

Australian Standard™

Project performance measurement using Earned Value



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Project performance measurement using Earned Value

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Preface

This Standard was prepared by the Standards Australia Committee OB-014, Earned Value Performance Measurement (EVPM) to supersede AS 4817—2003.

The objectives of this Standard are:

- To define the essential elements of the EVPM method.
- To be used as a measurement tool to determine whether the EVPM method has been implemented.
- To provide a basis for EVPM implementation for all industries and sizes of Projects.
- To clearly communicate the benefits of the EVPM method.
- To be fundamentally compatible with any existing Australian or International Standards.
- To be relevant to Project Managers (PMs) and executive management in organizations that manage by Projects.

The terminology used in this Standard has been chosen to be acceptable across a wide range of disciplines. Terms used in the Standard that are in common use have been adopted from the *PMBOK Guide 2000 Edition v1.2*, *ANSI/PMI 99-001-2000 (PMBOK)*. If the PMBOK did not provide an adequate definition of a term then the definition from ANSI/EIA-748-A-1998, *Earned Value Management Systems* was used. In some cases slight alterations have been made to the definitions to better reflect the Australian context. If neither the PMBOK nor ANSI/EIA-748 provided a satisfactory definition for a given term then the Committee created an applicable definition.

If terms have a common-use abbreviation then this abbreviation has been used, subsequent to its first use, throughout the remainder of the Standard.

The terms 'normative' and 'informative' have been used to distinguish between prescriptive and non-prescriptive parts in the Standard respectively. The 'normative' parts are the sub-sections in Section 3 titled 'Requirements' and Section 1.3 titled 'Definitions' where terms used in those requirements are defined. Parts of the Standard that are 'informative' include those marked 'informative' and titled 'Guidance'. Where a term from the 'Definitions' section is used in an 'informative' part of the Standard it is not intended that the term impart 'normativity' to that part.

Terms that are defined in Section 1.3 are set in SMALL CAPITALS throughout this Standard.

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Foreword

Earned Value Performance Measurement (EVPM) is a method for measuring and reporting project performance, and forecasting future performance based on past performance. The EVPM method measures performance of the time and cost aspects of a project and enables effective project management. The EVPM method provides:

- means for measuring project performance and status;
- means for measuring progress against a BASELINE (plan);
- forecasts of future performance based on past performance; and
- metrics for comparison of project performance across an organization and between organizations.

EVPM assists managers to:

- report cost and schedule performance using standardised techniques;
- analyse variances between the plan and actual progress;
- control changes to the BASELINE; and
- forecast completion costs and finish dates.

1 Introduction

1.1 Scope

This Standard establishes requirements and gives guidance for the measurement and reporting of cost and schedule performance of projects and programs using the EVPM method.

1.2 Application

This Standard can be applied to the measurement and reporting of the cost and schedule performance of projects and programs. It can be applied to any situation where a specified deliverable (product, service, output, result) is to be produced by a specified date and with finite resources.

The method can be used for the performance measurement of single projects, for parts of projects (including contracted and sub-contracted parts), for programs consisting of multiple projects, and for organizations that manage by projects.

In the multi-project environment, EVPM provides metrics for summary level reporting throughout the organization. The metrics can be rolled up by output, by program, by organizational unit, organizational objective, key performance indicator, or other organization-specific summarisation required for effective management reporting.

1.3 Definitions (Normative)

For the purposes of this Standard, the definitions below apply.

1.3.1 Activity

An element of work performed during the course of a project. An ACTIVITY normally has an expected duration, an expected cost, and expected resource requirements. ACTIVITIES can be subdivided into tasks.

1.3.2 Actual Cost (AC)

The costs actually incurred and recorded in accomplishing work performed.

NOTE: Previously, this was called the Actual Cost of Work Performed (ACWP).

1.3.3 Baseline

The original approved plan (for a project, CONTROL ACCOUNT, WORK PACKAGE or ACTIVITY), plus or minus approved scope changes. Usually used with a modifier (e.g., cost BASELINE, schedule BASELINE, PERFORMANCE MEASUREMENT BASELINE).

1.3.4 Budget

A cost target, based on the planned resource requirements (e.g. labour, material, OTHER DIRECT COSTS and possibly INDIRECT COSTS), for a given scope of work. The BUDGET is used for performance measurement and management purposes and generally remains static unless there is a variation in the scope of work or other approved changes. It MAY be expressed in terms of dollars, labour hours, or other measurable units.

