Analyzing Extreme Weather Costs for Roadway Investment Decisions

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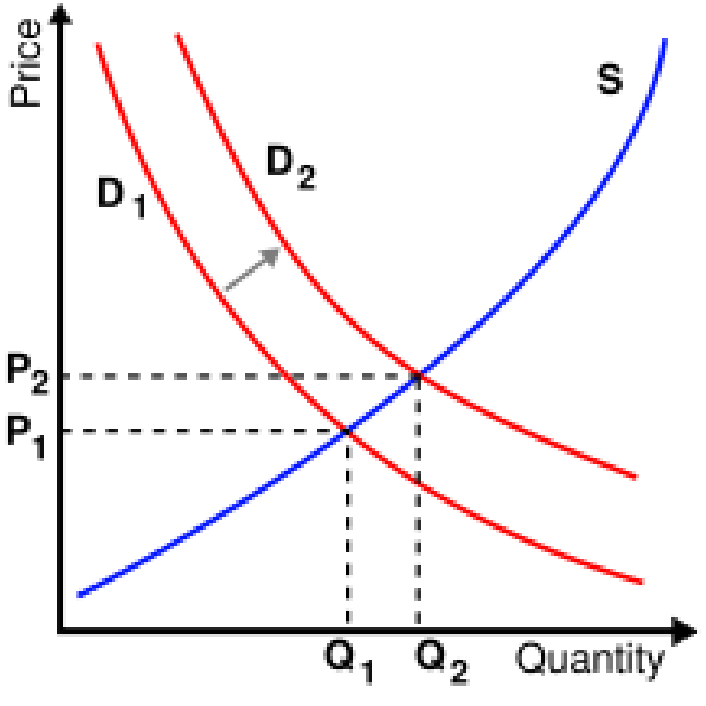
Topics

- Effects of Extreme Weather on Transportation
- Analyzing the effects
- Resources



Extreme Weather Events Increase the Challenge

Roadway assets impacted by weather events require immediate corrective measures. These costs are over and above planned budget expenditures.

Some cases pose serious budgetary challenges.

Roadway Costs Imposed by Weather Events

The 2 cost Components of Weather events:

- Direct Costs to the Agency to restore the roadway
- Costs to roadway users
  - Businesses
  - EMS vehicles
  - Fire trucks
  - General Public

Direct Costs to the Agency to Restore the Roadway

- Design and Engineering
- Construction
- Materials
- Operations
- Labor

Costs of Roadway Impacts on Roadway Users

- Businesses
- EMS vehicles
- Fire trucks
- School buses
- General Public

Impacts to businesses occur in the form of supply chain disruptions. A value of time estimate is used to represent costs to the general public of detour routes or access.

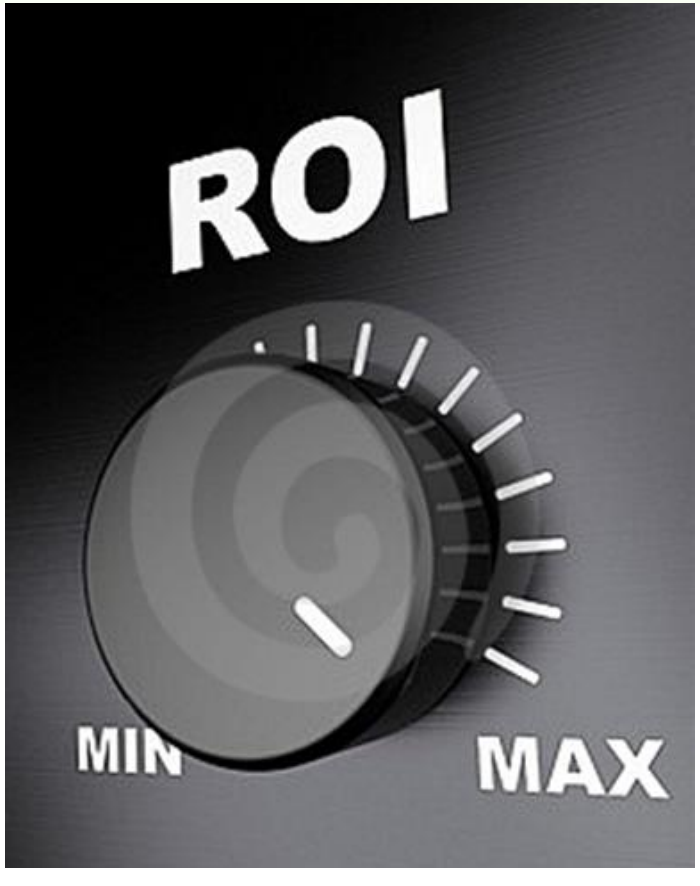
Impacts to EMS and Fire Vehicles extend to public health and property loss from fire.

