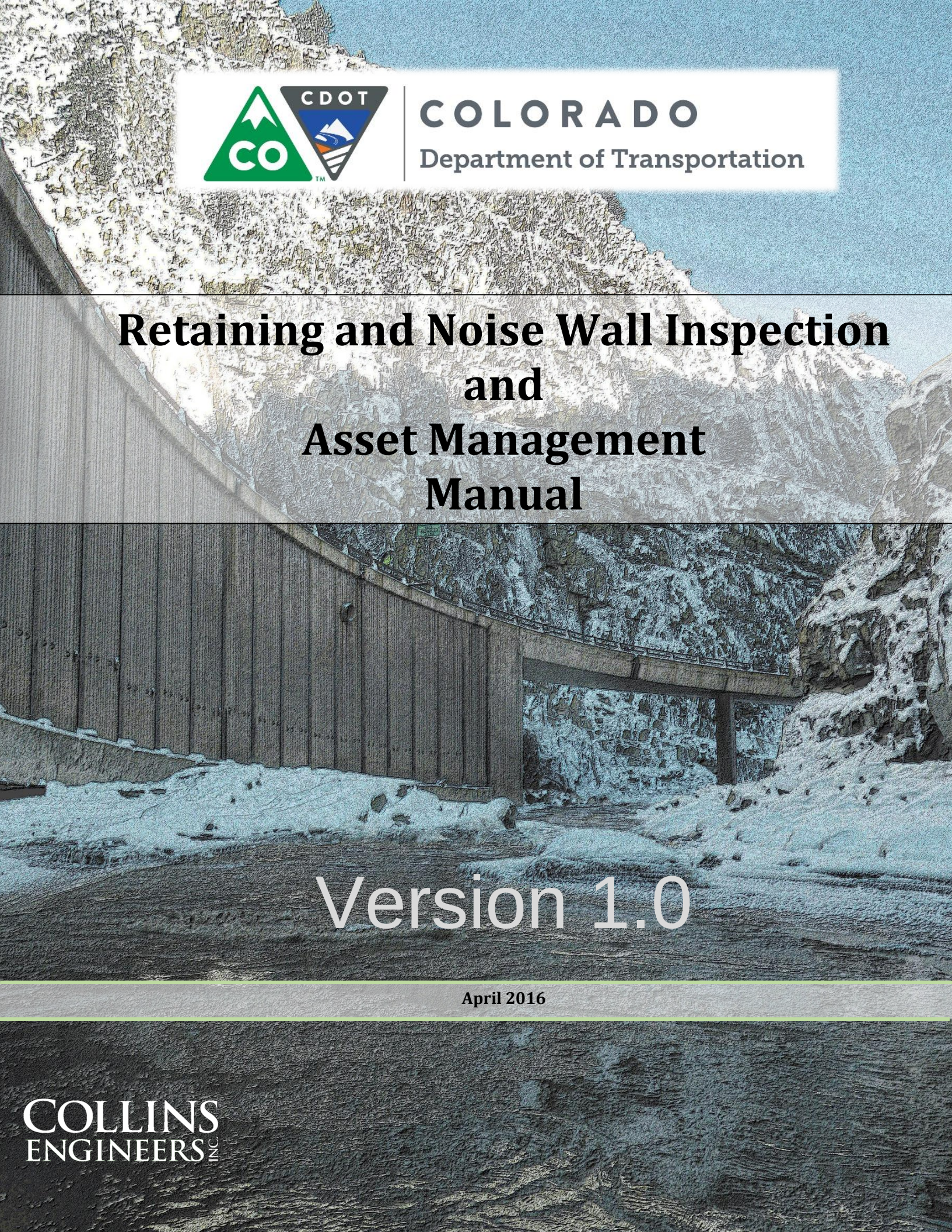

COLORADO
Department of Transportation

Retaining and Noise Wall Inspection and Asset Management Manual

Version 1.0

April 2016

COLLINS ENGINEERS INC.

Colorado Retaining and Noise Walls Inspection and Asset Management Manual

Version 1.0
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15. Supplementary Notes

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The Manual will be revised as methods, materials, policies, procedures, specifications, and the industry change. It is the Manual holder's responsibility to keep the Manual current.

16. Abstract

CDOT designed the *Retaining and Noise Wall Inspection and Asset Management Program* to protect the safety and welfare of the public and public works by creating a comprehensive inventory and continuing inspection to asses and report the condition of all wall assets throughout the state which could potentially impact CDOT owned roadway or Right-of-Way (ROW). Reporting wall condition and defects helps manage the wall assets, identify risk, and project where funding and maintenance need to be focused in an effort to increase the longevity of wall life by providing guidance on the asset management in accordance to MAP 21 requirements. Overall, CDOT's *Retaining and Noise Wall Inspection and Asset Management Program* compiles inventory data and provides consistent inspection condition rating and coding guidelines to facilitate management of transportation needs.

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1.1 Introduction and Purpose

In June of 2014, the Colorado Department of Transportation started development and implementation of the *Retaining and Noise Wall Inspection and Asset Management Program*. The purpose of this program is to inventory and inspect all retaining and noise walls located on or in proximity to Colorado's state highway system and analyze the data to aid in the management of the assets using a risk based asset management approach.

At the time of this program's establishment, asset inspection programs were in affect for CDOT owned Bridges, Minor Structures, Signs, Signals, and HMLTs, but little was known about the existing wall assets located on over 9000 miles of CDOT roadway. Some existing wall data was available in several locations within CDOT archived document storage, inventory spreadsheets, and existing asset geodatabases. A wall inventory spreadsheet held by CDOT Staff Bridge consisted of minimal structure information and semi-accurate location data for walls primarily constructed between the early 1990s to the present day. Wall information available outside that date range was minimal, if recorded at all. Design drawings and as-builts for many of CDOT's walls were located within archived project folders, which included design and construction information for all bridges, roadways, walls, and other structures associated with a particular project. All wall documents were extracted from these large project drawing sets.

In 2013, CDOT's Noise Wall Program gathered data on noise wall locations as a first attempt to begin an inventory for these structures, but found the finished inventory data to be incomplete and quickly outdated due to new construction projects within the CDOT ROW. This program used CDOT's video log of all CDOT roadways called "Windshield" to verify previous inventory data and add structures seen on the video log to the total inventory list. "Windshield" allows the user to drive all roads located on all the CDOT owned major roadways and highways throughout the state of Colorado. All four of these data sets were combined to provide CDOT with a preliminary wall inventory containing an estimated 3000 walls.

CDOT designed the *Retaining and Noise Wall Inspection and Asset Management Program* to protect the safety and welfare of the public and public works by creating a comprehensive inventory and continuing inspection to asses and report the condition of all wall assets throughout the state which could potentially impact CDOT owned roadway or Right-of-Way (ROW). Reporting wall condition and defects helps manage the wall assets, identify risk, and project where funding and maintenance need to be focused in an effort to increase the longevity of wall life by providing guidance on the asset management in accordance to MAP 21 requirements. Overall, CDOT's *Retaining and Noise Wall Inspection and Asset Management Program* compiles inventory data and provides consistent inspection condition rating and coding guidelines to facilitate management of transportation needs.

The establishment of this program was created from concepts and in accordance with the most current versions of the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*, the most current version of the *AASHTO Manual for Bridge Element Inspection*, and is in compliance with FHWA requirements and guidelines. Using the concepts from these programs, the *Retaining Wall and Noise Wall Inspection and Asset Management Coding Guide* was created and the inspection data reported and managed through AASHTO BrM. This program also incorporates components

of the *Bridge Asset Management and Inspection Manual (BRIAR)*, CDOT's *Pontis Bridge Inspection Coding Guide*, the *AASHTO Manual for Bridge Evaluation*, and the *Bridge Inspection Reference Manual*.

For this program, inspection data is captured in field using a tablet making data capture quick and easy, while efficiently bringing it back into a database for interface with an online application. The online application is used to interface with the data, integrate it with BRM, report, manage, and apply a risk based asset management approach for the program. Together, the tablet and online application are known as the System for Asset Management and Inspection, or SAMI. The risk asset management portion of this program is intended to aid in the assessment of structure conditions, identify construction and defect related trends, identify high risk structures, and develop a life cycle analysis for the identified inventory. While this program was developed using the assistance of the inspection application tool, this coding guide was developed as a standalone guide for the inspection of Retaining and Noise Walls.

Retaining and noise walls are currently being managed by the Staff Bridge Branch of CDOT. This program includes the inventory and inspection the following structures:

- **Noise Walls**
- **Retaining Walls**
- **Bridge Retaining Walls (Bridge Walls)**

Based on data provided by CDOT, the structure types listed here encompass the majority of the walls currently in service in the state of Colorado. Only those walls measuring at least 4 feet from the finished grade in height at the maximum point along the length of the wall and displaying greater than 45 degree vertical batter (as defined in **Chapter 2: Structure Inventory and Appraisal**, Item 147) qualify for this program. These qualifications apply to all three of the structure types listed above. The following provides more detailed definitions to the qualifications for each of these wall types:

1.1.1 Noise Walls

Noise walls encompass all noise wall types as well as highway partitions and any other wall types not retaining soil. If a noise wall doubles as a retaining wall, the retained fill should be recorded as an element in accordance with **Chapter 3: Wall Elements Inspection**. A noise wall is a structure that is constructed with the intent of protecting nearby inhabitants from the noise pollution generated by highway traffic. Only noise walls measuring at least 8 feet from grade at the tallest point will be inventoried and inspected in this program, including timber (fencing) noise walls.

Common Examples of Noise Walls found in Colorado

1.1.2 Retaining Walls:

Retaining walls are defined in this program as any wall with the function of retaining fill (soil) by resisting the lateral forces generated and any surcharge loads associated with that fill. Retaining walls serve one of two functions in relation to Colorado roadways: retaining fill from the roadway or retaining fill supporting the roadway. Fill retained from the roadway includes scenarios such as adjacent elevated roadways, buildings, grade, etc. Fill supporting (carrying) the roadway can involve scenarios where the roadway is elevated, adjacent to a waterway, or retaining fill supporting the foundation for a bridge carrying the above roadway (known as Bridge Walls). Exact distinctions between Retaining Walls and Bridge Retaining Walls are outlined below. A retaining wall is a wall that meets all of the following conditions:

1. The wall is located entirely outside of the bridge zone and either carries or protects a roadway by retaining fill.
2. The wall measures at least 4 feet in height from the finished grade to the top of the wall at its tallest point.
3. The wall does not meet any of the specifications for non-qualifying walls that are mentioned at the end of this section.

Specific examples of walls that should be included are wall supporting or protecting the roadway from ramps, frontage roads, parking areas, buildings, waterways and any wall that supports or protects the roadway.

Common Examples of Retaining Walls Found in Colorado

1.1.3 Bridge Retaining Walls (Bridge Walls)

For this program, **bridge retaining walls** are identified separately from retaining walls based on several unique criteria. **Bridge retaining walls** contribute to the stability of the bridge and/or bridge approach. Design and construction requirements for **bridge walls** must therefore be consistent with those for the bridge, and their performance requirements may exceed requirements for other retaining walls. Separating these **bridge walls** from the retaining wall inventory helps to identify which walls affect or influence the structural integrity of a bridge asset. A wall's association to a

Note: Bridge walls are associated with Roadway Bridges, Railroad Bridges, Pedestrian Bridges and any other type of bridge where a wall is used to retain fill that supports the bridge. If the wall does not contribute to the structural stability of a bridge, it should be inventoried as a retaining wall, NOT a bridge wall.

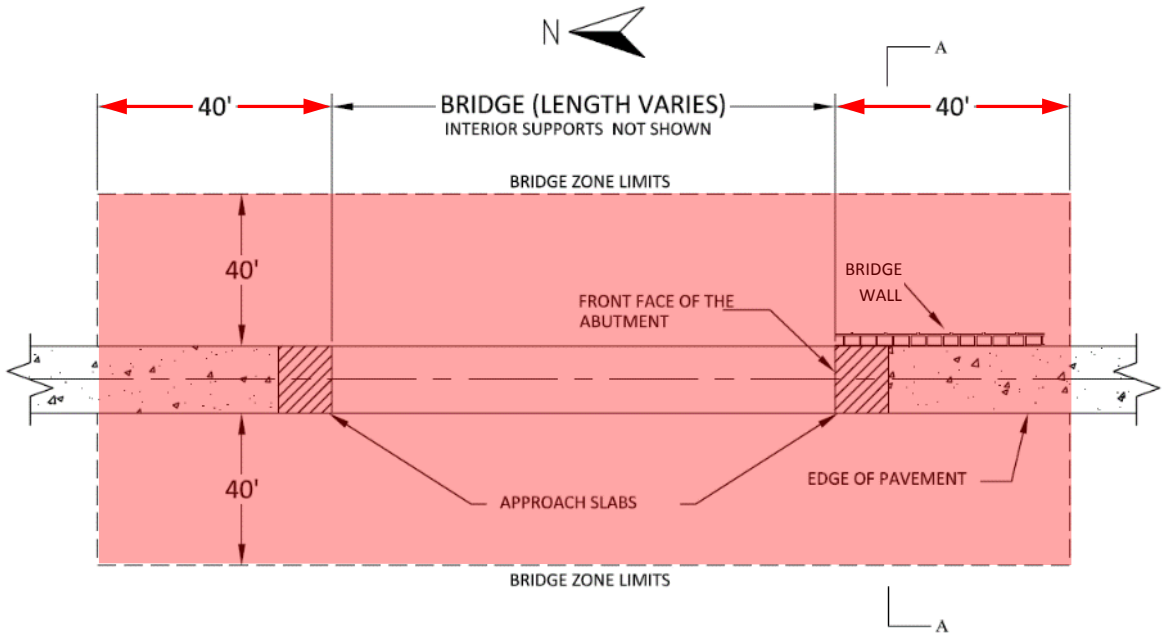
bridge increases the potential for defects which could in turn affect a bridge asset. Many defects found on **bridge walls** can be associated with the walls proximity to a bridge and are often related to the performance of bridge elements such as bridge expansion joints. These joints often allow drainage to run down the face or seep through the **bridge wall** facing below, creating defects related to the adjacent bridge and potentially affecting the bridge structure. Bridge zones have been defined to encompass this type of potential risk zone, so the associated defects can be reported to a single wall. Bridge zones also extract cases where the wall adjacent to a bridge is extremely long (miles). By separating such walls into one long wall (the retaining wall) and another shorter wall (the **bridge wall**), the overall inspection time spent at the site can be reduced since the retaining wall will likely be in better condition and receive a longer inspection frequency than the **bridge wall**. Further explanation to the definition and limits to a bridge zone can be found below in the following section.

The definition of a bridge retaining wall is a retaining wall that meets all of the following conditions:

1. The bridge retaining wall is located entirely within the bridge zone as shown in **FIGURE A: BRIDGE ZONE**. The bridge zone is a rectangular boundary created by measuring 40 feet perpendicular from the edge of the bridge on either side and 40 feet perpendicular from the face of the abutment (or abutment wall) along the approaches on either end of the bridge. Bridge walls can include a single faced wall that stems from an abutment and extends perpendicularly away from the bridge or back along the approach. Bridge walls also include multi-faced walls that begin on one side of the bridge, wrap around the foundation of the bridge under the span, and extend back along the opposite side of the approach. Only portions of walls within the boundary of the bridge zone should be considered bridge walls unless the wall meets one of the following criteria:

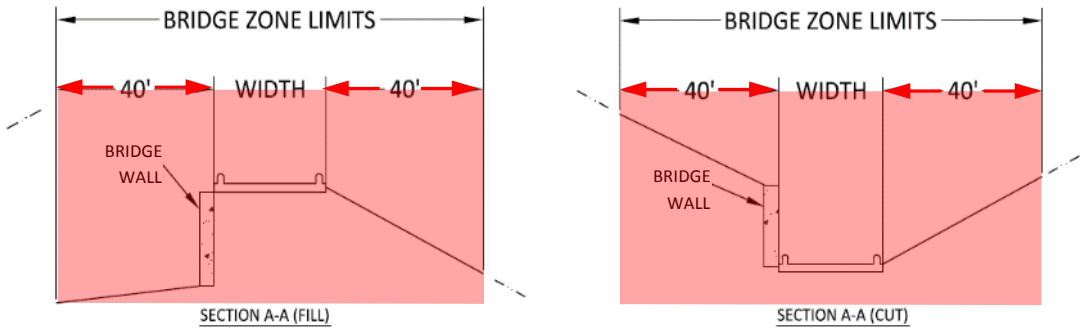
   - One end, or corner, of the wall starts at the face of the abutment of the bridge and the entire length of the wall face is no greater than 200 feet. Walls that fit this criteria should be inspected as a single bridge wall to prevent creating additional smaller walls. See **FIGURE B: EFFECTIVE BRIDGE ZONE** for further explanation. For a wall that begins within the bridge zone, but extends beyond the effective bridge zone, the wall should be separated into two walls at the 40-foot bridge zone mark as shown in **FIGURE C: SEPARATION OF WALL AT BRIDGE ZONE**.
   - A wall that is associated with two different bridges whose abutments are less than or equal to 200 feet apart should be inventoried as a single bridge wall. See **FIGURE D: EFFECTIVE BRIDGE ZONE BETWEEN TWO BRIDGES** for further explanation.

2. The wall does not meet the definition of bridge abutment. A bridge abutment supports the end span of a bridge and is considered to be integral with the bridge structure, which is included and addressed in CDOT's Routine Bridge or Minor Structure Inspections Programs. Wing walls that are monolithic with the bridge abutments are also considered elements to be captured and included with the Routine Bridge or Minor Structure Inspection Programs and should not be included in this inventory.



PLAN VIEW

The bridge zone extends from 40' north of the face of the north abutment to 40' south of the face of the south abutment and 40' to the east and west of the edge of pavement at the bridge.

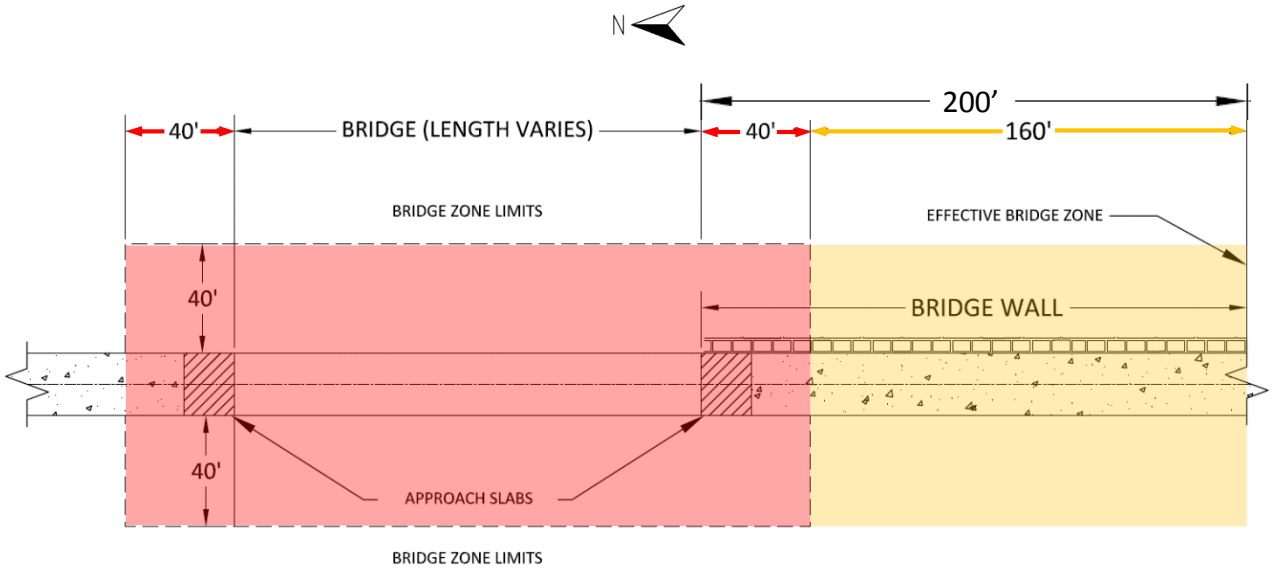


SECTION VIEW

The bridge wall shown at Section A-A could be either a fill or a cut.

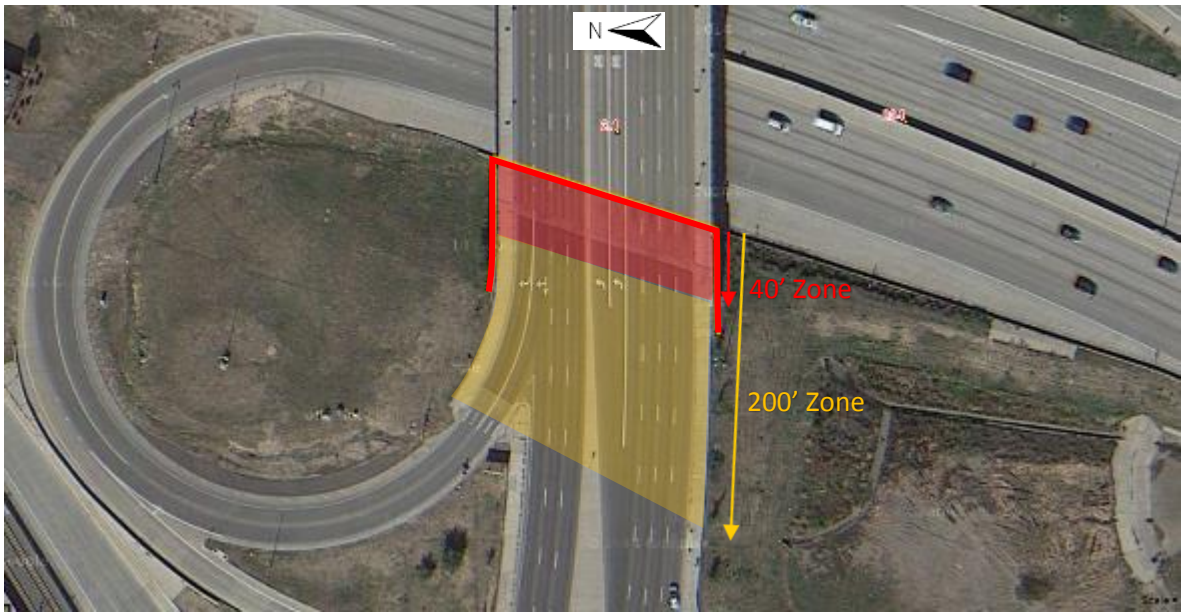
FIGURE A: BRIDGE ZONE

Note: In all figures, red overlay indicates the 40’ bridge zone, and yellow overlay indicates the extents of the effective bridge zone.



PLAN VIEW

A bridge wall supports the east side of the south bridge abutment. The entire wall is considered a single bridge wall because its overall length is within 200' of the face of the south abutment.



PLAN VIEW

The highlighted bridge wall supports all three sides of a west bridge abutment. Although the north and south sides of the bridge wall extend beyond the 40-foot bridge zone, it is still considered a single bridge wall because it falls within the effective bridge zone.

FIGURE B: EFFECTIVE BRIDGE ZONE

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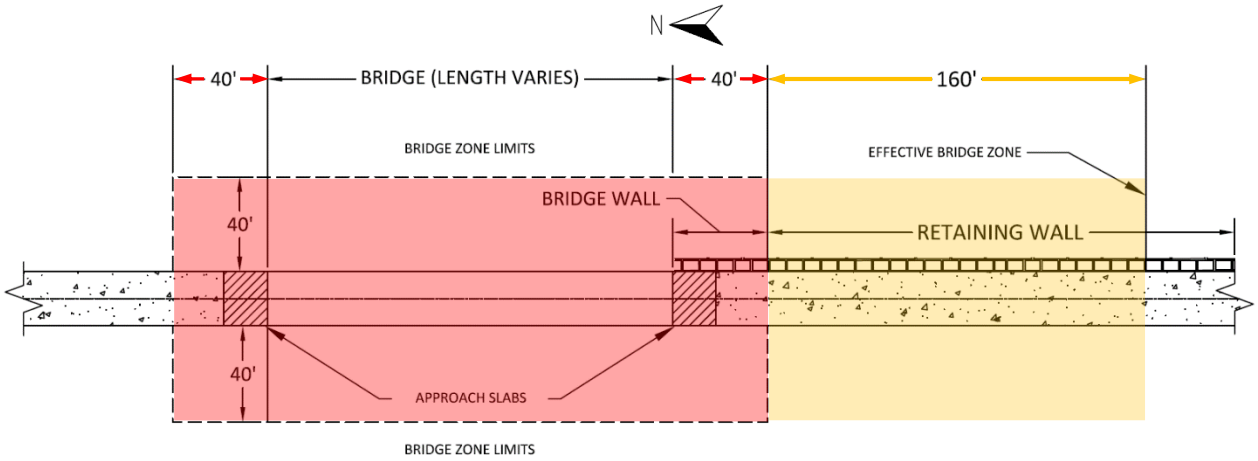
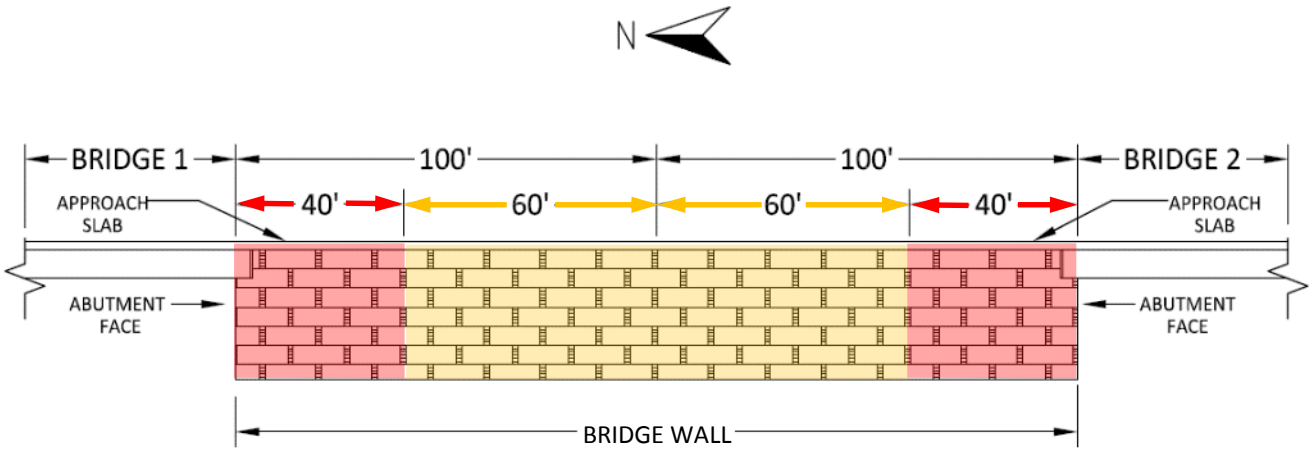


PLAN VIEW

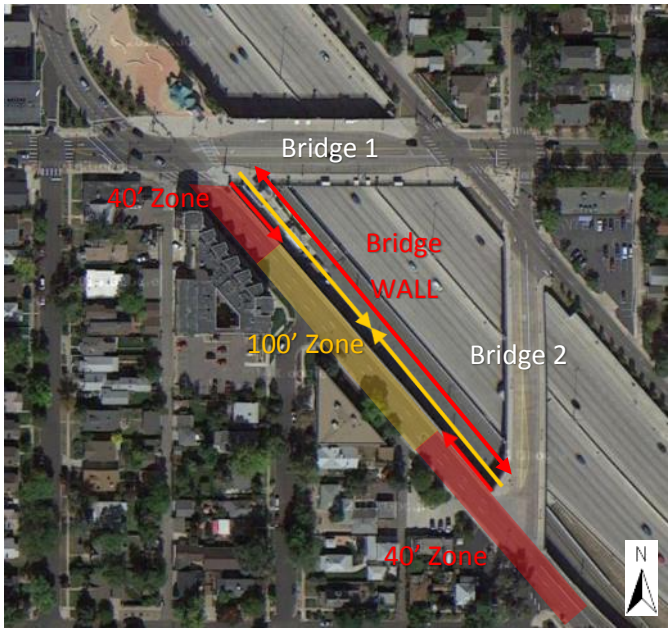
In this example, the east side of the wall extends beyond the 200' effective bridge zone, so the wall is split into two separate walls: a bridge wall (red) and a separate retaining wall (green).

FIGURE C: SEPARATION OF WALL AT BRIDGE ZONE



ELEVATION VIEW

A wall supports the west sides of two different bridge abutments. The entire wall is considered a single bridge wall because the two bridges are only 200 feet apart.



PLAN VIEW

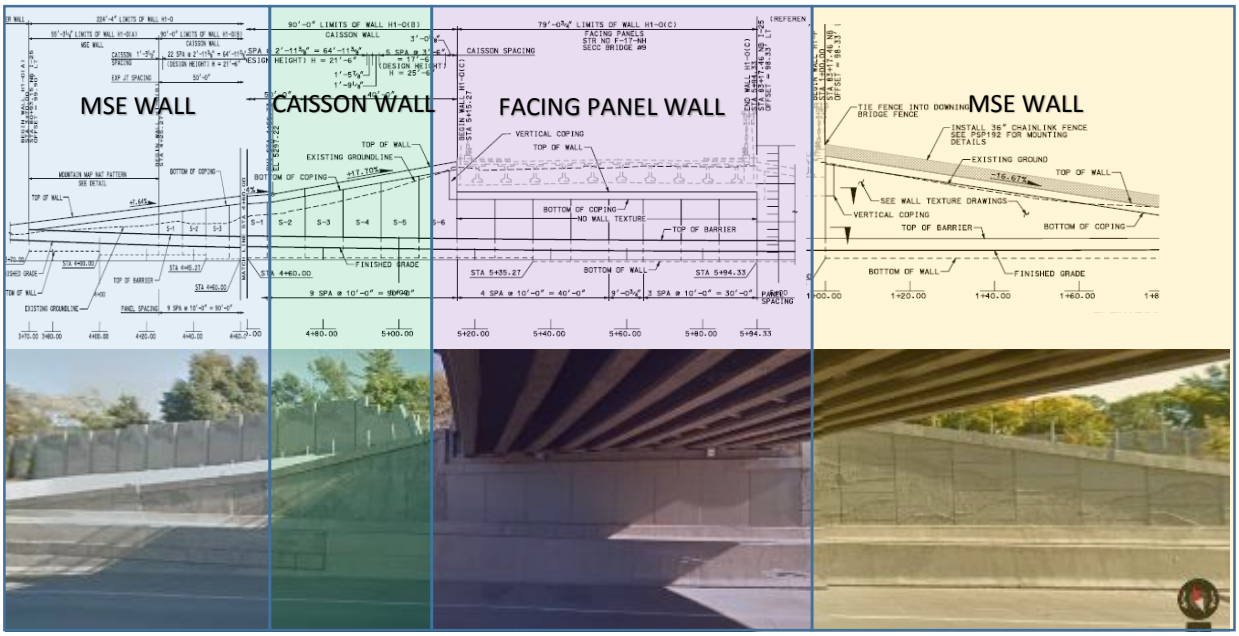
A wall supports a roadway that extends between two bridges. The wall is considered a single bridge wall because the abutments of the two bridges are only 200 feet apart.

FIGURE D: EFFECTIVE BRIDGE ZONE BETWEEN TWO BRIDGES

1.1.4 Determining Structure Limits

The start of the wall is defined as the end of the wall that is first encountered when travelling in the direction of increasing mile points. For those walls that begin on one side of the route and end on the other side (e.g. the bridge wall in **FIGURE B: EFFECTIVE BRIDGE ZONE**), the start of wall should be taken as the end on the left side of the route when looking in direction of increasing mile points. Typically, the start and end points of a wall are determined simply by looking at the entire structure. However, some cases may arise in which two or more structures are adjacent to one another and it may be more difficult to distinguish between the start of one wall and the end of another wall. The following are guidelines for making this distinction:

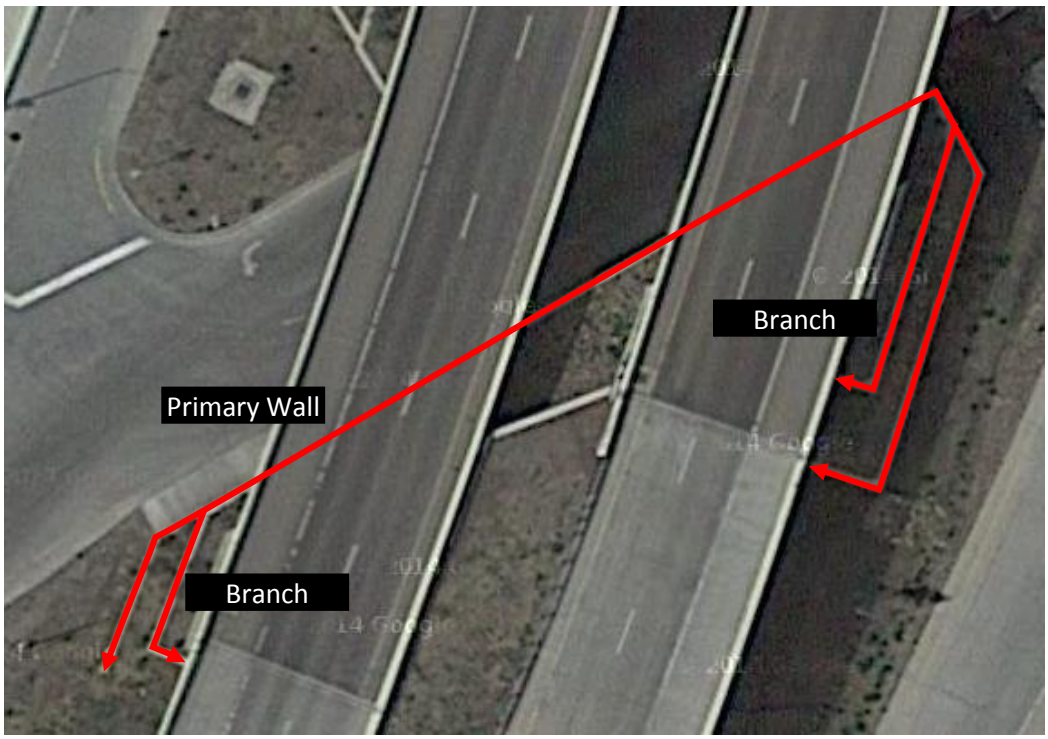
- Walls composed of two wall types, such as a wall which begins as a cantilever wall and ends as a tieback-soldier pile wall will be considered two different walls and receive unique structure numbers. In some cases it will only be known if the wall is composed of one or more walls when reviewing the design documents. The example below shows a wall appearing to be one design type can actually be composed of multiple wall designs. Each unique section would retain its own unique structure name and inspection. Due to the proximity of these walls, the 40’ bridge retaining wall rule will be ignored, meaning that the caisson wall and MSE wall on either side of the bridge would be classified as retaining walls, not as bridge retaining walls.



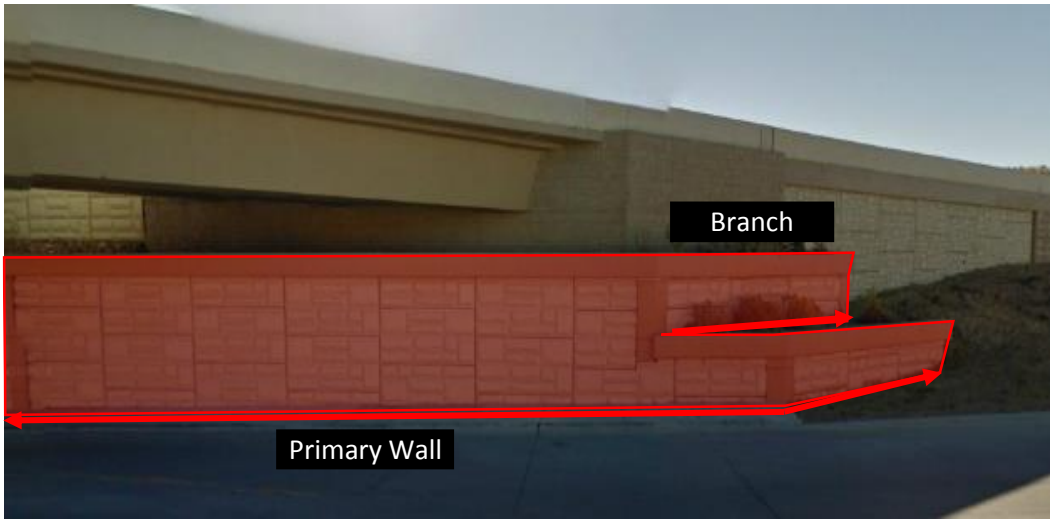
- A wall that bends or curves should be considered the same wall, while separation should denote new walls. The example below shows three separate noise walls outlined in red.

- If one end of a wall is located within the bridge zone, but the remainder of the wall exists out of the bridge zone and the total length of the wall is greater than 200 feet, this wall should be denoted as two separate walls. The portion of the wall within the bridge zone will be considered a bridge wall while the rest of the wall will be inventoried and inspected as a highway retaining wall. The two separate portions of the wall should receive separate structure numbers.

- Walls with multiple branches should be inventoried and inspected as a single wall. The lowest (in elevation) portion of the structure should be considered the primary wall, and all SI&A data (except for the length) should be recorded for this portion of the wall. The total length and area of the wall should be the sum of the primary wall plus the measurements for any of the branch walls.



PLAN VIEW



ELEVATION VIEW

When a case arises in which it is difficult to determine the separation of a wall and is not covered in this document, it is left to the discretion of the inspection team leader to determine when a wall should be considered as one or two separate structures.

1.1.5 Right of Way (ROW), Ownership and Exceptions

All walls owned by CDOT and within the CDOT ROW are included in this program. Any wall structures owned by agencies outside of CDOT (private, BLM, USFS, local city, etc) that meet the aforementioned wall structure qualifications are not included in this program unless they are observed to potentially impact CDOT roadway, motorists, or right-of-way Inclusion of any wall structures in question should be included in the program and can be later removed at the discretion of the CDOT Staff Bridge Manager.

1.1.6 Non-Qualifying Walls

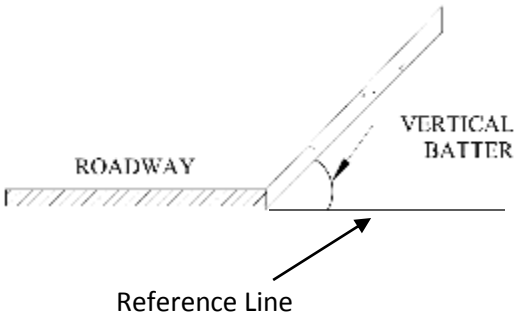
There are several characteristics that can disqualify a wall from this program. For the purposes of inspection, the following wall types are not to be considered:

- Any walls with a maximum height below 4’ at any point along the full length of the structure.
- Wingwalls or headwalls for bridges or culverts. These structural elements are considered part of a bridge or culvert and would be addressed in CDOT’s Routine Bridge or Minor Structure Inspections Programs.

- Jersey barriers, Jersey Walls, K-rails or any other types of barriers under 4' in height.

- Slope and rock face stabilization such as mesh, netting, anchors or soil nails. These types of systems will be considered part of CDOT's Rockfall Program.

- Slope protection or any walls with a vertical batter measuring less than 45° are not to be considered for this program. See below for the definition of vertical batter.



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- Bridge abutments should not be considered for this program.

1.2 Inspection Frequency

There is currently no federal mandate for the inventory and inspection of retaining and noise wall structures. It is the policy of CDOT Staff Bridge that routine inspections for retaining and noise walls be performed at a maximum interval of six years (72 months). The maximum inspection interval for bridge walls should not exceed four years (48 months). Certain structures may be deemed higher risk and require shorter inspection intervals at the discretion of the inspector. **Figure E** illustrates the current process and variables used to calculate the risk grade for a wall and the inspection paths associated with those grades. Refer to **Chapter 4: Wall Asset Management Plan** for further details on the risk calculations. **Table 1.A: Plan Levels and Inspection Types and Frequencies** within **Figure E** provides guidelines for the recommended inspection frequency of a wall depending on the type of inspection to be performed.

The proposed inspection interval along with justification should be noted during the inspection. Similar to the requirements for bridge inspection frequency, it is policy that an initial inventory and condition assessment be performed within 90 days of the CDOT acceptance of a wall. For inspection frequency schedules, the inspector should refer to CDOT's Bridge Ratings, Inspections And Records Manual (BRIAR Manual).

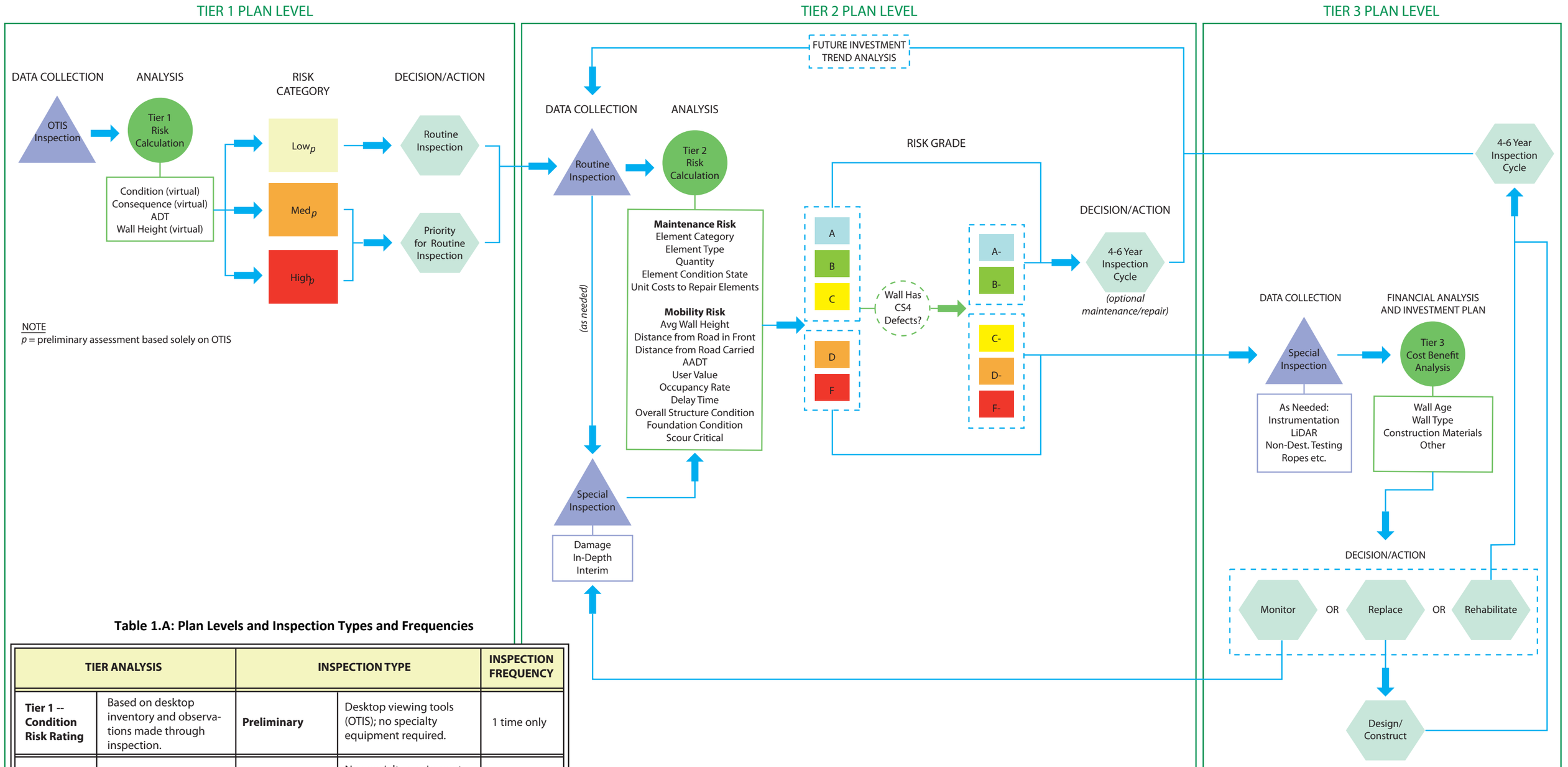

Table 1.A: Plan Levels and Inspection Types and Frequencies

TIER ANALYSIS		INSPECTION TYPE		INSPECTION FREQUENCY
Tier 1 -- Condition Risk Rating	Based on desktop inventory and observations made through inspection.	**Preliminary**	Desktop viewing tools (OTIS); no specialty equipment required.	1 time only
Tier 2 -- Performance Assessment Score	Based on field inventory/ inspection; incorporates performance measures.	**Routine**	No specialty equipment required; traffic control may be needed.	4 to 6 years
		Routine or Underwater	Specialty equipment may be required; work can be completed by inspection staff.	4 to 6 years
Tier 3 -- Cost Benefit Analysis	Based on field inspection, may involve special inspection; incorporates life-cycle and cost-benefit analysis.	**Special Damage, In-Depth, or Interim**	Specialty equipment may be required; work may involve subcontractor or outside vendor.	As needed

CDOT Statewide Wall Inventory

WORK FLOW FOR INSPECTION & RISK ASSESSMENT

Figure E

1.3 System for Asset Management and Inspection (SAMI)

1.3.1 Overview

The System for Asset Management and Inspection, or "SAMI", reduces the time and resources associated with the traditional inspection and reporting process and provides a geo-spatial platform for data analysis and planning. SAMI is composed of two inter-dependent pieces – mobile and in-office. Field data is collected using a mobile tablet device, and then uploaded to a web-based database and at the end of each inspection day. The mobile unit collects photographs as well as location, condition, and appraisal data in accordance with the guidelines described in this manual. Once this data is uploaded to the web-based database, SAMI can be used to generate and submit reports, analyze data, budget, and schedule inspections in-office. SAMI users are assigned a unique username and password which grants the user access to database. This login information is associated with permissions that are dependent on the user's role and is used to track any changes made by the user during the inspection and reporting process. The following sections provide further details on both components of SAMI.

1.3.2 Data Collection

Inspection team leaders are assigned with login credentials which allows for them to sign into the mobile component of SAMI. Only qualified team leaders can login to the mobile component and edit a structure's inspection data. With SAMI, structures are assigned to team leaders daily using the web-based component, which allows for multiple teams to inspect in the same area at the same time while preventing any accidental overlap of inspections. Once logged in, the team leader can access and edit the structure inventory, appraisal, and element inspection information for any structures assigned to their username. Inspectors can also create new inspections for structures that are discovered in-field.

The mobile component of SAMI follows an organizational system similar to traditional hard copy reports. Figure F shows the home screen for the inspection application. The tabs on the left of the screen indicate different types of data that can be collected or referenced during an inspection:

- Overview – provides an overall map of all of the structures assigned to the team leader logged into SAMI (See Figure F).

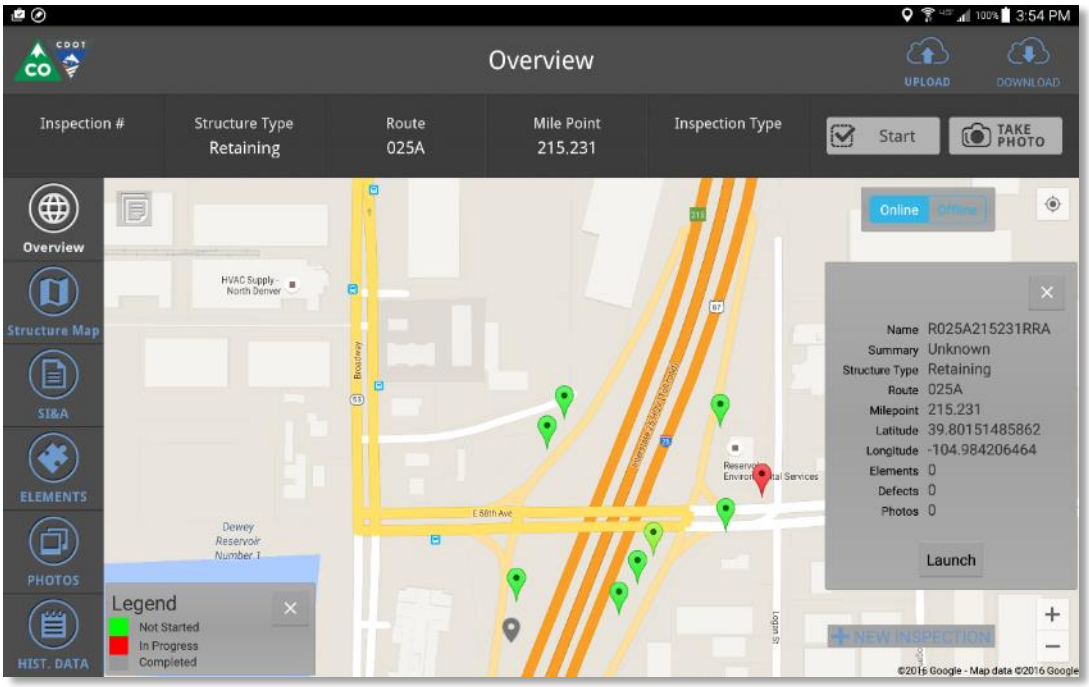

Figure F: Overall Map of Assigned Structures in Mobile SAMI Application

- Structure Map – provides the geospatial information associated with the structure including line geometry, associated photos, and defect locations (See Figure G).

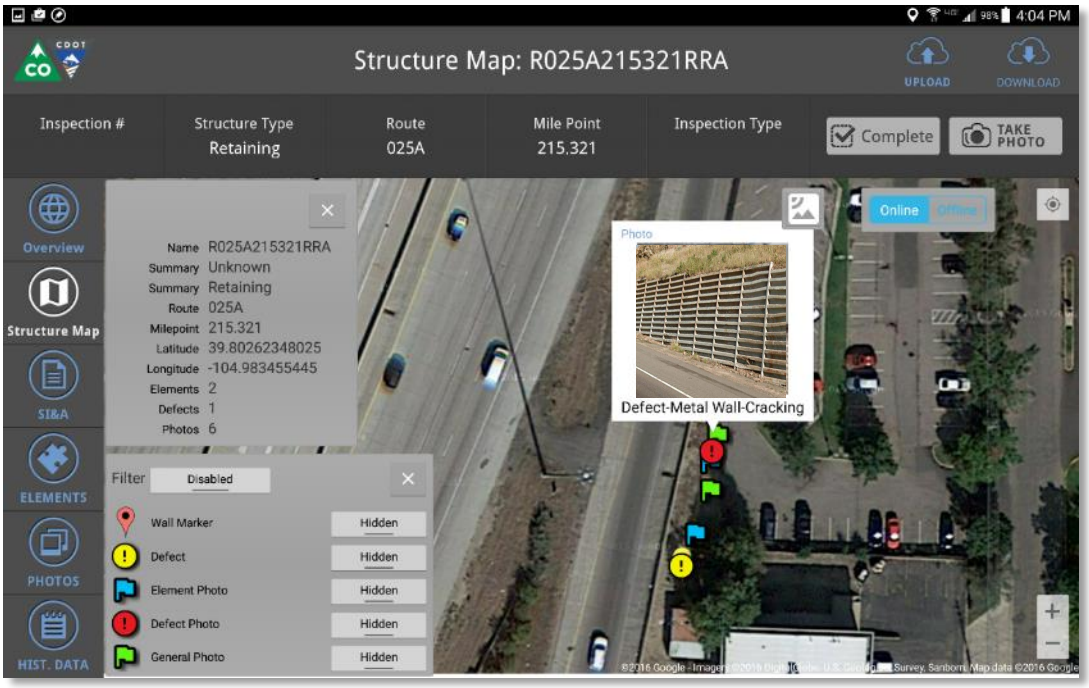

Figure G: Structure Map in Mobile SAMI Application

- SI&A – provides a list view of all SI&A data associated with the structure. While any of these fields can be populated during the field inspection, only those located in the sub-tab 'FIELD DATA' are required to be populated in-field. The other fields can be populated using the in-office component of SAMI. Information on how to code each SI&A item can be found by tapping the blue ellipses under the Description or Procedure columns (See Figures H and I).

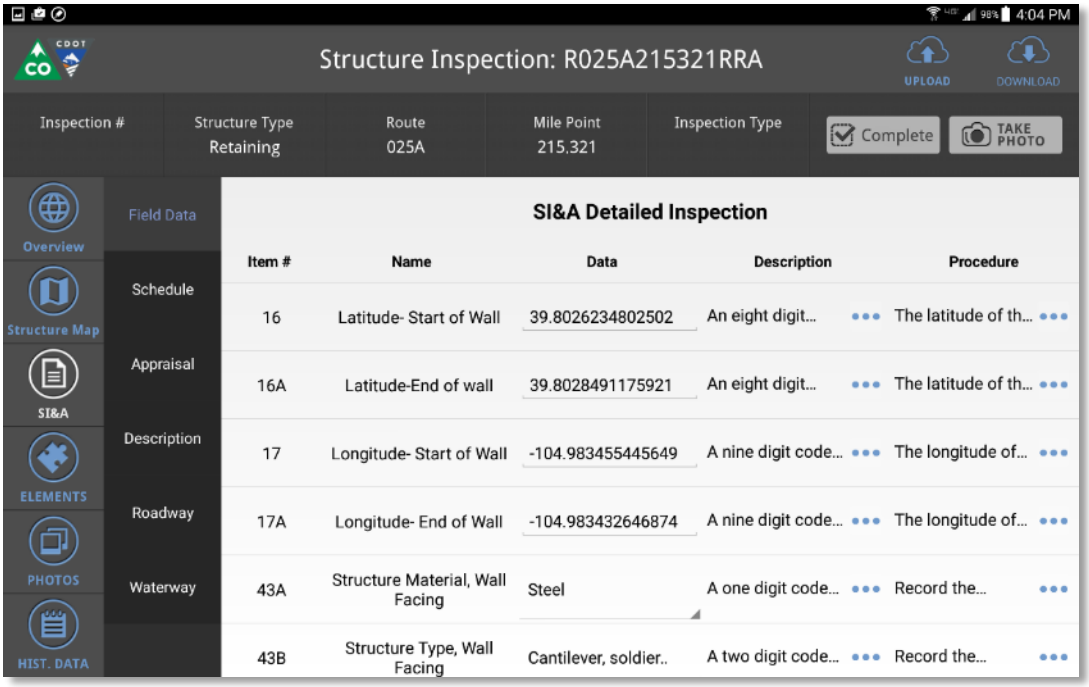

Figure H: SI&A Data Collection Tab in Mobile SAMI Application

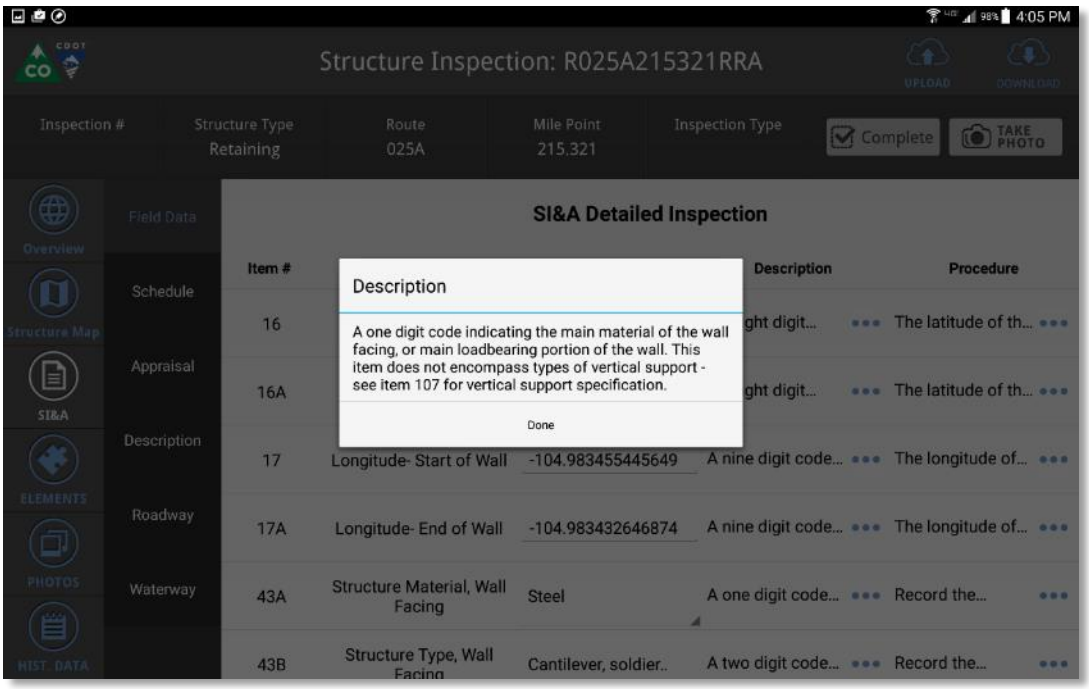

Figure I: Coding Description for SI&A Item 43A-Structure Material, Wall Facing

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- ELEMENTS – provides a dynamic interface to capture all elements and defects associated with a structure in accordance with this Program Manual (See Figure J). This dynamic interface provides a list of appropriate defects based on the element type, which reduces any errors when an inspector notes defects associated with an element.

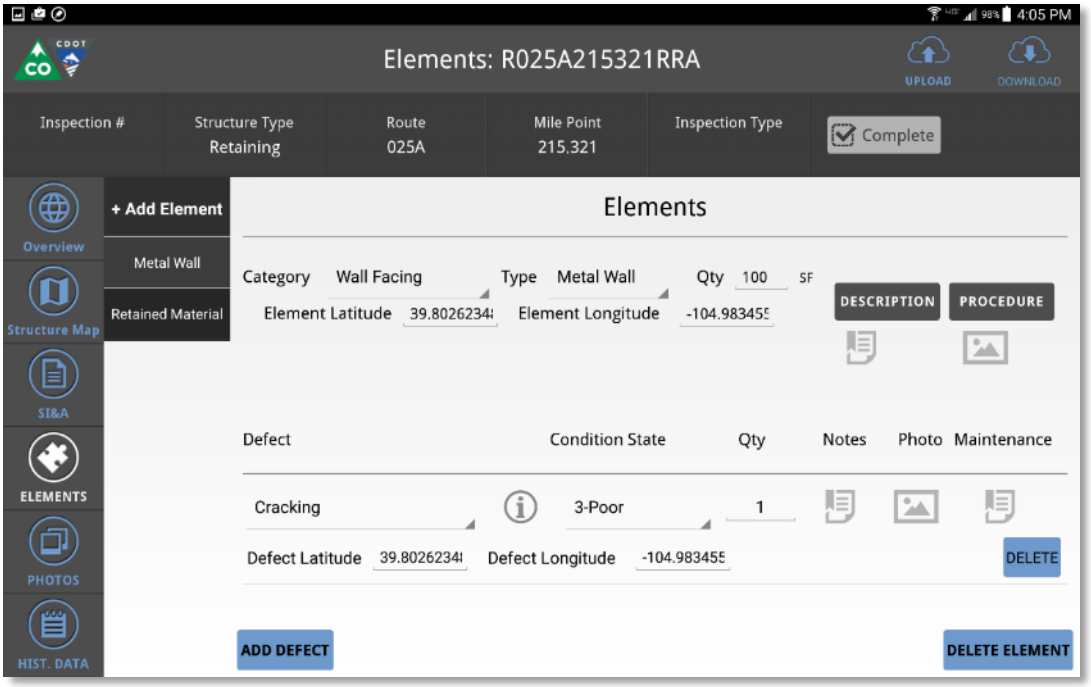

Figure J: Element Data Collection Tab in Mobile SAMI Application

- PHOTOS – photos taken during the inspection are stored within this tab for review and editing in-field. Photos can be organized by type and description (See Figure J).
- HIST. DATA – stores any historical data associated with the structure including previous reports and as-builts as well as PDF copies of the inspection manual.

Once the inspector has finalized the collection of data associated with a structure, the structure report is completed by tapping the 'Complete' button in the upper right-hand corner. At the end of the inspection day, all of the 'completed' reports are uploaded to the web-based component of SAMI for review and analysis.

1.3.3 Reporting

The web-based component of SAMI provides a platform to view, edit, and manage the data associated with any structures within the system. The website is accessible to anyone with login credentials, but the user's role dictates the experience. For example, a user with an administrator's role is able to view and edit all data associated with the structures within SAMI whereas a user with a public role is only able to view completed reports and cannot edit any information within the system. The web-based component provides a variety of functionality which can be sorted into the following three categories:

- Reporting

  There are two basic reporting options within SAMI – the first is a real-time dashboard which provides key information about projects or structures of interest, and the second is an in-depth reporting system which generates structure specific inspection reports. The real-time dashboard provides at-a-glance information about a project or group of structures that can be quickly utilized for analysis and planning. The dashboard can be tailored to provide high-level or detailed information depending on the preference of the user.

  The in-depth reporting system allows users to edit field data from the mobile SAMI application and produce inspection reports for submittal. This system utilizes geo-spatial information and automatically populates location data such as the roadway, county, or region in which the structure resides, thereby reducing the report generation time. Once all of the report data is completed, the report is refined using a built-in QA/QC process for final edits and review. The finalized report is then delivered to CDOT via xml for import into BrM or in a PDF format for electronic or hard copy review.

- Analysis

  Beyond the dashboard interface, SAMI can be used to query data for in-depth analysis. Any or all of the structure specific data within SAMI can downloaded as a shapefile or excel document.

- Scheduling

  SAMI can be used to schedule upcoming inspections for structures based on the type and frequency of the inspections as dictated by previous reports. This information can be displayed in a geo-spatial format and utilized for planning more efficient inspection schedules.

COLORADO
Department of Transportation

RETAINING AND NOISE WALL INSPECTION AND ASSET MANAGEMENT PROGRAM

CHAPTER 2: STRUCTURE INVENTORY AND APPRAISAL

April 2016

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Introduction

The inventory data items for a structure are those which describe the characteristics of the structure and generally should not change over time. The following is a list of the general inventory categories for wall structures:

1. Structure Identification
2. Location
3. Structure Data

These items are found in the SI&A form found in the **Structure Inventory and Appraisal Sheet** and are described in more detail in the following sections. Typically all identification and location inventory data (1 and 2 above) is entered when a structure is originally designed (for new structures) or the first time a structure is inspected. The inventory data for each structure should be reviewed in the field, and if needed, updated each inspection cycle.

In addition to the identification and location data collected for each wall, structure data including overall condition ratings should be recorded. All of these items comprise the Structure Inventory and Appraisal of the wall, and are detailed in the following coding guide. The condition ratings for the structure level inspection follow closely the language found in the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges", published by the FHWA. A similar 0-9 scale, as seen in the **Condition Ratings** section should be used to rate the condition of the Main Wall Facing, Foundation, and Channel and Channel Protection (Items 58-61). This evaluation data assists in the calculation of Condition Risk Rating for the wall as described in **Chapter 4 – Wall Asset Management Plan**, and should be recorded in the "Overall Structure Rating" field in the Inspection Report which can be found in **Appendix III**.

The following section describes all inventory items that could be recorded for wall structures in this program, as well as the methods for collecting the appropriate data.

Item 1 – State Code | 3 digits | FHWA

DESCRIPTION:

A three digit code used to identify the state in which the structure is located. The first two digits are the Federal Information Processing Standards (FIPS) code for States, and the third digit is the FHWA region code.

PROCEDURE:

The FIPS Code and FHWA region code for the State of Colorado and bordering states are as follows:

State	FIPS Code	FHWA Region Code
Colorado	08	8
Nebraska	31	7
Arizona	04	9
New Mexico	35	6
Oklahoma	40	6
Kansas	20	7
Utah	49	8
Wyoming	56	8

Note: Unless the structure is partially or entirely located within the boundaries of a neighboring state, the State Code for Colorado walls should be 088. For border walls, Item 1 should indicate the state that owns the majority of the wall.

CODING EXAMPLES:

Description	Code
Wall located in Summit County, Colorado	088
Wall with 55% of length in Colorado, and 45% of length in New Mexico	088

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	1A	BRIDGE	FIPS_STATE	2	VARCHAR
	1B	BRIDGE	FHWA_REGN	1	VARCHAR

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Item 2 – Highway Agency District	2 digits	MOD FHWA

DESCRIPTION:

A two part, two digit code used to identify the CDOT Engineering Region and Maintenance Section in which the wall is located.

PROCEDURE:

The Engineering Region and Maintenance Section maps are published by the Division of Transportation Development and can be used to determine the Region and Maintenance Section where the structure is located. If a wall is located in more than one region or maintenance section, code the region or maintenance section in which the majority of the wall resides.

REGION (Item2E)	MAINT SECTION (Item2M)	LOCATION	OFFICE ADDRESS	OFFICE PHONE #
1		DENVER METRO	2000 So. Holly St., Denver	303-757-6459
	SEC 5	Aurora Maintenance	18500 E. Colfax	303-365-7110
	SEC 9	Eisenhower Tunnel	P.O. Box 397, Idaho Spgs.	303-512-5730
2		PUEBLO	905 Erie Avenue, Pueblo	719-546-5452
	SEC 4	Pueblo Maintenance	905 Erie Avenue	719-546-5419
3		GRAND JCT / CRAIG	222 So. 6TH St., Grand Jct.	970-683-6202
	SEC 2	Grand Junction Maint	606 So. Ninth St.	970-683-6305
	SEC 6	Craig Maintenance	260 Ranney St.	970-826-5162
	SEC 7*	Alamosa Maintenance	1205 West Ave, Grand Jct.	970-385-1651
4		GREELEY	10601 W 10th St., Greeley	970-350-2109
	SEC 1	Greeley Maintenance	1420 2nd St.	970-350-2120
	SEC 4*	Pueblo Maintenance	905 Erie Avenue	719-546-5419
	SEC 5*	Aurora Maintenance	18500 E. Colfax, Aurora	303-365-7110
5		DURANGO / ALAMOSA	3803 N. Main, Durango	970-385-1402
	SEC 2*	Grand Junction Maint.	606 S. Ninth, Grand Jct.	970-683-6305
	SEC 3	Durango Maintenance	20581 Highway 60 W.	970-385-1651
	SEC 7	Alamosa Maintenance	1205 West Avenue	970-385-1651

* The Maintenance Sections that are marked with an asterisk have their main offices located in a different Engineering Region but have some maintenance responsibility within the listed Engineering Region's boundary.

See Appendix 2.C for map locations of Colorado Region and Maintenance Section boundaries.

CODING EXAMPLES:

Description	Code
Wall located in Dolores County, Colorado	53
Wall located in Denver, Colorado	15
Wall located in Grand Junction, Colorado	32

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	2	BRIDGE	DISTRICT	2	VARCHAR

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Item 3 – County Code | 3 digits | FHWA

DESCRIPTION:

A three digit, right justified code used to identify the county in which the wall is located.

PROCEDURE:

Each structure can be located by using the latest county maps published by the Division of Transportation Development. For structures located on county lines and maintained by the Division, code the county lowest in alphabetical order. For counties, cities and other municipalities with structures located on county lines, code the county that has the maintenance responsibility.