1.3.5 Budget at Completion (BAC)

The total authorized BUDGET for accomplishing the project scope of work. It is equal to the sum of all allocated BUDGETS plus any UNDISTRIBUTED BUDGET (MANAGEMENT RESERVE is not included). The BUDGET AT COMPLETION will form the PERFORMANCE MEASUREMENT BASELINE as it is allocated and time-phased in accordance with project schedule requirements.

The term BAC can likewise be used to refer to the total BUDGET for an ACTIVITY, WORK PACKAGE, CONTROL ACCOUNT or any other grouping of work, particularly to differentiate it from the PV for that work at a given point in time.

1.3.6 Constraint

Applicable restriction that will affect the performance of the project. Any factor that affects when an ACTIVITY can be scheduled.

1.3.7 Control Account

A management control point at which BUDGETS (resource plans) and ACTUAL COST are accumulated and compared to EARNED VALUE for management control purposes. A CONTROL ACCOUNT is a natural management point for planning and control since it represents the work assigned to one responsible organizational element on one project WORK BREAKDOWN STRUCTURE element.

1.3.8 Corrective Action

Changes made to bring expected future performance of the project in line with the plan (i.e. the BASELINE).

1.3.9 Cost Variance (CV)

The algebraic difference between the EARNED VALUE and the ACTUAL COST.

$$CV = EV - AC$$

A positive value indicates a favourable position and a negative value indicates an unfavourable condition.

1.3.10 Critical Path

The series of ACTIVITIES that determine the duration of the project. In a deterministic model the CRITICAL PATH is usually defined as those ACTIVITIES with FLOAT less than or equal to a specified value, often zero. It is the longest path through the project.

1.3.11 Direct Costs

The costs or resources expended in the accomplishment of work which are directly charged to the relevant work.

1.3.12 Earned Value (EV)

The value of completed work expressed in terms of the BUDGET assigned to that work.

NOTE: Previously, also called the Budgeted Cost of Work Performed (BCWP).

1.3.13 Estimate at Completion (EAC)

The expected total cost of an ACTIVITY, a group of ACTIVITIES, or the project when the defined scope of work has been completed. It equals ACTUAL COST to a point in time plus the estimated costs to completion (ESTIMATE TO COMPLETE).

$$EAC = AC + ETC$$

1.3.14 Estimate to Complete (ETC)

The expected additional cost needed to complete an ACTIVITY, a group of ACTIVITIES, or the project. Most techniques for forecasting ESTIMATE TO COMPLETE include some adjustment to the original estimate, based on project performance to date. (See also ESTIMATE AT COMPLETION).

1.3.15 Float

The amount of time that an ACTIVITY can be delayed from its early start without delaying the project finish date. FLOAT is a mathematical calculation, and can change as the project progresses and the schedule is updated.

1.3.16 Indirect Costs

The cost for common or joint objectives which cannot be identified specifically with a particular project or ACTIVITY. Also referred to as 'overhead cost' or 'burden'.

1.3.17 Management Reserve (MR)

An amount of the total BUDGET withheld for management control purposes rather than designated for the accomplishment of a specific ACTIVITY or set of ACTIVITIES.

1.3.18 May

Indicates the existence of an option.

1.3.19 Milestone

A significant event in the project, usually completion of a major deliverable.

1.3.20 Network Schedule

A schedule format in which the ACTIVITIES and MILESTONES are represented along with the interdependencies between ACTIVITIES. It expresses the logic of how the project will be accomplished. NETWORK SCHEDULES are the basis for CRITICAL PATH analysis, a method for identification and assessment of schedule priorities and impacts.

1.3.21 Other Direct Costs (ODC)

Usually the remaining DIRECT COSTS, other than labour and material, such as travel and computer costs.

1.3.22 Performance Measurement Baseline (PMB)

The total time-phased BUDGET plan against which project performance is measured. It is the schedule for expenditure of the resources allocated to accomplish project scope and schedule objectives and is formed by the BUDGETS assigned. The PERFORMANCE MEASUREMENT BASELINE also includes BUDGET for future scope assigned to UNDISTRIBUTED BUDGET. MANAGEMENT RESERVE is not included in the PMB as it is not yet designated for specific work scope.

1.3.23 Planned Value (PV)

The sum of the BUDGETS for work scheduled to be accomplished within a given time period.

NOTE: Previously this was called the Budgeted Cost of Work Scheduled (BCWS).

1.3.24 Project Budget

The total BUDGET for the project including all allocated BUDGET, MANAGEMENT RESERVE, and UNDISTRIBUTED BUDGET.