Businesses relying on sending shipments can to lose money from delays

Analyzing the Impacts

Our goal is to compare current issues against an alternate state of the world to determine if there are potentially positive net-benefits from implementing the alternative.

Definition of Benefit Cost Analysis



For public agencies benefit-cost analysis benefit-cost analysis is essentially ROI. Traditional benefit cost analysis and ROI analysis for transportation includes user benefits (time, cost, safety) for travelers and select environmental effects (air, quality, noise) along with capital, operations, and maintenance(O&M) costs.

Benefit Cost Analysis

The Process

Should We take Pre-emptive Actions?

Two lane divided highway with 60,000 vehicles per day (Average Annual Daily Traffic or AADT) in 2013; 80,000 AADT in 2023; and 100,000 AADT in 2043.

Benefit Cost Analysis shows that Pre-emptive will:

- saves users $47 million in delay costs,
- Save $500 thousand in property damage and injury costs
- costs users $4million in vehicle operating costs
- Has a benefit-cost ratio of 2.2

What if we tried a different approach?

- Pre-emptive action has a benefit-cost ratio of 2.2
- Respond to periodic impacts has a benefit cost ratio of .84

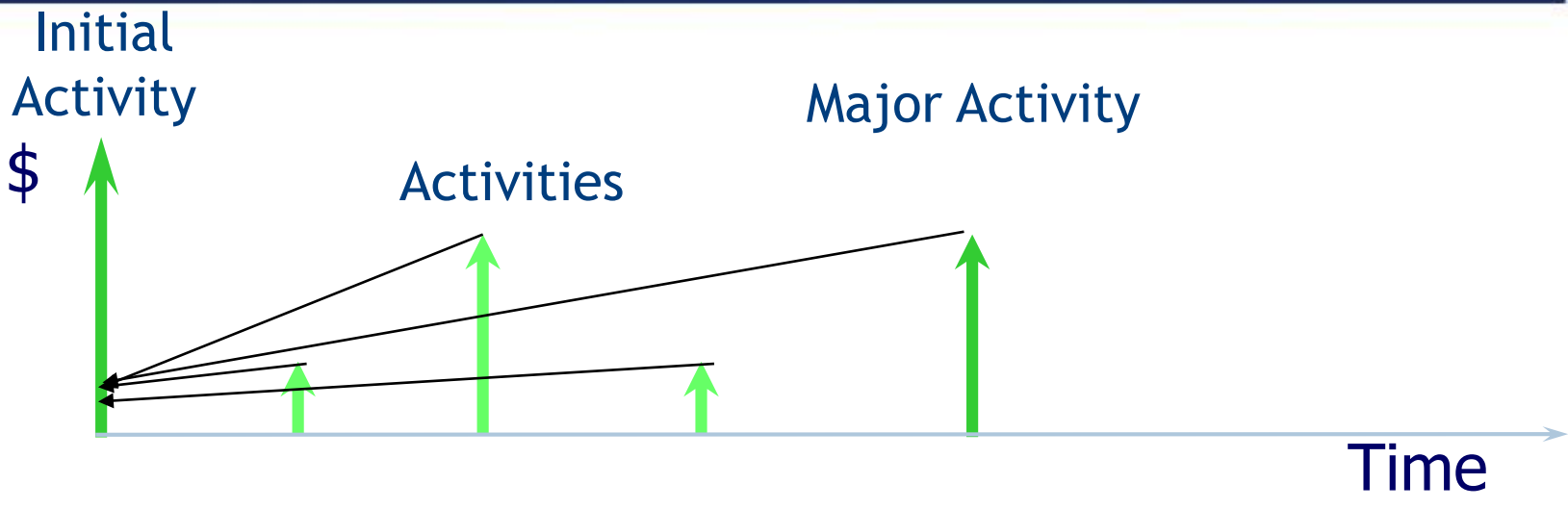
Should we improve now or wait?