Counties shall be identified using the Federal Information Processing Standards (FIPS) codes given in the current version of the Census of Population and Housing - Geographic Identification Code Scheme:

County Name	FIPS Code	County Name	FIPS Code	County Name	FIPS Code
ADAMS	001	**FREMONT**	043	**MORGAN**	087
ALAMOSA	003	**GARFIELD**	045	**OTERO**	089
ARAPAHOE	005	**GILPIN**	047	**OURAY**	091
ARCHULETA	007	**GRAND**	049	**PARK**	093
BACA	009	**GUNNISON**	051	**PHILLIPS**	095
BENT	011	**HINSDALE**	053	**PITKIN**	097
BOULDER	013	**HUERFANO**	055	**PROWERS**	099
BROOMFIELD	014	**JACKSON**	057	**PUEBLO**	101
CHAFFEE	015	**JEFFERSON**	059	**RIO BLANCO**	103
CHEYENNE	017	**KIOWA**	061	**RIO GRANDE**	105
CLEAR CREEK	019	**KIT CARSON**	063	**ROUTT**	107
CONEJOS	021	**LA PLATA**	067	**SAGUACHE**	109
COSTILLA	023	**LAKE**	065	**SAN JUAN**	111
CROWLEY	025	**LARIMER**	069	**SAN MIGUEL**	113
CUSTER	027	**LAS ANIMAS**	071	**SEDGWICK**	115
DELTA	029	**LINCOLN**	073	**SUMMIT**	117
DENVER	031	**LOGAN**	075	**TELLER**	119
DOLORES	033	**MESA**	077	**WASHINGTON**	121
DOUGLAS	035	**MINERAL**	079	**WELD**	123
EAGLE	037	**MOFFAT**	081	**YUMA**	125
ELBERT	039	**MONTEZUMA**	083		
EL PASO	041	**MONTROSE**	085		

CODING EXAMPLES:

Description	Code
Wall located in Clear Creek County	019
Wall located along Boulder and Grand County line, maintained by the division	013
Wall located along Pitkin and Gunnison County line, maintained by City of Aspen	197

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	3	BRIDGE	COUNTY	3	VARCHAR

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Item 4 – Place Code | 5 digits | FHWA

DESCRIPTION:

A five digit, right justified code identifying the city, town, township, village, or other census-designated place in which a wall is located.

PROCEDURE:

Cities, towns, townships, villages, and other census-designated places shall be identified using the Federal Information Processing Standards (FIPS) codes given in the current version of the Census of Population and Housing - Geographic Identification Code Scheme. For walls located in two census-designated places and maintained by the county, city, or other municipality, code the place that has maintenance responsibility. If there is no FIPS place code, then code all zeros. See Appendix 2.C for FIPS place codes.

CODING EXAMPLES:

Description	Code
Wall located in the city of Denver in Denver County	20000
Wall located along HWY 287 in Kiowa County, not within city limits	00000
Wall located in the town of Collbran in Las Animas County	15550

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	4	BRIDGE	PLACECODE	5	VARCHAR

Item 4A – City/Town Name | 25 characters | CDOT

DESCRIPTION:

A twenty-five character description to identify the municipality name.

PROCEDURE:

Each city code in Item4 will have a city name in this item. This item will allow city names to be used when necessary for reports. The source of these codes is the current version of the U.S. Census of Population and Housing – Geographic Identification Code scheme. See Appendix 2.C for current listing. For walls located in two cities/towns, code the city/town that has maintenance responsibility. If a city is encountered that is not on the list, contact Staff Bridge for the assignment of a number.

CODING EXAMPLES:

Description	Item 4	Item 4A
Wall located in the city of Denver in Denver County	20000	Denver
Wall located along HWY 287 in Kiowa County, not within city limits	00000	
Wall located in the town of Dove Creek in Dolores County	21265	Dove Creek

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	NA	NA	NA	NA	NA
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	NA	NA	NA	NA	NA

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Item 5 – Inventory Route | 9 characters | MOD FHWA

DESCRIPTION:

The inventory route is a 9 digit code composed of 5 segments:

Segment	Description	Length
5A	Record Type	1 digit
5B	Route Signing Prefix	1 digit
5C	Designated Level of Service	1 digit
5D	Route Number	5 characters
5E	Directional Suffix	1 character

PROCEDURE:

Item 5A – Record Type 1 digit

There are two types of wall inventory records: "**carried**" and "**in front**". This code specifies whether the inventory route identified with the wall is "**carried**" by the wall or if it is "**in front**" of the wall. Code the first digit (leftmost) using one of the following codes:

Description	Code
Inventory Route *carried* by the structure	1
Inventory route *in front* of the structure	2

Note: There will only be one inventory route coded for each wall.

"**Carried**" signifies that the inventory route is retained by or behind the structure. If the inventory route is carried by the wall, all of the SI&A data items must be coded, unless specifically excepted, with respect to the structure and the inventory route "**carried**" by it.

"**In front**" signifies that the inventory route is "**in front**" of the structure.

The inventory route should be determined based on the hierarchy shown in Item 5B. If a wall is located between two routes with different hierarchy, all SI&A data should be coded to the route higher in ranking in the list in Item 5B. In the case that a wall poses the dual purpose of carrying one route and protecting another, different route with the same hierarchy, all SI&A data should correspond to the route "**carried**" by the structure.

If a wall is located between two routes of the same hierarchy, but does not carry either route (e.g. a noise wall), the route recorded in Item 5 will be the route "in front" of the wall, and the other route will be the route "behind" the wall. If a wall is between two lanes of the same route, the route on the left side (when looking in the direction of increasing milepoints) of the wall will be the route "in front" of the wall, and the route on the right side of the wall will be the route "behind" the wall. These definitions apply to Items 47, 47A, 50A-50D, 51, and 51A.

It cannot be overemphasized that **all route-oriented** data must agree with the coding as to whether the inventory route is "**carried**" or "**in front**" of the structure.

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Item 5B – Route Signing Prefix 1 digit

In the second position, identify the route signing prefix for the inventory route using one of the following codes:

Description	Code
Interstate Highway	1
U.S. Numbered Highway	2
State Highway	3
County Highway	4
City Street	5
Federal Lands Road	6
State Land Road	7
Other (describe)	8

When 2 or more routes are concurrent, the highest class of route will be used. The hierarchy is in the order listed above. ***Note that this hierarchy applies to all other coded items describing routes.**

Item 5C – Designated Level of Service 1 digit

In the third position, identify the designated level of service for the inventory route using one of the following codes:

Description	Code
None of Below	0
Mainline	1
Alternate	2
Bypass	3
Spur	4
Business Route	6
Ramp, Wye, Connector	7
Service and/or unclassified frontage road	8

Item 5DN – On-System Route Number 5 digits

For on-system walls, or walls located on a State Highway, code the route number (four digits) of the inventory route in the next 5 positions. This value shall be right justified in the field with leading zeros filled in. (See examples below.)

If concurrent routes are of the same hierarchy level, denoted by the route signing prefix, the lowest numbered route shall be coded. Code 00000 for walls on roads without route numbers. For **county roads, city streets** or other roads that are not numbered, code 0.*

Item 5DX – Off-System Route Number 5 digits

For off-system walls, or walls located on a county road or city street, code the route name/number of the inventory route in the next 5 positions. This value shall be right justified in the field with leading zeros filled in. (See examples below.)

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* Item5DN is used to facilitate sorting State Highway system structures, and can be used with Off-System structures to facilitate sorting.

Item 5E – Directional Suffix 1 digit

In the last position is a placeholder to code the directional suffix to the route number of the inventory route when it is part of the route number. This code is **pre-filled** with a zero, *and is not used in the BrM database.*

CODING EXAMPLES:

Description	**Code**				
	5A	**5B**	**5C**	**5DN**	**5E**
Interstate 70 carried by the structure	1	1	1	00070	0
U.S. 40 Bypass carried by the structure	1	2	3	00040	0
I-25 in front	2	1	1	00025	0

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	5A	ROADWAY	ON_UNDER	1	VARCHAR
	5B	ROADWAY	KIND_HWY	1	VARCHAR
	5C	ROADWAY	LEVL_SRVC	1	VARCHAR
	5D(N,X)	ROADWAY	ROUTENUM	5	VARCHAR
	5E	NA	NA	1	VARCHAR

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Item 6 – Features Carried | 24 characters | MOD FHWA

DESCRIPTION:

A twenty-four character, left-justified description of the feature(s) carried by or behind the wall.

PROCEDURE:

This item describes the inventory route and/or features carried by or behind the structure. If Item 5A indicates a "**carried**" record, the inventory route corresponding to that record should be described here.

The information to be recorded for this item shall be the name or names of the features carried by the structure. When one of the features carried is a highway, the signed number or name of the highway shall appear first (leftmost) in the field.

Staff Bridge has designated some common abbreviations or spellings to be used for this item. It is suggested that these common abbreviations be used as often as possible to facilitate searches for specific drainage areas/types. See Appendix 2.E for these common abbreviations or spellings.

When a structure is on a frontage/service road or a ramp, an access road, a bike path, or other non-transit feature such as a building, it must be identified by one of the following abbreviations **in the 23rd and 24th positions:**

Description	Code
Frontage/Service Road	SR
Ramps	R
Access Roads	AC
Bike Path	BP
Other non-transit feature	OT

CODING EXAMPLES:

Description	Code
Retaining Wall along I-25 carrying D&RGW Railroad	D&RGW RR
Retaining Wall with D&RGW Railroad in front, and carrying I-25	I 25 ML
Noise Wall along I-70 in front of a Holiday Inn Hotel	HOLIDAY INN HOTEL OT
Retaining Wall along U.S. 40 carrying a Home Depot parking lot	HOME DEPOT PARKING OT

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	6	BRIDGE	FEATINT	24	VARCHAR

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Item 7 – Features In Front | 18 characters | MOD FHWA

DESCRIPTION:

An eighteen character, left-justified description of the feature(s) in front of the wall.

PROCEDURE:

This item describes the inventory route and/or features in front of the structure. If Item 5A indicates an "**in front**" record, the inventory route corresponding to that record should be described here.

The information to be recorded for this item shall be the name or names of the features in front of the structure. When one of the features in front is a highway, the signed number or name of the highway shall appear first (leftmost) in the field.

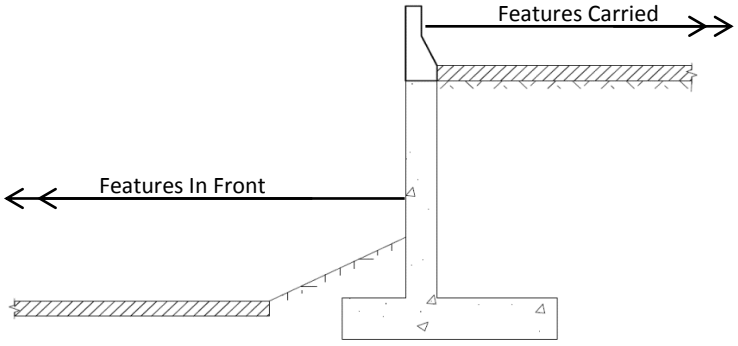
Staff Bridge has designated some common abbreviations or spellings to be used for this item. It is suggested that these common abbreviations be used as often as possible to facilitate searches for specific drainage areas/types. See Appendix 2.E for these common abbreviations or spellings.

When a structure is on a frontage/service road or a ramp, an access road, a bike path, or other non-transit feature such as a building, it must be identified by one of the following abbreviations **in the 17th and 18th positions:**

Description	Code
Frontage/Service Road	SR
Ramps	R
Access Roads	AC
Bike Path	BP
Other non-transit feature	OT

CODING EXAMPLES:

See item 6 for examples on how to code this item.



BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	7	BRIDGE	FACILITY	18	VARCHAR

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Item 8 – Structure Identification Number | 15 characters | MOD FHWA

DESCRIPTION:

A fifteen character, left justified code specifying the wall identification number (Wall ID).

PROCEDURE:

Record the unique structure identification number, specifically, the 14 to 15-digit ID number associated with the structure. ID numbers for walls are created based on the highway number, highway section, the mile point at the start of the wall, and the orientation of the wall in respect to the roadway (see the following pages for orientation explanation).

Even-numbered highways are generally logged from west to east whereas odd-numbered highways are generally logged from south to north. Each highway may also be divided into sections (A, B, C, etc.). Highways are logged and physically signed on the right shoulder with mile markers. The mile numbers generally begin at the western state line or the southern state line, with 000.000 miles. They may also start with 000.000 miles at the intersection of highways.

The general format for the Wall ID is as follows:

W-HHH-S-MMMMMM-OOOO

The ID number consists of five components: 1) One character indicating the wall function type – "R" for highway retaining wall, "B" for bridge retaining wall as described in **Chapter 1 – Wall Program Manual**, or "N" for a noise wall, crash barrier, or any other wall that does not retain soil; 2)The highway number (up to three characters – HHH); 3) The highway section letter (one character - S); 4) The reference point, in miles, without the decimal point to the thousandth of a mile (six characters - MMMMMM); and 5) The structure's orientation with respect to the roadway (up to four characters - OOOO). Orientation examples can be found on the following page.

The inspector should assign wall structure numbers as follows, without dashes between each component:

1. Wall function type as one character as described above.
2. Highway number. Left-fill this section with zeroes up to four characters.
3. The Section Letter can be obtained using CDOT's Online Transportation Information System (OTIS).
4. The mile point of the start of wall may be established in the field by measuring with an odometer from a mile marker, other highway appurtenance with a known mile point; it may be calculated from plans; it may be established through the use of a handheld GPS device (recommended); it may be calculated in office using OTIS; or by using Google Earth in the office with the coordinates of the wall (recommended).
5. The final component is determined by the location of the wall in respect to the roadway (See the following pages for explanation).

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CODING EXAMPLES:

Description	Code
Retaining wall located on the right side of U.S. 40B, at mile marker 270.843	R040B27085RR01A
Noise wall located on the left side of I-25 at mile marker 201.142. A retaining wall is located between the noise wall and the route	N025A20115LR02A

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	8A	BRIDGE	BRKEY	15	VARCHAR

Orientation Convention

The orientation is a record of the location of the start of the structure relative to the roadway/ramp. The orientation is found by looking in the direction of increasing mileposts. For all roadways, left and right are determined by looking in the direction of increasing milepost. In general, mileposts increase from south to north on odd numbered routes and west to east on even numbered routes. Orientation should be recorded using the appropriate format from the following list:

- MCXS
- MRXS
- MLXS
- RRXS
- LLXS

Where

- MC =Median Center, MR = Median Right, ML = Median Left, RR = Right Roadway, and LR = Left Roadway. Median Center refers to a wall that is directly between the north and southbound lanes of a route (see Examples below), while Median Right refers to walls located between the lanes of a split-lane route that are carrying the right lane and Median Left refers to those median ERS carrying the left lane. Right Roadway is defined as those walls located to the right of the center of the right lane, while Left Roadway is defined as those walls located to the left of the center of the left lane.
- X refers to the location of the wall with respect to surrounding walls and the roadway. For example, the wall closest to the route would be coded A, and an overlapping wall that is located further from the route at the exact same milepoint would be coded B.
- S refers to the order in which the walls were constructed. This character denotes when a new wall is constructed between two existing walls that have already been inventoried. For existing structures, this code will not be present. However, if a new wall is constructed in front of an existing wall, the new wall would receive a code of "A". See examples below for further clarification.

Note: Existing walls will have only 14 digits for the Structure Identification Number. The last digit in the orientation segment should not be coded for these walls.

If a wall exists between two parallel routes of different hierarchy (e.g. State HWY and Interstate), its orientation should be determined in relation to the route specified in SI&A Item 5. If a wall is located between two routes, but does not carry either route, the route recorded in SI&A Item 5 will be the route "in front" of the ERS.

For bridge walls that begin on one side of the roadway and end on the other side of the roadway (see example below), the start of the wall is considered to be on the left side of the roadway, and the orientation should be determined based on the start of the wall.

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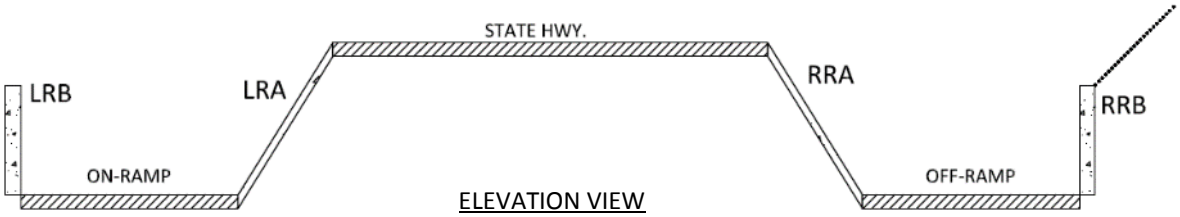
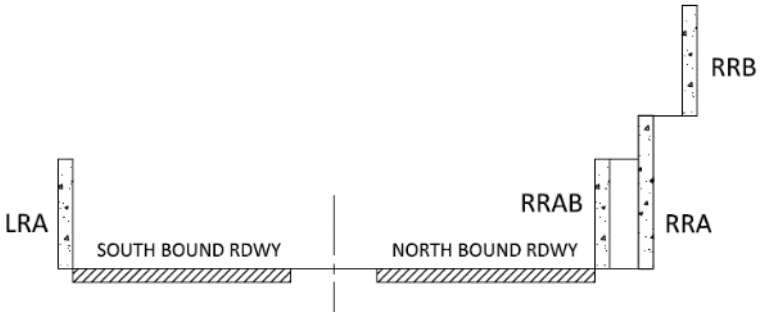


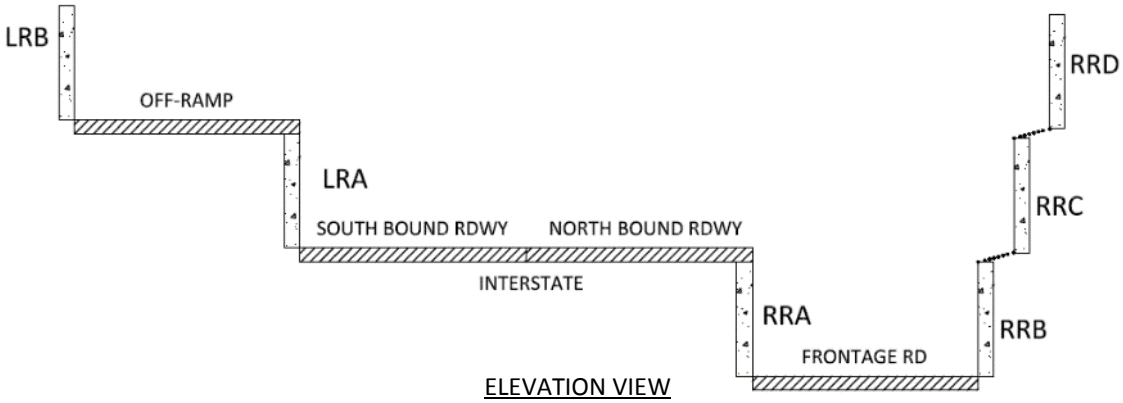
ELEVATION VIEW

LOOKING NORTH (direction of increasing mile marker)
Walls on the right side and left side of the roadway begin at the same milepoint, respectively



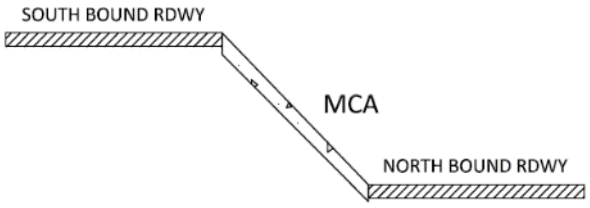
ELEVATION VIEW

SPLIT RDWY. LOOKING NORTH (direction of increasing mile marker)
New wall constructed on the right side of the road between the roadway and existing wall. Walls on the right side of the roadway begin at the same milepoint.

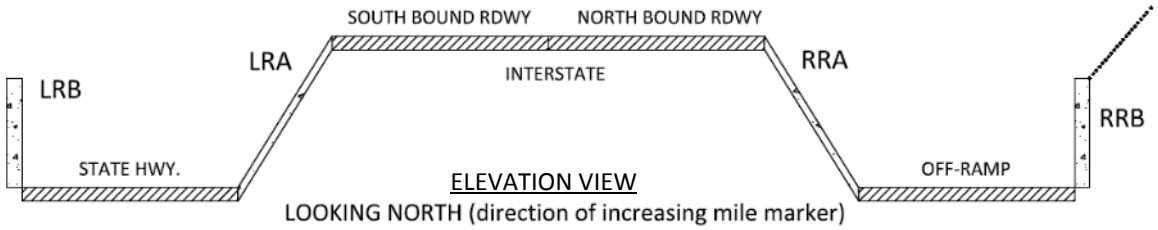


ELEVATION VIEW

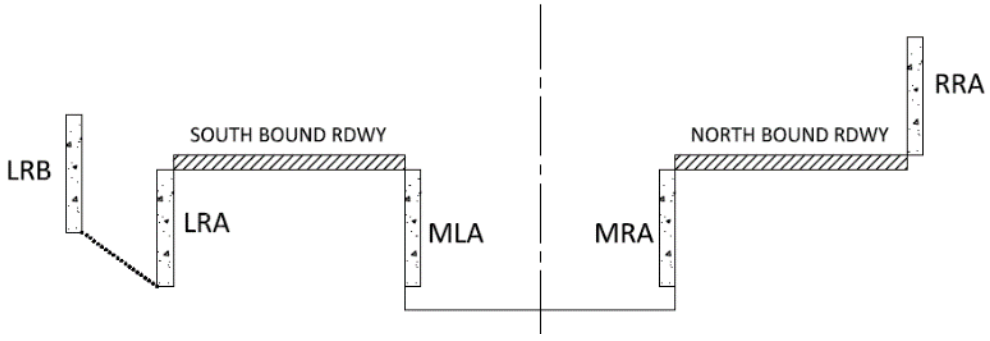
LOOKING NORTH (direction of increasing mile marker)
Walls on the right side of the roadway begin at the same milepoint



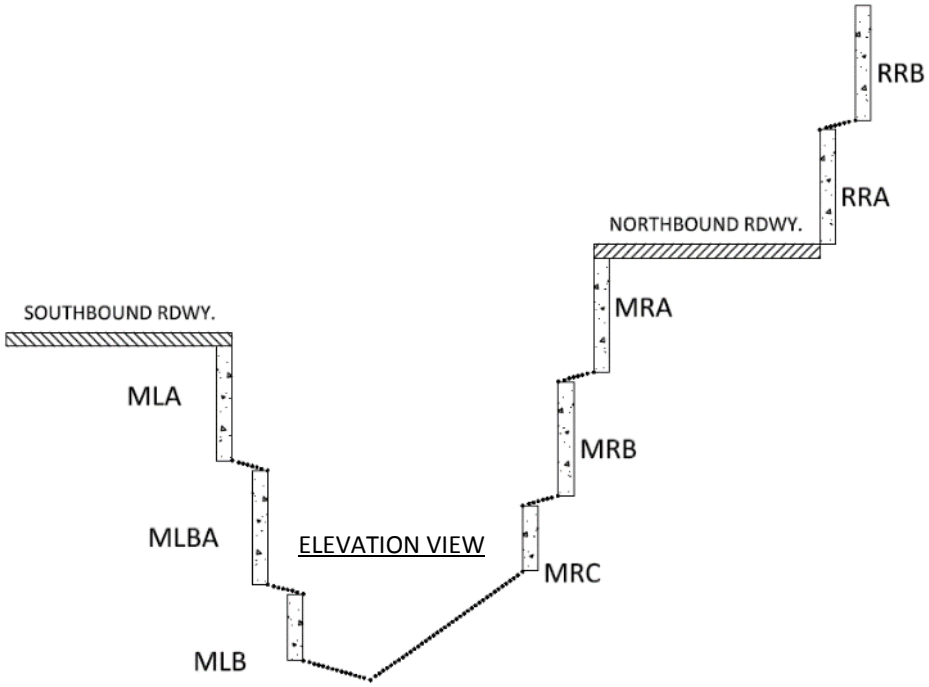
ELEVATION VIEW
LOOKING NORTH (direction of increasing mile marker)



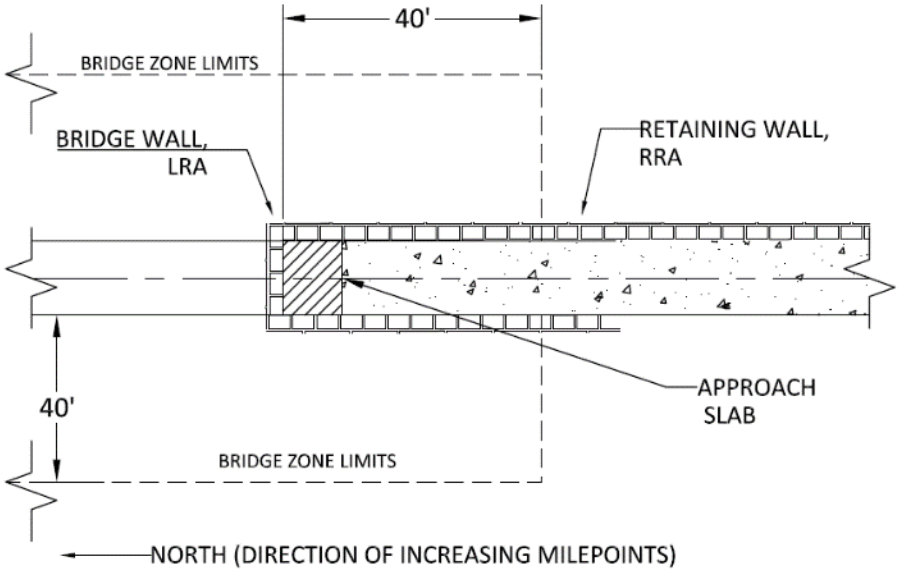
ELEVATION VIEW
LOOKING NORTH (direction of increasing mile marker)
Walls on the right side and left side of the roadway begin at the same milepoint, respectively



ELEVATION VIEW
LOOKING NORTH (direction of increasing mile marker)
Walls on the right side and left side of the roadway begin at the same milepoint, respectively



LOOKING NORTH (direction of increasing mile marker)
Walls on the right side and left side of the roadway begin at the same milepoint, respectively. A new wall has been constructed between two existing walls on the left side of the median, at the same milepoint.



PLAN VIEW

A bridge wall supports all three sides of the south abutment and approach slab of a bridge carrying a two-lane highway (orientation code = LRA). A retaining wall supports the northbound lane and ends at the south side of the bridge zone (orientation code = RRA).

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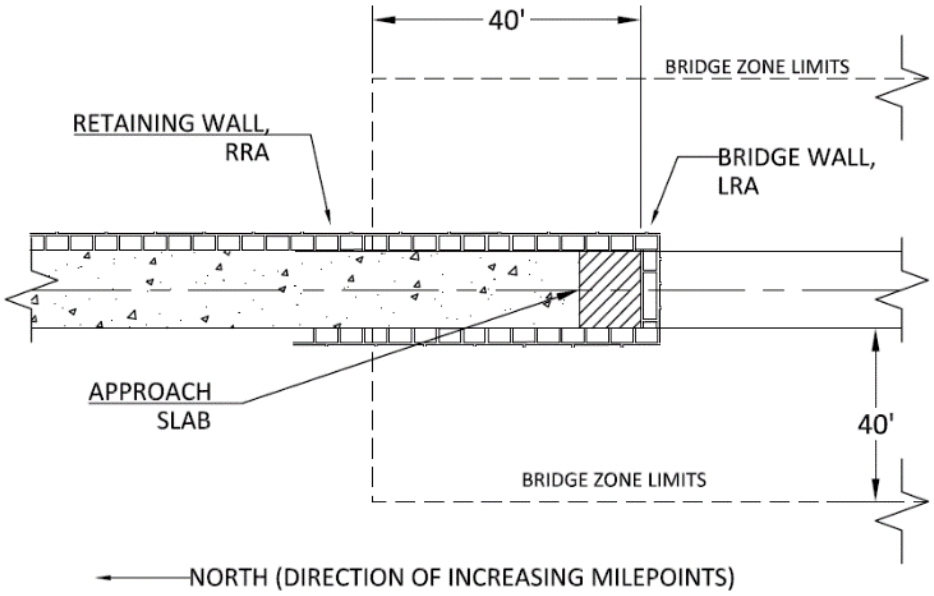

PLAN VIEW

A bridge wall supports all three sides of the north abutment and approach slab of a bridge carrying a two-lane highway (orientation code = LRA). A retaining wall supports the northbound lane and starts at the north side of the bridge zone (orientation code = RRA).

Item 8A – Structure Number | 15 characters | CDOT

DESCRIPTION:

A fifteen character, left justified code identifying the structure number.

PROCEDURE:

Structure numbers can be up to fifteen characters long. However, by CDOT convention, structure numbers for existing walls are created with an eight to nine-digit code scheme, based on a military quadrangle system. The state tourist map, Official Map to Colorado Scenery and Adventure, has marks on the borders to show these quadrangles. A similar reference map can be found in Appendix 2.C. On the map, this system consists of marks that are located every 15 minutes of latitude and longitude, creating a grid pattern across the state. The grid labels on the sides of the map, from north to south, are letters A through P. Across the top, from west to east, the grid sections are labeled from 1 through 28. These labels identify the quadrangles from A-01 in the northwest corner to P-28 in the southeast corner of the state. With this in mind, a structure number has the following format:

WALL-G-GG-OOO

Where *G-GG* is the grid in which the wall is located, e.g. A-15, and *OO* can be a combination of letters from A to ZZZ usually assigned in the order of construction. Thus, structure numbers can be from A-01-A to P-28-ZZZ. This number, including dashes as shown, should be recorded for existing walls that are already marked, and new structure numbers should be generated for walls that are not yet marked. This item should be left justified without trailing zeros.

The structure number must be unique for each wall within the State, and once established should preferably never change for the life of the wall. If it is essential that structure number(s) must be changed, all 15 digits are to be filled. If a wall is replaced, the new structure will be assigned a new structure number. The identical structure number must appear on the "carried" and all "in front" records associated with a particular structure. (Refer to Item 5 - Inventory Route).

CODING EXAMPLES:

Full Structure Number	WALL-E-06-AB___
Wall Designation	WALL-_____
Grid Location	_____E-06-_____
Unique Identification	_____AB___

Character Number 123456789012345 15 Characters Maximum

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	8	BRIDGE	STRUCNAME	15	VARCHAR

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Item 9 – Location | 25 characters | FHWA

DESCRIPTION:

A twenty-five character narrative description of the wall location.

PROCEDURE:

The location will be keyed to a distinguishable feature in the intersection such as a ramp, abutment or topographical feature. This description will record the intersection and direction of travel. For walls not located in an intersection, the distance should be measured in the direction of inventory from landmark.

It is important to ID the location if there is more than one wall in the intersection. Abbreviations may be used, but an effort should be made to keep them meaningful and uniform.

CODING EXAMPLES:

Description	Code
At Intersection of US 36 & I25	US 36 & I25 SW Ramp J
Westbound I-70 near SH 26 near Denver	2.2 MI SW of JCT US 6

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	9	BRIDGE	LOCATION	25	VARCHAR

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Item 11 – Reference Point | 6 digits | MOD FHWA

DESCRIPTION:

A seven digit code identifying the structure location according to a common reference point system.

PROCEDURE:

A Reference Point System has been established for state highways to identify the measured distance from the beginning of a route to the features on that route. The beginning of a route is usually the western or southern State Line or sometimes the junction with another highway. Reference points for odd numbered highways increase from South to North. Reference points for even numbered highways increase from West to East. Exceptions are stub routes, measured from their terminus with other highways along their route regardless of direction. This designation should not change. The reference point should be recorded for the start of the wall – i.e. the point on the route directly perpendicular to the start of the wall.

This item will be coded for the route identified in Item5DN.

CODING EXAMPLES:

Structure	Highway	Code Ref. Point	Item 11
WALL-L-21-I	50B	39.480	039.480
WALL-F-16-EO	25A	211.464	211.464

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	11	ROADWAY	KMPOST	7	VARCHAR

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Item 12 – Base Highway Network	1 digit	FHWA

DESCRIPTION:

A single digit code identifying whether or not the inventory route is on the Base Highway Network.

PROCEDURE:

This item is to be coded for all records in the inventory. The Base Highway Network includes the through lane (mainline) portions of the NHS, rural/urban principal arterial system and rural minor arterial system. Ramps, frontage roads and other roadways are not included in the Base Network. For the inventory route identified in Item 5 - Inventory Route, indicate whether the inventory route is on the Base Highway Network or not on that network. Use one of the following codes:

Description	Code
Inventory Route is not on the Base Network	0
Inventory Route is on the Base Network	1

CODING EXAMPLES:

Description	Code
Wall located on I-25 frontage road	0
Wall located on State HWY 6	1

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	12	ROADWAY	ONBASENET	1	VARCHAR

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Item 13 – LRS Inventory Route, Subroute Number | 12 digits | FHWA

DESCRIPTION:

A twelve digit code identifying the LRS Inventory Route and Subroute number.

PROCEDURE:

If Item 12 - Base Highway Network has been coded 1, the information to be recorded for this item is inventory route for the State's linear referencing system (LRS). If Item 12 has been coded 0, this entire item should be left blank. This item is a 12-digit code composed of 2 segments.

Segment	Description	Length
13A	LRS Inventory Route	10 digits
13B	Subroute Number	2 digits

The LRS inventory route and subroute numbers to be reported in this item must correspond to the LRS inventory route and subroute numbers reported by the State for the HPMS. The LRS inventory route number is coded in the ten positions of segment 13A, right justified and zero filled. The subroute number, if it exists, is coded in the two positions of segment 13B, right justified and zero filled.

The LRS inventory route number can be alphanumeric, but must not contain blanks. The LRS inventory route number is not necessarily the same as that posted along the roadway, but is a number used to uniquely identify a route within at least a county and perhaps throughout the State.

The subroute number is a number that uniquely identifies portions of an inventory route sections where duplicate milepoints occur. These subroute numbers, if they exist, are identified in the State's HPMS-LRS records. If there is no subroute number, code 00 in this segment.

CODING EXAMPLES:

Description	Code
Inventory Route 2775, Subroute Number 0	000000277500
Inventory Route 2775, Subroute Number 3	000000277503

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	13A	ROADWAY	LRSINVRT	10	VARCHAR
	13B	ROADWAY	SUBRTNUM	2	VARCHAR

Item 14 – (Reserved)

Item 15 – (Reserved)

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Item 16 – Latitude – Start of Wall | 8 digits | MOD FHWA

DESCRIPTION:

An eight digit code identifying the latitude of the start of the wall as defined below.

PROCEDURE:

The latitude at the start of the wall can be computed from existing U.S. Geological Survey maps or obtained with a GPS meter accurate to within three meters of latitude and longitude.

The latitude coordinate shall be determined at the start of the wall in degrees, minutes, seconds, and hundredths of seconds and shall be coded as shown below.

CODING EXAMPLES:

Latitude at the start of the wall	Code
37° 27' 15.00" North	37271500
36° 41' 42.30" North	36414230
40° 02' 00.80" North	40020080

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	16	BRIDGE	LATITUDE	8	VARCHAR

Item 16A – Latitude – End of Wall | 8 digits | CDOT

DESCRIPTION:

An eight digit code identifying the latitude of the end of the wall as defined below.

PROCEDURE:

The latitude at the end of the wall can be computed from existing U.S. Geological Survey maps or obtained with a GPS meter accurate to within three meters of latitude and longitude.

The latitude coordinate shall be determined at the start of the wall in degrees, minutes, seconds, and hundredths of seconds and shall be coded as shown below.

CODING EXAMPLES:

Latitude at the end of the wall	Code
37° 27' 18.00" North	37271800
36° 41' 44.20" North	36414420
40° 02' 00.80" North	40020080

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	16A	USERBRDG	ENDLATITUDE	8	VARCHAR

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Item 16B – Elevation – Start of Wall | 5 digits | CDOT

DESCRIPTION:

A five digit code identifying the elevation of the start of the wall.

PROCEDURE:

The elevation at the start of the wall can be computed from existing U.S. Geological Survey maps or obtained with a GPS meter. This elevation should be obtained at the same locations that the latitude and longitude for the start of the wall (16 and 17), at the bottom of the wall at finished grade.

The elevation should be right justified with zeros, and recorded to the nearest foot, rounding up. The elevation should be recorded as shown in the examples below.

CODING EXAMPLES:

Description	Code
Start of wall elevation is at 5243.2’	05244
Start of wall elevation is at 985.3’	00986
Start of wall elevation is at 10101’	10101

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	16B	USERBRDG	STARTELEVATION	5	VARCHAR

Item 17 – Longitude – Start of Wall | 9 digits | MOD FHWA

DESCRIPTION:

A nine digit code identifying the longitude of the start of the wall as defined below.

PROCEDURE:

The longitude at the start of the wall can be computed from existing U.S. Geological Survey maps or obtained with a GPS meter accurate to within three meters of latitude and longitude.

The longitude coordinate shall be determined at the start of the wall in degrees, minutes, seconds, and hundredths of seconds and coded as shown below.

CODING EXAMPLES:

Longitude at the start of the wall	Code
106° 57' 40.00" West	106574000
109° 02' 60.32" West	109026032
102° 30' 01.00" West	102300100

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	17	BRIDGE	LONGITUDE	9	VARCHAR

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Item 17A – Longitude – End of Wall | 9 digits | CDOT

DESCRIPTION:

A nine digit code identifying the longitude of the end of the wall as defined below.

PROCEDURE:

The longitude at the end of the wall can be computed from existing U.S. Geological Survey maps or obtained with a GPS meter accurate to within three meters of latitude and longitude.

The longitude coordinate shall be determined at the start of the wall in degrees, minutes, seconds, and hundredths of seconds and coded as shown below.

CODING EXAMPLES:

Longitude at the end of the wall	Code
106° 57' 20.00" West	106572000
109° 02' 30.27" West	109023027
102° 30' 00.48" West	102300048

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	17A	USERBRDG	ENDLONGITUDE	9	VARCHAR

Item 17B – Elevation – End of Wall | 5 digits | CDOT

DESCRIPTION:

A five digit code identifying the elevation of the end of the wall.

PROCEDURE:

The elevation at the end of the wall can be computed from existing U.S. Geological Survey maps or obtained with a GPS meter. This elevation should be obtained at the same locations that the latitude and longitude for the end of the wall (16A and 17A), at the bottom of the wall at finished grade.

The elevation should be right justified with zeros, and recorded to the nearest foot, rounding up. The elevation should be recorded as shown in the examples below.

CODING EXAMPLES:

Description	Code
End of wall elevation is at 5243.2’	05244
End of wall elevation is at 985.3’	00986
End of wall elevation is at 10101’	10101

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	17B	USERBRDG	ENDELEVATION	5	VARCHAR

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Item 18 – Range, Township, and Section | 10 characters | CDOT

DESCRIPTION:

A three-part, nine character code which identifies the Range, Township and Section for the location of the structure:

Segment	Description	Length
18A	Range	4 characters
18B	Township	4 characters
18C	Section	2 digits

PROCEDURE:

This code provides an additional geographic locator for the location of the structure.

Item 18A – Range

Range can usually be found on a county map. The Range number is always identified by the **"R"** at the beginning of the number and followed by an **"E"** or **"W"**. Record just the number and the **"E"** or **"W"** indicating east or west range. Right justify the range.

Item 18B – Township

Township can usually be found on a county map. The Township number is always identified by the **"T"** at the beginning of the number and followed by an **"N"** or **"S".** Record just the number and the **"N"** or **"S"** indicating North or South township. Right justify the township.

Item 18C – Section

Section is identified within the Township and Range boundaries and noted in the appropriate square mile box. Record the Section indicator by using the appropriate two digit number between 1 and 36.

If a wall is located in more than one range, township, and section, code the information for the range, township, and section in which the majority of the wall resides.

CODING EXAMPLES:

	Code		
Location	**18A**	**18B**	**18C**
Wall-E-16-NZ Just North of 62nd Av., Arvada	69W	3S	8
MGS-0.5-19 0.5 Miles E. of Co. Rd. 19	57W	3N	5

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	18A	USERBRDG	SRVYRANGE	4	VARCHAR
	18B	USERBRDG	SRVYTOWNSHIP	4	VARCHAR
	18C	USERBRDG	SRVYSECTION	2	VARCHAR

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Item 19 – Bypass, Detour Length	2 digits	MOD FHWA

DESCRIPTION:

A two digit code identifying the length of the detour or bypass in case of wall failure resulting in inventory route closure.

PROCEDURE:

Indicate the actual length to the nearest mile of the detour length. The detour length should represent the total additional travel for a vehicle which would result from closing of the roadway from failure of the wall, carried by or in front of the wall. The parallel distance traveled is not to be counted as part of the detour length. Record the distance to the nearest mile.

The factor to consider when determining if a bypass is available at the site is the potential for moving vehicles, including military vehicles, around the structure. This is particularly true when the structure is in an interchange. For instance, a bypass likely would be available in the case of diamond interchanges, interchanges where there are service roads available, or other interchanges where the positioning and layout of the ramps is such that they could be used without difficulty to get around the structure. If a ground level bypass is available at the structure site for the inventory route, record and code the detour length as 00.

Colorado allows any paved roadway to be used as a detour route for state highway structures. The detour route must be capable of carrying State Legal loads. Any passable roadway can be used for Off-System structures. These detours may or may not allow overloads. Code 99 for 99 miles or more.

CODING EXAMPLES:

Description	Code
Diamond interchange, structure by-passable	00
Cloverleaf, not bypassable; 18-mile detour	18
Structure over highway, no interchange, bypassable at ground level	00
Structure on dead end road, with a detour of 120 miles	99

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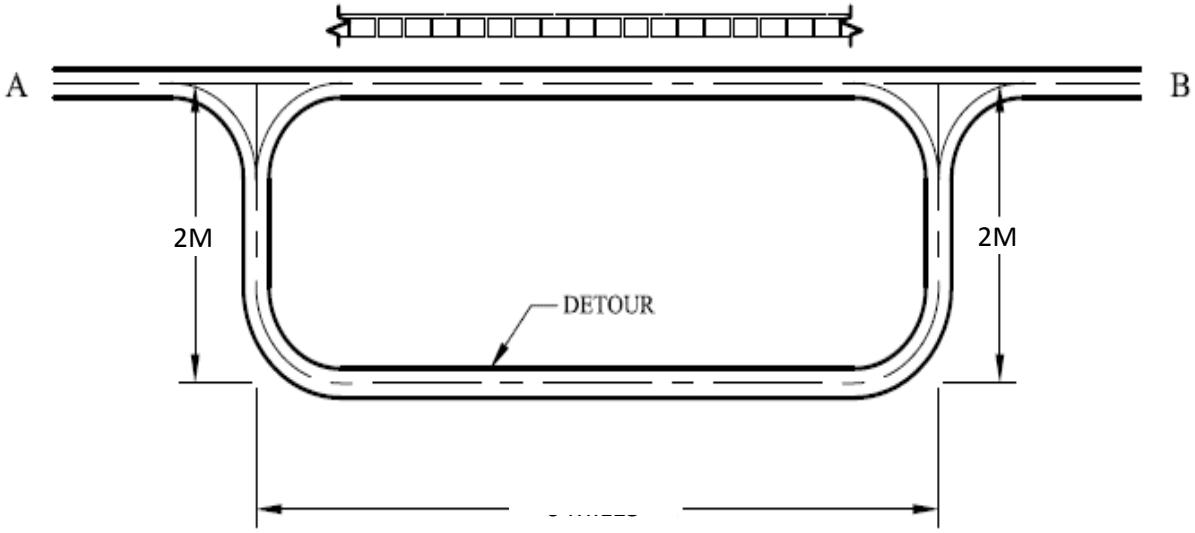
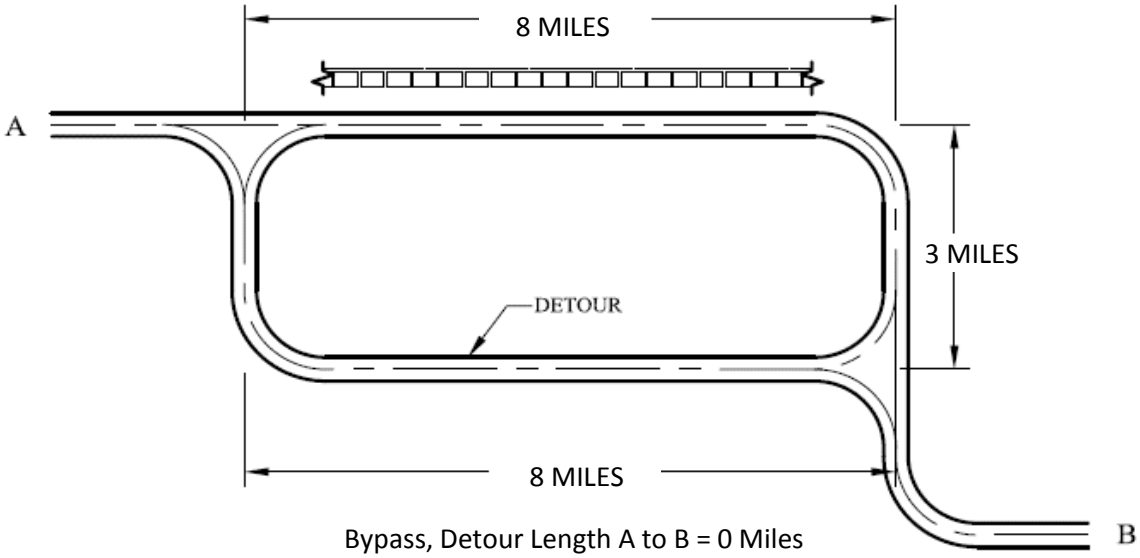


Bypass, Detour Length A to B = 4 Miles
Item 19 = 04



Bypass, Detour Length A to B = 0 Miles
Item 19 = 00

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	19	ROADWAY	BYPASSLEN	3	VARCHAR

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Item 20 – Toll	1 digit	FHWA

DESCRIPTION:

A single digit code indicating the toll status of the inventory route specified in item 5.

PROCEDURE:

The toll status of the inventory route associated with the structure is indicated by this item. Interstate toll segments under Secretarial Agreement (Title 23 - United States Code - Highways Section 129 as amended by 1991 ISTEA and prior legislation) should be identified separately. Use one of the following codes:

Description	Code
On toll road. The structure is associated with a toll road, that is, tolls are paid to use the facility, which includes both the highway and the structure.	2
On free road. The structure is associated with a toll-free highway.	3
On Interstate toll segment under Secretarial Agreement. Structure functions as a part of the toll segment.	4

CODING EXAMPLES:

Description	Code
Wall carrying E-470	2
Wall along State HWY 40 – HWY in front	3

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	20	ROADWAY	TOLLFAC	1	VARCHAR

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Item 21 – Maintenance Responsibility | 2 digits | FHWA

DESCRIPTION:

A two digit code indicating the agency responsible for the maintenance of the structure.

PROCEDURE:

The actual name(s) of the agency(s) responsible for the maintenance of the structure shall be recorded on the inspection form. The codes below shall be used to represent the type of agency that has primary responsibility for maintaining the structure. If more than one agency has equal maintenance responsibility, code one agency in the hierarchy of State, Federal, county, city, railroad, and other private.

Description	Code
State Highway Agency	01
County Highway Agency	02
Town or Township Highway Agency	03
City or Municipal Highway Agency	04
State Park, Forest, or Reservation Agency	11
Local Park, Forest, or Reservation Agency	12
Other State Agencies	21
Other Local Agencies	25
Private (other than railroad)	26
Railroad	27
State Toll Authority	31
Local Toll Authority	32
Other Federal Agencies (not listed below)	60
Bureau of Indian Affairs	62
Bureau of Fish and Wildlife	63
U.S. Forest Service	64
National Park Service	66
Bureau of Land Management	68
Bureau of Reclamation	69
Corps of Engineers (Civil)	70
Corps of Engineers (Military)	71
Unknown	80

CODING EXAMPLES:

Description	Code
Wall maintained by CDOT	01
Wall maintained by City of Boulder	04

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	21	BRIDGE	CUSTODIAN	2	VARCHAR

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Item 22 – Owner | 2 digits | FHWA

DESCRIPTION:

A two digit code indicating the owner of the wall.

PROCEDURE:

The actual name(s) of the owner(s) of the wall shall be recorded on the inspection form. The codes used in Item 21 – Maintenance Responsibility shall be used to represent the type of agency that is the primary owner of the structure. If more than one agency has equal ownership, code one agency in the hierarchy of State, Federal, county, city, railroad, and other private.

CODING EXAMPLES:

Description	Code
Wall owned by CDOT	01
Wall owned by U.S. Forest Service	64

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	22	BRIDGE	OWNER	2	VARCHAR

Item 23 – Original Construction Project Number | 25 characters | CDOT

DESCRIPTION:

A twenty-five character code for identifying the project number that built the structure referred to in Item 8.

PROCEDURE:

Record the construction project number that built the structure noted in Item 8. For those structures where no project number is available, record WS (WALL SURVEY) indicating that the structure was located during a structure inventory survey. If a year is available, put after WS.

CODING EXAMPLES:

Description	Code
Project I70-2(77)	I70-2(77)
No Project Number, wall found in 2014	WS14

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	23	PROJECTS	PROJKEY	25	VARCHAR

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Item 23E – Subaccount Number — 5 characters — CDOT

DESCRIPTION:

A five digit code identifying the subaccount number related to the project number in Item23.

PROCEDURE:

Record the subaccount number of the project referred to in Item23. If no number is available, leave blank.

CODING EXAMPLES:

Description	Code
Project I70-2 (119)	84009
No Project Number	Leave Blank

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	23E	PROJECTS	PROJECT_ID	5	VARCHAR

Item 23EE – Project Indicator — 5 characters — CDOT

DESCRIPTION:

A five digit code identifying the project that is building/replacing structures using the project subaccount number.

PROCEDURE:

Record the subaccount number of the project that is building/replacing a structure. In addition to all the new structures being built, the number should be recorded for all the structures being replaced and any structures being rehabed. The purpose of this item is to be able to call up all the structures involved on a project at one time. If no number is available, leave blank.

CODING EXAMPLES:

Description	Code
Project I70-2 (119)	84009
No Project Number	Leave Blank

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	23EE	USERPROJ	PROJECTINDICATOR	5	VARCHAR

Item 24 – (Reserved)

Item 25 – (Reserved)

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Item 26 – Functional Classification of Inventory Route | 2 digits | FHWA

DESCRIPTION:

A two digit code identifying the function classification of the inventory route.

PROCEDURE:

For the inventory route, code the functional classification using one of the following codes:

Description	Code
Rural	
Principal Arterial - Interstate	01
Principal Arterial - Other	02
Minor Arterial	06
Major Collector	07
Minor Collector	08
Local	09
Urban	
Principal Arterial - Interstate	11
Principal Arterial - Other Freeways or Expressways	12
Other Principal Arterial	14
Minor Arterial	16
Collector	17
Local	19

The wall shall be coded rural if not inside a designated urban area. The urban or rural designation shall be determined by the wall location and not the character of the roadway.

CODING EXAMPLES:

Description	**Code**
Wall located on I-25 near Trinidad	01
Wall located on State HWY 6	14

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	26	ROADWAY	FUNCCLASS	2	VARCHAR

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Item 27 – Year Built | 4 digits | MOD FHWA

DESCRIPTION:

A four digit code identifying the year in which the wall was constructed.

PROCEDURE:

Record and code the year of construction of the structure. Code all 4 digits of the year in which construction of the structure was completed. If the year built is unknown, provide a best estimate based on construction documents. If no documentation is available, leave blank. See also Item 106 - Year Reconstructed.

CODING EXAMPLES:

Description		Code
Construction completed	1956	1956
	1892	1892

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	27	BRIDGE	YEARBUILT	4	VARCHAR

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Item 28 – Lanes On and In Front of the Structure | 4 digits | MOD FHWA

DESCRIPTION:

A four digit code identifying the number of lanes on and/or in front of a wall.

PROCEDURE:

Record and code the number of lanes being carried by or behind the structure as a 2-digit number in the first segment, 28A and the number of lanes in front of the structure as a 2-digit number in segment 28B. The number of lanes should be right justified in each segment with leading zero(s) coded as required.

Segment	Description	Length
28A	Lanes carried by the structure	2 digits
28B	Lanes in front of the structure	2 digits

Include all lanes carrying highway traffic (i.e., cars, trucks, buses) which are striped or otherwise operated as a full width traffic lane carried by the entire length of the structure or in front of the structure by the owning/ maintaining authority. This shall include any full width merge lanes and ramp lanes, and shall be independent of directionality of usage (i.e., a wall carrying 2-directional traffic on a 1-way route is still considered to carry only one lane on the structure.)

When the inventory route is “carried by” or behind the wall (the first digit of Item 5 - Inventory Route is coded 1), the sum of the total number of lanes on the inventoried route shall be coded in Item 28A. When the inventory route is "in front" of the wall (the first digit of Item 5 - Inventory Route is coded 2), only the number of lanes being identified by that "in front" record shall be coded in Item 28B.

When the inventory route is "in front" of the structure, the feature retained by the wall may be other than a highway (upslope, vegetated slope, embankment, etc.). Code 00 for these cases if there are no highway lanes on the retained feature.

CODING EXAMPLES:

Description	Code
1 lane carried, 0 lanes in front	0100
3 lanes carried, 1 lane in front	0301

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	28A	ROADWAY	LANES	2	VARCHAR

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	28B	ROADWAY	SUMLANES	2	VARCHAR

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Item 29 – Average Daily Traffic | 6 digits | FHWA

DESCRIPTION:

A six digit code indicating the average daily traffic volume for the inventory route.

PROCEDURE:

Code a 6-digit number that shows the average daily traffic volume for the inventory route identified in Item 5. Make certain the unit's position is coded even if estimates of ADT are determined to tens or hundreds of vehicles; that is, appropriate trailing zeros shall be coded. The ADT coded should be the most recent ADT counts available. Included in this item are the trucks referred to in Item 109 - Average

Daily Truck Traffic. If the wall has failed and caused road closure or other restrictions to traffic, code the actual ADT from before the failure occurred.

CODING EXAMPLES:

Description		Code
Average Daily Traffic	540	000540
	15,600	015600
	24,000	024000

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	29	ROADWAY	ADTTOTAL	6	VARCHAR

Item 30 – Year of Average Daily Traffic | 4 digits | FHWA

DESCRIPTION:

A four digit code indicating the year represented by the ADT coded in Item 29.

PROCEDURE:

Record the year represented by the ADT in Item 29. Code all four digits of the year so recorded.

CODING EXAMPLES:

Description	Code
Year of ADT is 1994	1994

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	30	ROADWAY	ADTYEAR	4	VARCHAR

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Item 33 – Inventory Route Median	1 digit	FHWA

DESCRIPTION:

A one digit code to identify the median type on the inventory route.

PROCEDURE:

The area between two roadways is considered the median. The median is closed when the area between the two roadways "at the structure" is bridged over and capable of supporting traffic. The median is open when the area between the two roadways "at the structure" is not covered, or connected in such a way as to support traffic. There is no median if the two roadways are separated only by a painted centerline/lane line. If two structures are widened, but not connected and the approach roadway is built with a closed median, consider the structure to have a closed median. Use the list below to determine the appropriate code for each structure. See the examples below.

Description	Code
No Median	0
Open Median	1
Closed median (no barrier)	2
Closed median (non-mountable barrier)	3

CODING EXAMPLES:

Description	Code
Wall carried I-25 with open median between NB and SB lanes	1

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	33	BRIDGE	BRIDGEMED	1	VARCHAR

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Item 36 (A-D) – Traffic Safety Features On Top | 4 characters | MOD FHWA

DESCRIPTION:

A four digit code indicating adequacy of the traffic safety features associated with the top of the wall and corresponding inventory route.

PROCEDURE:

Wall inspection shall include the recording of information on the following traffic safety features so that the evaluation of their adequacy can be made.

Segment	Description	Length
36A	Wall railings	1 character
36B	Transitions	1 character
36C	Approach guardrail	1 character
36D	Approach guardrail ends	1 character

(A) Wall railings: Some factors that affect the proper functioning of wall railing are height, material, strength, and geometric features. Railings must be capable of smoothly redirecting an impacting vehicle. Wall railings should be evaluated using the current AASHTO Standard Specifications for Highway Bridges, which calls for railings to meet specific geometric criteria and to resist specified static loads without exceeding the allowable stresses in their elements. Wall railing should be crash tested per FHWA policy. Railings that meet these criteria and loading conditions are considered acceptable. Other railings that have been successfully crash tested are considered acceptable even though they may not meet the static loading analysis and geometric requirements. Acceptable guidelines for wall railing design and testing are also found in the AASHTO Guide Specifications for Bridge Railings 1989. Additional guidance for testing is found in National Cooperative Highway Research Program - Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features 1993.

(B) Transitions: The transition from approach guardrail to wall railing requires that the approach guardrail be firmly attached to the wall railing. It also requires that the approach guardrail be gradually stiffened as it comes closer to the wall railing. The ends of curbs and safety walks need to be gradually tapered out or shielded.

(C) Approach guardrail: The structural adequacy and compatibility of approach guardrail with transition designs should be determined. Rarely does the need for a barrier stop at the end of a wall. Thus, an approach guardrail with adequate length and structural qualities to shield motorists from the hazards at the wall site needs to be installed. In addition to being capable of safely redirecting an impacting vehicle, the approach guardrail must also facilitate a transition to the wall railing that will not cause snagging or pocketing of an impacting vehicle. Acceptable guardrail design suggestions are contained in the AASHTO Roadside Design Guide and subsequent FHWA or AASHTO guidelines.

(D) Approach guardrail ends: As with guardrail ends in general, the ends of approach guardrails to walls should be flared, buried, made breakaway, or shielded. Design treatment of guardrail ends is given in

the AASHTO Roadside Design Guide. Collision damage or deterioration of the elements are not considered when coding this item.

The reporting of these features shall be as follows:

Description	Code
Inspected feature does not meet currently acceptable standards or a safety feature is required and none is provided	0
Inspected feature meets currently acceptable standards	1
Not applicable, or a safety feature is not required, no carried by structure, e.g., wall retaining hillside adjacent to roadway	N

* For structures on the NHS, national standards are set by regulation. For those not on the NHS, it shall be the responsibility of the highway agency (state, county, local or federal) to set standards.

CODING EXAMPLE:

Description	**Code**
All features meet currently acceptable standards except transition	1011

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	36A	INSPEVNT	RAILRATING	1	VARCHAR
	36B	INSPEVNT	TRANSRATIN	1	VARCHAR
	36C	INSPEVNT	ARAILRATIN	1	VARCHAR
	36D	INSPEVNT	AENDRATING	1	VARCHAR

Item 36H – Height of Rail On Top — 4 digits — CDOT

DESCRIPTION:

A four character code indicating guardrail height from the top of wall to the top of the rail.

PROCEDURE:

This item should be coded to the nearest tenth of an inch. Do not code the height from the top of the asphalt since this can vary. Right justify the height. If no railing exists on top of the wall, code this item "N" for Not Applicable.

CODING EXAMPLE:

Description	**Code Item 36 H**
Measured height of rail is 36"	0360

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	36H	USERBRDG	RAILHEIGHT	4	VARCHAR

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Item 36 (I-L) – Traffic Safety Features In Front | 4 characters | MOD FHWA

DESCRIPTION:

A four digit code indicating adequacy of the traffic safety features in front of the wall and corresponding inventory route.

PROCEDURE:

Wall inspection shall include the recording of information on the following traffic safety features so that the evaluation of their adequacy can be made.

Segment	Description	Length
36I	Wall railings	1 character
36J	Transitions	1 character
36K	Approach guardrail	1 character
36L	Approach guardrail ends	1 character

(I) Wall railings: Some factors that affect the proper functioning of wall railing are height, material, strength, and geometric features. Railings must be capable of smoothly redirecting an impacting vehicle. Wall railings should be evaluated using the current AASHTO Standard Specifications for Highway Bridges, which calls for railings to meet specific geometric criteria and to resist specified static loads without exceeding the allowable stresses in their elements. Wall railing should be crash tested per FHWA policy. Railings that meet these criteria and loading conditions are considered acceptable. Other railings that have been successfully crash tested are considered acceptable even though they may not meet the static loading analysis and geometric requirements. Acceptable guidelines for wall railing design and testing are also found in the AASHTO Guide Specifications for Bridge Railings 1989. Additional guidance for testing is found in National Cooperative Highway Research Program - Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features 1993.

(J) Transitions: The transition from approach guardrail to wall railing requires that the approach guardrail be firmly attached to the wall railing. It also requires that the approach guardrail be gradually stiffened as it comes closer to the wall railing. The ends of curbs and safety walks need to be gradually tapered out or shielded.

(K) Approach guardrail: The structural adequacy and compatibility of approach guardrail with transition designs should be determined. Rarely does the need for a barrier stop at the end of a wall. Thus, an approach guardrail with adequate length and structural qualities to shield motorists from the hazards at the wall site needs to be installed. In addition to being capable of safely redirecting an impacting vehicle, the approach guardrail must also facilitate a transition to the wall railing that will not cause snagging or pocketing of an impacting vehicle. Acceptable guardrail design suggestions are contained in the AASHTO Roadside Design Guide and subsequent FHWA or AASHTO guidelines.

(L) Approach guardrail ends: As with guardrail ends in general, the ends of approach guardrails to walls should be flared, buried, made breakaway, or shielded. Design treatment of guardrail ends is given in

the AASHTO Roadside Design Guide. Collision damage or deterioration of the elements are not considered when coding this item.

The reporting of these features shall be as follows:

Description	Code
Inspected feature does not meet currently acceptable standards or a safety feature is required and none is provided	0
Inspected feature meets currently acceptable standards	1
Not applicable, or a safety feature is not required, no carried by structure, e.g., wall retaining hillside adjacent to roadway	N

* For structures on the NHS, national standards are set by regulation. For those not on the NHS, it shall be the responsibility of the highway agency (state, county, local or federal) to set standards.

CODING EXAMPLE:

Description	**Code**
All features meet currently acceptable standards except approach guardrail	1101

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	36I	USERBRDG	FRAILRATING	1	VARCHAR
	36J	USERBRDG	FTRANSRATING	1	VARCHAR
	36K	USERBRDG	FARAILRATIN	1	VARCHAR
	36L	USERBRDG	FAENDRATING	1	VARCHAR

Item 36M – Height of Rail In Front — 4 digits — CDOT

DESCRIPTION:

A four character code indicating guardrail height from the top of the rail foundation to the top of the rail.

PROCEDURE:

This item should be coded to the nearest tenth of an inch. Do not code the height from the top of the asphalt since this can vary. Right justify the height. If no railing exists in front of the wall, code this item "N" for Not Applicable.

CODING EXAMPLE:

Description	**Code Item 36 M**
Measured height of rail is 46.5"	0465

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	36M	USERBRDG	FRAILHEIGHT	1	VARCHAR

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Item 37 – Historical Significance	1 digit	MOD FHWA

DESCRIPTION:

A single digit code indicating the historical significance of a wall.

PROCEDURE:

The historical significance of a wall involves a variety of characteristics: the wall may be a particularly unique example of the history of engineering; the inventory route itself might be significant; the wall might be associated with a historical property or area; or historical significance could be derived from the fact the wall was associated with significant events or circumstances. Use one of the following codes:

Description	Code
Wall is on the National Register of Historic Places.	1
Wall is eligible for the National Register of Historic Places.	2
Wall is possibly eligible for the National Register of Historic Places (requires further investigation before determination can be made) or wall is on a State or local historic register.	3
Historical significance is not determinable at this time.	4
Wall is not eligible for the National Register of Historic Places.	5

Unless otherwise noted, a wall should be coded with a '5'.

CODING EXAMPLES:

Description	Code
Wall is not historically significant	5
Wall may be historically significant, but more research is needed to confirm significance.	3

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	37	BRIDGE	HISTSIGN	1	VARCHAR

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Item 42 – Type of Service	2 characters	MOD FHWA

DESCRIPTION:

A two digit character code used to indicate the type of service carried by and/or in front of the wall.

PROCEDURE:

The type of service carried by the wall and/or in front of the wall is indicated by a 2-digit code composed of 2 segments.

Segment	Description	Length
42A	Type of service carried by wall	1 character
42B	Type of service in front of wall	1 character

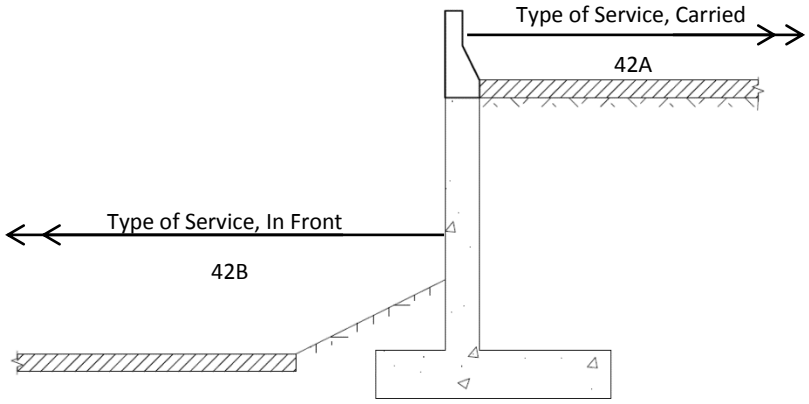
The first digit indicates the type of service "carried" by the wall and the second digit indicates the type of service "in front" of the wall. Each segment shall be coded using one of the following codes:

Description	Code
Highway	A
Railroad	B
Pedestrian-bicycle	C
Highway-railroad	D
Highway-pedestrian	E
Overpass structure at an interchange or second level of a multilevel interchange	F
Third level (Interchange)	G
Fourth level (Interchange)	H
Building or plaza	I
Slope – Rock Debris	J
Slope – Embankment	K
Slope – Canal	L
Slope – Vegetated	M
Slope – Rockfall Protection	N
Slope – Landslide	O
Slope – Shallow Slope (less than 10°)	P
Slope – Other	Q
Bridge	R
Isolated Foundations	S
Waterway	T
Other	U

Type of Service, cont….

CODING EXAMPLES:

Description	Code
A retaining wall carrying US HWY 40, with vegetated slope in front	AM
A retaining wall carrying a sidewalk, with I-70 in front	CA



BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	42A	BRIDGE	SERVTYPON	1	VARCHAR
	42B	BRIDGE	SERVTYPUND	1	VARCHAR

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Item 43 – Structure Type, Wall Facing | 3 digits | MOD FHWA

DESCRIPTION:

A three digit code indicating the main material and construction type of the wall facing, or main loadbearing portion of the wall. This item does not encompass types of vertical support – see item 107 for vertical support specification.

PROCEDURE:

Record the description on the inspection form and indicate the type of structure for the main wall face only with a 3-digit code composed of 2 segments.

