplish a preconceived objective by directing and implementing activities. (8/07)

EXEMPT EMPLOYEES – Employees exempt from overtime compensation by federal wage and hours guidelines. (6/07)

EXIT CRITERIA – Conditions that must be satisfied before the process element is considered complete. [8] (6/07)

EXPANSION – Any increase in the capacity of a plant facility or unit, usually by added investment. The scope of its possible application extends from the elimination of problem areas to the complete replacement of an existing facility with a larger one. (11/90)

EXPECTED BEGIN DATE – Syn.: TARGET START DATE. (11/90)

EXPENSE – Expenditures of short-term value, including depreciation, as opposed to land and other fixed capital. See: PLANT OVERHEAD. (11/90)

EXPERT JUDGMENT –
(1) Opinions, advice, recommendations, or commentary proffered, usually upon request, by a person or persons recognized, either formally or informally, as having specialized knowledge or training in a specific area. [8]
(2) Deliberate discernment of a situation or proposed course of action by those whose knowledge, skills, and abilities are developed from specialized education and experience, which enable them to better understand the situation or propose an optimal course of action than could those whose professional backgrounds are not so specialized. (8/07)

EXTERNAL CONSTRAINT – A constraint from outside the project network. (6/07)

EXPECTED DURATION – The length of time anticipated for a particular activity in the PERT method or in arrow or precedence diagramming methods (ADM, PDM). (11/90)

FACILITY – In project work, this term usually refers to the constructed environment, e.g., buildings, structures, infrastructure, plant and equipment. (6/07)

FACTORY EXPENSE – Syn.: PLANT OVERHEAD. (11/90)

FAIR VALUE – That estimate of the value of a property that is reasonable and fair to all concerned, after every proper consideration has been given due weight. (11/90)

FAST-TRACK(ING) – Scheduling activities to run simultaneously instead of consecutively as much as possible, in order to speed work completion. Fast-tracked activities thus typically begin before the predecessor activity is finished. See: SCHEDULE COMPRESSION; CRASHING. (8/07)

FEE – The charge for the use of one's services to the extent specified in the contract. (11/90)

FIELD COST – Engineering and construction costs associated with the construction site rather than with the home office. (11/90)

FIELD INDIRECTS – Refers to costs necessary to support the direct work. These generally include: 1) Temporary construction and consumables; 2) Field supervision and field office costs; and 3) Construction equipment and tools. (6/07)

FIELD LABOR OVERHEAD – The sum of the cost of payroll burden, temporary construction facilities, consumables, field supervision, and construction tools and equipment. See: FIELD INDIRECTS. (11/90)

FIELD ORDER – A written order issued by the engineer to the contractor which orders minor changes in the work but which does not involve an adjustment in the contract price or the contract time. (11/90)

FIELD SUPERVISION COSTS – The cost of salaries and wages of all field supervision personnel (excluding general foreman), plus associated payroll burdens, home office overhead, living and travel allowances, and field office operating costs. (6/07)

FIELD SUPERVISION – Project site supervisory and support staff personnel (excluding general foreman). (6/07)

FIFO (FIRST IN, FIRST OUT) – A method of determining the cost of inventory used in a product. In this method, the costs of materials are transferred to the product in chronological order. Also used to describe the movement of materials. See: LIFO (LAST IN, FIRST OUT). (11/90)

FINANCIAL LIFE – See: VENTURE LIFE. (11/90)

FINISH DATE – Actual or estimated time associated with an activity's completion. (6/07)

FINISH FLOAT – Amount of excess time an activity has between its early finish and late finish dates. This may be referred to as slack time. All floats are calculated when a project has its schedule computed. See: FREE FLOAT. (6/07)

FINISH-TO-FINISH LAG – The minimum amount of time that must pass between the finish of one activity and the finish of its successor(s). All lags are calculated when a project has its schedule computed. Finish-to-finish lags are often used with start-to-start lags. (6/07)

FINISH-TO-FINISH (FF) – A relationship in which the successor activity depends upon and can finish only after the predecessor activity finishes. The predecessor must finish first and then the successor can finish. (6/07)

FINISH-TO-START LAG – The minimum amount of time that must pass between the finish of one activity and the start of its successor(s). The default finish-to-start lag is zero. All lags are calculated when a project has its schedule computed. In most cases, finish-to-start lags are not used with other lag types. (6/07)

FINISH-TO-START (FS) – A relationship in which the successor activity can start only after the predecessor activity finishes. This is the most common relationship used. (6/07)

FINISHED GOODS – Commodities that will not undergo any further processing and are ready for sale to the user (e.g., apparel, automobiles, bread). (11/90)

FIRST COST – Costs incurred in placing a facility into service, including but not limited to costs of planning, design, engineering, site acquisition and preparation, construction, purchase, installation, property taxes paid and interest during the construction period, and construction-related fees. Syn.: INITIAL INVESTMENT COST; INITIAL COST. [1] (11/90)

FIRST EVENT NUMBER – The number of the first event in time for a work package or summary item. This event number defines the beginning of the work package or summary item in relation to the network. (11/90)

FIXED COST – Those costs independent of short term variations in output of the system under consideration. Includes such costs as maintenance; plant overhead; and administrative, selling and research expense. For the purpose of cash flow calculation, depreciation is excluded (except in income tax calculations). In construction this includes general and administrative costs. (6/07)

FIXED DATE – A calendar date (associated with a plan) that cannot be moved or changed during the schedule. (6/07)

FIXED START – See: IMPOSED START DATE. (6/07)

FIXED-DURATION SCHEDULING – A scheduling method in which, regardless of the number of resources assigned to the task, the duration remains the same. (6/07)

FIXED-PRICE CONTRACT – See: CONTRACT. (6/07)

FLOAT –
(1) In manufacturing, the amount of material in a system or process, at a given point in time, that is not being directly employed or worked upon.
(2) In projects, the amount of time that an activity may slip in its start and completion before becoming critical. Syn.: SLACK. See: TOTAL FLOAT (TF); FREE FLOAT (FF); PROJECT FLOAT; NETWORK FLOAT. (6/07)

FLOAT TREND CHARTS – A chart showing the progressive change over time in schedule float values. (6/07)

FLOW DIAGRAM – A graphic representation that utilizes symbols, labels, and arrows as to depict the details and sequence of operation of a procedure or process system. (6/07)

FOLLOW-ON WORK – Work that is expected to flow the result of current work. This may be a subsequent project, an enhancement, or the maintenance of the product of the current project. (6/07)

FORECAST –
(1) An estimate and prediction of future conditions and events based on information and knowledge available at the time of the forecast.
(2) When in respect to resource requirements, considering future conditions and events, it is a synonym for an estimate. See: ESTIMATE. (6/07)

FORECASTING –
(1) The work performed to estimate or predict future conditions and events. Forecasting establishes the range of possibilities within which one can come to focus on the objectives one will commit to achieve. Forecasting is the work involved in anticipating future events, while establishing objectives is the work necessary to commit oneself to accomplish predetermined results.
(2) When in respect to resource requirements, considering future conditions and events, it is a synonym for cost estimating. Forecasting and cost estimating are often confused with budgeting, which is a definite allocation of resources and not a prediction or estimate. (6/07)

FORWARD PASS –
(1) In projects, network calculations that determine the earliest start/earliest finish time (date) of each activity, and establishes the critical path.
(2) In manufacturing, often referred to as forward scheduling, a scheduling technique where the scheduler

proceeds from a known start date and computes the completion date for an order usually proceeding from the first operation to the last. (6/07)

FRAGNET –
(1) A subnet of the overall project network schedule. A fragnet is typically made up of related work activities to allow greater detail and better control of the work.
(2) A portion or fragment of a CPM network usually used to illustrate changes to the whole network. See: WORK BREAKDOWN STRUCTURE (WBS). (6/07)

FREE FLOAT (FF) –
Maximum amount by which an activity can be delayed beyond its early dates without delaying any successor activity beyond its early dates. See: FREE SLACK. (6/07)

FREE HAUL – The distance every cubic yard of excavated material is entitled to be moved without an additional charge for haul. (11/90)

FREE SLACK - For a task without successors, this is the amount of time the task can be delayed without delaying the finish date of the project. See: FREE FLOAT (FF). [15] (6/07)

FRINGE BENEFITS – Employee welfare benefits, i.e., expenses of employment such as holidays, sick leave, health and welfare benefits, retirement fund, training, supplemental union benefits, etc. (11/90)

FRONT END – Syn.: DEFINITION PHASE. (6/07)

FRONT END LOADING (FEL). Defining the project scope and plans in a way that assures the best practical level of definition is achieved as needed to support a project decision gate. (6/07)

FRONT END SCHEDULE – Usually, a bar chart schedule that is used to provide a project work schedule and a status reporting system early in the work. Definition and planning are generally still under way on the CPM schedule of activities. It is considered a project level schedule. (6/07)

FUNCTION – An expression of conceptual relationships useful in model formulations (e.g., productivity is a function of hours worked). (11/90)

FUNCTIONAL REPLACEMENT COST – The current cost of acquiring the same service potential as embodied by the asset under consideration. (11/90)

FUNCTIONAL USE AREA – The net usable area of a building or project - exclusive of storage, circulation, mechanical, and similar types of space. (11/90)

FUNCTIONAL SYSTEM – An assembly of parts or components and/or subsystems having one primary end use in the project. It should be noted that secondary and tertiary uses for functional systems are common. (11/90)

FUTURE VALUE – The value of a benefit or a cost at some point in the future, considering the time value of money. Syn.: FUTURE WORTH. [1] (11/90)

FUNCTIONAL WORTH – The lowest overall cost for performing a function. Four types are as follows: 1) COST VALUE - the monetary sum of labor, material, burden, and all other elements of cost required to produce an item or provide a service; 2) ESTEEM VALUE - the monetary measure of the properties of a product or service, which contribute to desirability or salability but not to required functional performance; 3) EXCHANGE VALUE - the monetary sum at which a product or service can be traded; and 4) USE VALUE - the monetary measure of the necessary functional properties of a product or service that contribute to performance. (11/90)

FUTURE WORTH – See: FUTURE VALUE. [1] (11/90)

GANTT CHART – A time-scaled bar chart named after Henry L. Gantt. Syn: BAR CHART. (6/07)

GENERAL & ADMINISTRATIVE COSTS (G&A) – The fixed cost incurred in the operation of a business. G&A costs are also associated with office, plant, equipment, staffing, and expenses thereof, maintained by a contractor for general business operations. G&A costs are not specifically applicable to any given job or project. See: OVERHEAD. (6/07)

GENERAL REQUIREMENTS – Non-technical specifications defining the scope of work, payments, procedures, implementation constraints, etc. pertaining to the contract. (6/07)

GENERAL TERMS AND CONDITIONS –
(1) That part of a contract, purchase order, or specification that is not specific to the particular transaction but applies to all transactions.
(2) General definition of the legal relationships and responsibilities of the parties to the contract and how the contract is to be administered. They are usually standard for a corporation and/or project. (6/07)

GENERALLY ACCEPTED ACCOUNTING PRINCIPLES (GAAP) – Principles established by a Financial Accounting Standards Board that provide a foundation for 'acceptable' accounting practices. The GAAP represent a set of guidelines and, as a practical matter, necessitate subjectivity in their application. (6/07)

GIVEN YEAR – The year or period selected for comparison, relative to the base year or base period. (11/90)

GLOBAL CALENDAR – Calendar which sets typical workweek, workdays and holidays. It is the default calendar used for activities. See: CALENDAR. (6/07)

GRAPHICAL EVALUATION AND REVIEW TECHNIQUE (GERT) – Network analysis technique that allows for conditional and probabilistic treatment of logical relationships (i.e., some activities may not be performed). (6/07)

GROSS AREA – Generally, the sum of all the floor or slab areas of a project that are enclosed by the exterior skin of the building. (11/90)

GROSS CONCURRENCY – The method of counting concurrent delay events based purely on contemporaneous occurrence without regard to CPM principles. (6/07)

GROSS NATIONAL PRODUCT (GNP) – The total national output of goods and services at the market prices for the stated year. (11/90)

GUIDELINE – A recommended or customary method of working to accomplish an objective. A guideline is not enforced but is generally followed. (6/07)

HAMMOCK ACTIVITY – An aggregate or summary activity. All related activities are tied as one summary activity and reported at the summary level. It has no duration of its own but derives one from the time difference between the two points to which it is connected. The hammock activity does not affect schedule dates of the activities it spans. (6/07)

HANGER – An unintended break in a network path. (6/07)

HARD LOGIC –
(1) Mandatory logic.
(2) Clearly understood work scope allows one to define work activities and logic with precision. The opposite of soft logic. (6/07)

HAUL DISTANCE – The distance measured along the center line or most direct practical route between the center of mass of excavation and the center of mass finally placed. It is the average distance material is moved by a vehicle. (11/90)

HEDGE – In master production scheduling, a quantity of stock used to protect against uncertainty in demand. The hedge is similar to safety stock, except that a hedge has the dimension of timing as well as amount. (11/90)

HEURISTIC – Procedure used to provide solutions at decision points. The solutions are not guaranteed as being best or optimal as they depend on using good judgment. Literally, leading toward discovery or finding out. (6/07)

HIERARCHICAL CODING STRUCTURE – A coding system that can be represented as a multi-level tree structure in which every code except those at the top of the tree has a parent code. (6/07)

HIERARCHICAL PLANNING – Planning approach where each managerial level breaks planning tasks down into those activities that must be done at that level. Typically, upper-level planning establishes the objectives for the next lower-level manager's planning. (6/07)

HIERARCHY (HIERARCHICAL) – A ranking of items according to their logical relationships. (6/07)

HIGHEST AND BEST USE – The valuation concept that requires consideration of all appropriate purposes or uses of the subject property in order to determine the most profitable likely utilization. (11/90)

HISTORIC RECORDS – Documentation from past projects that can be used to predict trends, analyze feasibility and highlight problem areas/pitfalls on future similar projects. (6/07)

HISTORICAL DATABASE – Records accumulating past project experience stored as data for use in planning, estimating, forecasting and predicting future events. Often includes data that has been processed so as to facilitate planning and other purposes such as validation and benchmarking (e.g., metrics, etc). (6/07)

HOLDING TIME – Time that an item is not operational so that it may be serviced. (11/90)

HOLIDAY – An otherwise valid working day that has been designated as exempt. Holidays typically occur on a yearly basis. In the US, holidays may include New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas. (6/07)

HOME OFFICE – Office of a company in the country of origin or centralized location. Usually synonymous with head office. (6/07)

HOME OFFICE COST – Those necessary costs, typically not incurred at the project site, involved in the conduct of everyday business, which can be directly assigned to specific projects, processes, or end products, such as engineering, procurement, expediting, legal fees, auditor fees inspection, estimating, cost control, taxes, travel, reproduction, communications, etc. (6/07)

HYPERCRITICAL – A condition when an imposed date has been set such that the critical path leading to that point is too long to finish by that date. The critical path then becomes hypercritical and possesses negative float. (6/07)

HYPERCRITICAL ACTIVITIES – Activities on the critical path with negative float. This can be achieved through the imposition of constraints such as target dates. (6/07)

I-NODE – In an activity on arrow (AOA) schedule, the node at the beginning of the activity arrow. (6/07)

I-J NOTATION – A system of numbering nodes in an activity-on-arrow network. The I-node is always the beginning of the activity, while the J-node is always the finish. (6/07)

IDENTIFIER – An alphanumeric code depicting a name or hierarchy. See: CODE. (6/07)

IDLE EQUIPMENT COST – The cost of equipment that remains on site ready for use but is placed in a standby basis. Ownership or rental costs are still incurred while the equipment is idle. (11/90)

IDLE TIME – A time interval during which either the worker, the equipment or both do not perform useful work. (6/07)

IMMEDIATE ACTIVITY – An activity that can be forced to start on its earliest feasible date by resource scheduling, even if that means overloading a resource. (6/07)

IMPACT COST – Added expenses due to the indirect results of a changed condition, delay, or changes that are a consequence of the initial event. Examples of these costs are premium time, lost efficiency, and extended field and home office overhead. (4/04)

IMPERFECTION – A deviation that does not affect the use or performance of the product, process, or service. In practice, imperfections are deviations that are accepted as-is. (11/90)

IMPOSED DATE –
(1) A predetermined calendar date set (usually externally) without regard to logical considerations of the network.
(2) A date externally assigned to an activity that establishes the earliest or latest date in which the activity is allowed to start or finish. (6/07)

IMPOSED FINISH DATE – A predetermined calendar date set without regard to logical considerations of the network, fixing the end of an activity and all other activities preceding that ending node. (11/90)

IMPOSED START DATE – A start date imposed on an activity by an external constraint. (6/07)

IMPOSSIBILITY – An inability to meet contract requirements because it was in fact physically impossible to do so (actual impossibility). (11/90)

IMPRACTICABILITY – Inability to perform because of extreme and unreasonable difficulty, expense, injury, or loss involved. This is sometimes considered practical impossibility. (11/90)

IMPUTATION (OF PRICE MOVEMENT) – The assignment of known price changes to a certain commodity on the basis of the assumed similarity of price movement. (11/90)

IN-PLACE VALUE – Value of a physical property, e.g., market value plus costs of transportation to site and installation. (11/90)

IN-PROGRESS ACTIVITY – An activity that has been started but not completed on a given reporting/data date. (6/07)

IN-PROGRESS INVENTORY – See: WORK-IN-PROCESS. (11/90)

INCLUSIVE OR RELATIONSHIP – Logical relationship indicating that at least one, but not necessarily all, of the activities have to be undertaken. (6/07)

INCOME – Used interchangeably with profit. Avoid using income instead of sales revenue. See: PROFIT. (11/90)

INCREMENTAL COST (BENEFIT) – The additional cost (benefit) resulting from an increase in the investment in a project. Syn.: MARGINAL COST (BENEFIT). [1] (11/90)

INDEPENDENT EVENT – An event which in no way affects the probability of the occurrence of another event. (11/90)

INDEPENDENT FLOAT – The degree of flexibility that an activity has which does not affect the float available on any preceding or succeeding activities. (6/07)

INDICATED TOTAL COST – An estimated final cost of a project, program or endeavor based on current progress and forecast effort to complete. See: ESTIMATE AT COMPLETION. (6/07)

INDIRECT COSTS –
(1) Costs not directly attributable to the completion of an activity. Indirect costs are typically allocated or spread across all activities on a predetermined basis.
(2) In construction, all costs which do not become a final part of the installation, but which are required for the orderly completion of the installation and may include, but are not limited to, field administration, direct supervision, capital tools, startup costs, contractor's fees, insurance, taxes, etc.
(3) In manufacturing, costs not directly assignable to the end product or process, such as overhead and general purpose labor, or costs of outside operations, such as transportation and distribution. Indirect manufacturing cost sometimes includes insurance, property taxes, maintenance, depreciation, packaging, warehousing and loading. See: DISTRIBUTABLES; FIELD INDIRECTS; HOME OFFICE COST. (6/07)

INDIRECT PACING – When the paced event does not have a logical relationship to the parent delay. The fact that the indirect pacing delay and the parent delay occur during the same period is merely a function of schedule timing, not mandatory logic. (6/07)

INDIVIDUAL PRICE INDEX – An index which measures the price change for a particular commodity and which may be computed as the ratio of its prices at two points in time. (11/90)

INDIVIDUAL WORK PLAN – The lowest level of the technical plan that defines the tasks and responsibilities of an individual team member. (6/07)

INEFFICIENCY – The state of being less productive or efficient that expected or planned. (6/07)

INEXCUSABLE DELAYS – Project delays those are attributable to negligence on the part of the contractor, which lead in many cases to penalty payments. (6/07)

INFLATION – A persistent increase in the level of consumer prices, or a persistent decline in the purchasing power of money, caused by an increase in available currency and credit beyond the proportion of available goods and services. Normally derives from governmental monetary policy, whereby government debt can be repaid more cheaply. (8/07)

INFLUENCE DIAGRAM – A graphical display of the relationships among factors influencing a decision. The diagram shows the influencing relationships among controllable decisions, uncertain conditions, objective variables, and dependent variables. (8/07)

INITIAL COST – Syn.: FIRST COST. [1] (11/90)

INITIAL INVESTMENT COST – Syn.: FIRST COST. [1] (11/90)

INITIATION – The process of preparing for, assembling resources and getting work started. May apply to any level, e.g., program, project, phase, activity, task. (6/07)

INPUT MILESTONES – Imposed target dates or target events that are to be accomplished, and which control the plan with respect to time. (6/07)

INPUT-OUTPUT ANALYSIS – A matrix which provides a quantitative framework for the description of an economic unit. Basic to input-output analysis is a unique set of input-output ratios for each production and distribution process. If the ratios of input per unit of output are known for all production processes, and if the total production of each end product of the economy, or of the section being studied is known, it is possible to compute precisely the production levels required at every intermediate stage to supply the total sum of end products. Further, it is possible to determine the effect at every point in the production process of a specified change in the volume and mix of end products. (11/90)

INTANGIBLES –
(1) In economy studies, conditions or economy factors that cannot be readily evaluated in quantitative terms as in money.
(2) In accounting, the assets that cannot be reliably evaluated (e.g., goodwill). (11/90)

INTEGRATED CHANGE CONTROL – The process of reviewing all change requests, approving changes and controlling changes to deliverables and organizational process assets. See: CHANGE CONTROL; CHANGE MANAGEMENT; CONFIGURATION MANAGEMENT. (6/07)

INTEGRATED COST/SCHEDULE REPORTING – The development of reports that measure actual versus budget, S-curves, BCWS, BCWP, and ACWP. See: EARNED VALUE MANAGEMENT [SYSTEM] (EVM[S]) (8/07)

INTERDEPENDENT EVENT – Not subject to a reciprocal relationship. (6/07)

INTEREST –
(1) Financial share in a project or enterprise.
(2) Periodic compensation for the lending of money.
(3) In economy study, synonymous with required return, expected profit, or charge for use of capital.
(4) The cost for the use of capital. Sometimes referred to as the time value of money. (11/90)

INTEREST RATE – The ratio of the interest payment to the principal for a given unit of time and is usually expressed as a percentage of the principal. (11/90)

INTEREST RATE, COMPOUND – The rate earned by money expressed as a constant percentage of the unpaid balance at the end of the previous accounting period. Typical time periods are yearly, semiannually, monthly, and instantaneous. (11/90)

INTEREST RATE, EFFECTIVE – An interest rate for a stated period (per year unless otherwise specified) that is the equivalent of a smaller rate of interest that is more frequently compounded. (11/90)

INTEREST RATE, NOMINAL – The customary type of interest rate designation on an annual basis without consideration of compounding periods. A frequent basis for computing periodic interest payments. (11/90)

INTEREST RATE OF RETURN – See: PROFITABILITY INDEX (PI). (11/90)

INTERFACE – A common physical or functional boundary between different organizations or contractor's products. It is usually defined by an interface specification and managed by a system integration organization. (6/07)

INTERFACE ACTIVITY – An activity connecting a node in one sub-net with a node in another sub-net, representing logical interdependence. The activity identifies points of interaction or commonality between the project activities and outside influences. (6/07)

INTERFACE MANAGEMENT – The management of communication, coordination and responsibility across a common boundary between two organizations, phases, or physical entities, which are interdependent. (6/07)

INTERFACE NODE – A common node for two or more subnets representing logical interdependence. (11/90)

INTERFERENCE – Conduct that interrupts the normal flow of operations and impedes performance. A condition implied in every construction contract is that neither party will do anything to hinder the performance of the other party. (11/90)

INTERIM DATES – Dates established which designate the start or the completion of designated facilities or features of a facility. Also referred to as intermediate access or intermediate completion dates. (6/07)

INTERIM DELIVERABLES – Intermediate deliverables that will be produced as precursors to the final deliverable. (6/07)

INTERMEDIATE EVENTS – Detailed events and activities, the completion of which are necessary for and lead to the completion of a major milestone. (11/90)

INTERMEDIATE MATERIALS – Commodities that have been processed but require further processing before they become finished goods (e.g., fabric, flour, sheet metal). (11/90)

INTERMEDIATE NODE – A node where at least one activity begins and one activity ends. (11/90)

INTERNAL RATE OF RETURN (IRR) – The compound rate of interest that, when used to discount study period costs and benefits of a project, will make their time-values equal. See: PROFITABILITY INDEX (PI). [1] (8/07)

INTERRUPTION – A stopping or hindering of the normal process or flow of an activity. (6/07)

INVENTORY – Raw materials, products in process, and finished products required for plant operation or the value of such material and other supplies, e.g., catalysts, chemicals, spare parts. (11/90)

INVESTMENT – The sum of the original costs or values of the items that constitute the enterprise; used interchangeably with capital; may include expenses associated with capital outlays such as mine development. (11/90)

INVESTMENT COST – Includes first cost and later expenditures that have substantial and enduring value (generally more than one year) for upgrading, expanding, or changing the functional use of a facility, product, or process. [1] (11/90)

INVESTOR'S METHOD – See: DISCOUNTED CASH FLOW. (11/90)

IRREFUTABLE LOGIC – Network logic that is rational and compelling and cannot be disputed on the basis of reason. See: DESIRABLE LOGIC. (6/07)

ISHIKAWA DIAGRAM – Diagram used to illustrate how various causes and sub-causes create a specific effect. Named after its developer Kaoru Ishikawa. Also called cause-and effect diagram or fishbone diagram. [8] (6/07)

ISSUES MANAGEMENT – Management of issues that remain unresolved because they are either in dispute, are uncertain, lack information, or lack authority or commitment for their resolution. (6/07)

ITEM – A commodity designated and defined specifically for direct price observation. (11/90)

J-NODE – In an activity on arrow (AOA) schedule, the node at the end of the activity arrow. (6/07)

JOB – A group of contiguous operations related by similarity of functions that can be completed by one or more workers without interference or delay. (6/07)

JOB OVERHEAD – The expense of such items as trailer, toilets, telephone, superintendent, transportation, temporary heat, testing, power, water, cleanup, and similar items possibly including bond and insurance associated with the particular project. (11/90)

JUDGMENTAL SAMPLING – A procedure of selecting the sample which is based on specific criteria established by sample designers. The selection of priced items and outlets is not a probability sample - that is, it is not based on random chance. (11/90)

JUST-IN-TIME – A 'pull' logistical system driven by actual demand. The goal is to produce, provide or deliver parts or supplies just in time for the next operation. The approach reduces stock inventories or storage costs, but leaves no room for error. As much a managerial philosophy as it is an inventory system. (6/07)

KEY ACTIVITY – An activity that is considered of major significance. A key activity is sometimes referred to as a milestone activity. (11/90)

KEY EVENT SCHEDULE – A schedule comprised of key events or milestones. These events are generally critical accomplishments planned at time intervals throughout the project and used as a basis to monitor overall project performance. The format may be either network or bar chart and may contain minimal detail at a highly summarized level. This is often referred to as a milestone schedule. (6/07)

