

# COLORADO BRIDGE ENTERPRISE

## Memorandum

---

Colorado Bridge Enterprise  
4201 East Arkansas Avenue  
Denver, Colorado 80222

**DATE:** February 8, 2013  
**TO:** Bridge Enterprise Board of Directors  
**FROM:** Josh Laipply, CDOT Bridge Engineer  
**SUBJECT:** Proposed Pilot Preservation Plan

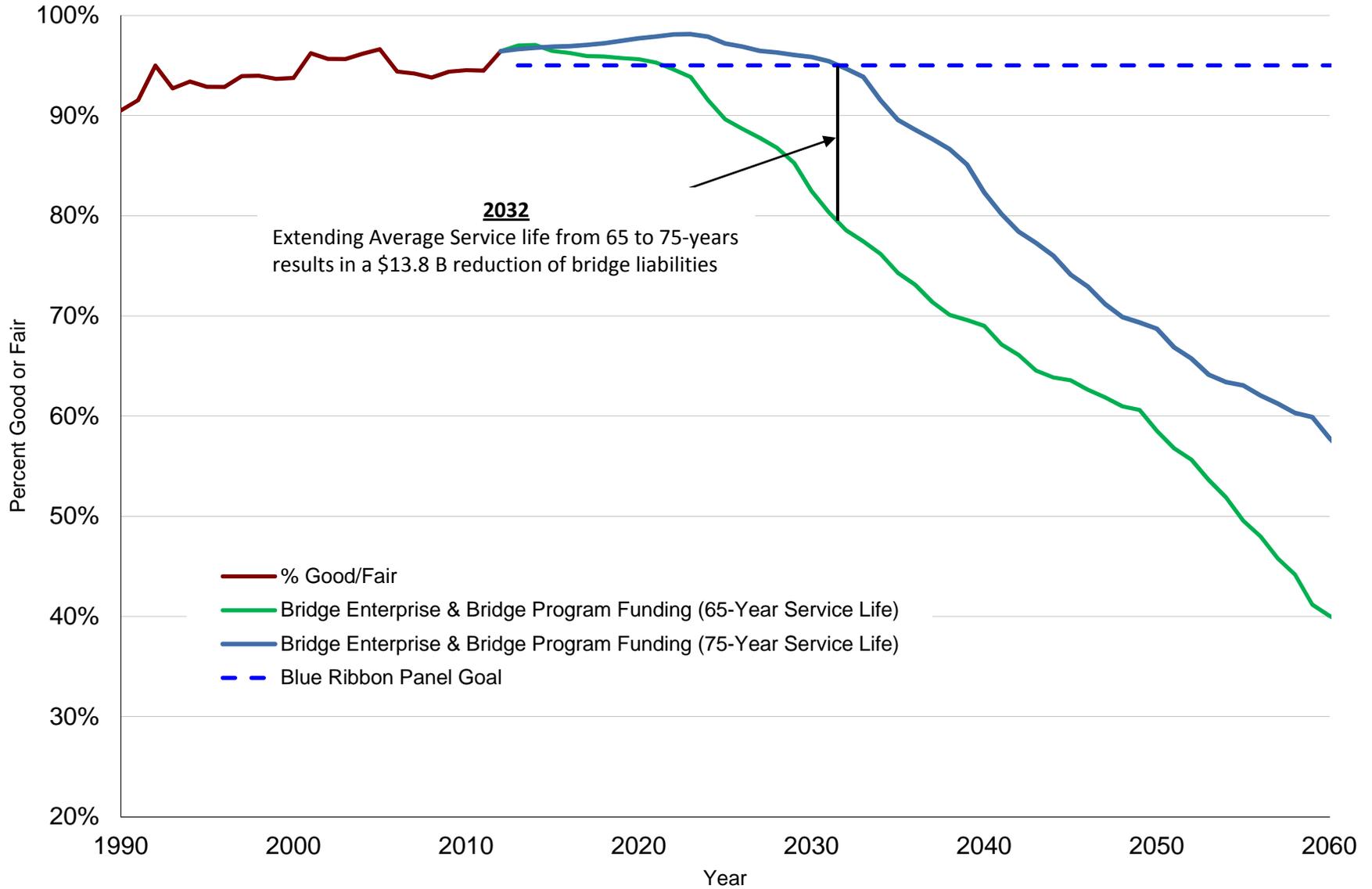
CBE is hereby seeking the Boards approval to implement a Pilot Preservation program. The purpose of the program is to test and document the effectiveness of preservation measures such as deck-washing and waterproofing of exposed concrete surfaces as it relates to extending the useful life of bridges.