Segment	Description	Length
43A	Kind of material	1 digit
43B	Type of design and/or construction	2 digits

The first digit indicates the kind of material and/or design and shall be coded using one of the following codes:

Description	Code
Cast-in-place Concrete	1
Precast Concrete	2
Shotcrete	3
Steel	4
Prestressed Concrete*	5
Wood or Timber	6
Stone/Masonry	7
Geosynthetic Wrapped Face	8
Aluminum	9
Other – including(Wrought Iron, Cast Iron, Gabion, welded-wire face)	0
Unknown	U

* Post-tensioned concrete should be coded as prestressed concrete.

The second and third digits indicate the predominant type of design and/or type of construction and shall be coded using one of the following codes, depending on the function of the wall – i.e. retaining wall or noise wall.

Retaining Wall Construction Types

Description	Code
Anchor, tieback H-pile/soldier pile	01
Anchor, micropile	02
Anchor, tieback sheet pile	03
Anchor, prestressed soil	04
Bin, reinforced concrete	05
Bin, unreinforced concrete	06
Bin, other	07
Cantilever, prestressed concrete panels	08
Cantilever, concrete, reinforced	09
Cantilever, concrete, unreinforced	10

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Retaining Wall Construction Types, cont…

Description	Code
Cantilever, soldier pile	11
Cantilever, sheet pile	12
Crib, concrete, reinforced	13
Crib, concrete, unreinforced	14
MSE, geosynthetic wrapped faced	15
MSE, welded wire face	16
MSE, concrete	17
MSE, segmental block	18
Gravity, concrete block/brick	19
Gravity, mass concrete, reinforced	20
Gravity, mass concrete, unreinforced	21
Gravity, dry stone	22
Gravity, gabion	23
Gravity, mortared stone	24
Soil Nail	25
Tangent/Secant Pile	26
Geosynthetic reinforced soil (GRS) wall	27
Other/unknown retaining wall construction type	98

Noise Wall Construction Types

Description	Code
Direct burial panel, ground-mounted	50
Free-standing on footing or leveling pad	51
Post and panel, steel post, bridge-mounted	52
Post and panel, timber posts, bridge-mounted	53
Post and panel, concrete posts, bridge-mounted	54
Post and panel, steel post, ground-mounted	55
Post and panel, timber posts, ground-mounted	56
Post and panel, concrete posts, ground-mounted	57
Post and panel, steel post, parapet-mounted	58
Post and panel, timber posts, parapet-mounted	59
Post and panel, concrete posts, parapet-mounted	60
Other/unknown noise wall construction type	99

CODING EXAMPLES:

Description	Code
Geosynthetic Reinforced MSE Wall	816
Post and panel pre-cast concrete noise wall, ground-mounted, steel posts	255
Free-standing masonry noise wall on footing	751

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	43A	BRIDGE	MATERIALMAIN	1	VARCHAR
	43B	BRIDGE	DESIGNMAIN	2	VARCHAR

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Item 47 – Total Horizontal Clearance, Carried/Behind — 3 digits — MOD FHWA

DESCRIPTION:

A three digit code indicating the total horizontal clearance on the inventory route carried by or behind the wall.

PROCEDURE:

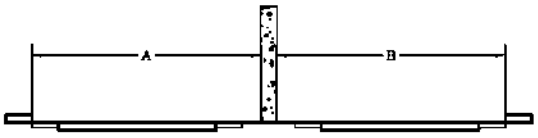
The total horizontal clearance for the route identified in Item 6 should be measured and recorded. The clearance should be the available clearance measured between the restrictive features -- curbs, rails, walls, piers or other structural features limiting the roadway (surface and shoulders). For routes without obvious restrictions such as curbs or rails, data should be recorded to the edge of pavement. The measurement should be recorded and coded as a 3-digit number truncated to the nearest foot. For structures that do not carry a route or are not associated with a route behind the structure (Item 6 is coded "NA"), code "000" for Item 47.

The purpose of this item is to give the largest available clearance for the movement of wide loads. Flush and mountable medians are not considered to be restrictions. This clearance is defined in 2 ways; use the most applicable:

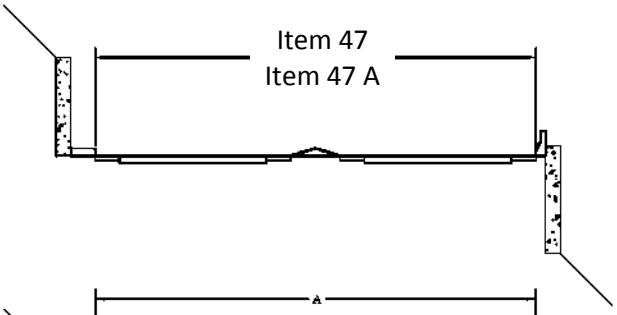
1. Clear distance between restrictions of the inventory route either "on" or "in front" of the structure.
2. Roadway surface and shoulders - when there are no restrictions.

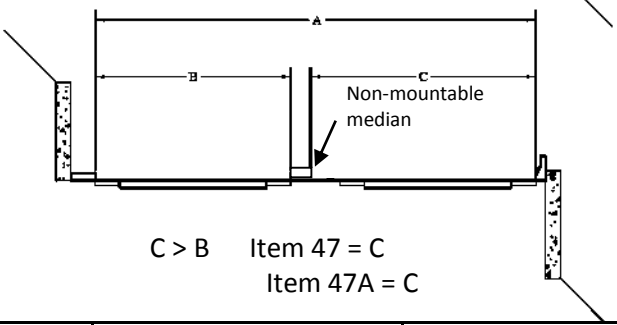
For a divided facility with a raised or non-mountable median, record the greater of the restricted widths in either direction, not both directions.

CODING EXAMPLES:



B > A Item 47A = B
Item 47 = "000"





C > B Item 47 = C
Item 47A = C

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	47	ROADWAY	HCLRINV	3	VARCHAR

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Item 47A – Total Horizontal Clearance, In Front	3 digits	CDOT

DESCRIPTION:

A three digit code indicating the total horizontal clearance on the inventory route in front of the wall.

PROCEDURE:

The total horizontal clearance for the route identified in Item 7 should be measured and recorded. The clearance should be the available clearance measured between the restrictive features -- curbs, rails, walls, piers or other structural features limiting the roadway (surface and shoulders). For routes without obvious restrictions such as curbs or rails, data should be recorded to the edge of pavement. The measurement should be recorded and coded as a 3-digit number truncated to the nearest foot. For structures that are not associated with a route in front (Item 7 is coded "NA"), code "000" for Item 47A.

The purpose of this item is to give the largest available clearance for the movement of wide loads. Flush and mountable medians are not considered to be restrictions. This clearance is defined in 2 ways; use the most applicable:

1. Clear distance between restrictions of the inventory route either "carried by" or "in front" of the structure.
2. Roadway surface and shoulders - when there are no restrictions.

For a divided facility with a raised or non-mountable median, record the greater of the restricted widths in either direction, not both directions.

CODING EXAMPLE:

See Item 47 for examples.

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	47A	USERRWAY	FHCLRINV	3	VARCHAR

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Item 49 – Structure Length | 6 digits | MOD FHWA

DESCRIPTION:

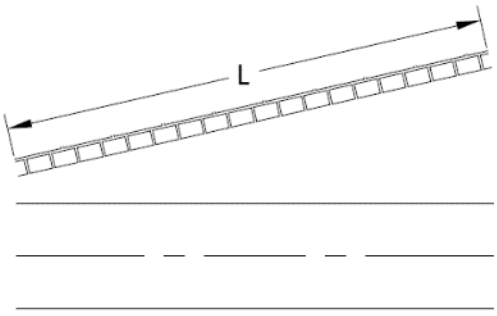
A six digit code indicating the total length, to the nearest tenth of a foot, of the wall.

PROCEDURE:

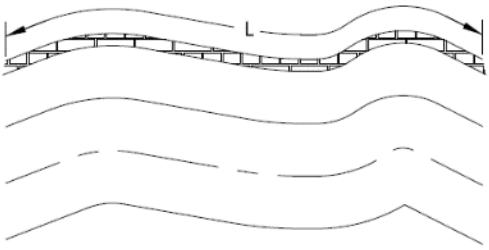
Record and code a 6-digit number to represent the length of the structure to the nearest tenth of a foot (with an assumed decimal point). The length should be measured from the start of the wall to the end of the wall as defined at the beginning of this document. This length should not include features such as concrete barriers, i.e. jersey barriers, unless these features were designed to retain soil. If a wall exhibits sharp turns or bends, it is up to the team leader to determine if the wall should be considered as one wall or if it should be separated into multiple walls at the connecting points. It is recommended that the wall be inspected as two separate walls if there is a change in construction type, or if one end of the wall is within the bridge zone and the other end exists outside of the bridge zone as described in Chapter 1.

CODING EXAMPLES:

Description		Code
Structure Length	35.5 feet	000355
	10123.5 feet	101235



(1) Item 49 – Structure Length, L



(2) Item 49 – Structure Length, L

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	49	BRIDGE	LENGTH	6	VARCHAR

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Item 50 (A-B) – Curb or Sidewalk Widths, Carried Route | 6 digits | MOD FHWA

DESCRIPTION:

A six digit code indicating the curb or sidewalk widths along the route carried by or behind the wall.

PROCEDURE:

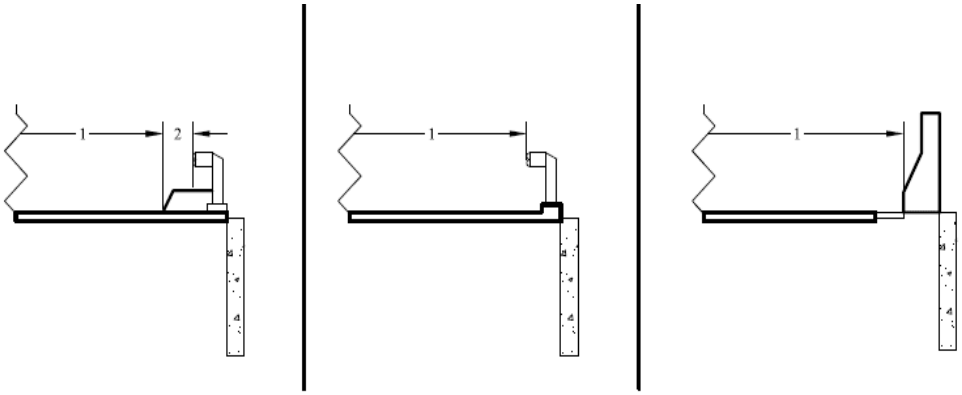
Record and code two contiguous 3-digit numbers to represent the widths of the left and right curbs or sidewalks on the inventory route described in Item 6 to nearest tenth of a foot (with assumed decimal points). This is a 6-digit number composed of 2 segments, with the leftmost 3 digits representing the left curb or sidewalk and the rightmost 3 digits representing the right curb or sidewalk. "Left" and "Right" should be determined on the basis of direction of the inventory. For structures that do not carry a route or are not associated with a route behind the structure (Item 6 is coded “NA”), code “000000” for Item 50.

Segment	Description	Length
50A	Left curb or sidewalk width	3 digits
50B	Right curb or sidewalk width	3 digits

CODING EXAMPLES:

	Left Side	Right Side	Code
Curb or sidewalk	None	2.3 ft	000023
	3.0 ft	4.1 ft	030041
	3.3 ft	None	033000
	12.1 ft	11.5 ft	121115
	None	None	000000
	0.6 ft	1.5 ft	006015

EXAMPLES:



(1) Item 51 – Width, Curb-to-Curb
(2) Item 50 – Curb or Sidewalk Width

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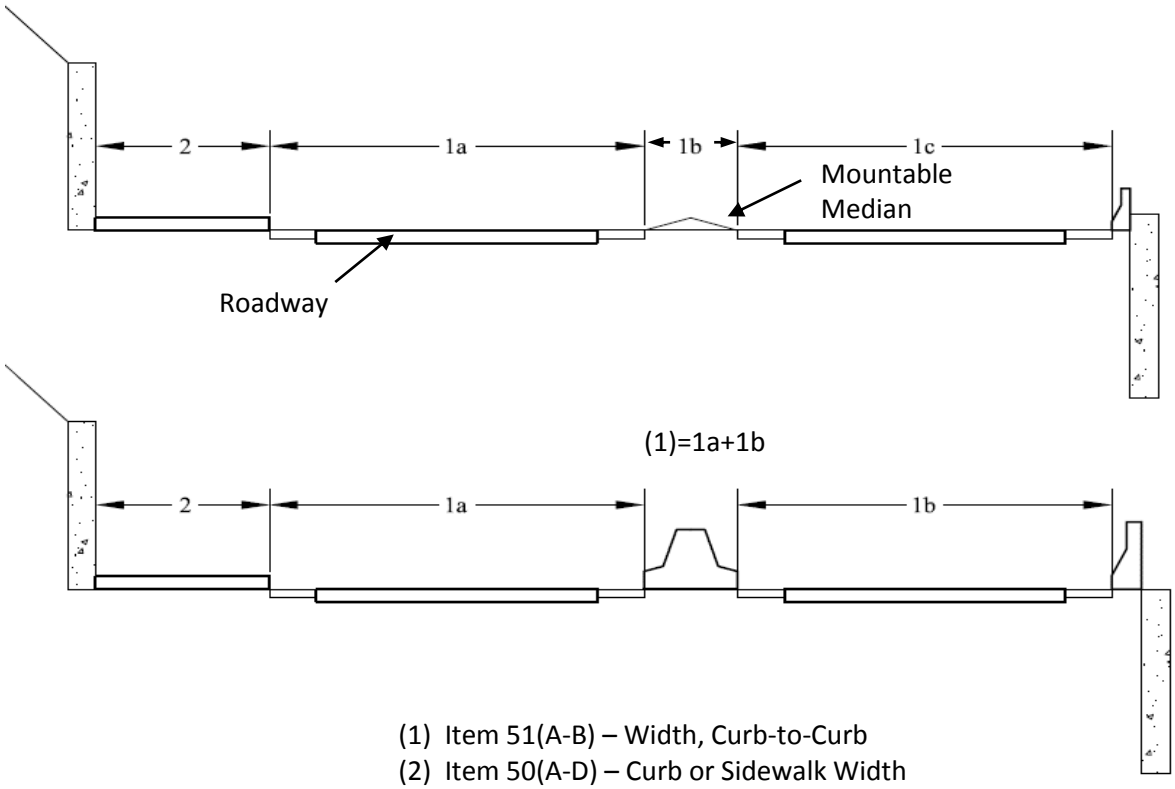

(1) Item 51(A-B) – Width, Curb-to-Curb
(2) Item 50(A-D) – Curb or Sidewalk Width

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	50A	BRIDGE	LFTCURBSW	3	VARCHAR
	50B	BRIDGE	RTCURBSW	3	VARCHAR

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Item 50 (C-D) – Curb or Sidewalk Widths, Route In Front — 6 digits — CDOT

DESCRIPTION:

A six digit code indicating the curb or sidewalk widths along the route in front of the wall.

PROCEDURE:

Record and code two contiguous 3-digit numbers to represent the widths of the left and right curbs or sidewalks on the inventory route described in Item 7 to nearest tenth of a foot (with assumed decimal points). This is a 6-digit number composed of 2 segments, with the leftmost 3 digits representing the left curb or sidewalk and the rightmost 3 digits representing the right curb or sidewalk. "Left" and "Right" should be determined on the basis of direction of the inventory. For structures that are not associated with a route in front (Item 7 is coded “NA”), code “000000” for Items 50C and 50D.

Segment	Description	Length
50C	Left curb or sidewalk width	3 digits
50D	Right curb or sidewalk width	3 digits

CODING EXAMPLES:

	Left Side	Right Side	Code
Curb or sidewalk	None	2.3 ft	000023
	3.0 ft	4.1 ft	030041
	3.3 ft	None	033000
	12.1 ft	11.5 ft	121115
	None	None	000000
	0.6 ft	1.5 ft	006015

EXAMPLES: See Item 50

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	50C	USERBRDG	FLFTCURBSW	3	VARCHAR
	50D	USERBRDG	FRTCURBSW	3	VARCHAR

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Item 51 – Width, Curb-to-Curb, Carried Route | 4 digits | MOD FHWA

DESCRIPTION:

A four digit code indicating the curb-to-curb roadway width of the inventory route carried by or behind the wall.

PROCEDURE:

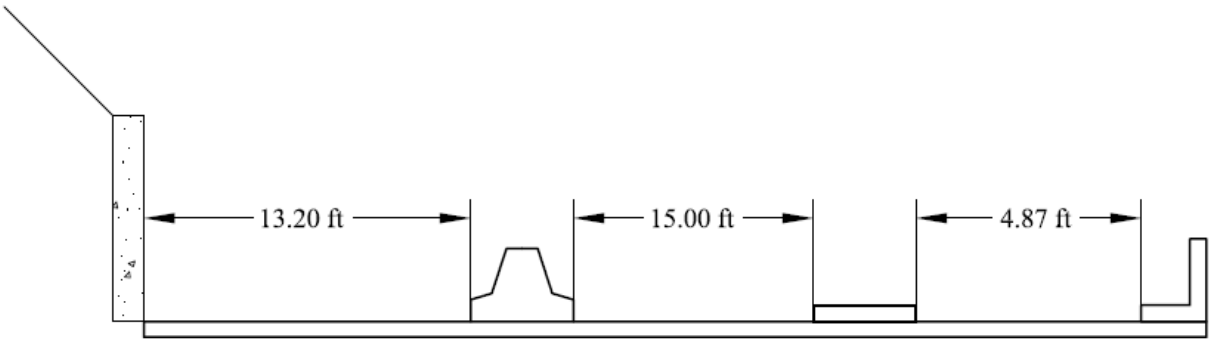
The information to be recorded is the most restrictive minimum distance between curbs or rails on the structure roadway associated with Item 6. For routes without obvious restrictions such as curbs or rails, data should be recorded to the edge of pavement. For roadways with closed medians, coded data will be the sum of the most restrictive minimum distances for all roadways carried by or protected by the structure*. The data recorded for this item must be compatible with other related route and wall data (i.e., Items 28, 29, etc.). The measurement should be exclusive of flared areas for ramps. A 4-digit number should be used to represent the distance to the nearest tenth of a foot (with an assumed decimal point). See examples on under item 50. For structures that do not carry a route or are not associated with a route behind the structure (Item 6 is coded "NA"), code "0000" for Item 51.

* Raised or non-mountable medians, open medians, and barrier widths are to be excluded from the summation along with barrier-protected bicycle and equestrian lanes.

CODING EXAMPLES:

Description		Code
Inventory Roadway Width	16.00 ft wide	0160
	21.43 ft wide	0215
	33.07 ft wide	0331

The last example above would be the coded value for the road section shown below. See examples in Item 50 for more figures.



BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	51	ROADWAY	ROADWIDTH	4	VARCHAR

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Item 51A – Width, Curb-to-Curb, Route In Front | 4 digits | CDOT

DESCRIPTION:

A four digit code indicating the curb-to-curb roadway width of the inventory route in front of the wall.

PROCEDURE:

The information to be recorded is the most restrictive minimum distance between curbs or rails on the structure roadway associated with Item 7. For roadways with closed medians, coded data will be the sum of the most restrictive minimum distances for all roadways carried by or protected by the structure*. For routes without obvious restrictions such as curbs or rails, data should be recorded to the edge of pavement. The data recorded for this item must be compatible with other related route and wall data (i.e., Items 28, 29, etc.). The measurement should be exclusive of flared areas for ramps. A 4-digit number should be used to represent the distance to the nearest tenth of a foot (with an assumed decimal point). See examples on under item 50. For structures that are not associated with a route in front (Item 7 is coded "NA"), code "0000" for Item 51A.

* Raised or non-mountable medians, open medians, and barrier widths are to be excluded from the summation along with barrier-protected bicycle and equestrian lanes.

CODING EXAMPLES:

Description		Code
Inventory Roadway Width	16.00 ft wide	0160
	21.43 ft wide	0215
	33.07 ft wide	0331

See examples in Item 50 and 51 for figures.

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	51A	USERBRDG	FROADWIDTH	4	VARCHAR

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Item 52 – Average Wall Height | 4 digits | MOD FHWA

DESCRIPTION:

A three digit code to identify the average height of the wall.

PROCEDURE:

Record the average height of the wall rounded up to the nearest foot. *Average height is to be determined at the discretion of the team lead.* The wall must be taller than 4 ft. at its tallest point to qualify as a numbered wall.

CODING EXAMPLE:

Description	Code
Average Wall Height =19'1"	0020

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	52	BRIDGE	DECKWIDTH	4	VARCHAR

Item 53 – Maximum Wall Height | 4 digits | MOD FHWA

DESCRIPTION:

A three digit code to identify the maximum height of the wall.

PROCEDURE:

Record the maximum height of the wall rounded up to the nearest foot. The wall must be taller than 4 ft. at its tallest point to qualify as a numbered wall. The measurement should be the maximum height at any point along the wall.

CODING EXAMPLE:

Description	Code
Wall at its tallest=6'8"	0007

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	53	BRIDGE	VCLROVER	4	VARCHAR

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Item 54 – Minimum Wall Height — 4 digits — MOD FHWA

DESCRIPTION:

A three digit code to identify the minimum height of the wall.

PROCEDURE:

Record the minimum measured height of the wall rounded up to the nearest foot. The wall must be taller than 4 ft. at its tallest point to qualify as a numbered wall. The measurement should be the minimum height at any point along the wall.

CODING EXAMPLE:

Description	**Code**
Wall at its shortest=1'1"	0002

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	54	BRIDGE	VCLRUNDER	4	VARCHAR

Condition Ratings

In order to promote uniformity between inspectors, these guidelines will be used to rate and code Items 58, 60, and 61.

Condition ratings are used to describe the existing, in-place wall as compared to the as-built condition. Evaluation is for the materials related, physical condition of the structure, and foundation components of a wall. Condition codes are properly used when they provide an overall characterization of the general condition of the entire component being rated. Conversely, they are improperly used if they attempt to describe localized or nominally occurring instances of deterioration or disrepair. Correct assignment of a condition code must, therefore, consider both the severity of the deterioration or disrepair and the extent to which it is widespread throughout the component being rated.

Portions of walls that are being supported or strengthened by temporary members will be rated based on their actual condition; that is, the temporary members are not considered in the rating of the item. (See Item 103 - Temporary Structure Designation for the definition of a temporary wall.)

The following general condition ratings shall be used as a guide in evaluating Items 58 and 60:

Code	Description
N	**NOT APPLICABLE**
9	**EXCELLENT CONDITION** - like new condition
8	**VERY GOOD CONDITION** - Main structure has very minor (and isolated) deterioration. • Concrete: minor cracking, leaching, scaling, or wear (no delamination or spalling). • Timber: minor weathering - isolated (minor) splitting. • Steel: no corrosion (paint/protection system remains sound). • Masonry: slight weathering or cracks (joints have no deterioration).
7	**GOOD CONDITION** - Main structure has minor (or isolated) deterioration. Evidences of light leakage may be present. • Concrete: minor cracking, leaching, scaling, or wear (isolated delamination, spalling, or temporary patches). • Timber: minor weathering or splitting (no decay or crushing) - all planks are secure. • Steel: minor paint failure or corrosion (no section loss) - all connections are secure. • Masonry: minor weathering or cracking (joints have little or no deterioration)
6	**SATISFACTORY CONDITION** - Main structure has minor to moderate deterioration (no repairs are necessary). Areas of slight backfill loss. Areas of leakage are minor and isolated. Scour or erosion (if present) is minor and isolated. • Concrete: moderate cracking, leaching, scaling, or wear (minor delamination or spalling). • Timber: moderate weathering or splitting (isolated decay or crushing) - some planks may be slightly loose. • Steel: moderate paint failure and/or surface corrosion (minor section loss) – some connections may have worked loose. • Masonry: moderate weathering or cracking (joints may have minor deterioration). Evidence of slight freeze-thaw.
5	**FAIR CONDITION** - Main structure has moderate deterioration (repairs may be necessary). Areas of backfill loss are minor and isolated. Areas of leakage are minor. There may be moderate scour, erosion, or undermining. There may be slight settlement, movement, misalignment, or bulging. Change in vertical batter is <4% different from intended design. • Concrete: extensive cracking, leaching, scaling, or wear (moderate delamination or spalling). • Timber: extensive weathering or splitting (moderate decay or crushing) - some planks may be loose, broken, or require replacement. • Steel: extensive paint failure and/or surface corrosion (moderate section loss) – several connections may be loose or missing, but deck components remain secure. • Masonry: extensive weathering or cracking (joints may have slight separation or offset). Evidence of minor freeze-thaw.
4	**POOR CONDITION** - Main structure has advanced deterioration (replacement should be planned). Moderate backfill loss and/or leakage may be present. There may be extensive scour, erosion, or undermining. Minor settlement, movement, misalignment, or bulging may be present. Changes in vertical batter are within 4%-10% compared to intended design. • Concrete: advanced cracking, leaching, scaling, or wear (extensive delamination or spalling) - isolated full-depth failures may be imminent. • Timber: advanced weathering, splitting, or decay - numerous planks may be loose, broken, or require replacement. • Steel: advanced corrosion (significant section loss) – main structure elements may be loose or slightly out of alignment. • Masonry: advanced weathering or cracking (joints may have separation or offset). Evidence of moderate freeze-thaw.

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3	**SERIOUS CONDITION** - Main structure has severe deterioration - immediate repairs may be necessary. Heavy and/or active backfill loss or leakage may be present. Scour, erosion, or undermining may have resulted in severe settlement, movement, or misalignment. Significant settlement, movement, misalignment, or bulging may be present. Changes in vertical batter may be >10% compared to intended design. • Concrete: severe cracking, leaching, delamination, or spalling - full-depth failures may be present. • Timber: severe splitting, crushing or decay - majority of planks may need replacement. • Steel: severe section loss – main structure elements may be severely out of alignment. • Masonry: severe cracking, offset or misalignment. Evidence of severe freeze-thaw.
2	**CRITICAL CONDITION** - advanced deterioration of primary structural elements or extreme backfill loss. Severe backfill loss may be affecting the structural integrity of the wall. Cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the routes carried or in front of the wall until corrective action is taken.
1	"**IMMINENT" FAILURE CONDITION** - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Route carried or in front of the wall is closed to traffic but corrective action may put back in light service.
0	**FAILED CONDITION** - out of service - beyond corrective action.

Item 58 – Main Structure | 1 character | MOD FHWA

DESCRIPTION:

A single digit code describing the overall condition rating of the overall structure – i.e. wall facing, vertical supports, and anchors.

PROCEDURE:

This item describes the overall condition rating of the main structure, which is to include the structural wall facing components, any associated vertical supports, as well as any anchors supporting the wall. Rate and code the condition in accordance with the above general condition ratings.

- Concrete walls should be inspected for cracking, scaling, spalling, leaching, chloride contamination, delamination, and full or partial depth failures.
- Steel wall components should be inspected for broken welds, section loss, and corrosion.
- Timber walls should be inspected for splitting, crushing, fastener failure, and deterioration from rot.
- All wall types should be inspected for significant bulging, vertical rotation (tilting), backfill loss, and leakage.

The condition of the protective system, joints, curbs, sidewalks, parapets, fascias, and wall rail shall not be considered in the overall wall evaluation. However, their condition should be noted on the inspection form.

The foundation of a wall will not influence the main structure rating.

CODING EXAMPLES:

Description	Code
Wall facing displays superficial spalls	6
Wall steel vertical supports display 5% section loss from corrosion	5

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	58	INSPEVNT	DKRATING	1	VARCHAR

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Item 60 – Foundation | 1 character | MOD FHWA

DESCRIPTION:

A single digit code describing the overall condition rating of the foundation.

PROCEDURE:

This item describes the physical condition of piles, footings, or other foundation components. Rate and code the condition in accordance with the previously described general condition ratings.

All foundation elements should be inspected for visible signs of distress including evidence of cracking, section loss, settlement, misalignment, scour, collision damage, and corrosion. The rating given by Item 113 - Scour Critical Walls, may have a significant effect on Item 60 if scour has substantially affected the overall condition of the foundation. For walls without a foundation or when the foundation elements are not visible, code "N" for not applicable. For walls that exhibit foundations integral to the main structure, i.e. there is no break in construction type or material from the wall facing to the foundation, the portion of the wall that was intended to provide foundational support should be rated in this category. The determination of the foundational portion of the wall is left to the discretion of the team leader.

The foundation condition rating shall be made independent of the main structure

CODING EXAMPLES:

Description	Code
Foundation displays spalls and scour	5
Foundation has no problems noted	8

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	60	INSPEVNT	SUBRATING	1	VARCHAR

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Item 61 – Channel and Channel Protection | 1 character | FHWA

DESCRIPTION:

A single digit code describing the overall condition rating of the channel and channel protection.

PROCEDURE:

This item describes the physical conditions associated with the flow of water along the wall such as stream stability and the condition of the channel, riprap, slope protection, or stream control devices including spur dikes. The inspector should be particularly concerned with visible signs of excessive water velocity which may affect undermining of the walls, slope protection, erosion of banks, and realignment of the stream which may result in immediate or potential problems.

Note: This item should be coded for any walls with 100' of a waterway, or at the discretion of the inspector.

Rate and code the condition in accordance with the previously described general condition ratings and the following descriptive codes:

Description	Code
Not applicable. Use when wall is not near a waterway (channel).	N
There are no noticeable or noteworthy deficiencies which affect the condition of the channel.	9
Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.	8
Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.	7
Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor stream bed movement evident. Debris is restricting the channel slightly.	6
Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.	5
Bank and embankment protection is severely undermined. River control devices have severe damage. Large deposits of debris are in the channel.	4
Bank protection has failed. River control devices have been destroyed. Stream bed aggradation, degradation or lateral movement has changed the channel to now threaten the wall and/or approach roadway.	3
The channel has changed to the extent the wall is near a state of collapse.	2
Wall failed because of channel failure. Corrective action may put back in light service.	1
Wall failed because of channel failure. Replacement necessary.	0

CODING EXAMPLES:

Description	Code
Bank protection displays signs of erosion	5
Severe undermining of the bank or embankment protection has occurred	4

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	61	INSPEVNT	CHANRATING	1	VARCHAR

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Indicate the Appraisal Ratings

The items in the Appraisal Section are used to evaluate a wall in relation to the level of service which it provides on the highway system of which it is a part. The structure will be compared to a new one which is built to current standards for that particular type of road as further defined in this section except for Item 72 - Approach Roadway Alignment. See Item 72 for special criteria for rating that item.

Items 71 and 72 will be coded with a 1-digit code that indicates the appraisal rating for the item. The ratings and codes are as follows:

Description	Code
Not applicable	N
Superior to present desirable criteria	9
Equal to present desirable criteria	8
Better than present minimum criteria	7
Equal to present minimum criteria	6
Somewhat better than minimum adequacy to tolerate being left in place as is	5
Meets minimum tolerable limits to be left in place as is	4
Basically intolerable requiring high priority of corrective action	3
Basically intolerable requiring high priority of replacement	2
This value of rating code not used	1
Wall failure	0

This table and the table for Item 71 shall be used by all evaluators to rate these items. They have been developed to closely match the descriptions for the appraisal evaluation codes of 0 to 9. The tables shall be used in all instances to evaluate the item based on the designated data in the inventory, even if a table value does not appear to match the descriptive codes. For unusual cases where the site data does not exactly agree with the table criteria, use the most appropriate table to evaluate the item. The code of N is not valid for use with Item 72.

Item 67 – (Reserved)

Item 71 – Waterway Adequacy | 1 character | FHWA

DESCRIPTION:

A single digit code indicating the appraisal rating of the waterway with respect to passage of flow adjacent to the wall.

PROCEDURE:

This item appraises the waterway with respect to passage of flow adjacent to the wall. The following codes shall be used in evaluating waterway adequacy (interpolate where appropriate). Site conditions may warrant somewhat higher or lower ratings than indicated by the table (e.g., flooding of an urban area).

Note: This item should be coded for any walls with 100' of a waterway, or at the discretion of the inspector.

Where overtopping frequency information is available, the descriptions given in the table for chance of overtopping mean the following:

Remote - greater than 100 years
Slight - 11 to 100 years
Occasional - 3 to 10 years
Frequent - less than 3 years

Adjectives describing traffic delays mean the following:

Insignificant - Minor inconvenience. Highway passable in a matter of hours.
Significant - Traffic delays of up to several days.
Severe - Long term delays to traffic with resulting hardship.

Functional Classification

Description	Principal Arterials – Interstates, Freeways, or Expressways	Other Principal and Minor Arterials and Major Collectors	Minor Collectors, Locals
Wall not adjacent to a waterway.	N	N	N
Wall and roadway above flood water elevations (high water). Chance of overtopping is remote	9	9	9
Wall above roadway. Slight chance of overtopping wall.	8	8	8
Slight chance of overtopping wall and roadway.	6	6	7
Wall above roadway. Occasional overtopping of roadway with insignificant traffic delays.	4	5	6
Wall above roadway. Occasional overtopping of roadway with significant traffic delays.	3	4	5
Occasional overtopping of wall and roadway with significant traffic delays.	2	3	4
Frequent overtopping of wall and roadway with significant traffic delays	2	2	3
Occasional or frequent overtopping of wall and roadway with severe traffic delays.	2	2	2
Wall failure	0	0	0

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	71	INSPEVNT	WATERADEQ	1	VARCHAR

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Item 72 – Adjacent Roadway Alignment | 1 digit | FHWA

DESCRIPTION:

A single digit code indicating the adequacy of the adjacent roadway alignment.

PROCEDURE:

Code the rating based on the adequacy of the adjacent roadway alignment. It is not intended that the roadway alignment be compared to current standards but rather to the existing highway alignment. This concept differs from other appraisal evaluations. The establishment of set criteria to be used at all wall sites is not appropriate for this item. The basic criteria is how the alignment of the roadway adjacent to the wall relate to the general highway alignment for the section of highway the wall is on.

The adjacent roadway alignment will be rated intolerable (a code of 3 or less) only if the horizontal or vertical curvature requires a substantial reduction in the vehicle operating speed from that on the highway section. A very minor speed reduction will be rated a 6, and when a speed reduction is not required, the appraisal code will be an 8. Additional codes may be selected between these general values.

For example, if the highway section requires a substantial speed reduction due to vertical or horizontal alignment, and the roadway adjacent to the wall requires only a very minor additional speed reduction at the wall, the appropriate code would be a 6. This concept shall be used at each wall site.

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	72	INSPEVNT	APPRALIGN	1	VARCHAR

Item 73 – (Reserved)

Item 74 – (Reserved)

Item 75 – (Reserved)

Item 76 – (Reserved)

Item 77 – (Reserved)

Item 78 – (Reserved)

Item 79 – (Reserved)

Item 80 – (Reserved)

Item 81 – (Reserved)

Item 82 – (Reserved)

Item 83 – (Reserved)

Item 84 – (Reserved)

Item 85 – (Reserved)

Item 86 – (Reserved)

Item 87 – (Reserved)

Item 88 – (Reserved)

Item 89 – (Reserved)

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Item 90 – Inspection Date | 4 digits | MOD FHWA

DESCRIPTION:

A four digit code indicating the month and year of the last routine inspection performed on the wall.

PROCEDURE:

Record the month and year that the last routine inspection of the structure was performed. This inspection date may be different from those recorded in Item 93 - Critical Feature Inspection Date. Code a 4-digit number to represent the month and year. The number of the month should be coded in the first 2 digits with a leading zero as required and the last 2 digits of the year coded as the third and fourth digits of the field.

CODING EXAMPLE:

Description		Code
Inspection date	November 1992	1192

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	SCHEDULE	-	SUMMARY	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	90	INSPEVNT	INSPDATE	4	VARCHAR

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Item 91 – Designated Inspection Frequency | 2 digits | FHWA

DESCRIPTION:

A two digit code indicating the number of months between designated inspections of the wall.

PROCEDURE:

Code 2 digits to represent the number of months between designated inspections of the structure. A leading zero shall be coded as required. This interval is usually determined by the individual in charge of the inspection program. For deficient walls, this interval should be substantially less than the 72 month standard. The designated inspection interval could vary from inspection to inspection depending on the condition of the wall at the time of inspection.

CODING EXAMPLES:

Description	Code
High risk wall which is designated to be inspected each month	01
Wall is scheduled to be inspected every 72 months	72

It should be noted that walls should be inspected after unusual physical traumas such as floods, earthquakes, fires or collisions. These special, non-scheduled, inspections may range from a very brief visual examination to a detailed in-depth evaluation depending upon the nature of the trauma. For example, when a foundation pier is struck by an errant vehicle, in most cases only a visual examination of the wall is necessary. After major collisions or earthquakes, in-depth inspections may be warranted as directed by the engineer in overall charge of the program. After and during severe floods, the stability of the walls may have to be determined by probing, underwater sensors or other appropriate measures. Underwater inspection by divers may be required for some scour critical walls immediately after floods. See Item 113 - Scour Critical Walls.

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	SCHEDULE	-	SCHEDULE	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	91	INSPEVNT	BRINSPFREQ	2	VARCHAR

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Item 92 – Critical Feature Inspection | 6 characters | MOD FHWA

DESCRIPTION:

A six character code indicating any critical feature inspections required on the wall and the interval at which these inspections occur.

PROCEDURE:

Using a series of 3-digit code segments, denote critical features that need special inspections or special emphasis during inspections and the designated inspection interval in months as determined by the individual in charge of the inspection program. The designated inspection interval could vary from inspection to inspection depending on the condition of the wall at the time of inspection.

Segment	Description	Length
92B	Underwater Inspection	3 digits
92C	Other Special Inspection	3 digits

For each segment of Item 92A and B, code the first digit Y for special inspection or emphasis needed and code N for not needed. The first digit of Item 92A and B must be coded for all structures to designate either a yes or no answer. Those walls coded with a Y in Item 92 A should be the same walls contained in the Master List of special underwater inspection walls. In the second and third digits of each segment, code a 2-digit number to indicate the number of months between inspections only if the first digit is coded Y. If the first digit is coded N, the second and third digits are left blank.

Current guidelines for the maximum allowable interval between inspections can be summarized as follows:

Underwater Inspection	60 months
Other Special Inspections	60 months

Description	**Code**	
MSE structure which is being inspected yearly and no other special inspections are required.	92B	N__
	92C	N__
A structure has been temporarily shored and is being inspected on a 6-month interval. Other special inspections are not required.	92B	N__
	92C	Y06

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	SCHEDULE	-	SCHEDULE	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	92B	INSPEVNT	UWINSPREQ; UWISNPFREQ	3	VARCHAR
	92C	INSPEVNT	OSINSPREQ; OSINSPFREQ	3	VARCHAR

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Item 93 – Critical Feature Inspection Date | 8 digits | MOD FHWA

DESCRIPTION:

An eight digit code indicating the month and year of the last critical feature inspection date.

PROCEDURE:

Code only if the first digit of Item 92A, or B is coded Y for yes. Record as a series of 4-digit code segments, the month and year that the last inspection of the denoted critical feature was performed.

Segment	Description	Length
93B	Underwater Inspection	4 digits
93C	Other Special Inspection	4 digits

For each segment of this item, when applicable, code a 4-digit number to represent the month and year. The number of the month should be coded in the first 2 digits with a leading zero as required and the last 2 digits of the year coded as the third and fourth digits of the field. If the first digit of any part of Item 92 is coded N, then the corresponding part of this item shall be blank. Underwater inspections are should be performed on structures in depths of water in excess of 3 feet.

CODING EXAMPLES:

Description	**Item**	**Code**
A structure requires underwater inspection and has other special features (for example, a temporary support) for which the State requires special inspection. The last underwater inspection was done in April 1986 and the last special feature inspection was done in November 1985.	93B	0486
	93C	1185

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	SCHEDULE	-	SCHEDULE	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	93B	INSPEVNT	UWLASTINSP	4	VARCHAR
	93C	INSPEVNT	OSLASTINSP	4	VARCHAR

Item 94 – (Reserved)

Item 95 – (Reserved)

Item 96 – (Reserved)

Item 97 – (Reserved)

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Item 98 – Border Wall | 5 digits | MOD FHWA

DESCRIPTION:

A five digit code indicating the neighboring state and percentage of the border wall maintained by that state.

PROCEDURE:

Use this item to indicate structures crossing borders of States. Code a 5-digit number composed of 2 segments specifying the percent responsibility for improvements to the existing structure when it is on a border with a neighboring State. Code the first 3 digits with the neighboring State code using State codes listed in Item 1 - State Code. Code the fourth and fifth digits with the percentage of total wall area of the existing wall that the neighboring State is responsible for funding.

Segment	Description	Length
98A	Neighboring State Code	3 digits
98B	Percent Responsibility	2 digits

If a neighboring State codes the structure and accepts 100% of the responsibility, but your State still codes a record for the structure, then Item 98B in your State's record should be coded 99 to represent that your State has no responsibility for the structure.

CODING EXAMPLES:

Description	Code
A structure connects Colorado with New Mexico and New Mexico is responsible for funding 45 percent of future improvement costs.	35645
A structure connects Colorado with Utah and Utah is not responsible for any funding of future improvement costs.	49800

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	98A	BRIDGE	NSTATECODE	3	VARCHAR
	98B	BRIDGE	BB_PCT	2	VARCHAR

Item 99 – Border Wall Structure Number | 15 characters | FHWA

DESCRIPTION:

A fifteen digit code indicating the structure number given by another state for a bordering wall identified in item 98.

PROCEDURE:

Code the neighboring State's 15-digit structure number for any structure noted in Item 98 - Border Wall. This number must match exactly the neighboring State's submitted The Wall Inventory and Appraisal Section structure number. The entire 15-digit field must be accounted for including zeros and blank spaces whether they are leading, trailing, or embedded in the 15-digit field. If Item 98 is blank, this item is blank.

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	99	BRIDGE	BB_BRDGEID	15	VARCHAR

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Item 100 – STRAHNET Highway Designation | 1 digit | FHWA

DESCRIPTION:

A single digit code indicating the STRAHNET highway designation of the inventory route associated with the wall.

PROCEDURE:

This item shall be coded for all records in the inventory. For the purposes of this item, the STRAHNET Connectors are considered included in the term STRAHNET. For the inventory route identified in Item 5, indicate STRAHNET highway conditions using one of the following codes:

Description	Code
The inventory route is not a STRAHNET route.	0
The inventory route is on an Interstate STRAHNET route.	1
The inventory route is on a Non-Interstate STRAHNET route.	2
The inventory route is on a STRAHNET connector route.	3

CODING EXAMPLES:

Description	Code
Wall is on Colorado HWY 74	0
Wall is on I-70	1

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	100	ROADWAY	DEFHWY	1	VARCHAR

Item 102 – Direction of Traffic | 1 digit | FHWA

DESCRIPTION:

A single digit code indicating the direction of traffic of the inventory route.

PROCEDURE:

Code the direction of traffic of the inventory route identified in Item 5 as a 1-digit number using one of the codes below. This item must be compatible with other traffic-related items such as Item 28A Lanes on the Structure, Item 29 - Average Daily Traffic, Item 47 – Total Horizontal Clearance and Item 51 - Wall Roadway Width, Curb-to-Curb.

Description	Code
Highway traffic not carried	0
1-way traffic	1
2-way traffic	2
One lane roadway for 2-way traffic	3

CODING EXAMPLES:

Description	Code
Wall carrying Northbound I-70	1
Wall carrying US HWY 40	2

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	102	ROADWAY	TRAFFICDIR	1	VARCHAR

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Item 103 – Temporary Structure Designation | 1 character | MOD FHWA

DESCRIPTION:

A single digit character indicating the existence of temporary structures or conditions.

PROCEDURE:

Code this item to indicate situations where temporary structures or conditions exist. This item should be blank if not applicable.

Description	Code
Temporary structure(s) or conditions exist.	T

Temporary structure(s) or conditions are those which are required to facilitate traffic flow. This may occur either before or during the modification or replacement of a structure found to be deficient. Such conditions include the following:

- Walls shored up, including additional temporary supports.
- Temporary repairs made to keep a wall operational.
- Temporary structures, temporary runarounds or bypasses.

Other temporary measures, such as barricaded traffic lanes to keep the roadway adjacent to the wall open.

Any repaired structure or replacement structure which is expected to remain in place without further project activity, other than maintenance, for a significant period of time shall not be considered temporary. Under such conditions, that structure, regardless of its type, shall be considered the minimum adequate to remain in place and evaluated accordingly.

If this item is coded T, then all data recorded for the structure shall be for the condition of the structure without temporary measures, except for the following items which shall be for the temporary structure:

Item 47 - Inventory Route, Total Horizontal Clearance

CODING EXAMPLES:

Description	Code
A temporary wall exists to prevent road collapse	T
Vertical supports on a wall are temporarily shored	T

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	103	BRIDGE	TEMPSTRUC	1	VARCHAR

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Item 104 – Highway System of the Inventory Route | 1 digit | FHWA

DESCRIPTION:

A single digit code indicating whether or not the wall is on the National Highway System.

PROCEDURE:

This item is to be coded for all records in the inventory. For the inventory route identified in Item 5, indicate whether the inventory route is on the National Highway System (NHS) or not on that system.

Initially, this code shall reflect an inventory route on the NHS "Interim System" description in Section 1006(a) of the 1991 ISTEA. Upon approval of the NHS by Congress, the coding is to reflect the approved NHS. Use one of the following codes:

Description	Code
Inventory Route is not on the NHS	0
Inventory Route is on the NHS	1

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	104	ROADWAY	NHS_IND	1	VARCHAR

Item 105 – Federal Lands Highways | 1 digit | FHWA

DESCRIPTION:

A single digit indicating which type of federal land a wall is located on.

PROCEDURE:

Structures owned by State and local jurisdictions on roads which lead to and traverse through federal lands sometimes require special coded unique identification because they are eligible to receive funding from the Federal Lands Highway Program. One of the following codes shall be used:

Description	Code
Not applicable	0
Indian Reservation Road (IRR)	1
Forest Highway (FH)	2
Land Management Highway System (LMHS)	3
Both IRR and FH	4
Both IRR and LMHS	5
Both FH and LMHS	6
Combined IRR, FH and LMHS	9

CODING EXAMPLES:

Description	Code
A wall is on an Indian Reservation Road	1

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	105	ROADWAY	FEDLANDHWY	1	VARCHAR

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Item 106 – Year Reconstructed | 4 digits | FHWA

DESCRIPTION:

A four digit code indicating the year of most recent construction of the structure.

PROCEDURE:

Record and code the year of most recent reconstruction of the structure. Code all 4 digits of the latest year in which reconstruction of the structure was completed. If there has been no reconstruction code 0000.

For a wall to be defined as reconstructed, the type of work performed, whether or not it meets current minimum standards, must have been eligible for funding under any of the Federal-aid funding categories. The eligibility criteria would apply to the work performed regardless of whether all State or local funds or Federal-aid funds were used.

Some types of eligible work not to be considered as reconstruction are listed:

- Safety feature replacement or upgrading (for example, wall rail, approach guardrail or impact attenuators).
- Painting of structural steel.
- Utility work.
- Emergency repair to restore structural integrity to the previous status following an accident.
- Retrofitting to correct a deficiency which does not substantially alter physical geometry or increase the load carrying capacity.
- Work performed to keep a wall operational while plans for complete rehabilitation or replacement are under preparation (for example, adding a substructure element or extra girder).

CODING EXAMPLES:

Description	**Code**
Reconstruction completed 1970	1970

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	106	BRIDGE	YEARRECON	4	VARCHAR

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Item 107 – Vertical Supports Structure Type | 1 character | MOD FHWA

DESCRIPTION:

A single character code indicating the predominant vertical support structure type.

PROCEDURE:

Record the type of vertical supports, if any, associated with the main wall facing. If more than one type of vertical support is present, code the most predominant. Use one of the following codes:

Description	Code
Concrete Cast-in-Place, column	1
Concrete Precast, column	2
Steel column	3
Timber column	4
Masonry column	5
Other	6
Not applicable	N
Unknown	U

CODING EXAMPLES:

Description	Code
A post and panel cast-in-place concrete wall with steel vertical supports	3
A free-standing noise wall with no vertical supports	N

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	107	BRIDGE	DKSTRUCTYP	1	VARCHAR

Item 109 – Average Daily Truck Traffic | 2 digits | FHWA

DESCRIPTION:

A two digit code indicating the percentage of average daily traffic that is truck traffic.

PROCEDURE:

Code a 2-digit percentage that shows the percentage of Item 29 – Average Daily Traffic that is truck traffic. Do not include vans, pickup trucks and other light delivery trucks in this percentage.

If this information is not available, an estimate which represents the average percentage for the category of road carried by the wall may be used. May be left blank if Item 29 - Average Daily Traffic is not greater than 100.

CODING EXAMPLES:

Description		Code
Average Daily Traffic	7% trucks	07
	12% trucks	12

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	109	ROADWAY	TRUCKPCT	2	VARCHAR

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Item 110 – Designated National Network | 1 digit | FHWA

DESCRIPTION:

A single digit code designating the route as a part of the National Network for trucks.

PROCEDURE:

The national network for trucks includes most of the Interstate System and those portions of Federal-Aid highways identified in the Code of Federal Regulations (23 CFR 658). The national network for trucks is available for use by commercial motor vehicles of the dimensions and configurations described in these regulations. For the inventory route identified in Item 5, indicate conditions using one of the following codes:

Description	Code
The inventory route is not part of the national network for trucks.	1
The inventory route is part of the national network for trucks.	2

CODING EXAMPLES:

Description	Code
A wall on State Highway 160	1

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	110	ROADWAY	TRUCKNET	1	VARCHAR

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Item 113 – Scour Critical Walls | 1 character | MOD FHWA

DESCRIPTION:

A single digit code indicating the current status of vulnerability to scour of a wall.

PROCEDURE:

Use a single-digit code as indicated below to identify the current status of the wall regarding its vulnerability to scour. Scour analyses shall be made by hydraulic/geotechnical/structural engineers. Details on conducting a scour analysis are included in the FHWA Technical Advisory 5140.23 titled, "Evaluating Scour at Bridges." Whenever a rating factor of 2 or below is determined for this item, the rating factor for Item 60 - Foundation may need to be revised to reflect the severity of actual scour and resultant damage to the wall. A scour critical wall is one with foundations which are rated as unstable due to (1) observed scour at the wall site or (2) a scour potential as determined from a scour evaluation study.

Description	Code
Wall not adjacent to waterway	N
Wall with "unknown" foundation that has not been evaluated for scour. Since risk cannot be determined, flag for monitoring during flood events and, if appropriate, closure. *CDOT Policy –* *The code of "U" is only to be used when the foundation is unknown and the scour calculations are not in the wall record. Any wall with a code of "U" will immediately be scheduled to have the foundation determined and the scour calculations completed and placed in the wall record.*	U
Wall adjacent to "tidal" waters that has not been evaluated for scour, but considered low risk. Wall will be monitored with regular inspection cycle and with appropriate underwater inspections. *CDOT Policy –* *The code of "T" is not used within Colorado*	T
Wall foundations (including piles) on dry land well above flood water elevations.	9
Wall foundations determined to be stable for assessed or calculated scour conditions; calculated scour is above top of footing. (Example A) *CDOT Policy –* *The code of "8" is to be used only for those walls that have been determined to be stable for the 500-year or controlling storm event based on the scour calculations within the wall record and where calculated scour is above the footing as shown in Example A.*	8
Countermeasures have been installed to correct a previously existing problem with scour. Wall is no longer scour critical. *CDOT Policy –* *The code of "7" will not be used unless the hydraulic countermeasure has been designed to resist the 500 year or controlling scour storm event on an otherwise scour critical wall. Hydraulic countermeasures that reduce the risk of wall failure during a flood event but do not resist the 500 year or controlling scour storm event will not use the code of "7" but will be recorded in:* *BrM – Scour, and Colorado BrM Comment – Channel Protection Material and Condition.*	7

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Scour calculation/evaluation has not been made. (Use only to describe case where wall has not yet been evaluated for scour potential.) *CDOT Policy –* *The code of "6" is only to be used when the scour calculations are not in the wall record. Any wall with a code of "6" will immediately be scheduled to have the scour calculations completed and placed in the wall record.*	6
Wall foundations determined to be stable for calculated scour conditions; scour within limits of footing or piles. (Example B) *CDOT Policy –* *The code of "5" is to be used only for those walls that have been determined to be stable for the 500-year or controlling storm event based on the scour calculations within the wall record and where calculated scour is within the limits of the footing or piles as shown in Example B.*	5
Wall foundations determined to be stable for calculated scour conditions; field review indicates action is required to protect exposed foundations from effects of additional erosion and corrosion. *CDOT Policy –* *The code of "4" is to be used only for those walls that:* *Have observed and documented scour that has exposed the piling or footings; and* *Have been determined to be stable for the 500-year or controlling storm event (Item 113 = "5" or "8") based on the scour calculations within the wall record.* *A code of "4" requires an essential repair finding notice be issued to the applicable region or local agency to address the observed scour.* *If Item113 is coded "4", then Item 60, Foundation, must be coded no greater than "5", Fair Condition.*	4
Wall is scour critical; wall foundations determined to be unstable for calculated scour conditions: - Scour within limits of footing or piles. (Example B) - Scour below spread-footing base or pile tips. (Example C) *CDOT Policy –* *The code of "3" is to be used only for those walls that have been determined to be unstable for the 500-year or controlling storm event based on the scour calculations within the wall record where calculated scour is below the footing or within the limits of the piling as shown in Example B or Example C.*	3
Wall is scour critical; field review indicates that extensive scour has occurred at wall foundations. Immediate action is required to provide scour countermeasures. *CDOT Policy –* *The code of "2" is to be used only for those walls that:* *Have observed and documented scour that has exposed the piling or footings but not enough observed scour to indicate that the wall failure is imminent; and* *Have been determined to be unstable for the 500-year or controlling storm event (Item 113 = "3") based on the scour calculations within the wall record;* *A code of "2" requires an essential repair finding notice be issued to the applicable region or local agency to address the observed and documented scour. Although walls in this category may not be in danger of imminent failure consideration should be given to closing the wall until repairs are in place to address the observed scour.* *If Item113 is coded "2", then Item 60, Substructure, must be coded no greater than "3", Serious Condition.*	2

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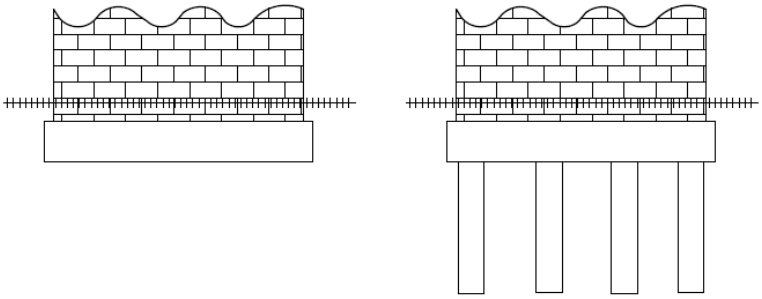
Wall is scour critical; field review indicates that failure of foundation elements is imminent. Wall has failed. *CDOT Policy –* *The code of "1" is to be used only for those walls that:* *Have observed and documented scour that has exposed the piling or footings enough to indicate that the wall failure is imminent; and* *Have been determined to be unstable for the 500-year or controlling storm event (Item 113 = "3") based on the scour calculations within the wall record;* *A code of "1" requires an essential repair finding notice be issued to the applicable region or local agency to address the observed and documented scour. Walls in this category are in danger of imminent failure and must be closed immediately until repairs are in place to address the observed scour.* *If Item113 is coded "1", then Item 60, Foundation, is to be coded "1", Imminent Failure Condition.*	1
Wall is scour critical. Wall has failed. *CDOT Policy –* *The code of "0" is to be used only for those walls that:* *Have observed scour that has caused the wall to fail.* *A code of "0" requires an essential repair finding notice be issued to the applicable region or local agency to address the observed scour. Walls in this category have failed and must be closed immediately until repairs are in place to address the observed scour.* *If Item113 is coded "0", then Item 60, Foundation, is to be coded "0", Failed Condition*	0

Item 113 – Scour Critical Walls (cont'd)

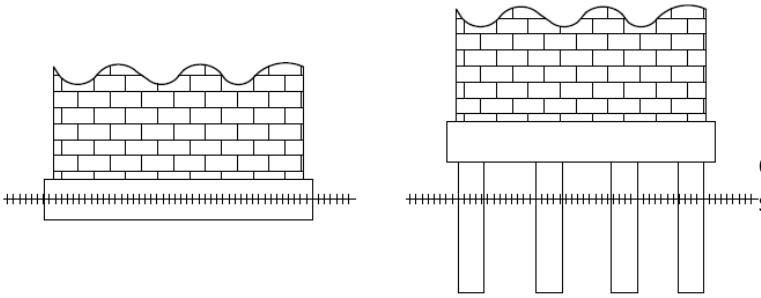
EXAMPLES: CALCULATED SCOUR DEPTH ACTION NEEDED

A. Above top of footing



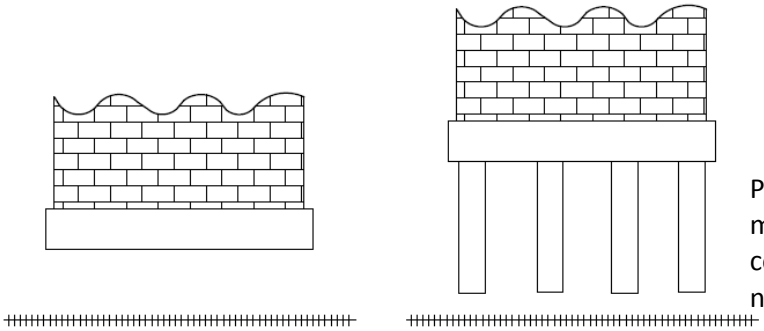
None – indicate rating of 8 for this item

B. Within limits of footing or piles/caissons



Conduct foundation structural analysis

C. Below pile/caisson tips or foundation



Provide for monitoring and scour countermeasures as necessary

= Calculated Scour Depth

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	113	INSPEVNT	SCOURCRIT	1	VARCHAR

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Item 114 – Future Average Daily Traffic | 6 digits | MOD FHWA

DESCRIPTION:

A six digit code indicating the future average daily traffic.

PROCEDURE:

Code for all walls the forecasted average daily traffic (ADT) for the inventory route identified in Item 5. This shall be projected at least 17 years but no more than 22 years from the year of inspection. The intent is to provide a basis for a 20-year forecast. This item may be updated anytime, but must be updated when the forecast falls below the 17-year limit. If planning data is not available, use the best estimate based on site familiarity.

The future ADT must be compatible with the other items coded for the wall. For example, parallel walls with an open median are coded as follows: if Item 28 -Lanes Carried by and In front of the Structure and Item 51 - Wall Roadway Width, Curb-to-Curb are coded for each wall separately, then the future ADT must be coded for each wall separately (not the total for the route).

CODING EXAMPLES:

Description		Code
Future ADT	540	000540
	15,600	015600
	240,000	240000

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	114	ROADWAY	ADTFUTURE	6	VARCHAR

Item 115 – Year of Future Average Daily Traffic | 4 digits | MOD FHWA

DESCRIPTION:

A four digit code indicating the year of the future average daily traffic.

PROCEDURE:

Record and code the year represented by the future ADT in Item 114. The projected year of future ADT shall be at least 17 years but no more than 22 years from the year of inspection.

CODING EXAMPLES:

Description		Code
Year of Future ADT is	2014	2014

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	115	ROADWAY	ADTFUTYEAR	4	VARCHAR

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Item 125 (A-B) – Type of Wall Railing On Top | 3 characters | CDOT

DESCRIPTION:

A two part, three character code to identify the type of railing on top of the wall, and if the rail has been modified.

PROCEDURE:

In **Appendix 2.F** there are sketches of standard railings identified by a letter code for use in this item. If railings are encountered during inspection that are not shown in **Appendix 2.F**, code as XX. This situation needs to be brought to the attention of the BMS unit.

Item 125A, A two digit code identifying the most common TYPE of railing on the structure.

Identify the correct rail and select the appropriate code from **Appendix 2.F**. Left justify the appropriate code letter.

If none of those codes apply, use the appropriate code listed below.

Description	Code
Known type of rail	A-AZ
No wall rail	X
Not applicable	NA
Non typical rail	XX

Item 125B A one digit code indicating whether the railing identified in Part A is a standard or modified version:

Description	Code
Not Modified	0
Modified up-to-standards	1
Modified not-up-to-standards	2
If median rail and outside rail differ	3
More than one type of rail	4

CODING EXAMPLES:

Description	**Code**	
	125A	**125B**
Timber, Type F, No Modification	F	0
Type 3, Type G, Modified not up to standard	G	2

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	125A	USERBRDG	STRRAILTYPE	2	VARCHAR
	125B	USERBRDG	STRRAILMOD	1	VARCHAR

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Item 125 (C-D) – Type of Wall Railing In Front | 3 characters | CDOT

DESCRIPTION:

A two part, three character code to identify the type of railing in front of the wall, and if the rail has been modified.

PROCEDURE:

In **Appendix 2.F** there are sketches of standard railings identified by a letter code for use in this item. If railings are encountered during inspection that are not shown in **Appendix 2.F**, code as XX. This situation needs to be brought to the attention of the BMS unit.

Item 125C, A two digit code identifying the most common TYPE of railing in front of the structure.

Identify the correct rail and select the appropriate code from **Appendix 2.F**. Left justify the appropriate code letter.

If none of those codes apply, use the appropriate code listed below.

Description	Code
Known type of rail	A-AZ
No wall rail	X
Not applicable	NA
Non typical rail	XX

Item 125D A one digit code indicating whether the railing identified in Part A is a standard or modified version:

Description	Code
Not Modified	0
Modified up-to-standards	1
Modified not-up-to-standards	2
If median rail and outside rail differ	3
More than one type of rail	4

CODING EXAMPLES:

Description	**Code**	
	125C	**125D**
Timber, Type F, No Modification	F	0
Type 3, Type G, Modified not up to standard	G	2

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	125C	USERBRDG	FSTRRAILTYPE	2	VARCHAR
	125D	USERBRDG	FSTRRAILMOD	1	VARCHAR

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Item 133 – Special Inspection Equipment | 2 digits | CDOT

DESCRIPTION:

A two digit code to identify special inspection equipment.

PROCEDURE:

Use the list below to identify special equipment necessary to complete an inspection.

Description	Code
Not Applicable	00
Snooper Only	01
Hi-Ranger Only	02
Boat Only	03
Transit Only	04
Level Only	05
Half-Cell Device and/or Drag Chain	06
Hi-Ranger and Radio Communications	07
Snooper and Radio Communications	08
Boat and Radio Communications	09
Radio Communications Only	10
Snooper and Hi-Ranger	11
Snooper and Generator	12
Magnetic Particle	13
Ultrasound	14
Climbing Equipment	15
Scuba Diving Equipment	16
Surface Supply Diving Equipment	17
Unknown	99

CODING EXAMPLES:

Description	Code
No Special Equipment Required	00
Inspection Requires the Snooper Only	01

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	133	USERINSP	INSPEQUIP	2	VARCHAR

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Item 136 – Mileage Log Section Letter | 1 character | CDOT

DESCRIPTION:

A one character code that identifies the section letter assigned to a highway.

PROCEDURE:

The section letter is assigned by the Division of Transportation Development. Each highway starts with Section Letter 'A' and continues unless overlapped by another route. When that overlap ends and the highway continues in its own right-of-way, then the next sequenced letter of the alphabet would be used. i.e. 'B'. This process continues until the highway leaves the State. Each section of highway, and the structures within each section, must have a Mileage Log Section Letter.

For those structures that carry a city street, county roads, or other conditions, choose the appropriate code listed below:

Description	Code
City structure	U
County structure	V
Unidentified routes	W
Structures on frontage Rd Nbnd side	X*
Structures on frontage Rd Sbnd side	Y*
Structures on one way reciprocal	Z**

*Do not use until DTD approves. Frontage road will continue to be coded to the main line.

**One-way reciprocal is a one-way street in the opposite direction of travel of the route.

All structures must be coded. There is no unknown condition.

CODING EXAMPLES:

Description	Code
WALL-F-12-A on State Highway 6, Section G near Dillon	G
City street carried by structure	U
County road carried by structure	V

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	136	USERRWAY	ROUTELOG	1	VARCHAR

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Item 143A – Min., Max., and Avg. Distance from Route Carried 12 digits CDOT

DESCRIPTION:

A twelve digit code indicating the minimum, maximum, and average measured distance from the wall to the route identified in Item 6 (route carried or behind).

PROCEDURE:

The minimum, maximum, and average distance from the wall to the nearest edge of pavement should be recorded rounding up to the tenth of a foot. The edge of pavement should be taken as the extents of the measurement made for Item 47. The average should be determined at the discretion of the team leader. Each measurement can be up to 999.9 feet, and should be right-justified with zeros filling the left-most positions For structures that do not carry a route or are not associated with a route behind the structure (Item 6 is coded "NA"), code "00NA00NA00NA" for Item 143A.

CODING EXAMPLES:

Description		Code
Minimum Measured Distance	16.0 ft	
Maximum Measured Distance	101.1 ft	
Average Measured Distance	33.07 ft	016010110331

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	143A	USERRWAY	MMADIST	12	VARCHAR

Item 143B – Min., Max., and Avg. Distance from Route, In Front 12 digits CDOT

DESCRIPTION:

A twelve digit code indicating the minimum, maximum, and average measured distance from the wall to the route identified in Item 7 (route in front).

PROCEDURE:

The minimum, maximum, and average distance from the wall to the nearest edge of pavement should be recorded rounding up to the tenth of a foot. The edge of pavement should be taken as the extents of the measurement made for Item 47. The average should be determined at the discretion of the team leader. For structures that are not associated with a route in front (Item 7 is coded "NA"), code "00NA00NA00NA" for Item 143B.

CODING EXAMPLES:

Description		Code
Minimum Measured Distance	16.0 ft	
Maximum Measured Distance	101.1 ft	
Average Measured Distance	33.07 ft	016010110331

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	143B	USERRWAY	FMMADIST	12	VARCHAR

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Item 144A – Speed Limit, Route Carried | 2 digits | CDOT

DESCRIPTION:

A two digit code to record the speed limit of the route carried by or behind the wall.

PROCEDURE:

Record the two digit speed limit in miles per hour for the route carried by or behind the wall. If the speed limit changes during the length of the wall, record the larger limit. For structures that do not carry a route or are not associated with a route behind the structure (Item 6 is coded "NA"), code "00" for Item 144.

CODING EXAMPLE:

Description		Code
Speed Limit of route carried by or behind wall	65	65
	45	45
	25 and 35	35

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	144A	USERRWAY	SPEEDLIMIT	2	VARCHAR

Item 144B – Speed Limit, Route In Front | 2 digits | CDOT

DESCRIPTION:

A two digit code to record the speed limit of the route in front of the wall.

PROCEDURE:

Record the two digit speed limit in miles per hour for the route in front of the wall. If the speed limit changes during the length of the wall, record the larger limit. For structures that are not associated with a route in front (Item 7 is coded "NA"), code "00" for Item 144A.