KEY EVENTS – Major events the achievement of which that are deemed to be critical to the execution of the project. A key event is sometimes referred to as a milestone. (6/07)

KEY PERFORMANCE – Performance that is critical to the project or a project system. See: KEY PERFORMANCE INDICATORS (KPI). (6/07)

KEY PERFORMANCE INDICATORS (KPI) – Indicators that: 1) Are determined at process/project initiation and listed in order of priority; 2) Reflect directly on key process/project objectives [goals]; and 3) Provide basis for trade-off decisions made during execution. At process/project completion these KPIs: 1) Will be the most relevant measures to confirm process/project acceptability and its product by the process/project's stakeholders as being "successful"; and 2) Can be reasonably measured in some way, at some time, on some scale with some level of confidence. (6/07)

KEY SUCCESS INDICATORS (KSI) – Syn.: KEY PERFORMANCE INDICATORS (KPI). (6/07)

KNOWN, KNOWN-UNKNOWN, UNKNOWN-UNKNOWN – A method of classifying risks according to the amount of information available. (6/07)

LABOR – Effort expended by people for wages or salary. Generally classified as either direct or indirect. Direct labor is applied to meeting project objectives and is a principal element used in costing, pricing, and profit determination; indirect labor is a component of indirect cost, such as overhead or general and administrative costs. [8] (10/06)

LABOR BURDEN – Taxes and insurances the employer is required to pay by law based on labor payroll, on behalf of or for the benefit of labor. (In the US these are federal old age benefits, federal unemployment insurance tax, state unemployment tax, and worker's compensation). (11/90)

LABOR COST –
(1) BARE LABOR: Gross direct wages paid to the worker.
(2) BURDENED LABOR: Gross direct wages paid to the worker, plus labor burden.
(3) ALL IN LABOR: Gross direct wages paid to the worker, plus labor burden, plus field indirects, plus general & administrative cost, plus profit. (6/07)

LABOR FACTOR – See: LABOR PRODUCTIVITY FACTOR. (6/07)

LABOR HOUR – A worker hour of effort. Syn.: WORKHOUR. (6/07)

LABOR PRODUCTIVITY – A measure of production output relative to labor input. In economics, industrial engineering, and earned value management, quantity/work hour measures are common (higher values reflect higher productivity or efficiency). In cost estimating, inverse measures such as work hours/quantity or unit hours are common (where lower values reflect higher productivity or efficiency). Regardless of the measure used, labor productivity (or efficiency) is improved by increasing production for a given work hour or decreasing work hours for a given production. (6/07)

LABOR PRODUCTIVITY FACTOR – A value by which a labor productivity measure for a reference project or activity is multiplied to obtain an adjusted productivity measure for the same of similar project or activity under a different set of conditions. Proper factor use requires that the user ascertain the type of labor productivity measure it will be applied against (e.g., consider whether the labor productivity measure to be factored is expressed in the form of work hours/quantity or quantity/work hours). (6/07)

LABOR RATE – Labor cost expressed on a per unit of labor effort basis (e.g., labor costs/labor hour). See: LABOR COST. (6/07)

LADDER – In planning and scheduling, a sequence of parallel activities connected at their starts or finishes, or both. The start and finish of each succeeding activity are linked only to the start and finish of the preceding activity by lead and lag activities, which consume only time. (6/07)

LADDER ACTIVITY – A type of activity identified in network scheduling. An arrangement in which two or more series of activities progress concurrently but in lockstep because of dependent links between the same rungs of each ladder. (6/07)

LADDERING – A method of showing the logic relationship of a set of several parallel activities with the arrow technique. (11/90)

LAG – Time that an activity follows, or is delayed from the start or finish of its predecessor(s). Sometimes called an offset. A lag may have a negative value tied to the finish of a previous activity, reflecting a fast track approach. However, the use of negative lags when building baseline schedule models is poor technique and often prohibited by specification. (6/07)

LAG DURATION – A duration by which a given task must be completed before the succeeding activity can begin. (6/07)

LAG RELATIONSHIP – The four basic types of lag relationships between the start and/or finish of a work item and the start and/or finish of another work item are: 1) Finish-to-start (FS); 2) Start-to-finish (SF); 3) Finish-to-finish (FF); and 4) Start-to-start (SS). (11/90)

LAG TIME – The amount of time delay between the completion of one task and the start of its successor task. (6/07)

LATE DATES – Calculated in the backward pass of time analysis, late dates are the latest dates on which an activity can start and finish without delaying a successor activity. (6/07)

LATE EVENT DATE – Calculated from backward pass, it is the latest date an event can occur. (6/07)

LATE FINISH (LF) – The latest date or time an activity may finish as calculated by the backward pass. (6/07)

LATE START (LS) – The latest date or time an activity may start so the project may be completed on time as calculated during the backward pass. (6/07)

LATENT CONDITION – A concealed, hidden, or dormant condition that cannot be observed by a reasonable inspection. (11/90)

LATEST EVENT TIME (LET) – The latest time an event may occur without increasing the project's scheduled completion date. (11/90)

LATE START – The latest time at which an activity can start without lengthening the project. (11/90)

LATEST REVISED ESTIMATE – In earned value, the sum of the actual incurred costs plus the latest estimate-to-complete for a work package or summary item as currently reviewed and revised, or both (including applicable overhead where direct costs are specified). (6/07)

LAWS AND REGULATIONS – Laws, rules, regulations, ordinances, codes and/or orders. (11/90)

LEAD – A PDM constraint introduced before a series of activities to schedule them at a later time. (11/90)

LEAD – Time that an activity precedes the start of its successor(s). Lead is the opposite of Lag. (6/07)

LEAD DURATION/LEAD TIME – A duration or time by which a given task must be started before the succeeding activity can begin. (6/07)

LEARNING CURVE – A graphic representation of the progress in production effectiveness as time passes. Learning curves are useful planning tools, particularly in the project oriented industries where new products and workers are phased in rather frequently. The basis for the learning curve calculation is the fact that workers will be able to perform work more quickly after they get used to performing it. (6/07)

LESSONS LEARNED – A project team's learning, usually defined during close out. Should be limited to capturing/identifying work process improvements. A ‘finding’ that established policies or procedures were not followed is not a valid lessons learned. (6/07)

LETTER OF CREDIT – A vehicle that is used in lieu of retention and is purchased by the contractor from a bank for a predetermined amount of credit that the owner may draw against in the event of default in acceptance criteria by the contractor. Also applies when an owner establishes a line of credit in a foreign country to provide for payment to suppliers of contractors for goods and services supplied. (11/90)

LEVEL FINISH/SCHEDULE (FS) – The date when the activity is scheduled to be completed using the resource allocation process. (6/07)

LEVEL FLOAT – The difference between the level finish and the late finish date. (6/07)

LEVELIZED FIXED-CHARGE RATE – The ratio of uniform annual revenue requirements to the initial investment, expressed as a percent. (11/90)

LEVEL OF DETAIL – All projects need to determine the level of detail requirements for estimates, accounting reports, cost reports, scheduling reports, and types of schedules. The level of detail is generally constrained by the level of scope definition. Determining the level of detail should consider requirements to execute the project and meet historical data requirements. (6/07)

LEVEL OF EFFORT (LOE) – Support effort (e.g., vendor liaison) that does not readily lend itself to measurement of discrete accomplishment. It is generally characterized by a uniform rate of activity over a specific period of time. (11/90)

LEVEL START/SCHEDULE/ (SS) – The date the activity is scheduled to begin using the resource allocation process. This date is equal to or later in time than early start. (11/90)

LEVELING – See: RESOURCE LEVELING. (6/07)

LEVELS OF SCHEDULES –. The level of schedule is differentiated by the degree of detail in the schedules. The three main levels of scheduling are the following: Management Summary, Project Level, and Control Level.

1. MANAGEMENT SUMMARY SCHEDULE (LEVEL 1 SCHEDULE) – The level of schedule containing the least amount of detail, typically including major functions, milestone objectives, master schedules, and bar chart summaries of project status. Used by management and the client to monitor all aspects of the project. It is a roll up of the project level schedule (level 2).
2. PROJECT LEVEL SCHEDULE (LEVEL 2 SCHEDULE) – An activity- and deliverable-centered schedule containing a middle amount of detail in time-scaled network diagrams or bar charts. It integrates the project's engineering, procurement, and construction activities by network logic, identifies critical path and key project dates, and provides measurement of accomplishments against established objectives. The CPM (critical path method) scheduling technique is used to develop the project level schedule. The status of the detail activities summarizes to the management summary schedule (level 1 schedule).
3. CONTROL LEVEL SCHEDULE (LEVEL 3 SCHEDULE) – Represents detail and individual work tasks, which summarize at the project level II activities and deliverables. Clearly, shows work by discipline or responsibility, and usually presented in bar chart or tabular form. Maintained by each discipline / contractor in the engineering phase and by superintendents and contractors in the construction phase. Immediate term schedules, also referred to as weekly work schedules, and should provide enough detail to manage work at the foreman level. (6/07)

LEVERAGE (TRADING ON EQUITY) – The use of borrowed funds or preferred stock in the intent of employing these "senior" funds at a rate of return higher than their cost in order to increase the return upon the investment of the residual owners. (11/90)

LIFE –
(1) PHYSICAL: That period of time after which a machine or facility can no longer be repaired in order to perform its design function properly.
(2) SERVICE: The period of time that a machine or facility will satisfactorily perform its function without a major overhaul. See: VENTURE LIFE; STUDY PERIOD; ECONOMIC LIFE (CYCLE). (11/90)

LIFE CYCLE – The stages, or phases that occur during the lifetime of an object or endeavor. A life cycle presumes a beginning and an end with each end implying a new beginning. In life cycle cost or investment analysis, the life cycle is the length of time over which an investment is analyzed (i.e., study period). The following are typical life cycles: See: STUDY PERIOD, LIFE. [1]

1. ASSET LIFE CYCLE – The stages, or phases of asset existence during the life of an asset. Asset life cycle stages typically include ideation, creation, operation, modification, and termination.
2. PRODUCT LIFE CYCLE − Complete history of a product through its concept, definition, production, operation, and obsolescence or disposal phases. The distinction between product life cycle and project life cycle is that the latter does not include the last two phases.
3. PROJECT LIFE CYCLE – The stages or phases of project progress during the life of a project. Project life cycle stages typically include ideation, planning, execution, and closure. (6/07)

LIFE CYCLE COST (LCC) METHOD – A technique of economic evaluation that sums over a given study period the costs of initial investment (less resale value), replacements, operations (including energy use),

and maintenance and repair of an investment decision (expressed in present or annual value terms). [1] (11/90)

LIFE CYCLE COSTING – Consideration of all costs when designing a project's product, including costs from concept, through implementation and startup, to dismantling. It is typically used for making decisions between alternatives. (6/07)

LIFO (LAST IN, FIRST OUT) – A method of determining the cost of inventory used in a product. In this method, the costs of material are transferred to the product in reverse chronological order. LIFO is used to describe the movement of goods. See: FIFO (FIRST IN, FIRST OUT). (11/90)

LIMIT (LOT SIZE INVENTORY MANAGEMENT INTERPOLATION TECHNIQUE) – A technique for looking at the lot sizes for groups of products to determine what effect economic lot sizes will have on the total inventory and total setup costs. (11/90)

LINE OF BALANCE (LOB) – A graphical display of scheduled units versus actual units over a given set of critical schedule control points on a particular day. The line of balance technique is oriented towards the control of production activities. (6/07)

LINE OF CREDIT – Generally an informal understanding between the borrower and the bank as to the maximum amount of credit that the bank will provide the borrower at any one time. (11/90)

LINEAR PROGRAMMING – Mathematical techniques for solving a general class of optimization problems through minimization (or maximization) of a linear function subject to linear constraints. For example, in blending aviation fuel, many grades of commercial gasoline may be available. Prices and octane ratings, as well as upper limits on capacities of input materials which can be used to produce various grades of fuel are given. The problem is to blend the various commercial gasolines in such a way that: 1) Cost will be minimized (profit will be maximized); 2) A specified optimum octane rating will be met; and 3) The need for additional storage capacity will be avoided. (11/90)

LINEAR RESPONSIBILITY CHART – A special type of matrix in which the rows list the series of functions, activities, or tasks in some logic sequence, such as the project life cycle, and the adjacent columns identify the positions, titles or people involved. At the intersection of each adjacent column and its line item is placed a distinguishing symbol representing the level or type of responsibility involved by that person. (6/07)

LINEAR SCHEDULING METHOD (LSM) – Scheduling method that may be used on horizontal projects (pipelines, highways, etc.) Highly repetitive tasks make up the majority of the work. LSM schedules use 'velocity' diagrams representing each activity. LSM scheduling is not widely used. (6/07)

LINK – A dependency between tasks that specifies when a task begins or ends relative to another task. (6/07)

LINKED BAR CHART – A bar chart drawn to show dependency links between activities/tasks. (6/07)

LINKED PROJECTS – Multiple related projects connected at interface points. Often depicted by use of a bar chart showing dependency links between activities on different projects. (6/07)

LINKING PROCEDURE – A procedure by which a 'new' series of indexes is connected to an 'old' series in a given link period, generally because of a change in baskets. Actually, indexes of the new series with link period as time base are multiplied by the old index for the link period as the given period. See: SPLICING TECHNIQUE. (11/90)

LIQUIDATED DAMAGES – See: DAMAGES, LIQUIDATED. (6/07)

LOAD FACTOR –
(1) A ratio that applies to physical plant or equipment average load/maximum demand, usually expressed as a percentage. It is equivalent to percent of capacity operation if facilities just accommodate the maximum demand.
(2) The ratio of average load to maximum load. (11/90)

LOAD LEVELING – The technique of averaging, to a workable number, the amount or number of people working on a given project or in a given area of a project at a particular point in time. Load leveling is a benefit of most scheduling techniques and is necessary to insure a stable use of resources. Syn.: WORK POWER LEVELING. (11/90)

LOCAL COST – The cost of local labor, equipment taxes, insurance, equipment, and construction materials incorporated in a construction project, with local currencies. This includes the finishing of imported goods using local labor and materials, the cost of transforming imported raw or semi-finished products using local labor and plant facilities, and the marketing of locally produced products. (6/07)

LOCATION FACTOR – An instantaneous (current – has no escalation or currency exchange projection) overall total project factor for translating the summation of all project cost elements of a defined construction project scope of work, from one geographical location to another. Location factors include given costs, freights, duties, taxes, field indirects, project administration, and engineering and design. Location factors do not include the cost of land, scope/design differences for local codes and conditions, and the cost for various operating philosophies. (6/07)

LOGIC – Relationship describing the interdependency of starts and finishes between activities or events. Every activity should have a predecessor (except for the initial activity or event), and every activity should have a successor (except for the ending activity or event). Activity logic is determined by need to meet competing constraints defined by contract requirements, physical capabilities of trades performing work, safety concerns, resource allocations, and preferential activity relationships. (6/07)

LOGIC CONSTRAINT – A restraint inserted in an activity of arrow (AOA) network, which defines dependent relationships between two activities. (6/07)

LOGIC DIAGRAM – Graphic diagram of a network schedule showing the relationships between a particular activity and its predecessors and successors. Syn.: LOGIC NETWORK DIAGRAM. (6/07)

LOGIC NETWORK – See: NETWORK (6/07)

LOGIC NETWORK DIAGRAM – Syn.: LOGIC DIAGRAM. See: NETWORK. (3/04)

LOGIC RESTRAINT –
(1) A dummy, which defines the dependency of one part of the network on another part of it.
(2) A dummy arrow or constraint connection that is used as a logical connector but that does not represent actual work items. It is usually represented by a dotted line, and is sometimes called a dummy because it does not represent work. It is an indispensable part of the network concept when using the arrow diagramming method of CPM scheduling. (6/07)

LOGIC SEQUENCING – The arranging of project activities in to a self-evident or reasoned and progressive series. (6/07)

LONG LEAD ITEMS – Those components of a system or piece of equipment for which the times to design and fabricate are the longest and for which an early commitment of funds may be desirable or necessary in order to meet the earliest possible date of system completion. (6/07)

LONG LEAD PROCUREMENT – Early procurement of material or parts to accommodate early use or long procurement spans. Contractors may choose to seek buyer-approved pre-award commitments of funds to meet long lead requirements. (6/07)

LONGEST PATH (LP) – Longest continuous path of activities through a project, which controls project early completion. It is possible for otherwise defined critical path activities to not be on the longest path and longest path activities to not show calculated critical float. The longest path analysis is unaffected by activity calendars. The longest path is determined by the string of activities, relationships, and lags that push the project to its latest, early finish date. The longest path is calculated by first performing a CPM 'forward pass' to determine driving relationships and the project's latest, early finish date. The activity (or activities) with the latest, early finish dates are then identified and all predecessor driving relationships traced back to the project start date. These activities constitute the project's longest path. The longest path depends upon relationships driving the timing of activity starts, thus use of constraints and resource leveling can interrupt and invalidate longest path analysis. Use of interruptible activities can also result in false longest path indications. For complete accuracy, longest path analysis should take place absent of constraints, resource leveling, and/or interruptible activities. (6/07)

LOOK-AHEAD SCHEDULE – A short period (two or three weeks) schedule, typically presented in bar chart format showing what needs to be accomplished to keep the project on schedule. Look-ahead schedules are often discussed at weekly project meetings to coordinate and control the following week's work. (6/07)

LOOP / LOGIC LOOP – A circular sequence of dependency links between activities in a network. Creates an error in network logic resulting from successor activities also being a predecessor to the activity in question. Also known as circular logic. Logic loops can be very frustrating and time consuming to eliminate in complex network schedules. (6/07)

LOSS OF PRODUCTIVITY/EFFICIENCY – See: INEFFICIENCY. (11/90)

LOST PRODUCTIVITY – See: INEFFICIENCY. (4/04)

LOT BATCH – A definite quantity of some product manufactured under conditions of production that are considered uniform. (11/90)

LOT SIZE – The number of units in the lot. (11/90)

LOWEST MANAGEMENT LEVEL (LML) – A term used in the dynamic baseline model hierarchy in which a project may be positioned and is the control point for a project. It represents the level at which the project must be managed on an on-going basis in order to deal effectively with the dynamic issues below the LSB.
a) For a production project the LML is the supervisor level. A supervisor is the lowest management level with sufficient capacity and authority to deal effectively with a dynamic procedures baseline.
b) For a construction project the LML is the manager level. A manager is the lowest management level with sufficient capacity and authority to deal effectively with a dynamic construction baseline.
c) For a development project the LML is the director level. A director is the lowest management level with sufficient capacity and authority to deal effectively with a dynamic requirements baseline.
d) For an evolution project the LML is the owner level. The project owner is the lowest management level with sufficient capacity and authority to deal effectively with a dynamic objectives baseline. (6/07)

LOWEST STATIC BASELINE (LSB) – Using the flow down of organizational objectives from corporate values to project objectives to functional requirements to product design, the LSB is the lowest level that is relatively fixed for a given project in the hierarchy and is therefore readily "baseline-able". A term used in the dynamic baseline model hierarchy in which a project may be positioned. A project can only be expected to meet its LSB, and therefore success or failure should only realistically be measured relative to that baseline. (6/07)

LUMP-SUM – The complete in-place cost of a system, a subsystem, a particular item, or an entire project. (6/07)

MAINTENANCE AND REPAIR COST – The total of labor, material, and other related costs incurred in conducting corrective and preventative maintenance and repair on a facility, on its systems and components, or on both. Maintenance does not usually include those items that cannot be expended within the year purchased. Such items must be considered as fixed capital. [2] (11/90)

MAJOR COMPONENTS – Part of the aggregation structure of a price index (e.g., a CPI can be subdivided into major components of food, housing, clothing, transportation, health and personal care, recreation, reading and education, tobacco and alcohol). (11/90)

MAJOR MILESTONE – The most significant milestones in the project's life or duration, representing major accomplishments or decision points; usually associated with the first breakdown level in the work breakdown structure. [4] (11/90)

MAJOR SYSTEM ACQUISITION PROJECTS – Those projects that are directed at and are critical to fulfilling a mission, entail the allocation of relatively large resources, and warrant special management attention. (11/90)

MANAGEMENT BY EXCEPTION – Issuance of management reports only when action is called for. Helps avoid wading through voluminous reports where progress is going according to plan. However, system may require subjective judgment by someone who is not as well placed to do so as the manager himself. Exception reports tend to be harbingers of bad news, lacking good news and hence seen as detrimental rather than beneficial. (6/07)

MANAGEMENT BY METHODS (MBM) – Level 2 of a five level dynamic baseline model in which those proficient in MBR build on their knowledge base, level 1 (MBR) with customized project management processes and procedures. At this level practitioners get acquainted with, and become proficient in the use of, standard project management tools, frameworks and templates. The work breakdown structure, the responsibility assignment matrix, scheduling techniques, cost/schedule performance control and monitoring and configuration management are the hallmarks of level 2 learning. At this level, an employee has the capacity to use the tools to analyze project performance data and to make recommendations for corrective actions accordingly. (6/07)

MANAGEMENT BY OBJECTIVES (MBO) – A management theory that calls for managing people based on documented work statements mutually agreed to by manager and subordinate. Progress on these work statements is periodically reviewed, and in a proper implementation, compensation is tied to MBO performance. Level 3 of a five level dynamic baseline model structure in which establishing and maintaining the project objectives as the reference point and managing and manipulating the methods at level 2 (MBM) and the rules at level 1 (MBR) as appropriate to that horizon. (6/07)

MANAGEMENT BY POLITICS (MBP) – A potential level 5 of a five level dynamic baseline model structure. This is an extrapolation of the model, which would lead to a management approach where the essential values of the corporation are a dynamic baseline. This would entail dealing with some higher order issues wherein project managers would contend with harmonizing various corporate agendas in a politicized environment. A level 5 MBP would be dealing with an intangible product with a focus on governance issues. The LML at level 5 would be in essence a politician. (6/07)

MANAGEMENT BY RULES (MBR) – Level 1 of a five level dynamic baseline model structure at which behavior is the first level of learning. MBR is indoctrination into the official operations for an organization. Employees are encouraged to develop a strong sense of affiliation with the organization’s institutional framework - rules, regulations, policies, procedures, directives, laws, acts, etc. At this level of learning, an employee is taught how to apply existing rules to conduct business, and on occasions, to interpret rules in

some new way for the purpose of addressing project issues not readily covered in the existing framework. (6/07)

MANAGEMENT BY VALUES (MBV) – Level 4 of a five level dynamic baseline model structure in which an employee has the capacity to manipulate and evolve the objective throughout the project life cycle as appropriate to the overarching corporate values. MBV practitioners are expected to revisit and adjust project objectives with their attention focused on the corporate values horizon. In turn, this requires the capacity to manipulate the tools and the rules with the knowledge and experience to understand the implications as per level 3 (MBO). (6/07)

MANAGEMENT BY WALKING AROUND (MBWA) – Part of the Hewlett Packard legacy and popularized by management theorist Tom Peters. MBWA works on the assumption that a manager must circulate to fully understand the team's performance and problems. The best managers, according to Peters, spend 10 percent of their time in their offices, and 90 percent of their time talking and working with their people, their customers, and their suppliers. (6/07)

MANAGEMENT CONTROL POINT – A point in the project life cycle, usually separating major phases or stages, at which senior management has the opportunity to confirm or deny continuation into the next phase or stage. See: CONTROL GATE. (6/07)

MANAGEMENT CONTROL SYSTEMS – The systems (e.g., planning, scheduling, budgeting, estimating, work authorization, cost accumulation, performance measurement, etc) used by owners, engineers, architects, and contractors to plan and control the cost and scheduling of work. [4] (11/90)

MANAGEMENT RESERVE – An amount added to an estimate to allow for discretionary management purposes outside of the defined scope of the project, as otherwise estimated. Use of management reserve requires a change to the project scope and the cost baseline, while the use of contingency reserve funds is within the project's approved budget and schedule baseline. Syn.: RESERVE; RESERVE ALLOWANCE. (6/07)

MANAGEMENT SCIENCE – The application of methods and procedures including sophisticated mathematical techniques to facilitate decision making in the handling, direction, and control of projects and manufacturing operations. (11/90)

MANDATORY DEPENDENCY – Dependency inherent in the nature of the work being done, such as a physical limitation. Used in hard logic. [8] (6/07)

MANPOWER LOADING CHART – Histogram showing the allocation of labor by period. See: HISTOGRAM. (6/07)

MANPOWER PLANNING – Process of forecasting an organization's manpower needs over time, in terms of numbers and skills, and obtaining the human resources required to match an organization's needs. See: RESOURCE PLANNING. (6/07)

MANUFACTURING COST – The total of variable and fixed or direct and indirect costs chargeable to the production of a given product, usually expressed in cents or dollars per unit of production, or dollars per year. Transportation and distribution costs, and research, development, selling and corporate administrative expenses are usually excluded. See: OPERATING COST. (11/90)

MANUFACTURING RESOURCE PLANNING (MRP II) – A method for the effective planning of all the resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning in dollars, and has a simulation capability to answer "what if" questions. It is made up of a variety of functions, each linked together: business planning, production planning, master production scheduling, material requirements planning, capacity requirements planning, and the execution systems for capacity and priority. Outputs from these systems would be integrated with financial reports such as the business

plan, purchase commitment report, shipping budget, inventory projections in dollars, etc. Manufacturing resource planning is a direct outgrowth and extension of material requirement planning (MRP). (11/90)

MAPI METHOD –
(1) A procedure for replacement analysis sponsored by the Machinery and Allied Products Institute.
(2) A method of capital investment analysis which has been formulated by the Machinery and Allied Products Institute. This method uses a fixed format and provides charts and graphs to facilitate calculations. A prominent feature of this method is that it explicitly includes obsolescence. (11/90)

MARGINAL ANALYSIS – An economic concept concerned with those incremental elements of costs and revenue which are associated directly with a specific course of action, normally using available current costs and revenue as a base and usually independent of traditional accounting allocation procedures. (11/90)

MARGINAL COST (BENEFIT) – Syn.: INCREMENTAL COST (BENEFIT). [1] (11/90)

MARKETING – The broad range of activities concerned primarily with the determination of consumer or user demands or desires, both existing and potential; the satisfaction of these demands or desires through innovation or modification; and the building of buyer awareness of product or service availability through sales and advertising efforts. (11/90)

MARKETING COST ANALYSIS – The study and evaluation of the relative profitability or costs of different marketing operations in terms of customer, marketing units, commodities, territories, or marketing activities. Typical tools include cost accounting. (11/90)

MARKETING RESEARCH – The systematic gathering, recording, and analyzing of data about problems relating to the marketing of goods and services. Such research may be undertaken by impartial agencies or by business firms, or their agents. Marketing research is an inclusive term which includes various subsidiary types:
a) MARKET ANALYSIS, of which product potential is a type, which is the study of size, location, nature, and characteristics of markets.
b) SALES ANALYSIS (OR RESEARCH), which is the systematic study and comparison of sales (or consumption) data.
c) CONSUMER RESEARCH, of which motivation research is a type which is concerned chiefly with the discovery and analysis of consumer attitudes, reactions, and preferences. (11/90)

