

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

MANUAL

COST CONTROL OF CAPITAL INVESTMENT PROJECTS

PTS 82.00.10.11
AUGUST 2000



PREFACE

PETRONAS Technical Standards (PTS) publications reflect the views, at the time of publication, of PETRONAS OPU/Divisions.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' OPU/Divisions in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardisation.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

The right to use PTS rests with three categories of users :

- 1) PETRONAS and its affiliates.
- 2) Other parties who are authorised to use PTS subject to appropriate contractual arrangements.
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PETRONAS disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PETRONAS and/or any company affiliated to PETRONAS that may issue PTS or require the use of PTS.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PETRONAS, be disclosed by users to any company or person whomsoever and the PTS shall be used exclusively for the purpose they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of PETRONAS. The copyright of PTS vests in PETRONAS. Users shall arrange for PTS to be held in safe custody and PETRONAS may at any time require information satisfactory to PETRONAS in order to ascertain how users implement this requirement.

TABLE OF CONTENTS

1.	INTRODUCTION
1.1	SCOPE
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS
1.3	DEFINITIONS
1.4	CROSS-REFERENCES
2.	PROJECT MANAGEMENT - RESPONSIBILITY AND DIVISION OF WORK
2.1	INTRODUCTION
2.2	DIVISION OF WORK AND CONSEQUENT RESPONSIBILITY FOR PROJECT MANAGEMENT AND COST CONTROL
3.	PRINCIPAL FEATURES OF COST CONTROL
3.1	GENERAL
3.2	BUDGET APPROPRIATION
3.3	APPROPRIATION BREAKDOWN
3.4	SITE CURRENT ESTIMATE
3.5	COMPARISON WITH THE APPROPRIATION BREAKDOWN
3.6	CHANGE CONTROL
3.7	BUDGET MAINTENANCE
3.8	PAYMENT CONTROL
3.9	PROJECT COST REVIEW
3.10	PROJECT COMPLETION
4.	REFERENCES

APPENDICES

APPENDIX 1	COST CODING
APPENDIX 2	ACTIVITY ALLOWANCE
APPENDIX 3	VALUE OF WORK DONE AND MEASUREMENT OF PROGRESS
APPENDIX 4	ASSESSMENTS DURING THE PHASES OF THE PROJECT
APPENDIX 5	CHANGE CONTROL
APPENDIX 6	PAYMENT CONTROL
APPENDIX 7	COST REPORTING AND MONITORING AGAINST BUDGET

1. INTRODUCTION

1.1 SCOPE

This new PTS specifies requirements and gives recommendations for the control of costs and progress during the execution of capital investment projects.

In each capital investment project commitments are continuously checked against budgeted amounts. By regularly assessing the value of work done and assessing the cost of work still to be done, any deviations from budgeted amounts can be detected in good time for proper management action (i.e. cost control). In addition, project progress is continuously monitored in both physical and monetary terms and measured against anticipated progress. Money is, however, used as the common denominator to report overall progress (i.e. progress control).

Proper cost control is an essential element of project management if projects are to be realised within agreed budgets and according to the agreed execution and implementation plans. The discipline of cost control is wholly complementary to that of planning and scheduling.

It introduces the organisation and the procedures which shall be followed to effectively collect, record, interpret and report project implementation cost and progress data.

Cost control shall also deliver data for:

- i) capital expenditure phasing, reflecting the anticipated progress of the value of work done;
- ii) cash flow forecasts, based on the expenditure phasing with due account of the payment conditions;
- iii) a breakdown of the final value into fixed assets; and
- iv) future estimating and planning purposes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS Group or managed by a Group company, and to Contractors and Manufacturers/Suppliers nominated by them.

