BRITISH
COLUMBIA

Value Analysis Guidelines

Provincially Funded Facilities

Capital Division, Treasury Board Staff
Ministry of Finance and Corporate Relations

December 2000 Edition

PREFACE

Treasury Board is the committee of Cabinet, chaired by the Minister of Finance and Corporate Relations (MFCR), responsible for financial matters including project approvals. Treasury Board Staff (TBS) is the secretariat to Treasury Board. The Capital Division within TBS, is responsible for capital projects and reports directly to Treasury Board.

The Capital Division has been tasked with developing standards, guidelines, and cost control mechanisms to ensure that projects proceed on time and on budget, while realizing the maximum value from capital expenditures. The purpose of these Guidelines is to formalize the concept of Value Analysis and its application.

This document will be amended from time to time in light of experience gained.

This version supersedes the July 2000 version.

Table Of Contents

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to:

- formalize the concept of Value Analysis (VA);
- communicate Treasury Board's VA policy;
- specify the Ministry of Finance and Corporate Relations' requirements in conducting VA on provincially funded projects; and
- outline VA procedures and the roles and responsibilities of VA participants.

1.2 Overview

Value Analysis:
VA is an objective and systematic process for enabling the life-cycle costs (using the net present value of all costs, including initial capital plus operating, maintenance, demolition, renovation, and disposal costs) of capital projects to be minimized while functional needs are met. The proposed design is evaluated against the original function it was to address. Alternatives are evaluated from perspectives of cost and functionality. Options that represent the best possible value-for-money are then implemented. In many cases, groups of options or system-wide options need to be evaluated to fully compare alternatives.

Where required on a project, VA is a condition of provincial funding.

Treasury Board Policy:
In July 1995, Treasury Board implemented a policy requiring formal VA(s) to be conducted on provincially funded projects. Since that time, hundreds of projects, including schools, health facilities, colleges, universities, office buildings, ferry terminals and roadways have undergone VA. This policy was updated in 1998. A copy of this policy can be found on pages 11-12.

Ministry of Finance and Corporate Relations (MFCR) VA Requirements:
The VA policy enables Ministries to establish their own policies and procedures for ensuring that VA policy is properly implemented. Section 4 of this document details MFCR's specific requirements for conducting VA.

Procedures, Roles, Responsibilities:
Successful VAs requires a clear understanding and acceptance of procedures, roles, and responsibilities by all parties involved in the process.

Standard VA Proposals

These proposals, found in Appendix A, fulfil two functions. They represent the outcome of life-cycle cost and functional analyses undertaken on past projects, and they are a vehicle to challenge pre-dispositions for certain design ideas and choices that may not result in optimum life cycle costs.

Design teams must endeavour to incorporate these proposals in their designs and specifications or demonstrate at the VA session that the proposed alternatives have superior value-for-money through a functional or life-cycle cost analysis.

Use of Green Buildings Checklist:

The Green Buildings Checklist (available at Project Management) is also to be reviewed as part of every Value Analysis. The items adopted, where applicable and appropriate, should be considered and recorded as additional VAPs.

1.3 Context

VA is a key component of the project cost control and monitoring framework utilized by MFCR (see Figure 1). This framework relies on VA results to update standards and design guidelines, which in turn are reflected in unit rates used to establish project budgets.