MARKET VALUE – The monetary price upon which a willing buyer and a willing seller in a free market will agree to exchange ownership, both parties knowing all the material facts but neither being compelled to act. The market value fluctuates with the degree of willingness of the buyer and seller and with the conditions of the sale. The use of the term market suggests the idea of barter. When numerous sales occur on the market, the result is to establish fairly definite market prices as the basis of exchanges. (11/90)

MARK-UP – As variously used in construction estimating, includes such percentage applications as general overhead, profit, and other indirect costs. When mark-up is applied to the bottom of a bid sheet for a particular item, system, or other construction price, any or all of the above items (or more) may be included, depending on local practice. (11/90)

MASTER PRODUCTION SCHEDULE (MPS) – In manufacturing, for selected items, a statement of what the company expects to manufacture. It is the anticipated build schedule for those selected items assigned to the master scheduler. The master scheduler maintains this schedule and, in turn, it becomes a set of planning numbers which "drives" MRP. It represents what the company plans to produce expressed in specific configurations, quantities, and dates. The MPS should not be confused with a sales forecast, which represents a statement of demand. The master production schedule must take forecast

plus other important considerations (backlog, availability of material, availability of capacity, management policy and goals, etc.) into account prior to determining the best manufacturing strategy. (11/90)

MASTER SCHEDULE – A consolidated schedule incorporating multiple, related projects or parts of a project so that they may be monitored and controlled as a unit. See: LEVEL OF SCHEDULES – MANAGEMENT SUMMARY SCHEDULE. (6/07)

MASTER SCHEDULE ITEM – In manufacturing, a part number selected to be planned by the master scheduler. The item would be deemed critical in terms of its impact on lower level components and/or resources such as skilled labor, key machines, dollars, etc. A master schedule item may be an end item, a component, a pseudo number, or a planning bill of material. (11/90)

MASTER SCHEDULER – The person who manages the master project or production schedule. (6/07)

MATERIAL COST – The cost of everything of a substantial nature that is essential to the construction or operation of a facility, both of a direct or indirect nature. Generally includes all manufactured equipment as a basic part. (11/90)

MATERIAL DIFFERENCE – A change that is important to the performance of the work or that will have a measurable influence or effect on the time, cost of, or procedures for the work under the contract. (11/90)

MATERIAL REQUIREMENTS PLANNING (MRP) – A system which uses bills of material, inventory and open order data, and master production schedule information to calculate requirements for materials. It makes recommendations to release replenishment orders for material. Further, since it is time-phased, it makes recommendations to reschedule open orders when due dates and need dates are not in phase. See: MANUFACTURING RESOURCE PLANNING (MRP II). (11/90)

MAXIMUM OUT-OF-POCKET CASH – The highest year-end negative cash balance during project life. (11/90)

MEANS AND METHODS – Syn.: METHOD OF PERFORMANCE. (6/07)

MECHANICAL COMPLETION – Placing a fixed asset in service. Mechanical completion is an event. (11/90)

MECHANICAL COMPLETION – Unit is essentially complete for startup operation and test run. All major work is completed. Minor work not interfering with operation may not be completed, such as punch list and minor touchup work. Acceptance letter will have been submitted to the client. Precise definition may vary and is usually a contractual provision. Client custody may commence. It is important that this definition be clearly defined in the contract. (6/07)

MERGE NODE – In a network diagram, a node at which two or more activities precede the start of subsequent activity. (6/07)

MERIT SHOP – Syn.: OPEN SHOP. (11/90)

METHOD OF MEASUREMENT – The procedure, usually standardized, according to which the quantities of work expressed in a bill of quantities (BOQ) shall be measured. See: BILL OF QUANTITIES (BOQ); RULES OF CREDIT. (6/07)

METHOD OF PERFORMANCE – Manner in which the specified product or objective is accomplished, which is left to the discretion of the contractor unless otherwise provided in the contract. If the owner orders the contractor to modify the construction procedure, this constitutes a change in method. If the imposition of this modification results in additional cost to the contractor, the contractor may be entitled to recovery under the changes clause. Syn.: MEANS AND METHODS. (6/07)

MICRO-SCHEDULING – Scheduling of activities with a duration less than one day (in minutes, hours or fractional days). (6/07)

MILESTONE – A zero duration activity or event which is used to denote a particular point in time for reference or measurement. Milestones are not true activities in that they do not consume time or resources. Often used for management summary reporting. A milestone should be capable of validation by meeting all of the items prescribed in a defining checklist as agreed with the stakeholders. See: KEY ACTIVITY; KEY EVENTS. (6/07)

MILESTONE DICTIONARY – A description of exactly what is required to satisfy each milestone. (6/07)

MILESTONE FLAG – A numeric code that may be entered on an event to flag the event as a milestone. (11/90)

MILESTONE LEVEL – The level of management at which a particular event is considered to be a key event or milestone. (11/90)

MILESTONE, PAYMENT – Those milestones on which payments fall due. (6/07)

MILESTONE PLAN – A plan containing only milestones that highlight key activities or events of the project. See: MILESTONE SCHEDULE. (6/07)

MILESTONE REPORT – An output report at a specified level showing the latest allowable date, expected date, schedule completion date, and the slack for the successor event contained on each activity or event name flagged as a milestone at the level specified. (11/90)

MILESTONE SCHEDULE – A schedule comprised of key events or milestones selected as a result of coordination between the client's and the contractor's project management. These events are generally critical accomplishments planned at time intervals throughout the project and used as a basis to monitor overall project performance. The format may be either network or bar chart and may contain minimal detail at a highly summarized level. (11/90)

MISREPRESENTATION – Inaccurate factual information furnished by either party to a contract, even if done unintentionally. (11/90)

MITIGATION –
(1) Working to lessen risk by lowering its chances of occurring or by reducing its effect if it does occur.
(2) Revising the project's scope, budget, schedule or quality, preferably without material impact on the project's objectives, in order to reduce uncertainty. (6/07)

MITIGATION OF DAMAGES – To take all possible measures to avoid damage and delay and, if not avoidable, to reduce or lessen the extra costs incurred due to occurrence of the event. (11/90)

MODEL PRICING – The techniques of using verbal, symbolic, or analog models to depict cost relationships, and the form which they take. Mathematics and computers are basic analytical tools for model pricing. (11/90)

MODELING – Creation of a physical representation or mathematical description of an object, system or problem that reflects the functions or characteristics of the item involved. Model building may be viewed as both a science and an art. Cost estimate and CPM schedule development should be considered modeling practices and not exact representations of future costs, progress and outcomes. (6/07)

MODIFICATION, BILATERAL – An agreement negotiated by and entered into by both parties for a modification of the existing contract terms of a mutually agreed time or price adjustment. (11/90)

MODIFICATION, UNILATERAL – A modification to the contract issued by the owner without the agreement of the contractor as to the time or price adjustment. (11/90)

MONITORING – Periodic gathering, validating and analyzing various data on contract status to determine any existing or potential problems. Usually one accomplishes this through use of the data provided in contractor reports on schedule, labor, cost and technical status to measure progress against the established baselines for each of these report areas. However, when deemed necessary, on-site inspection and validation and other methods can be employed. (11/90)

MONTE CARLO METHOD – A simulation technique by which approximate evaluations are obtained in the solution of mathematical expressions so as to determine the range or optimum value. The technique consists of simulating an experiment or model to determine some probabilistic property of a model, system or population of objects or events by use of random sampling applied to the components of the model, system, objects, or events. The method can be applied to cost estimates and schedules when they are expressed as a model (i.e., in a spreadsheet or scheduling system). See: MODELING. (6/07)

MONTHLY GUIDE SCHEDULE – A detailed two-month schedule used to detail the sequence of activities in an area for analysis or to plan work assignments. This schedule is usually prepared on an "as needed" basis or within a critical area. Syn.: SHORT-TERM ACTIVITIES (11/90)

MONTH-TO-MONTH PRICE INDEX – A price index for a given month with the preceding month as the base period. (11/90)

MOST LIKELY TIME – The most realistic time estimate for completing an activity under normal conditions. Used in probabilistic scheduling. See: PERT (PROJECT EVALUATION AND REVIEW TECHNIQUE). (6/07)

MOVING AVERAGE – Smoothing a time series by replacing a value with the mean of itself and adjacent values. (11/90)

MRP – Syn.: MATERIAL REQUIREMENTS PLANNING (MRP). (11/90)

MRP II – Syn.: MANUFACTURING RESOURCE PLANNING (MRP II) (6/07)

MULTI-PROJECT SCHEDULING – Technique used to consolidate multiple projects' CPM schedules into a master schedule. The technique is used to monitor and control an overall program. See: PROGRAM (6/07)

MULTIPLE FINISH NETWORK – A network that has more than one finish activity or finish event. (11/90)

MULTIPLE START NETWORK – A network that has more than one start activity or event. (11/90)

MULTIPLE STRAIGHT-LINE DEPRECIATION METHOD – A method of depreciation accounting in which two or more straight line rates are used. This method permits a predetermined portion of the asset to be written off in a fixed number of years. One common practice is to employ a straight line rate which will write off 3/4 of the cost in the first half of the anticipated service life; with a second straight line rate to write off the remaining 1/4 in the remaining half life. (11/90)

MUST FINISH – Date an activity must finish by. It is a constraint date. See: IMPOSED FINISH DATE. (6/07)

MUST FINISH BY DATE – Date used by scheduling software to calculate the final completion status of the project. Without the imposition of a must finish by date, the end of the project would float out to its natural completion. (6/07)

MUST START – Date an activity must start by. It is a constraint date. See: IMPOSED START DATE. (6/07)

NEAR-CRITICAL ACTIVITY – A schedule activity with minimal total float and for which there is some risk of delay that will cause the activity to become critical. The amount of float that management perceives to be near-critical is project-dependent and open to professional judgment. (8/07)

NEAR-TERM ACTIVITIES – Activities that are planned to begin, be in process, or be completed during a relatively short period, such as 30, 60, or 90 days. (6/07)

NEGATIVE FLOAT –
(1) The amount of time by which the early date of an activity exceeds its late date. It is how far behind an activity is from its planned early start/finish date.
(2) Time by which the duration of an activity or path has to be reduced in order to permit a limiting imposed date to be achieved. (6/07)

NEGLIGENCE – Failure to exercise that degree of care in the conduct of professional duties that should be exercised by the average, prudent professional, practicing in the same community under similar circumstances. Under this concept, an architect/engineer is not liable for errors of judgment, but only for a breach of duty to exercise care and skill. (11/90)

NET AREA – When used in building construction, it is the area, exclusive of encroachments by partitions, mechanical space, etc, which is available for circulation or for any other functional use within a project. (11/90)

NET BENEFITS (SAVINGS) – The difference between the benefits and the costs - where both are discounted to present or annual value dollars. [1] (11/90)

NET PRESENT VALUE – Syn.: PRESENT VALUE. (11/90)

NET PROFIT – Earnings after all operating expenses (cash or accrued non-cash) have been deducted from net operating revenues for a given period. (11/90)

NET PROFIT, PERCENT OF SALES – The ratio of annual profits to total sales for a representative year of capacity operations. An incomplete measure of profitability, but a useful guidepost for comparing similar products and companies. See: PROFIT MARGIN. (11/90)

NET PURCHASES (CONCEPT OF) – According to this concept, any proceeds from the sale in the reference year of a used commodity belongs to a given elementary group and are subtracted from the expenditure reported on commodities in that elementary group. (11/90)

NETWORK – The series of activities required to complete a project. Typically includes a logic diagram of a project consisting of the activities and events that must be accomplished to reach the objectives, showing their required sequence of accomplishments and interdependencies. See: CRITICAL PATH METHOD (CPM), LOGIC DIAGRAM. (6/07)

NETWORK ANALYSIS – Process of identifying early and late start and finish dates for activities by use of a forward and backward pass through the CPM model. See: CRITICAL PATH METHOD (CPM). (6/07)

NETWORK DIAGRAM – Syn.: LOGIC DIAGRAM. (6/07)

NETWORK FLOAT – The total float values that exist on the various chains of activities within the CPM network. Distinguish from project float. See: PROJECT FLOAT. (6/07)

NETWORK INTERFACE – Activity or event common to two or more network diagrams. (6/07)

NETWORK LOGIC – The collection of activity dependencies that make up a project network diagram. See: LOGIC. (6/07)

NETWORK OPEN END – A condition where at least one CPM network activity other than the first has no predecessor or other than the last has no successor. (8/07)

NETWORK PATH – Any continuous series of connected activities in a project network diagram. (6/07)

NETWORK PLANNING – A broad generic term for techniques used to plan complex projects using logic diagrams (networks). Two of the most popular techniques are ADM and PDM. (11/90)

NETWORK SCHEDULING – Method of planning and scheduling a project where activities are arranged based on predecessor and successor relationships. Network calculations determine when activities may be performed and which activities are critical or have float. See: CRITICAL PATH METHOD (CPM). (8/07)

NODE – In an activity on arrow (AOA) schedule, the event marking the start (I-node) or finish (J-node) of an activity. Nodes are typically represented graphically as a circle. (6/07)

NOMINAL DISCOUNT RATE – The rate of interest reflecting the time value of money stemming both from inflation and the real earning power of money over time. This is the discount rate used in discount formulas or in selecting discount factors when future benefits and costs are expressed in current dollars. [1] (11/90)

NON-CASH – A term frequently used for tangible commodities to be used from inventory and not replaced. (11/90)

NON-CRITICAL ACTIVITIES OR WORK ITEMS – Activities or work items that have positive float. i.e. within defined limits, can take longer to complete than planned without affecting total project duration. (6/07)

NON-DURABLE GOODS – Goods whose serviceability is generally limited to a period of less than three years (such as perishable goods and semi-durable goods). (11/90)

NON-EXCUSABLE DELAYS –
1) Delays that are caused by the contractor's or its subcontractor's actions or inactions. Consequently, the contractor is not entitled to a time extension or delay damages. On the other hand, owner may be entitled to liquidated or other damages.
2) A non-excusable delay is one for which the party assumes the risk of the cost and consequences, not only for itself but possibly for the resulting impact on others as well. The concept of non-excusability is used primarily as a defense to requests for time extensions or claims for delay. [10] See: EXCUSABLE DELAYS; EXCUSABLE COMPENSABLE DELAYS; EXCUSABLE NON-COMPENSABLE DELAYS; CONCURRENT DELAYS. (6/07)

NON-EXEMPT EMPLOYEES – Employees not exempt from overtime compensation by federal wage and hours guidelines. (6/07)

NON-SPLITTABLE ACTIVITY – An activity that, once started, has to be completed to plan without interruption. Resources should not be diverted from a non-splittable activity. (6/07)

NON-WORK UNIT – A calendar-specified time unit during which work will not be scheduled. (11/90)

NORMALIZATION − In database management, a process used to modify data so that it conforms to a standard or norm (e.g., conform to a common basis in time, currency, location, etc.) (6/07)

NORMAL WEATHER – That kind of weather, which could be expected for a period of time, based upon the historical weather experience of the locale. (6/07)

NOT EARLIER THAN – A restriction on an activity that indicates that it may not start or end earlier than a specified date. (6/07)

NOT LATER THAN – A restriction on an activity that indicates that it may not start or end later than a specified date. (6/07)

NOTICE OF AWARD – The written notice of acceptance of the bid by the owner to a bidder stating that upon compliance by the bidder with the conditions precedent enumerated therein, within the time specified, the owner will sign and deliver the agreement. (11/90)

NOTICE TO PROCEED (NTP) – Formal notification to a contractor or supplier, requesting the start of the work or a defined phase of work. May be in the form of a limited NTP (LNTP), which authorizes only limited areas of a program or project to begin within stated boundaries in anticipation of a subsequent NTP. (6/07)

OBJECTIVE – Something one wants to get done. A specific statement of quality, quantity and time values. In contract/procurement management, to define the method to follow and the service to be contracted or resource to be procured for the performance of work. In time management, a predetermined result, toward which effort is directed. (6/07)

OBJECTIVE EVENT – An event that signifies the completion of a path through the network. A network may have more than one objective event. (11/90)

OBSOLESCENCE –
(1) The condition of being out of date. A loss of value occasioned by new developments which place the older property at a competitive disadvantage. A factor in depreciation.
(2) A decrease in the value of an asset brought about by the development of new and more economical methods, processes, and/or machinery.
(3) The loss of usefulness or worth of a product or facility as a result of the appearance of better and/or more economical products, methods or facilities. (11/90)

OFFSITES – General facilities outside the battery limits of all process units, such as field storage, service facilities, utilities, main electric substation, administrative buildings, rail tracks and storage yard, etc. (6/07)

OMISSION – Any part of a system, including design, construction and fabrication, that has been left out, resulting in a deviation. An omission requires an evaluation to determine what corrective action is necessary. (11/90)

ON-STREAM FACTOR – The ratio of actual operating days to calendar days per year. (11/90)

OPEN SHOP – An employment or project condition where either union or non-union contractors or individuals may be working. Open shop implies that the owner or prime contractor has no union agreement with workers. Syn.: MERIT SHOP. (11/90)

OPERATING COST – The expenses incurred during the normal operation of a facility, or component, including labor, materials, utilities, and other related costs. Includes all fuel, lubricants, and normally scheduled part changes in order to keep a subsystem, system, particular item, or entire project functioning. Operating costs may also include general building maintenance, cleaning services, taxes, and similar items. See: MANUFACTURING COST. (11/90)

OPERATION – Ongoing endeavor, or activities that utilize strategic assets for a defined function or purpose. (1/02)

OPERATION PHASE – Period when the completed deliverable is used and maintained in service for its intended purpose. The operation phase is part of the asset or product life cycle as distinct from the project life cycle. See: LIFE CYCLE – ASSET LIFE CYCLE. (6/07)

OPERATIONS RESEARCH (OR) – Quantitative analysis of industrial and administrative operations with intent to derive an integrated understanding of the factors controlling operational systems and in view of supplying management with an objective basis to make decisions. OR frequently involves representing the operation or the system with a mathematical model. (11/90)

OPPORTUNITY – Uncertain event that could improve the results, or improve the probability that the desired outcome will happen. See: RISK; THREAT; UNCERTAINTY. (6/07)

OPPORTUNITY COST OF CAPITAL – The rate of return available on the next best available investment of comparable risk. [1] (11/90)

OPTIMISTIC DURATION – The shortest of the three durations in the three duration technique or PERT. (6/07)

OPTIMISTIC TIME ESTIMATE – The minimum time in which the activity can be completed if everything goes exceptionally well. (6/07)

OPTIMUM PLANT SIZE – The plant capacity which represents the best balance between the economics of size and the cost of carrying excess capacity during the initial years of sales. (11/90)

ORDER OF MAGNITUDE ESTIMATE – An estimate made without detailed engineering data. (This term is superceded by Recommended Practice No. 17R-97 “Cost Estimate Classification System”.) (6/07)

ORGANIZATIONAL BREAKDOWN STRUCTURE (OBS) – Hierarchical structure designed to pinpoint area of an organization responsible for each part of a project. See: WORK BREAKDOWN STRUCTURE (WBS). (6/07)

ORGANIZATIONAL CODES – Numerical or alphabetized characters that the user specifies for the system to associate with a particular activity for sorting purposes. See: CODE. (11/90)

ORIGINAL DURATION – First estimate of work time / duration needed to execute an activity. The most common units of time are hours, days and weeks. See: BASELINE. (6/07)

OUT-OF-SEQUENCE PROGRESS – Progress that has been reported even though activities that have been deemed predecessors in project logic have not been completed. Scheduling software may include a “switch” to turn on or off how the calculations deal with out-of-sequence progress. (6/07)

OUTPUT – Goods, services, or other results created by a process. (8/07)

OVERHAUL – The distance in excess of that given as the stated haul distance to transport excavated material. (11/90)

OVERHEAD – A cost or expense inherent in the performing of an operation, (e.g., engineering, construction, operating, or manufacturing) which cannot be charged to or identified with a part of the work, product or asset and, therefore, must be allocated on some arbitrary base believed to be equitable, or handled as a business expense independent of the volume of production. Plant overhead is also called factory expense. See: GENERAL & ADMINISTRATIVE COSTS (G&A). (6/07)

OVERLOAD – In planning and scheduling and resource planning, an amount by which the resource required exceeds its resource limit. (6/07)

OVERPLAN (UNDERPLAN) – The planned cost to date minus the latest revised estimate of cost to date. When planned cost exceeds latest revised estimate, a projected underplan condition exists. When latest revised estimate exceeds planned cost, a projected overplan condition exists. (11/90)

OVERRUN (UNDERRUN) – The actual costs for the work performed to date minus the estimate or value for that same work. If the actual costs are greater, it is an overrun; if the actual costs are less, it is an underrun. See: PROBABILITY OF UNDERRUN (OR OVERRUN). (6/07)

OWNER – Entity, public body or authority, corporation, association, firm or person with whom the contractor has entered into the agreement and for whom the work is to be provided, See: CLIENT. (6/07)

OWNER FURNISHED FIXTURES & EQUIPMENT (OFFE) – That items the responsibility of the owner to furnish that become incorporated into the contractor's work. The timing, interface and quality of OFFE are often the subject of dispute, delaying and affecting the contractor's work. (6/07)

PARALLEL ACTIVITIES – Two or more activities than can be done at the same time. Allows a project to be completed faster than if activities were arranged sequentially. See: FAST-TRACK(ING). (8/07)

PARAMETRIC ESTIMATE – In estimating practice, describes estimating algorithms or cost estimating relationships that are highly probabilistic in nature (i.e., the parameters or quantification inputs to the algorithm tend to be abstractions of the scope). Typical parametric algorithms include, but are not limited to, factoring techniques, gross unit costs, and cost models (i.e., algorithms intended to replicate the cost performance of a process of system). Parametric estimates can be as accurate as definitive estimates. (1/03)

PARENT – A higher-level element in a hierarchical structure. See: CHILD. (6/07)

PARENT ACTIVITY – Task within the work breakdown structure that embodies several subordinate child tasks. (6/07)

PARETO DIAGRAM – A histogram, arranged by frequency of occurrence, which shows how many results were generated by each identified cause. (6/07)

PARTIAL UTILIZATION – Placing a portion of the work in service for the purpose for which it is intended (or a related purpose) before reaching substantial completion for all the work. (11/90)

PATH – A continuous chain of activities within a network. (6/07)

PATH CONVERGENCE – A condition where multiple CPM activities precede a shared event. (8/07)

PATH DIVERGENCE – A condition where multiple CPM activities succeed a shared event. (8/07)

PATH FLOAT – See: FLOAT. (11/90)

PAYBACK METHOD – A technique of economic evaluation that determines the time required for the cumulative benefits from an investment to recover the investment cost and other accrued costs. See: DISCOUNTED PAYBACK PERIOD (DPB); SIMPLE PAYBACK PERIOD (SPB). [1] (11/90)

PAYOFF (PAYBACK) PERIOD – See: PAYOUT TIME. [1] (11/90)

PAYOUT TIME – The time required to recover the original fixed investment from profit and depreciation. Most recent practice is to base payout time on an actual sales projection. Syn.: PAYOFF (PAYBACK) PERIOD. See: SIMPLE PAYBACK PERIOD (SPB). (11/90)

PAYROLL BURDEN – Syn.: LABOR BURDEN. (6/07)

PDM – Syn.: PRECEDENCE DIAGRAMMING METHOD (PDM). (11/90)

PDM ARROW – A graphical symbol in PDM networks used to represent the lag describing the relationship between work items. (11/90)

PDM FINISH TO FINISH RELATIONSHIP – This relationship restricts the finish of the work item until some specified duration following the finish of another work item. (11/90)

PDM FINISH TO START RELATIONSHIP – The standard node relationship, where a successor activity starts after the predecessor finishes. Routinely used in ADM. (8/07)

PDM START TO FINISH RELATIONSHIP – The relationship restricts the finish of the work item until some duration following the start of another work item. (11/90)

PDM START TO START RELATIONSHIP – This relationship restricts the start of the work item until some specified duration following the start of the preceding work item. (11/90)

PERCENT COMPLETE – A comparison of the work completed to the current projection of total work. The percent complete of an activity in a program can be determined by inspection of quantities placed as workhours expended and compared with quantities planned or workhours planned. Other methods can also be used. (11/90)

PERCENT COMPLETE – An estimate of the percentage complete for an activity as of a particular data date. Percent complete may be based on time expended, cost or resources employed, or measurement of work in place. See: EARNED VALUE (EV); QUANTITY SURVEY; REMEASUREMENT; METHOD OF MEASUREMENT. (6/07)

PERCENT ON DIMINISHING VALUE – Syn.: DECLINING BALANCE DEPRECIATION. (11/90)

PERFORMANCE MEASUREMENT BASELINE – The time-phased budget plan against which contract performance is measured. It is formed by the budgets assigned to scheduled work elements and the applicable indirect budgets. For future effort not planned in detail, the performance measurement baseline also includes budgets assigned to higher level CWBS elements and undistributed budget. It will reconcile to the contract budget base. It equals the total allocated budget less management reserve. See: BASELINE.(11/90)

PERFORMANCE MEASUREMENT SYSTEM –
(1) An organization’s defined processes for monitoring and updating project and/or organization progress at a detailed level over time.
(2) A quantitative tool (for example, rate, ratio, index, percentage) that provides an indication of an organization's performance in relation to a specified process or outcome. See: KEY PERFORMANCE INDICTATORS (KPI). (6/07)

PERT (PROJECT EVALUATION AND REVIEW TECHNIQUE) – Along with CPM, PERT is a probabilistic technique for planning and evaluating progress of complex programs. Attempts to determine the time required to complete each element in terms of pessimistic, optimistic, and best-guess estimates. (6/07)

PERT ANALYSIS – A process by which you evaluate a probable outcome based on three scenarios: 1) Best-case; 2) Expected-case; and 3) Worst-case. The outcome in question may be duration of a task, its start date, or its finish date. (6/07)

PERT CHART – A flowchart that shows all tasks and task dependencies. Tasks are represented by boxes and task dependencies are represented by lines connecting the boxes. In this instance, a PERT chart is not based on PERT probabilistic activity durations. (6/07)

PESSIMISTIC TIME ESTIMATE – The maximum time required for an activity under adverse conditions. It is generally held that an activity would have no more than one chance in a hundred of exceeding this amount of time. (11/90)

PHASE – A major period in the life of an asset or project. A phase may encompass several stages. See: LIFE CYCLE. (6/07)

PHASED CONSTRUCTION – Implies that construction of a facility or system or subsystem commences before final design is complete. Phased construction is used in order to achieve beneficial use at an advanced date. See: FAST-TRACK(ING). (8/07)

