

Statewide NPS Bridge Asset Management, Inspection, & Load Rating Services Scope of Work

Contract Administration:

Lynn Crowell, Bridge Inspections Engineer
Colorado Department of Transportation Headquarters
2829 W. Howard Pl., Denver, CO 80204

Natasha Butler, Bridge Asset Management Engineer
Colorado Department of Transportation Headquarters
2829 W. Howard Pl., Denver, CO 80204

CDOT Staff Bridge has identified tasks at locations throughout Colorado where additional resources may be needed. These tasks include, but are not limited to, the following:

- A. Inspection (Estimated portion of total contract = 25-35%)
 - 1. Post-Tensioned tendon inspection on selected bridges
 - 2. Inspection Quality Control Report
 - 3. Emergency Inspection Services
- B. Asset Management (Estimated portion of total contract = 20-30%)
 - 1. Structure record scanning
 - 2. Existing CDOT Staff Bridge custom program maintenance until retired
 - 3. Asset Management Model Enhancements
 - 4. Federal funding grant applications support
 - 5. Critical culvert definition update
 - 6. Vertical clearance measurements over public roadways utilizing LiDAR
- C. Inspection / Asset Management (Estimated portion of total contract = 15-20%)
 - 1. Bridge Weigh In-Motion
 - 2. Bridge monitoring
 - 3. Bridge deck non-destructive evaluation (NDE)
 - 4. Inspection and Asset Management coding guide development and maintenance
- D. Project Support (Estimated portion of total contract = 10-15%)
 - 1. Load rating major structures

Note: This Scope of Work has been carefully reviewed and reflects an approach based on the known goals of the Inspection, Asset Management, and Load Rating units of the Staff Bridge Branch. The Consultant's analysis of the project goals, its evaluation of the work elements, and its formulation of the work plan, coupled with its understanding of and sensitivity to the key issues may produce new approaches or modifications to the project's work elements. Therefore, the final Scope of Work for the project may change in some details to incorporate the Consultant's input.

I. GENERAL REQUIREMENTS

WORK DURATION

The time period for the work described in this scope will be 5 years from the execution of the contract. Work may be required: night or day; weekends; holidays; or on a split shift basis.

AUTHORIZATION TO PROCEED

Work shall not commence until the consultant receives the written Notice to Proceed for each task order. Work shall be completed within the allotted task order time.

ROUTINE REPORTING AND BILLING

The consultant shall provide the following on a routine basis:

- Monthly billing reports in formats suitable to the Contract Administrator for all contract activities performed by the Consultant's personnel authorized to perform work on this project.
- Periodic reports and billings as requested.

PREQUALIFICATION

The Consultant shall include a Colorado Registered Professional Engineer. The Consultant will also need a comprehensive knowledge of CDOT manuals, guidelines, policies and procedures. The Contract Administrator will approve all Consultant personnel task-specific qualifications.

All tasks assigned to the Consultant must be conducted by a person on the Consultant team that is qualified and has specific expertise in that task. The qualified person is a professional with the necessary education, certifications (including registrations and licenses), skills, experience, qualities, or attributes to complete a particular task. Design of any special project features must be directed, completed, and overseen by a professional engineer with significant experience in design of those special project features. See below for specific required qualifications.

For inspection related tasks, the individual in charge of the organizational unit, in charge of the inspection team, and the structure inspectors, shall meet the qualifications as stated in the Code of Federal Regulations, 23 CFR, 650.309. The one exception to this regulation is that the Program Manager shall be a registered professional engineer in the state of Colorado.

Certified Welding Inspectors (CWI) shall be qualified and certified in conformance with the provisions of AWS QC1, Standard for AWS Certification of Welding Inspectors, or shall be an engineer or technician who, by training and experience in metals fabrication, testing and/or in-service inspection, is acceptable to the Owner.