- Prevention now has a benefit cost ration of 2.2
- Waiting 7 years has a benefit cost ratio of 3.7
- Waiting 12 years has a benefit cost ratio of 1.6

Calculate Present Values of Costs and Benefits

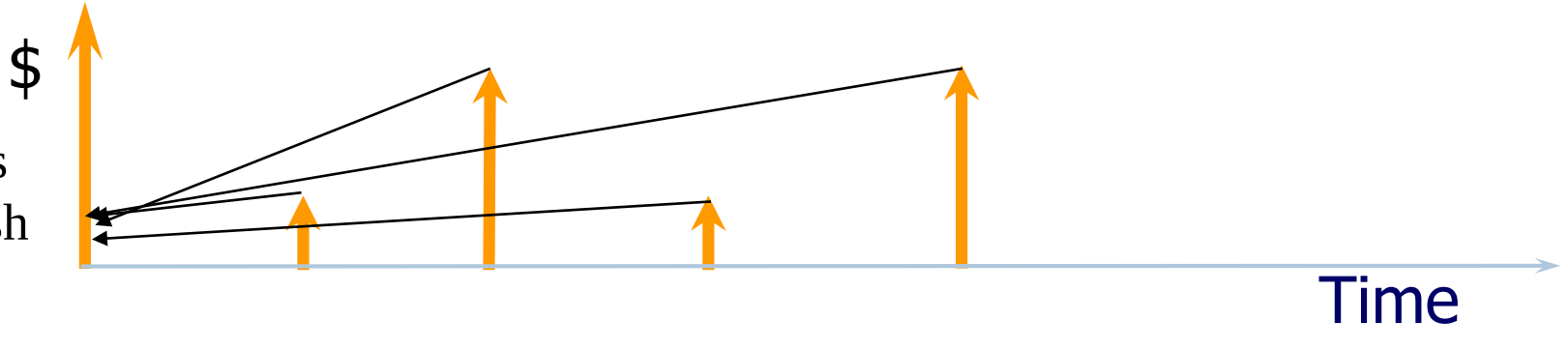
Costs

- Accelerated construction costs and premiums



Benefits

- Reduced Delay Costs
- VOC Savings
- Avoided Crash Costs



What is the present value of future sums?

Roadway User Costs Components

Definition

Costs to highway users over the life of a Highway Project

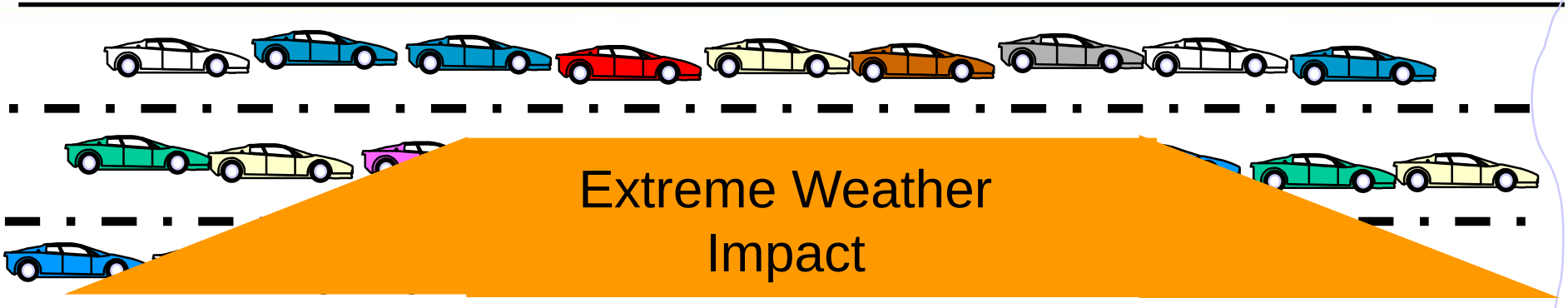
Components

- **Delay Costs** – Costs associated with an increase (or decrease) in the amount of time it takes for a user to travel from point A to B. (In our case, navigating through or around a work zone)