PHYSICAL PERCENTAGE COMPLETE – Percentage of work content of an activity or project achieved as of a particular date. Physical completion of any activity represents the most accurate, unbiased measure or appraisal in accordance with the accept method of measurement, tempered with judgment and experience. Physical completion is not linked to work hours budgeted or expended. See: METHOD OF MEASUREMENT; PHYSICAL PROGRESS. (6/07)

PHYSICAL PROGRESS – The status of a task, activity, or discipline based on pre-established guidelines related to the amount or extent of work completed. See: METHOD OF MEASUREMENT; PHYSICAL PERCENTAGE COMPLETE. (11/90)

PHYSICAL RESTRAINT – A situation in which a physical activity or work item must be completed before the next activity or work items in the sequence can begin (e.g., concrete must harden before removing formwork). (6/07)

PLAN –
(1) Formalized, written method of accomplishing a project task.
(2) An intended future course of action.
(3) The basis for project controls.
(4) A generic term used for a statement of intentions whether they relate to time, cost or quality in their many forms.
(5) A predetermined course of action over a specified period of time which represents a projected response to an anticipated environment in order to accomplish a specific set of adaptive objectives. (6/07)

PLAN-DO-CHECK-ACT (PDCA) CYCLE –
(1) Universal improvement methodology, advanced by W. Edwards Deming and based on the work of Walter Shewart, designed to continually improve processes by which an organization produces a product or delivers a service.
(2) The foundation for the Total Cost Management (TCM) process. Syn.: DEMING CYCLE. [8] (6/07)

PLANNED COST – The approved estimated cost for a work package or summary item. This cost when totaled with the estimated costs for all other work packages results in the total cost estimate committed under the contract for the program or project. (11/90)

PLANNED VALUE (PV) – Measure of the value of work planned to have been performed so far. The budgeted cost of work scheduled (BCWS) is a more appropriate term. The “value” of the work schedule to have been completed at the date of analysis (data date). In comparison to Earned Value (EV), provides a

measure of performance taking into account both time and cost expended. See: EARNED VALUE (EV). (8/07)

PLANNER – In project control, a team member with the responsibility for planning, scheduling and tracking of projects. They are often primarily concerned with schedule, progress and manpower resources. (6/07)

PLANNING –
(1) The determination of a project's objectives with identification of the activities to be performed, methods and resources (cost, hours, time, materials, etc.) to be used for accomplishing the tasks, assessment of both value and risks, assignment of responsibility and accountability, and establishment of an integrated plan to achieve completion as required.
(2) In planning and scheduling, the identification of the project objectives and the ordered activity necessary to complete the project (the thinking part) and not to be confused with scheduling; the process by which the duration of the project task is applied to the plan. It involves answering the questions: 1) What must be done in the future to reach the project objective?; 2) How it will be done?; 3) Who will do it?; and 4) When it will be done? (10/06)

PLANNING BILL (OF MATERIAL) – An artificial grouping of items, in bill of material format, used to facilitate master scheduling and/or material planning. See: BILL OR MATERIALS (BOM); BILL OF QUANTITIES (BOQ). (11/90)

PLANNING HORIZON – In an MRP system, the span of time from the current to some future date for which material plans are generated. This must cover at least the cumulative purchasing and manufacturing lead time and is usually substantially longer to facilitate MRP II. See: MRP; MRP II. (11/90)

PLANNING PACKAGE – A logical aggregation of work within a cost account, normally the far term effort that can be identified and budgeted in early baseline planning, but which will be further defined into work packages, level of effort (LOE), or apportioned effort. See: WORK PACKAGE. (11/90)

PLANNING PHASE – Syn.: DEFINITION PHASE. (6/07)

PLANNING SESSION – A meeting of the principal members of the project team for the purpose of establishing a consistent scope basis for control by defining manageable segments that meet the specific needs of the project. (6/07)

PLANT OVERHEAD – Those costs in a plant that are not directly attributable to any one production or processing unit and are allocated on some arbitrary basis believed to be equitable. Includes plant management salaries, payroll department, local purchasing and accounting, etc. Syn.: FACTORY EXPENSE. (11/90)

PLUG DATE – A date assigned externally to an activity that establishes the earliest or latest date when the activity is scheduled to start or finish. Syn.: CONSTRAINT DATE. (11/90)

POLICY – Definitive position of an organization on a specific issue. A policy provides a basis for consistent and appropriate decision making and defines authority and accountability within the organization. See: DECISION POLICY. (6/07)

PORTFOLIO – An array of assets—projects, programs, or other valuable and often revenue-producing items—that are grouped for management convenience or strategic purpose. When strategically combined, the portfolio assets serve to create synergies among and otherwise complement one-another. (8/07)

PORTFOLIO MANAGEMENT –
(1) Direction and oversight of an array of assets grouped together for strategic purpose or convenience.

(2) In total cost management (TCM), this is considered an aspect of strategic asset management (SAM). See: PORTFOLIO. (8/07)

POSITIVE FLOAT – Amount of time available to complete non-critical activities or work items without affecting the total project duration. See: FLOAT. (6/07)

PRECEDENCE DIAGRAMMING METHOD (PDM) –
(1) A notation of a network that places the activity on a single node. A superset of the activity on node (AON) method, which allows additional precedent relationships along with lead and lag times. See: START-TO-START (SS); FINISH-TO-FINISH (FF); START-TO-FINISH (SF).
(2) An activity oriented system in which activities are displayed in uniform boxes complete with activity number, start duration and finish dates. The logical relation between activity boxes is shown by logic connector lines. Lead and lag times can also be shown. The display is more effective than arrow diagramming and is also easier to revise, update, and program on computer. See: CRITICAL PATH METHOD (CPM); PERT (PROJECT EVALUATION AND REVIEW TECHNIQUE). (6/07)

PRECEDING EVENT – Syn.: BEGINNING EVENT. (11/90)

PRECONSTRUCTION CPM – A plan and schedule of the construction work developed during the design phase preceding the award of contract. (11/90)

PREDECESSOR – An activity that immediately precedes another activity. (3/04)

PREDECESSOR ACTIVITY – Any activity that exists on a common path with the activity in question and occurs before the activity in question. (11/90)

PREDECESSOR ACTIVITY –
(1) An activity that must necessarily be completed before its successor activity may start.
(2) Any activity that exists on a common path with the activity in question and occurs before the activity in question. (6/07)

PREDECESSOR EVENT – See: BEGINNING EVENT. (11/90)

PREFERENTIAL LOGIC –
(1) Contractor's approach to sequencing work over and above those sequences indicated in or required by contract documents. Examples include equipment restraints, crew movements, form reuse, special logic (lead/lag) restraints, etc., factored into the progress schedule instead of disclosing the associated float times.
(2) Modeling execution work flow in a CPM schedule using logic ties, constraints and other mechanisms contrary to the expected norm for that type of effort. May or may not be an attempt at float suppression, float ownership, or necessary to model the expected means and methods actually used in this instance more accurately. The term preferential logic normally has a negative connotation.
See: DISCRETIONARY DEPENDENCY. (6/07)

PRELIMINARY CPM PLAN – CPM analysis of the construction phase made before the award of contracts to determine a reasonable construction period. See: PRECONSTRUCTION CPM. (11/90)

PRELIMINARY ENGINEERING – Includes all design-related services during the evaluation and definition phases of a project. (11/90)

PRESCRIPTIVE – Laid down as a guide, direction, or rule of action specified. Usually implies instructions that are given step-by-step in some detail and that are to be followed without questioning, i.e. what is to be done, rather than how it is to be done, i.e. descriptive. (6/07)

PRESENT VALUE – The value of a benefit or cost found by discounting future cash flows to the base time. Also, the system of comparing proposed investments, which involves discounting at a known interest rate (representing a cost of capital or a minimum acceptable rate of return) in order to choose the alternative having the highest present value per unit of investment. This technique eliminates the occasional difficulty with profitability index of multiple solutions, but has the troublesome problem of choosing or calculating a "cost of capital" or minimum rate of return. Syn.: PRESENT WORTH; NET PRESENT VALUE. [2] (11/90)

PRESENT VALUE FACTOR –
(1) The discount factor used to convert future values (benefits and costs) to present values.
(2) A mathematical expression also known as the present value of an annuity of one.
(3) One of a set of mathematical formulas used to facilitate calculation of present worth in economic analysis involving compound interest. Syn.: PRESENT WORTH FACTOR. [2] (11/90)

PRESENT WORTH – Syn.: PRESENT VALUE. [1] (11/90)

PRESENT WORTH FACTOR – Syn.: PRESENT VALUE FACTOR. [1] (11/90)

PREVENTION – Quality activities employed to avoid deviations; includes such activities as quality systems development, quality program development, feasibility studies, quality system audits, contractor/subcontractor evaluation, vendors/suppliers of information/materials evaluation, quality orientation activities, and certification/qualification. (11/90)

PRICE – The amount of money asked or given for a product (e.g., exchange value). The chief function of price is rationing the existing supply among prospective buyers. (11/90)

PRICE INDEX – A number which relates the price of an item at a specific time to the corresponding price at some specified time in the past. See: COST INDEX. (6/07)

PRICE RELATIVES – The ratio of the commodity price in a given period to its price in the base period. (11/90)

PRICING – In estimating practice, after costing an item, activity, or project, the determination of the amount of money asked in exchange for the item, activity, or project. Pricing determination considers business and other interests (e.g., profit, marketing, etc.) in addition to inherent costs. The price may be greater or less than the cost depending on the business or other objectives. In the cost estimating process, pricing follows costing and precedes budgeting. (6/07)

PRICING, FORWARD – An estimation of the cost of work prior to actual performance. It is also known as prospective pricing. Pricing forward is generally used relative to the pricing of proposed change orders. See: PRICING. (11/90)

PRICING, RETROSPECTIVE – The pricing of work after it has been accomplished. See: PRICING. (11/90)

PRIMARY CLASSIFICATION – The classification of commodities by "commodity type." (11/90)

PRIME CONTRACTOR – The principal (or only) contractor performing a contract for an owner. (6/07)

PROACTIVE – Acting in anticipation of future problems, needs, or changes. See: MITIGATION. (6/07)

PROBABILISTIC DEPENDENCIES – Dependencies between activities that indicate alternative sequences of logic that have probabilities attached to them. (6/07)

PROBABILISTIC NETWORK – Network containing alternative paths with which probabilities are associated rather than deterministic relationships between activities. (6/07)

PROBABILITY OF UNDERRUN OR OVERRUN − In risk analysis and contingency estimating, the chance that the cost or time will be less (underrun) or more (overrun) than a given cost or time from the distribution of outcomes of the risk analysis model. (6/07)

PROCEDURE – A prescribed method for performing specified work. (6/07)

PROCESS – Set of steps or activities required to achieve an output. (6/07)

PROCESS CONTROL – Managing a process to a proven standard. (6/07)

PROCESS DESIGN – Design of a process, which may be a management process either as required in corporate management, or technical as in commercial or industrial engineering. (6/07)

PROCUREMENT – A process for establishing contractual relationships to accomplish project objectives. Typically, the acquisition (and directly related matters) of equipment, material, and non-personal services (including construction) by such means as purchasing, renting, leasing (including real property), contracting, or bartering, but not by seizure, condemnation, or donation. Includes preparation of inquiry packages, requisitions, and bid evaluations; purchase order award and documentation; plus expediting, in-plant inspection, reporting, and evaluation of vendor performance. The assembly, tendering and award of contracts or commitment documents. Specific procedures should be established for the procurement process. (6/07)

PRODUCT – The output from a process in tangible or intangible form. Examples include the project brief as an output from the planning phases, or the completed facility as an output from the producing phases. See: DELIVERABLE; END ITEM. (6/07)

PRODUCT BREAKDOWN STRUCTURE (PBS) – Structure that identifies the products that are required and that must be produced. It displays the system in a hierarchic way. (6/07)

PRODUCTION PLAN – The agreed upon strategy that comes from the production planning function. See: PRODUCTION PLANNING. (11/90)

PRODUCTION PLANNING – The function of setting the overall level of manufacturing or construction output. Its prime purpose is to establish production rates that will achieve management's objective, while usually attempting to keep the production force relatively stable. (11/90)

PRODUCTION RATE – The amount of work, which may be accomplished in a given unit of time. (4/04)

PRODUCTION SCHEDULE –
(1) In manufacturing, a plan which authorizes the factory to manufacture a certain quantity of a specific item. Usually initiated by the production planning department.
(2) In projects, a short-interval schedule used to plan and coordinate a group of activities. (6/07)

PRODUCTIVITY – A measure of output relative to input. Productivity (or efficiency) is improved by increasing output for a given input, or decreasing input for a given output. If the input is specifically work hours, the term commonly used is labor productivity. See: LABOR PRODUCTIVITY. (6/07)

PRODUCTIVITY FACTOR – See: LABOR PRODUCTIVITY FACTOR. (6/07)

PROFIT –
1) GROSS PROFIT: Earnings from an on-going business after direct and project indirect costs of goods sold have been deducted from sales revenue for a given period.

2) NET PROFIT: Earnings or income after subtracting miscellaneous income and expenses (patent royalties, interest, capital gains) and federal income tax from operating profit.
3) OPERATING PROFIT: Earnings or income after all expenses (selling, administrative, depreciation) have been deducted from gross profit. (6/07)

PROFIT MARGIN – A ratio of profit to either total cost or total revenue. Usage often varies depending on the type of company. Retail companies generally use the profit to revenue ratio. Wholesale companies and contractors generally use the profit to cost ratio. (6/07)

PROFITABILITY – A measure of the excess income over expenditure during a given period of time. (11/90)

PROFITABILITY ANALYSIS – The evaluation of the economics of a project, manufactured product, or service within a specific time frame. (11/90)

PROFITABILITY INDEX (PI) – The rate of compound interest at which the company's outstanding investment is repaid by proceeds for the project. All proceeds from the project, beyond that required for interest, are credited, by the method of solution, toward repayment of investment by this calculation. Also called discounted cash flow, interest rate of return, investor's method, internal rate of return. Although frequently requiring more time to calculate than other valid yardsticks, PI reflects in a single number both the dollar and the time values of all money involved in a project. In some very special cases, such as multiple changes of sign in cumulative cash position, false and multiple solutions can be obtained by this technique. (11/90)

PROGRAM –
(1) A grouping of related projects usually managed using a master schedule.
(2) A set of projects with a common strategic goal.
(3) In Europe and elsewhere, the term 'program' or ‘programme’ may be used to mean a network schedule. (6/07)

PROGRAM MANAGEMENT – Management of a series of related projects designed to accomplish broad goals, to which the individual projects contribute, and typically executed over an extended period of time. (6/07)

PROGRAM MANAGER – An official in the program division who has been assigned responsibility for accomplishing a specific set of program objectives. This involves planning, directing and controlling one or more projects of a new or continuing nature, initiation of any acquisition processes necessary to get project work under way, monitoring of contractor performance and the like. (11/90)

PROGRESS –
(1) Development to a more advanced stage. Progress relates to a progression of development and therefore shows relationships between current conditions and past conditions.
(2) Partial completion of a project, or a measure of it. Also, the act of entering current progress update information into project management software. See: LIFE CYCLE; STATUS. (6/07)

PROGRESS DATE – Date used in order to calculate the progress of the project. All estimates to complete or remaining durations should be assessed in accordance with the progress date. See..: AS-OF-DATE; DATA DATE; TIME NOW. (6/07)

PROGRESS LINE – A visual representation of the progress of a project, displayed on the Gantt chart. For a given progress date, the progress line connects in-progress tasks, thereby creating a graph on the Gantt chart with peaks pointing to the left for work that is behind schedule and peaks pointing to the right for work that is ahead of schedule. The distance of a peak from the vertical line indicates the degree to which the task is ahead of or behind schedule at the progress date. (6/07)

PROGRESS MEASUREMENT – Measurement of the current amount of work completed for purposes of assessing progress of the project or contract, as well as for determining amounts due under contract agreements. See: METHOD OF MEASUREMENT; PHYSICAL PROGRESS. (6/07)

PROGRESS MILESTONES – Those project milestones identified as the basis for earning progress and/or making progress payments. (6/07)

PROGRESS OVERRIDE – One of two types of scheduling software logic used to handle activities that occur out of sequence. When specified, it treats an activity with out-of-sequence progress as though it has no predecessor constraints; its remaining duration is scheduled to start immediately, rather than wait for the activities predecessors to complete. See: RETAINED LOGIC. (6/07)

PROGRESS REPORT – A report that informs management of overall project progress (physical percent complete), costs, performance and manpower at a specific reporting cut-off date. Includes major accomplishments, objectives for the upcoming report period, areas of concern, and other pertinent information necessary for management and control. See: STATUS REPORT. (6/07)

PROGRESS TREND – Syn.: TREND. (6/07)

PROJECT – A temporary endeavor with a specific objective to be met within the prescribed time and monetary limitations and which has been assigned for definition or execution. (6/07)

PROJECT BOUNDARY – Boundary that defines how project interacts with other projects and non-project activity both within and outside the organization. See: BATTERY LIMIT. (6/07)

PROJECT CALENDAR – Calendar that defines global project working and non-working periods. See: CALENDAR. (6/07)

PROJECT CODE – Set of symbols assigned to a set of cost classes or sub-divisions of the scope of work in a project. The code reflects a systematic (or hierarchic) sub-division of scope i.e. its WBS. See: CODE; CODE OF ACCOUNTS. (6/07)

PROJECT CONTROL – A management process for controlling the investment of resources in an asset where investments are made through the execution of a project. Project control includes the general steps of: 1) Project planning including establishing project cost and schedule control baselines; 2) Measuring project performance; 3) Comparing measurement against the project plans; and 4) Taking corrective, mitigating, or improvement action as may be determined through forecasting and further planning activity. (6/07)

PROJECT DEFINITION – Process of exploring thoroughly all aspects of proposed project and to explore relations between required performance, development time and cost. See: FRONT END; DEFINITION (PROJECT); DEVELOPMENT PHASE. (6/07)

PROJECT DURATION –
(1) The elapsed duration from project start date through project finish date.
(2) The overall duration a project within which it is scheduled to be completed. Contractual requirements may impose a given project duration for successful completion, from which the schedule is developed to achieve. (6/07)

PROJECT FINISH DATE (SCHEDULE) – The latest scheduled calendar finish date of all activities on the project. (11/90)

PROJECT FLOAT – The time that exists between the early finish of the last activity of a CPM network and the contractual completion date of the project. Project float can be internalized into the network and become network float. See: NETWORK FLOAT. (6/07)

PROJECT LIFE – See: ECONOMIC LIFE (CYCLE). [1] (11/90)

PROJECT MANAGEMENT –
(1) The utilization of skills and knowledge in coordinating the organizing, planning, scheduling, directing, controlling, monitoring and evaluating of prescribed activities to ensure that the stated objectives of a project, manufactured product, or service, are achieved.
(2) The art and science of managing a project from inception to closure as evidenced by successful product delivery and transfer. (6/07)

PROJECT MANAGEMENT SOFTWARE - A class of computer applications specifically designed to aid with planning and controlling project resources, costs and schedules. (6/07)

PROJECT MANAGER – An individual who has been assigned responsibility and authority for accomplishing a specifically designated unit of work effort or group of closely related efforts established to achieve stated or anticipated objectives, defined tasks, or other units of related effort on a schedule for performing the stated work funded as a part of the project. The project manager is responsible for the planning, controlling, and reporting of the project. [4] (11/90)

PROJECT NETWORK ANALYSIS – Syn.: NETWORK ANALYSIS. (6/07)

PROJECT OFFICE – The organization responsible for administration of the project management system, maintenance of project files and documents, and staff support for officials throughout the project life cycle. (11/90)

PROJECT PHASES – The main elements of a project life cycle. For engineering and construction projects, they typically include preplanning, design, procurement, construction, start-up, operation, and final disposition. See: LIFE CYCLE – PROJECT LIFE CYCLE. (6/07)

PROJECT PLAN – The primary document for project activities. It covers the project from initiation through completion. See: PLAN. (11/90)

PROJECT SCOPE – Syn.: SCOPE. (6/07).

PROJECT START DATE – The date a project is scheduled to start. Scheduling software uses the project start date as the starting date for all network calculations until a data date is used for calculating updated progress. (6/07)

PROJECT SUMMARY WORK BREAKDOWN STRUCTURE (PSWBS) – A summary WBS tailored by project management to the specific project, and identifying the elements unique to the project. (11/90)

PROJECT TIME – The time dimension in which the project is being planned. (11/90)

PROJECTED FINISH DATE – The current estimate of the calendar date when an activity or project will be completed. (6/07)

PROJECTED START DATE – The current estimate of the calendar date when an activity or project will begin. (6/07)

PROJECTION – An extension of a series, or any set of values, beyond the range of the observed data. See: FORECASTING. (11/90)

PROPOSAL SCHEDULE – The first schedule issued on a project; accompanies either the client's request or the contractor's proposal. (11/90)

PROPOSED BASE CONTRACT PRICE – The sum total of the individual total price amounts for items of work designated as base bid items listed on the schedule of prices on the bid form (excluding alternates, if any). (11/90)

PROPOSED COMBINED CONTRACT PRICE – The sum total of bidder's proposed base contract price and all of the individual total price amounts for items of work designated as alternate bid items listed on the schedule of prices for alternate bid items on the bid form (excluding all additional alternates, if any). (11/90)

PROPOSED CHANGE ORDER – The form furnished by the owner or the engineer which is to be used: 1) By the owner, when signed by the owner, as a directive authorizing addition to, deletion from, or revision in the work, or an adjustment in contract price or contract time, or any combination thereof; 2) By the owner, when unsigned, to require that the contractor figure the potential effect on contract price or contract time of a proposed change, if the proposed change is ordered upon signing by the owner; 3) By the contractor, to notify the owner that in the opinion of the contractor, a change is required as provided in the applicable provisions of the contract documents. When signed by the owner, a proposed change order may or may not fully adjust contract price or contract time, but is evidence that the change directed by the proposed change order will be incorporated in a subsequently issued change order following negotiations as to its effect, if any, on contract price or contract time. When countersigned by the contractor, a proposed change order is evidence of the contractor's acceptance of the basis for contract adjustments provided, except as otherwise specifically noted. (11/90)

PRUDENT INVESTMENT – That amount invested in the acquisition of the property of an enterprise when all expenditures were made in a careful, businesslike, and competent manner. (11/90)

PUNCHLIST – A list generated by the owner, architect, engineer, or contractor of items yet to be completed by the contractor. Sometimes called a "but" list ("but" for these items the work is complete). (11/90)

PURE PRICE CHANGE – Change in the price of a particular commodity which is not attributable to change in its quality or quantity. (11/90)

QUALIFICATION SUBMITTALS – Data pertaining to a bidder's qualifications which shall be submitted as set forth in the instructions to bidders. (11/90)

QUALIFICATIONS & ASSUMPTIONS – Items that are not completely defined in the project documents for which the estimator is required to use judgment in developing the estimate. (6/07)

QUALITY – Conformance to established requirements (not a degree of goodness). (11/90)

QUALITY ACCEPTANCE CRITERIA – Specified limits placed on characteristics of a product, process, or service defined by codes, standards, or other requirement documents. (11/90)

QUALITY ACTIVITIES – Those activities directly associated with appraisal, training, and prevention. (11/90)

QUALITY APPRAISAL – Quality activities employed to determine whether a product, process, or service conforms to established requirements, including: design review, specification review, other documentation review, constructability review, materials inspection/tests, personnel testing, quality status documentation, and post project reviews. (11/90)

QUALITY ASSURANCE – All those planned or systematic actions necessary to provide adequate confidence that a product, process, or service will conform to established requirements. (11/90)

QUALITY AUDIT – A formal, independent examination with intent to verify conformance with the acceptance criteria. An audit does not include surveillance or inspection for the purpose of process control or product acceptance. (11/90)

QUALITY CONFORMANCE – Quality management activities associated with appraisal, training, and prevention adapted to achieve zero deviations from the established requirements. (11/90)

QUALITY CONTROL – Inspection, test, evaluation or other necessary action to verify that a product, process, or service conforms to established requirements and specifications. (11/90)

QUALITY CORRECTIVE ACTION – Measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition. Corrective action includes rework and remedial action for nonconformance deviations. (11/90)

QUALITY MANAGEMENT – Concerns the optimization of the quality activities involved in producing a quality product, process or service. As such, it includes appraisal, training, and prevention activities. (11/90)

QUALITY MANAGEMENT COSTS – The sum of those costs associated with appraisal, training, and prevention activities. (11/90)

QUALITY NONCONFORMANCE – A deviation that occurs with a severity sufficient to consider rejection of the product, process, or service. In some situations the product, process, or service may be accepted as is; in other situations, it will require corrective action. It also may involve the provision of deliverables that are more than required. (11/90)

QUALITY PERFORMANCE TRACKING SYSTEM – A management tool providing data for the quantitative analysis of certain quality-related aspects of projects by systematically collecting and classifying costs of quality. (11/90)

QUANTIFICATION – In estimating practice, an activity to translate project scope information into resource quantities suitable for costing. In the engineering and construction industry, a take-off is a specific type of quantification that is a measurement and listing of quantities of materials from drawings. See: TAKE-OFF. (1/03)

QUANTITY RATIO – A ratio which measures, for a given commodity, its quantitative shift between alternative baskets. (11/90)

QUANTITY SURVEY – Using standard methods measuring all labor and material required for a specific building or structure and itemizing these detailed quantities in a book or bill of quantities. (11/90)

QUANTITY SURVEY – In traditional terms means using standard methods of measuring all labor and material required for a specific project, building, or a structure, and itemizing these detailed quantities in a book or bill of quantities. See: BILL OF QUANTITIES (BOQ); METHOD OF MEASUREMENT. (6/07)

QUANTITY SURVEYING – A formalized method of periodically (typically monthly) detailing the actual progress accomplished on individual activities and the units of work performed or put in place. This is usually done in accordance with an established method of measurement against a bill of quantities. Often used on unit price contracts and on international civil works projects. See: BILL OF QUANTITIES (BOQ); METHOD OF MEASUREMENT; REMEASUREMENT. (6/07)

QUANTITY SURVEYOR – In the United Kingdom and elsewhere, contractors bidding a job receive a document called a bill of quantities, in addition to plans and specifications, which is prepared by a quantity surveyor, according to well-established rules. In many countries, the quantity surveyor has to undergo extensive technical training and must pass a series of professional examinations. In the United Kingdom

and elsewhere a quantity surveyor establishes the quantities for all bidders, and is professionally licensed to do so. (6/07)

RANGE ESTIMATING – A risk analysis technology which combines Monte Carlo sampling, focus on the few key variables, and heuristics (rules of thumb) to rank critical risk elements. This approach is used to establish the range of the total project estimate and define how contingency should be allocated among the critical elements. (6/07)