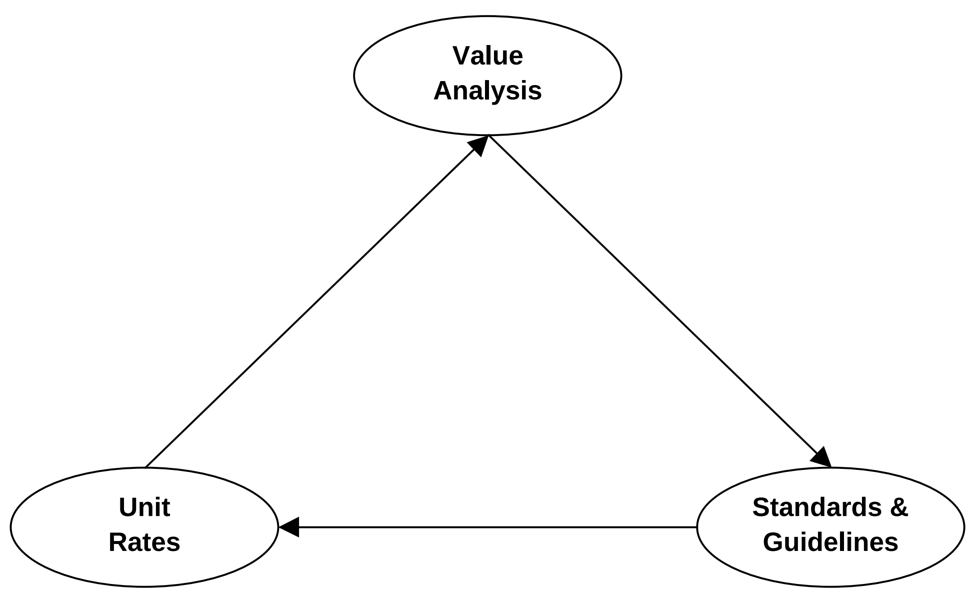


Figure 1: **Cost Control Framework**

2.0 UNDERSTANDING VALUE ANALYSIS

2.1 History

The concept of VA has been around for several decades. It evolved out of the necessity to find substitutions for manufacturing materials that became scarce during World War II. The methodology that preceded today's concept of VA was developed in the early 1950's for the General Electric Company in an effort to improve quality, and reduce the cost of materials and labour in a mass-production setting. Since then, the concept has been applied to military and other industrial hardware settings, and on capital construction projects by various levels of government in North America, Europe, and Japan.

The popularity of VA can be linked to the demand on governments to provide increasing levels of public infrastructure without a corresponding increase in overall expenditures. As a result, all levels of government are looking for innovative ways to do more with less. VA is an important tool for ensuring maximum value on a life-cycle basis.

2.2 Life Cycle Costing

VA is also an important tool for identifying life-cycle cost in the decision-making process for capital projects. Life-cycle costing ensures that all costs over the life of the project are adequately taken into consideration when choosing between alternatives. If life-cycle costing is not used, capital costs (sometimes referred to as first costs) will be used as the sole determinant, which can result in inferior value-for-money decisions (e.g. choosing a slightly less expensive material with much higher maintenance costs).

2.3 What is Value Analysis

VA differs from traditional cost-reduction analysis, which generally focuses on providing smaller quantities or less-expensive materials, in that it provides a methodology for identifying major savings in a facility without compromising value-for-money, reliability, or performance.

It is often argued that this process is inherent in good design; however, in all building projects there are trade-offs between functional requirements and design. This is due to the complex nature of the design process and is particularly evident in large complex projects. The design of a project requires the interaction of many design professionals working under schedule and budget constraints. During the design process, countless variables must be considered, selected, and coordinated under circumstances that limit the consideration of many alternative design options with the potential to reduce costs. For example, efforts taken to stay on schedule and maintain the design budget may minimize the analysis of alternatives that can improve the cost effectiveness of a facility. Likewise, adherence to past practice may increase project costs through the use of a design feature that is outmoded, unnecessary, or inappropriate for the current project. Architectural and aesthetic constraints and/or embellishments may be imposed on a project by participants or outsiders with little or no value-for-money rationale.

If not monitored and controlled, trade-offs between function and design can result in buildings that are more costly and less functional than desired. VA provides that monitoring and control function by providing a critical second look.

VA is typically conducted through a number of workshops involving a representative from each participant group.

2.4 Who Is Involved

VA involves the cooperative participation of a number of players. These include:

- the VA Consultant;
- the design team; including the Cost Consultant;
- speciality consultants, such as energy engineers;
- the project owner (including an operations and maintenance representative);
- facility users; and
- the funding agents.

The workshops involve all of these interests working together to ensure that the final design represents the most efficient combination of cost, performance and reliability. The success of a VA depends on the management and organization skills of the VA Consultant, and the attitude and cooperative spirit of the participants.

2.5 General Responsibilities of Participants

The VA Consultant, who is selected by and responsible to the funding agent, manages all aspects of the VA, and is responsible for achieving the objectives of government VA policy. The VA Consultant organizes and co-ordinates the workshops, records the proposals, and subsequently produces a written report. Unless personally skilled in the applicable design/engineering disciplines, he/she uses a 'shadow' team consisting of various consultants who are experienced in the project type. This team reviews the proposed plans and outline specifications, and identifies/generates potential VA items. Generally, shadow team members attend the workshops only in limited cases where technical or sophisticated program advice is needed at the table in order to minimize the potential for a confrontational atmosphere between consultant teams.