Individuals performing Nondestructive Testing (NDT) shall be qualified in accordance with the current edition of the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A. Only individuals qualified for NDT Level II may perform the testing. The testing program shall be administered by an ASNT certified Level III. **This paragraph only applies to NDT performed on steel structures.**

This contract requires that the prime firm or any member of its team be pre-qualified in the following disciplines for the entire length of the contract:

Bridge Design, Bridge Inspection, Hydraulics, and Materials Testing

DELIVERABLES

Deliverables for each task will be defined in the individual task orders.

II. GENERAL TASK DESCRIPTIONS:

A. Inspection

1. Post-Tensioned tendon inspection on selected bridges

CDOT requires non-destructive inspection and invasive inspection on post-tensioned (PT) tendons on select bridges to confirm continued efficacy of the post-tensioned tendons and the tendon protection system. The contractor shall be capable of:

- i. Performing visual inspections for cracks, evidence of water in the tendon, and evidence of corrosion byproducts
- ii. Performing hammer sounding to detect evidence of concrete delamination around tendons
- iii. Using ground penetrating radar (GPR) to locate embedded PT tendons
- iv. Using Ultrasonic Shear-wave Tomography (MIRA) to locate embedded PT tendons, reinforcing steel, or concrete defects
- v. Using infrared thermography to detect concrete defects
- vi. Performing magnetic flux leakage tests to detect evidence of PT tendon corrosion
- vii. Sampling PT grout without damaging the tendon
- viii. Exposing PT tendons embedded in a concrete web for invasive inspection
- ix. Determining chloride or other corrodant concentrations in the PT tendon grout
- x. Performing petrographic analysis on sampled grout

2. Inspection Quality Control Report

CDOT Staff Bridge has a need for an updated inspection quality control report. The contractor must be capable of:

- i. Writing reports that pull from Postgres (PostgreSQL) databases, SQL databases, and HTML file data structures
- ii. Understanding the FHWA NBIS Oversight Program
- iii. Understanding the CDOT Staff Bridge Inspection Programs

The inspection quality control report must:

- i. Be able to report on the FHWA NBIS Oversight Program performance metrics
- ii. Be able to report on CDOT specific performance metrics for each inspected asset type

3. Emergency Inspection Services

CDOT Staff Bridge has an intermittent need for emergency inspection services. The contractor shall be capable of providing the following services:

- i. On-call emergency response for inspection of bridges, tunnels, culverts, walls, signs, signals, or HML.
- ii. Performing damage, underwater, or rope-access inspections in accordance with FHWA and CDOT inspection guidelines.
- iii. Performing NDT or destructive testing as need.
- iv. Scour inspection and evaluation in the event of a flood.

- v. Monitoring equipment installation, including but not limited to, tilt meters and strain gauges.
- vi. LiDAR, or other related data collection.

B. Asset Management

1. Structure record scanning

CDOT Staff Bridge is in the process of converting all paper and microfilm structural records to an electronic form. The contractor shall be capable of providing the following services:

- i. Collection
- ii. Transport
- iii. Storage
- iv. Scanning
- v. Optical Character Recognition (OCR), if required
- vi. Geospatial analysis
- vii. Placement within CDOT Bentley ProjectWise (PWZ)
- viii. Recording Metadata within PWZ
- ix. Placement within another CDOT database, if required
- x. Recording Metadata within another CDOT database, if required
- xi. Shredding and disposal, if required
- xii. Returning documents to the original location, if required
- xiii. Document management in accordance with PD 21.1

2. Existing CDOT Staff Bridge custom program maintenance until retired

CDOT has a need to continue the maintenance of custom CDOT Staff Bridge programs until they are replaced by the SIMSA (System for Inspection and Asset Management of Structural Assets) program currently under development. The contractor shall be capable of:

- i. Managing the code of existing programs using Microsoft Visual Studio
- ii. Managing filing programs and file extraction programs that interact with information stored in a HTML file structure

3. Asset Management Model Enhancements

CDOT Staff Bridge has a need to enhance the existing Asset Management Models. The contractor shall be capable of:

- i. Understanding life cycle cost analysis
- ii. Return on Investment (ROI) analysis
- iii. Running deterioration models utilizing Deighton dTIMS®

