



COLORADO

Department of Transportation

Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual

Version 1.3: 9/24/2019



Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual

Version 1.3

Date: 9/24/2019

Prepared for:

Colorado Department of Transportation

Staff Bridge & Asset Management

2829 W Howard Place

Denver, CO 80204

Prepared by:

Stantec Consulting Services Inc.

2000 S. Colorado Blvd, Suite 2-300

Denver, CO 80222

Acknowledgements

This manual would not have been possible without the foresight and dedication to public safety by the Colorado Department of Transportation, especially those within Staff Bridge and the Chief Engineer.



TABLE OF CONTENTS

ACKNOWLEDGEMENTS 2

SECTION.1 INTRODUCTION 1

 Section.1.1 Purpose..... 2

 Section.1.2 Organization of the Specification 2

 Section.1.3 History of Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual 3

 Section.1.4 Purpose of the Specification..... 3

 Section.1.5 Units & Standards..... 3

 Section.1.6 Structure Numbering..... 4

 Section.1.6.1 Structure Numbers for Signs 4

 Section.1.6.2 Structure Numbering for Signals 4

 Section.1.6.3 Structure Numbers for High-Mast Lights 8

SECTION.2 SIGNS, SIGNALS, AND HIGH-MAST LIGHTS INVENTORY ITEMS 9

 Section.2.1 Introduction 11

 Section.2.2 Inventory Item Matrix 12

 Section.2.3 Item1A – State Code 14

 Section.2.4 Item 1B – FHWA Region 15

 Section.2.5 Item 2 (2E, 2M) – State Highway Regions 16

 Section.2.6 Item 2T – Transportation Planning Region..... 18

 Section.2.7 Item 3 – County FIPS Code 19

 Section.2.8 Item 4 – Placecode (City/Town FIPS Code)..... 20

 Section.2.9 Item 5A – On/Under Indicator 21

 Section.2.10 Item 5B – Route Prefix..... 22

 Section.2.11 Item 5C – Level of Service..... 23

 Section.2.12 Item 5D – Route Number 24

 Section.2.13 Item 6A – Feature Intersected..... 25

 Section.2.14 Item 8 – Structure Number 26

 Section.2.15 Item 9 – Location 27

 Section.2.16 Item 10 – Inventory Route Maximum Vertical Clearance 28

 Section.2.17 Item 11 – Reference Point (Mile Point) 29



Section.2.18 Item 16 – Latitude 30

Section.2.19 Item 17 – Longitude..... 31

Section.2.20 Item 21 – Maintenance Responsibility 32

Section.2.21 Item 22 – Owner 34

Section.2.22 Item 26 – Functional Classification 36

Section.2.23 Item 27 – Year Built 38

Section.2.24 Item 28B – Lanes Under Structure 39

Section.2.25 Item 29 – Average Daily Traffic 40

Section.2.26 Item 30 – Year of Average Daily Traffic 41

Section.2.27 Item 36A – Bridge Rail Adequacy 42

Section.2.28 Item 36B – Transition Rail Adequacy..... 43

Section.2.29 Item 36C – Approach Rail Adequacy 44

Section.2.30 Item 36D – Approach Rail End Treatment..... 45

Section.2.31 Item 41 – Open/Posted/Closed 46

Section.2.32 Item 45 – Number of Spans 47

Section.2.33 Item 49 – Total Structure Length..... 48

Section.2.34 Item 54A and 54B – Minimum Vertical Underclearance..... 49

Section.2.35 Item 62 – Sign, Signal, & High-Mast Light (SSHML) Rating..... 50

Section.2.36 Item 90 – Inspection Date 52

Section.2.37 Item 90B – Inspection Team 53

Section.2.38 Item 90C – Inspector Name 54

Section.2.39 Item 90VC – Vertical Clearance Measurement Date..... 55

Section.2.40 Item 91 – Inspection Frequency 56

Section.2.41 Item 109 – Average Daily Truck Traffic..... 57

Section.2.42 Item 110 –Truck Network..... 58

Section.2.43 Item 120A – Structure Type..... 59

Section.2.44 Item 120D – Mast Arm/Frame Type..... 60

Section.2.45 Item 120E – Column Type..... 61

Section.2.46 Item 120F – Foundation Type..... 62

Section.2.47 Item 120G – Upper Connection Type 63

Section.2.48 Item 123 – Maintenance Patrol..... 64

Section.2.49 Item 134A – Vertical Clearance Direction Northbound/Eastbound..... 65



Section.2.50 Item 134B – Maximum Vertical Clearance Northbound/Eastbound 66

Section.2.51 Item 134C – Minimum Vertical Clearance Northbound/Eastbound 67

Section.2.52 Item 135A – Vertical Clearance Direction Southbound/Westbound 68

Section.2.53 Item 135B – Maximum Vertical Clearance Southbound/Westbound 69

Section.2.54 Item 135C – Minimum Vertical Clearance Southbound/Westbound 70

SECTION.3 SIGNS, SIGNALS, AND HIGH-MAST LIGHTS ELEMENTS..... 71

Section.3.1 Introduction 72

Section.3.2 Element Matrices 74

Section.3.3 Elements 74

Section.3.4 Defect Matrices 76

 Section.3.4.1 Concrete Defects 76

 Section.3.4.2 Steel Defects 78

Section.3.5 Element Guidance 80

Section.3.6 9600 – General Comments 81

Section.3.7 9601 – Foundation..... 82

Section.3.8 9610 – Anchor Bolts and Leveling Nuts 84

Section.3.9 9611 – Base Plate 88

Section.3.10 9612 – Base Weld/Gusset Weld 90

Section.3.11 9620 – Column - Steel..... 92

Section.3.12 9621 – Column - Concrete/Pre-Stressed Concrete 94

Section.3.13 9630 – Bolted Upper Connection and Splices 96

Section.3.14 9631 – Welded Upper Connection and Splices 98

Section.3.15 9640 – Mast Arm/Frame 100

Section.3.16 9660 – Guardrail Protection - Concrete 102

Section.3.17 9661 – Guardrail Protection - Steel 104

Section.3.18 9662 – Sign Lighting..... 106

Section.3.19 9663 – Catwalk - Steel 108

Section.3.20 9694 – Essential Repair Finding..... 110

Section.3.21 515 – Steel Protective Coating 111

SECTION.4 INSPECTION & SAFETY STANDARDS 113

Section.4.1 Introduction – Inspection & Safety Standards 114

Section.4.2 CDOT Organization and Hierarchy..... 114



Section.4.3 Inspector Qualifications..... 114

 Section.4.3.1 Inspection Program Manager 114

 Section.4.3.2 Team Leader 114

 Section.4.3.3 General Inspectors..... 115

 Section.4.3.4 Specialty Contractors or Discipline-Specific Inspectors..... 115

Section.4.4 Inspection Procedures, Techniques and Scheduling 116

 Section.4.4.1 Traffic Control..... 116

 Section.4.4.2 Night Inspection Work..... 116

 Section.4.4.3 Rope Access Work 116

Section.4.5 Inspection Types and Frequencies 117

 Section.4.5.1 Initial 117

 Section.4.5.2 Routine 117

 Section.4.5.3 Special..... 117

 Section.4.5.4 Damage..... 117

Section.4.6 Health and Safety Procedures 118

 Section.4.6.1 Safe Working Environment..... 118

 Section.4.6.2 General Inspection Safety and Safety Equipment 119

 Section.4.6.3 Traffic Control Safety..... 119

 Section.4.6.4 Night Inspection Safety 119

 Section.4.6.5 Overhead Power/Utility Lines 120

 Section.4.6.6 Mobile and Mechanical Equipment 121

Section.4.7 Inspection Techniques..... 122

 Section.4.7.1 Concrete Inspection Techniques 122

 Section.4.7.2 Steel Inspection Techniques..... 122

 Section.4.7.3 Vertical Clearance Techniques 122

SECTION.5 INSPECTION DELIVERABLES 123

 Section.5.1 Data Collecting and Deliverables..... 124

 Section.5.1.1 SSHML Report Content..... 124

 Section.5.1.2 Structure Inventory and Appraisal 124

 Section.5.1.3 Inspection Findings..... 124

 Section.5.1.4 Recommendations..... 124

 Section.5.1.5 Photographs 124



Section.5.2 Essential Repair Findings 125

Section.5.3 Inaccessible Structures 125

SECTION.6 TREATMENT RECOMMENDATIONS 127

Section.6.1 Introduction 128

Section.6.2 Treatment Recommendations per the Inspection 128

 Section.6.2.1 Element..... 128

 Section.6.2.2 Action..... 128

 Section.6.2.3 Category 129

 Section.6.2.4 Priority 129

 Section.6.2.5 Timeline 131

 Section.6.2.6 Quantity and Type 131

 Section.6.2.7 Auxiliary Tasks 131

 Section.6.2.8 Estimated Cost..... 132

 Section.6.2.9 Status 132

 Section.6.2.10 Date Recommended..... 133

 Section.6.2.11 Commentary of Recommendation 133

Section.6.3 Maintenance Actions..... 133

SECTION.7 APPENDICES..... 135

APPENDIX I ABBREVIATIONS 136

APPENDIX II REFERENCES 136

APPENDIX III FIPS PLACE CODES 137

APPENDIX IV COLORADO MAPS 148

APPENDIX IV.A COLORADO REGION MAP 148

APPENDIX IV.B CDOT MAINTENANCE SECTIONS MAP 149

APPENDIX IV.C CDOT TRANSPORTATION PLANNING REGIONS MAP..... 150

APPENDIX IV.D CDOT MAINTENANCE PATROL MAP 151

APPENDIX V SIGN AND SIGNAL UPPER CONNECTION TYPES 152

APPENDIX V.A SIGN UPPER CONNECTION TYPES, SORTED IN NUMERICAL ORDER 153

APPENDIX V.B FRAME OR TRUSS CONNECTION TYPES (EXCLUDING BUTTERFLY SIGNS)..... 186

APPENDIX V.C COLLAR OR U-BOLT, FINGER CONNECTIONS 201

APPENDIX V.D MONOTUBE CONNECTIONS 207

APPENDIX V.E BUTTERFLY SIGN CONNECTIONS 210



APPENDIX V.F MISCELLANEOUS OR NO LONGER USED CONNECTIONS 220

APPENDIX V.G SIGNAL UPPER CONNECTION TYPES..... 221

APPENDIX VI ANCHOR BOLT NUMBERING 231

APPENDIX VII CONNECTION BOLT AND WELD NUMBERING 232

APPENDIX VIII TEMPLATES 233

APPENDIX VIII.A ERF TEMPLATE..... 233

APPENDIX VIII.B IAF TEMPLATE..... 235



THIS PAGE INTENTIONALLY LEFT BLANK



Section.1 Introduction

SECTION 1 TABLE OF CONTENTS

Section.1.1 Purpose..... 2

Section.1.2 Organization of the Specification 2

Section.1.3 History of Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual 3

Section.1.4 Purpose of the Specification..... 3

Section.1.5 Units & Standards..... 3

Section.1.6 Structure Numbering..... 4

 Section.1.6.1 Structure Numbers for Signs 4

 Section.1.6.2 Structure Numbering for Signals 4

 Section.1.6.3 Structure Numbers for High-Mast Lights 8

Section.1.1 Purpose

This manual updates the 2008 *Recording and Coding Guide for the Inventory and Inspection of Colorado's Overhead Signs, Signals, and High-Mast Lights* and is only valid for such assets. The manual guides Signs, Signals, and High-Mast Lights inspectors on the required inventory data and how to properly and consistently code the condition of individual elements found on these structures for the Colorado Department of Transportation (CDOT).

When performing work for CDOT, it is important to understand the vision and mission statements in order to provide the best possible product for the users of all of CDOT's assets.

CDOT Vision Statement: To enhance the quality of life and the environment of the citizens of Colorado by creating an integrated transportation system that focuses on safely moving people and goods by offering convenient linkages among modal choices.

CDOT Mission Statement: The mission of the Colorado Department of Transportation is to provide the best multi modal transportation system for Colorado that most effectively moves people, goods, and information.

CDOT Values:

- **Safety** – We work and live safely! We protect human life, preserve property, and put employee safety before production.
- **People** – We value our employees! We acknowledge and recognize the skills and abilities of our coworkers, place a high priority on employee safety, and draw strength from our diversity and commitment to equal opportunity.
- **Integrity** – We earn Colorado's trust! We are honest and responsible in all that we do and hold ourselves to the highest moral and ethical standards.
- **Customer Service** – We satisfy our customers! With a can-do attitude, we work together and with others to respond effectively to our customer's needs.
- **Excellence** – We are committed to quality! We are leaders and problem solvers, continuously improving our products and services in support of our commitment to provide the best transportation systems for Colorado.
- **Respect** – We respect each other! We are kind and civil with everyone, and we act with courage and humility.

Section.1.2 Organization of the Specification

- Section.1 – Introduction
- Section.2 – Signs, Signals, and High-Mast Lights Inventory Items
- Section.3 – Signs, Signals, and High-Mast Lights Elements
- Section.4 – Inspection & Safety Standards
- Section.5 – Inspection Deliverables
- Section.6 – Treatment Recommendations

Click to return to: [Table of Contents](#)

- Section.7 – Appendices

Section.1.3 History of Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual

A signs database was established in 1975 to maintain an inventory of overhead sign structures on Colorado’s state highway system. The purpose of the first database was to provide basic information such as sign locations, conditions, and vertical clearances for the Field Log of Structures. This information was determined and documented in the database.

In 1996, twenty-five overhead sign structures were removed from service due to wind induced damage. As a result, design standards were updated and CDOT inspected 780 overhead signs on the state’s highway system in 1998. Between 1999 and 2005, sign and signal structures were inspected intermittently as time and resources allowed. High-Mast Lights were not formally inspected until CDOT began initial inspections of all Signs, Signals, and High-Mast Lights in 2005. By 2008, initial inspections were completed. An inventory and formal inspection program was established. For this new program, many more items of information were collected on each structure than was previously documented. The 1975 database was redesigned to accommodate the additional information and comments.

In 2003, the American Association of State Highway and Transportation Officials’ (AASHTO) Pontis Bridge Management System (BMS) was modified to document the inspections of signs and signals. The Pontis BMS required an element level-based inspection. These elements were defined and condition state codes assigned to document the condition of each element within the structure. CDOT transitioned to AASHTO’s Bridge Management (BrM) software and adopted AASHTO’s condition state ratings and defect coding in 2014.

The original 780 sign inventory has increased to nearly 7000 signs, signals, and high-mast lights. This manual reflects the changes, adoptions, and decisions made throughout the history of the inspection program since 1975.

Section.1.4 Purpose of the Specification

The Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual was prepared for the Colorado Department of Transportation to compliment Signs, Signals, and High-Mast Lights (SSHML) inventory and inspections. The specifications and procedures in this manual will satisfy CDOT requirements and state specific elements. This manual will be used to inspect SSHMLs in the state of Colorado and provide consistent inspection requirements throughout the state.

Section.1.5 Units & Standards

All units within this specification are United States customary units.

The Federal Highway Administration’s (FHWA) publication, Guidelines for the Installation, Inspection, Maintenance and Repair of Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Publication No. GHWA NHI 05-036, March 2005, was used freely and extensively as a guide to writing this document.

Click to return to: [Table of Contents](#)

Section.1.6 Structure Numbering

The structure number is one of the most important items of information in the inventory. It must be unique for each structure and once established, it should not be changed without specific instruction from the Bridge Management Unit of Staff Bridge.

Structures on the state highway system are identified with a maximum 15-digit code. For signs, the code is made up of numbers, text, and dashes. Signals and high-mast lights have no dashes or dots in the structure name.

Section.1.6.1 Structure Numbers for Signs

Structure numbers for signs on the state highway system are created with an 11-digit to 13-digit coding scheme, based on a military quadrangle system. The first 4 characters are always SIGN. The state tourist map, *Official Map to Colorado Scenery and Adventure*, has marks on the borders to show these quadrangles. These marks are 15 minutes of latitude and longitude.

On the sides of the map, from north to south, are letters from A through P. Across the top, from west to east, are numbers from 1 through 28. They identify the quadrangles from A-01 in the northwest corner to P-28 in the southeast corner of the state. These quadrangles are the root of the structure number for structures within a quadrangle.

The last portion of the structure number is a letter, or 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.

Dashes are **always** used between each group of numbers or letters.

Contact the Bridge Management Unit of Staff Bridge to have structure numbers assigned. At a minimum, the following information should be provided when requesting a new structure number:

- Geographical location (latitude and longitude).
- Highway number serviced by the structure.
- Milepost number.
- Structure information (type, material, etc.).

Section.1.6.2 Structure Numbering for Signals

Structure numbers for signals on the state highway system are created with a 15-digit coding scheme, based on the highway number, highway section, the mile point at the center of the intersection, and the corner of the intersection occupied by the signal pole.

Even numbered highways are generally logged from west to east (i.e. I-70) whereas odd numbered highways are generally logged from south to north (i.e. I-25). Each highway may also be divided into sections (A, B, C, etc.).

Each highway is also logged and physically signed on the 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 naming convention is based off the level of service. For structures on state or U.S. highways that intersect:

Click to return to: [Table of Contents](#)

- U.S. highway takes precedent over state highways.
 - For instance, US 40 and SH 121 (Colfax & Wadsworth), structure numbers will start with 040.
- Intersecting U.S. highways and intersecting state highways, lower number highway takes precedent.
 - For instance, US 285 and US 34 (in Loveland), structure numbers will start with 034.
 - SH 52 and SH 144 (in Fort Morgan), structure numbers will start with 052.

The signal structure number is a concatenation of four components:

1. The highway number (three characters)
2. The Section Letter (one character)
3. The Mile Point without the decimal to the thousandth of a mile (six characters)
4. The structure's location in an intersection (one or two characters).

The inspector should assign signal structure numbers as follows:

1. Highway number. Left-fill with zeros to three characters.
2. The Section Letter can be obtained from CDOT's On-line Transportation Information System ([OTIS](#)), or other common sources published by the Colorado Department of Transportation.
3. The mile point of the center of the intersection 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; or by using Google Earth in the office with the coordinates of the pole (recommended). Measure to the center of the intersection and use the same mile point for all signals in the intersection.
4. The final component is determined by the location of the signal in the intersection.

Examples:

When positioned in the middle of the inventory highway, approaching the intersection in an increasing mile point direction, the first signal encountered on the right is designated **A**, the second signal on the right is designated **B**, the first signal encountered on the left is designated **D**, and the second signal on the left is designated **C**. The signals should be A, B, C, and D around the intersection, counterclockwise from A.

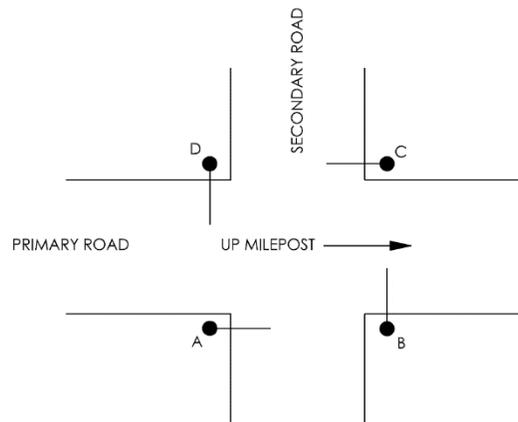


Figure 1: Illustration for determining the location of a signal in an intersection

As with any naming convention scheme, exceptions will occur. If more than one signal is on a corner, use two characters to describe its position on the corner. The first character to indicate the corner it is on, and the second character to indicate the nearest adjacent corner. See the sketches above and below for further explanation.

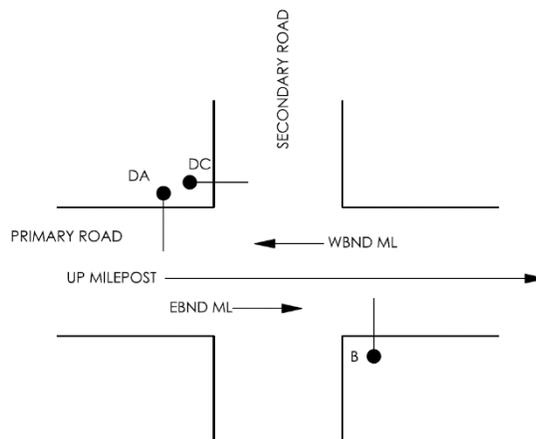


Figure 2: Illustrated location of naming convention for more than one signal on a corner

The structure numbers for the above three signal poles on SH 83, section A, at mile post 62.7 are then: **083A062700B**, **083A062700DA**, and **083A062700DC**.

A signal that is located within or near the center of an intersection will be designated **CT**.

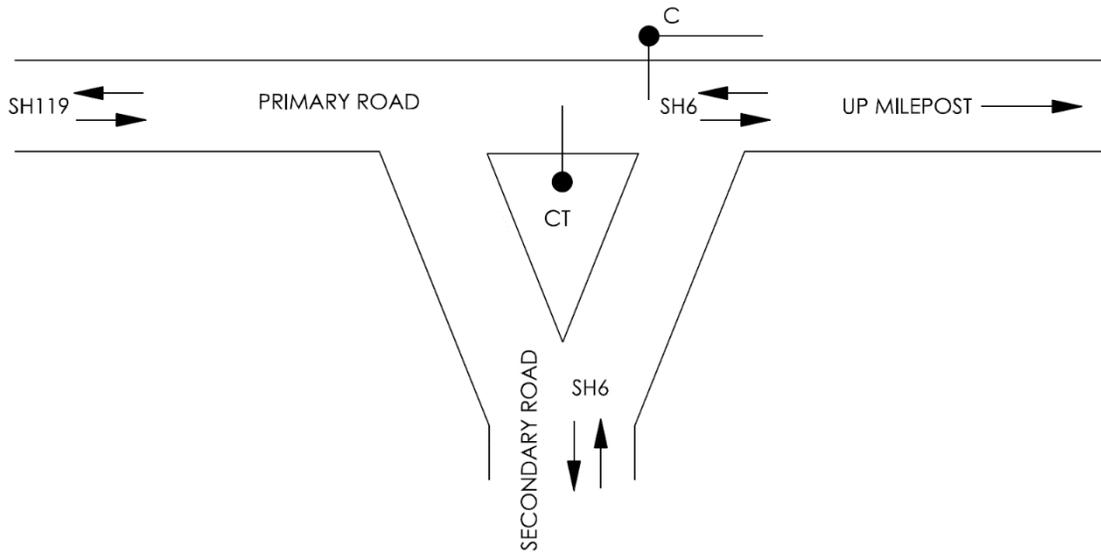


Figure 3: Illustrated Location of a CT-Designated Signal

The structure numbers for the above two signal poles on U.S. 6, section G, at mile post 260.32 are then: **006G260320C** and **006G260320CT**.

A signal can be located within or near a diverging diamond interchange. A diverging diamond interchange shall be divided into two separate intersections. When traveling in the direction of inventory (up milepost), the first corner on the right will be labeled **A**. Subsequent counterclockwise corners will be named **B**, **C**, and **D** respectively.

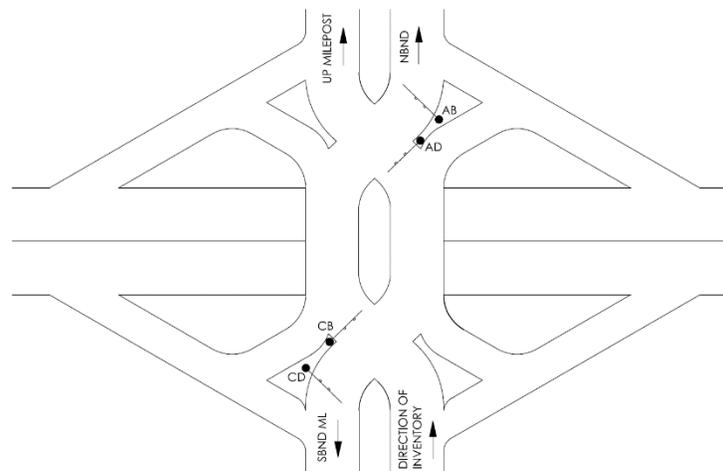


Figure 4: Illustrated location of diverging diamond interchange signals

The structure numbers for the above four signal poles at I 70 off ramps on US 6, section A, at mile point 25.99 and mile point 26.09 are then: **006A025990CB**, **006A025990CD**, **006A026090AB**, and **006A026090AD**.

For unique intersection scenarios, contact Bridge Management Unit of Staff Bridge to assign signal numbering.

Click to return to: [Table of Contents](#)

Section.1.6.3 *Structure Numbers for High-Mast Lights*

Structure numbers for high-mast lights (HML) on the state highway system are created with a 7-digit to 9-digit coding scheme, based on a military quadrangle system. The HML structure number is similar to overhead signs except there are **no dashes**. The first 3 characters will always be HML. The state tourist map, *Official Map to Colorado Scenery and Adventure*, has marks on the borders to show these quadrangles. These marks are 15 minutes of latitude and longitude.

On the sides of the map, from north to south, are letters from A through P. Across the top, from west to east, are numbers from 1 through 28. They identify the quadrangles from A01 in the northwest corner to P28 in the southeast corner of the state. These quadrangles are the root of the structure number for structures within a quadrangle.

The last portion of the structure number is a letter, or letters, from A to ZZZ usually assigned in the order of construction. Thus, structure numbers can be from A01A to P28ZZZ. A high-mast light located in the F17 quadrangle may be named **HMLF17A** (note, **no dashes**).

Dashes are **never** used between each group of numbers or letters for HMLs.

Contact the Bridge Management Unit of Staff Bridge to have structure numbers assigned. At a minimum the following information should be provided when requesting a new structure number:

- Geographical location (latitude and longitude).
- Highway number serviced by the structure.
 - If the structure is a high-mast light in the gore area between two intersecting highways, but not near the shoulder of one of the highways, log the HML to the highway with the lowest highway number.
 - If the HML is in a gore area between two intersecting highways but on or near the shoulder of one of the highways, then log it to the highway to which it is nearest.
 - If the structure is over a deceleration lane, log the structure to the highway it is on.
 - If the structure is along a ramp leading to another highway, then log the structure to the highway that the ramp is leading toward.
- Milepost number.
- Structure information (type, material, etc.).



Section.2 Signs, Signals, and High-Mast Lights Inventory Items

SECTION 2 TABLE OF CONTENTS

Section.2.1 Introduction 11

Section.2.2 Inventory Item Matrix 12

Section.2.3 Item1A – State Code 14

Section.2.4 Item 1B – FHWA Region 15

Section.2.5 Item 2 (2E, 2M) – State Highway Regions 16

Section.2.6 Item 2T – Transportation Planning Region 18

Section.2.7 Item 3 – County FIPS Code 19

Section.2.8 Item 4 – Placecode (City/Town FIPS Code)..... 20

Section.2.9 Item 5A – On/Under Indicator 21

Section.2.10 Item 5B – Route Prefix 22

Section.2.11 Item 5C – Level of Service 23

Section.2.12 Item 5D – Route Number 24

Section.2.13 Item 6A – Feature Intersected 25

Section.2.14 Item 8 – Structure Number 26

Section.2.15 Item 9 – Location 27

Section.2.16 Item 10 – Inventory Route Maximum Vertical Clearance 28

Section.2.17 Item 11 – Reference Point (Mile Point) 29

Section.2.18 Item 16 – Latitude 30

Section.2.19 Item 17 – Longitude 31

Section.2.20 Item 21 – Maintenance Responsibility 32

Section.2.21 Item 22 – Owner 34

Section.2.22 Item 26 – Functional Classification 36

Section.2.23 Item 27 – Year Built 38

Section.2.24 Item 28B – Lanes Under Structure 39

Section.2.25 Item 29 – Average Daily Traffic 40

Section.2.26 Item 30 – Year of Average Daily Traffic 41

Section.2.27 Item 36A – Bridge Rail Adequacy 42

Section.2.28 Item 36B – Transition Rail Adequacy 43

Section.2.29 Item 36C – Approach Rail Adequacy 44

Section.2.30 Item 36D – Approach Rail End Treatment 45

[Click to return to: Table of Contents](#)



Section.2.31 Item 41 – Open/Posted/Closed 46

Section.2.32 Item 45 – Number of Spans 47

Section.2.33 Item 49 – Total Structure Length..... 48

Section.2.34 Item 54A and 54B – Minimum Vertical Underclearance..... 49

Section.2.35 Item 62 – Sign, Signal, & High-Mast Light (SSHML) Rating..... 50

Section.2.36 Item 90 – Inspection Date 52

Section.2.37 Item 90B – Inspection Team..... 53

Section.2.38 Item 90C – Inspector Name 54

Section.2.39 Item 90VC – Vertical Clearance Measurement Date..... 55

Section.2.40 Item 91 – Inspection Frequency 56

Section.2.41 Item 109 – Average Daily Truck Traffic..... 57

Section.2.42 Item 110 –Truck Network..... 58

Section.2.43 Item 120A – Structure Type..... 59

Section.2.44 Item 120D – Mast Arm/Frame Type..... 60

Section.2.45 Item 120E – Column Type..... 61

Section.2.46 Item 120F – Foundation Type..... 62

Section.2.47 Item 120G – Upper Connection Type 63

Section.2.48 Item 123 – Maintenance Patrol..... 64

Section.2.49 Item 134A – Vertical Clearance Direction Northbound/Eastbound..... 65

Section.2.50 Item 134B – Maximum Vertical Clearance Northbound/Eastbound 66

Section.2.51 Item 134C – Minimum Vertical Clearance Northbound/Eastbound 67

Section.2.52 Item 135A – Vertical Clearance Direction Southbound/Westbound 68

Section.2.53 Item 135B – Maximum Vertical Clearance Southbound/Westbound..... 69

Section.2.54 Item 135C – Minimum Vertical Clearance Southbound/Westbound 70

SECTION.3 SIGNS, SIGNALS, AND HIGH-MAST LIGHTS ELEMENTS..... 71

Section.2.1 Introduction

Section 2 presents SSHML inventory items arranged into the categories described below, to facilitate ease of use and consistency by SSHML inspectors. The inventory items for a SSHML describe the function and characteristics of the asset in a specific format. This manual contains items common to the National Bridge Inventory (NBI) and CDOT specific. Each item is designated as an NBI Item or CDOT Item in the header of each section.

The Item ID is a unique indicator assigned to each SSHML item.

For consistency amongst all CDOT asset inspection manuals, the terms Description and Procedure will be used. Additional commentary, CDOT guidance, format and coding examples shall be provided for specific scenarios.

The Description and Procedure portions provide the detailed description of each inventory item and some explanation or additional clarification to consider for coding each item. The Description is the required information to be recorded and shall be followed. The Procedure is intended to provide clarifying information and general guidance for recommended methods to meet the Description. Where there is ambiguity in the Description, CDOT Guidance has been provided.

The Format portion provides examples of how items are coded in the database, currently BrM.

The Coding Example portion provides examples of how to code the item.

Most inventory items for a specific SSHML will be recorded and submitted to CDOT for the initial inspection. Many of these items will not change from inspection to inspection unless a rehabilitation or reconstruction has been performed. Review of the inventory items prior to the submittal of each inspection should be performed to ensure correctness of the information. Many items can be changed by the inspector, but other items should not be changed and should be discussed with CDOT.

DESCRIPTION

Detailed description of requirements of each inventory item.

PROCEDURE

A series of explanations for each inventory item.

COMMENTARY

Supplemental information provided when necessary.

CDOT GUIDANCE

Specific guidance requested by CDOT.

FORMAT

How items are coded in BrM.

CODING EXAMPLES

Examples of how to code the item.

Section.2.2 Inventory Item Matrix

The following table lists the required inventory items with their corresponding NBI Item numbers, the table names, and a brief description. Not all items are applicable to all structure types.

NBI Item Number	Description
Item 1A	State Code
Item 1B	FHWA Region
Item 2 (2E, 2M)	State Highway Regions
Item 2T	Transportation Planning Region
Item 3	County FIPS Code
Item 4	Placecode (City/Town FIPS Code)
Item 5A	On/Under Indicator
Item 5C	Level of Service
Item 5D	Route Number
Item 6A	Feature Intersected
Item 8	Structure Number
Item 9	Location
Item 10	Maximum Vertical Clearance
Item 11	Reference Point (Mile Point)
Item 16	Latitude
Item 17	Longitude
Item 21	Maintenance Responsibility
Item 22	Owner
Item 26	Functional Classification
Item 27	Year Built
Item 28B	Lanes Under Structure
Item 29	Average Daily Traffic
Item 30	Year of Average Daily Traffic
Item 36A	Bridge Rail Adequacy
Item 36B	Transition Rail Adequacy
Item 36C	Approach Rail Adequacy
Item 36D	Approach Rail End Treatment
Item 41	Open/Posted/Closed
Item 45	Number of Spans
Item 49	Total Structure Length
Item 62	Sign, Signal, & High-Mast Light (SSHML) Rating
Item 90	Inspection Date
Item 90B	Inspection Team Indicator
Item 90C	Inspector Name
Item 90VC	Vertical Clearance Measurement Date
Item 91	Designated Inspection Frequency
Item 109	Truck ADT
Item 110	Truck Network
Item 120A	Structure Type
Item 120D	Frame Type

Click to return to: [Table of Contents](#)

NBI Item Number	Description
Item 120E	Pole Type
Item 123	Maintenance Patrol
Item 131C	Foundation Type
Item 134A	Direction of Travel N or E
Item 134B	Maximum Vertical Clearance N or E
Item 134C	Minimum Vertical Clearance N or E
Item 135A	Direction of Travel S or W
Item 135B	Maximum Vertical Clearance S or W
Item 135C	Minimum Vertical Clearance S or W
Item 158	Upper Connection Type

For additional information regarding NBI coding items, refer to the latest version of Colorado's *NBI Structure Inventory Coding Guide* and FHWA's *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*.

This Coding Guide is valid for Signs, Signals, and High-Mast Lights only.



Section.2.3 Item1A – State Code

NBI

DESCRIPTION

Item 1A is a 2-digit code used to identify the State Code where the sign, signal, or high-mast light is located.

PROCEDURE

State codes are derived from the Federal Information Processing Standard (FIPS) Codes for States (FIPS PUB 5-2). In the case of structure being shared between states, the State Code should reflect the state who is responsible for the maintenance of the structure.

Description	Code
Colorado	08
Nebraska	31
Arizona	04
New Mexico	35
Oklahoma	40
Kansas	20
Utah	49
Wyoming	56

COMMENTARY

CDOT has no shared assets. All assets should be coded with 08.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
Colorado	08

Section.2.4 Item 1B – FHWA Region

NBI

DESCRIPTION

Item 1B is a 1-digit code used to identify the FHWA Region where the structure is located.

PROCEDURE

This item is coded “8” as determined from the list provided in the FHWA Coding Guide. This code is pre-filled in the database.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 1-digit.

CODING EXAMPLES

The code for Colorado’s FHWA Region is 8. No other code is valid.



Section.2.5 Item 2 (2E, 2M) – State Highway Regions NBI

DESCRIPTION

Item 2 is a 2-digit concatenation of CDOT Item 2E, Engineering Region (1 digit), and CDOT Item 2M, Maintenance Section (1 digit) that defines the engineering and maintenance responsibilities for the structure.

PROCEDURE

To determine the proper assignment of this code, refer to the maps published by the Division of Transportation Development (DTD) located in Appendix IV.a and Appendix IV.b. Then, select the appropriate Region/Maintenance Section combination from the dropdown menu.

COMMENTARY

The Engineering Region numbers, Maintenance Section numbers within each Region, office addresses, and phone numbers are listed below. 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.

Maintenance Sections are generally within the boundaries of an Engineering Region. An Engineering Region generally follows county boundaries and may have multiple Maintenance Sections within the Region. There are a few locations that have roadways and structures assigned to a Maintenance Section not attached to the structure’s Engineering Region. This occurs where it is more expedient, or cost effective, to overlap responsibilities because of geography, efficient deployment of equipment, or other extenuating circumstance(s).

Note: Former Region 6 and former Maintenance Section 8 have been absorbed into Region 1 and Maintenance Section 5. There is no longer a Region 6 or a Maintenance Section 8.

Engineering Region (Item 2E)	Maint. Section (Item 2M)	Location	Office Address	Office Phone #
1		REGION 1 OFFICE	2000 S. Holly St., Denver	303-757-6459
	Sec 5	Aurora Maintenance	18500 E. Colfax, Aurora	303-365-7110
	Sec 9	Eisenhower Tunnel	P.O. Box 397, Idaho Spgs.	303-512-5730
2		REGION 2 OFFICE	905 Erie Avenue, Pueblo	719-546-5452
	Sec 4	Pueblo Maintenance	905 Erie Avenue, Pueblo	719-546-5419
3		REGION 3 OFFICE	222 S. 6 TH St., Grand Jct.	970-683-6202
	Sec 2	Grand Junction Maintenance	606 S. Ninth St., Grand Jct.	970-683-6305
	Sec 6	Craig Maintenance	260 Ranney St., Craig	970-826-5162
	Sec 7*	Alamosa Maintenance	1205 West Ave, Grand Jct.	970-385-1651

[Click to return to: Table of Contents](#)



Engineering Region (Item 2E)	Maint. Section (Item 2M)	Location	Office Address	Office Phone #
4		REGION 4 OFFICE	1420 2 nd St., Greeley	970-350-2103
	Sec 1	Greeley Maintenance	1420 2 nd St., Greeley	970-350-2120
	Sec 4*	Pueblo Maintenance	905 Erie Avenue, Pueblo	719-546-5419
	Sec 5*	Aurora Maintenance	18500 E. Colfax, Aurora	303-365-7110
5		REGION 5 OFFICE	3803 N. Main, Durango	970-385-1402
	Sec 2*	Grand Junction Maintenance	606 S. Ninth, Grand Jct.	970-683-6305
	Sec 3	Durango Maintenance	20581 Highway 60 W., Durango	970-385-1651
	Sec 7	Alamosa Maintenance	1205 West Ave, Grand Jct.	970-385-1651

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
A structure located within Engineering Region 1 (Denver Metro) Maintenance Section 5 (Aurora) - From the dropdown menu select Reg1 MSec5	15
A structure located within Engineering Region 5 (Durango) but assigned to Maintenance Section 2 within Engineering Region 3 (Grand Junction): From the dropdown menu select Reg 5 MSec 2	52

Section.2.6 Item 2T – Transportation Planning Region NBI

DESCRIPTION

Item 2T is a 2-digit code used to identify the Transportation Planning Region (TPR) that the structure is in.

PROCEDURE

A map showing the boundaries of the TPRs is in Appendix IV.c. From the TPR map, determine the appropriate TPR and enter the code from the table below.

TPR CODE - Title: Area covered	TPR CODE - Title: Area covered
01-Pikes Peak Area: Colorado Springs, portion of El Paso County, Teller	09-Gunnison Valley : Delta, Gunnison, Hinsdale, Montrose, Ouray, San Miguel
02-Greater Denver Area: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin, Jefferson	10-Southwest: Archuleta, Dolores, La Plata, Montezuma, San Juan
03-North Front Range: Fort Collins Area, portions of Larimer and Weld Counties	11-Intermountain: Eagle, Garfield, Lake, Pitkin, Summit
04-Pueblo Area: Pueblo County	12-Northwest: Grand, Jackson, Moffat, Rio Blanco, Routt
05-Grand Valley: Mesa County	13-Upper Front Range: Larimer, Morgan, Weld
06-Eastern: Cheyenne, Elbert, Kit Carson, Lincoln, Logan, Phillips, Sedgwick, Washington, Yuma	14-Central Front Range: Custer, El Paso outside of Pikes Peak, Fremont, Park, Teller
07-Southeast: Baca, Bent, Crowley, Kiowa, Otero, Prowers	15-South Central: Huerfano, Las Animas
08-San Luis Valley: Alamosa, Chaffee, Conejos, Costilla, Mineral, Rio Grande, Saguache	

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 2-digit.

[Click to return to: Table of Contents](#)



Section.2.7 Item 3 – County FIPS Code

NBI

DESCRIPTION

Item 3 is a 3-digit code used to identify the FIPS code for the county, parish or borough in which the structure is located.

PROCEDURE

Use the table below to identify the appropriate county code where the structure is located. If a structure crosses more than one county, use the county that predominately encompasses the structure.