The Design Team consists of the Architect, Engineers, and the Cost Consultant assigned to the project. They are responsible for the design, preparation of documents, cost estimates and life-cycle computations for the VA items. It is the responsibility of the Design Team to ensure that all approved VA items are incorporated into their designs. The Cost Consultant (who is also selected by and responsible to the funding agent) verifies this in writing to the funding agent.

The project owner and users provide valuable programmatic, operations and maintenance input to the workshops. The owner also contracts with the VA Consultant, and fees are paid out of the project budget.

The funding agent is usually the Ministry of Finance and Corporate Relations, although some projects are cost shared. Their role is to monitor the project for compliance with government policies, goals and objectives.

2.6 A Generic VA Approach

A typical VA can be broken down into the following phases:

(1) Information Gathering (VA Preparation)

Data is gathered to answer the following questions:

- What are the approved program requirements?
- What is the approved project scope that fulfils those requirements?
- What is the approved project budget?
- What are the proposed plans / outline specifications?
- What resources are needed for the VA?

- What constraints apply?

During this phase, the VA Consultant reviews the plans and outline specifications, and the Ministry of Finance and Corporate Relations Standard Value Analysis Proposals. Items for further discussion are identified and/or Value Analysis Proposals (VAPs) are generated for introduction at the first meeting. Typically, these include:

- Items that can be made repetitive to reduce production costs.
- Custom items that can be replaced with standard manufactured items.
- Items that are difficult to source locally.
- Areas of design complexity.
- Restrictive design.
- Spare capacity, or capacity for future expansion.
- Areas of potentially high maintenance or operating costs.
- Items with operational unreliability, and potentially obsolete or critical materials.
- Items that have potential for saving sufficient money to pay back the cost.

(2) Idea Generation (the first Workshop)

The VA Consultant, the Design Team, the owner's representative, and the funding agent(s) meet to discuss the VAPs generated by the VA Consultant, and brainstorm possible alternatives that can also satisfy program criteria. All potentially viable VAPs are recorded by the VA Consultant and distributed to the various VA attendees. Estimates are requested from consultants for additional work that may be required in order for the Cost Consultant to assign a cost to certain proposals. The VA Consultant then vets these estimates for reasonableness. VAPs that will likely cost more to evaluate than they will save should **not** be evaluated. VAPs that will likely result in higher life-cycle costs should also be rejected.

Good VAPs can often be generated by asking questions such as:

- Can all or part of a design component be eliminated?
- What else will perform the function?
- Can two functions be combined or be addressed by one solution?
- Is a component too complex, over-detailed, or over-specified?
- Could a standard item be used instead of a custom one?
- What are the operating and maintenance costs of the specified items – are there more efficient alternatives?

(3) Evaluation / Selection (the second Workshop)

When the life-cycle costs of the VAPs are ascertained (typically a maximum of three weeks after the first meeting) the group reconvenes to discuss the results. Each alternative is evaluated to determine:

- If it will satisfy the program requirements.
- Its impact on capital and life-cycle costs.

Based on this analysis, alternatives that offer the best value-for-money are identified and selected for implementation into the design (while staying within the approved total project budget per funding category).