CODING EXAMPLE:

Description		Code
Speed Limit of route in front of the wall	65	65
	45	45
	25 and 35	35

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	144B	USERRWAY	FSPEEDLIMIT	2	VARCHAR

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Item 145 – Wall System | 2 digits | CDOT

DESCRIPTION:

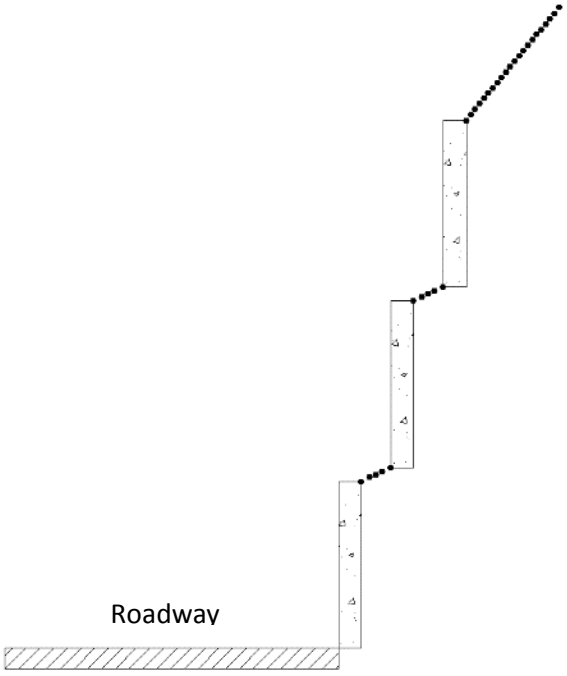
A two digit code indicating that the wall is part of a wall system and how many walls compose that system.

PROCEDURE:

Record two digits, right justified, indicating the number of walls composing the wall system. A wall system is defined as tiered retaining walls such that in the event of failure of a wall in the system, the loading or foundational elements of at least one other wall will be affected. See examples of tiered walls below. If the wall does not belong to a wall system, or if the wall is a noise wall, code Item 145 "00".

CODING EXAMPLES:

Description		Code
Number of walls located in wall system:	5	05
	12	12



ELEVATION VIEW
System of three walls, Item 145 = 03

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	145	USERBRDG	WALLSYS	2	VARCHAR

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Item 146 – Associated Bridge	50 characters	CDOT

DESCRIPTION:

A fifty digit code indicating the bridge number(s) associated with bridge walls.

PROCEDURE:

Record fifty digits, right justified, indicating the bridge number(s) associated with the bridge wall. This can include off-system bridges as well as on-system bridges. For on-system bridges, code the bridge number, including dashes, as it would appear in the NBI – e.g. – A-01-PQ. For off-system bridges, code the bridge number as it would appear in the NBI, including dashes and decimals – e.g. – BA15-15-43.7-18. In the event that a wall is associated with more than one bridge, record all bridge numbers separated by a semi-colon, starting with the bridge closest to the start of the wall, and ending with the bridge closest to the end of the wall. This way, the rightmost bridge number to appear in Item 146 will be the bridge closest to the end of the wall.

CODING EXAMPLE:

Description	**Code**
Bridge wall associated with bridges A-15-PY and A-15-PZ Where A-15-PY is located nearest to the start of the wall	A-15-PY;A-15-PZ
Bridge wall located within the bridge zones of bridges BA15-15-43.7-18, P-19-SQ, and P-19-SR, with the off-system bridge closest to the start of the wall and P-19-SR located nearest to the end of the wall	BA15-15-43.7-18;P-19-SQ;P-19-SR
Bridge wall located within the bridge zone of Bridge L-20-AR	L-20-AR

BrM Screen	**TAB**	**TASK**	**SUB-TASK**	**GROUP**	**SUB-GROUP**
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	146	USERBRDG	ASSOCBRIDGE	50	VARCHAR

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Item 147 – Vertical Batter | 2 digits | CDOT

DESCRIPTION:

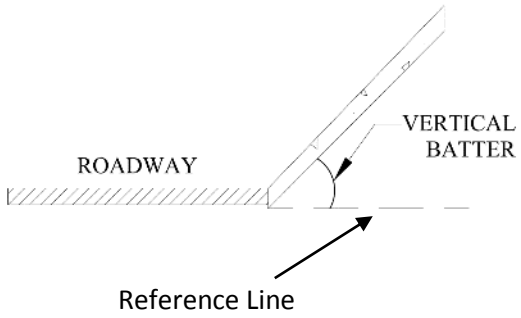
A 2 digit code indicating the vertical batter of the wall.

PROCEDURE:

Record two digits indicating the vertical batter to the nearest degree, rounding up, of the wall as measured from a horizontal plane to the interior wall surface where the interior wall surface is defined as the surface directly in contact with the retained soil or the surface creating the smallest angle with respect to the horizontal plane in the case of a noise wall. This measurement should be taken as the average of all vertical batter measurements across the wall at the discretion of the team leader. If a wall is perfectly plumb, record "90" for Item 147. The recorded angle should not be less than 45°. If the vertical batter is measured to be less than 45°, the wall should not be considered for this inventory. If the vertical batter is greater than 90°, code "99" for Item 147.

CODING EXAMPLES:

Description	Code
Measured vertical batter is 76°	76
Measured vertical batter is 55°	55
Measured vertical batter is 61°	61



ELEVATION VIEW

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	147	USERBRDG	VERTBATTER	2	VARCHAR

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Item 148 – Slope Angle, Carried and In Front	2 digits	CDOT

DESCRIPTION:

A 2 part, 2-digit code indicating the angle of the slope carried by or behind and in front of the wall.

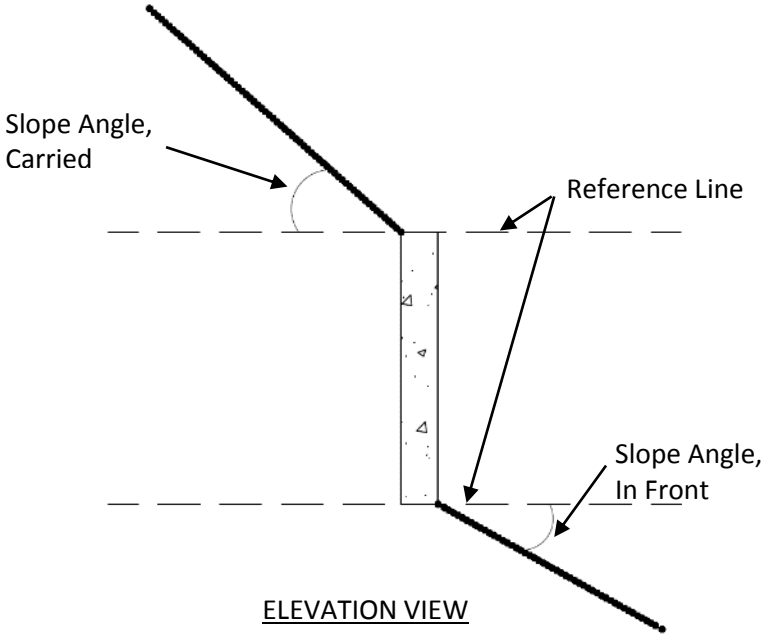
PROCEDURE:

Using the following list, indicate the measured angle of the slopes carried or behind and in front of the wall. The slope angle should be measured as the angle between a horizontal reference line perpendicular to the bottom or top of the wall, to the top of the slope. This applies to both the slope carried or behind and in front of the wall. See below for examples.

Measured Angle	Item 148A or B
0-10	1
11-30	2
31-45	3
46-90	4
(-1) - (-10)	5
(-11) - (-30)	6
(-31) - (-45)	7
(-46) - (-90)	8

CODING EXAMPLES:

Description	Code: Item 148A	Item 148B	Item 148
Measured slope angle carried is 6° and measured slope angle in front is 56°	1	4	14
Measured slope angle carried is 5° and measured slope angle in front is 10°	1	1	11



ELEVATION VIEW

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	INSPECTION	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	148	USERBRDG	SLOPE	2	VARCHAR

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Item 149 – Protective Coating Type | 1 digit | CDOT

DESCRIPTION:

A 1-digit code indicating the type of protective coating on the wall facing.

PROCEDURE:

Using the following list, indicate the type of protective coating present on the wall facing. This applies to all wall construction types.

Coating Type	Item 149
Integral Concrete Coating	1
Paint	2
Stain	3
Weathering steel	4
Creosote	5
Other	0
Unknown	U
None	N

Description	Code
Concrete noisewall with integral coating	1
Metal retaining wall, painted	2

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	8	CDOT WALLS	SIA	-	-
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	149	USERBRDG	COATING	1	VARCHAR

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Notes	30 characters	MOD FHWA

DESCRIPTION:

A thirty character code to record any important/unusual facts about the structure.

PROCEDURE:

Record any significant information pertaining to the structures type, condition, status etc. e.g.: 'Replaced w/ . . . ' or 'Washed out'.*

*If a structure is replaced code: Replaced WALL-13-F-A

*If structure has been removed code: Removed

*If Project number is available code: Removed per I70-5(31)

If information is placed in notes on a temporary basis, remove when it no longer pertains

CODING EXAMPLES:

Description	Code
Structure replaced by non-qualifying CMP	Replaced w/non qual CMP

BrM Screen	TAB	TASK	SUB-TASK	GROUP	SUB-GROUP
	NA	NA	NA	NA	NA
BrM TABLE	**ITEM**	**TABLE**	**FIELD NAME**	**FIELD LENGTH**	**FORMAT**
	NA	NA	NA	NA	NA

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APPENDIX 2.A: STRUCTURE INVENTORY AND APPRAISAL SHEET

1.	State Name:	
2E,M	Region/Maint. Section	
3.	County Code	
4,4A.	Place Code	
5A.	Inventory Rte (On/In Front)	
5B.	Inventory Rte (Signing)	
5C.	Inventory Rte (L.O.S.)	
5DN.	Inventory Rte (Rte. Num)	
5E.	Inventory Rte (Dir. Suffix)	
6.	Features Carried	
7.	Features In Front	
8.	Structure Number	
8A.	Structure ID Number	
9.	Location	
11.	Reference Point	
12.	Base Hwy. Network	
13.	LRS Rte, Sub. Rte Number	
16.	Latitude - Start of Wall	
16A.	Latitude - End of Wall	
16B.	Elevation - Start of Wall	
17.	Longitude - Start of Wall	
17A.	Longitude - End of Wall	
17B.	Elevation - End of Wall	
18A.	Range	
18B.	Township	
18C.	Section	
19.	Bypass, Detour Length	
20.	Toll	
21.	Maintenance Resp.	
22.	Owner	
23.	Orig. Project Number	
23E.	Subaccount Number	
23EE.	Project Indicator	
26.	Functional Class	
27.	Year Built	
28.	Lanes On Structure	
	Lanes In Front	
29.	Average Daily Traffic	
30.	Year of ADT	
33.	Median	
36AD	Traffic Safety Feat. on Top	
36H.	Height of Rail on Top	
36IL.	Traffic Safety Feat. in Front	
36M.	Height of Rail In Front	
37.	Historical Significance	
42.	Type of Service, Carried	
	In Front	
43.	Struct Type, Wall Face Mat.	
	Type of design/const	
47.	Total Horz. Clearance, Carried	
47A.	Total Horz. Clearance, In Front	
49.	Structure Length	

50A.	Curb or Sidewalk, Carried (lt)	
50B.	Curb or Sidewalk, Carried (rt)	
50C.	Curb or Sidewalk, In Front (lt)	
50D.	Curb or Sidewalk, In Front (rt)	
51.	Width, Curb-to-Curb, Carried	
51A.	Width, Curb-to-Curb, In Front	
52.	Average Wall Height	
53.	Maximum Wall Height	
54.	Minimum Wall Height	
58.	Main Structure	
60.	Foundation	
61.	Channel & Channel Protection	
71.	Waterway Adequacy	
72.	Adjacent Roadway Alignment	
90.	Inspection Date	
91.	Frequency	
92A.	UW Frequency	
92B.	Special Frequency	
93A.	UW Inspection Date	
93B.	Special Inspection Date	
98A.	Border Wall State Code	
98B.	Percent Responsibility	
99.	Border Wall Structure No.	
100.	STRAHNET Highway Desc.	
102.	Direction of Traffic	
103.	Temporary Structure	
104.	Highway System	
105.	Federal Lands Highways	
106.	Year Reconstructed	
107.	Vertical Support Struct. Type	
109.	Truck ADT	
110.	Designated National Network	
113.	Scour Critical Walls	
114.	Future ADT	
115.	Year of Future ADT	
125A,B.	Type of Wall Rail on Top	
125C,D.	Type of Wall Rail In Front	
133.	Special Inspection Equipment	
136.	Mileage Log Section Letter	
143A.	Avg. Dist Fr. Route, Carried	
	Max. Dist Fr. Route, Carried	
	Min. Dist. Fr. Route, Carried	
143B.	Avg. Dist Fr. Route, In Front	
	Max. Dist Fr. Route, In Front	
	Min. Dist. Fr. Route, In Front	
144A.	Speed Limit, Route Carried	
144B.	Speed Limit, Route In Front	
145.	Wall System	
146.	Associated Bridge	
147.	Vertical Batter	
148.	Slope Angle Carried & In Front	
149.	Type of Protective Coating	

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APPENDIX 2.B: STATE WALL INVENTORY RECORD FORMAT

Appendix 2.B.1: Sorted by Table

ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
99	Border Wall Structure Number	BRIDGE.bb_brdgeid	15/AN	FHWA
98B	Percent Responsibility	BRIDGE.bb_pct	2/N	MOD FHWA
8	Structure Identification Number	BRIDGE.brkey	15/AN	FHWA
3	County (Parish) Code	BRIDGE.county	3/N	FHWA
21	Maintenance Responsibility	BRIDGE.custodian	2/N	FHWA
52	Average Wall Height	BRIDGE.deckwidth	4/N	MOD FHWA
43B	Type of Design/Construction	BRIDGE.designmain	2/N	MOD FHWA
2	Highway Agency District	BRIDGE.district	2/N	MOD FHWA
107	Vertical Supports Structure Type	BRIDGE.dkstructyp	1/AN	MOD FHWA
7	Features In Front	BRIDGE.facility	18/AN	MOD FHWA
6	Features Carried	BRIDGE.featint	24/AN	MOD FHWA
1	State Code	BRIDGE.fips_state; BRIDGE.fhwa_rgn	3/N	FHWA
37	Historical significance	BRIDGE.histsign	1/N	FHWA
16	Latitude - Start of Wall	BRIDGE.latitude	8/N	MOD FHWA
49	Structure Length	BRIDGE.length	6/N	MOD FHWA
50A	Left Curb/Sidewalk Width, Carried Rte	BRIDGE.lftcurbsw	3/N	MOD FHWA
9	Location	BRIDGE.location	25/AN	FHWA
17	Longitude - Start of Wall	BRIDGE.longitude	9/N	MOD FHWA
43A	Kind of Material/Design	BRIDGE.materialmain	1/AN	MOD FHWA
33	Inventory Route Median	BRIDGE.median	1/N	MOD FHWA
98A	Neighboring State Code	BRIDGE.nstatecode; BRIDGE.n_fhwa_reg	3/N	MOD FHWA
22	Owner	BRIDGE.ownerbrdg	2/N	FHWA
4	Place Code	BRIDGE.placecode	5/N	FHWA
50B	Right Curb/Sidewalk Width, Carried Rte	BRIDGE.rtcurbsw	3/N	MOD FHWA
42A	Type of Service Carried by Wall	BRIDGE.servtypon	1/AN	MOD FHWA
42B	Type of Service In Front of Wall	BRIDGE.servtypund	1/AN	MOD FHWA
8A	Structure Number	BRIDGE.structnum	15/AN	CDOT
103	Temporary Structure Designation	BRIDGE.tempstruc	1/AN	MOD FHWA
53	Maximum Wall Height	BRIDGE.vclrover	4/N	MOD FHWA
54	Minimum Wall Height	BRIDGE.vclrunder	4/N	MOD FHWA
27	Year Built	BRIDGE.yearbuilt	4/N	MOD FHWA
106	Year Reconstructed	BRIDGE.yearrecon	4/N	FHWA
36D	Approach Guardrail Ends On Top	INSPEVNT.aendrating	1/AN	MOD FHWA
72	Adjacent Roadway Alignment	INSPEVNT.appralign	1/AN	FHWA
36C	Approach Guardrail On Top	INSPEVNT.arailratin	1/AN	MOD FHWA
91	Designated Inspection Frequency	INSPEVNT.brinspfreq	2/N	FHWA
61	Channel/Channel Protection	INSPEVNT.chanrating	1/AN	FHWA
58	Main Structure	INSPEVNT.dkrating	1/AN	MOD FHWA
90	Inspection Date	INSPEVNT.inspdate	4/N	MOD FHWA
92C	Other Special Inspection	INSPEVNT.osinspreq; INSPEVNT.osinspfreq	3/AN	MOD FHWA
93C	Other Special Inspection Date	INSPEVNT.oslastinsp	4/AN	MOD FHWA
113	Scour Critical Walls	INSPEVNT.scourcrit	1/AN	MOD FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
36A	Wall Railings On Top	INSPEVNT.railrating	1/AN	MOD FHWA
60	Foundation	INSPEVNT.subrating	1/AN	MOD FHWA
36B	Transitions On Top	INSPEVNT.transratin	1/AN	MOD FHWA
92B	Underwater Inspection	INSPEVNT.uwinspreq; INSPEVNT.uwinspfreq	3/AN	MOD FHWA
93B	Underwater Inspection Date	INSPEVNT.uwlastinsp	4/AN	MOD FHWA
71	Waterway Adequacy	INSPEVNT.wateradeq	1/AN	FHWA
4A	City/Town Name	N/A	25/AN	CDOT
5E	Directional Suffix	N/A	1/N	MOD FHWA
-	Notes	N/A	30/AN	CDOT
23E	Subaccount Number	PROJECTS.project_id	5/AN	CDOT
23	Original Construction Project Number	PROJECTS.projkey	25/AN	CDOT
114	Future Average Daily Traffic	ROADWAY.adtfuture	6/N	FHWA
115	Year of Future Average Daily Traffic	ROADWAY.adtfutyear	4/N	FHWA
29	Average Daily Traffic	ROADWAY.adttotal	6/N	FHWA
30	Year Of Average Daily Traffic	ROADWAY.adtyear	4/N	FHWA
19	Bypass/Detour Length	ROADWAY.bypasslen	3/N	MOD FHWA
100	STRAHNET Highway Designation	ROADWAY.defhwy	1/N	FHWA
105	Federal Lands Highways	ROADWAY.fedlandhwy	1/N	FHWA
26	Functional Class Of Inventory Rte.	ROADWAY.funcclass	2/N	FHWA
47	Total Horz Clearance, Carried/Behind	ROADWAY.hclrinv	3/N	MOD FHWA
5B	Route Signing Prefix	ROADWAY.kind_hwy	1/N	MOD FHWA
11	Reference Point	ROADWAY.kmpost	7/N	MOD FHWA
28B	Lanes In Front of Structure	ROADWAY.lanes	2/N	MOD FHWA
28A	Lanes On Structure	ROADWAY.lanes	2/N	MOD FHWA
28	Lanes On/In Front of Structure	ROADWAY.lanes	4/N	MOD FHWA
5C	Designated Level of Service	ROADWAY.levl_srvc	1/N	MOD FHWA
13A	LRS Inventory Route	ROADWAY.lrsinvrt	10/AN	FHWA
104	Highway System Of Inventory Route	ROADWAY.nhs_ind	1/N	FHWA
5A	Record Type	ROADWAY.on_under	1/N	MOD FHWA
12	Base Highway Network	ROADWAY.onbasenet	1/N	FHWA
51	Width, Curb-to-Curb, Carried Route	ROADWAY.roadwidth	4/N	MOD FHWA
5D(N,X)	Route Number (On-System, Off-System)	ROADWAY.routenum	5/AN	MOD FHWA
13B	Subroute Number	ROADWAY.subrtnum	2/N	FHWA
20	Toll	ROADWAY.tollfac	1/N	FHWA
102	Direction Of Traffic	ROADWAY.trafficdir	1/N	FHWA
110	Designated National Network	ROADWAY.trucknet	1/N	FHWA
109	Average Daily Truck Traffic	ROADWAY.truckpct	2/N	FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
146	Associated Bridge	USERBRDG.assocbridge	50/AN	CDOT
17B	Elevation – End of Wall	USERBRDG.endelevation	5/N	CDOT
16A	Latitude - End of Wall	USERBRDG.endlatitude	8/N	CDOT
17A	Longitude - End of Wall	USERBRDG.endlongitude	9/N	CDOT
36L	Approach Guardrail Ends In Front	USERBRDG.faendrating	4/N	CDOT
36K	Approach Guardrail In Front	USERBRDG.farailratin	1/AN	CDOT
50C	Left Curb/Sidewalk Width, Rte In Front	USERBRDG.flftcurbsw	3/N	CDOT
36M	Height of Rail In Front	USERBRDG.frailheight	1/AN	CDOT
36I	Wall Railings In Front	USERBRDG.frailrating	1/AN	CDOT
51A	Width, Curb-to-Curb, Route In Front	USERBRDG.froadwidth	4/N	CDOT
50D	Right Curb/Sidewalk Width, Rte In Front	USERBRDG.frtcurbsw	3/N	CDOT
125D	Standard or Modified Railing, In Front	USERBRDG.fstrrailmod	1/AN	CDOT
125C	Most Common Type of Railing, In Front	USERBRDG.fstrrailtype	2/AN	CDOT
36J	Transitions In Front	USERBRDG.ftransratin	4/N	CDOT
149	Type of Protective Coating	USERBRDG.coating	1/N	CDOT
36H	Height of Rail On Top	USERBRDG.railheight	4/N	CDOT
148	Slope Angle	USERBRDG.slope	2/N	CDOT
18A	Range	USERBRDG.srvyrange	4/AN	CDOT
18C	Section	USERBRDG.srvysection	2/N	CDOT
18B	Township	USERBRDG.srvytownship	4/AN	CDOT
16B	Elevation – Start of Wall	USERBRDG.startelevation	5/N	CDOT
125B	Standard or Modified Railing, On Top	USERBRDG.strrailmod	1/AN	CDOT
125A	Most Common Type of Railing, On Top	USERBRDG.strrailtype	2/AN	CDOT
147	Vertical Batter	USERBRDG.vertbatter	2/N	CDOT
145	Wall System	USERBRDG.wallsys	2/N	CDOT
133	Special Inspection Equipment	USERINSP.inspequip	2/N	CDOT
23EE	Project Indicator	USERPROJ.projectindicator	5/AN	CDOT
47A	Tot. Horiz. Clearance, In Front	USERRWAY.fhclrinv	3/N	CDOT
143B	Min, Max, and Avg Dist. From Rte In Front	USERRWAY.fmmadist	12/N	CDOT
144B	Speed Limit, Route In Front	USERRWAY.fspeedlimit	2/N	CDOT
143A	Min, Max, and Avg Dist. From Rte Carried	USERRWAY.mmadist	12/N	CDOT
136	Mileage Log Section Letter	USERRWAY.routelog	1/AN	CDOT
144A	Speed Limit, Route Carried	USERRWAY.speedlimit	2/N	CDOT

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Appendix 2.B.2: Sorted by Item Number

ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
1	State Code	BRIDGE.fips_state; BRIDGE.fhwa_rgn	3/N	FHWA
2	Highway Agency District	BRIDGE.district	2/N	MOD FHWA
3	County (Parish) Code	BRIDGE.county	3/N	FHWA
4	Place Code	BRIDGE.placecode	5/N	FHWA
4A	City/Town Name	N/A	25/AN	CDOT
5A	Record Type	ROADWAY.on_under	1/N	MOD FHWA
5B	Route Signing Prefix	ROADWAY.kind_hwy	1/N	MOD FHWA
5C	Designated Level of Service	ROADWAY.levl_srvc	1/N	MOD FHWA
5D(N,X)	Route Number (On-System, Off-System)	ROADWAY.routenum	5/AN	MOD FHWA
5E	Directional Suffix	N/A	1/N	MOD FHWA
6	Features Carried	BRIDGE.featint	24/AN	MOD FHWA
7	Features In Front	BRIDGE.facility	18/AN	MOD FHWA
8	Structure Identification Number	BRIDGE.brkey	15/AN	FHWA
8A	Structure Number	BRIDGE.strucname	15/AN	CDOT
9	Location	BRIDGE.location	25/AN	FHWA
11	Reference Point	ROADWAY.kmpost	7/N	MOD FHWA
12	Base Highway Network	ROADWAY.onbasenet	1/N	FHWA
13A	LRS Inventory Route	ROADWAY.lrsinvrt	10/AN	FHWA
13B	Subroute Number	ROADWAY.subrtnum	2/N	FHWA
16	Latitude - Start of Wall	BRIDGE.latitude	8/N	MOD FHWA
16A	Latitude - End of Wall	USERBRDG.endlatitude	8/N	CDOT
16B	Elevation – Start of Wall	USERBRDG.startelevation	5/N	CDOT
17	Longitude - Start of Wall	BRIDGE.longitude	9/N	MOD FHWA
17A	Longitude - End of Wall	USERBRDG.endlongitude	9/N	CDOT
17B	Elevation – End of Wall	USERBRDG.endelevation	5/N	CDOT
18A	Range	USERBRDG.srvyrange	4/AN	CDOT
18B	Township	USERBRDG.srvytownship	4/AN	CDOT
18C	Section	USERBRDG.srvysection	2/N	CDOT
19	Bypass/Detour Length	ROADWAY.bypasslen	3/N	MOD FHWA
20	Toll	ROADWAY.tollfac	1/N	FHWA
21	Maintenance Responsibility	BRIDGE.custodian	2/N	FHWA
22	Owner	BRIDGE.owner	2/N	FHWA
23	Original Construction Project Number	PROJECTS.projkey	25/AN	CDOT
23E	Subaccount Number	PROJECTS.project_id	5/AN	CDOT
23EE	Project Indicator	USERPROJ.projectindicator	5/AN	CDOT
26	Functional Class Of Inventory Rte.	ROADWAY.funcclass	2/N	FHWA
27	Year Built	BRIDGE.yearbuilt	4/N	MOD FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
28	Lanes On/In Front of Structure	ROADWAY.lanes	4/N	MOD FHWA
28A	Lanes On Structure	ROADWAY.lanes	2/N	MOD FHWA
28B	Lanes In Front of Structure	ROADWAY.lanes	2/N	MOD FHWA
29	Average Daily Traffic	ROADWAY.adttotal	6/N	FHWA
30	Year Of Average Daily Traffic	ROADWAY.adtyear	4/N	FHWA
33	Inventory Route Median	BRIDGE.median	1/N	MOD FHWA
36A	Wall Railings On Top	INSPEVNT.railrating	1/AN	MOD FHWA
36B	Transitions On Top	INSPEVNT.transratin	1/AN	MOD FHWA
36C	Approach Guardrail On Top	INSPEVNT.arailratin	1/AN	MOD FHWA
36D	Approach Guardrail Ends On Top	INSPEVNT.aendrating	1/AN	MOD FHWA
36H	Height of Rail On Top	USERBRDG.railheight	4/N	CDOT
36I	Wall Railings In Front	USERBRDG.frailrating	1/AN	CDOT
36J	Transitions In Front	USERBRDG.ftransratin	4/N	CDOT
36K	Approach Guardrail In Front	USERBRDG.farailratin	1/AN	CDOT
36L	Approach Guardrail Ends In Front	USERBRDG.faendrating	4/N	CDOT
36M	Height of Rail In Front	USERBRDG.frailheight	1/AN	CDOT
37	Historical significance	BRIDGE.histsign	1/N	FHWA
42A	Type of Service Carried by Wall	BRIDGE.servtypon	1/AN	MOD FHWA
42B	Type of Service In Front of Wall	BRIDGE.servtypund	1/AN	MOD FHWA
43A	Kind of Material/Design	BRIDGE.materialmain	1/AN	MOD FHWA
43B	Type of Design/Construction	BRIDGE.designmain	2/N	MOD FHWA
47	Total Horz Clearance, Carried/Behind	ROADWAY.hclrinv	3/N	MOD FHWA
47A	Tot. Horiz. Clearance, In Front	USERRWAY.fhclrinv	3/N	CDOT
49	Structure Length	BRIDGE.length	6/N	MOD FHWA
50A	Left Curb/Sidewalk Width, Carried Rte	BRIDGE.lftcurbsw	3/N	MOD FHWA
50B	Right Curb/Sidewalk Width, Carried Rte	BRIDGE.rtcurbsw	3/N	MOD FHWA
50C	Left Curb/Sidewalk Width, Rte In Front	USERBRDG.flftcurbsw	3/N	CDOT
50D	Right Curb/Sidewalk Width, Rte In Front	USERBRDG.frtcurbsw	3/N	CDOT
51	Width, Curb-to-Curb, Carried Route	ROADWAY.roadwidth	4/N	MOD FHWA
51A	Width, Curb-to-Curb, Route In Front	USERBRDG.froadwidth	4/N	CDOT
52	Average Wall Height	BRIDGE.deckwidth	4/N	MOD FHWA
53	Maximum Wall Height	BRIDGE.vclrover	4/N	MOD FHWA
54	Minimum Wall Height	BRIDGE.vclrunder	4/N	MOD FHWA
58	Main Structure	INSPEVNT.dkrating	1/AN	MOD FHWA
60	Foundation	INSPEVNT.subrating	1/AN	MOD FHWA
61	Channel/Channel Protection	INSPEVNT.chanrating	1/AN	FHWA
71	Waterway Adequacy	INSPEVNT.wateradeq	1/AN	FHWA
72	Adjacent Roadway Alignment	INSPEVNT.appralign	1/AN	FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
90	Inspection Date	INSPEVNT.inspdate	4/N	MOD FHWA
91	Designated Inspection Frequency	INSPEVNT.brinspfreq	2/N	FHWA
92B	Underwater Inspection	INSPEVNT.uwinspreq; INSPEVNT.uwinspfreq	3/AN	MOD FHWA
92C	Other Special Inspection	INSPEVNT.osinspreq; INSPEVNT.osinspfreq	3/AN	MOD FHWA
93B	Underwater Inspection Date	INSPEVNT.uwlastinsp	4/AN	MOD FHWA
93C	Other Special Inspection Date	INSPEVNT.oslastinsp	4/AN	MOD FHWA
98A	Neighboring State Code	BRIDGE.nstatecode;	3/N	MOD FHWA
98B	Percent Responsibility	BRIDGE.bb_pct	2/N	MOD FHWA
99	Border Wall Structure Number	BRIDGE.bb_brdgeid	15/AN	FHWA
100	STRAHNET Highway Designation	ROADWAY.defhwy	1/N	FHWA
102	Direction Of Traffic	ROADWAY.trafficdir	1/N	FHWA
103	Temporary Structure Designation	BRIDGE.tempstruc	1/AN	MOD FHWA
104	Highway System Of Inventory Route	ROADWAY.nhs_ind	1/N	FHWA
105	Federal Lands Highways	ROADWAY.fedlandhwy	1/N	FHWA
106	Year Reconstructed	BRIDGE.yearrecon	4/N	FHWA
107	Vertical Supports Structure Type	BRIDGE.dkstructyp	1/AN	MOD FHWA
109	Average Daily Truck Traffic	ROADWAY.truckpct	2/N	FHWA
110	Designated National Network	ROADWAY.trucknet	1/N	FHWA
113	Scour Critical Walls	INSPEVNT.scourcrit	1/AN	MOD FHWA
114	Future Average Daily Traffic	ROADWAY.adtfuture	6/N	FHWA
115	Year of Future Average Daily Traffic	ROADWAY.adtfutyear	4/N	FHWA
125A	Most Common Type of Railing	USERBRDG.strrailtype	2/AN	CDOT
125B	Standard or Modified Railing	USERBRDG.strrailmod	1/AN	CDOT
125C	Most Common Type of Railing, In Front	USERBRDG.fstrrailtype	2/AN	CDOT
125D	Standard or Modified Railing, In Front	USERBRDG.fstrrailmod	1/AN	CDOT
133	Special Inspection Equipment	USERINSP.inspequip	2/N	CDOT
136	Mileage Log Section Letter	USERRWAY.routelog	1/AN	CDOT
143A	Min, Max, and Avg Dist. From Rte Carried	USERRWAY.mmadist	12/N	CDOT
143B	Min, Max, and Avg Dist. From Rte In Front	USERRWAY.fmmadist	12/N	CDOT
144A	Speed Limit, Route Carried	USERRWAY.speedlimit	2/N	CDOT
144B	Speed Limit, Route In Front	USERRWAY.fspeedlimit	2/N	CDOT
145	Wall System	USERBRDG.wallsys	2/N	CDOT
146	Associated Bridge	USERBRDG.assocbridge	50/AN	CDOT
147	Vertical Batter	USERBRDG.vertbatter	2/N	CDOT
148	Slope Angle	USERBRDG.slope	2/N	CDOT
149	Type of Protective Coating	USERBRDG.coating	1/N	CDOT
-	Notes	N/A	30/AN	CDOT

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Appendix 2.B.3: Sorted by Item Name

ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
72	Adjacent Roadway Alignment	INSPEVNT.appralign	1/AN	FHWA
36K	Approach Guardrail In Front	USERBRDG.farailratin	1/AN	CDOT
36C	Approach Guardrail On Top	INSPEVNT.arailratin	1/AN	MOD FHWA
36L	Approach Guardrail Ends In Front	USERBRDG.faendrating	4/N	CDOT
36D	Approach Guardrail Ends On Top	INSPEVNT.aendrating	1/AN	MOD FHWA
146	Associated Bridge	USERBRDG.assocbridge	50/AN	CDOT
29	Average Daily Traffic	ROADWAY.adttotal	6/N	FHWA
109	Average Daily Truck Traffic	ROADWAY.truckpct	2/N	FHWA
52	Average Wall Height	BRIDGE.deckwidth	4/N	MOD FHWA
12	Base Highway Network	ROADWAY.onbasenet	1/N	FHWA
99	Border Wall Structure Number	BRIDGE.bb_brdgeid	15/AN	FHWA
19	Bypass/Detour Length	ROADWAY.bypasslen	3/N	MOD FHWA
61	Channel/Channel Protection	INSPEVNT.chanrating	1/AN	FHWA
4A	City/Town Name	N/A	25/AN	CDOT
3	County (Parish) Code	BRIDGE.county	3/N	FHWA
91	Designated Inspection Frequency	INSPEVNT.brinspfreq	2/N	FHWA
5C	Designated Level of Service	ROADWAY.levl_srvc	1/N	MOD FHWA
110	Designated National Network	ROADWAY.trucknet	1/N	FHWA
102	Direction Of Traffic	ROADWAY.trafficdir	1/N	FHWA
5E	Directional Suffix	N/A	1/N	MOD FHWA
17B	Elevation – End of Wall	USERBRDG.endelevation	5/N	CDOT
16B	Elevation – Start of Wall	USERBRDG.startelevation	5/N	CDOT
6	Features Carried	BRIDGE.featint	24/AN	MOD FHWA
7	Features In Front	BRIDGE.facility	18/AN	MOD FHWA
105	Federal Lands Highways	ROADWAY.fedlandhwy	1/N	FHWA
60	Foundation	INSPEVNT.subrating	1/AN	MOD FHWA
26	Functional Class Of Inventory Rte.	ROADWAY.funcclass	2/N	FHWA
114	Future Average Daily Traffic	ROADWAY.adtfuture	6/N	FHWA
36M	Height of Rail In Front	USERBRDG.frailheight	1/AN	CDOT
36H	Height of Rail On Top	USERBRDG.railheight	4/N	CDOT
2	Highway Agency District	BRIDGE.district	2/N	MOD FHWA
104	Highway System Of Inventory Route	ROADWAY.nhs_ind	1/N	FHWA
37	Historical significance	BRIDGE.histsign	1/N	FHWA
90	Inspection Date	INSPEVNT.inspdate	4/N	MOD FHWA
33	Inventory Route Median	BRIDGE.median	1/N	MOD FHWA
43A	Kind of Material/Design	BRIDGE.materialmain	1/AN	MOD FHWA
28B	Lanes In Front of Structure	ROADWAY.lanes	2/N	MOD FHWA
28A	Lanes On Structure	ROADWAY.lanes	2/N	MOD FHWA
28	Lanes On/In Front of Structure	ROADWAY.lanes	4/N	MOD FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
16A	Latitude - End of Wall	USERBRDG.endlatitude	8/N	CDOT
16	Latitude - Start of Wall	BRIDGE.latitude	8/N	MOD FHWA
50A	Left Curb/Sidewalk Width, Carried Rte	BRIDGE.lftcurbsw	3/N	MOD FHWA
50C	Left Curb/Sidewalk Width, Rte In Front	USERBRDG.flftcurbsw	3/N	CDOT
9	Location	BRIDGE.location	25/AN	FHWA
17A	Longitude - End of Wall	USERBRDG.endlongitude	9/N	CDOT
17	Longitude - Start of Wall	BRIDGE.longitude	9/N	MOD FHWA
13A	LRS Inventory Route	ROADWAY.lrsinvrt	10/AN	FHWA
58	Main Structure	INSPEVNT.dkrating	1/AN	MOD FHWA
21	Maintenance Responsibility	BRIDGE.custodian	2/N	FHWA
53	Maximum Wall Height	BRIDGE.vclrover	4/N	MOD FHWA
136	Mileage Log Section Letter	USERRWAY.routelog	1/AN	CDOT
143A	Min, Max, and Avg Dist. From Rte Carried	USERRWAY.mmadist	12/N	CDOT
143B	Min, Max, and Avg Dist. From Rte In Front	USERRWAY.fmmadist	12/N	CDOT
54	Minimum Wall Height	BRIDGE.vclrunder	4/N	MOD FHWA
125A	Most Common Type of Railing	USERBRDG.strrailtype	2/AN	CDOT
125C	Most Common Type of Railing, In Front	USERBRDG.fstrrailtype	2/AN	CDOT
98A	Neighboring State Code	BRIDGE.nstatecode; BRIDGE.n_fhwa_reg	3/N	MOD FHWA
-	Notes	N/A	30/AN	CDOT
23	Original Construction Project Number	PROJECTS.projkey	25/AN	CDOT
92C	Other Special Inspection	INSPEVNT.osinspreq; INSPEVNT.osinspfreq	3/AN	MOD FHWA
93C	Other Special Inspection Date	INSPEVNT.oslastinsp	4/AN	MOD FHWA
22	Owner	BRIDGE.ownerbrdg	2/N	FHWA
98B	Percent Responsibility	BRIDGE.bb_pct	2/N	MOD FHWA
4	Place Code	BRIDGE.placecode	5/N	FHWA
23EE	Project Indicator	USERPROJ.projectindicator	5/AN	CDOT
18A	Range	USERBRDG.srvyrange	4/AN	CDOT
5A	Record Type	ROADWAY.on_under	1/N	MOD FHWA
11	Reference Point	ROADWAY.kmpost	7/N	MOD FHWA
50B	Right Curb/Sidewalk Width, Carried Rte	BRIDGE.rtcurbsw	3/N	MOD FHWA
50D	Right Curb/Sidewalk Width, Rte In Front	USERBRDG.frtcurbsw	3/N	CDOT
5D(N,X)	Route Number (On-System, Off-System)	ROADWAY.routenum	5/AN	MOD FHWA
5B	Route Signing Prefix	ROADWAY.kind_hwy	1/N	MOD FHWA
113	Scour Critical Walls	INSPEVNT.scourcrit	1/AN	MOD FHWA
18C	Section	USERBRDG.srvysection	2/N	CDOT
148	Slope Angle	USERBRDG.slope	2/N	CDOT
133	Special Inspection Equipment	INSPEVNT.insptype	2/N	CDOT
144A	Speed Limit, Route Carried	USERRWAY.speedlimit	2/N	CDOT

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
144B	Speed Limit, Route In Front	USERRWAY.fspeedlimit	2/N	CDOT
125B	Standard or Modified Railing	USERBRDG.strrailmod	1/AN	CDOT
125D	Standard or Modified Railing, In Front	USERBRDG.fstrrailmod	1/AN	CDOT
1	State Code	BRIDGE.fips_state; BRIDGE.fhwa_rgn	3/N	FHWA
100	STRAHNET Highway Designation	ROADWAY.defhwy	1/N	FHWA
8A	Structure Number	BRIDGE.structnum	15/AN	CDOT
49	Structure Length	BRIDGE.length	6/N	MOD FHWA
8	Structure Identification Number	BRIDGE.brkey	15/AN	FHWA
23E	Subaccount Number	PROJECTS.project_id	5/AN	CDOT
13B	Subroute Number	ROADWAY.subrtnum	2/N	FHWA
103	Temporary Structure Designation	BRIDGE.tempstruc	1/AN	MOD FHWA
20	Toll	ROADWAY.tollfac	1/N	FHWA
47A	Tot. Horiz. Clearance, In Front	USERRWAY.fhclrinv	3/N	CDOT
47	Total Horz Clearance, Carried/Behind	ROADWAY.hclrinv	3/N	MOD FHWA
18B	Township	USERBRDG.srvytownship	4/AN	CDOT
36J	Transitions In Front	USERBRDG.ftransratin	4/N	CDOT
36B	Transitions On Top	INSPEVNT.transratin	1/AN	MOD FHWA
43B	Type of Design/Construction	BRIDGE.designmain	2/N	MOD FHWA
149	Type of Protective Coating	USERBRDG.coating	1/N	CDOT
42A	Type of Service Carried by Wall	BRIDGE.servtypon	1/AN	MOD FHWA
42B	Type of Service In Front of Wall	BRIDGE.servtypund	1/AN	MOD FHWA
92B	Underwater Inspection	INSPEVNT.uwinspreq; INSPEVNT.uwinspfreq	3/AN	MOD FHWA
93B	Underwater Inspection Date	INSPEVNT.uwlastinsp	4/AN	MOD FHWA
147	Vertical Batter	USERBRDG.vertbatter	2/N	CDOT
107	Vertical Supports Structure Type	BRIDGE.dkstructyp	1/AN	MOD FHWA
33	Inventory Route Median	BRIDGE.median	1/N	MOD FHWA
36A	Wall Railings On Top	INSPEVNT.railrating	1/AN	MOD FHWA
36I	Wall Railings In Front	USERBRDG.frailrating	1/AN	CDOT
145	Wall System	USERBRDG.wallsys	2/N	CDOT
71	Waterway Adequacy	INSPEVNT.wateradeq	1/AN	FHWA
51	Width, Curb-to-Curb, Carried Route	ROADWAY.roadwidth	4/N	MOD FHWA
51A	Width, Curb-to-Curb, Route In Front	USERBRDG.froadwidth	4/N	CDOT
27	Year Built	BRIDGE.yearbuilt	4/N	MOD FHWA
30	Year Of Average Daily Traffic	ROADWAY.adtyear	4/N	FHWA
115	Year of Future Average Daily Traffic	ROADWAY.adtfutyear	4/N	FHWA
106	Year Reconstructed	BRIDGE.yearrecon	4/N	FHWA

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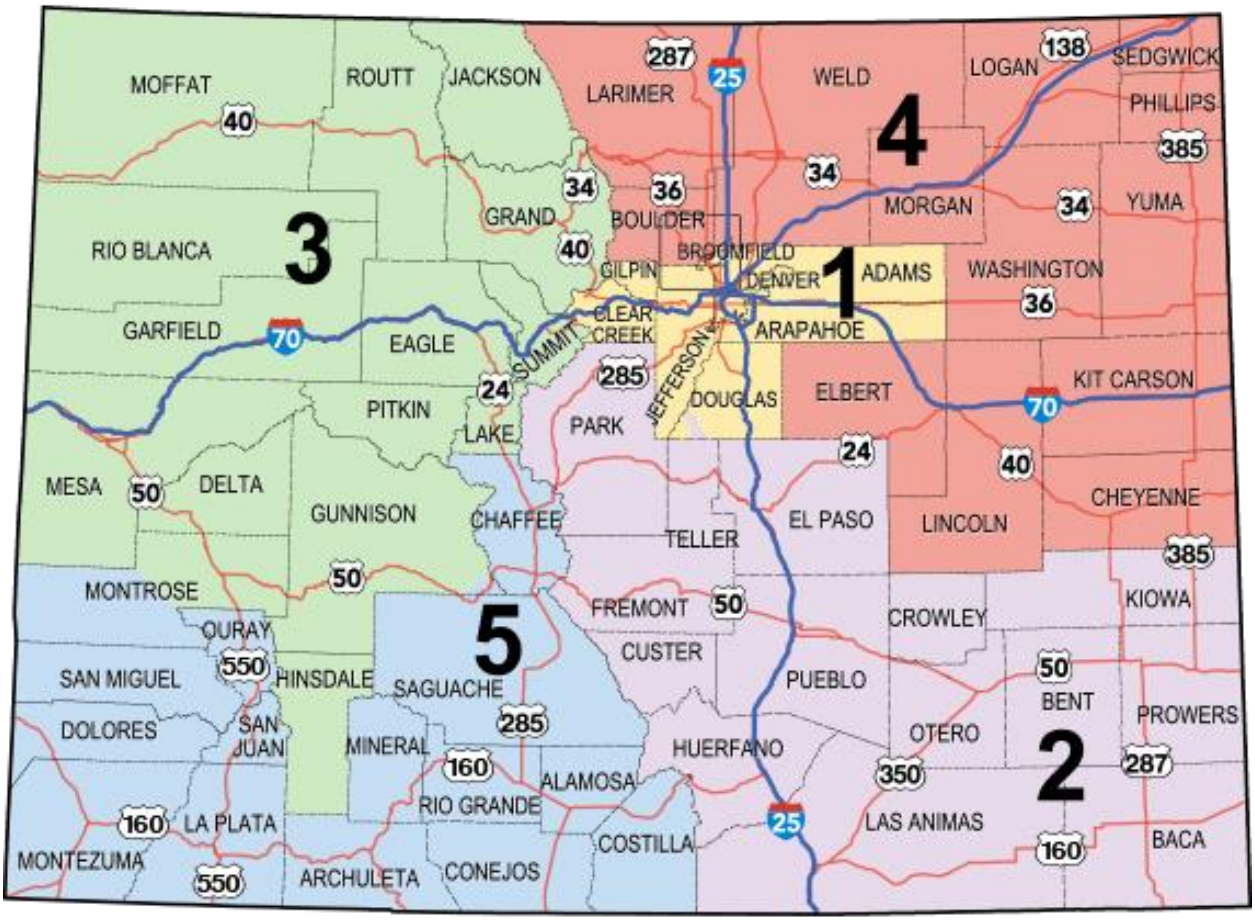
APPENDIX 2.C: FIPS COLORADO CODES

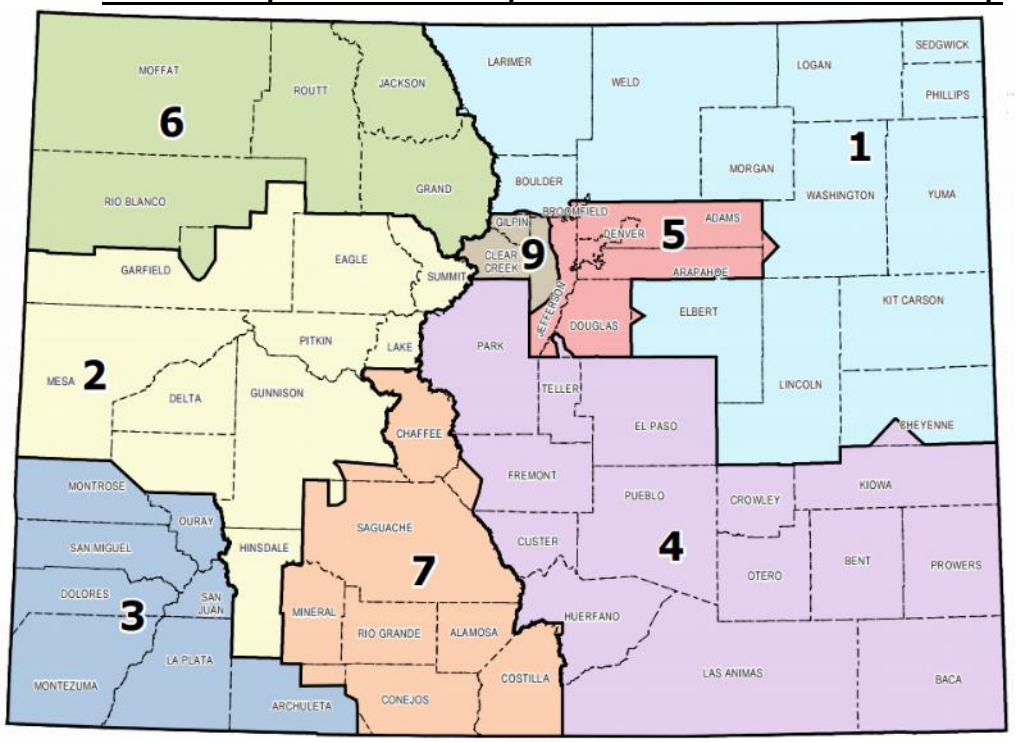
Appendix 2.C.1: Colorado Region and Maintenance Codes

REGION	MAINT. SEC.	HEADQUARTERS LOCATION	CODE
1	5	DENVER	15
1	9	DENVER	19
2	4	PUEBLO	24
3	2	GRAND JUNCTION	32
3	6	GRAND JUNCTION	36
4	1	GREELEY	41
5	3	DURANGO	53
5	7	DURANGO	57

Appendix 2.C.2: Colorado Department of Transportation Engineering Regions Map



Appendix 2.C.3: Colorado Department of Transportation Maintenance Sections Map



Appendix 2.C.4: Colorado State Grid Map

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Appendix 2.C.5: FIPS Place Codes for Colorado Cities with Associated FIPS County Codes

CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code	CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code
Aguilar	00760	Las Animas	71	Brush	09555	Morgan	87
Air Force Academy	00870	El Paso	41	Buena Vista	10105	Chaffee	15
Akron	00925	Washington	121	Burlington	10600	Kit Carson	63
Alamosa	01090	Alamosa	3	Byers	10985	Arapahoe	5
Alamosa East	01145	Alamosa	3	Calhan	11260	El Paso	41
Alma	01530	Park	93	Campion	11590	Larimer	69
Antonito	02355	Conejos	21	Campo	11645	Baca	9
Applewood	02575	Jefferson	59	Cañon City	11810	Fremont	43
Arriba	03235	Lincoln	73	Carbondale	12030	Garfield	45
Arvada	03455	Jefferson	59	Cascade-Chipita Park	12325	El Paso	41
Aspen	03620	Pitkin	97	Castle Rock	12415	Douglas	35
Ault	03950	Weld	123	Castlewood	12442	Douglas	35
Aurora	04000	Adams	1	Cedaredge	12635	Delta	29
Aurora	04000	Arapahoe	5	Centennial	12815	Arapahoe	5
Avon	04110	Eagle	37	Center	12855	Rio Grande	105
Basalt	04935	Eagle	37	Central City	12910	Gilpin	47
Battlement Mesa	05120	Garfield	45	Cheraw	13460	Otero	89
Bayfield	05265	La Plata	67	Cherry Hills Village	13845	Arapahoe	5
Bennett	06090	Adams	1	Cheyenne Wells	14175	Cheyenne	17
Berthoud	06255	Larimer	69	Cimarron Hills	14587	El Paso	41
Bethune	06530	Kit Carson	63	Clifton	15165	Mesa	77
Black Forest	06970	El Paso	41	Coal Creek	15330	Fremont	43
Black Forest	06970	Elbert	39	Cokedale	15550	Las Animas	71
Black Hawk	07025	Gilpin	47	Collbran	15605	Mesa	77
Black Hawk	07025	Jefferson	59	Colorado City	15935	Pueblo	101
Blanca	07190	Costilla	23	Colorado Springs	16000	El Paso	41
Blue River	07410	Summit	117	Columbine	16110	Jefferson	59
Bonanza City	07575	Saguache	109	Columbine Valley	16385	Jefferson	59
Boone	07795	Pueblo	101	Commerce City	16495	Adams	1
Boulder	07850	Boulder	13	Cortez	17375	Montezuma	83
Bow Mar	08070	Jefferson	59	Craig	17760	Moffat	81
Branson	08345	Las Animas	71	Crawford	17925	Delta	29
Breckenridge	08400	Summit	117	Creede	17980	Mineral	79
Brighton	08675	Adams	1	Crested Butte	18310	Gunnison	51
Brookside	09115	Fremont	43	Crestone	18420	Saguache	109
Broomfield	09280	Broomfield	14	Cripple Creek	18530	Teller	119
Crook	18640	Logan	75	Fort Lupton	27700	Weld	123
Crowley	18750	Crowley	25	Fort Morgan	27810	Weld	123
Dacono	19080	Weld	123	Fountain	27865	El Paso	41
De Beque	19355	Mesa	77	Fowler	27975	Otero	89
Deer Trail	19630	Arapahoe	5	Fraser	28305	Grand	49
Del Norte	19795	Rio Grande	105	Frederick	28360	Weld	123
Delta	19850	Delta	29	Frisco	28690	Summit	117
Denver	20000	Denver	31	Fruita	28745	Mesa	77

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CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code	CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code
Derby	20275	Adams	1	Fruitvale	28800	Mesa	77
Dillon	20440	Summit	117	Garden City	29185	Weld	123
Dinosaur	20495	Moffat	81	Gateway	29455	Mesa	77
Dolores	20770	Montezuma	83	Genesee	29625	Jefferson	59
Dove Creek	21265	Dolores	33	Genoa	29680	Logan	75
Durango	22035	La Plata	67	Georgetown	29735	Clear Creek	19
Eads	22145	Kiowa	61	Gilcrest	29955	Weld	123
Eagle	22200	Eagle	37	Glendale	30340	Denver	31
Eagle-Vail	22207	Eagle	37	Gleneagle	30420	El Paso	41
Eaton	22860	Weld	123	Glenwood Springs	30780	Garfield	45
Eckley	23025	Yuma	125	Golden	30835	Jefferson	59
Edgewater	23135	Jefferson	59	Granada	31550	Powers	99
El Jebel	23795	Pitkin	97	Granby	31605	Grand	49
Elizabeth	23740	Elbert	39	Grand Junction	31660	Mesa	77
Empire	24620	Clear Creek	19	Grand Lake	31715	Grand	49
Englewood	24785	Arapahoe	5	Greeley	32155	Weld	123
Erie	24950	Weld	123	Green Mountain Falls	32650	El Paso	41
Estes Park	25115	Larimer	69	Greenwood Village	33035	Arapahoe	5
Evans	25280	Weld	123	Grover	33310	Weld	123
Evergreen	25390	Jefferson	59	Gunbarrel	33502	Boulder	13
Fairplay	25610	Park	93	Gunnison	33640	Gunnison	51
Federal Heights	26270	Adams	1	Gypsum	33695	Eagle	37
Firestone	26600	Weld	123	Hartman	34520	Prowers	99
Flagler	26765	Kit Carson	63	Haswell	34740	Kiowa	61
Fleming	26875	Logan	75	Haxtun	34960	Phillips	95
Florence	27040	Fremont	43	Hayden	35070	Routt	107
Fort Carson	27370	El Paso	41	Highlands Ranch	36410	Douglas	35
Fort Collins	27425	Larimer	69	Hillrose	36610	Morgan	87
Holly	37215	Prowers	99	Limon	44980	Lincoln	73
Holyoke	37270	Phillips	95	Lincoln Park	45145	Fremont	43
Hooper	37380	Alamosa	3	Littleton	45255	Arapahoe	5
Hotchkiss	37545	Delta	29	Littleton	45255	Douglas	35
Hot Sulphur Springs	37600	Grand	49	Lochbuie	45530	Adams	1
Hudson	37820	Weld	123	Log Lane Village	45695	Morgan	87
Hugo	37875	Lincoln	73	Lone Tree	45955	Douglas	35
Idaho Springs	38370	Clear Creek	19	Longmont	45970	Boulder	13
Ignacio	38535	La Plata	67	Longmont	45970	Weld	123
Iliff	38590	Logan	75	Louisville	46355	Boulder	13
Jamestown	39195	Boulder	13	Loveland	46465	Larimer	69
Johnstown	39855	Weld	123	Lyons	47070	Boulder	13
Julesburg	39965	Sedgwick	115	Manassa	48060	Conejos	21
Keenesburg	40185	Weld	123	Mancos	48115	Montezuma	83
Ken Caryl	40377	Jefferson	59	Manitou Springs	48445	El Paso	41
Keota	40405	Weld	123	Manzanola	48500	Otero	89
Kersey	40515	Weld	123	Marble	48555	Garfield	45
Kim	40570	Las Animas	71	Mead	49600	Weld	123

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CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code	CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code
Kiowa	40790	Elbert	39	Meeker	49875	Rio Blanco	103
Kit Carson	41010	Cheyenne	17	Merino	50040	Logan	75
Kremmling	41560	Grand	49	Milliken	50480	Weld	123
La Jara	42055	Conejos	21	Minturn	50920	Eagle	37
La Junta	42110	Otero	89	Moffat	51250	Saguache	109
La Salle	43605	Weld	123	Monte Vista	51635	Rio Grande	105
La Veta	44100	Huerfano	55	Montezuma	51690	Summit	117
Lafayette	41835	Boulder	13	Montrose	51745	Montrose	85
La Junta	42110	Otero	89	Monument	51800	El Paso	41
Lake City	42330	Hinsdale	53	Morrison	52075	Jefferson	59
Lakeside	42495	Jefferson	59	Mount Crested Butte	52570	Gunnison	51
Lakewood	43000	Denver	31	Mountain View	52350	Jefferson	59
Lakewood	43000	Jefferson	59	Naturita	53120	Montrose	85
Lamar	43110	Prowers	99	Nederland	53175	Boulder	13
Larkspur	43550	Douglas	35	New Castle	53395	Garfield	45
Las Animas	43660	Bent	11	Niwot	53780	Boulder	13
Leadville	44320	Lake	65	Northglenn	54330	Adams	1
Leadville North	44375	Lake	65	Norwood	54880	San Miguel	113
Nucla	54935	Montrose	85	Ridgway	64200	Ouray	91
Nunn	55045	Weld	123	Rifle	64255	Garfield	45
Oak Creek	55155	Routt	107	Rockvale	64970	Fremont	43
Olathe	55540	Montrose	85	Rocky Ford	65190	Otero	89
Olney Springs	55705	Crowley	25	Romeo	65740	Conejos	21
Ophir	55870	San Miguel	113	Rye	66895	Pueblo	101
Orchard City	55980	Delta	29	Saguache	67005	Saguache	109
Orchard Mesa	56035	Mesa	77	Salida	67280	Chaffee	15
Ordway	56145	Crowley	25	Salida	67280	Gunnison	51
Otis	56365	Washington	121	San Luis	68105	Costilla	23
Ouray	56420	Ouray	91	Sanford	67830	Conejos	21
Ovid	56475	Sedgwick	115	Sawpit	68655	San Miguel	113
Pagosa Springs	56860	Archuleta	7	Security-Widefield	68820	El Paso	41
Palisade	56970	Mesa	77	Sedgwick	68930	Sedgwick	115
Palmer Lake	57025	El Paso	41	Seibert	69040	Kit Carson	63
Paoli	57245	Phillips	95	Severance	69150	Weld	123
Paonia	57300	Delta	29	Sheridan	69645	Arapahoe	5
Parachute	57400	Garfield	45	Sheridan Lake	69700	Kiowa	61
Parker	57630	Douglas	35	Sherrelwood	69810	Adams	1
Peetz	58235	Logan	75	Silt	70195	Garfield	45
Penrose	58400	Fremont	43	Silver Cliff	70250	Custer	27
Pierce	59005	Weld	123	Silver Plume	70360	Clear Creek	19
Pitkin	59830	Gunnison	51	Silverthorne	70525	Summit	117
Platteville	60160	Weld	123	Silverton	70580	San Juan	111
Poncha Springs	60600	Chaffee	15	Simla	70635	Elbert	39
Ponderosa Park	60655	Elbert	39	Snowmass	71680	Pitkin	97
Pritchett	61315	Baca	9	Snowmass Village	71755	Pitkin	97

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CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code	CITY NAME	FIPS Place Code	COUNTY NAME	FIPS County Code
Prospect Heights	61480	Fremont	43	Two Buttes	79270	Baca	9
Pueblo	62000	Pueblo	101	Vail	80040	Eagle	37
Pueblo West	62220	Pueblo	101	Victor	80865	Teller	119
Ramah	62660	El Paso	41	Vilas	81030	Baca	9
Rangely	62880	Rio Blanco	103	Vona	81690	Kit Carson	63
Raymer	63045	Weld	123	Walden	82130	Jackson	57
Red Cliff	63265	Eagle	37	Walsenburg	82350	Huerfano	55
Redlands	63375	Mesa	77	Walsh	82460	Baca	9
Rico	64090	Dolores	33	Ward	82735	Boulder	13
South Fork	72395	Rio Grande	105	Welby	83120	Adams	1
Southglenn	72505	Arapahoe	5	Wellington	83230	Larimer	69
Springfield	73330	Baca	9	Westcliffe	83450	Custer	27
Starkville	73715	Las Animas	71	Westminster	83835	Boulder	13
Steamboat Springs	73825	Routt	107	Westminster	83835	Adams	1
Sterling	73935	Logan	75	Westminster East	83890	Adams	1
Stratmoor	74430	El Paso	41	Wheat Ridge	84440	Denver	31
Stratton	74485	Kit Carson	63	Wiggins	84770	Morgan	87
Sugar City	74815	Crowley	25	Wiley	85045	Prowers	99
Superior	75640	Boulder	13	Williamsburg	85155	Fremont	43
Swink	75970	Otero	89	Windsor	85485	Weld	123
Telluride	76795	San Miguel	113	Winter Park	85705	Grand	49
The Pinery	77235	Arapahoe	5	Woodland Park	86090	Teller	119
Thornton	77290	Adams	1	Woodmoor	86117	El Paso	41
Thornton	77290	Boulder	13	Wray	86310	Yuma	125
Timnath	77510	Larimer	69	Yampa	86475	Routt	107
Towaoc	78280	Montezuma	83	Yuma	86750	Yuma	125
Trinidad	78610	Las Animas	71				

APPENDIX 2.D: SHAPEFILES FOR AUTO-POPULATED SI&A DATA

Item Number	Item Name	Shapefile
1	State Code	state
2	Highway Agency District	engineering_regions_cdot_py; maintenance_section_cdot_py
3	County Code	counties
4	Place Code	cities
4A	City/Town Name	cities
5B	Route Signing Prefix	highways
5DN	On-System Route Number	highways
8	Structure ID Number (milepoint)	highways
11	Reference Point	highways
12	Base Highway Network	highways
13	LRS Inventory Route, Subroute Number	nhpn
16	Latitude- Start of Wall	Google
16A	Latitude-End of wall	Google
16B	Elevation- Start of Wall	Google
17	Longitude- Start of Wall	Google
17A	Longitude- End of Wall	Google
17B	Elevation-End of Wall	Google
18	Range, Township and Section	plss_township; plss_section
22	Owner	nhpn
26	Functional Classification of Inv Route	nhpn
29	Average Daily Traffic	highways
30	Year of Average Daily Traffic	highways
100	STRAHNET Highway Designation	nhpn
104	Highway System of the Inventory Route	highways
105	Federal Lands Highways	fedlanp020
109	Average Daily Truck Traffic	highways
114	Future Average Daily Traffic	highways
115	Year of Future Average Daily Traffic	highways
136	Mileage Log Section Letter	highways

APPENDIX 2.E: ABBREVIATIONS

Recommended Abbreviations for Inventory and Appraisal:

Access Road	AR
Avenue	AVE
Boulevard	BLVD
Business	BUS
County	CO
Creek	CRK
Ditch	DTCH
Diversion	DIV
East	E
Eastbound	EEND
Fork	FK
Frontage	FR
Gulch	GUL
Interstate	I
Lower	LWR
Mainline	ML
Maintenance	MAINT
Mile	MI
Mount	MT
North	N
Northbound	NBND
Overflow	OVFLW
Pedestrian	PED
Railroad	RR
Ramp	R
Reservoir	RES
River	RVR
Road	RD
Roadway	RDWY
Route	RT
Saint	ST
Service Road	SR
South	S
Southbound	SBND
Street	ST
United States	US
Route	RTE
West	W
Westbound	WBND
First	1st
Second	2nd

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Abbreviations

Railroad Companies:

Atchison, Topeka and Santa Fe	AT&SF
Burlington Northern	BN
Colorado and Southern	C&S
Denver and Rio Grande Western	D&RGW
Great Western	GW
Missouri Pacific	MP
Chicago, Rock Island and Pacific	CR&P
Union Pacific	UP

COLORADO DEPARTMENT OF TRANSPORTATION STAFF BRIDGE BRIDGE DETAIL MANUAL	Chapter: Appendices Effective: January 2, 2009 Supersedes: NEW
APPENDIX A - Abbreviations & Acronyms	

A(1) ABBREVIATIONS & ACRONYMS

The use of abbreviations and acronyms is generally discouraged unless required due to time or space limitations. If more than one abbreviation is shown, the first abbreviation is currently preferred although the others are acceptable and have been used in the past. This list may not be inclusive. Where special abbreviations are used, a descriptive tabulation may be necessary and is allowed in the plan drawings. See the Field Log of Structures for Structure Type abbreviations.