County	FIPS Code	County	FIPS Code	County	FIPS Code	County	FIPS Code
Adams	001	Denver	031	Kit Carson	063	Phillips	095
Alamosa	003	Dolores	033	Lake	065	Pitkin	097
Arapahoe	005	Douglas	035	La Plata	067	Prowers	099
Archuleta	007	Eagle	037	Larimer	069	Pueblo	101
Baca	009	Elbert	039	Las Animas	071	Rio Blanco	103
Bent	011	El Paso	041	Lincoln	073	Rio Grande	105
Boulder	013	Fremont	043	Logan	075	Routt	107
Broomfield	014	Garfield	045	Mesa	077	Saguache	109
Chaffee	015	Gilpin	047	Mineral	079	San Juan	111
Cheyenne	017	Grand	049	Moffat	081	San Miguel	113
Clear Creek	019	Gunnison	051	Montezuma	083	Sedgwick	115
Conejos	021	Hinsdale	053	Montrose	085	Summit	117
Costilla	023	Huerfano	055	Morgan	087	Teller	119
Crowley	025	Jackson	057	Otero	089	Washington	121
Custer	027	Jefferson	059	Ouray	091	Weld	123
Delta	029	Kiowa	061	Park	093	Yuma	125

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 3-digit.

Description	Code
Clear Creek	019
Lincoln	073

[Click to return to: Table of Contents](#)



Section.2.8 Item 4 – Placecode (City/Town FIPS Code) NBI

DESCRIPTION

Item 4 is a 5-digit code to identify the municipality in which the structure is located.

The Placecode (004) is a dropdown field in BrM showing the City/Town name (Item 4A) only. These are linked in the parameters table and the Placecode along with the City/Town Name are shown on reports.

PROCEDURE

The source of these codes is the current version of the U.S. Census of Population and Housing - Geographic Identification Code Scheme, commonly known as the FIPS Code. This is an extensive list; please refer to Appendix III for a complete list. If a city is encountered that is not in the on the list, contact the Bridge Management Unit for a proper code and to update the information.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

For structures located on city boundaries and maintained by CDOT, code the city lowest in alphabetical order. For counties, cities, and other municipalities with structures located on county boundaries, code the entity that has the maintenance responsibility.

If a city is not on the list, contact the Bridge Management Unit, for the assignment of a number or code 00000. For local records the newly assigned number will be used for identification.

FORMAT

Numerical, 5-digit.

CODING EXAMPLES

Description	Code
A structure in Denver	20000
A structure in Castle Rock	12415
Not in a city or town	00000

Section.2.9 Item 5A – On/Under Indicator

NBI

DESCRIPTION

Item 5A is a 1-digit code used to identify how the structure relates to the state highway.

PROCEDURE

Code 2 for all signs, signals, and high-mast lights.

COMMENTARY

For signs and signals, code this item with a 2 to indicate that the highway goes under the structure and that the structure creates a vertical restriction. High-mast lights do not create a vertical restriction; however, shall be coded as two (2) due to their proximity and association.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 1-digit.

CODING EXAMPLES

Description	Code
Overhead signs and mast arm signals over traffic lanes	2
High-mast lights	2
Butterfly signs in a median and not extending over a traffic lane	2



Section.2.10 Item 5B – Route Prefix NBI

DESCRIPTION

Item 5B is a 1-digit code used to identify the Route Prefix or type of highway.

PROCEDURE

When two or more routes are concurrent, code the highest hierarchy of the routes.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 1-digit.

CODING EXAMPLES

Hierarchy	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

Section.2.11 Item 5C – Level of Service

NBI

DESCRIPTION

Item 5C is a 1-digit code to identify the Level of Service for the route.

PROCEDURE

Assign the Level of Service for the inventory route.

COMMENTARY

Only those routes legally designated and signed will be identified with a code other than mainline.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 1-digit.

CODING EXAMPLES

The following codes will be utilized:

Designation	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

Section.2.12 Item 5D – Route Number

NBI

DESCRIPTION

Item 5D is a 5-character code to identify the Route Number. The Route Number a concatenation of the Highway Number and Section Letter.

PROCEDURE

Use CDOT’s [OTIS](#) to identify the Route Number.

COMMENTARY

When two or more routes are concurrent, the highest of the hierarchy of the routes according to Item 5B will be used.

The Section Letter is assigned to all Highway Numbers by the Division of Transportation Development starting with Section Letter “A”. This Section Letter continues until overlapped by a higher hierarchy route (Item 5B). When the overlap ends and the route resumes in its own right-of-way, the Section Letter becomes the next sequential letter.

If the routes are of the same hierarchy level, the lowest numbered route will be used.

CDOT GUIDANCE

The Route Number can be obtained from CDOT’s [OTIS](#), or other common sources published by the Colorado Department of Transportation.

FORMAT

Alpha-Numerical, 5-character.

CODING EXAMPLES

Description	Code
A sign structure over I-70 mainline	0070A
A sign structure over US 40 Business	0040B
Signals controlling the intersection of a city street with US 36	0036B
A high-mast light in the interchange linking US 36 with I-25 mainline	0025A



Section.2.13 Item 6A – Feature Intersected NBI

DESCRIPTION

Item 6A is a 24-character field naming the feature(s) intersected by the structure.

PROCEDURE

The first twenty-four characters, left justified, will identify the name(s) of the feature(s) intersected by the structure. If more than one feature is intersected by the structure, list the features in the following order:

- (leftmost) Highway - Signed number or name
- (second) Railroad - Abbreviated as RR
- (third) Waterway - Common or local name

COMMENTARY

The Bridge Management Unit 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 database searches.

CDOT GUIDANCE

The 23rd and 24th characters are Colorado’s modification as explained below:

Colorado’s modification: If a structure is on a frontage/service road, a ramp, an access road, or a bike path, 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	AR
Bike Path	BP

FORMAT

Alpha-Numerical, 24-character.

CODING EXAMPLES

Description	Code
Interstate 25 over D&RGW Railroad	D&RGW RR
D&RGW Railroad over Interstate 25	I 25 ML
U.S. 85 over Platte River	S. PLATTE



Section.2.14 Item 8 – Structure Number

NBI

DESCRIPTION

Item 8 is a 15-character code to identify the structure number.

PROCEDURE

This is one of the most important items of information in the inventory. Each structure is assigned a specific number up to fifteen characters long. Once a structure number is assigned, *it is unique and must never be revised or reused.*

COMMENTARY

If the structure is replaced, a new number must be assigned, DO NOT reuse the old number. DO NOT delete the old structure data from the database.

CDOT GUIDANCE

The CDOT procedure used for numbering SSHML structures is documented in Section 1.6 Structure Numbering.

FORMAT

Alpha-Numerical, 15-character.

CODING EXAMPLES

Description	Code
An overhead sign over SH 55 near Crook	SIGN-A-25-AR
A high-mast light near Crook	HMLA25CC
An overhead sign over US 36 near Broomfield	SIGN-E-16-OK
A signal pole over SH 74 near Evergreen	074A003300B



Section.2.15 Item 9 – Location

NBI

DESCRIPTION

Item 9 is a 25-character field to describe the geographical location of the structure.

PROCEDURE

Relate the location to a distance from a distinguishable feature on the route such as a road junction or topographical feature.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha-Numerical, 25-character.

CODING EXAMPLES

Description	Code
SIGN-A-24-M is 12.5 miles north of SH 113	12.5 MI N of JCT SH 113
SIGN-F-20-BJ is 5.1 miles west of the town of Deer Trail	5.1 MI W of DEER TRAIL

Section.2.16 Item 10 – Inventory Route Maximum Vertical Clearance NBI

DESCRIPTION

Item 10 is a 5-digit number with 3 decimals, XX.XXX, to the nearest thousandth of a foot (truncated, not rounded up), to identify the maximum useable vertical clearance over the inventory route. This is the practical maximum clearance.

PROCEDURE

Identify and record the maximum practical vertical clearance for a ten-foot wide lane, excluding shoulders, over the inventory route. The practical vertical clearance represents the location in a travel lane under the structure where a typical high load truck can pass safely.

Measure and record the maximum practical vertical clearance under the structure beginning at the edge of pavement, at each lane line, and to the opposite edge of pavement. Record each of these measurements individually in the BrM USERWAY table.

For structures with multiple openings, the maximum of the clearances over all lanes should be reported regardless of the direction of travel.

Where no vertical restriction exists, or where a clearance is greater than 100 feet, code 99.999. Where an obstruction exists but the clearance is unknown, or has not been measured, code 55.555.

COMMENTARY

Item 10 must be completed for all structures that present an obstruction to the inventory route. It is the maximum practical height available for a vehicle to pass safely under the structure or obstruction. These may include roadways, railroads, pedestrian facilities, tunnels, thru trusses and buildings. Clearances for county roads and city streets under state facilities must also be reported.

Item 10 can be confusing in that this is the least restrictive clearance in a lane under a structure and represents the practical maximum height of a vehicle, or load, which can pass under the structure. This vertical clearance must be in one of the travel lanes only.

CDOT GUIDANCE

CDOT Items 10F and 10I are no longer used.

FORMAT

Numerical, 5-digit with 3 decimals.

CODING EXAMPLES

Description	Code
Maximum height is over lane #3 = 19'2"	19.166 (.1667 is truncated, not rounded up)
Unrestricted	99.999
Unknown or not measured	55.555

Section.2.17 Item 11 – Reference Point (Mile Point) NBI

DESCRIPTION

Item 11 is a 7-digit code to locate the structure along the route identified in Item 5D according to a common reference point system.

PROCEDURE

The Reference Point or Mile Point system has been established for state highways to identify the location of a structure on a route based on the measured distance from the beginning of the route. The beginning of a route is usually the western or southern state line or it may be 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, they are measured from their terminus with other highways along their route regardless of direction. The designation should not change. Refer to CDOT’s Field Log of Structures for more details and to establish the direction of inventory for stub routes.

When parallel structures at the same location appear in the highway system, the structure carrying traffic in the direction of inventory is identified as the first reference point. The parallel structure in the opposite direction of inventory will be identified with a reference point one thousandth (0.001) mile larger. Code this information to the thousandth of a mile.

COMMENTARY

The Reference Point (Mile Point) can be obtained from CDOT’s [OTIS](#), or other common sources published by the Colorado Department of Transportation.

CDOT GUIDANCE

Do not change this item without explicit approval of BMS Data Manager.

FORMAT

Numerical, 7-digit XXX.XXX.

CODING EXAMPLES

Structure	Highway	Ref. Point	Code
SIGN-E-16-OW	25A NBND	211.843	211.843
SIGN-C-17-ED	25A SBND	256.12	256.120



Section.2.18 Item 16 – Latitude

NBI

DESCRIPTION

Item 16 is an 8-digit code, with an implied 2-decimal field, to identify the Latitude of the bridge at the center of the foundation.

PROCEDURE

The Latitude can be computed from existing U.S. Geological Survey maps or determined using Global Positioning System (GPS) data. The coordinate shall be recorded at the left foundation unit (if more than one) and shall be coded in degrees, minutes, and seconds to the nearest hundredth of a second.

Coordinates should be as accurate as possible. The reason for increased precision is to facilitate the use of GPS data directly into this item.

COMMENTARY

Coordinates should not be entered in decimal degree form.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 8-digit.

CODING EXAMPLES

Latitude	Code
37° 27' 15"	37271500
40° 02' 00.53"	40020053

Section.2.19 Item 17 – Longitude NBI

DESCRIPTION

Item 17 is a 9-digit code, with an implied 2-decimal field, to identify the Longitude of the structure at the center of the foundation.

PROCEDURE

The Longitude can be computed from existing U.S. Geological Survey maps or determined using Global Positioning System (GPS) data. The coordinate shall be recorded at the foundation and shall be coded in degrees, minutes, and seconds to the nearest hundredth of a second.

Coordinates should be as accurate as possible. The reason for increased precision is to facilitate the use of GPS data directly into this item.

COMMENTARY

Coordinates should not be entered in decimal degree form.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 9-digit.

CODING EXAMPLES

Longitude	Code
105° 19' 32.17"	105193217
102° 13' 40.33"	102134033



Section.2.20 Item 21 – Maintenance Responsibility NBI

DESCRIPTION

Item 21 is a 2-digit code to identify who has the maintenance responsibility for the structure.

PROCEDURE

The codes below shall be used to identify 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
GSA	57
Zoo / Smithsonian	58
NSA	59
Other Federal Agencies (not listed below)	60
Indian Tribal Government	61
Bureau of Indian Affairs	62
Bureau of Fish and Wildlife	63
U.S. Forest Service	64
National Park Service	66
Tennessee Valley Authority	67
Bureau of Land Management	68
Bureau of Reclamation	69
Corps of Engineers (Civil)	70
Corps of Engineers (Military)	71

[Click to return to: Table of Contents](#)



Description	Code
Air Force	72
Navy/Marines	73
Army	74
NASA	75
Metropolitan Washington Airports Authority	76
Pentagon	77
USDA / ARS	78
DOE	79
Unknown	80

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
State Highway	01
County Highway Agency	02
U.S. Forest Service road	64



Section.2.21 Item 22 – Owner

NBI

DESCRIPTION

Item 22 is a 2-digit code used to identify who is the primary owner of the structure.

PROCEDURE

The codes below shall be used to identify the type of agency that has primary ownership for the structure. Although the codes are the same as those for Item 21, they are reproduced here. If more than one agency has equal ownership 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
GSA	57
Zoo / Smithsonian	58
NSA	59
Other Federal Agencies (not listed below)	60
Indian Tribal Government	61
Bureau of Indian Affairs	62
Bureau of Fish and Wildlife	63
U.S. Forest Service	64
National Park Service	66
Tennessee Valley Authority	67
Bureau of Land Management	68
Bureau of Reclamation	69
Corps of Engineers (Civil)	70

[Click to return to: Table of Contents](#)



Description	Code
Corps of Engineers (Military)	71
Air Force	72
Navy/Marines	73
Army	74
NASA	75
Metropolitan Washington Airports Authority	76
Pentagon	77
USDA / ARS	78
DOE	79
Unknown	80

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
State Highway	01
County Highway Agency	02
U.S. Forest Service road	64
Private (other than railroad)	26



Section.2.22 Item 26 – Functional Classification

NBI

DESCRIPTION

Item 26 is a 2-digit code to identify the Functional Classification for the Inventory Route referred to in Item 5D.

PROCEDURE

Functional Classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. The classifications are determined through a statewide planning process and approved by the Transportation Commission and then provided to BMS. Any changes to this classification must be addressed through the Division of Transportation Development (DTD) and approved by the Transportation Commission.

If the structure carries a ramp, frontage road or access road and carries the main line number in Item 5D, then it must be coded with the same functional classification (Item 26) and NHS number (Item 104) as the main line. If the structure carries a county road or city street over an NHS route, the "ON" condition must reflect the appropriate codes for the route and the "UNDER" condition must reflect the NHS codes.

The following list of codes is used to identify these routes. The appropriate code is based on the Inventory Route identified in Item 5D.

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	12
Freeways or Expressways	
Other Principal Arterial.	14
Minor Arterial	16
Collector	17
Local	19

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

[Click to return to: Table of Contents](#)



FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
Interstate 25 in Denver	11
City Street in Vail	19

Section.2.23 Item 27 – Year Built

NBI

DESCRIPTION

Item 27 is a 4-digit code to identify the year in which the structure was originally constructed.

PROCEDURE

Code all four digits of the year the structure was built. This year should be the date the construction was completed. If rehabilitation or other reconstruction work is performed on the structure, the date this work is completed should be coded in Item 106, Year Reconstructed.

If the year of original construction is unknown, code 1901.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 4-digit.

CODING EXAMPLES

Description	Code
Found in Bridge Survey, 1954	1954
Built in 1932	1932
Built in 1985	1985
Structure is estimated to be built circa 1941	1941
Date of Original Construction is unknown	1901



Section.2.24 Item 28B – Lanes Under Structure NBI

DESCRIPTION

Item 28B is a 2-digit code to record the number of Lanes Under Structure.

PROCEDURE

Record the total of all lanes on all inventoried routes passing under the structure.

NOTE: CDOT’s recommended procedure for defining Item 5A for the under routes is to identify them from far left to far right looking in the direction of inventory, or south to north and west to east.

COMMENTARY

Roadway shoulders should not be considered Lanes.

CDOT GUIDANCE

Record the number of lanes on each individual route under the structure separately for First Route Under (Item 5A is always = 2), Second Route Under (Item 5A = A), Third Route Under (Item 5A = B), etc.

The code for Item 28B identifies travel lanes that are striped or otherwise operated as a full width traffic lane. For lanes under the structure Item28B is the total of all lanes on all inventoried routes passing under the structure.

For example, a sign has one route beneath it and the sign extends over two full lanes of traffic and one partial lane of traffic on a four lane highway. The number of lanes under the sign, Item 28B, is 3.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
1 lane under	01
4 streets w/12 total lanes under	12
4 lanes under	04

Section.2.25 Item 29 – Average Daily Traffic NBI

DESCRIPTION

Item 29 is an 8-digit code to identify the Average Daily Traffic (ADT).

PROCEDURE

On-System ADT numbers are provided by the Division of Transportation Development.

Code up to an 8-digit number that identifies the ADT volume for the route being inventoried on the structure, including truck traffic from Item 109 - Average Daily Truck Traffic. The ADT count must be the most current count available.

When taking a traffic count, as for off-system structures, the counter shall be placed and operated for a minimum period of 48 hours, which will include two weekdays. The raw data obtained from the counters shall be adjusted using the seasonal adjustment rate tables annually provided by the Division of Transportation Development.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 8-digit.

CODING EXAMPLES

Description	Code
Adjusted ADT Volume 540	540
Adjusted ADT Volume 15,660	15660
Adjusted ADT Volume 24,000	24000



Section.2.26 Item 30 – Year of Average Daily Traffic NBI

DESCRIPTION

Item 30 is a 4-digit code to identify the Year of Average Daily Traffic count that Item 29 was taken.

PROCEDURE

Code the 4-digit year the ADT (Item 29) was taken. This item will be coded for the route being inventoried (Item 5D) at the structure.

COMMENTARY

Code 1901 if the year of ADT count is unknown.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 4-digit.

CODING EXAMPLES

Description	Code
ADT Counted in 1976	1976
ADT Counted in 2010	2010
Year of ADT count is unknown	1901

Section.2.27 Item 36A – Bridge Rail Adequacy NBI

DESCRIPTION

Item 36A is a 1-character code to identify the Bridge Rail Adequacy. Because a sign, signal, or high-mast light does not have a bridge rail, code this item “N”.

PROCEDURE

Code this item with an “N” as it does not apply to sign, signal, or high-mast light structures.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha-Numerical, 1-character.

CODING EXAMPLES

Definition	Code
Not applicable	N



Section.2.28 Item 36B – Transition Rail Adequacy NBI

DESCRIPTION

Item 36B is a 1-character code to identify the Transition Rail Adequacy.

PROCEDURE

Code this Item with an “N” as it does not apply to sign, signal, or high-mast light structures.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha-Numerical, 1-character.

CODING EXAMPLES

Definition	Code
Not applicable	N



Section.2.29 Item 36C – Approach Rail Adequacy NBI

DESCRIPTION

Item 36C is a 1-character code to identify the Approach Rail Adequacy.

PROCEDURE

Code the Approach Rail Adequacy from the list below as compared to the currently acceptable standard.

Definition	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	N

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha-Numerical, 1-character.

CODING EXAMPLES

Definition	Code
Approach Rail meets currently acceptable standards	1
Approach Rail does not meet currently acceptable standards	0



Section.2.30 Item 36D – Approach Rail End Treatment NBI

DESCRIPTION

Item 36D is a 1-character code to identify the adequacy of the Approach Rail End Treatment.

PROCEDURE

Code the adequacy of the Approach Rail End Treatment from the list below as compared to the currently acceptable standard.

Definition:	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	N

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha-Numerical, 1-character.

CODING EXAMPLES

Definition	Code
Approach Rail End Treatment meets currently acceptable standards	1
Approach Rail End Treatment does not meet currently acceptable standards	0



Section.2.31 Item 41 – Open/Posted/Closed NBI

DESCRIPTION

Item 41 is a 1-character code to identify the operational status of a structure.

PROCEDURE

A field review will identify the operational status of a structure. Inspections, re-ratings or structural damage can cause the status to change. Use the list of codes below to identify the operational status of the structure.

Description	Code
Open, no restriction	A
Open, posting recommended but not legally implemented (all signs not in place, etc.)	B
Open, would be posted or closed except for temporary shoring, etc., to allow for unrestricted traffic	D
Open, temporary structure in place to carry legal loads while original structure is closed and awaiting rehabilitation or replacement	E
New structure, not yet open to traffic	G
Bridge closed, to all traffic (SSHML no longer in service or removed from inventory)	K
Posted for load, (may include other restrictions)	P
Posted for other load capacity restriction, i.e. speed, number of vehicles on structure, or posted but not required	R
Structure reportedly replaced. Confirmation is needed	S

COMMENTARY

No additional commentary.

CDOT GUIDANCE

Codes A and K will only be applicable to Signs, Signals, and High-Mast Lights. No other codes apply.

FORMAT

Alpha, 1-character.

CODING EXAMPLES

Description	Code
SSHML open	A
SSHML removed from inventory	K

Section.2.32 Item 45 – Number of Spans NBI

DESCRIPTION

Item 45 is a 3-digit code to identify the following:

- The number of spans in a sign, or
- The number of signal mast arms attached to a traffic signal pole, or
- The number of high-mast light luminaires.

PROCEDURE

Code this item “001” for single mast arm signals (SGNAL), a cantilevered sign (SIGNC), a sign bridge (SIGN), or a butterfly sign (SIGNB) with sign panels mounted only on one side of the frame.

This item will be coded “002” for those sign bridges that include a cantilevered sign (SIGND), for double-armed signals (SGNAL), and for butterfly signs with panels on both sides of the frame.

This item will be coded “00n” for high-mast light (HML) structures where n = the number of luminaires.

COMMENTARY

High-mast light luminaires are the lights in an array at the top of the structure.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 3-digit.

CODING EXAMPLES

Description	Code
High-mast light (HML) with five luminaires	005
A cantilever sign (SIGNC) or a butterfly sign with one-directional panels (SIGNB) or a sign bridge (SIGN)	001
A sign bridge with cantilever (SIGND) or double-arm signals or a butterfly sign (SIGN B) with sign panels on both sides	002
A signal pole (SGNAL) with three mast arms	003

Section.2.33 Item 49 – Total Structure Length

NBI

DESCRIPTION

Item 49 is an 8-digit code to identify the total length of the sign and is right justified with leading zeros.

PROCEDURE

- **High-mast lights (HML):** Measure the structure height. Round up to the nearest 5-foot increment. This measurement should not be changed once recorded/inventoried.

For all other structures, record the horizontal length of the structure using the following guidelines:

- **Butterfly signs (SIGNB):** Measure the length from end to end of the horizontal frame.
- **Cantilevered signs (SIGNC):** Measure the length from the center of the pole unit to the end of the horizontal structure.
- **Sign bridge (SIGN):** Measure the length between the center of poles.
- **Sign bridge with cantilever (SIGND):** Measure the length of the horizontal member from end to end, including the cantilever portion outside of the vertical members.
- **Single-arm signal:** Measure from the center of the pole to the end of the arm.
- **Double-arm signal:** Measure both arms from the center of the pole to the end of the arm. Record only the longest arm in this field.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

If a structure frame is a double arm (excluding a double-arm truss), then the element quantity (Element 9640) is two times the length entered here.

FORMAT

Numerical, 8-digit with 3 decimal places.

CODING EXAMPLES

Description	Code	Element Quantity
Sign bridge E-17-AY, length 79'-0" C to C of pole	0079.000	79
Cantilevered sign E-17-NL, length 27'-3"	0027.000	27
A high-mast light in the I-25/I-70 interchange	0000.000	00
Double-arm butterfly sign, horizontal length 22'	0022.000	44*
Double-arm signal (65 feet and 30 feet)	0065.000	95*

*Record the total of both arms.

[Click to return to: Table of Contents](#)



Section.2.34 Item 54A and 54B – Minimum Vertical Underclearance NBI

DESCRIPTION

Items 54A and 54B are a 2-part code to identify and record the Minimum Vertical Clearance beneath the structure. The first part identifies the feature under the structure, the second part records the minimum vertical clearance from the highway or railroad to the structure, truncated to the nearest thousandth of a foot.

PROCEDURE

Whenever a structure intersects a roadway or a railroad, a minimum clearance under the structure must be recorded from the travelway beneath the structure to the underside of the SSHML.

If not over a highway or railroad, code Item 54A = “N” and record Item 54B = 0.00. If the under clearance over a highway or railroad is unknown, or not measured, code Item 54B = 55.555. For a vertical clearance greater than 30 feet, code 99.999.

Item 54A: This mandatory code identifies whether the feature under the structure is a highway, a railroad, or neither. Using one of the codes below, code in the first position the reference feature from which the clearance measurement is taken:

Description	Code
Highway beneath structure	H
Railroad beneath structure	R
Feature not a highway or railroad	N

Item 54B: Measure and record the Minimum Vertical Clearance to the roadway in the travel lanes, or from the top of the most restrictive rail for a railroad track. Code the clearance to the nearest thousandth of a foot. For a vertical clearance greater than 30 feet, code 99.999. When multiple roadways or both a railroad and a highway are under the structure, code the most critical dimension.

COMMENTARY

Item 54BF and Item 54BI are no longer valid.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Tow part code: Alpha, 1-character, Numerical, 5-digit with 3 decimal places.

CODING EXAMPLES

Description	54A	54B
Minimum Vertical Clearance over railroad tracks = 26'-8"	R	26.667
Minimum Vertical Clearance over roadway is 38'-0" (>30'-0"	H	99.999
Unknown Vertical Clearance over railroad tracks	R	55.555
Intersected feature is not a highway or railroad	N	0.000

[Click to return to: Table of Contents](#)

Section.2.35 Item 62 – Sign, Signal, & High-Mast Light (SSHML) Rating CDOT

DESCRIPTION

Item 62 is a 1-digit code that assigns a numerical condition rating (0-9) to describe the overall condition of the structure.

PROCEDURE

Using the general condition ratings below, code the overall condition of the SSHML. Inspect the SSHML elements for signs of distress including cracking, deterioration, section loss, and anchor bolt assembly defects.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

An Essential Repair Finding (ERF) is required for any condition rating of 3 or less. The inspector should use best judgement if an ERF is required for other conditions regardless of the condition rating. See Appendix VIII.a for an ERF example.

FORMAT

Numerical, 1 digit.

CODING EXAMPLES

Rating	Condition	Description
9	Excellent	Newly completed construction.
8	Very Good	Near new construction. No damage or deterioration.
7	Good	Minor problems. Shrinkage cracking in concrete and/or staining of surfaces. All connections are sound and hardware is tight. Coating system is functioning as designed with minor peeling or damage in isolated areas with no active corrosion.
6	Satisfactory	Structural elements show minor deterioration. Hairline cracking in concrete greater than 0.012 inches wide with minor efflorescence, scaling, or pop-outs. Connections are functioning as intended. Coating system may be chalking, peeling, curling, or showing other early evidence of distress with isolated minor surface rust with no section loss. Minor impact damage is present.



Rating	Condition	Description
5	Fair	All primary structural elements are sound. Cracking in concrete less than 0.05 inches wide with moderate efflorescence, scaling, delamination, and/or spalls. Exposed rebar may have active corrosion with minor section loss. A few upper connection or splice fasteners may be loose and minor fabrication gaps may exist between mating flange surfaces. Coating system has evidence of distress with active corrosion and/or minor section loss to primary steel elements. Moderate impact damage may be present.
4	Poor	Primary structural elements show advanced deterioration. Structural analysis is not yet warranted. Cracking in concrete greater than 0.05 inches wide with heavy efflorescence, scaling, delamination, and/or spalls. Exposed rebar has moderate section loss. Up to 25% of the fasteners are loose and mating flange surfaces may have moderate gaps not due to fabrication. Severe impact damage may be present. Coating has failed and moderate section loss to primary steel elements may be present. No cracking to steel elements exists. An increased inspection frequency is required. An Essential Repair Finding notification may be warranted.
3	Serious	Deterioration or damage has seriously affected primary structural elements. Structural analysis may be warranted. Major repairs may be necessary. Concrete elements have significant cracking, spalling, and/or exposed rebar with advanced section loss. More than 25% of the fasteners are loose and/or some nuts and bolts may be missing, mating flange surfaces may have significant gaps not due to fabrication. Significant impact damage has occurred. Coating has failed with advanced section loss to primary steel members. Fatigue cracks in steel may be present. An increased inspection frequency and Essential Repair Finding notification is required.
2	Critical	Advanced deterioration or damage to primary structural elements. Structural elements no longer functioning as designed. Structural analysis is warranted. Emergency repairs or shoring devices may be necessary for structure to remain in-service. Consideration should be given to removing or replacing the structure. Immediate notification and Essential Repair Finding is required.
1	Imminent Failure	Major deterioration or damage to primary structural elements. Structural stability has been compromised. Through-wall section loss in critical components, fatigue cracking, or damage that could cause structural failure is present. Traffic should be diverted from under the structure and it should immediately be removed from service. Immediate notification and Essential Repair Finding is required.
0	Failed	One or more primary structural elements has failed. Structure is beyond repair and has been removed from service.

[Click to return to: Table of Contents](#)



Section.2.36 Item 90 – Inspection Date NBI

DESCRIPTION

Item 90 is a 10-character date to document the month, day, and year that the last routine inspection was performed.

PROCEDURE

Record the month, day, and year that the last inspection was conducted on the structure. The coding submitted for the NBI will be extracted from this data.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

MM/DD/YYYY.

CODING EXAMPLES

Description	Code
Inspected on May 29, 2018	05/29/2018



Section.2.37 Item 90B – Inspection Team CDOT

DESCRIPTION

Item 90B is a 20-character field to document the CDOT inspection team, or the Consultant company, that performed the last inspection recorded in Item 90.

PROCEDURE

For inspections conducted by an inspection team, whether by CDOT or a consultant, select the name of the team that conducted the inspection on the date recorded in Item 90.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 20-character.

CODING EXAMPLES

Description	Code
Blue Team	BLUE TEAM
Green Team	GREEN TEAM
Orange Team	ORANGE TEAM
Red Team	RED TEAM
White Team	WHITE TEAM
Benesch	BENESCH
SEH	SEH
Stantec	STANTEC



Section.2.38 Item 90C – Inspector Name CDOT

DESCRIPTION

Item 90C is a 24-character field used to identify the inspector (team leader) that performed the inspection.

PROCEDURE

Record inspector’s (team leader’s) name.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 24-character.

CODING EXAMPLES

Description	Code
Mark Stadig	M.STADIG
Anthony Macias	A.MACIAS



Section.2.39 Item 90VC – Vertical Clearance Measurement Date CDOT

DESCRIPTION

Item 90VC is a 10-character code to identify when the vertical clearances were measured at the structure.

PROCEDURE

Identify the month, day, and year that the vertical clearance measurements were taken as recorded on the Vertical Clearance Sheet.

COMMENTARY

Typically the Inspection Date and Vertical Clearance Measurement Date are the same.

CDOT GUIDANCE

If measurements are completed by a vehicle mounted laser measurement device code 99/99/9999

FORMAT

Date, MM/DD/YYYY.

CODING EXAMPLES

Description	Code
Measurement on May 16, 2017	05/16/2017
Measurement on February 28, 2013	02/28/2013
Measurements done by laser by CDOT	99/99/9999



Section.2.40 Item 91 – Inspection Frequency NBI

DESCRIPTION

Item 91 is a 2-digit code identifying the number of months between regular inspections of the structure.

PROCEDURE

For Signs, Signals, and High-Mast Lights, this interval is typically 48 months. Leading zeros shall be coded for intervals less than 10 months.

Structures may also require special nonscheduled inspections after unusual physical traumas (e.g., floods, earthquakes, fires, or collisions), commonly referred to as Reduced Frequency Inspection.

The designated inspection interval can vary from inspection to inspection, depending on the condition of the structure at the time of an inspection (as recommended by the inspector).

COMMENTARY

No additional commentary.

CDOT GUIDANCE

An inspection frequency will not exceed 48 months. Reduced frequency inspections will usually occur on a 12 month inspection cycle if Item 62 is rated a 3 or less. Frequencies other than 48 months and 12 months can be recommended at the Team Leader’s discretion.

Although the frequency of inspections increases, the time frame is reduced, hence the term Reduced Frequency Inspections.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
Damaged structure with questionable structural details, designated to be inspected every three months.	03
Structure is scheduled for inspection every 48 months	48

Section.2.41 Item 109 – Average Daily Truck Traffic NBI

DESCRIPTION

Item 109 is a 2-digit code indicating the percentage of Item 29 Average Daily Traffic (ADT) attributed to truck traffic.

PROCEDURE

Code the percentage of Item 29, ADT, that is truck traffic. Do not include vans, pickup trucks and other light delivery trucks. If this information is not available, an estimate which represent the average percentage for the category of road carried by the structure may be used.

This item may be left blank if Item 29 is not greater than 100.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

Refer to Colorado Department of Transportation’s Online Traffic Information System ([OTIS](#)) Traffic Data, for the most up-to-date current and future ADT information to complete this item.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
Average Daily Traffic is 7% trucks and Item 29 > 100	07
Average Daily Traffic is 18% trucks and Item 29 > 100	18
Average Daily Traffic is 10% trucks and Item 29 < 100	Blank



Section.2.42 Item 110 –Truck Network NBI

DESCRIPTION

Item 110 is a 1-digit code designating the route as a part of the National Truck Network.

PROCEDURE

The National Truck Network includes most of the Interstate System and those portions of the Federal-aid highways identified in the Code of Federal Regulations (23 CFR 658). The National Truck Network is available for use by commercial motor vehicles of the dimensions and configurations described in these regulations. For Inventory Route, Item 5D, indicate the condition using one of the following codes:

Description	Code
Not a part of the National Truck Network	0
A part of the National Truck Network	1

COMMENTARY

The National Truck Network was created to allow conventional combinations on the Interstate System and portions of the Federal-aid Primary Highway System. This information is provided by the Division of Transportation Development (DTD). Any changes to this classification must be provided by them.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 1-digit.

CODING EXAMPLES

Description	Code
SIGN-P-19-F on S.H. 160	1



Section.2.43 Item 120A – Structure Type

CDOT

DESCRIPTION

Item 120A is a 5-character code to describe the type of main span used in the structure. This item is used to prepare the Field Log of Structures for Staff Bridge Branch.

PROCEDURE

Code the Structure Type using the abbreviated codes listed below.

Description	Code
Overhead sign, sign bridge	SIGN
Overhead sign, butterfly	SIGNB
Overhead sign, cantilever	SIGNC
Overhead sign, sign bridge with cantilever	SIGND
Signal	SGNAL
High mast light	HML

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 5-character.

CODING EXAMPLES

Description	Code
Overhead sign bridge with cantilever	SIGND
Traffic signal whether single arm, double arm, or span wire	SGNAL
High mast light	HML
Overhead sign, cantilever	SIGNC



Section.2.44 Item 120D – Mast Arm/Frame Type CDOT

DESCRIPTION

Item 120D is a 15-character code to describe the type of frame/arm used to support the sign panels or signal heads.

PROCEDURE

Code the Frame Type using the abbreviated codes listed below.

Description	Code
Single arm	SNGL ARM
Double-arm	DBL ARM
Double-arm truss	DBL ARM TRUSS
Box beam truss	BOX BEAM TRUSS
Triple arm	TRI ARM
Monotube	MONOTUBE
High-mast light	HML
Span wire	SPAN WIRE
Nonstandard	OTHER

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 15-character.

CODING EXAMPLES

Description	Code
Sign bridge with a double-arm truss	DBL ARM
Single mast-arm on signal pole	SNGL ARM
Monotube cantilever sign	MONOTUBE



Section.2.45 Item 120E – Column Type CDOT

DESCRIPTION

Item 120E is a 5-character code to describe the type of column or pole used to support the sign.

PROCEDURE

Code the Column Type using the abbreviated codes listed below.

Description	Code
Single tapered column	SNGTC
Single uniform column	SNGUC
Monotube column	MTUBE
Split monotube column	SPTBE
Double uniform column	DBLUC
Built-up column	BLTUC

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 5-character.

CODING EXAMPLES

Description	Code
Monotube sign bridge	MTUBE
Single tapered column or pole	SNGTC



Section.2.46 Item 120F – Foundation Type CDOT

DESCRIPTION

Item 131C is a 1-digit code to identify the Foundation Type.

PROCEDURE

Code the Foundation Type using the codes listed below.

Description	Code
Buried, not visible, or otherwise not accessible	0
Caisson	1
Median barrier wall	2
Formed concrete, rectangular	3
Formed concrete, round	4
Other	5

COMMENTARY

For signs exhibiting different Foundation Types, code the right pole under Item 120F. Identify the Foundation Type for the left pole under the Structure Notes.

NBI Item 120F – Foundation Type was previously 131C – Foundation Type.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 1-digit.

CODING EXAMPLES

Description	Code
Signal pole on a caisson	1
Structure foundation not visible	0
Sign bridge, right pole on caisson, left pole on median barrier wall	1

Section.2.47 Item 120G – Upper Connection Type CDOT

DESCRIPTION

Item 158 is a 3-digit code to identify the type of upper connection used for the pole-to-chord connection.

PROCEDURE

Refer to Appendix V (Sign and Signal Upper Connection Types) to determine the Upper Connection Type code.

COMMENTARY

NBI Item 120G – Upper Connection Type was previously 158 – Upper Connection Type.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 3-digit.

CODING EXAMPLES

Description	Code
Single column to pipe box truss	016
Single column to clamped double arm	025
Monotube sign – cantilevered	006
Signal mast arm clamped to pole	103



Section.2.48 Item 123 – Maintenance Patrol CDOT

DESCRIPTION

Item 123 is a 2-digit code to identify the CDOT Maintenance Patrol responsible for maintenance on the road section containing the SSHML.

PROCEDURE

Each Maintenance Section is divided into Patrols identified by a Patrol Number. The Patrol Number can be obtained from the Maintenance Patrol Map published by Staff Maintenance. A copy of the map is located in Appendix IV.d. The current map can be accessed on CDOT's [OTIS](#). Only those structures on the state highway system need to be coded with the patrol number. For those structures that the Maintenance Patrol is unknown, Code 99 until the patrol is identified.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 2-digit.

CODING EXAMPLES

Description	Code
Structure on I-25 south of Trinidad, Patrol No. 1	01
Structure on U.S. 34 east of Akron, Patrol No. 46	46
Unknown Maintenance Patrol	99



Section.2.49 Item 134A – Vertical Clearance Direction Northbound/Eastbound CDOT

DESCRIPTION

Item 134A is a 1-character code identifying the direction of travel for the northbound or eastbound lanes for which the vertical clearances are measured.

The vertical clearance items are used to record the maximum vertical clearance available under a structure (Item 134B), as well as the minimum vertical clearance under a structure (Item 134C), in the direction of travel.

PROCEDURE

Use the codes below to identify which direction of travel of a divided highway the vertical clearance measurements are taken. These directions are with regard to the direction of inventory.

Description	Code
Northbound	N
Eastbound	E
Undivided highway with no median or with a mountable median	U
Not applicable	X

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 1-character.

CODING EXAMPLES

Description	Code
Northbound lanes of divided highway under a SIGN	N
Eastbound lanes of divided highway under a SIGN	E
Two-way traffic with no barrier between the traffic lanes	U
SIGN is not over northbound or eastbound	X



Section.2.50 Item 134B – Maximum Vertical Clearance Northbound/Eastbound CDOT

DESCRIPTION

Item 134B is a 5-digit code that documents the maximum vertical clearance under the structure, in feet to the hundredths, for the northbound or eastbound lanes.

PROCEDURE

Input the maximum available vertical clearance for the northbound or eastbound direction. If a cantilever, butterfly sign or traffic signal arm restricts any portion of a lane, regardless of direction of travel, then consider the entire lane restricted.

1. If no vertical clearance restriction exists or if the sign is not over the northbound or eastbound direction of traffic (i.e., it is over southbound or westbound lanes only):

Item 134A = X Item 134B = 99.99 Item 134C = 00.00

2. If the vertical clearance is unknown and Item 134A = N or E.

Item 134A = N or E Item 134B = 55.55 Item 134C = 00.00

3. If there are lane(s) with a vertical restriction as well as lanes without restriction in the direction of travel (e.g., a cantilever sign that is over only one lane of a multilane roadway for the maximum clearance is “99.99” but the minimum clearance is unknown):

Item 134A = N or E Item 134B = 99.99 Item 134C = 55.55

4. If Item 134A = U, code the least restrictive clearance regardless of direction.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 5-digit with 2 decimal places.