The enhanced asset management model shall:

- i. Include per structure life cycle cost (LCC) rather than a population average LCC
- ii. Consider deck replacements
- iii. Consider different deck treatments
- iv. Consider treatments separately
- v. Include updated treatments

- vi. Include updated treatment costs
 - vii. Include the actual treatment projects
 - viii. Include treatments that do not have dedicated funding
 - ix. Include updated deterioration forecast models
 - x. Include repair findings
 - xi. Include scour critical bridges
 - xii. Produce prioritization that directly addresses the performance metrics
4. Federal Funding Grant Applications Support
- CDOT Staff has an intermittent need to prepare grant applications for funding. The contractor shall be capable of:
- i. Providing support to the grant application preparation including writing, reviewing, economic analysis, expertise and guidance
 - ii. Identifying applicable grant opportunities for structures
5. Critical culvert definition update
- CDOT has a need to update the current critical culvert definition based on essential repair needs to one that also considers structure condition, structural details, channel condition, scour risk, structure importance, and hydraulic capacity vs. design storm. The contractor must be capable of:
- i. Understanding culvert inspection and inventory data
 - ii. Understanding culvert design
 - iii. Using the USGS StreamStats tool
 - iv. Performing culvert hydraulic capacity and design storm calculations
6. Vertical clearance measurements over public roadways utilizing LiDAR
- CDOT has a need to collect vertical clearance data over all CDOT roadways utilizing LiDAR. The contractor shall be capable of:
- i. Providing LiDAR data with sufficient density and accuracy to define the vertical clearance between the roadway and the overhead structure within 1-2 cm.
 - ii. Providing vertical clearance data for each lane line for all of CDOT's roadways. This encompasses striped lines as well as edge of pavement where applicable.
 - iii. Providing CSV and SHP files containing the extracted and calculated vertical clearance data associated with each structure. These files must match up to CDOT's existing vertical clearance database.

C. Inspection / Asset Management

1. Bridge Weigh In-Motion

CDOT has a need to collect vehicle configurations and axle weights for vehicles crossing selected bridges utilizing a Bridge Weigh-in-Motion (B-WIM) system. The contractor shall be capable of:

- i. Researching commercially available and custom B-WIM systems
- ii. Being familiar with National Institute of Standards and Technology (NIST) Handbook (HB) 44 Section 2.25 - Weigh-In-Motion Systems Used for Vehicle Enforcement Screening

- iii. Providing traffic control for B-WIM system installation, calibration, and removal
- iv. Installing and calibrating the selected B-WIM system
- v. Operating the B-WIM system

The B-WIM system shall be capable of:

- i. Being reusable
- ii. Being powered by solar panels in remote locations
- iii. Being calibrated using known loads
- iv. Being accurate to within a predetermined allowable error
- v. Determining vehicle lane
- vi. Determining vehicle speed
- vii. Determining the number of axles
- viii. Determining axle spacing
- ix. Determining axle weights
- x. Determining the total vehicle weight
- xi. Taking photographs of vehicles that are above a predetermined threshold
- xii. Storing collected data at the bridge site
- xiii. Transmitting data to a central location, if required

2. Bridge monitoring

CDOT has a need to monitor select bridges utilizing a bridge monitoring system (BrMS).

The contractor shall be capable of:

- i. Researching commercially available and custom BrMS systems
- ii. Providing traffic control for BrMS system installation, calibration, and removal
- iii. Installing and calibrating the selected BrMS system
- iv. Operating the BrMS system
- v. Able to operate existing BrMS installed on select Colorado bridges

The BrMS system shall be capable of:

- i. Being reusable
- ii. Being powered by solar panels in remote locations
- iii. Being calibrated using known loads
- iv. Being accurate to within a predetermined allowable error
- v. Determining vehicle lane
- vi. Determining vehicle speed
- vii. Determining the number of axles
- viii. Determining axle spacing
- ix. Determining axle weights
- x. Determining the total vehicle weight
- xi. Taking photographs of vehicles that are above a predetermined threshold
- xii. Storing collected data at the bridge site for periodic retrieval
- xiii. Transmitting data to a central location, if required and if possible