2.7 Timing

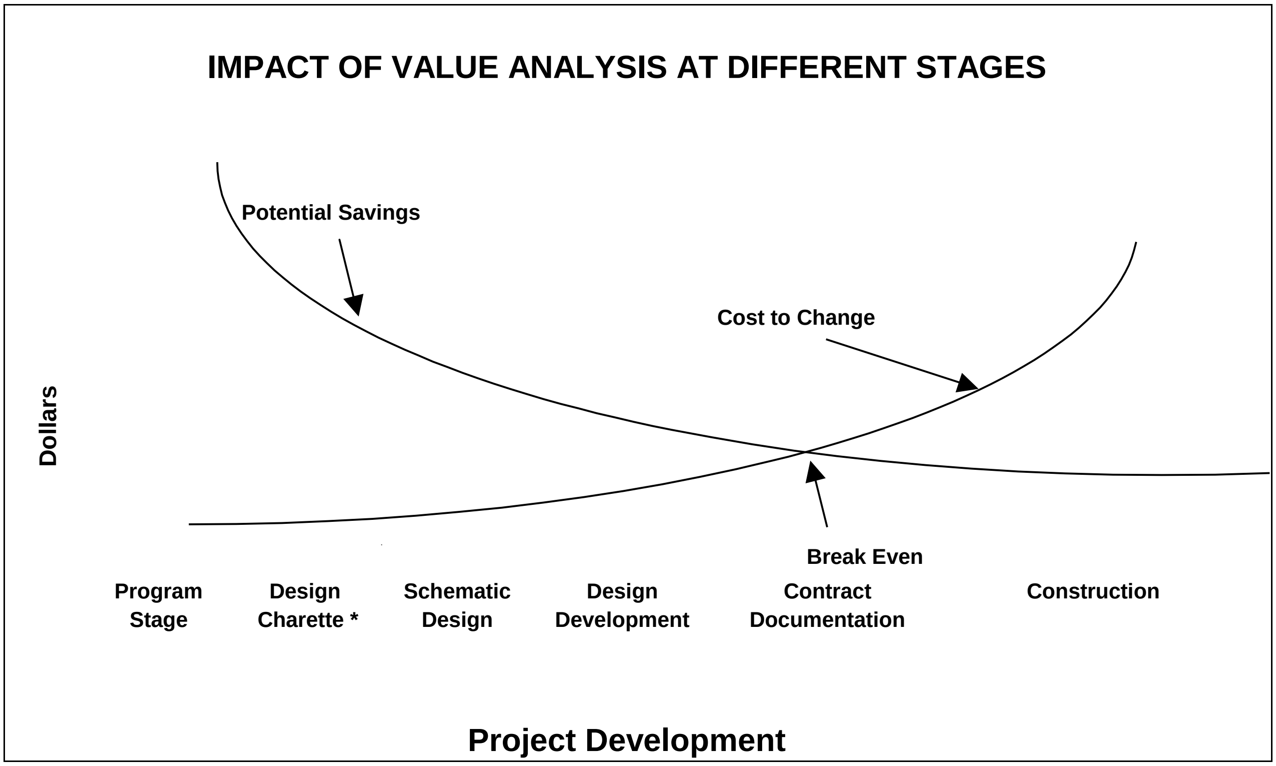
VA can be applied at any point in the design/construction continuum. In general, the earlier that it is applied, the better. To be most effective, VA is applied at a number of points, each focusing on a different aspect of the design. For example:

Timing	Focus
Program Stage	Program requirements
Pre-Design Workshop	[1]Pre-design brainstorm of optimal location and form (used in conjunction with 'Green' design)
Schematic Design	Spatial analysis, selection of basic building systems and site development (also location and massing if no pre-design workshop)
Design Development	System specifics, materials, finishes, Outline Specifications
Working Drawings	Details, Final Specifications

[1] This workshop is sometimes called a "design charette", "gaming" or "options analysis". The process is conducted before drawings or sketches have commenced, and involves the same participants. The team evaluates, on a life-cycle basis, possible siting, shapes and configurations of the new facility. This process is most often done as a part of 'Green' building projects to minimize energy consumption and environmental impact, but it can be used for minimizing any other costs as well.

While it is not necessary to conduct multiple VAs on every project to benefit from the process, the potential for return is determined by the timing of the VA exercise (see Figure 2). In general, the smaller the project, or the less complex, the fewer stages of VA that are needed. In addition, if a project is similar to others that have been subject to VA, fewer VA stages may suffice. For large, complex or unique projects, particularly involving complicated technology, multiple VA stages often yield maximum value-for-money.

Figure 2: **Potential VA Savings**



VA yields the greatest returns when instituted early in the project life-cycle, when basic design choices have not yet been fixed. Some studies show that 80% of total life-cycle costs of a capital project are determined by the time 1% of total project costs are expended (early in Schematic Design).

Early in project development:

- the design team is still considering a relatively wide range of design solutions, so cooperation will be greatest;
- the impact on the project schedule is minimized;
- detailed plans are still in the formative stage, and as a result changing them is less costly; and
- there is less chance that "pride of authorship" will be a stumbling block to the consideration of different ideas.

2.8 Return on Investment

The cost of a VA exercise varies depending on the size of the project and scope of the exercise. One reference cites the cost at between 0.1 percent and 0.3 percent of the total building cost. If implemented early enough in the design process, there can be total savings in the area of 20-40 percent for operating and maintenance budgets, and from 5-30 percent of construction costs.