1.3.25 Schedule Variance (SV)

A metric for the schedule performance on a project. It is the algebraic difference between EARNED VALUE and PLANNED VALUE.

$$SV = EV - PV$$

A positive value indicates an 'ahead of plan' situation while a negative value indicates 'behind plan'.

1.3.26 Shall

Indicates that a statement is mandatory.

1.3.27 Undistributed Budget (UB)

BUDGET associated with specific work scope or project changes which has not yet been incorporated into the time-phased BUDGET.

1.3.28 Variance at Completion (VAC)

Algebraic difference between BUDGET AT COMPLETION and ESTIMATE AT COMPLETION.

$$VAC = BAC - EAC$$

1.3.29 Work Breakdown Structure (WBS)

A hierarchical division of project work depicting the breakdown of work scope for work authorization, tracking and reporting purposes. An accompanying dictionary of WBS element scope definitions MAY be necessary to clearly identify and segregate the work scope of each.

1.3.30 Work package

An ACTIVITY or set of ACTIVITIES.

1.4 What is earned value?

One of the problems faced by managers is to understand how much work has actually been performed and how much it has cost. Of greater concern to managers is the difficulty of estimating the final cost and completion date of the planned work, especially if the work is not running according to schedule.

This problem and the solutions provided by the EVPM method are illustrated in Figures 1.1 to 1.4 and the accompanying text. Figure 1.1 shows a graphical representation of a time-phased schedule. The BUDGET line represents the cumulative BUDGET for the work spread over time.

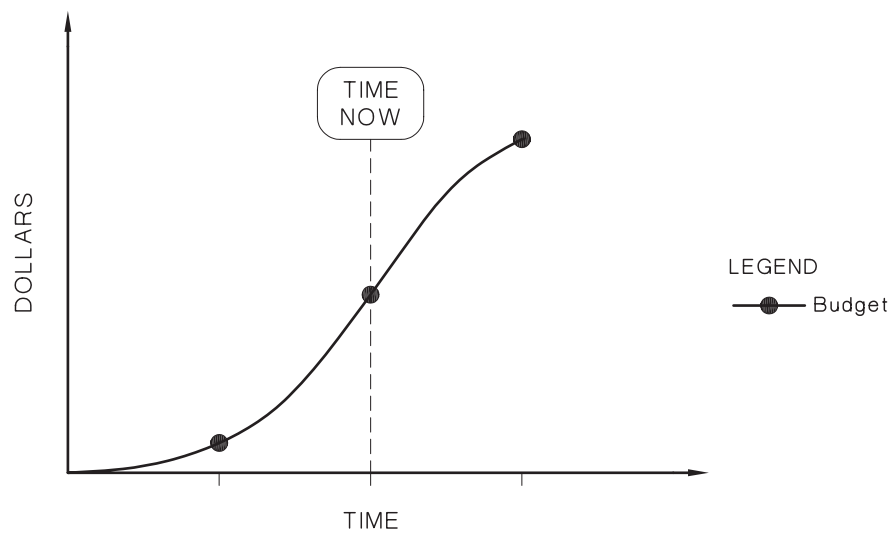


FIGURE 1.1 TIME-PHASED BUDGET

Work does not necessarily run exactly to plan, so the manager needs to know how work is progressing compared with the plan. Many managers have access to the ACTUAL COST (AC) that has been incurred for their work. Figure 1.2 shows the cumulative AC for the work due to date.