CODING EXAMPLES

Description	Code
SIGN in northbound lane, max. clearance = 17'-8", min. = 16'-2"	17.67
SIGNC over one lane of a two-lane divided highway, min. = 17'-3"	99.99
Undivided, eastbound direction, max. = 27'-2", min. 16'-5"	27.17
Not applicable/unrestricted	99.99
Unknown	55.55

Click to return to: [Table of Contents](#)



Section.2.51 Item 134C – Minimum Vertical Clearance Northbound/Eastbound CDOT

DESCRIPTION

Item 134C documents the minimum vertical clearance under the structure, in feet to the hundredths, for the northbound or eastbound lanes.

PROCEDURE

Input the minimum (most restrictive) vertical clearance for the northbound or eastbound direction. If a cantilever, butterfly sign or traffic signal arm restricts any portion of a lane, regardless of direction of travel, then consider the entire lane restricted.

1. If no vertical clearance restriction exists or if the sign is not over the northbound or eastbound direction of traffic (i.e., it is over southbound or westbound lanes only):

Item 134A = X Item 134B = 99.99 Item 134C = 00.00

2. If the vertical clearance is unknown:

Item 134A = N Item 134B = 55.55 Item 134C = 00.00

3. If there are lane(s) with a vertical restriction as well as lanes without restriction in the direction of travel (e.g., a cantilever sign that is over only one lane of a multilane roadway but the minimum clearance is unknown):

Item 134A = N or E Item 134B = 99.99 Item 134C = 55.55

4. If Item 134A = U, code the restrictions regardless of direction.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 5-digit with 2 decimal places.

CODING EXAMPLES

Description	Code
SIGNC over one of two lanes on a divided highway where max. = 99.99, min. = 17'-3"	17.25
SIGNC over one of two lanes on a divided highway, max. = 99.99, min. is unknown	55.55
SIGN over undivided highway, max. = 17'-2", min. = 16'-5"	16.42
Not applicable/unrestricted	00.00



Section.2.52 Item 135A – Vertical Clearance Direction Southbound/Westbound CDOT

DESCRIPTION

Item 135A is a 1-character code identifying the direction of travel for the southbound or westbound lanes for which the vertical clearances are measured.

The vertical clearance items are used to record the maximum vertical clearance available under a structure (Item 135B), as well as the minimum vertical clearance under a structure (Item 135C), in the direction of travel.

PROCEDURE

Use the codes below to identify which direction of travel of a divided highway the vertical clearance measurements are taken. These directions are with regard to the direction of inventory.

Description	Code
Southbound	S
Westbound	W
Not applicable	X
Two-way traffic with no effective restrictions between the traffic lanes	U

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Alpha, 1-character.

CODING EXAMPLES

Description	Code
Southbound lanes of divided highway under a SIGN	S
Westbound lanes of divided highway under a SIGN	W
Two-way traffic with no barrier between the traffic lanes	U
SIGN is not over southbound or westbound	X

Section.2.53 Item 135B – Maximum Vertical Clearance Southbound/Westbound CDOT

DESCRIPTION

Item 135B is a 4-digit code that documents the maximum vertical clearance under the structure, in feet to the hundredths, for the southbound or westbound lanes.

PROCEDURE

Input the maximum available vertical clearance for the southbound or westbound direction. If a cantilever, butterfly sign or traffic signal arm restricts any portion of a lane, regardless of direction of travel, then consider the entire lane restricted.

1. If no vertical clearance restriction exists or if the sign is not over the southbound or westbound direction of traffic (i.e., it is over northbound or eastbound lanes only):

Item 135A = X Item 135B = 99.99 Item 135C = 00.00

2. If the vertical clearance is unknown:

Item 135A = S or W Item 135B = 55.55 Item 135C = 00.00

3. If there are lane(s) with a vertical restriction as well as lanes without restriction in the direction of travel (e.g., a cantilever sign that is over only one lane of a multilane roadway, but the minimum clearance is unknown):

Item 135A = S or W Item 135B = 99.99 Item 135C = 55.55

4. If Item 135A = U, code the least restrictive clearance regardless of direction.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 5-digit with 2 decimal places.

CODING EXAMPLES

Description	Code
SIGN in southbound lane, max. clearance = 17'-8", min. = 16'-2"	17.67
Multilane roadway, one lane restricted by SIGNC, max. = 17'-8", min. = 17'-3"	99.99
Undivided, westbound direction, max. = 27'-2", min. 16'-5"	27.17
Not applicable/unrestricted	99.99



Section.2.54 Item 135C – Minimum Vertical Clearance Southbound/Westbound CDOT

DESCRIPTION

Item 135C documents the minimum vertical clearance under the structure, in feet to the hundredths, for the southbound or westbound lanes.

PROCEDURE

Input the minimum (most restrictive) vertical clearance for the southbound or westbound direction. If a cantilever, butterfly sign or traffic signal arm restricts any portion of a lane, regardless of direction of travel, then consider the entire lane restricted.

1. If no vertical clearance restriction exists or if the sign is not over the southbound or westbound direction of traffic (i.e., it is over northbound or eastbound lanes only):

Item 135A = X Item 135B = 99.99 Item 135C = 00.00

2. If the vertical clearance is unknown:

Item 135A = S or W Item 135B = 55.55 Item 135C = 00.00

3. If there are lane(s) with a vertical restriction as well as lanes without restriction in the direction of travel (e.g., a cantilever sign that is over only one lane of a multilane roadway for which the maximum clearance is “99.99” but the minimum clearance is unknown):

Item 135A = S or W Item 135B = 99.99 Item 135C = 55.55

4. If Item 135A = U, code the restrictions regardless of direction.

COMMENTARY

No additional commentary.

CDOT GUIDANCE

No additional CDOT guidance.

FORMAT

Numerical, 5-digit with 2 decimal places.

CODING EXAMPLES

Description	Code
SIGNC over one of two lanes on a divided highway where max. = 99.99, min. = 17'-3"	17.25
SIGNC over one of two lanes on a divided highway, max. = 99.99, min. is unknown	55.55
SIGN over undivided highway, max. = 17'-2", min. = 16'-5"	16.42
Not applicable/unrestricted	00.00
SIGN over roadway where maximum and minimum are unknown	00.01

[Click to return to: Table of Contents](#)



Section.3 Signs, Signals, and High-Mast Lights Elements

SECTION 3 TABLE OF CONTENTS

Section.3.1 Introduction 72

Section.3.2 Element Matrices 74

Section.3.3 Elements 74

Section.3.4 Defect Matrices 76

 Section.3.4.1 Concrete Defects 76

 Section.3.4.2 Steel Defects 78

Section.3.5 Element Guidance 80

Section.3.6 9600 – General Comments 81

Section.3.7 9601 – Foundation 82

Section.3.8 9610 – Anchor Bolts and Leveling Nuts 84

Section.3.9 9611 – Base Plate 88

Section.3.10 9612 – Base Weld/Gusset Weld 90

Section.3.11 9620 – Column - Steel 92

Section.3.12 9621 – Column - Concrete/Pre-Stressed Concrete 94

Section.3.13 9630 – Bolted Upper Connection and Splices 96

Section.3.14 9631 – Welded Upper Connection and Splices 98

Section.3.15 9640 – Mast Arm/Frame 100

Section.3.16 9660 – Guardrail Protection - Concrete 102

Section.3.17 9661 – Guardrail Protection - Steel 104

Section.3.18 9662 – Sign Lighting 106

Section.3.19 9663 – Catwalk - Steel 108

Section.3.20 9694 – Essential Repair Finding 110

Section.3.21 515 – Steel Protective Coating 111

[Click to return to: Table of Contents](#)

Section.3.1 Introduction

This section is comprised of Sign, Signal, and High-Mast Light elements arranged by general element type, material, and in order of their physical location on the structure to facilitate ease of use by inspectors in the field. An element is defined as part of a Sign, Signal, or High-Mast Light that is needed for the respective structure to function as intended. All elements related to Signs, Signals, and High-Mast Lights are Agency Defined Elements (ADE) defined by the Colorado Department of Transportation. Some elements may not be applicable to all structures.

The Element Number is the unique number assigned to represent that element.

The Element Name is the name used to describe that particular element.

The Unit of Measure details the units to quantify that element. The Unit of Measure will be Length, Area, or Each. Length should be reported in feet and Area should be reported in square feet (SF). The quantity of Each (EA) should be recorded as the number of individual elements for the subsection. Each single unit quantity of an element is given a Condition State.

For consistency amongst all CDOT asset inspection manuals, the terms Description and Procedure shall be used. Additional Commentary and CDOT Guidance will be provided for Colorado specific guidance.

The Description and Procedure sections provide the detailed description of each element, how to calculate the quantity of the element and some explanation or additional clarification to consider when coding each element.

In addition to material defects defined by AASHTO, this manual identifies additional defect criteria for specific elements. The intent of the additional guidance is to aid in consistency of condition state assignment and distribution amongst inspectors. Additionally, the construct allows CDOT to expand their asset management program over time.

The Condition State Definition table lists defects and condition state language that is specific to that element and material. Only those defects which are appropriate for a specific element are listed. Each defect is then associated with four condition states and descriptive language based on the material type. This is done to recognize that the defect is dependent on the material and its severity.

- Condition State 1 is analogous to Good Condition
- Condition State 2 is analogous to Fair Condition
- Condition State 3 is analogous to Poor Condition
- Condition State 4 is analogous to Severe Condition

The limits of Condition States 1 through 3 are typically well defined for each defect. Condition State 4 is reserved for instances when the defect's condition is beyond the limits of those defined in Condition States 1 through 3 and a structural review by a qualified individual is recommended or has been performed and a reduced strength or serviceability condition exists following the review process.

Additional guidance for identifying a Condition State 4 condition is provided in the condition state table of many elements. This guidance may be overlooked if the condition merits a structural review or poses a direct safety concern. If a structural review has been performed and the strength or serviceability of the element is affected, the defect is to remain in Condition State 4 with a note indicating that a structural review has been performed. If a structure review has been performed and

Click to return to: [Table of Contents](#)

the strength or serviceability of the element is NOT affected, the condition state distribution for that defect is to be documented in Condition State 3.

An additional defect has been added for CDOT purposes regarding safety. If a defect poses an immediate safety concern to the travelway below or adjacent, the defect is to be recorded in Condition State 4. This shall also be followed by issuance of an Essential Repair Finding (ERF).

When inspecting and developing an element based report, a list of elements will be developed using the plans and on-site observation for the Sign, Signal, or High-Mast Light. Each element will be given a quantity as designated by the element table provided in this text. The element quantities will then be divided into condition states based on the defect descriptions, locations and extent of the defects present, and engineering judgement. Comments will be added under each element describing the defects and their locations.



Section.3.2 Element Matrices

The Sign, Signal, High-Mast Light elements have been summarized, where applicable, via a series of matrices below according to the following:

- Element category relating name and material type denoting the element number or ID
- Material type relating applicable defects (name and number) to elements
- Defect tables per material type with all applicable defects

Following the summary matrices, each element is provided a narrative including Description, Procedure, Commentary, and CDOT Guidance instructing the inspector on the Federal, CDOT, and industry best practices related to each element. When an element’s defect table varies from that applicable to summary tables below, an element specific defect table will be included within the narrative. This may often be the case with ADEs or elements with multiple components and/or unique deterioration mechanics.

Section.3.3 Elements

Element #	Element Name	Unit of Measure	Agency	Steel	Reinforced Concrete	Prestressed Concrete
9600	General Comments	EACH	CDOT			
9601	Foundation	EACH	CDOT		X	X
9610	Anchor Bolts and Leveling Nuts	EACH	CDOT	X		
9611	Base Plate	EACH	CDOT	X		
9612	Base Weld/Gusset Weld	EACH	CDOT	X		
9620	Column – Steel	EACH	CDOT	X		
9621	Column – RC/PSC Concrete	EACH	CDOT		X	X
9630	Bolted Upper Connection and Splices	EACH	CDOT	X		
9631	Welded Upper Connection and Splices	EACH	CDOT	X		
9640	Mast Arm/Frame	LENGTH (Feet)	CDOT	X		
9660	Guardrail Protection – Concrete	LENGTH (Feet)	CDOT		X	
9661	Guardrail Protection – Steel	LENGTH (Feet)	CDOT	X		
9662	Sign Lighting	EACH	CDOT	X		
9663	Catwalk – Steel	LENGTH (Feet)	CDOT	X		
9694	Essential Repair Finding	EACH	CDOT			
515	Steel Protective Coating	AREA (Square Feet)	NBE	X		

[Click to return to: Table of Contents](#)



THIS PAGE INTENTIONALLY LEFT BLANK

Section.3.4 Defect Matrices

All defects related to signs, signals, and high mast lights are coded. Some defects may not be applicable to all elements. Concrete and steel are materials applicable to SSHMLs.

Section.3.4.1 Concrete Defects

Defect Name	Delamination/ Spall/Patched Area	Exposed Rebar	Cracking – Pre-Stressed Concrete	Efflorescence /Rust Staining	Cracking – Reinforced Concrete	Abrasion/ Wear
Defect Number	1080	1090	1110	1120	1130	1190
9601	X	X	X	X	X	X
9621	X	X	X	X	X	X
9660	X	X		X	X	X



Concrete Defects	Concrete Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall 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 structure; OR a structural review has been completed and the defects impact strength or serviceability of the element or structure.
Exposed Rebar/Welded Wire Fabric/Strands (1090)	None.	Present without measurable section loss.	Present with measurable 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 crack or heavy pattern (map) cracking.	
Efflorescence/ Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up and/or 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 crack 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.	
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.	

[Click to return to: Table of Contents](#)



Section.3.4.2 Steel Defects

Aluminum is often used for Signs and Signals material. Aluminum elements shall be coded the same as steel elements.

Defect Name	Corrosion	Cracking	Connection	Distortion	Damage
Defect Number	1000	1010	1020	1900	7000
9610	X	X	X	X	X
9611	X	X		X	X
9612	X	X			X
9620	X	X		X	X
9630	X	X	X	X	X
9631	X	X			X
9640	X	X	X	X	X
9661	X	X	X	X	X
9662	X	X	X		X
9663	X	X	X		X



Steel Defects	Steel 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 structure review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or structure; OR a structural review has been completed and the defects impact strength or serviceability of the element or structure.
Cracking (1010)	None.	Crack that has self arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack exists 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, broken welds, fasteners or pack rust with distortion but does not warrant a structure 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.	
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.	



Section.3.5 Element Guidance

Element Number	Element Name	Unit of Measure
9600	General Comments	EACH
9601	Foundation	EACH
9610	Anchor Bolts and Leveling Nuts	EACH
9611	Base Plate	EACH
9612	Base Weld/Gusset Weld	EACH
9620	Column – Steel	EACH
9621	Column – Concrete/Pre-Stressed Concrete	EACH
9630	Bolted Upper Connection and Splices	EACH
9631	Welded Upper Connection and Splices	EACH
9640	Mast Arm/Frame	LENGTH (Feet)
9660	Guardrail Protection - Concrete	LENGTH (Feet)
9661	Guardrail Protection - Steel	LENGTH (Feet)
9662	Sign Lighting	EACH
9663	Catwalk - Steel	LENGTH (Feet)
9694	Essential Repair Finding	EACH
515	Steel Protective Coating	AREA (Square Feet)



Section.3.6 9600 – General Comments	EACH	ADE
-------------------------------------	------	-----

DESCRIPTION

This element is used for General Comments about a SSHML, conditions in the general area of the structure, vehicle parking, access to the structure, existence of utilities, history of the structure from local property owners, etc. as well as a continuation of element condition narratives. If this is used for further element narration, comment with the respective element number first.

PROCEDURE

The quantity for this element will be “1” and shall be coded under Condition State 1.

Include the word “Access” followed by a brief description of where to access the structure, any special equipment necessary, lock key number, safety concerns, and any other information that may be helpful in order to access the structure.

COMMENTARY

No additional commentary.

DEFECT AND CONDITION STATE DEFINITION

Only Condition State 1 shall be recorded for this element.

Section.3.7 9601 – Foundation	EACH	ADE
-------------------------------	------	-----

DESCRIPTION

This element defines the condition of concrete foundations. These may be concrete caissons, concrete traffic barriers, rectangular, or other formed or prestressed concrete.

PROCEDURE

Visual assessments may be supplemented with non-destructive or destructive testing results for all elements.

COMMENTARY

The Foundation may also be referred to as the base or pedestal.

The number of Foundations will be quantified as each. When traveling in the direction of inventory, the Foundations will be numbered from left to right and can also be referred to by cardinal direction.

The condition of grout pads, if present, shall be included and noted in this element. The condition of the grout pad shall not affect the condition state of the Foundation. The Foundation Type is to be coded under NBI Item 131C (Foundation Type).

DEFECT AND CONDITION STATE DEFINITION

See concrete defect matrix on page 77.



9601 - Foundation

Condition Rating Examples (Concrete Foundation Element)



Condition State 2
Cracks protruding into foundation
from anchor bolt



Condition State 2
Cracking throughout foundation. Note, condition
of grout pad does not affect condition state rating



Condition State 3
Moderate spalling throughout foundation



Condition State 4
Large cracks and incipient spalling, exposed
corroded rebar and/or anchor bolts

Section.3.8 9610 – Anchor Bolts and Leveling Nuts	EACH	ADE
---	------	-----

DESCRIPTION

This element defines the condition of anchor bolts, top nuts, leveling nuts, and washers that secure the base plate to the foundation. The nuts and bolts may be coated or uncoated.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

Visual, tactile, and/or mechanical testing of the nuts and washers is sufficient. Test washers by tapping with a hammer in different directions around the washer. If slippage of washers occurs when struck with a hammer, this shall constitute a loose nut. If a nut is determined to be loose, a field snugness test shall be performed with an adequate sized slugging wrench. If the top nut and leveling nut on the same bolt are loose, report this as one loose bolt, not two loose nuts. Presence of lock washers and/or missing washers shall be noted. Lock washers are non-standard and may not be utilized in high strength bolt connections. Test the soundness and anchorage of the embedment of the anchor bolt in the foundation by tapping the top of the anchor bolt with a hammer. A sharp, sturdy sound will be experienced if the anchor bolt is adequately secured in the foundation.

COMMENTARY

Anchor rods are commonly referred to as anchor bolts. Fasteners refer to anchor rod nuts.

Anchor bolts shall be quantified by the total amount of anchor bolts at all bases.

If anchor bolt covers exist, the covers shall be removed for testing purposes.

The anchor bolt numbering system shall be controlled by the primary roadway. Standing behind the structure facing the primary roadway, the first bolt to the right of the base plate/pole centerline is labeled as Bolt #1 and subsequent bolts are numbered consecutively in a clockwise direction. See Anchor Bolt Numbering in Appendix VI.

The protective coating of this element will be assessed in Element 9620 under protective systems.

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.

The unsupported length (H) of the anchor bolts shall not exceed tolerance. This height is measured from the bottom of base plate to the top of concrete pedestal. Unsupported length tolerance correlates to the diameter (D) of the anchor bolt.

Deficiency Criteria	Condition States
$H \leq 2D$	Condition State 1
$2D < H \leq 2D + 1"$	Condition State 2
$H > 2D + 1"$	Condition States 3 or 4



Condition states of loose anchor bolt nuts will be coded individually. For example, one loose leveling nut in an 8 bolt configuration will be coded as Condition State 2. The remaining 7 bolts will remain in Condition State 1.

Deficiency Criteria	Condition States
All bolts and nuts are tight.	Condition State 1
Less than 25% of bolts have loose nuts.	Condition State 2
25% or more of bolts have loose nuts.	Condition States 3 or 4

If anchor bolt protrusion extends greater than 3 inches above the top nut, this could indicate that the bolts extending into the foundation may not have full design embedment. This defect shall not affect the condition states but should be recorded.



9610 – Anchor Bolts and Leveling Nuts

Condition Rating Examples (Steel Anchor Bolt and Leveling Nut Elements)



Condition State 2

Corrosion initiated on anchor rods, nuts, and washers



Condition State 2

Corrosion with section loss on anchor rods, nuts, and washers



Condition State 3

Anchor rod unsupported length above tolerance



Condition State 4

Missing anchor rod nuts and washers



THIS PAGE INTENTIONALLY LEFT BLANK

Section.3.9 9611 – Base Plate	EACH	ADE
-------------------------------	------	-----

DESCRIPTION

This element defines the condition of base plate(s) supporting the structure. The anchor bolts and welds are evaluated separately under their appropriate elements.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

COMMENTARY

Base plates shall be numbered left to right looking in the direction of inventory.

The protective coating of this element will be assessed in Element 9620 under protective systems.

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9611 – Base Plate

Condition Rating Examples (Steel Base Plate Element)



Condition State 2
Corrosion initiated on base plate



Condition State 3
Corrosion with section loss on baseplate



Condition State 3
Oversized anchor bolt holes in base plate



Condition State 3
Distorted base plate

[Click to return to: Table of Contents](#)

Section.3.10 9612 – Base Weld/Gusset Weld	EACH	ADE
---	------	-----

DESCRIPTION

This element defines the condition of welds at the base of the pole connecting the pole to the base plate and any gusset plates to the pole and base plate. Any defect to the Column or Base Plate that is associated with the weld, shall be coded under Element 9612. Evaluate all welds as a unit.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report. If cracking has propagated into base metal, report that defect in the respective element.

COMMENTARY

The base weld numbering system shall be controlled by the direction of inventory. When traveling in the direction of inventory, an overhead sign bridge base welds will be numbered left to right. The left and right base weld shall be named Base Weld #1 and Base Weld #2 respectively. See Connection Bolt and Weld Numbering in Appendix VII.

The protective coating of this element will be assessed in Element 9620 under protective systems.

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9612 – Base Weld/Gusset Weld	
Condition Rating Examples (Base Weld/Gusset Weld Elements)	
 <p>Condition State 3 Corrosion with section loss of base weld</p>	 <p>Condition State 3 Corrosion with section loss of base weld</p>
 <p>Condition State 4 Fractured base weld</p>	 <p>Condition State 4 Fractured base weld protruding through steel pole</p>

[Click to return to: Table of Contents](#)

Section.3.11 9620 – Column - Steel	EACH	ADE
------------------------------------	------	-----

DESCRIPTION

This element defines the condition of the column and includes the pole or columns, handhole covers, and caps for the column supports of the structure. The element components may be coated, uncoated, galvanized, weathering steel or aluminum.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

COMMENTARY

The column may also be referred to as a pole, post, or vertical support.

Columns should be numbered left to right when traveling in the direction of inventory.

For Signs and HMLs, a Structure ID plaque should be present on the column. If no Structure ID plaque is present, inspectors shall stencil the structure number with paint using 3” high letters. The stencil should be in a visible location when traveling in the direction of inventory and at eye level height.

Protective systems Element 515 for base plate, base weld, anchor bolts, nuts, and washers, and column shall be assessed as a unit under Element 9620.

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9620 – Column - Steel

Condition Rating Examples (Steel Column Elements)



Condition State 2
Minor impact damage



Condition State 2
Moderate corrosion throughout pole



Condition State 3
Corrosion with section loss near base of column



Condition State 4
Punched hole in pole

[Click to return to: Table of Contents](#)



Section.3.12 9621 – Column - Concrete/Pre-Stressed Concrete	EACH	ADE
---	------	-----

DESCRIPTION

This element defines the condition of the column and includes the pole or columns, and handhole covers (if present) for the column supports of the structure.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements.

COMMENTARY

The column may also be referred to as a pole, post, or vertical support.

Columns should be numbered left to right when traveling in the direction of inventory.

Visual assessments may be supplemented with non-destructive testing results for all elements.

DEFECT AND CONDITION STATE DEFINITION

See concrete defect matrix on page 77.



9621 – Column – Concrete/Pre-Stressed Concrete	
Condition Rating Examples (Concrete/Pre-Stressed Column Elements)	
	
Condition State X Description	Condition State X Description
	
Condition State X Description	Condition State X Description

[Click to return to: Table of Contents](#)

Section.3.13 9630 – Bolted Upper Connection and Splices	EACH	ADE
--	-------------	------------

DESCRIPTION

This element defines the condition of those bolted connections that attach portions of the structure together (such as the connection of the horizontal members to the pole and horizontal splices in frame members).

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

Visual, tactile, and/or mechanical testing of the nuts and washers is sufficient. Test washers by tapping with a hammer in different directions around the washer. If slippage of washers occurs when struck with a hammer, this shall constitute a loose bolt. Presence of lock washers and/or missing washers shall be noted. Lock washers are non-standard and may not be utilized in high strength bolt connections. The protective coating of this element will be assessed in the Mast Arm/Frame element under protective systems. If a gap between flanges is present, it should be determined whether it is a fabrication distortion or a gap due to loose hardware.

COMMENTARY

Bolted Upper Connections and Splices shall be numbered left to right when traveling in the direction of inventory. If a structure exhibits a double-arm (exclude truss frames), each arm will have its own connection or splice. See Connection Bolt and Weld Numbering in Appendix VII

The upper connection bolt numbering shall be controlled by the location of the column. This quantity is used to provide bolt locations and will not determine the element quantity. When facing in the direction of the column, the first bolt to the right (clockwise) of the 12 o'clock (top) position shall be labeled as Bolt #1 and subsequent bolts are numbered consecutively in a clockwise direction. If the upper connection has more than one flange connection to the pole, each flange shall be numbered separately. For splices located in the center of the frame/arm, connections shall be numbered clockwise when facing the direction in which the bolt is inserted, i.e. facing bolt head side, with the first bolt to the right (clockwise) of the 12 o'clock position labeled as Bolt #1.

The protective coating of this element will be assessed in Element 9640 under protective systems.

DEFECT AND CONDITION STATE DEFINITION

Average Gap Opening	Deficiency Criteria	Condition States
0" to 1/16"	All bolts and nuts are tight. Minor fabrication distortion.	Condition State 1
>1/16" to 1/8"	All bolts and nuts are tight. Moderate fabrication distortion.	Condition State 2
>1/8" to 3/16"	25% or less of nuts may be loose/missing and/or gap is due to loose or missing fasteners and not fabrication.	Condition State 3
>3/16"	More than 25% of nuts may be loose/missing and/or gap is due to loose or missing fasteners and not fabrication.	Condition State 4

[Click to return to: Table of Contents](#)



9630 – Bolted Upper Connection and Splices

Condition Rating Examples (Steel Upper Connection and Splice Elements)



Condition State 2
R1 corrosion and paint cracking at upper connection



Condition State 3
Loose nuts on upper connection



Condition State 3
Missing/sheared off bolts at upper connection



Condition State 4
Gap in upper connection

Section.3.14 9631 – Welded Upper Connection and Splices	EACH	ADE
---	------	-----

DESCRIPTION

This element defines the condition of those welded connections, including gusset plates, which connect portions of the sign, signal, or high-mast light structure together. These include welds attaching flange plates at bolted connections to horizontal members of frame and signal mast arms and the welded assembly connecting horizontal members to the pole.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

Evaluate all the welds as a unit. Welds at the base are evaluated in Element 9612 – Base Weld/Gusset Weld. Any defect to the Column or Frame that is associated with the weld, shall be coded under Element 9631.

COMMENTARY

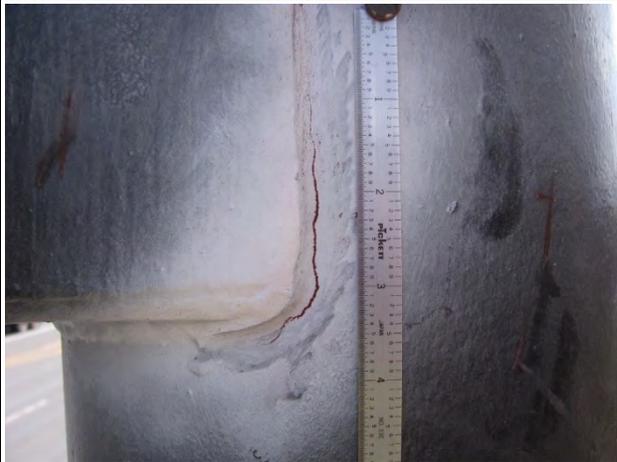
The upper connection weld numbering system shall be controlled by the direction of inventory. When traveling in the direction of inventory, an overhead sign bridge upper connection welds will be numbered left to right. See Connection Bolt and Weld Numbering in Appendix VII.

The protective coating of this element will be assessed in Element 9640 under protective systems.
_Toc524525804

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9631 – Welded Upper Connection and Splices	
Condition Rating Examples (Steel Upper Connection and Splice Weld Elements)	
	
<p>Condition State 2 R1 corrosion on weld repair</p>	<p>Condition State 2 Isolated areas of R1 corrosion on upper connection weld</p>
	
<p>Condition State 4 Magnetic Particle Test reveals crack on upper welded connection</p>	<p>Condition State 4 Cracking through upper connection side plate to pole weld</p>

[Click to return to: Table of Contents](#)



Section.3.15 9640 – Mast Arm/Frame	LINEAR FEET	ADE
------------------------------------	-------------	-----

DESCRIPTION

This element defines the general condition of the horizontal frame (sometimes referred to as the frame, mast arm, span arm, truss, etc.) supporting signal heads, sign panels or Variable Message Sign boards. The element components may be coated/uncoated/galvanized/weathering steel or aluminum.

PROCEDURE

Visual assessments may be supplemented with non-destructive testing results for all elements. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

COMMENTARY

The total length of mast arm/frame will be used to quantify this element. Measure both arms from the center of the pole to the end of the arm and record the total quantity. NBI Item 49 (Structure Length) is similar but only records the longest mast arm/frame.

The horizontal and vertical attachment members on the back of a sign panel are commonly referred to as wind beams and hangers respectively.

Protective systems Element 515 for bolted and/or welded upper connection and splices, catwalk, and mast arm/frame shall be assessed as a unit under Element 9640. The frame type is to be coded under NBI Item 120D (Frame Type).

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9640 – Mast Arm/Frame

Condition Rating Examples (Steel Frame Elements)



Condition State 2
Corrosion initiated throughout truss frame



Condition State 2
Corrosion initiated throughout mast arm



Condition State 3
Distortion to frame



Condition State 4
Damaged frame



Section.3.16 9660 – Guardrail Protection - Concrete	LINEAR FEET	ADE
---	-------------	-----

DESCRIPTION

This element defines the condition of the reinforced concrete railing that is specifically installed to protect the structure being inspected. All elements of the rail must be concrete. If the rail is a combination of both concrete and metal components, the rail shall be coded separately under both respective elements (Element 9660 and Element 9661).

PROCEDURE

Record the linear feet of railing in respective Condition States.

COMMENTARY

Do not include this element if the rail is installed to separate traffic lanes such as along a median, or to protect traffic from a nearby steep side slope, or other reason that is not specifically for protecting the Sign, Signal, or High-Mast Light.

The maximum quantity of guardrail coded shall not exceed 150 feet. Examples include:

- If the guardrail protects a sign structure but is continuous for a long distance, include no more than 150 feet of the rail.
- If a guardrail is present on both sides and protecting a sign structure in a median and the total length of rail exceeds 150 feet, include no more than 150 feet of the rail.
- If a guardrail is continuous leading up to a sign and terminates at or just past the sign, record up to 150 feet of the rail.

DEFECT AND CONDITION STATE DEFINITION

See concrete defect matrix on page 77.



9660 – Guardrail Protection – Concrete	
Condition Rating Examples (Concrete Guardrail Elements)	
 <p>Condition State 2 Map cracking throughout rail</p>	 <p>Condition State 3 Spalls with exposed and corroded rebar</p>
 <p>Condition State 3 Spalls, delamination and exposed rebar</p>	 <p>Condition State 4 Severe Impact damage</p>

[Click to return to: Table of Contents](#)



Section.3.17 9661 – Guardrail Protection - Steel	LINEAR FEET	ADE
--	-------------	-----

DESCRIPTION

This element defines the condition of all types and shapes of metal railing. Steel, aluminum, metal beam, rolled shapes, etc., will all be considered part of this element. Rail posts may be either timber or steel. If the rail is a combination of both concrete and metal components, the rail shall be coded separately under both respective elements (Element 9660 and Element 9661).

PROCEDURE

Record the linear feet of railing in respective Condition States.

COMMENTARY

Do not include this element if the rail is installed to separate traffic lanes such as along a median, to protect traffic from a nearby steep side slope, or other reason that is not specifically for protection of the Sign, Signal, or High-Mast Light.

The maximum quantity of guardrail coded shall not exceed 150 feet. Examples include:

- If the guardrail protects a sign structure but is continuous for a long distance, include no more than 150 feet of the rail.
- If a guardrail is present on both sides and protecting a sign structure in a median and the total length of rail exceeds 150 feet, include no more than 150 feet of the rail.
- If a guardrail is continuous leading up to a sign and terminates at or just past the sign, record up to 150 feet of the rail.

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9661 – Guardrail Protection – Steel

Condition Rating Examples (Steel Guardrail Elements)



Condition State 2
Missing blockouts at timber post



Condition State 3
Impact damage to guardrail with broken post



Condition State 3
Impact damage to guardrail end termination



Condition State 4
Severe impact damage to guardrail



Section.3.18 9662 – Sign Lighting	EACH	ADE
-----------------------------------	------	-----

DESCRIPTION

This element defines the condition of lighting fixtures attached to sign structures for illumination of the sign panels. The lighting may be any configuration or type.

PROCEDURE

Visual assessment may be supplemented with hands-on inspection of the sign lighting. Ensure the fixtures and conduits are intact and in alignment to perform their intended function. Damage and weathering shall be recorded.

COMMENTARY

All lighting fixtures will be coded as one unit. The number of fixtures does not determine the sign lighting quantity.

This element does not address whether the lighting fixtures are operational or not, but only documents their physical condition if present.

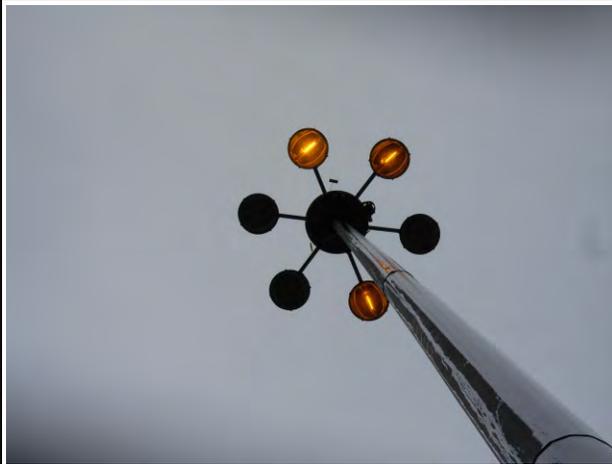
DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9662 – Sign Lighting

Condition Rating Examples (Sign Lighting Elements)



Condition State 1
Lights not functioning



Condition State 3
Lights damaged and not properly aligned



Condition State 3
Impact damage to sign lighting



Condition State 4
HML light fixture failed and hanging from cable

[Click to return to: Table of Contents](#)

Section.3.19 9663 – Catwalk - Steel	EACH	ADE
-------------------------------------	------	-----

DESCRIPTION

This element defines the condition of the walkway structure intended to provide access to the sign for maintenance and repair. Painted, galvanized, and weathering steel catwalks are all included in this element. Report the linear feet of catwalk in each condition state.

PROCEDURE

Visual assessments may be supplemented with non-destructive or destructive testing results for all elements. Ensure that the catwalk railing is functioning properly. Any indication of cracking or fracture shall be evaluated and quantified by a qualified ASNT technician as defined by CDOT. The date of evaluation and summary of methods and findings shall be captured in the report.

The condition of walkway grating, supports, and railings shall be recorded. Ensure all members are in alignment to perform their intended function.

COMMENTARY

The protective coating of this element will be assessed in Element 9640 under protective systems.

DEFECT AND CONDITION STATE DEFINITION

See steel defect matrix on page 79.



9663 – Catwalk – Steel

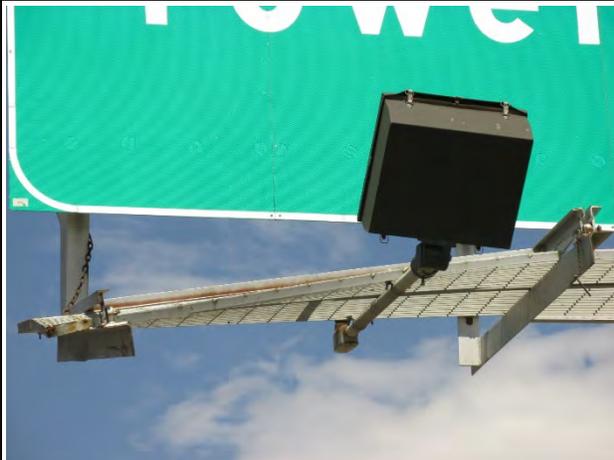
Condition Rating Examples (Steel Catwalk Elements)



Condition State 2
Minor impact damage to catwalk



Condition State 3
Impact damage and non-operational safety rail



Condition State 3
Impact damage to walk and vertical support



Condition State 4
Severe impact damage to catwalk

Section.3.20 9694 – Essential Repair Finding	EACH	ADE
--	------	-----

DESCRIPTION

This element defines an Essential Repair Finding (ERF) requiring immediate action or an Inaccessible Finding requiring access.

PROCEDURE

Record and retain the date(s) of each ERF notification letter along with the reason for the notification. Use the inspection notes field to record the date of the ERF letter and reason for the notification. Condition States 3 and 4 shall be considered for an Essential Repair Finding based upon the element, severity, and judgement of the inspector and engineer review (for Condition State 4). An Essential Repair Finding Memo may be required if Item 62 is rated a 4 and is required for a rating of 3 or less.

Inaccessible structures will also be captured under this element as Condition State 2. An inaccessible structure may have a buried foundation (soil or concrete), fenced in, or otherwise not accessible. An Inaccessible Finding Memo is required if a structure is inaccessible.

COMMENTARY

No additional commentary.

DEFECT AND CONDITION STATE DEFINITION

Element 9694 Condition	Condition States
Previous ERF has been repaired/corrected.	Condition State 1
Structure is inaccessible	Condition State 2
ERF with a Green or Blue color code	Condition State 3
ERF with an Orange or Yellow color code	Condition State 4

Essential Repair Finding Repair Color Coding and Actions

Code	Color	Action
O	Orange	Accomplish repairs within the timeframe specified by the memo or within 30 days.
Y	Yellow	Recommend accomplishing repairs within the next 90 days.
G	Green	Recommend accomplishing repairs within the next year or as funding allows.
B	Blue	Monitoring by maintenance in lieu of repairs. The type and frequency of monitoring as specified by the repair notice.

Determination of ERF based on Combined Stress Ratio (CSR), refer to CDOT’s CSR Spreadsheet

CSR	Action
< 1.0	Submit ERF
≥ 1.0	ERF not necessary

Click to return to: [Table of Contents](#)

Section.3.21 515 – Steel Protective Coating	SQUARE FEET	NBE
---	-------------	-----

DESCRIPTION

This element defines the condition of the steel protective coating protecting the metal on a structure. Paint, galvanizing, and weathering steel are types of steel protective coatings. Steel Protective Coating is the only protective systems element used to code Signs, Signals, and High-Mast Lights.

PROCEDURE

Element 515 will be assessed as a secondary element under primary Elements 9620 Column – Steel and 9640 Mast Arm/Frame.

The quantity of Element 515 will be equal to the value of the parent element. For example, if the length of the mast arm is 30 feet, the quantity of Element 515 will be 30 square feet. If there are 2 columns, the quantity of Element 515 will be 2 square feet.

COMMENTARY

Element 9620 Column – Steel: Steel protective coatings evaluated under the column primary element will include the condition of the coatings for base plate, base welds, anchor bolts, nuts, washers, and column.

Element 9640 Mast Arm/Frame: Steel protective coatings evaluated under the mast arm/frame primary element will include the condition of the bolted and/or welded upper connection and splices, catwalk, and mast arm/frame.

DEFECT AND CONDITION STATE DEFINITION

	Condition States			
	1	2	3	4
Defects	GOOD	FAIR	POOR	SEVERE
Effectiveness (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed, no protection of the underlying metal.