With Board approval, CBE shall work in collaboration with CDOT Staff Bridge on plan development that includes:

- Identify what preservation measures should be deployed and based upon prior examination this will initially include deck-washing and waterproofing exposed concrete surfaces. Other preservation measures will also be examined for potential deployment as well.
- Develop cost estimates associated with each preservation measure.
- Identification of 10-12 candidate bridges to test the effectiveness of each preservation measure. Selection criteria will include but not be limited to: geographical location (intended to be a blend of mountain vs. urban bridges), bridge usage including ADT (average daily traffic) and percent of truck-traffic, structure types, and weather conditions.
- Development and implementation of a formal Plan which outlines the preservation measures, proposed deployment frequency (for example bridge decks should be washed every two-years), periodical monitoring and inspection requirements, data collection, and metrics to document and measure effectiveness.
- Development of a CBE/CDOT preservation program Memorandum of Agreement (or MOU) similar to the Maintenance and Inspection MOU. Resolutions adopting the MOU will be presented to the Transportation Commissioners and CBE Board of Directors for approval.

If acceptable, BE will present a budget supplement (in the range of \$50K to \$100K) for Board approval and requisite MOU resolutions at the March TC/Board meetings.

## Good/Fair Projection Based on Average Service Life



# COLORADO BRIDGE ENTERPRISE

## Memorandum

---

Colorado Bridge Enterprise  
4201 East Arkansas Avenue  
Denver, Colorado 80222

**DATE:** February 8, 2013  
**TO:** Bridge Enterprise Board of Directors  
**FROM:** Tim Harris, CBE Chief Engineer  
Ben Stein, CBE Chief Financial Officer  
**SUBJECT:** Proposed Bridge Prioritization Plan

The following is the development methodology, recommended scoring system, and delivery timeline associated with the Bridge Enterprise Prioritization Plan.

### **Prioritization Plan - Purpose Statement**

Develop an objective scoring system whereas both **quantitative** and **qualitative** criteria are taken into consideration to determine which FASTER eligible bridge(s) represent the best use of available funding.

### **3-Step Process**

1. Identify the most relevant quantitative and qualitative criteria.
2. Develop scoring system (or scoring worksheet) that;
  - a. Determines if a bridge satisfies minimal threshold requirements and should be advanced within the program; and
  - b. Assign each FASTER eligible bridge a numerical value that can be compared to other eligible bridges to ensure funding is being applied to the most relevant structure.
3. Empirically develop threshold value for program inclusion based upon available bridge data (i.e., NBI reporting and bridge inspection forms) as maintained by Staff Bridge and / or other sources.
  - a. The scoring worksheet will be tested using data from bridges already included in the program; as well as, future candidate structures to confirm anticipated results are achieved commensurate with identified criteria.

### **Identify Quantitative / Qualitative criteria**

- A survey will be sent to transportation industry stakeholders to (1) solicit input and respective buy-in, and (2) help identify the major quantitative and qualitative criteria that will serve as the basis of the scoring system.
  - o Proposed survey population includes: CBE Board, Senior CDOT/CBE HQ management, FHWA, Regional Transportation Director's, CDOT Staff Bridge personnel, regional program engineers, bridge inspection and maintenance personnel, and CBE staff. Estimated survey population +/- 70.