This PTS is intended for use in oil refineries, chemical plants, and gas plants and in exploration and production facilities.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this PTS which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal

may also include an agent or consultant, authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific abbreviations and definitions

activity allowance	estimated amount assigned to a control item to cover unpredictable work, generally computed on a statistical basis as a function of the progress of the specific items under consideration.
anticipated ultimate net value of work	anticipated cost of the completed project, comprising the cumulative commitments and estimated value of uncommitted work but excluding the activity allowances
appropriation breakdown	breakdown of the budget appropriation into identifiable technical items ("control items") with their estimated cost.
balance	difference between the site current estimate and the appropriation breakdown, whether positive or negative.
budget appropriation	amount approved by the board of the company, expressed in its own operating currency, in respect of a particular capital project.
changes, scope	alterations to the definition of the project scope, i.e. the business objectives and the means to achieve them, as originally set out to support the capital budget proposal.
changes, implementation	alterations to the detailed execution of the work which do not alter the scope of the project as originally defined.
changes, evolutionary	changes which develop during the project and evolve with the project itself and do not occur "out of phase".
commitment	value of any contract, purchase order or other obligation between the company and a supplier of goods and/or services.
control item	discrete activity into which the project can be split and for which costs can be monitored in line with the technical execution of the work.
cost progress	value of work done as a percentage of the anticipated ultimate net value of work.
development contingency	allowance which will be established in co-operation with the development division for those sections of the process unit being estimated to cover for possible changes in scope which may result from development work or laboratory work still in hand.
estimated value of uncommitted work	total value of work still to be committed such as purchase orders and contracts still to be placed.
outstanding commitments	value of committed goods and services not yet received, i.e. the difference between cumulative commitments and the value of work done.
project contingency	amount included in the appropriation breakdown to cover small changes in design and engineering unforeseen in the detailed definition. This contingency is not intended for changes of project scope.

site current estimate	best estimate, at the time of reporting, of the final cost of the project, embracing the anticipated ultimate net value of work and the activity allowances.
value of work done (VOWD)	value of goods and services received, regardless of whether or not they have been paid for.
50/50 estimate	estimate which has equal probability of overrun or underrun.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced in this PTS are listed in (4.).

2. PROJECT MANAGEMENT - RESPONSIBILITY AND DIVISION OF WORK

2.1 INTRODUCTION

Project Management is responsible for realising the project according to its defined scope, in time, and at the lowest possible cost commensurate with the required quality of work, all within the agreed project implementation plan and budget. To ensure that the project costs are properly controlled, procedures described in this PTS shall be implemented.

2.2 DIVISION OF WORK AND CONSEQUENT RESPONSIBILITY FOR PROJECT MANAGEMENT AND COST CONTROL

2.2.1 General

Overall cost control is the prerogative of the Principal with whom responsibility and accountability for the authorised capital budget rests.

To avoid any confusion or ambiguity, cost control responsibilities for a project shall be clearly defined and set down in writing before start of project definition.

Furthermore, throughout the various phases of the project clearly defined authorities shall be effective, covering such matters as project scope control, the award of purchase orders and contracts, the approval of changes and the use of contingencies.

2.2.2 Project preparation phase

The Principal shall make funds available to cover project preparation costs as a budget item for initial design and engineering. These costs are spent before the budget proposal for the entire capital investment project is approved. At a later stage, these costs shall be included in the final Budget Proposal.

2.2.3 Implementation phase

During Implementation the field organisation shall be adequately staffed to perform cost control, applying a cost control system which meets the requirements of the Principal.

2.2.4 Project handling

The project execution strategy can vary widely, given the different types of contract forms and negotiable terms. This strategy is often laid down in a project execution plan (PEP) which also deals with the budget, planning, QA, resourcing, etc.

Decisions regarding project handling depend upon the prevailing circumstances (e.g. availability of resources, market conditions, type of project, completeness of design and engineering data) which are not dealt with specifically in this PTS.

