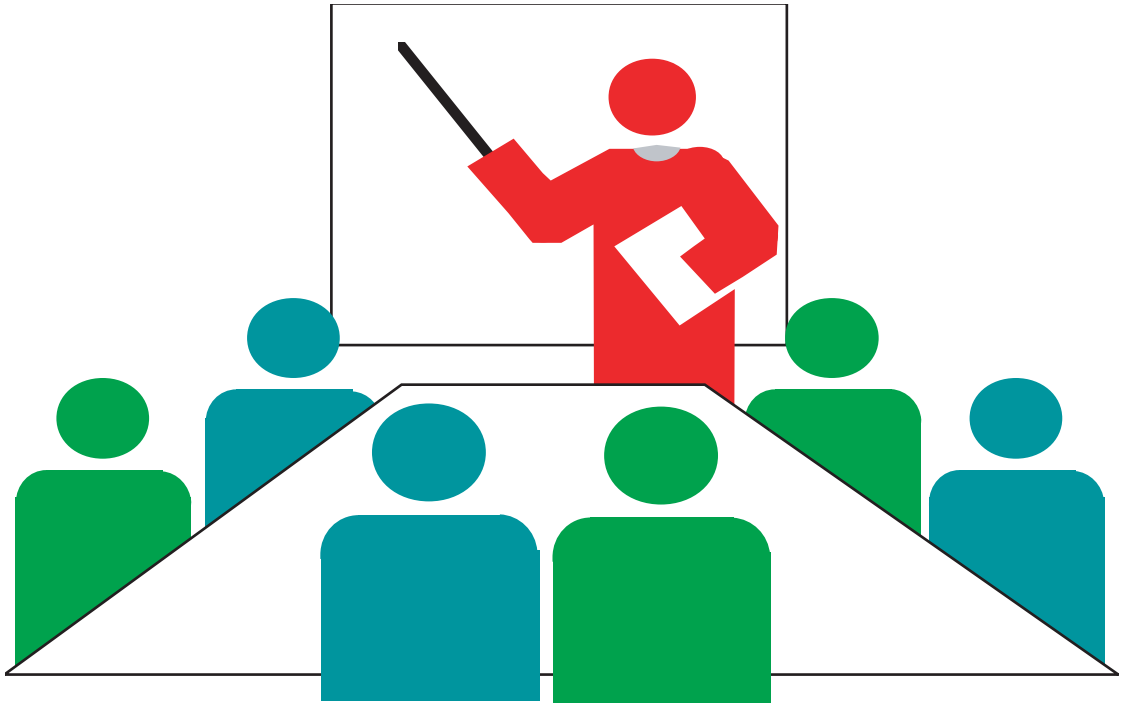
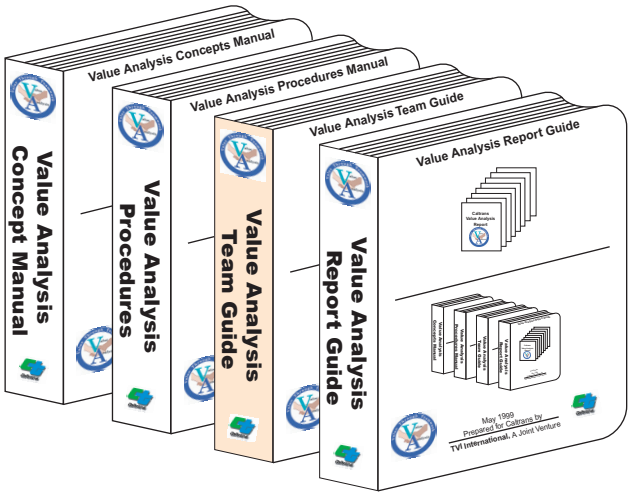
Value Analysis Team Guide





Third Edition
April 2003

State of California Department of Transportation
Division of Design
Value Analysis Branch

Prepared for Caltrans by

VMS
Value Management Strategies, Inc.

State of California Business Transportation and Housing Agency

M e m o r a n d u m

To: District Value Analysis (VA) Coordinators **Date:** April 1, 2003

File: 303

From: **DEPARTMENT OF TRANSPORTATION**
Division of Design
Mail Stop #28

Subject: VA Team Guide / VA Report Guide

The VA Branch is pleased to send you the third edition of the Team Guide and Report Guide. These guides document Caltrans' VA Study requirements. Please share these guides with interested District personnel and make them available to team members during VA studies.

The purposes of these manuals are as follows:

> **VA Team Guide:** Assists the VA Study participants in employing the Caltrans VA Study methodology over the course of the VA Study. The VA team guide includes all of the forms, with instructions, needed to document the VA team activities and the individual VA alternatives. The Third Edition expands on the Caltrans project performance measures, and provides more detail on the study initiation activities and the implementation activities of the VA Study.
>
> **VA Report Guide:** The Report Guide outlines the Caltrans VA Study Report requirements for the VA report writer, including instructions and examples. The Third Edition separates and details the Preliminary Report and the Final Report.

If you have any questions, please call me at 916-653-3538 (CALNET 453-3538).

Sincerely,

GEORGE HUNTER, PE, CVS
Chief, Value Analysis Branch

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FOREWORD

The Team Guide serves as a reference document for the Value Analysis (VA) methodology and as a detailed guide to the preparation of the documentation needed to report the results of a VA Study. See the following VA Reference Documents table for other available information on value analysis.

This Team Guide describes the steps to fill out the preprinted forms during the VA Study, to compile a clear and concise report that will communicate the findings of the VA Study, and facilitate implementation of the VA alternatives.

All pages in this guide printed in italics are specific instructions for the example documents on facing pages. Blank forms for use by VA team members are provided at the end of the Team Guide.

Caltrans Value Analysis Reference Documents Modified April 2003			
		REFERENCE DOCUMENT	
Topic	**Item**	**VA Team Guide**	**VA Report Guide**
Topic	Primary Users	Team Leaders and Team Members	Team Leaders
	Function	Execute Caltrans VA Study Methodology	Document VA Study Results
Introduction	Foreword	X	X
	Reference Documents	X	X
	Overview	X	X
	Activity Chart	X	X
Caltrans VA Methodology	Initiate Study	X	
	Organize Study	X	
	Prepare Data	X	
	Inform Team	X	
	Analyze Functions	X	
	Create Ideas	X	
	Evaluate Ideas	X	
	Develop Alternatives	X	
	Critique Alternatives	X	
	Present Alternatives	X	
	Assess Alternatives	X	
	Resolve Alternatives	X	
	Present Results	X	
Report Preparation	Report Organization		X
	Executive Summary		X
	VA Study Summary Report		X
	VA Alternatives		X
	Project Analysis		X
	Project Description		X
	Idea Evaluation		X
	VA Process		X
Close Out Study	Resolve CA Alternatives		X
	Update Executive Summary		X
	Update VA Study Summary Report		X

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VA PROGRAM OVERVIEW

- **Caltrans VA Policy**
- **VA Applications**
- **VA Activity Chart**

CALTRANS VA POLICY

The Caltrans Project Development Procedures Manual (PDPM), Chapter 19 – Value Analysis, presents the policy and procedures to apply Value Analysis (VA) to highway construction projects and other activities of the department. The applications, roles and responsibilities, and activities necessary to carry out a VA Study are outlined. In summary, the PDPM covers the following topics in five sections:

1. General Policy, Procedures, and Benefits of Value Analysis
2. Value Analysis Annual Program
3. Roles and Responsibilities of District and Headquarters Personnel
4. Integrating VA and the Project Development Process
5. VA Job Plan and Activities

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VA APPLICATIONS

According to the PDPM, the VA process can be equally applied to projects, products (engineering items), and processes as follows:

1. **Highway Construction Projects.** The use of VA to improve the value of projects has been demonstrated in all Caltrans Districts since 1969. Highway VA studies are broken down into two categories:

   - **NHS-Mandated Studies.** Congress signed into legislation Section 303 of the NHS Act, which is elaborated in the Federal Rule (23 CFR Part 627), dated February 14, 1997. The federal rule requires Caltrans to establish a program to assure that VA studies are performed on all federal-aid highway projects on the NHS with a ***total*** estimated cost of $25 million or more. The procedures outlined in the Caltrans VA manuals ensure that VA studies within the Caltrans VA Program are in compliance with the federal mandate for NHS studies.

   - **District-Identified Studies.** The Districts are encouraged to voluntarily identify studies. Some of the criteria that may indicate a need for a study include cost overruns, projects with few alternatives identified, high maintenance cost, controversial projects, projects with difficult construction, operational problems, difficult traffic handling, safety considerations, environmental difficulties, right-of-way concerns, major structures, maintenance, and complex geometrics. In addition, Value Analysis can be used to build consensus among project stakeholders.

   - **VA Studies During Construction.** Projects that have already been awarded may be value analyzed during construction, at the discretion of the contractor, if specified in the construction contract's special provisions, leading to cost reduction incentive proposals.

2. **Product Studies.** The VA methodology can improve the quality of highway products. These are items and systems as described in Caltrans Standard Plans and Specifications. Value Analysis can help identify products that need to be updated due to changing technology, outdated application, or any other changes that affect our standard engineering products. Product studies of modifications to headlight glare screens, concrete barriers, and overhead signs have led to statewide modifications.

3. **Process Studies.** The VA methodology can improve the effectiveness of Caltrans processes, such as policies and procedures and business practices. Process study topics that have benefited from VA studies include workload balancing, project development procedures, intergovernmental reviews, District business plans, information access and distribution, regional strategic traffic operations plans, tort liability claims, maintenance operations, and quality of support services.

VA ACTIVITY CHART

The VA Activity Chart on the following page summarizes the 15 steps required to successfully complete a VA Study. It begins with *Initiate Study* and ends with *Close Out VA Study*. The activities are grouped in three phases:

- **PREPARATION**
  - **Initiate Study** – Identify study project; define study goals; prepare draft study charter and Task Order Initiation Document.
  - **Organize Study** – Conduct preparation meeting; select team members; finalize study charter and Task Order Initiation Document.
  - **Prepare Data** – Collect and distribute data; prepare cost models; develop LCC model.

- **VA STUDY**

  Segment 1
  - **Inform Team** – Receive designer presentation; develop performance criteria; visit project site.
  - **Analyze Functions –** Identify basic functions and cost drivers; prepare FAST diagram.
  - **Create Ideas –** List a large quantity of alternative ideas; use group/individual brainstorming.
  - **Evaluate Ideas** – Evaluate all ideas against performance criteria; rank all ideas.

  Segment 2
  - **Develop Alternatives** – Develop high-ranked ideas into VA alternatives; measure performance.
  - **Critique Alternatives –** Review of alternatives by VA team and Technical Reviewers to develop and ensure team consensus and technical viability. Develop and rate recommended VA alternative set(s).
  - **Present Alternatives –** Give interim presentation of alternatives; prepare preliminary report.

  Segment 3
  - **Assess Alternatives** – Review alternatives; prepare draft implementation decisions.
  - **Resolve Alternatives** – Resolve dispositions; edit and revise alternatives; summarize results.
  - **Present Results** – Give formal presentation of accepted alternatives.

- **REPORT**

  Following the VA Study, the Team Leader assembles all study documentation into the final report:
  - **Publish Results** – Prepare final VA Study Report; distribute printed and electronic copies.
  - **Close Out VA Study –** Resolve open conditionally accepted VA alternatives and update the Executive Summary and VASSR. Provide final deliverables to the HQ VA Branch.

The VA Study is complete when the VA Study Report is issued as a record of the VA team's analysis and development work, and the project development team's implementation dispositions for the alternatives. The VA Activity Chart serves as a guide to the VA Coordinator, the VA team, and the Team Leader, as well as the stakeholders, all of whom are participants in VA studies.

This VA Team Guide outlines the steps necessary for the performance of the VA Study activities (Boxes 4-13). The VA Report Guide focuses on the preliminary and final report preparation that is identified in Present Alternatives (Box 10) and Publish Results (Box 14) activities. It describes how the Team Leader organizes all of the material generated during the study into a VA Study Report.

Caltrans Value Analysis Activity Chart

PREPARATION

INITIATE STUDY
- Identify study project
- Identify study roles and responsibilities
- Define study goals
- Select team leader
- Prepare draft Study Charter

1

ORGANIZE STUDY
- Conduct Pre-Study Meeting
- Select team members
- Identify stakeholders, decision-makers, and technical reviewers
- Identify data collection
- Select study dates
- Determine study logistics
- Update VA Study Charter

2

PREPARE DATA
- Collect and distribute data
- Develop construction cost models
- Develop highway user benefit / life cycle cost (LCC) model

3

VA STUDY

Segment 1

INFORM TEAM
- Review study activities and confirm reviewers
- Present design concept
- Present stakeholders' interests
- Review project issues and objectives
- Identify key functions and performance criteria
- Visit project site

4

ANALYZE FUNCTIONS
- Analyze project data
- Expand project functions
- Prepare FAST diagram
- Determine functional cost drivers

5

CREATE IDEAS
- Focus on functions
- List all ideas
- Apply creativity and innovation techniques (group and individual)

6

EVALUATE IDEAS
- Apply key performance criteria
- Consider cost impacts
- List advantages and disadvantages
- Rate each idea
- Rank all ideas
- Assign alternatives for development

7

Segment 2

DEVELOP ALTERNATIVES
- Develop alternative concepts
- Prepare sketches and calculations
- Measure performance
- Estimate costs, LCC benefits/costs

8

CRITIQUE ALTERNATIVES
- VA Alternatives Technical Review
- VA Alternatives Team Consensus Review
- Identify mutually exclusive groups of alternatives
- Identify VA sets
- Validate performance

9

PRESENT ALTERNATIVES*
- Present findings
- Document feedback
- Confirm pending reviews
- Prepare preliminary report

**Interim presentation of study findings*

10

Segment 3

ASSESS ALTERNATIVES**
- Review Preliminary Report
- Assess alternatives for project acceptance
- Prepare draft implementation dispositions

***Activities performed by PDT, Technical Reviewers, and Stakeholders*

11

RESOLVE ALTERNATIVES
- Review implementation dispositions
- Resolve implementation actions with decision-makers and stakeholders
- Edit alternatives
- Revisit rejected alternatives, if needed

12

PRESENT RESULTS*
- Present results
- Obtain management approval on implemented alternatives
- Summarize performance, cost, and value improvements

**Final presentation of study results*

13

REPORT

PUBLISH RESULTS
- Document process and study results
- Incorporate all comments and implementation actions
- Distribute Final VA Report
- Distribute electronic report to HQ VA Branch
- Update VA Study Summary Report (VASSR)
- Provide HQ the Final VA Report in pdf format

14

CLOSE OUT VA STUDY
(if Conditionally Accepted Alternatives exist)
- Resolve Conditionally Accepted Alternatives
- Finalize VA Study Summary Report (VASSR)
- Finalize Performance Measures
- Finalize VA Report Executive Summary and provide electronically to HQ

15

Note: The dashed boxes indicate steps that ***may*** not be required in some VA Studies.

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VA STUDY
PREPARATION FORMS

Organize Study

- Conduct Pre-Study Meeting
- Task Order Identification
- Study Participants and Schedule
- Data Collection
- VA Study Charging Information

Prepare Data

- Cost Model – Initial Costs
- Original Concept Life Cycle Costs

CONDUCT PRE-STUDY MEETING

The following checklist guides the VA Team Leader through the Pre-Study Meeting. It is important that the Project Manager, stakeholders, DVAC, and others responsible for the success of the VA Study understand their roles and responsibilities to ensure this success. It is also important that the Team Leader accumulate critical information to lead the VA Study effectively. ***Following the Pre-Study Meeting, the VA Team Leader is to provide Pre-Study Task Order deliverables to the HQ VA Branch.***

Understand Process

- ❑ Review VA Study Process
  (Caltrans VA Activity Chart)
- ❑ Discuss Performance Measures Concept, Purpose and Process
  (Develop PM and stakeholder understanding of performance measures)
- ❑ Discuss General Schedule
  (What happens when, and who participates when)
- ❑ Discuss Roles and Responsibilities
  (*Arrangements, identify and validate participants – Caltrans and consultants, VA alternative technical review, ultimate decision makers*

Understand Project

- ❑ Discuss Project Scope and Concept
- ❑ Discuss Need and Purpose
- ❑ Identify which PID/PAD Alternative is the Baseline for the VA Study
- ❑ Identify Project Milestone Dates
- ❑ Identify Key Project Issues and Concerns
- ❑ Identify Goals and Objectives for the VA Study
- ❑ Identify Preliminary List of Performance Measures

Organize Study

- ❑ Identify/Confirm
  - ❍ Study Dates
  - ❍ Study Location
  - ❍ Team Members and Disciplines
  - ❍ Technical Reviewers
  - ❍ On-Call Technical Resources
  - ❍ External Stakeholders
  - ❍ Decision Makers
- ❑ Determine Site Visit Arrangements (Van and Safety Equipment)
- ❑ Obtain Any Missing Information Needed for the VA Study Charter
- ❑ Review Data Collection Checklist and Assign Responsibilities to Provide Necessary Information for the VA Study

VA Report Format

- ❑ Review and Discuss Preliminary and Final Report Content
- ❑ Determine Report Distribution List
- ❑ Identify Who Should Receive Comments on the Preliminary Report

TASK ORDER IDENTIFICATION

The Task Order Identification form summarizes, on one page, the pertinent data about the project and the VA team. This form is started by the DVAC as part of the VA Study initiation document. The VA Team Leader is responsible for completing the form for the study and reporting requirements to document the results of the Pre-Study Meeting. This form becomes the first page of the VA Study Summary Report, which is included in the Final VA Study Report and provided electronically to the HQ VA Branch for inclusion into the VA database of results.

Task Order Identification. *The example one-page Task Order Identification (form T-02-1) identifies:*

- ***Contract No.*** *– VA Contract Manager will insert the Caltrans Consultant Contract number, if appropriate*
- ***Task Order*** *– VA Contract Manager will insert the VA Task Order number, if appropriate*
- ***District*** *– Identify the District in which the project is located*
- ***County*** *– Identify the County(s) in which the project is located*
- ***Route*** *– State Route highway identification number(s)*
- ***KP*** *– Identify the kilometer posts that define the limits of the project*
- ***EA*** *– Identify the project's EA number(s)*
- ***Study Type*** *– Identify the nature of the VA Study: project, product, or process – if it is a project, indicate whether the study is NHS mandated.*
- ***Annual VA Program*** *– Indicate whether this project was part of the Annual VA Program that was submitted to HQ at the beginning of the Fiscal Year*
- ***Project Milestones*** *– Identify the key milestone dates of the project schedule. This information should be readily available on the District's PM Web-site. The month and year of each milestone is sufficient. If a specific milestone is not available, leave it blank.*

Milestone	***Description***
M000	***Identify Need*** *– District identified need and purpose and begins project studies.*
M010	***Approve PID*** *– District approves PID*
M015	***Program Project*** *– Project is programmed as part of workload document.*
M020	***Begin Environmental*** *– District begins Environmental Studies*
M100	***Approve Draft Project Report*** *– District approval of DPR*
M200	***PA&ED*** *– FHWA approval received. Approval to start PS&E.*
M380	***Project PS&E****– District sends completed PS&E to ESC Office Engineer*
M500	***Approve Contract*** *– Caltrans approves construction contract*

Note: Milestone dates are end dates. Do not confuse Milestone numbers with WBS numbers.

- ***Project Description*** *– Briefly describe the project being studied.*
- ***Capital Outlay Support Costs*** *– Insert the cost for the project development for the project.*
- ***Estimated Right-of-Way Cost*** *– Insert the right-of-way cost for the project alternative that is used as the baseline for the VA Study.*
- ***Estimated Project Cost*** *– Insert the construction cost of the project alternative that is used as the baseline for the VA Study.*
- ***Project Purpose and Need*** *– Briefly describe the established purpose and need for the project.*
- ***VA Study Purpose and Objectives*** *– Summarize the reason(s) the VA Study was assembled, and the goals of the study. The focus of the study should support the activities of the current project development phase.*

VA STUDY SUMMARY REPORT TASK ORDER IDENTIFICATION	Caltrans
Project Name: *Example Project*	

TASK ORDER IDENTIFICATION INFORMATION

Contract	Task Order	District	County	Route	KP	EA
53A0020	115	13	NCA	64	51.8/80.8	3917U0
			NCA	64	80.8/90.0	39580K

STUDY TYPE

Highway	X	**Process**		**Product**	
NHS Mandated?	Y				

ANNUAL VA PROGRAM

Study listed on District VA Annual Program? (Y/N)	Y

KEY PROJECT MILESTONE DATES

M000	**Identify Need:**	June 1998	**M100**	**Approve DPR:**	December 2002
M010	**Approve PID:**	April 1999	**M200**	**PA&ED:**	October 2003
M015	**Program Project:**	July 1999	**M380**	**Project PS&E:**	March 2006
M020	**Begin Environmental:**	August 2000	**M500**	**Approve Contract:**	October 2006

PROJECT DESCRIPTION

The project will widen SR 64 from a two-lane conventional highway to a four-lane expressway. The project limits extend from Airport Road in South Paseo, California, to the intersection of SR 14, a distance of about 38 kilometers. The project is being designed with a median width of 18.6 meters, a design speed of 130 km/h, and use of the existing highway as much as possible. Several structures are included. Phase 1 (Western section) is funded through construction, and Phase 2 (Eastern section) is funded through project approval. At Olive Hill Road there is a signalized intersection that will be upgraded with dual left-turn lanes from the mainline. The current estimate for the total project significantly exceeds available funding.

Capital Outlay Support Costs:	$2,640,000
Estimated Right of Way Cost:	$60,387,075
Estimated Project Construction Cost:	$172,534,500

PROJECT PURPOSE and NEED

The purpose of the project as stated in the Project Initiation Document is to increase capacity, reduce congestion, enhance safety, and improve level of service.

VA STUDY PURPOSE and OBJECTIVES

The VA Study will help create new alternatives and refine existing alternatives for the environmental document. By applying the VA process before the start of the technical studies, the environmental work will be better focused. The VA Study will comply with the Federal requirement for value analysis on NHS projects. The VA team will focus on alternatives that would improve operations, maintain or improve safety, reduce costs if possible, and satisfy the local stakeholders. Specific issues the team should address include cut and fill balance within each segment, widening between the river and refinery, and the impact on the river, trucks turning crossing the median especially at the rest area, and the potential to replace the box culvert with a bridge structure.

Example Only

STUDY PARTICIPANTS and SCHEDULE

The Participants and Schedule form summarizes on one page the pertinent data about all of the potential participants in the VA Study, including the VA team, project contacts, team resource advisors, study technical reviewers, and project decision makers. Key study dates are also identified.

This form is also initiated by the DVAC as part of the VA Study Initiation Documents. The VA Team Leader is responsible for completing the form for the study and reporting requirements as a result of the Pre-Study Meeting with the Project Manager, DVAC, and others involved in planning the VA Study. This form becomes the second page of the VA Study Summary Report, which is included in the Final VA Study Report, and it is provided electronically to the HQ VA Branch for inclusion into the VA database of results. The information is delivered to the DVAC for distribution to the VA team.

Since VA studies provide guidance for project management decisions on major state transportation projects, recruited VA team members should be at the **advanced (3)** to **expert (4)** level in their knowledge, tenure, and overall experience in the referenced discipline. Expertise level for all participants except external stakeholders and decision makers should be noted. Expertise levels are defined as:

4 – Expert Level: Sufficient experience to review and critique work developed by advanced level professionals within the specified discipline for a project of similar complexity.

3 – Advanced Level: Sufficient experience to perform advanced quality work within a given discipline independently for a project of similar complexity.

2 – Mid Level: Experienced in providing support level work within a discipline for a project of similar complexity.

1 – Low Level: Less than two years experience within a discipline.

Participants and Schedule. *The example one-page Participants and Schedule (form T-02-2) identifies the key players in the VA process:*

- ***Team Leaders*** *– Identify the VA specialist that is assigned to lead the VA Study. If there is an Assistant VA Team Leader assigned to the project, this person is also identified.*
- ***Study Team Members*** *– Identify the full-time VA Study team members, their areas of specialty, and their level of expertise (knowledge, tenure, and overall experience) in the referenced discipline. Team members needed for the project may include design, traffic operations, traffic planning, construction, structures, hydraulics, environmental, maintenance, geotechnical, and right-of-way.*
- ***Project Contacts*** *– Identify the project technical contacts—typically the Project Engineer and key members of the PDT and the DVAC.*
- ***Team Resource Advisors*** *– Identify any added resources that may be needed to answer project questions or provide additional information. These resources may be requested to sit in part-time with the team to assist in a specialty area of the project where a full-time team member is not available, or to provide added depth to a specialty area.*
- ***Study Technical Reviewers*** *– Identify the technical reviewers that need to be involved in reviewing the VA team's alternatives before the report is produced. At a minimum, this includes the HQ Design Reviewer for the District. Other reviewers may include Structural, Project Development Coordinator, and representatives from Functional Units.*
- ***Project Decision Makers*** *– Identify those who will decide if the VA alternative(s) will be accepted into the project or rejected. The project decision makers typically include the Project Manager, Project Design Engineer Senior, and representatives from the stakeholders (communities or RTP).*
- ***VA Study Schedule*** *– Identify the dates, times, and locations of the key meetings that occur during the VA process. The key meetings include Pre-Study Meeting, Segment 1, Kick-Off Meeting, Segment 2, Technical Review Session, Presentation, and Implementation Meeting.*

VA STUDY SUMMARY REPORT PARTICIPANTS and SCHEDULE	Caltrans
Project Name: *Example Project*	

TEAM LEADERS				
Name	**Organization**	**Discipline/Position**	**Phone/Email**	**Expertise Level ***
Ginger Adams	Value Management Strategies, Inc.	Team Leader	(760) 721-3012	4
STUDY TEAM MEMBERS				
Terry Hodges	Caltrans	Traffic Operations	(855) 555-3664	4
Jeff West	Caltrans	Design	(855) 555-3393	4
Mary E. Campbell	Local Transportation Committee	Chairperson	(855) 555-2888	N/A
Meg Williams	City Representative	Planner	(855) 555-3970	N/A
Steve Dennison	Regional Transportation Agency	Planner	(855) 555-4662	N/A
Mike Ireland	Caltrans	Construction	(855) 555-3111	3
Wendy Weldon	Caltrans	Environmental Planning	(855) 555-3118	3
John Majors	Caltrans	Right-of-Way	(855) 555-3002	3
Graham Fraser	Fraser Engineering, Inc.	Civil/Highway Engineer	(760) 555-3495	4
Mark Creveling	Simon Wong Engineering	Bridge Engineer	(760) 555-6844	3
PROJECT CONTACTS				
Tom Dallas	Caltrans	Project Engineer	(855) 555-3240	N/A
Wendy O'Mally	Caltrans	Design Manager	(855) 555-3681	N/A
TEAM RESOURCE ADVISORS				
Scott Williamson	Caltrans	Maintenance	(855) 555-3269	3
STUDY TECHNICAL REVIEWERS				
Larry Bonds	Caltrans – District 13	Environmental Planning	(855) 555-3801	4
Sherman Stallone	Caltrans – HQ	Senior Bridge Engineer	(855) 555-8248	4
Bruce Patton	Caltrans – District 13	Construction Engineer	(916) 555-9340	4
Alex Fitzgerald	Caltrans – HQ	Traffic	(916) 555-3838	4
PROJECT DECISION MAKERS				
Nevin Samuels	Caltrans – District 13	Traffic	(855) 555-	N/A
Kim Peterson	Caltrans – South Region	Project Development	(855) 555-0971	N/A
Jorge Granola	Caltrans – South Region	Chief - Design II	(855) 555-3860	N/A

VA STUDY SCHEDULE			
Meeting	**Dates**	**Times**	**Location**
Pre-Study Meeting	May 23, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 1	June 13-15, 2000	8:00 – 4:00	D-13 Conference Room
Study Briefing (Kick Off) Mtg.	June 13, 2000	8:00 – 12:00	D-13 Conference Room
VA Study Segment 2	June 20-22, 2000	8:00 – 4:00	Embassy Suites
Technical Review Session	June 21, 2000	1:00 – 3:00	Embassy Suites
Presentation (End of Segment 2)	June 21, 2000	1:00 – 3:00	Embassy Suites
Implementation Meeting	August 8-9, 2000	8:00 – 4:00	D-13 Conference Room

* VA TEAM EXPERTISE LEVELS	
Since VA studies provide guidance for project management decisions on major state transportation projects, recruited VA team members should be mid-level to expert-level in their knowledge, tenure, and overall experience in the referenced discipline. DVACs should contact the appropriate functional managers, well in advance of the study dates, to provide to the VA team individuals with this level of expertise, and begin recruiting for the VA teams. Consequently, DVACs will contact appropriate functional managers well in advance of the Pre-Study Meeting date to ensure the early recruitment of VA team members with the highest level of expertise.	**Expertise Level** 4- Expert 3- Advanced 2- Mid 1- Low

Example

DATA COLLECTION

The VA Study Project Data checklist has been developed based on information that has proven to be necessary on previous VA Studies. While all items are not needed on all studies, this checklist provides a good guide to ensure the essential information is available to the VA team. These items are to be discussed at the Pre-Study Meeting to validate what is necessary and who will provide the data. In some cases, additional information may be identified during the Pre-Study Meeting as necessary for a particular VA Study. If this is the case, add the item to the list and make appropriate assignments. The completed checklist should be provided to the DVAC and others responsible for providing the information within a few days of the Pre-Study Meeting to ensure that everyone is clear on their assignments.

VA Study Project Data. *The example one-page VA Study Project Data (form T-03) identifies the key players in the VA Process:*

- ***Number of Copies*** *– Identify the number of copies of each item appropriate for the VA Study. For some items, each team member will need a copy; for others, the team may share one or two copies.*
- ***Responsibility*** *– Identify who is responsible to provide the item. Responsibility for providing this information is typically one of the PDT members such as the Design Engineer, Project Manager, or Structures Representative. In some cases the DVAC will coordinate this information with the PDT to assure the information is available.*
- ***Due Date*** *– Identify when the information needs to be provided. Some information is needed a week or two before the VA Study starts. Other data is not needed until the first day of the VA Study.*

Note: For this example, the titles or departments were used for responsibility. During the Pre-Study Meeting, the individual name of the person responsible is identified. Also, NA was used for information not applicable to this project.

VA STUDY PROJECT DATA ***Example Project***	**Caltrans**

The Project Development staff, in coordination with the DVAC, collects, copies, and distributes relevant project data necessary to conduct the study.

The project data can include plans, specifications, correspondence, calculations, estimates, and other relevant information available prior to the beginning of the study. The following checklist is provided to facilitate the identification and distribution of project data required for the VA Study. Include additional items of data collection not included on the checklist. At a minimum, the PSR/PR/PSSR and cost estimate should be provided to each VA team member a week prior to the study.