2.9 Additional Benefits

As previously outlined, the VA process results in lower life-cycle costs and a marked increase in value-for-money. The use of VA on capital projects can provide a number of other benefits. These include:

- providing a forum to review and revise design standards;
- ensuring that all alternatives have been well researched and documented in the search for value;
- providing a defensible justification for a chosen course of action;
- improved appreciation by team members of the concerns and issues of other functional areas or disciplines;
- improved incorporation of sustainable design principles;
- enhanced team work and team dynamics in the design process; and
- better understanding of, and confidence in, the project cost estimate.

2.10 Summary

VA is an important tool for ensuring that function and value are received in exchange for public funds. VA is an organized, creative approach to efficiently optimize life cycle costs. Properly implemented, VA will help to ensure that facilities are built to perform their intended function at the lowest life-cycle cost.

3.0 TREASURY BOARD POLICY

Province of British Columbia

Responsible Agency
Ministry of Finance and Corporate Relations

POLICY FOR CONDUCTING VALUE ANALYSIS ON PROVINCIALLY FUNDED CAPITAL PROJECTS

1 General:

Value Analysis (VA) is a formalized, systematic process in which the scope, design, and material components (and where appropriate, operating equipment) of a capital project (transportation-related or building) are evaluated against the project's intended function. Alternatives are identified and evaluated from the perspectives of cost, reliability, performance and other provincial government requirements. Options which represent the best possible value for money are selected for implementation.

For the purpose of this policy the term *Value Analysis* refers to the range of methodologies alternatively referred to as value management and value engineering.

2 Objective:

The purpose of this policy is to ensure that the life cycle costs (operating and capital) of provincially funded capital projects are minimized while functional needs are met.

3 Policy:

Value Analysis is required on all capital projects to which the province contributes funding when total project cost is $5 million or greater, or when required by Treasury Board and/or the Chair of Treasury Board.

Ministries and taxpayer supported Crown Corporations shall establish procedures which ensure:

- VAs are conducted at the appropriate stage(s) during project planning and design;
- appropriate resources are dedicated to conducting VAs;
- VAs are conducted by independent, qualified consultants;
- the rationale for implementing or rejecting all VA proposals and their associated costs are fully documented; and
- all costs related to VAs are paid out of the project's approved budget by the funding agency or local agency responsible for the project.

As directed by Treasury Board, a specified central agency will conduct audits to verify Ministry and Crown Corporation compliance with the policy and its objectives.

page 1 of 2 *Amendment #2 October, 1998*

Province of British Columbia

Responsible Agency
Ministry of Finance and Corporate Relations

4 Guidelines:

- Where applicable, Ministries and Crown Corporations should establish procedures to ensure VA results are reflected in their facility standards, design guidelines, unit rates and/or any other program, space, design or cost standards or controls in place.
- Ministries and Crown Corporations may establish a lower threshold (i.e. less than $5 million) for conducting VAs.

4.0 MINISTRY OF FINANCE AND CORPORATE RELATIONS' REQUIREMENTS

4.1 General

Consistent with Treasury Board policy, MFCR requires that VA be undertaken on all projects with total project costs of $5 million or greater ($3 million for schools), or as directed by MFCR.

Unless otherwise specified, MFCR requires, at a minimum, VAs to be conducted at the Schematic Design and Design Development stages. Large and/or complex projects may also benefit from additional VA sessions as outlined in Section 2.7. MFCR may require only a single stage VA on certain projects, such as repeat designs.

It is important that the Design Team coordinate their design schedule to allow VAs to be accomplished concurrently with the design so the project's completion is not delayed. It is critical that the Design Team does not proceed with the design beyond the stage being assessed at VA.

The VA Consultant must ensure that all necessary documentation for each VA session is acceptable and complete, and is distributed with ample time to be reviewed by all parties prior to each and every scheduled VA session (see Section 4.6 for more information).

4.2 Life-cycle cost

Alternatives that reduce ongoing costs should be supported through a net present value (NPV) argument, and any VAP that has a positive NPV must be considered. Alternatives that have a payback of 10 years or better should be accepted as they represent good investments. For this purpose, unless otherwise directed, the discount rate is 7.0 percent nominal (4.25 percent real). A proper inflator from a 3rd party source (e.g. BC Stats) should be used for each type of future cash flow.