THIS PAGE INTENTIONALLY LEFT BLANK



Section.4 Inspection & Safety Standards

SECTION 4 TABLE OF CONTENTS

- Section.4.1 Introduction – Inspection & Safety Standards 114
- Section.4.2 CDOT Organization and Hierarchy..... 114
- Section.4.3 Inspector Qualifications..... 114
 - Section.4.3.1 Inspection Program Manager 114
 - Section.4.3.2 Team Leader 114
 - Section.4.3.3 General Inspectors..... 115
 - Section.4.3.4 Specialty Contractors or Discipline-Specific Inspectors..... 115
- Section.4.4 Inspection Procedures, Techniques and Scheduling 116
 - Section.4.4.1 Traffic Control..... 116
 - Section.4.4.2 Night Inspection Work..... 116
 - Section.4.4.3 Rope Access Work 116
- Section.4.5 Inspection Types and Frequencies 117
 - Section.4.5.1 Initial 117
 - Section.4.5.2 Routine 117
 - Section.4.5.3 Special..... 117
 - Section.4.5.4 Damage..... 117
- Section.4.6 Health and Safety Procedures 118
 - Section.4.6.1 Safe Working Environment..... 118
 - Section.4.6.2 General Inspection Safety and Safety Equipment 119
 - Section.4.6.3 Traffic Control Safety..... 119
 - Section.4.6.4 Night Inspection Safety 119
 - Section.4.6.5 Overhead Power/Utility Lines 120
 - Section.4.6.6 Mobile and Mechanical Equipment 121
- Section.4.7 Inspection Techniques 122
 - Section.4.7.1 Concrete Inspection Techniques 122
 - Section.4.7.2 Steel Inspection Techniques 122
 - Section.4.7.3 Vertical Clearance Techniques 122

[Click to return to: Table of Contents](#)

Section.4.1 Introduction – Inspection & Safety Standards

The following sections of Chapter 4 will focus on the general practices regarding inspection and safety procedures, as well as, definitions regarding Sign, Signal, and High-Mast Light infrastructure of Colorado. This chapter also addresses CDOT specific processes and requirements.

Section.4.2 CDOT Organization and Hierarchy

The Colorado Department of Transportation organization is important to inspectors for obtaining documents such as previous reports, permits; notifying staff for upcoming inspections; and coordination with the appropriate personnel.

Reference current [organizational chart](#) from CDOT’s website for more information on hierarchy personnel.

Section.4.3 Inspector Qualifications

The following sections outline the roles and duties of the inspection team.

Section.4.3.1 Inspection Program Manager

Inspection Program Managers must be a registered Professional Engineer (PE) in the State of Colorado or have at least 10 years of bridge and/or SSHML inspection experience. The Program Manager is in charge of the overall inspection program.

The Inspection Program Manager:

- Communicates directly with the CDOT Program Manager.
- Confirms that all requirements of the Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual are met.
- Develops the inspection safety plan to be approved by CDOT.
- Gives direction to the inspection Team Leader(s).
- Reviews and maintains all documents pertaining to the inspections.
- Develops inspection schedules to be approved by CDOT.
- Is responsible to inform the CDOT Program Manager of any essential repair findings within the specified time frame.
- Confirms structural reviews are performed when necessary.
- Coordinates schedule with CDOT Program Manager.

Section.4.3.2 Team Leader

Team Leaders must be a certified inspector and have the experience and knowledge of the specific SSHML elements.

Team Leaders must meet one of the following requirements:

- Registered professional engineer with 6 months of bridge or ancillary inspection experience, or
- 2 years of bridge or ancillary inspection experience, or a combination of education and experience as described in the National Bridge Inspection Standards (NBIS) defined in 23 CFR

Click to return to: [Table of Contents](#)

650, Subpart C. The Team Leader must have also taken the NHI 130055 - Safety Inspection of In-Service Bridges course and maintained an updated refresher course every 5 years and taken the NHI 130087 - Inspection and Maintenance of Ancillary Highways Structure course.

The Team Leader:

- Communicates directly with the Inspection Program Manager.
- Reviews all available historical data prior to inspection.
- Administers the inspection safety plan.
- Prepares the inspection schedule.
- Assembles the inspection team and verifies inspector qualifications.
- Enforces the inspection safety plan and all safety practices.
- Conducts safety meetings prior to inspections.
- Coordinates the inspections with the; Inspection Program Manager, appropriate Maintenance Superintendent, Highway Supervisors, Resident Engineer, and Traffic Engineer (see organizational charts).
- Manages and assigns the daily activities of the inspection team.
- Determines equipment and material requirements.
- Directs inspection team on evaluating elements and reporting in accordance with the Colorado Signs, Signals, and High-Mast Lights Inventory & Inspection Manual.
- Recommends repairs to the CDOT Program Manager.
- Immediately reports essential repair findings to the Inspection Program Manager.

Team Leaders must be on-site for initial, routine, and in-depth inspections at all times.

Section.4.3.3 General Inspectors

General Inspectors, or Assistant Team Leaders, assist the Team Leader throughout the inspection process. This may consist of taking photographs, making sketches, tabulating inventory, performing inspection, assessing element ratings, and creating documentation.

General Inspectors should have the training and experience to inspect ancillary structures. The Team Leader is responsible for overseeing the entire inspection and integrating the findings into the report, including the actions of all General Inspectors.

Section.4.3.4 Specialty Contractors or Discipline-Specific Inspectors

Specialty contractors may be required to inspect SSHML components. These contractors may include non-destructive testing (NDT) companies. CDOT requires that the individuals performing NDT methods shall be certified in conformance with the American Society for Nondestructive Testing's (ASNT) Recommended Practice No. SNT-TC-1A. Individuals who perform NDT shall be certified as NDT Level II at a minimum.

Section.4.4 Inspection Procedures, Techniques and Scheduling

Section.4.4.1 Traffic Control

Lane closures for ancillary inspection work must be in conformance with the most current version of the Manual on Uniform Traffic Control Devices (MUTCD) and the appropriate Region Lane Closure Strategy which can be accessed on the CDOT home page. Lane closures that do not comply with the Lane Closure Strategy must have written approval from the Region Traffic Engineer. Often, CDOT will provide traffic control for ancillary inspections. This should be determined in the pre-inspection meeting with the Maintenance Superintendent. Requests for Colorado State Patrol presence in the work zone should be made at the pre-inspection meeting. The appropriate CDOT Labor, Trades, Craft Operator (LTC OPS) will be the contact for CDOT Traffic Control. The appropriate LTC OPS should be contacted following the pre-inspection meeting with the Superintendent for planning purposes. A follow-up contact with the LTC OPS should be made one week prior to the inspection to confirm the traffic control details. Contact with the LTC OPS will follow the same process if a traffic control contractor is utilized. Also ensure all permit requirements are met when using a contractor for traffic control.

Current CDOT Lane Closure Strategies by region can be found [online](#).

Section.4.4.2 Night Inspection Work

Night inspections may be necessary when traffic conditions dictate. Notifications for night inspections will follow the same protocols outlined in Section 4.4.1 of this manual. The traffic control plan for night inspections must have written approval from the Region Traffic Engineer. The following items should be considered when performing inspections at night on the roadway:

- Personal Protective Equipment (PPE) shall meet all the requirements of ANSI/ISEA/OSHA/MUTCD/ 29 CFR/CDOT
- Proper Hard Hats and Class 3 Body wear
- Properly Illuminated work zone
- Reflective Traffic Control Devices placed with appropriate tapers, transitions, and spacing in accordance with MUTCD
- Reflective Work Signs in accordance with MUTCD
- Crash Protection (i.e. crash attenuator)
- Reflective Traffic Control Devices for advanced warning
- Reduced Vehicle Speeds, if deemed necessary
- Amber vehicle beacons
- Colorado State Patrol presence should be requested in the initial meeting with the Maintenance Superintendent, if deemed necessary

Section.4.4.3 Rope Access Work

Inspection over live traffic via roped access may be allowed with prior approval from the CDOT Project Manager or his/her designee. Roped access will be restricted to the same hours as traffic control set by the maintenance coordinator or Regional Traffic Engineer. Structural components over shoulders may not require traffic control (to be determined in conjunction with the Inspection Program Manager and Regional Traffic Engineer).

Click to return to: [Table of Contents](#)

Section.4.5 Inspection Types and Frequencies

Inspections will be one of four types: Initial, Routine, Special, and Damage. Inspection requirements are outlined in the subsequent sections.

Inspection Type	Application	Interval	Purpose
Initial	New structure	Prior to opening	Establish a condition baseline and gather SI&A information
Routine	Default condition/ monitor changes	Every 48 months or less	Monitor element Condition States at regular intervals
Special	Monitoring known deficiencies	Established by the CDOT Program Manager	Observe and monitor known deficiencies at more regular intervals; determine if Condition State is progressing
Damage	Safety after damage	After an event damages the structure	Document damage due to an event, ensure structure is safe to remain in service and is performing as intended

Section.4.5.1 Initial

Initial Inspections are performed on newly-constructed structures prior to functioning over traffic. The Initial Inspection is performed to establish a baseline for future inspections. The Initial Inspection shall develop a complete list of inventory items including a list of elements identified by quantity and condition. Diagrams, sketches, and photographs may be included to further illustrate the various systems.

Section.4.5.2 Routine

Routine Inspections are performed every 48 months or less if the facility is open to traffic. Routine Inspections evaluate all ancillary elements and systems and are performed to evaluate changes in the structure condition from the initial recorded condition or previous Routine Inspection findings. Typically visual and quantitative assessments are used, as well as some types of NDT such as sounding concrete and magnetic particle. All elements are inspected during the same Routine Inspection.

Section.4.5.3 Special

Special Inspections are performed periodically between routine inspections. These inspections monitor a known or suspected deficiency and the frequency will be established by the CDOT Program Manager.

Special Inspections are usually performed following other types of inspection where a specific deficiency has been identified or as requested by the owner. Special Inspections shall occur only with the written approval/request of the CDOT Program Manager and the appropriate Maintenance Superintendent.

Section.4.5.4 Damage

Damage Inspections are not scheduled and occur after damage is incurred by a natural or human induced event. The most common Damage Inspection to Signs, Signals, and High-Mast Lights are due to

Click to return to: [Table of Contents](#)

vehicular impact. Damage Inspections shall be performed at the request of the CDOT Program Manager. These inspections should be scheduled as soon as is plausible after the damage has occurred. This is to ensure the structure is in serviceable condition and no safety hazards exist that may endanger the traveling public. In some cases, roadway lanes may need to be closed until the inspection has taken place.

Section.4.6 Health and Safety Procedures

The safe inspection of CDOT Signs, Signals, and High-Mast Lights is the highest priority of the inspection team. Public safety and inspector safety protocols shall be defined in the early planning stages of the inspection. These protocols shall be addressed explicitly in the written inspection safety plan, communicated with CDOT staff, and discussed daily by the inspection team prior to each day's inspection. CDOT specific safety rules shall be reviewed and followed.

All safety procedures shall be performed in accordance with the written safety plan. The procedures shall enforce CDOT safety rules, OSHA, MUTCD, and other applicable regulatory guidelines. The safety procedures will provide worker and traveling public safety. The safety procedures shall emphasize personal safety of the inspectors to include proper PPE. Traffic control and the proper use of communication devices among other topics shall be included in the safety procedures.

Public safety shall include, but not be limited to, safe roadway lane closures and mitigation of potential overhead risks to the travelling public.

Inspector safety shall include, but not be limited to, awareness of the written safety plan and CDOT safety rules. CDOT lane closure policies and the MUTCD procedures shall be followed at all times. Inspectors shall always utilize proper personal protection equipment (PPE). The inspectors shall be aware of potential electrical hazards, de-energizing policies, and lockout/tag-out procedures. Prior to initiating inspection activities, the team will perform a risk assessment of the structure for unique hazards. Prior to inspection, the team shall be aware of the emergency plan, and first aid/rescue procedures. The safety goal of the inspection team shall be zero accidents and zero injuries.

Be sure to compare employer safety regulations with CDOT. If more than one safety procedure pertains to a safety element in the inspection, use the more stringent procedure.

Section.4.6.1 Safe Working Environment

The Team Leader and the Inspection Team shall make safety the first priority. Close coordination with CDOT forces prior to, and during, inspections will protect the inspectors and the travelling public from potential danger.

The Team Leader shall develop a Risk /Hazard Assessment that includes:

- Written Rules
- Emergency Plan
- First Aid/Rescue Procedures
- Appropriate Personal Protection Equipment (PPE)
- Traffic Control
- OSHA Regulations
- Necessary Tools/Equipment

[Click to return to: Table of Contents](#)

- Overhead Hazards/Access Equipment
- Clean Work Area/Housekeeping
- Identify Near Misses

Section.4.6.2 General Inspection Safety and Safety Equipment

It is important that appropriate safety equipment is utilized for the type of environment and tasks to be performed. Personal protective equipment (PPE) is designed to protect the individual from injury and death. Most of this equipment needs to be fitted for the individual to be effective. Some examples of standard PPE are: hard hat, goggles, ear plugs, dust mask or respirator, safety vest, gloves, boots, knee pads, and safety belts or harnesses. Additional safety equipment that meets appropriate industry standards should also be furnished for the inspection team. Additional equipment includes, but is not limited to, appropriate devices for traffic control, first aid kits, flashlights, and two-way radios. Proper use of this equipment should be provided by a qualified safety representative. In addition to using proper PPE, field attire should be sturdy and fit properly. It should be appropriate for the tasks to be performed. Loose attire can catch in elements of the structures and cause severe injury. Be sure attire fits closely but is comfortable. A tool pouch free the hands and correctly fitting leather gloves that do not greatly reduce dexterity are recommended.

Section.4.6.3 Traffic Control Safety

Uniform traffic control is needed for the safe and efficient transportation of goods and people. The Manual on Uniform Traffic Control Devices (MUTCD) sets minimum standards, provides guidance, and ensures uniformity. All traffic control shall adhere strictly with the MUTCD and The Colorado Supplement to the Federal Manual on Uniform Traffic Control Devices. It is also required to follow the proper CDOT Region Lane Closure Strategy and the approved traffic control plan signed by the Region Traffic Engineer.

Traffic control shall be used in the event travel lanes or shoulders are to be closed during the time of inspection for access to ancillary structure elements. The use of crash attenuators, electronic messaging, and VMS should be utilized whenever possible. Certified law enforcement presence should be considered as an added safety precaution whenever possible. For times and lane closure guidelines of state highways, consult the reference Region specific CDOT Lane Closure Strategy documents. Specific traffic control protocols shall be addressed in the written safety plan prior to inspection and follow all state, employer, and federal requirements. When necessary, obtain the needed permits for road closures.

Section.4.6.4 Night Inspection Safety

Inspection of CDOT ancillary structures may require work to be performed at night to minimize negative traffic impact. Nighttime work comes with inherent dangers such as: reduced visibility, increased average speed of traveling vehicles due to lower traffic congestion, and decreased performance of workers and drivers. It is important that safety of the inspection team and traveling public are stressed during night inspection work to account for accident prevention.

These inspections require additional equipment to ensure visibility. Equipment may include: lighting stations or floodlights, additional PPE, proper retro-reflective channeling devices and signage, and flashing warning lights. Class 3 full body reflectivity which includes leg reflectors in association with reflective vests is required. For more information on Performance Class 3 reflectivity requirements refer to ANSI/ISEA 107. When temporary traffic control is required for nighttime inspections, adequate lighting must be used without producing a disabling glare for road users, flaggers, or workers. All flagger

Click to return to: [Table of Contents](#)

stations must be illuminated except in emergency situations. For more information on temporary nighttime traffic control requirements refer to MUTCD Part 6. All night inspection protocols shall be addressed in the written safety plan prior to inspection and follow all state, employer, and federal requirements. When the requirements do not agree use the more stringent regulations.

Section.4.6.5 Overhead Power/Utility Lines

Occupational Health and Safety (OHS) regulations require elevated structures, machinery, and traveling vehicles maintain a minimum distance from high voltage power lines to prevent electrocution. When working on ancillary structures, identify the route for all services adjacent to the structure and verify safe operational distances for traffic and equipment. Refer to the table below for OSHA recommended safe approach distance for qualified personnel when working around overhead power and utility lines.

Operating Voltage between Conductors of Overhead Power Lines	Safe Limit of Approach Distance for Operation of Equipment
Up to 50 kV	10 Feet
Over 50 kV	Increase clearance by 4 inches for every 10 kV above 50 kV

Operating Voltage between Conductors of Overhead Power Lines	Safe Limit of Approach Distance for Vehicles in Transit with Structures Lowered
Up to 50 kV	4 Feet
Over 50 kV	Increase clearance by 4 inches for every 10 kV above 50 kV

Voltage Range (Phase to Phase)	Minimum Approach Distance
300V and less	Avoid Contact
Over 300V, not over 750V	1 ft. 0 in.
Over 750V, not over 2kV	1 ft. 6 in.
Over 2kV, not over 15kV	2 ft. 0in.
Over 15kV, not over 37kV	3 ft. 0 in.
Over 37kV, not over 87.5kV	3 ft. 6 in.
Over 87.5kV, not over 121kV	4 ft. 0 in.
Over 121kV, not over 140kV	4 ft. 6 in.

Note: If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or

Click to return to: [Table of Contents](#)

its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

More stringent distances during the inspection may be required by CDOT. Be sure to verify these distances during the preliminary planning if high voltage powerlines and equipment exist adjacent to the structures to be inspected. Use the more stringent policies/procedures when carrying out the inspection.

Section.4.6.6 Mobile and Mechanical Equipment

Every piece of equipment has its own set of unique hazards. A risk assessment should be conducted before the inspection to identify risks associated with the equipment being used. For example, hazards associated with using a bucket truck boom are: operating in bad weather or on unstable ground, crush or pinch points, overloading with heavy objects, removing guardrails during operation, failure of lifting mechanism, operator error, falls due to improper tie-offs, and arc flash due to proximity with electrical systems. All manufacturer recommendations shall be followed.

Equipment should only be operated by those who have adequate training and experience with the equipment in use.

Common risk mitigation techniques for mobile equipment include:

- Never occupy the space under a suspended load, or within range of the swing arm
- Establish clear communication methods with the operator
- Remain a safe distance from power lines
- Establish eye contact with the operator and communicate intentions; wait for acknowledgement from the operator before moving
- Regular maintenance and inspections on equipment shall be performed by qualified personnel
- Only work from equipment that is purpose-built as a work platform
- When not in use, equipment should be properly locked and protected from unwanted movement with the moving parts in a resting position
- Prior to the inspection, review hazards associated with the equipment to be used
- Mechanical equipment presents hazards such as:
 - Pinch points – where two parts move together, one in a circular motion (ex. belt drives, gear drives, and feed rollers)
 - Wrap points – an exposed component that rotates, usually a shaft
 - Shear points – edges of two moving parts move past each other, or a moving part moves against a stationary part
 - Crush points – points where two objects move towards each other, or one moves towards a stationary object
 - Pull-in points - points where objects are pulled into the equipment, usually for processing

Section.4.7 Inspection Techniques

The primary method of inspection for Signs, Signals, and High-Mast Lights is a visual method. Sounding elements can be used to determine condition of elements such as concrete and steel. If the extent of a defect cannot be determined, non-destructive testing shall be utilized for accurate descriptions and limits of defects. Finally, vertical clearances must be verified to ensure safe travel for roadway users.

General inspection techniques are discussed below for the two most common materials found on Signs, Signals, and High-Mast Lights: concrete and steel.

Section.4.7.1 Concrete Inspection Techniques

Concrete shall be inspected by visual means and sounding. Other methods may be used if suitable. The most common defects found on concrete elements are cracking, scaling, delamination, spalling with or without exposed reinforcing, efflorescence, and rust staining. When sounding for defects in concrete, a sharp ring generally indicates adequate material exists beneath the surface. Conversely, a dull sound may signify the presence of delamination or a subsurface defect. Generally, a defect will have dimension and location which shall be recorded in the inspection findings (i.e. 8 inch diameter surface spall, no exposed reinforcing, on the east face of the caisson).

Section.4.7.2 Steel Inspection Techniques

Steel shall be inspected by visual means, sounding, and non-destructive testing if necessary. Other methods may be used if suitable. The most common defects found on steel elements are corrosion, cracks, distortion, and connection irregularities. When sounding for defects in steel, a sharp ring generally indicates adequate material or connections. Conversely, a dull sound may signify a defect or loose connection. Non-destructive testing may be utilized if a crack or other defect is suspected. All cracks (suspected or otherwise) must be verified by an experienced ANST Level II technician at a minimum. Generally, a defect will have dimension and location which shall be recorded in the inspection findings (i.e. 3 inch long fracture in base weld at 3 o'clock position of base plate verified using MT by *inspector name* from *company name* on M/D/YYYY).

The steel protective system must also be evaluated for effectiveness. A protective system can either be fully effective, be substantially effective, or have limited effectiveness. Once the protective systems is no longer effective, it is said to have failed. If corrosion is present, that portion of the protective system is no longer effective and has failed.

Section.4.7.3 Vertical Clearance Techniques

Vertical clearance measurements shall be measured at all signs and signals over a roadway and recorded in the proper Structure Inventory and Appraisal field. Measurements shall be taken at the lowest point of the sign over the roadway and at each lane and lane line under the structure. Various methods of vertical clearance measurements include a laser distance measurer, terrestrial LIDAR scan, and a photo of the sign with a leveling rod used to scale clearance later. Inspector safety is most important followed by accuracy.

It is unlikely that signs and signals will require posting for vertical clearance. Notify CDOT if the vertical clearance is less than 14 feet on any roadway or less than 16 feet on interstates. An ERF may be required.



Section.5 Inspection Deliverables

SECTION 5 TABLE OF CONTENTS

Section.5.1 Data Collecting and Deliverables..... 124

 Section.5.1.1 SSHML Report Content..... 124

 Section.5.1.2 Structure Inventory and Appraisal 124

 Section.5.1.3 Inspection Findings..... 124

 Section.5.1.4 Recommendations..... 124

 Section.5.1.5 Photographs 124

Section.5.2 Essential Repair Findings 125

Section.5.3 Inaccessible Structures 125

Section.5.1 Data Collecting and Deliverables

Before planning and performing inspections, it is important to understand the necessary deliverables to be included in the final report. Be sure to verify with CDOT if any additional information is desired for a specific inspection.

Reports shall be entered into BrM and submitted to the CDOT Program Manager within the timeframes outlined in the Consultant's scope of work:

Section.5.1.1 SSHML Report Content

- Structure Inventory and Appraisal (SI&A)
- Inspection Findings
- Recommendations
- Photographs

Section.5.1.2 Structure Inventory and Appraisal

This Structure Inventory and Appraisal Report is to include all SSHML inventory items covered in Section 2 of the manual including: identification items, age and service items, classification items, geometric data items, inspection items, navigation items, and structure type and material items. This information will be presented in the proper format as provided in Section 2.

Section.5.1.3 Inspection Findings

The inspection findings include the defects and conditions for each element. It will be in the form of an Element Level Inspection Report and contain: Element Number and descriptions, quantity of the elements including the units. Condition State distribution of elements between Condition States 1, 2, 3, and 4, and a detailed description of defects for each element and their size and location. Sizes and locations should be described in a manner that the defects can easily be found. The report will be in order of the Element Number and photographs will be provided for any elements with condition states of 3 or higher. If a structural review was performed on a defect, include the element number, condition, review procedure, date of the review, and name of the reviewing Team Leader within the report.

Significant findings shall be classified with an Essential Repair Finding (ERF). The inspection Team Leader shall notify the CDOT Program Manager or his or her designee.

Section.5.1.4 Recommendations

Treatment and/or project recommendations should be appropriate for the types of defects found and address if SSHML components meet current code requirements.

Section.5.1.5 Photographs

Standard SSHML photographs shall be taken and ordered in the report as follows:

- Structure ID
- Elevation looking in the direction of inventory or at the face of the sign panel or signal head
- Foundation(s)
- Upper connection(s)
- Defects in Condition State 3 or 4

Click to return to: [Table of Contents](#)

Photos shall be renamed according to the CDOT BRIAR memo *File Naming Convention for Inspection Submittals* dated September 23, 2014. Each photograph will also include a comment or description. Deficiency photos shall be taken of elements or components of Condition States 3 or 4, specific maintenance items, and/or at the discretion of the Inspection Team Leader. Deficiency photos are not required for every unit of an element; however, one is required for each type of defect for each element.

Section.5.2 Essential Repair Findings

Essential repairs are the repairs necessary to ensure the safe and continued service of the department's structures. Signs, Signals, and High-Mast Lights only require an Essential Repair Finding (ERF) to be issued. Critical Inspection Findings (CIF), as defined in 23 CFR 650.305 are not applicable to ancillary structures. ERFs are supplemental and provide notice to CDOT however, do not require notification to the FHWA via the CDOT Program Manager.

Examples of ERFs may include but are not limited to:

- Any unarrested steel crack resulting from fatigue, impact, or in a high-tension area
- Loose bolts at the base(s), upper connection(s), or splice(s)
- Severe section loss in critical areas
- Severe damage from impact

Inspection findings that are deemed by the Team Leader sufficient to warrant advanced notification to CDOT beyond the timeframe of the typical inspection report deadline, shall be denoted as an ERF. It is the responsibility of the Team Leader to inform the Inspection Program Manager and discuss the extent of the conditions. A structural review may be required at this point to determine if the strength and/or serviceability of the structure has been impacted. The Inspection Program Manager will notify the CDOT Program Manager as soon as possible. Depending on severity and history of the defect, an ERF must be reported to CDOT within 24 hours and up to seven days after the inspection. It will be the CDOT Program Manager's responsibility to notify the appropriate maintenance personnel of the actions to be taken.

All ERFs shall be documented via the template provided in Appendix VIII.a. Email notification, including all information within the template, is acceptable for immediate notification provided follow up documentation is provided per the standard. All ERFs shall be additionally documented via the CDOT tracking system developed and maintained by the CDOT Program Manager.

In general, a structural element with a portion in Condition State 4 shall be considered for an ERF notification. However, a rating of Condition State 4 does not necessarily qualify as an ERF. If an ERF is filed, a Condition State 4 is warranted.

Example of Condition State 4 that does not require supplemental notification:

- Steel protective coating has failed and is no longer protecting the underlying material

Section.5.3 Inaccessible Structures

Structures or structure elements which are deemed inaccessible for evaluation due to decorative covers, buried by debris, buried by concrete, or otherwise unavailable to inspect are to be identified to the CDOT Project Manager or his/her designee within 15 days of the original site visit. Notification shall be written as an Inaccessible Finding (IAF).

Click to return to: [Table of Contents](#)

Any element that is deemed inaccessible for evaluation shall have the following note in the element notes:

“Element not visible for inspection.”

The quantity of the inaccessible portion of the element shall be coded in Condition State 1 unless a worse defect dictates a more severe condition state rating.

All IAFs shall be documented via the template provided in Appendix VIII.b. Return trips and inspections may be required provided the CDOT Project Manager or his/her designee notifies the Consultant of corrective actions taken within 45 days of notice by Consultant. In the event of a site visit, inspection dates and reports are to be created within BrM documenting the site visit and conditions encountered.



Section.6 Treatment Recommendations

SECTION 6 TABLE OF CONTENTS

Section.6.1 Introduction 128

Section.6.2 Treatment Recommendations per the Inspection 128

 Section.6.2.1 Element..... 128

 Section.6.2.2 Action..... 128

 Section.6.2.3 Category 129

 Section.6.2.4 Priority 129

 Section.6.2.5 Timeline 131

 Section.6.2.6 Quantity and Type 131

 Section.6.2.7 Auxiliary Tasks 131

 Section.6.2.8 Estimated Cost..... 132

 Section.6.2.9 Status 132

 Section.6.2.10 Date Recommended 133

 Section.6.2.11 Commentary of Recommendation 133

Section.6.3 Maintenance Actions..... 133

Section.6.1 Introduction

An integral part of the inspection process is the inclusion of asset project and maintenance recommendations, hereafter called Treatment Recommendations or Recommendations. Recommendations assist CDOT in developing reactive and proactive programs to repair and maintain assets prolonging service life at desired performance and safety levels while minimizing costs.

This section will introduce the components and methodology to the development and format of Recommendations for CDOT assets as it pertains to the inspection process via Staff Bridge. The first section addresses how to code Recommendations following an inspection and how it may be tracked. The second section addresses Treatment Recommendations for each element of a SSHML that may be recommended to gain further knowledge on a defect for maintenance and/or condition assessment.

The purpose of this section is not to delineate how a SSHML structure should be maintained or repaired, but rather to organize how maintenance and repair should be recommended following an inspection.

Section.6.2 Treatment Recommendations per the Inspection

The use of maintenance codes allows all inspection reports to be easily understood and compared with one another. This consistency provides improved accuracy of cost effective maintenance actions and the ability to observe when maintenance items were recommended and their status.

It is imperative for inspection personnel to consider both reactive and proactive recommendations during the course of the condition and operational evaluation of SSHML elements. Beyond reactive, this may include upgrades, engineering or cost-benefit studies, safety improvements, and proactive measures to mitigate deterioration and increased future repair costs. For any element with Condition State 3 or 4, a recommendation shall be developed.

It may be necessary to have overlapping recommendations to complete both reactive repair or proactive rehabilitation or replacement at a larger scale of the same defect or element. This allows CDOT to weigh options and cost-benefit as well as risk in developing their asset management plan and fiscal needs.

Currently, structures that require an ERF are the only structures that require a Treatment Recommendation. This Recommendation will be similar to that submitted on the ERF letter.

When recommending an action for a particular defect or element of the SSHML, the following fields must be populated and coded for each action.

Section.6.2.1 Element

The CDOT Element code shall coincide with the element being repaired or maintained. This allows the recommendation to be “linked” to the specific SSHML element. Utilize the Element Numbers from Section 3 of this manual to code CDOT Elements. In the event, multiple element codes are valid, use the most specific and appropriate element code for the recommendation.

Section.6.2.2 Action

The Action code is based on a standardized set of CDOT specific repair codes used by CDOT Division of Maintenance to track items of repair and time within SAP. The list of action codes specific to SSHMLs is currently in development by Staff Bridge, Asset Management, and Division of Maintenance. A table of these maintenance items is included in Section.6.3 and will be updated when complete.

[Click to return to: Table of Contents](#)

Section.6.2.3 *Category*

The Category refers to the purpose and/or use of the recommendation. This code must be evaluated independently from Priority and Timeline codes. Listed below are the available codes for Category:

- Maintenance
 - Shall be utilized to identify repair requirements due to an element exhibiting localized defects. This may include repairs required due to normal anticipated deterioration mechanisms. Maintenance level repairs may include actions required to mitigate further deterioration.
- Preventative
 - Shall be utilized for cyclical preventative actions and may or may not be routinely scheduled due to length of cycle. Actions typically will pertain to products or components with anticipated service lives less than the structure design life. Examples may include cleaning, proactive galvanizing application, application of concrete sealant, etc. This should not include actions which may affect structural or safety capacity and/or serviceability of the element or structure.
- Safety
 - Shall be utilized to identify actions pertaining to safety feature or defect that is a potential hazard to the traveling public.
- Rehabilitate
 - Shall be utilized for projects intended to restore, add, or otherwise modify the capacity or serviceability of an existing element or structure in an effort to significantly lengthen the service. This will likely involve engineering design. It shall not qualify as a replacement.
- Replace
 - Shall be utilized when elements or the structure require replacement in their entirety and may involve replacement in kind, or of modified design.
- Engineering
 - Shall be utilized when engineering review/analysis is the primary requirement of the recommendation such as testing or analysis of systems, or in-depth or engineered analysis of a defect.
- Not Applicable
 - Shall be utilized in the event of all other categories deemed not suitable. For example, in the event of No Maintenance Required.

Section.6.2.4 *Priority*

Priorities shall be set to maximize benefits in terms of cost and deterioration from maintenance as it relates to the service life, structural capacity and safety of the structure or associated elements. It is imperative that the Priority be evaluated independent from the timeline and other Maintenance Elements including other recommendations and associated priorities for the same structure. Listed below are the available codes for Priority:

- Urgent
 - Damage or immediate threat of danger creating a potentially unsafe condition and/or high to imminent danger to the traveling public. Key elements exist that degrade the physical condition and reduce the capacity or serviceability of the structure. In the event an Urgent Priority is recommended, an ERF may also be required, see Section 5 for more information.
- High
 - Conditions or advanced deterioration of key elements which has affected the current capacity, but not serviceability, and anticipated service life of the element or structure requiring action to prolong the service life. If left uncorrected, the deterioration will likely accelerate resulting in increased repair costs and/or scope. Does not significantly affect safety at the time of inspection.
- Moderate
 - Conditions or deterioration exist which may affect the current capacity and/or shorten the service life of the element. If left uncorrected these conditions may accelerate deterioration of the element or structure resulting in additional deterioration, maintenance, or increased repair cost and/or scope in the near future. Does not affect safety at the time of inspection.
- Low
 - Conditions or minor deterioration exist which may shorten the service life of the element but has minimal to no effect on the current capacity or serviceability of the element. If left uncorrected, these conditions may or may not accelerate deterioration of the localized defect resulting in a minor increase in future repair costs and/or scope. Does not affect safety at the time of inspection.
- Monitor/Stable
 - No maintenance is required immediately, or maintenance action cost-benefit is not efficient at this time. Conditions need to be noted for follow-up investigation to assure that conditions are not worsening, Investigations recommended are to be done before the next inspection, this code is not to be used to address routine inspection procedures but may recommend for Special Inspection or monitoring.

Relationship amongst diction:

Safety relates directly to the safety, real and not perceived, to the traveling public or inspection and maintenance personnel.

Deterioration relates to degradation by normal deterioration mechanisms or wear and not potential external forces such as impact. Increases in deterioration over time results in: increase in repair cost and may lead to rehabilitation or replacement being required; decreased capacity (load or functional); decrease in serviceability is often defined as moderate while affecting the structure is often defined as high), and ultimately results in safety being of primary concern (load or functional).

Serviceability relates to the ability of an element or structure to function without reduction to the safety of the traveling public.

[Click to return to: Table of Contents](#)

Service life relates to the anticipated life in years of the element or structure. Accelerated deterioration will lead to reduced service life which will result at extreme conditions in a reduced serviceability and safety of the element or structure.

Section.6.2.5 Timeline

The recommended timeline shall be set in order to maximize the benefit from the maintenance to be performed and to mitigate cost increase due to subsequent deterioration. It is imperative that the Timeline be identified independent from the Priority. There will be inherent correlations; however, they should be viewed as independent. It will be unlikely to have the Timeline and Priority separated by extremes, although possible. Listed below are the available codes for Timeline:

- Immediate
- Less than 1 year
- 1 to 2 years
- 2 to 5 years
- 5 to 10 years
- 10 to 20 years
- More than 20 years

Section.6.2.6 Quantity and Type

The inspector shall use engineering judgment, references available, or measuring devices to quantify the material required for a given maintenance recommendation. In some cases, this may directly correlate to the Condition State quantity for that element; however, that is not always the case. Listed below are the available codes for Quantity and Type:

- Cubic Yards (CY)
- Cubic Feet (CF)
- Square Feet (SF)
- Lineal Feet (LF)
- Each (EA)
- Lump Sum (LS)

Section.6.2.7 Auxiliary Tasks

The use of these tasks shall serve as a “flag” or notification to CDOT of tasks and associated costs that may require inclusion into maintenance recommendations based on visual observations and site condition. This code will help adjust cost requirements based on situations that may impede repair or maintenance tasks. This code is separated into two parts to delineate the degree of conflict and level of effort required. Listed below are the available codes for Auxiliary Tasks:

Degree of Conflict

- Probable
- Possible
- Not Applicable

[Click to return to: Table of Contents](#)

Level of Effort

- Access Difficulty
- Traffic Control
- Utility Conflict
- Environmental Conflict
- Right of Way Conflict
- Other
- Not Applicable

Section.6.2.8 Estimated Cost

Estimated Cost shall be based on information provided by the CDOT Bridge Management Unit of Staff Bridge, most recent CDOT cost data book, or engineering judgement. This estimate should not be attempted to include provision of auxiliary tasks as noted by the inspector. The cost shall be a product of the quantity and the standard unit costs provided by CDOT asset management.

Currently cost development is not included within the scope of SSHML inspection.

Section.6.2.9 Status

The status of each maintenance recommendation history is critical for CDOT to track recommendations provided by inspectors from year to year. Listed below are the available codes for Status:

- New
 - Used in the event a new recommendation has been added per the inspection.
- Existing
 - Used for existing recommendations which have not been completed or revised and are still valid for the current inspection.
- Revised
 - Used for existing recommendations which has been revised (including Quantity, Priority, and Timeline) and are still valid for the current inspection.
- Completed
 - Used for non-cyclical recommendations which have been completed between inspections. After this code has been left as “Completed” for one cycle (typically 48 months) the maintenance recommendation is to be deleted.
- No Longer Valid
- Recurring
 - Used for maintenance recommendations that are new, existing, and/or completed but are recurring actions for the SSHML.



Section.6.2.10 Date Recommended

Utilize this field for the inspection date corresponding to the original date or recommendation. If it is recurring, use the most recent inspection date.

Section.6.2.11 Commentary of Recommendation

The commentary for each recommendation must include; location, description of specific maintenance items to be improved, improvement, the type of defect, etc. If applicable, describe how the quantity for the maintenance item was derived.

Section.6.3 Maintenance Actions

Typical maintenance activities are listed below. CDOT Action Codes have not yet been defined by CDOT as of current publication date. This list is not an exhaustive list of maintenance .