Item	No. of Copies	Responsibility	Due Date
VISUAL AIDS			
• Graphics, such as public displays, showing project details	1	PM	6-13
• Aerials	1	PM	6-13
• Project photographs (Provide electronic copies of digital photos)	1	PE	6-13
• Highway and structure as-built plans (or portions, if extensive)	1	PE	6-13
• Photologs (frame-by-frame movie of the route, by kilometer post)	1	PE	6-13
PROJECT DOCUMENTS			
• Important correspondence and memoranda	1	PM	5-24
• Project work plan	1	PM	5-24
• Project Report (PR) / Project Study Report (PSR) / Project Scope Summary Study Report (PSSR)	10	PE	5-24
• Environmental Documents or Environmental Assessment (EIS/EIR, FONSI/ND,CE) and related technical reports	3	PE	5-24
• Cooperative agreements	1	PM	6-13
• Permits from regulatory agencies	NA		
• Utility plans and encroachments	1	PE	6-13
• Completed plans (1 full-size set and copies of half-size OK)	10	PE	6-13
• Latest project estimates (Please provide most recent and include breakdown by item)	10	PE	5-24
• Right-of-way acquisition information and right-of-way record maps	3	PE	6-13
• Detours and/or staging construction or concepts	3	PE	5-24
• Hydrology/hydraulics information and calculations	1	ESC	5-24
• District Maintenance Records queried by County, Route, and Kilometer Post (last five years) – CCA Data collection item	1	Maintenance	6-13
• Traffic data (AADT, Truck Traffic %, DHV, Directional Split, etc.) – LCCA data collection item	2	Traffic	5-24
• Accident data (last three years – TSAR, Table B and C) – LCCA data collection item	2	Traffic	5-24
STRUCTURES ITEMS			
• Bridge plans (half-size OK)	5	Structures	5-24
• Advance Planning Study(s) and correspondence requesting detailed advance planning study and technical design strategy	5	Structures	5-24
• Retrofit strategy (if applicable) and related correspondence	NA		
• Supplementary bridge reports – LCCA data collection item	NA		
• Sufficiency rating	1	Structures	5-25
• Geological, Soils Report(s) and Foundation Report (including Log of Borings), Seismic Site Data (i.e., ARS Curves)	1	ESC	5-24

Example

VA STUDY CHARGING INFORMATION

The DVAC works with the Project Manager to identify charging information for the VA Study. This information includes accounting charge codes and estimated costs for VA team participation and stakeholder participation. Specific project charge codes for consultant services should be provided if necessary. Collecting this information ensures study time and costs are charged to the correct expenditure authorization codes. The VA Study Charging Information form is used to collect this information. Charging information on this form is assembled by the DVAC and validated by the Project Manager.

VA Study Charging Information. *The VA Study Charging Information (form T-03-2) identifies participants in the VA Study, including the DVAC, Caltrans team members, VA consultant Team Leader, consultant team members, and other Caltrans participants, such as Resource Advisors. Do not include Headquarters staff, such as Design Reviewers or Traffic Reviewers. Each category of participant requires the same basic information.*

- ***EA*** *– Identify the proper Expenditure Authorization Code for the project. Note: Many projects can have multiple EAs, or the VA Study may encompass projects developed under separate EAs that need to be studied from a VA perspective as one project.* ***The Project Manager must provide direction regarding what is to be charged to which EA(s). In some cases, the Project Manager may want to split the charges between EAs.***
- ***FAO*** *– Federal Aid Eligibility and Activity or Object Code. This code has two parts: the Federal Aid Eligibility Code (1 for Federal Aid Eligibility and 2 for State Only Funds), and the Activity Code (the Level 5 WBS Code for the particular project phase). The Object Code is for purchased items. For VA Studies, Activity Codes are defined as:*
  - *150 (PID K-Phase)*
  - *160 (PAD 0-Phase)*
  - *185 (Design 1-Phase)*
- ***MSA*** *– Management System Activity Codes are used to identify expenditures for various Management Reports. These are WBS Level 6 or 7 codes that explicitly define the functional activity. For VA Studies, MSA Codes are defined as:*
  - *1010 for Activity Code 150 (PID K-Phase)*
  - *1020 for Activity Code 160 (PAD 0-Phase)*
  - *1520 for Activity Code 185 (Design 1-Phase)*
- ***Hours*** *– Budgeted hours for all participants under each classification.*
- ***Rate (Average)*** *– Average hourly rate for all participants under each classification.*
- ***Cost*** *– Budgeted hours times the average hourly rate.*
- ***ODC*** *– For the consultant Team Leader or technical team members, other direct costs may need to be budgeted for items such as travel and living expenses, meeting room, and printing and shipping expenses. HQ VA Branch can provide guidance on these values if desired.*

Note: This form is a good tool for the DVACs to use to resource project workplans for the District's VA Annual Programs. However, at that time the information would be more preliminary in nature.

VA STUDY CHARGING INFORMATION

Attachment D

Caltrans

The Project Manager is to identify charging information for the study. Provide the charge codes and estimated costs for VA team participation and stakeholder participation. Provide specific project charge codes for the Consultant Services.

STUDY CHARGING INFORMATION

DVAC Study Charges

EA	FAE	MSA	Hours	Rate (Avg.)	Cost
3917U0 39580K	1-160 2-150	P1020 P1010	30 10	$75	$2,250 $750

Caltrans Team Member Study Charges

EA	FAE	MSA	Hours	Rate (Avg.)	Cost
3917U0 39580K	1-160 2-150	P1020 P1010	300 100	$75	$22,500 $7.500

Caltrans Study Participants Study Charges

EA	FAE	MSA	Hours	Rate (Avg.)	Cost
3917U0 39580K	1-160 2-150	P1020 P1010	400	$75	$30,000

*** VA Consultant Team Leader Study Labor Charges (Includes clerical and other labor costs)**

EA	FAO	MSA	Hours	Rate (Avg.)	Cost
3917U0 39580K	1-160 2-150	P1020 P1010	150 50	$140	$21,000 $7,000

*** VA Consultant Team Leader Study ODC Charges**

EA	FAO	MSA			Cost
3917U0 39580K	1-160 2-150	P1020 P1010			$3,000 $1,000

*** VA Consultant Team Member Study Labor Charges**

EA	FAO	MSA	Hours	Rate (Avg.)	Cost
3917U0 39580K	1-160 2-150	P1020 P1010	90 30	$150	$13,500 $4,500

*** VA Consultant Team Member ODC Charges**

EA	FAO	MSA			Cost
3917U0 39580K	1-160 2-150	P1020 P1010			$1,200 $400

* Consultant fees will be determined at the conclusion of the Task Order.

Note: Based on the cost of the two EAs, the PM determined that the VA Study cost would be split 75% for EA 3917U0 and 25% for EA 39580K

Example

COST MODEL – INITIAL COSTS

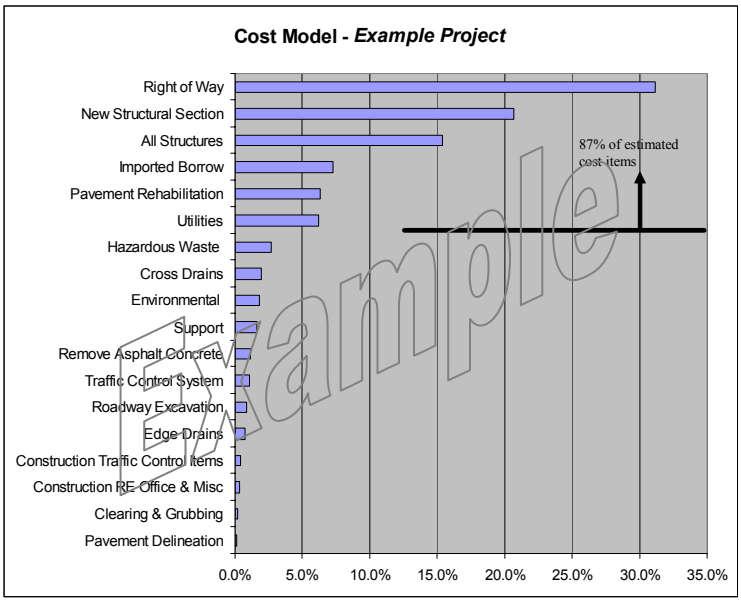
A cost model is a synthesis of the project cost estimate, reducing often-voluminous documents to single pages, making the cost estimate for the project more readily understood. The cost model also highlights the significant cost drivers for a project. By gathering costs into functional descriptions, construction trade categories, or project element groupings, the VA team gains an appreciation for the high cost contributors. The cost model also facilitates the cost/function analysis that occurs later in the VA process. The information in the cost model is organized into a Pareto Chart to make it easier to see which items dominate the estimated cost. Typically, 75%-80% of project cost is in just a handful of items. A sample of a Pareto Chart is shown below.

Cost information used in the Cost Model should reflect estimated items. Costs that are simply percentages of estimated items and mark-up should be separated in this analysis—for example, mobilization, supplemental, contingencies, etc., are typically found in the Roadway Items portion of the estimate.

The VA team may need to adjust the estimate to account for items they identified that may have been missed in the cost estimate. These items are to be discussed with the Project Manager and Design Manager to obtain their consensus that these items should be added to the project cost and to verify that they are not already included in the cost estimate. These items are added as a line item in the cost model.

Cost Model. *The example Cost Model (form T-04) summarizes the project cost information in conjunction with either the Caltrans 6-page cost estimate (PSR estimate) or 13-page (PR and later phase estimate).*

% of Estimated Items Identifies Cost Drivers. *A percentage of the total for estimated cost items is calculated to show the distribution of the project costs and provide the VA team with insight as to the major cost contributors.*



Cost Model - *Example Project*

Item	Quantity	Unit	Unit Price	Cost	% of Total*
Earthwork					
Imported Borrow	780,000	M3	$15	$11,700,000	10.5%
Clearing & Grubbing	1	LS	$375,000	$375,000	0.3%
Roadway Excavation	145,000	M3	$10	$1,450,000	1.3%
Remove Asphalt Concrete	45,640	M	$40	$1,825,600	1.6%
Total Earthwork				**$15,350,600**	**13.8%**
Structural Section					
Pavement Rehabilitation	700,000	M2	$15.00	$10,186,230	9.2%
New Structural Section	1,800,000	M2	$19.00	$33,447,390	30.1%
Total Structural Section				**$43,633,620**	**39.2%**
Drainage					
Cross Drains	1	LS	$3,100,000	$3,100,000	2.8%
Edge Drains	78,000	M	$15	$1,170,000	1.1%
Total Drainage				**$4,270,000**	**3.8%**
Specialty Items					
Construction RE Office & Misc	1	LS	$554,000	$554,000	0.5%
Hazardous Waste	1	LS	$4,300,000	$4,300,000	3.9%
Environmental	1	LS	$2,981,000	$2,981,000	2.7%
Total Specialty Items				**$7,835,000**	**7.0%**
Traffic Items					
Pavement Delineation	1	LS	$259,000	$259,000	0.2%
Construction Traffic Control Items	1	LS	$637,000	$637,000	0.6%
Traffic Control System	1	LS	$1,771,000	$1,771,000	1.6%
Total Traffic Items				**$2,667,000**	**2.4%**
Subtotal				**$73,756,220**	**66.3%**
Minor Items (1)	11%	%	$73,756,220	$8,113,184	N/A
Roadway Mobilization (1)	10%	%	$81,869,404	$8,186,940	N/A
Roadway Addit. Suppl. (1)	8%	%	$90,056,345	$7,204,508	N/A
Roadway Addit. Conting. (1)	25%	%	$97,260,852	$24,315,213	N/A
Total Roadway Items				**$121,576,065**	
Structures					
All Structures	1	LS		$24,887,860	22.4%
Total Structures				**$24,887,860**	
Escalation (16.46%)	17.80%	%	$146,463,925	$26,070,579	N/A
Subtotal Construction Cost				**$172,534,504**	
Right of Way	1	LS	$ 50,387,075	$50,387,075	45.3%
Utilities	1	LS	$ 10,000,000	$10,000,000	9.0%
Support	1	LS	$ 2,640,000	$2,640,000	2.4%
TOTAL COST				**$235,561,579**	

Total cost of Estimated Items	**$111,284,080**	**100%**

(1) Percentage of Total Cost was NOT calculated for Section 6, 7, or 8 costs. Costs for items in these Sections are calculated as a percentage of Roadway Costs and are automatically affected by any changes made within that Section.

** Percentage is of theTotal Cost of estimated items*

Example

ORIGINAL CONCEPT LIFE CYCLE COSTS

Because all of the costs for owning and maintaining a highway facility are accounted for, the analysis of life cycle costs is essential for the full evaluation of competing alternatives. Rather than basing decisions only on initial construction costs, the life cycle analysis shows where the significant costs occur over a 20-year period. Knowing the life cycle costs of two alternatives improves the decision-making process; it is an essential part of the VA process. To facilitate the use of life cycle costing in VA Studies, it is beneficial if an estimated life cycle cost model is developed for the original concept.

Life Cycle Costs. *The example Life Cycle Costs (form T-17) shows calculations for the original and alternative concepts for a 20-year analysis. The terminology and breakdown of the life cycle cost follows the standards set by the Caltrans Economics Branch.*

- ***Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Number*** *– Alternative number as shown on the VA Alternative form*
- ***Page Number*** *– Next in sequence after the Initial Costs page*
- ***Life Cycle Period*** *– Typically 20 years for highway projects—40 years is typically used if the comparison is primarily between structural sections.*
- ***Real Discount Rate*** *– Use Standard Caltrans Real Discount Rate, set by the Economics Planning Branch (nominal discount rate minus inflation), available at the following Caltrans website:* http://www.dot.ca.gov/hq/tpp/planning_tools/Cal-BC.xls
- ***Initial Cost (A)*** *– Total construction costs for original and alternative concepts taken from the Initial Costs form*
- ***Service Life*** *– Actual service life of concept, in years*
- ***Subsequent Annual Cost (B)*** *– As many of the following annual costs as needed:*
  - *Maintenance and Inspection*
  - *Operating*
  - *Energy*
  - *Total Subsequent Annual Costs – Sum of the above three costs*
  - *Present Value Factor –P/A factor as taken from financial tables* $\{P/A = [(1+i)^n-1/1(1+i)^n]\}$
  - *Present Value of Subsequent Annual Costs – Product of the above two figures*
- ***Subsequent Single Costs (C)*** *– As many of the following single costs as needed:*
  - *Rehabilitations – Replacement of items scheduled by year (5, 10, 20)*
  - *Repairs – Repair of items scheduled by year*
  - *Expended Service Life – Accounts for the difference in capital needed to provide a given service life*
  - *Present Value Factor – P/F factor as taken from financial tables* $\{P/F = (1+i)-n\}$
  - *Present Value of Subsequent Single Costs – Sums of individual costs*
  - *Total Subsequent Annual and Single Costs (D)* – Sums of B and C costs*
- ***Highway User Annual Costs (E)*** *– As taken from Life Cycle Benefit-Cost Model (See Caltrans Benefit-Cost Model for details). Note the values are expressed as savings over the "No-Build" condition.*
  - *Accidents*
  - *Travel Time*
  - *Vehicle Operating*
- ***Total Highway User Annual Costs*** *– Sum of above three items*
- ***Total Present Value Cost (A+D+E)*** *– Sum of all above costs*
- ***Total Life Cycle Savings**** *– Difference between original and alternative totals*

LIFE CYCLE COSTS *Example Project*					Caltrans	
TITLE:	Original Concept vs. No Build					
Life Cycle Period	20 Years	Real Discount Rate	4.50%		**NO BUILD**	**ORIGINAL CONCEPT**
A. INITIAL COST					$0	$235,562,000
Service Life-Original	20 Years	**INITIAL COST SAVINGS:**				**($235,562,000)**
Service Life-Alternative	20 Years					
B. SUBSEQUENT ANNUAL COSTS						
1. Maintenance and Inspection ($4,500 vs. $3,000 per lane/kilometer)					$433,800	$578,400
2. Operating (Ramp meters, signals, FSP)					$5,600	$10,000
3. Energy (Pump Station, signals)					$3,800	$4,200
Total Subsequent Annual Costs:					$443,200	$592,600
Present Value Factor (P/A):					13.008	13.008
PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS (Rounded):					**$5,765,000**	**$7,709,000**
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**		**Present Value**	**Present Value**
Rehabilitations - Original	5	15,000,000	0.8025		$12,037,500	
Rehabilitations - Alternative	15	5,000,000	0.5167			$2,583,500
Repairs - Original	15	6,000,000	0.5167		$3,100,200	
Repairs - Alternative	10	2,000,000	0.6439			$1,287,800
Expended Service Life - Original					$0	
Expended Service Life - Alternative						$0
Salvage - Original					$0	
Salvage - Alternative						$0
PRESENT VALUE OF SUBSEQUENT SINGLE COSTS (Rounded):					**$15,138,000**	**$3,871,000**
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)					**$20,903,000**	**$11,580,000**
TOTAL SUBSEQUENT COSTS SAVINGS:						**$9,323,000**
E. HIGHWAY USER ANNUAL COSTS					**Present Value**	**Present Value**
1. Accident						($548,743,000)
2. Travel Time						$18,060,000
3. Vehicle Operating						($42,819,000)
TOTAL HIGHWAY USER ANNUAL COSTS:					$0	($573,502,000)
TOTAL HIGHWAY USER COST SAVINGS:						**$573,502,000**
F. TOTAL PRESENT VALUE COST (A+D+E)					**$20,903,000**	**($326,360,000)**
TOTAL LIFE CYCLE SAVINGS:						**$347,263,000**

Example Only

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VA STUDY
SEGMENT 1 FORMS

Inform Team

- Comments
- Define Performance Rating Measures and Parameters
- Performance Criteria Matrix
- Rating Rationale – Original Concept
- Performance Rating Matrix – Original Concept
- Project Information

Analyze Functions

- Function Analysis
- FAST Diagram
- Dimensioning the FAST Diagram – Cost and Performance to Function Analysis

Create Ideas

- Idea Evaluation

Evaluate Ideas

- Idea Evaluation

VA STUDY – SEGMENT 1

The Caltrans VA Study is conducted in three segments; Segments 1 and 2 are typically 3 days each and are conducted on successive weeks. For small projects, or projects with narrow scopes, the two segments may be conducted in fewer total days within one week.

Segment 1 focuses on developing the team's understanding of the project through discussions with the designer and application of VA analytical techniques. Once the project is clearly understood by the VA team, ideas that could improve the project are identified, then evaluated with respect to specific project criteria. The short list of ideas developed are further analyzed and developed in Segment 2. The VA Study Segment 1 activities include Inform Team, Analyze Functions, Create Ideas, and Evaluate Ideas.

Activity	Purpose
Inform Team	The VA team develops a broad understanding of the project. Stakeholders identify baseline performance measures.
Analyze Functions	Deepens the team's understanding of the project, validates project need and purpose, and identifies where opportunities exist to improve the project.
Create Ideas	Identify ideas that could benefit the project.
Evaluate Ideas	Systematically evaluate the ideas with respect to the stakeholders' performance criteria, and identify those alternatives worthy of a more detailed examination. Identify the team member(s) that will take the lead in developing each concept.

Having these activities grouped together establishes a synergy among the team members and permits the efficient identification of the valid concepts on which the team will focus their efforts during Segment 2

COMMENTS

During the VA Study, District management and project stakeholder representatives observe and participate in the work of the VA team. Comments made by management, technical reviewers, and stakeholders during the Kick-Off Meeting, Technical Review Meeting, VA team's presentation, and Implementation Meeting, are recorded and made part of the documentation for the study. The team members should use these forms to document key management comments and provide them to the Team Leader so that these comments can be acted upon and documented in the VA Study Report. By including these comments in the VA Study Report, the project development team can refer to them for guidance on the selection of VA alternatives for implementation into the project design.

Comments. *The example Comments (form T-21) provides space to record:*

- ***Prepared By*** *– Name of individual making comments*
- ***Organization*** *– Organization or agency with which the individual is associated*
- ***Telephone –*** *Contact telephone number for the individual preparing the comments*
- ***Date*** *– Date comments were made/recorded*
- ***VA Activity***
  - ***Kick-off Meeting*** *– Comments made during the Kick-off Meeting by management and stakeholders.*
  - ***Technical Review*** *– Comments made as part of a technical review*
  - ***VA Presentation*** *– Comments made in response to the VA Presentation (formal or informal)*
  - ***Implementation*** *– Comments made during the VA Implementation Meeting*
  - ***Other*** *– Comments made at some other point during the VA process – identify the activity within the VA process*
- ***Comments*** *– Positive (and negative) feedback to information presented as part of the VA process*

COMMENTS *Example Project*			Caltrans
PREPARED BY	**ORGANIZATION**	**TELEPHONE**	**DATE**
Graham Fraser	Fraser Engineering	760-555-3495	June 13, 2000

VA ACTIVITY

☒ **Kick-Off Meeting** ☐ **Technical Review** ☐ **VA Presentation**
☐ **Implementation** ☐ **Other**_____

COMMENTS:

DDD – Construction: While the project requires a lot of import borrow, there is actually a net export for the project. Due to the construction phasing, the cut is primarily in Phase 1 and the fill is required in Phase 2. It would be beneficial if we could find a way to use the export from Phase 1 in Phase 2, but the construction of these phases is three years apart.

Regional Transportation Agency – Director: Avoiding added right-of-way along Phase 1 is critical due to planned county development along the corridor. This development is critical to the local community. Access points along the route appear to service a relatively low volume of traffic. This will increase greatly over the next 20 years with the planned development in the area, and it is critical that these access points be able to service future demand. This is the largest and most important highway project planned for our region in the foreseeable future.

Example

DEFINE PERFORMANCE RATING CRITERIA AND PARAMETERS

The definition of value is given as: $\textbf{Value} = \frac{\textbf{Performance}}{\textbf{Cost}}$

Value improvement requires improvement in performance and/or cost, where the measure of cost is dollars and the measure of performance is a set of project-specific performance criteria.

Performance measures are an integral part of the Caltrans VA Process. It is important that the performance criteria be well defined and agreed to by the stakeholders at the start of the VA Study, as they will be used throughout the study to identify, evaluate, and document alternatives. They will also be used to report performance improvement at the conclusion of the study.

Typical performance criteria have been developed to provide some level of consistency between studies when similar performance measures are used. It is important that the performance criteria be developed with the participation of the project stakeholders to ensure that the VA alternatives developed by the team reflect what is important to the stakeholders. *Note: Public Acceptance and Stakeholder Consensus are not valid performance measures. Performance measures should address project scope issues. The purpose of the performance measurement process is to accomplish acceptance and consensus based on the facts of the project.*

Determine Performance Criteria. *In conjunction with the stakeholders, the team needs to identify the performance criteria, define the performance criteria, and develop the rating scale for the performance criteria. The development of performance criteria, including clear, concise definitions and rating scale, is critical in making the performance more credible and quantitative. Performance criteria should be a measure of the project scope. Therefore, performance criteria such as* Community Impact *and* Stakeholder Consensus *should not be used, as they are too abstract and difficult to quantify. Start with the standardized list of criteria names in Appendix 1, Section 7, pages 7.3 to 7.11.*

- ***Identify Performance Criteria.*** *For each project, there are typically 5 to 7 performance criteria that are critical to the project. The stakeholders should define these performance criteria. The VA team's participation is primarily to listen and develop an understanding of what is important to the stakeholders. However, frequently some of the team members represent a stakeholder or functional unit and have necessary input into the development of the performance criteria. Refer to Appendix 1, Section 7, for supporting information.*
- ***Define Performance Criteria.*** *It is important that a clear understanding exists regarding each performance measure. For that reason a project-specific definition for each performance measure is developed. Providing a detailed definition of the performance measure will prevent overlap between performance criteria. Refer to typical Caltrans standardized performance criteria in Appendix 1, Section 7.*
- ***Develop Scale to Rate Performance Criteria.*** *The original design and each alternative developed will be rated against the performance criteria using a scale of 1 to 10. To provide realistic and consistent ratings for the performance criteria, a rating scale is developed and documented for each performance measure. The unit of measure selected should be one that allows the rating to be quantifiable, (e.g. level of service, accident rate, number of accidents per mvm, etc.*

The following table illustrates how rating scales might be developed for a typical highway project. Rating scales need to be carefully considered by the VA team and should reflect the project's specific requirements. The unit of measurement could vary, based on the VA team's approach in assessing the performance measures. A qualitative (subjective) rating scale is also valid; however, it is always preferable to use a quantitative (objective) approach where possible.

Performance Rating Criteria and Parameter Scales

Performance Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Mainline Traffic Operations	A measure of the efficiency of traffic operations as they relate directly to the mainline alignment (including on-ramps and off-ramps) based upon a 20-year projected traffic forecast.	10	LOS "A": Volume/Capacity = 0.0–0.30; Free flow – excellent operation
		9	LOS "B": Volume/Capacity = 0.31–0.48; Stable flow – very good operation
		8	LOS "C": Volume/Capacity = 0.49–0.64; Stable flow – good operation
		7	LOS "D": Volume Capacity = 0.65–0.80; Approaching unstable flow – fair operation
		6	LOS "E": Volume/Capacity = 0.81–0.90; Unstable flow – poor operation
		4	LOS "F": Volume/Capacity = 0.91–1.05; Traffic congestion for 15 minutes to 1 hour
		3	LOS "F"; Volume/Capacity = 1.06–1.20; Traffic congestion for 1 to 2 hours
		2	LOS "F": Volume/Capacity = 1.21–1.34; Traffic congestion for 2 to 3 hours
		1	LOS "F": Volume/Capacity = 1.35 or more; Traffic congestion for more than 3 hours

The Appendix includes additional examples of standardized performance measures, along with a possible defined performance rating parameter scale for each.

Note: ***When developing performance criteria, refer to the list of standardized criteria in Appendix 1. The performance criteria listed in Appendix 1 should be used, if applicable, for Program reporting purposes. If you are using these criteria, do not give these established criteria different names.***

Note: ***If the VA team develops any VA alternatives during the study that add functions, the corresponding performance measures need to be considered. If this is the case, the VA team will update and reevaluate the functions, FAST Diagram, and performance measurements accordingly, and review them with the stakeholders during Segment 2 for final acceptance of the performance measure analysis. See Appendix 2 for details.***

PERFORMANCE CRITERIA MATRIX

The Performance Criteria Matrix is used to select the key evaluative criteria to be applied to the creative ideas. Candidate criteria are listed randomly, as contributed by the stakeholders, designer, and VA team. The matrix allows comparison of each criterion with all others in turn. The results give a ranking so that the top four or five criteria can be used to evaluate the creative ideas.

Performance Criteria Matrix: *The example Performance Criteria Matrix (form T-05) demonstrates the results of the criteria selection and prioritization process.*

- ***List Performance Criteria*** *– List the candidate performance criteria in the left part of the form; assign designators (A, B, C). The definitions developed for each performance measure should help to prevent overlapping performance criteria.*
- ***Discuss Pairs*** *– Compare criterion A with criterion B asking, "Which is more important to the project?" Enter "a" in the intersecting box (next to the A designator and above the B designator). Continue for all pairs until the matrix is completed.*
- ***Total Scores*** *– Add the number of times each criterion was selected. Half scores (0.5) result from ties, where performance criteria are judged to be of equal importance.*
- ***Normalize Scores*** *– Calculate percentages for each criterion, rounding off as needed. Criteria not getting a vote will be awarded 3-5 points, with the highest two performance criteria getting adjusted so that the total points equal 100.*
- ***Apply Key Performance Criteria*** *– The highest-ranked performance criteria are used for evaluating the creative ideas. Other performance criteria are included in the performance assessment of alternatives.*

The complete list of weighted performance measures is used for evaluating developed ideas using the Performance Rating Matrix (see pages 3.10 and 3.11).

PERFORMANCE CRITERIA MATRIX *Example Project*	Caltrans

								TOTAL	%
Mainline Traffic Operations	**A**	b	a	a	a	a	a	5.0	24%
Highway User Safety		**B**	b	b	b	b	b	6.0	29%
Access			**C**	c	c	c	c	4.0	19%
Local Traffic Operations				**D**	d	f	d	2.0	10%
Constructibility					**E**	f	e/g	0.5	2%
Environmental Impacts						**F**	f	3.0	14%
Right-of-Way Impacts							**G**	0.5	2%
								21.0	100%

a	More Important
a/b	Equal Importance

Example

RATING RATIONALE – ORIGINAL CONCEPT

The project decision makers and stakeholders develop the performance rating for the original concept as they participate with the VA team in the Kick-Off Meeting on the first day of the VA study. The VA Team Leader documents the rationale for their ratings, which relates to the performance measure scales previously developed.

Rating Rationale – Original Concept. *The example Rating Rationale – Original Concept (form T-07) records performance ratings against the project-specific criteria for the original design.*

- ***Rationale*** *– A summary of the project decision makers' and stakeholders' rationale for the numerical rating in the performance (rating 1-10), as indicated on the Performance Rating Matrix – Original Concept. The more detailed the rationale the better justification for the rating.*

Rating Rationale – Original Concept

Performance Criteria	Rationale
Mainline Traffic Operations	The project upgrades a two-lane highway to a four-lane divided highway, which increases capacity. While there are numerous at-grade intersections and turning movements along this project, there is only one signalized intersection that impacts the free flow of traffic. The majority of the alignment has horizontal and vertical sight distances that meet freeway standards.
Highway User Safety	Changing the roadway from a 2-lane to a 4-lane divided highway reduces the potential for traffic accidents that currently result from passing maneuvers. There are still a number of at-grade crossings and turning movements across oncoming traffic (especially at the shopping center near Olive Hill Road). There is one high-volume signalized intersection near the shopping center.
Access	All local access points are maintained, and the quality of these access points are improved through the addition of turning pockets.
Local Traffic Operations	New signalized intersection with dual left-turn lanes from the mainline and operational improvements to other at-grade intersections will significantly reduce driver wait times to access or cross the State highway.
Constructibility	Construction is complicated by three significant cuts and construction around the refinery, due to the coordination of the oil pipeline relocations and their proximity to the creek.
Environmental Impacts	Significant mitigation is necessary due to the impact on wetlands, hazardous material expected near the refinery, and the appearance and erosion potential of the steep cuts. Habitat and Oak mitigation are necessary due to the steep cuts.
Right-of-Way Impacts	While most of the alignment is within the State's right-of-way, there are several large parcels required due to the urban intersection, large cuts, a section near the refinery, and the interchange at the east end of the project.

Note: The No-Build condition may be rated for applicable criteria as a reference when rating the Original Concept.

Example

PERFORMANCE RATING MATRIX – ORIGINAL CONCEPT

The Performance Rating Matrix compares competing sets of alternatives by applying the weighted performance criteria in a matrix to yield value ratios. VA alternatives are compared to the original concept for the full range of criteria to reach a judgment about their technical feasibility, as well as their acceptability to stakeholders. The matrix is essential for understanding the relationship of cost, performance, and value of the original and VA concepts.