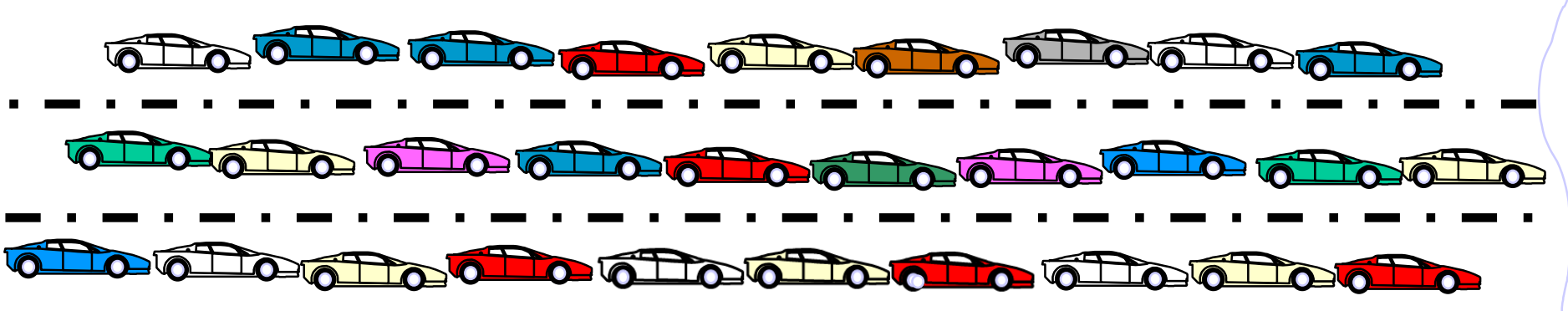
- **Vehicle Operating Costs** – Costs attributable to the operation or maintenance of a vehicle(brake wear, idling, fuel consumption, tire ware, etc.)

- **Crash costs**-Cost resulting from property damage, injuries, or loss of life

Weather Impacts on Traffic



1. Existing Costs on impacted Route(Pre-Event)
2. Additional Costs from Impact



1. Existing cost on detour route(Pre-Event)
2. Additional Costs of detoured traffic on Detour Route

Comparing Benefits To Costs

Net Present Value (NPV)

Features of NPV:

NPV = PV Benefits – PV Costs

As in BCA Formula Example

If NPV is positive, project is worth pursuing

Highest NPV alternative to accomplish a project is usually preferred, subject to budget, risk, and policy issues

Comparing Benefits To Costs

Benefit-Cost Ratio (BCR)

- Discounted benefits and costs can be compared as a ratio, "B/C"

BCR = PV (Benefits + Disbenefits)/ PV (Cost)