Element #	Maintenance Activities	Action Codes
9601 Foundation	Re-grade/provide proper drainage/install in-ground block-outs for base access	
	Remove or replace deteriorated grout pad	
	Remove soil and vegetation around foundation	
	Seal cracks in foundation	
	Miscellaneous foundation repair	
9610 Anchor Bolts and Leveling Nuts	Tighten anchor rod nuts	
	Tighten leveling nuts	
	Lower base plate within anchor rod unsupported length tolerance	
	Install washers above leveling nut	
	Install washers below anchor rod nut	
9620 Column - Steel	Clean debris from inside of pole	
	Clean debris from outside of pole	
	Arrest crack	
	Replace missing handhole cover	
	Secure handhold cover	
	Blast clean and repaint splash zone	
	Drill drainage hole at base of pole	
Replace missing pole cap		
9630 Bolted Upper Connection and Splices	Support mast arm until permanent repairs or replacement can be made	
	Remove mast arm dead load and tighten connection	
	Remove lock washers	
	Replace bolt(s)	
9640 Mast Arm/Frame	Replace broken U-bolts and hardware	
	Secure mast arm end cap	
9660 Guardrail Protection - Concrete	Patch spalls in guardrail	

[Click to return to: Table of Contents](#)



Element #	Maintenance Activities	Action Codes
9661 Guardrail Protection - Steel	Replace w-beam rail	
	Replace broken rail posts	
	Install spacer block at rail posts	
9662 Sign Lighting	Remove or replace exposed conduit	
	Secure lighting attachments	
	Replace lighting hardware	
9663 Catwalk - Steel	Secure/replace safety rail	
	Replace walkway	
General	Arrest crack	
	Clean and paint entire structure	



Section.7 Appendices

SECTION 7 TABLE OF APPENDICES

APPENDIX I ABBREVIATIONS 136

APPENDIX II REFERENCES 136

APPENDIX III FIPS PLACE CODES 137

APPENDIX IV COLORADO MAPS 148

APPENDIX IV.A COLORADO REGION MAP 148

APPENDIX IV.B CDOT MAINTENANCE SECTIONS MAP 149

APPENDIX IV.C CDOT TRANSPORTATION PLANNING REGIONS MAP..... 150

APPENDIX IV.D CDOT MAINTENANCE PATROL MAP 151

APPENDIX V SIGN AND SIGNAL UPPER CONNECTION TYPES 152

APPENDIX V.A SIGN UPPER CONNECTION TYPES, SORTED IN NUMERICAL ORDER 153

APPENDIX V.B FRAME OR TRUSS CONNECTION TYPES (EXCLUDING BUTTERFLY SIGNS) 186

APPENDIX V.C COLLAR OR U-BOLT, FINGER CONNECTIONS 201

APPENDIX V.D MONOTUBE CONNECTIONS 207

APPENDIX V.E BUTTERFLY SIGN CONNECTIONS 210

APPENDIX V.F MISCELLANEOUS OR NO LONGER USED CONNECTIONS 220

APPENDIX V.G SIGNAL UPPER CONNECTION TYPES..... 221

APPENDIX VI ANCHOR BOLT NUMBERING 231

APPENDIX VII CONNECTION BOLT AND WELD NUMBERING 232

APPENDIX VIII TEMPLATES 233

APPENDIX VIII.A ERF TEMPLATE..... 233

APPENDIX VIII.B IAF TEMPLATE 235

Appendix I Abbreviations

- AASHTO** – American Association of Highway Transportation Officials
- ADE** – Agency Defined Element
- ASNT** – American Society for Nondestructive Testing
- CDOT** – Colorado Department of Transportation
- ERF** – Essential Repair Finding
- FHWA** – Federal Highway Administration
- FIPS** – Federal Information Processing Standard (standard codes for States)
- MUTCD** – Manual on Uniform Traffic Control Devices
- NDT** – Non-destructive Testing
- NDE** – Non-destructive Evaluation
- NBI** – National Bridge Inventory
- NHI** – National Highway Institute
- OSHA** – Occupational Safety & Health Administration
- OTIS** – Online Transportation Information System
- PPE** – Personal Protection Equipment
- SI&A** – Structure Information and Appraisal
- SSHML** – Signs, Signals, High-Mast Lights
- TPR** – Transportation Planning Region
- VMS** – Variable Message Sign

Appendix II References

- AASHTO Manual for Bridge Evaluation
- AASHTO Transportation Asset Management Guide
- ACI 201.1R-08 Guide for Conducting a Visual Inspection of Concrete in Service
- FHWA Manual for Uniform Traffic Control
- Recording and Coding Guide for the Inventory and Inspection of Colorado’s Overhead Signs, Signals and High-Mast Lights
- OSHA Occupational Safety and Health Standards



Appendix III FIPS Place Codes

City/Town/Municipality FIPS codes:

CDP = Census Designated Place

Municipality Name	Designation	FIPS	In County	County FIPS
Berkley	CDP	06172	Adams	001
Acres Green	CDP	00320	Douglas	035
Aetna Estates	CDP	00620	Arapahoe	005
Aguilar	town	00760	Las Animas	071
Air Force Academy	CDP	00870	El Paso	041
Alamosa	city	01090	Alamosa	003
Alamosa East	CDP	01145	Alamosa	003
Allenspark	CDP	01420	Boulder	013
Alma	town	01530	Park	093
Alpine	CDP	01640	Rio Grande	105
Altona	CDP	01740	Boulder	013
Amherst	CDP	01915	Phillips	095
Antonito	town	02355	Conejos	021
Applewood	CDP	02575	Jefferson	059
Arboles	CDP	02905	Archuleta	007
Aristocrat Ranchettes	CDP	03015	Weld	123
Arriba	town	03235	Lincoln	073
Arvada	city	03455	Adams, Jefferson	001, 059
Aspen	city	03620	Pitkin	097
Aspen Park	CDP	03730	Jefferson	059
Atwood	CDP	03840	Logan	075
Ault	town	03950	Weld	123
Aurora	city	04000	Adams, Arapahoe, Douglas	001, 005, 035
Avon	town	04110	Eagle	037
Avondale	CDP	04165	Pueblo	101
Bark Ranch	CDP	04620	Boulder	013
Basalt	town	04935	Eagle , Pitkin	037, 097
Battlement Mesa	CDP	05120	Garfield	045
Bayfield	town	05265	La Plata	067
Bennett	town	06090	Adams, Arapahoe	001, 005
Berthoud	town	06255	Larimer, Weld	069, 123
Bethune	town	06530	Kit Carson	063
Beulah Valley	CDP	06602	Pueblo	101
Black Forest	CDP	06970	El Paso	041
Black Hawk	city	07025	Gilpin	047
Blanca	town	07190	Costilla	023
Blende	CDP	07245	Pueblo	101
Blue River	town	07410	Summit	117
Blue Sky	CDP	07420	Morgan	087

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Bonanza Mountain Estates	CDP	07580	Boulder	013
Bonanza	town	07571	Saguache	109
Boone	town	07795	Pueblo	101
Boulder	city	07850	Boulder	013
Bow Mar	town	08070	Arapahoe, Jefferson	005, 059
Brandon	CDP	08290	Kiowa	061
Branson	town	08345	Las Animas	071
Breckenridge	town	08400	Summit	117
Brick Center	CDP	08530	Arapahoe	005
Brighton	city	08675	Adams, Weld	001, 123
Brookside	town	09115	Fremont	043
Broomfield	city	09280	Broomfield	014
Brush	city	09555	Morgan	087
Buena Vista	town	10105	Chaffee	015
Burlington	city	10600	Kit Carson	063
Byers	CDP	10985	Arapahoe	005
Calhan	town	11260	El Paso	041
Campo	town	11645	Baca	009
Cañon City	city	11810	Fremont	043
Capulin	CDP	11975	Conejos	021
Carbondale	town	12045	Garfield	045
Cascade-Chipita Park	CDP	12325	El Paso	041
Castle Pines	CDP	12387	Douglas	035
Castle Pines North	city	12390	Douglas	035
Castle Rock	town	12415	Douglas	035
Cathedral	CDP	12450	Hinsdale	053
Catherine	CDP	12460	Garfield	045
Cattle Creek	CDP	12470	Garfield	045
Cedaredge	town	12635	Delta	029
Centennial	city	12815	Arapahoe	005
Center	town	12855	Rio Grande, Saguache	105, 109
Central City	city	12910	Clear Creek, Gilpin	019, 047
Chacra	CDP	12945	Garfield	045
Cheraw	town	13460	Otero	089
Cherry Creek	CDP	13590	Arapahoe	005
Cherry Hills Village	city	13845	Arapahoe	005
Cheyenne Wells	town	14175	Cheyenne	017
Cimarron Hills	CDP	14587	El Paso	041
City of Creede	town	14765	Mineral	079
Clifton	CDP	15165	Mesa	077
Coal Creek	CDP	15302	Boulder, Gilpin, Jefferson	013, 047, 059
Coal Creek	town	15330	Fremont	043
Coaldale	CDP	15440	Fremont	043
Cokedale	town	15550	Las Animas	071

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Collbran	town	15605	Mesa	077
Colona	CDP	15825	Ouray	091
Colorado City	CDP	15935	Pueblo	101
Colorado Springs	city	16000	El Paso	041
Columbine	CDP	16110	Arapahoe, Jefferson	005, 059
Columbine Valley	town	16385	Arapahoe	005
Comanche Creek	CDP	16465	Arapahoe	005
Commerce City	city	16495	Adams	001
Conejos	CDP	16715	Conejos	021
Copper Mountain	CDP	17150	Summit	117
Cortez	city	17375	Montezuma	083
Cotopaxi	CDP	17485	Fremont	043
Craig	city	17760	Moffat	081
Crawford	town	17925	Delta	029
Crested Butte	town	18310	Gunnison	051
Crestone	town	18420	Saguache	109
Cripple Creek	city	18530	Teller	119
Crisman	CDP	18585	Boulder	013
Crook	town	18640	Logan	075
Crowley	town	18750	Crowley	025
Dacono	city	19080	Weld	123
Dakota Ridge	CDP	19150	Jefferson	059
De Beque	town	19355	Mesa	077
Deer Trail	town	19630	Arapahoe	005
Del Norte	town	19795	Rio Grande	105
Delta	city	19850	Delta	029
Denver	city	20000	Denver	031
Derby	CDP	20275	Adams	001
Dillon	town	20440	Summit	117
Dinosaur	town	20495	Moffat	081
Divide	CDP	20605	Teller	119
Dolores	town	20770	Montezuma	083
Dotsero	CDP	21155	Eagle	037
Dove Creek	town	21265	Dolores	033
Dove Valley	CDP	21330	Arapahoe	005
Downieville-Lawson-Dumont	CDP	21390	Clear Creek	019
Durango	city	22035	La Plata	067
Eads	town	22145	Kiowa	061
Eagle	town	22200	Eagle	037
East Pleasant View	CDP	22575	Jefferson	059
Eaton	town	22860	Weld	123
Eckley	town	23025	Yuma	125
Edgewater	city	23135	Jefferson	059
Edwards	CDP	23300	Eagle	037

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
El Jebel	CDP	23795	Eagle	037
El Moro	CDP	24290	Las Animas	071
Elbert	CDP	23520	Elbert	039
Eldora	CDP	23575	Boulder	013
Eldorado Springs	CDP	23630	Boulder	013
Elizabeth	town	23740	Elbert	039
Ellicott	CDP	24235	El Paso	041
Empire	town	24620	Clear Creek	019
Englewood	city	24785	Arapahoe	005
Erie	town	24950	Boulder, Weld	013, 123
Estes Park	town	25115	Larimer	069
Evans	city	25280	Weld	123
Evergreen	CDP	25390	Jefferson	059
Fairmount	CDP	25550	Jefferson	059
Fairplay	town	25610	Park	093
Federal Heights	city	26270	Adams	001
Firestone	town	26600	Weld	123
Flagler	town	26765	Kit Carson	063
Fleming	town	26875	Logan	075
Florence	city	27040	Fremont	043
Florissant	CDP	27095	Teller	119
Floyd Hill	CDP	27175	Clear Creek	019
Fort Carson	CDP	27370	El Paso	041
Fort Collins	city	27425	Larimer	069
Fort Garland	CDP	27535	Costilla	023
Fort Lupton	city	27700	Weld	123
Fort Morgan	city	27810	Morgan	087
Fountain	city	27865	El Paso	041
Fowler	town	27975	Otero	089
Foxfield	town	28105	Arapahoe	005
Franktown	CDP	28250	Douglas	035
Fraser	town	28305	Grand	049
Frederick	town	28360	Weld	123
Frisco	town	28690	Summit	117
Fruita	city	28745	Mesa	077
Fruitvale	CDP	28800	Mesa	077
Fulford	CDP	28830	Eagle	037
Garden	town	29185	Weld	123
Garfield	CDP	29295	Chaffee	015
Genesee	CDP	29625	Jefferson	059
Genoa	town	29680	Lincoln	073
Georgetown	town	29735	Clear Creek	019
Gerrard	CDP	29845	Rio Grande	105
Gilcrest	town	29955	Weld	123

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Glendale	CDP	30350	Boulder	013
Glendale	city	30340	Arapahoe	005
Gleneagle	CDP	30420	El Paso	041
Glenwood Springs	city	30780	Garfield	045
Gold Hill	CDP	30945	Boulder	013
Golden	city	30835	Jefferson	059
Goldfield	CDP	30890	Teller	119
Granada	town	31550	Prowers	099
Granby	town	31605	Grand	049
Grand Junction	city	31660	Mesa	077
Grand Lake	town	31715	Grand	049
Grand View Estates	CDP	31935	Douglas	035
Greeley	city	32155	Weld	123
Green Mountain Falls	town	32650	El Paso, Teller	041, 119
Greenwood Village	city	33035	Arapahoe	005
Grover	town	33310	Weld	123
Guffey	CDP	33420	Park	093
Gunbarrel	CDP	33502	Boulder	013
Gunnison	city	33640	Gunnison	051
Gypsum	town	33695	Eagle	037
Hartman	town	34520	Prowers	099
Hasty	CDP	34685	Bent	011
Haswell	town	34740	Kiowa	061
Haxtun	town	34960	Phillips	095
Hayden	town	35070	Routt	107
Heeney	CDP	35400	Summit	117
Hidden Lake	CDP	35860	Boulder	013
Highlands Ranch	CDP	36410	Douglas	035
Hillrose	town	36610	Morgan	087
Hoehne	CDP	36940	Las Animas	071
Holly Hills	CDP	37220	Arapahoe	005
Holly	town	37215	Prowers	099
Holyoke	city	37270	Phillips	095
Hooper	town	37380	Alamosa	003
Hot Sulphur Springs	town	37600	Grand	049
Hotchkiss	town	37545	Delta	029
Howard	CDP	37655	Fremont	043
Hudson	town	37820	Weld	123
Hugo	town	37875	Lincoln	073
Idaho Springs	city	38370	Clear Creek	019
Idalia	CDP	38425	Yuma	125
Idledale	CDP	38480	Jefferson	059
Ignacio	town	38535	La Plata	067
Iliff	town	38590	Logan	075

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Indian Hills	CDP	38810	Jefferson	059
Inverness	CDP	38910	Arapahoe	005
Jackson Lake	CDP	39160	Morgan	087
Jamestown	town	39195	Boulder	013
Jansen	CDP	39250	Las Animas	071
Joes	CDP	39745	Yuma	125
Johnson Village	CDP	39800	Chaffee	015
Johnstown	town	39855	Larimer, Weld	069, 123
Julesburg	town	39965	Sedgwick	115
Keenesburg	town	40185	Weld	123
Ken Caryl	CDP	40377	Jefferson	059
Kersey	town	40515	Weld	123
Keystone	CDP	40550	Summit	117
Kim	town	40570	Las Animas	071
Kiowa	town	40790	Elbert	039
Kirk	CDP	40900	Yuma	125
Kit Carson	town	41010	Cheyenne	017
Kittredge	CDP	41065	Jefferson	059
Kremmling	town	41560	Grand	049
La Jara	town	42055	Conejos	021
La Junta	city	42110	Otero	089
La Junta Gardens	CDP	42165	Otero	089
La Salle	town	43605	Weld	123
La Veta	town	44100	Huerfano	055
Lafayette	city	41835	Boulder	013
Laird	CDP	42000	Yuma	125
Lake City	town	42330	Hinsdale	053
Lakeside	town	42495	Jefferson	059
Lakewood	city	43000	Jefferson	059
Lamar	city	43110	Prowers	099
Laporte	CDP	43220	Larimer	069
Larkspur	town	43550	Douglas	035
Las Animas	city	43660	Bent	011
Lazy Acres	CDP	44270	Boulder	013
Leadville	city	44320	Lake	065
Leadville North	CDP	44375	Lake	065
Lewis	CDP	44595	Montezuma	083
Leyner	CDP	44695	Boulder	013
Limon	town	44980	Lincoln	073
Lincoln Park	CDP	45145	Fremont	043
Littleton	city	45255	Arapahoe, Douglas, Jefferson	005, 035, 059
Lochbuie	town	45530	Adams, Weld	001, 123
Log Lane Village	town	45695	Morgan	087
Loghill Village	CDP	45680	Ouray	091

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Loma	CDP	45750	Mesa	077
Lone Tree	city	45955	Douglas	035
Longmont	city	45970	Boulder, Weld	013, 123
Louisville	city	46355	Boulder	013
Louviers	CDP	46410	Douglas	035
Loveland	city	46465	Larimer	069
Lynn	CDP	47015	Las Animas	071
Lyons	town	47070	Boulder	013
Manassa	town	48060	Conejos	021
Mancos	town	48115	Montezuma	083
Manitou Springs	city	48445	El Paso	041
Manzanola	town	48500	Otero	089
Marble	town	48555	Gunnison	051
Maybell	CDP	49325	Moffat	081
Maysville	CDP	49490	Chaffee	015
McCoy	CDP	47345	Eagle	037
Mead	town	49600	Weld	123
Meeker	town	49875	Rio Blanco	103
Meridian	CDP	50012	Douglas	035
Merino	town	50040	Logan	075
Midland	CDP	50380	Teller	119
Milliken	town	50480	Weld	123
Minturn	town	50920	Eagle	037
Moffat	town	51250	Saguache	109
Monte Vista	city	51635	Rio Grande	105
Montezuma	town	51690	Summit	117
Montrose	city	51745	Montrose	085
Monument	town	51800	El Paso	041
Morgan Heights	CDP	51975	Morgan	087
Morrison	town	52075	Jefferson	059
Mount Crested Butte	town	52570	Gunnison	051
Mountain Meadows	CDP	52210	Boulder	013
Mountain View	town	52350	Jefferson	059
Mountain Village	town	52550	San Miguel	113
Mulford	CDP	52820	Garfield	045
Naturita	town	53120	Montrose	085
Nederland	town	53175	Boulder	013
New Castle	town	53395	Garfield	045
Niwot	CDP	53780	Boulder	013
No Name	CDP	53875	Garfield	045
Norrie	CDP	53945	Pitkin	097
North La Junta	CDP	54495	Otero	089
North Washington	CDP	54750	Adams	001
Northglenn	city	54330	Adams, Weld	001, 123

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Norwood	town	54880	San Miguel	113
Nucla	town	54935	Montrose	085
Nunn	town	55045	Weld	123
Oak Creek	town	55155	Routt	107
Olathe	town	55540	Montrose	085
Olney Springs	town	55705	Crowley	025
Ophir	town	55870	San Miguel	113
Orchard	CDP	55925	Morgan	087
Orchard	town	55980	Delta	029
Orchard Mesa	CDP	56035	Mesa	077
Ordway	town	56145	Crowley	025
Otis	town	56365	Washington	121
Ouray	city	56420	Ouray	091
Ovid	town	56475	Sedgwick	115
Padroni	CDP	56695	Logan	075
Pagosa Springs	town	56860	Archuleta	007
Palisade	town	56970	Mesa	077
Palmer Lake	town	57025	El Paso	041
Paoli	town	57245	Phillips	095
Paonia	town	57300	Delta	029
Parachute	town	57400	Garfield	045
Paragon Estates	CDP	57445	Boulder	013
Parker	town	57630	Douglas	035
Parshall	CDP	57850	Grand	049
Peetz	town	58235	Logan	075
Penrose	CDP	58400	Fremont	043
Peoria	CDP	58510	Arapahoe	005
Perry Park	CDP	58592	Douglas	035
Peyton	CDP	58675	El Paso	041
Phippsburg	CDP	58758	Routt	107
Piedra	CDP	58960	Hinsdale	053
Pierce	town	59005	Weld	123
Pine Brook Hill	CDP	59240	Boulder	013
Pitkin	town	59830	Gunnison	051
Platteville	town	60160	Weld	123
Poncha Springs	town	60600	Chaffee	015
Ponderosa Park	CDP	60655	Elbert	039
Portland	CDP	60765	Ouray	091
Pritchett	town	61315	Baca	009
Pueblo	city	62000	Pueblo	101
Pueblo West	CDP	62220	Pueblo	101
Ramah	town	62660	El Paso	041
Rangely	town	62880	Rio Blanco	103
Raymer (New Raymer)	town	63045	Weld	123

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Red Cliff	town	63265	Eagle	037
Red Feather Lakes	CDP	63320	Larimer	069
Redlands	CDP	63375	Mesa	077
Redstone	CDP	63650	Pitkin	097
Redvale	CDP	63705	Montrose	085
Rico	town	64090	Dolores	033
Ridgway	town	64200	Ouray	091
Rifle	city	64255	Garfield	045
Rock Creek Park	CDP	64870	El Paso	041
Rockvale	town	64970	Fremont	043
Rocky Ford	city	65190	Otero	089
Rollinsville	CDP	65685	Gilpin	047
Romeo	town	65740	Conejos	021
Roxborough Park	CDP	66197	Douglas	035
Rye	town	66895	Pueblo	101
Saddle Ridge	CDP	66995	Morgan	087
Saguache	town	67005	Saguache	109
Salida	city	67280	Chaffee	015
Salt Creek	CDP	67445	Pueblo	101
San Acacio	CDP	67500	Costilla	023
San Luis	town	68105	Costilla	023
Sanford	town	67830	Conejos	021
Sawpit	town	68655	San Miguel	113
Security-Widefield	CDP	68847	El Paso	041
Sedalia	CDP	68875	Douglas	035
Sedgwick	town	68930	Sedgwick	115
Segundo	CDP	68985	Las Animas	071
Seibert	town	69040	Kit Carson	063
Seven Hills	CDP	69110	Boulder	013
Severance	town	69150	Weld	123
Shaw Heights	CDP	69480	Adams	001
Sheridan	city	69645	Arapahoe	005
Sheridan Lake	town	69700	Kiowa	061
Sherrelwood	CDP	69810	Adams	001
Silt	town	70195	Garfield	045
Silver Cliff	town	70250	Custer	027
Silver Plume	town	70360	Clear Creek	019
Silverthorne	town	70525	Summit	117
Silverton	town	70580	San Juan	111
Simla	town	70635	Elbert	039
Smelertown	CDP	71625	Chaffee	015
Snowmass Village	town	71755	Pitkin	097
Snyder	CDP	71790	Morgan	087
South Fork	town	72395	Rio Grande	105

[Click to return to: Table of Contents](#)



Municipality Name	Designation	FIPS	In County	County FIPS
Southern Ute	CDP	72320	La Plata	067
Springfield	town	73330	Baca	009
St. Ann Highlands	CDP	67040	Boulder	013
St. Mary's	CDP	67142	Clear Creek	019
Starkville	town	73715	Las Animas	071
Steamboat Springs	city	73825	Routt	107
Sterling	city	73935	Logan	075
Stonegate	CDP	74080	Douglas	035
Stonewall Gap	CDP	74275	Las Animas	071
Strasburg	CDP	74375	Adams, Arapahoe	001, 005
Stratmoor	CDP	74430	El Paso	041
Stratton	town	74485	Kit Carson	063
Sugar City	town	74815	Crowley	025
Sugarloaf	CDP	74980	Boulder	013
Sunshine	CDP	75585	Boulder	013
Superior	town	75640	Boulder, Jefferson	013, 059
Swink	town	75970	Otero	089
Tabernash	CDP	76190	Grand	049
Tall Timber	CDP	76325	Boulder	013
Telluride	town	76795	San Miguel	113
The Pinery	CDP	77235	Douglas	035
Thornton	city	77290	Adams, Weld	001, 123
Timnath	town	77510	Larimer	069
Todd Creek	CDP	77757	Adams	001
Towaoc	CDP	78280	Montezuma	083
Towner	CDP	78335	Kiowa	061
Trail Side	CDP	78345	Morgan	087
Trinidad	city	78610	Las Animas	071
Twin Lakes	CDP	79100	Adams	001
Twin Lakes	CDP	79105	Lake	065
Two Buttes	town	79270	Baca	009
Upper Bear Creek	CDP	79785	Clear Creek	019
Vail	town	80040	Eagle	037
Valdez	CDP	80095	Las Animas	071
Valmont	CDP	80370	Boulder	013
Vernon	CDP	80755	Yuma	125
Victor	city	80865	Teller	119
Vilas	town	81030	Baca	009
Vineland	CDP	81305	Pueblo	101
Vona	town	81690	Kit Carson	063
Walden	town	82130	Jackson	057
Walsenburg	city	82350	Huerfano	055
Walsh	town	82460	Baca	009
Ward	town	82735	Boulder	013

[Click to return to: Table of Contents](#)

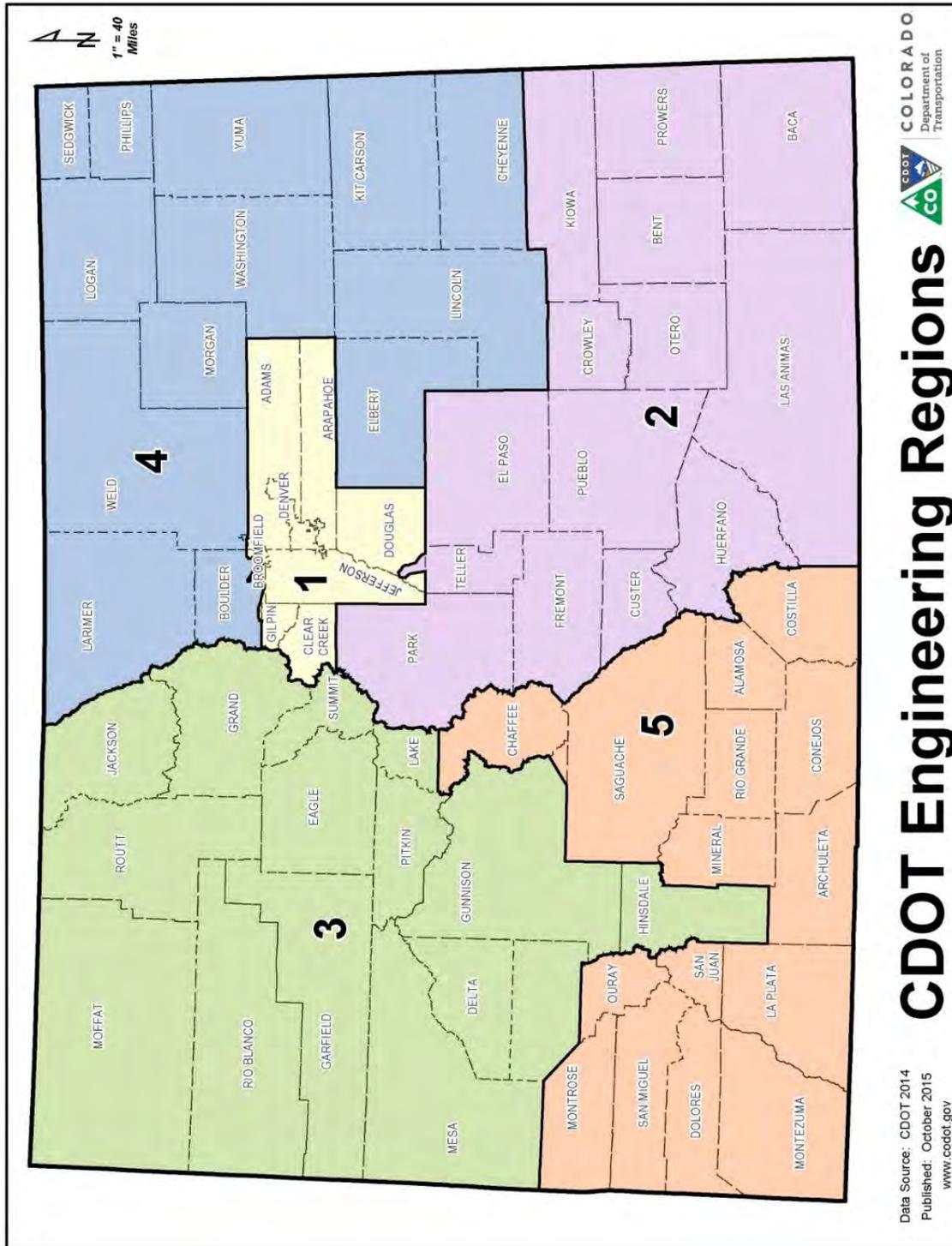


Municipality Name	Designation	FIPS	In County	County FIPS
Watkins	CDP	82905	Adams, Arapahoe	001, 005
Welby	CDP	83120	Adams	001
Weldona	CDP	83175	Morgan	087
Wellington	town	83230	Larimer	069
West Pleasant View	CDP	84042	Jefferson	059
Westcliffe	town	83450	Custer	027
Westcreek	CDP	83500	Douglas	035
Westminster	city	83835	Adams, Jefferson	001, 059
Weston	CDP	84000	Las Animas	071
Wheat Ridge	city	84440	Jefferson	059
Wiggins	town	84770	Morgan	087
Wiley	town	85045	Prowers	099
Williamsburg	town	85155	Fremont	043
Windsor	town	85485	Larimer, Weld	069, 123
Winter Park	town	85705	Grand	049
Wolcott	CDP	85760	Eagle	037
Woodland Park	city	86090	Teller	119
Woodmoor	CDP	86117	El Paso	041
Woody Creek	CDP	86200	Pitkin	097
Wray	city	86310	Yuma	125
Yampa	town	86475	Routt	107
Yuma	city	86750	Yuma	125



Appendix IV Colorado Maps

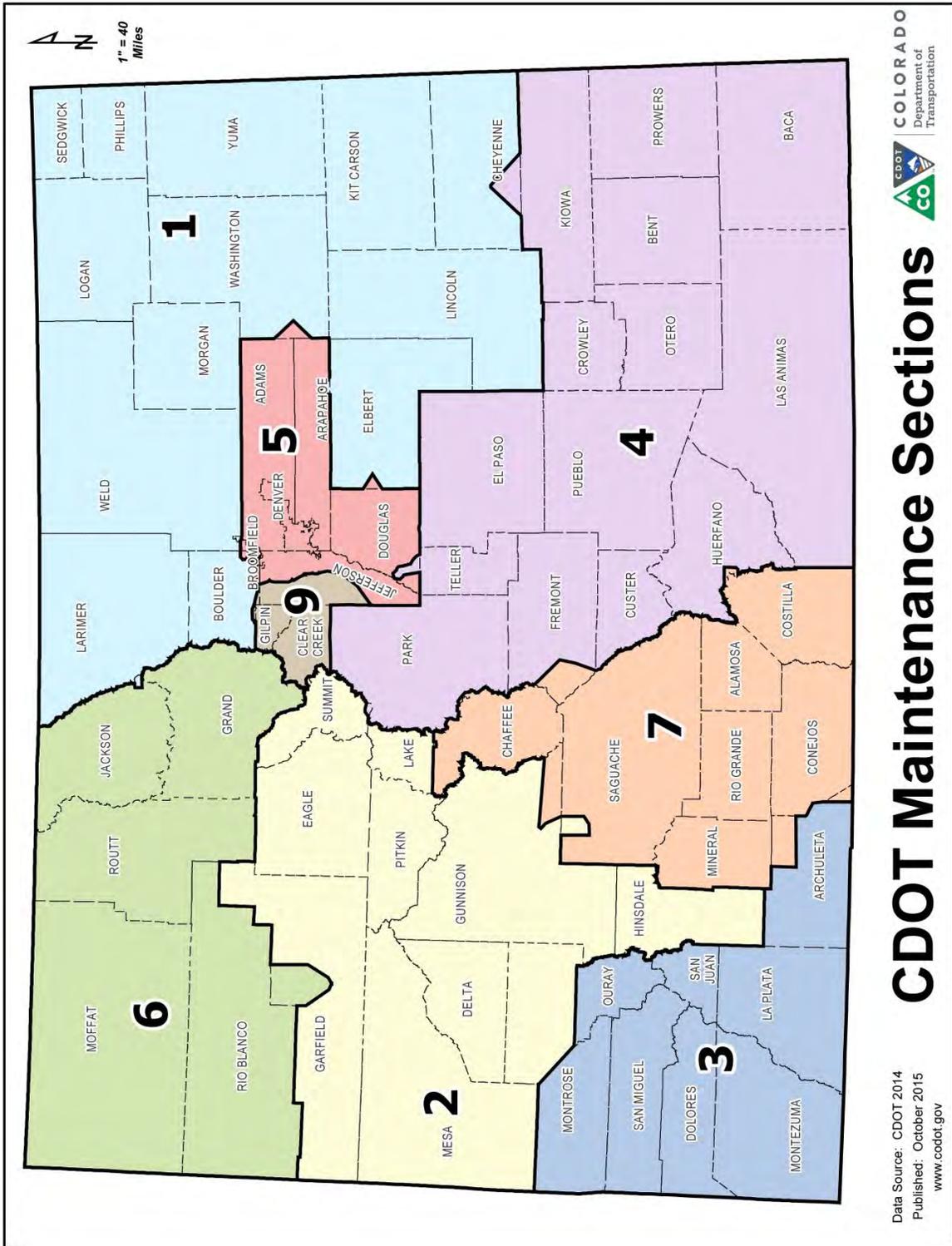
Appendix IV.a Colorado Region Map



[Click to return to: Table of Contents](#)



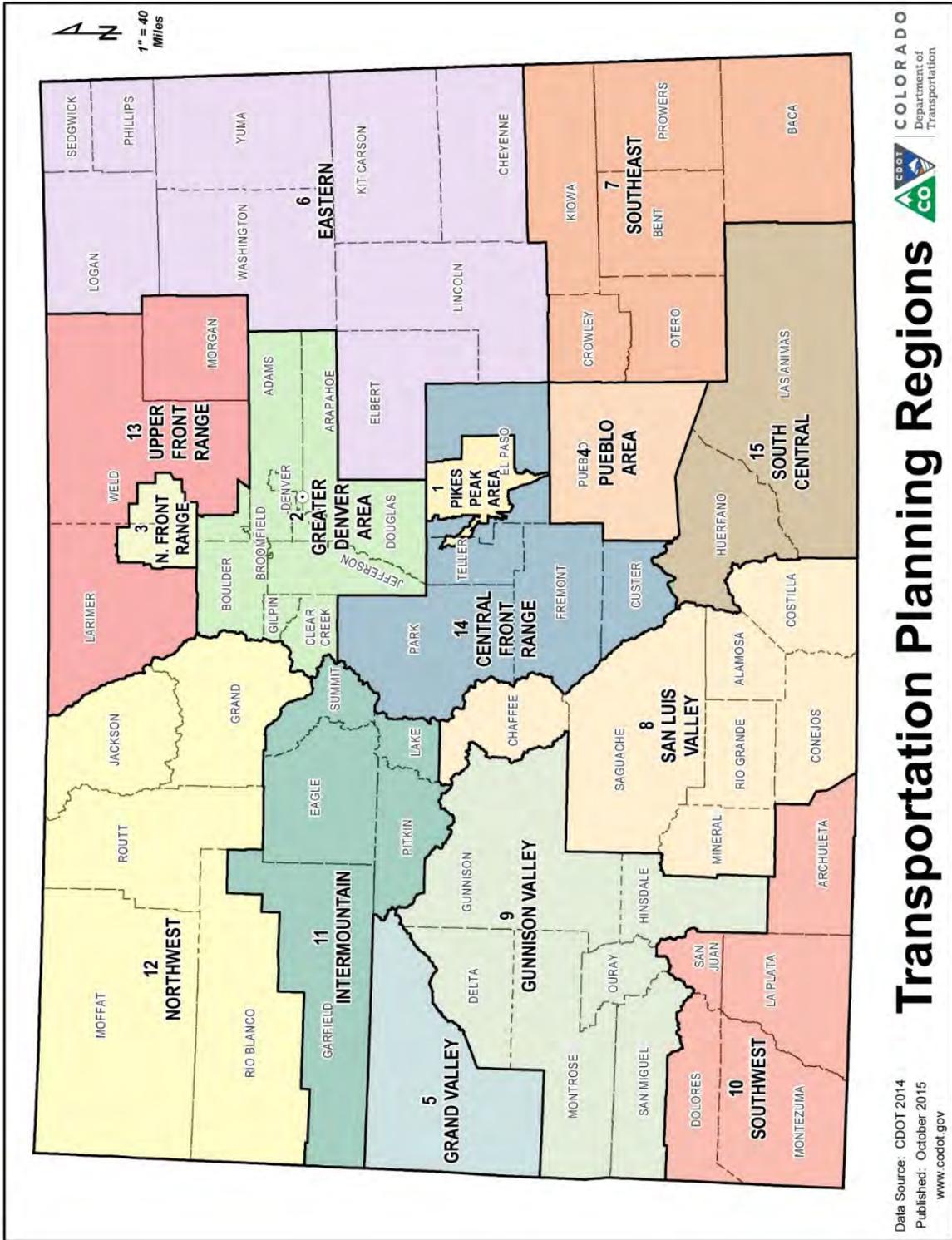
Appendix IV.b CDOT Maintenance Sections Map



[Click to return to: Table of Contents](#)



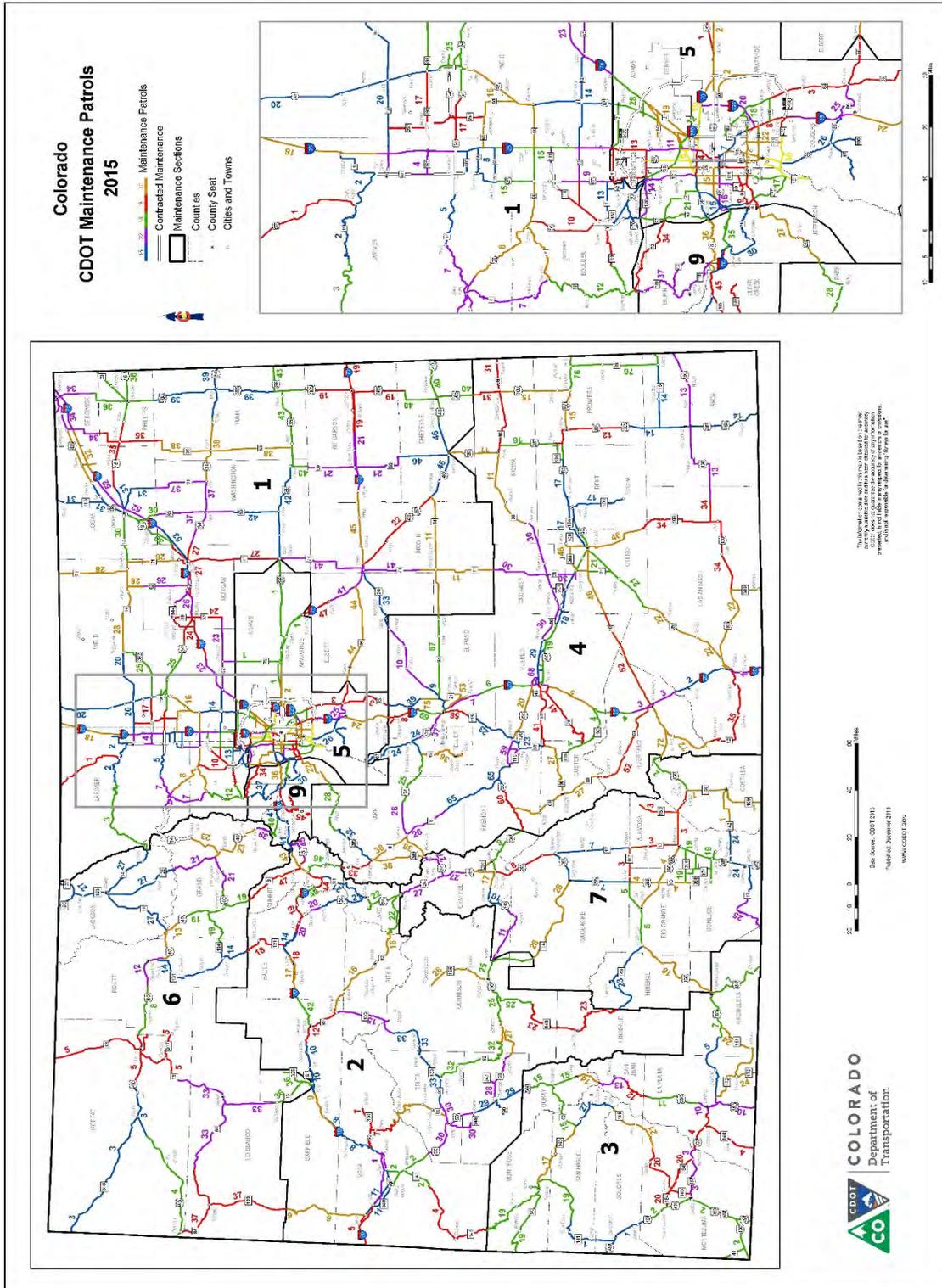
Appendix IV.c CDOT Transportation Planning Regions Map



[Click to return to: Table of Contents](#)



Appendix IV.d CDOT Maintenance Patrol Map



[Click to return to: Table of Contents](#)



Appendix V Sign and Signal Upper Connection Types

This appendix has examples of the different sign and signal upper connection types. The appendix sorts sign connections numerically (Appendix V.a) and by similar connection types (Appendices V.b – V.f). Signs are only sorted numerically (Appendix V.g).

Appendix V.a	Sign Upper Connection Types, sorted in Numerical Order
Appendix V.b	Frame or Truss Connection Types (excluding Butterfly Signs)
Appendix V.c	Collar or U-Bolt, Finger Connections
Appendix V.d	Monotube Connections
Appendix V.e	Butterfly Sign Connections
Appendix V.f	Miscellaneous or No Longer Used Connections
Appendix V.g	Signal Upper Connection Types



Appendix V.a Sign Upper Connection Types, sorted in Numerical Order

This matrix sorts all sign upper connection types in numerical order by type.