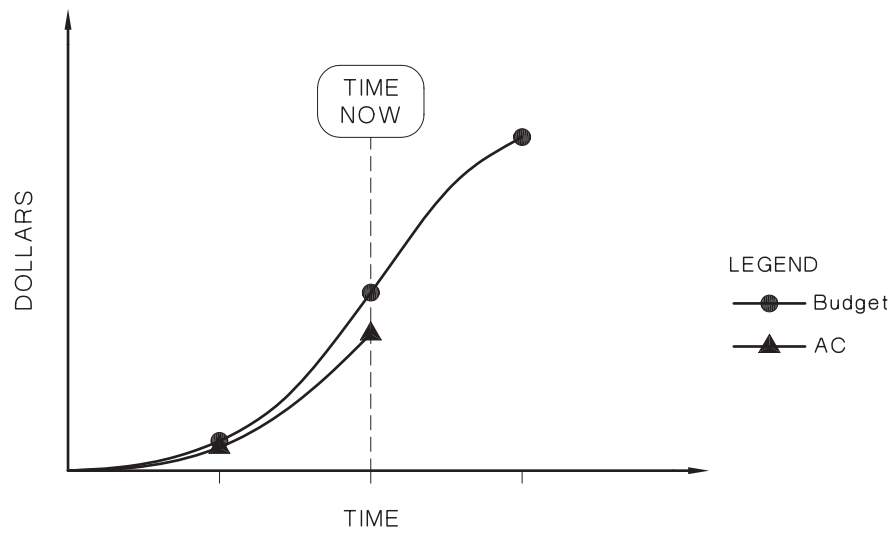


FIGURE 1.2 COMPARISON OF BUDGET AND ACTUAL COST

Figure 1.2 shows that the cost of the work at any point in time is running under BUDGET. This information by itself gives the impression that the work will be completed under BUDGET. However, the manager might only have a little understanding of how much work has actually been performed. The AC involved might have been on tasks outside the original scope or it might have been spent inefficiently.

To overcome this problem, the manager needs a third item of information, which is known as the EARNED VALUE (EV). EV is the value of completed work expressed in terms of the BUDGET assigned for that work. Figure 1.3 shows the EV for the work completed to date.

Figure 1.3 puts the work performance in a different perspective. The EV is actually below the AC. This means the work is really running over cost. This is contrary to the impression given in Figure 1.2.

Figure 1.3 also shows the EV is below BUDGET, which means that the project is running behind schedule. This could not have been recognized from Figure 1.2.

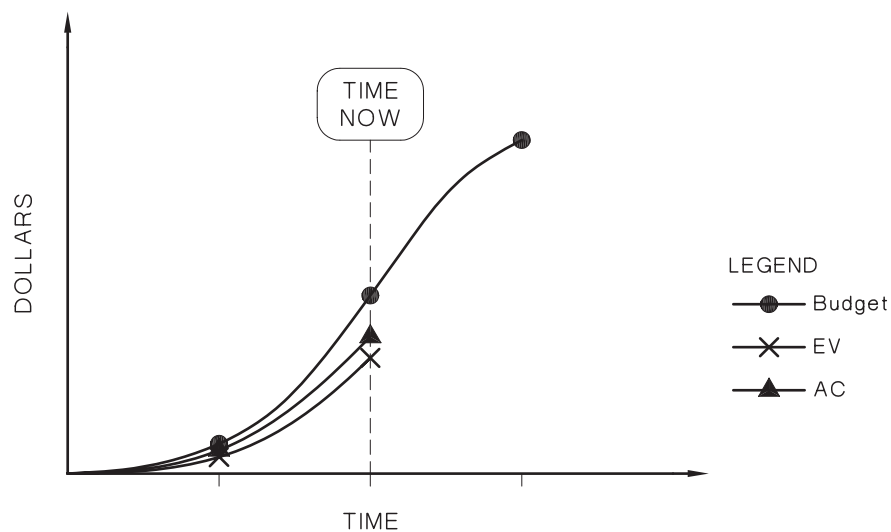


FIGURE 1.3 COMPARISON OF BUDGET, ACTUAL COSTS AND EARNED VALUE

This demonstrates the benefit of knowing the EV of the work in addition to the BUDGET and AC. This information is only available in a project management system utilizing EVPM.

Managers need a reliable forecast of when the work will be completed and how much it will cost at completion. When the EV is available, the manager knows how much work has actually been performed. The eventual cost and completion date of the work can be forecast, as the original BUDGET is known, assuming efficiencies remain the same. The forecast can take into account past performance. Figure 1.4 shows a forecast for cost and completion for the project based on past performance.

