

## C.2. Bridge & Colorado Bridge Enterprise Plan

### C.2.1. Introduction

The Colorado Department of Transportation's (CDOT) bridge program is composed of the state-wide headquarters branch known as "Staff Bridge" and the Colorado Bridge Enterprise, a State Enterprise Program with dedicated funding focused on the replacement of the state's structures that have a poor rating. The Staff Bridge Branch of the CDOT is within CDOT's Project Support division focused on specialty services and is responsible for supporting the design, construction, and maintenance of all major structures owned by the State of Colorado.

The Colorado Bridge Enterprise (CBE) was formed in 2009 as part of the Funding Advancement for Surface Transportation and Economic Recovery (FASTER) legislation (Senate Bill 09-108). CBE operates as a government-owned business within CDOT, with the Colorado Transportation Commission (TC) serving as the CBE Board of Directors. The purpose of the CBE is to finance, repair, reconstruct, and replace bridges which have "poor" rating.

There are approximately 3,500 state-owned bridges in Colorado.

### C.2.2. Regulatory Considerations

#### C.2.2.1. 2.1 Regulations/Resolutions

The following provides an overview of relevant federal and state regulations and requirements governing planning, policy, data, performance, funding, and project selection of bridge and bridge enterprise assets and projects.

- 23 United States Code Fixing America's Surface Transportation (FAST) Act, <https://www.fhwa.dot.gov/fastact/>
- Code of Federal Regulations (CFR) Part 490 Subpart D, The National Performance Management Measures for Assessing Bridge Condition <https://www.law.cornell.edu/cfr/text/23/part-490/subpart-D>
- 23 CFR Chapter 1, Subchapter F, Transportation Infrastructure Management, <https://www.law.cornell.edu/cfr/text/23/part-667>
- 23 CFR Part 667, Periodic Evaluation of Facilities repeatedly requiring repair and reconstruction due to emergency events. <https://www.law.cornell.edu/cfr/text/23/part-667>
- National Bridge Inspection Standards <https://www.fhwa.dot.gov/bridge/nbis.cfm>
- Moving Ahead for Progress in the 21<sup>st</sup> Century Act (MAP-21) <https://www.fhwa.dot.gov/map21/summaryinfo.cfm>

- Colorado Senate Bill 09-108, which forms CBE as part of the Funding Advancement for Surface Transportation and Economic Recovery legislation  
<https://www.codot.gov/projects/faster>
- TC-17-10-12
- TC-18-03-12

### C.2.2.2. Guidelines

There are many agreements, Colorado Transportation Commission Resolutions, CDOT Procedural Directives and technical manuals that guide the bridge program.

- CDOT/FHWA Stewardship and Oversight Agreement
- Procedural Directive 14
- Procedural Directive 703
- Procedural Directive 16
- Procedural Directive 16.1
- AASHTO Load and Resistance Factor Design Bridge Design Specifications
- Load and Resistance Factor and Design Bridge Design Manual
- CDOT Bridge Design Manual
- CDOT Bridge Detail Manual
- CDOT Bridge Rating Manual
- CDOT Bridge Fabrication Inspection Manuals
- CDOT Pontis Bridge Inspection Coding Guide
- CDOT Structural Worksheets
- National Bridge Inspection Coding Guide
- Bridge Technical Memorandums
- CBE Guidance Documents 1-13
- CBE Strategies for Enhancing Bridge Service Life

### C.2.3. Asset Inventory & Condition

#### C.2.3.1. Asset Inventory

There are approximately 3,500 state-owned major structures in Colorado. CDOT combines bridges and culverts with openings or spans greater than 20 feet into a single asset class called Major Structures. Bridges that are on the National Highway System (NHS) are subject to the condition related performance measures outlined in CFR 490 Subpart D, The National Bridge Inspection Standards (NBIS). Refer to the link below for a complete inventory of CDOT's bridges.

The default routine bridge inspection frequency used by CDOT is 24 months. Some bridges may be inspected more frequently. Regularly updated bridge inventory summaries are provided by the Performance and Asset Management Branch. For example, an inventory can be found in [CDOT's Risk-Based Asset Management Plan](#). Custom queries

and reporting requests can be made through the Performance and Asset Management Branch.

To comply with SB-09-108, CBE acquires ownership of bridges which have been addressed by the CBE program. The ownership of the assets is accomplished by resolution approved by the CBE Board of Directors, and CBE becomes responsible for inspection, maintenance, and repair of these assets.