4.3 Use of Standard VA Proposals

These proposals, found in Appendix A, fulfil two functions. They represent the outcome of life-cycle cost and functional analyses undertaken on past projects, and they are a vehicle to challenge pre-dispositions for certain design ideas and choices that may not result in optimum life cycle costs. Design Teams must endeavour to incorporate these proposals in their designs and specifications, or demonstrate through functional and life-cycle cost analysis at VA sessions that their proposed alternatives provide superior value for money. By providing this information at the VA, MFCR can continue to update guidelines and design standards to ensure that lessons learned on one project are passed onto others.

4.4 Green Buildings Checklist

The Green Guidelines checklist
(available at Project Management) is also to be reviewed as part of every Value Analysis. The items adopted, where applicable and appropriate, should be considered and recorded as additional VAPs.

4.5 Reporting Requirements

The VA Consultant is responsible for preparing a VA Report for *each* VA stage, and for distributing it to MFCR, the facility operator, the Managing Consultant, and the local agency.

The mandatory components of the VA Report include:

1. **Index**

2. **Project Information**
   - Name, Location, Description and Document Stage

3. **Participants List**
   - Name, Company, E-mail Address, and Phone/Fax Numbers

4. **Objectives**
   - *Brief* description of the objectives of the study

5. **Project Budget**
   - Treasury Board approved project budget, as indicated by the source document of the approval.

6. Pre- VA Project Cost Estimate

- A pre-VA cost estimate prepared by the Cost Consultant *including a summary in a table corresponding to the Treasury Board approved budget categories (see item 4.5.7 below).*

- *Note: VA sessions are not capital cost reduction exercises, and must be held only if a project is within budget or within very close proximity to its budget.*

7. Budget Summary Table of Results

A summary of the net capital cost impact (and life-cycle cost) of all VAPs is required, categorized and sub-totalled as follows:

- Land acquisition
- Off-site
- Site Development
- [2]Supplementary Site
- Construction
  - New
  - Renovations
- [2]Supplementary Building

Each cost is to include estimated contractor's overhead + profit, plus applicable GST.

The VAP capital cost subtotals, when subtracted from or added to the pre-VA estimates for the same, easily identify the post-VA estimate per funding category. When verified by MFCR, this also serves as the approved budget per category for the next stage of design.

8. VA Proposal Summary

- A list of all VA Proposals by discipline with a brief description
- Capital cost impact
- Net cost (net of implementing change)
- Operating cost impact
- Payback analysis if the VAP is an investment in lower operating costs (use NPV or express payback in years)
- Status (accepted, rejected or pending)

[2] Supplementary expenses are unavoidable requirements unique to a particular project and site that do not form part of the normal cost of building (e.g.: demolition; asbestos removal, site contamination, etc). MFCR can be consulted to confirm if an item belongs in this category.

- Total net VAP capital savings (or costs) per MFCR funding category (site development, building, etc).

9. Building Component Breakdown Table

Provide a breakdown using a column each for Budget Estimate, VAP Capital Impact and New Estimate. The components to include:

- Architectural
- Structural
- Mechanical
- Electrical
- Landscape
- Siteworks
- Equipment (only applicable to some projects)
- Provide impacts, if any, for these line items also
  - Contingency
  - Escalation

10. Individual VA Proposal Information

Provide the following detailed information on each VAP including:

- Project
- Date
- VAP Number
- Current Design
- VA Proposal
- *Advantages
- *Disadvantages
- *Comments
- Capital Cost Impact
- Design Fee Implication
- *Life-cycle Cost Issues
- Project Schedule Implications (if any)
- Action Required By
- Status of Proposal

11. Spatial Analysis

- Area comparison of the post-VA design to the approved gross area.
- Comparison of net program area total to gross area total.

* Ensure these items are fully addressed and itemized in report

4.6 VA Procedures

4.6.1 Specific Responsibilities

The Value Analysis Consultant

1. Organizes and conducts the VA workshops.

2. A minimum of five working days prior to each VA session, confirms in writing that the project is within budget and meets the intended scope. If the VA Consultant cannot confirm these facts, he/she must postpone the workshop, with notification and explanation in writing to all VA participants.

3. A minimum of five working days prior to all VA workshops, briefs the MFCR Project Analyst, including a general assessment of the project and a review of specific VAPs.

4. Chairs the meetings; leads in idea generation; documents VAPs; coordinates the costing of VAPs (actual costing is done by the Cost Consultant).

5. Minimizes the cost of the VA by:
- Holding the VA in the location of least-cost to the project budget;
- Scheduling consultants so as to minimize their cost to the project (usually by limiting their time at the VA session); and
- In conjunction with the MFCR Project Analyst, limiting the number of attendees at the Value Analysis to those in decision-making or information-providing positions.