# COLORADO BRIDGE ENTERPRISE

## Memorandum

---

- A draft survey has already been developed and issued to a limited population to help refine proposed scoring criteria and question development. Based upon data input and suggestions received, the survey was adjusted accordingly and is ready for distribution to larger audience.
- The survey uses a pair-wise comparison or Analytical Hierarchy Principles (or AHP) to quantify;
  - o The list of major criteria and a weighted-scoring system that compares each element to each other.
  - o The sub-criteria that make up the major criteria elements and a weighted-scoring of importance as compared to each other.

***The survey is a deconstruction of the Sufficiency Rating calculation where the program decides what the most important criteria are and their relative importance as compared to each other to ensure funding is being applied to the most appropriate structure(s) which is consistent with the MAP-21 risk-based asset management requirements.***

### **Scoring System (or worksheet)**

- Use the ABC (Accelerated Bridge Construction) pre-scoping guidance document as model
- Reference attached sample

### **Next Step**

- With Board / CBE management approval issue survey to appropriate CDOT and transportation stakeholders
- Collect and analyze survey results and finalize scoring worksheet
- Test / challenge data results
- Complete Prioritization Plan and implement for usage in next 60 days

Attached to this memorandum are the following documents which will be reviewed in further detail at the February Board workshop:

- Proposed survey questionnaire
- Sample scoring worksheet
- ABC guidance document (2 pages)
- FHWA Sufficiency Rating "pie-chart"

# Bridge Replacement Prioritization Survey

Colorado Bridge Enterprise (CBE) is in the process of developing a formalized Prioritization Policy which will include an objective scoring system to determine whether or not a FASTER eligible bridge should be incorporated into the program.

The Policy will go beyond the current FASTER eligibility requirements (Structural Deficient or Functionally Obsolete and "poor" rating) and scoring system will address both quantitative and qualitative criteria to objectively determine which FASTER eligible bridge should be advanced to ensure that available FASTER funding is applied to the most appropriate structure(s).

The purpose of this survey is to solicit input from transportation industry stakeholders including; engineers, policy-makers, technical and financial professionals, and maintenance personnel to identify what are the most important and relevant quantitative and qualitative criteria that will be incorporated into an objective scoring system.

The survey will ask about overall weighting for what we believe to be the major criteria. Then the survey will expand on each criteria and ask for a weighting for each sub criteria. If we have missed a subject matter, there are opportunities to enter your thoughts. Please include a short explanation with each.

The survey is 15 questions and should not take you longer than 15 minutes. "\*" before a number means question requires an answer to continue.

Thank you for your time and please contact Ken Szeliga "Kenneth.Szeliga@state.co.us" with any additional questions.

## 1. Name (Last, First) (optional)

## \*2. Affiliation/Involvement

**Please select one of the following categories which best describes your involvement and/or affiliation with the Colorado Bridge Enterprise program. You can also select the "other" field and write-in your organization, affiliation, area of expertise, etc.**

- CBE Board of Directors
- FHWA
- CDOT HQ Management
- Regional Transportation Director
- CDOT Staff Bridge/Engineering
- Program Engineer
- Bridge Maintenance/Inspection
- CBE Staff
- Other (please specify)

## \*3. Title

## 4. Email (optional)

## Criteria

Below are the prioritization criteria with descriptions. If there is a topic not listed, place a rating in the "other" field and answer the subsequent question with the topic title and a brief description.

**\*5. Allocate 100 points to the following criteria based on the degree of importance of each topic in relation to each other.**

Bridge Designation (SD or FO)

Sufficiency Rating

Bridge/Structural Condition - Load restricted, poor substructure, poor superstructure, poor deck, scour critical, insufficient vertical clearance

Average Daily Traffic

Percent Truck Traffic

Bridge Importance - On emergency evacuation route or National Interstate Highway System, Primary access to local community, historic structure, located on economic strategic corridor, significant pedestrian/bike crossing

Economic Factors/Impacts - The economic benefit/influence to prioritize the bridge because of construction type (rehabilitation or replacement), close proximity of other roadway improvement or companion structure projects, significant long-term maintenance and/or interim repair costs

Other Factors - Rate and include description in next question

### 6. Other

**Please describe the topic and include potential sub criteria that would fit into this topic.**

## Sub Criteria Weighting

For each question, allocate 100 points across the sub criteria, weighing the most important with the most points.