This technique is an all-inclusive and objective means of comparing competing alternative sets; it avoids using a single criterion, such as initial cost or schedule, to judge a new concept. The Performance Rating Matrix is first developed by the VA team and is later validated by the project's decision makers and stakeholders.

Comparing the performance and cost suggests which alternatives are potentially as good as, or better than, the original concept in terms of overall value. Comparison at the value ratio level suggests which alternatives have the best functionality per unit cost, or provides the project with the "best value".

Performance Rating Matrix – Original Concept. *The example Performance Rating Matrix – Original Concept (form T-06) records performance ratings against the project-specific performance criteria for the no-build and original design.*

- ***Performance Criteria*** *– Project-specific performance criteria previously developed on the Performance Criteria Matrix.*
- ***Performance Criteria Weight*** *– Percentage weight developed on the Performance Rating Matrix.*
- ***Concept*** *– No-Build, Original Concept(s). The design alternative that is used as the "baseline" for the VA Study is identified as the Original Concept. In some cases, other design alternatives are rated to identify the relative strengths and weaknesses of those alternatives. When evaluating the Original Concept(s), it may be beneficial to rate the No Build condition for performance criteria related to the project's need and purpose—typically, Operations and Safety criteria. This aids in clarifying the rating of the Original Concept and helps the team understand the ultimate benefit of the planned changes. Since criteria such as Constructibility, Right-of-Way Impacts, and Environmental Impacts are by-products of the design and generally are not impacted by the No-Build configuration, they should not be rated, and the "No Build" condition is* ***not*** *totaled at the bottom of the form.*
- ***Performance Rating*** *– Selected rating on a scale of 1 (low) to 10 (high), based on the measurable scale developed for each criterion. The no-build performance rating can be used as a reference point only for applicable criteria. Criteria such as Environmental Impacts, Constructibility, and Project Schedule are not applicable, as in most cases the no-build would rate a 10 and not satisfy the project's need and purpose.*
- ***Total Performance*** *– Arithmetic product of performance criteria weight and performance rating. No-build is not to be totaled, as it cannot be rated for all performance criteria.*
- ***% Performance*** *– The difference between the total score for the baseline and the total score for the VA alternative, expressed as a percentage increase or decrease.*
- ***Total Project Cost*** *– Estimated cost of the project with the VA alternatives incorporated ($ million). The cost figure should be expressed with the base number to three places in front of the decimal point. For example, $145,562,000 should be expressed as 145.5 in order to have a value ratio in the magnitude of 1 to 10. Generally, this figure should be construction costs and not life cycle costs (especially if performance criteria are represented in the life cycle costs).*
- ***Value Index*** *– Arithmetic division of total project performance by project cost. The value will be between 1 and 10 with two decimal places.*
- ***Percent Value Improvement*** *– Net increase (+) or decrease (-) of value index in percent*

This form is completed later for the ranking of VA alternatives (pages 4.30 and 4.31).

PERFORMANCE RATING MATRIX - Original Concept *Example Project*	Caltrans

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	No Build		2									48
		Original Concept								8			192
Highway User Safety	29	No Build				4							116
		Original Concept						6					174
Access	19	No Build			3								57
		Original Concept							7				133
Local Traffic Operations	10	No Build				4							40
		Original Concept							7				70
Constructibility	2	No Build											N/A
		Original Concept							7				14
Environmental Impacts	14	No Build											N/A
		Original Concept						6					84
Right-of-Way Impacts	2	No Build											N/A
		Original Concept					5						10

Example

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	

PROJECT INFORMATION

Obtaining complete and accurate information is critical to accomplishing a VA study successfully. The information phase includes examining the project documents, as well as receiving complementary data during briefing site visits and team discussions. Team members are encouraged to record their notes for later reference.

Project Information. *The example Project Information (form T-08) provides space to record notes during the Information Phase activities:*

- ***Project Briefings*** *– Note key design assumptions and alternatives presented by the designers and resource advisors. A review of the project documents is done to determine if additional documentation needs to be made available to the team.*
- ***Site Visit(s)*** *– Record salient project features observed during visits to the project site, such as topography, community development, condition of transportation facilities, and environmental issues.*
- ***Project Constraints*** *– List apparent constraints to the design of the project.*
- ***Paradigm Shifts*** *– Note changes in design standards and design philosophy that could improve the project function and costs.*

PROJECT INFORMATION ***Example Project***	**Caltrans**
TEAM MEMBER: Mark Creveling	**DATE:** June 13, 2000

PROJECT BRIEFING(S):

Design engineers for the two segments noted that while the project overall is well balanced from an earthwork perspective, there are significant import and export requirements within each segment. This could significantly increase project cost, depending upon the timing of the construction of the two segments.

SITE VISIT(S):

- Topography (for large cuts) and stream crossings create challenges
- Drainage is an issue that must be addressed in certain project areas
- Cut of the ridge at Chandler Creek
- Can the alignment be shifted further north at the refinery?
- Further erosion of creek on roadway at the refinery
- Rest area will need access from both directions of the divided roadway
- Moving refinery elements will be expensive
- Howard Ranch and golf course impact with a wide median
- Interchange operations and environmental impact
- Majority of earthwork at Solitude to Union, Chandler Creek, and the vineyard
- Pipeline alignment may create need for relocation of pipelines or realignment of roadway
- Construction timing of the three project segments will affect the method of surplus dirt disposal
- Underground storage tank may represent environmental issues (hazardous waste)
- Parking problem – trucks currently use roadside

PROJECT CONSTRAINTS:

- Median width of 18.6 m is perceived to be driving costs up – consider narrowing this width where possible
- Construction staging is challenging, especially on the Western Section
- Excavation and asphalt costs have increased significantly since the original PSR estimates were developed in 1997 and 1998
- Design speed throughout the corridor is planned to be 130 km/hour – in some areas design exceptions will be required for lower design speeds to accommodate curves and sight distance requirements
- Chandler Creek crosses State Route 64 several times
- Refinery plant location is having an effect on the roadway alignment decisions
- The San Andreas Fault and wetlands areas are major factors affecting placement of any interchange at the east junction of State Routes 14 and 64

PARADIGM SHIFTS:

- This project could benefit if the design speed standards were revised from full freeway to expressway standards
- Full freeway standards require excessive cuts and earthwork, and there are no plans to convert to an access controlled freeway in the future

Example

FUNCTION ANALYSIS

Function analysis results in a unique view of the study project. It transforms project elements into functions, which moves the VA team mentally away from the original design and takes it toward a functional concept of the project. Functions are defined in verb-noun statements to reduce the needs of the project to their most elemental level. Identifying the functions of the project allows a broader consideration of alternative ways to accomplish the functions.

The VA Team Leader guides the team through the identification of project functions. The list of functions need not be exhaustive and complete, but thorough enough to provide a good starting point for the development of the Function Analysis Systems Technique (FAST) Diagram.

To determine functions the question is asked, "What does it do?" Typically, the Purpose and Need is queried first to identify the Higher Order Function(s). Then the project design elements are queried, either via a random questioning of the project or by a more methodical analysis of each cost element.

Identifying the type of each function further enhances the understanding of the project functions. Functions are categorized as Basic, Secondary, Required Secondary, Aesthetic, Unwanted, Higher Order, and Assumed. These are described below.

Function Listing. *The example Functions (form T-09) records the following:*

- ***Description –*** *The total project or an individual project element (Project Design Elements)*
- ***Function –*** *An active verb and a measurable noun (Separate Traffic)*
- ***Type of Function***
  - ***B = Basic*** *– Specific work that must be accomplished*
  - ***S = Secondary*** *– Work subordinate to basic function*
  - ***RS = Required Secondary*** *– Necessary for basic function to perform better*
  - ***AS = Aesthetic*** *– Improves appearance or aesthetics; a "sell" function*
  - ***U = Unwanted*** *– Undesirable by-products adding cost to mitigate*
  - ***HO = Higher Order*** *– Objective of project (Need and Purpose) or output; outside scope*
  - ***A = Assumed*** *– Initiator or input; outside scope*

Note: The Function Analysis form is a "work in process" form and is used only to help identify the functions to facilitate the development of the FAST Diagram. It is normally not needed as part of the process documentation.

FUNCTIONS ***Example Project***		**Caltrans** **PAGE NO.** 1 of 1	
ITEM	**FUNCTION**		
Description	**Verb**	**Noun**	**Type**
Project Purpose and Need	Reduce	Fatalities	HO
	Improve	Highway User Safety	B
	Improve	Quality of Life	S
	Improve	Highway Worker Safety	RS
Project Design Elements	Separate	Traffic	RS
	Increase	Recovery Area	RS
	Improve	Sight Distance	RS
	Accommodate	Speed Differential	RS
	Improve	Accessibility	RS
	Control	Access	RS
	Add	Lanes	RS
	Establish	Median	S
	Increase	Capacity	RS
	Preserve	Existing Facility	S
	Protect	Road	S
	Improve	Shoulders	S
	Increase	Horizontal & Vertical Curves	S
	Determine	Right-of-Way	R
	Change	Visual Characteristics	R
	Change	Topography	R
	Minimize	Environmental Impacts	R
	Mitigate	Environmental Impacts	U
	Establish	Footprint	R
	Minimize	Erosion	R
	Relocate	Utilities	U
	Apply	Design Criteria	A
	Stage	Construction	R
	Reduce	Maintenance	R

Function: **Active Verb** **Measurable Noun**

Type: **B = Basic** **S = Secondary** **RS = Required Secondary** **HO = Higher Order** **A = Assumed** **U = Unwanted**

EXAMPLE

FAST DIAGRAM

The Function Analysis System Technique (FAST) Diagram is a logic diagram that arranges the random functions into How? Why? When? relationships. This diagram helps determine the basic and secondary functions, which serve to clarify the functional purpose for the whole project and elements of the project.

The random functions are arranged by selecting a candidate basic function and placing it on the left side of the diagram. By asking *How?* more functions are added horizontally to the right. By asking *Why?* the functional relationships are tested and confirmed to the left. Vertical patterns represent *When?* relationships, or subordinate functions that happen at the same time or are caused by secondary functions.

The FAST diagram stimulates team discussion of the functions for the project under study. There is no perfect, complete diagram; the value of the analysis is that it focuses the team on the essential elements of the project in terms of functions to ensure that less important aspects of the project do not dominate the discussion.

FAST Diagram. *The example FAST Diagram (form T-10) illustrates the arrangement of random functions into a major logic path. The steps to construct the diagram are:*

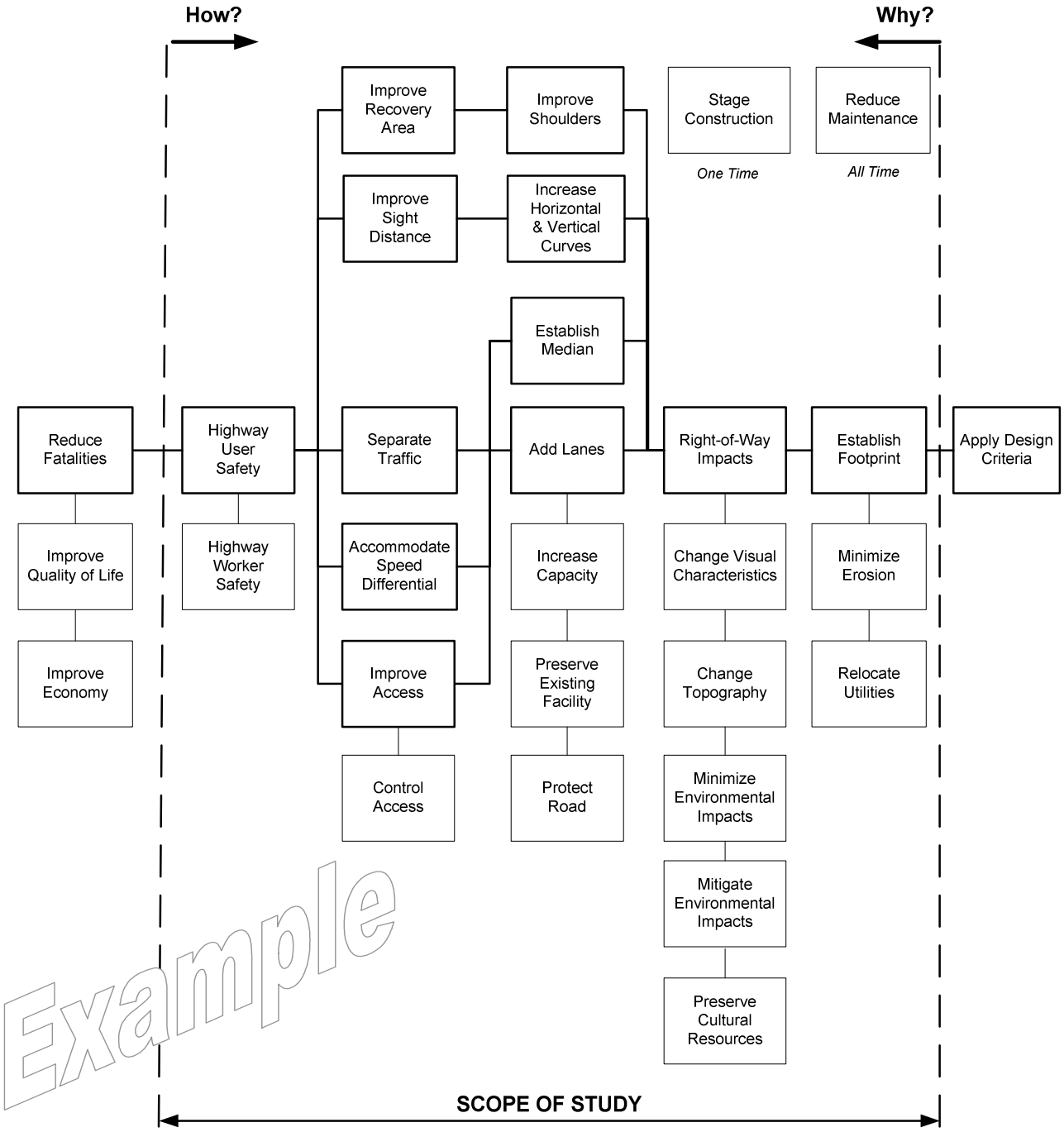
- ***Basic Function*** *– Locate the presumed Basic Function to the right of the left scope line.*
- ***Ask "How?"*** *– Verbalize the question, "How do we (verb-noun)?" or "What work must be done to (verb-noun)?" Place the functional answer to the right. Continue until there is no logical answer to the "How" question.*
- ***Ask "Why?"*** *– Verbalize the question, "Why do we (verb-noun)?" Validate the functional answers to the left. If a pair of functions do not answer the "How?" "Why?" questions, one or both are changed until the logic is sound.*
- ***Ask "When?"*** *– Supporting functions are placed under the critical logic path as responses to "When? or "What happens at the same time as (verb-noun)?", or "What is caused by (verb-noun)?"*
- ***Other*** *– Adding other functions above the major logic path identifies them as "one time" or "all the time" functions, such as design goals or performance criteria. Unwanted functions are highlighted.*

As the VA study proceeds, the FAST Diagram is adjusted to accommodate new understandings of the functional requirements.

Note: All functions identified in the initial lists of functions may not be included on the FAST Diagram, as they could be redundant or considered insignificant by the team. In addition, during the process of developing the FAST Diagram, additional functions may be identified and included on the FAST Diagram.

FUNCTION ANALYSIS SYSTEM TECHNIQUE DIAGRAM

Example Project



DIMENSIONING THE FAST DIAGRAM – COST & PERFORMANCE TO FUNCTION ANALYSIS

In order to identify the functions on which the VA team should focus their efforts to improve the value of the project (increase performance or reduce cost), the FAST Diagram is dimensioned with cost and performance data to show which functions have the greatest influence on the project's performance and cost.

Cost/Function Analysis is a merging of the Cost Model and the FAST Diagram. Assigning costs directly to the functions appearing on the FAST Diagram furthers the function analysis by showing high cost functions, as compared to the high cost items.

Cost/Function Analysis. *The example Cost/Function Analysis builds on the initial FAST Diagram (form T-10) and includes the following additional data. Costs for large highway projects are typically expressed in $ millions.*

- ***Costs*** *from items in the cost model are assigned to functions, either wholly or in estimated portions, beginning from the right side and working to the left side of the diagram. Note that some costs may be split between two or more functions.*
- ***Total Allocated Costs*** *for each function are calculated. Cost figures that are expressed as a sum of function costs for connected functions to the right or below are circled for clarity.*
- ***Percentage*** *of costs can be calculated for the basic functions and shown instead of dollars if desired by the team.*

Performance/function analysis is a merging of the performance measure weight and the FAST Diagram. Assigning these weights directly to the functions appearing on the FAST Diagram furthers the function analysis by showing which functions have the greatest influence on the project's performance characteristics.

Performance/Function Analysis. *The Performance/Function Analysis builds on the FAST Diagram, which has been enhanced with the cost/function analysis. The additional data included in this step of the process is the distribution of the project performance weights to the functions:*

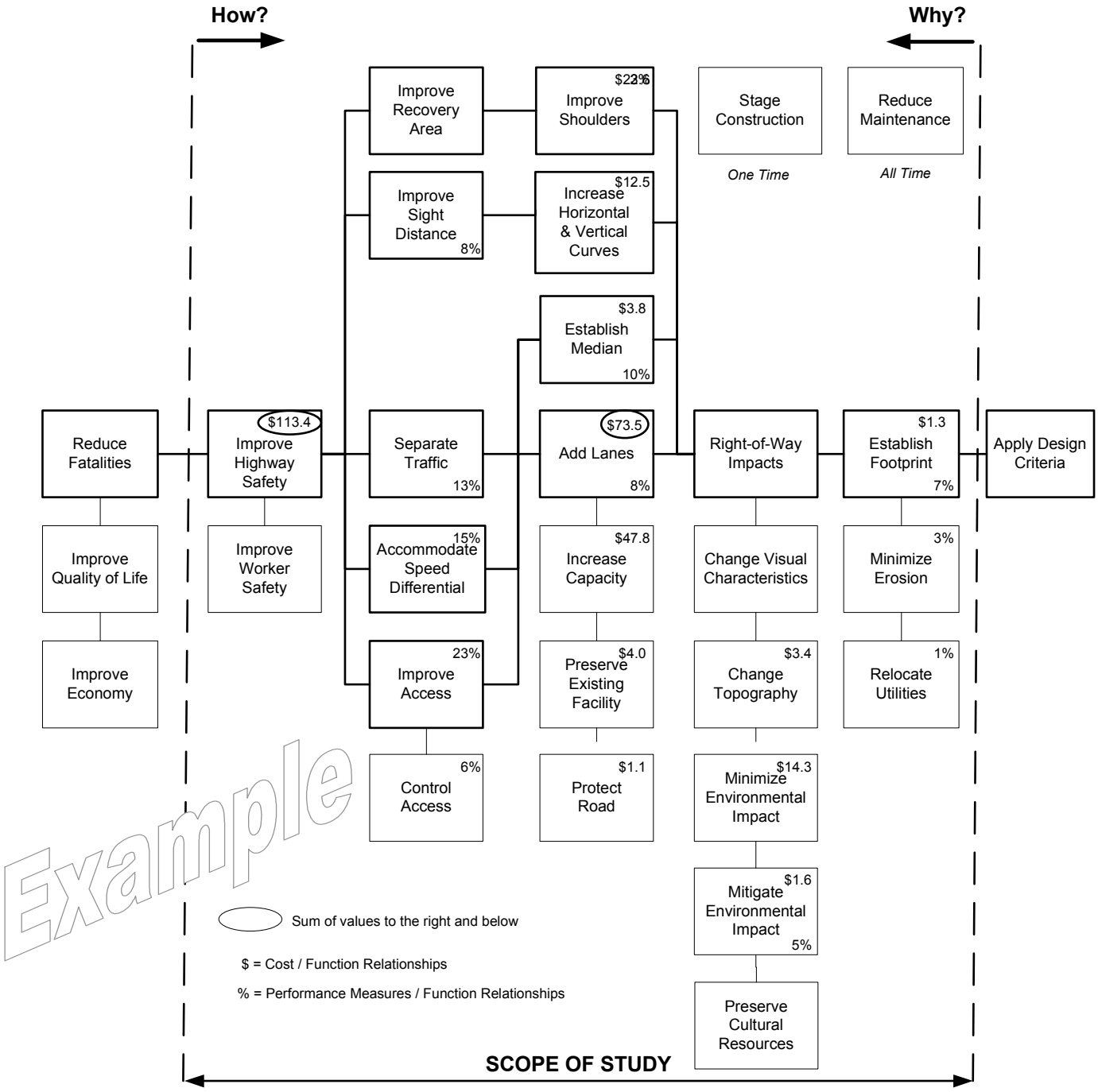
- ***Performance Criteria Weights*** *as determined from the Performance Rating Matrix total 100%. The percentage contribution of each performance measure is assigned to functions, either wholly or in estimated portions. First the team identifies which functions have the greatest influence on a performance measure. Then the team estimates a reasonable distribution for that performance measure's weight among the functions that influence it.*

  Note that some weights may be split between two or more functions and some functions may receive no weight, as the relationship is determined to be insignificant.
- ***Total Performance Criteria Weights*** *for each function are totaled, as a function can influence multiple performance criteria. The total weight developed is placed next to the function on the FAST Diagram.*

By analyzing the results of applying the cost and performance measure weights on the FAST Diagram, the VA team is then able to determine which functions they should focus their efforts on to have the greatest impact on improving the project. This opens the door to creative solutions that would not necessarily be apparent if the approach of seeking cost reductions of project parts were used.

FUNCTION ANALYSIS SYSTEM TECHNIQUE DIAGRAM

Example Project



CREATE IDEAS

The "create ideas" activity involves identifying and listing creative ideas. The VA team participates in a creative session—using group and individual brainstorming techniques—to identify as many means as possible to provide the necessary functions within the project. Judgment of the ideas is not permitted at this point. The VA team looks for a large quantity and association of ideas. The idea list is grouped by function or project element.

Create Ideas. *The example Idea Evaluation (form T-11) records:*

- ***Function*** *– The verb-noun function being brainstormed (Increase Capacity)*
- ***Number*** *– Alpha-numeric designation assigned by function and sequential number (IC-3)*
- ***Idea*** *– The idea as expressed by the VA team; the idea may be modified during discussion and evaluation*

This form may be filled out by a team member during the later evaluation activity to allow full team participation in the creativity session.

IDEA EVALUATION *Example Project*											Caltrans		
Ideas		**Performance Criteria**							**Advantages**	**Disadvantages**	**$**	**Rank**
No.	**Function**											
	INCREASE CAPACITY											
IC-1	Relocate/consolidate/improve at-grade intersections											
IC-2	Have variable median appropriate for topography and location											
IC-3	Undercrossing at Olive Hill Road with interchange											
IC-4	Simplify the 14/64 interchange to an at-grade urban intersection with a light											
IC-5	Build 4-lane conventional highway with no separation											

Example

Ranking Scale: **5 = Significant Value Improvement** **4 = Good Value Improvement** **3 =Minor Value Improvement** **2 = Minor Value Degradation** **1 = Significant Value Degradation or Does Not Meet Project Purpose and Need**

Evaluation Criteria Rating: **Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**

EVALUATE IDEAS

The purpose of the "evaluate ideas" activity is to systematically focus the team's limited time on those ideas that appear most promising for development into VA alternatives that will improve the project. The VA team and stakeholders identified the key performance measures against which the ideas will be evaluated (see previous Performance Rating Matrix). Each idea is tested with respect to these performance measures to determine if it increases or decreases performance and cost as compared to the original concept.

Idea Evaluation. *The example Idea Evaluation (form T-11) records the results of the evaluation discussion. The performance measures are coded (M, S, LA, TO) to facilitate discussion and recording of ratings.*

Performance Criteria. *The VA team, as a group, judges the ideas relative to performance of the functions required. Ideas are rated on a five-point system with a maximum possible rating of a plus two (+2) points, and a minimum of negative two (-2) points:*

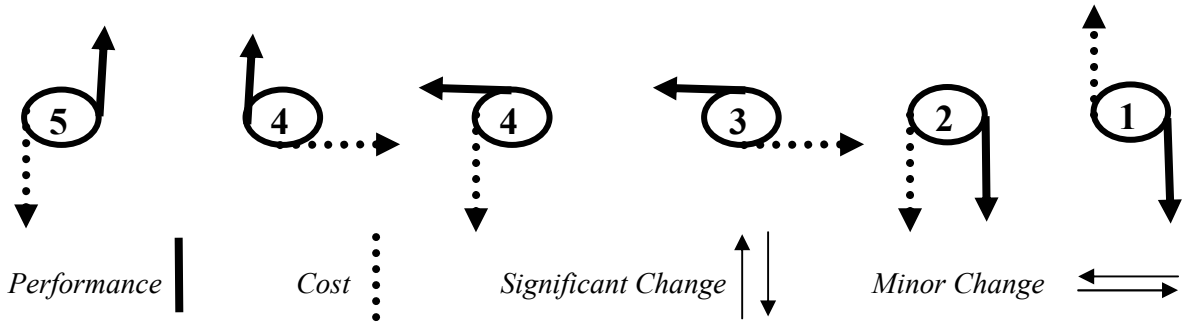
+2 Greatly improved	*0 No significant change*	*-1 Slight degradation*
+1 Some improvement		*-2 Significant degradation*

Advantages/Disadvantages. *Notations on the pros and cons of the idea are made. Complete documentation is essential, both as a record of the team evaluation and as a guide to the future development of the alternatives. Advantages and disadvantages should describe the reason for a ± change in the rating.*

Cost: *Once the idea has been evaluated against the performance measures, the VA team should make a cursory assessment of the idea's potential cost impacts using the same ranking system identified above for performance criteria.*

Rank. *Once each idea is fully evaluated, it is given a ranking number, based on a scale of 1 to 5:*

5 *Significant Value Improvement – Develop as a VA alternative*
4 *Good Value Improvement – Develop as a VA alternative*
3 *Minor Value Improvement – Develop as time permits*
2 *Minor Value Degradation – Do not develop further*
1 *Significant Value Degradation, or does not meet project purpose and need – do not develop further*



Note: During the VA Study, all alternatives developed will be documented on the VA forms. If alternatives are developed and found to have no real cost or performance impact, they may be summarized in the narrative of the VA Alternatives section of the report. The Caltrans Report Guide shows the format if this action is necessary. This is to ensure that the significant alternatives receive proper focus.

IDEA EVALUATION

Example Project

Caltrans

Ideas		Performance Criteria							Advantages	Disadvantages	$	Rank
No.	Function	M	S	A	L	C	E	RW				
	INCREASE CAPACITY											
IC-1	Relocate/consolidate/improve at-grade intersections	0	+2	0	+2	0	0	0	◆ Could reduce environmental impact ◆ Reduces vehicle conflicts	◆ Could negatively impact previously avoided environmentally sensitive areas	0	4
IC-2	Have variable median appropriate for topography and location	0	-1	0	0	+1	+2	+2	◆ Reduces earthwork in large cut areas ◆ Avoids environmentally sensitive areas ◆ Reduces footprint ◆ Reduces right-of-way requirements	◆ Reduces recovery area ◆ Challenges design criteria ◆ Reduces opportunity for future widening	+2	5
IC-3	Undercrossing at Olive Hill Road with interchange	+2	+2	+2	+2	-1	-1	-1	◆ Improves traffic operations ◆ Good sight distance ◆ Improves pedestrian and cyclist safety crossing State Route ◆ Eliminates at-grade intersection ◆ Reduces number of traffic lights ◆ Improves transition to new County bridge	◆ Increases construction cost ◆ Requires additional right-of-way ◆ Hook ramps are generally undesirable ◆ Freeway-type interchange may not match rural area ◆ Hinders bicycle movements on State Route	-1	4

Example

Ranking Scale: **5 = Significant Value Improvement** **4 = Good Value Improvement** **3 =Minor Value Improvement** **2 = Minor Value Degradation** **1 = Significant Value Degradation or Does Not Meet Project Purpose and Need**

Evaluation Criteria Rating: **Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**

M = Mainline Traffic Operations **S = Highway User Safety** **A = Access** **L = Local Traffic Operations**
C = Constructibility **E = Environmental Impacts** **RW = Right-of-Way Impacts**

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VA STUDY
SEGMENT 2 FORMS

Develop Alternatives

- VA Alternative
- Sketches
- Performance Measures
- Assumptions and Calculations
- Initial Costs
- Life Cycle Costs

Critique Alternatives

- Technical Review
- Team Consensus Review
- Update and Reevaluate Functions and Performance (if necessary)
- Group and Number Alternatives
- Rating Rationale – Proposed Alternative Sets
- Performance Rating Matrix – Proposed Alternative Sets
- Summary of VA Alternatives

Present Alternatives

- Present Alternatives
- Comments
- VA Study Evaluation

VA STUDY – SEGMENT 2

Segment 2 of the VA Study focuses on the development and refinement of the VA alternatives. While most of the development and documentation of the VA alternatives are performed by team members with the specific technical expertise necessary to address the issues of the alternative, reviews of the documentation by other team members and Caltrans technical reviewers are performed to ensure thoroughness and the validity of the proposed VA alternative. This segment ends with a presentation of the VA team's preliminary findings to the management team and other project stakeholders.

The VA Study Segment 2 activities include Develop Alternatives, Critique Alternatives, and Present Alternatives.

Activity	Purpose
Develop Alternatives	The high-ranked ideas are developed into VA alternatives, sketches and calculations are prepared, performance is measured, and each alternative's costs are estimated. Life cycle benefits and costs are estimated when appropriate.
Critique Alternatives	The VA alternatives are reviewed by the VA team and technical reviewers to ensure team consensus and technical viability. Mutually exclusive sets of alternatives are developed, and their costs and performance are rated.
Present Alternatives	The team gives an interim presentation of the alternatives, documents feedback from that meeting, and confirms pending reviews.

Upon completion of Segment 2, the VA Team Leader prepares and distributes the Preliminary VA Study Report.

DEVELOP ALTERNATIVES

During the develop alternatives activity, the ideas are developed into workable, alternative solutions.