### **C.2.3.2. Asset Conditions**

The NBIS provides a uniform set of standards by which to inspect the nation's bridges based on materials and physical condition of the structure. The deck, superstructure, and substructure (or culvert as applicable) components of a bridge are given a rating from 0 to 9, based on the NBIS rating scale. CDOT assigns a condition classification of Good, Fair, or Poor based on structure condition. If the NBI rating is 4 or below for the bridge superstructure, substructure, deck or culvert component, the structure is classified in poor condition.

Additional condition-based information collected by CDOT's inspection programs includes scour-critical structures, vertical clearances, load-restricted structures, and structure element conditions.

Inventory data, queries, and reporting requests can be made through the Performance and Asset Management Branch.

## **C.2.4. Performance**

### **C.2.4.1. Metrics**

CDOT's bridge performance metrics for major structures are dictated by Federal Regulations as well as addition state-defined metrics. See Federal Regulation 23 CFR 490 Subpart D [here](#). In addition to the metrics in 23 CFR 490, CDOT tracks bridge performance against the performance metrics found [here](#).

Periodically, CDOT compares its performance with other state DOTs as a means of benchmarking. In 2014, CDOT compared percent of deck area (riding surface) on structurally deficient bridges against all other states. Third-party rankings and reports such as American Society of Civil Engineers' *Report Card for America's Infrastructure* and Transportation for America's *State of Our Nation's Bridges* also are used as benchmarking tools.

Bridges that are rated poor, which is synonymous with a classification of structurally deficient, are eligible for the CBE program funded by FASTER.

### **C.2.4.2. Targets**

The performance targets are found located with the performance metrics linked in section 4.1.

## C.2.5. Funding

### C.2.5.1. Funding Mechanisms

Commonly used funding sources include:

- Senate Bill 09-108, Funding Advancement for Surface Transportation and Economic Recovery Act (FASTER) – Special Bridge Fund 538
- State Highway Fund (SHF)- The SHF is the operating fund used by CDOT to manage state transportation projects. The SHF receives revenue from the Highway Users Tax Fund, various other revenue and fees, federal funds, and the General Fund.
- Colorado Highway Users Tax Fund (HUTF) CRS 43-4-201
- Federal Highway Trust Fund, 26 USC 9503

### C.2.5.2. Region Pool Distributions

The current four-year funding forecast for region distributions for bridge funding are summarized in Table 1.

Table 1. Four-Year Funding Forecast

CDOT Region	FY 20	FY 21	FY 22	FY 23
1	\$9,189,950	\$4,692,719	\$7,058,965	\$6,705.059
2	\$4,589,550	\$4,409,021	\$6,289,629	\$6,006,450
3	\$2,170,560	\$3,321,762	\$4,692,951	\$4,583,384
4	\$5,404,700	\$4,909,663	\$6,799,066	\$6,549,243
5	\$2,137,890	\$1,270,239	\$1,751,389	\$1,666,568
Statewide	\$5,160,000	\$4,958,546	\$6,648,000	\$6,377.676

CBE is a state-wide program and as such does not distribute funds into region pools. Fiscal year budget pools are provided by OFMB annually, and phases of projects are funded based on readiness and the CBE Prioritization Plan. Since SB 09-108 states that all CBE revenues must be deposited to the Special Bridge Fund and not used for any other purpose, pool balances are rolled forward into subsequent fiscal years.

## C.2.6. Investment Strategies

One of the primary objectives of CDOT's bridge asset management plan is to preserve the remaining service life of existing CDOT structures in good and fair condition. Structures in poor condition typically are not good candidates for preservation actions because they are likely better candidates for major rehabilitation or replacement.

## C.2.7. Lifecycle Management & Project Selection

### C.2.7.1. Lifecycle Management

Historically, CDOT has not used lifecycle cost (LCC) analysis directly when selecting bridge types or bridge preservation actions. Instead, structure type selection was based on lowest first cost, corridor requirements, or EIS/NEPA requirements. LCC was addressed indirectly by incorporating activities that extended service life.

The primary effect of LCC on new bridge type selection is to identify the total LCC per service year in current dollars to preserve the structure for its design service life of 75 years, recognizing that not all components of the structure will last 75 years. The identified total LCC per service year is used to compare to other bridge type options before the preferred option is selected. The primary effect of LCC on preservation action selection is to identify the preservation actions that will have the largest reduction in LCC per service year by delaying the replacement cost to the latest but most appropriate year in the future. This process is addressed by the Statewide Asset Management (SAM) Plan.

### C.2.7.2. Treatment Lists

There are four categories of treatments utilized to prolong the useful life and ensure the safety of CDOT's bridges: preventative, rehabilitative, safety and replacement. Table 2 below describes common and representative treatments that are applied.