Ratios of less than 1 indicate project is not cost-beneficial

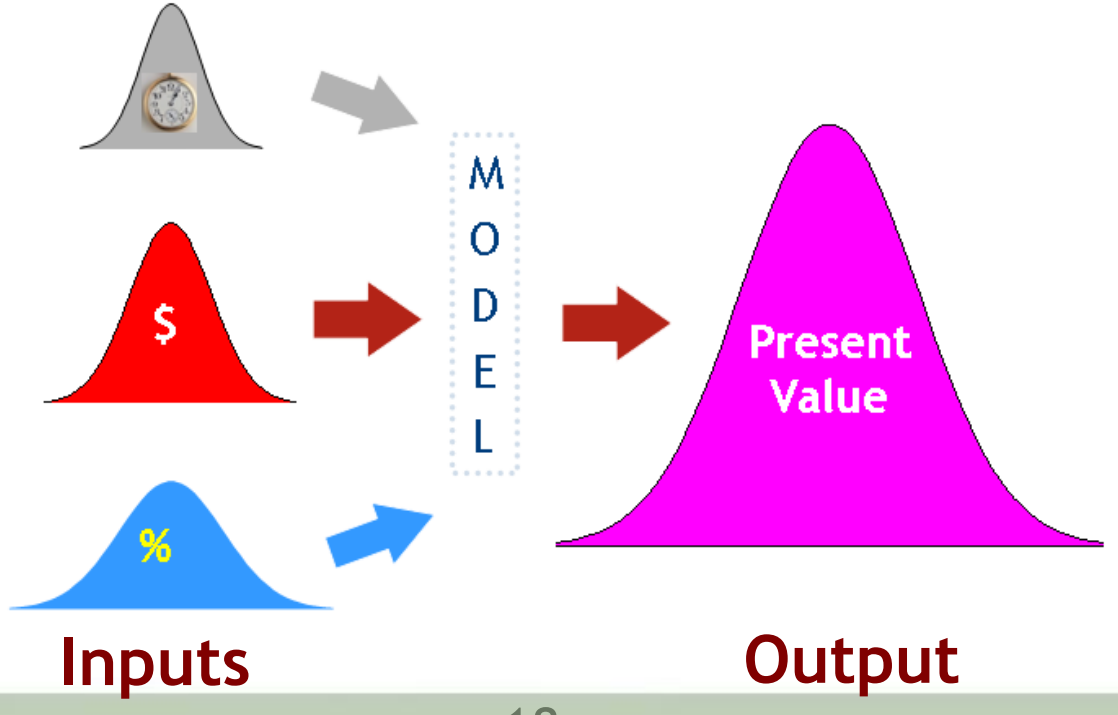
Project Level BCA Guidance

Recommended Sources of input data

- OST Value of time and value of life guidance
- Highway Capacity Manual(HCM) Developing Traffic inputs
- AASHTO Redbook Developing User Impacts
- FHWA Work Zone Road User Costs - Concepts and Applications comprehensive instructions

Probabilistic Analysis

- Inputs are defined by their range of values and probability of occurrence (probability distribution)
- Through simulation, outputs are expressed as ranges of values with probabilities of occurrence



Investment Analysis Tools - BCA.net

- web-based benefit-cost analysis
- develop strategies for improving and managing assets; evaluate & compare the benefits and costs of the alternative strategies; provide summary metrics for investment decisions.
- Calculates the traffic impacts and the present values of agency and user costs and externalities for the base case & alternative & compares them to arrive at measures including the net present value, benefit-cost ratio, and internal rate of return

Investment Analysis Tools - BCA.net

U.S. Department of Transportation
Federal Highway Administration

BCA.Net Highway Project Benefit-Cost Analysis System
Office of Asset Management

Navigation Bar and Menu (Ctrl+1) ==>

›Manage | ›Strategies | ›Project | ›Parameters | ›Scenario | ›Simulation | **Results** | ›Admin | Help | Logout

Current Settings ==>	User: dbrod	Dataset: Initial	Project: US-88 Improvement Design Alt.1	Scenario: Base, with ranges	Results: US-88 Design

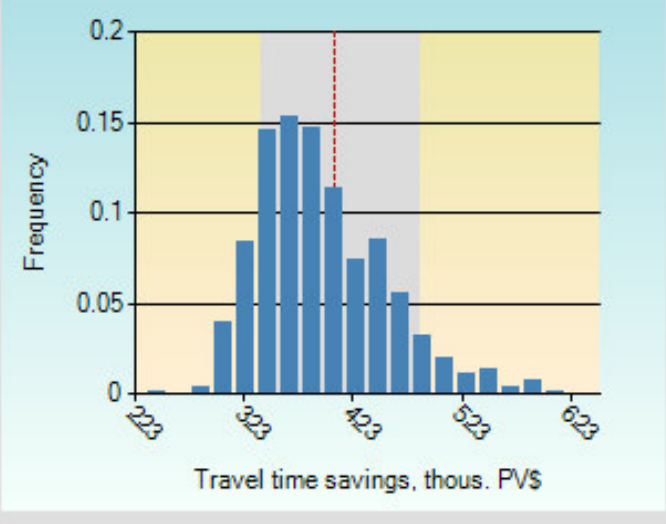
Results: US-88 Design Alt. 1

Selected results data group: Benefit-Cost Summary [Go]