Each VA alternative is a multi-page write-up of the developed idea or combination of ideas that were highly ranked during the evaluation phase of the study. The documentation includes graphics and calculations, as well as narrative descriptions to communicate the alternative concept without the reader having to refer to outside information. The figure on the following page illustrates the forms that are used and their sequence for a fully developed alternative, including:

♦ **Summary Description**	The original and alternative concepts, advantages and disadvantages, discussion/justification, technical reviewer comments, project management considerations, cost savings, and performance are summarized.
♦ **Sketches**	Graphics for original and alternative concepts.
♦ **Performance Measures**	Summary of non-financial benefits.
♦ **Assumptions and Calculations**	State the assumptions used to determine material quantity or unit cost changes, and show the calculations used to determine the VA alternative quantities or unit costs. The results of these calculations are then used on the Initial Cost worksheet to calculate cost totals.
♦ **Initial Costs**	Estimates of the original and alternative initial costs of project elements affected by the VA alternative.
♦ **Life Cycle Costs**	Total of initial and subsequent costs. These may include annual operational costs, future periodic maintenance costs, and highway user cost impacts.
♦ **VA Team Alternative Review**	VA team review and comments on the alternative.
♦ **VA Alternative Implementation Action**	The Implementation Action forms are completed by the Team Leader and represent the agreements made at the Implementation Meeting.

All of the documentation is transcribed to improve readability and create a permanent electronic record.

Explanations of each form used to document the VA alternatives follow with examples; blank forms are included in the back of this Team Guide. It is recommended that the process of developing the alternatives be completed in the following sequence:

- Conceptualize the design of alternative concept. Sketch the original and alternative concept. (Form T-13)
- Develop and document supporting calculations. Document all major design concept and cost assumptions. (Form T-15)
- Develop initial and life cycle costs (original/alternative). (Forms T-16 and T-17)
- Analyze performance changes. Discuss how the performance measures change, even if the change is not sufficient to change the rating from the original concept. (Form T-14)
- Describe the original and alternative concepts. (Form T-12-1)
- Summarize the remaining items on Form T-12-1 and T-12-2:
    - Identify key advantages and disadvantages
    - Complete the discussion/justification section. Expand on the advantages and disadvantages and conclude why this alternative should be implemented.
    - Outline key activities that need to be considered to implement the alternative.
    - Provide a cost and performance summary on the first page.

VA ALTERNATIVE DOCUMENTATION

A complete VA alternative is a stand-alone document using the following forms:

VA ALTERNATIVE IMPLEMENTATION ACTION

VA TEAM ALTERNATIVE REVIEW

LIFE CYCLE COSTS (1)

INITIAL COSTS (2)

ASSUMPTIONS and CALCULATIONS (1, 2)

PERFORMANCE MEASURES

SKETCHES (3)

VALUE ANALYSIS ALTERNATIVE *Project Name*	**Caltrans**	
FUNCTION:	**IDEA NO.**	**ALTERNATIVE NO.**
TITLE:		**PAGE NO.** 1 of

ORIGINAL CONCEPT:

ALTERNATIVE CONCEPT:

ADVANTAGES :

-

DISADVANTAGES :

-

DISCUSSION / JUSTIFICATION:

TECHNICAL REVIEWER'S COMMENTS:

PROJECT MANAGEMENT CONSIDERATIONS::

COST SUMMARY	**Initial Cost**	**Present Value Subsequent Cost**	**Present Value Highway User Cost**	**Net Present Value**
Original Concept	$	$	$	$
Alternative Concept	$	$	$	$
Savings	$	$	$	$

Team Member:	**Discipline:**	**Performance:**

Notes: (1) Optional, depending on needs of the alternative
(2) Additional back-up sheets may support calculations, and costs
(3) Include original and alternative sketches

VALUE ANALYSIS ALTERNATIVE (Page 1)

The first page of the Value Analysis Alternative is a narrative of the technical and cost data developed during the VA Study. It describes the alternative concept and compares the technical aspects, the performance, and the costs with the original concept. The advantages and disadvantages are also listed.

Value Analysis Alternative. *The example Value Analysis Alternative (form T-12-1) shows the following information:*

- ***Function*** *– The verb-noun function that was the basis of the creative idea (Increase Capacity)*
- ***Idea Number*** *– The alpha-numeric designator assigned to the idea in the creative session. When ideas are combined to form one alternative, the most prominent number is used (IC-3)*
- ***Alternative Number*** *– A numeric designator assigned after the completed alternatives are grouped for implementation during Critique Alternatives phase.*
- ***Page No.*** *– Page number 1 of the set*
- ***Title*** *– The title of the alternative, which may be similar to the original creative idea or modified to reflect later analysis*
- ***Original Concept*** *– Brief description of the original design concept*
- ***Alternative Concept*** *– Brief description of the alternative design concept*
- ***Advantages and Disadvantages*** *– Bulleted listings of both the advantages and disadvantages of the alternative concept to present a balanced analysis*
- ***Cost Summary*** *– Summary of cost comparisons between original and alternative concepts with savings; costs are to be rounded to nearest $1,000.*
- ***Initial Cost*** *– Construction cost, including project development (see Initial Costs, page 4.16)*
- ***Present Value of Subsequent Cost*** *– Maintenance and Inspection, Operating, Energy, Rehabilitations, Repairs, and Expended Service Life Costs (see Life Cycle Costs, page 4.18)*
- ***Present Value Highway User Cost*** *– Accidents, Travel Time, Vehicle Operating Costs (see Life Cycle Costs form)*
- ***Net Present Value*** *– Total of the above three costs*
- ***Team Member*** *– Names of team authors of the alternative*
- ***Discipline*** *– Technical discipline of the team authors*
- ***Performance*** *– Percentage change from the Performance Measures form*

VALUE ANALYSIS ALTERNATIVE *Example Project*		Caltrans	
FUNCTION:	Increase Capacity	**IDEA NO.** IC-3	**ALTERNATIVE NO.** —
TITLE:	Undercrossing at Olive Hill Road with Interchange		**PAGE NO.** 1 of 8

ORIGINAL CONCEPT:

The original concept shows an at-grade intersection at Olive Hill Road. This intersection has a dual left-turn lane and single right-turn lane in each direction on the mainline. The intersection will be signalized to control left-turn movements. This is the only signalized intersection within the project limits.

ALTERNATIVE CONCEPT:

This alternative provides grade separation at Olive Hill Road, with the mainline crossing over Olive Hill Road. A diamond interchange is provided for the westbound on-ramp and eastbound off- and on-ramps. The westbound off-ramp is a hook ramp to the service road near the shopping center. No traffic signals will be required. Stop signs will be sufficient at the end of the on-ramps to control traffic in this area.

ADVANTAGES:

- Traffic operations are significantly improved
- Maintains good access and visibility of the shopping center from the State Route
- Improves access to the residential area serviced by Olive Hill Road
- Improves pedestrian and cyclist safety crossing the State Route
- Reduces traffic conflicts that contribute to local accident concentration
- Eliminates at-grade intersection
- Reduces number of traffic lights on State Route
- Works with all alternatives in PSR
- Minimal increase in environmental impacts
- The Base Realignment already takes the majority of the businesses at the southeast corner
- Improves transition to a new County bridge over the river on Olive Hill

DISADVANTAGES:

- Increases construction cost
- Requires visual impact analysis during the environmental process
- Requires acquiring businesses at the southeast corner
- Freeway-type interchange may not match rural character
- Hook ramps are generally undesirable
- Requires dedication of 1,700 feet of existing SR 67 to the County (frontage road in front of shopping center)
- Hinders bicycle movements on the State Route; requires bicyclists to exit at Olive Hill and reenter the State Route

Example

COST SUMMARY	Initial Cost	Present Value Subsequent Cost	Present Value Highway User Cost	Net Present Value
Original Concept	$ 1,804,000	$ 357,000	$ 34,146,000	$ 36,307,000
Alternative Concept	$ 3,786,000	$ 441,000	$ 0	$ 4,227,000
Savings	$ (1,982,000)	$ (84,000)	$ 34,146,000	$ 32,080,000

Team Member:	Mark Creveling	**Discipline:**	Bridge Engineer	**PERFORMANCE:**	**+15%**

VALUE ANALYSIS ALTERNATIVE (Page 2)

The second page of the Value Analysis Alternative continues the narrative of the technical and cost data developed during the VA study. It includes a discussion that summarizes the justification for the alternative, followed by Technical Reviewer comments and implementation considerations.

Value Analysis Alternative. *The example Value Analysis Alternative (form T-12-2) shows the following information:*

- ***Discussion/Justification*** *– Narrative recapitulation of the information noted above; focus on key technical issues that the alternative resolves; note any standards that are challenged by the alternative. The basic design assumption of the alternative should be discussed here (i.e., geometrics, right-of-way takes, maintenance impacts, etc.). Also explain why the VA team chose to develop the alternative, such as project history and information discovered during the course of the VA Study.*
- ***Technical Reviewer's Comments*** *– Indicate which technical reviewers (Design, Environmental, other) should review the alternative when completed.*
- ***Project Management Considerations*** *– Project management impacts of the alternative; the critical project development steps required for the Project Manager to integrate the alternative into the project.*

VALUE ANALYSIS ALTERNATIVE *Project Name*		Caltrans	
TITLE:	Undercrossing at Olive Hill Road with Interchange	**ALTERNATIVE NO.** —	**PAGE NO** 2 of 8

DISCUSSION / JUSTIFICATION:

The grade separation would provide a significant improvement to traffic operations (service) on the mainline, and it would correct conditions that contribute to an above statewide average accident rate in this area. This is the main area within the entire project limits with a high accident concentration rate. This alternative maintains good access and visibility to the shopping center, which is important to the local merchants and residents. Elimination of the signalized intersection will improve local traffic circulation patterns, reduce travel delays, and reduce conflicts between residential traffic and regional truck traffic.

The State Route is a major bicycle route in the area, and the grade separation will require bicyclists to exit and reenter at Olive Hill to avoid conflicts with motorists at the on- and off-ramps. The geometrics of the ramps are based on a similar interchange recently constructed in an area with similar terrain.

The project scope improvements associated with this alternative should justify the increase in project cost.

TECHNICAL REVIEWER COMMENTS:

To be completed during Critique Alternatives Phase

Example

PROJECT MANAGEMENT CONSIDERATIONS:

Perform a complete evaluation to accurately determine traffic benefits, costs, and the environmental impact of this alternative. This study only looked at the immediate interchange area. The alignment may have impacts beyond that need to be studied.

During the Draft PR phase, determine if a full diamond is viable at this location, and identify the cost and environmental impacts.

SKETCHES

The next page(s) of the Value Analysis Alternative is for sketches. Graphic information supports the narrative description of the alternative concept, as well as the listed advantages and disadvantages.

It is important that the VA alternatives be stand-alone documents so the reader can grasp the salient points of the concept without referring to other information. Sketches accelerate understanding and facilitate decision making.

Two sketches are preferred, one showing the original concept and a second showing the alternative concept. Showing both the current concept and the alternative concept aids in the communication of what is changing. Hand-drawn sketches are acceptable when copies of available drawings are not available. The sketches may be scanned into an electronic memory to be part of the report file.

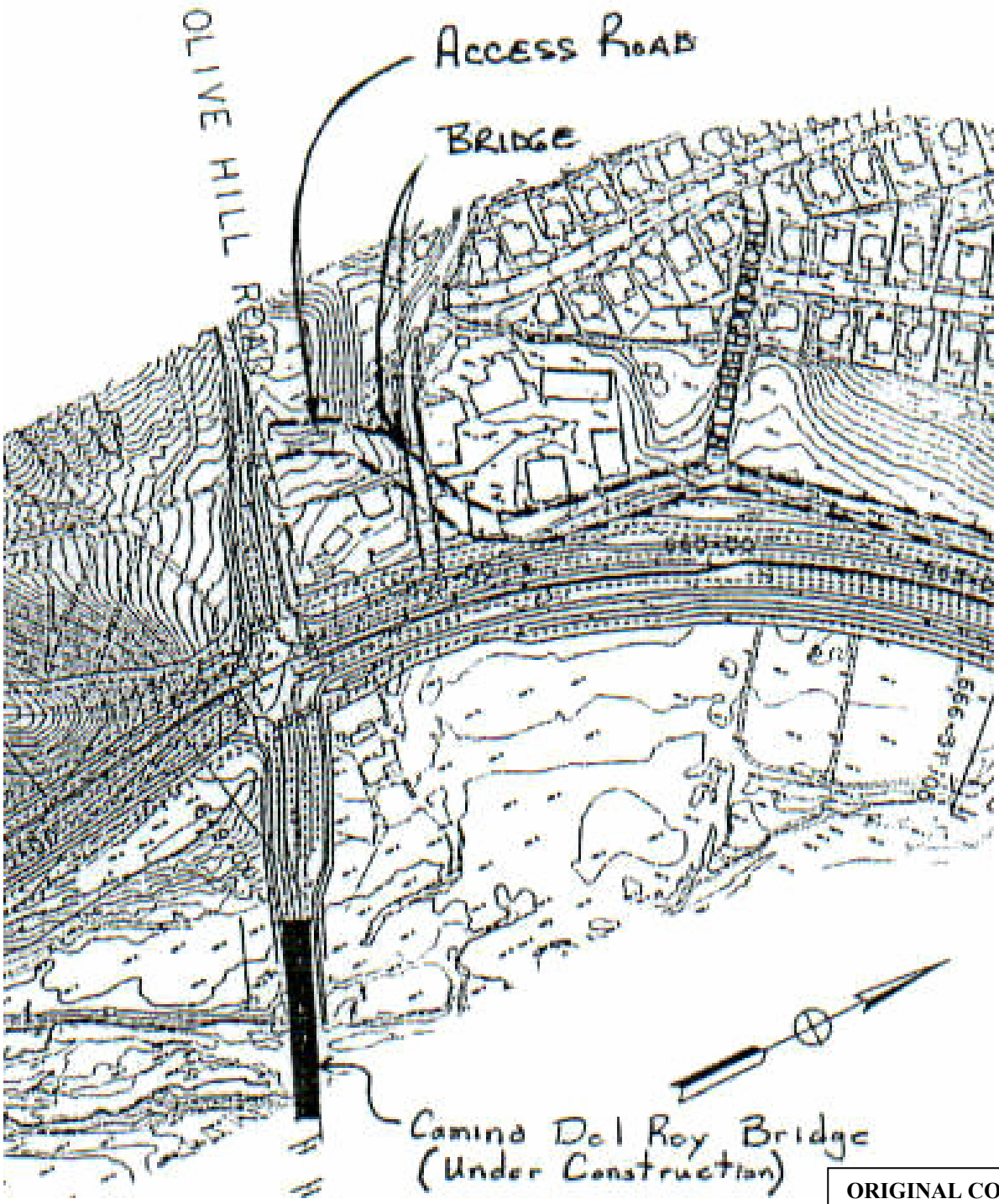
Most sketches are reproduced as single pages in black and white in the VA report. When color sketches are needed (e.g., to depict complex highway layouts), color reproductions are made to retain the color-coded information. When larger sketches are needed for large project elements, fold-out pages are included in the report.

Sketches. *The example Sketches (form T-13) shows two separate sketches for both the original and alternative concepts:*

- ***Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Number -*** *Alternative number as shown on the VA Alternative form*
- ***Page Number*** *– Next in sequence after the VA Alternative form*
- ***Sketches*** *– The original concept as one sketch and the alternative concept as another sketch. For plan views, a north arrow helps orient the drawing*

Note: Current and alternative sketches may be shown on the same page, as long as the detail is clear.

SKETCHES ***Example Project***	**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** —	**PAGE NO.** 3 of 8



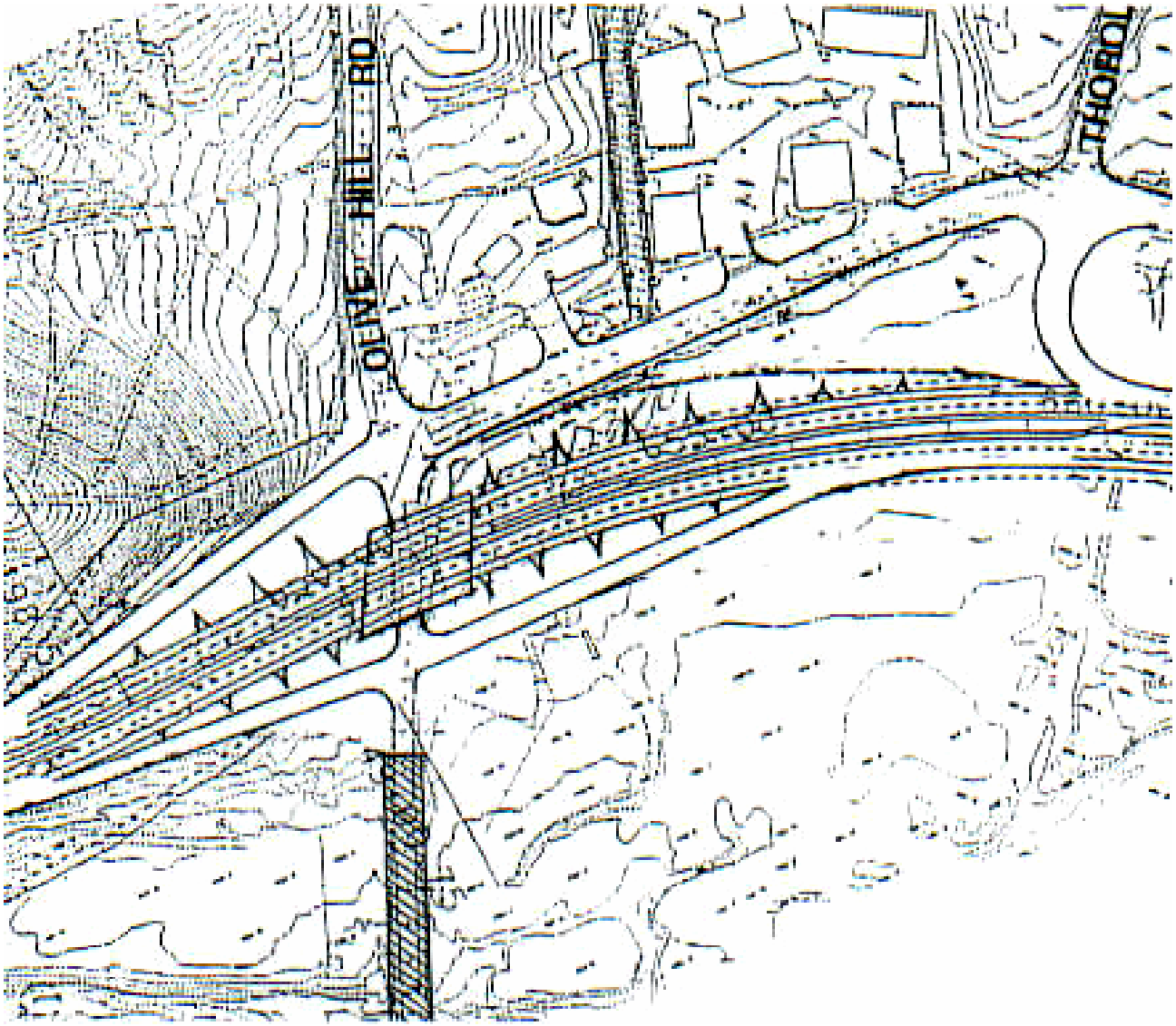
ORIGINAL CONCEPT:
At-Grade Intersection

Example

SKETCHES *Example Project*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** —	**PAGE NO.** 4 of 8

ALTERNATIVE CONCEPT:
Undercrossing with
Tight Diamond Interchange

Example



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PERFORMANCE MEASURES

The Performance Measures form documents the performance of the VA alternative—exclusive of cost—relative to the original concept. This information is used to evaluate the alternatives and, in the aggregate, to track the non-financial benefits of the Caltrans VA Program.

At the beginning of the VA Study, the performance ratings for the entire project were determined with the project stakeholders. During this phase of the project, each VA alternative is rated for each performance measure and compared against the rating that was previously developed for the entire project. It is important that, when rating the VA alternative, the rating is in the context of **how the entire project would rate** with the VA alternative included. Care must be taken, as a significant improvement to a small portion of the project may result in just a small improvement in a performance measure. It is important that the VA team document the rationale for the improvement in this form.

Performance Measures. *The example Performance Measures (form T-14) shows ratings of performance for an alternative using a number of project-specific criteria:*

- ***Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Number*** *– Alternative number as shown on the VA Alternative form*
- ***Page Number*** *– Next in sequence after the Sketches form*
- ***Project Specific Criteria*** *– Criteria derived from the Performance Criteria Matrix; rationale for the difference between the alternative concept with the original concept for each criterion:*
  - ***Mainline Traffic Operations***
  - ***Highway User Safety***
  - ***Access***
  - ***Local Traffic Operations***
  - ***Constructibility***
  - ***Environmental Impacts***
  - ***Right-of-Way Impacts***
- ***Performance*** *– Three parameters defining the contribution for both the original and alternative concepts:*
  - ***Rating –*** *Rating on a scale of 1 to 10, based on previously defined Rating Scales, for each criterion. (Remember - the rating is for how the* ***entire*** *project rates with this alternative included and not just a piece of the project)*
  - ***Weight –*** *Weight for each criterion derived from Performance Criteria Matrix*
  - ***Contribution –*** *Arithmetic product of rating times weight for each criterion*
- ***Total Performance*** *– Arithmetic sum of contributions for all criteria for both original and alternative concepts*
- ***Net Change in Performance*** *– Percentage change of alternative total performance measures with original total performance measures taken as 100% performance (+% = increased performance for the alternative; -% = reduced performance)*

This Performance Measures form may be preprinted with the original concept performance figures to facilitate completion of the form for the alternative concept.

PERFORMANCE MEASURES ***Example Project***		**Caltrans**	
TITLE: Undercrossing at Olive Hill Road with Interchange		**NUMBER** —	**PAGE NO.** 5 of 8
CRITERIA and RATING RATIONALE for ALTERNATIVE	**Performance**	**Original**	**Alternative**
MAINLINE TRAFFIC OPERATIONS Greatly improves mainline operations in this area; the traffic signal is eliminated along with slowing for turning traffic, as the on-ramps will get traffic up to speed before merging into traffic. While this is a significant improvement locally, it is a minor improvement when considering the overall project.	Rating	8	9
	Weight	24	24
	Contribution	192	216
HIGHWAY USER SAFETY Eliminates conflicts at the entrance and exit to the shopping center northeast of the intersection and associated left-turn movements—especially the truck turning movements. This location is the major accident concentration remaining along the corridor. With this correction, accident rate should not be greater than the statewide average.	Rating	6	9
	Weight	29	29
	Contribution	174	261
ACCESS Maintains good local access to businesses and homes in the area.	Rating	7	7
	Weight	19	19
	Contribution	133	133
LOCAL TRAFFIC OPERATIONS Improves traffic flow on local streets, as traffic the signal is improved. Adds a side entrance to the shopping center from Olive Hill.	Rating	7	8
	Weight	10	10
	Contribution	70	80
CONSTRUCTIBILITY Grade separation increases construction time and complexity in the area. Will not impact the overall schedule, but will increase local impact during construction.	Rating	7	6
	Weight	2	2
	Contribution	14	12
ENVIRONMENTAL IMPACTS Visual impact of grade separation needs to be evaluated. No other environmental impacts are anticipated.	Rating	6	5
	Weight	14	14
	Contribution	84	70
RIGHT-OF-WAY IMPACTS The westbound on-ramp would require added right-of-way from a market, and it will probably require a full take of the parcel that is currently planned for just a partial take.	Rating	5	4
	Weight	2	2
	Contribution	10	8
Total Performance:		**677**	**780**
Net Change in Performance:			**+15%**

Remember—the ratings relate to the <u>entire</u> project, not just the scope of the specific VA alternative.

Example

ASSUMPTIONS and CALCULATIONS

The Assumptions and Calculations page contains technical assumptions and calculations that support the alternative concept. Calculations of material quantities that are used for the cost estimates and engineering assumptions belong on this page, as well as calculations and assumptions used in the Life Cycle Costs analysis. ***It is imperative that all assumptions are specified so the reader can understand the basis of the calculations.*** Keeping the technical data separate from the cost estimates systematically organizes the information and facilitates communication. These calculations may be transcribed to improve readability. Any supporting catalog pages or other reference data are included following this page.

Assumptions and Calculations. *The example Assumptions and Calculations (form T-15) shows data, equations, and calculations necessary to determine quantities of material for use in the cost estimates.*

- ***Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Number -*** *Alternative number as shown on the VA Alternative form*
- ***Page Number*** *– Next in sequence after the Performance Measures page*
- ***Assumptions*** *– Specify all assumptions needed to explain the basis of the calculations and design parameters. Also include any assumptions for initial and life cycle costs*
- ***Calculations*** *– Technical calculations as required in support of the alternative design concept and cost estimate. Calculations are to support quantities used in the cost estimate or the unit cost used for the alternative, if it varies from the original design.* ***Calculations showing the unit cost times the quantities of the alternative are not to be done on this sheet. The cost worksheet is to be used for that calculation.***

ASSUMPTIONS and CALCULATIONS *Example Project*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** —	**PAGE NO.** 6 of 8

Design Assumptions

- Current intersection has dual left-turn lanes and a single right-turn lane in each direction with standard deceleration lanes for all turning movements. This design will be similar to the recently completed interchange on SR87 at Wilder Road, which is about 15 miles from this location.
- The area of excavation and pavement for these turning lanes are approximately the same as the off-ramps and their shoulders for the proposed interchange.

Assumptions for Construction Cost Estimates

- Added area for on-ramps:
  12-foot lane + two 8-foot shoulders = 28 feet wide
  Length of on-ramps ~850 feet each
  Therefore, total added area for ramps = 2 x 28 feet x 850 feet = 47,500 SF ~ Say 50,000 SF
- Undercrossing = 80 feet wide and 150 feet long = 12,000 SF
- Add 10% mark-up to the undercrossing for uncertainties in geotechnical information and foundation design.

Assumptions for Life Cycle Cost Estimates

- Maintenance and inspection cost based on $5,000 per lane mile for the area of influence, which is ~0.5 mile long.
- Alternative is increased by 1/3 to account for added area of on-ramps and overcrossing. Also increased to account for bridge inspection.
- Energy cost of traffic signals is eliminated in the VA alternative.
- Rehabilitation cost is increased by 1/6 to account for added pavement area to be rehabilitated.
- Highway User Costs are the differences based on the Caltrans Highway User Benefit Cost Model, using the following key assumptions:
  - ADT: year 1 = 55,000, year 20 = 77,000
  - Area of influence = 0.5 mile
  - Average operating speed is increased 5 mph with grade separation.
  - Accident rate in this area is over 50% higher than the statewide average at this location (3.04 per MVM). This is not expected to change significantly with the new project, as accidents relate to both the entrance/exit to the shopping center to the northeast corner of the intersection and the left-turn movement at the intersection, especially truck turning movements. Although the statewide average for a highway with a grade-separated facility is 1.0 per MVM, we are assuming 1.52 for the grade-separated alternative.
  - Truck traffic is ~9% of the total

Example

INITIAL COSTS

Two estimates of the initial costs are made to support the VA alternative: one for the original concept, and one for the alternative concept. The difference in these two estimates is the initial potential cost savings for the alternative. The estimates are in five categories to ensure that all construction costs are accounted for.

The original cost estimate is taken from the project cost estimate when available; if it is not, or the detail is insufficient, the VA team creates an estimate of costs for the original concept. The alternative cost estimate is made comparable to the original by using the same units but different quantities, or by making proportional changes in costs. ***Not all costs are required; only costs that <u>change</u> are needed to determine the potential savings.***

Initial Costs. *The example Initial Costs (form T-16) illustrates the calculations of quantities and costs for five categories.*

- ***Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Number*** *– Alternative number as shown on the VA Alternative form*
- ***Page Number*** *– Next in sequence after the Performance Measures page*
- ***Construction Element***
  1. ***Roadway Items*** *– As many of the following as needed:*
     - *a. Earthwork*
     - *b. Pavement Structural Section*
     - *c. Drainage*
     - *d. Specialty Items*
     - *e. Traffic Items*
     - *f. Minor Items*
     - *g. Roadway Mobilization*
     - *h. Roadway Additions*
  2. ***Structure Items*** *– For each structure:*
     - *a. Structure Cost*
     - *b. Railroad Related Costs*
  3. ***Right-of-Way Items*** *– As many of the following as needed:*
     - *a. Right-of-Way Acquisition*
     - *b. Utility Relocation*
     - *c. Relocation Assistance*
     - *d. Demolition*
     - *e. Title and Escrow Fees*
  4. ***Environmental Mitigation Items***
  5. ***Capital Outlay Support Items***
     - *a. Reengineering and Redesign*
     - *b. Project Engineering*
- ***Unit*** *– Engineering units for each item (m, m^2, ea)*
- ***Quantity*** *– Number of units per item*
- ***Cost/Unit*** *– Dollar cost for each unit ($/m, $/$m^2$, $/ea)*
- ***Total*** *– Sums for each item for each concept*
- ***Roadway Mark-up and Structure Mark-up*** *– VA mark-ups (%) same as original mark-ups*
- ***VA Added Mark-up*** *– Added mark-up (%) for uncertainties in VA alternative analysis.*
- ***Total*** *– Sums for original and alternative concepts (entered on VA Alternative form)*
- ***Total (Rounded)*** *– Rounds the total to the nearest $1,000.*
- ***Savings*** *– Difference between original and alternative concepts (entered on VA Alternative form) for the affected items.*

INITIAL COSTS ***Example Project***							**Caltrans**
TITLE Undercrossing at Olive Hill with Interchange						**NUMBER**	**PAGE NO.** 7 of 8
CONSTRUCTION ELEMENT		**ORIGINAL CONCEPT**			**ALTERNATIVE CONCEPT**		
Description	**Unit**	**Quantity**	**Cost/Unit**	**Total**	**Quantity**	**Cost/Unit**	**Total**
ROADWAY ITEMS							
At Grade Intersection	SF	64,300	$ 3.50	$225,050			
Signals	EA	4	$ 110,000	$440,000			
Access Road	SF	30,000	$ 3.50	$105,000			
Traffic Control	LS	1	$ 100,000	$100,000	1	$ 50,000	$50,000
Roadway Embankment	CY				68,000	$ 7.00	$476,000
Ramps	SF				50,000	$ 3.50	$175,000
ROADWAY SUBTOTAL				*$870,050*			*$701,000*
ROADWAY MARK-UP		*50%*		*$435,025*			*$350,500*
VA ADDED MARK-UP				*$0*			*$0*
ROADWAY TOTAL				*$1,305,075*			*$1,051,500*
STRUCTURE ITEMS							
Undercrossing (150x80)	SF				12,000	$130.00	$1,560,000
Channel Bridge (30x160)	SF	4,800	$80.00	$384,000			
STRUCTURE SUBTOTAL				*$384,000*			*$1,560,000*
STRUCTURE MARK-UP		*30%*	*$384,000*	*$115,200*	*30%*	*$1,560,000*	*$468,000*
VA ADDED MARK-UP		*0%*	*$384,000*	*$0*	*10%*	*$1,560,000*	*$156,000*
STRUCTURE TOTAL				*$499,200*			*$2,184,000*
RIGHT-OF-WAY ITEMS							
Right-of-Way Acquisition	LS			$0	1	$500,000	$500,000
Utility Relocation							
Relocation Assistance							
Demolition							
Title and Escrow Fees							
RIGHT-OF-WAY TOTAL				*$0*			*$500,000*
ENVIRONMENTAL MITIGATION ITEMS							
				$0			$0
				$0			$0
CAPITAL OUTLAY SUPPORT ITEMS	LS			$0	$1	50,000	$50,000
Reengineering and Redesign				$0			$0
Project Engineering				$0			$0
TOTAL				$1,804,275			$3,785,500
TOTAL (Rounded)				$1,804,000			$3,786,000
						SAVINGS	($1,982,000)

Example

LIFE CYCLE COSTS

Because all of the costs for owning and maintaining a highway facility are accounted for, the analysis of life cycle costs is essential for the full evaluation of competing alternatives. Rather than basing decisions only on initial construction costs, the life cycle analysis shows where the significant costs occur over a 20-year period. Knowing the life cycle costs of two alternatives improves the decision-making process; it is an essential part of the VA process.