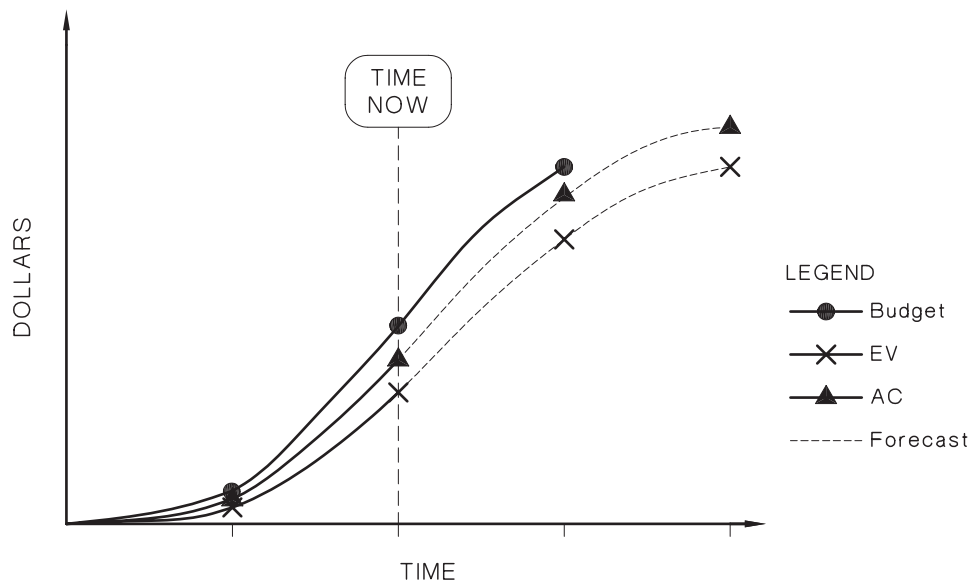


FIGURE 1.4 COMPARISON OF BUDGET, ACTUAL COST AND EARNED VALUE WITH FORECASTS BASED ON PAST PERFORMANCE

1.5 Benefits of earned value performance measurement

Direct and indirect benefits accrue from the focussed planning needed for implementation, objectivity in EVPM and the availability of robust data for future management decisions.

Specific benefits are:

- objective measurement of project performance in both cost and time;
- forecasting of future performance, completion date and cost at completion based on past performance;
- objective metrics for comparison of project performance across an organization and between organizations;
- development of appropriate BUDGETS and BASELINES;
- compilation of appropriate estimates;
- ensures that percentage complete of ACTIVITIES is consistently measured;
- focus on comparison between actual performance and budget;
- reinforces emphasis on disciplined change control; and
- immediate highlighting of inconsistencies in the above measures in EV reports.

Regular EV reporting provides a strong incentive to ensure consistency of the overall reporting and performance measurement framework.

2

Earned value performance measurement

This Section provides an introduction to, and examines the basic concepts of, EVPM using simple examples.

2.1 Basic actions

EVPM requires that PMs:

- determine what work is to be done, by whom, and when;
- establish realistic resource requirements for the work;
- objectively measure work achievement and record associated costs;
- report any significant deviations from the plan;
- forecast the completion date and cost; and
- plan and implement CORRECTIVE ACTION plans and authorize scope changes.

EVPM requires that planning includes the establishment of clear objectives for achievement and demands that progress is monitored so as to measure any deviations from the plan. It encourages PMs to be objective in planning, assessment of progress, use of resources and forecasting of future progress.

2.2 Basic concepts

2.2.1 Implementation

There are three keys to success in using EVPM:

- (a) Work is planned in such a way that objective measurement of achievement is possible.
- (b) Objective techniques are selected, in advance, to measure 'achievement' for each piece of work.

- (c) Cost, schedule and technical achievement aspects are integrated in one management system i.e. cost and schedule are not managed in isolation.

Setting up a project for EVPM requires a suitable decomposition of the work (as set out in Clause 3.1), establishment of a WORK BREAKDOWN STRUCTURE (WBS), identification of personnel to be assigned responsibility, scheduling of the work and assignment of resources to the work scope.

At this point a slight variation is introduced to conventional planning. Objective methods, which will be used to determine whether work has been accomplished, are pre-planned. A BASELINE is established in the form of a time-phased BUDGET, showing planned expenditure for each element of work in a given time frame. This is known as PLANNED VALUE (PV) and can be plotted to produce the PERFORMANCE MEASUREMENT BASELINE (PMB) (refer to Figure 2.1).

2.2.2 Example of EVPM

A project is assigned a value of \$3000. For simplicity, it is assumed that the project consists of three ACTIVITIES namely *Outline*, *Draft* and *Review/Acceptance*. Each ACTIVITY is assigned a value of \$1000 and is scheduled to occur over a three month period. Table 2.1 shows the BASELINE schedule and actual schedule for each of the activities.

The ACTIVITIES were completed as follows:

- (a) *Outline* – started on time in Month 1 and finished early in Month 1.
- (b) *Draft* – started early in Month 1 and finished late in Month 3 (vs a planned finish in Month 2).
- (c) *Review/Acceptance* – started late in Month 3 (vs a planned start in Month 2) and finished late in Month 4 (vs a planned finish in Month 3).

TABLE 2.1
Baseline schedule & actual schedule

Activity	Month			
	1	2	3	4
Outline				
Draft				
Review and acceptance				

When the project is completed it is said that it earned the value of \$3000 against the plan; or more simply EV = \$3000. Note that the AC of the project is not required to determine EV as it is determined during the planning process. Tables 2.2 and 2.3 show the performance of the project.