6. Reviews proposed VAPs for reasonableness:
- Are all factors pertinent to the cost included;
- Will it cost more to explore this option than it is worth (vets proposed consultant's fees for reasonableness on additional work required to ascertain the cost of certain VAPs; and
- Is the least <u>life-cycle cost</u> solution already known, and would any further analysis be a waste of money?

7. Includes as VAPs the scope of Off-Site, Supplementary Site, and Supplementary Building work, and confirms local DCC charges, if applicable.

8. Tallies the total cost of the VA.

4.6.2 The Design Team

1. Provides appropriate and sufficient documentation drawings to the Cost Consultant and the VA Consultant as requested so VA may proceed in a timely fashion. Provides appropriate drawings for the workshop to clearly explain the project parameters and the intended design.

2. Includes the Cost Consultant as an *integral* member of the team from the outset. Significant design alternatives are costed on an ongoing basis, and those costs are recorded for review and discussion at the VA workshops. The Cost Consultant provides pre-workshop estimates of an accuracy and detail appropriate to the design phase confirming the project remains within its approved budget.

3. Attends the VA workshops; participates in idea generation, and demonstrates how the project responds to programmatic needs yet conforms to government policy, approvals, and guidelines.

4.6.3 Capital Division Representative

Monitors the project for compliance with government policies, goals and objectives, including VA. The Project Analyst is assisted in this duty by the Cost Consultant and VA Consultant who have more in-depth contact with, and greater technical knowledge of, the project.

4.6.4 Responsible Agency, or local agency:

Representatives from the local agency or facility offer insight into: program delivery; practical (user) aspects of design; and life-cycle cost implications (operations and maintenance costs).

APPENDIX A: STANDARD VA PROPOSALS

Introduction

As explained in the VA Guidelines document, these proposals fulfil two functions. They represent the outcome of life-cycle cost and functional analyses undertaken on past projects, and they are a vehicle to challenge pre-dispositions for certain design ideas and choices that may not result in optimum life cycle costs

1.0 Architectural; Structural

- Examine and cost alternate structural systems and combinations thereof (e.g.: wood vs. cast-in-place concrete vs. tilt-up concrete vs. concrete block vs. steel) recognizing building code requirements, such as fire rating and non-combustible construction, where applicable.

- Set the main floor level to minimize required cut and fill, exterior stairs, foundation walls, retaining walls, etc.

- Minimize roof and floor-to-floor heights, consistent with natural ventilation, adequate daylighting, and design considerations for an adaptable structure. Consider sloping the roof to reduce perimeter wall height.

- For tilt-up concrete structures, examine the proposed plan and suggest adjustments that increase the efficiency of this construction method (e.g.: minimize the number of different panel modules that are required).

- Examine alternate exterior wall assemblies. Select the most life cycle cost-effective combination of materials that meets functional requirements and Green design objectives.
- Eliminate exterior wall articulation that is not part of an integrated design strategy proven to reduce life cycle costs (i.e.: cooling loads / size and cost of mechanical equipment.

- Eliminate curved walls, especially those that trigger custom built elements, such as radiating beams and odd sized windows, except where proven not to incur a cost premium.

- Minimize roof parapet height and decorative form.

- Optimize roof overhangs. Balance cost in conjunction with exterior wall assembly, wall orientation (e.g.: south facing), and local climatic considerations.

- Examine the amount of roof insulation and the roof assembly details to minimize work required to seal the building to a high level of airtightness, consistent with an integrated design strategy that considers the roofs' contribution to lower cooling or heating loads, and the size and cost of mechanical equipment.

- Limit the size/extent of entrance canopies & covered walkways to the amount essential to provide shelter for supportable user functions, and to encourage use of alternative transportation to the single-occupant vehicle, such as transit, bicycles, and vehicle pooling.

- Eliminate glazing that is not part of an integrated design strategy to provide adequate daylighting while reducing cooling or heating loads, and the size and cost of mechanical equipment. In particular, examine the amount (area) and specifications of glazing on each exposure (e.g.: north, south, east, west) in conjunction with adjacent interior functional requirements and external shading elements, such as trees or buildings, to optimize the performance of this component.

- Delete sunshades, window eyebrows and lightshelves not forming part of an integrated design strategy proven to reduce the mechanical and electrical systems or loads on a life cycle cost basis.