Abbreviation or Acronym	Meaning
Symbols	
@	at
&	and
[	channel (steel)
⌀	Diameter
#	pound or number
3R	Resurfacing, Restoration, Rehabilitation
8UN	8 thread series (screw thread)
Ⓔ	Epoxy Coated Rebar
Ⓝ	Non-Epoxy Coated Rebar
A	
&	and
@	at
AADT	Annual Average Daily Traffic
AAN	American Association of Nurserymen
AAR	Association of American Railroads (functions of the Communications and Signal Division merged into AREMA)
AASHO	American Association of State Highway Officials (defunct 1973, now known as AASHTO)
AASHTO	American Association of State Highway and Transportation Officials
ABS	Acrylonitrite-Butadiene-Styrene Pipe
Abt.	About
Abut.	Abutment
ACI	American Concrete Institute
ACM	Abestos Containing Materials
ADA	Americans with Disabilities Act
ADJ.	Adjust
ADT	Average Daily Traffic
AESC	American Engineering Standards Committee (defunct, now known as ANSI)
AGA	American Gas Association
AGC	Associated General Contractors of America
AH, A.H., Ah.	Ahead
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
Alt.	Alternate
ANSI	American National Standards Institute, Inc. (formerly USASI, ASA and AESC)
API	American Petroleum Institute
APL	Approved Products List

Abbreviation or Acronym	Meaning
ARBBA	American Railway Bridge and Building Assocation (merged into AREMA)
Approx.	Approximate
APWA	American Public Works Association
AQCC	Air Quality Control Commission
AGCM	Air Quality Congestion Mitigation
ARA	American Railway Association (merged into Association of American Railroads)
AREA	American Railway Engineering Association (merged into AREMA)
AREMA	American Railway Engineering & Maintenance-of-Way Association
ARTBA	American Road and Transportation Builders Association
AS, A.S.	Ahead Station
ASA	American Standards Association (defunct, now known as ANSI)
ASBI	American Segmental Bridge Institute
ASCE	American Society of Civil Engineers
ASD	Allowable Stress Design
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering, American Society of Safety Engineers
Asst.	Assistant
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AUTS	Actual Ultimate Tensile Strength
Ave.	Avenue
AWG	American Wire Gauge
AWPA	American Wood Protection Association, formerly American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
B	
BAFO	Best and Final Offer
B to B	Back to Back
B.E.I.	By Equal Increments
B.M.	Bench mark
B.P.F.	Blows Per Foot
BT, B.T.	Beginning of Transition
B/	Bottom of
Bbl.	Barrels
BC, B.C.	Bolt Circle
Beg.	Begin
BFBW, B.F.B.W.	Back Face of Backwall
BK, B.K., Bk.	Back
Bldg.	Building
BLM	Bureau of Land Management
Blvd.	Boulevard
BMP	Best Management Practice
Bms.	Beams
BM_1	Quantities of Structure Backfill (Class 1) without Shoring
BM_2	Quantities of Structure Backfill (Class 1) with Shoring
Bott., Bot.	Bottom
BP	Maximum Required Allowable Bearing Pressure
BPO	Business Programs Office (CDOT)
BR, Br.	Bridge On-System Program, Bridge
Brg.	Bearing

Abbreviation or Acronym	Meaning
BRO	Bridge Off-System Program
BS, B.S.	Back Station
Btwn.	Between
C	
℄, CL	Centerline
[	channel (steel)
C&G	Curb and Gutter
C.R.S.	Colorado Revised Statutes, as amended. "43-1-225, C.R.S." means "§ 225, Article 1 of Title 43, C.R.S., as amended."
CAD	Computer Aided Design or Computer Aided Drafting
CADD	Computer Aided Design and Drafting
CatEx	Categorical Exclusion
CBC	Concrete Box Culvert
CCA	Colorado Contractors Association
CCI	Construction Cost Index
CCR	Code of Colorado Regulations, as amended
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CE	Construction Engineering
CF, Cu. Ft.	Cubic Feet
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CFS, C.F.S.	Cubic Feet per second
CG, C.G.	Center of Gravity
CHP	Colorado Highway Patrol
CI, C.I.	Cast Iron
CIOG, C.I.O.G.	Cast Iron Ogee (Washer)
CIP, C.I.P.	Cast-in-Place, Cost in Place
CL., Clr.	Clear
CM, C.M.	Corrugated Metal
CMAQ	Congestion Mitigation Air Quality
CMO	Contract Modification Order
CMP, C.M.P.	Corrugated Metal Pipe
CMS	Changeable Message Sign
CMU	Concrete Masonry Unit
COFRS	Colorado Financial Reporting System
Col.	Column
Comp.	Composite
Con.	Connection
Conc.	Concrete
Conn.	Connections
Const.	Construction
Const. Jt.	Construction Joint
Cont.	Continuous
Corr.	Corrugated
Cov.	Cover
CP	Colorado Procedure
CPE	Corrugated Polyethylene Pipe
CP-L	Colorado Procedure - Laboratory
CPM	Critical Path Method
CPT	Corrugated Polyethylene Tubing
CRS	Colorado Revised Statutes, 1973, as amended
CRSI	Concrete Reinforcing Steel Institute
CS, C.S.	Curve to Spiral, Commercial Standard
Csk.	Countersunk
CSL	Cross Sonic Log
CSP	Corrugated Steel Pipe
CTR	Certified Test Reports

Abbreviation or Acronym	Meaning
Ctr.	Center
CY, Cu. Yd., c.y.	Cubic Yards
D	
D	Degree of Curvature, Depth, Density, Distance, Diameter
D/B	Design Build
DAS, D.A.S.	Deformed Anchor Stud
DI, D.I.	Ductile Iron
dB	decibels
DBE	Disadvantaged Business Enterprise
Dbl.	Double
Deg., °	Degrees (Angular)
Deg., °F., °C.,	Degrees (Thermal) - Degrees Fahrenheit, Degrees Celsius
Dept.	Department
DGN, Dgn.	Design, Microstation Drawing
DH	Design Height (or, Avg. height for qty. calculations)
DHV	Design Hour Volume
DHW	Design High Water
Dia., ℄, ∅	Diameter
Dist.	District
Div.	Division
DNR	Department of Natural Resources
DOR	Design Office Review
DOW	Division of Wildlife (Colorado)
DPA	Department of Personnel & Administration
DRCOG	Denver Regional Council of Governments
DS, D.S.	Down Station
DSR	Design Scoping Review
DTD	Division of Transportation Development (CDOT)
DTM	Digital Terrain Model
Dwg.	Drawing, Sheet
E	
℄	Epoxy Coated Rebar
E to E	End to End
E/A	Engineer and/or Architect
EA	Environmental Assessment
Ea., EA	Each
EB, E.B.	Eastbound
EEO	Equal Employment Opportunity
EF, E.F.	Each Face
EIA	Electronic Industries Alliance (formerly Electronic Industries Association)
EIS	Environmental Impact Statement
El., EL, Elev.	Elevation
Elast.	Elastomeric
Elect. Cond.	Electrical Conduit
EM_1	Quantity of Structure Excavation without Shoring
EM_2	Quantity of Structure Excavation with Shoring
Engr.	Engineer
EPA	Environmental Protection Agency
EPDM	Eethylene Propylene Ddiene Monomer-class rubber
Eq.	Equal
ESAL	Equivalent Single Axle Load
ESB	Emerging Small Business
Est.	Estimate
ET, E.T.	Ending of Transition

Abbreviation or Acronym	Meaning
Ex, E	Expansion Bearing
Ex.	Example, Except
Exc., Excav.	Excavation
Exist.	Existing
Exp	Non-guided (free floating) expansion bearing
Exp. Jt.	Expansion Joint
Expn., Exp'n	Expansion
Ext.	Exterior
F	
FAA	Federal Aviation Administration
FAPG	Federal Aid Policy Guide
F to F	Face to Face
F.A.P., FAP	Federal Aid Project
FF, F.F.	Far Face, Front Face
FIPI	Finding-in-the-Public-Interest
F.L.	Flow Line
fpm, F.P.M.	Feet Per Minute
Fps, F.P.S., FPS	Feet Per Second
FS, F.S.	Planned Finish Surface
Fdn.	Foundation
FCM	Fracture Critical Member
Fed.	Federal
FEMA	Federal Emergency Management Agency
FES	Flared End Section
FFBW, F.F.B.W.	Front Face of Backwall
FHWA	Federal Highway Administration
Fig.	Figure
Fin.	Finished
FIPI	Finding-in-the-Public-Interest
FIR	Field Inspection Review
Fl.	Floor
Flg.	Flange
FM	Factory Mutual
FMV	Fair Market Value
FONSI	Finding of No Significant Impact
FOR	Final Office Review
FRA	Federal Railroad Administration
Freq.	Frequency
FRP	Fiber Reinforced Polymer
FSS	Federal Specifications and Standards
Ft. Kip.	Foot Kips
Ft. Lb., FT LB	Foot Pounds
FT, Ft., ft	Feet
FTA	Federal Transit Administration
Ftg.	Footing
FTP	File Transfer Protocol
Fut.	Future
Fx, F	Fixed Bearing
G	
Ga.	Gage, Gauge
Gal.	Gallons
Galv.	Galvanized
Gd	Guided expansion bearing
GEIA	Government Electronics and Information Technology Group (ITAA)
Gird.	Girder
GIP	Galvanized Iron Pipe
GIS	Geographical Information System
GPM	Gallons Per Minute

Abbreviation or Acronym	Meaning
GRS	Geosynthetic Reinforced Soil
GUTS	Guaranteed Ultimate Tensile Strength (replaced by AUTS & MUTS)
H	
H	Depth of Excavation at Wall Layout Line
HAS, H.A.S.	Headed Anchor Stud
HAZMAT	Hazardous Materials
HBP	Hot Bituminous Pavement
HC	Horizontal Clearance
HCL, H.C.L.	Horizontal Control Line
HCM	Highway Capacity Manual
HD, Hd.	Head
HDPE	High Density Polyethylene
HDPP	High Density Polypropylene
HES	Hazard Elimination System
Hex. Hd.	Hexagonal Head
HID	High Intensity Discharge (Lamps)
HLMR	Highload Multi-Rotational
HMA	Hot Mix Asphalt
Horz., Horiz., Hor.	Horizontal
HOV	High-Occupancy Vehicle
HP	H pile
HP	Horsepower
HS Bolt, H.S. Bolt	High Strength Bolt
HS, H.S.	High Strength
Ht.	Height
HTF	Highway Trust Fund (Federal)
HUTF	Highway Users Tax Fund (State)
HW, H.W.	High Water
Hwy.	Highway
Hyd.	Hydraulic
Hyd.	Hydraulic
I	
I	I beam or Wide Flange section (steel), Interstate
ICEA	Insulated Cable Engineers Association, formerly IPCEA
ID, I.D.	Inside Diameter
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IGA	Inter-Governmental Agreement
IMP	Incident Management Plan
IMSA	International Municipal Signal Association
Incl., Inc.	Included
In. Kips	Inch Kips
In. Lb.	Inch Pounds
In., IN	Inches
Insp.	Inspector
Int.	Interior
Inv.	Invert
IP	Iron Pipe
IPCEA	Insulated Power Cable Engineers Association (defunct, currently known as ICEA)
IRI	International Roughness Index
IRIS	Inventory Road Information System
ISA	Initial Site Assessment
ISO	International Organization for Standards
ISP	Information or Internet Service Provider
ISTEA	Intermodal Surface Transporation Efficiency Act
ITAA	Information Technology Association of America
ITE	Institute of Transportation Engineers

Abbreviation or Acronym	Meaning
ITS	Intelligent Transportation System
IVHS	Intelligent Vehicle Highway System
J	
J, JB	Junction Box
JBC	Joint Budget Committee
Jct.	Junction
Jt., jt.	Joint
K	
kips, Kip	Kilo Pounds, Thousand Pounds
ksf	kips per square foot
ksi	Kips per square inch
KW	Kilowatt
L	
L	Length
L, ∟	Angle (steel)
LS, L.S.	Lump Sum, Length of Spiral
LA	Local Agency
Lac.	Lacing
LAN	Local Area Network
LB, Lb., lb	Pounds
lb./ft.	pound per foot
Lb/sy	Pounds per square yard
lb-ft.	pound foot
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LFD	Load Factor Design
LF, Lin. Ft.	Linear Feet
LRFD	Load and Resistance Factor Design
Lt.	Left
LTDS	Required Long Term Design Strength
Lum.	Luminaire
M	
M	Mass
Maint.	Maintenance
MARV	Minimum Average Roll Value
Matl.	Material
Max., max.	Maximum
MBTA	Migratory Bird Treaty Act
MCR	Minor Contract Revision
MD	Machine Direction
MFBM, M.F.B.M.	Thousand Foot Board Measure
Mfg.	Manufactured, Manufacturer
MHT	Method of Handling Traffic
Mi.	Mile
MIL	Military Specification
Min., min.	Minimum
Misc.	Miscellaneous
MMIS	Maintenance Management Information System
MMP	Materials Management Plan
MMS	Maintenance Management System
MOA	Memorandum of Agreement
Mobl.	Mobilization
MOT	Maintenance of Traffic
MOU	Memorandum of Understanding
MP, M.P.	Milepost
MPH	Miles Per Hour
MPH, M.P.H.	Miles Per Hour
MPO	Metropolitan Planning Organization

Abbreviation or Acronym	Meaning
MRS	Quantity of Mechanical Reinforcement for precribed Soil zone
MSE	Mechanically Stabilized Earth
MSEW	Mechanically Stabilized Earth Wall
MSS	Manufacturers Standardization Society of the Valve and Fitting Industry
MTIP	Materials Testing and Inspection Plan
MUTCD	Manual on Uniform Traffic Control Devices
MUTS	Minimum Ultimate Tensile Strength
N	
(N)	Non-Epoxy Coated Rebar
NAD	North American Datum
NAVD	North American Vertical Datum
NB, N.B.	Northbound, Total Number of Blocks
NBIS	National Bridge Inspection Standards
NBS	National Bureau of Standards
NC	Uniform National Coarse (screw thread)
NCHRP	National Cooperative Highway Research Program
NCR	Nonconformance Report
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NF, N.F.	Near Face, Uniform National Fine (screw thread)
NFPA	National Fire Protection Association
NFRT&AQPC	North Front Range Transportation & Air Quality Planning Council
NGS	National Geodetic Survey
NGVD	National Geodetic Vertical Datum of 1929
NHI	National Highway Institute
NHS	National Highway System
NIC, N.I.C.	Not in Contract
NIP, N.I.P.	Nail in Place
NIST	National Institute of Standards and Technology
No.	Number
Nom.	Nominal
NPDES	National Pollutant Discharge Elimination System
NPT	National Pipe Thread
NS, N.S.	Near Side
NSF	NSF International, formerly National Sanitation Foundation
NTCIP	National Transportation Communications for ITS Protocol
NTP	Notice to Proceed
NTS, N.T.S.	Not to Scale
NWN	Nonconforming Work Notice
O	
OC, O.C.	On Center
OD, O.D.	Outside Diameter
OG, O.G.	Original Ground
OFMB	Office of Financial Management and Budget
OJT	On-the-Job Trainee or On-the-Job Training
Opp. Hand	Opposite Hand
OSHA	Occupational Health and Safety Administration
Oz.	Ounces

Abbreviation or Acronym	Meaning
P	
#	pound or number
PGL, P.G.L.	Profile Grade Line
POC, P.O.C.	Point on Curve
POT, P.O.T.	Point on Tangent
PS, P.S.	Planned Subgrade
PS&E, P.S.& E.	Plans, Specification and Estimate
PACOG	Pueblo Area Council of Governments
PC, P.C.	Point of Curve
PCA	Portland Cement Association
PCC, P.C.C.	Point of Compound Curve
PCCP	Portland Concrete Cement Pavement
PCI	Precast/Prestressed Concrete Institute
PCO	Potential Change Order
PCP	Product Control Plan
PD	Procedural or Policy Directive
PDA	Pile Driving Analyzer
PE	Preliminary Engineering, Professional Engineer, Permanent Easement
PG	Profile Grade, Performance Grade
PGL	Profile Grade Line
PI, P.I.	Point of Intersection
PIP	Public Information Plan
PL, PL., Pl.	Plate
PLS	Professional Land Surveyor
PM	Project Manager
PPACG	Pikes Peak Area Council of Governments
PPE	Personal Protective Equipment
PPPP	Project Priority Programming Process
PRC, P.R.C.	Point of Reverse Curve
Prin.	Principle
Proj.	Project, Projection
ProMIS	Project Management Information System
Prov.	Provisions
PSC	Prestressed Concrete
PS&E	Plans, Specifications and Estimate
psf	pounds per square foot
PSI	Preliminary Site Investigation
psi, P.S.I.	Pounds per square inch
PSIG	Pounds Per Square Inch Gauge
PT, P.T.	Point of Tangent
PTFE	Polytetrafluoroethylene
PTI	Post-Tensioning Institute
PUC	Public Utilities Commission
PVC	Poly Vinyl Chloride (pipe), Point of Vertical Curve
PVI	Point of Vertical Intersection
Pvmt.	Pavement
PVT	Point of Vertical Tangency
Q	
Q	Peak Discharge or Flow Volume
QA	Quality Assurance
QC	Quality Control
R	
R, R., Rad.	Radius
RC, R.C.	Reinforced Concrete, Reverse Crown
RCO	Request for Change Order
RCP, R.C.P.	Reinforced Concrete Pipe, Request for Change Proposal
ROW, R.O.W., R/W, RW	Right of Way

Abbreviation or Acronym	Meaning
rad	radians
RCRA	Resource Conservation and Recovery Act
Rdwy.	Roadway
RE	Resident Engineer, Railroad Easement
Ref.	Reference
Reinf.	Reinforcing
Rem.	Remove, Removal
Repl.	Replace
Req., Req'd, Reqd.	Required
Rev.	Revised
RFC	Released for Construction
RFP	Request for Proposals
RFQ	Request for Qualifications
RHM	Recognized Hazardous Materials
RL	Reinforcement Length
RME	Region Materials Engineer
RMWA	Roadmasters and Maintenance of Way Association (merged into AREMA)
ROD	Record of Decision
RPC	Region Planning Commission
RPM, rpm	Revolutions Per Minute
RSC	Rigid Steel Conduit
RSS	Reinforced Soil Slope
Rt.	Right
RTD	Region Transportation Director
RWIS	Road Weather Information System
S	
S	Tributary reinforcement spacing for MSE walls
SB, S.B.	Southbound
SCS, S.C.S	Spiral Curve Spiral
SAE	Society of Automotive Engineers
San.	Sanitary
SAP	Sample Analysis Plan
SBA	Small Business Administration
SC, S.C.	Spiral to Curve
Sch.	Schedule
SDI	Steel Decks Institute or Steel Door Institute
Sec.	Section
SF, Sq. Ft.	Square Feet
Shldr.	Shoulder
SHPO	State Historic Preservation Office
Sht.	Sheet
SIA, SI&A	Structural Inventory & Appraisal
SIC	Standard Industrial Code
Sim.	Similar
SIP, S.I.P.	Stay in Place
SJI	Steel Joists Institute
SLWK., Sdwk	Sidewalk
SMA	Stone Matrix Asphalt
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMP	Safety Management Plan
SMSE	Shored Mechanically Stabilized Earth
SOQ	Statement of Qualification
Spa.	Spaces or Spaced
Specs.	Specifications
Spl.	Splice
Sq. In.	Square Inches
Sq. Mi.	Square Miles
SRW	Segmental Retaining Walls

Abbreviation or Acronym	Meaning
SSPC	Society for Protective Coatings, formerly Steel Structures Painting Council
ST, S.T.	Spiral to Tangent
St.	Straight, Street
STA, Sta.	Station
STAC	Statewide Transportation Advisory Committee
Std.	Standard
STIP	Statewide Transportation Improvement Program
STP	Surface Transportation Program
Str.	Structure, Structural
SWMP	Stormwater Management Plan
SY, Sq. Yd.	Square Yards
Symm.	Symmetrical
T	
T&B	Top and Bottom
T&E	Threatened & Endangered Species
T.	Tons
TAS, T.A.S.	Threaded Anchor Stud
TS, T.S.	Tangent to Spiral
TC, T.C.	Tangent to Curve
TCC	Traffic Communications Center
TCP	Traffic Control Plan
TDH	Total Dynamic Head
TE	Transportation Enhancement funding
TEA-21	Transportation Efficiency Act for the 21st Century
Temp.	Temporary, Temperature
Thd.	Thread
THHN	Thermoplastic High Heat-resistant Nylon coated (Insulation designation for wire)
THWN	Thermoplastic High Water-resistant Nylon coated (Insulation designation for wire)
TIG	Tungsten Inert Gas (Welding)
TIP	Transportation Improvement Program
TOC	Traffic Operations Center
Tot.	Total
TPI	Threads per Inch
TPR	Transportation Planning Region
TRB	Transportation Research Board
Typ.	Typical
U	
8UN	8 thread series (screw thread)
UDBE	Underutilized Disadvantaged Business Enterprises
UG	Underground
UL	Underwriters Laboratories, Inc.
UMTA	Urban Mass Transportation Administration
UNC	Uniform National Coarse (screw thread)
UNCC	Utility Notification Center of Colorado
UNF	Uniform National Fine (screw thread)
UNO	Unless Noted Otherwise
UON	Unless Otherwise Noted
UPRR	Union Pacific Railroad
UPS	Uninterruptible Power Supply
US, U.S.	Upstation, United States
USACE	United States Army Corp of Engineers
USASI	United States of America Standards Institute (defunct, now known as ANSI)
USC	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture

Abbreviation or Acronym	Meaning
USDOT	U.S. Department of Transportation
USFWS	U. S. Fish and Wildlife Service
USGS	US Geological Survey
Util.	Utility, Utilities
UV	Ultraviolet
V	
VC, V.C.	Vertical Curve
VCP	Vitrified Clay Pipe
VE	Value Engineering
VECP	Value Engineering Change Proposal
Veh.	Vehicle
Vert.	Vertical
VMS	Variable Message Sign
VMT	Vehicle Miles Traveled
Vol.	Volume
W	
Wash.	Washer
WASHTO	Washington Association of State Highway and Transporation Officials
WB, W.B.	Westbound
WBS	Work Breakdown Structure
W/C	Water-Cement Ratio
WF	Wide Flange (Steel section)
WP, W.P.	Work Point
WPA	Works Projects Administration (formerly Works Progress Administration (defunct as of 1943)
WQCD	Water Quality Control Division (Colorado Department of Public Health and Environment)
WS, W.S.	Water Surface
Wt.	Weight
WWF	Welded Wire Fabric, typically referred to very light gauge wire for crack control
WWR	Welded Wire Reinforcement
WRI	Wire Reinforcement Institute
X	
XD	Cross Machine Direction
Y	
Yd.	Yard

APPENDIX 2.F: TRAFFIC SAFETY FEATURES AND RAIL TYPES

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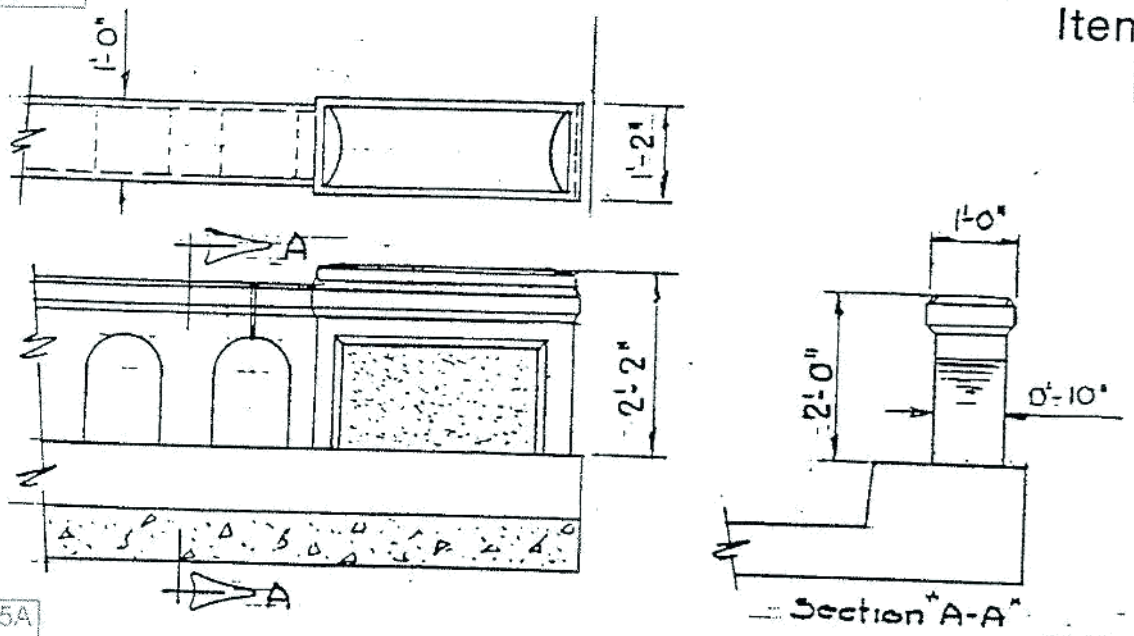
3/24/2010
M.Nord

Appendix F
Item ~~98~~

125A



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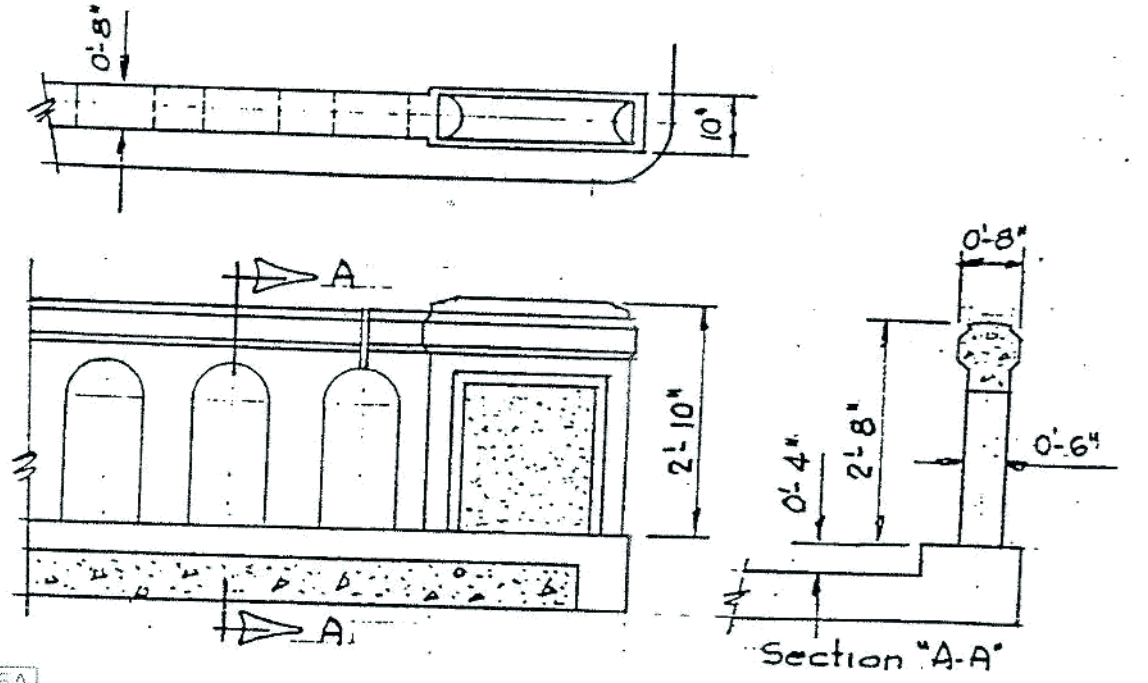

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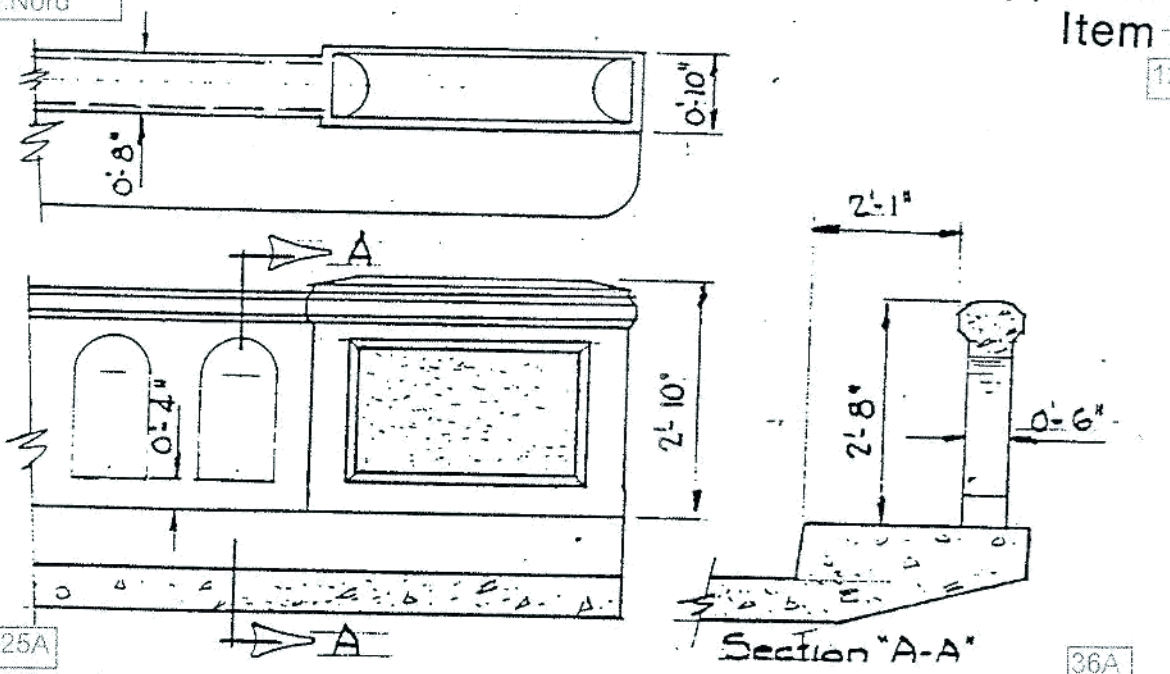
Appendix F
Item ~~98~~

125A



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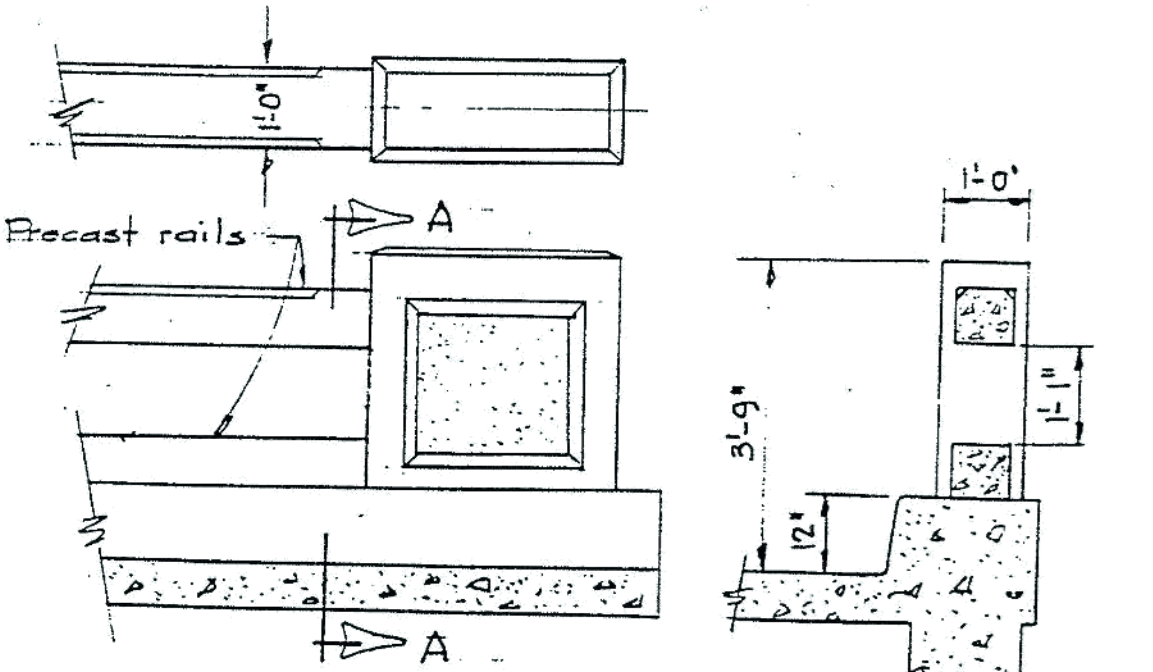

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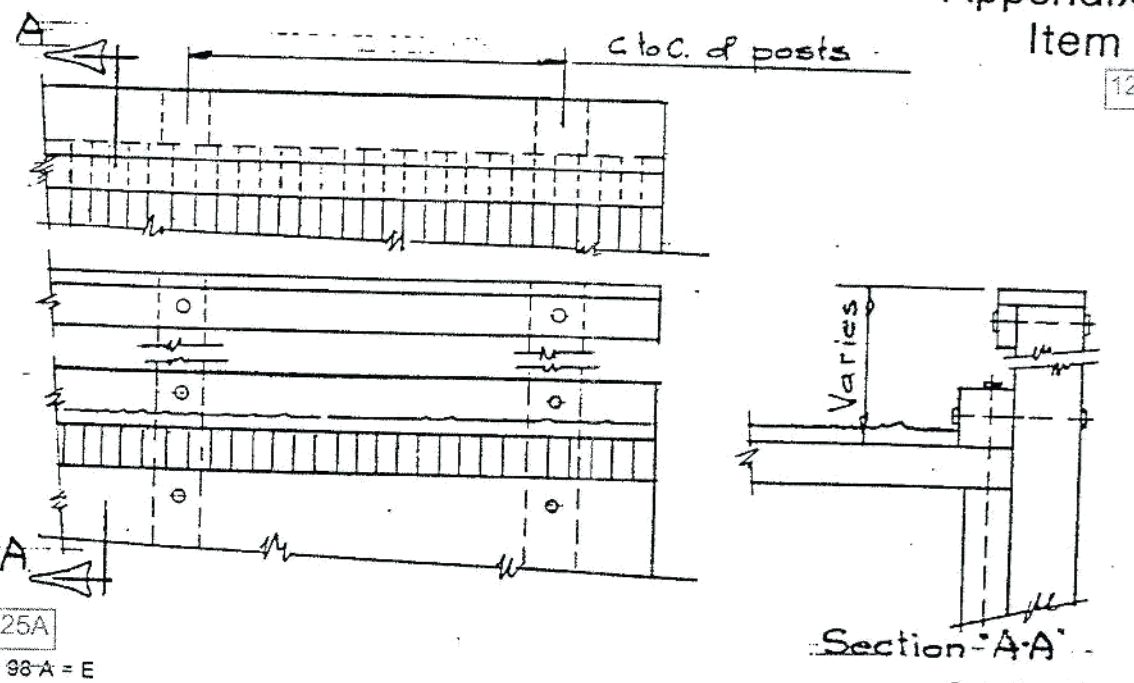
Appendix F
Item 98

125A



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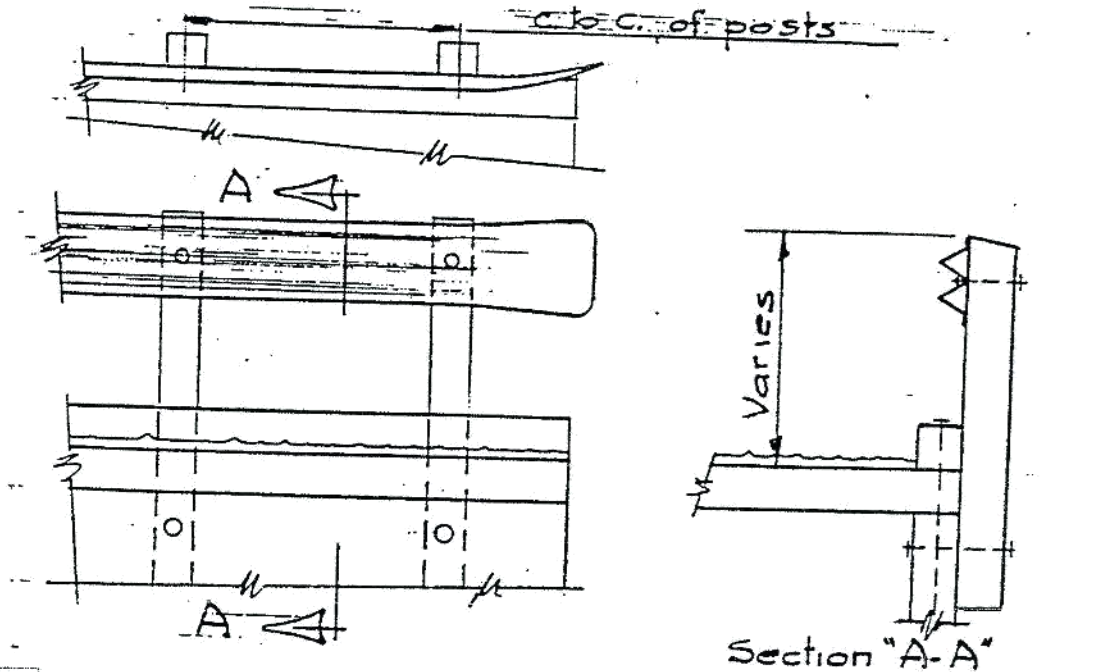

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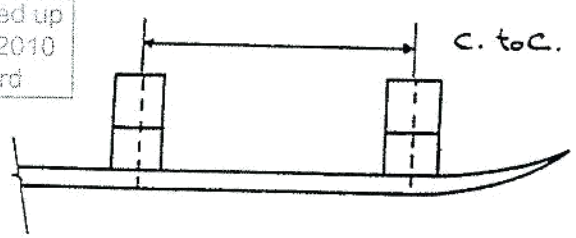

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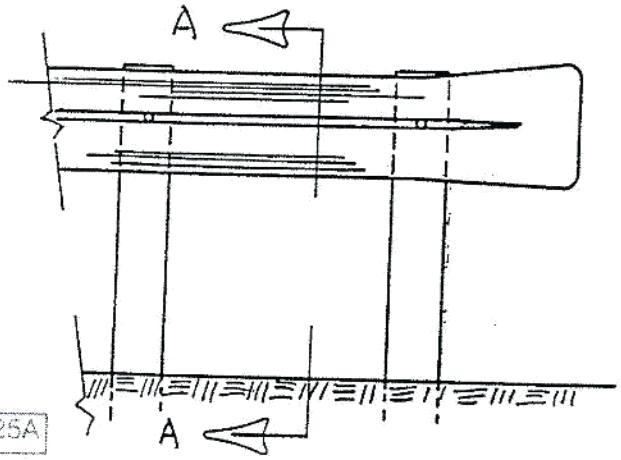

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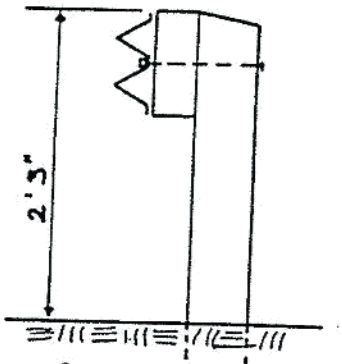

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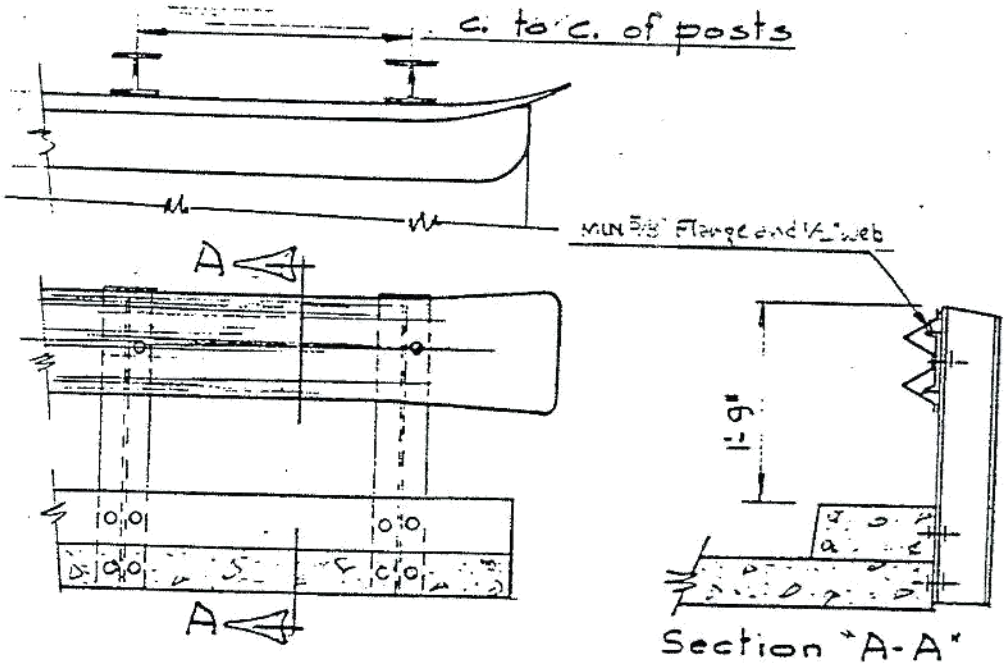

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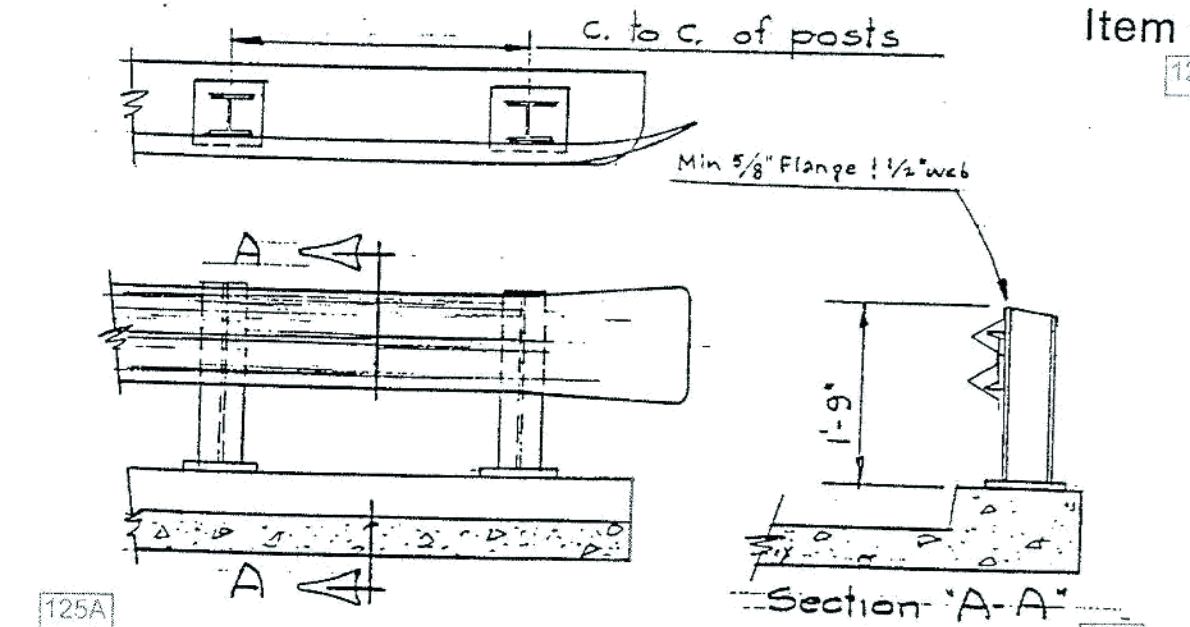
Appendix F
Item 98

125A



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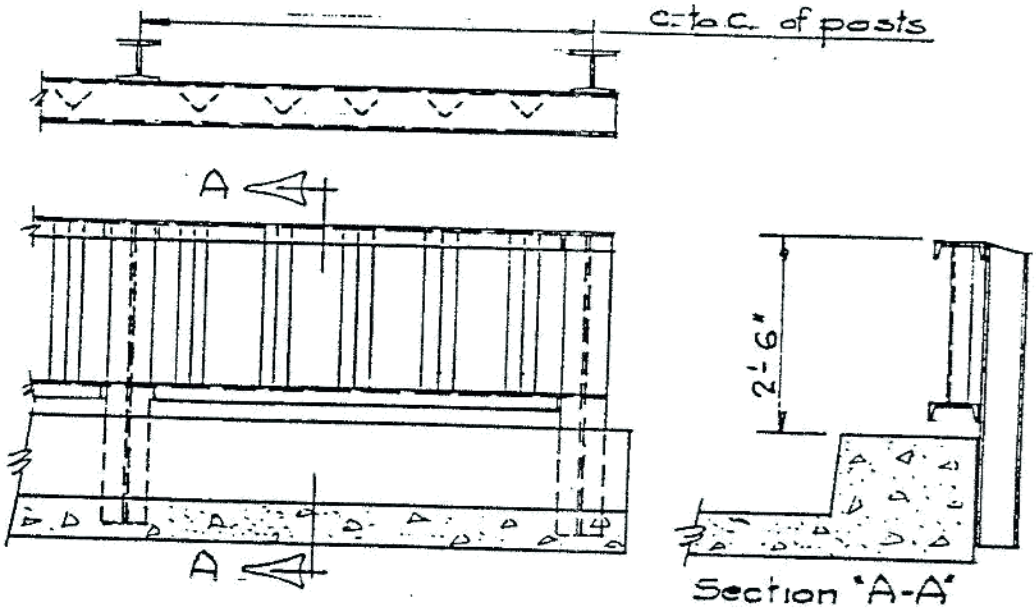

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Appendix F
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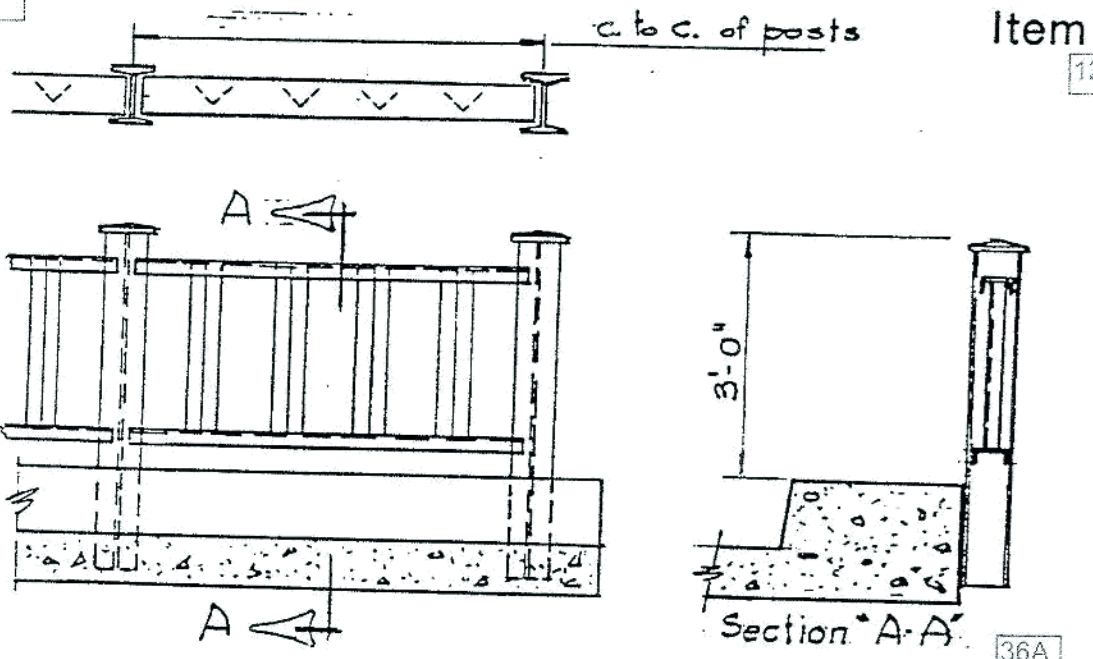
125A



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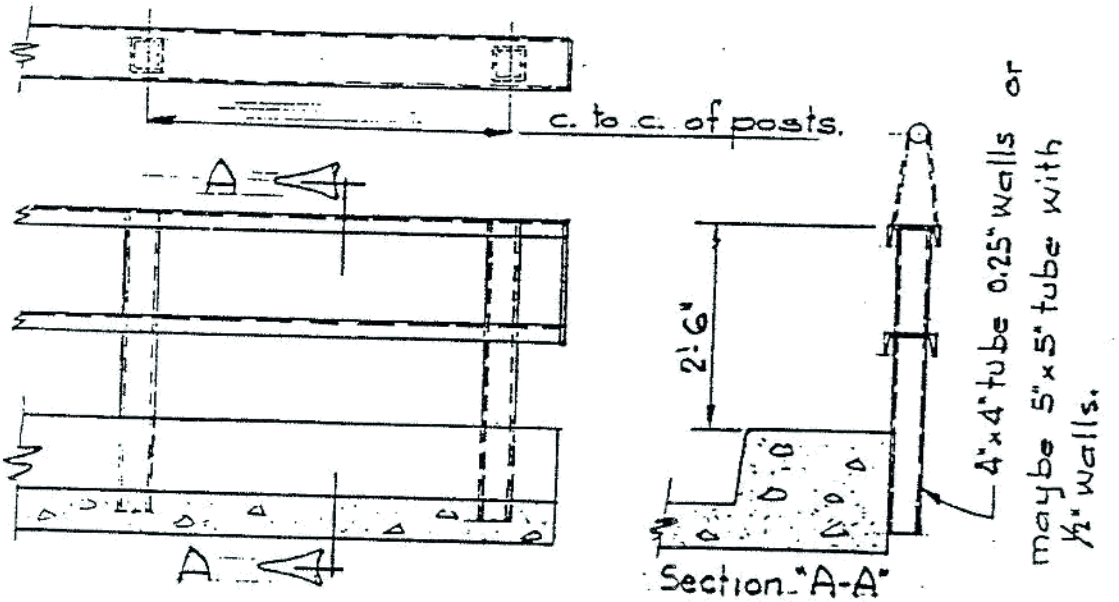

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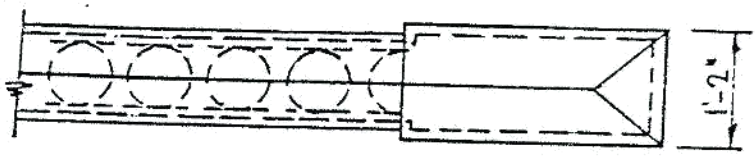
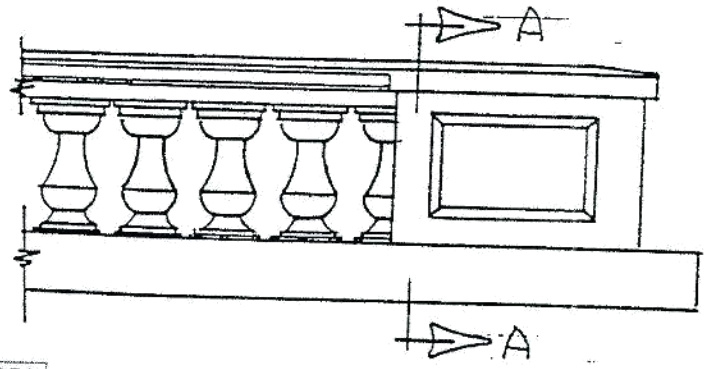
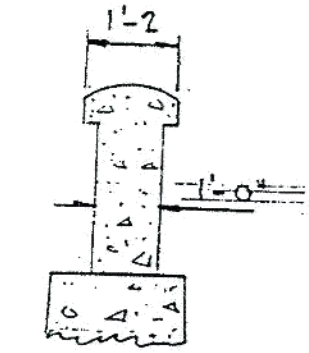
Appendix F
Item 98

125A







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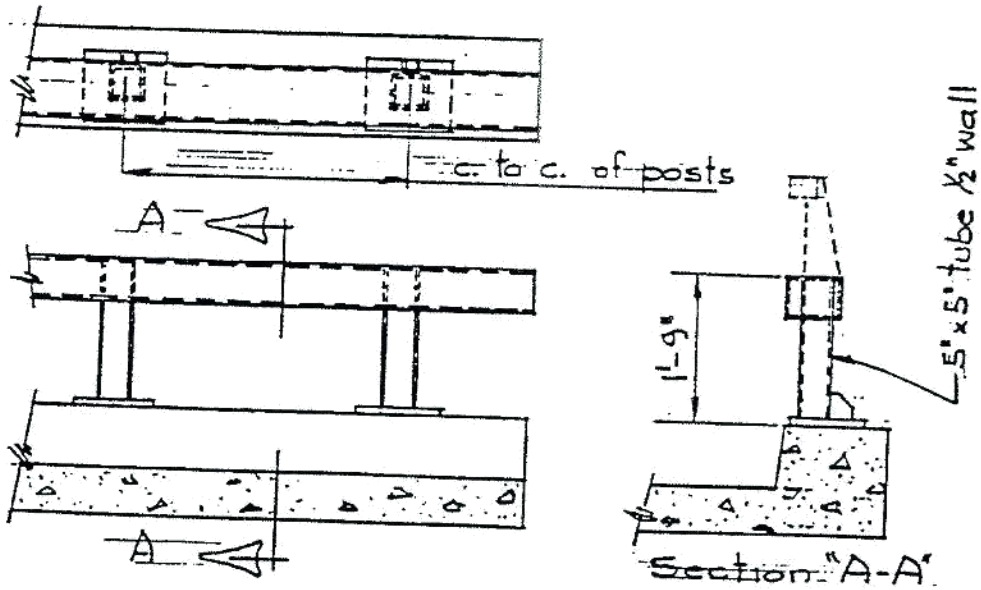

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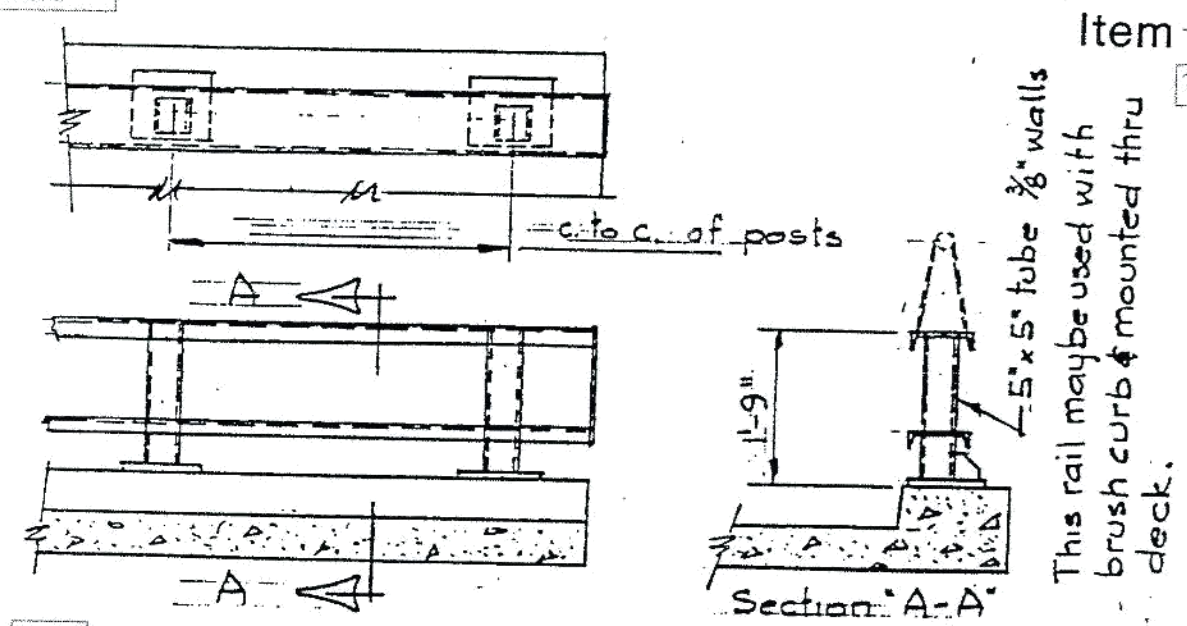

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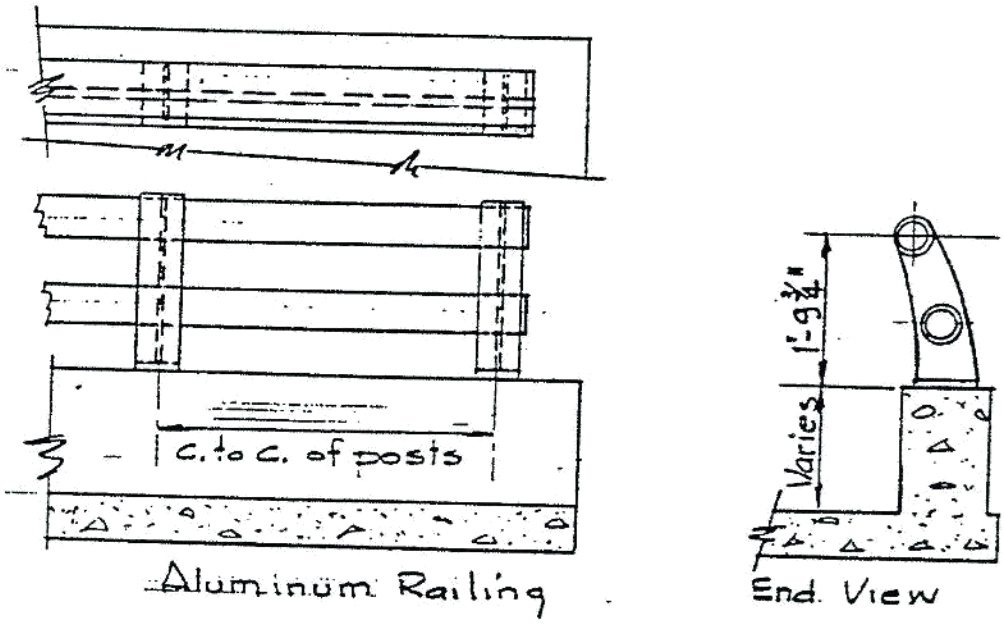

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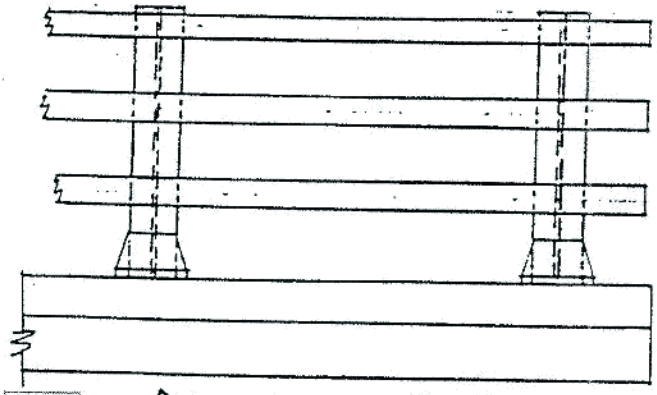

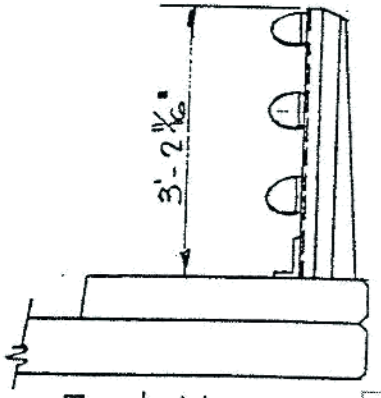

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Aluminum Railing

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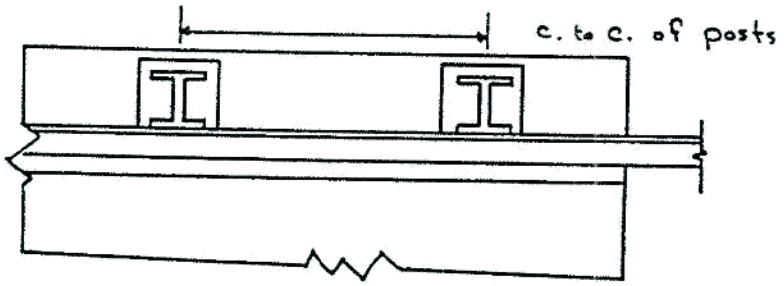

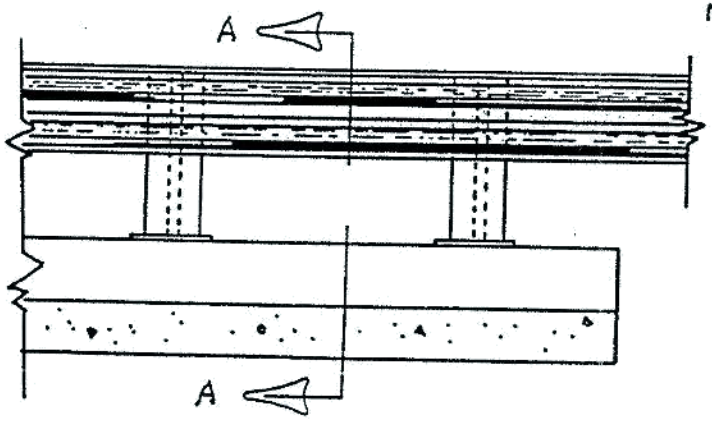

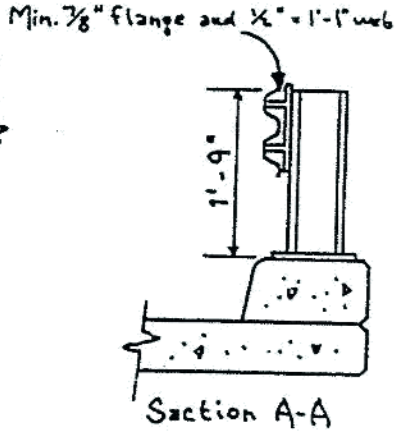

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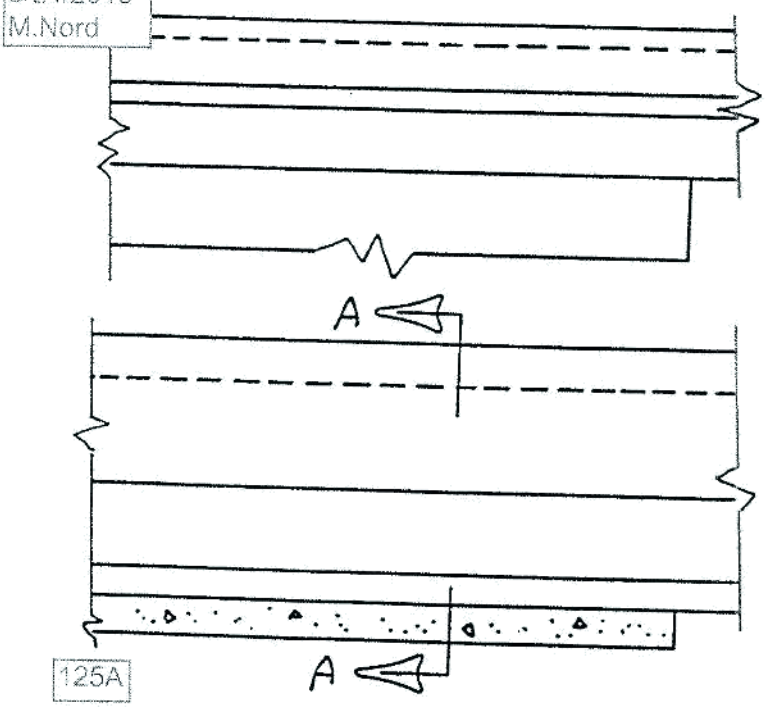

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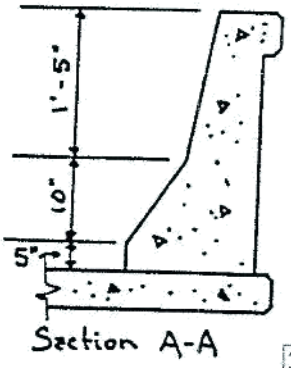

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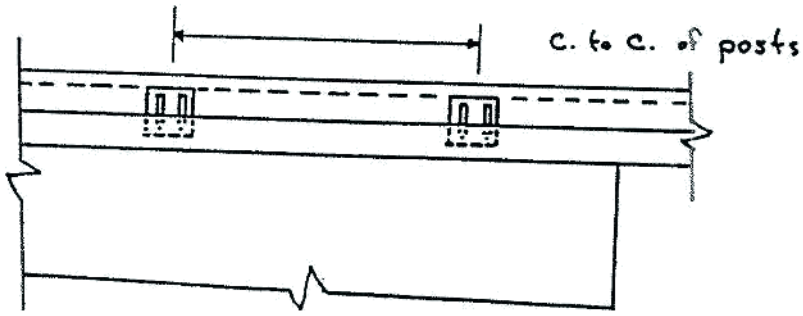

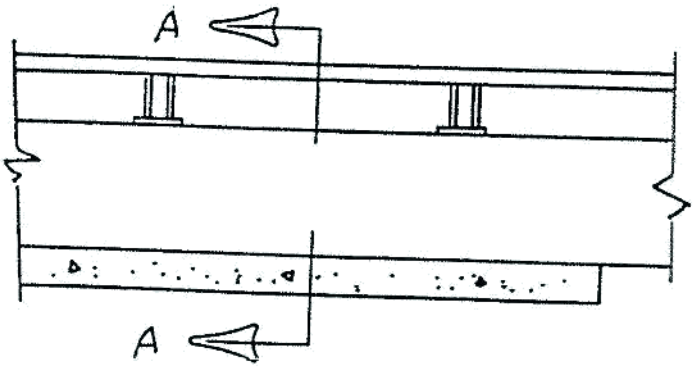

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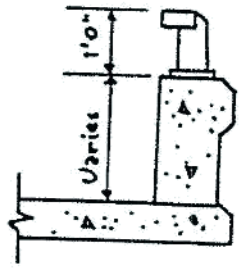

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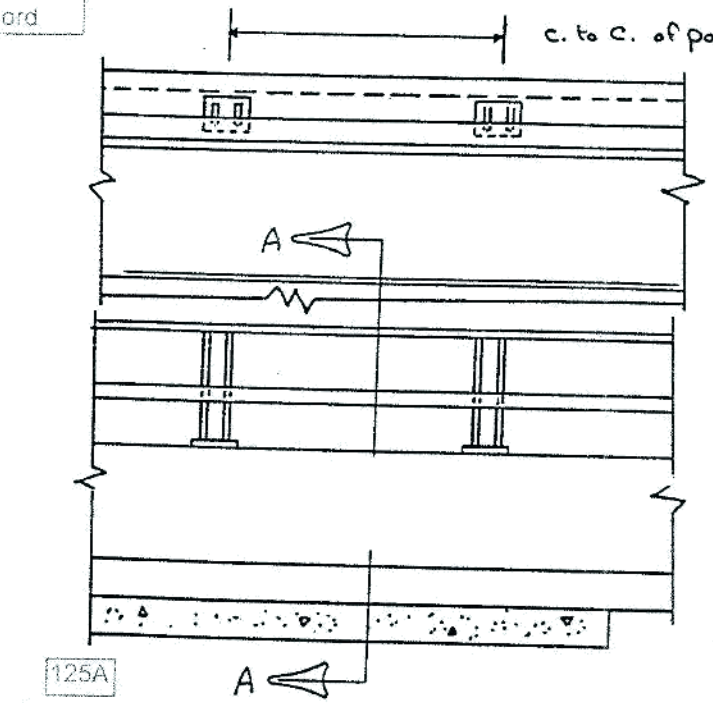

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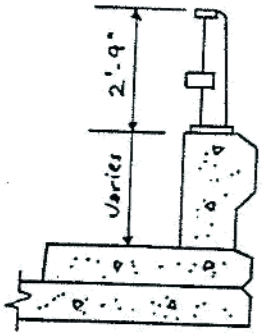