Table 2. Treatment List and Applications

Type of Treatment	Typical Treatments
Preventative	Girder Cleanout, Clean Deck Drains, Scour Mitigation
Repair/Rehabilitative	Bridge Widening, Concrete Patching, Address Fatigue Crack, Joint and Membrane Replacement
Safety Treatments	Guardrail Repair, Loose Concrete Removal
Replacement	Replacement

### C.2.7.3. Project Selection Process

The CDOT Asset Investment Management System (AIMS) is utilized to predict asset condition approximately 20 years into the future utilizing an asset planning budget plus and minus one and two intervals. The interval is chosen by the AIMS analyst to show the predicted asset condition due to incremental changes to the budget into the future. The interval has been between 5% to 20% of the planning budget where assets with larger budgets have smaller percentage intervals. Using these pre-determined budget amounts, projects are identified and prioritized. The two primary processes that identify and prioritize bridge projects are the Structure Preservation Program and CBE processes.

#### Structure Preservation Program Project Selection – On-System Bridges

In order to provide recommended bridge preservation projects to each region and determine the funding breakdown for each region, Staff Bridge uses a Total Priority Score using a model-based data analytics (MODA) based approach. The bridge risk-based Total

Priority Score combines condition, mobility, safety, economic, deck seal, expansion joint, and channel/scour scores where the higher the score the higher the priority. Each bridge is given a priority score, and funding is allocated to each region based on the sum of the priority scores for all the bridges in that region.

The Total Priority Score is the sum of the Bridge Preventative Maintenance (BPM) Score and the Scour Priority Score, multiplied by the Combined Prioritization Factor (CPF). Condition, mobility, safety, and economic scores combine to generate the CPF. This factor is combined with scores for bridge deck seal and expansion joint to produce the BPM Priority Score for BPM project prioritization. The channel/scour score is combined with the CPF to produce the Scour Priority Score for scour project prioritization. The Total Priority Score is separated into a BPM Priority Score (Deck Seal + Exp. Joints) and a Scour Priority Score so that the Project Priorities may be examined independently.

### **Colorado Bridge Enterprise Project Selection**

CBE collaborated with CDOT to develop a prioritization tool to determine which projects are best suited to be programmed based on CDOT and CBE goals, using a MODA based approach. The process is a means to help generally prioritize and rank structures in order of importance based on the quantitative and qualitative factors. The prioritization plan converts these factors for each structure to weighted numerical values. The combination of factors will determine a final score for each structure. These scores rank structures in the program in a consistent method and help the Bridge Enterprise allocate resources in a more effective, transparent manner. The following is a high-level overview of the workflow between Staff Bridge and CBE:

- Staff Bridge publishes the NBI/NBE Federal Submission Poor and Eligibility Changes report.
- CBE Staff evaluates inventory and condition data (quantitative) for eligible bridges and develops a draft of the CBE Prioritization Plan.
- Qualitative data (safety issues, regional priorities, asset bundling opportunities, etc.) is solicited from Staff Bridge and Region Staff and incorporated into the CBE Prioritization Plan
- External comments are validated, and the CBE Prioritization Plan is finalized.
- Candidate projects are selected for programming based on availability of resources.