- Review concrete floor slab thickness and use of reinforcing mesh. Where possible, based on favourable geotechnical data and thermal storage requirements, reduce floor slabs to 100mm.

- Consider the impact of floor finish selection on indoor air quality, and on thermal storage capacity in integrated design strategies that use the floor for heat storage.

- Substitute alternate floor finishes where supported by life cycle costing on an individual project basis:
    - 22 oz. level-loop carpet in lieu of other carpet selections, except where functional requirements necessitate other products (e.g.: some medical care applications).
    - Sheet vinyl goods in selected heavy traffic/wear areas in lieu of ceramic tile
    - Integral colour concrete vs. sheet goods or vinyl composite tile

- Substitute alternate interior wall finishes where possible:
  - Eliminate decorative vinyl wall coverings in favour of painted gypsum wallboard.
  - delete decorative wall panelling in favour of painted gypsum wallboard.
  - limit corner guards & bumper rails to high traffic/wear areas.
  - Wainscoting protection (e.g.: medite) where supported by life cycle cost analysis only.
  - Painted concrete block where supported by life cycle cost analysis.
  - Minimize area and height of ceramic tile wall finish in W/Cs; substitute sheet goods or painted concrete block where life cycle cost-effective.

- Substitute alternate ceiling finishes, or delete them if ceiling structure thermal storage is part of an integrated design strategy:
  - Lay-in tile in preference to painted drywall, except in wet areas, code required applications (e.g.: fire rating), and health care facility resident rooms.
  - Minimize lay-in tile specifications (e.g.: no tegular edge tile; use 2' x 4 ' vs. 2' x 2' tile module).

- Delete decorative gypsum wallboard bulkheads, valences, etc. When lay-in tile is used in conjunction with a ceiling return-air plenum, select tile specifically designed to eliminate release of man-made mineral fibres to the return air stream.

- Eliminate side lights and transom lights to doors, as well as extensive door glazing, in favour of slot windows in doors; unless such glazing is part of an integrated design for natural light penetration to interior spaces supported by life cycle cost analysis.

- Review extent of millwork against functional needs; review millwork specifications.

2.0 Mechanical

- Select mechanical equipment and systems, their capacities and efficiencies, as part of an integrated design strategy that considers the interaction of the buildings' form & envelope with its mechanical and electrical systems. The aim is to reduce heating and cooling loads, the size of installed equipment, and optimize equipment efficiency for the lowest life-cycle cost.

- Substitute 6 L/flush flush tank WCs in staff & common washrooms, in lieu of flush valve.

- Delete perimeter radiation as a secondary heating source (except in severe climates with continuous occupancy adjacent to windows).

- Size primary mechanical plant equipment to satisfy load calculations performed in accordance with ASHRAE Fundamentals Handbook; and limit safety factors for heating and cooling design loads to account for unexpected loads or changes in space usage to 10%. Determine any additional “pickup load” safety factors on engineering analysis that determines the additional loads resulting from transient cool-down or warm-up energy required under normal operation & schedules.
- Substitute floating-point valves in lieu of proportional valves, where proportional flow is not required for control or energy-conservation strategies.

- For Acute Care Health facilities:
  Substitute simple positive/negative air pressure control to Isolation Rooms, in lieu of sensor, digital pressure indicator & control, where energy required to condition air is not increased by simpler control.

3.0 Electrical

- Use “Power Kut” or similar hybrid ballasts, or instant-start electronic ballasts instead of standard conventional magnetic ballasts.
- Reduce numbers or specification of lighting fixtures, without degrading lighting quality or control capabilities.
- Substitute line-power clocks in lieu of central clock system.
- Delete gypsum wallboard lighting valences in favour of less expensive fixture covers (e.g.: sconces)

4.0 Site Work

- Locate the building on the site to minimize length of access roads and service connections, consistent with Green design siting principles.
- Work with existing contours to reduce or eliminate retaining walls; minimize cut and fill.
- Reduce extent of concrete pavers (where storm water infiltration is not a priority); substitute brushed concrete or asphalt.
- Delete curbs/gutters where possible.

- Use landscaping as a design element to reduce building heat loads, where applicable, consistent with Green design principles.

- Reduce car parking to a minimum. Seek relaxation from number required by local authorities in trade for joint use parking, and encouragement of alternate forms of transportation.

- Consider smaller, more natural and informal outdoor play areas versus typical regulation size, irrigated, all-weather playing fields.