RATE OF RETURN – The interest rate earned by an investment. See: RETURN ON AVERAGE INVESTMENT; RETURN ON ORIGINAL INVESTMENT, PROFITABILITY INDEX (PI); INTERNAL RATE OF RETURN (IRR); DISCOUNTED CASH FLOW. (11/91)

RAW MATERIALS – Syn.: CRUDE MATERIALS. (6/07)

RE-BASELINING – Process whereby the project's costs, time scale or resources have to be replanned (usually in an integrated way) due to changes in objectives, deliverables to meet requirements, and/or original scope and the baseline plan is now obsolete. A need to re-baseline often results from poor project definition and/or project control (i.e., re-baselining is not a valid substitute for best practices). Reassessment of the project control process going forward is typically an element of re-baselining. See: REPLANNING. (6/07)

REAL DISCOUNT RATE – The rate of interest reflecting that portion of the time value of money related to the real earning power of money over time. This is the discount rate used in discount formulas or in selecting discount factors when future benefits and costs are expressed in constant dollars. [1] (11/90)

REAL DOLLARS – See: CONSTANT DOLLARS. [1] (11/90)

REAL ESTATE – This refers to the physical land and appurtenances, including structures affixed thereto. In some states, by statute, this term is synonymous with real property. (11/90)

REAL PROPERTY – Refers to the interests, benefits, and rights inherent in the ownership of physical real estate. It is the bundle of rights with which the ownership of real estate is endowed. (11/90)

REASONABLENESS STANDARD – Costs that do not exceed the amount incurred by a prudent contractor or those costs which are generally accepted. Some factors on which reasonableness is based are recognition of the costs as ordinary and necessary and restraints imposed by law, contract terms, or sound business practices. (11/90)

REBASING – Conversion of a price index from one time base to another. (11/90)

RECOVERY SCHEDULE – A special schedule showing special efforts to recover time lost compared to the master schedule. Often a contract requirement when the projected finish date is no longer showing timely completion. (6/07)

RECURRING TASK – A task that occurs repeatedly during the course of a project, such as a weekly staff meeting. (6/07)

RECYCLE – Revisiting partially or fully completed activities to perform additional work due to a change. See: REWORK. (6/07)

RELATIONSHIP – A logical connection between two activities. See: LOGIC. (6/07)

RELATIONSHIP FLOAT – Relationship free float is the amount by which lag on that relationship would have to be increased in order to delay the successor activity. Relationship total float is the amount by

which it would have to be increased in order to cause a delay in the completion of the project as a whole (or the violation of a late target). See: TOTAL FLOAT (TF); FREE FLOAT (FF). (6/07)

RELATIVE TOTAL FLOAT – The difference between the total float calculation on any activity or path and another activity or path, regardless of whether those activities or paths are logically linked. (6/07)

REMAINING AVAILABLE RESOURCES – The difference between the resource availability pool and the level schedule resource requirements. It is computed from the resource allocation process. (11/90)

REMAINING DURATION – Estimated remaining amount of time necessary to complete an in-progress activity. Should not be based solely on activity percent complete. (6/07)

REMAINING FLOAT (RF) – The difference between the early finish and the late finish. (11/90)

REMEASUREMENT – A type of contract (usually used in Europe) that provides for the use of quantity surveys to measure progress. Contractor's periodic payment is from a detailed survey of the actual work in place and not on milestone payments or other methods. Places a larger degree of cost risk on the owner than lump sum or milestone based compensation schemes. (6/07)

RENTAL (LEASED) EQUIPMENT COST – The amount which the owner of the equipment (lessor) charges to a lessee for use of the equipment. The best evidence of such costs is rental invoices that indicate the amount paid for leasing such equipment. (11/90)

REPLACEMENT – A facility proposed to take the place of an existing facility, without increasing its capacity, caused either by obsolescence or physical deterioration. (11/90)

REPLACEMENT COST –
(1) The cost of replacing the productive capacity of existing property by another property of any type, to achieve the most economical service, at prices as of the date specified.
(2) Facility component replacement and related costs, included in the capital budget, that are expected to be incurred during the study period. [2] (11/90)

REPLACEMENT VALUE – That value of an item determined by repricing the item on the basis of replacing it, in new condition, with another item that gives the same ability to serve, or the same productive capacity, but which applies current economic design, adjusted for the existing property's physical deterioration. (11/90)

REPLANNING – A change in the original plan necessitating reevaluation and changes. There are two types of replanning effort: 1) INTERNAL REPLANNING - A change in the original plan that remains within the scope of the authorized contract, caused by a need to compensate for cost, schedule, or technical problems which have made the original plan unrealistic; and 2) EXTERNAL REPLANNING - Customer-directed changes to the contract in the form of a change order that calls for a modification in the original plan. (6/07)

REPRODUCTION COST – The cost of reproducing substantially the identical item or facility at a price level as of the date specified. (11/90)

REPROGRAMMING – A comprehensive replanning of the efforts remaining in the contract resulting in a revised total allocated budget which exceeds the contract budget base. (11/90)

REPUDIATION – See: ANTICIPATORY BREACH. (11/90)

REQUIRED COMPLETION DATE – The required date of completion assigned to a specific activity or project. (11/90)

REQUIRED RETURN – The minimum return or profit necessary to justify an investment. It is often termed interest, expected return or profit, or charge for the use of capital. (11/90)

REQUIREMENT –
(1) An established requisite characteristic of a product, process, or service. A characteristic is a physical or chemical property, a dimension, a temperature, a pressure, or any other specification used to define the nature of a product, process, or service.
(2) A negotiated set of measurable customer wants and needs. (6/07)

RESALE VALUE – The monetary sum expected from the disposal of an asset at the end of its economic life, its useful life, or at the end of the study period. [1] (11/90)

RESCHEDULE –
(1) In construction, the process of changing the duration and/or dates of an existing schedule in response to externally imposed conditions or progress.
(2) In manufacturing, the process of changing order or operation due dates, usually as a result of their being out of phase with when they are needed. (11/90)

RESEARCH EXPENSE – Those continuing expenses required to provide and maintain the facilities to develop new products and improve present products. (11/90)

RESERVE – Syn.: MANAGEMENT RESERVE. (6/07)

RESERVE ALLOWANCE – Syn.: MANAGEMENT RESERVE. (6/07)

RESERVE STOCK – Syn.: SAFETY STOCK. (11/90)

RESIDENT ENGINEER – The authorized representative of the engineer who is assigned to the site or any part thereof whose duties are ordinarily set forth in the contract documents and/or the engineer's agreement with the owner. (11/90)

RESIDUAL RISK – Risk that yet remains for a project or activity after management acts as willing and able to avoid, reduce, or transfer risks. (8/07)

RESOURCE – Any consumable, except time, required to accomplish an activity. From a total cost and asset management perspective, resources may include any real or potential investment in strategic assets including time, monetary, human, and physical. A resource becomes a cost when it is invested or consumed in an activity or project. (6/07)

RESOURCE AGGREGATION – Summation of the requirements for each resource, and for each time period. (6/07)

RESOURCE ALLOCATION PLAN (RAP) – Scheduling of activities in a network with knowledge of certain resource constraints and requirements. This process adjusts activity level start and finish dates to conform to resource availability and use. See: RESOURCE LEVELING. (6/07)

RESOURCE AVAILABILITY DATE – Calendar date when a resource pool becomes available for a given resource. (6/07)

RESOURCE AVAILABILITY POOL – The extent to which resources are available to meet the project's needs. (6/07)

RESOURCE CALENDAR –
(1) Calendar or database used to model available resources, which is then used by project management

software for resource leveling analysis.
(2) Calendar denoting when a resource or resource pool is available for work on a project. [8] (6/07)

RESOURCE CODE – Code used to identify a given resource type. See: CODE; CODE OF ACCOUNTS (COA). (6/07)

RESOURCE CONSTRAINT – The limitations on available resources. See: RESOURCE CALENDAR. (6/07)

RESOURCE DESCRIPTION – The actual name or identification associated with a resource code. (11/90)

RESOURCE DRIVEN TASK DURATION – Task duration that is driven by constrained resources. (6/07)

RESOURCE GROUP – A set of resources that share some characteristics and that is categorized by a group name, such as job function, skill or contractor. See: RESOURCE CODE. (6/07)

RESOURCE HISTOGRAM – A graphic display of the amount of resource required as a function of time on a graph. Individual, summary, incremental, and cumulative resource curve levels can be shown. Syn.: RESOURCE PLOT. (11/90)

RESOURCE LEVEL – A specified quantity of resource units required by an activity per time unit. (6/07)

RESOURCE LEVELING – Any form of network analysis in which scheduling decisions are driven by resource management concerns (e.g., limited resource availability or difficult to manage changes in resource levels). See: RESOURCE SMOOTHING. (6/07)

RESOURCE LIMITED SCHEDULING – A schedule of activities so that a pre-imposed resource availability level (constant or variable) is not exceeded in any given project time unit. See: RESOURCE LEVELING. (11/90)

RESOURCE LOADING / RESOURCE ALLOCATION – The process of allocating or defining, through the use of resource calendars, the resources to be used on given activities. (6/07)

RESOURCE OPTIMIZATION – See: RESOURCE LEVELING; RESOURCE PLANNING. (6/07)

RESOURCE PLANNING: The process of ascertaining future resource requirements for an organization or a scope of work and developing plans to meet those requirements. (6/07)

RESOURCE PLOT – Syn.: RESOURCE HISTOGRAM. (11/90)

RESOURCE REQUIREMENTS PLANNING – In manufacturing, the process of converting the production plan and/or the master production schedule into the impact on key resources, such as labor, machine hours, storage, standard cost dollars, shipping dollars, inventory levels, etc. (6/07)

RESOURCE SMOOTHING – Process of rescheduling activities such that the requirement for resources does not exceed resource limits. Smoothing is a type of resource leveling, except that the project completion date may not be delayed. Activities may only be delayed within their float. See: RESOURCE LEVELING. (6/07)

RESOURCE THRESHOLDS – In resource-limited scheduling it is possible to specify that a particular resource may be exceeded, if necessary, by an amount not to exceed the specified threshold for that resource. See: RESOURCE LIMITED SCHEDULING. (6/07)

RESPONSIBLE ORGANIZATION – The organization responsible for management of a work package. See: ORGANIZATIONAL BREAKDOWN STRUCTURE (OBS). (11/90)

RESPONSIBILITY – Originates when one accepts the assignment to perform assigned duties and activities. The acceptance creates a liability for which the assignee is held answerable for and to the assignor. It constitutes an obligation or accountability for performance. (11/90)

RESPONSIBILITY CODE – System of applying an alphanumeric tag to an activity for grouping, sorting and summarization purposes. The responsibility code generally identifies the entity responsible for performing the coded activities. See: ORGANIZATIONAL CODES. (6/07)

REST DAY – A day where no work is schedule on an activity or the project. See: CALENDAR. (6/07)

RESTRAINT – Syn.: CONSTRAINT. (11/90)

RETAINAGE – Syn.: RETENTION. (6/07)

RETAINED LOGIC – One of two types of logic used to handle activities that occur out of sequence. When used, scheduling software schedules the remaining duration of an out-of-sequence activity according to current network logic - after its predecessors. See: PROGRESS OVERRIDE. (6/07)

RETENTION – Usually refers to a percent of contract value retained by the purchaser until work is finished and testing of equipment is satisfactorily completed. Syn.: RETAINAGE. (6/07)

RETIREMENT OF DEBT – The termination of a debt obligation by appropriate settlement with the lender. It is understood to be in full amount unless partial settlement is specified. (11/90)

RETURN ON AVERAGE INVESTMENT – The ratio of annual profits to the average book value of fixed capital, with or without working capital. This method has some advantages over the return-on-original-investment method. Depreciation is always considered; terminal recoveries are accounted for. However, the method does not account for the timing of cash flow and yields answers that are considerably higher than those obtained by the return-on-original-investment and profitability index methods. Results may be deceiving when compared, say, against the company's cost of capital. (11/90)

RETURN ON ORIGINAL INVESTMENT – The ratio of expected average annual after tax profit (during the earning life) to total investment (working capital included). It is similar in usefulness and limitations to payoff period. (11/90)

RETURN ON RATE BASE – For a public utility, that monetary sum established by the proper regulatory authority as a basis for determining the charges to customers and the "fair return" to the owners of the utility. (11/90)

REVERSE SCHEDULING – Method in which project completion date is fixed and task duration and dependency information is used to compute corresponding project start date. [8] (6/07)

REVISION – In the context of planning and scheduling, a change in the network logic, activity duration, resources availability or resources demand which requires network recalculation and drawing correction(s). (6/07)

REWORK –
(1) Correction of defective work. May take place before, during or after inspection or testing.
(2) Action taken to ensure that a defective or nonconforming item complies with requirements or specifications. [8] See: RECYCLE. (6/07)

RIPPLE EFFECT – The multiplying effect of change(s) and/or productivity impacts to upstream work that may have an adverse impact on the subsequent work to be performed. (4/04)

RISK –
(1) The degree of dispersion or variability around the expected or "best" value which is estimated to exist for the economic variable in question, e.g., a quantitative measure of the upper and lower limits which are considered reasonable for the factor being estimated.
(2) An ambiguous term that can mean any of the following: a) All uncertainty (threats + opportunities); or b) Downside uncertainty (a.k.a. threats); or c) The net impact or effect of uncertainty (threats – opportunities). The convention used should be clearly stated to avoid misunderstanding.
(3) Probability of an undesirable outcome. See: OPPORTUNITY; EVENT; CONDITION (UNCERTAIN); THREAT; UNCERTAINTY. (6/07)

RISK – PROJECT-SPECIFIC
A risk taxonomy designation used to classify project risks for the purposes of selecting a quantification method (i.e., contingency determination). Project-specific risks are uncertainties (threats or opportunities) related to events, actions, and other conditions that are specific to the scope of a project. (e.g., weather, soil conditions, etc.). The impacts of project-specific risks are more or less unique to a project. The historically inconsistent project-specific nature of the risk-to-impact relationship favors the use of more deterministic methods of quantification such as expected value calculations. In this taxonomy usage, it is the opposite of “systemic” risks. See: RISK; RISK – SYSTEMIC. (1/09)

RISK – SYSTEMIC
A risk taxonomy designation used to classify project risks for the purposes of selecting a quantification method (i.e., contingency determination). Systemic risks are uncertainties (threats or opportunities) that are an artifact of an industry, company or project system, culture, strategy, complexity, technology, or similar over-arching characteristics. The historically consistent nature of the systemic risk-to-impact relationship favors the use of methods such as empirically-based parametric modeling for quantification. In this taxonomy usage, it is the opposite of “project-specific” risks. See: RISK; RISK – PROJECT-SPECIFIC. (1/09)

RISK ANALYSIS – A risk management process step, which includes the quantification of the effect of all uncertainty (risks) on a project. Usually done by identifying risks and quantifying each risk's probability of occurrence, and potential severity of impact. Note: The impact may be expressed as a range of values, or with a confidence level, or as a probability distribution. (6/07)

RISK ANALYSIS METHOD – The technique used to analyze the risks associated with a project or program. Specific categories of risk analysis methods are:
1) Qualitative - based on project characteristics and historical data (check lists, scenarios, etc.)
2) Risk models - combination of risks assigned to parts of the estimate or project to define the risk of the total project.
3) Probabilistic models - combining risks from various sources and events (e.g., Monte Carlo, Latin hypercube, decision tree, influence diagrams, etc.) (6/07)

RISK ASSESSMENT – A risk management process step, which includes the identification of risks or uncertainties which may impact a project. (6/07)

RISK CONTROL – A risk management process step which includes the implementation of the risk management plan. (6/07)

RISK MANAGEMENT – All of the steps (phases) associated with managing risk (risk assessment, risk analysis, risk mitigation, risk control. See: RISK ANALYSIS; RISK ASSESSMENT; RISK MANAGEMENT PLAN; RISK MITIGATION; RISK CONTROL. (6/07)

RISK MANAGEMENT PLAN – The product of risk mitigation which includes a list of the action steps to: 1) Eliminate or reduce the probability of a threat occurring; and/or 2) Eliminate or reduce the impact of the threat if it does occur (mitigate the threat); and/or 3) Assure or increase the probability of an opportunity occurring; and/or 4) Increase the impact of an opportunity if it does occur. The plan includes predefined

action steps to be taken and the "trigger points" that will indicate when they are to be executed to mitigate risks. The plan also defines what to monitor to determine the "trigger points". The steps may include, holding portion of funds and/or scope in reserve, until outcome is more certain; trading cost risk for schedule or quality risk; and/or buying "insurance" (such as lump sum, firm price subcontracts). (6/07)

RISK MITIGATION –
(1) The risk management process step that includes developing a risk management plan.
(2) Action to reduce, transfer, or eliminate risk. (6/07)

RISK SOURCES – Events or conditions that have been defined for use in Risk Assessment that might affect the outcome of a project. Risk sources are frequently subdivided into the following groups, based on the underlying source of the source: 1) Business needs risks; 2) Results definition risks; 3) Scope definition risks; 4) Execution plan, mastery and processes risks; and 5) External risks. See: CONDITION; EVENT. (6/07)

RISK TYPES – A means of characterizing risk for use in risk assessment by the type of risk: 1) Inherited - derived from preceding stages of project; 2) Economic - associated with availability and costs of resources; 3) Commercial - associated with customers needs and wants, competition, etc.; 4) Technological - associated with ability to achieve desired results, produce products, etc. life of current or new technology and compatibility of new technologies; and 5) Implementation - ability to meet project plan and commitments due to human behavior or organizational factors. (6/07)

ROLLING WAVE PLANNING – Cost and schedule planning method where details are developed for near term and general or summary allocations are made for out periods. Detail is developed for the out periods as information becomes available to do so. (6/07)

ROYALTIES – payments a company receives to allow others to use a design or concept the company has researched and developed to commercialization. Generally, one of two types: 1) Paid-up royalties where a lump sum payment is made; and 2) Running royalties where continuous payments are made, usually based on actual production or revenues. (11/90)

RULES OF CREDIT – In project control, a procedure according to which the progress on project activities shall be measured. See: METHOD OF MEASUREMENT. (6/07)

S-CURVE – In project control planning, a cumulative distribution graph of costs, labor hours or other quantities plotted against time. Name derives from S-like shape of curve, flatter at beginning and end and steeper in middle, which is typical of most activity or project resource usage. The beginning represents a slow, deliberate but accelerating start, while the end represents a deceleration as work runs out. (6/07)

SAFETY STOCK – The average amount of stock on hand when a replenishment quantity is received. Its purpose is to protect against the uncertainty in demand and in the length of the replenishment lead time. Safety stock and cycle stock are the two main components of any inventory. Syn.: RESERVE STOCK. (11/90)

SAFETY TIME – In a time series planning system, material is frequently ordered to arrive ahead of the forecast requirement date to protect against forecast error. The difference between the forecast requirement date and the planned in-stock date is safety time. (11/90)

SALES – Orders booked by customers. (11/90)

SALES ANALYSIS (OR RESEARCH) – A systematic study and comparison of sales for consumption data along the lines of market areas, organizational units, products or product groups, customers or customer groups, or such other units as may be useful. Typical analyses would include: 1) Promotion Evaluation; 2) Quota Assignment; and 3) Territory Assignment. See: MARKETING RESEARCH. (11/90)

SALES FORECAST – A prediction or estimate of sales, in dollars or physical units, for a specified future period under a proposed marketing plan or program and under an assumed set of economic and other forces outside the unit for which the forecast is made. The forecast may be for a specified item of merchandise or for an entire line. (11/90)

SALES PROFILE – The growth or decline of historical or forecast sales volume, by years. (11/90)

SALES PRICE – The revenue received for a unit of a product. Gross sales price is the total amount paid. Net sales are gross sales less returns, discounts, freight and allowances. Plant netbacks are net sales less selling, administrative and research expenses. Syn.: SELLING PRICE. (11/90)

SALES REVENUE – Revenue received as a result of sales, but not necessarily during the same time period. (11/90)

SALVAGE VALUE –
(1) The cost recovered or which could be recovered from a used property when removed, sold, or scrapped.
(2) The market value of a machine or facility at any point in time (normally an estimate of an asset's net market value at the end of its estimated life).
(3) The value of an asset, assigned for tax computation purposes, which is expected to remain at the end of the depreciation period. (11/90)

SAVINGS-TO-INVESTMENT RATIO (SIR) – Either the ratio of present value savings to present value investment costs, or the ratio of annual value savings to annual value investment costs. [1] (11/90)

SCALING FACTOR – The exponent used in the capacity factoring method. The exponent is used in the capacity factor algorithm to adjust the cost of one item, commodity, or project to another. See: CAPACITY FACTOR. (6/07)

SCHEDULE –
(1) A description of when each activity in a project can be accomplished and must be finished so as to be completed timely. The simplest of schedules depict in bar chart format the start and finish of activities of a given duration. More complex schedules, general in CPM format, include schedule logic and show the critical path and floats associated with each activity.
(2) A time sequence of activities and events that represent an operating timetable. The schedule specifies the relative beginning and ending times of activities and the occurrence times of events. A schedule may be presented on a calendar framework or on an elapsed time scale. (6/07)

SCHEDULE COMPRESSION – A method of schedule analysis used to shorten the critical path of the schedule. This may be accomplished by re-sequencing work, employing greater resources to accomplish more work in a given time, or otherwise reducing the duration of critical path activities. The need for schedule compression may come about because of the owner’s desire to complete early, make up for delays, or to accommodate added work. (6/07)

SCHEDULE CONTINGENCY –
(1) Duration added to a schedule activity to allow for the probability of possible or unforeseen events. Use in this manner is not recommended as the contingency is hidden and may be misused.
(2) A unique activity used to model specific float available to a project phase. Used in this manner gives ownership of float to those activities and or responsibility entity. (6/07)

SCHEDULE DECOMPRESSION – The opposite of schedule compression and results in lengthening the critical path. The need to reduce costs, work within limited resource constraints, and eliminate the use of overtime are some of the reasons for schedule decompression. (6/07)

SCHEDULE GRAPHICS – Presentation charts and images used to communicate schedule progress and highlight areas of concern. Usually supplements the schedule report. Schedule graphics can include bar charts, time scaled logic diagrams, fragnets, etc. See: SCHEDULE REPORT. (6/07)

SCHEDULE MODEL – A mathematical representation of a schedule that can be used in modeling. A CPM schedule network is the most common schedule model. See: CRITICAL PATH METHOD (CPM); MODELING; NETWORK. (6/07)

SCHEDULE OF VALUES – A detailed statement furnished by a construction contractor, builder, or others, apportioning the contract value into work packages. It is used as the basis for submitting and reviewing progress payments. (6/07)

SCHEDULE PERCENT COMPLETE – The proportion of an activity or all the project's activities that has been completed. (6/07)

SCHEDULE PERFORMANCE INDEX (SPI) – Ratio of work performed (earned value or BCWP) to work scheduled (planned value or BCWS). See: EARNED VALUE (EV); PLANNED VALUE (PV). (6/07)

SCHEDULE REFINEMENT – Rework, redefinition or modification of the logic or data that may have previously been developed in the planning process as required to properly input milestones, restraints and priorities. See: SCHEDULE REVISION. (6/07)

SCHEDULE REPORT – A periodic report outlining progress, highlighting significant progress of activities on the critical path and areas of concern that may require corrective action. A schedule report typically includes a narrative, tabular listings by various sorts, and time scaled CPM diagrams. (6/07)

SCHEDULE REVISION – In the context of scheduling, a change in the network logic or in resources which requires redrawing part or the entire network. (6/07)

SCHEDULE RISK – The risks (threats, opportunities, or both) the team might encounter in meeting the deadlines for the final deliverable. (6/07)

SCHEDULE SLIP – Slippage in the final completion date of a project. See: SLIPPAGE. (6/07)

SCHEDULE UPDATE – Process of updating progress as of a data date and reporting that progress. (6/07)

SCHEDULE VARIANCE –
(1) Difference between projected start / finish dates and actual or revised start / finish dates.
(2) The difference between the earned value and scheduled value. Schedule variance = budgeted cost of work performed (BCWP) - budgeted cost of work scheduled (BCWS). A negative cost variance indicates that the activity(ies) is running behind schedule. (6/07)

SCHEDULE WORK UNIT – A calendar time unit when work may be performed on an activity. (6/07)

SCHEDULED COMPLETION DATE – A date assigned for completion of activity or accomplishment of an event for purposes of meeting specified schedule requirements. (11/90)

SCHEDULED DATES – The start, intermediate, or final dates imposed by contract or other means that impact the project schedule. See: CONTRACT DATES. (6/07)

SCHEDULED EVENT TIME – In PERT, an arbitrary schedule time that can be introduced at any event but is usually only used at a certain milestone or the last event. (11/90)

SCHEDULING –
(1) Assignment of desired start and finish times to each activity in the project within overall time cycle required for completion according to plan.
(2) Process of converting a general or outline plan for a project into a time-based schedule based on available resources and time constraints. See: PLANNING. (6/07)

SCHEDULING RULES – Basic rules that are spelled out ahead of time so that they can be used consistently in a scheduling system. (11/90)

SCHEDULING TECHNIQUES – Systems and processes available for determination and presentation (modeling) of a project plan. Examples include, arrow diagramming, logic networks, bar charts, PERT, trending, etc. using a variety of software. See: SCHEDULE MODEL. (6/07)

SCOPE – The sum of all that is to be or has been invested in and delivered by the performance of an activity or project. In project planning, the scope is usually documented (i.e., the scope document), but it may be verbally or otherwise communicated and relied upon. Generally limited to that which is agreed to by the stakeholders in an activity or project (i.e., if not agreed to, it is "out of scope"). In contracting and procurement practice, includes all that an enterprise is contractually committed to perform or deliver. Syn.: PROJECT SCOPE. (1/03)

SCOPE CHANGE – Syn.: CHANGE IN SCOPE. (4/07)

SCOPE CREEP – Gradual progressive change (usually additions to) of the project's scope such that it is not noticed by project management team or customer. Typically occurs when the customer identifies additional, sometimes minor, requirements that, when added together, may collectively result in a significant scope change, resulting in cost and schedule overruns. [8] (6/07)

SCOPE DEFINITION – Division of the major deliverables into smaller, more manageable components to: 1) Improve the accuracy of cost, time, and resource estimates; 2) Define a baseline for performance measurement and control; and 3) Facilitate clear responsibility assignments. See: FRONT END; FRONT END LOADING (FEL). [8] (6/07)

SEASONAL COMMODITIES – Commodities which are normally available in the market-place only in a given season of the year. (11/90)

SEASONAL VARIATION – That movement in many economics series which tends to repeat itself within periods of a year. (11/90)

SECONDARY FLOAT (SF) – Same as total float, except that it is calculated from a schedule date upon an intermediate event. (11/90)

SECULAR TREND – The smooth or regular movement of a long-term time series trend over a fairly long period of time. (11/90)

SELLING EXPENSE – The total expense involved in marketing the products in question. This normally includes direct selling costs, advertising, and customer service. (11/90)