3. PRINCIPAL FEATURES OF COST CONTROL

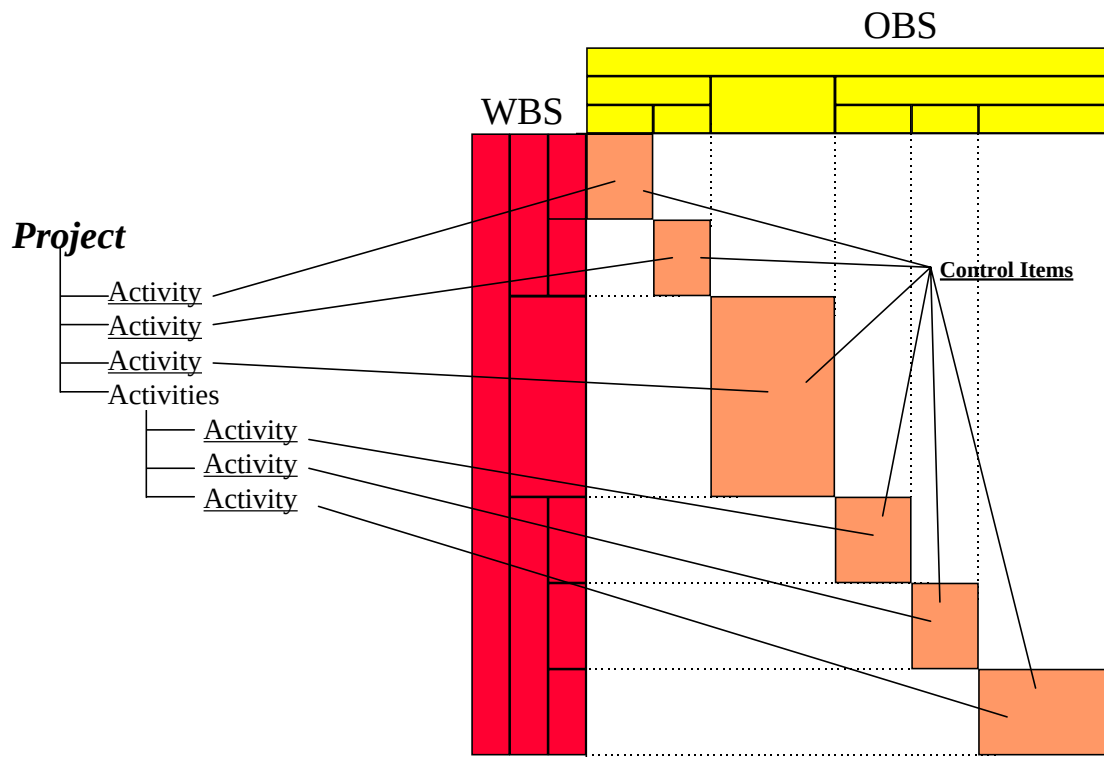
3.1 GENERAL

Cost control during any phase of a project is focused on the registration of deviations and on following trends in order to allow project management to manage and control the project. For this purpose, all project activities shall be broken down into controllable technical items.

3.1.1 Control items

Those controllable technical items, termed "control items", shall be defined in accordance with the technical execution of the work. Two structures are imposed on the activities in order to break them down into control items. First the Work Breakdown Structure (WBS) shall be set up to cover the technical aspects of all activities or parts thereof. The standard PETRONAS coding system is described in PTS 40.10.01.11 Secondly the Organisation Breakdown Structure (OBS) shall be created to cover the organisational aspects of all activities or parts thereof. This breakdown shall be based on the logistical aspects of the projects, e.g geographical location of the work, construction area or contractors working on the project.

Every control item shall be identified by a WBS reference and an OBS reference.



Further details on how to set up to subdivide the project into control items and how to code and group costs are given in [Appendix 1](#).

3.2 BUDGET APPROPRIATION

Cost control shall begin when the Principal signifies its approval of a Capital Budget Proposal which includes a clear and complete definition of the scope and the cost of the project.

The cost of the project approved by the Principal, expressed in its own operating currency, shall be referred to as the "budget appropriation" and shall be fixed unless any change is subsequently authorised according to agreed change control procedures.

Accordingly, the budget appropriation for the project shall be subdivided according to the WBS, the OBS and the required level of detail for the organisation monitoring and reporting of individual control items. This breakdown into control items shall be referred to as the appropriation breakdown.

An allowance shall be integrated into the budget appropriation to cater for unidentified elements of statistically calculated magnitude.