### \*7. Bridge Description

Structurally Deficient

Functionally Obsolete

### \*8. Sufficiency Rating

< than 30.0

30.1 to 40.0

40.1 to 49.9

### \*9. Bridge/Structural Condition

Load Restricted

Scour Critical Poor

Sub-structure Poor

Superstructure Poor

Deck structure Poor

Insufficient Vertical Clearance

### \*10. Average Daily Traffic

0 - 400

401 - 5,000

5,001 - 15,000

15,001 - 25,000

25,001+

### \*11. Percent of Truck Traffic (TT)

Low (TT < 5%)

Medium (6% to 10%)

High (TT > 10%)

### \*12. Bridge Importance

Emergency/Evacuation Route

Located along National Interstate Highway System

Primary access to local community

Located along economic strategic corridor: freight, tourism, AG, oil/gas, etc.

Historic Structure

Significant pedestrian/bike crossing

**\*13. Economic Factors/Impacts**

Rehabilitation

Replacement

Combine structure repair/replacement with companion bridge

Combine structure with adjacent roadway improvement project

Continued significant long-term maintenance and/or interim repair costs

**14. Other factors. Please elaborate on other items to be on the Bridge Prioritization Policy.**

## Additional Thoughts

### 15. Additional thoughts/comments for the Bridge Replacement Prioritization Worksheet.

Thank you for your time on this important effort.



Project:			
By:	Initials	Checked:	Initials
Date:	0/0/00		0/0/00
Sheet No.	1 of		1

Bridge Prioritization Plan

Scoring Worksheet

Major Criteria	Point totals	Sub-Criteria
----------------	--------------	--------------

Bridge Designation  
(pick one)

10

- Structurally Deficient
- Functionally Obsolete

Sufficiency Rating  
(pick one)

10

- < than 30.0
- 30.1 to 40.0
- 40.1 to 49.9

Bridge Condition or Structural Condition  
(select if relevant)

15

- Load Restricted
- Scour Critical rating  $\leq 4$
- Sub-structure rating  $\leq 4$
- Superstructure rating  $\leq 4$
- Deck structure rating  $\leq 4$
- Insufficient vertical clearance

Average Daily Traffic  
(pick one)

15

- 0 - 400
- 401 - 5,000
- 5,001 - 15,000
- 15,001 - 25,000
- 25,001 +

% of Truck Traffic  
(pick one)

10

- Low (TT < 5%)
- Medium (6% to 10%)
- High (TT > 10%)

Bridge Importance  
(select if relevant)

18

- Emergency/Evacuation Route
- Located along National Interstate Highway System
- Primary Access to Local Community
- Located along economic strategic corridor; freight, tourism, AG, oil/gas, etc.
- Historic Structure
- Significant pedestrian/bike crossing (CSS)

Economic Factors / Impacts  
(select if relevant)

17

- Rehabilitation
- Replacement
- Combine structure repair/replacement with companion bridge
- Combine structure with adjacent roadway improvement project
- Continued significant long-term maintenance and/or interim repair costs

Other Factors or Issues  
(select if relevant)

10

Identify other item(s) that necessitate rehabilitation or replacement of the structure not listed above. Collectively the maximum scoring value of all items cannot exceed 10 points.

Total Points Possible **180**

Combined Score **105**

Prioritization Rating Score **58%**

The scoring weights indicated are for informational purposes only and intended to demonstrate how the scoring worksheet calculates a bridges' rating score. The actual scoring weights will be determined from information collected from the survey.



