AACE INTERNATIONAL RECOMMENDED PRACTICE

32R-04

DETERMINING ACTIVITY DURATIONS

AACE INTERNATIONAL

AACE® International Recommended Practice No. 32R-04

DETERMINING ACTIVITY DURATIONS

TCM Framework: 7.2 – Schedule Planning and Development

Rev. January 14, 2012

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Disclaimer: The opinions expressed by the authors and contributors to this recommended practice are their own and do not necessarily reflect those of their employers, unless otherwise stated.

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INTRODUCTION

Purpose

This recommended practice (RP) for *Determining Activity Durations* is intended to provide a guideline and a resource, not to establish a standard. As a recommended practice of AACE International, it provides guidelines for the project scheduler to determine schedule activity durations and understand the limitations and assumptions involved in such determination as part of the total cost management (TCM) project planning, scheduling forecasting, and change management processes (7.2).

This recommended practice provides information about determining the original durations for activities for developing the project schedule and general considerations related to the establishment of remaining durations while updating the project schedule. Specific considerations regarding the topic of establishing the activities remaining durations for schedule performance assessment are not within the scope of this RP. Therefore the information presented here generally applies to determining original activity durations, and general considerations for the establishment of remaining durations be provided only as appropriate.

This recommended practice offers methods for determining original activity durations through the analysis of past project data with anticipated future performance data. It also incorporates an iterative effect-analysis of constraints on activity duration.

Overview

Many methods have been used to determine scheduled activity duration estimates; the number of continuous work periods required to complete an activity. Critical path method (CPM) is a deterministic network model that uses a single duration estimate, whereas program (or project) evaluation and review technique (PERT) is a probabilistic or stochastic network model that uses three duration estimates. In either of those methods the activity duration is still an estimate of the continuous time (in work-units) required to perform the work of an activity. This estimate normally takes into consideration the nature of the work and the resources needed to complete an activity; and it may also need to consider productivity impacts and nonstandard production rates needed to meet the constraints of a project.

Duration estimates are typically made through the comparison of actual data with anticipated performance, and an effective analysis of constraints on activity duration. Accurately estimating activity durations is essential to developing schedules for which project milestones and completion dates can realistically be achieved. It is important to estimate durations that are realistic given the work to be done, the resources to be made available, and other influences and constraints on performance.

Two performance areas are considered when estimating an activity's duration: past performance and expected future performance. From past performance the scheduler can review actual durations of similar activities completed in the past and apply professional judgment for anticipated future performance. This establishes a basis for determining an activity's duration, but does not consider constraints that may keep the activity from being completed within the planned time frame. There will be some activities for which there are no past performance measures to rely upon (e.g., in new technology, or work not performed in recent years). If the organization does not have prior experience in the work activity there may be industrial databases or other resources to rely upon. An alternative is to use the PERT method as described above.

The Critical Path Method is a project modeling technique used for scheduling a set of project activities. Traditionally, the Critical Path Method uses deterministic (no randomness) values when applying activity durations. The Critical Path Method calculates the longest path of the project, establishing the earliest and latest dates that each activity can start and finish. The forward pass calculation allows you to determine the earliest start dates, while the backward calculation allows you to determine the latest dates. The forward and backward calculation allows you to identify the critical activities based on the total float. The "Total Float" represents the schedule flexibility and is measured by subtracting early dates to late dates of path completion. Total Float is the defining core of the Critical Path Method.

The PERT Method or Project Evaluation Review Technique is a method to analyze the set of project activities that allows for randomness by introducing uncertainty to activity duration estimates. This is completed by determining the expected time for each activity. The following identifies the typical PERT calculation.

TE = (O + 4M + P) ÷ 6
Where:
TE = Expected Time
O = Optimistic Time (minimal amount of time)
M = Most Likely Time (the best estimated time)
P = Pessimistic Time (maximum amount of time)

The CPM and PERT models can be used in conjunction with each other to develop an improved Critical Path that addresses uncertainty. Both the CPM and PERT models can be represented as Gantt or network diagrams.

Determining realistic original durations for scheduled activities is essential for proper schedule development. There is always a chance that target project milestone dates are not achievable given the scope of work to be performed and the resources made available. Realistic durations should be utilized even if the dates derived from the time estimates do not meet target project requirements. If the target milestone dates are not in-line with realistic project requirements, the professional scheduler should not reduce durations to fit the target dates unless explicit schedule adjustments have been approved that will provide more resources, reduce scope, or allow for some realistic alternative approach (e.g., parallel activities).

RECOMMENDED PRACTICE

This RP has been organized as follows:

- Phase I – Determine unconstrained activity durations
- Phase II – Adjust activity duration based on constraint impact
- Phase III – Revise activity original durations to meet project requirements
- Determining activity duration - flowcharts

General guidelines for estimating a schedule's activity duration:

1. Duration = Quantity of work / work units per time period.
   Quantity of work is a function of the definition or scope of the activity. Work units per time period is commonly referred to as the production rate.

2. Duration is typically specified in rounded continuous working time periods in the unit common to the activity, e.g. hours, days, weeks, years, etc. Generally, durations are rounded up to the next whole unit, even when the

estimated duration is less than ½ a work unit (e.g., if estimated duration calculates to 1.25 work days, it is rounded up to 2 work days).

3. There are some activities which need to be measured in calendar time periods rather than working time periods (e.g., the time for curing of concrete).

4. Durations should be estimated using an analytical and systematic method.

5. Activity or resource calendars should be used to model constraints related to a particular time range (e.g., winter, dry, or wet seasons) so that the effect on activity duration does not persist if the activity slips into or out of the affected period. For example, if a project's start date slips 6 months, and an activity originally scheduled in the summer now occurs in the winter, the appropriate calendars will automatically adjust the activity's duration. Major shifts in start dates should be reviewed with the responsible performing organizations.

6. The basis of activity duration estimates should be identified as a part of the overall schedule basis documentation.

Phase I – Determine Unconstrained Activity Durations

1. The approved project (baseline) estimate can be used to determine unconstrained original durations. For details concerning this process, please refer to the *Supplemental Calculations* section of this recommended practice.

2. Historical data consists of actual duration data from similar previous projects that can be used to estimate how long an activity may take in the future. For example, historical project data provides that for a particular activity:

Project Name	Completed Activity	Average Actual Duration (Days)
Completed Project 1	Issue Purchase Req.	10
Completed Project 2	Issue Purchase Req.	5
Completed Project 3	Issue Purchase Req.	8
Completed Project 4	Issue Purchase Req.	6

Table 1 – Sample Historical Project Data

Assume that these actual average activity durations are normally distributed, and compute a confidence interval on the mean duration. This is better than just taking an average since it gives a range of values instead of a single number. The confidence interval for the above example would be roughly 7 days ±2 days. This means that the next duration could be anywhere from 5 to 9 days. This calculation gives the shortest and longest probable original activity durations based on historical data. Any analysis of historical data requires normalization for scope and other characteristics that may affect the data. Refer to statistical texts to understand data analysis, and the confidence level (and risk) associated with these types of calculations.

3. Professional judgment may be used to help determine an activity's estimated duration. Often, key project team members can provide their experience related to particular types of work activities. Their knowledge may reveal that doing work in certain geographical areas or under specific climatic conditions generally takes shorter or longer than anticipated. Using the opinion of an experienced professional helps to identify non-typical conditions to consider when assigning original durations to those activities.