Type	Description	Page
001	Double arm frame, vertical bolted connection, welded to vertical pole	155
002	Monotube, horizontal bolted connection, stiffened flanges	155
003	Double arm, horizontal bolted connection to simplex plate	156
004	Single face, single arm, double horizontal bolted connection to simplex plate (butterfly signs)	156
005	Double arm, square column, vertical bolted connection (butterfly signs)	157
006	Monotube, horizontal bolted connection, no gussets	157
007	Single face sign, single arm, cap-T horizontal bolted connection (butterfly signs)	158
008	Double face sign, single arm, cap-T horizontal bolted connection (butterfly signs)	158
009	Double arm (angle) truss, cap connection	159
010	Double face sign, single arm, double horizontal bolted connection to simplex plate (butterfly signs)	159
011	Three arm truss, U-bolt fitted connection on bearing plate	160
012	Double arm truss, bolted connection to top of pole and lower bearing plate	160
013	Double arm truss, bolted connection on bearing plates	161
014	Double arm, 3 finger collar connection	161
015	Double arm truss, U-bolt fitted connection on bearing plates on front of pole	162
016	Double arm (pipe) truss, cap connection	162
017	No longer used, see Type 003	163
018	Double arm box truss, collar connection	163
019	Double arm box truss, cap connection (butterfly signs)	164
020	Double arm, 5 finger collar connection, or 5 finger U-bolt clamp connection	164
021	Double arm welded through vertical, vertical bolted cap connection	165
022	No longer used, see Type 004	165
023	No longer used, see Type 012	166
024	Double arm, 6 finger collar connection, or 6 finger U-bolt clamp connection	166
025	No longer used, see Type 014	167
026	Double arm, welded collar to vertical, vertical bolted cap connection	167
027	Double arm frame, horizontal bolted connection to simplex plate with welded stiffener	168
028	Single arm, double collar connection, or double U-bolt connection	168
029	No longer used, see Type 024	169
030	Double arm, bracket welded to vertical, vertical bolted connection	169
031	No longer used, see Type 014	170
032	Double face sign, double arm, double horizontal bolted connection to simplex plate (butterfly signs)	170
033	Double arm, round column, vertical bolted cap connection (butterfly signs)	171
034	Double arm (angle) truss bolted cap connection to plates welded to vertical	171
035	Ornamental connection	172
036	Single face sign, double arm, double horizontal bolted connection to simplex plate (butterfly signs)	172
037	No longer used, see Type 015	173

[Click to return to: Table of Contents](#)



Type	Description	Page
038	Double arm, double horizontal bolted connection to simplex plate with welded stiffeners (butterfly signs)	173
039	Monotube, vertical bolted connection, no gussets	174
040	No longer used, see Type 006	174
041	Double arm truss, bolted connection to top of pole and lower bearing plate	175
042	Double arm, pipe fitted through vertical (butterfly signs)	175
043	No longer used, see Type 030	176
044	No longer used, see Type 003	176
045	Double arm, horizontal bolted connection to plate	177
046	Single arm, 3 finger collar connection	177
047	Single arm, horizontal bolted connection to simplex plate on front of pole	178
048	Double arm, horizontal bolted connection to stiffener reinforced plates	178
049	Double arm, horizontal bolted connection to simplex plate on front of pole (butterfly signs)	179
050	No longer used, see Type 030	179
051	No longer used, see Type 028	180
052	No longer used, see Type 030	180
053	Double arm (angle) truss, top cap connection, truss bearing on bottom	181
054	No longer used, see Type 019	181
055	No longer used, see Type 033	182
056	No longer used, see Type 033	182
057	No longer used	183
058	Double arm, pipe fitted through vertical, welded	183
059	No longer used, see Type 034	184
060	Double arm, horizontal bolted connection, stiffened flanges	184
061	No longer used, see Type 042	185
062	No longer used	185
999	Unknown	-



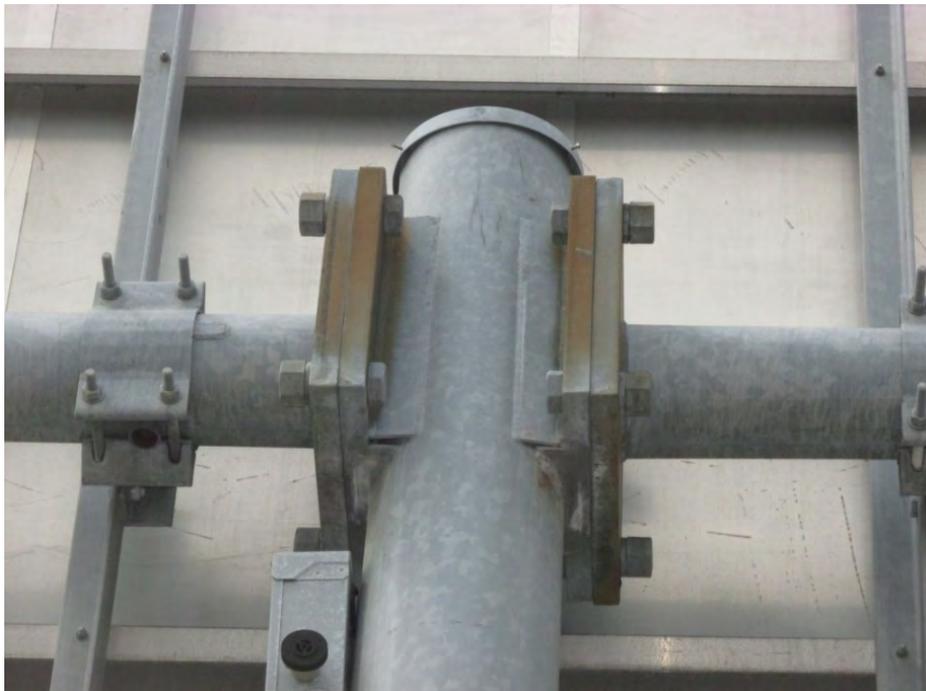
Type 001: Double arm frame, vertical bolted connection, welded to vertical pole



Type 002: Monotube, horizontal bolted connection, stiffened flanges



Type 003: Double arm, horizontal bolted connection to simplex plate



Type 004: Single face, single arm, double horizontal bolted connection to simplex plate



Type 005: Double arm, square column, vertical bolted connection



Type 006: Monotube, horizontal bolted connection, no stiffeners



Type 007: Single face sign, Single arm, cap-T horizontal bolted connection



Type 008: Double face sign, single arm, cap-T horizontal bolted connection



Type 009: Double arm (angle) truss, cap connection



Type 010: Double face sign, single arm, double horizontal bolted connection to simplex plate



Type 011: Three arm truss, U-bolt fitted connection on bearing plates



Type 012: Double arm truss, bolted connection to top of pole and lower bearing plate



Type 013: Double arm truss, bolted connection on bearing plates



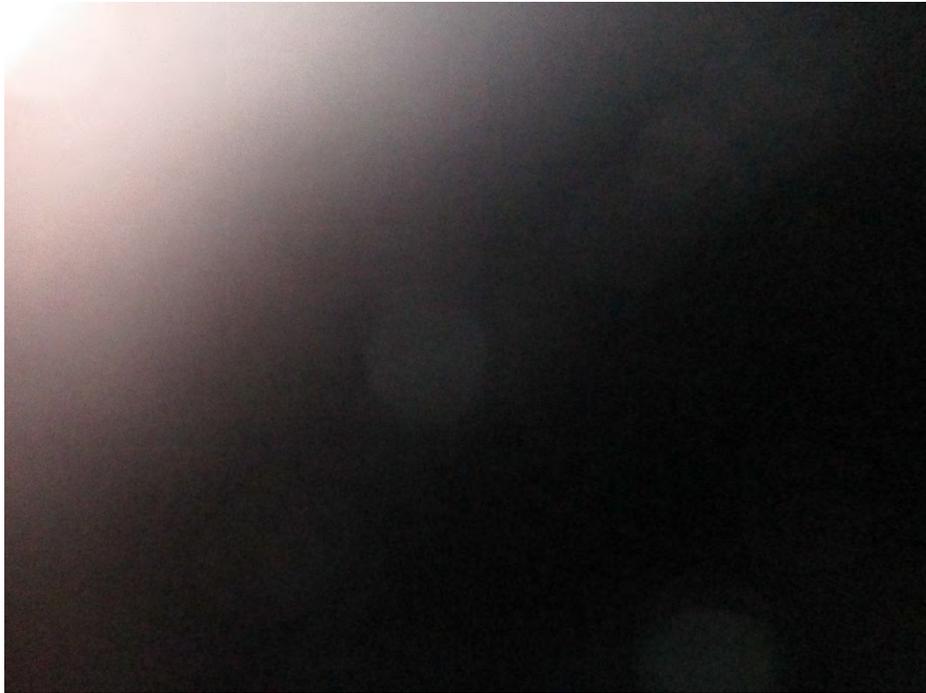
Type 014: Double arm, 3 finger collar connection, or 3 finger U-bolt clamp connection



Type 015: Double arm truss, U-bolt fitted connection on bearing plates on front of pole



Type 016: Double arm (pipe) truss, cap connection



Type 017: No longer used, see Type 003



Type 018: Double arm box truss, collar connection



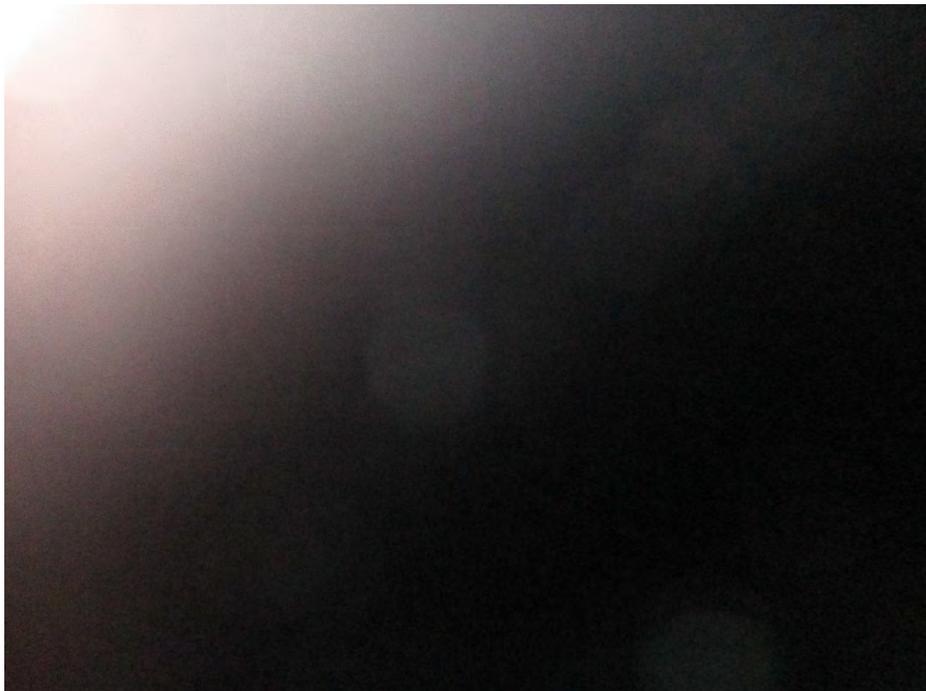
Type 019: Double arm box truss, cap connection



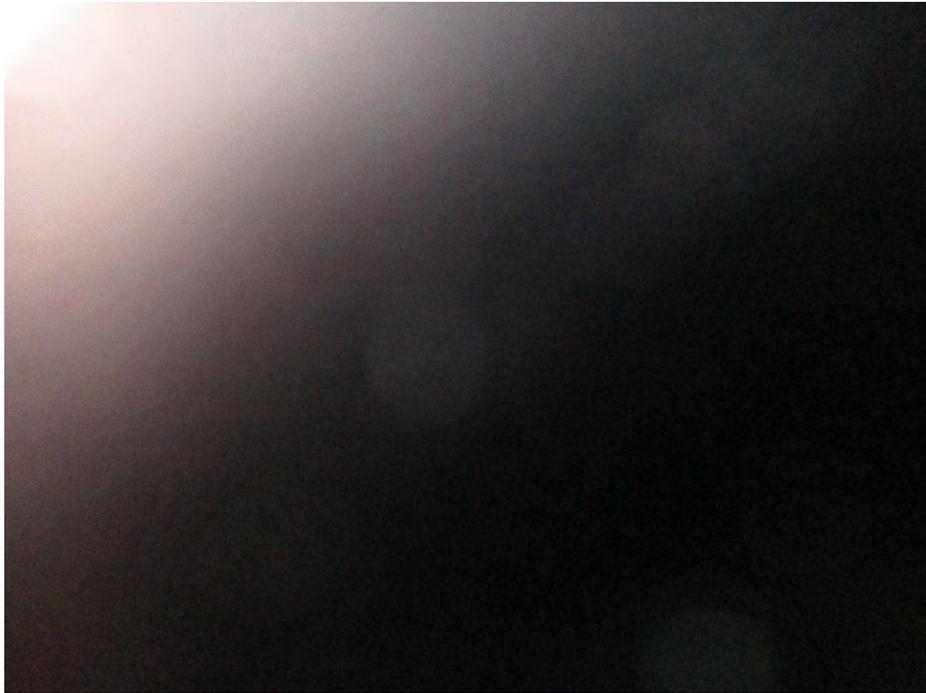
Type 020: Double arm, 5 finger collar connection, or 5 finger U-bolt clamp connection



Type 021: Double arm welded through vertical, vertical bolted cap connection



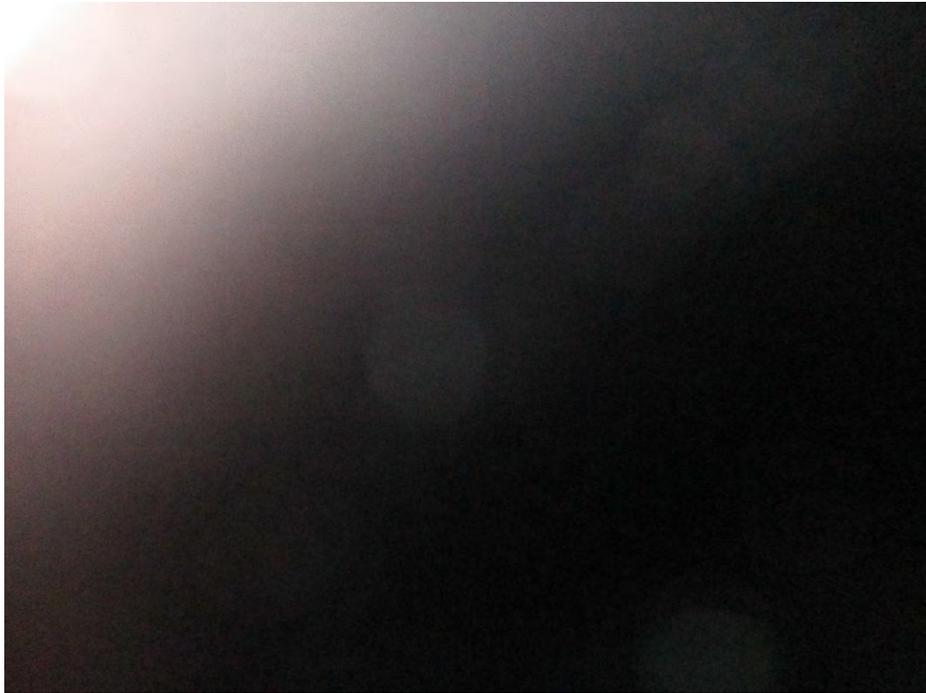
Type 022: No longer used, see Type 004



Type 023: No longer used, see Type 012



Type 024: Double arm, 6 finger collar connection, or 6 finger U-bolt clamp connection



Type 025: No longer used, see Type 014



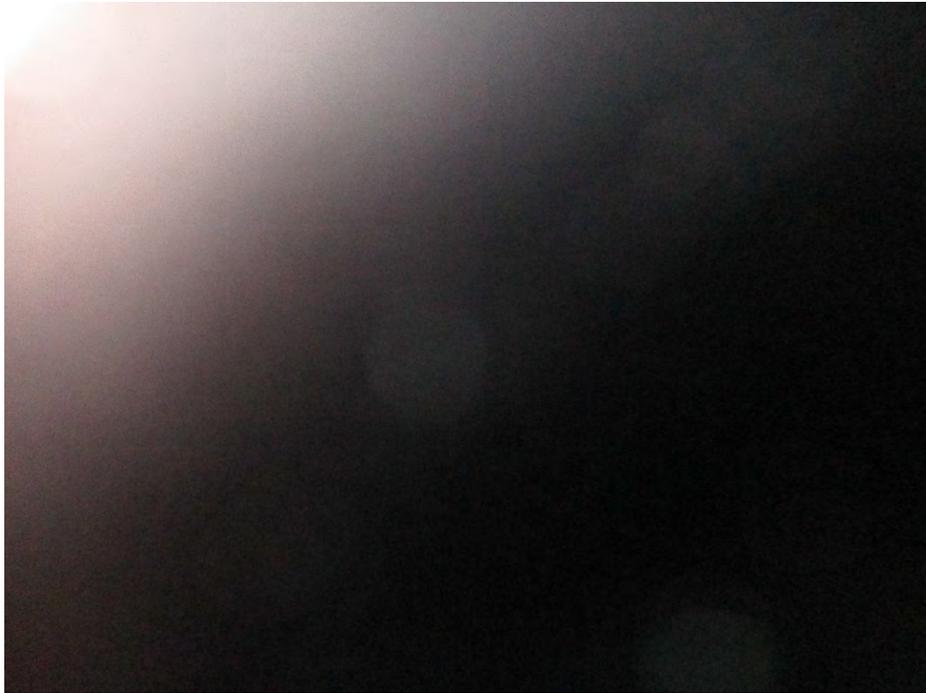
Type 026: Double arm, welded collar to vertical, vertical bolted cap connection



Type 027: Double arm frame, horizontal bolted connection to simplex plate with welded stiffener



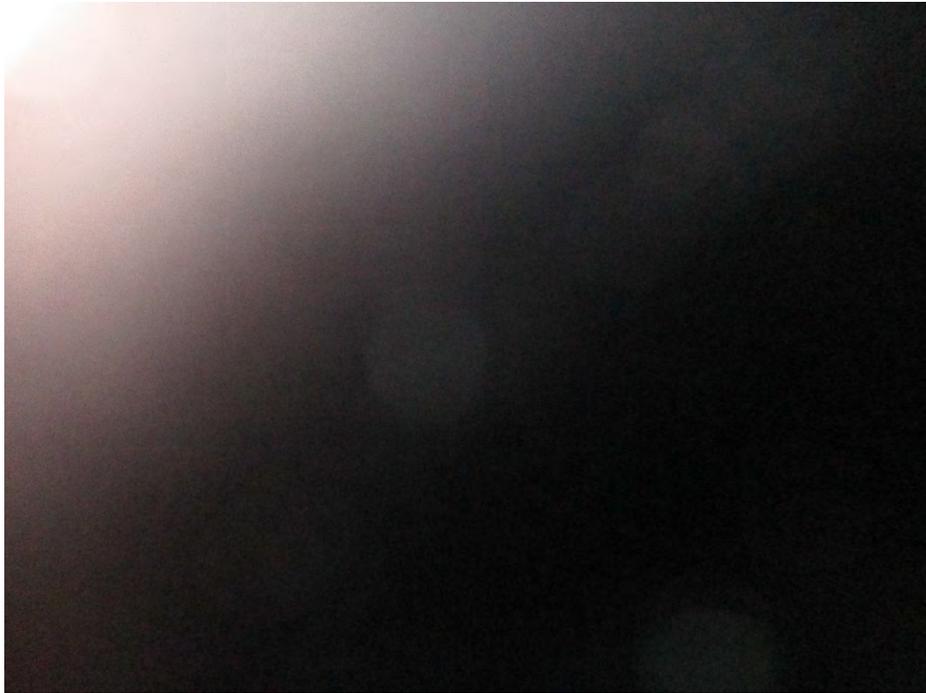
Type 028: Single arm, double collar connection, or double U-bolt connection



Type 029: No longer used, see Type 024



Type 030: Double arm, bracket welded to vertical, vertical bolted connection



Type 031: No longer used, see Type 014



Type 032: Double face sign, double arm, double horizontal bolted connection to simplex plate



Type 033: Double arm, round column, vertical bolted cap connection



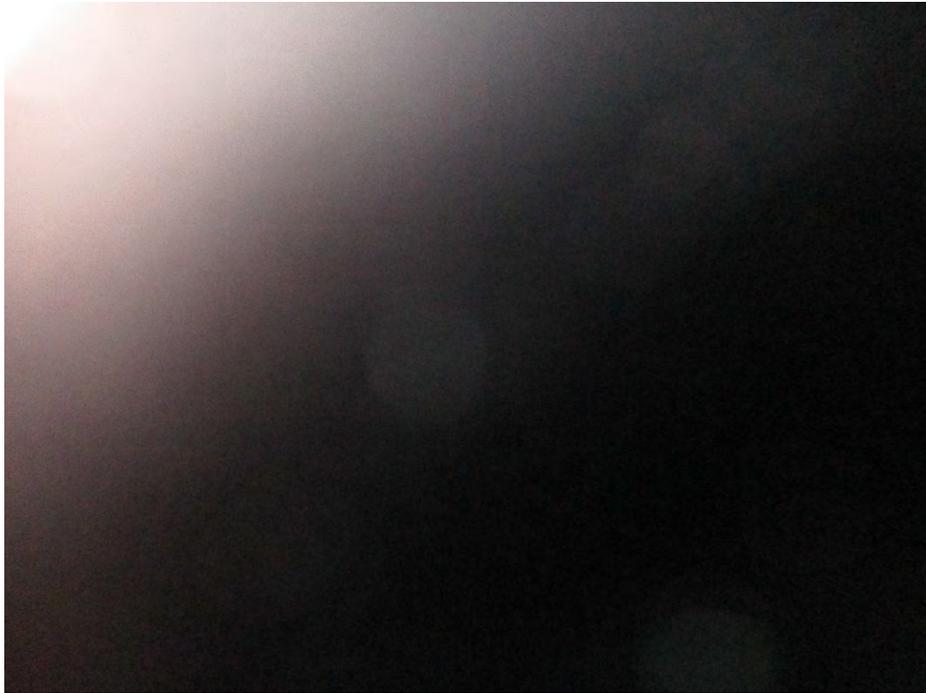
Type 034: Double arm (angle) truss bolted cap connection to plates welded to vertical



Type 035: Ornamental connection



Type 036: Single face sign, double arm, double horizontal bolted connection to simplex plate



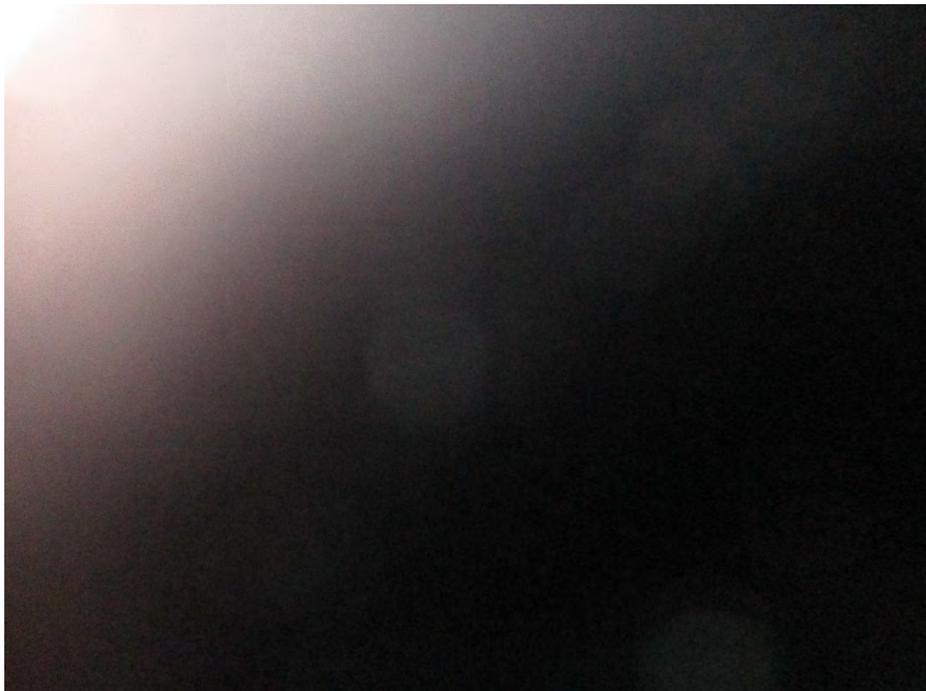
Type 037: No longer used, see Type 015



Type 038: Double arm, double horizontal bolted connection to simplex plate with welded stiffeners



Type 039: Monotube, vertical bolted connection, no stiffeners



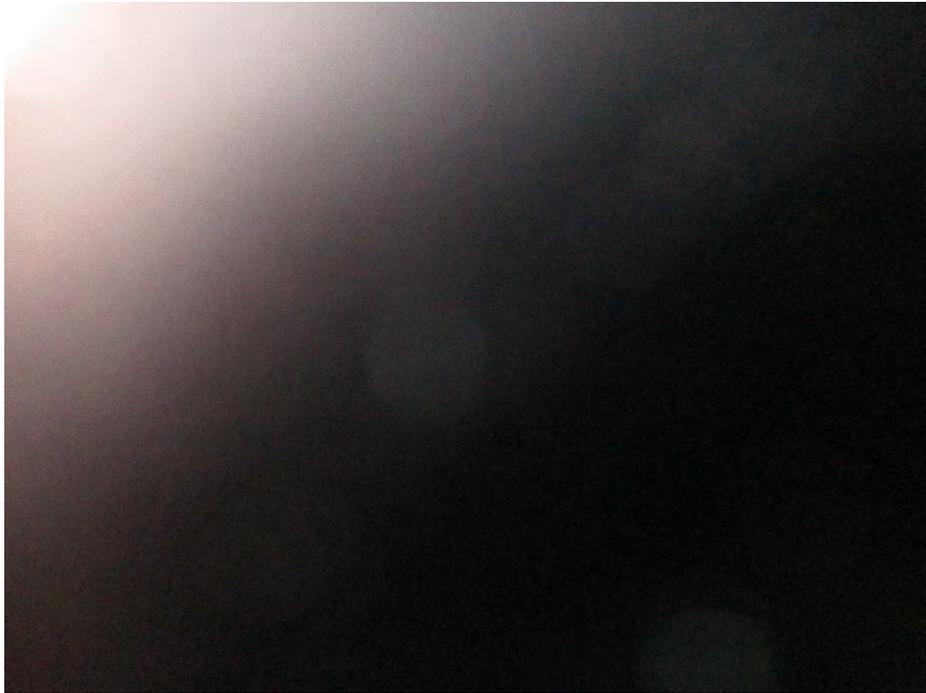
Type 040: No longer used, see Type 006



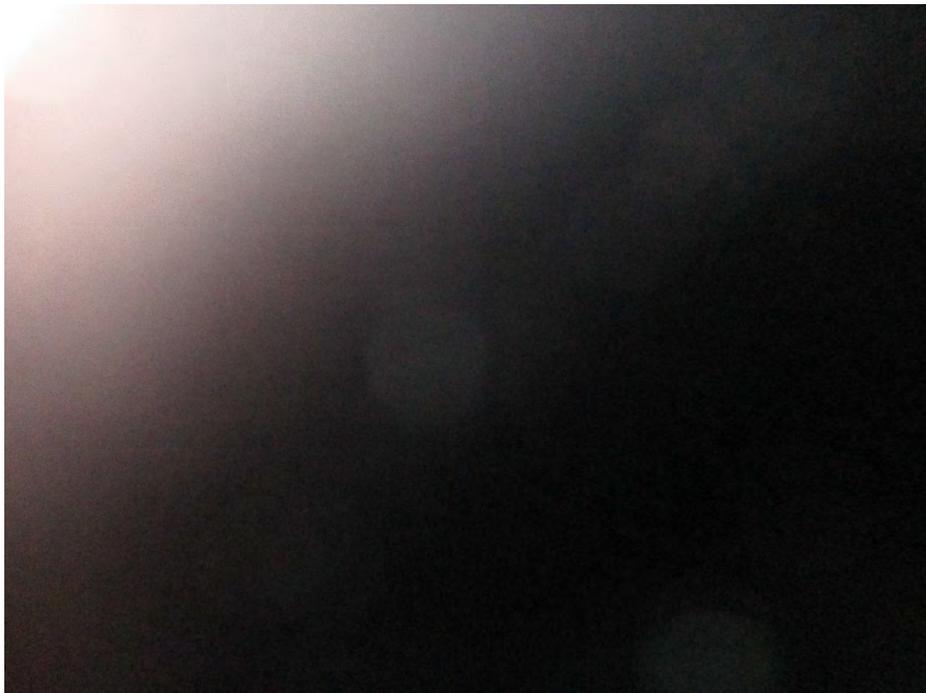
Type 041: Double arm box truss, bolted connection to top of pole and lower bearing plate



Type 042: Double arm, pipe fitted through vertical



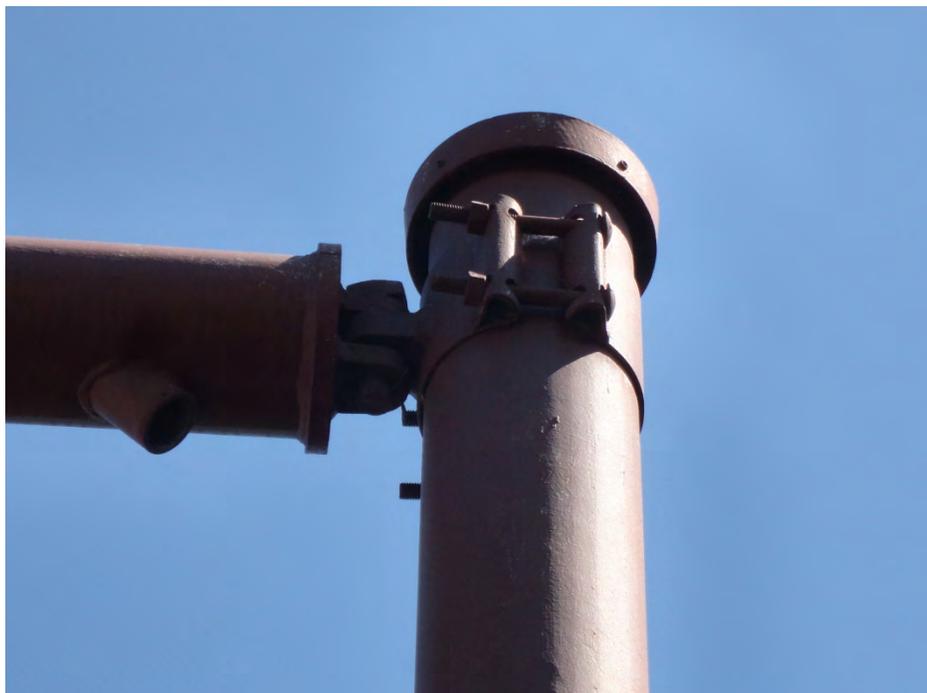
Type 043: No longer used, see Type 030



Type 044: No longer used, see Type 003



Type 045: Double arm, horizontal bolted connection to plate



Type 046: Single arm, 3 finger collar connection



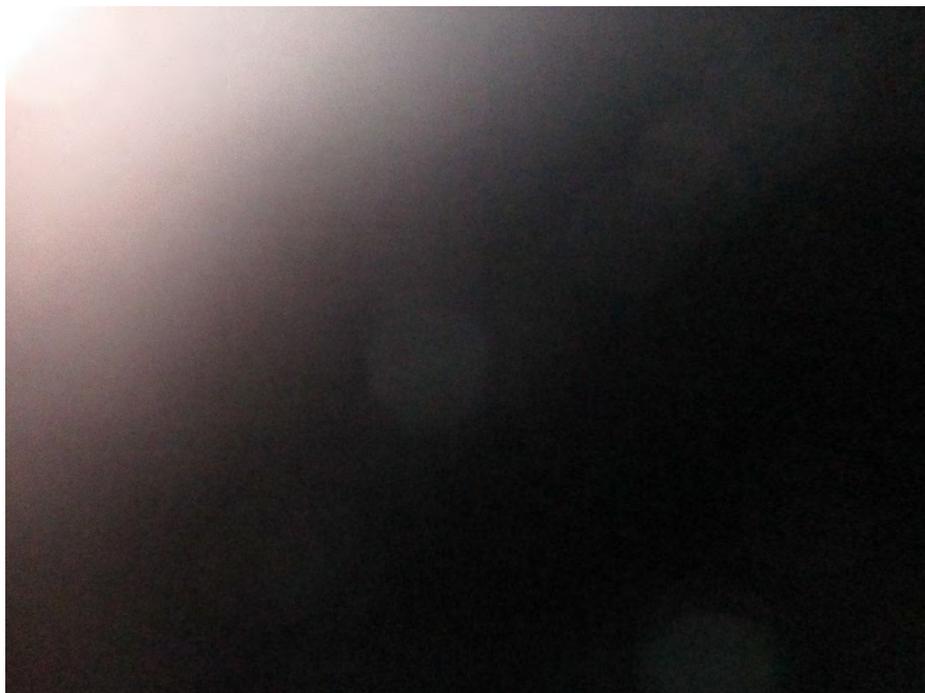
Type 047: Single arm, horizontal bolted connection to simplex plate on front of pole



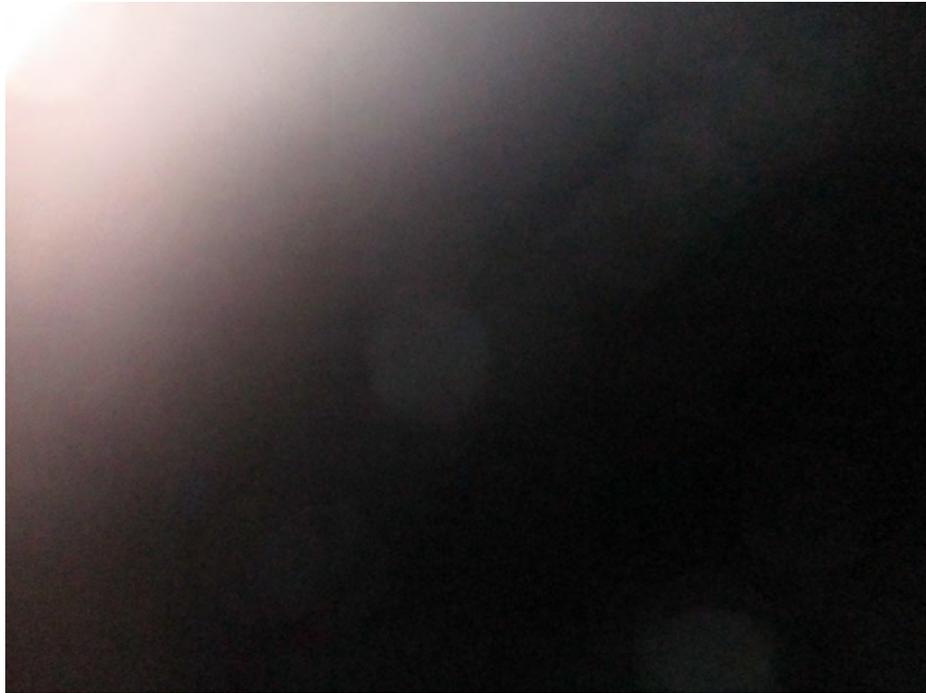
Type 048: Double arm, horizontal bolted connection to stiffener reinforced plates



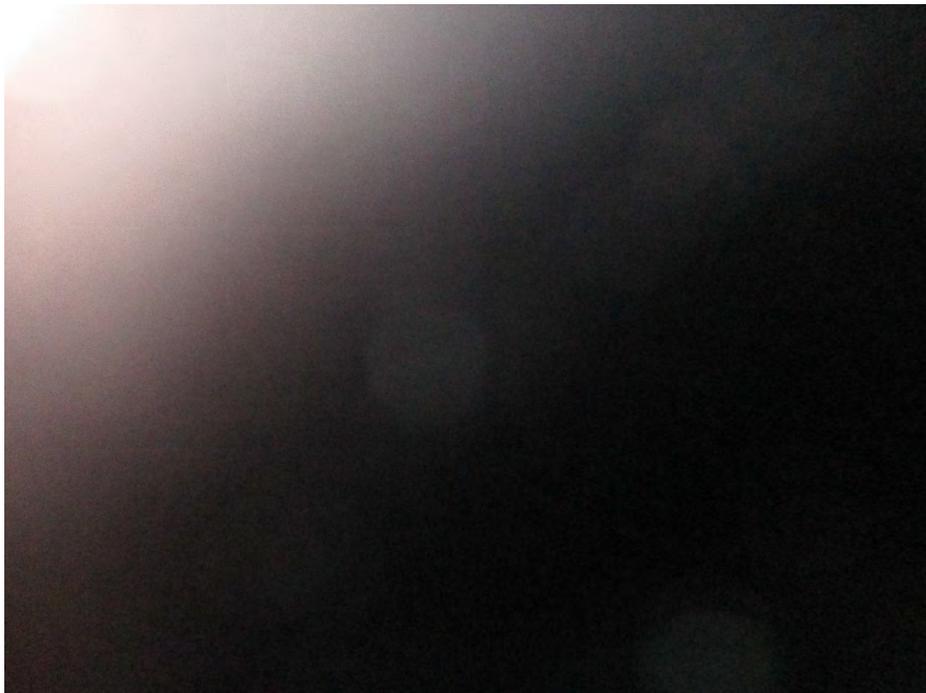
Type 049: Double arm, horizontal bolted connection to simplex plate on front of pole



Type 050: No longer used, see Type 030



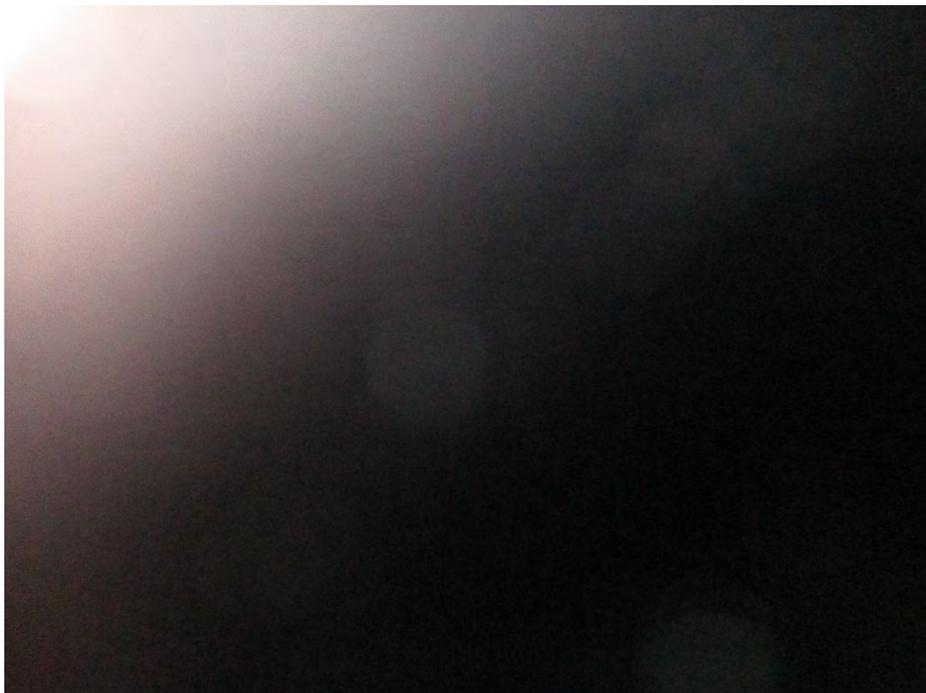
Type 051: No longer used, see Type 028



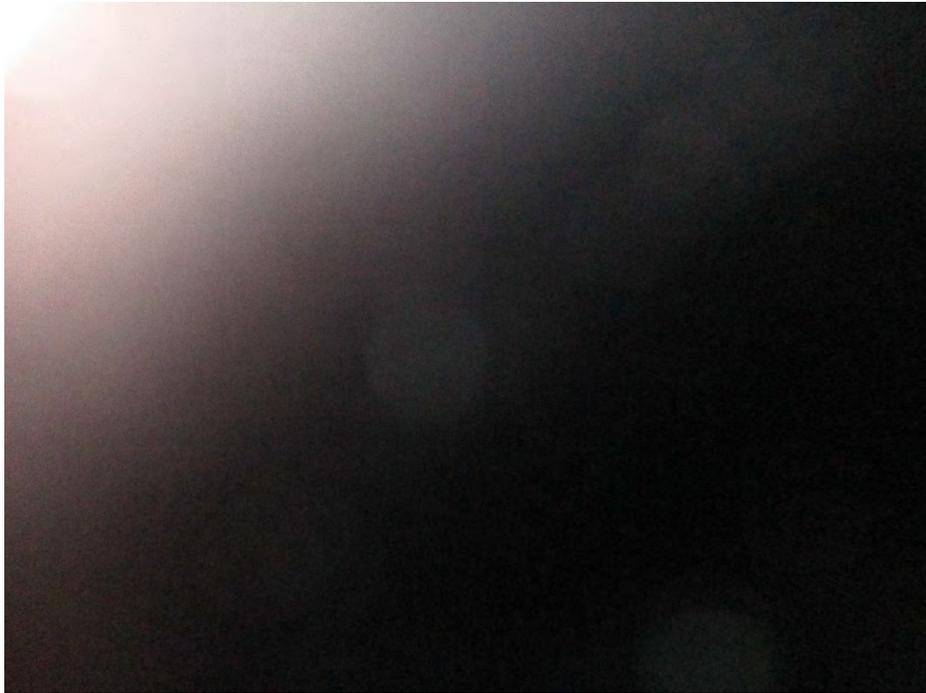
Type 052: No longer used, see Type 030



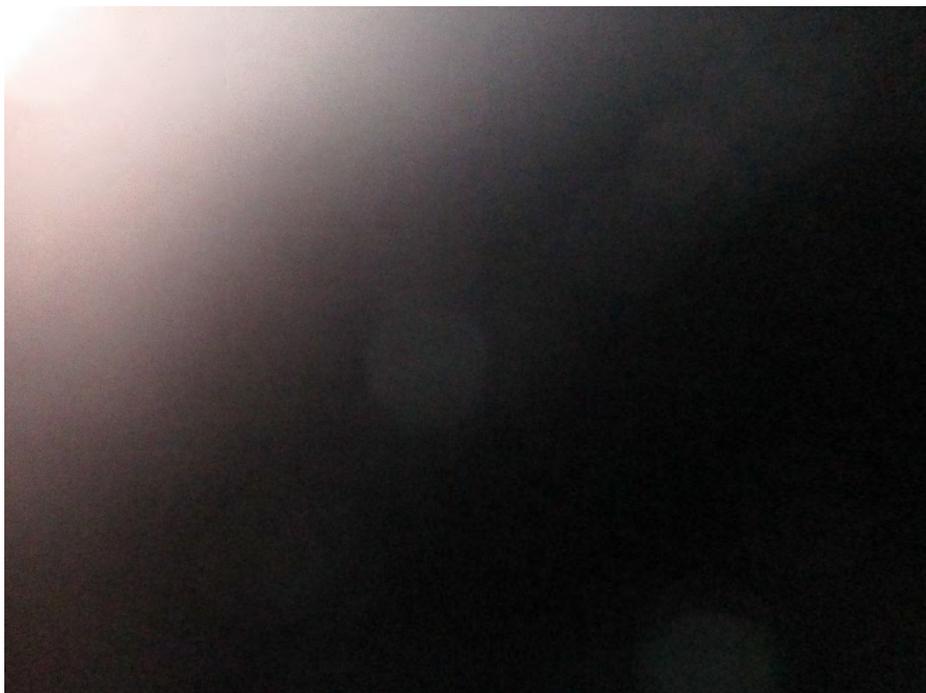
Type 053: Double arm (angle) truss, top cap connection, truss bearing on bottom