Life Cycle Costs. *The example Life Cycle Costs (form T-17) shows calculations for the original and alternative concepts for a 20-year analysis:*

- ***Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Number*** *– Alternative number as shown on the VA Alternative form*
- ***Page Number*** *– Next in sequence after the Initial Costs page*
- ***Life Cycle Period*** *– Typically 20 years for highway projects—40 years is typically used if the comparison is primarily between structural sections.*
- ***Real Discount Rate*** *– Use Standard Caltrans Real Discount Rate, set by the Economics Planning Branch (nominal discount rate minus inflation), available at the following Caltrans website:* http://www.dot.ca.gov/hq/tpp/planning_tools/Cal-BC.xls
- ***Initial Cost (A)*** *– Total construction costs for original and alternative concepts taken from the Initial Costs form*
- ***Service Life*** *– Actual service life of concept, in years*
- ***Subsequent Annual Cost (B)*** *– As many of the following annual costs as needed:*
  - *Maintenance and Inspection*
  - *Operating*
  - *Energy*
  - *Total Subsequent Annual Costs – Sum of the above three costs*
  - *Present Value Factor –P/A factor as taken from financial tables* $\{P/A = [(1+i)^n\text{-}1/1(1+i)^n]\}$
  - *Present Value of Subsequent Annual Costs – Product of the above two figures*
- ***Subsequent Single Costs (C)*** *– As many of the following single costs as needed:*
  - *Rehabilitations – Replacement of items scheduled by year (5, 10, 20)*
  - *Repairs – Repair of items scheduled by year*
  - *Expended Service Life – Accounts for the difference in capital needed to provide a given service life*
  - *Present Value Factor – P/F factor as taken from financial tables* $\{P/F = (1+i)\text{-}n\}$
  - *Present Value of Subsequent Single Costs – Sums of individual costs*
  - *Total Subsequent Annual and Single Costs (D)* – Sums of B and C costs*
- ***Highway User Annual Costs (E)**** *– As taken from Life Cycle Benefit-Cost Model (See Caltrans Benefit-Cost Model for details):*
  - *Accidents*
  - *Travel Time*
  - *Vehicle Operating*
- ***Total Highway User Annual Costs*** *– Sum of above three items, which represents the savings over the original concept.*
- ***Total Present Value Cost (A+D+E)*** *– Sum of all above costs*
- ***Total Life Cycle Savings**** *– Difference between original and alternative totals*

**Costs are transferred to VA Alternative form*

LIFE CYCLE COSTS *Example Project*				Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange				**NUMBER**	**PAGE NO.** 8 of 8
Life Cycle Period 20 Years		Real Discount Rate 4.50%		**ORIGINAL**	**ALTERNATIVE**
A. INITIAL COST				$1,804,000	$3,786,000
Service Life-Original 20 Years Service Life-Alternative 20 Years		**INITIAL COST SAVINGS:**			**($1,982,000)**
B. SUBSEQUENT ANNUAL COSTS					
1. Maintenance and Inspection				$15,000	$20,000
2. Operating					
3. Energy				$500	$0
Total Subsequent Annual Costs:				$15,500	$20,000
Present Value Factor (P/A):				13.008	13.008
PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS (Rounded):				**$202,000**	**$260,000**
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**	**Present Value**	**Present Value**
Rehabilitations - Original	15	300,000	0.5167	$155,010	
Rehabilitations - Alternative	15	350,000	0.5167		$180,845
Repairs - Original				$0	
Repairs - Alternative					$0
Expended Service Life - Original				$0	
Expended Service Life - Alternative					$0
Salvage - Original				$0	
Salvage - Alternative					$0
PRESENT VALUE OF SUBSEQUENT SINGLE COSTS (Rounded):				$155,000	$181,000
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)				**$357,000**	**$441,000**
TOTAL SUBSEQUENT COSTS SAVINGS:					**($84,000)**
E. HIGHWAY USER ANNUAL COSTS				**Present Value**	**Present Value**
1. Accident					($32,264,000)
2. Travel Time					($2,714,000)
3. Vehicle Operating					$832,000
TOTAL HIGHWAY USER ANNUAL COSTS:				**$0**	**($34,146,000)**
TOTAL HIGHWAY USER COST SAVINGS:					**$34,146,000**
F. TOTAL PRESENT VALUE COST (A+D+E)				**$2,161,000**	**($29,919,000)**
TOTAL LIFE CYCLE SAVINGS:					**$32,080,000**

Example Only

TECHNICAL REVIEW

Near the end of the idea development stage, the VA team obtains review by appropriate technical reviewers, the PM, and the PDT to verify the validity of the alternative and identify any possible issues or concerns that need to be addressed. The discussions and decisions resulting from these reviews and related to critical project elements, such as traffic safety, traffic operations, and geometric design, are included in the documentation of the VA alternative. All comments, conclusions, and data relating to traffic and safety are also reviewed and concurred with by the Traffic Branch and the Headquarters Traffic Reviewer, as appropriate. Likewise, the Design Branch and Headquarters Project Development Coordinator and/or Technical Reviewer are consulted regarding any design features or design exceptions presented in the VA alternative that do not meet current Caltrans design standards. The team members should use the Comments form (T-21) to document key management comments and provide them to the Team Leader so that these comments can be acted upon and documented in the VA Report.

Technical Reviewer's Comments. *The example page 2 of the VA Alternative (T-12-2) shows that the technical reviewers identified by the VA team (Design, Environmental, other) add their comments to the narrative summary. Information from the technical reviewers is captured on the Comments form so that it can be documented on the VA Alternative form. This completes the documentation of the VA alternative, unless comments require modification of the alternative documentation to bring it into compliance with standards.*

The Comments form captures the information from the technical reviewers, so it can be documented on the VA Alternative form.

VALUE ANALYSIS ALTERNATIVE *Project Name*	Caltrans	
TITLE: Undercrossing at Olive Hill Road with Interchange	**ALTERNATIVE NO.** —	**PAGE NO** 2 of 8

DISCUSSION / JUSTIFICATION:

The grade separation would provide a significant improvement to traffic operations (service) on the mainline, and it would correct conditions that contribute to an above statewide average accident rate in this area. This is the main area within the entire project limits with a high accident concentration rate. This alternative maintains good access and visibility to the shopping center, which is important to the local merchants and residents. Elimination of the signalized intersection will improve local traffic circulation patterns, reduce travel delays, and reduce conflicts between residential traffic and regional truck traffic.

The State Route is a major bicycle route in the area, and the grade separation will require bicyclists to exit and reenter at Olive Hill to avoid conflicts with motorists at the on- and off-ramps. The geometrics of the ramps are based on a similar interchange recently constructed in an area with similar terrain.

The project scope improvements associated with this alternative should justify the increase in project cost.

TECHNICAL REVIEWER COMMENTS:

Environmental: This slightly increases the impact to the wetland. Added mitigation will be necessary. This should not be a major problem to the delivery of the project.

Design Reviewer: Bike traffic will need to exit and enter the State Route to avoid crossing the on- and off-ramps. This alternative should greatly improve traffic operations at this location.

PROJECT MANAGEMENT CONSIDERATIONS:

Perform a complete evaluation to accurately determine traffic benefits, costs, and the environmental impact of this alternative. This study only looked at the immediate interchange area. The alignment may have impacts beyond that need to be studied.

During the Draft PR phase, determine if a full diamond is viable at this location, and identify the cost and environmental impacts.

Example

TEAM CONSENSUS REVIEW

The VA alternatives are generally developed by an individual team member or several team members. It is important for the VA Report to reflect the VA team's consensus. Therefore, each team member reviews and provides comments for all of the alternatives. All comments are reviewed, and the team agrees to the final alternative content. If there is a minority dissenting opinion within the team, it is noted in the Discussion/Justification section of the VA Alternative form. The impact of the alternative on key performance measures is also reviewed for each alternative as a team.

VA Team Alternative Review. *The example VA Team Alternative Review (form T-18) is a record of comments by VA team members:*

- ***Alternative Title*** *– The title of the alternative as shown on the VA Alternative form*
- ***Alternative Number*** *– Alternative number as shown on the VA Alternative form will be filled in once assigned.*
- ***Team Member*** *– Name of VA team member*
- ***Comments by VA Team Member:***
  - *Agree with it as it is written*
  - *Suggest the following (or attached) changes*

Note: If the VA team develops any VA alternatives during the study that add functions, the corresponding performance measures need to be considered. If this is the case, the VA team will revise the FAST Diagram and performance analysis accordingly, and review it with the stakeholders during Segment 2 for final acceptance of the performance measure analyses.

VA TEAM ALTERNATIVE REVIEW ***Example Project***	**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** —

Team Member: Wendy Weldon

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Luis Diaz

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Mary E. Campbell

☐ I have reviewed this alternative and agree with it as it is written
☑ I have reviewed this alternative and suggest the following (or attached) changes

Need to discuss impact on bicyclists, as the State Route is a major part of the county bicycle route in this area. *The VA alternative was edited to address this comment.*

Team Member: Jeff West

☑ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member: Terry Hodges

☐ I have reviewed this alternative and agree with it as it is written
☑ I have reviewed this alternative and suggest the following (or attached) changes

Note as a disadvantage that the road between Thoroughbred Lane and Olive Hill in front of the shopping center will need to be transferred to the County. Sometimes the County does not want to take over these frontage roads unless we rebuild them first.

The frontage road will need to be realigned and reconstructed as part of this proposal; therefore, this will not be an issue with the County.

Example

UPDATE AND REEVALUATE FUNCTIONS & PERFORMANCE MEASURES (if necessary)

During the team consensus review, the team members should determine if any of the VA alternatives add functions; corresponding performance measures may need to be considered. If this is the case, the VA team takes the following actions:

Update Function and Performance Analysis. *The VA team will update their analysis to account for any new functions and performance measures that result from new alternatives developed by the team. This information needs to be reviewed with the project stakeholders for their concurrence to ensure that the reportables are comprehensive and accurate.*

- ***Update FAST Diagram*** *– Add the new functions to the FAST Diagram*
- ***Identify and Define New Performance Criteria*** *– Determine if the added function results in new Performance Criteria. If so, define and develop a parameter scale for that performance criterion.*
- ***Update Performance Criteria Matrix*** *– Add the new performance criteria to the Performance Criteria Matrix and reevaluate the performance criteria weights. This analysis will need to be validated by the project stakeholders.*
- ***Allocate Cost/Performance to the FAST Diagram -*** *Reallocate the cost and the updated performance criteria weights to determine the performance and cost / function allocations and place this information on the FAST Diagram.*
- ***Update Performance Rating Matrix – Original Concept*** *– Reevaluate the Performance Rating Matrix – Original Concept with the new performance criteria. This analysis will need to be validated by the project stakeholders*
- ***Update VA Alternative Performance Measures –*** *Update each of the VA alternative's Performance Measures forms to account for the new Performance Criteria.*

Any revisions to the performance measures analysis shall be reviewed and validated with the project stakeholders. This should be done during the Interim Presentation at the end of Segment 2.

Note: The examples in the Team Guide will continue with the assumption that no new functions or performance measures have occurred as a result of alternatives developed by the VA team.

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GROUP AND NUMBER ALTERNATIVES

At the conclusion of the development phase, the VA team and Team Leader examine the VA alternatives to determine if they are competing or mutually exclusive alternatives, and how the various alternatives can be combined into possible solutions or "sets" of alternatives in preparation for their presentation to the stakeholders. At this time, the VA Alternative numbers are assigned. The Summary of VA Alternatives form is used to list all of the team results.

Summary of VA Alternatives. *The example Summary of VA Alternatives (form T-20-1) is a listing of the VA alternatives and sets that summarize the estimated cost and performance of potential changes.*

- ***Alternative Number*** *– Alternatives are numbered sequentially (1.0, 2.0, 3.0). The .0 indicates this alternative does not have any competing ideas. When several competing ideas are developed and only one may be implemented, the same number is used with decimal designators (3.1, 3.2, 3.3) for the competing alternatives within the group. The VA alternative number is independent of the idea number; i.e., IC-3. Typically, the competing ideas can be combined with other alternatives on the list. There is a possibility that there are added restrictions regarding how the alternatives can be combined; these restrictions should be described in the narrative. Further complicating the numbering system is not desired.*

- ***Set Development and Numbering*** *– Sets of VA alternatives are developed by combining alternatives selected from the groups, to provide the decision makers a clear picture of how the alternatives fit together into possible solutions. At least one set is developed to present the VA team's consensus of what should be implemented. Additional sets are developed as necessary to present other combinations to the decision makers that should be considered.*

  The VA sets are established by the VA team as their "best value" solutions, based on improved performance, likelihood of implementation, least community impact, most cost savings, etc. A VA set may contain one or more alternatives, and each set is exclusive of other sets (implementing Set 1 eliminates Sets 2, 3, etc.).

  The team establishes the VA sets as their "best value" solutions, based on the performance and cost factors of the project. A number and descriptive title identifying the overall "theme" of the set should be established for each VA set. Sets contain multiple alternatives and are exclusive of other sets. While there may be common VA alternatives in each set, some alternatives are different and cannot be implemented together; therefore, only one set or part of a set could be implemented.

  There may be some VA alternatives that have been developed to provide an independent assessment of an issue. Although they are not recommended by the VA team, they are included in the report to help close out the issue. These may not be part of any set. Once a set is developed, a performance rating for the set is determined.

SUMMARY OF VA ALTERNATIVES *Example Project*		Caltrans	
Number	**Description**	**Potential Savings Initial /** ***Highway User***	**Performance**
1.1	Relocate / Consolidate / Improve At-Grade Intersections	$885,000	+3%
1.2	Realign SR 64 Southbound and Reroute Solitude Road	$16,183,000	-1%
1.3	Eliminate Wiley Drive Connection	$1,700,000	+8%
2.1	Design Median Width for Projected Traffic Volumes	$5,097,000	0%
2.2	Reduce Solitude Grade Median to 7 Meters, with Concrete Barrier for ~1,000 Meters	$1,814,000	0%
3.0	Steepen Slopes to 1.5:1	$6,420,000	+1%
4.1	Lower Design Speed to 120 kph in Selected Areas	$6,409,000	+3%
4.2	Lower Design Speed to 110 kph in Specific Areas	$9,853,000	+1%
5.0	Go Around the Oil Refinery; Realign Roadway to Intersect Utilities at 90º	$1,011,000	-3%
6.1	Relocate 14/64 Interchange Beyond Wetlands	$400,000	+2%
6.2	Design Simple Flyover at 14/64 Interchange	$4,006,000	+4%
7.0	Eliminate asphalt treated permeable base (ATPB) and edge drains	$3,170,000	0%
8.0	Undercrossing at Olive Hill Road with Interchange	($1,982,000) *$34,146,000*	+15%

Example

SUMMARY OF VA SETS

Set No.	Description	Cost Savings Initial / *Highway User*	Change in Performance	Change in Value
1	Use 110 km/hour design speed in selected areas (1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	($1,982,000) *$42,296,000*	To be determined in the following steps.	
2	Use 120 km/hour design speed in selected areas (1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	($1,982,000) *$45,740,000*		

RATING RATIONALE – PROPOSED ALTERNATIVE SETS

The Rating Rationale – Proposed Alternative Sets form is used to document the rationale, showing why a set of alternatives has a performance rating that is different from the original concept. The rationale for the individual alternatives included in the set are combined and edited as appropriate to reflect the impact that the alternatives have when they are combined. This can be greater or less than the sum of the individual alternatives due to either overlapping areas of the alternatives, or the fact that some benefits occur only when alternatives are combined (i.e., two alternatives viewed independently may not have an impact on corridor traffic operations; however, when combined they could significantly improve corridor traffic).

Rating Rationale – Proposed Alternative Sets. *The example Rating Rationale – Proposed Alternative Sets (form T-19-1) records performance ratings against the project-specific criteria for the sets of VA alternatives.*

- ***Rationale*** *– A summary of the VA team's basis/rationale for the proposed sets' performance ratings, as indicated on the Performance Rating Matrix. The rationales for the alternatives within a set are combined and edited to reflect a rationale for the set.*

As the discussions regarding the basis for performance rating occurs, the rating that the team determines based on this rationale and the scales developed for the performance measures is recorded on the Performance Rating Matrix – Proposed Alternatives.

When summarizing the net potential rating for a set of alternatives, it is important to note that the performance values are not the sum of the individual alternatives. The performance rating for each set needs to be determined by assessing how the set rates for each performance measure. While two alternatives within the same set may both change a specific performance measure <u>one point</u>, their combined impact may still not be enough to increase the rating more than <u>one point</u> (note the sensitivity of the performance rating is ±1 point). In other cases, there could be a synergistic effect of the two alternatives and the rating could change 3 points. This effect can be due to several factors, including the integer rating system (the 1 could be a .7 or a 1.4), the Performance Measure Scale may not be linear, or the alternatives have either an overlapping or multiplying influence. This condition may even occur with determining total cost change. Understanding these interactions when combining alternatives into sets is important when documenting the rationale and determining the performance and cost change.

Rating Rationale – Proposed Alternative Sets

Performance Criteria	VA Set 1 Reduce Design Speed to 110 kph in Selected Areas	VA Set 2 Reduce Design Speed to 120 kph in Selected Areas
Mainline Traffic Operations	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 110 kph should not have any significant impact, as the design speed is still greater than the average operating speed.	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 120 kph should not have any significant impact, as the design speed is still greater than average operating speed.
Highway User Safety	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.
Access	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.
Local Traffic Operations	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.
Constructibility	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impacts	Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.	Reduced cuts slightly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.
Right-of-Way Impacts	Slope steepening, reduced cuts, and spot location reduction in median widths reduces the right-of way takes. Most building takes and the need for new frontage roads are eliminated.	Slope steepening, reduced cuts, and spot location reduction in median widths reduces the right-of-way takes and about 50% of the building takes.

Example

PERFORMANCE RATING MATRIX – PROPOSED ALTERNATIVES

The Performance Rating Matrix – Proposed Alternatives is used to record the performance rating for the original concept and VA alternative sets to determine how the total project, with the selected VA alternatives included, would compare with the original concept. The VA sets of alternatives are chosen by the VA team to offer best value solutions in comparison to the original concept. As a result of these ratings, the total performance, percent performance improvement, value index, and percent value change can be calculated.

Performance Rating Matrix – Proposed Alternatives. *The example Performance Rating Matrix – Proposed Alternatives (form T-06) records performance ratings against the project-specific criteria for the sets of VA alternatives.*

- ***Criteria*** *– Project-specific criteria developed on the Performance Criteria Matrix*
- ***Criteria Weight*** *– Percentage weight developed on the Performance Criteria Matrix*
- ***Concept*** *– Alternative set(s) selected by the VA team (may be one or more alternatives)*
- ***VA Set No****. – Combination of selected alternatives from within mutually exclusive groups that can offer cost, performance, and value improvements to the original concept*
- ***Performance Rating*** *– Selected rating on a scale of 1 (low) to 10 (high) (See pages 4.28 and 4.29 for rationale). The rating change for a criterion cannot be determined by simply adding the performance change for each alternative in the set, as discussed on page 4.28)*
- ***Total Performance*** *– Arithmetic product of criteria weight and performance rating*
- ***Rating Parameters*** *– A correlation of quantifiable performance criteria to the performance rating (1 to 10). It is only necessary to list the performance criteria that are quantifiable; subjective parameters need not be identified here.*
- ***Overall Performance*** *– The matrix is completed for each VA alternative set, calculating the following:*
  - ***Total Performance*** *– Arithmetic sum of total performance for each VA alternative set*
  - ***% Performance*** *– The difference between the total score for the baseline and the total score for the VA alternative, expressed as a percentage increase or decrease.*
  - ***Total Project Cost*** *– Estimated cost of the project with the VA alternatives incorporated ($ million). The cost figure should be expressed with the base number to three places in front of the decimal point. For example, $145,562,000 should be expressed as 145.5 in order to have a value ratio in the magnitude of 1 to 10. Generally, this figure should be construction costs and not life cycle costs (especially if performance criteria are represented in the life cycle costs).*
  - ***Value Index*** *– Arithmetic division of total project performance by project cost. The value will be between 1 and 10 with two decimal places.*
  - ***Percent Value Improvement*** *– Net increase (+) or decrease (-) of value index in percent*

Note:
- *The estimated cost for each set is derived by adding the cumulative cost change for each alternative in the set to the original concept project cost. Care must be taken to make sure that there are not overlapping cost savings with the selected VA alternatives.*
- *The performance change for each set is determined by assessing the performance criteria for the group of VA alternatives in each set.*
- *The no-build rating used to help rate the original concept is not to be included in the Performance Rating Matrix.*

PERFORMANCE RATING MATRIX - Proposed Alternatives *Example Project*	Caltrans

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		VA Set 1									9		216
		VA Set 2									9		216
Highway User Safety	29	Original Concept						6					174
		VA Set 1									9		261
		VA Set 2									9		261
Access	19	Original Concept							7				133
		VA Set 1								8			152
		VA Set 2								8			152
Local Traffic Operations	10	Original Concept							7				70
		VA Set 1								8			80
		VA Set 2								8			80
Constructibility	2	Original Concept							7				14
		VA Set 1								8			16
		VA Set 2								8			16
Environmental Impacts	14	Original Concept						6					84
		VA Set 1								8			112
		VA Set 2							7				98
Right-of-Way Impacts	2	Original Concept					5						10
		VA Set 1								8			16
		VA Set 2							7				14

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	677		235.6	2.87	
VA Set 1 (Alternatives 1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	853	26%	195.3	4.37	52%
VA Set 2 (Alternatives 1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	837	24%	191.8	4.36	52%

Example

SUMMARY OF VA ALTERNATIVES

Once the performance of the sets has been rated by the VA team, the Performance and Value Improvement can be added to the Summary of VA Alternatives form.

When summarizing the net potential change for a set, it is important to note that the performance values are not the sum of the individual alternatives. The performance rating for each set needs to be determined by assessing how the set rates for each performance criterion. While two alternatives within the same set may change both a specific performance criterion *one point,* their combined impact may still not be enough to increase the rating more than *one point*. In other cases, there could be a synergistic effect of the two alternatives and the rating could change 3 points. This effect can be due to several factors, including the integer rating system (the 1 could be a .7 or a 1.4), the Performance Measure Scale may not be linear, or the alternatives have either an overlapping or multiplying influence.

SUMMARY OF VA ALTERNATIVES *Example Project*		Caltrans	
Number	**Description**	**Potential Savings Initial / *Highway User***	**Performance**
1.1	Relocate / Consolidate / Improve At-Grade Intersections	$885,000	+3%
1.2	Realign SR 64 Southbound and Reroute Solitude Road	$16,183,000	+3%
1.3	Eliminate Wiley Drive Connection	$1,700,000	+8%
2.1	Design Median Width for Projected Traffic Volumes	$5,097,000	0%
2.2	Reduce Solitude Grade Median to 7 Meters, with Concrete Barrier for ~1,000 Meters	$1,814,000	0%
3.0	Steepen Slopes to 1.5:1	$6,420,000	+5%
4.1	Lower Design Speed to 120 kph in Selected Areas	$6,409,000	+3%
4.2	Lower Design Speed to 110 kph in Specific Areas	$9,853,000	+1%
5.0	Go Around the Oil Refinery; Realign Roadway to Intersect Utilities at 90º	$1,011,000	+3%
6.1	Relocate 14/64 Interchange Beyond Wetlands	$400,000	+2%
6.2	Design Simple Flyover at 14/64 Interchange	$4,006,000	+4%
7.0	Eliminate asphalt treated permeable base (ATPB) and edge drains	$3,170,000	0%
8.0	Undercrossing at Olive Hill Road with Interchange	($1,982,000) *$34,146,000*	+15%

Example

SUMMARY OF VA SETS

Set No.	Description	Cost Savings Initial/*Highway User*	Change in Performance	Change in Value
1	Use 110 km/hour design speed in selected areas (1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	($1,982,000) *$42,296,000*	26%	52%
2	Use 120 km/hour design speed in selected areas (1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	($1,982,000) *$45,740,000*	24%	52%

PRESENT ALTERNATIVES

The VA team and Team Leader give an informal oral presentation to the Caltrans managers and project stakeholders at the conclusion of the study. Team members may use the materials developed for each alternative, or they may prepare presentation graphics (overhead projector or slides, flip charts) to communicate the essential features of the alternatives.

Presentation Outline. *The Presentation Outline illustrates how the oral briefing is organized:*

- ***Introduction*** *– Project name, location, number, team members*
- ***Project*** *– Major elements, length, significant costs, schedule*
- ***Alternatives –*** *Organized in groups*
  - *Original and alternative concepts*
  - *Sketches*
  - *Advantages and disadvantages*
  - *Performance and potential savings*
- ***Summary***
  - *Key alternatives*
  - *Performance indicators*
  - *Total potential savings – More than one tally may be needed to account for alternative sets*
- ***Closing***
  - *Confirm additional reviews needed – Obtain feedback from the management team if any of the VA alternatives should be forwarded to any Caltrans functional groups for their review*
  - *Management comments – Comments on VA alternatives by management representatives*
  - *VA study evaluation form – Comments on the VA study by participants*

The VA team presents the set of proposals Caltrans should implement—the ones they would implement if they were the implementation team. They also state which other proposals are viable. They respond to issues regarding the proposals as they arise, and record them. They also record any pending action items (including responsible individual[s]) required to implement any viable alternatives.

At the end of the discussion, the facilitator requests the audience to identify missing reviewers (technical reviewers or stakeholders) that need to comment on particular alternatives, to ensure their involvement in resolving the disposition of the VA alternatives.

The VA team members are requested to complete the VA Study Evaluation (form T-23) to provide feedback to the VA Program Managers.

Preliminary Report

Following this presentation, the Team Leader completes the Preliminary VA Report, which is comprised of the Executive Summary, VA Alternative, Idea Evaluation, and VA Process sections, along with a list of Meeting Attendees. This is printed and circulated to the PDT, technical reviewers, District management, project stakeholders, and others as determined by the Project Manager and DVAC.

PRESENTATION OUTLINE

Presentation graphics may be overhead slides, flip charts, or pages of documented alternatives, organized as follows:

INTRODUCTION

- Project Name
- Location/Number
- Team Members

1

PROJECT

- Description
- Major Elements
- Length
- Significant Costs
- Schedule

2

ALTERNATIVE SET 1

1.3

1.2

ALTERNATIVE 1.1

- Original Concept
- Alternative Concept
- Sketches
- Advantages
- Disadvantages
- Performance
- Potential Savings

3

ALTERNATIVE SET 2

2.3

2.2

ALTERNATIVE 2.1

- Original Concept
- Alternative Concept
- Sketches
- Advantages
- Disadvantages
- Performance
- Potential Savings

4

SUMMARY

- Key Alternatives
- Performance and Value Indices
- Total Potential Savings

5

CLOSING

- Request Additional Reviews Needed
- Presentation Comments
- VA Study Evaluation Form

6

COMMENTS

During the VA Study, District management and project stakeholder representatives observe and participate in the work of the VA team. Comments made by management, technical reviewers, and stakeholders, during the Kick-Off Meeting, Technical Review Meeting, VA Team's Presentation, and Implementation Meeting, are recorded and made part of the documentation for the study. The team members should use these forms to document key management comments and provide them to the Team Leader so that these comments can be acted upon and documented in the VA Report. By including these comments in the VA Study Report, the project development team can refer to them for guidance on the selection of VA alternatives for implementation into the project design.

Comments. *The example Presentation Comments (form T-21) provides space to record:*

- ***Prepared By*** *– Name of individual making comments*
- ***Date*** *– Date comments were made/recorded*
- ***Telephone –*** *Contact telephone number for the individual preparing the comments*
- ***Organization*** *– Organization or agency with which the individual is associated*
- ***VA Activity***
  - ***Kick-off Meeting*** *– Comments made during the Kick-off Meeting by management and stakeholders.*
  - ***Technical Review*** *– Comments made as part of a Technical Review*
  - ***VA Presentation*** *– Comments made in response to the VA Presentation (formal or informal)*
  - ***Implementation*** *– Comments made during the VA Implementation Meeting*
  - ***Other*** *– Comments made at some other point during the VA process – identify the activity within the VA process*
- ***Comments*** *– Positive (and negative) feedback to information presented as part of the VA process*

COMMENTS ***Example Project***			**Caltrans**
PREPARED BY	**ORGANIZATION**	**TELEPHONE**	**DATE**
Terry Hodges	Traffic Operations	(855) 555-3664	August 9, 2000

VA ACTIVITY

☐ **Kick-Off Meeting** ☐ **Technical Review** ☑ **VA Presentation**
☐ **Implementation Meeting** ☐ **Other**_____

COMMENTS:

Alternative 4.0

Need to discuss Alternative 4.0 with the oil refinery soon, as they are planning expansion at the facility. I think this will be a better solution for them as well, but we may want to make sure there are no other possible conflicts. They would be easy to solve now.

General

May want a wider median in the area of the rest stop, as there is just one, and it is on the south side of the State Route. Added area would provide more storage in the median and permit vehicles, especially trucks, to exit from and merge into traffic better and with reduced chance of incidents.

Example

VA STUDY EVALUATION

At the conclusion of the study, the VA team is requested to complete the VA Study Evaluation (form T-23) to provide feedback to the VA Program Managers. This information is used to help continually evaluate and improve the Caltrans Value Analysis Program.

VA STUDY EVALUATION
Value Analysis Study

Project: **Example Project**

Location: **South Paseo, CA**

Date: **June 13-15 and 20-22, 2000**

PERSONNEL	**Excellent**	**Good**	**Fair**	**Poor**
VA Coordinator	4	3	2	1
VA Team Leader	4	3	2	1
VA Team Members	4	3	2	1
Resource Advisors	4	3	2	1

Comments: .....
.....

PROJECT	**Excellent**	**Good**	**Fair**	**Poor**
Study Scope	4	3	2	1
Documentation	4	3	2	1
Information Briefing	4	3	2	1
Supplemental Data	4	3	2	1

Comments: .....
.....