Project: Hypothetical Bridge Project	
By: TJH	Checked: SM
Date: 6/1/2012	6/15/2012
Sheet No. 1	of 3

## Pre-Scoping ABC Rating

May 2012

Enter values for each aspect of the project. Attach applicable supporting data.

<b>Average Daily Traffic</b> Combined on and under Enter 5 for Interstate Highways	<input type="text" value="5"/>	0 No traffic impacts 1 Less than 5000 2 5000 to 10000 3 10000 to 15000 4 15000 to 20000 5 More than 20000
<b>Delay/Detour Time</b>	<input type="text" value="2"/>	0 No delays 1 Less than 5 minutes 2 5-10 minutes 3 10-15 minutes 4 15-20 minutes 5 More than 20 minutes
<b>Bridge Importance</b>	<input type="text" value="1"/>	1 Normal Bridge - minimal access impacts 3 Essential Bridge - impacts to locals and business 5 Critical Bridge - only access to community or business
<b>User Costs</b>	<input type="text" value="4"/>	0 No user costs 1 Less than \$10,000 2 \$10,000 to \$50,000 3 \$50,000 to \$75,000 4 \$75,000 to \$100,000 5 More than \$100,000
<b>Economy of Scale</b> (repetitive work or standard details)	<input type="text" value="2"/>	0 1 span 1 2 to 3 spans 2 4 to 5 spans 3 > 5 spans or multiple structures
<b>Safety</b>	<input type="text" value="5"/>	1 Short duration impact with simple MOT scheme 2 Short duration impact with multiple traffic shifts 3 Normal duration impact with multiple traffic shifts 4 Extended duration impact with multiple traffic shifts 5 Extended duration impact with complex MOT scheme
<b>Railroad Impacts</b>	<input type="text" value="0"/>	0 No railroad or minor railroad spur 3 One mainline railroad track 5 Multiple mainline railroad tracks
<b>Site Conditions</b>	<input type="text" value="5"/>	0 Inhibiting site constraint (e.g. > 1 ft. profile shift) 3 Time sensitive constraint (e.g. utility shedules) 5 Favorable site conditions



Project:	Hypothetical Bridge Project		
By:	TJH	Checked:	SM
Date:	6/1/2012		6/15/2012
Sheet No.	2	of	3

## Pre-Scoping ABC Rating

May 2012

Note: Do not adjust weight factors without prior consultation with CDOT Project Development Manager

ABC RATING SCORE FACTORS AND WEIGHTS					
	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	5	10	50	5	50
Delay/Detour Time	2	10	20	5	50
Bridge Importance	1	5	5	5	25
User Costs	4	10	40	5	50
Economy of Scale	2	3	6	3	9
Safety	5	10	50	5	50
Railroad Impacts	0	5	0	5	25
Site Conditions	5	5	25	5	25
	Total Score		196	Max. Score	284

**ABC Rating Score: 69 % of Maximum Score**

The ABC Rating Score is driven by the four most heavily weighted factors: Average Daily Traffic, Delay/Detour Time, User Costs and Safety. For a detailed explanation, review the narrative on page 4 of the ABC Decision Making Process.