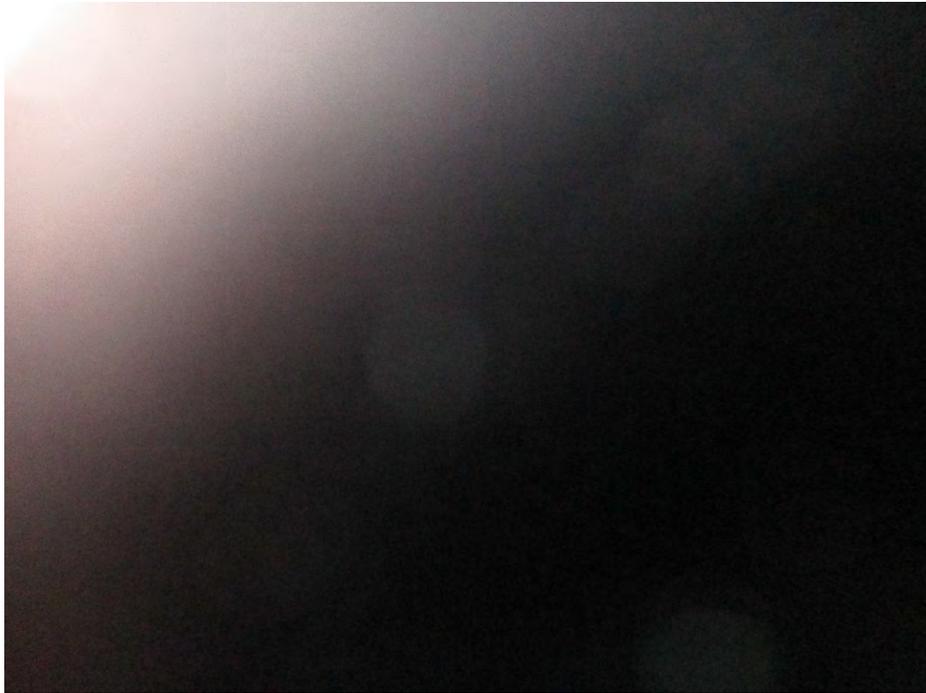
Type 054: No longer used, see Type 019



Type 055: No longer used, see Type 033



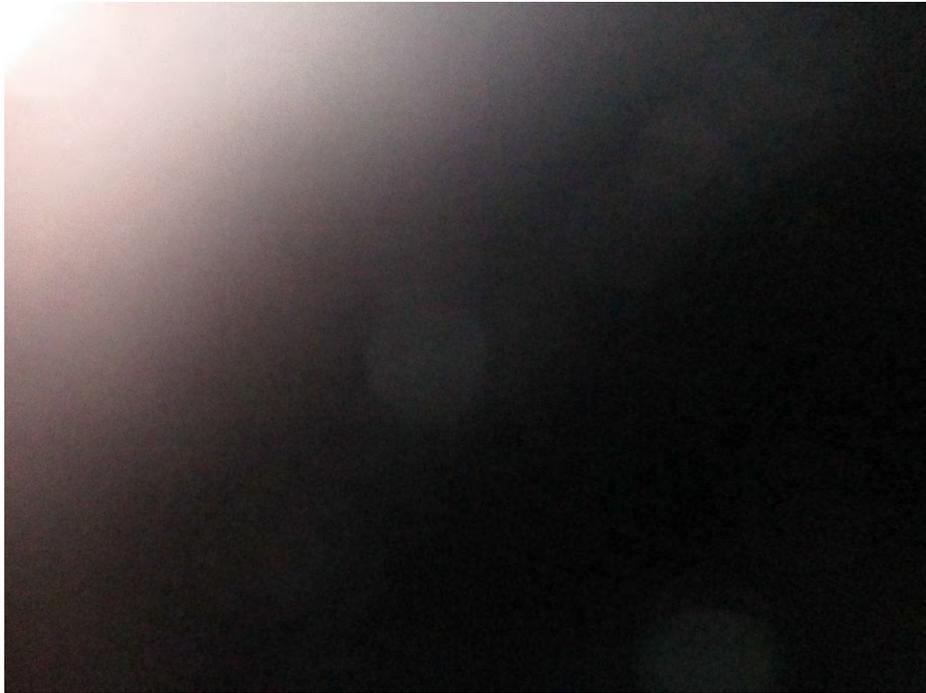
Type 056: No longer used, see Type 033



Type 057: No longer used



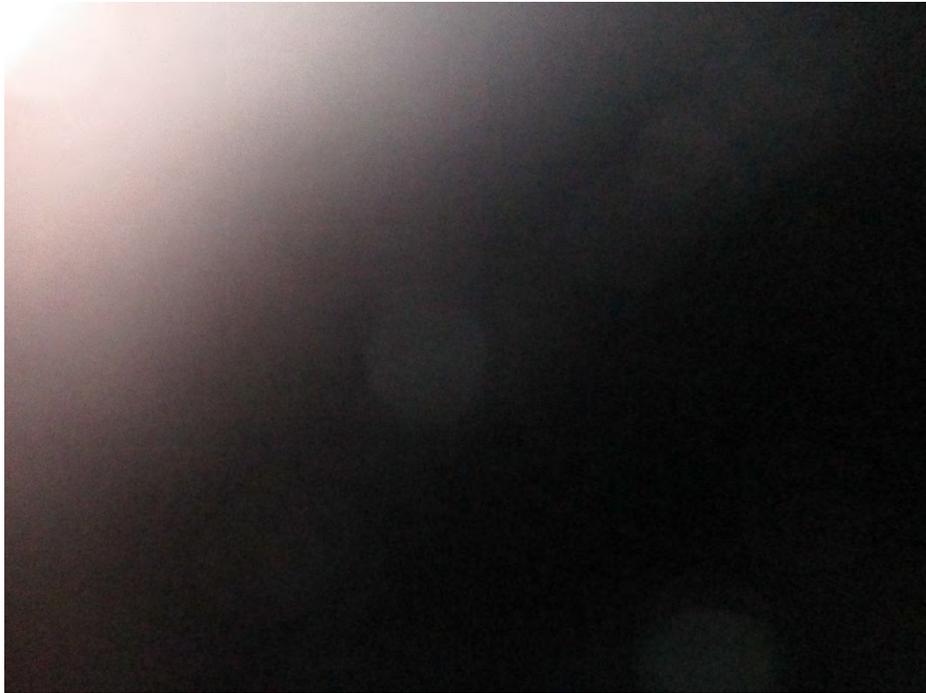
Type 058: Double arm, pipe fitted through vertical, welded



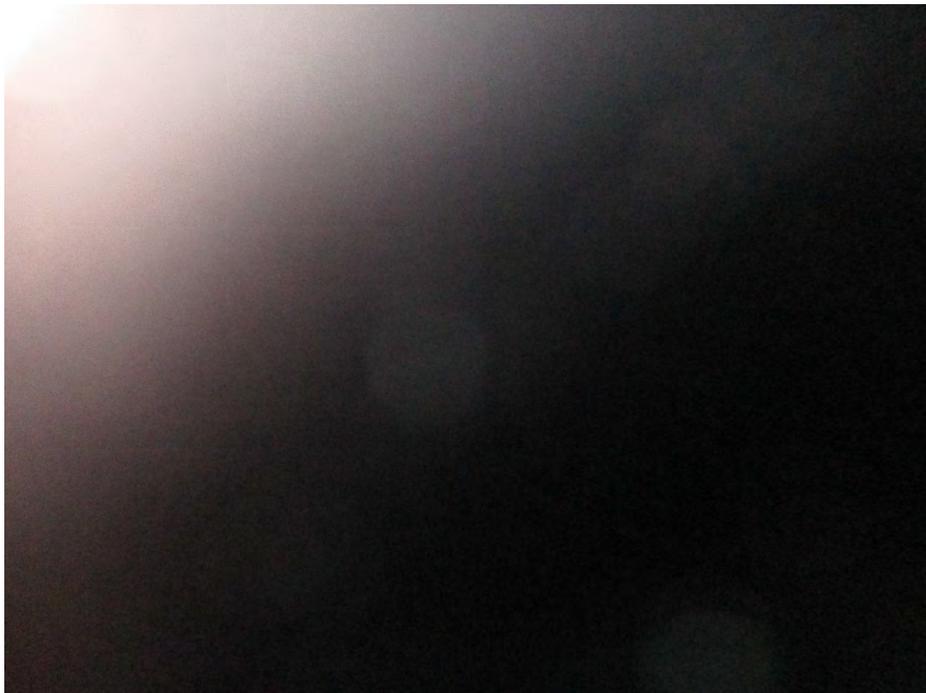
Type 059: No longer used, see Type 034



Type 060: Double arm, horizontal bolted connection, stiffened flanges



Type 061: No longer used, see Type 042



Type 062: No longer used



Appendix V.b Frame or Truss Connection Types (excluding Butterfly Signs)

This matrix sorts frame or truss sign upper connection types in numerical order. Butterfly sign connections that are frame or trusses are including in Appendix V.e.

Type	Frame or Truss Connection Types (excluding Butterfly Signs)	Page
001	Double arm frame, vertical bolted connection, welded to vertical pole	187
003	Double arm, horizontal bolted connection to simplex plate	187
009	Double arm (angle) truss, cap connection	188
011	Three arm truss, U-bolt fitted connection on bearing plate	188
012	Double arm truss, bolted connection to top of pole and lower bearing plate	189
013	Double arm truss, bolted connection on bearing plates	189
015	Double arm truss, U-bolt fitted connection on bearing plates on front of pole	190
016	Double arm (pipe) truss, cap connection	190
017	No longer used, see Type 003	191
018	Double arm box truss, collar connection	191
021	Double arm welded through vertical, vertical bolted cap connection	192
023	No longer used, see Type 012	192
026	Double arm, welded collar to vertical, vertical bolted cap connection	193
027	Double arm frame, horizontal bolted connection to simplex plate with welded stiffener	193
030	Double arm, bracket welded to vertical, vertical bolted connection	194
034	Double arm (angle) truss bolted cap connection to plates welded to vertical	194
037	No longer used, see Type 015	195
041	Double arm truss, bolted connection to top of pole and lower bearing plate	195
043	No longer used, see Type 030	196
044	No longer used, see Type 003	196
045	Double arm, horizontal bolted connection to plate	197
048	Double arm, horizontal bolted connection to stiffener reinforced plates	197
050	No longer used, see Type 030	198
052	No longer used, see Type 030	198
053	Double arm (angle) truss, top cap connection, truss bearing on bottom	199
058	Double arm, pipe fitted through vertical, welded	199
059	No longer used, see Type 034	200
060	Double arm, horizontal bolted connection, stiffened flanges	200
999	Unknown	-



Type 001: Double arm frame, vertical bolted connection, welded to vertical pole



Type 003: Double arm, horizontal bolted connection to simplex plate



Type 009: Double arm (angle) truss, cap connection



Type 011: Three arm truss, U-bolt fitted connection on bearing plates



Type 012: Double arm truss, bolted connection to top of pole and lower bearing plate



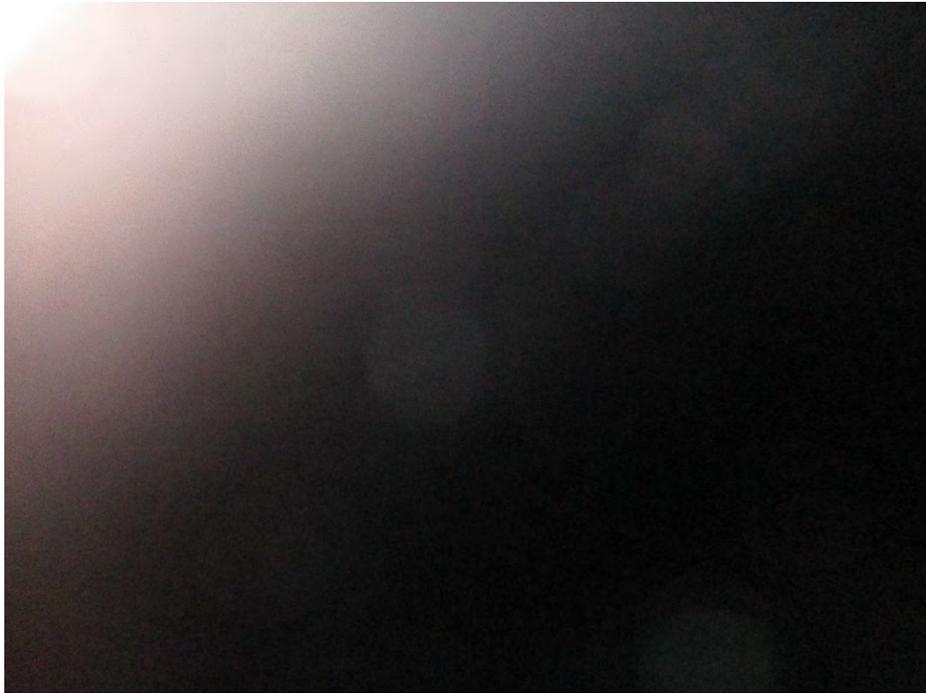
Type 013: Double arm truss, bolted connection on bearing plates



Type 015: Double arm truss, U-bolt fitted connection on bearing plates on front of pole



Type 016: Double arm (pipe) truss, cap connection



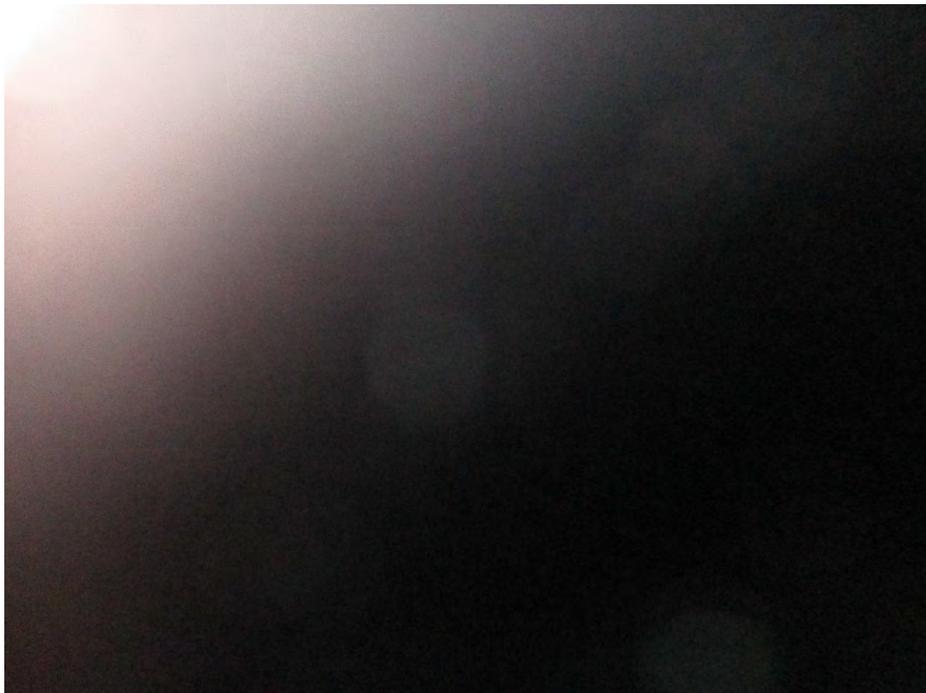
Type 017: No longer used, see Type 003



Type 018: Double arm box truss, collar connection



Type 021: Double arm welded through vertical, vertical bolted cap connection



Type 023: No longer used, see Type 012



Type 026: Double arm, welded collar to vertical, vertical bolted cap connection



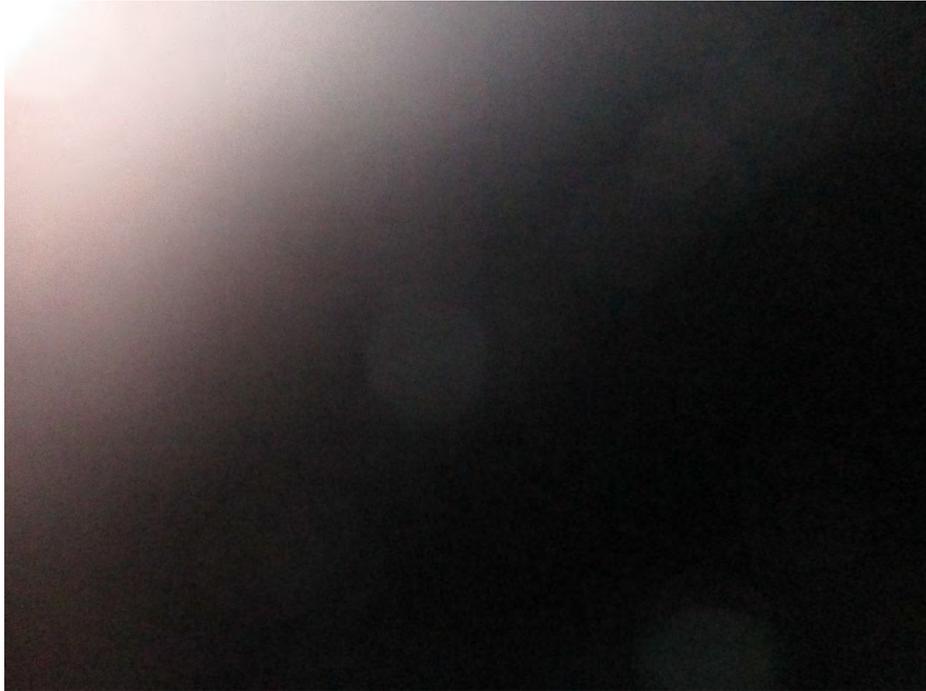
Type 027: Double arm frame, horizontal bolted connection to simplex plate with welded stiffener



Type 030: Double arm, bracket welded to vertical, vertical bolted connection



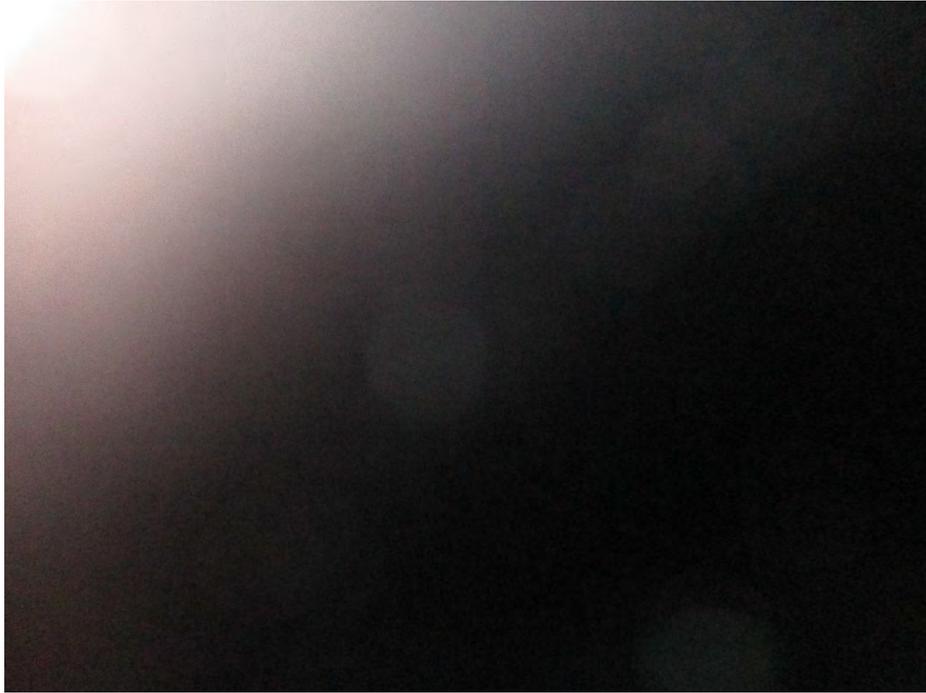
Type 034: Double arm (angle) truss bolted cap connection to plates welded to vertical



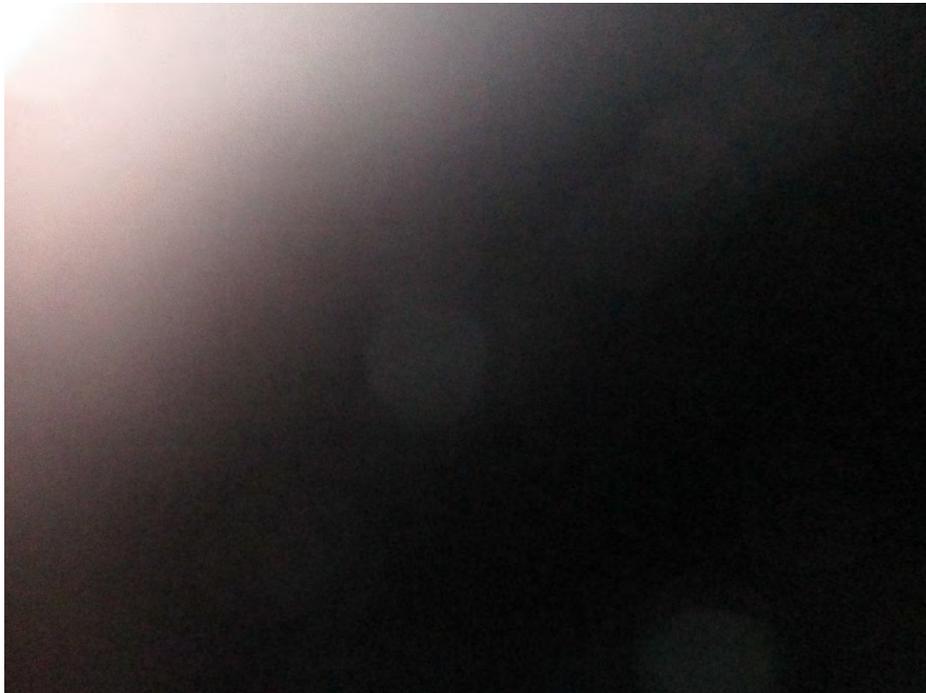
Type 037: No longer used, see Type 015



Type 041: Double arm box truss, bolted connection to top of pole and lower bearing plate



Type 043: No longer used, see Type 030



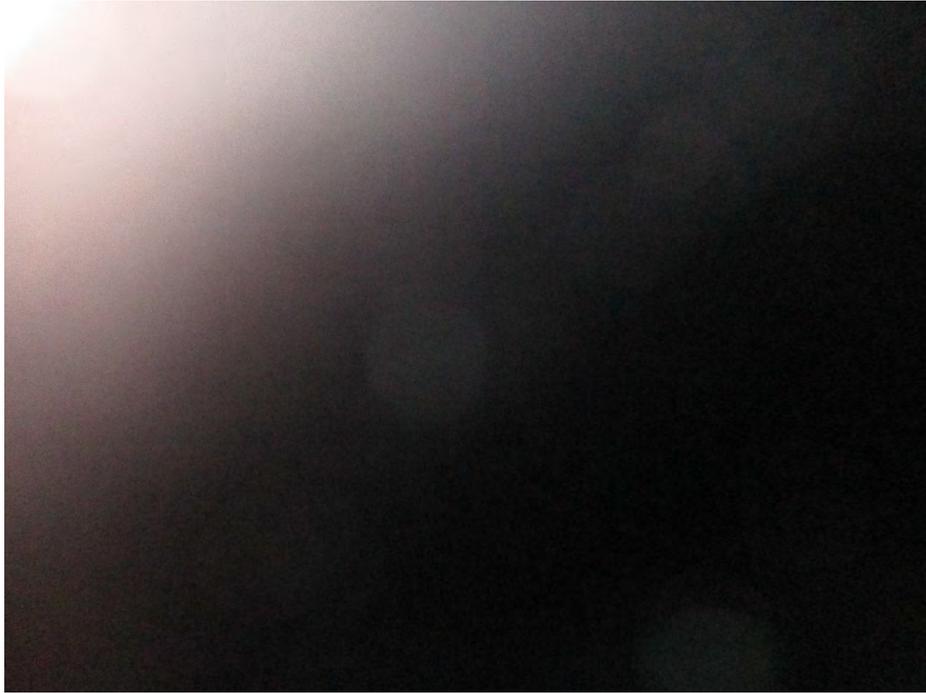
Type 044: No longer used, see Type 003



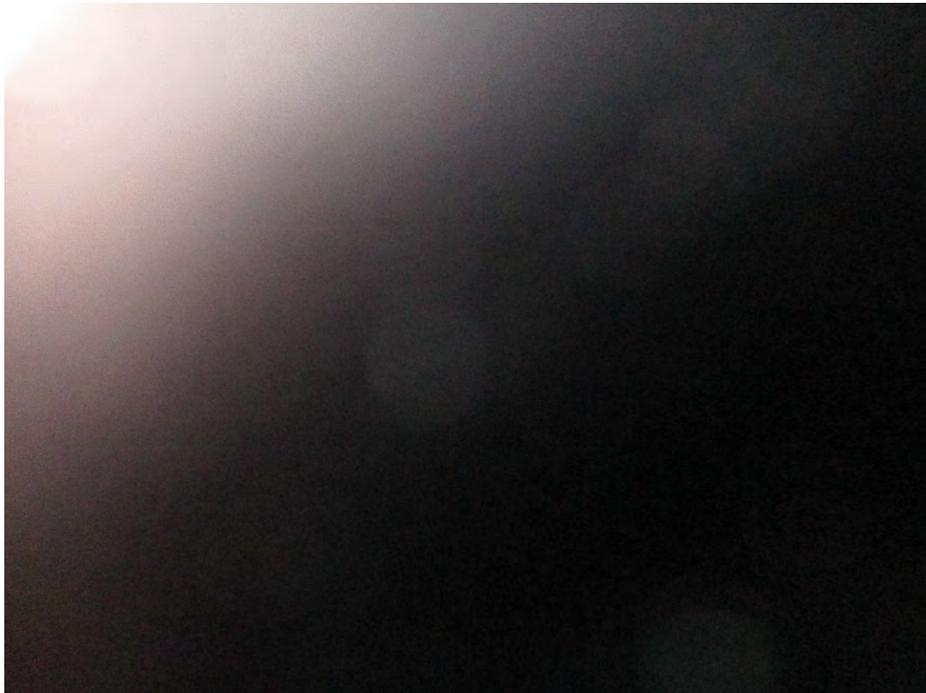
Type 045: Double arm, horizontal bolted connection to plate



Type 048: Double arm, horizontal bolted connection to stiffener reinforced plates



Type 050: No longer used, see Type 030



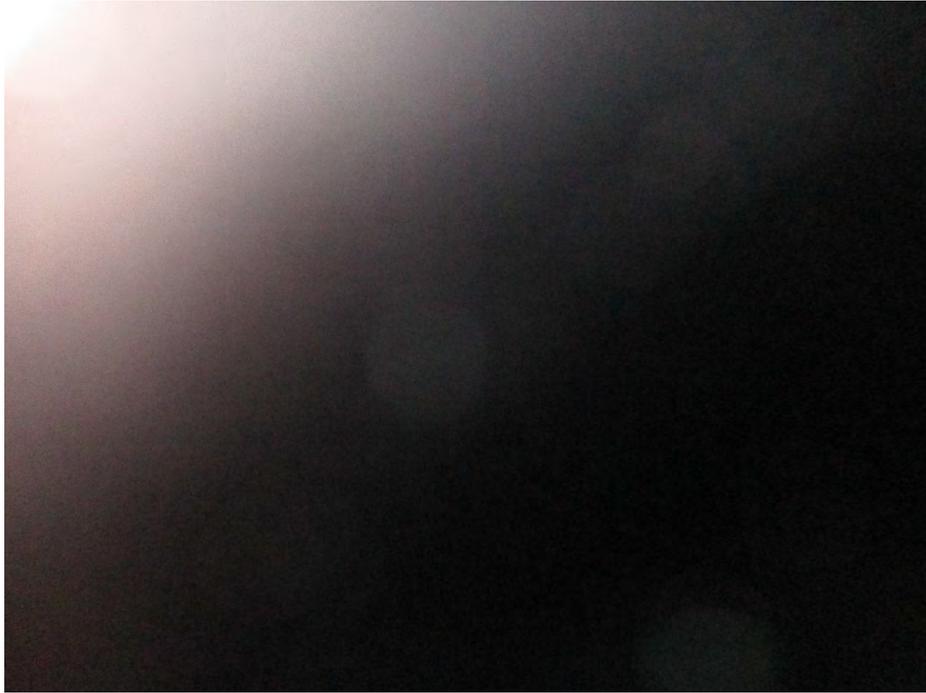
Type 052: No longer used, see Type 030



Type 053: Double arm (angle) truss, top cap connection, truss bearing on bottom



Type 058: Double arm, pipe fitted through vertical, welded



Type 059: No longer used, see Type 034



Type 060: Double arm, horizontal bolted connection, stiffened flanges



Appendix V.c Collar or U-Bolt, Finger Connections

This matrix sorts collar or U-bolt finger sign upper connection types in numerical order.

Type	Collar or U-Bolt, Finger Connections	Page
014	Double arm, 3 finger collar connection	202
020	Double arm, 5 finger collar connection, or 5 finger U-bolt clamp connection	202
024	Double arm, 6 finger collar connection, or 6 finger U-bolt clamp connection	203
025	No longer used, see Type 014	203
028	Single arm, double collar connection, or double U-bolt connection	204
029	No longer used, see Type 024	204
031	No longer used, see Type 014	205
046	Single arm, 3 finger collar connection	205
051	No longer used, see Type 028	206
999	Unknown	-



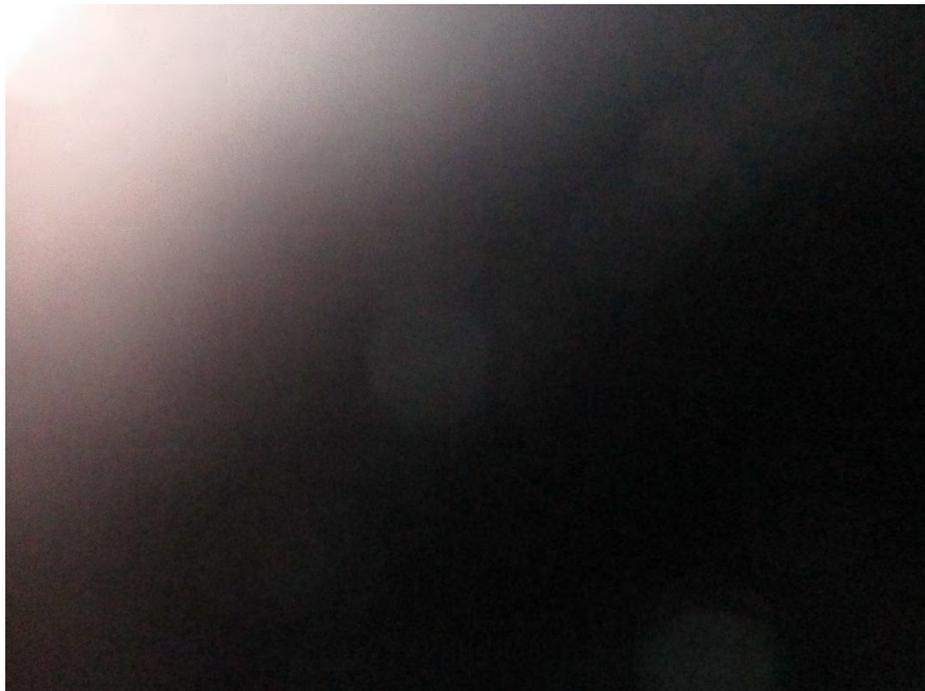
Type 014: Double arm, 3 finger collar connection, or 3 finger U-bolt clamp connection



Type 020: Double arm, 5 finger collar connection, or 5 finger U-bolt clamp connection



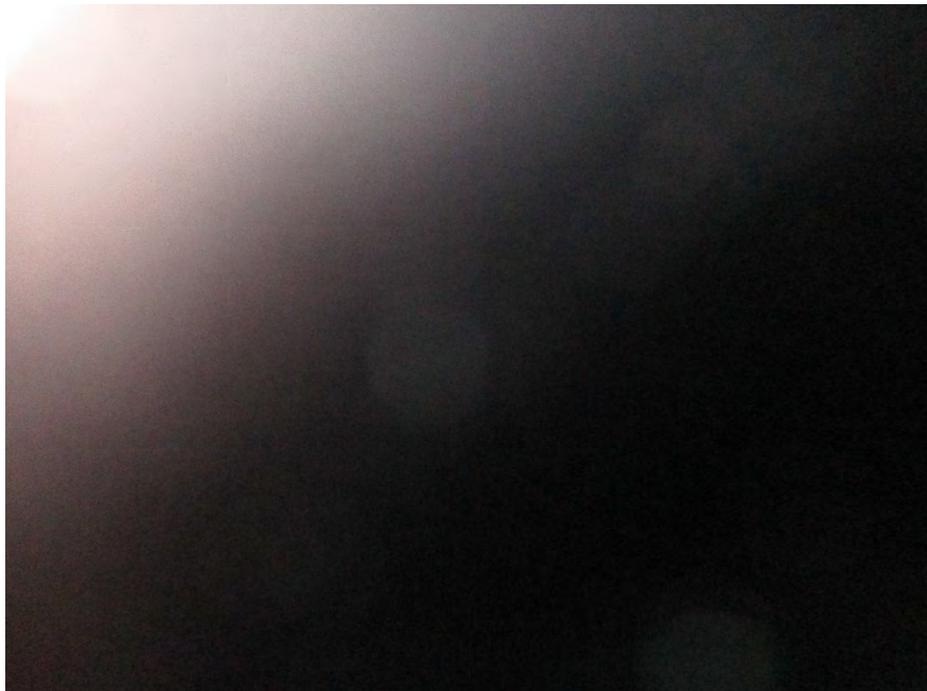
Type 024: Double arm, 6 finger collar connection, or 6 finger U-bolt clamp connection



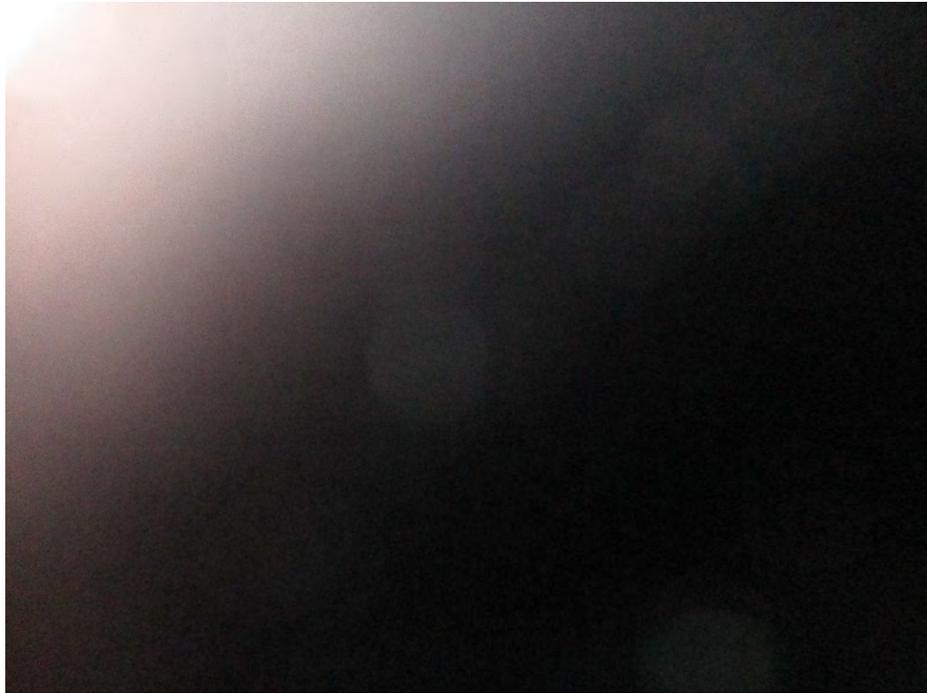
Type 025: No longer used, see Type 014



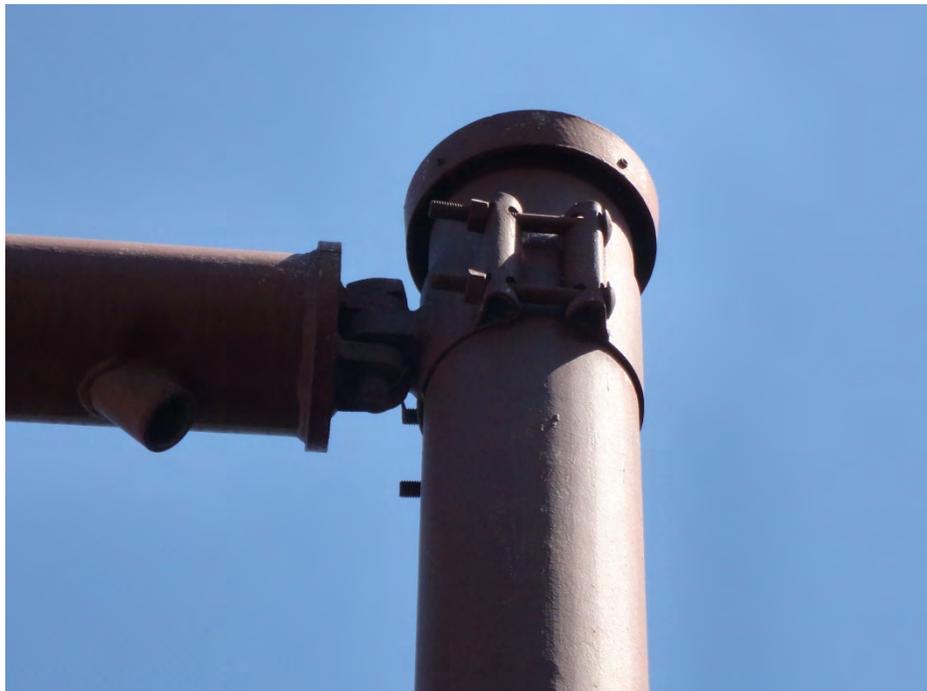
Type 028: Single arm, double collar connection, or double U-bolt connection



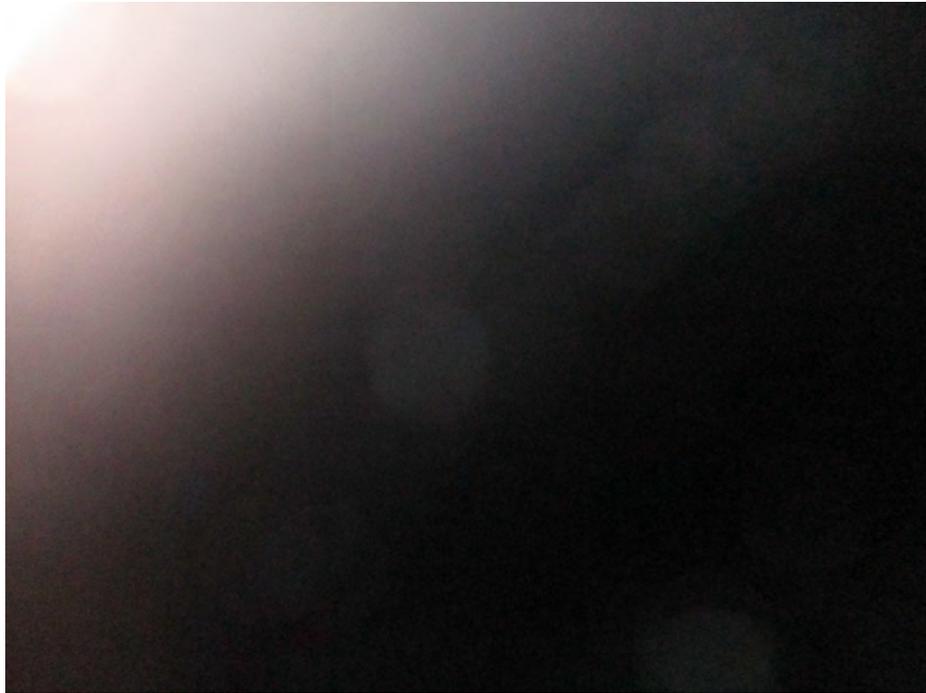
Type 029: No longer used, see Type 024



Type 031: No longer used, see Type 014



Type 046: Single arm, 3 finger collar connection



Type 051: No longer used, see Type 028



Appendix V.d Monotube Connections

This matrix sorts monotube sign upper connection types in numerical order.