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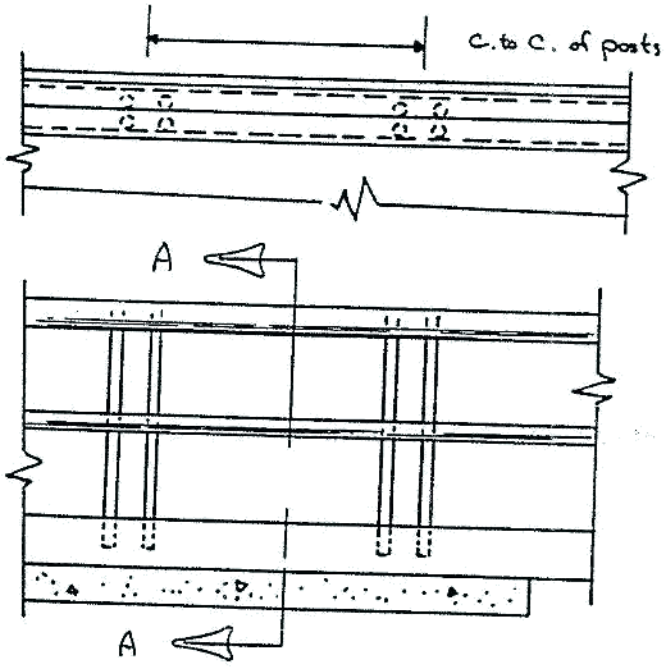

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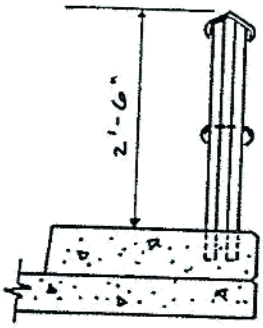

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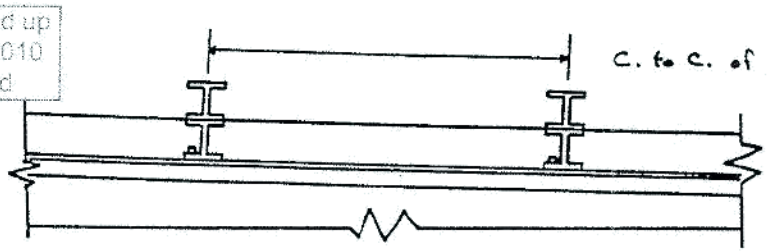

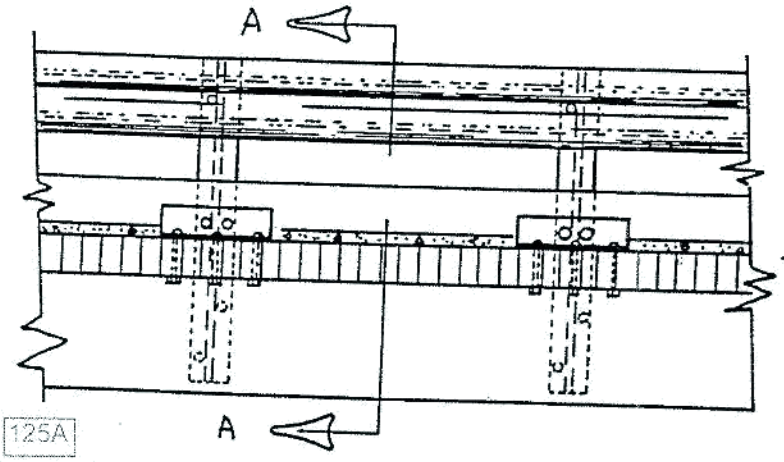

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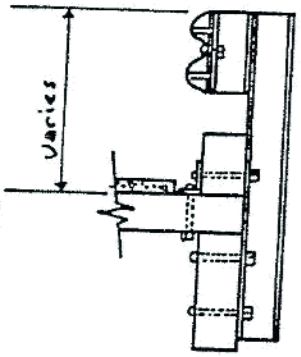

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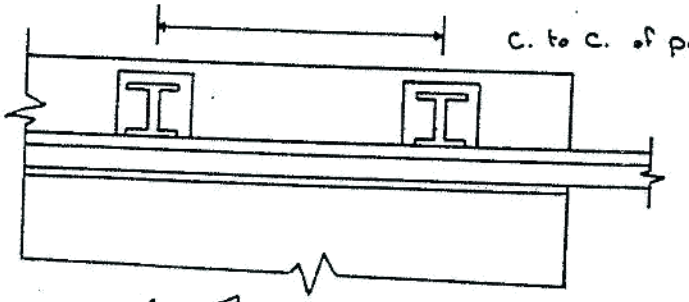

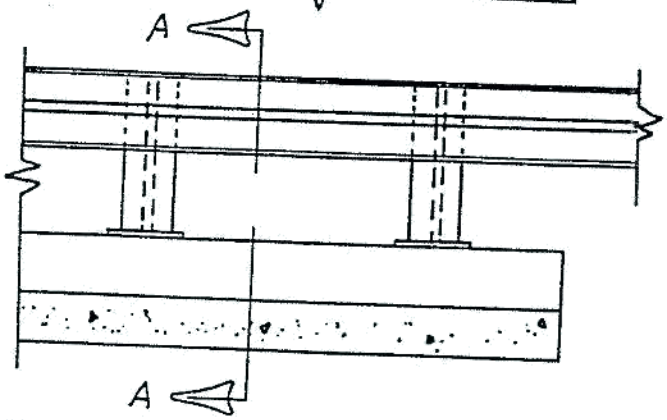

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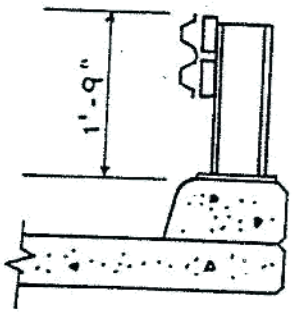

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Appendix F
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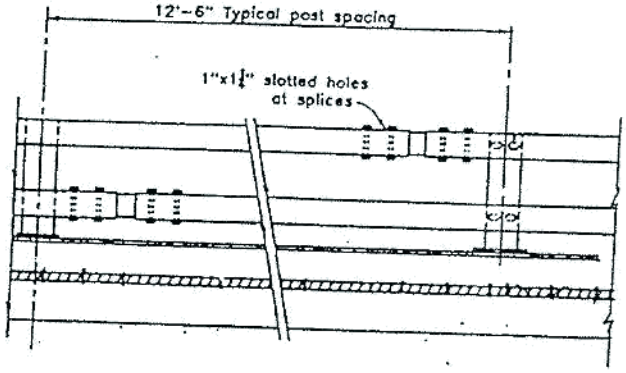

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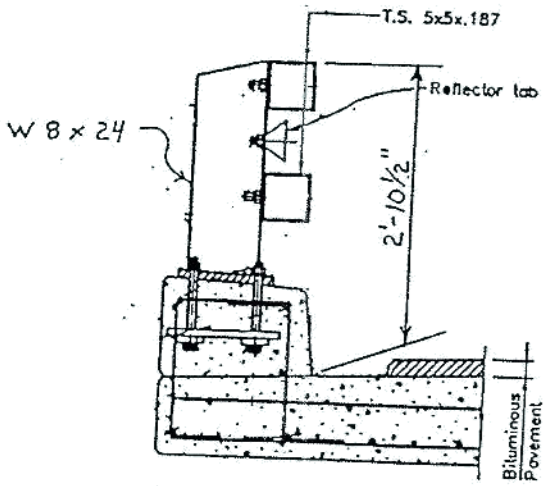

SECTION

125A
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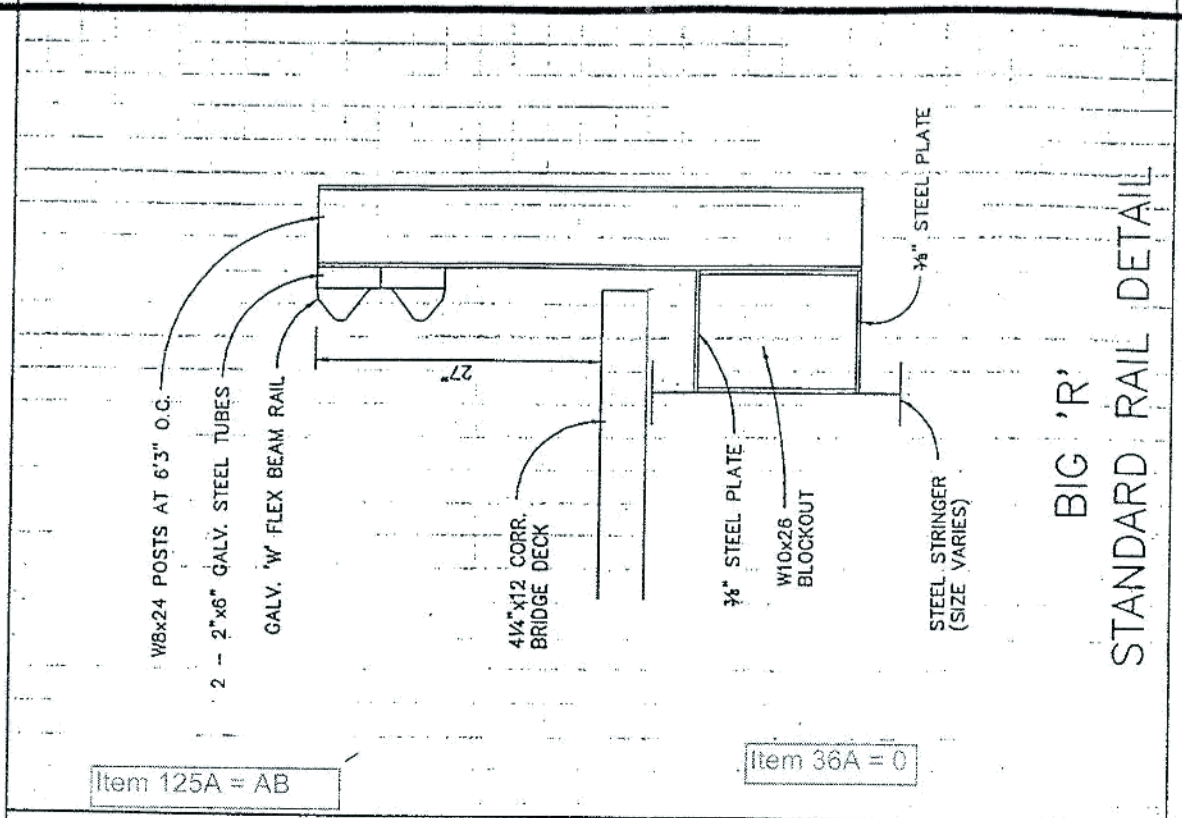

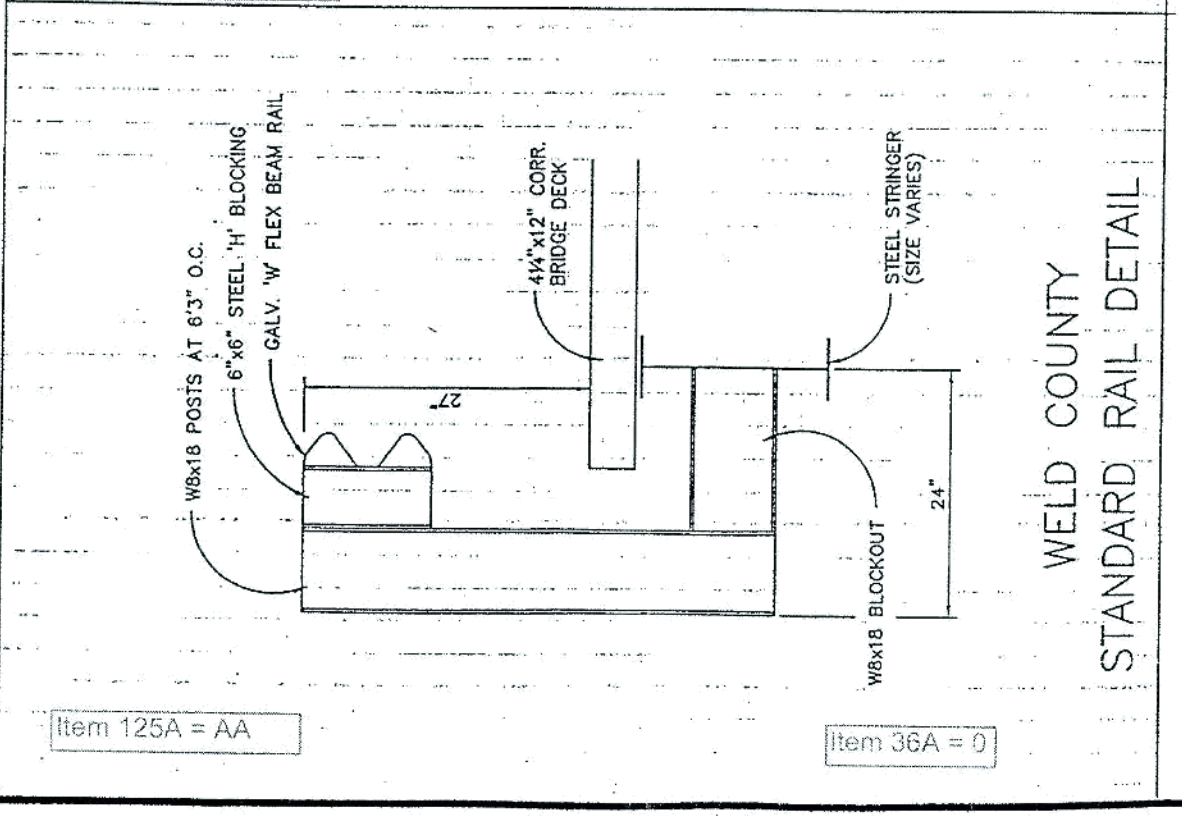

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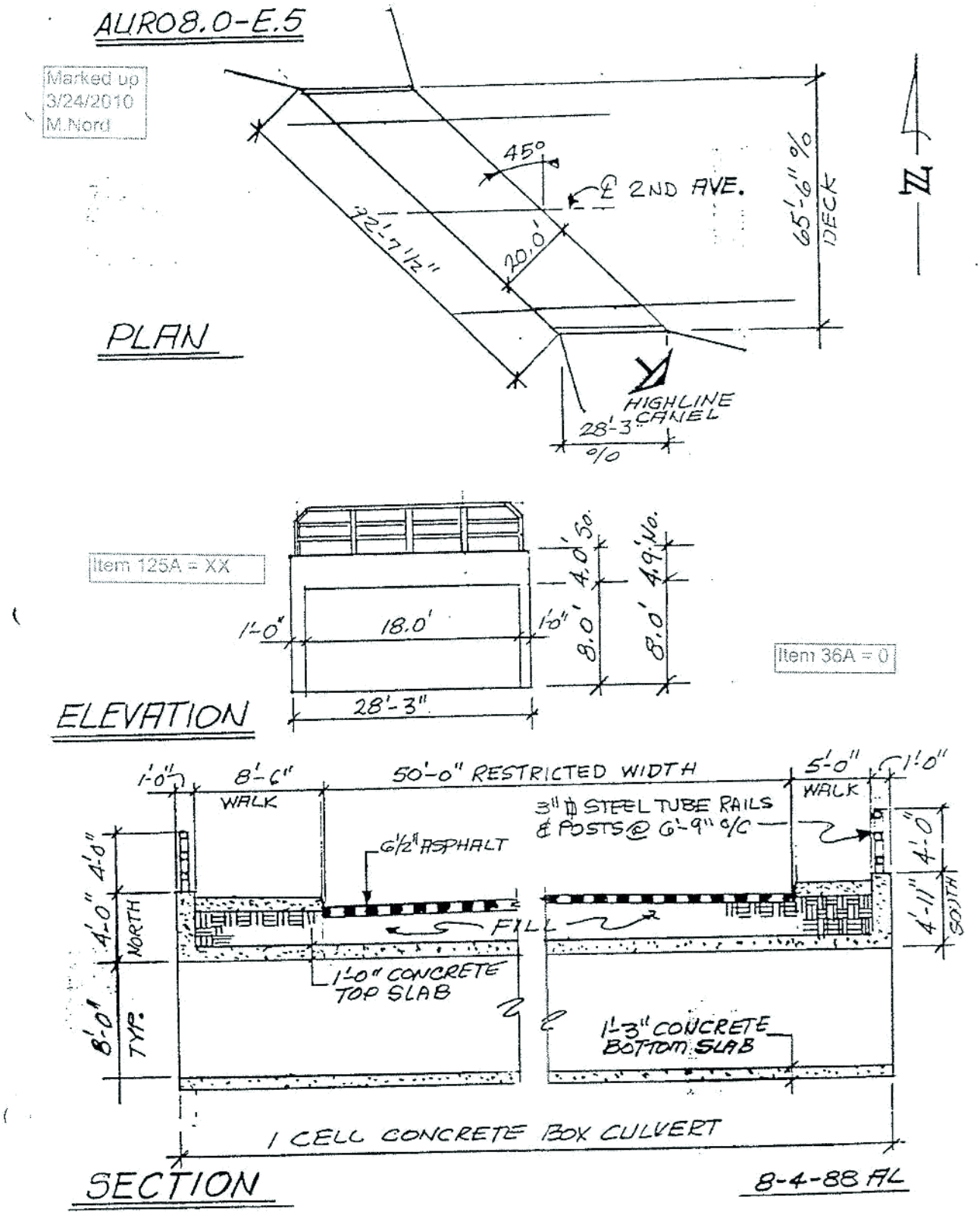
AURO8.0-E.5
Marked up
3/24/2010
M.Nord
45°
℄ 2ND AVE.
32'-7 1/2"
20.0'
65'-6" %
DECK
PLAN
HIGHLINE
CANIEL
28'-3"
%
Item 125A = XX
1'-0"
18.0'
1'-0"
4.0'
8.0'
4.9'
8.0'
28'-3"
Item 36A = 0
ELEVATION
1'-0"
8'-6"
WALK
50'-0" RESTRICTED WIDTH
5'-0"
1'-0"
WALK
3" ϕ STEEL TUBE RAILS
& POSTS @ 6'-9" C/C
6 1/2" ASPHALT
4'-0"
4'-0"
NORTH
8'-0"
TYP.
FILL
1'-0" CONCRETE
TOP SLAB
1'-3" CONCRETE
BOTTOM SLAB
4'-11"
SOUTH
1 CELL CONCRETE BOX CULVERT
SECTION
8-4-88 AL

COLORADO
Department of Transportation

RETAINING AND NOISE WALL INSPECTION AND ASSET MANAGEMENT PROGRAM

CHAPTER 3: MANUAL FOR WALL ELEMENT INSPECTION

April 2016

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3.1 Introduction

A wall element inspection consists of observations and/or measurements needed to determine the physical and functional condition of the wall elements, to identify any changes from "initial" or previously recorded conditions, and to ensure that the structure continues to satisfy present service conditions. Condition states are to be assigned to each element, as outlined in **Section 3.3**.

The concept of Elements for walls is adapted from AASHTO Commonly Recognized (CoRe) Structural Elements for bridges and is used in the BrM program. Wall Elements are subdivided into Primary and Secondary Elements.

- **Primary Elements –** Primary Elements are the main structural features of a wall, including the wall face, vertical supports, foundations, and anchors. They are subject to distress and deterioration and are the most important features rated during the wall condition assessment. These elements are denoted in **Section 3.2.1**.
- **Secondary Elements –** Secondary Elements include the attachments, appurtenances, and surrounding features that can impact the performance of the wall. They exhibit a lower degree of distress and deterioration from the Primary Element and are also rated during the wall condition assessment. Secondary Elements include coping, drainage elements, architectural facings, protective coatings, slopes and backfill, railings, and joints. These elements are denoted in **Section 3.2.2**.
- **Incidental Elements** – Some elements are considered incidental to primary or secondary wall elements and the location of these incidental elements should be noted under the general description of the parent element. If an incidental element is damaged or deteriorated, an appropriate work candidate should be created to address the issue. **Section 3.4.13** describes these elements.

3.1.1 Work Candidates

One of the primary roles of the inspector is to provide guidance on maintenance recommendations, or work candidates, that will ensure the longevity of the structure. All work candidates should include the category, type, quantity, priority, and cost of the activity recommended. In general, maintenance can be broken down into five categories; Do Nothing, Protect, Repair, Rehabilitate, or Replace. **Appendix 3.C: Materials and Feasible Action by Material Type** provides guidelines for the maintenance activities relevant to retaining and noise walls. For essential repair procedures, the inspector should reference the BRIAR Manual. All former and new known maintenance should be recorded in the inspection report, and any properly repaired, rehabilitated, or replaced elements should revert to condition state 1. The list below describes the five maintenance categories, which are shown in more detail along with relevant maintenance activities and codes in **Appendix 3.D: Work Candidate Codes**.

- **Do Nothing**. If an element is found to be in a good, fair, poor, or severe condition state, and there are no maintenance recommendations, this maintenance category should be selected.
- **Protect**. If an element is found to be in a good, fair, poor, or severe condition state, and requires protection such as paint, protective coating, or sealant, the protect maintenance category should be selected. Additionally, this maintenance category includes removing brush, trees, or poison ivy and cleaning graffiti, dirt, and debris from around critical wall elements.
- **Repair**. If an element is found to be in a fair, poor, or severe condition state and repairs are necessary this maintenance category should be selected. Repairs include epoxy injected or sealed cracks as well as tightening of any bolt less than one inch in diameter, removing signs and repairing concrete spalls.
- **Rehabilitate**. If an element is found to be in a poor or severe condition state and rehabilitation of the element is necessary, this maintenance category should be selected. This includes any type of field welding or tightening of bolts greater than or equal to one inch in diameter
- **Replace**. If an element is found to be in a severe condition state, replacement may be necessary. This maintenance category also covers the replacement of missing units such as wall facing panels or masonry blocks.

In addition to these maintenance categories, there are specific actions used to further describe the type of work that should be performed. These actions are described in **Appendix 3.D: Work Candidate Codes**.

3.1.2 Element Ratings

Inspectors should follow the same inspection procedures described in the "Manual for Bridge Element Inspection". Individual elements should be defined and total quantities calculated in the appropriate units – linear feet, square feet, or each – and the condition of the element should be determined through the field inspection and any observed defects. Quantities of the element that exhibit defects should be noted using the same units of the element with which they are associated, along with the severity of the defects which are defined in the following sections. All defects that fall into the categories defined in the following sections should be noted. However, in the case of overlapping defects, the defect with the worst condition state should be recorded in the BrM total while the defect with a better condition state should be measured and noted for maintenance recommendations. See **Figure 3.A** for an example of this concept.

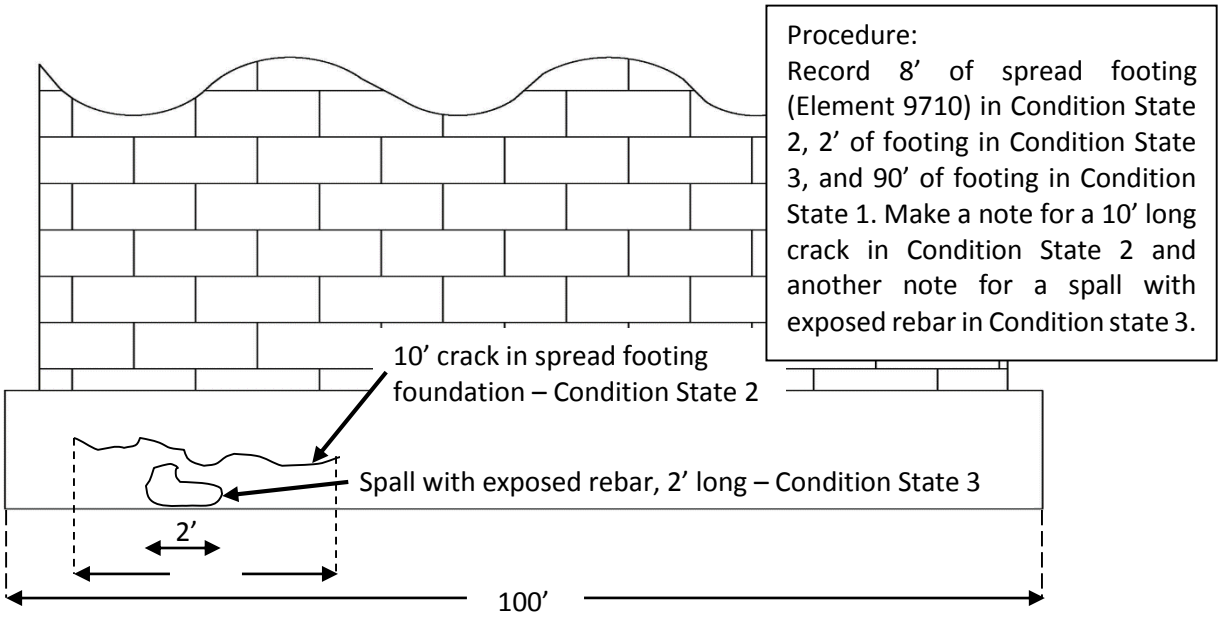


Figure 3.A: Example of Overlapping Defects

The following sections describe the primary and secondary elements found in retaining and noise walls, and the corresponding defects and condition state ratings for each material type. The defects listed within the following sections are classified into two categories – National Bridge Element (NBE) Defects, or Agency Defined Element (ADE) Defects. These classifications denote the origin of the condition state language, where the NBE Defects language originated from the "Manual for Bridge Element Inspection" and the "ADE" Defects language was developed for CDOT internal use. A map of these classifications is provided in **Appendix 3.B: Materials and Defects by Material Type**.

3.2 Element Location Matrix

This section is designed to give inspectors a quick reference guide to the defined wall elements. The matrix of elements is grouped into Primary Elements, Secondary Elements, and Incidental Elements as defined in **Section 3.1**. The elements are sorted by general type and possible material types. Click on the element number to see a description of the element.

3.2.1 Primary Elements

3.2.1.1 Wall Facing

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Wall Facing	area, ft^2	9700	9702	9703	9704	9705	9701

3.2.1.2 Foundation

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Spread Footing	lf	-	-	9710	-	-	-
Pile/Caisson	ea	9711	9712	9713	9714	-	9715
Pile/Caisson Cap	lf	9716	9717	9718	9719	-	9720

3.2.1.3 Anchors

Element	Units	Ground Anchors	Soil Nails	Micropiles	Other
Wall Anchor	ea	9725	9726	9727	9728

3.2.1.4 Vertical Supports

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Vertical Supports/ Columns	ea	9730	9732	9733	9734	9735	9731

3.2.2 Secondary Elements

3.2.2.1 Vertical Coping/Pilasters

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Vertical Coping	ea	9740	-	9742	9743	9744	9741

3.2.2.2 Horizontal Coping

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Horizontal Coping	lf	9745	-	9747	9748	9749	9746

3.2.2.3 Retained Material

Element	Units	Element Number
Retained Material	lf	9750

3.2.2.4 Joints

Element	Units	Element Number
Strip Seal Expansion Joint	ea	9760
Compression Joint Seal	ea	9761
Expansion Joint	ea	9762
Other Joint	ea	9763

3.2.2.5 Drainage Elements

Element	Units	Element Number
Weep Holes/slots	each	9770
Area Drain	each	9771
Drainage Swale	area, ft^2	9772
Other Drain	each	9773

3.2.2.6 Railings/Barriers

Element	Units	Steel	Prestressed Concrete	Reinforced Concrete	Timber	Masonry	Other
Wall Railing	lf	9780	-	9781	9782	9784	9783

3.2.2.7 Architectural Facings

Element	Units	Steel	Concrete	Timber	Masonry	Other
Architectural Facing	area, ft^2	9785	9786	9787	9789	9788

3.2.2.8 Protective Coatings and Systems

Element	Units	Element Number
Steel Protective Coating	area, ft^2	9790
Concrete and Masonry Protective Coating	area, ft^2	9791
Concrete Reinforcing Steel Protective System	area, ft^2	9792
Timber Protective System	area, ft^2	9793
Other Protective System	area, ft^2	9794

3.2.3 Incidental Elements

3.2.3.1 Incidental Elements

Element	Element Number
Sign Attachment to Wall	9342
Pole Attachment to Wall	9343
Channel Condition	9501
Channel Protection Material and Condition	9502
Bank Condition	9504
Guardrail	9530
Adjacent Roadway	9795
Leveling Pad/Toe Protection	9796
Adjacent Slope	9797
Pedestrian Railing/Fencing	9798
Access Panels	9799

3.3 Elements and Defects

This section provides details on all defined wall elements and their applicable defects. Subsections are divided based on material type. Each subsection consists of a table which lists the elements applicable to the material in question, as well as the corresponding defect numbers for each element. The condition state language for each listed defect can also be found within each subsection.

3.3.1 Reinforced Concrete Elements

Elements	**9703** Wall Facing	**9710** Spread Footing	**9713** Pile/ Caisson	**9718** Pile/Caisson/ Pier Cap	**9733** Vertical Support Columns	**9781** Wall Railing	**9747** Horizontal Coping	**9742** Vertical Coping	**9786** Concrete Architectural Facing
	SF	LF	EA	LF	EA	LF	LF	LF	SF
Applicable Defects	1080	1080	1080	1080	1080	1080	1080	1080	1080
	1090	1090	1090	1090	1090	1090	1090	1090	1120
	1120	1120	1120	1120	1120	1120	1120	1120	1130
	1130	1130	1130	1130	1130	1130	1130	1130	1190
	1190	1190	1190	1190	1190	1900	1190	1190	1900
	1900	1900	1900	1900	1900	1910	1900	1900	1910
	1910	1950	1950	1950	1910	1920	1910	1910	1920
	1920	1960	1960	1960	1920	1930	1920	1920	1930
	1930	1990	1990	1990	1930	1940	1930	1930	1940
	1940	4000	4000	4000	1940	1950	1940	1940	1950
	1950	5030	5030	5030	1950	1960	1950	1950	1960
	1960	6000	6000	6000	1960	1990	1960	1960	1990
	1990	7000	7000	7000	1990	7000	1990	1990	2310
	2310	8020	8020	8020	2310	8030	2310	2310	7000
	5030	8030	8030	8030	5030		7000	7000	8030
	7000				7000				
	8020				8020				
	8030				8030				

1080	Delamination/ Spall/ Patched Area
1090	Exposed Rebar/Welded Wire Fabric/Strands
1120	Efflorescence/ Rust Staining
1130	Cracking (RC and Other)*
1190	Abrasion/Wear (PSC/RC)
1900	Distortion
1910	Bulging
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
1990	Freeze-thaw Damage
2310	Leakage
4000	Settlement
5030	Erosion
6000	Scour
7000	Damage
8020	Temporary Support
8030	Alkali-Silica Reactivity (ASR)

*Refer to Section 3.B.2: CDOT Suggested Condition States for Corrosion and Cracking on page 3.73 for guidance on cracking condition states.

3.3.1.1 Defect Condition State Language for Reinforced Concrete Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall/void/honeycombing 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall/void/honeycombing greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Exposed Rebar/Welded Wire Fabric/Strands (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate-width cracks that have been sealed.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.	
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Bulging (1910)	None.	Minor bulging evident from visual inspection, but within tolerable limits.	Moderate to extreme bulging exceeding tolerable limits, but not warranting structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.

Defect Condition State Language for Reinforced Concrete Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Freeze-thaw Damage (1990)	None.	Evidence of freeze-thaw damage on isolated portions of the element (<10%) or freeze-thaw damage ≤ 1 inch deep.	Moderate. Freeze-thaw damage evident on ≥10% of element, damage >1 inch deep, or exposed reinforcing steel.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Temporary Support (8020)	None	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.
Alkali-Silica Reactivity (ASR) (8030)	None	Some evidence of ASR in few and minor surface cracks	Moderate cracking caused by ASR. Gel staining around surface cracks and dark reaction rims at periphery of reacted aggregate.	Spalls, swelling, water retention, and deterioration caused by ASR; alkali-silica gel in voids of cement paste, cracks within reactive aggregates, and deposits of reaction products on element surface

3.3.2 Prestressed Concrete Elements

Elements	**9702** Wall Facing	**9712** Pile/Caisson	**9717** Pile/Caisson/Pier Cap	**9732** Vertical Support Columns
	SF	EA	LF	EA
Applicable Defects	1080	1080	1080	1080
	1090	1090	1090	1090
	1100	1100	1100	1100
	1110	1110	1110	1110
	1120	1120	1120	1120
	1190	1190	1190	1190
	1900	1900	1900	1900
	1910	1950	1950	1910
	1920	1960	1960	1920
	1930	1990	1990	1930
	1940	4000	4000	1940
	1950	5030	5030	1950
	1960	6000	6000	1960
	1990	7000	7000	1990
	2310	8020	8020	2310
	5030	8030	8030	5030
	7000			7000
	8020			8020
	8030			8030

1080	Delamination/Spall/ Patched Area
1090	Exposed Rebar/Welded Wire Fabric/Strands
1100	Exposed Prestressing
1110	Cracking (PSC)*
1120	Efflorescence/Rust Staining
1190	Abrasion/Wear (PSC/RC)
1900	Distortion
1910	Bulging
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
1990	Freeze-thaw Damage
2310	Leakage
4000	Settlement
5030	Erosion
6000	Scour
7000	Damage
8020	Temporary Support
8030	Alkali-Silica Reactivity (ASR)

*Refer to Section 3.B.2: CDOT Suggested Condition States for Corrosion and Cracking on page 3.73 for guidance on cracking condition states.

3.3.2.1 Defect Condition State Language for Prestressed Concrete Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall/void/honeycombing 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall/void/honeycombing greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Exposed Rebar/ Welded Wire Fabric/Strands (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Exposed Prestressing (1100)	None.	Present without section loss.	Present with section loss but does not warrant structural review.	
Cracking (PSC) (1110)	Insignificant cracks or moderate-width cracks that have been sealed.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	Abrasion or wearing has exposed coarse aggregate but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix due to abrasion or wear.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Bulging (1910)	None.	Minor bulging evident from visual inspection, but within tolerable limits.	Moderate to extreme bulging exceeding tolerable limits, but not warranting structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.

Defect Condition State Language for Prestressed Concrete Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Freeze-thaw Damage (1990)	None.	Evidence of freeze-thaw damage on isolated portions of the element (<10%) or freeze-thaw damage ≤ 1 inch deep.	Moderate. Freeze-thaw damage evident on ≥10% of element, damage >1 inch deep, or exposed reinforcing steel.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Temporary Support (8020)	None	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.
Alkali-Silica Reactivity (ASR) (8030)	None	Some evidence of ASR in few and minor surface cracks	Moderate cracking caused by ASR. Gel staining around surface cracks and dark reaction rims at periphery of reacted aggregate.	Spalls, swelling, water retention, and deterioration caused by ASR; alkali-silica gel in voids of cement paste, cracks within reactive aggregates, and deposits of reaction products on element surface

3.3.3 Masonry Elements

Elements	**9705** Wall Facing	**9735** Vertical Support Columns	**9784** Wall Railing	**9749** Horizontal Coping	**9744** Vertical Coping	**9789** Masonry Architectural Facing
	SF	EA	LF	LF	LF	SF
Applicable Defects	1080	1080	1080	1080	1080	1080
	1090	1090	1090	1090	1090	1120
	1120	1120	1120	1120	1120	1610
	1610	1610	1610	1610	1610	1620
	1620	1620	1620	1620	1620	1630
	1630	1630	1630	1630	1630	1640
	1640	1640	1640	1640	1640	1900
	1900	1900	1900	1900	1900	1910
	1910	1910	1910	1910	1910	1920
	1920	1920	1920	1920	1920	1930
	1930	1930	1930	1930	1930	1940
	1940	1940	1940	1940	1940	1950
	1950	1950	1950	1950	1950	1960
	1960	1960	1960	1960	1960	1990
	1990	1990	1990	1990	1990	2310
	2310	2310	7000	2310	2310	7000
	5030	5030		7000	7000	
	7000	7000				
	8020	8020				

1080	Delamination/Spall/ Patched Area
1090	Exposed Rebar/Welded Wire Fabric/Strands
1120	Efflorescence/Rust Staining
1610	Mortar Breakdown (Masonry)
1620	Split/Spall (Masonry)
1630	Patched Area (Masonry)
1640	Masonry Displacement
1900	Distortion
1910	Bulging
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
1990	Freeze-thaw Damage
2310	Leakage
5030	Erosion
7000	Damage
8020	Temporary Support

3.3.3.1 Defect Condition State Language for Masonry Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/Spall/ Patched Area (1080)	None.	Delaminated. Spall/void/honeycombing 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall/void/honeycombing greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Exposed Rebar/Welded Wire Fabric/Strands (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Efflorescence/Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Mortar Breakdown (Masonry) (1610)	None.	Cracking or voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
Split/Spall (Masonry) (1620)	None.	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting but does not warrant a structural review.	
Patched Area (Masonry) (1630)	None.	Sound patch.	Unsound patch.	
Masonry Displacement (1640)	None.	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Bulging (1910)	None.	Minor bulging evident from visual inspection, but within tolerable limits.	Moderate to extreme bulging exceeding tolerable limits, but not warranting structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	

Defect Condition State Language for Masonry Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Freeze-thaw Damage (1990)	None.	Evidence of freeze-thaw damage on isolated portions of the element (<10%) or freeze-thaw damage $\leq$ 1 inch deep.	Moderate. Freeze-thaw damage evident on $\geq$10% of element, damage >1 inch deep, or exposed reinforcing steel.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Temporary Support (8020)	None.	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.

3.3.4 Steel Elements

Elements	**9700** Wall Facing	**9711** Pile/ Caisson	**9716** Pile/Caisson/ Pier Cap	**9730** Vertical Support Column	**9780** Wall Railing	**9745** Horizontal Coping	**9740** Vertical Coping	**9785** Steel Architectural Facing
	SF	EA	LF	EA	LF	LF	LF	SF
Applicable Defects	1000	1000	1000	1000	1000	1000	1000	1000
	1010	1010	1010	1010	1010	1010	1010	1010
	1020	1020	1020	1020	1020	1020	1020	1020
	1900	1900	1900	1900	1900	1900	1900	1900
	1910	1950	1950	1910	1910	1910	1910	1910
	1920	1960	1960	1920	1920	1920	1920	1920
	1930	4000	4000	1930	1930	1930	1930	1930
	1940	5030	5030	1940	1940	1940	1940	1940
	1950	6000	6000	1950	1950	1950	1950	1950
	1960	7000	7000	1960	1960	1960	1960	1960
	2310	8020	8020	2310	7000	2310	2310	2310
	5030			5030		7000	7000	7000
	7000			7000				
	8020			8020				

1000	Corrosion*
1010	Cracking
1020	Connection
1900	Distortion
1910	Bulging
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
2310	Leakage
4000	Settlement
5030	Erosion
6000	Scour
7000	Damage
8020	Temporary Support

*Refer to Section 3.B.2: CDOT Suggested Condition States for Corrosion and Cracking on page 3.73 for guidance on corrosion condition states.

3.3.4.1 Defect Condition State Language for Steel Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Bulging (1910)	None.	Minor bulging evident from visual inspection, but within tolerable limits.	Moderate to extreme bulging exceeding tolerable limits, but not warranting structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.

Defect Condition State Language for Steel Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Temporary Support (8020)	None.	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.

3.3.5 Timber Elements

Elements	**9704** Wall Facing	**9714** Pile/ Caisson	**9719** Pile/Caisson/ Pier Cap	**9734** Vertical Support Columns	**9782** Wall Railing	**9748** Horizontal Coping	**9743** Vertical Coping	**9787** Timber Architectural Facing
	SF	EA	LF	EA	LF	LF	LF	SF
Applicable Defects	1020	1020	1020	1020	1020	1020	1020	1020
	1140	1140	1140	1140	1140	1140	1140	1140
	1150	1150	1150	1150	1150	1150	1150	1150
	1160	1160	1160	1160	1160	1160	1160	1160
	1170	1170	1170	1170	1170	1170	1170	1170
	1180	1180	1180	1180	1180	1180	1180	1180
	1900	1900	1900	1900	1900	1900	1900	1900
	1910	1950	1950	1910	1910	1910	1910	1910
	1920	1960	1960	1920	1920	1920	1920	1920
	1930	4000	4000	1930	1930	1930	1930	1930
	1940	5030	5030	1940	1940	1940	1940	1940
	1950	6000	6000	1950	1950	1950	1950	1950
	1960	7000	7000	1960	1960	1960	1960	1960
	2310	8020	8020	2310	7000	2310	2310	2310
	5030			5030		7000	7000	7000
	7000			7000				
	8020			8020				

1020	Connection
1140	Decay/Section Loss
1150	Check/Shake
1160	Crack (Timber)
1170	Split/Delamination (Timber)
1180	Abrasion/Wear (Timber)
1900	Distortion
1910	Bulging
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
2310	Leakage
4000	Settlement
5030	Erosion
6000	Scour
7000	Damage
8020	Temporary Support

3.3.5.1 Defect Condition State Language for Timber Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Decay/ Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%-50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split/ Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion/ Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Bulging (1910)	None.	Minor bulging evident from visual inspection, but within tolerable limits.	Moderate to extreme bulging exceeding tolerable limits, but not warranting structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	

Defect Condition State Language for Timber Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Temporary Support (8020)	None	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.

3.3.6 Other Material Type Elements

Elements	**9701** Wall Facing	**9715** Pile/ Caisson	**9720** Pile/Caisson/ Pier Cap	**9731** Vertical Support Columns	**9783** Wall Railing	**9746** Horizontal Coping	**9741** Vertical Coping	**9788** Other Architectural Facing
	SF	EA	LF	EA	LF	LF	LF	SF
Applicable Defects	1000	1000	1000	1000	1000	1000	1000	1000
	1010	1010	1010	1010	1010	1010	1010	1010
	1020	1020	1020	1020	1020	1020	1020	1020
	1080	1080	1080	1080	1080	1080	1080	1080
	1120	1120	1120	1120	1120	1120	1120	1120
	1130	1130	1130	1130	1130	1130	1130	1130
	1220	1220	1220	1220	1220	1220	1220	1220
	1900	1900	1900	1900	1900	1900	1900	1900
	1910	1950	1950	1910	1910	1910	1910	1910
	1920	1960	1960	1920	1920	1920	1920	1920
	1930	1990	1990	1930	1930	1930	1930	1930
	1940	4000	4000	1940	1940	1940	1940	1940
	1950	5030	5030	1950	1950	1950	1950	1950
	1960	6000	6000	1960	1960	1960	1960	1960
	1990	7000	7000	1990	1990	1990	1990	1990
	2310	8020	8020	2310	7000	2310	2310	2310
	5030	8030	8030	5030	8030	7000	7000	7000
	7000			7000				8030
	8020			8020				
	8030			8030				

1000	Corrosion*
1010	Cracking*
1020	Connection
1080	Delamination/ Spall/ Patched Area
1120	Efflorescence/ Rust Staining
1130	Cracking (RC and Other)
1220	Deterioration (Other)
1900	Distortion
1910	Bulging
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
1990	Freeze-thaw Damage
2310	Leakage
4000	Settlement
5030	Erosion
6000	Scour
7000	Damage
8020	Temporary Support
8030	Alkali-Silica Reactivity (ASR)

*Refer to Section 3.B.2: CDOT Suggested Condition States for Corrosion and Cracking on page 3.73 for guidance on corrosion and cracking condition states.

3.3.6.1 Defect Condition State Language for Other Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall/void/honeycombing 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall/void/honeycombing greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate-width cracks that have been sealed.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Bulging (1910)	None.	Minor bulging evident from visual inspection, but within tolerable limits.	Moderate to extreme bulging exceeding tolerable limits, but not warranting structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.

Defect Condition State Language for Other Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Freeze-thaw Damage (1990)	None.	Evidence of freeze-thaw damage on isolated portions of the element (<10%) or freeze-thaw damage ≤ 1 inch deep.	Moderate. Freeze-thaw damage evident on ≥10% of element, damage >1 inch deep, or exposed reinforcing steel.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.
Temporary Support (8020)	None	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.
Alkali-Silica Reactivity (ASR) (8030)	None	Some evidence of ASR in few and minor surface cracks	Moderate cracking caused by ASR. Gel staining around surface cracks and dark reaction rims at periphery of reacted aggregate.	Spalls, swelling, water retention, and deterioration caused by ASR; alkali-silica gel in voids of cement paste, cracks within reactive aggregates, and deposits of reaction products on element surface

3.3.7 Anchors

Elements	**9725** Ground Anchors	**9726** Soil Nails	**9727** Micropiles	**9728** Other Anchors
	EA	EA	EA	EA
Applicable Defects	1000 1020 1220 1900 1980 7000	1000 1010 1020 1080 1120 1130 1220 1940 1980 7000	1000 1020 1220 1900 1980 7000	1000 1010 1020 1130 1220 1900 1980 7000

1000	Corrosion*
1010	Cracking*
1020	Connection
1080	Delamination/Spall/ Patched Area
1120	Efflorescence/Rust Staining
1130	Cracking (RC and Other)
1220	Deterioration (Other)
1900	Distortion
1940	Separation
1980	Effectiveness - Anchors
7000	Damage

*Refer to Section 3.B.2: CDOT Suggested Condition States for Corrosion and Cracking on page 3.73 for guidance on corrosion and cracking condition states.

3.3.7.1 Defect Condition State Language for Anchors

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination /Spall/ Patched Area (1080)	None.	Delaminated. Spall/void/honeycombing 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall/void/honeycombing greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence /Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate-width cracks that have been sealed.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Separation (1940)	None.	Separation of individual elements up to .1 in.	Separation of individual elements greater than .1 in, but does not warrant structural review.	
Effectiveness - Anchors (1980)	Anchor is performing as intended	Anchor head is exposed, but the anchor remains in tension and is performing adequately.	Anchor is exposed past the anchor head, but remains in tension and does not warrant structural review.	Anchor has failed; signs of movement may be noted or anchor is no longer attached to the wall.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.3.8 Retained Material

Elements	**9750** Retained Material
	LF
Applicable Defects	1960 5010 5020 5030 4000 7000

3.3.8.1 Defect Condition State Language for Retained Material

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Backfill Loss (5010)	Isolated losses along the length of the wall as noted by backfill deposits away from the wall <1 cubic foot in volume.	Isolated losses along the length of the wall as noted by backfill deposits away from the wall (<3 cubic feet in volume) and/or hollow noises indicated from soundings.	Substantial losses along the length of the wall as noted by large (>3 cubic feet in volume) backfill deposits away from the wall and/or collapse of topsoil above wall. Does not warrant a structural review.	Losses exceeding tolerable limits; potential collapse of adjacent wall elements into slope. May warrant a structural review.
Water Retention (5020)	None.	Mild water retention noted by prior evidence of standing water. Water has since drained.	Moderate water retention noted by saturated topsoil behind the wall and/or moderate areas of standing water.	Extreme water retention as noted by continuous standing water and/or deterioration of wall elements from exposure to water. May warrant structural review.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.3.9 Joint Elements

Elements	**9760** Strip Seal Expansion Joint	**9761** Compression Joint Seal	**9762** Open Expansion Joint	**9763** Other Joint
	LF	LF	LF	LF
Applicable Defects	1940 1960 2310 2320 2330 2340 2350 2370 7000	1940 1960 2310 2320 2330 2340 2350 7000	1940 1960 2310 2350 2380 7000	1940 1960 2310 2350 2370 2380 7000

1940	Separation
1960	Vegetation Growth
2310	Leakage
2320	Seal Adhesion
2330	Seal Damage
2340	Seal Cracking
2350	Debris Impaction
2370	Metal Deterioration or Damage
2380	Joint Material
7000	Damage

3.3.9.1 Defect Condition State Language for Joints

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Separation (1940)	None.	Minor (<1/4") separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme (>1/4") separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or ERS; OR a structural review has been completed and the defects impact strength or serviceability of the element or ERS.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Seal Adhesion (2320)	Fully adhered.	Adhered for more than 50% of the joint height.	Adhered 50% or less of joint height but still some adhesion.	Complete loss of adhesion.
Seal Damage (2330)	None.	Seal abrasion without punctures.	Punctured or ripped or partially pulled out.	Punctured completely through, pulled out or missing.
Seal Cracking (2340)	None.	Surface crack.	Crack that partially penetrates the seal	Crack that fully penetrates the seal.
Debris Impaction (2350)	No debris to a shallow cover of loose debris may be evident but does not affect the performance of the joint.	Partially filled with hard-packed material but still allowing free movement.	Completely filled and impacts joint movement or.	Completely filled and prevents joint movement.
Metal Deterioration or Damage (2370)	None.	Freckled rust; metal has not cracks or impact damage. Connection may be loose but functioning as intended.	Section loss, missing or broken fasteners, cracking of the metal or impact damage but joint still functioning.	Metal cracking, section loss, damage, or connection failure that prevents the joint from functioning as intended.

Defect Condition State Language for Joints Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Joint Material (2380)	Joint material is in good condition.	50% or less of the joint material in a single joint is missing, deteriorated, or is not functioning as intended.	More than 50% of the joint material in a single joint is missing, deteriorated, or is not functioning as intended.	Joint material is missing or has completely deteriorated.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.3.10 Drainage Elements

Elements	**9770** Weep Holes/Slots	**9771** Area Drain	**9772** Drainage Swale	**9773** Other Drain
	EA	EA	EA	EA
Applicable Defects	1900 1940 1950 1960 1970 2310 7000	1000 1010 1020 1080 1120 1130 1220 1900 1940 1950 1960 1970 2310 7000	1000 1010 1020 1080 1120 1130 1220 1900 1920 1930 1950 1960 1970 2310 5030 7000	1000 1010 1020 1080 1120 1130 1220 1900 1920 1930 1940 1950 1960 1970 2310 5030 7000

1000	Corrosion*
1010	Cracking*
1020	Connection
1080	Delamination/Spall/ Patched Area
1120	Efflorescence/Rust Staining
1130	Cracking (RC and Other)
1220	Deterioration (Other)
1900	Distortion
1920	Vertical Rotation
1930	Horizontal Rotation
1940	Separation
1950	Graffiti
1960	Vegetation Growth
1970	Blockage
2310	Leakage
5030	Erosion
7000	Damage

*Refer to Section 3.B.2: CDOT Suggested Condition States for Corrosion and Cracking on page 3.73 for guidance on corrosion and cracking condition states.

3.3.10.1 Defect Condition State Language for Drainage Elements

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates or similar.	Identified crack that is not arrested but does not warrant structural review.	
Connection (1020)	Connection is in place and functioning as intended.	Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall/void/honeycombing 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall/void/honeycombing greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Insignificant cracks or moderate-width cracks that have been sealed.	Unsealed moderate-width cracks or unsealed moderate pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.	
Deterioration (Other) (1220)	None.	Initiated breakdown or deterioration.	Significant deterioration or breakdown but does not warrant structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Vertical Rotation (1920)	None.	Minor vertical rotation of elements within tolerable limits.	Moderate to extreme vertical rotation exceeding tolerable limits, but not warranting structural review.	
Horizontal Rotation (1930)	None.	Minor horizontal rotation of elements within tolerable limits.	Moderate to extreme horizontal rotation exceeding tolerable limits, but not warranting structural review.	
Separation (1940)	None.	Minor separation of elements or units such as blocks or panels within whole elements. Separation is within tolerable limits.	Moderate to extreme separation of elements or units such as blocks or panels within whole elements. Separation exceeds tolerable limits, but does not warrant structural review.	

Defect Condition State Language for Drainage Elements Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Blockage (1970)	None	Partially filled with shallow layer of loose debris or hard-packed material but still allowing adequate drainage.	Completely filled and impacts drainage.	Completely filled and prevents drainage.
Leakage (2310)	None.	Minimal. Evidence of or active minor dripping through the joint or other wall element.	Moderate. Evidence of or active process of more than a drip and less than free flow of water.	Evidence of or active free flow of water through the joint or other wall element.
Erosion (5030)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but is less than the critical limits determined by erosion evaluation and does not warrant structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or wall; OR a structural review has been completed and the defects impact strength or serviceability of the element or wall.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.3.11 Protective System Elements

Elements	**9755** Steel Protective Coating	**9756** Concrete and Masonry Protective Coating	**9757** Concrete Reinforcing Steel Protection System	**9758** Timber Protective System	**9759** Other Protective System
	SF	SF	SF	SF	SF
Applicable Defects	1950 1960 3410 3420 3430 3440 7000	1950 1960 3510 3540 3550 3560	1950 1960 3600 7000	1950 1960 3610 3620 7000	1950 1960 3630 3640 7000

1950	Graffiti
1960	Vegetation Growth
3410	Chalking (Steel Protective Coatings)
3420	Peeling/Bubbling/Cracking (Steel Protective Coatings)
3430	Oxide Film Degradation Color/Texture Adherence (Steel Protective Coatings)
3440	Effectiveness (Steel Protective Coatings)
3510	Wear (Concrete Protective Coatings)
3540	Effectiveness (Concrete Protective Coatings)
3550	Chalking (Concrete and Masonry Protective Coatings)
3560	Peeling/Bubbling/Cracking (Concrete and Masonry Protective Coatings)
3600	Effectiveness - Protective System (e.g. cathodic)
3610	Wear (Timber Protective Coatings)
3620	Effectiveness - (Timber Protective Coatings)
3630	Wear (Other Protective Coatings)
3640	Effectiveness - (Other Protective Coatings)
7000	Damage

3.3.11.1 Defect Condition State Language for Protective Systems

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Graffiti (1950)	Graffiti or other undesired markings present on element.	Not applicable.	Not applicable.	Not applicable.
Vegetation Growth (1960)	None.	Minor vegetation growth through or around element. No evidence of damage from growth.	Moderate vegetation growth through or around element and/or evidence of minor to moderate damage to the element caused by the growth. Structural elements are still sound.	Heavy vegetation growth through or around elements and/or severe damage or deterioration of the element due to growth.
Chalking (Steel Protective Coatings) (3410)	None.	Surface dulling.	Loss of pigment.	Not applicable.
Peeling/Bubbling/ Cracking (Steel Protective Coatings) (3420)	None.	Finish coats only.	Finish and primer coats.	Exposure of bare metal.
Oxide Film Degradation Color/Texture Adherence (Steel Protective Coatings) (3430)	Yellow-orange or light brown for early development. Chocolate-brown to purple-brown for fully developed. Tightly adhered, capable of withstanding hammering or vigorous wire brushing.	Granular texture.	Small flakes, less than 1/2 -in. diameter.	Dark black color. Large flakes, 1/2 in diameter or greater, or laminar sheets or nodules.
Effectiveness (Steel Protective Coatings) (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed; no protection of the underlying metal.
Wear (Concrete Protective Coatings) (3510)	None.	Underlying concrete not exposed; coating showing wear from UV exposure; friction course missing.	Underlying concrete is not exposed; thickness of the coating is reduced.	Underlying concrete exposed. Protective coating no longer effective.
Effectiveness (Concrete Protective Coatings) (3540)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Chalking (Concrete and Masonry Protective Coatings) (3550)	None.	Surface dulling.	Loss of pigment.	Not applicable.
Peeling/Bubbling/ Cracking (Concrete and Masonry Protective Coatings) (3560)	None.	Finish coats only.	Finish and primer coats.	Exposure of bare concrete or masonry.
Effectiveness - Protective System (e.g. cathodic) (3600)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.

Defect Condition State Language for Protective Systems Continued

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Wear (Timber Protective Coatings) (3610)	None.	Underlying timber not exposed; coating showing wear from UV exposure; friction course missing.	Underlying timber is not exposed; thickness of the coating is reduced.	Underlying timber exposed. Protective coating no longer effective.
Effectiveness - (Timber Protective Coatings) (3620)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Wear (Other Protective Coatings) (3630)	None.	Underlying element not exposed; coating showing wear from UV exposure; friction course missing.	Underlying element is not exposed; thickness of the coating is reduced.	Underlying element exposed. Protective coating no longer effective.
Effectiveness - (Other Protective Coatings) (3640)	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

3.4 Element Descriptions

This Section describes typical primary and secondary element types as well as the elements' intended purpose with relation to the wall. Each element description contains detailed identification and classification of the element, including units of measurement and guidelines on how to collect the quantity of the element in a consistent manner. If the units of measurement and guidelines on quantity recording are consistent regardless of element material, these guidelines are noted under the introduction of the element. Otherwise these guidelines are noted directly beneath the element to which they correspond.

The elements are organized into major groupings such as Walls, Foundations, and Vertical Supports. The common defects identified for each element material are further described in Section **3.2** and **Appendix 3.B**.

3.4.1 Wall Facing – Primary Element

This Article covers the main load resisting element for retaining walls and the main noise barrier element for noise walls. This includes modular units such as Mechanically Stabilized Earth (MSE) panels and concrete panels/blocks or masonry blocks, as well as Geosynthetic Reinforced Soil (GRS) blocks. It does not include vertical supports, anchors, or aesthetic elements. Wall facing can be metal, prestressed or reinforced concrete, timber (lagging and other), masonry, or other types of material. Embedded and buried portions of walls are not counted as part of the wall face and are not subject to inspection and condition assessment. Footing is not considered part of the wall face when figuring the face area. Only the exposed face area is considered for the wall height and the depth of any piles or other foundation elements is neglected. Barriers and coping at the wall top do not count as part of the wall face area. The wall evaluation is three-dimensional in nature with the defects observed on the front surface, bottom surface, edges, or all; and being captured using the defined condition states. An Erosion (5030) defect should be noted only if no foundation or vertical support elements are present.

Units of Measurement: SF

Quantity Calculation: Area of the wall facing from start of wall to end of wall and from just beneath the coping (if present), to the top of foundation or finished grade.

Intended Use: In reference to retaining walls, the wall facing element provides the primary restraint to the slope behind the wall by adequately resisting the lateral forces generated by the slope. This element can be supported by vertical support elements as described in Section **3.4.3**, but these elements should be assessed separately. Similarly, the wall facing element in noise walls should provide the primary noise barrier, and may be supported by vertical elements described in Section **3.4.3**.

3.4.1.1 Element 9700 – Metal Wall Facing

Element 9700 includes all types and shapes of metal wall facing. Horizontal steel, aluminum, metal beam, rolled shapes, etc. will all be considered part of this element.

3.4.1.2 Element 9701 – Other Wall Facing

Element 9701 includes all types and shapes of wall facing except those defined as metal, concrete, timber, or masonry, including gabion basket walls, GRS walls, etc.

3.4.1.3 Element 9702 – Prestressed Concrete Wall Facing

Element 9702 includes all types and shapes of prestressed concrete wall facing. All elements of the facing must be concrete.

3.4.1.4 Element 9703 – Reinforced Concrete Wall Facing

Element 9703 includes all types and shapes of reinforced concrete wall facing. All elements of the facing must be concrete.

3.4.1.5 Element 9704 – Timber Wall Facing

Element 9704 includes all types and shapes of timber wall facing. Included in this element are posts of timber, timber lagging, slats, and stacked beams.

3.4.1.6 Element 9705 – Masonry Wall Facing

Element 9705 includes all types and shapes of masonry block or stone wall facing. All elements of the facing must be masonry block or stone. The block or stone may be placed with or without mortar.

3.4.2 Foundation – Primary Element

This article covers footings, piles, caissons, and pile and caisson caps of all materials. These elements should be rated when visible and it is left to the team leader's discretion to rate partially visible or non-visible elements using non-destructive or destructive testing methods. This includes all shallow foundations and any visible portions of deep foundations.

Intended Use: Foundation elements should provide adequate load bearing capacity to the base of the retaining or noise wall by transferring any lateral or gravity loads into the ground. These elements may provide support directly to the wall facing, or to vertical support elements, and should prevent overturning of these elements. Foundation elements should be rated on their adequacy to support the element(s) they were designed to support.

3.4.2.1 Element 9710 – Spread Footing

Element 9710 includes reinforced spread footings that are visible for inspection, including caps or footing exposed from erosion or scour or visible during an underwater inspection. The exposure may be intentional or caused by erosion or scour.

Units of Measurement*:* LF

Quantity Calculation*:* Sum of the length of the footing.

3.4.2.2 Element 9711 – Steel Pile

Element 9711 includes steel piles that are visible for inspection, including piles exposed from erosion or scour or visible during an underwater inspection. For all steel piles regardless of protective system.

Units of Measurement*:* Each

Quantity Calculation*:* Sum the number of piles visible for inspection.

3.4.2.3 Element 9712 – Prestressed Concrete Pile/Caisson

Element 9712 includes prestressed concrete piles or caissons that are visible for inspection, including piles or caissons exposed from erosion or scour or visible during an underwater inspection. For all prestressed concrete piles and caissons regardless of protective system.

Units of Measurement*:* Each

Quantity Calculation*:* Sum the number of piles or caissons visible for inspection

3.4.2.4 Element 9713 – Reinforced Concrete Pile/Caisson

Element 9713 includes prestressed concrete piles or caissons which are visible for inspection, including piles and caissons exposed from erosion or scour or visible during an underwater inspection. For all reinforced concrete piles and caissons regardless of protective system.

Units of Measurement*:* Each

Quantity Calculation: Sum the number of piles or caissons visible for inspection

3.4.2.5 Element 9714 – Timber Pile

Element 9714 includes timber piles that are visible for inspection, including piles exposed from erosion or scour or visible during an underwater inspection. For all timber piles regardless of protective system.

Units of Measurement*:* Each

Quantity Calculation*:* Sum the number of piles visible for inspection

3.4.2.6 Element 9715 – Other Pile

Element 9715 includes other material piles which are visible for inspection, including piles exposed from erosion or scour or visible during an underwater inspection. For all other material piles regardless of protective system.

Units of Measurement*:* Each

Quantity Calculation*:* Sum the number of piles visible for inspection

3.4.2.7 Element 9716 – Steel Pile/Caisson Cap

Element 9716 includes those steel pile/caisson caps that support wall facing and transfer load into piles or caissons. For all steel pile/caisson caps regardless of protective system.

Units of Measurement*:* LF

Quantity Calculation*:* Sum of the cap lengths measured along the wall.

3.4.2.8 Element 9717 – Prestressed Concrete Pile/Caisson Cap

Element 9717 includes those prestressed concrete pile/caisson caps that support the wall facing and transfer load into piles or caissons/drilled piers. For all prestressed concrete pile/caisson caps regardless of protective system.

Units of Measurement*:* LF

Quantity Calculation*:* Sum of the cap lengths measured along the wall.

3.4.2.9 Element 9718 – Reinforced Concrete Pile/Caisson Cap

Element 9718 includes those reinforced concrete pile/caisson caps that support the wall facing and transfer load into piles, or caissons. For all reinforced concrete pile/caisson caps regardless of protective system.

Units of Measurement*:* LF

Quantity Calculation*:* Sum of the cap lengths measured along the wall.

3.4.2.10 Element 9719 – Timber Pile/Caisson Cap

Element 9719 includes those timber pile/caisson caps that support the wall facing and transfer load into piles or caissons. For all timber pile/caisson caps regardless of protective system.

Units of Measurement*:* LF

Quantity Calculation: Sum of the cap lengths measured along the wall.

3.4.2.11 Element 9720 – Other Pile/Caisson Cap

Element 9720 includes those other material caps that support the wall facing and transfer load into piles or columns. For all other material caps regardless of protective system.

Units of Measurement*:* LF

Quantity Calculation*:* Sum of the cap lengths measured along the wall

3.4.3 Anchors – Primary Element

This Article covers wall anchors, specifically those anchoring the wall system to the backfill. This includes anchor systems for MSE and GRS walls when appropriate. All visible anchors and anchor heads should be rated, and discretion should be used when rating partially visible and non-visible anchor elements through the use of non-destructive or destructive testing methods. Evidence of anchor defects should be noted on the inspection form even when anchors are not visible.

Units of Measurement: Each

Quantity Calculation: Count of all known anchors. Only count anchors that are exposed or known from as-builts, otherwise leave as unknown.

Intended Use: Anchors are lateral load resisting elements, and provide support to the main wall facing element and/or vertical support elements. Anchors can be steel rods or ties grouted into the slope behind the wall, or concrete micropiles can be used to provide lateral support and prevent overturning of the wall. In the case of some MSE walls, the anchors may be a synthetic material layered behind the main wall facing. Typically, noise walls do not use anchors, however, if present, these elements should be rated using the "Other Anchor Types" element.

3.4.3.1 Element 9725 – Ground Anchors

Element 9725 includes all types and shapes of ground anchors, deadmen, or tiebacks.

3.4.3.2 Element 9726 – Soil Nails

Element 9726 includes all types and shapes of soil nails.

3.4.3.3 Element 9727 – Micropiles

Element 9727 includes all types and shapes of micropiles providing wall anchorage.

3.4.3.4 Element 9728 – Other Anchor Types

Element 9728 includes all other types and shapes of anchors not including ground anchors, soil nails, or micropiles. This includes geosynthetic anchor systems.

3.4.4 Vertical Supports – Primary Element

This Article covers all above ground vertical supports including metal, prestressed or reinforced concrete, timber, masonry, or other columns or posts that provide structural support to the wall facing. This also includes any connection hardware present between the vertical supports and adjacent elements. An Erosion (5030) defect should be noted only if no foundation elements are present.

Units of Measurement: Each

Quantity Calculation: Total of all columns summed.

Intended Use: Vertical support elements should provide structural support to the main wall facing of the retaining or noise wall and should adequately resist lateral loads. Vertical support elements may

transfer these loads directly to the ground, or to attached foundation elements – foundation elements should be rated separately.

3.4.4.1 Element 9730 – Steel Columns

Element 9730 includes all steel columns regardless of protective system.

3.4.4.2 Element 9731 – Other Columns

Element 9731 includes all other material columns/posts regardless of protective system.

3.4.4.3 Element 9732 – Prestressed Concrete Columns

Element 9732 includes all prestressed columns regardless of protective system.

3.4.4.4 Element 9733 – Reinforced Concrete Columns

Element 9733 includes all reinforced concrete columns regardless of protective system.

3.4.4.5 Element 9734 – Timber Columns

Element 9734 includes all timber columns regardless of protective system.

3.4.4.6 Element 9735 – Masonry Columns

Element 9735 includes all masonry and stone columns regardless of protective system. The block or stone may be placed with or without mortar.

3.4.5 Vertical Coping/Pilasters – Secondary Elements

This article covers all types of vertical coping or pilasters including, but not limited to, metal, prestressed and reinforced concrete, timber, and masonry. Vertical coping or pilasters are defined as the element attached directly to the wall facing, typically covering a vertical joint (expansion or construction). Typically, the vertical coping/pilaster differs slightly in appearance from the wall facing. Slip joint panels, corner panels, and RTD monuments should be classified using this element category.

Units of Measurement*:* LF

Quantity Calculation*:* Total length of vertical copings/pilasters extending from the groundline to the top of the wall.

Intended Use*:* Vertical coping or pilasters provide protection from deterioration caused by water runoff, snow, freeze/thaw, and ice by diverting water away from the underlying joint. Additionally, vertical coping/pilasters can be used for aesthetic enhancement of a wall.

3.4.5.1 Element 9740 – Metal Vertical Coping/Pilaster

Element 9740 includes all types and shapes of metal vertical coping/pilasters. Steel, aluminum, metal beam, rolled shapes, etc. will all be consider part of this element.

3.4.5.2 Element 9741 – Other Vertical Coping/Pilaster

Element 9741 includes all types and shapes of vertical coping/pilasters except those defined as metal, concrete, timber, or masonry.

3.4.5.3 Element 9742 – Reinforced Concrete Vertical Coping/Pilaster

Element 9742 includes all types and shapes of reinforced concrete vertical coping/pilasters. All elements of the coping must be concrete.