3. Bridge deck non-destructive evaluation (NDE)

CDOT has a need to evaluate selected bridge decks to refine preservation action treatment options. The contractor must be capable of:

- i. Providing traffic control for day or night deck NDE work
- ii. Bridge deck scanning utilizing impact echo (IE), spectral analysis of surface waves (SASW), ground penetrating radar (GPR), infrared thermography (IR), and high-resolution video (HRV)
- iii. Determining chloride concentration by weight of cement in bridge deck concrete

4. Inspection and Asset Management coding guide development and maintenance

CDOT Staff Bridge has a need to develop a major structure inspection and asset management coding guide to provide Colorado specific guidance to the inspectors and asset managers in a single document. The contractor will be expected to:

- i. Be familiar with national bridge inspection regulations and guidance
- ii. Be familiar or become familiar with CDOT Staff Bridge major structure inspection practices
- iii. Combine existing manuals, memorandums and practices into a single MSWord document
- iv. Update the coding guide to be compliant with current national guidance and current Colorado practice, including PD 21.1
- v. Collaborate with internal and external stakeholders for review and comments

D. Project Support

1. Load Rating Major and Minor Structures

CDOT has a need to update load ratings on existing structures to satisfy FHWA and CDOT requirements. The contractor must be capable of:

- i. Load rating bridges and culverts in accordance with the CDOT Bridge Rating Manual primarily utilizing AASHTOWare Bridge Rating (BrR) or CANDE (Culvert ANalysis and Design)
- ii. Load rating structures when AASHTOWare BrR or CANDE are unable to be used by utilizing programs such as CSI Bridge, SAP2000, LARSA, MDX, LEAP, BRASS, MathCad, MS Excel, or other as approved by the Contract Administrator
- iii. Load rating structures without plans with using field investigation for steel structures, or physical inspection / non-destructive test loading for concrete bridges.

III. REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) and OTHER FEDERAL PUBLICATIONS (using latest approved versions):

- A. Standard Specifications for Highway Bridges
- B. Standard Specifications for Transportation Materials and Methods of Sampling and Testing – Part 1, Specifications and Part II, Tests

- C. Load Resistance Factor Design (LRFD) Specifications
- D. Guide Specifications for Design and Construction of Segmental Concrete Bridges
- E. Guide Specifications for LRFD Seismic Bridge Design
- F. Guidelines for Steel Girder Bridge Analysis
- G. LRFD Bridge Construction Specifications
- H. LRFD Bridge Design Specifications
- I. Manual for Bridge Element Inspection
- J. Manual for Bridge Evaluation
- K. AASHTO/AWS D1.5M/D1.5:2015 Bridge Welding Code
- L. CFR – Code of Federal Regulations
- M. Bridge Inspector’s Reference Manual (FHWA NHI 12-049) (BIRM)
- N. FHWA HEC-18 Evaluating Scour at Bridges (FHWA-HIF-12-003)
- O. FHWA HEC-20 Stream Stability at Highway Structures (FHWA-HIF-12-004)
- P. FHWA HEC-23 Bridge Scour and Stream Instability Countermeasures
- Q. FHWA Highway Performance Monitoring System Field Manual
- R. FHWA Inspection of Fracture Critical Bridge Members
- S. FHWA Manual for the Safety Inspection of In-Service Bridges
- T. FHWA Manual on Uniform Traffic Control Devices for Streets and Highways
- U. FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges (FHWA-PD-96-001)
- V. FHWA Specifications for the National Tunnel Inventory (FHWA-HIF-15-006)
- W. FHWA Specification for the National Bridge Inventory Bridge Elements
- X. FHWA Tunnel Operations, Maintenance, Inspection, and Evaluation (TOMIE) Manual (FHWA-HIF-15-005)
- Y. FHWA Underwater Inspection of Bridges (FHWA-DP-80-1)
- Z. FHWA Underwater Bridge Inspection Manual (FHWA-NHI-10-027)
- AA. FHWA Underwater Bridge Repair, Rehabilitation, and Countermeasures (FHWA-NHI-10-029)
- BB. FHWA Culvert Inspection Manual (FHWA-IP-86-2))
- CC. NCHRP Report 575 - Legal Truck Loads and AASHTO Legal Loads for Posting
- DD. NCHRP Report 816 - Guide for the Preservation of Highway Tunnel Systems
- EE. NCHRP Synthesis 474 - Service Life of Culverts
- FF. NCHRP Web Only Document 107: Risk-Based Management Guidelines for Scour at Bridges with Unknown Foundations