	Variable	Mean Value	Standard Deviation
View	Travel time savings, thous. PV$	88.3	14.82222
View	Vehicle operating cost savings, thous. PV$	77.2	9.594951
View	Safety benefits, thous. PV$	-2.9	0.4961381
View	Environmental benefits, thous. PV$	0.0	0
View	Project residual value, thous. PV$	121.1	7.057887
View	Disbenefit of traffic disruption from construction, thous. PV$	0.0	0
View	Total benefits, thous. PV$	283.8	24.80117
View	Of this, benefits to new users, thous. PV$	0.0	0.004338904
View	Total costs, thous. PV$	1129.7	51.36357
View	Net benefits, thous. PV$	-846.0	46.4683
View	Benefit-cost ratio	0.25	0.01990146
View	Rate of return, percent	-6.19	0.5805153

Investment Analysis Tools - BCA.net

Variable: Travel time savings, thous. PV$



Summary Statistics	
Mean	405.4258
Std. Deviation	60.23414
Minimum	243.0547
Maximum	649.5156
Skewness	0.8867129
Kurtosis	0.9656861

Percentiles	
1%	308.9688
5%	327.6875
10%	339.2188
20%	354.5313
30%	367.8281
40%	381.5
50%	394.7969
60%	408.625
70%	428.2656
80%	453.125
90%	484.0781
95%	520.3281
99%	596.9531

Select chart type: (•) Histogram ( ) Cumul ( ) De-cumul ( ) Tornado [Refresh] Bins: 20

The chart shows the probability distribution for the result variable.
For the Histogram, Cumulative and De-Cumulative Charts:
The shaded gray region of the chart is the 80% confidence interval.
The dotted red line is the mean value.
For the Tornado Chart
The bars show the percent change in the mean of the result when the input varies within its 80% confidence interval while the other inputs are held constant at their central value.

More Information

Publications

Events

Training

Economic Analysis

Economic analysis is a critical component of a comprehensive project or program evaluation methodology such as Asset Management. It allows highway agencies to identify, quantify, and value the economic benefits and costs of highway projects and programs over a multi-year timeframe. Highway agencies are then better able to target scarce resources to their best uses in terms of maximizing benefits to the public and to be more accountable for those decisions.

The FHWA's Office of Asset Management is promoting the application of economic analysis methods to highway decision-making by developing, collecting, and distributing relevant information and tools to the transportation community. The office is publishing a number of documents, including the Economic Analysis Primer, various fact sheets on economic analysis topics, and case studies of successful State and local applications of economic analysis.

Economic Analysis for Highway Decision Makers Workshop: The Office of Asset Management is now offering to State and local governments a one-day workshop on the application of economic analysis to highway decision-making. This free workshop covers a broad range of economic subjects, including inflation, life-cycle cost analysis, benefit-cost analysis, traffic forecasts, and risk analysis. The workshop does not require prior training in economics. If you are interested in the workshop, please contact your State's Federal Highway Administration (FHWA) Division Office.

STEAM Technical Support: The Office of Asset Management is now partnering with the FHWA's Office of Planning to provide technical support to the Surface Transportation Efficiency Analysis Model (STEAM). Visit the STEAM site for more information on STEAM, including the new "Ask the STEAM Expert" feature, Frequently Asked Questions, and STEAM User's Group Registration.

Features

- Introduction to BCA.NET

Publications

- **Case Studies**
  - Florida
  - Ohio-Kentucky-Indiana Regional Council of Governments Experience
- Economic Analysis Primer
- "Putting Economic Analysis to Work for You" Focus Article

Events

- View all Upcoming Asset Management Events

More Information

- Economic Analysis Links
- Highway Construction Cost Increases and Competition Issues
- STEAM

Contact

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Thank You

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http://www.fhwa.dot.gov/infrastructure/asstmgmt/economic.cfm