3.4.5.4 Element 9743 – Timber Vertical Coping/Pilaster

Element 9743 includes all types and shapes of timber vertical coping/pilasters. Included in this element are posts of timber.

3.4.5.5 Element 9744 – Masonry Vertical Coping/Pilaster

Element 9744 includes all types and shapes of masonry block or stone vertical coping/pilasters. All elements of the coping must be masonry block or stone. The block or stone may be placed with or without mortar

3.4.6 Horizontal Coping – Secondary Element

This Article covers all types of horizontal coping including, but not limited to, metal, prestressed and reinforced concrete, timber, and masonry. Horizontal coping is defined as the element attached directly to the top of the wall facing. Typically, the coping differs slightly in appearance from the wall facing, and is wider than the facing, providing an overhang at the top of the wall.

Units of Measurement: LF

Quantity Calculation: Total length of horizontal coping on top of the wall. This may not necessarily be equal to the length of the wall.

Intended Use: Horizontal coping provides protection from deterioration caused by water runoff, snow, freeze/thaw, and ice by diverting water away from vertical seams, the top of the wall, and the wall facing. The coping may be integral with parapet walls, which also may also provide aesthetic features or assist in redirecting impacting vehicles. If the coping is integral with a parapet wall or railing, this should be noted in the inspection report.

3.4.6.1 Element 9745 – Metal Horizontal Coping

Element 9745 includes all types and shapes of metal wall coping. Steel, aluminum, metal beam, rolled shapes, etc. will all be consider part of this element.

3.4.6.2 Element 9746 – Other Horizontal Coping

Element 9746 includes all types and shapes of wall coping except those defined as metal, concrete, timber, or masonry.

3.4.6.3 Element 9747 – Reinforced Concrete Horizontal Coping

Element 9747 includes all types and shapes of reinforced concrete wall coping. All elements of the coping must be concrete.

3.4.6.4 Element 9748 – Timber Horizontal Coping

Element 9748 includes all types and shapes of timber wall coping. Included in this element are posts of timber.

3.4.6.5 Element 9749 – Masonry Horizontal Coping

Element 9749 includes all types and shapes of masonry block or stone wall coping. All elements of the coping must be masonry block or stone. The block or stone may be placed with or without mortar.

3.4.7 Retained Material – Secondary Element

This article covers any material retained by the wall that may affect the condition and/or performance of the wall. This material can consist of all types of soil and may be bare or covered in vegetation.

Units of Measurement: LF

Quantity Calculation: Measure the total linear feet of backfill supported by the wall.

Intended Use: The slope behind the wall should be stable and adequately supported by the wall. Any backfill losses, indication of water retention, or other defects may indicate performance issues with the wall and should be noted.

3.4.7.1 Element 9750 – Retained Material

Element 9750 includes the slope at the top of the wall, including backfill and retained fill, vegetated slope, talus, or other slope.

3.4.8 Joints – Secondary Element

This Article covers expansion, contraction, and other joints.

Units of Measurement: EA

Quantity Calculation: Sum of joints along the wall.

Intended Use: All joints should provide the function of joining two portions of a wall such that the structural integrity of the wall is not compromised. The joint should adequately support any loads, and should prevent water penetration through the wall. Joints should allow for expansion and contraction of wall panels or blocks due to temperature changes.

3.4.8.1 Element 9760 – Strip Seal Expansion Joint

Element 9760 includes those expansion joint devices which utilize a waterproof gland with some type of metal extrusion or other system to anchor the gland.

3.4.8.2 Element 9761 – Compression Joint Seal

Element 9761 includes only those joints filled with a preformed compression type seal. This joint may or may not have an anchor system to confine the seal.

3.4.8.3 Element 9762 – Expansion Joint

Element 9762 includes all expansion joints which do not use a waterproof gland. This includes joints designed as open joints, as well as expansion joints filled with expansion material other than a waterproof gland.

3.4.8.4 Element 9763 – Other Joint

Element 9763 includes only those other joints that are not defined by any other joint element. The other material joint element is intended for joints constructed of materials that cannot be classified using any other defined joint elements.

3.4.9 Drainage – Secondary Element

This Article covers all drainage elements integral to the wall. These elements include subsurface pipe or sheet drains connected to one or multiple weep holes or slots, as well as area drains providing drainage from above roadway or fill through the wall facing and drainage swales located at the top corners of the wall. Weep holes and slots are typically constructed of metal or plastic, area drains typically consist of metal grating set in a concrete base, and drainage swales can be simple ditches typically overlaid with concrete or masonry located on the slope adjacent to the top or front of the wall.

Intended Use: All drainage elements associated with the wall should adequately divert water from the structure. Internal elements such as subsurface pipes and sheet drains connected to weep holes should prevent water accumulation within the slope behind the wall. Area drains and drainage swales should divert running water from the structural elements on the wall by providing clear pathways from the source of runoff to sufficient drainage paths.

3.4.9.1 Element 9770 – Weep Holes/Slots

Element 9770 includes those weep holes or slots located within a wall connected to a horizontal drainage pipe or a sheet drain within the backfill or retained fill, allowing drainage from the fill to the exterior.

Units of Measurement: Each

Quantity Calculation: Sum of all drainage elements within the wall.

3.4.9.2 Element 9771 – Area Drain

Element 9771 includes those drains located within the face of the wall providing drainage for the above roadway.

Units of Measurement: Each

Quantity Calculation: Sum of all drainage elements within the wall.

3.4.9.3 Element 9772 – Drainage Swale

Element 9772 includes those drains located behind or in front of the wall providing drainage and erosion control in those areas. This includes the fabricated materials such as concrete that have been built to assist in drainage.

Units of Measurement: LF

Quantity Calculation: Total length of drainage swale adjacent to the wall.

3.4.9.4 Element 9773 – Other Drain

Element 9773 includes any other drains associated with the wall not classified as weep holes, slots, surface drains or drainage swales.

Units of Measurement: each

Quantity Calculation: Sum of all drainage elements within the wall.

3.4.10 Railings – Secondary Element

This Article covers wall railing or barriers, which may be fabricated from steel, other metal, concrete, masonry and other materials. Walls can include railings both on top and in front of the wall. Typically, barriers are found in front of the wall to prevent vehicle collision with the main structure. All railings associated with a wall should be rated using the following tables, regardless of their position in reference to the wall.

Units of Measurement: LF

Quantity Calculation: Total length of railing/barrier on top of and in front of the wall. Railing on top of the wall should be separated from railing in front of the wall. The length of the railing may not necessarily be the same as the length of the wall.

Intended Use: Barriers in front of the wall exist to provide protection of the wall from motorists. These railings should reduce damage to the wall in the event of impact. Railings on top of a wall exist to redirect an impacting vehicle. In the event of a traffic accident, these railings should prevent the vehicle(s) from leaving the roadway.

3.4.10.1 Element 9780 – Metal Wall Railing

Element 9780 includes all types and shapes of metal wall railing. Steel, aluminum, metal beam, rolled shapes, etc. will all be considered part of this element. Included in this element are posts of metal, timber, or concrete; blocking; and curb.

3.4.10.2 Element 9781 – Reinforced Concrete Wall Railing

Element 9781 includes all types and shapes of reinforced concrete wall railing. All elements of the railing must be concrete.

3.4.10.3 Element 9782 – Timber Wall Railing

Element 9782 includes all types and shapes of timber wall railing. Included in this element are posts of timber, metal, or concrete; blocking; and curb.

3.4.10.4 Element 9783 – Other Wall Railing

Element 9783 includes all types and shapes of wall railing except those defined as metal, concrete, timber, or masonry.

3.4.10.5 Element 9784 – Masonry Wall Railing

Element 9784 includes all types and shapes of masonry block or stone wall railing. All elements of the railing must be masonry block or stone. The block or stone may be placed with or without mortar.

3.4.11 Architectural Facings – Secondary Element

This Article includes architectural facings, whether decorative or protective in function, not providing support capacity to the structure. Architectural facing elements will be rated the same, regardless of intended use. If it is not possible to clearly determine the structural support contribution of the facing, default to evaluating the facing as a structural support element, i.e. Wall Facing as described in Section 3.4.1.

Units of Measurement: SF

Quantity Calculation: Area of the architectural facing from start of wall to end of wall and from just beneath the coping (if present), to the foundation or finished grade.

Intended Use: Aesthetic architectural facings should be clean in appearance, and should not display any signs of damage or deterioration. Protective architectural facings should adequately protect underlying structural elements, and are evaluated the same as aesthetic architectural facings.

3.4.11.1 Element 9785 – Steel Architectural Facing

Element 9785 includes all types and shapes of metal wall architectural facing. Steel, aluminum, metal beam, rolled shapes, etc. will all be consider part of this element.

3.4.11.2 Element 9786 – Concrete Architectural Facing

Element 9786 includes all types and shapes of concrete wall architectural facing. All elements of the architectural facing must be concrete.

3.4.11.3 Element 9787 – Timber Architectural Facing

Element 9787 includes all types and shapes of timber wall architectural facing. Included in this element are posts of timber.

3.4.11.4 Element 9788 – Other Architectural Facing

Element 9788 includes all types and shapes of architectural wall facing except those defined as metal, concrete, timber, or masonry.

3.4.11.5 Element 9789 – Masonry Architectural Facing

Element 9789 includes all types and shapes of architectural masonry block or stone wall facing. All elements of the architectural facing must be masonry block or stone. The block or stone may be placed with or without mortar.

3.4.12 Protective Coatings and Systems – Secondary Element

The elements encompassed in this Article are steel and concrete protective coatings, and concrete reinforcing steel protection systems such as epoxy or cathodic protection. These systems will influence the deterioration and condition of the underlying structural element. More than one protective coating or system type can exist on a wall. For example, the concrete wall facing may be protected with one protective coating type and the steel vertical support elements may be protected with another protective coating type.

Units of Measurement: SF

Quantity Calculation: Should include the entire protected surface of the element. Separate quantities should be used for individual elements – e.g. one quantity should describe the coated area of the wall facing and the other quantity should describe the coated area of the coping. For elements that exhibit textured surfaces, the coating quantity should be the area of the element plus a 20%, 10%, or 5% increase depending on the degree of texture – heavy, moderate, or light, respectively. The degree of texture is left to the discretion of the Team Leader, and should be recorded on the inspection report.

Intended Use: Protective coatings and systems should provide adequate protection and preservation for underlying structural elements. This can result in extended life for the protected elements, and may enhance the aesthetics of the elements.

3.4.12.1 Element 9790 – Steel Protective Coating

Element 9790 includes steel elements that have a protective coating such as paint, galvanization, weathering steel patina, stains, or other top coat steel corrosion inhibitor. Assess protective coatings based upon the defects that would apply. The inspector should specify the type of coating in the inspection report when known.

3.4.12.2 Element 9791 – Concrete and Masonry Protective Coating

Element 9791 includes concrete elements that have a protective coating applied to them. These coatings include silane/siloxane water proofers, crack sealers such as High Molecular Weight Methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion. The inspector should specify the type of coating in the inspection report when known.

3.4.12.3 Element 9792 – Concrete Reinforcing Steel Protective System

Element 9792 includes all types of protective systems used to protect reinforcing steel in concrete elements from corrosion such as rebar coatings, cathodic protection, or other similar protection methods. This protection system element is intended to capture situations where the concrete element may be expected to deteriorate at a rate that is slower than unprotected situations. Protection systems may include rebar coatings, cathodic protection, or other similar protection methods. The inspector should specify the type of coating in the inspection report when known.

3.4.12.4 Element 9793 – Timber Protective System

Element 9793 includes timber elements that have a protective coating applied to them. These coatings include preservatives, stains, and tars. The inspector should specify the type of coating in the inspection report when known.

3.4.12.5 Element 9794 – Other Protective Coating

Element 9794 includes other elements that have a protective coating applied to them. The inspector should specify the type of coating in the inspection report when known.

3.4.13 Incidental Elements

Inspectors should make note of elements that are incidental to primary or secondary wall elements as described below. Unlike primary and secondary elements, incidental elements will not receive condition ratings. Instead, the inspector should note the location of the element using geospatial coordinates and make a general comment about the type and condition of the element when appropriate. If an incidental element requires maintenance, the proper work candidate should be created using the activities defined in **Appendix 3.D: Work Candidate Codes**. The following describes some elements which are considered incidental to retaining and noise walls.

Units of Measurement: EA

3.4.13.1 Element 9342 – Sign Attachment to Wall – Incidental

This element addresses signs attached to walls as well as the attachment utilized to connect signs to walls. These attachments support overhead signs (SIGN, CSIGN, BSIGN, DSIGN). Examine the lower portions of the vertical sign member within 4' of the attachment (referred to as the "sign connection" below) for cracks and distress.

CDOT Notes: Wall components in the vicinity of the attachment are to be inspected for any signs of deterioration or distress and the condition reported with the appropriate element. The following sentence should be modified for the situation and included in the comments for this element: "<Sign Str. No.> is attached to this wall.

3.4.13.2 Element 9343 – Pole Attachment to Wall – Incidental

This element addresses the miscellaneous pole attachments connected to walls. These attachments include signal poles, light poles, camera poles, or any other item which utilizes a pole that is attached to a wall. The pole attachment does not include regulatory traffic signs. Examine portions of the pole within 4' of the wall attachment (referred to as the "pole connection") for cracks and distress.

3.4.13.3 Element 9501 – Channel Condition – Incidental

This element describes the actual physical condition of that part of the waterway that is associated with the flow of water adjacent to the wall. A comment would normally describe conditions that might adversely affect the flow of water through the channel.

3.4.13.4 Element 9502 – Channel Protection Material and Condition – Incidental

This element describes the material used to protect the banks and streambed of the waterway in association with the wall, but excluding the slope protection at the wall. The comment would describe the material and the condition of the channel protection material. Use this element for check dams, aprons, and materials used to protect the channel.

3.4.13.5 Element 9504 – Bank Condition - Incidental

This element describes the actual physical condition of the bank of the waterway that is associated with the flow of water adjacent to the wall. A comment would normally describe conditions that might adversely affect the flow of water through the channel.

3.4.13.6 Element 9530 – Guardrail – Incidental

This element should be used to describe the adequacy of the approach guardrail, its end treatment, and the transition to the wall rail. It shall be limited to the approach guardrail within 150 feet of the wall. Use this element when SI&A Items 36B, 36C, 36D, 36J, 36K, and/or 36L = 0 (inadequate). This element may also be used when approach guardrail is in place, but not functioning as intended due to impact damage, slope erosion or other problems. The approach guardrail components shall be compared to the M & S Standards for approach rails M-606-1 describing the locations, lengths, stiffness, and other details relative to the structure location.

Walls without guardrail are considered adequate if the fill slope is 3:1 or flatter and the horizontal distance from the outside edge of the travel lanes (shoulder stripe) to the wall is 30 feet or greater.

Items 36B, 36C, 36D, 36J, 36K, and/or 36L shall be coded a 0 if the existing approach rail is damaged significantly. The condition and change shall be noted here. When the rail has been repaired adequately, then Items 36B, 36C, 36D, 36J, 36K, and/or 36L should be changed again accordingly.

This element should also be used to denote the reason why a rail is considered adequate for reasons beyond the M & S Standards. For example, there is an adequate amount of approach rail for the reduced speeds along this highway and there is a road along the canal.

The ends of rails beyond 150 feet from the wall are not to be considered. For wall purposes, the end treatment should be considered adequate because it is continuous.

3.4.13.7 Element 9795 – Adjacent Roadway – Incidental

This element should describe any deterioration or other issues seen on the roadway adjacent to the wall. This includes both the routes in front and carried by or behind the wall. The inspector should especially note any sagging or cracking in carried routes parallel to the wall, as this may be sign of backfill loss.

3.4.13.8 Element 9796 – Leveling Pad/Toe Protection – Incidental

This element should be used to describe any issues with the leveling pad or toe protection of the wall. This may include erosion, scour, or large construction projects adjacent to the wall which may affect the stability of the wall foundations.

3.4.13.9 Element 9797 – Adjacent Slope – Incidental

This element should be used to describe any abnormalities with the slope carried by, behind, or in front of the wall. This may include erosion, heavy vegetation growth, or unstable soils.

3.4.13.10 Element 9798 – Pedestrian Railing/Fencing - Incidental

The element includes all pedestrian railings or fencings in front of or on top of the wall. These elements should be inspected for impact damage, corrosion, and other signs of stress or deterioration.

3.4.13.11 Element 9799 – Access Panels – Incidental

The element includes all access panels on the wall. Access panels should be inspected for impact damage, corrosion, and other signs of stress or deterioration.

3.4.14 Environmental Factors (Service Environments)

Elements exposed to different environmental factors and service environments deteriorate differently. For the purposes of this program, these factors include:

- Adjacent Waterway – This environmental factor should be indicated for any wall element within 100 feet of a waterway, or at the discretion of the inspector.
- Splash Zone - The splash zone is defined as a perimeter measuring 10 feet horizontally from the edge of the road and 10 feet vertically. If a wall element is within this zone, the inspector should indicate that finding.

When inventorying and assessing the condition of the elements, an inspector should consider the environment in which the element is operating. The environmental designation of an element can change over time; as it would, for example, if operating policies were changed to reduce the use of road salt. However, by definition, the environmental designation for any element cannot change as the result of maintenance work or deterioration.

Environment	Description
1 – Benign	Neither environmental factors nor operating practices are likely to significantly change the condition of the element over time, or their effects have been mitigated by the presence of highly effective protective systems.
2 – Low	Environmental factors, operating practices, or both either do not adversely influence the condition of the element, or their effects are substantially lessened by the application of effective protective systems. This rating should be coded for elements in the following locations: 1. Wall element is located next to an adjacent waterway as described above – OR – 2. Wall element is located within the splash zone as described above
3 – Moderate	Any change in the condition of the element is likely to be quite normal as measured against the environmental factors, operating practices, or both that are considered typical by the agency. This rating should be coded for elements in the following locations: 1. Wall element is located next to an adjacent waterway as described above – AND – 2. Wall element is located within the splash zone as described above
4 – Severe	Environmental factors, operating practices, or both contribute to the rapid decline in the condition of the element. Protective systems are not in place or are ineffective.

Appendix 3.A: State Specific Defects (Former Smart Flags)

The following defects were created to take the place of the former Smart flags. They are used to note defects which may not be adequately described in the original element conditions states. Two new defects were created for retaining and noise walls and are noted below with descriptions for their use.

3.A.1 Defect (8020) – Temporary Support

Description: This condition state language addresses the use of false foundational supports and other temporary supports under the wall facing. These supports may be used to **temporarily** raise the load carrying capacity of the wall or as a **temporary repair** for an element.

Units of Measurement: varies

Quantity Calculation: Count of the total locations at which temporary supports are in effect.

Defect	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Temporary Support (8020)	None	The temporary support is functioning as intended. All components are as constructed, there is full bearing with the wall facing, and the foundation is sound.	There are some wall facing elements not bearing as intended or constructed, the false temporary support is loose and not stable, the foundation is starting to be undermined by water/wind etc.	The temporary support is no longer in contact with wall facing, the foundation is undermined to the point of affecting its stability, it is no longer functioning as intended or constructed.

3.A.2 Defect (8030) – Alkali-Silica Reactivity (ASR)

Description: The condition states for this defect identify the severity of ASR in individual concrete components of the wall i.e. wall facing, foundation, vertical supports.

Units of Measurement: varies

Quantity Calculation: Record the estimated quantity in the appropriate condition state. The Total Quantity is the sum of quantities in Condition States 2 through 5 and can be as large as 99999.

Defect	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Alkali-Silica Reactivity (ASR) (8030)	None	Some evidence of ASR in few and minor surface cracks	Moderate cracking caused by ASR. Gel staining around surface cracks and dark reaction rims at periphery of reacted aggregate.	Spalls, swelling, water retention, and deterioration caused by ASR; alkali-silica gel in voids of cement paste, cracks within reactive aggregates, and deposits of reaction products on element surface

Appendix 3.B: Materials and Defects by Material Type

This Appendix describes the element materials defined for this manual and the defects that may be observed for each condition state. Included are individual materials, such as reinforced and prestressed concrete, steel, timber, masonry, and other materials; and element types that are made of mixed materials or are not material-based, including joints, protective coatings, and wall facing protection systems. For each material type, the defects are identified with a unique defect code and conditions are described for each state. The primary intent of this Appendix is to provide a roadmap of defined defects for each material, without considering the specific element constructed of the material. Defect identification codes are provided for reference consistent with Appendix 3.C. Article 3.B1 provides a list of the defects cross-tabulated with the materials for which the defects are defined, as well as the classification of the defect – NBE or ADE. CDOT suggested condition states for corrosion of steel elements are described in **Article 3.B2**. **Figure B-1** presents the information from **3.B.1** in graphical form.

3.B.1 Defect Definitions and Materials

Defect Name (Number)	Used to report	Materials	Class
Corrosion (1000)	Corrosion of metal and other material elements. 	Steel/Metal Other Materials	NBE
Cracking (1010)	Fatigue cracking in metal and other material elements.	Steel/Metal Other Materials	NBE

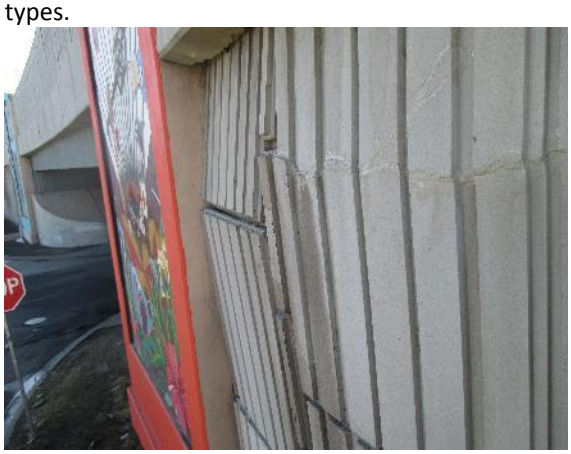
Defect Name (Number)	Used to report	Materials	Class
Connection (1020)	Connection distress in metal and other material elements.  	Steel/Metal Timber Other Materials	NBE

Defect Name (Number)	Used to report	Materials	Class
Delamination/Spall/ Patched Area (1080)	Spalls, voids, honeycombing, delamination, and patched areas in concrete, masonry, and other material elements. 	PSC RC Masonry Other Materials	NBE
Exposed Rebar/Welded Wire Fabric/Strands (1090)	Exposed conventional reinforcing steel, welded wire fabric, or strands in reinforced and prestressed concrete elements. 	PSC RC	NBE
Exposed Prestressing (1100)	Exposed prestressing steel in concrete elements.	PSC	NBE
Cracking (PSC) (1110)	Cracking in prestressed concrete elements.	PSC	NBE

Defect Name (Number)	Used to report	Materials	Class
Efflorescence/Rust Staining (1120)	Efflorescence/rust staining in concrete and masonry elements. 	PSC RC Masonry Other Materials	NBE
Cracking (RC and Other) (1130)	Cracking in reinforced concrete and other material elements. 	RC Other Materials	NBE
Decay/Section Loss (1140)	Decay (section loss) in timber elements.	Timber	NBE

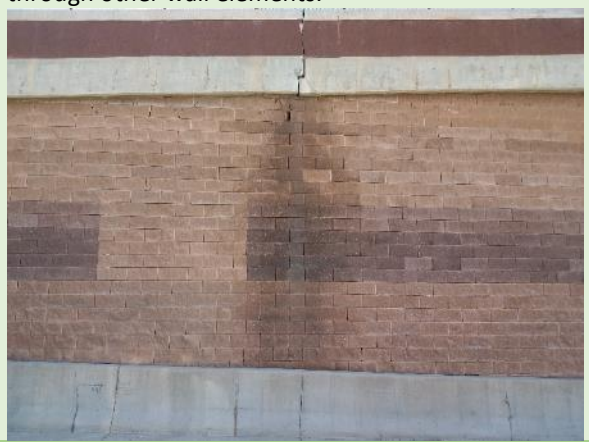
Defect Name (Number)	Used to report	Materials	Class
Check/Shake (1150)	Checks and shakes in timber elements. 	Timber	NBE
Crack (Timber) (1160)	Cracking in timber elements.	Timber	NBE
Split/Delamination (Timber) (1170)	Splits/delaminations in timber elements 	Timber	NBE
Abrasion/Wear (Timber) (1180)	Abrasion in timber elements	Timber	NBE
Abrasion/Wear (PSC/RC) (1190)	Abrasion/wear in PSC and RC elements. 	PSC RC	NBE
Deterioration (Other) (1220)	General deterioration in elements constructed of other materials such as fiber reinforced plastics or similar.	Other Materials	NBE

Defect Name (Number)	Used to report	Materials	Class
Mortar Breakdown (Masonry) (1610)	Breakdown of masonry mortar between brick, block, or stone.	Masonry	NBE
Split/Spall (Masonry) (1620)	Splits or spalls in brick, block or stone. 	Masonry	NBE
Patched Area (Masonry) (1630)	Masonry patched areas. 	Masonry	NBE
Masonry Displacement (1640)	Displaced brick, block, or stone. 	Masonry	NBE

Defect Name (Number)	Used to report	Materials	Class
Distortion (1900)	Distortion from the original line or grade of the element; used to capture all distortion regardless of cause that is not described by another defect.	Steel/Metal	NBE
		PSC	
		RC	
		Masonry	
		Timber	
		Other Materials	
Bulging (1910)	Bulging of wall facing or vertical support elements. Includes panels, blocks, posts, and other element types. 	Steel/Metal	ADE
		PSC	
		RC	
		Masonry	
		Timber	
		Other Materials	
Vertical Rotation (1920)	Vertical rotation of elements from intended vertical orientation. 	Steel/Metal	ADE
		PSC	
		RC	
		Masonry	
		Timber	
		Other Materials	

Defect Name (Number)	Used to report	Materials	Class
Horizontal Rotation (1930)	Horizontal rotation of elements from intended horizontal orientation. 	Steel/Metal PSC RC Masonry Timber Other Materials	ADE
Separation (1940)	Separation of wall facing or vertical support elements such as blocks and panels. 	Steel/Metal PSC RC Masonry Timber Other Materials	ADE
Graffiti (1950)	Any graffiti, or unwanted painting or marking on the wall element. 	Steel/Metal PSC RC Masonry Timber Other Materials	ADE

Defect Name (Number)	Used to report	Materials	Class
Vegetation Growth (1960)	Any vegetation growth through or around wall elements that may pose a threat to the function of the elements. 	Steel/Metal PSC RC Masonry Timber Other Materials	ADE
Blockage (1970)	Blockage of drainage elements. 	Other Materials	ADE
Effectiveness - Anchors (1980)	Any anchor conditions that may be detrimental to their intended function such as loss of tension, exposure, corrosion, etc.	Steel/Metal RC Other Materials	ADE
Freeze-Thaw Damage (1990)	Deterioration of a wall element caused by freeze-thaw. 	PSC RC Masonry Other Materials	ADE

Defect Name (Number)	Used to report	Materials	Class
Leakage (2310)	Leakage through or around sealed wall joints or through other wall elements. 	Steel/Metal PSC RC Masonry Timber Other Materials	ADE
Seal Adhesion (2320)	Loss of adhesion in sealed wall joints.	Other Materials	NBE
Seal Damage (2330)	Damage to the sealant in wall joint seals.	Other Materials	NBE
Seal Cracking (2340)	Cracking in the sealant in wall joint seals.	Other Materials	NBE
Debris Impaction (2350)	Accumulation of debris in wall joint seals that may or may not affect the performance of the joints.	Other Materials	NBE
Metal Deterioration or Damage (2370)	Metal damage or deterioration in the wall joint.	Other Materials	NBE
Joint Material (2380)	Deterioration, missing, loose, or any other defect associated with joint material other than strip seal expansion joint material.	Other Materials	ADE

Defect Name (Number)	Used to report	Materials	Class
Chalking (Steel Protective Coating) (3410)	Chalking in metal protective coatings.	Steel/Metal Protective Coatings	NBE
Peeling/Bubbling/Cracking (Steel Protective Coatings) (3420)	Peeling, bubbling, or cracking in metal protective coatings.	Steel/Metal Protective Coatings	NBE
Oxide Film Degradation Color/Texture Adherence (Steel Protective Coatings) (3430)	Oxide film degradation of texture in metal protective coatings.	Steel/Metal Protective Coatings	NBE
Effectiveness (Steel Protective Coatings) (3440)	Loss of effectiveness of metal protective coatings.	Steel/Metal Protective Coatings	NBE
Wear (Concrete Protective Coatings) (3510)	Wearing of concrete protective coatings.	Concrete Protective Coatings	NBE
Effectiveness (Concrete Protective Coatings) (3540)	Effectiveness of concrete protective coatings.	Concrete Protective Coatings	NBE
Chalking (Concrete and Masonry Protective Coating) (3550)	Chalking in concrete and masonry protective coatings.	Concrete and Masonry Protective Coatings	ADE
Peeling/Bubbling/Cracking (Concrete and Masonry Protective Coatings) (3560)	Peeling, bubbling, or cracking in metal protective coatings. 	Concrete and Masonry Protective Coatings	ADE

Defect Name (Number)	Used to report	Materials	Class
Effectiveness - Protective System (e.g. cathodic) (3600)	Effectiveness of internal concrete protective systems (epoxy rebar, cathodic protection, etc.). 	Concrete Reinforcing Steel Protective Systems	NBE
Wear (Timber Protective Coatings) (3610)	Wearing of timber protective coatings 	Timber Protective Coatings	ADE
Effectiveness (Timber Protective Coatings) (3620)	Effectiveness of timber protective coatings.	Timber Protective Coatings	ADE
Wear (Other Protective Coatings) (3630)	Wearing of other protective coatings	Other Protective Coatings	ADE
Effectiveness (Other Protective Coatings) (3640)	Effectiveness of other protective coatings.	Other Protective Coatings	ADE

Defect Name (Number)	Used to report	Materials	Class
Backfill Loss (5010)	Backfill loss associated with the slope behind a retaining wall. 	Slope	ADE
Water Retention (5020)	Accumulation of water behind the wall as indicated by surface ponding. 	Slope/Drainage Element	ADE
Erosion (5030)	Erosion of any material adjacent to the wall, especially that as evidenced by toe exposure or around drainage swales. 	Slope/Drainage Element	ADE

Defect Name (Number)	Used to report	Materials	Class
Settlement (4000)	Settlement in foundation elements. 	Steel/Metal PSC RC Masonry Timber Other Materials	NBE
Scour (6000)	Scour in foundation or main facing elements. 	Steel/Metal PSC RC Masonry Timber Other Materials	NBE
Damage (7000)	Impact damage. 	Steel/Metal PSC RC Masonry Timber Other Materials Wearing Surfaces Steel/Metal Protective Coatings Concrete Protective Coatings Concrete Reinforcing Steel Protective Systems	NBE

Defect Name (Number)	Used to report	Materials	Class
Temporary Support (8020)	Addresses the use of false foundations and other temporary supports on the wall facing, vertical supports, or foundation. These supports may be used to temporarily raise the load carrying capacity of the wall or as a temporary repair for an element.	Steel/Metal	ADE
		PSC	
		RC	
		Masonry	
		Timber	
		Other Materials	
Alkali-Silica Reactivity (ASR) (8030)	The condition states for this defect identify the individual concrete components of the wall i.e. wall facing, foundation, vertical supports. Use the following condition states to identify the component with suspected ASR.	PSC	ADE
		RC	
		Other Materials	

3.B.2 CDOT Suggested Condition States for Corrosion and Cracking

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON UNPAINTED STEEL ELEMENTS		
	Description	CS
R1	Pitting or surface rust, etc. No measurable section loss	2
R2	Flaking, minor section loss (≤ 10% thickness loss)	3
R3	Flaking, swelling, mod. section loss (10% < thickness loss ≤ 30%) **structural analysis is not warranted.**	3
R3	Flaking, swelling, mod. section loss (10% < thickness loss ≤ 30%) **structural analysis is warranted due to location of corrosion on the member.**	4
R4	Heavy section loss (> 30% thickness loss), may have holes through base metal.	4

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON PAINTED STEEL ELEMENTS		
	Description	CS
Light R1	Slight peeling of the paint, pitting, or surface rust, etc. No measurable section loss	2
R1	Peeling of the paint, pitting, surface rust, etc. No measurable section loss	2
R2	Flaking, minor section loss (≤ 10% thickness loss)	3
R3	Flaking, swelling, mod. section loss (10% < thickness loss ≤ 30%) **structural analysis is not warranted.**	3
R3	Flaking, swelling, mod. section loss (10% < thickness loss ≤ 30%) **structural analysis is warranted due to location of corrosion on the member.**	4
R4	Heavy section loss (> 30% thickness loss), may have holes through base metal	4

CDOT SUGGESTED CONDITION STATES FOR CRACKS IN REINFORCED CONCRETE ELEMENTS						
WIDTH (W) in millimeters (inches)						
TYPE OF CRACK	NONE	≤ 0.8 mm (≤1/32 in)	8 < W ≤ 2 (1/32) (1/16)	2 < W ≤ 2.5 (1/16) (3/32)	8 < W ≤ 2 (3/32) (1/8)	W > 3 mm (>1/8 in)
SHEAR	1	2	2	3	4	4
FLEXURE	1	1	2	3	4	4
DIAGONAL	1	2	2	3	3	4

CDOT SUGGESTED CONDITION STATES FOR CRACKS IN PRESTRESSED CONCRETE ELEMENTS			
CS1	CS2	CS3	CS4
≤ 0.10 mm (≤ 0.004 in)	0.10 < W ≤ 0.25 (0.004 in) (0.009 in)	0.25 < W ≤ 0.76 (0.009 in) (0.030 in)	W > 0.76 mm (> 0.030 in)

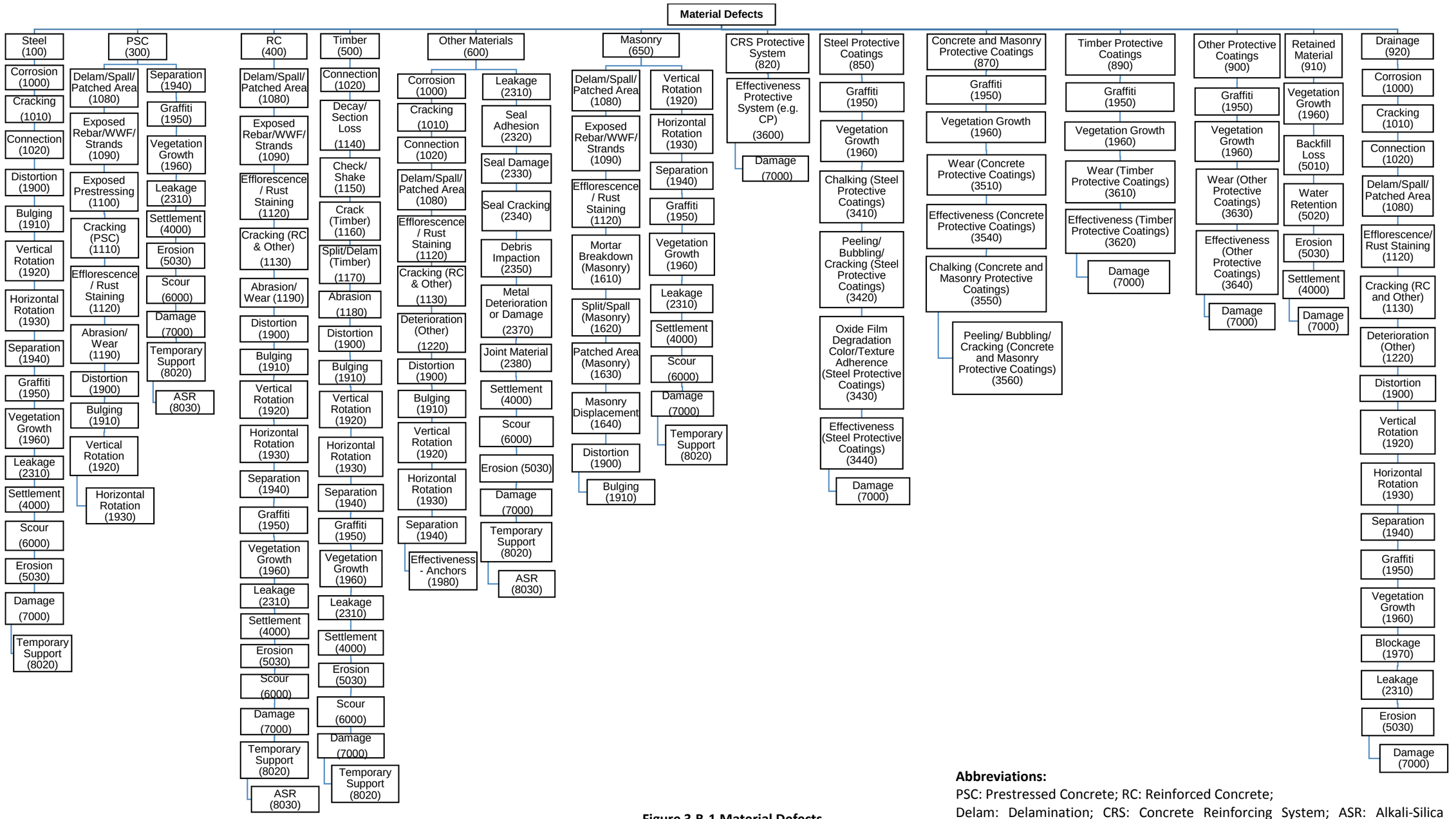


Figure 3.B-1 Material Defects

Abbreviations:
PSC: Prestressed Concrete; RC: Reinforced Concrete;
Delam: Delamination; CRS: Concrete Reinforcing System; ASR: Alkali-Silica Reactivity

Appendix 3.C: Materials and Feasible Action by Material Type

This Appendix describes the element materials defined for this manual and the feasible actions that may be applied for each condition state. Included are individual materials, such as reinforced and prestressed concrete, steel, timber, masonry, and other materials; and element types that are made of mixed materials or are not material-based, including joints, protective coatings, and wall facing protection systems. For each material or element type, the feasible actions are listed at a high level, with the understanding that actual actions may differ in scope and detail. Actual actions and recommendations should be noted on the inspection report using the maintenance activity codes at the end of this section. The primary intent is to provide a roadmap of possible actions scaled by distress or defect severity, with the assumption that needed work for all elements constructed of these materials or in an element family may be addressed by one or more of these common feasible actions.

3.C.1 Steel (100)

	Condition States			
	1	2	3	4
Feasible Actions	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.2 Prestressed Concrete (300)

	Condition States			
	1	2	3	4
Feasible Actions	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.3 Reinforced Concrete (400)

	Condition States			
	1	2	3	4
Feasible Actions	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.4 Timber (500)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.5 Other Materials (600)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.6 Masonry (650)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.7 Concrete Reinforcing Steel Protective Systems (820)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.8 Steel Protective Coatings (850)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.9 Concrete and Masonry Protective Coatings (870)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.10 Concrete Protective Coatings (880)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.11 Timber Protective Coatings (890)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.12 Other Protective Coatings (900)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.13 Retained Material (910)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

3.C.14 Drainage Elements (920)

Feasible Actions	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
	Do Nothing	Do Nothing	Do Nothing	Do Nothing
	Protect	Protect	Protect	Protect
		Repair	Repair	Repair
			Rehabilitate	Rehabilitate
			Replace	Replace

Appendix 3.D: Work Candidate Codes

The inspector should define the work candidate activity(ies) recommended for any discovered defects, using the activity names described below. Italicized maintenance activities were created specifically for the wall inspection program, while normal font indicates maintenance activity codes that are also used for CDOT's bridge inspection program.

Signs (Installation, Repair, Maintenance)

Activity Name	Description
Misc-Sign	Any sign work not specified elsewhere
Misc-Install Sign	Install signs- narrow/one-lane/stop/horizontal clearance/speed reduction/delineators/object markers
Misc-Repair/Replace Util or Sgn	Replace/reset/revise signs - narrow/one-lane/stop/horizontal clearance/speed reduction/ delineators/object markers

Cleaning or Washing

Activity Name	Description
Cleaning or Washing	All cleaning or washing not specified elsewhere
Drain – Cln/Clr Dck Drain/Dwnspout	Clean out drains.
Clean sidewalks/curbs/joints	Remove sand and debris from sidewalks/curbs/ joints.
Tree/Brush/Grass Removal and Trimming	Remove vegetation from around structure.

Special Inspection

Activity Name	Description
Wall – Monitor	*Wall/Structural Visual Inspection/Monitoring*

Wall/Architectural Facings

Activity Name	Description
Wall	*Any wall or architectural facing work not specified elsewhere*
Paint – General	*Clean and/or paint wall*
Wall – Repair Timber	*Tighten/repair timber wall facing*
Wall – Patch Spalls	*Patch delaminations or spalls on concrete or masonry wall facing (may include cleaning of rebar)*
Wall – Replace	*Replace concrete wall panel(s)/facing unit(s) (includes stabilization of existing backfill)*
Wall – Repair Damage	*Repair damaged wall facing (may include stabilization of existing backfill)*
Wall – Metal/Corrosion	*Remove corrosion and overlay protective coating on metal wall facing*
Wall – Erosion	*Fill erosion/scour holes around wall*

Foundation

Activity Name	Description
Wall – Foundation	*Any foundation work not specified elsewhere*
Wall – Replace Foundation	*Replace foundation*
Wall – Repair Foundation	*Repair concrete foundation*
Wall – Stabilize Foundation	*Place fill/riprap/material at base of wall on foundation platform or leveling pad*
Wall – Foundation Erosion	*Fill erosion/scour holes around foundation*

Vertical Support Members

Activity Name	Description
Vertical Supports	*Any vertical support work not specified elsewhere*
Wall – Paint Vertical Supports	*Clean and/or paint vertical support members*
Wall – Replace Vertical Supports	*Replace vertical support member*
Wall – Repair Vertical Supports	*Repair vertical support member*
Wall – Stabilize Vertical Supports	*Re-stabilize vertical support member (insert grout plugs, anchors, etc.)*
Wall – Vertical Supports Erosion	*Fill erosion/scour holes around vertical supports*

Anchors

Activity Name	Description
Wall – Anchors	*Repair/replace anchors*

Curbs and Railings

Activity Name	Description
Wall – Paint Railing	*Clean and paint wall rail.*
Wall – Repair Railing	*Repair wall rail.*
Wall – Replace Railing	*Replace damaged or non-compliant wall rail.*
Curbs and Rail	*All curb and sidewalk work not specified elsewhere.*
Wall – Repair Curb/SW	*Repair/Replace curb/sidewalk or wheel guard.*

Horizontal and Vertical Copings or Pilasters

Activity Name	Description
Coping	*Any horizontal or vertical coping work not specified elsewhere*
Wall – Paint Coping	*Clean and/or paint coping/pilaster*
Wall – Replace Coping	*Replace coping/pilaster*
Wall – Repair Coping	*Repair concrete coping/pilaster*

Retained Material

Activity Name	Description
Wall – Backfill Repair	*Replace/repair berms/fill slopes and slope protection.*
Wall – Backfill Erosion	*Fill erosion/voids/scour holes in backfill*
Wall – Re-stabilize Slope	*Re-stabilize slope*

Joints

Activity Name	Description
Wall – Seal Open Joint	*Seal open joints (non-expansion).*
Wall – Repair Joints	*Repair joints (non-expansion) e.g. "D" cracking.*
Wall – Rep Expansion Joints	*Repair/replace expansion joints and seals.*
Wall – Tighten Expansion Joint	*Tighten expansion joint.*

Drainage Elements

Activity Name	Description
Wall – Drainage	*Any drainage work not specified elsewhere*
Wall – Repair/Repl Weep Holes	*Repair/Replace weep holes*
Wall – Repair/Repl Drain Swales	*Repair/Replace drainage swales/area drains/other drains*
Wall – Install Weep Holes	*Install weep holes (for walls with no prior drainage)*
Wall – Install Other Drain	*Install drainage swales/area drains/other drains*

Miscellaneous Wall Work

Activity Name	Description
Wall – Misc	*Describe the type of miscellaneous work needed that is not covered under another activity e.g. wrong structure number, loose utilities, etc.*

Maintenance Requiring Engineering

Activity Name	Description
Wall – Maint Engineering	*Describe the condition that requires engineering before maintenance can proceed with the repair.*

3.D.1 Maintenance Priority Definitions

Priority levels should be assigned to each work candidate at the discretion of the inspector based on the severity of the defect. More severe defects involving the structural stability of the wall should receive higher priority, and less severe defects such as aesthetic defects should receive a lower priority rating. The following table describes the repair timeline associated with each priority level.

Priority Definitions	
Priority Level 3 – High (Orange)	Repair within the time specified by the inspector or at most within 30 days
Priority Level 2 – Medium (Yellow)	Repair within 90 days
Priority Level 1 – Low (Green)	Repair within one year or as funding allows

COLORADO
Department of Transportation

RETAINING AND NOISE WALL INSPECTION AND ASSET MANAGEMENT PROGRAM

CHAPTER 4: WALL ASSET MANAGEMENT PLAN

April 2016

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4.1 Basis for Asset Management

The purpose of asset management is to meet performance targets through the management of assets in the most cost-effective manner. The Federal Transportation Authorization, Moving Ahead for Progress in the 21st Century Act (MAP-21) created the National Highway Performance Program (NHPP) which requires states to develop *risk-based* asset management plans for the National Highway System (NHS). In developing asset management plans, states are encouraged in "*to include all infrastructure assets within the right-of-way corridor,"* [Section 1106e(3)]. Therefore, in addition to bridges and pavements, plans may include other assets such as retaining walls. The state plan must, at a minimum, (1) provide an inventory of NHS assets; (2) state the plan objectives and measurements; (3) identify performance gaps; (4) provide a framework for asset lifecycle cost analysis, risk analysis, and risk management; and (5) provide a financial plan and investment strategy.

Based on the MAP-21 and the current FAST Authorization legislative guidance, risk will be incorporated into the CDOT retaining wall asset management plan. Further, the asset management plan considered the seven National Performance Areas under MAP-21/FAST legislation, which serve as the basis for risk analyses under this plan and are listed below.

- Safety: To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- Infrastructure condition: To maintain the highway infrastructure asset system in a state of good repair.
- Congestion reduction: To achieve a significant reduction in congestion on the NHS.
- System reliability: To improve the efficiency of the surface transportation system.
- Freight movement and economic vitality: To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
- Environmental sustainability: To enhance the performance of the transportation system while protecting and enhancing the natural environment.
- Reduced project delivery delays: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

4.2 Incorporation of Risk in Retaining Wall Asset Management Plan

For this asset management plan, risk is defined as the product of likelihood and consequence for an adverse event, such as a wall failure or deterioration in wall condition or condition states. It is important to note that a variety of direct field observation parameters as well as surrogate parameters are used to establish likelihood. For example, the condition of an asset, recurrence intervals for maintenance activities, or expert opinion can be indicators of likelihood for an occurrence. For risk based asset management of walls, this plan evaluates a range in potential consequences that align with the

performance goals indicated in the current Federal FAST legislation as well as the CDOT Fiscal Year 14-15 Performance Plan. The consequences initially considered for plan development include the following:

- condition loss and damage to the wall;
- safety hazards to traveling public;
- potential traveler delay, congestion, and mobility impacts;
- CDOT Maintenance expenses for wall repair;
- impacts to environmental resources;
- economic loss to users (user costs); and
- private property damage.

In general, the risk-based asset management approach includes the evaluation of the likelihood of an adverse occurrence and the associated consequences in the performance areas above. Based on the initial assessment, the consequences associated with retaining wall assets appear to have the largest impact to performance areas related to, mobility and wall condition, which includes maintenance expenses. Impacts to other performance areas such as safety and the environmental resources could also result. However, these impacts are generally minor or duplicative to mobility and maintenance performance outcomes and, thus, are proposed in the overall asset management risk evaluation of a wall at this time.

The risk analysis is the plan can be performed at multiple plan levels ranging from qualitative (subjective) levels of accuracy for higher level plan decisions to more rigorous quantitative (numerical) evaluations for specific wall assets. In both instances, the risk process can assign values to various conditions, the extent of infrastructure vulnerability and the measures used to manage adverse consequences.

4.3 Purpose and Need for Wall Management

Retaining, bridge, and noise walls are a growing asset class within CDOT. The wall asset inventory is anticipated to expand as walls are becoming more common on projects requiring avoidance of right-of-way or environmental impacts. As shown in **Figure 4.1**, the growth of the know wall asset inventory has increased every year since 1998, with an average of approximately 110 walls added each year during this period. These data should be considered approximate due to the initial basis of the wall inventory; however, the trend is presumed to be accurate. Although the current inventory is still in formulation, the estimated wall area for existing structures is around 12 million square feet. Using a conservative replacement cost of $60 per square foot, this asset class represents over $720M dollars of replacement value.

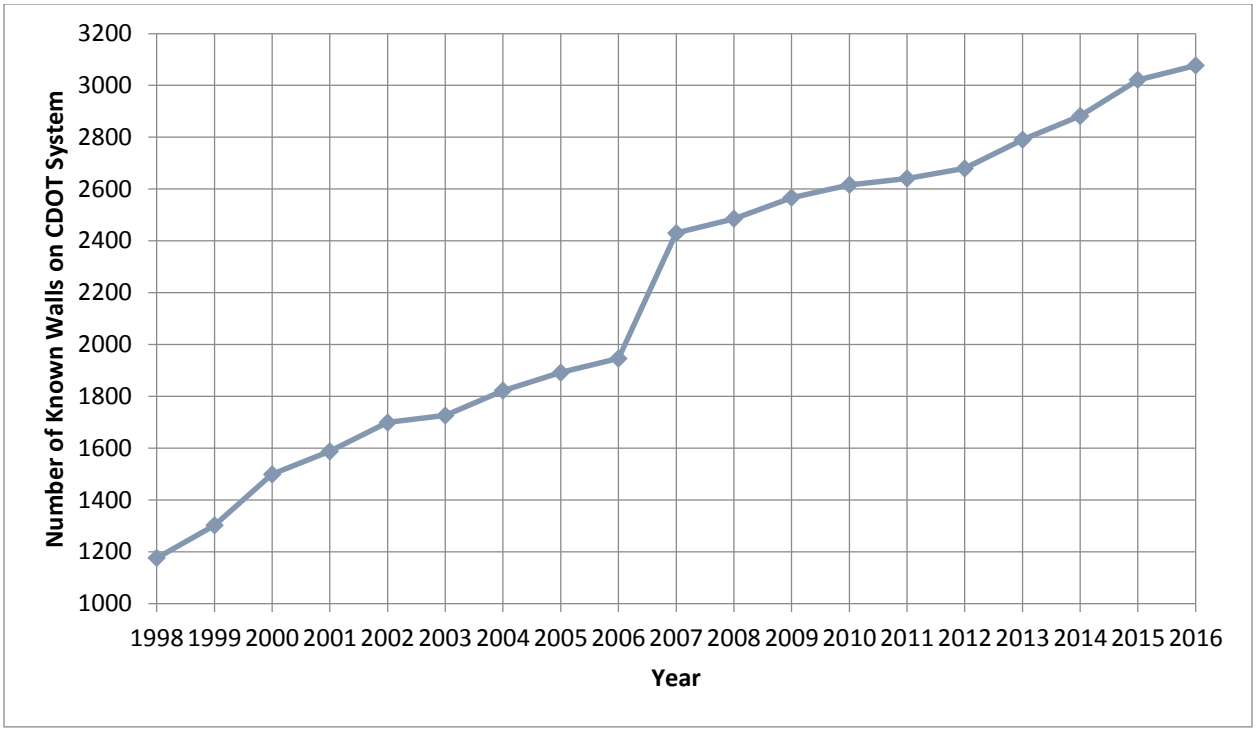


Figure 4.1 – CDOT Wall Asset Inventory Growth, 1998-2016.

Additionally, CDOT has observed an increasing frequency of maintenance activities or repairs associated with wall assets, particularly retaining and bridge walls. This trend also is anticipated to increase due to the growth of the asset inventory in the last 15 years. As documented below, some walls have required repairs 10-15 years after construction and older walls have failed within 40 years of construction. Given the growth of the wall asset inventory, CDOT is anticipating a considerable need for wall asset management moving forward as a larger quantity of walls age.

With the anticipated growth in wall assets comes the need to better manage the wall system as a whole. Factors considered throughout the development of the asset management program include redefining the management approach, understanding the economic impacts for risk-based management, and improving data collection methodologies to obtain parameters that will support risk evaluation and financial planning. These factors are discussed in greater detail below.

4.3.1 Shifting the Management Approach

Within CDOT, as well as many local agencies and other state DOTs, the current program approach for managing wall assets is typically reactive in nature. As a result, most repairs and wall maintenance are carried out in response to failure events, vehicle impact damage, or observed deterioration reported by Maintenance staff or periodic inspections. One goal of the risk-based asset management approach is to shift the process towards a more proactive approach with a long-term view of the overall health of the statewide wall system and develop a multi-year investment plan that will support wall assets to optimize life-cycle costs. This requires the wall program to consider multiple approaches as shown in **Figure 4.2**. For example, a portion of the management approach considers the need for unanticipated or emergency repair or maintenance activities in response to events such as impact damage or wall failure. Another

aspect of the management approach involves routine maintenance activities intended to preserve wall assets and slow deterioration rates to obtain the anticipated life-cycle. Lastly, the management approach considers the wall system as a statewide asset class with long-term financial plans to maintain the system and reduce risk statewide.

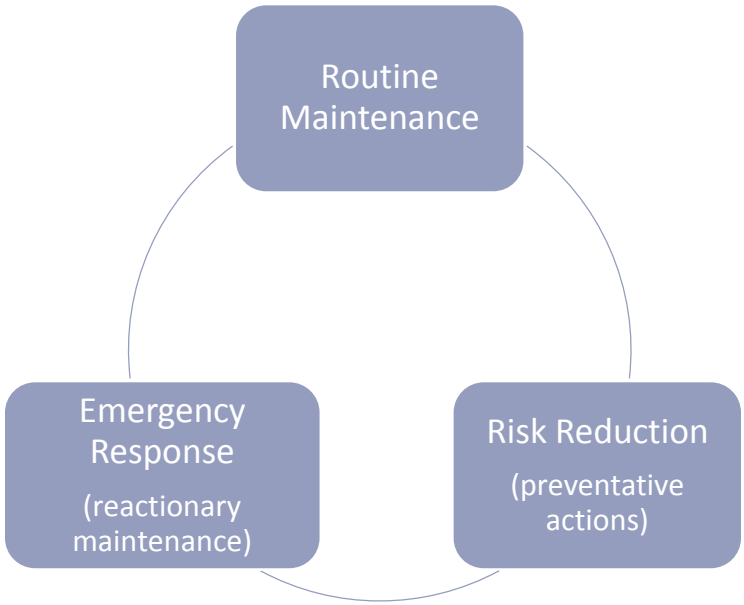


Figure 4.2: Wall asset management program activity levels.

4.3.2 Reducing the Potential for Unanticipated High-Cost Incidents

The risk-based asset management plan identifies walls with a high risk to mobility and economic consequences to provide CDOT the opportunity to manage risks using a lowest life-cycle cost approach. Management of these risks can reduce the need for reactionary response and the resulting unplanned expenditure of funds. Below are two examples of recent adverse wall events that required reactive and unplanned financial investment. In both of these examples, there were indications that investment was needed to preserve the wall asset earlier in the life-cycle; however, the ability to inventory, assess, and mitigate the performance risk was not established at the time and larger investment was ultimately required.

US40 Berthoud Pass Retaining Wall Facing Repair - In 2011, CDOT contracted for the repair of deteriorating precast modular block wall facing (Project No. NH0403-053). The purpose of the project was only repair of the wall facing, which could not be completed by maintenance staff. Additionally, there were no future projects programmed in the area that could have eventually addressed the deterioration as part of a separate effort. As result, the deterioration was worsening and intervention was required.

The walls were constructed in 1998 and evidence of the facing deterioration was noted relatively early in the life cycle. The bid quantity for the repair project included 516 square feet of block facing replacement with an awarded bid price of approximately $67 per square foot, or $35,000 for the total item quantity.

With all other bid items, such as traffic control, mobilization, and ancillary items to support the repair, the total project cost was approximately $260,000 or near $500 per square foot of facing repaired (unadjusted dollars). Based on the outcome of this repair project and the increasing quantity of similar facing type in the asset inventory, CDOT will use the wall condition data collected in this plan to manage similar deterioration conditions with a lower life cycle cost goal.

US6 Dowd Junction Bin Wall Failure - A section of a metal bin wall failed in 2008 near US6 mile marker 174. The wall was approximately 35 years old and the failed section was reported to be in poor condition for several years prior to the failure. The bin wall failure also destabilized a landslide prone embankment that supports I-70, resulting in a permanent embankment stabilization and wall reconstruction project that exceeded $10M. This example was considered in the development of the plan approach in order to give CDOT the ability to identify, prioritize, and invest in mitigation efforts than can prevent a larger adverse event with economic consequences that exceed the required investment for preventive rehabilitation.

4.3.3 Data Improvements

Improvements in data collection and analysis are needed to maximize the benefits of a risk-based management program. Areas of interest for this plan include a detailed inventory and appraisal of each wall asset, internal CDOT operating costs to maintain the wall structure, and user costs associated with wall maintenance and/or adverse events. To date, there is a lack of data in these categories. As part of the current effort, wall assets are being inventoried and inspected to capture more than 140 data items per wall. This data collection step is improving understanding of the statewide wall system life-cycle performance. Furthermore, having a complete inventory of wall assets will allow CDOT to improve how maintenance activities, or the need for activities, are tracked. Previously, operational expenses such as minor wall repairs or rehabilitation efforts by Maintenance staff, non-routine inspection requests from Region staff, and repair of other assets affected by poor wall performance such as pavement or roadway barrier were not well documented with respect to individual wall features. In the future, as the wall inventory data quantity and reliability improves, CDOT Maintenance staff will be able to apply SAP work activity codes directly to individual walls. This will allow for improved accuracy in reporting and a better understanding of expenditures for managing wall assets.

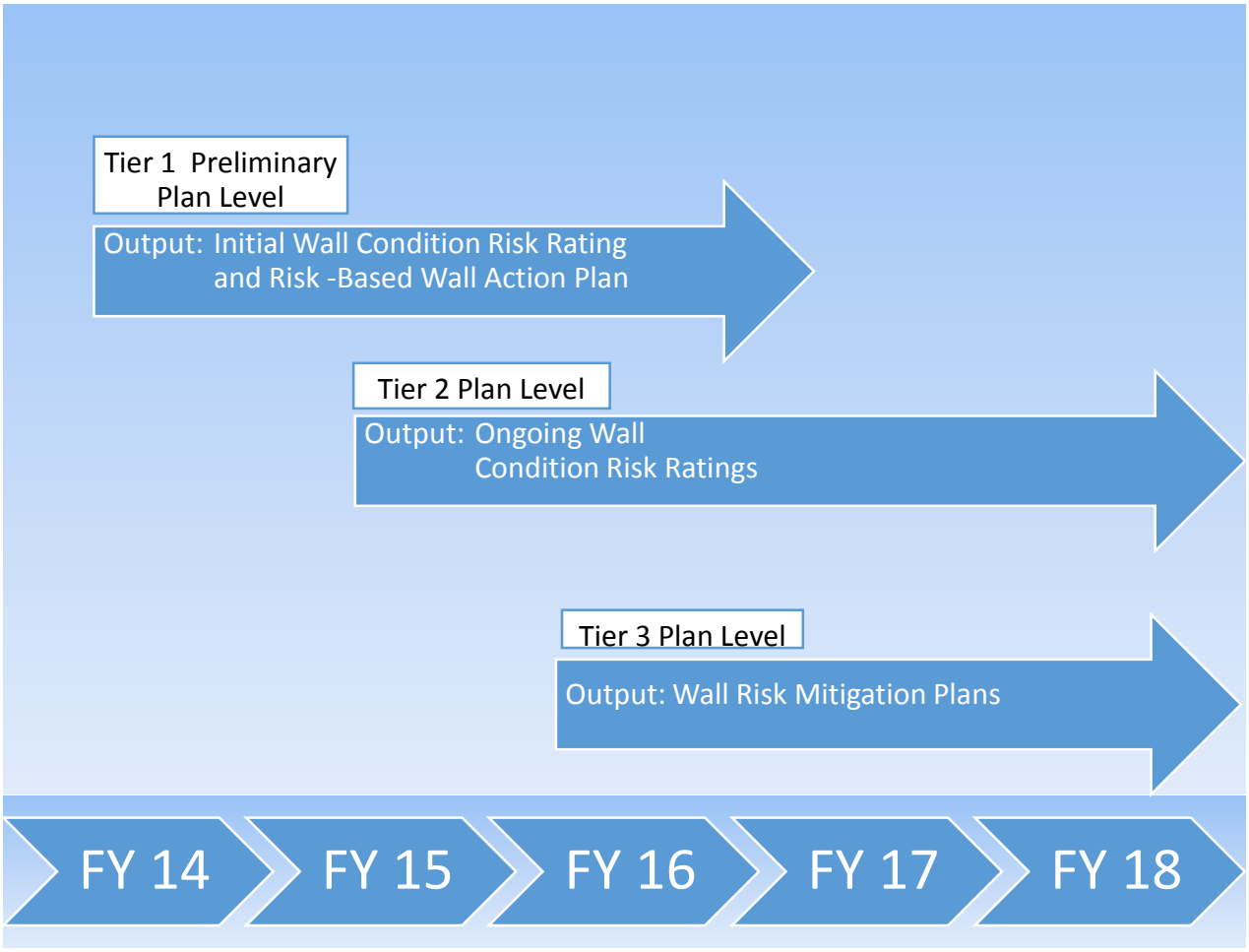
User costs incurred by the traveling public in response to delays due to wall maintenance or failure events are also not well documented at this time. In developing this plan assessment, annual user cost expenses are estimated based on average annual data presented by AASHTO[1] and an assumed average delay time of approximately 2 hours during a worst case adverse event. As part of the inventory and inspection process, field crews are evaluating if traffic control would be needed to complete the inspection and the amount of time for traffic impacts. This can be used to estimate anticipated delay times for roadway users. Additionally, the new inventory listing, traffic control associated with maintenance activities could be tracked to a specific wall in SAP.

[1] AASHTO. User and Non-User Benefit Analysis for Highways. American Association of State Highway and Transportation Officials, 2010. Available at https://bookstore.transportation.org/collection_detail.aspx?ID=65.

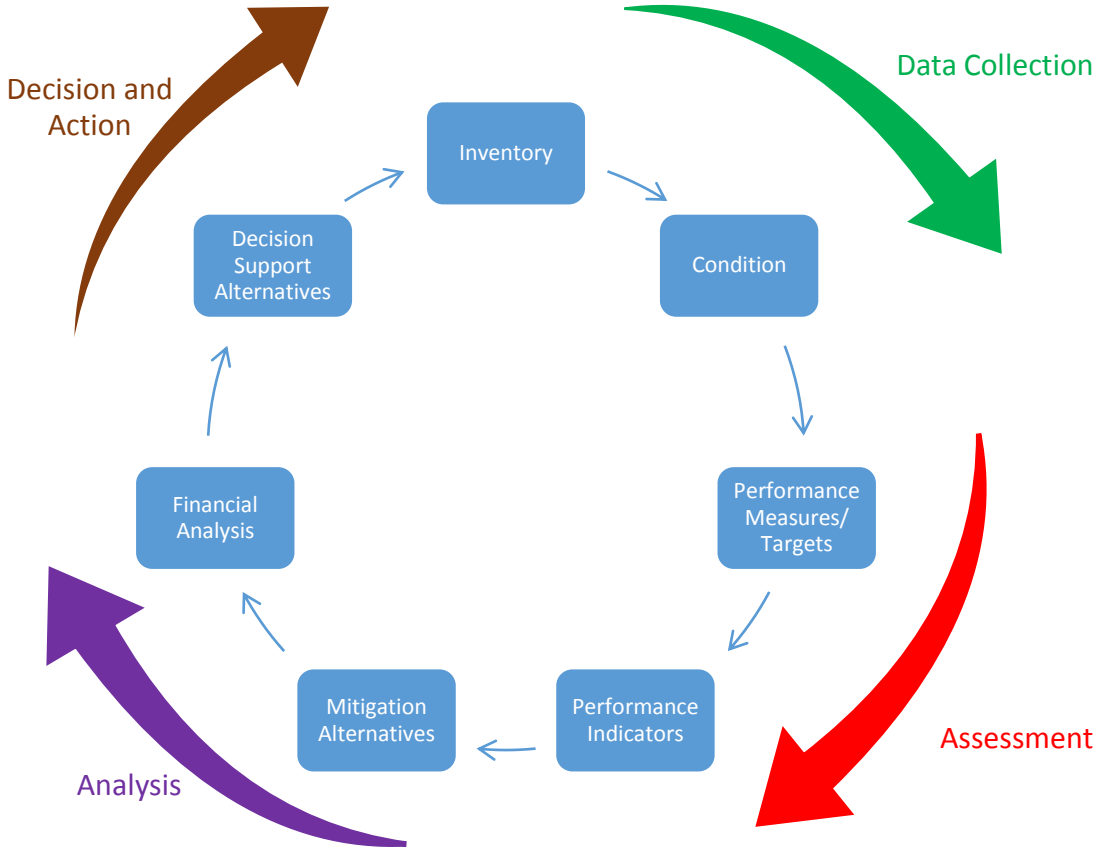
4.4 Risk-Based Wall Asset Management

4.4.1 Risk Concept for Wall Assets

For this plan, risk is evaluated in the context of goal areas related to mobility and wall condition with respect to maintenance costs which are measurable. For the retaining wall asset management plan, multiple plan tiers are utilized to develop risk registers that allow for the prioritization of wall assets on the basis of higher risk. This integrated plan will allow resources to be directed to those walls and/or wall elements that present the greatest risk to CDOT performance in the context of performance measures. The multilevel planning process is illustrated below.



At each tier level, the process will consist of data collection, assessment, analysis, and recommended actions (see figure below). The Tier 1 level is based on a desktop inventory of retaining walls and subjective determination of likelihood and consequence of a potential wall failure. The Tier 2 level is based on measurable data collected during field inspections and is thus, a more detailed assessment of risk to mobility and maintenance. Tier 3 is focused on higher risk walls and cost-benefit analysis to determine the preferred investment strategy such as continued monitoring, rehabilitation, or replacement.



The process steps include the following.

a. Inventory – Determination of what wall assets exist and the associated element parameters. The level of inventory detail will start at a basic level for all walls and progress to greater detail as field inspections occur.
b. Condition – Determination of wall asset conditions based on known data obtained through inventory, inspection, and department records.
c. Performance Measures/Targets – Determination of existing wall performance relative to performance measures and targets such as mobility and condition.
d. Performance Indicators – Assessment of performance relative to targets that are established in accordance with CDOT performance goals or recommended where goals are not defined.
e. Mitigation Alternatives – Development of asset management options to improve or prevent further degradation of performance.
f. Financial Analysis and Investment Planning –Feasibility evaluation for proposed alternatives.
g. Decision Support – Preparation of reports and plan documents to address the process outcomes.