3.3 APPROPRIATION BREAKDOWN

3.3.2 Budget allocation

From the budget appropriation, appropriate amounts shall be allocated to the control items in accordance with the proper execution of the project. The budget allocated to each control item shall consist of two parts:

- 1) Activity estimate, being the estimate of the cost of the activity
- 2) Activity allowance, being the allowance for unidentified elements of an statistically calculated magnitude for this activity.

3.3.3 Contingencies

For a project a **project contingency** shall be included in the appropriation breakdown as a statistical allowance for the costs of incomplete definition, especially small variations in design and execution. It shall appear as such in the appropriation breakdown. This contingency shall not include changes of scope. It shall be used at the sole discretion of the Project Manager and can either be allocated to the various control items as an activity allowance or controlled as an activity estimate of a separate control item.

A **development contingency** shall be included for those sections of the project which are part of a new development. It shall cover possible changes in scope which may result from development work still in hand. It shall appear as a distinct activity allowance allocated to separate control items in the appropriation breakdown exclusively representing changes directly related to those new developments.

The total of all activity estimates, activity allowances and project contingencies should add up to the expected 50/50 estimate of the total project.

Further details on activity allowances can be found in [Appendix 2](#).

3.3.4 Exchange rates

The effect of fluctuating exchange rates upon the value of imported goods and services shall be prevented by adopting "frozen" exchange rates, being those which prevailed when the budget appropriation was approved.

Upon payment of the foreign currency invoices, any difference arising due to variations between current and "frozen" exchange rates shall be recorded separately as an exchange rate variation.

3.3.5 Escalation

When the budget appropriation is prepared for submission, the anticipated escalation of costs shall be estimated and incorporated in the relevant control items.

It is common practice to distinguish the effect of cost escalation as follows:

- Fixed price purchase orders and contracts will include escalation.

- An escalation clause in a purchase order or contract constitutes, in a legal sense, part of the commitment.

In some countries inflation might be high and unpredictable which could cause significant deviation from the forecast. Where such costs are likely to represent an appreciable proportion of the final cost, the escalation part of the commitment should be separately treated for cost control purposes. In such circumstances it may be advisable to maintain the budget in two parts; one in local currency for local expenditures and one in a selected, reasonably stable foreign currency to cover non-local costs, or to report the total project costs in that foreign currency.

3.4 SITE CURRENT ESTIMATE

3.4.1 General

The site current estimate is the latest estimate of the final cost of the project based on Commitments made and outstanding for each of the control items. The first site current estimate shall be identical to the appropriation breakdown. Thereafter, at agreed regular intervals (usually monthly), revised site current estimates shall be prepared on the basis of current and expected commitments (i.e. as and when further information materialises, e.g. engineering contracts awarded, bids for material and equipment received) when on-site work begins.

3.4.2 Commitments

A record of commitments shall be maintained during each of the major phases of a capital project.

The total value of all commitments and any approved additional costs incurred is referred to as the "**cumulative commitments**".

In the monthly up-dating of the commitment report, attention should be paid to changes in the value of orders and contracts which can be foreseen but have not yet been formalised. Especially with "schedule of rates" contracts and other types of contract in which the total commitment value is reported as an estimate instead of a fixed value, the reported commitment value should be subject to regular review and re-estimation.

For each control item, the difference between the cumulative commitments and the value of the work done is the value of "**outstanding commitments**". When updating the commitment report, the value of "outstanding commitments" should be re-assessed in the light of experience with the work already completed.

From the definition it is clear that a commitment is generally derived from a contractual document. Apart from the documents which constitute a contract or purchase order there are other commitments based on the law of the land or generally accepted rules and regulations. Examples of the latter are:

- Freight charges and transport insurance
- Services and utilities provided by public services at published rates
- Custom duties and taxes not included in prices

Where these charges are predictable, an estimate of the value shall be made and entered as a commitment, as soon as the commitment arises. Taxes which are recoverable shall not be included in the value of the commitment.

The assessment of commitment is described in [Appendix 4](#).

The **value of work done** (VOWD) is defined as the value of goods and services received, **regardless of whether they have been paid for or not**. Correctly determined, VOWD is a convenient single parameter by which to assess the cost progress achieved by the reference date. It is arrived at by valuating the work physically completed (physical progress) and the goods and services actually received at site.