FACILITIES	**Excellent**	**Good**	**Fair**	**Poor**
Study Room	4	3	2	1
Furnishings	4	3	2	1
Temperature, Light	4	3	2	1
Equipment	4	3	2	1
Communications	4	3	2	1
Resource Materials	4	3	2	1

Comments: .....
.....

VA METHODOLOGY	**Excellent**	**Good**	**Fair**	**Poor**
VA Job Plan	4	3	2	1
Instructions	4	3	2	1
Schedule	4	3	2	1
Site Visit	4	3	2	1

Comments: .....
.....

STUDY RESULTS	**Excellent**	**Good**	**Fair**	**Poor**
VA Alternatives	4	3	2	1
VA Presentations	4	3	2	1

Comments: .....
.....

NAME (Optional) _____

Example

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VA STUDY

SEGMENT 3 FORMS

Assess Alternatives

- VA Alternative Implementation – Preliminary Dispositions

Resolve Alternatives

- VA Alternative Implementation – Final Dispositions
- VA Study Summary Report – Proposed Alternatives
- VA Study Summary Report – Proposed Alternatives
- Rating Rationale – Accepted Alternatives
- Performance Rating Matrix – Accepted Alternatives
- VA Study Summary Report – Conditionally Accepted Alternatives
- VA Study Summary Report – Benefit Summary

Present Results

- Present Results

VA STUDY – SEGMENT 3

Segment 3 of the VA Study focuses on determining the disposition of the VA alternatives and validating their benefits. Once the decision makers have had a chance to review the Preliminary VA Study Report and provide their written analysis of each VA alternative to the Team Leader, an Implementation Meeting is scheduled to agree upon the disposition of each VA alternative. A presentation to the District management and other stakeholders to ensure concurrence with the dispositions completes Segment 3 activities.

The VA Study Segment 3 activities include Assess Alternatives, Resolve Alternatives, and Present Results.

Activity	Purpose
Assess Alternatives	The Preliminary VA Study Report is reviewed by the Project Development Team, technical reviewers, and stakeholders; the alternatives are assessed for project acceptance; and draft implementation dispositions are prepared.
Resolve Alternatives	Implementation dispositions are reviewed and resolved with the decision makers and stakeholders, the alternatives are edited, and rejected alternatives are revisited, if needed. The results of the study are then summarized.
Present Results	A final presentation of accepted alternatives is made to Caltrans management, stakeholders, and other interested parties.

Upon completion of Segment 3, the VA Team Leader prepares and distributes the Final VA Study Report. If conditionally accepted VA alternatives remain at this time, an action plan and timetable for completion are established. The VA Team Leader will follow up on any open items with the Project Manager and DVAC until resolution is achieved.

VA ALTERNATIVE IMPLEMENTATION – PRELIMINARY DISPOSITIONS

The purpose of the assessment is to provide the project stakeholders and the VA team with the assurance that the alternatives contain accurate information and that the assessments are based on their merits with the current information. During the assessment of alternatives, the Project Manager, key PDT members, technical reviewers, and external project stakeholders review the Preliminary VA Study Report and document their comments and implementation positions on all VA alternatives. It is not uncommon for the various reviewers of the VA Study Report to have different positions regarding the implementation disposition of the VA alternatives. For this reason, these comments should be collected by the DVAC and forwarded to the VA Team Leader so that proper preparation for the Implementation Meeting can be accomplished.

Any outstanding technical reviews (due to technical reviewers not being available during the VA Study) should be pursued during this timeframe.

A decision to implement a VA alternative constitutes the intent to incorporate it into the present or subsequent project development phase, based on current information. This final decision is made at the Implementation Meeting. The VA Alternative Implementation Action (Preliminary) form is provided to the report reviewer with each VA alternative to help document the report reviewer's position regarding the merits of the VA alternative.

VA Alternative Implementation Action (Preliminary)*. The example VA Alternative Implementation (Preliminary) (form T-22) shows a sample of one of many responses to a particular alternative.*

- ***Title –*** *The title of the alternative as shown on the VA Alternative form.*
- ***Alternative No.*** *– Alternative number as shown on the VA Alternative form.*
- ***Responses*** *– Written comments on criteria chosen by the reviewer:*
  - ***Prepared by*** *– Identify who is preparing the response and date.*
  - ***Technical Feasibility/Validated Performance –*** *Agree/disagree with the technical feasibility of the alternative based on project-specific criteria, and record agreement/disagreement with initial performance ratings.*
  - ***Implementable Portions*** *– If the VA Alternative is not implementable in its entirety, identify portions of the alternative that may be selectively implemented.*
  - ***Validated Cost Savings –*** *Agree/disagree with the estimated cost savings; substantiate revised implemented savings.*
  - ***Project Development Support Cost Savings –*** *Savings (increases) to project development costs resulting from the VA alternative. This can be due to reduced (or increased) design effort needed, or an earlier project delivery date.*
  - ***Project Development Delivery Impact*** *– Check boxes to designate if the alternative has no change to the project delivery phase, or indicate the months saved or increased for each phase. Discuss the areas in which these schedules will be impacted.*
  - ***Other Comments*** *– Comments on other issues relating to the alternative. Note any concerns or controversial items.*
- ***Implementation Disposition*** *– Choose one of the following dispositions:*
  - ***Accept*** *– Acceptance of the alternative denotes intent to implement in the given project development phase.*
  - ***Conditionally Accept*** *– Alternative is desired but requires added technical analysis and/or stakeholder agreement before final disposition can be made.*
  - ***Reject*** *– Alternative is not acceptable as presented. For rejected alternatives, check the appropriate box to note whether or not rejection is due to the fact that the VA study took place too late in the Project Development Process.*
- ***Validated Performance*** *– Validated performance.*
- ***Validated Savings*** *– Validated cost savings in dollars.*

VA ALTERNATIVE IMPLEMENTATION ACTION (PRELIMINARY) ***Example Project***		**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange		**NUMBER** 8.0
RESPONSES	**Prepared by:** Joe Q. Reviewer	**Date:** 07/27/00

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition and the cost and performance changes for the alternative are required by Caltrans to ensure that the project decision makers agree with the study results. These validated results become the basis for the VA Program reportables.

Technical Feasibility / Validated Performance:

The undercrossing concept is feasible and will be implemented in the PAD. The westbound off-ramp will be studied further to determine if a conventional diamond can be used at this location.

The construction of an interchange might have a greater impact on the project than indicated by the VA team; I suggest reducing the performance rating by one point each for Constructibility, Environmental Impacts, and Right-of-Way Impacts.

DISPOSITION

☑ **Accept**

☐ **Conditionally Accept**

☐ **Reject**

Validated Performance
+12%

Implementable Portions:

The concept can be implemented in full. The bridge cost for the Olive Hill Undercrossing will have to be verified by Structures in an Advance Planning Study.

If Alternative is Rejected

Was rejection due to VA study taking place too late in the project development process to implement the change?

Yes ☐ No ☐

Validated Cost Savings:

The bridge design as shown in this VA study will be reviewed as part of the APS to determine whether the $2.0 million increase is sufficient. At this time the cost assumptions and cost estimate appear reasonable.

Significant operational benefits result from this alternative. However, with this improvement, demand would probably be increased in this area ~5% as well. As a result, the highway user benefits savings projected by the VA team of $34,200,000 may be slightly higher than expected. My calculations show the operational improvements of ~$29,700,000 to be more reasonable.

Validated Savings

($2,300,000) Initial
$29,700,000 LCC

Project Development Support Cost Savings

($170,000)

Project Development Delivery Impact:

This alternative will add Structures design work and project development costs for this new structure. The PA&ED phase will be extended to get the geotechnical information necessary for Structures and address visual impacts in the Environmental Document.

	No Change	Reduced by	Increased by
PID	☑	Mo.	Mo.
PA&ED	☐	Mo.	2 Mo.
PS&E	☑	Mo.	Mo.
Const.	☑	Mo.	Mo.

Other Comments:

HQ has provided verbal approval of this concept due to the significant operational benefits it provides, but has requested that we study the full diamond interchange possibility further to see what it would take to make it work.

Example

VA ALTERNATIVES – FINAL DISPOSITION

A meeting is scheduled to develop consensus and resolve the implementation dispositions of the VA alternatives. The meeting(s) include(s) pertinent VA team members and the individuals with the authority to determine the alternatives' implementation decisions, the Project Manager, the Project Engineer, District management, key PDT members, relevant technical reviewers, and external project stakeholders.

The meeting should be an informal working meeting to encourage the exchange of opinions, supporting data, and discussion. The implementation disposition for each alternative is discussed with the Project Manager, relevant project development functional units, and other project stakeholder representatives. The meeting results in the resolution of the dispositions for every alternative, categorized by one of the following: "accepted," "conditionally accepted," or "rejected." The VA team is challenged to modify rejected alternatives when it is possible that a modification could facilitate acceptance of the alternative.

Any alternatives noted as "conditionally accepted" shall include the action required, responsibilities, and timing of the final decision. The Value Analysis Program will review the resolution of the conditionally accepted alternatives at a later date to complete the reporting on the study.

All relevant comments and dispositions during this activity shall be documented by the VA Team Leader and included in the Final VA Report.

VA Alternative Implementation Action (Final). *The example VA Alternative Implementation Action (Final) (form T-20) shows the disposition of the alternative and comments supporting the disposition. This form is prepared by the Team Leader, based on the discussions and decisions made in the Implementation Meeting. The final disposition form should document the Project Manager's concurrence with the disposition, and the reportable cost and performance.*

- ***Title –*** *The title of the alternative as shown on the VA Alternative form*
- ***Alternative No.*** *– Alternative number as shown on the VA Alternative form*
- ***Responses*** *– Written comments on criteria chosen by the reviewer:*
  - ***Prepared by*** *– Identify who is preparing the response*
  - ***Technical Feasibility/Validated Performance*** *– Agree/disagree with the technical feasibility of the alternative based on project-specific criteria, and record agreement/disagreement with initial performance ratings*
  - ***Implementable Portions*** *– Identify portions of the alternative that may be selectively implemented*
  - ***Validated Cost Savings*** *– Agree/disagree with the estimated cost savings; substantiate revised implemented savings*
  - ***Project Development Support Cost Savings –*** *Savings (increases) to project development costs resulting from the VA alternative. This can be due to reduced (or increased) design effort needed, or an earlier project delivery date.*
  - ***Project Development Delivery Impact*** *– Check boxes to designate if the alternative has no change to the project delivery phase, or indicate the months saved or increased for each phase. Discuss the areas in which these schedules will be impacted.*
  - ***Other Comments*** *– Comments on other issues relating to the alternative. Note any concerns or controversial items.*
- ***Implementation Disposition*** *– Choose one of the following dispositions:*
  - ***Accept*** *– Acceptance of the alternative denotes intent to implement in the given project development phase.*
  - ***Conditionally Accept*** *– Alternative is desired but requires added technical analysis and/or stakeholder agreement before final disposition can be made.*
  - ***Reject*** *– Alternative is not acceptable as presented. For rejected alternatives, check the appropriate box to note whether or not rejection is due to the fact that the VA study took place too late in the Project Development Process.*
  - ***Validated Performance –*** *Performance rating agreed to by decision makers*
  - ***Validated Savings –*** *Cost savings agreed to by decision makers*

VA ALTERNATIVE IMPLEMENTATION ACTION (FINAL) ***Example Project***		**Caltrans**
TITLE: Undercrossing at Olive Hill Road with Interchange		**NUMBER** 8.0
RESPONSES	**Prepared by:** Ginger Adams	**Date:** 07/27/00

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition and the cost and performance changes for the alternative are required by Caltrans to ensure that the project decision makers agree with the study results. These validated results become the basis for the VA Program reportables.

Technical Feasibility / Validated Performance:

The undercrossing concept is feasible and will be implemented in the PA&ED. The westbound off-ramp will be studied further to determine if a conventional diamond can be used at this location.

The construction of an interchange might have a greater impact on the project than indicated by the VA team; I suggest reducing the performance rating by one point each for Constructibility, Environmental Impacts, and Right-of-Way Impacts.

DISPOSITION

☑ **Accept**

☐ **Conditionally Accept**

☐ **Reject**

Validated Performance
+12%

Implementable Portions:

The concept can be implemented in full. The bridge cost for the Olive Hill Undercrossing will have to be verified by Structures in an Advance Planning Study.

If Alternative is Rejected

Was rejection due to VA study taking place too late in the project development process to implement the change?

Yes ☐ No ☐

Validated Cost Savings:

The bridge design as shown in this VA study is being reviewed as part of the APS, and preliminary estimates at a cost of $150/sf versus the $130/sf proposed by the VA team. This preliminary APS cost estimate of $2.3 million will be used. The original cost estimate has been marked up to reflect the change.

The highway user benefits savings as revised by the PDT of $29,700,000 is accepted. The change is due to a revision to the percentage of truck traffic projected for the new facility. Significant operational benefits result from this alternative.

Validated Savings

($2,300,000) Initial
$29,700,000 LCC

Project Development Support Cost Savings

($70,000)

Project Development Delivery Impact:

This will add Structures design work and project development costs for this new structure. The PA&ED phase will be extended to get the necessary geotechnical information necessary for Structures and address visual impact in the Environmental Document. *Construction phasing is expected to add time to construct the structure and maintain traffic over the original concept.*

	No Change	Reduced by	Increased by
PID	☑	Mo.	Mo.
PA&ED	☐	Mo.	2 Mo.
PS&E	☑	Mo.	Mo.
Const.	☐	Mo.	1 Mo.

Other Comments:

HQ has provided verbal approval of this concept due to the significant operational benefits it provides, but has requested that we study the full diamond interchange possibility further to see what it would take to make it work.

This alternative not only improves operations in the area, but it will be able to accommodate increased traffic demands in the future while maintaining a high level of service.

Example

VA STUDY SUMMARY REPORT PROPOSED ALTERNATIVES

The Value Analysis Study Summary Report (VASSR) is a seven-page form used by the Caltrans VA Program Administrators for auditing and reporting purposes. The summary report is filled out portion-by-portion as the VA study progresses, and is submitted as part of the Final VA Study Report. At the completion of Segment 2, the VA Team Leader completes the VASSR page 3, which summarizes the proposed VA alternatives. Note: Pages 1 and 2 are the same as the Study Initiation Documents (pages 1 and 2), which describe the projects, identify the participants, and detail the schedule.

VA Study Report – Proposed Alternatives. *The example VA Study Report Proposed Alternatives (form T-02-3) lists each alternative by group:*

- ***VA Alternative Number*** *– Alternative number is sequential (1.0, 2.0, 3.0). The .0 indicates this alternative does not have any competing ideas. When several competing ideas are developed and only one can be implemented, the same number is used with decimal designators (3.1, 3.2, 3.3) for the competing alternatives.*
- ***Initial Cost Savings*** *– Initial Cost Savings as shown on the VA Alternative form*
- ***Subsequent Cost Savings*** *– Subsequent Cost Savings as shown on the VA Alternative form*
- ***Highway User Cost Savings*** *– Highway User Cost Savings as shown on the VA Alternative form*
- ***Total LCC (NPV) Cost Savings –*** *The sum of all of the Cost Savings as shown on the VA Alternative form*
- ***Change in Performance*** *– The percent change in performance for that VA alternative as shown on the VA Alternative form*
- ***Comments*** *– Any comments that may assist the report reviewer in more fully understanding some of the VA alternatives*

Summary of Proposed VA Alternatives – Cumulative Study Savings *– Selected alternatives combined from mutually exclusive groups (sets) that can compete in whole, or in part, against the original design concept to provide reviewers an understanding of how the alternatives can best be combined into implementable solutions. Each set has its own performance rating, to determine % performance and % value improvement, and totaling of costs for the sets. Care must be taken in summing these values, as there may be an overlap in costs between the alternatives in the set.*

- *In totaling the cost impact for the sets, the savings and increases are totaled separately for initial, subsequent, and highway user costs.*
- *LCC cost is the sum of all costs.*
- *Performance and value ratings developed and documented on the Performance Measures form for each set are recorded here. The set that* ***the VA team*** *considers the best combination of alternatives that can be realistically implemented in the project should be noted in the comments. This set will be used in all reporting as "Proposed" in the Caltrans VA Annual Report. Performance and value improvements shown here are calculated in the Performance Rating Matrix form.*
- *Typically, at a minimum, there are two sets. One set competes with major elements of the original concept, and the second refines the original concept.*
- ***Comments –*** *Any comments that may assist the report reviewer to more fully understand the theme and rationale of the VA alternative sets.*

VA STUDY SUMMARY REPORT PROPOSED ALTERNATIVES	**Caltrans**
Project Name: *Example Project*	

Summary of *Proposed* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
1.1	$885,000	$0	$0	$885,000	+3%
1.2	$16,183,000	$0	$0	$16,183,000	+3%
1.3	$1,700,000	$0	$0	$1,700,000	+8%
2.1	$5,097,000	$0	$0	$5,097,000	0%
2.2	$1,814,000	$0	$0	$1,814,000	0%
3.0	$6,420,000	$0	$0	$6,420,000	+5%
4.1	$6,409,000	$0	$0	$6,409,000	+3%
4.2	$9,853,000	$0	$0	$9,853,000	+1%
5.0	$1,011,000	$0	$0	$1,011,000	+3%
6.1	$400,000	$0	$0	$400,000	+2%
6.2	$4,006,000	$0	$0	$4,006,000	+4%
7.0	$3,170,000	$0	$0	$3,170,000	0%
8.0	($1,982,000)	($84,000)	$34,146,000	$32,080,000	+15%

Comments

Amount of savings estimated for Alternative 3.0 is ~$6,400,000. Actual savings could be as much as $12,000,000 to $13,000,000.

Summary of *Proposed* VA Alternatives – *Cumulative* Study Savings

VA Set No.	VA Alt. No.	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value
1	1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0	$42,296,000	$0	$34,146,000	$74,376,000	+26%	+52%
		($1,982,000)	($84,000)	$0			
2	1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0	$45,740,000	$0	$34,146,000	$77,820,000	+24%	+52%
		($1,982,000)	($84,000)	$0			

Comments

Alternative 2.1 reduces median width to meet the expected road use – a divided highway, not an expressway.
Alternative 2.2 reduces the median width locally to reduce the impacts of large cuts.

Example

VA STUDY SUMMARY REPORT ACCEPTED ALTERNATIVES

The Value Analysis Study Summary Report (VASSR) is a seven-page form used by the Caltrans VA Program Administrators for auditing and reporting purposes. The summary report is filled out portion-by-portion as the VA study progresses, and it is submitted as part of the Final VA Study Report. After the Segment 3 meeting, the VA Team Leader completes the VASSR Accepted Alternatives and VASSR Conditionally Accepted forms to reflect the disposition of those VA alternatives that were not rejected.

Note: Pages 1 and 2 are the same as the Study Initiation Documents (pages 1 and 2), which describe the project, identify the participants, and detail the schedule. Page three of the VASSR, which documents the proposed alternatives and sets, was completed by the Team Leader at the conclusion of Segment 2.

The VA alternatives that are accepted for implementation into the project are summarized and the cost and performance improvements validated by the decision makers; in particular, the Project Manager must approve the values being reported by the VA team.

VA Study Report – Accepted Alternatives. *The example VA Study Report – Accepted Alternatives (form T-02-4) lists each alternative by group:*

- ***VA Alternative Number*** *– Alternative number is sequential (1.0, 2.0, 3.0). The .0 indicates this alternative does not have any competing ideas. When several competing ideas are developed and only one can be implemented, the same number is used with decimal designators (3.1, 3.2, 3.3) for the competing alternatives.*
- ***Initial Cost Savings*** *– Initial Cost Savings as shown on the VA Alternative form*
- ***Subsequent Cost Savings*** *– Subsequent Cost Savings as shown on the VA Alternative form*
- ***Highway User Cost Savings*** *– Highway User Cost Savings as shown on the VA Alternative form*
- ***Total LCC (NPV) Cost Savings –*** *The sum of all the Cost Savings as shown on the VA Alternative form*
- ***Change in Performance*** *– The change in performance for that VA alternative from the original concept* ***total*** *design, as shown on the VA Alternative form.*
- ***Comments*** *– Any comments that may assist the report reviewer in more fully understanding some of the accepted VA alternatives*
- ***Summary of Accepted VA Alternatives – Cumulative Study Savings*** *– Show the total impact of the accepted VA alternatives. Performance improvements are to be reevaluated by the team and key decision makers to validate the project improvement for the acceptance of these alternatives. The Performance Rating Matrix form is used to determine the percentage change in performance and value.*
- ***Comments –*** *Any comments that may assist the report reviewer in more fully understanding the benefits of these accepted alternatives.*

VA STUDY SUMMARY REPORT ACCEPTED ALTERNATIVES	**Caltrans**
Project Name: ***Example Project***	

Summary of *Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
1.2	$16,000,000	$0	$0	$16,000,000	+3%
3.0	$6,000,000	$0	$0	$6,000,000	+5%
5.0	$1,000,000	$0	$0	$1,000,000	+3%
8.0	($2,300,000)	($84,000)	$29,700,000	$27,316,000	+15%

Comments

Reduction in performance for alternative 1.2 is due to removal of one local access point.

Summary of *Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Perf.	Change in Value
1.2, 3.0, 5.0, 8.0	$23,000,000	$0	$29,700,000	$50,316,000	+26%	+38%
	($2,300,000)	($84,000)	$0			

Comments

*Indicates Set Used in Report Calculations.

Example

RATING RATIONALE – ACCEPTED ALTERNATIVES

Once VA alternatives have been selected for implementation, the performance rating that these alternatives will have on the project is validated with the stakeholders. The Performance Rating Matrix is used to measure the original and cumulative effect of the accepted VA alternatives against project-specific criteria. It is based on the weighted performance criteria developed earlier to rate the original concept and is used throughout the process to evaluate VA alternatives.

When summarizing the net potential change for the accepted VA alternatives, it is important to note that performance values are not the sum of the individual alternatives. The performance rating for the accepted alternatives needs to be determined by assessing how the combination of these alternatives rates for each performance measure. While two accepted alternatives may both change a specific performance measure one point, their combined impact may still not be enough to increase the rating more than one point (note the sensitivity of the performance rating is ±1 point). In other cases, there could be a synergistic effect of the two alternatives, and the rating could change 3 points. This effect can be due to several factors, including the integer rating system (the 1 could be a .7 or a 1.4), the Performance Measure Scale may not be linear, or the alternatives have either an overlapping or multiplying influence.

Rating Rationale – Accepted Alternatives. *The example Rating Rationale – Accepted Alternatives (form T-19-2) records performance ratings against the project-specific criteria for the accepted VA alternatives.*

- ***Rationale*** *– A summary of the VA team's basis/ rationale for the numerical change in performance, as indicated on the Performance Rating Matrix. The rationales for the accepted alternatives are combined and edited to reflect the rationale for the set.*

As the discussions regarding the basis for performance changes occur, the rating that the team determines, based on this rationale and the scales developed for the performance measures, is recorded on the Performance Rating Matrix – Accepted Alternatives.

Rating Rationale – Accepted Alternatives

Performance Criteria	Rationale
Mainline Traffic Operations	Improvement is primarily due to elimination of the only traffic signal on SR 64 within the project limits that resulted from converting the signalized intersection to an interchange.
Highway User Safety	Reduced almost a mile of existing sustained 6% grade to 4%. Eliminated an existing intersection at the bottom of sustained grade. Significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt on or across SR 64. Improved sight distance by using Wiley Drive intersection and a flatter curve. Addition of the interchange and elimination of turning movements into the commercial areas at this location will reduce the conflicts that have been the primary source of a number of accidents in this area.
Access	Elimination of the traffic signal and replacing it with an interchange will improve the accessibility to the area where a new industrial park is planned.
Local Traffic Operations	Localized improvements will result from these changes, but the overall rating will not be significantly impacted.
Constructibility	Reduction in excavation quantities of >2 million m^3. This is made possible by the reduction in design speed. The interchange at Olive Hill does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impacts	Reduction in design speed through the steep cut area and realignment near the river and refinery will significantly reduce environmental impacts to the project. Wetland mitigation is reduced to less than one acre. The potential to encounter contaminated soils is greatly reduced when the need to relocate old oil pipelines is eliminated. Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation are avoided.
Right-of-Way Impacts	Significant reduction in the right-of way requirements. Eliminates most building takes and reduces the need for new frontage roads.

Example

PERFORMANCE RATING MATRIX – ACCEPTED VA ALTERNATIVES

The Performance Rating Matrix is used to record the performance rating for the original concept and accepted VA alternative sets to show how the total project changed with the selected VA alternatives implemented into the design. As a result of these ratings, the total performance, percent performance improvement, value index, and percent value change can be calculated.

Performance Rating Matrix – Accepted VA Alternatives. *The example Performance Rating Matrix – Accepted VA Alternatives (form T-06) records performance ratings against the project-specific criteria for the sets of VA alternatives.*

- ***Criteria*** *– Project-specific criteria developed on the Performance Criteria Matrix*
- ***Criteria Weight*** *– Percentage weight developed on the Performance Criteria Matrix*
- ***Concept*** *– Combination of accepted VA alternatives (may be one or more alternatives)*
- ***VA Set No****. – Combination of selected alternatives from within mutually exclusive groups that can offer cost, performance, and value improvements to the original concept*
- ***Performance Rating*** *– Selected rating on a scale of 1 (low) to 10 (high) (See pages 5.8 and 5.9 for rationale). The rating change for a criterion cannot be determined by simply adding the performance change for each alternative in the set, as discussed on page 5.8)*
- ***Total Performance*** *– Arithmetic product of criteria weight and performance rating*
- ***Rating Parameters*** *– A correlation of quantifiable performance criteria to the performance rating (1 to 10). It is only necessary to list the performance criteria that are quantifiable; subjective parameters need not be identified here.*
- ***Overall Performance*** *– The matrix is completed for each VA alternative set, calculating the following:*
  - ***Total Performance*** *– Arithmetic sum of total performance for the Original Concept and combined effect of the accepted VA alternatives.*
  - ***% Performance*** *– The difference between the total score for the baseline and the total score for the accepted VA alternatives, expressed as a percentage increase or decrease.*
  - ***Total Project Cost*** *– Cumulative estimated cost of the project with the accepted VA alternatives incorporated ($ million). The cost figure should be expressed with the base number to three places in front of the decimal point. For example, $145,562,000 should be expressed as 145.5 in order to have a value ratio in the magnitude of 1 to 10. Generally, this figure should be construction costs and not life cycle costs (especially if performance criteria are represented in the life cycle costs).*
  - ***Value Index*** *– Arithmetic division of total project performance by project cost. The value will be between 1 and 10 with two decimal places.*
  - ***Percent Value Improvement*** *– Net increase (+) or decrease (-) of value index in percent*

Note:

- The estimated cost for the accepted VA alternatives is derived by adding the cumulative cost change for each accepted alternative to the original concept project cost.
- The cumulative performance change for each set is determined by assessing the performance measures for the accepted VA alternatives.

PERFORMANCE RATING MATRIX - Accepted Alternatives ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	Original Concept								8			192
		Accepted Alts.									9		216
Highway User Safety	29	Original Concept						6					174
		Accepted Alts.									9		261
Access	19	Original Concept							7				133
		Accepted Alts.								8			152
Local Traffic Operations	10	Original Concept							7				70
		Accepted Alts.								8			80
Constructibility	2	Original Concept							7				14
		Accepted Alts.								8			16
Environmental Impacts	14	Original Concept						6					84
		Accepted Alts.								8			112
Right-of-Way Impacts	2	Original Concept					5						10
		Accepted Alts.								8			16

Example

OVERALL PERFORMANCE	**Total Performance**	**% Perf. Improve.**	**Total Cost**	**Value Index (Performance / Cost)**	**% Value Improvement**
Original Concept	677		235.6	2.87	
Accepted VA Alternatives (1.2, 3.0, 5.0, 8.0)	853	26%	214.9	3.97	38%

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 1)

At the completion of Segment 3, the Team Leader documents any conditionally accepted alternatives on the VASSR form to facilitate tracking and the ultimate resolution of the open VA alternatives. The VA alternatives that are conditionally accepted for implementation into the project are summarized and the cost and performance improvements validated by the decision makers; in particular, the Project Manager must approve the values being reported by the VA team. An action plan is developed to track the conditionally accepted VA alternatives so their ultimate disposition can be tracked. ***The cost and performance changes are differentials from the accepted changes.***

VA Study Conditionally Accepted Alternatives (Page 1). *The example VA Study Conditionally Accepted Alternatives (Page 1) (form T-02-5) lists each alternative by group:*

- ***VA Alternative Number*** *– Alternative number is sequential (1.0, 2.0, 3.0). The .0 indicates this alternative does not have any competing ideas. When several competing ideas are developed and only one can be implemented, the same number is used with decimal designators (3.1, 3.2, 3.3) for the competing alternatives.*
- ***Initial Cost Savings*** *– Initial Cost Savings as shown on the VA Alternative form*
- ***Subsequent Cost Savings*** *– Subsequent Cost Savings as shown on the VA Alternative form*
- ***Highway User Cost Savings*** *– Highway User Cost Savings as shown on the VA Alternative form*
- ***Total LCC (NPV) Cost Savings –*** *The sum of all Cost Savings as shown on the VA Alternative form*
- ***Change in Performance*** *– The change in performance for that VA alternative as shown on the VA Alternative form*
- ***Comments*** *– Any comments that may assist the report reviewer in more fully understanding some of the accepted VA alternatives*
- ***Summary of Conditionally Accepted VA Alternatives – Cumulative Study Savings*** *– Show the total potential* ***added*** *impact that the conditionally accepted VA alternatives would have on the alternatives already accepted. Performance improvements are to be reevaluated by the team and key decision makers to validate the project improvement for the acceptance of these alternatives.*
- ***Comments –*** *Any comments that may assist the report reviewer in more fully understanding the benefits of these conditionally accepted alternatives.*
- ***Follow-Up Actions for Conditionally Accepted Alternatives*** *– Document the key actions required, responsible parties, and estimated due date for each conditionally accepted VA alternative.*

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 1)	**Caltrans**
Project Name: *Example Project*	

Summary of *Conditionally Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance
4.1	$6,000,000	$0	$0	$6,000,000	+3%

Comments

Alternative 4.1 involves reducing the design speed in selected areas of the project, and it is anticipated to be accepted once a Design Exception is approved.

Summary of *Conditionally Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alt. Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value
4.1	$6,000,000	$0	$0	$6,000,000	+3%	+7%.
	$0	$0	$0			

Comments

Alternative 4.1 involves reducing the design speed in selected areas of the project, and it is anticipated to be accepted once a design exception is approved.

Follow-Up Actions for *Conditionally Accepted* Alternatives

Follow-up with Project Manager (805-555-3016) in Spring, 2002, to determine whether a design exception has been approved.