Sections **4.5** through **4.7** detail the plan inputs and outcome for each level.

4.4.2 Risk Considerations between Wall Types

Risk is a means to evaluate the potential threats to CDOT performance areas such as mobility or maintenance expenditures. When considering mobility performance measures, retaining and bridge walls typically will have a higher risk relative to noise walls class due to the potential for greater impacts to mobility. For example, in the worst case consequence of a wall failure, there likely will be greater disturbance to travel lanes from a retaining wall collapse versus a noise wall collapse. The financial consequences typically would be greater as well. Further, among retaining walls, fill walls that directly retain traffic or bridge approaches could have higher risk relative to a retaining wall supporting an uphill slope adjacent to the right-of-way, due to the threat to traffic. This is example is not to diminish the consequence of any wall failure; however, due to constrained funding conditions all walls likely cannot be maintained to equal condition levels. By using risk analysis in the asset management process, the CDOT wall asset management approach is directing limited funds to the assets that present the greatest performance risk. This results in a plan that manages the performance of the wall rather than the wall. For reference, the distribution of wall types relative to the risk levels discussed below is presented in **Section 4.6.3**.

4.5 Tier 1 Plan Level

This initial desktop planning level was focused on a developing an overall ranking of known wall assets based on relative risk to support and help guide the inspection process. This preliminary ranking was used to qualitatively prioritize field inspections, in that regions containing higher risk wall features were generally scheduled for inspection before areas dominated primarily by lower risk walls.

4.5.1 Tier 1 Data Collection

Because no comprehensive retaining or noise wall inventory existed when this plan was initiated, the preliminary Tier 1 inventory procedure was designed to obtain an approximate estimate of the number of wall structures as well as general geometric and functional data. To this end, CDOT's Online Transportation Information Systems (OTIS) application, which allows desktop users to see the roadways as if viewed from a car windshield, was used to virtually drive all CDOT-maintained roadways. Through these virtual observations, the following types of information were recorded.

- Location (route, milepost, latitude and longitude)
- Geometry (length, average height, length, distance from road carried and/or in front)
- Wall Function (retaining, bridge, noise, cut retention, fill retention)
- Wall Type (ex: cast-in-place, masonry, precast, and others)

Additionally, the inspector making the virtual observations was tasked with providing a subjective assessment of the wall condition and likely consequence of an adverse event or failure. Scoring criteria for these parameters are shown in the table below. Lastly, annual average daily traffic (AADT) information was obtained from GIS shapefiles provided by CDOT. Scoring criteria for AADT are also shown below.

Score	Descriptor
Wall Condition	
1	New condition or no noticeable condition loss
2	Acceptable performance, prior maintenance/repair evident
3	Deterioration or condition loss occurring
4	Potentially unstable conditions
Consequence of Failure	
1	Negligible: No impacts to structures, roadway, or off ROW property
2	Minor: No to slight impact to traffic (temporary: less than 1 day)
3	Major: Impact beyond CDOT ROW and/or debris on roadway
4	Critical: Collapse of at least one travel lane (essential structure)
Annual Average Daily Traffic (AADT)	
1	AADT below the 25 percent quartile (less than 13,000)
1.25	AADT between 25 and 50 percent quartile (13,000-31,000)
1.5	AADT between 50 and 75 percent quartile (31,000-107,000)
2	AADT greater than 75 percent quartile (greater than 107,000)

4.5.2 Tier 1 Analysis

The Tier 1 risk ratings were determined based on the product of the virtual inventory parameters that address likelihood of an adverse event or failure and the consequence of the event as it may impact traffic. The calculation for the risk score is presented below.

Tier 1 Risk Score = [**Wall Condition**] x [**Failure Consequence** x **AADT Factor** x **Height Factor**]

The wall condition score was used as a surrogate for the likelihood of an adverse event. This presumes that a wall observed to be experiencing deterioration or condition loss is more likely to experience an adverse event than a newly constructed wall with few or no noticeable defects. Together, the height of the wall, distance to the adjacent roadway, and volume of traffic on the adjacent roadway were used to estimate the consequence from a potential failure. The assumption was that a wall failure on a roadway with 10,000 vehicles per day would likely have a lower mobility performance impact when compared to a failure on a roadway with 100,000 vehicles per day. Additionally, a taller wall was presumed to have an elevated hazard above a shorter wall due to the potential for a greater influence area and potentially greater consequence. Therefore, walls with a height greater than 15 feet were assigned a height factor of 1.1 applied to the consequence value.

Without application of additional factors related to AADT and height, the maximum Tier 1 risk score would be 16 (i.e., 4 x 4). This is indicative of a wall with potentially unstable conditions and loss of at least one travel lane on a low volume road. With the AADT and height factors applied, the maximum rating value would be 35.2 (i.e., 4 x 4 x 2 x 1.1), which would represent the same wall condition risk, but for a wall greater than 15 feet tall and on a high volume roadway.

Preliminary Tier 1 Risk scores were grouped into three categories representing relative risk: high, medium, and low. The thresholds that bound these categories are based bridge inspection and asset management staff judgment. The Preliminary Tier 1 risk categories are as follows:

- Low: risk score of 8 or less
- Medium: risk score between 8 and 12
- High: risk score of 12 or higher

4.5.3 Tier 1 Results and Planning

The Tier 1 planning level was based largely on qualitative and subjective values, and as such, only general statements regarding the performance of the statewide wall system could be made. Through the virtual inventory process, 1,675 walls were identified and assessed. The majority of the walls evaluated under the Tier 1 processes were assigned to the low risk category. Approximately 9 percent of the walls carried a medium risk, and 3 percent of the walls were considered to have relatively high risk as shown in the chart below.

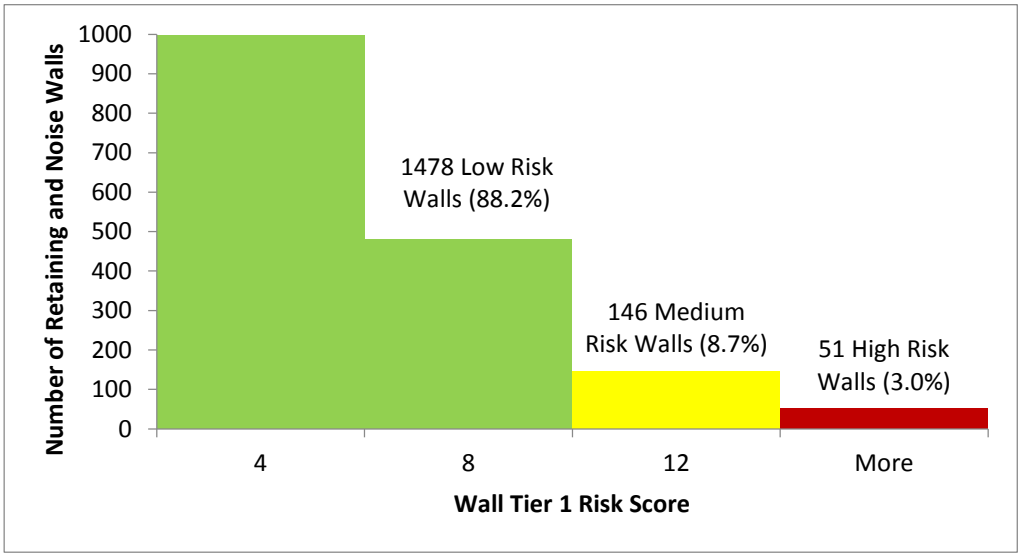


Chart 4.1 Distribution of Walls by Tier 1 Risk Value

The results from the Tier 1 inventory and risk assessment were used to guide subsequent field inspections. Wall assets and associated risk categories were viewed in a GIS map environment to better understand the geographic distribution of high and medium risk walls throughout the state. While weather conditions played an important role in developing the schedule for field inspections, clusters of high and medium risk walls were also identified and targeted for Tier 2 level completion early in the inspection process.

4.6 Tier 2 Plan Level

Whereas the Tier 1 plan level utilized data obtained through virtual, or desktop, observations of wall assets, the Tier 2 plan level incorporates measurable data collected during boots-on-the-ground field inspections of wall and element conditions. The use of these quantitative Tier 2 data allows CDOT to assess wall performance in accordance with CDOT performance areas and asset management program

goals for reducing overall risk with a specific focus on managing mobility and maintenance risk costs. The Tier 2 planning level is intended to provide a risk based scoring of all wall assets in the system, develop performance goals and metrics, and support decisions for long-range planning.

4.6.1 Tier 2 Data Collection

Tier 2 data collection involves deployment of inspection crews to visit each wall asset to measure and collect the data items outlined in the Chapters 2 and 3 of this manual. Whereas the Tier 1 plan level relies on a handful of subjective parameters to assess risk potential, the Tier 2 level incorporates numerous qualitative parameters that capture direct field observations and condition measurements. The parameters used to evaluate potential maintenance risk focus largely on the condition of the individual elements that make up the wall and the unit costs to repair element defects. With respect to mobility, key parameters include the height of the wall and its proximity to the roadway, volume of traffic on the adjacent roadway, user costs that could be incurred in the event of a delay caused by a wall failure, and overall condition of the wall structure. The parameters used in the maintenance and mobility risk calculations are outlined in the table below.

Performance Area	Factor	Parameter
Maintenance		
	Consequence	Element Category (primary or secondary)
		Element Type
		Quantity of Elements
		~Unit Costs
	Likelihood	Condition State
Mobility		
	Consequence	Avg. Wall Height
		Avg. Distance from Road in Front
		Avg. Distance from Road Carried
		AADT
		^Delay Time, 2 hours
		*User Value, $30.50
		*Occupancy Rate, 1.67
		*ADT Delay, 33% of Actual ADT
	Likelihood	Main Structure Condition
		Foundation Condition
		Scour Critical

~Data compiled based on inspector experience and with CDOT input.

^Assumed value based on likely time of delay from an urgent adverse event, similar to delay associated with over-height bridge strikes.

*Per AASHTO 2010, see Footnote 1.

4.6.2 Tier 2 Analysis

The Tier 2 risk ratings consider risk costs in regards to CDOT maintenance and traveler mobility. As in the Tier 1 planning level, the Tier 2 risk calculations are based on the premise that risk is the product of likelihood and consequence. Maintenance risk costs are determined based on a consequence cost to repair all defects in the wall versus the weighted repair costs based on the element category (primary or secondary) and the condition state of the element. The assumption is that primary elements, which are structural in nature, have a greater priority for repair than secondary elements, which tend to be cosmetic or ancillary. Structural elements are thus weighted more heavily in the determination of risk cost due to the potential for the financial consequences to be recognized by CDOT for these elements over the wall life cycle. Similarly, defects in elements categorized in good or fair condition typically have a lower priority for repairs than those in severe condition and are, accordingly, weighted less heavily.

The unit costs to repair defects represent consequence in the determination of maintenance risk cost. The element category and the condition state score are used as surrogates for likelihood and represent the probability of repairs being made and maintenance costs being incurred. The likelihood (or probability) estimates presented below for various element categories and condition states are based on input from CDOT and consultant staff and reflect past experience and professional judgment.

Likelihood of Incurring Maintenance Cost		
Condition State	**Primary Elements**	**Secondary Elements**
CS1	0%	0%
CS2	11%	7%
CS3	59%	37%
CS4	98%	66%

The maintenance risk score is based on the ratio calculation summarized as follows:

$$\textbf{Tier 2 Maintenance Risk Score} = \frac{\textbf{Weighted Maintenance Risk Costs}}{\textbf{Raw Maintenance Costs}}$$

In assessing mobility risks, it is first necessary to determine if an adverse event or wall failure will impact the roadway. A wall with a low height, or large distance away from the roadway, may not impact the traveling lanes of the roadway even during a complete failure, and as such, would not impede the flow traffic. An interim calculation to develop a Roadway Impact (RI) score was used to estimate the potential mobility consequence associated with the wall structure. The RI score is based on the inspection parameters for height of the wall and the distance to adjacent roadways as shown in the following equation.

$$\textbf{RI} = (\textbf{Avg. Wall Height} - \textbf{Distance from Roadway In Front}) + (2 * \textbf{Avg. Wall Height} - \textbf{Distance from Roadway Carried})$$

If the RI score is zero, or a negative number, then there is likely to be no impact to the roadway and the mobility risk costs are assumed to be zero. If the RI score is a positive number, the roadway could be impacted and there is a potential risk to mobility.

Risk to mobility was calculated for all walls with an RI score greater than zero. The mobility risk calculation incorporates user costs that could be incurred by the traveling public in the event of an adverse event or wall failure. The user costs are calculated as such:

$$\text{User Costs} = \frac{\text{Delay Time}}{3600} \times \frac{(\text{AADT Actual} - \text{AADT During the Delay})}{24} / 2 \times \text{User Value} \times \text{Occupancy Rate}$$

The mobility risk calculation is based on the following assumptions:

- Delay time is assumed to be 2 hours for all walls
- AADT during any delay is assumed to be 33 percent of actual AADT
- User cost value = $30.50 per hour
- Occupancy rate = 1.67 per vehicle

User costs are calculated for both the roadway in front and the roadway carried, as applicable, and as determined by the RI score. The user costs represent the consequence estimate in the determination of mobility risk. The likelihood of an event is determined by the condition of the wall as dictated by the lowest inspection score received for either overall wall condition, foundation condition, or scour critical condition. The likelihood (or probability) of an event based on the condition score is based on input from CDOT and consultant staff and reflect past experience and professional judgment.

Condition	Likelihood
9	2%
8	
7	
6	5%
5	
4	26%
3	
2	78%
1	
0	

Thus, the final mobility risk calculation may be summarized as follows:

Tier 2 Mobility Risk Score = User Costs x Wall Condition

4.6.3 Tier 2 Results

Based on the continued progress of the inspection program, there are currently over 3,000 walls identified in the wall inventory. Of this inventory, the Tier 2 risk analysis considers the 645 walls that have been

fully inspected to date and have data to complete the Tier 2 analysis. Furthermore the risk assessment process continues to evolve as more walls are added to the inventory and risk evaluation concepts are refined in support of the CDOT asset management plans and experience. Currently, the Tier 2 plan level assigns a Level of Risk (LOR) grade to each wall feature based on the lower value of either the maintenance or mobility score. As this program is in development, this process may be adjusted based the eventual incorporation into the CDOT asset management plan. The grade categories for each parameter are as presented in the table below.

Level of Risk Grade	Maintenance Risk Score	Mobility Risk Score
A	0 to 0.1	$0 to $500
B	0.1 to 0.3	$500 to $5,000
C	0.3 to 0.5	$5,000 to $40,000
D	0.5 to 0.7	$40,000 to $95,000
F	>0.7	$95,000

To further characterize risk potential, walls with reported Condition State 4 (CS4) defects in primary (structural) elements receive a half grade deduction. Thus, a wall with an initial risk grade of C that also has one or more primary elements which exhibit a CS4 defect would receive an overall level of risk grade of C minus (C-). The lowering of the risk grade by a half point serves to flag the wall as a candidate for proactive mitigation. This presumes that a wall with CS4 defects may be more likely to degrade to a lower risk category more quickly than a similar wall structure without CS4 defects. The investment return of a prompt, but relatively small expenditure to address CS4 defects may rehabilitate the wall to a more favorable level of risk, which will be reviewed during the cost-benefit analysis.

The Tier 2 risk criteria have been applied to the current inventory of 656 fully inspected walls. The results indicate that the majority of wall structures are performing at a level of risk grade of C or better. The distribution of level of risk grades and wall type is presented in the table and **Chart 4.2** below.

Level of Risk	Retaining Wall	Noise Wall	Bridge Wall
A	84	6	20
A-	0	0	0
B	155	22	61
B-	5	1	0
C	80	23	69
C-	7	3	2
D	68	7	18
D-	3	12	1
F	0	0	0
F-	2	6	1

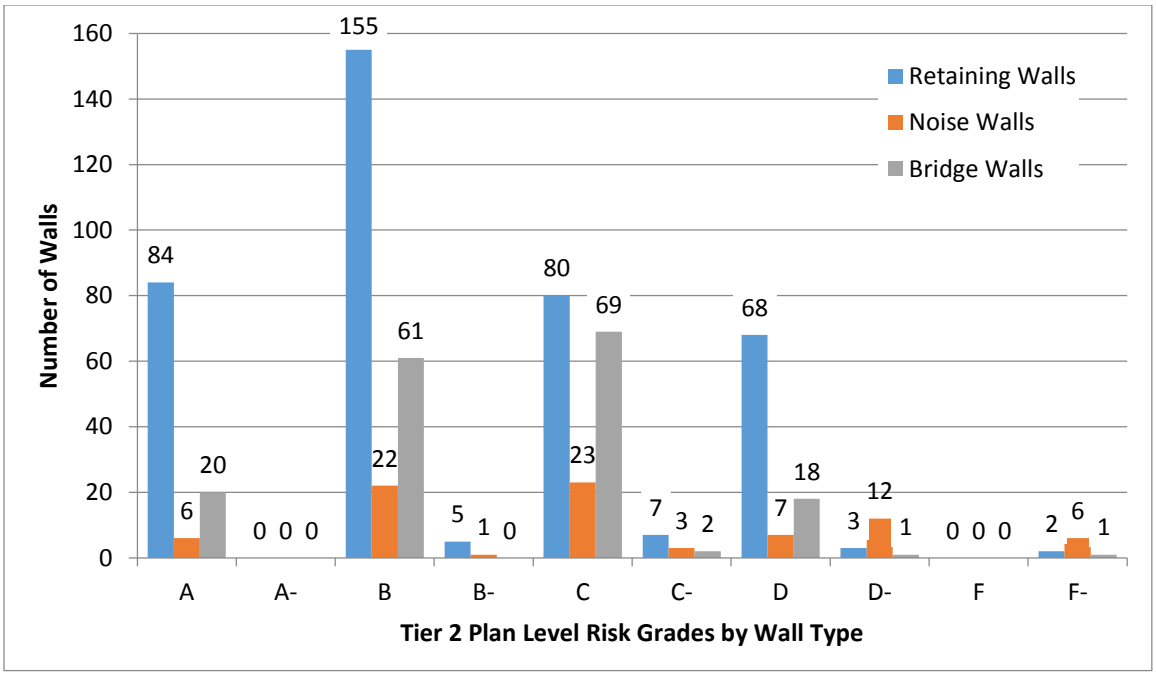


Chart 4.2 Distribution of Walls by Level of Risk Value

4.7 Tier 3 Plan Level

The Tier 3 Plan level is primarily focused on management of higher risk walls based on a life-cycle cost-benefit analysis. The plan targets for wall asset management that will form the basis of the Tier 3 plan will be finalized with input from CDOT asset management staff. Tentative targets for the wall asset management program include the following:

- 95 percent of all walls with a Level of Risk grade of a C or better.
- Less than 1 percent of walls with CS4 defects at or above the C level, aka “minus” indicator.
- Less than 1 percent of walls with deterioration accelerator condition states.

The risk-based wall asset management targets will be finalized after input from cross-asset analyses and financial planning for the CDOT transportation asset management plan. The proposed investment strategies developed during the Tier 3 plan level will evaluate the cost-benefit of treatment options for each high-risk wall such as continued monitoring and inspection, rehabilitation, and replacement. Additionally, investment strategies will consider any available cross-asset activities such as drainage improvements that also can affect wall performance.

4.7.1 Tier 3 Analysis

Based on the Tier 2 assessments of 656 walls to date, approximately 18 percent of the walls are identified as having a Level of Risk grade of D or F.

The current proposed performance target is to reduce and maintain the number of walls with a Level of Risk of D or F to 5 percent of the total wall inventory. For this initial baseline analysis, the current

percentage of D and F walls (18 percent) was extrapolated to the whole wall asset inventory prior to 2016. Further, this percentage was conservatively assumed to remain constant in the future and was applied to the projected increase in inventory. The projected growth in wall asset inventory and quantity of walls with a Level of Risk grade of D or F is presented below in **Figure 4.3**.

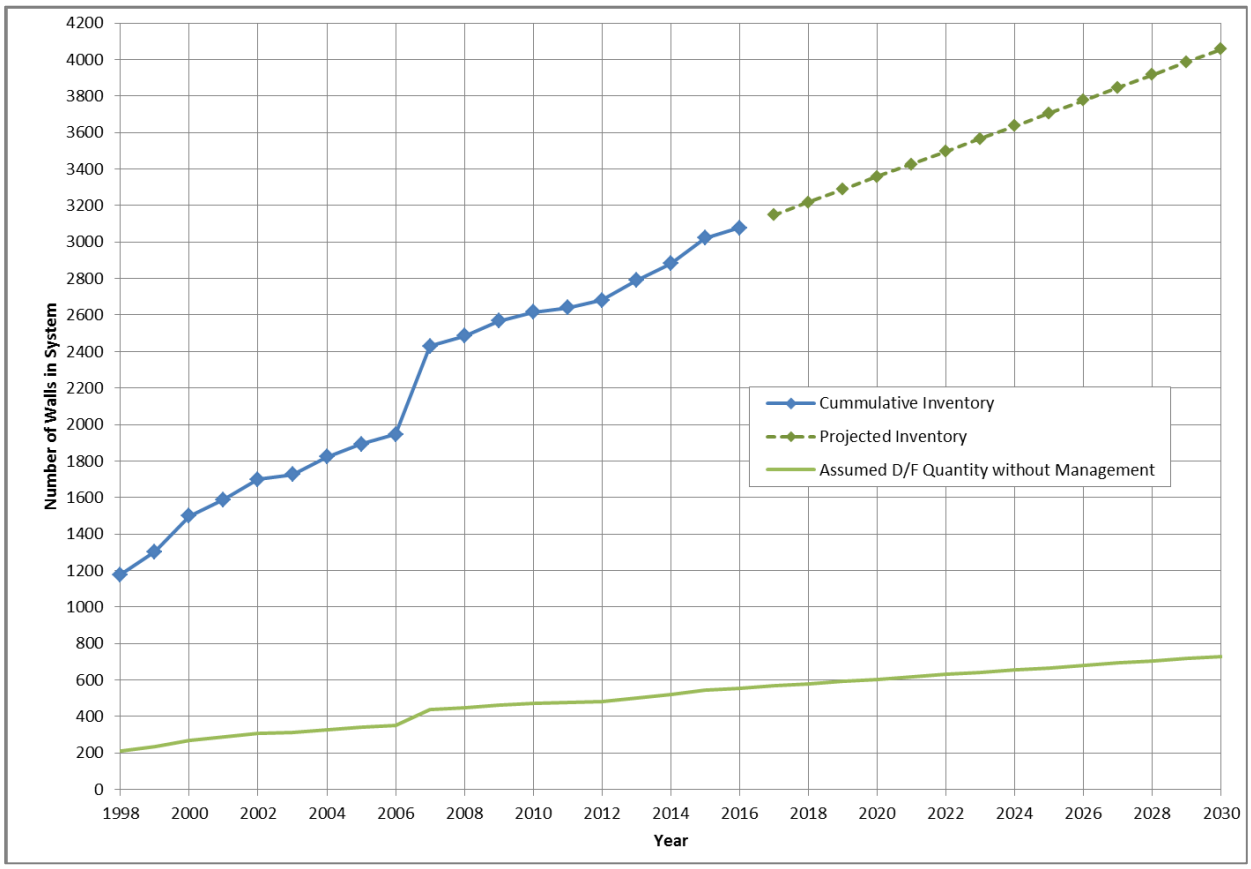


Figure 4.3 Walls Asset Inventory Quantity and Projected Level of Risk Values without Management

The assumption of a linear and parallel growth in the quantity of walls with a Level of Risk of D or F is conservative because deterioration rates for other asset types often approximate a linear trend in the early portion of the life cycle, but become exponential with time. As a result, the actual increase in walls with a Level of Risk value of D or F could increase as the average age of the asset class increases. By implementing the wall asset management plan, these deterioration rates can be established based on actual data and the plan can be adjusted if necessary.

In support of mitigation alternative analysis, it is necessary to establish the potential costs and level of risk reduction that may be associated with various management options. At this time, reliable CDOT cost data associated with wall maintenance activities are limited. However, the cost data for the significant unplanned rehabilitation and replacement projects that occurred for US40 Berthoud Pass in 2011 and US6 Dowd Junction in 2008, along with the a future wall repair project planned in FY2017 for a fill wall on I-70 near Genesee, can be used to provide a potential upper bound in costs associated with wall asset management. Conversely, there are several anecdotal examples of urgent need CDOT Maintenance

projects for facing, coping, and other element repairs on an annual basis that would represent lower bound costs.

Using the Tier 2 analyses, the Berthoud Pass wall would likely have been classified with C- or D Level of Risk, and the Dowd Junction wall would have been classified with at least a D Level of Risk. The associated repair cost for these two walls provides an estimate of the potential upper bound in costs associated with proactive or emergency repairs that require standalone projects. For example, the Berthoud Pass wall repair cost of approximately $250,000, or $500 per square foot of damaged area, could be representative of the general cost to proactively rehabilitate one wall to an acceptable Level of Risk. Conversely, the Dowd Junction wall failure is representative of the potential cost when a wall failure occurs and reconstruction is required ($10M).

Based on data from a six year period from 2008 to 2013, the costs associated with wall assets were at least $11.6M, which includes an estimated $100,000 per year for untracked maintenance activities and approximately $800,000 in user costs associated with repair or rehabilitation projects (discussed above). Of note, these costs are generally associated with walls that are greater than 15 years old. Due to the likelihood that not all costs are being captured, the assumed current annual un-managed wall asset cost is estimated at a minimum of $2M per year (2014 dollars) when averaged over a multi-year period of known historical costs.

To develop an investment plan for wall asset management, a mitigation strategy to reduce the quantity of walls with a Level of Risk of D and F, the number of CS4 condition states, and the number of elements with poor condition states that correspond to accelerated wall deterioration rates was developed. The investment plan assumes an average rehabilitation cost of $50,000 per wall, condition state, or repair element. The estimated cost was assumed based on the US40 Berthoud Pass wall repair, which consisted of a standalone project with additional items related to mobilization, traffic control, and erosion control. This value is assumed to be an upper bound cost to rehabilitate a wall into a lower, or improved, Level of Risk. Conversely, many of the maintenance repairs appear to be completed by Maintenance staff for less than $50,000, which would form the lower bound cost data for the assumed average. The cost estimates for improving the Level of Risk grades will be updated once actual data are available.

Figure 4.4 presents a proposed funding plan for wall asset management through 2030. The proposed plan is compared to a no-action alternative that assumes a $2M reactionary cost that will increase with a linear rate equal to the increase in wall inventory. The proposed plan assumes the following:

- A 1 percent decrease per year in the number of walls with a D or F Level of Risk until reaching a target of 5 percent total;
- A 1 percent decrease per year in the number of walls with a with CS4 defects above the C level, aka “minus” indicator to the target of 1 percent total;
- An investment of $250,000 per year to reduce the number of walls with deterioration accelerator condition states; and
- Ongoing investment to maintain these measures at the target levels once the goals are obtained.

To demonstrate a favorable cost-benefit relationship, the funding plan is based on obtaining a similar program life-cycle cost between mitigation and no action. Beyond year 2030 the cost-benefit ratio would further improve as CDOT recognizes the savings realized from proactive maintenance and mitigation to avoid the high cost of reactionary treatments on an expanding inventory of assets. The projected comparison between continued passive wall treatment and a proactive risk-based asset management program is illustrated in **Figures 4.4** and **4.5**. This analysis and the figures presented below are preliminary and may be revised as the Tier 2 inventory is completed and funding allocations are finalized.

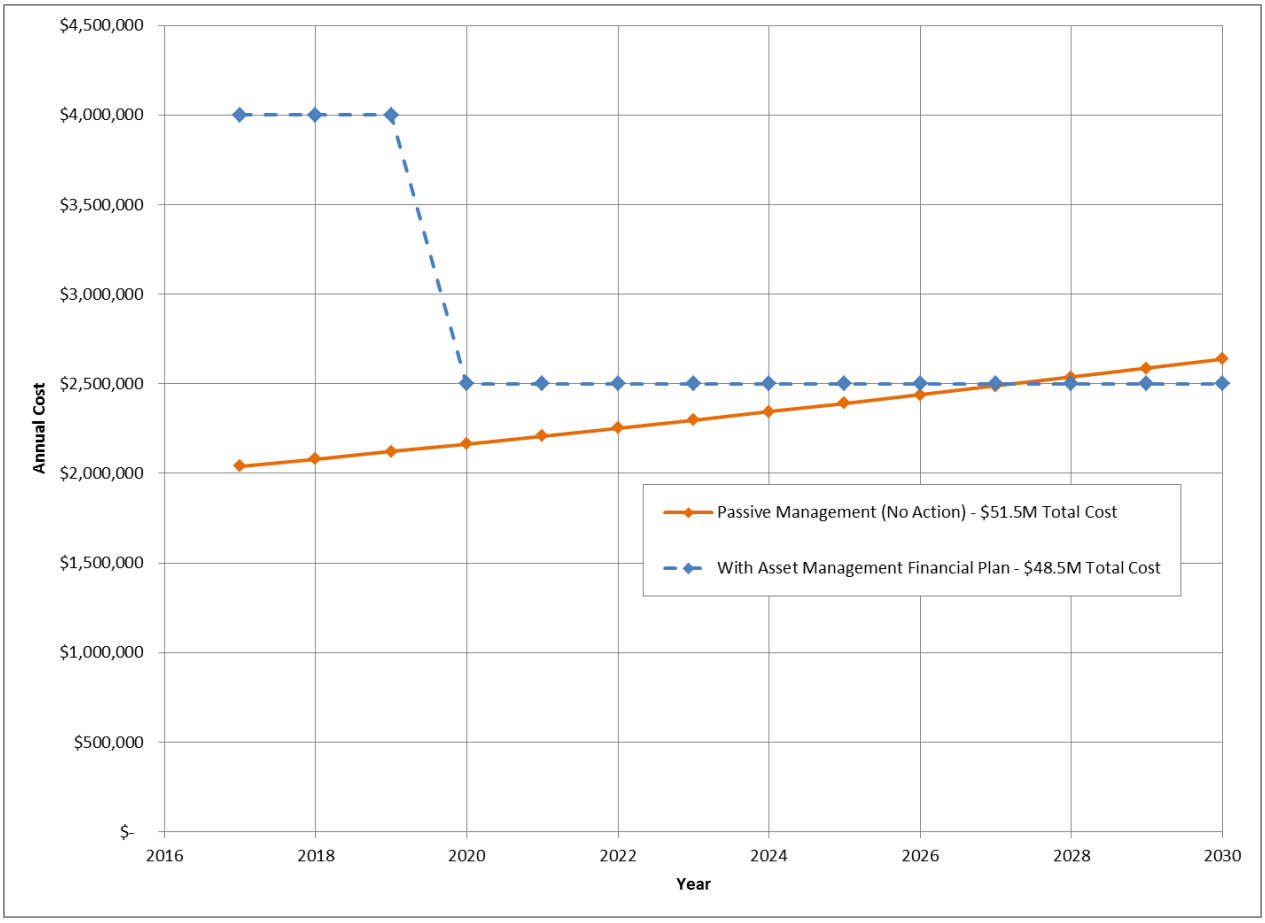


Figure 4.4. Projected Wall Expenditures Through 2030.

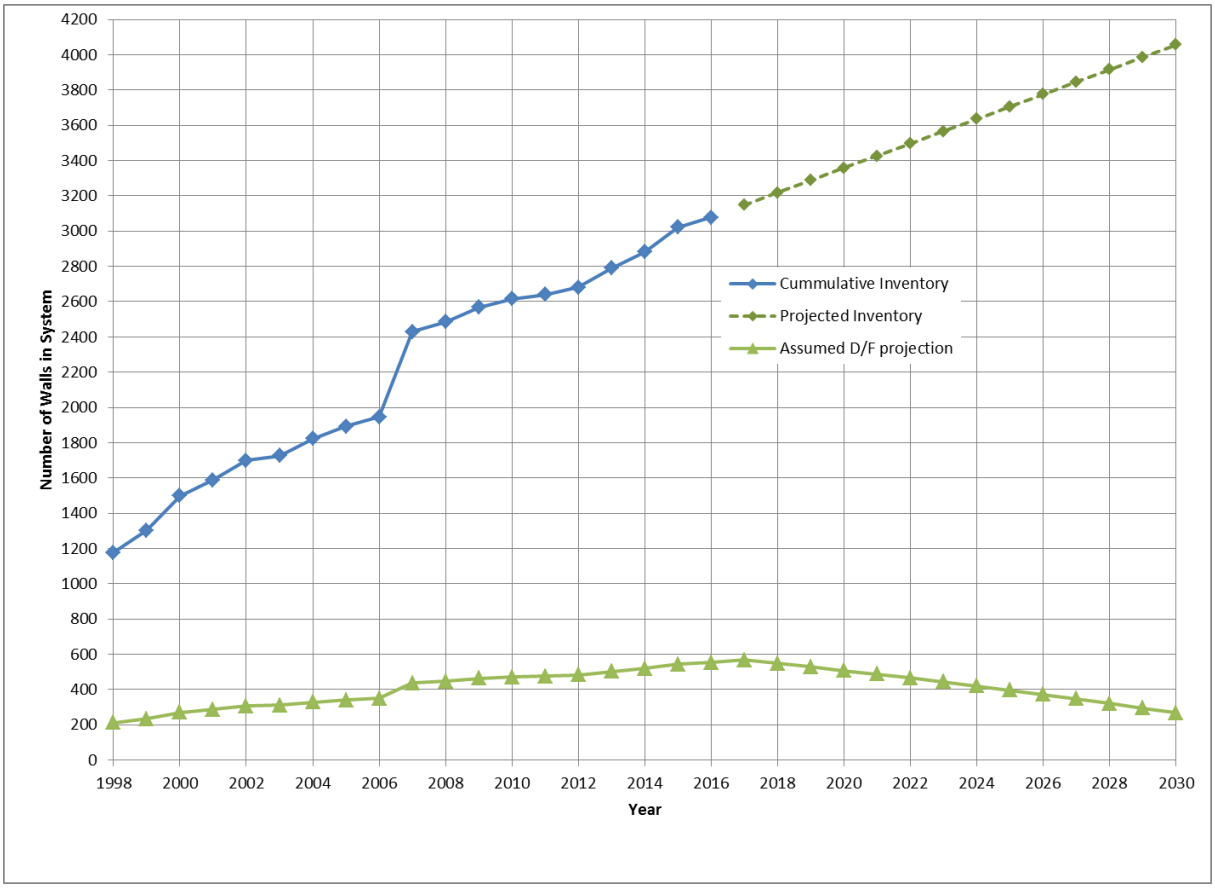


Figure 4.5. Projected reduction in Level of Risk D and F walls through 2030 with proposed investment plan.

Appendix I: CDOT Database Structure

ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
1	State Code	BRIDGE.fips_state; BRIDGE.fhwa_rgn	3/N	FHWA
2	Highway Agency District	BRIDGE.district	2/N	MOD FHWA
3	County (Parish) Code	BRIDGE.county	3/N	FHWA
4	Place Code	BRIDGE.placecode	5/N	FHWA
4A	City/Town Name	N/A	25/AN	CDOT
5A	Record Type	ROADWAY.on_under	1/N	MOD FHWA
5B	Route Signing Prefix	ROADWAY.kind_hwy	1/N	MOD FHWA
5C	Designated Level of Service	ROADWAY.levl_srvc	1/N	MOD FHWA
5D(N,X)	Route Number (On-System, Off-System)	ROADWAY.routenum	5/AN	MOD FHWA
5E	Directional Suffix	N/A	1/N	MOD FHWA
6	Features Carried	BRIDGE.featint	24/AN	MOD FHWA
7	Features In Front	BRIDGE.facility	18/AN	MOD FHWA
8	Structure Number	BRIDGE.brkey	15/AN	FHWA
8A	Structure Identification Number	BRIDGE.strucname	15/AN	CDOT
9	Location	BRIDGE.location	25/AN	FHWA
11	Reference Point	ROADWAY.kmpost	7/N	MOD FHWA
12	Base Highway Network	ROADWAY.onbasenet	1/N	FHWA
13A	LRS Inventory Route	ROADWAY.lrsinvrt	10/AN	FHWA
13B	Subroute Number	ROADWAY.subrtnum	2/N	FHWA
16	Latitude - Start of Wall	BRIDGE.latitude	8/N	MOD FHWA
16A	Latitude - End of Wall	USERBRDG.endlatitude	8/N	CDOT
16B	Elevation – Start of Wall	USERBRDG.startelevation	5/N	CDOT
17	Longitude - Start of Wall	BRIDGE.longitude	9/N	MOD FHWA
17A	Longitude - End of Wall	USERBRDG.endlongitude	9/N	CDOT
17B	Elevation – End of Wall	USERBRDG.endelevation	5/N	CDOT
18A	Range	USERBRDG.srvyrange	4/AN	CDOT
18B	Township	USERBRDG.srvytownship	4/AN	CDOT
18C	Section	USERBRDG.srvysection	2/N	CDOT
19	Bypass/Detour Length	ROADWAY.bypasslen	3/N	MOD FHWA
20	Toll	ROADWAY.tollfac	1/N	FHWA
21	Maintenance Responsibility	BRIDGE.custodian	2/N	FHWA
22	Owner	BRIDGE.owner	2/N	FHWA
23	Original Construction Project Number	PROJECTS.projkey	25/AN	CDOT
23E	Subaccount Number	PROJECTS.project_id	5/AN	CDOT
23EE	Project Indicator	USERPROJ.projectindicator	5/AN	CDOT
26	Functional Class Of Inventory Rte.	ROADWAY.funcclass	2/N	FHWA
27	Year Built	BRIDGE.yearbuilt	4/N	MOD FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
28	Lanes On/In Front of Structure	ROADWAY.lanes	4/N	MOD FHWA
28A	Lanes On Structure	ROADWAY.lanes	2/N	MOD FHWA
28B	Lanes In Front of Structure	ROADWAY.lanes	2/N	MOD FHWA
29	Average Daily Traffic	ROADWAY.adttotal	6/N	FHWA
30	Year Of Average Daily Traffic	ROADWAY.adtyear	4/N	FHWA
33	Inventory Route Median	BRIDGE.median	1/N	MOD FHWA
36A	Wall Railings On Top	INSPEVNT.railrating	1/AN	MOD FHWA
36B	Transitions On Top	INSPEVNT.transratin	1/AN	MOD FHWA
36C	Approach Guardrail On Top	INSPEVNT.arailratin	1/AN	MOD FHWA
36D	Approach Guardrail Ends On Top	INSPEVNT.aendrating	1/AN	MOD FHWA
36H	Height of Rail On Top	USERBRDG.railheight	4/N	CDOT
36I	Wall Railings In Front	USERBRDG.frailrating	1/AN	CDOT
36J	Transitions In Front	USERBRDG.ftransratin	4/N	CDOT
36K	Approach Guardrail In Front	USERBRDG.farailratin	1/AN	CDOT
36L	Approach Guardrail Ends In Front	USERBRDG.faendrating	4/N	CDOT
36M	Height of Rail In Front	USERBRDG.frailheight	1/AN	CDOT
37	Historical significance	BRIDGE.histsign	1/N	FHWA
42A	Type of Service Carried by Wall	BRIDGE.servtypon	1/AN	MOD FHWA
42B	Type of Service In Front of Wall	BRIDGE.servtypund	1/AN	MOD FHWA
43A	Kind of Material/Design	BRIDGE.materialmain	1/AN	MOD FHWA
43B	Type of Design/Construction	BRIDGE.designmain	2/N	MOD FHWA
47	Total Horz Clearance, Carried/Behind	ROADWAY.hclrinv	3/N	MOD FHWA
47A	Tot. Horiz. Clearance, In Front	USERRWAY.fhclrinv	3/N	CDOT
49	Structure Length	BRIDGE.length	6/N	MOD FHWA
50A	Left Curb/Sidewalk Width, Carried Rte	BRIDGE.lftcurbsw	3/N	MOD FHWA
50B	Right Curb/Sidewalk Width, Carried Rte	BRIDGE.rtcurbsw	3/N	MOD FHWA
50C	Left Curb/Sidewalk Width, Rte In Front	USERBRDG.flftcurbsw	3/N	CDOT
50D	Right Curb/Sidewalk Width, Rte In Front	USERBRDG.frtcurbsw	3/N	CDOT
51	Width, Curb-to-Curb, Carried Route	ROADWAY.roadwidth	4/N	MOD FHWA
51A	Width, Curb-to-Curb, Route In Front	USERBRDG.froadwidth	4/N	CDOT
52	Average Wall Height	BRIDGE.deckwidth	4/N	MOD FHWA
53	Maximum Wall Height	BRIDGE.vclrover	4/N	MOD FHWA
54	Minimum Wall Height	BRIDGE.vclrunder	4/N	MOD FHWA
58	Main Structure	INSPEVNT.dkrating	1/AN	MOD FHWA
60	Foundation	INSPEVNT.subrating	1/AN	MOD FHWA
61	Channel/Channel Protection	INSPEVNT.chanrating	1/AN	FHWA
71	Waterway Adequacy	INSPEVNT.wateradeq	1/AN	FHWA
72	Adjacent Roadway Alignment	INSPEVNT.appralign	1/AN	FHWA

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ITEM NO	ITEM NAME	ITEM POSITION	ITEM LENGTH/TYPE	CLASS
90	Inspection Date	INSPEVNT.inspdate	4/N	MOD FHWA
91	Designated Inspection Frequency	INSPEVNT.brinspfreq	2/N	FHWA
92A	Underwater Inspection	INSPEVNT.uwinspreq; INSPEVNT.uwinspfreq	3/AN	MOD FHWA
92B	Other Special Inspection	INSPEVNT.osinspreq; INSPEVNT.osinspfreq	3/AN	MOD FHWA
93A	Underwater Inspection Date	INSPEVNT.uwlastinsp	4/AN	MOD FHWA
93B	Other Special Inspection Date	INSPEVNT.oslastinsp	4/AN	MOD FHWA
98A	Neighboring State Code	BRIDGE.nstatecode;	3/N	MOD FHWA
98B	Percent Responsibility	BRIDGE.bb_pct	2/N	MOD FHWA
99	Border Wall Structure Number	BRIDGE.bb_brdgeid	15/AN	FHWA
100	STRAHNET Highway Designation	ROADWAY.defhwy	1/N	FHWA
102	Direction Of Traffic	ROADWAY.trafficdir	1/N	FHWA
103	Temporary Structure Designation	BRIDGE.tempstruc	1/AN	MOD FHWA
104	Highway System Of Inventory Route	ROADWAY.nhs_ind	1/N	FHWA
105	Federal Lands Highways	ROADWAY.fedlandhwy	1/N	FHWA
106	Year Reconstructed	BRIDGE.yearrecon	4/N	FHWA
107	Vertical Supports Structure Type	BRIDGE.dkstructyp	1/AN	MOD FHWA
109	Average Daily Truck Traffic	ROADWAY.truckpct	2/N	FHWA
110	Designated National Network	ROADWAY.trucknet	1/N	FHWA
113	Scour Critical Walls	INSPEVNT.scourcrit	1/AN	MOD FHWA
114	Future Average Daily Traffic	ROADWAY.adtfuture	6/N	FHWA
115	Year of Future Average Daily Traffic	ROADWAY.adtfutyear	4/N	FHWA
125A	Most Common Type of Railing	USERBRDG.strrailtype	2/AN	CDOT
125B	Standard or Modified Railing	USERBRDG.strrailmod	1/AN	CDOT
125C	Most Common Type of Railing, In Front	USERBRDG.fstrrailtype	2/AN	CDOT
125D	Standard or Modified Railing, In Front	USERBRDG.fstrrailmod	1/AN	CDOT
133	Special Inspection Equipment	USERINSP.inspequip	2/N	CDOT
136	Mileage Log Section Letter	USERRWAY.routelog	1/AN	CDOT
143A	Min, Max, and Avg Dist. From Rte Carried	USERRWAY.mmadist	12/N	CDOT
143B	Min, Max, and Avg Dist. From Rte In Front	USERRWAY.fmmadist	12/N	CDOT
144A	Speed Limit, Route Carried	USERRWAY.speedlimit	2/N	CDOT
144B	Speed Limit, Route In Front	USERRWAY.fspeedlimit	2/N	CDOT
145	Wall System	USERBRDG.wallsys	2/N	CDOT
146	Associated Bridge	USERBRDG.assocbridge	50/AN	CDOT
147	Vertical Batter	USERBRDG.vertbatter	2/N	CDOT
148	Slope Angle	USERBRDG.slope	2/N	CDOT
149	Type of Protective Coating	USERBRDG.coating	1/N	CDOT
-	Notes	N/A	30/AN	CDOT

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Appendix II: Common Wall Structure Types and Primary Element Examples

MSE Segmental Block Retaining Wall


Precast Panel MSE Retaining Wall


Cast-in-place Cantilever Retaining Wall


Cantilever, Soldier Pile

Post-and-Panel Noise Wall

Free-standing Noise Wall

Appendix III: Example Forms and Reports
Appendix III.a: Wall Structures Example Inspection Report Form

Colorado Department of Transportation

Wall Inspection Report

COLORADO Department of Transportation

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

Owner:	01 - State Highway Agency	Year Built:	2002
Maintained By:	01 - State Highway Agency	Region/Section:	19
Main Structure Type:	18 - MSE, segmental block	Start of Wall MP:	244.649
Location:	11.3 MI WEST OF EMPIRE	Route:	040A
Service Type-Carried:	A - Highway	Features Carried:	US 40
Service Type-In Front:	M - Slope - Vegetated	Features In Front:	VEGETATED SLOPE
Inspection Frequency:	12 months		

Essential Repair Finding [X]

Type of Inspection [X] **Routine** [ ] **Underwater** [ ] **Damage** [ ] **Interim** [ ] **In-Depth**

Elevation looking west

OVERALL RATINGS		**Inspection Team**	**Agency**
Main Structure:	4		
Foundation:	N		
Channel & Channel Protection:	N		

		Inspection Resources	
Project:	CDOT RET/NOISE WALL INSP	Crew Hours	3.00
Project Number:	25-08264.02	Flagger Hours	0.00
Temperature:	80° F	Helper Hours	0.00
Weather Conditions:	Clear	Snooper Hours	0.00
		Special Crew Hours	0.00
		Special Equipment Hours	0.00

Access Issues:

[ ] Rail Road [ ] MOHT [ ] Animals [ ] 3rd Party Fencing [ ] Other: _____

Colorado Department of Transportation

Wall Inspection Report

COLORADO Department of Transportation

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

1	State Name		088 – Colorado
2E/M	Region/Maint Section		19 – Denver
3	County Code		019 - Clear Creek
4	Place Code		00000 - None
5A	Inventory Rte (On/In Front)		1 – Inventory Rte Carried
5B	Inventory Rte (Signing)		2 – U.S. numbered highway
5C	Inventory Rte (L.O.S.)		1 – Mainline
5D	Inventory Rte (Rte Num)		040A
5E	Inventory Rte (Dir Suffix)		0
6	Features Carried		US 40
7	Features In Front		VEGETATED SLOPE
8	Structure ID Number		R040A244649RRA
8A	Structure Number		WALL-E-13-F
9	Location		11.3 MI WEST OF EMPIRE
11	Reference Point		244.649
12	Base Hwy Network		1 Mainline NHS
13	LRS Inventory & Subroute #		000000040A00
16	Latitude Start-of-Wall	39471321	39.78700
16A	Latitude End-of-Wall	39471244	39.78679
16B	Start of Wall Elevation	10907	10907'
17	Longitude Start-of-Wall	105473428	-105.79286
17A	Longitude End-of-Wall	105471041	-105.78623
17B	End of Wall Elevation	10814	10814'
18A	Range		075W
18B	Township		003S
18C	Section		016
19	Bypass Detour Length		99
20	Toll		3 - No Toll
21	Maint. Responsibility		01 - State Highway Agency
22	Owner		01 - State Highway Agency
23	Orig Project Number		
23E	Subaccount Number		
23EE	Project Indicator		
26	Functional Class		07 - Rural Major Collector
27	Year Built		2002
28A	Lanes on Structure		3
28B	Lanes In Front		0
29	Average Daily Traffic		4700
30	Year of ADT		2013
33	Inventory Route Median		0
36AD	Traffic Safety Features on Top		1111
36H	Rail Height On Top		34"
36IL	Traffic Safety Features in Front		NNNN
36M	Height of Rail In Front		00NA"
37	Historical Significance		4 – Not determinable
42	Type of Service, On		A - Highway
	In Front		M - Slope – Vegetated
43	Wall Face Material		7 - Stone/Masonry
	Type of Design/Construction		18 - MSE, segmental block
47	Tot Horz Clearance, Carried		68'
47A	Tot Horz Clearance, In Front		NA
49	Structure Length		2010'

50A	Curb or Sidewalk, Carried(L)	0'
50B	Curb or Sidewalk, Carried(R)	0'
50C	Curb or Sidewalk, In Front(L)	0'
50D	Curb or Sidewalk, In Front(R)	0'
51	Width Curb-to-Curb, Carried	68'
51A	Width Curb-to-Curb, In Front	0'
52	Average Wall Height	20'
53	Maximum Wall Height	24'
54	Minimum Wall Height	0'
58	Main Structure	4 – Poor Condition
60	Foundation	N – Not Applicable
61	Channel & Channel Protection	N – Not Applicable
71	Water Adequacy	N – Not Applicable
72	Adjacent Roadway Alignment	7 - Better than present minimum criteria
90	Inspection Date	06/23/2015
91	Frequency	12 m
92B	Crit Feat Insp – Underwater	N
92C	Crit Feat Insp – Special	Y 12
93B	Underwater Inspection Date	
93C	Special Inspection Date	12/11/2013
98A	Border Wall State Code	
98B	Percent Responsibility	
99	Border Wall Structue #	
100	STRAHNET Hwy Designation	0 - The inventory route is not a STRAHNET route.
102	Direction of Traffic	2
103	Temp Structure Designation	
104	Highway System	1 Mainline NHS
105	Federal Lands Highway	2 - Forest Highway (FH)
106	Year Reconstructed	
107	Vertical Supports Type	N – Not Applicable
109	Truck ADT	1 %
110	Designated National Network	1
113	Scour Critical Walls	N – Not Applicable
115	Year of Future ADT	2033
125AB	Type of Wall Rail on Top	S1
125CD	Type of Wall Rail in Front	NA0
133	Special Insp. Equipment	00 – Not Applicable
136	Mileage Log Section Letter	A
143A	Min Dist Fr Route, Carried	0'
	Max Dist Fr Route, Carried	0'
	Avg Dist Fr Route, Carried	0'
143B	Min Dist Fr Route, In Front	NA
	Max Dist Fr Route, In Front	NA
	Avg Dist Fr Route, In Front	NA
144A	Speed Limit, Rte Carried	45
144B	Speed Limit, Rte in Front	00
145	Wall System	0
146	Associated Bridge #	
147	Vertical Batter	87
148	Slope Angle Carried & In Front	13
149	Protective Coating Type	1

Colorado Department of Transportation

Wall Inspection Report

COLORADO
Department of Transportation

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

Structure Notes:

Inventoried from west to east.

Inspection Notes:

An ERF was submitted to CDOT on 6/23/2015 regarding freeze-thaw damage below the railing expansion joints throughout.

Colorado Department of Transportation

Wall Inspection Report

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

BrM and Element Data Collection

Element # / Defect	Element Description	Total Qty	Units	Env. Factor	CS1 Qty	CS2 Qty	CS3 Qty	CS4 Qty
9342	Sign Attachment to Wall	3	EA	4	3	0	0	0
9705	Masonry Wall	36180	SF	4	34141	1810	47	182
1990	Freeze-thaw Damage			4	0	1	47	182
1120	Efflorescence/Rust Staining			4	0	1809	0	0
9747	Reinforced Concrete Horizontal Coping	2010	LF	4	1608	402	0	0
1130	Cracking (RC and Other)			4	0	402	0	0
9750	Retained Material	2010	LF	4	2010	0	0	0
9762	Expansion Joint	23	EA	4	0	9	11	3
2310	Leakage			4	0	9	11	3
9770	Weep Holes/Slots	9	EA	4	6	3	0	0
1970	Blockage			4	0	3	0	0
9771	Area Drain	4	EA	4	1	3	0	0
1970	Blockage			4	0	1	0	0
1080	Delamination/Spall/ Patched Area			4	0	2	0	0
9780	Metal Wall Railing	2010	LF	4	2010	0	0	0
7000	Damage			4	6	0	0	0
9790	Steel Protective Coating	4020	SF	4	4020	0	0	0
9781	Reinforced Concrete Wall Railing	2010	LF	4	0	2010	0	0
1130	Cracking (RC and Other)			4	0	1920	0	0
1990	Freeze-thaw Damage			4	0	90	0	0
9795	Adjacent Roadway	1	EA	4	1	0	0	0

Element	Description	Element Notes
9342	Sign Attachment to Wall	A survey marker and mile marker 245 are attached to the wall railing. There is one ground water indicator marker on the wall facing.
9705	Masonry Wall	8 in. x 18 in. masonry MSE block facing (CS 3/4) - Freeze-thaw Damage/(CS 2) -Efflorescence: The expansion joints are allowing drainage from the above roadway onto the wall facing below, causing deterioration of the facing blocks and associated efflorescence at each joint. Freeze-thaw damage exists on the wall facing directly below 14 expansion joints in the railing, with dimensions as follows: (CS 4) Joint 3: 7 ft. 6 in. long x 16 ft. 8 in. high x 12 in. deep (CS 3) Joint 4: 1 ft. 6 in. long x 7 ft. 4 in. high x up to 6 in. deep (CS 2) Joint 6: 10 in. long x 5 in. high x up to 1 in. deep (CS 4) Joint 7: 4 ft. 6 in. long x 11 ft .4 in. high x up to 12 in. deep (CS 3) Joint 8: 1 ft. 8 in. long x 4 ft. 8 in. high x 6 in. deep (CS 3) Joint 9: (1) area up to 1 ft. 6 in. long x 7 ft. 4 in. high x 12 in. deep, (1) area 2 ft. long x 3 ft. 4 in. high x 12 in. deep (CS 3) Joint 10: (2) areas up to 10 in. long x 1 ft. 4 in. high x 4 in. deep (CS 4) Joint 11: up to 3 ft. long x 8 ft. high x 11 in. deep (CS 3) Joint 12 (6) areas up to 5 in. long x 5 in. high x up to 12 in. deep (CS 3) Joint 14: 1 ft. 6 in. long x 3 ft. 4 in. high x up to 11 in. deep (CS 3) Joint 15: 5 in. long x 6 in. high x 4 in. deep (CS 3) Joint 17: 10 in. long x 8 in. high x 6 in. deep (CS 3) Joint 21: 1 ft. 6 in. long x 1 ft. 4 in. high x 4 in. deep
9747	Reinforced Concrete Horizontal Coping	The concrete coping is integral with the above railing. (CS 2) - Cracking (RC and Other): The concrete coping typically exhibits 1/32 in. wide full height cracks with associated corrosion staining spaced approximately every 5 ft. throughout.
9750	Retained Material	Retained fill supports US 40.
9762	Expansion Joint	23 expansion joint exists in the railing on top of the wall. (CS 4/3/2) - Leakage: Evidence of leakage and associated efflorescence can be seen at each joint. Leakage from (14) of these joints has caused freeze-thaw damage on the wall facing below.
9770	Weep Holes/Slots	4-inch diameter weep holes. (CS 2) - Blockage: (1) weep hole is actively draining water, (3) are partially blocked with debris and broken.
9771	Area Drain	There are (3) area drains directly above the wall, and the outlets for these drains exit through the wall facing below. Area Drain 4 is adjacent to the end of the wall. (CS 2) - Blockage: Area Drain 1 is a large collection drain and has up to 3 ft. of sand and dirt built-up at the inlet. (CS 2) - Delamination/Spall/Patched Area: The slab around the Area Drain 2 inlet has (2) 1/8 in. cracks emanating from the northeast and south corners and a spall 6 in. long x 4 in. wide x 3 in. deep adjacent to the north face. All of the area drain outlets exhibit scaling up to 1.5 in. Area Drain 1 outlet has a spall 11 in. long x 4 in. high by 3 in. deep. Area Drain 3 outlet exhibits deterioration up to 12 in. long x 12 in. high x 3 in. deep and has associated minor erosion which has been stabilized with riprap.

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Wall Inspection Report

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

9780	Metal Wall Railing	Metal wall railing on top of the concrete railing (CS 1) - Damage: The metal railing exhibits (2) areas of impact damage 3 ft. long with deflections up to 3/4 in.
9790	Steel Protective Coating	The weathering steel patina on the metal wall railing is in good condition.
9781	Reinforced Concrete Wall Railing	The concrete railing is integral with the coping below. (CS 2) - Cracking (RC and Other): The concrete railing typically exhibits map cracking and 1/32 in. wide full height cracks with associated corrosion staining. (CS 2) - Freeze-thaw Damage: The side of the railing adjacent to the roadway exhibits moderate freeze-thaw damage for 90 feet near the center of the wall.
9795	Adjacent Roadway	Three roadway joints are separated and allowing water to leak through adjacent railing Joints 3, 4, and 5 causing freeze-thaw damage on the wall facing below. The roadway joint is separated up to 1.5 in. at Joint 3, 2 in. at Joint 4, and 1.5 in. at Joint 5. Roadway has moderate dirt and sand build-up up to 12 in. high adjacent to the wall railing throughout.

Colorado Department of Transportation

Wall Inspection Report

COLORADO Department of Transportation

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

Maintenance/Repair Recommendations

Activity No : 200_33 Priority: High
Description: Seal open joints (non-expansion).
Detail of Work: Seal all joints, roadway cracks, and interface between roadway and railing in proximity to railing joints to prevent further leakage onto the wall facing.
Maint Qty : 23 Maint Cost: $50000_00
Target Year: 2016

Activity No : 370_03 Priority: High
Description: Replace concrete wall panel(s)/facing unit(s) (includes stabilization of existing backfill)
Detail of Work: Patch or replace freeze-thaw damaged wall facing.
Maint Qty : 245 Maint Cost: $38000_00
Target Year: 2016

Priority Definitions

Priority Level 1 - High (Orange)	**Repair within the time specified by the inspector or at most within 30 days**
Priority Level 2 - Medium (Yellow)	**Repair within 90 days**
Priority Level 3 - Low (Green)	**Repair within one year or as funding allows**

Colorado Department of Transportation

Wall Inspection Report

COLORADO Department of Transportation

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

Overview of Wall R040A244649RRA on CDOT Route 040A

Start of Wall: 39.787,-105.79286 End of Wall: 39.78679,-105.78623

PHOTO LOG

General Overview	Photo 1	Elevation looking west
General	Photo 2	Structure sign
Inventory Elevation	Photo 3	Elevation looking northeast
Inventory Elevation	Photo 4	Elevation looking east
Inventory Roadway	Photo 5	Roadway carried looking west
Inventory Roadway	Photo 6	Roadway carried looking east
Defect	Photo 7	Freeze-thaw damage and exposed backfill at Joint 3
Defect	Photo 8	Freeze-thaw damage at Joint 3
Defect	Photo 9	Freeze-thaw damage at Joint 3 looking northwest
Defect	Photo 10	Typical efflorescence on wall facing
Element	Photo 11	Joint 22
Element	Photo 12	Joint 20
Element	Photo 13	Joint 21
Element	Photo 14	Joint 18
Element	Photo 15	Joint 17
Element	Photo 16	Joint 9
Element	Photo 17	Joint 13

Colorado Department of Transportation

Wall Inspection Report

Structure ID#: R040A244649RRA Structure #: WALL-E-13-F Inspection Date: 06/23/2015

PHOTO LOG

Element	Photo 18	Joint 5
Element	Photo 19	Joint 7
Element	Photo 20	Joint 8
Element	Photo 21	Joint 3
Element	Photo 22	Joint 1
Element	Photo 23	Joint 2
Element	Photo 24	Joint 23
Element	Photo 25	Joint 19
Element	Photo 26	Joint 4
Element	Photo 27	Joint 6
Element	Photo 28	Joint 12
Element	Photo 29	Joint 14
Element	Photo 30	Joint 10
Element	Photo 31	Joint 11
Element	Photo 32	Joint 15
Element	Photo 33	Joint 16
Element	Photo 34	Typical weep hole
Defect	Photo 35	Heavily active weep hole, mostly blocked with hillside debris
Element	Photo 36	Area Drain 4
Element	Photo 37	Area Drain 2 Outlet
Element	Photo 38	Area Drain 3
Element	Photo 39	Area Drain 2
Defect	Photo 40	Debris in Area Drain 1 inlet
Defect	Photo 41	Scaling and spall on Area Drain 1 outlet
Defect	Photo 42	Scaling and spall on Area Drain 2 outlet
Defect	Photo 43	Deterioration on Area Drain 3
Element	Photo 44	Typical railing
Defect	Photo 45	Impact damage on metal wall railing
Element	Photo 46	Typical concrete railing
Defect	Photo 47	Typical freeze-thaw damage on concrete railing
Element	Photo 48	Debris build-up in roadway

Appendix IV: List of References

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Appendix V: List of Definitions

Note: An asterisk (*) denotes definitions from the ***Recording and Coding Guide for the Structure Invenotry and Appraisal of the Nation's Bridges.***

AASHTO – American Association of State Highway and Transportation Officials.

Ancillary Structures - Non bridge structures that are part of the roadway system, such as overhead sign structures, high mast light poles and traffic signal mast arms, as well as retaining and noise walls.

Appurtenances – Items that are not technically part of the bridge but are generally associated, inspected, and maintained with the bridge. Examples include approach guardrail, fender systems, traffic control devices, bridge mounted signs, and approach slabs.

Base Highway Network* – The Base Highway Network includes the through lane (mainline) portions of the NHS, rural/urban principal arterial system and rural minor arterial system. Ramps, frontage roads and other roadways are not included in the Base Network.

BLM – Bureau of Land Management

BRIAR – Bridge Ratings, Inspections and Records

Bridge* – The National Bridge Inspection Standards published in the Code of Federal Regulations (23 CFR 650.3) give the following definition:

A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet* between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

* (6.1 meters)

Conversion of Numerical Data* – Throughout this Guide the following conversion factors are used:

Convert - foot to meter multiply by 0.3048

- mile to kilometer multiply by 1.609

- english ton to metric ton multiply by .9

Culvert* – A structure designed hydraulically to take advantage of submergence to increase hydraulic capacity. Culverts, as distinguished from bridges, are usually covered with embankment and are composed of structural material around the entire perimeter, although some are supported on spread footings with the streambed serving as the bottom of the culvert.

Electronic Data Files - Electronic files containing inventory and inspection data for each structure in the version of Pontis, AASHTOWARE, or other database format as specified by the Bridge Inspection Engineer. Electronic sketches of structures in a MicroStation compatible format as needed. PDF files of all inspection reports. JPG files of structure photographs.

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Engineer – CDOT Bridge Inspection Engineer or his/her designee.

FHWA – Federal Highway Administration.

Forest Highway (FH)* – A road, under the jurisdiction of, and maintained by, a public authority and open to public travel; wholly or partly within, or adjacent to, and serving the National Forest System (NFS) and which is necessary for the protection, administration, and utilization of the NFS and the use and development of its resources. (23 CFR 660).

Forest Service Development Road* – A forest road wholly under the jurisdiction of the Forest Service, which may be "open to public travel". Bridges on Forest Service Development Roads which are "open to public travel" are subject to the NBIS.

FY – Fiscal Year

Highway Performance Monitoring System* – The Highway Performance Monitoring System (HPMS) is a database of universe and sample data that describes the nation's public road mileage. The data are annually updated and submitted to FHWA by the State Highway Agencies, Puerto Rico and the District of Columbia. The universe data provides some basic characteristics of all public road mileage while the sample of the arterial and collector systems allows for assessment of the condition, performance, usage and additional characteristics of the nation's major highway systems.

Indian Reservation Road (IRR)* – A public road that is located within or provides access to an Indian reservation as described in Title 23, U.S.C., Sect.101. The terminus of a road providing access to an Indian reservation or other Indian land is defined as the point at which the road intersects with a road functionally classified as a collector or higher classification (outside the reservation boundary) in both urban and rural areas. In the case of access from an Interstate Highway, the terminus is the first interchange outside the reservation.

Inventory Route – The route which the wall is associated with. The inventory route may be on the structure or in front the structure. Generally inventories along a route are made from west to east or south to north.

Land Management Highway System (LMHS)* – Consists of adjoining state and local public roads that provide major public access to Bureau of Land Management administered public lands, resources, and facilities.

MUTCD – Manual on Uniform Traffic Control Devices

New Structures – Structures not previously inspected such as newly constructed structures requiring initial inspection or structures found to be qualifying and without prior inspections.

NHS – National Highway System.

Off-System bridges – Those bridges where Item 26 of the NBI = one of the following: 08 (Rural, Minor Collector), 09 (Rural, Local), 17 (Urban Collector), or 19 (Urban, Local).

On-System bridges - Those bridges where Item 26 of the NBI = one of the following: 01 (Rural, Principal Arterial - Interstate), 02 (Rural, Principal Arterial - Other), 06 (Rural, Minor Arterial), 07 (Rural,

Major Collector), (Urban, Principal Arterial - Interstate), (Urban, Principal Arterial - Other Freeways or Expressways), 14 (Urban, Other Principal Arterial), or 16 (Urban, Minor Arterial).

Pontis/BrM – A computer program for bridge management system developed by AASHTO.

Public Road* – Any road under the jurisdiction of and maintained by a public authority and open to public travel.

PEI – Pontis Element Inspection form. A structure inspection form found within the inspection module of Pontis AASHTOWARE, on which the applicable structure element condition states and comments are reported for each structure inspected.

Rounding and Truncating of Numerical Data* – All numeral values in this Guide, except as specifically noted, will follow standard rounding criteria, that is, 5 and above will be rounded up to the next higher unit and 4 and below will be rounded down to the next lower unit. This is applicable to any/all decimal rounding. **In certain items where rounding may cause a safety hazard for clearance, the numeric measurements will be truncated at the appropriate decimal place.** This means that a fractional portion less than a whole unit will be dropped to the lower whole number, for example 2.88 would be truncated to 2.8 when using tenth of a meter accuracy. All decimal points are assumed in the locations as specified in the Guide.

ROW – Right of Way

SI&A – Structure Inventory and Appraisal form, (formerly CDOT Form #422). An inventory and appraisal form found within the Pontis AASHTOWARE inspection module that contains information about a structure.

STRAHNET Connectors* – roads that connect military installations and ports of embarkation to the STRAHNET. The connector routes represent about 3,042 kilometers of roads that complement STRAHNET.

Strategic Highway Corridor Network (STRAHNET)* – A system of highways which are strategically important to the defense of the United States. It includes the Interstate Highways and 25,215 kilometers of other non-interstate highways. The Military Traffic Management Command Report SE 89-4b-27, Strategic Highway Corridor Network, January 1991, contains additional information on STRAHNET.