SELLING PRICE – Syn.: SALES PRICE. (11/90)

SENSITIVITY – The relative magnitude of the change in one or more elements of an engineering economy, estimate, schedule or other planning analysis that will reverse a decision among alternatives. (6/07)

SENSITIVITY ANALYSIS – A test of the outcome of an analysis by altering one or more parameters from an initially assumed value(s). [1] (11/90)

SENTIMENTAL VALUE – A value associated with an individual's personal desire, usually related to a prior personal relationship. (11/90)

SEQUENCE – Order in which activities will occur with respect to one another. Establishes priority and dependencies between activities. Successor and predecessor relationships are developed in a network format. Allows project participants to visualize work flow. See: NETWORK. (6/07)

SERVICEABILITY – A measure of the degree to which servicing of an item will be accomplished within a given time under specified conditions. (11/90)

SERVICING – The replenishment of consumables needed to keep an item in operating condition, but not including any other preventive maintenance or any corrective maintenance. (11/90)

SERVICE WORTH VALUE – Earning value, assuming the rates and/or prices charged are just equal to the reasonable worth to customers of the services and/or commodities sold. (11/90)

SHALL – Use of the word 'shall' in contract language means that 'you must', as opposed to ‘may’. (6/07)

SHIFTING BASE – Changing the point of reference of an index number series from one time reference period to another. (11/90)

SHOP DRAWINGS – All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the contractor to illustrate some portion of the work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a supplier and submitted by the contractor to illustrate material or equipment for some portion of the work. (11/90)

SHOP ORDER NUMBER – Syn.: ACCOUNT NUMBER. (11/90)

SHOP PLANNING – The coordination of material handling, material availability, the setup and tooling availability so that a job can be done on a particular machine. (11/90)

SHORT-INTERVAL SCHEDULING – The process of updating CPM schedules weekly or even daily, and generally using activity duration's in hours and days. Short-interval scheduling is employed in plant shutdowns / turnarounds or for very time critical / short duration sub-projects. See: PRODUCTION SCHEDULE. (6/07)

SHORT-TERM ACTIVITIES – See: MONTHLY GUIDE SCHEDULE. (11/90)

SHUTDOWN POINT – The production level at which it becomes less expensive to close the plant and pay remaining fixed expenses out-of-pocket rather than continue operations; that is, the plant cannot meet its variable expense. (11/90)

SIGNIFICANT VARIANCES – Those differences between planned and actual performance which exceed established thresholds and which require further review, analysis and action. (11/90)

SIMPLE INTEREST –
(1) Interest that is not compounded - is not added to the income-producing investment or loan.
(2) The interest charges under the condition that interest in any time period is only charged on the principal. (11/90)

SIMPLE PAYBACK PERIOD (SPB) – The time required for the cumulative benefits from an investment to pay back the investment cost and other accrued costs, not considering the time value of money. [1] (11/90)

SIMULATION – Application of a physical or mathematical model to observe and predict probable performance of the actual item or phenomenon to which it relates. See: MODELING; MONTE CARLO METHOD. (8/07)

SINKING FUND
(1) A fund accumulated by periodic deposits and reserved exclusively for a specific purpose, such as retirement of a debt or replacement of a property.
(2) A fund created by making periodic deposits (usually equal) at compound interest in order to accumulate a given sum at a given future time for some specific purpose. (11/90)

SITE PREPARATION – An act involving grading, landscaping, drainage, installation of roads and siding, of an area of ground upon which anything previously located had been cleared so as to make the area free of obstructions, entanglements or possible collisions with the positioning or placing of anything new or planned. (6/07)

SLACK – Syn.: FLOAT. (11/90)

SLACK PATHS – The sequences of activities and events that do not lie on the critical path or paths. (11/90)

SLACK TIME – The difference in calendar time between the scheduled due date for a job and the estimated completion date. If a job is to be completed ahead of schedule, it is said to have slack time; if it is likely to be completed behind schedule, it is said to have negative slack time. Slack time can be used to calculate job priorities using methods such as the critical ratio. In the critical path method, total slack is the amount of time a job may be delayed in starting without necessarily delaying the project completion time. Free slack is the amount of time a job may be delayed in starting without delaying the start of any other job in the project. (11/90)

SLIP CHART – A pictorial representation of the predicted completion dates of milestones. Also referred to as trend chart. (6/07)

SLIPPAGE – Amount of time a task has been delayed from its original baseline plan. Slippage is the difference between scheduled start or finish date for a task and baseline start or finish date. Slippage can occur when a baseline plan is set and actual dates subsequently entered for tasks are later than baseline dates, or actual durations are longer than baseline durations. See: SCHEDULE SLIP. (6/07)

SMOOTHING – In resource-scheduling, refers to an option that modifies the way time-limited (and resource-limited with thresholds) scheduling works. Objective is to minimize the extent that each resource availability is exceeded. Standard algorithm gives itself the maximum flexibility to achieve this by making use of any excess already incurred. Smoothing option modifies this so that it will not use excess for a particular activity unless necessary in order to schedule that activity within its total float. (6/07)

SOFT LOGIC –
Activity(ies) and logic that with current knowledge cannot be modeled in detail. As design and construction evolves, soft logic is transformed into detailed or hard logic, with activities being split into component parts and logic ties refined. See: DISCRETIONARY DEPENDENCY. (6/07)

SPECIFICATION, DESIGN – A design specification providing a detailed written and/or graphic presentation of the required properties of a product, material, or piece of equipment, and prescribing the procedure for its fabrication, erection, and installation. (6/07)

SPECIFICATION, PERFORMANCE – A statement of required results, verifiable as meeting stipulated criteria, and generally free of instruction as to the method of accomplishment. (11/90)

SPECIFICATION(S) –
(1) A detailed, exact statement of particulars, especially a statement prescribing materials, dimensions, and quality of work for something to be built, installed, or manufactured.
(2) A document that prescribes the requirements with which the product or services has to conform. (6/07)

SPECIFICATION TREE – A graphic portrayal arranged to illustrate interrelationships of hardware and/or software performance / design requirements specifications. Normally, this portrayal is in the form of a "family tree" subdivision of specifications, with each lower level specification applicable to a hardware / software item that is part of a higher level item. [7] (6/07)

SPLICING TECHNIQUE – One of the procedures used for maintaining the continuity of a price index series in the case of substituted items (and/or replaced outlets). The basic assumption underlying the technique is that, at a given point in time, the relative difference in prices between the replaced and replacing items (and/or outlets) reflects the difference in respective qualities. In effect, the splicing technique is analogous to, and may be considered a particular case of, the linking procedure. (11/90)

SPLIT TASK – A task divided into two or more portions, with time gaps between one portion and another that indicate an interruption in work on the task. (6/07)

SPLITTABLE ACTIVITY – Activity that can be interrupted in order to allow temporary transfer of its resources to another activity. (6/07)

SPLITTING – In resource scheduling, it is possible to specify that an activity may be split if this results in an earlier scheduled finish date. This means that the specified duration may be divided into two or more pieces, while retaining the specified profile for resource requirements relative to this split duration. (6/07)

SPOT MARKET PRICE INDEX – Daily index used as a measure of price movements of sensitive basic commodities whose markets are to be presumed to be among the first to be influenced by changes in economic conditions. It serves as one early indicator of impending changes in business activity. (6/07)

STAGE OF PROCESSING – A commodity's intermediate position in the value-added channel of production. (11/90)

STAND ALONE – A system that performs its function requiring little or no assistance from interfacing systems. (6/07)

STANDARD – A specific statement of the rules and constraints governing the naming, contents, and operations of deliverables. The rules and constraints are designed to support specific objectives. (6/07)

STANDARDS – Established or accepted rules, models or criteria against which comparisons are made. (6/07)

STANDARD ERROR OF ESTIMATE – An expression for the standard deviation of the observed values about a regression line, i.e., an estimate of the variance likely to be encountered in making predictions from the regression equation. (11/90)

STANDARD NETWORK DIAGRAM – A predefined network intended to be used more than one time in any given project. (11/90)

STANDARD OPERATING PROCEDURE – Detailed step-by-step instructions for repetitive operations. Examples are aircraft takeoff and landing procedures. (6/07)

STANDARD TIME – A measure of the time it should take a qualified worker to perform a particular task. (6/07)

STARTING EVENT – Syn.: BEGINNING EVENT. (11/90)

START EVENT OF A PROJECT – Event with succeeding, but no preceding activities. There may be more than one start event. (6/07)

START FLOAT – Amount of excess time an activity has between its early start and late start dates. See: FREE FLOAT. (6/07)

START-TO-FINISH (SF) – A relationship in which the successor activity depends upon and can finish only after the predecessor activity starts. The predecessor must start first and then the successor can finish. (6/07)

START-TO-START (SS) – A relationship between activities in which the start of a successor activity depends on the start of its predecessor. The predecessor must start prior to the successor starting. (6/07)

START-TO-START LAG – Minimum amount of time that must pass between the start of one activity and the start of its successor(s). May be expressed in terms of duration or percentage. (6/07)

STARTUP – The project activities (or phase) that take place between commissioning and the achievement of steady-state operation. In some usage, the term startup may include both commissioning (i.e., testing after mechanical completion) and startup (it may then be referred to as 'startup and testing'); one must take care to ascertain what the user of this term means. Production may not be at planned capacity or quality at the end of the phase. See: COMMISSIONING; MECHANICAL COMPLETION. (6/07)

STARTUP COSTS – Extra operating costs to bring the plant on stream incurred between the completion of construction and beginning of normal operations. In addition to the difference between actual operating costs during that period and normal costs, it also includes employee training, equipment tests, process adjustments, salaries and travel expense of temporary labor, staff and consultants, report writing, post-startup monitoring and associated overhead. Additional capital required to correct plant problems may be included. Startup costs are sometimes capitalized. (11/90)

STATEMENT OF WORK – A narrative description of the work to be performed. (6/07)

STATUS –
(1) Comparison of actual progress against the plan to determine variance and corrective action.
(2) An instantaneous snapshot of the then current conditions. See: PROGRESS. (6/07)

STATUS DATE – A date that is set (rather than the current date) for purposes of evaluating and forecasting, based on the project's trends so far, where you can expect costs, work and other aspects of the project to be on the status date set. See: TIME NOW; DATA DATE. (6/07)

STATUS LINE – A vertical line on a time-scaled schedule indicating the point in time (date) on which the status of the project is reported. Often referred to as the time now line. See: DATA DATE. (11/90)

STATUS REPORT –
(1) Description of where the project currently stands; part of the performance reporting process.
(2) Formal report on the input, issues, and actions resulting from a status meeting. See: PROGRESS REPORT. [8] (6/07)

STATUSING – Indicating on the schedule the most current project status. See: UPDATE. (11/90)

STOCK AND BOND VALUE – A special form of market value for enterprises, which can be owned through possession of their securities. Stock and bond value is the sum of: 1) The par values in dollars of the different issues of bonds multiplied by the corresponding ratios of the market price to the par value;

and 2) The number of shares of each issue of stock multiplied by the corresponding market price in dollars per share. (11/90)

STOP WORK ORDER – Request for interim stoppage of work due to non-conformance, or funding or technical limitations. See: SUSPENSION OF WORK, DIRECTED. (6/07)

STRAIGHT-LINE DEPRECIATION – Method of depreciation whereby the amount to be recovered (written off) is spread uniformly over the estimated life of the asset in terms of time periods or units of output. (11/90)

STRATEGIC ASSET – Any unique physical or intellectual property that is of long term or ongoing value to the enterprise. As used in total cost management, it most commonly includes capital or fixed assets, but may include intangible assets. Excludes cash and purely financial assets. Strategic assets are created by the investment of resources through projects. (1/02)

STRATEGIC ASSET MANAGEMENT − A subprocess of the total cost management (TCM) process that includes the management of the total life cycle cost investment of resources in an enterprise's portfolio of strategic assets. Excludes, but integrated with, the project control process. See: PROJECT CONTROL; STRATEGIC ASSET; TOTAL COST MANAGEMENT (TCM). (6/07)

STRATEGY – Action plan to set the direction for the coordinated use of resources through programs, projects, policies, procedures, and organizational design and establishment of performance standards. [8] (6/07)

STRETCHING – In resource scheduling it is possible to specify that an activity duration may be stretched if this results in an earlier scheduled finish date. This means that the specified duration may be increased, while the specified resource profile is reduced proportionally. (6/07)

STUDY PERIOD – The length of time over which an investment is analyzed. See: LIFE CYCLE; TIME HORIZON. [1] (11/90)

SUBCONTRACT – Any agreement or arrangement between a contractor and any person (in which the parties do not stand in the relationship of an employer and an employee) and where neither party is the owner. (11/90)

SUBCONTRACT – A contract that assigns some of the obligations of a prior contract to another party. (6/07)

SUBCONTRACTOR – One that enters into a subcontract and assumes some of the obligations of the primary contractor. (6/07)

SUBINDEX – A price index for a sub-aggregate of a given basket of commodities. (11/90)

SUBNETWORK – Syn.: FRAGNET.

SUBNETWORK FLOAT – Total float on a fragnet when it is extracted from the overall network. This is relevant in dealing with delay issues particular to a certain subcontractor or a supplier responsible for only a part of the overall project. (6/07)

SUBPROJECT -
(1) A smaller project within a larger one. Often used to segregate into components that are more manageable.
(2) Component of a project. Often contracted out to an external enterprise or another functional unit in the performing organization. [8] (6/07)

SUBSTANTIAL COMPLETION –
(1) Work (or a specified part thereof) which has progressed to the point where in the opinion of the engineer, as evidenced by the engineer's definitive certificate of substantial completion, it is sufficiently complete, in accordance with the contract documents, so that the work (or specified part) can be utilized for the purposes for which it is intended; or if there be no such certificate issued, when final payment is due in accordance with the general conditions. Substantial completion of the work, or specified part thereof, may be achieved either upon completion of pre-operational testing or startup testing, depending upon the requirements of the contract documents. The terms substantially complete and substantially completed as applied to any work refer to substantial completion thereof.
(2) For an activity, when the work is generally completed with the exception of minor remedial work, thus allowing any successor activities to start unimpeded. For a project this is the point where the work is complete and the owner can start using the project for its intended purpose. The only remaining work would be categorized as punch list work.
(3) The time when the facility is available to operate safely for the intended purpose. (6/07)

SUBSTANTIAL PERFORMANCE – Considered to be reached when: 1) The work or a substantial part of it is ready for use or is being used for the purpose intended; 2) The work to be done under the contract can be completed or corrected at a cost of not more than, say, 1% to 3% of the contract price depending on the size of the contract; and 3) Is so certified by a certificate of substantial performance issued by client or its consultant. See: SUBSTANTIAL COMPLETION. (6/07)

SUBSYSTEM – An aggregation of component items (hardware and software) performing some distinguishable portion of the function of the total system of which it is a part. Normally, a subsystem could be considered a system in itself if it were not an integral part of the larger system. (11/90)

SUBTASK – Portion of a task or work element. [8] (6/07)

SUCCESSOR – An activity that immediately succeeds another activity. (3/04)

SUCCESSOR ACTIVITY – An activity, which logically follows the accomplishment of part or all of a given activity. (6/07)

SUCCESSOR EVENT – The event that signifies the completion of an activity. (11/90)

SUM-OF-DIGITS METHOD – A method of computing depreciation in which the amount for any year is based on the ratio: (years of remaining life)/(1+2+3+...+n), where n is the total anticipated life. Syn.: SUM-OF-THE-YEARS-DIGITS METHOD. (11/90)

SUM-OF-THE-YEARS-DIGITS METHOD – Syn.: SUM-OF-DIGITS METHOD. (6/07)

SUMMARY ITEM – An item appearing in the work breakdown structure. (11/90)

SUMMARY NETWORK – A summarization of the CPM network for presentation purposes. This network is not computed. (11/90)

SUMMARY NUMBER – A number that identifies an item in the work breakdown structure. (11/90)

SUMMARY SCHEDULE – A single page, usually time-scaled, project schedule. Typically included in management level progress reports. See: MILESTONE SCHEDULE; MASTER SCHEDULE. (6/07)

SUMMARY TASK – A task that consists of a logical group of tasks, called subtasks, and usually represents a phase. Primarily used for reporting purposes. See: HAMMOCK. (6/07)

SUNK COST – A cost that has already been incurred and which should not be considered in making a new investment decision. [2] (11/90)

SUPER-CRITICAL ACTIVITY – An activity that is behind schedule is considered to be super-critical. It has been delayed to a point where its float is calculated to be a negative value. See: HYPERCRITICAL ACTIVITIES. (6/07)

SUPERIOR KNOWLEDGE – See: MISREPRESENTATION. (11/90)

SUPPLEMENTARY CONDITIONS – The part of the contract documents which amends or supplements the general conditions. (11/90)

SUPPLIER – A manufacturer, fabricator, distributor or vendor. (11/90)

SURETY – A bonding company licensed to conduct business which guarantees the owner that the contract will be completed (performance bond) and that subcontractors and suppliers will be paid (payment bond). (11/90)

SURVEILLANCE – A term used in an earned value management system (e.g. EVMS or C/SCSC) to mean the monitoring of continued compliance with an approved/validated management control system. (6/07)

SUSPENSION OF WORK, CONSTRUCTIVE – An act or failure to act by the owner, or the owner's representative, which is not a directed suspension of work or work stoppage, but which has the effect of delaying, interrupting, or suspending all or a portion of the work. (11/90)

SUSPENSION OF WORK, DIRECTED – Actions resulting from an order of the owner to delay, interrupt, or suspend any or all portions of the work for a given period of time, for the convenience of the owner. (11/90)

SYSTEM CONCEPT DOCUMENT – Syn.: CONCEPT DEFINITION DOCUMENT. (6/07)

SYSTEMS STUDIES – The development and application of methods and techniques for analyzing and assessing programs, activities and projects to review and assess efforts to date and to determine future courses and directions. These studies include cost/ benefit analysis, environmental impact analysis, assessment of the likelihood of technical success, forecasts of possible futures resulting from specific actions, and guidance for energy program planning and implementation. (11/90)

TAKE-OFF – A take-off is a specific type of quantification that is a measurement and listing of quantities of materials from drawings in order to support the estimate costing process and/or to support the material procurement process. See: QUANTIFICATION. (1/03)

TANGIBLES – Things that can be quantitatively measured or valued, such as items of cost and physical assets. (11/90)

TARGET DATE – Date imposed on an activity or project by the user or client that constrains or otherwise modifies the network analysis. There are two types: target start dates, and target finish dates. (6/07)

TARGET FINISH DATE – A target date where the date imposed is on the finish date. See: TARGET DATE. (6/07)

TARGET PLAN – The target plan prioritized by critical total float taken from the current schedule. (6/07)

TARGET REPORTING – A method of reporting the current schedule against some established base line schedule and the computations of variances between them. (11/90)

TARGET SCHEDULE – A schedule devised or selected as an objective measure against which actual performance can be gauged. See: BASELINE SCHEDULE. (8/07)

TARGET START DATE – A target date where the date imposed is on the start date. See: TARGET DATE. (6/07)

TASK – Smallest unit of work planned. It must have an identifiable start and finish, and usually produces some recognizable results. (3/04)

TASK –
(1) A cohesive, individual unit of work that is part of the total work needed to accomplish a project.
(2) Well-defined component of project work; a discrete work item. There are usually multiple tasks for one activity. [8] (6/07)

TASK MONITOR – The individual assigned the monitoring responsibility for a major effort within the program. (11/90)

TASK TYPES – Characterization of task by resource requirement, responsibility, discipline, jurisdiction, function, etc. (6/07)

TAXES PAYABLE – Tax accruals due within a year. (11/90)

TEMPLATE –
(1) A guideline for a document outline and its contents. A template is used to record the work activities, discussions, findings, and specification to help achieve a common understanding. In addition it is used to provide a consistent look and feel to the project documentation. [8] Care must be taken with the use of templates to ensure that normal planning and schedule quality analysis and control processes are not bypassed or shortchanged.
(2) A document whose required content is predetermined and format is pre-structured, usually in some measure of detail, in order to speed its completion to a higher level of accuracy and uniformity. (8/07)

TEMPORARY CONSTRUCTION COST – Includes costs of erecting, operating, and dismantling non-permanent facilities, such as offices, workshops, etc, and providing associated services such as utilities. (6/07)

TERMINATION – Actions by the owner, in accordance with contract clauses, to end, in whole or in part, the services of the contractor. Termination may be for the convenience of the owner or for default by the contractor. (11/90)

TERMS OF PAYMENT – Defines a specific time schedule for payment of goods and services and usually forms the basis for any contract price adjustments on those contracts that are subject to escalation. (11/90)

THEORY OF CONSTRAINTS (TOC) – A four-step management philosophy developed by Dr. Eli Goldratt that involves: 1) Identifying the system's constraints; 2) Working to exploit those constraints (either through strengthening the constraint or getting maximum performance out of the key constraint); 3) Subordinating everything else to the above decision (given the key constraint, all operational decisions involve improving the processes as much as possible relative to this controlling constraint, e.g., a bottleneck in a production process); and 4) Working to elevate the constraint (improve or eliminate the bottleneck and then reexamine the system). Once the critical constraint is eliminated, a new constraint will arise to take its place. So the process continues until the smallest level constraint is identified that can impact on the whole system. In project management, the key constraint (using TOC ideas) is the critical path of the project since it determines the length of the project and hence is the key constraint. TOC is used in the critical chain approach as an alternative to CPM or PERT for determining the length of a project by using critical resource control and application. (6/07)

THIRD PARTY CLAIM – A claim against either or both the owner or the contractor by members of the public, or other parties, usually for property damage or personal injury. (11/90)

THREAT – Uncertain event that is potentially negative, or reduces the probability that the desired outcome will happen. See: RISK; OPPORTUNITY; UNCERTAINTY. (6/07)

TIED ACTIVITY – An activity that must start within a specified time or immediately after its predecessor's completion or start. (11/90)

TIME EXTENSION – An increase in contract time by modification or change order to complete an item of work. An excusable delay generally entitles a contractor to a time extension. Depending upon contract terms, the time extension may or may not be compensable. (6/07)

TIME HORIZON – Syn.: STUDY PERIOD. [1] (11/90)

TIME IS OF THE ESSENCE – Contract requirement that completion of the work within the time limits in the contract is essential. Failure to do so is a breach for which the injured party is entitled to damages. (6/07)

TIME LINE – Schedule line showing key dates and planned events. (6/07)

TIME NOW – Current calendar date from which a network analysis, report, or update is being made. See: SCHEDULED DATES; PROGRESS DATE; DATA DATE. (6/07)

TIME NOW LINE – The point in time that the network analysis is based upon. May or may not be the data date. See: STATUS LINE. (11/90)

TIME PHASING – Strategic pacing of project and overlapping between different activities or blocks of activities. For example, with the decision on whether or not to use rapid application development prototyping, concurrent engineering, simultaneous design, fast track, phased hand-over, etc. Phasing and overlapping of activities is also an important aspect of management team's skills. Properly done, it can have a significant positive impact on performance. (6/07)

TIME UNIT – A unit of measure used in a scheduling calendar when modeling an activity duration, usually expressed in hours, days or weeks, but can also be shifts or even minutes. See: CALENDAR UNIT. (6/07)

TIME VALUE OF MONEY –
(1) The time-dependent value of money stemming both from changes in the purchasing power of money (that is, inflation or deflation), and from the real earning potential of alternative investments over time.
(2) The cumulative effect of elapsed time on the money value of an event, based on the earning power of equivalent invested funds.
(3) The expected interest rate that capital should or will earn. See: FUTURE WORTH; PRESENT WORTH. [2] (11/90)

TIME-CONSTRAINED SCHEDULING – The network schedule calculations are constrained by the time allowed to complete the project as opposed to the resources available to do the work. (6/07)

TIME-LIMITED RESOURCE SCHEDULING – Production of scheduled dates in which resource constraints may be relaxed in order to avoid any delay in project completion. (6/07)

TIME-LIMITED SCHEDULING – The scheduling of activities so predetermined resource availability pools are not exceeded unless the further delay will cause the project finish to be delayed. Activities can be delayed only until their late start date. However, activities will begin when the late start date is reached,

even if resource limits are exceeded. Networks with negative total float time cannot be processed by time-limited scheduling. (11/90)

TIME-SCALED CPM – A plotted or drawn representation of a CPM network where the length of the activities indicates the duration of the activity as drawn to a calendar scale. Float is usually shown with a dashed line as are dummy activities. (11/90)

TIME-SCALED LOGIC/NETWORK DRAWING (OR DIAGRAM) – Any project network diagram drawn in such a way that the positioning of the activity represents its expected start and finish date. Essentially, a Gantt chart that includes depiction of network logic. (6/07)

TOTAL COST BIDDING – A method of establishing the purchase price of movable equipment. The buyer is guaranteed that maintenance will not exceed a set maximum amount during a fixed period and that the equipment will be repurchased at a set minimum price when the period ends. (11/90)

TOTAL COST MANAGEMENT (TCM) – The effective application of professional and technical expertise to plan and control resources, costs, profitability and risks. Simply stated, it is a systematic approach to managing cost throughout the life cycle of any enterprise, program, facility, project, product, or service. This is accomplished through the application of cost engineering and cost management principles, proven methodologies and the latest technology in support of the management process. Can also be considered the sum of the practices and processes that an enterprise uses to manage the total life cycle cost investment in its portfolio of strategic assets. (1/02)

TOTAL FLOAT (TF) –
(1) The maximum number of work periods by which an activity can be delayed without delaying project completion or violating a target (milestone) finish date.
(2) The number of work periods the start or finish of an activity can be delayed without affecting the project finish date. Float is measured in hours, days, weeks, or months depending on the project's planning unit, and can have negative, zero, or positive values. [14]
(3) The amount of time a task can be delayed without delaying the finish date of the project. [15] (6/07)

TOTAL QUALITY MANAGEMENT (TQM) – The consistent integrated orchestration of the total complex of an organization's work processes and activities to achieve continuous improvement in the organization's processes and products. (11/90)

TRACKING – Form of monitoring applied. (6/07)

TRANSFER PRICE – A term used in economic analysis in the mineral processing industries. Used to assign a value to raw materials when the same company does the mining and processing, Usually equal to the fair market value. (11/90)

TREND – In project control, a general tendency of events, conditions, performance, etc. In a change management system, a trend is the first indication of potential change that must be tracked and properly dealt with. A trend may later be identified as a deviation (not normally reimbursable) or a change (which is typically reimbursable in time and or money). (6/07)

TREND ANALYSES – Mathematical methods for studying trends based on past project history allowing for adjustment, refinement or revision to predict cost. Regression analysis techniques can be used for predicting cost/schedule trends using historical data. (6/07)

TREND LINE – A line on a schedule or chart showing the pattern of progress that is being set over time, i.e. from measurement period to measurement period. (6/07)