COLORADO DEPARTMENT OF TRANSPORTATION PUBLICATIONS (using latest approved versions):

- A. Bridge Inspection Manual
- B. Design Guide (all volumes)
- C. Bridge Design Guide
- D. Bridge Detailing Manual
- E. Bridge Rating Manual
- F. Project Development Manual
- G. Cost Data Book
- H. Field Materials Manual
- I. Standard Plans, M & S Standards
- J. Standard Specifications for Road and Bridge Construction and Supplemental Specifications

IV. DEFINITIONS

Note: For other definitions and terms, refer to Section 101 of the CDOT Standard Specifications for Road and Bridge Construction and the CDOT Design Guide.

AASHTO	American Association of State Highway & Transportation Officials
ADT	Average two-way 24-hour Traffic in Number of Vehicles
AT&SF	Atchison, Topeka & Santa Fe Railway Company
BFE	Base Flood Elevation
BLM	Bureau of Land Management
BNRR	Burlington Northern Railroad
CA	Contract Administrator – The CDOT Manager responsible for the satisfactory completion of the contract by the consultant.
CBC	Concrete Box Culvert
CDOT	Colorado Department of Transportation
CDOT/PM	Colorado Department of Transportation Project Manager – The CDOT Engineer responsible for the day to day direction and CDOT Consultant coordination of the design effort (as defined in Section 2 of this document)
CEQ	Council on Environmental Quality
COG	Council of Governments
CONSULTANT	Consultant for the project
CONTRACT ADMINISTRATOR	Typically a Region Engineer or Branch Head. The CDOT employee directly responsible for the satisfactory completion of the contract by the Consultant. The contract administration is usually delegated to a CDOT Project Manager (as defined in Section 2 of this document).

C/PM	Consultant Project Manager – The Consultant Engineer responsible for combining the various inputs in the process of completing the project plans and managing the Consultant design effort.
DRCOG	Denver Regional Council of Governments
D&RGW	Denver & Rio Grande Western Railroad
ESAL	Equivalent Single Axle Load
FEMA	Federal Emergency Management Agency
FHPG	Federal Aid Highway Policy Guide
FHWA	Federal Highway Administration
FIR	Field Inspection Review
FONSI	Finding of No Significant Impact
GPS	Global Positioning System
MAJOR STRUCTURES	Bridges and culverts with a total clear span length greater than twenty feet. This length is measured along the centerline of roadway for bridges and culverts, from abutment face to abutment face, Retaining structures are measured along the horizontal distance along the top of the wall. Structures with exposed heights at any section over five feet and total lengths greater than a hundred feet as well as overhead structures including (bridge signs, cantilevers and butterflies extending over traffic) are also considered major structures.
MPO	Metropolitan Planning Organization (i.e. Denver Regional Council of Governments, Pikes Peak Area Council of Governments, Grand Junction MPO, Pueblo MPO, and North Front Range Council of Governments).
NFIP	National Flood Insurance Program
NICET	National Institute for Certification in Technology
PE	Professional Engineer registered in Colorado
PM	Program Manager
PROJECT	The work defined by this scope
ROW	Right-of-Way: A general term denoting land, property, or interest therein, usually in a strip acquired for or devoted to a highway
ROWPR	Right-of-Way Plan Review
RTD	Regional Transportation Director
SFHA	Special Flood Hazard Area
SH	State Highway Numbers