Example

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 2)

At the completion of Segment 3 the Team Leader documents any conditionally accepted alternatives on the VASSR form to facilitate tracking and the ultimate resolution of the open VA alternatives. The VA alternatives that are conditionally accepted for implementation into the project are reevaluated for performance impact. It is necessary to determine the **added** impact on performance that each conditionally accepted VA alternative will ultimately have on the already accepted VA alternative sets, so that the total performance impact can be determined without reassembling the team at a later date and to reassess the performance improvement of the VA alternatives. These performance improvements are to be validated by the decision makers; in particular, the Project Manager must approve the values being reported by the VA team.

VA Study Conditionally Accepted Alternatives (Page 2). *The example VA Study Conditionally Accepted Alternatives (form T-02-6) discusses the impact of conditionally improved alternatives on the performance rating of accepted alternatives:*

- ***Criteria*** *– Criteria used in the evaluation of alternatives for this VA Study*
- ***Criteria Weight*** *– The weighting factor determined for these criteria*
- ***Conditionally Accepted Alternative*** *– The number of the conditionally accepted VA alternative*
- ***Cumulative Performance Change*** *– The added performance improvement* ***to the total project*** *that each VA alternative would have for each criterion*
- ***Total Performance Adjustment*** *– The product of the Criteria Weight times the Cumulative Performance Change.*
- ***Rating Rationale****– A narrative explaining the rationale for the performance change. Even if the VA alternative will not change the total rating, but it represents an improvement, it should be discussed here.*

To determine the Change in Performance and Change in Value, the added rating points for the conditionally accepted alternatives that become accepted needs to be recalculated on the Performance Rating Matrix

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 2)					**Caltrans**
Project Name:	***Example Project***				
Impact of Conditionally Accepted Alternatives on Performance Rating					
Criteria	**Criteria Weight**	**Conditionally Accepted Alternative**	**Cumulative Performance Change**	**Total Performance Adjustment**	**Rating Rationale**
Mainline Traffic Operations	24	4.1	0	0	No significant impact
Highway User Safety	29	4.1	0	0	No significant impact
Access	19	4.1	0	0	No significant impact
Local Traffic Operations	10	4.1	0	0	No significant impact
Constructibility	2	4.1	1	2	Significantly reduces cuts and export
Environmental Impacts	14	4.1	1	14	Reduces environmental impact of significant cuts
Right-of-Way Impacts	2	4.1	1	2	Reduces significant amount of new right-of-way required

VA STUDY SUMMARY REPORT
BENEFIT SUMMARY

After the Implementation Meeting, the VA Team Leader completes the VA Study Benefit Summary form. The results at this time are preliminary, as the costs of the study will not be finalized until the end of the fiscal year. Final VA Study Benefits will be updated and reported by HQ VA Branch.

VA Study Summary Report – Benefit Summary. *The example VA Study Summary Report – Benefit Summary (form T-02-7) summarizes key information needed by HQ VA Branch in their reporting of the VA Program.*

Cost of Performing VA Study:

- ***Caltrans Administrative Costs*** *– This value is provided by the VA HQ Branch at the end of the fiscal year. For the final report, the value (administrative cost/study) for the previous fiscal year will be used. In the Annual VA Report that is compiled at the end of the fiscal year, this number is updated for official reporting purposes.*
- ***In-House Team Members*** *– The time the Caltrans team members have spent on the VA Study is multiplied by $75 per hour to determine this value.*
- ***Consultant Team Leader*** *– The cost of the consultant Team Leader, clerical support, travel and living expenses, and other direct cost items is inserted here.*
- ***Consultant Team Members*** *– The cost of the consultant team member(s), travel and living expenses, and other direct cost items is inserted here.*
- ***Total Study Costs*** *– The above costs are totaled here.*

Summary of VA Study Benefits:

- ***Accepted Implementation Rate (Accepted/Accepted + Conditionally Accepted)*** *– The number of accepted and conditionally accepted VA alternatives are divided by the total number of mutually exclusive VA alternatives.*
- ***Cost Reduction, Expressed as a Percentage (Accepted + Conditionally Accepted)*** *– The savings resulting from accepted VA alternatives and conditionally accepted VA alternatives is divided by the total project cost that the team studied to determine the percent cost reduction.*
- ***Study Return on Investment (Accepted + Conditionally Accepted) –*** *Accepted VA Alternative Savings ÷ Study Costs (Stated as xx:1) and Conditionally Accepted VA Alternative Savings ÷ Study Costs.*

  Note: *The above values are calculated without, then with, conditionally accepted alternatives to show the minimum impact based on the alternatives initially accepted, and the ultimate potential impact if the conditionally accepted alternatives are accepted.*
- ***Project Delivery Time Saved (Months)*** *– Identify the Project Delivery time saved (or added time if necessary) to the overall schedule as a result of the implemented VA alternatives.*
- ***Project Capital Outlay Support Costs Saved ($)*** *– Identify the Project Delivery cost saved (or added time if necessary) to the project as a result of the implemented VA alternatives.*
- ***Summary of Study Impacts –*** *A narrative, which summarizes the benefits of the VA Study. This should be written so that it can be used as an effective marketing tool to share the benefits of the study throughout the organization.*
- ***VA Study Timing Impacts*** *–* ***General Comments*** *– A narrative, which summarizes how the timing of the study impacted the scope of the study and the results.*
- ***VA Alternatives Rejected Due to VA Study Timing –*** *Identify any VA alternatives that were rejected because it was too late in the Project Delivery Process to make the change due either to the fact that the cost to redesign to the same level would eliminate the savings, or that it would unacceptably delay the project.*

VA STUDY SUMMARY REPORT BENEFIT SUMMARY	**Caltrans**
Project Name: *Example Project*	

Cost of Performing VA Study	
Caltrans Administrative Costs	$14,400
In-House Team Members	$21,450
Consultant Team Leader	$43,061
Consultant Team Members	$11,620
Total Study Costs	$90,531

Summary of VA Study Benefits	
Accepted Implementation Rate (Accepted / Accepted + CA)	50%/67.5%
Cost Reduction, Expressed as a Percentage Accepted /Accepted + CA)	9% / 11%
Study Return on Investment (ROI) (Accepted / Accepted + CA) Implemented Savings Divided by Study Costs (Stated as xx:1)	254:1 / 320:1
Study Value Return on Investment (VROI) (Accepted / Accepted + CA) (Value Improvement x 1,000,000) divided by Study Costs (Stated as xx:1)	342:1 / 420:1
Project Delivery Time Saved (Months)	12
Project Capital Outlay Support Costs Saved ($)	($70,000)

Summary of Study Impacts

Implemented VA alternatives reduced the project's excavation quantities by almost 70%, reduced almost a mile of existing sustained 6% grade to 4%, and eliminated an existing intersection at the bottom of a sustained grade. The alternatives also significantly reduced the number of potential conflicts between the traveling public and construction vehicles hauling dirt during construction. Construction time was reduced by at least one year. The new interchange will eliminate the only traffic signal along the corridor, which will help to improve operations. The interchange will also reduce turning conflicts in an area that has historically had a very high accident rate. It will also reduce a bottleneck along the route that will result in improving operations as traffic demands increase. The relationship between Caltrans and the local stakeholders (Regional Transportation Agency, City & Community Groups) were strengthened as they used the VA process to work together to address and resolve project concerns to the benefit of all.

VA Study Timing Impacts – General Comments

The VA Study was conducted early in the Project Approval Document Phase, before the detailed Environmental Technical Studies started. This provided the VA team maximum flexibility to develop alternatives to improve the project. There were no alternatives rejected due to timing.

VA Alternatives Rejected Due to VA Study Timing

Alternative	Reason

Example

PRESENT RESULTS

The VA team and Team Leader give a formal oral presentation to the project designers, decision makers, and stakeholders at the conclusion of the study. Team members may use the materials developed for each alternative, or they may prepare presentation graphics (overhead projector, slides, or flip charts) to communicate the essential features of the alternatives.

Presentation Outline. *The Presentation Outline illustrates how the oral briefing is organized:*

- ***Introduction*** *– Project name, location, number, team members*
- ***Project*** *– Major elements, length, significant costs, schedule*
- ***Alternatives***
  - *Accepted alternatives*
  - *Conditionally accepted alternatives*
  - *Advantages and disadvantages*
  - *Performance and accepted savings*
- ***Summary***
  - *Accepted alternatives*
  - *Total accepted savings/performance – More than one tally may be needed to account for alternative sets*
  - *Conditionally accepted alternatives*
  - *Additional savings/performance from conditionally accepted alternatives*
- ***Closing***
  - *Final comments – Comments on VA alternatives by decision makers and stakeholders*

PRESENTATION OUTLINE

Presentation graphics may be overhead projector, slides, flip charts, or pages of documented alternatives, organized as follows:

INTRODUCTION

- Project Name
- Location/Number
- Team Members

1

PROJECT

- Description
- Major Elements
- Length
- Significant Costs
- Schedule

2

ACCEPTED ALTERNATIVES

4.0

2.2

ALTERNATIVE 1.1

- Original Concept
- Alternative Concept
- Sketches
- Advantages
- Disadvantages
- Performance
- Total Accepted Savings

3

CONDITIONALLY ACCEPTED ALTERNATIVES

5.0

ALTERNATIVE 3.0

- Original Concept
- Alternative Concept
- Sketches
- Advantages
- Disadvantages
- Performance
- Additional Savings
- Pending Action

4

SUMMARY

- Accepted Alternatives
- Total Accepted Savings/ Performance
- Conditionally Accepted Alternatives
- Additional Savings/Performance from Conditionally Accepted Alternatives

5

CLOSING

- Decision Makers' Comments
- Stakeholders' Comments

6

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BLANK FORMS

- Meeting Attendees (T-01)
- VASSR – Task Order Identification (T-02-1)
- VASSR – Participants and Schedule (T-02-2)
- VASSR – Proposed Alternatives (T-02-3)
- VASSR – Accepted Alternatives (T-02-4)
- VASSR – Conditionally Accepted Alternatives, Page 1 (T-02-5)
- VASSR – Conditionally Accepted Alternatives, Page 2 (T-02-6)
- VASSR – Benefit Summary (T-02-7)
- VA Study Project Data (T-03-1)
- VA Study Charging Information (T-03-2)
- Cost Model Worksheet (T-04)
- Performance Criteria Matrix (T-05)
- Performance Rating Matrix – (T-06)
- Rating Rationale – Original Concept (T-07)
- Project Information (T-08)
- Functions (T-09)
- FAST Diagram (T-10)
- Idea Evaluation (T-11)
- Value Analysis Alternative, page 1 (T-12-1)
- Value Analysis Alternative, page 2 (T-12-2)
- Sketches (T-13)
- Performance Measures (T-14)
- Assumptions and Calculations (T-15)
- Initial Costs (T-16)
- Life Cycle Costs (T-17)
- VA Team Alternative Review (T-18)
- Rating Rationale – Proposed Alternatives (T-19-1)
- Rating Rationale – Accepted Alternatives (T-19-2)
- Summary of VA Alternatives – Preliminary (T-20-1)
- Summary of VA Alternatives – Final (T-20-2)
- Comments (T-21)
- VA Alternative Implementation Action (T-22)
- VA Study Evaluation (T-23)

BLANK FORMS

- Meeting Attendees (T-01)
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- VASSR – Conditionally Accepted Alternatives, Page 1 (T-02-5)
- VASSR – Conditionally Accepted Alternatives, Page 2 (T-02-6)
- VASSR – Benefit Summary (T-02-7)
- VA Study Project Data (T-03-1)
- VA Study Charging Information (T-03-2)
- Cost Model Worksheet (T-04)
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- Performance Measures (T-14)
- Assumptions and Calculations (T-15)
- Initial Costs (T-16)
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- Summary of VA Alternatives – Final (T-20-2)
- Comments (T-21)
- VA Alternative Implementation Action (T-22)
- VA Study Evaluation (T-23)

MEETING ATTENDEES *Project Name*											Caltrans		
								NAME	ORGANIZATION	POSITION	TELEPHONE		FAX
											E-MAIL		

VA STUDY SUMMARY REPORT TASK ORDER IDENTIFICATION		Caltrans
Project Name:		

TASK ORDER IDENTIFICATION INFORMATION						
Contract	**Task Order**	**District**	**County**	**Route**	**KP**	**EA**

STUDY TYPE					
Highway		**Process**		**Product**	
NHS Mandated?					

ANNUAL VA PROGRAM	
Study listed on District VA Annual Program? (Y/N)	

KEY PROJECT MILESTONE DATES					
M000	**Identify Need:**		**M100**	**Approve DPR:**	
M010	**Approve PID:**		**M200**	**PA&ED:**	
M015	**Program Project:**		**M380**	**Project PS&E:**	
M020	**Begin Environmental:**		**M500**	**Approve Contract:**	

PROJECT DESCRIPTION

Capital Outlay Support Costs:	
Estimated Right of Way Cost:	
Estimated Project Construction Cost:	

PROJECT PURPOSE and NEED

VA STUDY PURPOSE and OBJECTIVES

VA STUDY SUMMARY REPORT PARTICIPANTS and SCHEDULE		Caltrans
Project Name:		

TEAM LEADERS				
Name	**Organization**	**Discipline/Position**	**Phone/Email**	**Expertise Level ***
VA STUDY TEAM MEMBERS				
PROJECT CONTACTS				
TEAM RESOURCE ADVISORS				
STUDY TECHNICAL REVIEWERS				
PROJECT DECISION MAKERS				

VA STUDY SCHEDULE			
Meeting	**Dates**	**Times**	**Location**

* VA TEAM EXPERTISE LEVELS	
Since VA Studies provide guidance for project management decisions on major state transportation projects, recruited VA team members should be mid-level to expert-level in their knowledge, tenure, and overall experience in the referenced discipline. DVACs should contact the appropriate functional managers, well in advance of the study dates, to provide to the VA team individuals with this level of expertise, and begin recruiting for the VA teams. Consequently, DVACs will contact appropriate functional managers well in advance of the Pre-Study Meeting date to ensure the early recruitment of VA team members with the highest level of expertise.	**Expertise Level** 4- Expert 3- Advanced 2- Mid 1- Low

VA STUDY SUMMARY REPORT PROPOSED ALTERNATIVES		Caltrans
Project Name:		

Summary of *Proposed* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance

Comments

Summary of *Proposed* VA Alternatives - *Cumulative* Study Savings

VA Set No.	VA Alt. No.	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value

Comments

VA STUDY SUMMARY REPORT ACCEPTED ALTERNATIVES		Caltrans
Project Name:		

Summary of *Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance

Comments

Summary of *Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Perf.	Change in Value

Comments

*Indicates Set Used in Report Calculations.

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 1)		**Caltrans**
Project Name:	***Project Name***	

Summary of *Conditionally Accepted* VA Alternatives

VA Alt Number	Initial Cost Savings	Subsequent Cost Savings	Highway User Cost Savings	Total LCC (NPV) Cost Savings	Change in Performance

Comments

Summary of *Conditionally Accepted* VA Alternatives - *Cumulative* Study Savings

VA Alternative Number	Initial Cost Savings / Cost Increase	Subsequent Cost Savings/ Cost Increase	Highway User Cost Savings/ Cost Increase	Total LCC (NPV) Cost Savings	Change in Performance	Change in Value

Comments

Follow-Up Actions for *Conditionally Accepted* Alternatives

VA STUDY SUMMARY REPORT CONDITIONALLY ACCEPTED ALTERNATIVES (Page 2)		Caltrans
Project Name:		

Impact of Conditionally Accepted Alternatives on Performance Rating

Criteria	Criteria Weight	Conditionally Accepted Alternative	Cumulative Performance Change	Total Performance Adjustment	Rating Rationale

VA STUDY SUMMARY REPORT BENEFIT SUMMARY		Caltrans
Project Name:		

Cost of Performing VA Study	
Caltrans Administrative Costs	
In-House Team Members	
Consultant Team Leader	
Consultant Team Members	
Total Study Costs	

Summary of VA Study Benefits	
Accepted Implementation Rate (Accepted / Accepted + CA)	
Cost Reduction, Expressed as a Percentage Accepted /Accepted + CA)	
Study Return on Investment (ROI) (Accepted / Accepted + CA) Implemented Savings Divided by Study Costs (Stated as xx:1)	
Study Value Return on Investment (VROI) (Accepted / Accepted + CA) (Value Improvement x 1,000,000) divided by Study Costs (Stated as xx:1)	
Project Delivery Time Saved (Months)	
Project Capital Outlay Support Costs Saved ($)	

Summary of Study Impacts

VA Study Timing Impacts – General Comments

VA Alternatives Rejected Due to VA Study Timing	
Alternative	**Reason**

VA STUDY PROJECT DATA *Project Name*	Caltrans

The Project Development staff, in coordination with the DVAC, collects, copies, and distributes relevant project data necessary to conduct the study.

The project data can include plans, specifications, correspondence, calculations, estimates, and other relevant information available prior to the beginning of the study. The following checklist is provided to facilitate the identification and distribution of project data required for the VA Study. Include additional items of data collection not included on the checklist. At a minimum, the PSR/PR/PSSR and cost estimate should be provided to each VA team member a week prior to the study.

Item	No. of Copies	Responsibility	Due Date
VISUAL AIDS			
• Graphics, such as public displays, showing project details			
• Aerials			
• Project photographs (Provide electronic copies of digital photos)			
• Highway and structure as-built plans (or portions, if extensive)			
• Photologs (frame-by-frame movie of the route, by kilometer post)			
PROJECT DOCUMENTS			
• Important correspondence and memoranda			
• Project work plan			
• Project Report (PR) / Project Study Report (PSR) / Project Scope Summary Study Report (PSSR)			
• Environmental Documents or Environmental Assessment (EIS/EIR, FONSI/ND,CE) and related technical reports			
• Cooperative agreements			
• Permits from regulatory agencies			
• Utility plans and encroachments			
• Completed plans (1 full-size set and copies of half-size OK)			
• Latest project estimates (Please provide most recent and include breakdown by item)			
• Right-of-way acquisition information and right-of-way record maps			
• Detours and/or staging construction or concepts			
• Hydrology/hydraulics information and calculations			
• District Maintenance Records queried by County, Route, and Kilometer Post (last five years) – CCA Data collection item			
• Traffic data (AADT, Truck Traffic %, DHV, Directional Split, etc.) – LCCA data collection item			
• Accident data (last three years – TSAR, Table B and C) – LCCA data collection item			
STRUCTURES ITEMS			
• Bridge plans (half-size OK)			
• Advance Planning Study(s) and correspondence requesting detailed advance planning study and technical design strategy			
• Retrofit strategy (if applicable) and related correspondence			
• Supplementary bridge reports – LCCA data collection item			
• Sufficiency rating			
• Geological, Soils Report(s) and Foundation Report (including Log of Borings), Seismic Site Data (i.e., ARS Curves)			

VA STUDY CHARGING INFORMATION *Attachment D*	**Caltrans**

The Project Manager is to identify charging information for the VA Study. Provide the charge codes and estimated costs for VA team participation and stakeholder participation. Provide specific project workplan charge codes for the Consultant Services.

STUDY CHARGING INFORMATION

DVAC Study Charges

EA	FAE	MSA	Hours	Rate (Avg.)	Cost

Caltrans Team Member Study Charges

EA	FAE	MSA	Hours	Rate (Avg.)	Cost

Caltrans Study Participants Study Charges

EA	FAE	MSA	Hours	Rate (Avg.)	Cost

*** VA Consultant Team Leader Study Labor Charges (Includes clerical and other labor costs)**

EA	FAO	MSA	Hours	Rate (Avg.)	Cost

*** VA Consultant Team Leader Study ODC Charges**

EA	FAO	MSA			Cost

*** VA Consultant Team Member Study Labor Charges**

EA	FAO	MSA	Hours	Rate (Avg.)	Cost

*** VA Consultant Team Member ODC Charges**

EA	FAO	MSA			Cost

* Consultant fees will be determined at the conclusion of the Task Order.

COST MODEL *Project Name*		Caltrans
COST SUMMARY		
Item	**Cost**	**Percent**

PARETO CHART	
COST SUMMARY	
Item	**Cost ($_____)**

PERFORMANCE CRITERIA MATRIX *Project Name*	Caltrans

										TOTAL	%
A											
B											
C											
D											
E											
F											
G											
H											
I											

a	More Important
a/b	Equal Importance

PERFORMANCE RATING MATRIX ***Project Name***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept					

PERFORMANCE RATING MATRIX - Original Concept *Example Project*	Caltrans

Criteria	Criteria Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	
		No Build											0
		Original Concept											0
													0
													0
													0
		No Build											0
		Original Concept											0
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		No Build											0
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													0
		No Build											0
		Original Concept											0
													0
													0
													0

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	0			#DIV/0!	

PERFORMANCE RATING MATRIX - Proposed Alternatives ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0
		Original Concept											0
		VA Set 1											0
		VA Set 2											0
													0
													0

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	0			#DIV/0!	
VA Set 1	0	#DIV/0!		#DIV/0!	#DIV/0!
VA Set 2	0	#DIV/0!		#DIV/0!	#DIV/0!

PERFORMANCE RATING MATRIX - Accepted Alternatives ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	
		Original Concept											0
		Accepted Alts											0
													0
													0
													0
		Original Concept											0
		Accepted Alts											0
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		Original Concept											0
		Accepted Alts											0
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													0
													0
		Original Concept											0
		Accepted Alts											0
													0
													0
													0
		Original Concept											0
		Accepted Alts											0
													0
													0
													0
		Original Concept											0
		Accepted Alts											0
													0
													0
													0

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	0			#DIV/0!	
Accepted Alternatives	0	#DIV/0!		#DIV/0!	#DIV/0!

PERFORMANCE RATING MATRIX - Conditionally Accepted Alternatives ***Example Project***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating										Total Performance
			1	2	3	4	5	6	7	8	9	10	
		Original Concept											0
		CA Alts											0
													0
													0
													0
		Original Concept											0
		CA Alts											0
													0
													0
													0
		Original Concept											0
		CA Alts											0
													0
													0
													0
		Original Concept											0
		CA Alts											0
													0
													0
													0
		Original Concept											0
		CA Alts											0
													0
													0
													0
		Original Concept											0
		CA Alts											0
													0
													0
													0
		Original Concept											0
		CA Alts											0
													0
													0
													0

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	0			#DIV/0!	
CA Alternatives	0	#DIV/0!		#DIV/0!	#DIV/0!

Rating Rationale – Original Concept

Performance Criteria	Rationale

PROJECT INFORMATION ***Project Name***	**Caltrans**
TEAM MEMBER:	**DATE:**

PROJECT BRIEFING(S):

SITE VISIT(S):

-

PROJECT CONSTRAINTS:

-

PARADIGM SHIFTS:

-

FUNCTIONS
Project Name

Caltrans

PAGE NO.
1 of 1

ITEM	**FUNCTION**		
Description	**Verb**	**Noun**	**Type**

Function: **Active Verb**
Measurable Noun

Type:
B = Basic
S = Secondary
RS = Required Secondary
HO = Higher Order
A = Assumed
U = Unwanted

FAST DIAGRAM *Project Name*	Caltrans

How? →

When? ↕

← **Why?**

IDEA EVALUATION *Project Name*									Caltrans		
Ideas		Performance Criteria						Advantages	Disadvantages	$	Rank
No.	Function										

Ranking Scale:	**5 = Significant Value Improvement** **4 = Good Value Improvement** **3 =Minor Value Improvement**	**2 = Minor Value Degradation** **1 = Significant Value Degradation or Does Not Meet Project Purpose and Need**
Evaluation Criteria:	**Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**	

IDEA EVALUATION *Project Name*										Caltrans		
Ideas		Performance Criteria							Advantages	Disadvantages	$	Rank
No.	Function											

Ranking Scale:	**5 = Significant Value Improvement**	**2 = Minor Value Degradation**
	4 = Good Value Improvement	**1 = Significant Value Degradation, or Does Not Meet Project Purpose and Need**
	3 = Minor Value Improvement	
Evaluation Criteria:	**Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**	

VALUE ANALYSIS ALTERNATIVE *Project Name*	Caltrans	
FUNCTION:	**IDEA NO.**	**NUMBER**
TITLE:		**PAGE NO.** 1 of

ORIGINAL CONCEPT:

ALTERNATIVE CONCEPT:

ADVANTAGES:

-

DISADVANTAGES:

-

COST SUMMARY	Initial Cost	Present Value Subsequent Cost	Present Value Highway User Cost	Net Present Value
Original Concept	$	$	$	$
Alternative Concept	$	$	$	$
Savings	$	$	$	$

Team Member:	Discipline:	PERFORMANCE:

VALUE ANALYSIS ALTERNATIVE *Project Name*	Caltrans	
TITLE:	NUMBER	PAGE NO.

DISCUSSION / JUSTIFICATION:

TECHNICAL REVIEWER COMMENTS:

PROJECT MANAGEMENT CONSIDERATIONS:

SKETCHES *Project Name*	Caltrans	
TITLE:	**NUMBER**	**PAGE NO.** of

PERFORMANCE MEASURES *Project Name*	Caltrans		
TITLE:	**NUMBER**		**PAGE NO.** of
CRITERIA and RATING RATIONALE for ALTERNATIVE	**Performance**	**Original**	**Alternative**
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
	Rating		
	Weight		
	Contribution		
Total Performance:			
Net Change in Performance:			

ASSUMPTIONS and CALCULATIONS *Project Name*	Caltrans	
TITLE:	NUMBER	PAGE NO. of

INITIAL COSTS *Project Name*							Caltrans
TITLE						NUMBER	PAGE NO.
CONSTRUCTION ELEMENT		ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
Description	Unit	Quantity	Cost/Unit	Total	Quantity	Cost/Unit	Total
ROADWAY ITEMS							
ROADWAY SUBTOTAL							
ROADWAY MARK-UP							
VA ADDED MARK-UP							
ROADWAY TOTAL							
STRUCTURE ITEMS							
STRUCTURE SUBTOTAL							
STRUCTURE MARK-UP							
VA ADDED MARK-UP							
STRUCTURE TOTAL							
RIGHT-OF-WAY ITEMS							
Right-of-Way Acquisition							
Utility Relocation							
Relocation Assistance							
Demolition							
Title and Escrow Fees							
RIGHT-OF-WAY TOTAL							
ENVIRONMENTAL MITIGATION ITEMS							
CAPITAL OUTLAY SUPPORT ITEMS							
Reengineering and Redesign							
Project Engineering							
TOTAL							
TOTAL (Rounded)							
						SAVINGS	

LIFE CYCLE COSTS *Project Name*				Caltrans	
TITLE:				**NUMBER**	**PAGE NO.** of
Life Cycle Period _____ Years		Real Discount Rate _____		**ORIGINAL**	**ALTERNATIVE**
A. INITIAL COST					
Service Life-Original _____ Years Service Life-Alternative _____ Years		**INITIAL COST SAVINGS:**			
B. SUBSEQUENT ANNUAL COSTS					
1. Maintenance and Inspection					
2. Operating					
3. Energy					
Total Subsequent Annual Costs:					
Present Value Factor (P/A):					
PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS (Rounded):					
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**	**Present Value**	**Present Value**
Rehabilitations - Original					
Rehabilitations - Alternative					
Repairs - Original					
Repairs - Alternative					
Expended Service Life - Original					
Expended Service Life - Alternative					
Salvage - Original					
Salvage - Alternative					
PRESENT VALUE OF SUBSEQUENT SINGLE COSTS (Rounded):					
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)					
TOTAL SUBSEQUENT COSTS SAVINGS:					
E. HIGHWAY USER ANNUAL COSTS				**Present Value**	**Present Value**
1. Accident					
2. Travel Time					
3. Vehicle Operating					
TOTAL HIGHWAY USER ANNUAL COSTS:					
TOTAL HIGHWAY USER COST SAVINGS:					
F. TOTAL PRESENT VALUE COST (A+D+E)					
TOTAL LIFE CYCLE SAVINGS:					

VA TEAM ALTERNATIVE REVIEW *Project Name*	**Caltrans**
TITLE:	**NUMBER**

Team Member:

☐ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member:

☐ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member:

☐ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member:

☐ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Team Member:

☐ I have reviewed this alternative and agree with it as it is written
☐ I have reviewed this alternative and suggest the following (or attached) changes

Rating Rationale – Proposed Alternatives

Performance Criteria	VA Set 1 (Title)	VA Set 2 (Title)

Rating Rationale – Accepted Alternatives

Performance Criteria	Rationale

SUMMARY OF VA ALTERNATIVES - Preliminary *Project Name*		Caltrans	
Number	**Title**	**Potential Savings Initial/*LCC***	**Performance**

SUMMARY OF VA SETS

Set No.	Description	Initial Costs Savings/Increase	Change in Performance	Change in Value

SUMMARY OF VA ALTERNATIVES - Final *Project Name*				Caltrans	
Number	**Description**	**Potential Savings Initial/*LCC***	**Potential Performance Improvement**	**Validated Savings Initial/*LCC***	**Validated Performance Improvement**

Note *Potential Savings and Potential Performance Improvement are the original values identified by the VA team in the Preliminary Report. Validated Savings and Validated Performance Improvement are the values agreed to during the Implementation Meeting for the accepted and conditionally accepted alternatives. There are no validated costs or performance improvements for the rejected VA alternatives.*

COMMENTS *Project Name*			Caltrans
PREPARED BY	**ORGANIZATION**	**TELEPHONE**	**DATE**

VA ACTIVITY

- ☐ **Kick-off Meeting**
- ☐ **Technical Review**
- ☐ **VA Presentation**
- ☐ **Implementation**
- ☐ **Other_____**

COMMENTS:

VA ALTERNATIVE IMPLEMENTATION ACTION *Project Name*		Caltrans
TITLE:		**NUMBER**
RESPONSES	**Prepared by:**	**Date:**

Acceptance of alternatives denotes intent to implement, based on current information, in the given project development phase (PID, PA&ED or PS&E). It is recognized that future conditions may change this disposition. The validation of disposition and the cost and performance changes for the alternative are required by Caltrans to ensure that the project decision makers agree with the study results. These validated results become the basis for the VA Program reportables.

Technical Feasibility / Validated Performance	**DISPOSITION** ☐ **Accept** ☐ **Conditionally Accept** ☐ **Reject** **Validated Performance**
Implementable Portions	**<u>If Alternative is Rejected</u>** Was rejection due to VA study taking place too late in the project development process to implement the change? Yes ☐ No ☐
Validated Cost Savings	**Validated Savings** **Project Development Support Cost Savings**

Project Development Delivery Impacts

	No Change	Reduced by	Increased by
PID	☐	Mo.	Mo.
PA&ED	☐	Mo.	Mo.
PS&E	☐	Mo.	Mo.
Const.	☐	Mo.	Mo.