**Cost Considerations:**

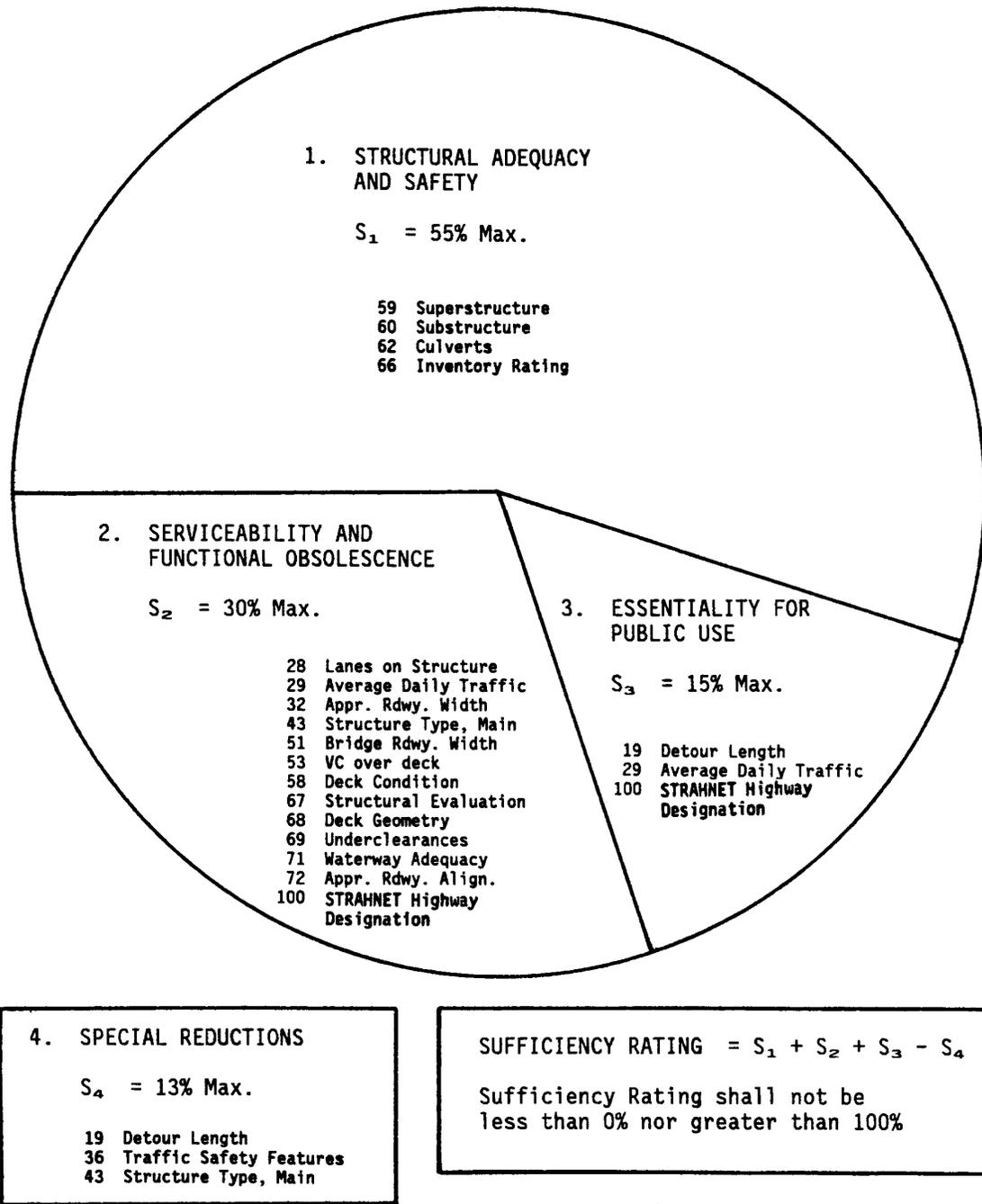
Calculate the following costs for use in determining the lowest total project cost

TOTAL PROJECT COST EVALUATION		
	Traditional Const.	ABC Construction
* Construction Costs	\$2,500,000	\$3,000,000
User Costs	\$1,000,000	\$250,000
<b>Total Project Cost</b>	<b>\$3,500,000</b>	<b>\$3,250,000</b>

\* Account for the following Construction Costs that can be dramatically reduced with ABC construction:

- Detour**
- Traffic Control**
- Railroad flagging**
- Railroad shoefly**
- Increased Contractor and/or CDOT safety**

Figure 1. Summary of Sufficiency Rating Factors



**Reweighting of quantitative criteria included additive qualitative factors such as bridge importance and economic impacts.**