TREND MONITORING – A system for tracking estimated cost-schedule-resources of a project vs. those planned. (6/07)

TREND REPORTS – Indicators of variations of project control parameters or measures against planned objectives or measures. (6/07)

TRENDING – A review of current progress compared to last reported progress which, when displayed graphically, shows whether a course correction is necessary to achieve the baseline plan. (6/07)

TURNOVER − Syn: DELIVERY. (6/07)

TURNOVER RATIO – The ratio of annual sales to investment. Inclusion of working capital is preferable, but not always done. Turnover ratio is considered by some to be reasonable basis for a guesstimate of facilities cost, for new products similar to existing products. It ranges around 1.0 for many chemical plants. The product of turnover ratio and profit margin on sales gives a return-on-investment measure. (11/90)

UNBALANCING – A technique used in the pricing process to allocate estimated costs to accounts whose definitions do not fully reflect the nature of the cost being allocated. The purpose of unbalancing is to achieve a desired business result such as improved cash flow. For example, a disproportionate amount of overhead costs may be allocated in a contract bid to early project activities so that early income is maximized. (1/03)

UNCERTAINTY –
(1) The total range of events that may happen and produce risks (including both threats and opportunities) affecting a project. (Uncertainty = threats + opportunities.)
(2) All events, both positive and negative whose probabilities of occurrence are neither 0% nor 100%. Uncertainty is a distinct characteristic of the project environment. See: OPPORTUNITY; EVENT; CONDITION (UNCERTAIN); RISK; THREAT. (6/07)

UNDERGROUND FACILITIES – All pipelines, conduits, ducts, cables, wires, utility access-ways, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water. (11/90)

UNION – An organization of wage earners formed for the purpose of serving the members' interests with respect to compensation and working conditions. (6/07)

UNIT COST – The cost of a given unit of a product or service. (6/07)

UNIT HOURS – Work hours per unit of production. (6/07)

UNIT RATE – See: UNIT COST. (6/07)

UNJUST ENRICHMENT DOCTRINE – The belief in law that one person should not be allowed to profit or enrich himself or herself unfairly at the expense of another person. (11/90)

UNLIMITED SCHEDULE – Infinite schedule, schedule produced without resource constraint. (6/07)

UNUSUALLY SEVERE WEATHER – That kind of weather, which is in itself severe and can be of violent nature. If the average weather over time is significantly different from the normal then it is said to be other than normal. In either case, if such weather affects the job and causes a delay, it may be excusable and form the basis for a contract adjustment for time and possibly money once all relevant contract clauses are considered. (6/07)

UPDATING – The regular review, analysis, evaluation, and reporting of progress of the project, including recomputation of an estimate or schedule. See: STATUSING. (11/90)

UPDATE – To revise the estimate, schedule or other planning deliverable to reflect the most current information on the project. (6/07)

UPDATE DATE – See: DATA DATE. (6/07)

USE VALUE – See: FUNCTIONAL WORTH. (11/90)

USEFUL LIFE – The period of time over which an investment is considered to meet its original objective. [1] (11/90)

USER – The consumer of a service or product, sometimes but not always a project owner. See: CUSTOMER. (8/07)

VALIDATION – Testing to confirm that a product or service satisfies user or stakeholder needs. Note difference from verification. (8/07)

VALUATION OR APPRAISAL – The art of estimating the fair-exchange value of specific properties. (11/90)

VALUE, ACTIVITY – That portion of the contract price which represents a fair value for the part of the work identified by that activity. (11/90)

VALUE ADDED BY DISTRIBUTION – The portion of the value of a product or service to the consumer or user which results from distribution activities. This value includes such components as time utility and place utility. (11/90)

VALUE ADDED BY MARKETING – That portion of the value of a product or service to the consumer or user which results from marketing activities. This value includes such components as price reduction through economies of scale and buyer awareness of more desirable innovations in products or services. (11/90)

VALUE OF WORK PERFORMED TO DATE – The planned cost for completed work. (11/90)

VALUE EFFECTIVE – Generally used to describe decisions which have a cost impact; value-effective decisions tend to optimize the value received for the decision made and to maximize return on investments. (11/90)

VALUE ENGINEERING – A practice function targeted at the design itself, which has as its objective the development of design of a facility or item that will yield least life-cycle costs or provide greatest value while satisfying all performance and other criteria established for it. (11/90)

VALUE ENGINEERING COST AVOIDANCE – A decrease in the estimated overall cost for accomplishing a function. (11/90)

VALUE ENGINEERING COST REDUCTION – A decrease in the committed and/or established overall cost for accomplishing a function. (11/90)

VALUE ENGINEERING JOB PLAN – An aid to problem recognition, definition, and solution. It is a formal, step-by-step procedure followed in carrying out a value engineering study. (11/90)

VARIABLE COSTS – Those costs that are a function of production, e.g., raw materials costs, by-product credits, and those processing costs that vary with plant output (such as utilities, catalysts and chemical, packaging, and labor for batch operations). (11/90)

VARIANCE – The difference between what was originally expected and what actually happened. See: SCHEDULE VARIANCE; COST VARIANCE. (6/07)

VARIANCE ANALYSIS – Analysis of the following: (1) Cost variance = BCWP – ACWP; (2) Percent over/under = 100 x (ACWP - BCWP) / BCWP; (3) Unit variance analysis; (4) Labor rate; (5) Labor hours/units of work accomplished; (6) Material rate; (7) Material usage; and (8) Schedule variance = BCWP – BCWS. See: SCHEDULE VARIANCE. (6/07)

VARIANCE AT COMPLETION (VAC) – The budget at completion less the estimate at completion. A negative result indicates that the project is over budget. (6/07)

VARIATION IN ESTIMATED QUANTITY – The difference between the quantity estimated in the bid schedule and the quantity actually required to complete the bid item. Negotiation or adjustment for variations is generally called for when an increase or decrease exceeds 15 percent. (11/90)

VELOCITY DIAGRAM – A graphical presentation of production schedules, which shows the relationship of the output of work crews / equipment spreads as a function of time. (6/07)

VENTURE LIFE – The total time span during which expenditures and/or reimbursements related to the venture occur. Venture life may include the research and development, construction, production and liquidation periods. See: FINANCIAL LIFE. (11/90)

VENTURE WORTH – Present worth of cash flows above an acceptable minimum rate, discounted at the average rate of earnings. (11/90)

VERIFICATION – Testing to confirm that a product or service meets specifications. (8/07)

VERTICAL EVENT NUMBERING – Assigning event numbers in vertical order. (11/90)

WAGE RATE – Labor cost per work hour where the labor cost includes only wages and not benefits, burdens, or other markups. See: LABOR COST. (6/07)

WBS DICTIONARY – A document that describes each element in the work breakdown structure (WBS) including a statement of work (SOW), describing work content of each WBS element, and a basis of estimate (BOE), documenting each element's budget. Additional information may include responsible organization, contract number, etc. The WBS dictionary will often result in a project or contract statement of work (SOW). See: WORK BREAKDOWN STRUCTURE (WBS). (6/07)

WEIGHTS – Numerical modifiers used to infer importance of commodities in an aggregative index. (11/90)

WORK – Any and all obligations, duties, responsibilities, labor, materials, equipment, temporary facilities, and incidentals, and the furnishing thereof necessary to complete the construction which are assigned to, or undertaken by the contractor, pursuant to contract documents. In addition, the entire completed construction or various separately identifiable parts thereof required to be furnished under the contract documents. Work results from performing services, furnishing labor, and furnishing and incorporating materials and equipment into the construction, all as required by contract documents. (6/07)

WORK BREAKDOWN STRUCTURE (WBS) –
(1) Framework for organizing and ordering the activities that makes up a project. Systematic approach to reflect a top-down hierarchy structure with each lower level providing more detail and smaller elements of the overall work.
(2) A product-oriented family tree division of hardware, software, facilities and other items which organizes, defines and displays all of the work to be performed in accomplishing the project objectives. Some variations include the following:

a) PROJECT WORK BREAKDOWN STRUCTURE (PWBS) - A summary WBS tailored by project management to the specific project with the addition of the elements unique to the project.
b) CONTRACT WORK BREAKDOWN STRUCTURE (CWBS) - A work breakdown structure of the products or services to be furnished under contract. It is comprised of selected PWBS (program / project WBS) elements specified in the contractual document and the contractor's lower level extensions of those elements. [7] (6/07)

WORK BREAKDOWN STRUCTURE ELEMENT – Any one of the individual items or entries in the WBS hierarchy, regardless of level. (11/90)

WORK BREAKDOWN STRUCTURE LEVELS – The arrangement or configuration of a work breakdown structure, which establishes an indenture of projects to programs, systems to projects, subsystems to systems, etc. [7] (6/07)

WORK CATEGORY – A division of work according to some distinct characteristics, such as the trade involved, e.g., mechanical, electrical, etc. See: CODE OF ACCOUNTS (COA). (6/07)

WORK DIRECTIVE CHANGE – A written directive to the contractor, issued on or after the effective date of the agreement and signed by the owner and recommended by the engineer ordering an addition, deletion or revision in the work, or responding to differing or unforeseen physical conditions or emergencies under which the work is to be performed as provided in the general conditions. A work directive change may not change the contract price or the contract time, but is evidence that the parties expect that the change directed or documented by a work directive change will be incorporated in a subsequently issued change order following negotiations by the parties as to its effect, if any, on the contract price or contract time. (11/90)

WORK FLOW – Relationship of the activities from start to finish. Work flow takes into consideration all types of activity relationships. (6/07)

WORK ITEM –
(1) The precedence notation equivalent of an activity.
(2) A portion of the project that can be clearly identified and isolated. See: ACTIVITY. (6/07)

WORK PACKAGE –
(1) A segment of effort or work scope required to complete a specific job which is within the responsibility of a single unit within the performing organization.
(2) A unit within a work breakdown structure (WBS) at the lowest level of its branch, not necessarily at the lowest level of the whole WBS.

WORK PATTERN – An established and recognizable flow of work. (6/07)

WORK POWER LEVELING – Syn.: LOAD LEVELING. (11/90)

WORK SAMPLING – A direct method of measuring and monitoring labor productivity so that labor resources can be minimized and wasted effort eliminated from work processes. Work sampling provides information about the work process (i.e., how work is done) in a way that supports statistical assessment of such processes in order to optimize productivity. (1/04)

WORK SITE – The area designated in the contract where the facility is to be constructed. (11/90)

WORK UNIT – A unit of time used to estimate the duration of activities. (11/90)

WORK-IN-PROCESS –
(1) In manufacturing, product in various stages of completion throughout the factory, including raw material that has been released for initial processing and completely processed material awaiting final

inspection and acceptance as finished product or shipment to a customer. Many accounting systems also include semi-finished stock and components in this category. Syn.: IN-PROGRESS INVENTORY.
(2) In projects, product or deliverables in various stages of completion throughout the duration of a project. (6/07)

WORKAROUND –
(1) An alternative solution to a potential problem. An unplanned response (that requires its own plan) to a negative event that may be accomplished in less than optimal conditions leading to productivity losses.
(2) Ad hoc action to overcome an unexpected condition or situation that would otherwise delay completion, in order to enable the work to be timely finished or finished sooner than could occur without the action. See: REWORK; RECYCLE. (8/07)

WORKDAY – Any days that are not rest days or holidays when work can be scheduled. (6/07)

WORKER – A definition of the behavior and responsibilities of an individual. The worker represents a role played by individuals on a project, and defines how they carry out work. (6/07)

WORKHOUR – Syn.: LABOR HOUR. (6/07)

WORKHOUR ANALYSIS – An analysis of planned versus actual staffing of the project used to determine work progress, productivity rates, staffing of the project, etc. (6/07)

WORKING CALENDAR – The total calendar dates that cover all project activities, from start to finish. (6/07)

WORKWEEK – The calendar that describes the number of workdays in a typical week. (6/07)

WORTH – The worth of an item or groups of items, as in a complete facility, is determined by the return on investment compared to the amount invested. The worth of an item is dependent upon the analysis of feasibility of the entire item or group or items under discussion (or examination). (11/90)

WRITTEN AMENDMENT – A written amendment of the contract, executed by the parties on or after the effective date of the agreement and normally dealing with the non-engineering or non-technical rather than strictly work-related aspects of the contract. (6/07)

YEAR-TO-YEAR PRICE INDEX – A price index for a given year with the preceding year as the base period. (11/90)

YIELD – The ratio of return or profit over the associated investment, expressed as a percentage or decimal usually on an annual basis. See: RATE OF RETURN. (11/90)

ZERO FLOAT – A condition where there is no excess time between activities. An activity with zero float is considered a critical activity. If the duration of any critical activity is increased (the activity slips), the project finish date will slip. An activity has zero float when the early and late start / finish dates equal each other. Activities with zero float are considered to be on the critical path(s) of the project even when there are activities with negative float. (6/07)

REFERENCES

1. ASTM Standard No E833. (Reprinted, with permission, from the Annual Book of ASTM Standards, copyright American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. ASTM terminology may not be reproduced in any form whatsoever without the expressed written consent of ASTM.)
2. Based in part upon ASTM Standard No. E833 with modifications

3. US Department of Defense
4. PMI Representative
5. Various Bechtel project controls presentations and publications
6. International Association for Professional Management of Construction
7. NASA Work Breakdown Structure Reference Guide, May, 1994
8. Oregon Department of Human Services – PMO Glossary
9. Westinghouse Savannah River Company EVMS Pocket Guide
10. *Construction Delay Claims*, Third Edition, Barry B. Bramble, Esq., Michael T. Callahan, Esq., Aspen Publishers, New York, NY, 2006
11. *Construction Scheduling: Preparation, Liability & Claims*, Second Edition, Jon M. Wickwire, Esq., Thomas J. Driscoll, Stephen B. Hurlbut, Esq., Scott B. Hillman, Esq., Aspen Publishers, New York, NY, 2006
12. *SCL Delay and Disruption Protocol*, Society of Construction Law, Oxon, United Kingdom, 2002
13. *How to Get Paid for Construction Changes: Preparation and Resolution Tools and Techniques*, Steven S. Pinnell, McGraw-Hill, New York, NY, 1998
14. Primavera Project Planner Documentation
15. Microsoft Project Documentation
16. Various Halliburton–Kellogg, Brown and Root Earned Value Management publications
17. *Construction Claims Deskbook: Management, Documentation, and Presentation of Claims*, Robert S. Brams and Christopher Lerner, John Wiley & Sons, Inc., New York, NY 1996

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CSC.14

Construction Cost Contingency Tracking System

Mr. John F. Rowe, PE

The author will present an objective, forward-looking cost contingency tracking system (CTS) that uses readily available cost information and a simple spreadsheet format. Using the CTS, project managers can assign contingency to construction contracts, track its consumption and manage a reserve for upcoming work. The paper will discuss the development of rules, using the perceived risk of each construction contract, to assign an initial contingency value to each construction contract. The author will then describe setting up the CTS using this initially assigned contingency value, basic cost information and cost trends from field staff. Once in place, project managers can use the CTS to assess a project's overall budget health and focus on contracts that require special attention. The CTS can also be used to calculate the estimated cost at completion for each contract to provide early warning of overruns. It has been successfully tested on a $1.4 billion rail and highway improvement program.

CONTINGENCY

The Association for Advancement of Cost Engineering defines contingency as, "An amount added to the estimate to allow for changes that experience shows will likely be required"[5]. The value of possible changes, and thus contingency, is proportional to the risk present in a project and this risk drops as the design advances, construction contracts are awarded, and construction is completed. Figure 1 shows a downward sloping channel that represents total project contingency over the life cycle of a project. Typically, the baseline project budget is set at some point in the project life cycle and project managers must live within that contingency budget. Ideally, the baseline budget should not be set until the project manager has a good handle on the remaining project risk and can determine a sufficient value of contingency to include in the budget to cover that risk [1,2]. Although beyond the scope of this paper, much has been written about techniques to initially set the contingency budget including expert opinion, Monte Carlo analysis, and other statistical methods [3,4]. This paper will focus on managing that contingency budget once it has been set, specifically during the construction phase of a capital project. This is accomplished by solving the twin problems of how to assign cost contingency to each construction contract and how to accurately forecast the final cost of these contracts at any given time.

The construction phase is where the rubber meets the road in managing capital projects. The pace quickens, spending accelerates, and an unprepared project team can be left in the dust. During the construction phase, the estimate at completion (EAC) of the contract packages changes more quickly than at any other phase of the project. A project manager must be able to detect potential project contingency shortfalls in order to down-scope or otherwise rebuild contingency. Conversely, if it becomes apparent that excess contingency will remain at the end of the project, project managers should re-deploy that capital to a more productive use as soon as possible.

ASSIGNING CONTINGENCY TO CONSTRUCTION CONTRACTS

By the start of the construction phase, final design should be complete and most, if not all, risk associated with each contract should result from change order growth occurring after contract award. Since the engineer's estimate for a construction contract is only intended to predict the bid price of the contract, contingency must be included in the contract budget to account for change order growth.

Project managers should establish guidelines governing the amount of change order contingency to be assigned to each contract. A survey of past experience with change order growth on completed contracts can provide a good basis for setting these guidelines. Typically, since different types of contracts contain different levels of change order risk, initial contingency guidelines should take the contract type into account. Table 1 shows an example set of guidelines by contract type—the details will vary by project. Using established guidelines, the project team can quickly determine the desired contingency value to assign to each contract as its design is completed. The same guidelines will be used to reset the contingency based on the original contract value once bids are received on each contract. This initial contingency value (C_I) is a key numerical input to the CTS.

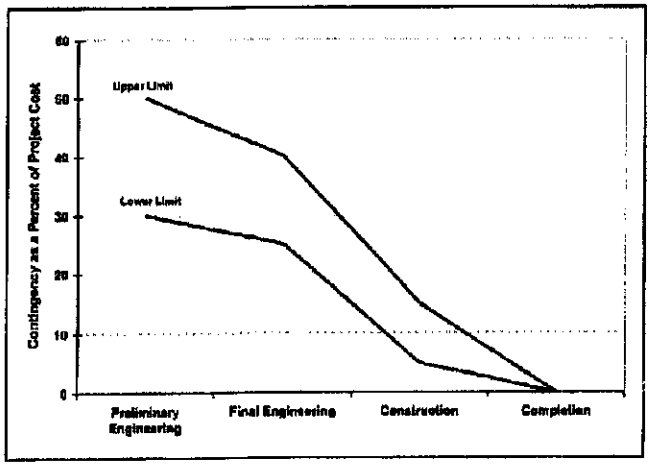

Figure 1—Project Contingency Should Decrease Over the Life of a Project.

Table 1—Example Guidelines for Initial Contingency Assignment.

Contract Type	Initial Change Order Contingency *(as a % of Contract Cost)*
Procurement Only	5%
Typical Construction	10%
Special Construction :	
Tunnels	15%
Very Small Contracts	20%

ACCURATE CONSTRUCTION CONTRACT FORECASTING

Once construction contracts have been awarded, accurate forecasts are needed to track contingency consumption. The people most able to provide accurate forecast information for each construction contract are those closest to the action. These are typically the resident engineers, project controls engineers, or contract administrators with direct responsibility for day-to-day construction management. Using either spreadsheets or specialized construction management software, the field team should maintain the most thorough contract forecast possible, given the other demands on their time. This forecast should include the original contract amount, approved change orders, pending change orders, and all identified cost issues. A well maintained forecast will change from day to day as issues are identified, negotiations are completed, and costs are agreed upon. This field-generated contract forecast (F) is another important numerical input to the CTS.

From experience we know that even the best field team will not be able to forecast all the change issues and associated costs until very close to the end of construction. For this reason, to develop an accurate value for the estimate at completion (EAC), we must keep some retained contingency (C_R) in addition to the field-generated Contract Forecast (F). This can be expressed as follows:

$$EAC = F + C_R$$

(equation 1)

Intuitively, the value of retained contingency (C_R) should be based on the initial contingency (C_I) value assigned at contract award and should drop as the contract is completed and risk drops.

AN EMPIRICAL FORMULA FOR RETAINED CONTINGENCY

For simplicity, one could assign retained contingency (C_R) based on the assumption that risk drops linearly as a contract is completed and is inversely related to the percent complete. As an example, at 80 percent complete 20 percent of initial contingency (C_I) would be retained to account for changes that have not yet been identified. Intuitively, this linear assumption seems conservative, as we would expect that more than half of the change issues should have been identified at the 50 percent completion point. In order to test the straight-line assumption and modify it if necessary, the author collected some real world data. Actual cost (A) and contract forecast (F) data were collected over four years, on a monthly basis, for 15 of the largest construction contracts on a light rail expansion program managed by the Valley Transportation Authority in San Jose, California. The contracts studied had a combined value of $257 million and covered a wide array of work including heavy civil and track, tunnel, elevated structure, station finish and overhead contact system construction contracts.

For each monthly Contract Forecast (F) reading, the Value of Changes Forecast (Δ_t) at that time was calculated by subtracting the Original Contract Amount (C_0).

$$\Delta_t = F - C_0$$

(equation 2)

Once each contract is complete, the final contract amount (CF) is known and the final value of changes (Δ_F) can be calculated as follows:

$$\Delta_F = C_F - C_0$$

(equation 3)

The proportion of final changes forecast ($\Delta_{t/F}$) at each point in time can be readily calculated using the final value of changes (DF) as follows:

$$\Delta_{t/F} = \Delta_t / \Delta_F$$

(equation 4)

Figure 2 shows a scatter diagram with a total of 282 monthly coordinates for the proportion of final changes forecast ($\Delta_{t/F}$) on the y-axis (expressed as a percent) and percent complete (P) on the x-

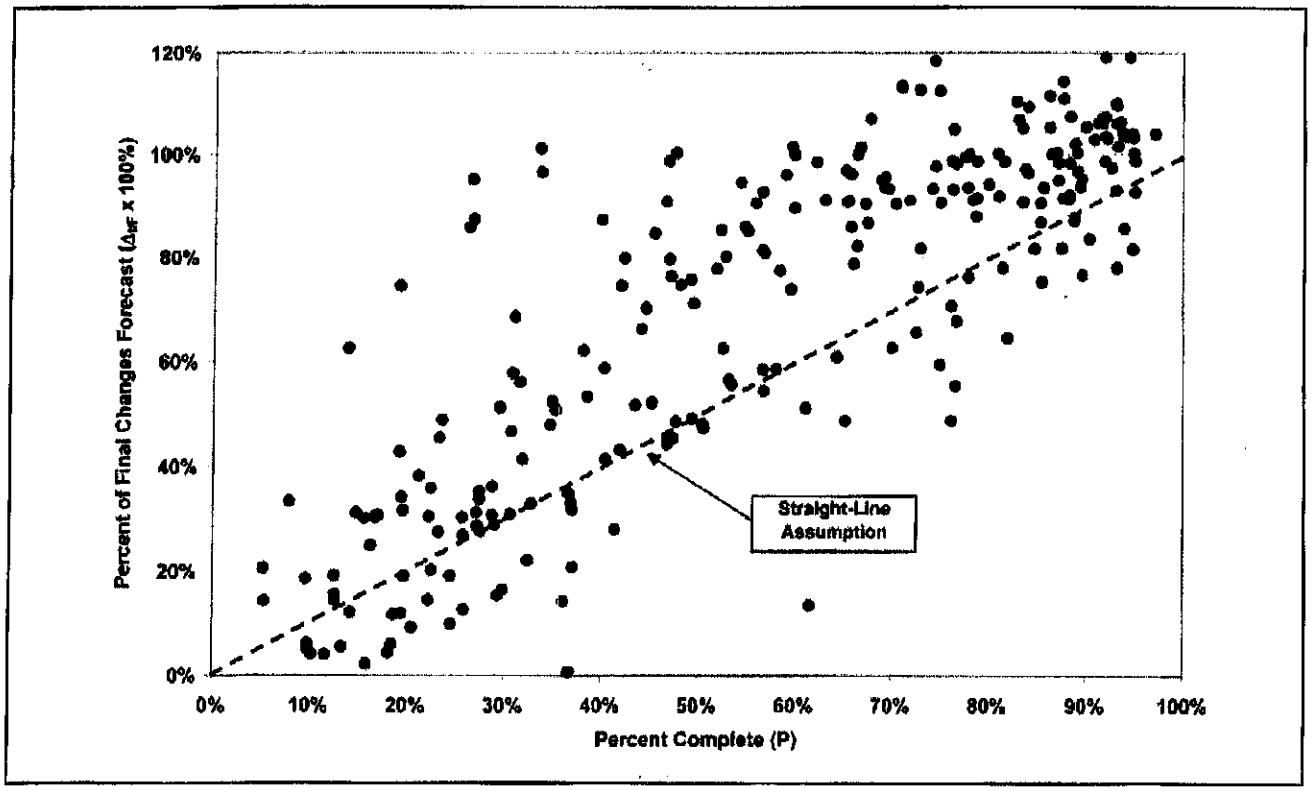

Figure 2—Scatter Diagram of Data with Straight-Line Assumption Superimposed.

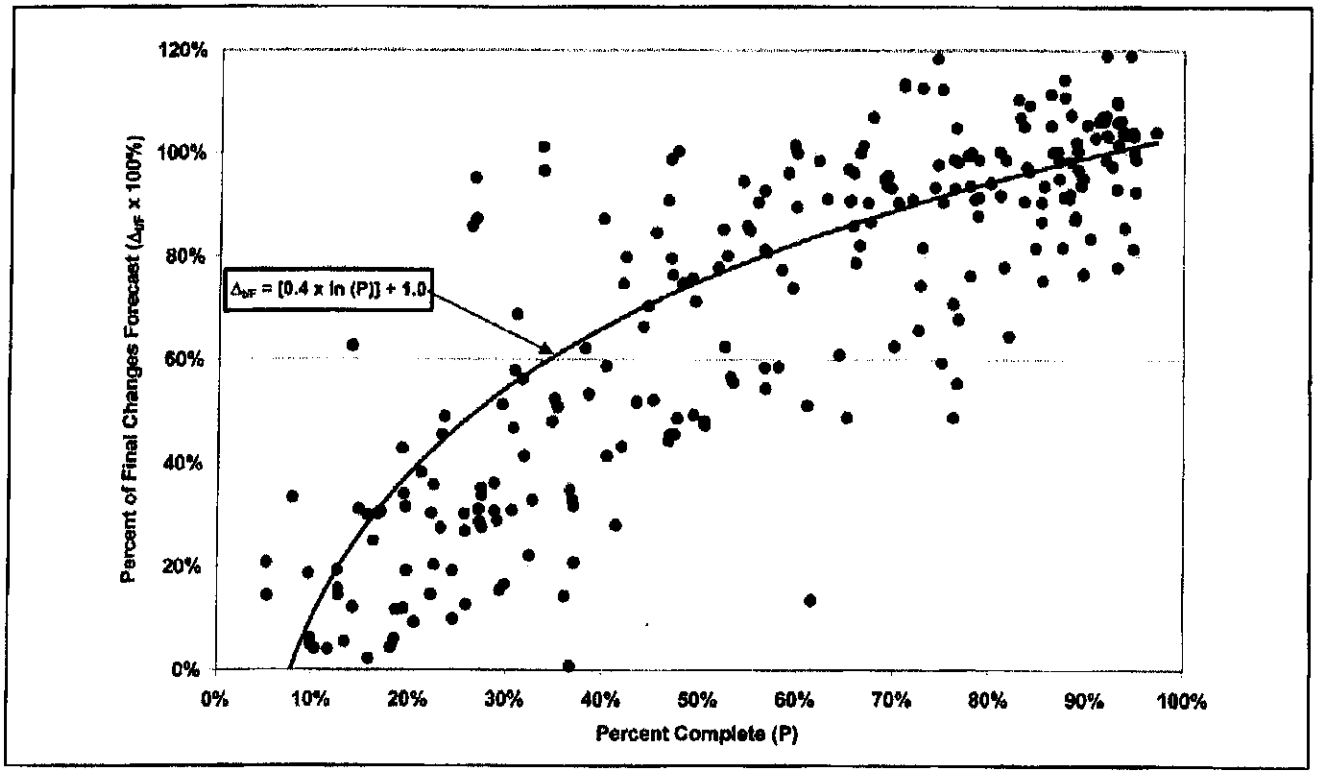

Figure 3—Scatter Diagram from Figure 2 With the Best-Fit Curve and Equation.

axis. (Values for P<5% and P>95% were excluded for clarity.) The dashed line on the graph shows the straight-line assumption we are testing.

