1130.6. Cost-Effective Analysis

1130.6.1 Introduction

A cost-effective analysis (CEA) is one that compares the benefits of an improvement to the cost of that improvement. This subsection focuses on roadway improvements where costs are borne by the Department and benefits accrued by the public.

The CEA procedures presented in Subsection 1130.6 apply to engineering analyses that compare alternatives with respect to the reduction of crash costs (fatalities, injuries, and property damage) to motorists.

The CEA procedures presented here do not apply to Highway Safety Improvement Program (HSIP) projects. See the HSIP Handbook for its own specific procedures.

1130.6.2 Procedure

The procedure presented here is an overview. Consult the ROADSIDE or RSAP User's Manual for more detailed procedures.

To perform a CEA, you must estimate the costs and benefits for a given alternative. These are calculated as an equivalent uniform annual cost for the design life of the roadway improvement.

Costs

The general formula for cost is: Cost = Improvement Costs + Maintenance Costs + Accident Costs + Salvage Value, where:

- **Improvement Costs** = Construction Costs + Right-of-Way Costs + Utilities Costs.
- **Maintenance Costs** = Cost of maintaining the roadside, including repairing and maintaining obstacles that are damaged by vehicular impacts.
- **Crash Costs** = Predicted or actual costs of fatalities, injuries or property damage due to vehicles impacting obstacles or hazards.

  Costs for actual crashes come from crash reports that identify the type of crash and whether there were fatalities, injuries or property damage. These crash costs are monetized so they can be compared to the cost of the improvement.

  Actual crash data is obtained from the Department's statewide crash database. This data is reported in conformance with the Model Minimum Uniform Crash Criteria (MMUCC). Under the MMUCC crash report system, data is presented in the following format, with the corresponding KABCO value (refer to the Benefits section below) identified:

INJURY STATUS		KABCO Value
Code	Injury Description	
00	No Apparent Injury	O
01	Possible Injury	C
02	Suspected Minor Injury	B
03	Suspected Serious Injury	A
04	Fatal Injury (Killed)	K

  Predicted crash costs come from the use of an engineering analysis program, which is discussed later.

- **Salvage Value** = Value of the material or hardware at the end of its economic life. The salvage value is commonly considered zero for highway applications.

Benefits

In order to determine the benefits of a roadway improvement alternative, it is necessary to monetize the value of reducing fatalities and injuries. The benefit of preventing one fatality is quantified by the Value of a Statistical Life (VSL). The VSL is not the valuation of life as such; rather, it is the valuation in reduction of risks.

The US DOT issues the VSL number and updates it periodically. The following KABCO values are derived from the VSL:

K = Fatality = VSL
A = Incapacitating Injury
B = Non-incapacitating Injury (Evident)
C = Possible Injury
O = Property Damage

The KABCO values are used by engineering analysis programs to predict the crash costs of a given alternative or existing condition. Official KABCO values and discount rates are updated annually and published on the Design and

Engineering Services Preconstruction webpage located here:

http://dot.alaska.gov/stwddes/dcsprecon/index.shtml

There are two department approved analysis programs available for predicting crash costs for roadway improvements:

- ROADSIDE
- Road Side Analysis Program (RSAP)

ROADSIDE is an engineering analysis tool that determines the benefits and costs of a given alternative under consideration. The value of ROADSIDE is its ability to predict accident rates and crash costs associated with a given roadside model. It requires input of estimated costs and modeling of the roadway segment under analysis, including cross-sectional geometry, horizontal and vertical alignment, obstacles, et.al.

ROADSIDE was included with early versions of the AASHTO Roadside Design Guide (RDG) beginning in 1989. Copies of this program and its user manual can be found on the Design and Engineering Services Preconstruction webpage located here:

http://dot.alaska.gov/stwddes/dcsprecon/index.shtml

The RSAP (Roadside Safety Analysis Program) is a roadside evaluation model that was developed under National Cooperative Highway Research Program Project 22-9 to assist designers in benefit-cost analyses. It is similar to ROADSIDE in function.

RSAP was included with the RDG (Appendix A) beginning in 2002. Copies of the current RSAP program and user manual can be found on the Design and Engineering Services Preconstruction webpage located here:

http://dot.alaska.gov/stwddes/dcsprecon/index.shtml

Designers may use either, or both, of these programs and should apply engineering judgement in interpreting the results from their use.

CEA Procedure

The discount rate, KABCO values, design life, and improvement costs need to be selected for use in the selected analysis program. In addition, the roadway alignment and cross section geometry, including roadside hardware, need to be modeled and input into the analysis program. The analysis program will compute the uniform annualized cost and benefit for each alternative under consideration and provide the benefit-to-cost (B/C) ratio.

As illustrated in Figure 1130-9, evaluation of alternatives is based on the following order of precedence:

1. Remove the obstacle
2. Redesign the obstacle
3. Relocate the obstacle
4. Reduce the Severity of the obstacle
5. Shield the obstacle
6. Delineate the obstacle

An alternative with a B/C ratio greater than 1.00 is considered cost-effective; however, having a B/C ratio greater than one is not, in itself, sufficient justification for selection of a given alternative.

When comparing several alternatives, do not rely on the magnitude of the B/C ratio as the indicator of the best alternative. Use incremental B/C ratios to determine the most cost-effective solution. Consult the ROADSIDE or RSAP user's manual for further information on incremental B/C ratios and selection of the most cost-effective alternative.

Any alternatives under consideration that are within 10 percent of each other are essentially equal given the accuracy of estimating, analysis program modeling (user input), and analysis program output. The designer should ultimately use engineering judgement in selecting a final solution.