### **Statewide Asset Management (SAM) Plan**

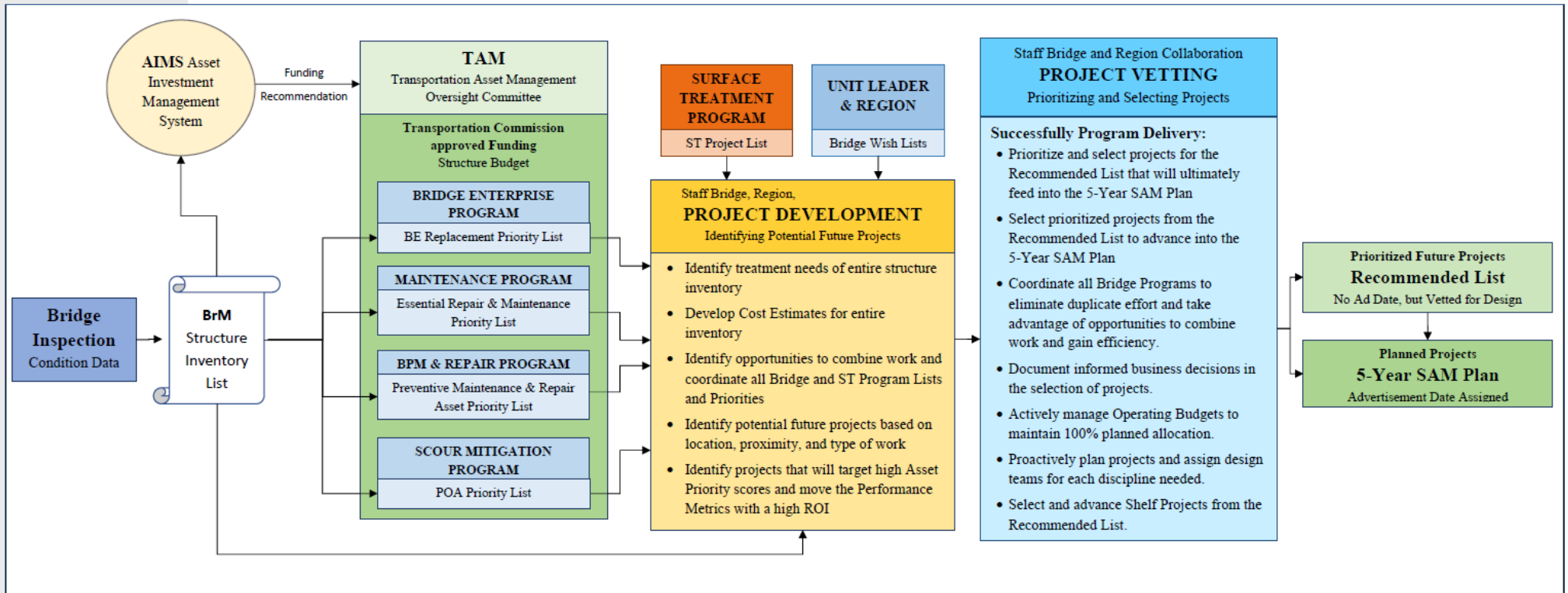
The SAM Plan incorporates the Structure Preservation Program and Bridge Enterprise project prioritization lists into a final four-year asset management plan. The SAM plan is developed using the following process:

- Identifying Potential and Future Projects
  - Identify treatment needs of entire structure inventory.
  - Develop cost estimates for entire inventory.
  - Identify opportunities to combine work and coordinate all Bridge and Surface Treatment Program lists and priorities.

- Identify potential future projects based on location, proximity, and type of work.
- Identify projects that will target high asset priority scores and move the performance metrics with a high return on investment (ROI).
  
- Prioritizing and Selecting Projects
  - Prioritize and select projects for the Recommended List that will ultimately feed into the four-year Structure Asset Management (SAM) Plan.
  - Select prioritized projects from the Recommended List to advance into the four-year SAM Plan.
  - Coordinate all Bridge Programs to eliminate duplicate effort and take advantage of opportunities to combine work and gain efficiency.
  - Document informed business decisions in the selection of projects.
  - Actively manage operating budgets to maintain 100-percent planned allocation.
  - Proactively plan projects and assign design teams for each discipline needed.
  - Select and advance shelf projects from the Recommended List.

Figure 1 provides a summary of the on-system bridge project selection process.

Figure 1. Process to Identify, Prioritize, and Select Projects (Draft)



Source: Structure Asset Management Plan (SAM Plan)



## C.2.8. Headquarter and Region Roles

### 1.1 Headquarters Roles

Staff Bridge provides project support to the Regions by collecting bridge data, assessing bridge conditions, and grouping bridges into recommended replacement, repair, or preventative maintenance categories.

CBE develops a prioritization plan for “Poor” bridges and takes ownership and maintenance responsibilities for bridges that were rehabilitated or replaced with CBE funding.

### 1.2 Regions Roles

Throughout the project selection process, the Regions provide invaluable “local” input regarding project needs and desires. Ultimately, the Regions identify candidate structures to treat with budgeted asset management funds and establish preventative maintenance or repair budgets.

## C.2.9. Reporting, Management, Documentation

### C.2.9.1. Reporting to Internal and External Stakeholders

Key Stakeholders for bridge performance are:

- Regional Transportation Director (RTD)/PE III
- Resident Engineer
- Region Bridge Maintenance
- Bridge Asset Management and Inspections
- Bridge Enterprise
- Staff Bridge Design

### C.2.9.2. Management/Advisory Committees

The following management units and committees influence how bridges are governed.

- Design and Construction Unit
- Fabrication and Construction Unit
- Project Support and Overload Investigations Unit
- Bridge Inspection Unit
- Bridge Asset Management Unit
- Bridge Enterprise
- Transportation Asset Management Oversight Committee (TAMOC)
- Transportation Asset Management Working Committee (TAMWC)