Type	Monotube Connections	Page
002	Monotube, horizontal bolted connection, stiffened flanges	208
006	Monotube, horizontal bolted connection, no gussets	208
039	Monotube, vertical bolted connection, no gussets	209
040	No longer used, see Type 006	209
999	Unknown	-



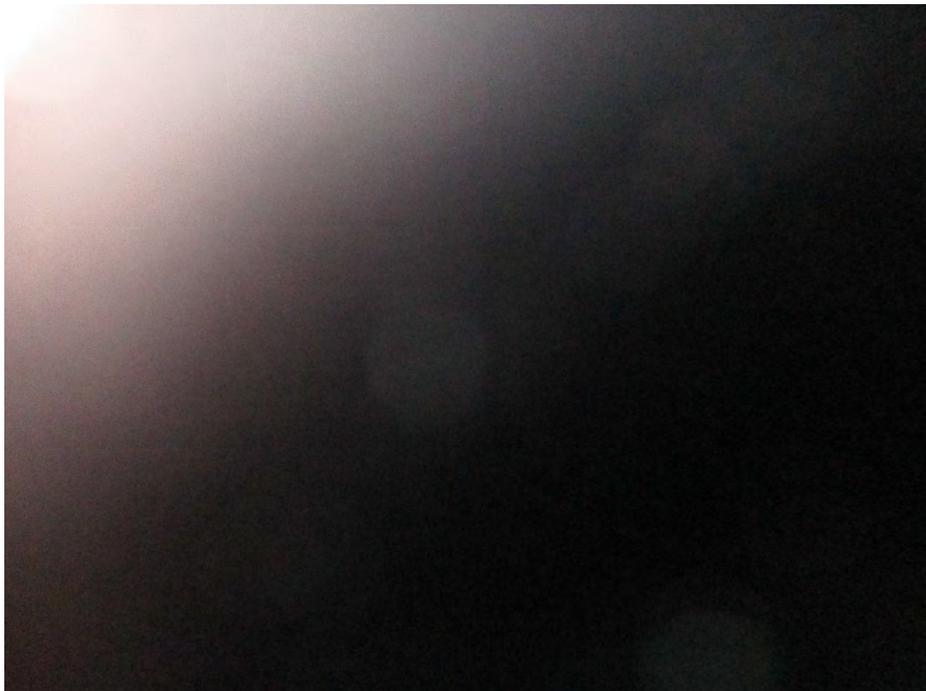
Type 002: Monotube, horizontal bolted connection, stiffened flanges



Type 006: Monotube, horizontal bolted connection, no stiffeners



Type 039: Monotube, vertical bolted connection, no stiffeners



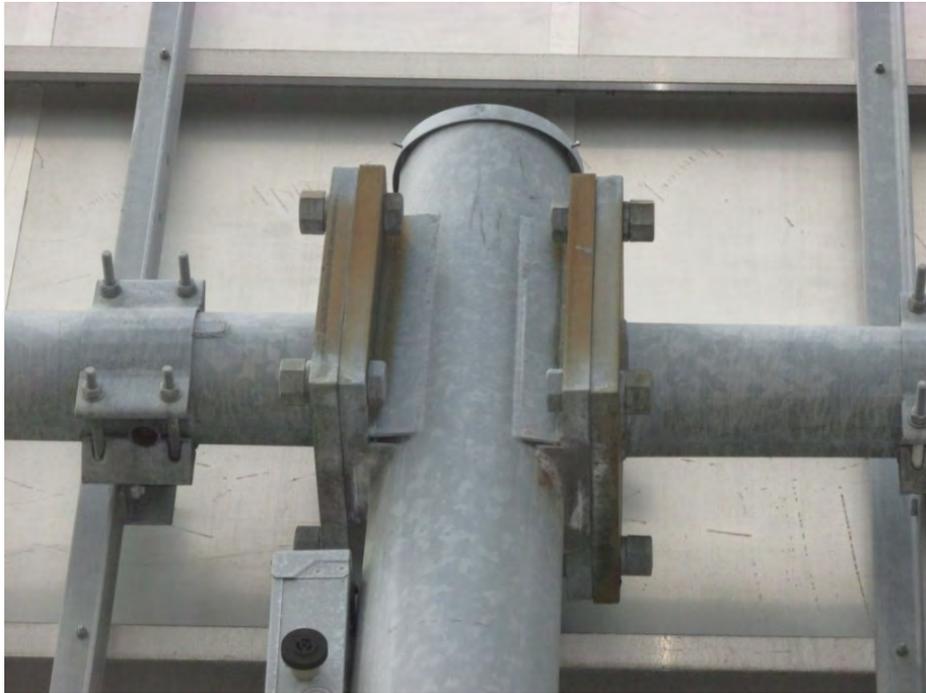
Type 040: No longer used, see Type 006



Appendix V.e Butterfly Sign Connections

This matrix sorts butterfly sign upper connection types in numerical order.

Type	Butterfly Sign Connections	Page
004	Single face, single arm, double horizontal bolted connection to simplex plate (butterfly signs)	211
005	Double arm, square column, vertical bolted connection (butterfly signs)	211
007	Single face sign, single arm, cap-T horizontal bolted connection (butterfly signs)	212
008	Double face sign, single arm, cap-T horizontal bolted connection (butterfly signs)	212
010	Double face sign, single arm, double horizontal bolted connection to simplex plate (butterfly signs)	213
019	Double arm box truss, cap connection (butterfly signs)	213
022	No longer used, see Type 004	214
032	Double face sign, double arm, double horizontal bolted connection to simplex plate (butterfly signs)	214
033	Double arm, round column, vertical bolted cap connection (butterfly signs)	215
036	Single face sign, double arm, double horizontal bolted connection to simplex plate (butterfly signs)	215
038	Double arm, double horizontal bolted connection to simplex plate with welded stiffeners (butterfly signs)	216
042	Double arm, pipe fitted through vertical (butterfly signs)	216
047	Single arm, horizontal bolted connection to simplex plate on front of pole	217
049	Double arm, horizontal bolted connection to simplex plate on front of pole (butterfly signs)	217
054	No longer used, see Type 019	218
055	No longer used, see Type 033	218
056	No longer used, see Type 033	219
061	No longer used, see Type 042	219
999	Unknown	



Type 004: Single face, single arm, double horizontal bolted connection to simplex plate



Type 005: Double arm, square column, vertical bolted connection



Type 007: Single face sign, Single arm, cap-T horizontal bolted connection



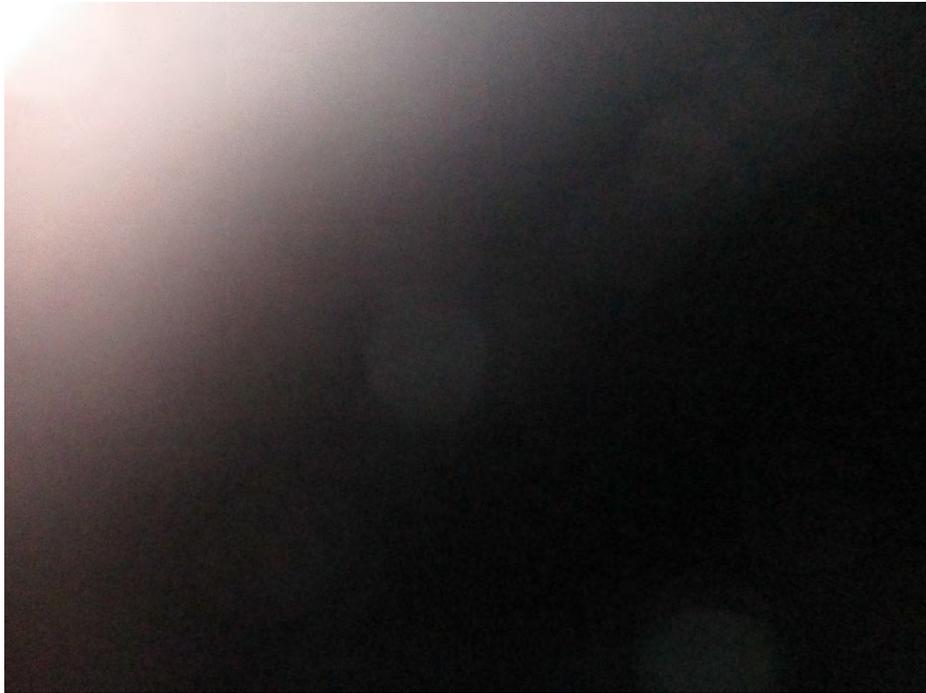
Type 008: Double face sign, single arm, cap-T horizontal bolted connection



Type 010: Double face sign, single arm, double horizontal bolted connection to simplex plate



Type 019: Double arm box truss, cap connection



Type 022: No longer used, see Type 004



Type 032: Double face sign, double arm, double horizontal bolted connection to simplex plate



Type 033: Double arm, round column, vertical bolted cap connection



Type 036: Single face sign, double arm, double horizontal bolted connection to simplex plate



Type 038: Double arm, double horizontal bolted connection to simplex plate with welded stiffeners



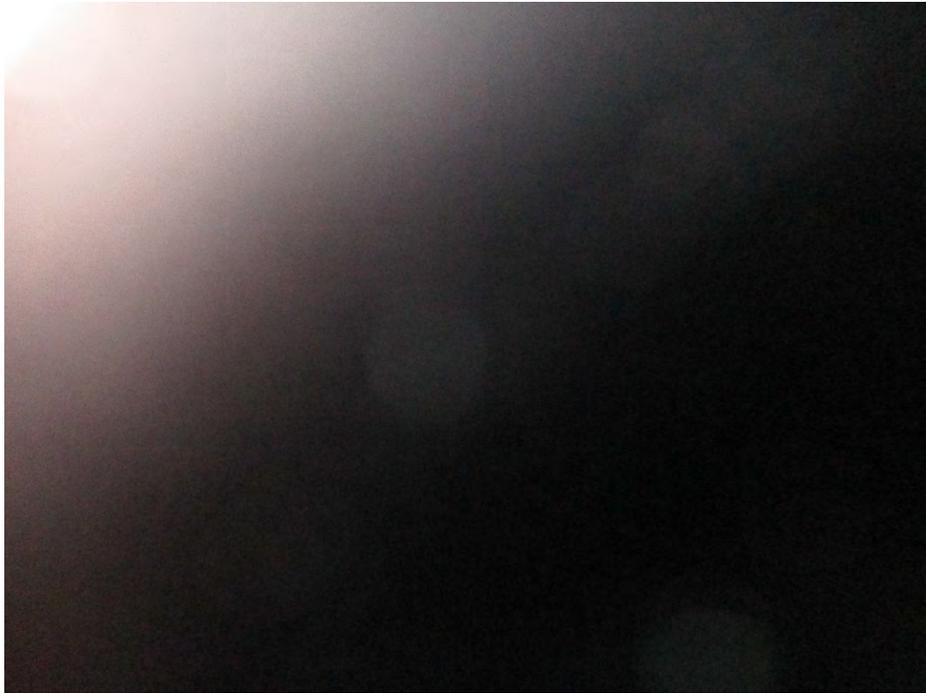
Type 042: Double arm, pipe fitted through vertical



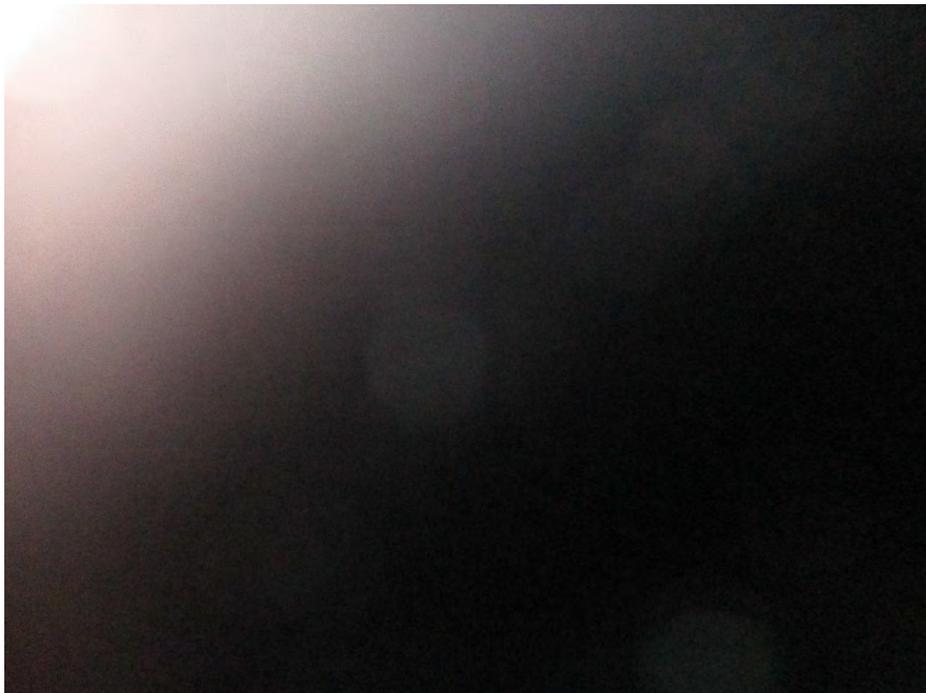
Type 047: Single arm, horizontal bolted connection to simplex plate on front of pole



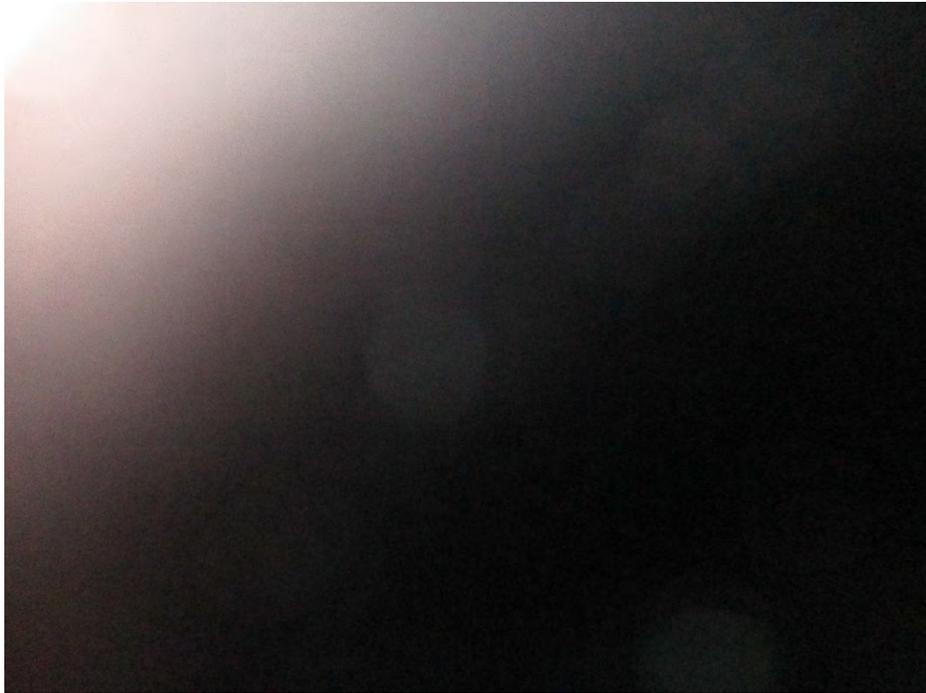
Type 049: Double arm, horizontal bolted connection to simplex plate on front of pole



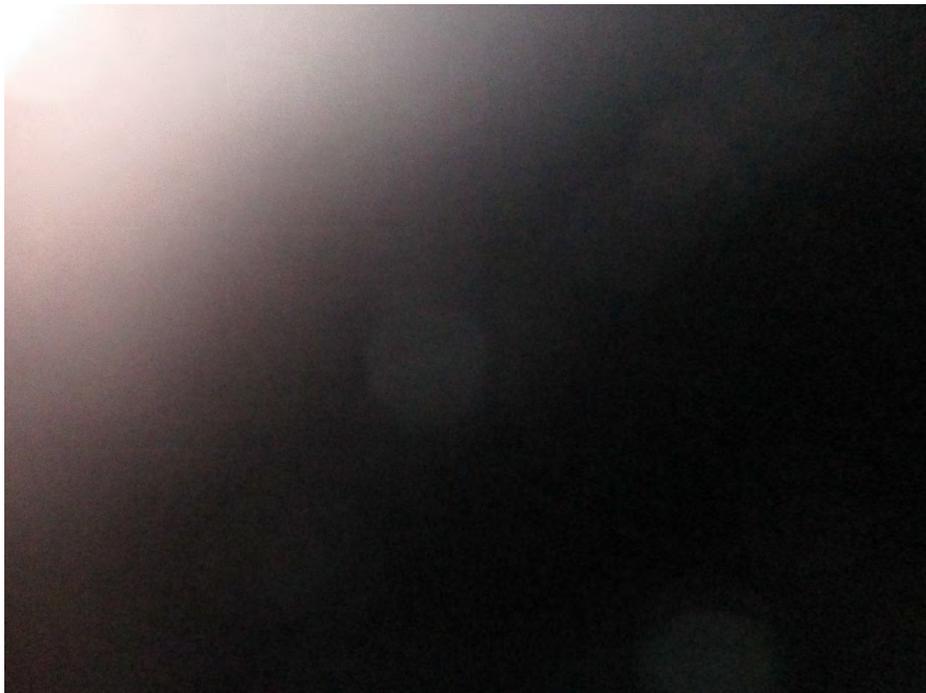
Type 054: No longer used, see Type 019



Type 055: No longer used, see Type 033



Type 056: No longer used, see Type 033



Type 061: No longer used, see Type 042

Appendix V.f Miscellaneous or No Longer Used Connections

This matrix captures miscellaneous sign upper connection types or upper connection types that are no longer used.

Type	Miscellaneous
035	Ornamental connection
057	No longer used
062	No longer used
999	Unknown



Type 035: Ornamental connection



Appendix V.g Signal Upper Connection Types

This matrix sorts all signal upper connection types in numerical order by type.

Type	Description	Page
100	Single arm, 4 bolt connection to simplex plate	222
101	Single arm, 6 bolt connection to simplex plate	222
102	Single arm, 4 bolt connection to simplex plate with welded stiffener	223
103	Single arm, 3 U-bolt connection	223
104	Single arm, box connection	224
105	Single arm, welded-clamped connection	224
106	Single arm, 3 bolt connection	225
107	Single arm, 4 bolt connection to wide simplex plate	225
108	Single arm, angled weld directly to column, with or without vertical pole on top	226
109	Quad arm, clamped connection	226
110	Double arm, clamped connection	227
111	Single arm, 4 bolt connection to simplex plate with welded bracket stiffener	227
112	Single arm, butterfly clamped connection	228
113	Single arm, circular welded connection	228
114	Double arm, 4 bolt connection to simplex plate	229
115	Double arm frame	229
116	No longer used, see Type 113	230
117	Single arm, welded-clamped connection, with stiffeners	230
999	Unknown	-



Type 100: Single arm, 4 bolt connection to simplex plate



Type 101: Single arm, 6 bolt connection to simplex plate



Type 102: Single arm, 4 bolt connection to simplex plate with welded stiffener



Type 103: Single arm, 3 U-bolt connection



Type 104: Single or multi arm, box connection



Type 105: Single arm, welded-clamped connection



Type 106: Single arm, 3 bolt connection



Type 107: Single arm, 4 bolt connection to wide simplex plate



Type 108: Single arm, angled weld directly to column, with or without vertical pole on top



Type 109: Quad arm, clamped connection



Type 110: Double arm, clamped connection



Type 111: Single arm, 4 bolt connection to simplex plate with welded bracket stiffener



Type 112: Single arm, butterfly clamped connection



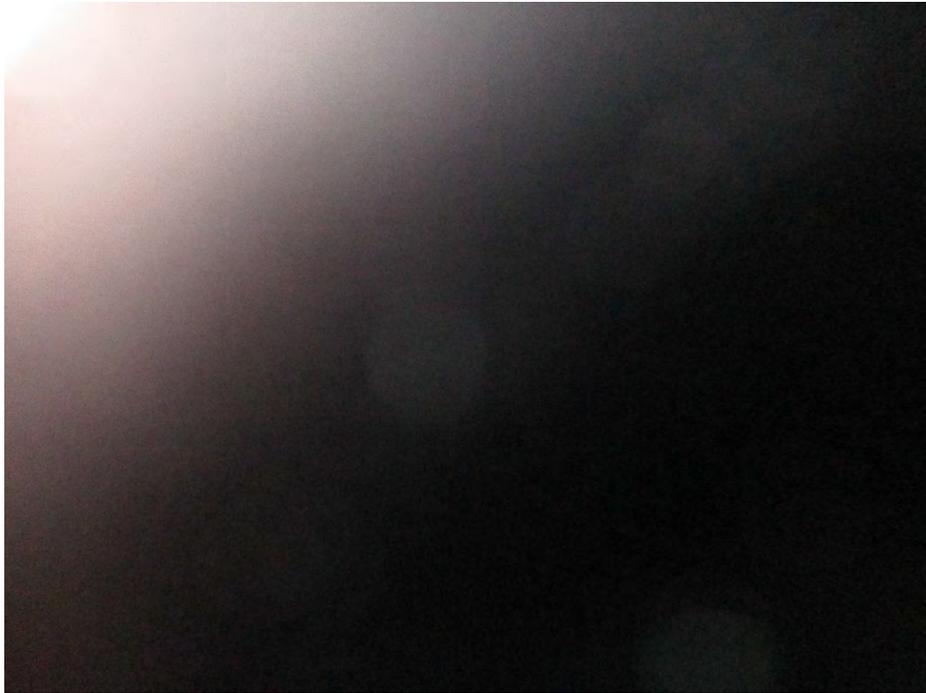
Type 113: Single arm, circular welded connection



Type 114: Double arm, 4 bolt connection to simplex plate



Type 115: Double arm frame

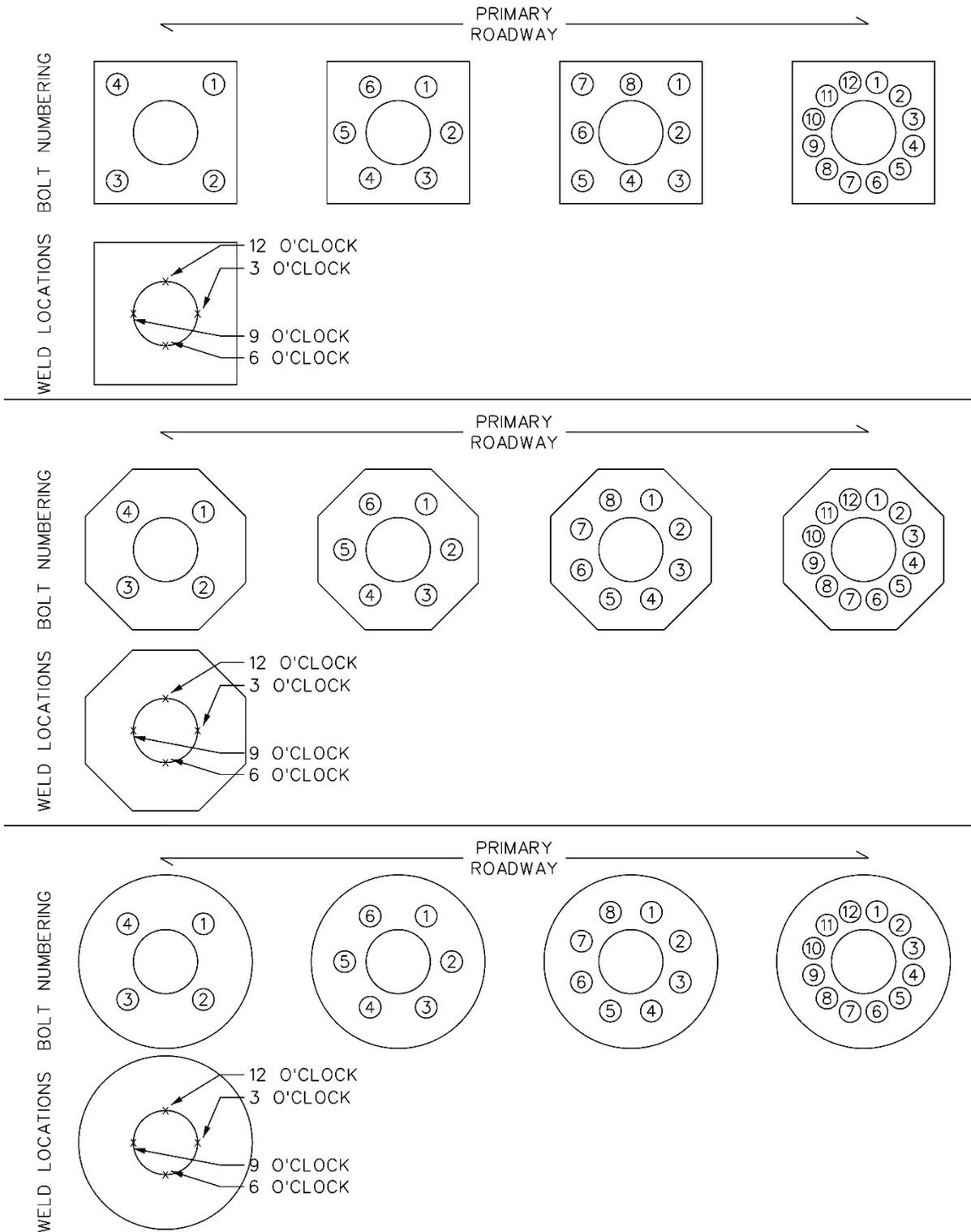


Type 116: No longer used, see Type 113

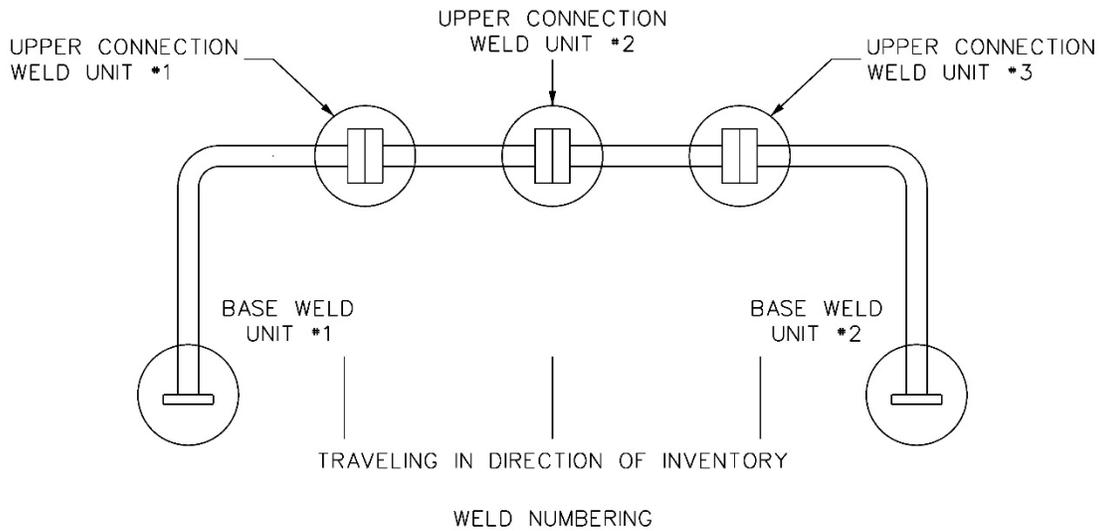
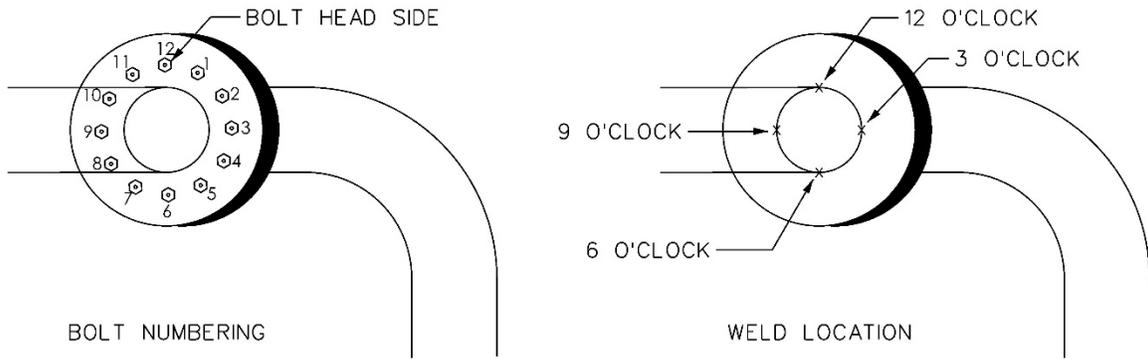
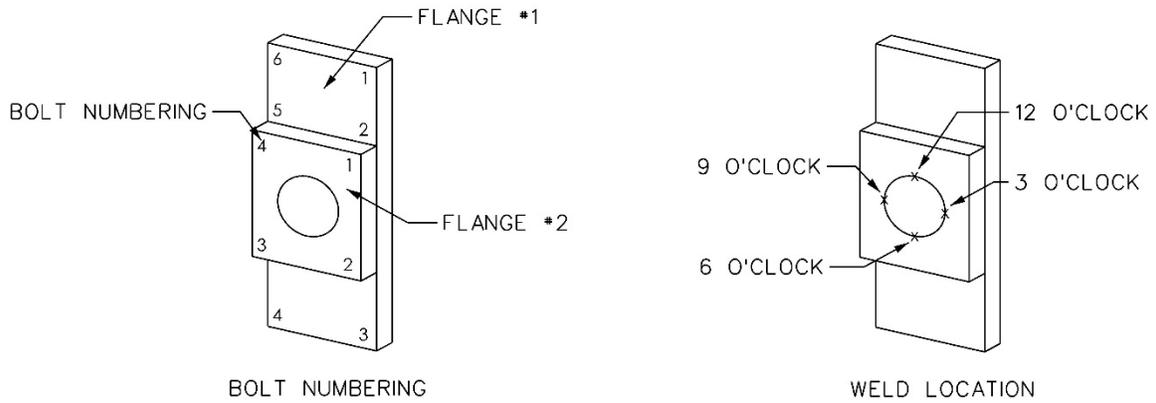


Type 117: Single arm, welded-clamped connection, with stiffeners

Appendix VI Anchor Bolt Numbering



Appendix VII Connection Bolt and Weld Numbering





Appendix VIII Templates

Appendix VIII.a ERF Template

COMPANY LOGO

ERF Memo

<p>To: CDOT Project Manager Title</p> <p>Additional CDOT Personnel Title</p> <p>Colorado Dept. of Transportation 2829 W. Howard Place Denver, CO 80204</p> <p>Project: Contract Routing #: ## XXX XX ##### SAP PO#: #####</p>	<p>From: Name Title</p> <p>Consultant Street Address City, State, Zip</p> <p>Date: M/D/YYYY</p>
---	---

Reference: STR NUMBER - ESSENTIAL REPAIR FINDING (ERF)

The documentation below identifies the field evidence and background information for the ERF. Please review the information herein including attachments as applicable.

Structure: STR NUMBER **Region:** X **Mile Post:** XXX.XXX

Structure Type:
Feature Intersected:
Location:
Latitude/Longitude:
Previous Inspection Date:
Previous Inspection Frequency:

Previous Rating: 62:

Proposed Rating: 62:

Proposed Inspection Frequency:

Description of ERF:

Recommended Maintenance:

- Rehabilitation
- Replacement

LONG DATE

Page X of X



COMPANY LOGO

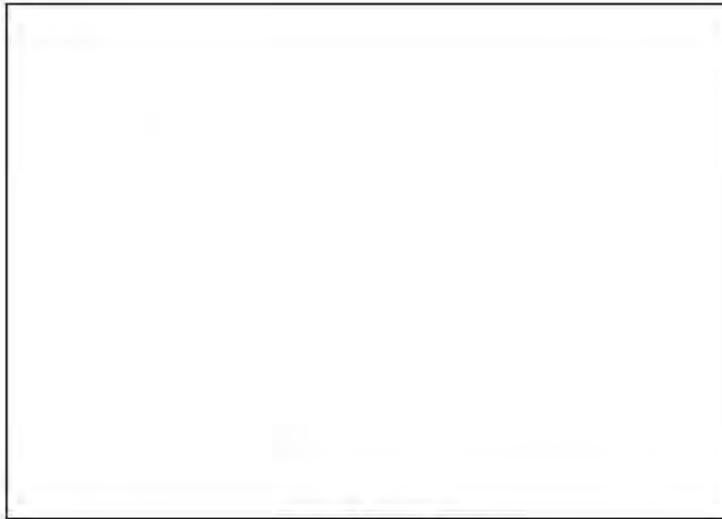


Photo Description

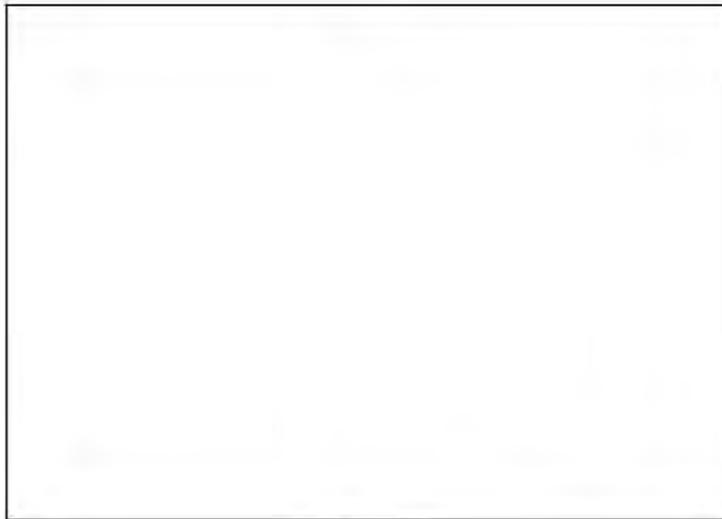


Photo Description

Please review the included and attached documentation (if applicable) for the above structure.

Name
Title

LONG DATE

Page X of X



Appendix VIII.b IAF Template

COMPANY LOGO

Inaccessible Memo

<p>To: CDOT Project Manager Title</p> <p>Additional CDOT Personnel Title</p> <p>Colorado Dept. of Transportation 2829 W. Howard Place Denver, CO 80204</p> <p>Project: Contract Routing #: ## XXX XX ##### SAP PO#: #####</p>	<p>From: Name Title</p> <p>Consultant Address City, State, Zip</p> <p>Date: M/D/YYYY</p>
---	--

Reference: STR NUMBER - INACCESSIBLE STRUCTURE

The documentation below identifies the field evidence and background information for the inaccessible structure. Please review the information herein including attachments as applicable.

Structure: STR NUMBER **Region:** X **Mile Post:** XXX.XXX

Structure Type:
Feature Intersected:
Location:
Latitude/Longitude:
Previous Inspection Date:
Previous Inspection Frequency:

Previous Rating: 62:

Reason for Inaccessibility:

Recommended Maintenance:

LONG DATE

Page X of X



COMPANY LOGO

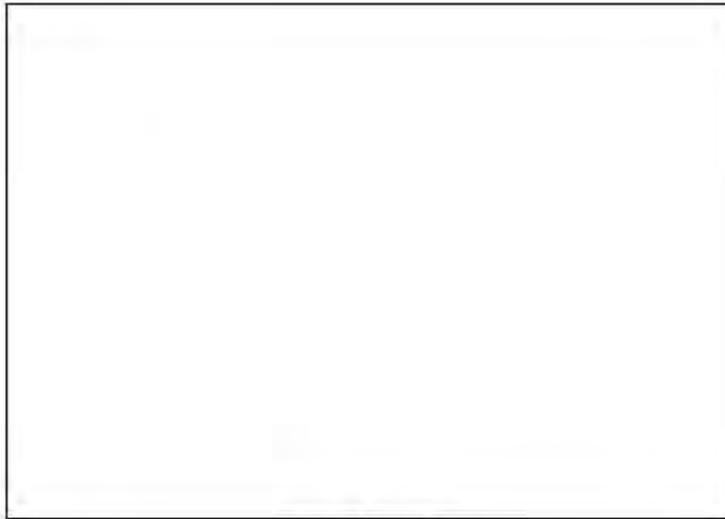


Photo Description

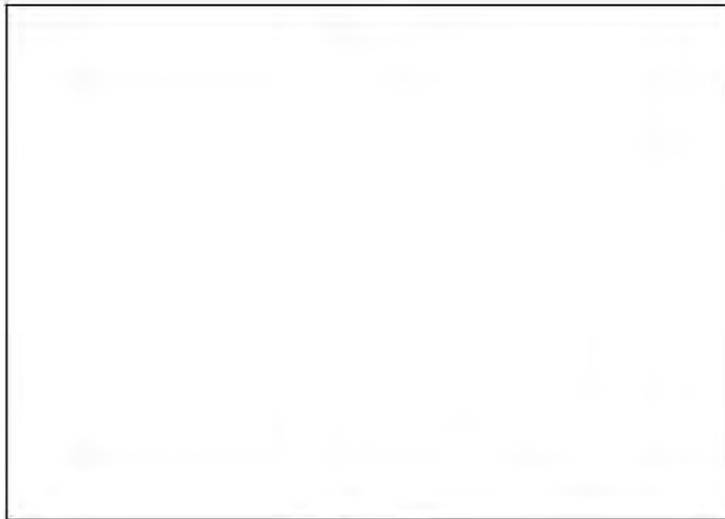


Photo Description

Please review the included and attached documentation (if applicable) for the above structure.

Name

Title

LONG DATE

Page X of X