Although the data points in our sample don't trace out a perfect curve, it is clear that the straight-line assumption is not accurate and is probably too conservative. In order to find a better solution, the author employed the spreadsheet program's curve-fitting feature. The best-fit curve (R^2=0.46), shown in figure 3, is a natural logarithmic function (ln = $\log_e$) described as follows:

$$\Delta_{t/F} = 0.4 \ln(P) + 1.0$$

(equation 5)

This equation provides a value for the proportion of final changes Forecast ($\Delta_{t/F}$) expected to be included in the contract forecast (F) as a function of percent complete (P). It should be noted that, for values of percent complete (P) less than approximately 25percent, the best-fit curve does not fit the data very well. For this reason, and due to the fact that forecast data can be highly variable in the early stages of contract execution, estimate at complete (EAC) values derived from this equation and the contingency Tracking system (CTS), to be described shortly, should be considered to be unreliable until at least 25 percent completion is reached.

Natural log functions are readily calculated by spreadsheet programs, and table 2 shows the results of this equation for a range of percent complete (P) values. The numerical results generated by this empirical equation seem to be intuitively more accurate than the straight-line assumption, as the proportion of final changes forecast ($\Delta_{t/F}$) rises quickly in the first half of contract completion as cost issues are identified and negotiated, then levels out as completion is reached.

As an example, for a contract that is 50 percent complete, table 2 shows that we can expect that a good contract forecast (F) figure has captured 72 percent of the final changes that will occur on the contract. To account for the 28 percent of changes that have not yet been forecast, we would simply retain 28 percent of the initial contingency (C_I) value in addition to the contract forecast (F) value. Since the value of $\Delta_{t/F}$ derived in our empirical equation is expressed as a decimal, we would subtract it from one to arrive at a value for retained contingency (C_R). Mathematically, retained contingency (C_R) is derived as follows:

$$C_R = (1 - \Delta_{t/F}) \times C_I$$

(equation 6)

Substituting in our empirical equation for $\Delta_{t/F}$:

$$C_R = [1 - (0.4 \ln(P) + 1.0] \times C_I$$

(equation 7)

Simplifying the equation results in the following:

$$C_R = -0.4 \ln(P) \times C_I$$

(equation 8)

Table 2—Values of $\Delta_{t/F}$ Resulting from the Empirical Equation.

Percent Complete (P)	Percent of Final Changes Included in Contract Forecast ($\Delta_{t/F}$ x 100%)
10%	8%
20%	36%
30%	52%
40%	63%
50%	72%
60%	80%
70%	86%
80%	91%
90%	96%
100%	100%

Table 3—An Example CTS for a Simplified Light Rail Project.

		Numerical Inputs				*Calculated Values*			
		B	*F*	*A*	C_I	*P = (A/F) as %*	$C_R = -0.4 \ln(P) \times C_I$	*EAC = F + C_{RET}*	$C_{SD} = B - EAC$
Contract No.	Contract Description	Current Budget	Current Forecast	Actual Costs	Initial Contingency	Percent Complete	Retained Contingency	Estimate at Completion	Contingency Surplus/(Deficit)
A100	Procure Rail, Ties and Special Trackwo	525,000	525,000	525,000	25,000	100.0%	0	525,000	0
A999	Procurement Allocated Contingency	0	0	0	0	0.0%	0	0	0
	Subtotal Procurement	525,000	525,000	525,000	25,000	100.0%	0	525,000	0
C100	Civil, Track & Landscaping	11,000,000	11,325,000	7,630,000	1,000,000	67.4%	157,970	11,482,970	(482,970)
C200	Stations & Park and Ride Facilities	3,300,000	3,125,000	1,000,000	300,000	32.0%	136,732	3,261,732	38,268
C999	Civil Allocated Contingency	25,000	0	0	0	0.0%	0	0	25,000
	Subtotal Construction	14,325,000	14,450,000	8,630,000	1,300,000	59.7%	294,702	14,744,702	(419,702)
S100	Overhead Contact System	1,650,000	1,550,000	50,000	150,000	3.2%	206,039	1,756,039	(106,039)
S200	Combined Communications & Signals	2,300,000	2,000,000	0	300,000	0.0%	300,000	2,300,000	0
S999	Systems Allocated Contingency	25,000	0	0	0	0.0%	0	0	25,000
	Subtotal Systems	3,975,000	3,550,000	50,000	450,000	1.4%	506,039	4,056,039	(81,039)
Z999	Project (Unallocated) Contingency	1,500,000	0			0.0%	0	0	1,500,000
	Subtotal Project Contingency	1,500,000	0	0	0	0.0%	0	0	1,500,000
	TOTAL PROJECT	$20,325,000	$18,525,000	$9,206,000	$1,775,000	49.7%	$800,741	$19,325,741	$999,259

Table 4—Numerical Inputs to the CTS

Numerical Input	Designation	Contract Status / Type	Value to Use
Current Budget	B	Pre-Bid	Current Budget, which should include change order contingency that was developed using the contingency guidelines.
		Active	Current Budget, which was reset at award to equal the Original Contract Value + Initial Contingency (C_I).
		Contingency Line	Current Budget for the contingency line.
Current Forecast	F	Pre-Bid	Set equal to the Current Budget (B) less any change order contingency included in that number.
		Active	Original Contract Amount + Approved/Pending Change Orders + Identified Potential Changes. *(Note: This value should not include any allowance for changes that have not yet been identified.)*
		Contingency Line	Always zero.
Actual/Incurred Costs to Date	A	Pre-Bid	Always zero.
		Active	Use either Actual or Incurred Costs for the contract, depending on what's available from the cost system.
		Contingency Line	Always zero.
Initial Contingency	C_I	Pre-Bid	Change order contingency included in the Current Budget
		Active	Use the contingency guidelines, based on the contract risk type, to develop a percentage factor to apply to the Original Contract Amount.
		Contingency Line	Always zero.

Table 5—Calculated Values Used in the CTS

Calculated Value	Designation	Calculation	Description
Contract Percent Complete	P	A / F	Measure of progress toward contract completion expressed as a percentage.
Retained Contingency	C_R	$-0.4\ ln(P) \times C_I$	This equation was derived empirically. C_R is an allowance for future changes that have not yet been identified. *(For P=0, $C_R = C_I$)*
Estimate at Completion	EAC	$F + C_R$	Contract estimated cost at completion that takes into account all approved/identified changes plus an allowance for future changes.
Contingency Surplus/Deficit	$C_{S/D}$	B - E	A contract's projected impact on project contingency. Negative values (deficit) represent consumption of project contingency while positive values (surplus) indicate contracts that will return contingency back to the project upon completion.

We now have all the prerequisites in place for a construction phase contingency tracking system (CTS).

THE CONTINGENCY TRACKING SYSTEM (CTS)

The contingency tracking system (CTS) was developed to provide an up-to-date snapshot of remaining cost contingency on a large rail and highway expansion program. The goal was to provide an objective measure of remaining contingency that takes into account the latest forecast cost for each component construction contract as well as an allowance for changes that will likely occur but have not yet been identified. The CTS had to be simple to understand so that it would be accepted by a number of project stakeholders, and easily maintained so as not to present a recurring burden to the project controls staff. The CTS focuses on the construction category of project costs since, during the construction phase, this is where the vast majority of risk remains. Table 3 shows the CTS as applied to a simplified project, in this example a small light rail project. At first glance, it looks somewhat complex but as will be shown, it consists of readily available numerical inputs and values derived from these inputs with simple calculations.

The rows of the CTS represent construction contracts and contingency line items that are organized by contract type. In this example, an allocated contingency line is included in each construction category as well as a project contingency line at the bottom. The specifics of how contingency is deployed across the project categories are a matter of preference, but the CTS can be adapted to any scenario.

The contracts in table 3 range in progress from pre-bid (S200), to active (C100, C200, and S100), to completed (A100) in order to demonstrate how the CTS treats each type. Totals for each column are shown by category and at the bottom line. The columns are organized into two groups: numerical inputs and calculated values.

NUMERICAL INPUTS TO THE CTS

The numerical inputs to the CTS should all be readily available information from either the project cost report or forecast reports maintained by field construction management staff. These numerical inputs are as follows and are summarized in table 4 for handy reference:

Current Budget (B)

Taken from the project cost report, it should include all budget transfers/changes that resulted from the evolution of contract scope up until contract award and, as discussed, should also include an amount to cover change orders. When bids are received and the contract is awarded, the budget should be re-set to equal the original contract amount plus an initial contingency (C_I) by transferring budget to/from allocated and/or project contingency. Ideally, this budget will not be changed again until the contract is completed and excess budget is returned to contingency.

Current Forecast (F)

Before a contract is bid, this will equal the current budget, less the amount included to cover change orders. After contract award, field construction management personnel typically maintain the current forecast as previously discussed. Note that the current forecast should not include any factors to predict the value of unidentified changes, as the CTS will account for these.

Actual Costs (A)

Taken from the project cost report. The value of all payments made on a given contract as of the date the CTS is being updated.

Initial Contingency (C_I)

Before a contract is bid, the initial contingency guidelines discussed earlier are typically employed to develop the Initial Contingency (C_I) value based on the engineer's estimate. When bids are received and the contract is awarded, C_I is recalculated using the same guidelines applied to the bid amount. Note that, while the other numerical inputs are updated on a regular basis, initial contingency is a static number that will not change once contract award is made.

CALCULATED VALUES USED IN THE CTS

The CTS takes the numerical inputs described above to derive calculated values that are ultimately used to arrive at the total contingency available after taking construction cost trends into account. These calculated values are as follows and are summarized in table 5 for handy reference:

Contract Percent Complete (P)

There are many ways to ascertain progress toward completion of construction contracts. For simplicity, the CTS relies on Actual Costs (A) and the Current Forecast (F) to generate this number as follows:

$$P = A / F \qquad \text{(equation 9)}$$

Retained Contingency (C_R)

This calculation is at the heart of the CTS. It represents a forecast value of change orders that have not yet been identified by the construction management team but that we anticipate from experience will sooner or later be encountered. As derived earlier, this number is a natural log function, calculated as follows:

$$C_R = -0.4 \ln(P) \times C_I \qquad \text{(equation 8)}$$

This formula provides invalid results for a zero value of percent complete (P). In this case, the value of initial contingency (C_I) should be used.

Estimate at Completion (EAC)

This number is simply the sum of the current forecast (F) provided by our field construction management staff and Retained Contingency (C_R). The estimate at completion (EAC) is calculated as equation 1 demonstrates.

The author has used this EAC value as an early warning of contracts that are trending toward exceeding agency contract authorization limits. It often provides a warning several months before an overrun becomes readily apparent, but tends to be unreliable until a contract is at least 25 percent complete, as discussed earlier.

Contingency Surplus/Deficit (CS/D)

By comparing the estimate at completion (EAC) to the current budget (B) we can determine whether a given contract is trending towards adding to or depleting project contingency. The contingency surplus/deficit ($C_{S/D}$) is calculated as follows:

$$C_{S/D} = B - F \qquad \text{(equation 10)}$$

When the contingency surplus/deficit ($C_{S/D}$) is totaled across all construction contracts, allocated contingency lines and the project contingency line, the resulting value represents a good estimate of contingency available for non-construction project categories (e.g. right-of-way, design, and management).

The "punch line" of our CTS example is shown in the bottom right corner of table 3. This number represents the contingency available for other project risks after construction risks are

covered. In the example, although the budgeted project contingency is $1.5 million, the CTS shows that only about $1.0 million in contingency is actually available for non-construction project risks. The CTS is forecasting that the construction contracts will consume $0.5 million of project contingency to complete.

Note that, in the example project depicted in table 3, the total bottom-line value for retained contingency (C_R) is approximately $0.8 million. Recall, that this is the amount the CTS is adding to the field-generated contract forecasts to account for unidentified changes. Therefore, a project manager who relied solely on the field-generated forecasts to calculate EAC's would think that $1.8 million in contingency was available. If a scope addition valued at $1.25 million was approved, it might lead to a nasty surprise, as construction contracts progressed and additional changes were identified, resulting in an overrun of the project budget.

ADVANTAGES AND LIMITATIONS OF THE CTS

The main advantage of the CTS is its simplicity. It does not require advanced mathematics, statistics, or computer programming abilities to set up and maintain. This simplicity makes it easier to explain to and achieve buy-in from project stakeholders for the results that it generates. The basis for the Retained Contingency (C_R) calculation at the heart of the CTS is a set of real-world data, and the results pass the reasonableness test. The simple spreadsheet format and readily available numerical inputs make maintenance quite easy, which is important because the CTS should be updated on a regular basis in order to spot trends early. Another advantage is that the CTS provides an objective reading of remaining contingency, generated in a consistent manner from month to month. The only subjective input to the CTS is the initial contingency (C_I) value for each contract, and even that results from the application of a pre-determined set of guidelines and is set just one time for the life of the contract. Individual judgment can be applied to the values that result from the CTS, but the objectivity and consistency of the calculation method is important given the high stakes involved in managing project contingency.

As discussed, the retained contingency (C_R) calculation at the heart of the CTS was derived empirically from real world data on a light rail project. That data did not conform perfectly to a smooth curve; hence there is bound to be some inaccuracy in the empirical equation that resulted from it. However, the results shown in table 2 seem to be intuitively more representative of reality than the simplified straight-line alternate assumption. The fact that the data used to derive the calculation came from light rail projects may limit its usefulness in other sectors, e.g. building construction. More study is needed here, with forecast data collection and analysis in other sectors of construction necessary to verify or modify the retained contingency (C_R) calculation as appropriate. Also, as mentioned earlier, the estimate at completion (EAC) calculation can produce inaccurate results on an individual contract basis prior to approximately 25 percent completion due to inconsistent forecast information and poor correlation of the model in the early stages of contract execution.

As with any mathematical system, the CTS is only as good as the data that goes into it. The most important and hardest numerical input to come by is an accurate current forecast (F) for each contract. If reliable current forecast numbers are not available, the CTS will be of limited value. Finally, although simple, the CTS does require that consumers of its output be educated on the assumptions and calculations that underpin it to the point that they can understand and trust its results. There is no purpose in setting up and maintaining the CTS if project stakeholders have no understanding of or faith in it and are unwilling to act on its results.

As stated at the beginning of this paper, contingency is defined as an amount added to the budget to account for changes that inevitably occur. Using pre-established guidelines, we can establish a percentage of the original bid to initially include in our contract budget to account for change order growth. We have seen that, to derive an accurate estimate at completion (EAC) for each construction contract, we must start with a thorough contract forecast and add a retained portion of the initially established change order contingency to account for changes that have not yet been identified. A formula for calculating the retained contingency value was then derived based on a sample of real-world data. By comparing EAC's calculated in this way with the current budget for each contract, we can determine the amount each contract will add to or subtract from project contingency. Finally, by summing these impacts over all contracts and contingency lines, a bottom-line value of project contingency available for non-construction uses can be obtained.

The contingency tracking system (CTS) combines all of these steps into a compact and easily maintainable spreadsheet table. Using the CTS, project managers have a guide to the expected final cost of each contract and the approximate value of project contingency left after accounting for construction risks. This ability to see into the future will serve project managers well as they navigate the many obstacles standing in the way of successful project delivery.

REFERENCES

1. Collins, Jack J. and Rowe, John F. *"Management Challenges Unique to Transit Projects."* 2005 **AACE International Transactions**. (Morgantown, WV, 2005): PM.15.
2. Collins, Jack J. *"Steps to Better Cost Control of Transit Projects."* **American Public Transportation Association 1998 Rapid Transit Conference**, (June 1998).
3. Nassar, Khaled. *"Cost Contingency Analysis for Construction Projects Using Spreadsheet Techniques."* **Cost Engineering**, (September 2002): 26-31.
4. Oswald, Phillip F. **Construction Cost Analysis and Scheduling**. (New Jersey: Prentice Hall, 2001.
5. Woodward, Charles P. and Chen, Mark T. *"Chapter 1 - Cost Estimating Basics"* **Skills and Knowledge of Cost Engineering**. (Morgantown, WV: AACE International, 1999): 1-2.

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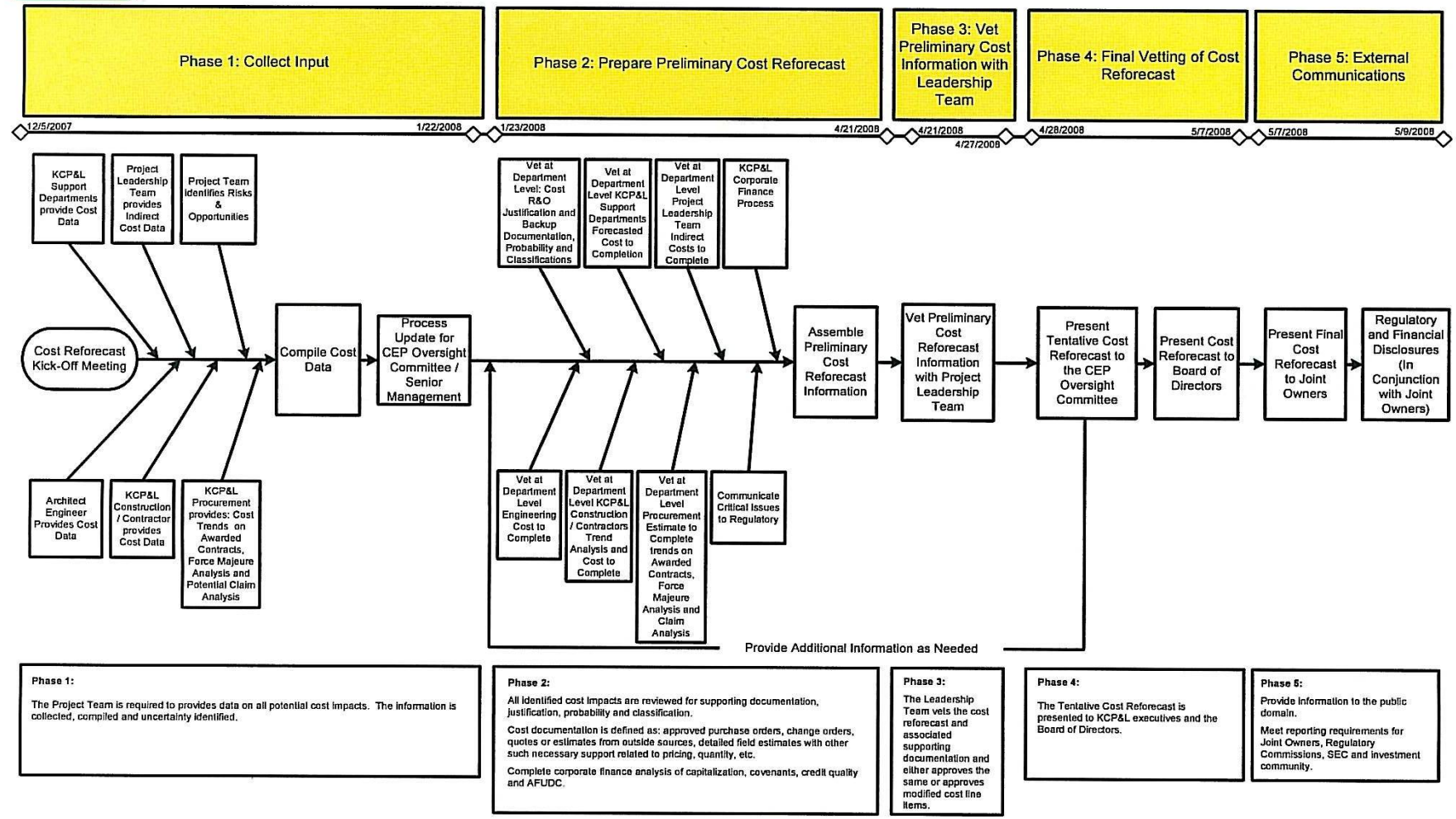
Project Cost Reforecast Process



Schedule DFM-3

DANIEL F. MEYER

DATE AND PLACE OF BIRTH: June 27, 1944
Springfield, Ohio

EDUCATION:

Ohio University, 1968
Bachelor of Science Civil Engineering
Cum Laude Graduate

Harvard University, 1979
Graduate School of Business Administration
Program for Management Development

EXPERIENCE SUMMARY

Position experience, commencing at age fourteen, worked as a laborer, carpenter, general foreman, methods engineer, estimator, contract/claim analyst, cost engineer, field engineer and superintendent, project engineer, project manager, projects (multiple) manager, operations manager overseeing multiple profit center divisions, Vice-President-Group Operations, and General Vice-President. President of consulting firm.

Project experience encompasses highways, bridges (steel, concrete, and precast concrete); steel fabrications; foundations works including piling, caissons and slurry walls; infrastructure repair, underground works including tunnels, shafts, powerhouses and pump stations; rail and mass transit, subways and light rail; commercial and governmental buildings, wastewater and fresh water treatment plants, marine construction (river and ocean), powerhouses (nuclear, wood fired, and hydroelectric), cleanroom facilities for high technology manufacturing, convention centers and hospital modifications.

Contract experience includes negotiated, fixed price, guaranteed maximum, performance based compensation, design-build and variations thereto.

Functional responsibility has been broad and includes results of operations, claim and contract dispute resolution, entity wind-downs, financial statement, financial planning, investment decision, and long range strategic planning including start-up of grass-root profit center divisions, business development, joint venture and partnership formulation, internal task forcing, human resource profiling/evaluation/development, and control

systems formulation and implementation. Responsibilities have also included equipment acquisition/management/liquidation, and new work acquisition.

PRESENT POSITION

President, Meyer Construction Consulting, Inc. Firm focuses on claim and dispute resolution services. Mr. Meyer also sits on twenty three (23) Dispute Review Boards concerning projects ranging in size up to US$380M: total value of associated projects is approximately US$2.4Billion.

Mr. Meyer is the past President of the *Dispute Review Board Foundation* (DRBF) which is the international founding organization relating to the use of Dispute Review Boards in the worldwide construction industry: he currently serves on the Board of Directors of the DRBF.

Mr. Meyer is also active as a AAA arbitrator on the large and complex case roster and he has experience in mediation of complex construction disputes.

In 1999, Mr. Meyer authored a 200 page chapter on Delay, Disruption and Damage Calculation for the Illinois Institute for Continuing Legal Education.

PAST POSITIONS

Served as General Vice-President of Paschen Contractors Inc., a privately held, Chicago based, general contracting firm, engaged in most aspects of the domestic construction market. Types of work included tunnel, highway, bridge, building, foundation, treatment plant, and powerhouse projects. Annual backlog, burn-off, and number of employees peaked at $400 million, $175 million and 800, respectively.

In this position was responsible for claim and dispute negotiation and resolution, liability and litigation management, cash management, results of operations, long range planning, cost and management control systems modification and implementation, equipment management, internal task forcing, and limited subsidiary oversight. Reported directly to the Chairman, and President of the company.

Prior to joining Paschen in 1986, served as Vice-President, Group Operations for Perini Corporation, a diversified contracting and real estate development firm operating on an international scale, with annual revenue approximating $800 million, as measured in 1985 dollars.

In this position, was responsible for multiple, independent profit center divisions that included underground & tunnel, heavy & highway, marine, and special projects divisions; plus Group support entities such as central engineering, business development, central scheduling, and equipment operations. Backlog, annual burn-off and number of employees in the Group approximated $500 million, $200 million, and 1500 to 2000, respectively. The direct reporting relationship was to a Senior Executive, and Corporate Board Member. There was one reporting level between my position and the President of the company.

Prior to joining Perini Corporation in 1983, served as Division Manager-Waste Isolation, and Operations Manager-Underground, and Marine Divisions for Morrison-Knudsen Company Inc., a worldwide contracting, engineering, mining, and ship building concern.

In this position was responsible for day-to-day operations of three profit center divisions specializing in underground construction, heavy foundation and structure work and marine construction for both private and governmental clients. Backlog, annual burn-off, and number of employees in these divisions approximated $350 million (measured in 1983 dollars), $125 million and 800 to 1,000, respectively. The direct reporting relationship was dual, and was to the Vice-President of the Underground and Marine Divisions, and also to the Vice-President, Group Operations, Heavy and Marine Group. There were two reporting levels between the President of the company, and my position.

EMPLOYMENT HISTORY

President, Meyer Construction Consulting, Inc.

General Vice-President, Paschen Contractors, 1986 through 1990.

Vice-President, Group Operations, Heavy Construction Group, Perini Corporation, 1983 to 1986.

Division Manager-Waste Isolation, Operations Manager-Underground and Marine Divisions, Morrison-Knudsen Company, 1981 to 1983.

Projects Manager, Morrison-Knudsen Company Inc., 1977 to 1981.

Project Manager, Morrison-Knudsen Company Inc., 1975 to 1977.

Project Manager/Project Engineer, Morrison-Knudsen Company Inc., 1971 to 1975.

Contract Administrator/Methods Analyst/Estimator and various other positions, Morrison-Knudsen Company Inc., 1968 to 1971.

General Foreman/Carpenter/Laborer, B.G. Danis Company, Inc., 1962 to 1964 (entered college in September 1964)

HONORS AND PROFESSIONAL ASSOCIATIONS

Cum Laude Graduate, The Ohio University
The Tau Beta Pi Association (National Engineering Honorary)
United States National Committee on Tunneling Technology (Past)
The Moles
The Harvard Business School Club of Chicago
Board of Directors - Dispute Review Board Foundation