Other Comments

Value Analysis Study
EVALUATION

Project: _____

Location: _____

Date: _____

PERSONNEL	**Excellent**	**Good**	**Fair**	**Poor**
VA Coordinator	4	3	2	1
VA Team Leader	4	3	2	1
VA Team Members	4	3	2	1
Resource Advisors	4	3	2	1

Comments: .....
.....
.....

PROJECT	**Excellent**	**Good**	**Fair**	**Poor**
Study Scope	4	3	2	1
Documentation	4	3	2	1
Information Briefing	4	3	2	1
Supplemental Data	4	3	2	1

Comments: .....
.....
.....

FACILITIES	**Excellent**	**Good**	**Fair**	**Poor**
Study Room	4	3	2	1
Furnishings	4	3	2	1
Temperature, Light	4	3	2	1
Equipment	4	3	2	1
Communications	4	3	2	1
Resource Materials	4	3	2	1

Comments: .....
.....
.....

VA METHODOLOGY	**Excellent**	**Good**	**Fair**	**Poor**
VA Job Plan	4	3	2	1
Instructions	4	3	2	1
Schedule	4	3	2	1
Site Visit	4	3	2	1

Comments: .....
.....
.....

STUDY RESULTS	**Excellent**	**Good**	**Fair**	**Poor**
VA Alternatives	4	3	2	1
Design Suggestions	4	3	2	1
VA Presentations	4	3	2	1

Comments: ..... Presentation ended on time.....
.....
.....

NAME (Optional) _____

APPENDIX 1

- **Caltrans Project Performance Measures**
- **Standardized Performance Criteria Names**
- **Typical Caltrans Performance Criteria**

CALTRANS PROJECT PERFORMANCE MEASURES

Project performance measures explicitly measure the project scope and delivery of a project, providing the project stakeholders an opportunity to effectively compare the three project management components: scope, schedule, and budget. Performance criteria can generally be divided between project scope components (Highway Operations, Environmental Impacts, and System Preservation) and project delivery components.

PROJECT SCOPE COMPONENTS

Highway Operations

Highway Operations criteria measure the impacts to highway users and are generally covered in the project's purpose and need. These typically involve, but are not limited to:

- **Traffic Operations** (Typically measured in travel time between project limits for highway user.) Mainline versus Local Street operations are commonly segregated in this category. Other possible categories include Ramp Operations and HOV Traffic Operations.
- **System Compatibility** (Integration of the project with the regional transportation system and intermodal facilities.) This also includes non-motorized mobility.
- **Access** (Access to and from the highway and key locations within a community.) Vehicular and non-motorized are subcategories to consider. Traffic circulation patterns.
- **Highway Safety** (A measure of probability and severity to the highway user and highway maintenance crews.) Highway user safety is generally measured by fatality, injury, and property damage only. These are generally covered in the project's purpose and need.
- **Traffic Operations during Construction** (Travel time delays during construction.)

Environmental Impacts

Environmental Impact criteria measure how the proposed facility impacts its surrounding environment, both in terms of the final scope and during construction of the project. These are statutorily required by environmental laws and regulations that are constantly updated.

Final scope impacts, to address the impact of the facility upon the community, as constructed and in place, should be considered as follows:

- **Physical Environment** – Includes such factors as topography, geology, soils, seismic, paleontology, water quality, hydrology, storm water run-off, hazardous waste, air quality, noise, and energy.
- **Natural Environment** – Includes such factors as vegetation, fish and wildlife, wetlands and other waters of the U.S., and special status plants, animals, and communities.
- **Special Status Land Use Designations** – Includes such factors as floodplains, coastal zone, wild and scenic rivers, section 4(f) resources, and section 6(f) properties.

- **Community Issues** – Includes such factors as land use planning, farmlands, economic issues, environmental justice and Title VI, relocations, community and public services, traffic, visual and aesthetic resources, and public partnerships.
- **Cultural Resources –** Includes such factors as archaeological resources and historical resources.

Construction impacts upon the community during the construction of the facility should be considered, as follows*:*

- **Construction Impacts to the Community –** Includes items such as construction noise, dust, business access, water pollution, and air pollution.

System Preservation

System preservation criteria measure the sustainability of the proposed facility. These criteria are typically related to maintenance operations or design considerations required to ensure the facility will withstand natural events. The following major topics could be considered:

- **Maintainability** – A measure of the maintenance effort needed to preserve an acceptable level of operations of the facility for the duration of the service life of the facility. Highway roadways typically require maintenance on the traveled way, slopes and drainage, roadside, and traffic guidance, as a result of wear and tear caused by natural forces and the facility users.
- **Hydraulics –** A measure of the ability to pass floodwaters through roadway facilities without impacting the roadway facility, or the upstream or downstream flow of the drainage facility.
- **Geotechnical Stability –** A measure of the ability of the facility to preserve the structural integrity of the soil/structure and soil/pavement stability interaction during the service life of the facility.
- **Riding Surface** – A measure of the comfort, appearance, and durability of the pavement surface and its effect on vehicle wear and tear during the service life of the facility.

PROJECT DELIVERY COMPONENTS

Project Delivery criteria measure the potential impact to delivering the project to the stakeholders as proposed.

- **Construction Risk** – A measure of the risk that the contractor will not be able to deliver the project scope, as defined in the contract documents, and the potential for change orders and disputes.
- **Project Schedule** – A measure of the time to complete the project.
- **Project Phaseability** – The ability to build in incremental phases over an extended period of time, typically due to incremental amounts of funding or demand. Includes compatibility with the ultimate alignment.

Typically, there are 5-8 key performance criteria that need to be considered for a particular project. The following pages contain examples of a number of criteria that have been used on Caltrans projects.

STANDARDIZED PERFORMANCE CRITERIA NAMES

When performance criteria are being developed for a project, standardized names for each criterion should be used if the criterion is applicable to the project. Maintaining standardized names for the criteria is important for the VA Program in reporting performance measures. A project may have specific criteria that need to be developed but are not included in the standardized list of names; however, if criteria are included in the standardized list, use the standardized name and not a variation of that name.

Standardized names are:

- Mainline Traffic Operations
- Local Traffic Operations
- Highway User Safety
- Highway Worker Safety
- Access
- System Compatibility
- Environmental Impacts
- Constructibility
- Construction Impacts to Community
- Hydraulics
- Geotechnical Stability
- Project Schedule
- Project Phaseability
- Construction Risk
- Maintainability
- Aesthetics
- Ramp Operations
- HOV Traffic Operations
- Non-Motorized Mobility
- Construction Impact on Business
- Traffic Operations During Construction
- Roadway Geometrics
- Right-of-Way Impacts
- Riding Surface

TYPICAL CALTRANS PERFORMANCE CRITERIA

Following are definitions and rating scales for some of the standardized performance criteria.

Highway Operations

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Mainline Traffic Operations	A measure of the efficiency of traffic operations as they relate directly to the mainline alignment (including on-ramps and off-ramps), based upon a 20-year projected traffic forecast.	10	LOS "A": Volume/Capacity = 0.0–0.30; Free flow – excellent operation
		9	LOS "B": Volume/Capacity = 0.31–0.48; Stable flow – very good operation
		8	LOS "C": Volume/Capacity = 0.49–0.64; Stable flow – good operation
		7	LOS "D": Volume Capacity = 0.65–0.80; Approaching unstable flow – fair operation
		6	LOS "E": Volume/Capacity = 0.81–0.90; Unstable flow – poor operation
		4	LOS "F": Volume/Capacity = 0.91–1.05; Traffic congestion for 15 minutes to 1 hour
		3	LOS "F"; Volume/Capacity = 1.06–1.20; Traffic congestion for 1 to 2 hours
		2	LOS "F": Volume/Capacity = 1.21–1.34; Traffic congestion for 2 to 3 hours
		1	LOS "F": Volume/Capacity = 1.35 or more; Traffic congestion for more than 3 hours
Highway User Safety	A measure of how the expected accident rate for the project compares with the original concept's expected accident rate, expressed by comparing to the statewide average.	10	20% below the statewide average
		9	
		8	Statewide average for the roadway configuration
		7	
		6	20% greater than the statewide average
		5	
		4	60% greater than the statewide average
		3	
		2	Twice the statewide average
		1	

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Local Traffic Operations	A measure of the efficiency of traffic operations as they relate to the local roadway infrastructure, based upon a 20-year projected traffic forecast.	10	Optimal operations (i.e., highest level of service achievable for the facility in question – LOS "A")
		9	
		8	Good operations – traffic delays during peak hours are minimal (i.e., overall level of service is equivalent to a "B")
		7	
		6	Satisfactory operations – delays during peak hours are acceptable (i.e., overall level of service is equivalent to a "C")
		5	
		4	Satisfactory operations – delays during peak hours are acceptable (i.e., overall level of service is equivalent to a "D")
		3	
		2	Unsatisfactory operations – major delays during peak hours (i.e., overall level of service is equivalent to an "E")
		1	Unacceptable operations – traffic gridlock is the norm (i.e., overall level of service is equivalent to an "F")

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Access	An approximation of a facility's degree of access (both ingress and egress) between the local roadway infrastructure and the highway system. This criterion considers how well the facility meets driver expectations, the quantity (number of on-and off-ramps), and quality (directness) of access.	10	Optimal access (i.e., all major and minor movements are provided for, and driver expectations for access are fully met)
		9	Excellent access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – one minor movement requires out-of-direction travel)
		8	Good access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – two minor movements require out-of-direction travel)
		7	Good access (i.e., meets driver expectations; all major movements are accommodated in a direct manner – several minor movements require out-of-direction travel)
		6	Satisfactory access (i.e., essentially meets driver expectations; one major movement and one minor movement require out-of-direction travel)
		5	Satisfactory access (i.e., essentially meets driver expectations; several major and minor movements require out-of-direction travel)
		4	Marginal access (i.e., several major movements require out-of-direction travel – some minor movements are not provided)
		3	Limited access (i.e., multiple major movements are not provided and/or significant out-of-direction travel is required)
		2	Severely limited access (i.e., multiple major movements are not provided and significant out-of-direction travel is required)
		1	Unsatisfactory access (i.e., no access is provided – facility relies upon other interchanges or ramps beyond the scope of the project for access)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Non-Motorized Mobility	An approximation of the degree and nature of the access and mobility available to non-motorized travelers (typically pedestrians and bicyclists) within the proposed facility.	10	Full mobility (i.e., all directions of travel are provided and are separated from vehicular traffic)
		9	
		8	
		7	
		6	
		5	Moderate mobility (i.e., access and mobility is provided across a major facility)
		4	
		3	
		2	
		1	No mobility is provided

Environmental Impacts

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Environmental Impacts	An approximation of the concept's overall effect on the surrounding environment. This criterion includes the following areas: ◆ *Physical Environment:* Topography, geology, soils, seismic, paleontology, water quality, hydrology, storm water run off, hazardous waste, air quality, noise, and energy ◆ *Natural Environment:* Vegetation, fish and wildlife, wetlands and other waters of the U.S., special status plants, animals, and communities ◆ *Land Use:* Floodplains, coastal zone, wild and scenic rivers, section 4(f) resources, and section 6(f) properties ◆ *Community Issues:* Land use planning, farmlands, economic issues, environmental justice and Title VI, relocations, community and public services, traffic, visual and aesthetic resources, and public partnerships ◆ *Cultural Resources:* Includes such factors as archaeological resources and historical resources	10	Major improvement upon existing environmental conditions
		9	Minor improvement upon existing environmental conditions
		8	No environmental impacts
		7	Negligible degradation (i.e., does not require mitigation)
		6	Minor degradation (i.e., requires limited mitigation)
		5	Moderate degradation (i.e., requires significant mitigation in one area or limited mitigation in two)
		4	Moderate degradation (i.e., requires significant mitigation in two areas or limited mitigation in three)
		3	Major degradation (i.e., requires substantial mitigation in one area and limited/significant mitigation in others)
		2	Major degradation (i.e., requires substantial mitigation in two areas and limited/significant mitigation in others)
		1	Severe degradation (i.e., requires substantial mitigation in multiple areas)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Construction Impacts to Community	An approximation of the temporary impacts to the surrounding community due to construction issues such as noise, vibration, dust, and visual; direct impacts to access to communities; and traffic impacts such as delays, closures, and detours.	10	No direct or indirect impacts
		9	No direct and minor indirect impacts (i.e., noise, vibration, dust, or visual, requiring limited mitigation effort)
		8	Minor direct impacts (i.e., minor traffic delays, occasional temporary nighttime lane closures, etc.)
		7	Minor direct and indirect impacts
		6	Moderate indirect impacts (i.e., noise, vibration, dust, or visual, requiring significant mitigation efforts and/or inconveniences to the public)
		5	Moderate direct impacts (i.e., multiple minor traffic delays, lengthy detours, extended temporary night closures, etc.)
		4	Moderate direct and indirect impacts
		3	Major indirect impacts (i.e., noise, vibration, dust, or visual, requiring substantial mitigation efforts and/or inconveniences to the public)
		2	Major (i.e., daytime lane closures, etc.)
		1	Major direct and indirect impacts

System Preservation

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Hydraulics	A measure of the ability to pass floodwaters through the roadway facilities without impacting the roadway facility or the upstream or downstream flow of the drainage facility.	10	Major improvement upon existing hydraulic conditions
		9	Minor improvement upon existing hydraulic conditions
		8	No impacts to existing hydraulic conditions
		7	Negligible degradation to existing hydraulic conditions
		6	Minor degradation to existing hydraulic conditions
		5	
		4	Moderate degradation to existing hydraulic conditions
		3	
		2	Major degradation to existing hydraulic conditions
		1	Severe degradation to existing hydraulic conditions

Project Delivery

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Project Schedule	A measure of the total time to complete the project from the present milestone to the end of construction. This is usually measured in months.	10	>50% reduction in schedule
		9	36-50% reduction in schedule
		8	21-35% reduction in schedule
		7	11-20% reduction in schedule
		6	1-10%
		5	Current schedule
		4	1-10% increase in schedule
		3	11-20% increase in schedule
		2	21-35% increase in schedule
		1	>35% increase in schedule
Construction Risk	The risk that the contractor will NOT deliver the project scope as specified in the contract bid documents within the bid price and schedule. This includes the potential for change orders and disputes.	10	No discernible risks to the contractor beyond those that would be anticipated as "normal"
		9	
		8	Minor risk
		7	
		6	Moderate risk
		5	
		4	
		3	Major risk
		2	
		1	Extreme risk to the contractor (i.e., major contractor claims, change orders, and/or disputes are imminent)

Criteria	Definition	Rating Scale	Unit of Measure/Quantification
Project Phaseability	An approximation of the project's capacity to be built in incremental phases over an extended period of time, while tying into the existing highway system, and/or its capacity to be expanded upon for future phases.	10	Optimal phaseability (i.e., project is easily broken into phases and/or expanded)
		9	
		8	
		7	
		6	
		5	Moderate phaseability (i.e., project can be broken into a limited number of major phases and/or requires transitional elements – future expansion requires some additional reconstruction)
		4	
		3	
		2	
		1	Severely restricted phaseability (i.e., project cannot be phased and/or expanded without great difficulty)

APPENDIX 2

Update and Reevaluate Functions and Performance Measurements

UPDATE AND REEVALUATE FUNCTIONS AND PERFORMANCE MEASUREMENTS

Example Project

If the VA team develops any VA alternatives that add functions (change project scope) during the VA Study, the corresponding performance measures need to be considered. If this is the case, the VA team will reevaluate and update the FAST Diagram and performance analysis accordingly, and review it with the stakeholders during Segment 2 for final acceptance of the performance measure analyses.

Updated Analysis Assumptions

For the purpose of demonstrating this process, it will be assumed that the VA team discovered during the VA Study that the County (local stakeholder) is reviewing a plan for a new County development along the corridor, which is important for the local economy. Currently this property has direct access to the State Route; however, the addition of the County facility would require significant upgrades to the intersection and add a traffic signal intersection to the State Route. The addition of the traffic signal would have significant impact to operations on the State Highway. The property is located just east of Olive Hill Road. Traffic from the County facility was not considered in the Original Concept provided to the VA team.

As a result of this new information, the team developed an alternative to add a frontage road to provide access from the new interchange rather than add another at-grade access to the State Route to serve this development. The frontage road to the interchange would provide better operations and safety on the state highway and better segregate regional from local travel.

During the team review, the team realized that they had added a function—*Add Frontage Road*—that had not been considered as part of the original concept. When they added this function to the FAST Diagram to validate the logic of incorporating this function into the project scope, they also added the function *Support County Improvements*. The updated FAST Diagram demonstrates how these functions support the Higher Order Functions for the project.

The added functional analysis helped the team to realize that all of the performance criteria critical to the project had not been considered, and a new performance measure—*Stimulate Local Economy*—was identified. As a result, they needed to revisit all performance measure analyses that had been done to ensure that each alternative, and the analysis of the Original Concept, considered all of the performance criteria.

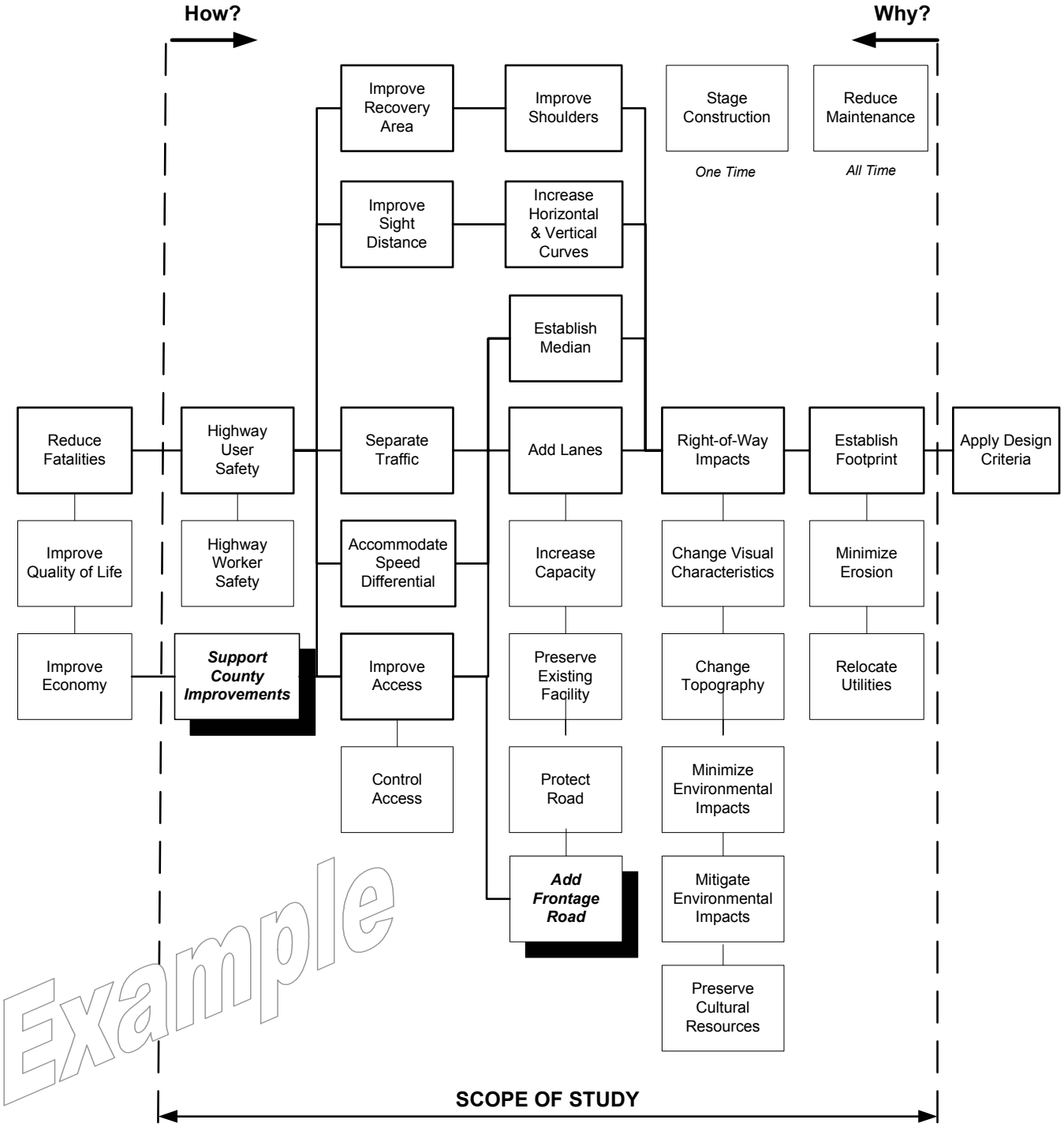
Forms for Updated Analyses

Following this page are updated forms to demonstrate how this change would impact the VA Study and result in updating the team's analyses. The following updated forms include:

- FAST Diagram
- Performance Criteria Matrix
- Performance Definitions
- Performance Rating Matrix – Original Concept
- Performance Rating Matrix – Proposed Alternatives
- Performance Measures (for each alternative – one example is shown here)

FUNCTION ANALYSIS SYSTEM TECHNIQUE DIAGRAM

Example Project - Update and Reevaluate Functions and Performance Measurements



PERFORMANCE CRITERIA MATRIX ***Example Project - Update and Reevaluate Functions and Performance Measurements***	**Caltrans**

									TOTAL	%
Mainline Traffic Operations	**A**	b	a	a	a	a	a	a	6.0	21%
Highway User Safety	**B**	b	b	b	b	b	b	b	7.0	25%
Access	**C**	c	c	c	c	c	c	c	5.0	18%
Local Traffic Operations	**D**	d	d	f	d	h			2.0	7%
Constructibility	**E**	f	f	e/g	h				0.5	2%
Environmental Impacts	**F**	f	h						3.0	11%
Right-of-Way Impacts	**G**	h							0.5	2%
Stimulate Local Economy	**H**	*4.0*							*4.0*	*14%*
									28.0	100%

a	More Important
a/b	Equal Importance

Example

Stimulate Local Economy

A measure of how the project impacts the local revenues.

- ***1*** *Reduces local revenue or tax base due to property takes, lost access, or convenience of access*
- ***4*** *No change from current status*
- ***7*** *Improves local revenue or tax base due to avoided takes, improved access, or convenience of access*
- ***10*** *Significantly improves local revenue, tax base, and jobs, due to improved access and convenience of access*

Rating Rationale – Original Concept:
Update and Reevaluate Functions and Performance Measurements

Performance Criteria	Rationale
Mainline Traffic Operations	The project upgrades a two-lane highway to a four-lane divided highway, which increases capacity. While there are numerous at-grade intersections and turning movements along this project, there is only one signalized intersection that impacts the free flow of traffic. The majority of the alignment has horizontal and vertical sight distances that meet freeway standards.
Highway User Safety	Changing the roadway from a 2-lane to a 4-lane divided highway reduces the potential for traffic accidents that currently result from passing maneuvers. There are still a number of at-grade crossings and turning movements across oncoming traffic (especially at the shopping center near Olive Hill Road). There is one high-volume signalized intersection near the shopping center.
Access	All local access points are maintained, and the quality of these access points is improved through the addition of turning pockets.
Local Traffic Operations	New signalized intersection with dual left-turn lanes from the mainline and operational improvements to other at-grade intersections will significantly reduce driver wait times to access or cross the State highway.
Constructibility	Construction is complicated by three significant cuts and construction around the refinery, due to the coordination of the oil pipeline relocations and their proximity to the creek.
Environmental Impacts	Significant mitigation is necessary due to the impact on wetlands, hazardous material expected near the refinery, and the appearance and erosion potential of the steep cuts. Habitat and Oak mitigation is necessary due to the steep cuts.
Right-of-Way Impacts	While most of the alignment is within the State's right-of-way, there are several large parcels required due to the urban intersection, large cuts, a section near the refinery, and the interchange at the east end of the project.
Stimulate Local Economy	*Improved operations and access to the project should help to improve the local economy and accommodate planned growth.*

Example

PERFORMANCE RATING MATRIX - Original Concept ***Example Project - Update and Reevaluate Functions and Performance Measurements***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	24	No Build		2									48
		Original Concept								8			192
Highway User Safety	29	No Build				4							116
		Original Concept						6					174
Access	19	No Build			3								57
		Original Concept							7				133
Local Traffic Operations	10	No Build				4							40
		Original Concept								8			80
Constructibility	2	No Build											N/A
		Original Concept							7				14
Environmental Impacts	14	No Build											N/A
		Original Concept						6					84
Right-of-Way Impacts	2	No Build										10	N/A
		Original Concept					5						10
Stimulate Local Economy	*14*	*No Build*											*N/A*
		Original Concept							7				*98*

OVERALL PERFORMANCE	**Total Performance**	**% Perf. Improve.**	**Total Cost**	**Value Index (Performance / Cost)**	**% Value Improvement**
Original Concept	681		235.6	2.89	

Example

Rating Rationale – Proposed Alternative Sets:
Update and Reevaluate Functions and Performance Measurements

Performance Criteria	VA Set 1 Reduce Design Speed to 110 kph in Selected Areas	VA Set 2 Reduce Design Speed to 120 kph in Selected Areas
Mainline Traffic Operations	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 110 kph should not have any significant impact, as the design speed is still greater than the average operating speed.	Slight improvement due to grade separation at Olive Hill Road. Local area reduction in design speed to 120 kph should not have any significant impact, as the design speed is still greater than average operating speed.
Highway User Safety	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Improvement due to grade separation at Olive Hill Road eliminates major influence to local accident concentration. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.
Access	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.	Improvement due to interchange at Olive Hill Road creates improved access to businesses and residences in the area.
Local Traffic Operations	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.	Improves local traffic accessing shopping centers and businesses at Olive Hill Road.
Constructibility	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.	Construction staging is simplified in the three areas of the project with significant cut. This is made possible by the revised design speed. The interchange at Olive Hill Road does not complicate the construction, as the topography simplifies the construction of the interchange versus an intersection.
Environmental Impacts	Reduced cuts significantly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.	Reduced cuts slightly reduce the visual impacts of road widening. Habitat and Oak mitigation are reduced, and oil line relocation is avoided.
Right-of-Way Impacts	Slope steeping, reduced cuts, and spot location reduction in median widths reduce the right-of-way takes. Most building takes and the need for new frontage roads are eliminated.	Slope steeping, reduced cuts, and spot location reduction in median widths reduce the right-of-way takes and about 50% of the building takes.
Stimulate Local Economy	*The addition of the frontage road with good access to the Olive Hill Interchange will significantly improve local revenue, tax base, and jobs, by supporting the new industrial and commercial complex along the western portion of the alignment.*	*The addition of the frontage road with good access to the Olive Hill Interchange will significantly improve local revenue, tax base, and jobs, by supporting the new industrial and commercial complex along the western portion of the alignment.*

Example

PERFORMANCE RATING MATRIX - Proposed Alternatives ***Example Project - Update and Reevaluate Functions and Performance Measurements***	**Caltrans**

Criteria	Criteria Weight	Concept	Performance Rating 1	2	3	4	5	6	7	8	9	10	Total Performance
Mainline Traffic Operations	21	Original Concept								8			168
		VA Set 1									9		189
		VA Set 2									9		189
Highway User Safety	25	Original Concept						6					150
		VA Set 1									9		225
		VA Set 2									9		225
Access	18	Original Concept							7				126
		VA Set 1								8			144
		VA Set 2								8			144
Local Traffic Operations	7	Original Concept							7				49
		VA Set 1								8			56
		VA Set 2								8			56
Constructibility	2	Original Concept							7				14
		VA Set 1								8			16
		VA Set 2								8			16
Environmental Impacts	11	Original Concept						6					66
		VA Set 1								8			88
		VA Set 2							7				77
Right-of-Way Impacts	2	Original Concept					5						10
		VA Set 1								8			16
		VA Set 2							7				14
Stimulate Local Economy	14	Original Concept							7				98
		VA Set 1									9		126
		VA Set 2									9		126

OVERALL PERFORMANCE	Total Performance	% Perf. Improve.	Total Cost	Value Index (Performance / Cost)	% Value Improvement
Original Concept	681		235.6	2.89	
VA Set 1 (Alternatives 1.2, 2.1, 3.0, 4.1, 5.0, 6.2, 7.0, 8.0)	860	26%	195.3	4.40	52%
VA Set 2 (Alternatives 1.2, 2.1, 3.0, 4.2, 5.0, 6.2, 7.0, 8.0)	847	24%	191.8	4.42	53%

Example

PERFORMANCE MEASURES ***Example Project*** ***Update and Reevaluate Functions and Performance Measurements***	**Caltrans**		
TITLE: Undercrossing at Olive Hill Road with Interchange	**NUMBER** 8.0		**PAGE NO.** 5 of 8
CRITERIA and RATING RATIONALE for ALTERNATIVE	**Performance**	**Original**	**Alternative**
MAINLINE TRAFFIC OPERATIONS Greatly improves mainline operations in this area; the traffic signal is eliminated along with slowing for turning traffic, as the on-ramps will get traffic up to speed before merging into traffic. While this is a significant improvement locally, it is a minor improvement when considering the overall project.	Rating	8	9
	Weight	21	21
	Contribution	168	189
HIGHWAY USER SAFETY Eliminates conflicts at the entrance and exit to the shopping center northeast of the intersection and associated left-turn movements—especially truck turning movements. This location is the major accident concentration remaining along the corridor. With this correction, the accident rate should not be greater than the statewide average.	Rating	6	9
	Weight	25	25
	Contribution	150	225
ACCESS Maintains good local access to businesses and homes in the area. The interchange will be able to better support the traffic from the new frontage road and provide good access to the State Route from the new commercial and industrial center.	Rating	7	8
	Weight	18	18
	Contribution	126	144
LOCAL TRAFFIC OPERATIONS Improves traffic flow on local streets, as traffic the signal is improved. Adds a side entrance to the shopping center from Olive Hill.	Rating	7	8
	Weight	7	7
	Contribution	49	56
CONSTRUCTIBILITY Grade separation increases construction time and complexity in the area. This will not impact the overall schedule, but it will increase local impact during construction.	Rating	7	6
	Weight	2	2
	Contribution	14	12
ENVIRONMENTAL IMPACTS Visual impact of grade separation needs to be evaluated. No other environmental impacts are anticipated.	Rating	6	5
	Weight	11	11
	Contribution	66	55
RIGHT-OF-WAY IMPACTS The westbound on-ramp would require added right-of-way from the El Establo Market, and it will probably require a full take of the parcel that is currently planned for just a partial take.	Rating	5	4
	Weight	2	2
	Contribution	10	8
STIMULATE LOCAL ECONOMY *This will eliminate traffic congestion in front of the local shopping center. Currently, the local population avoids the center during times when congestion typically occurs.*	*Rating*	*7*	*8*
	Weight	*14*	*14*
	Contribution	*98*	*122*
Total Performance:		**681**	**801**
Net Change in Performance:			**+18%**

Example

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