This Manual of Bridge Inspection has been prepared in accordance with the provisions of Section 5501.23 of the Revised Code of the State of Ohio which became effective June 11, 1968, and in compliance with the National Bridge Inspection Standards, published as a Notice in the Federal Register, Volume 36, No. 81, page number 7851, on Tuesday, April 27, 1971. These State and Federal requirements provide for regular and systematic inspection of bridges on or over public highways and streets in the interest of public safety and protection of the public investment in such structures.

These requirements establish the areas of responsibility of various authorities regarding inventory requirements, frequency of inspection, qualifications of inspectors, and recording of inspections. Section 5501.23 of the Revised Code provides for the preparation of this manual to establish standards and procedures for inspectors representing the several authorities of the State charged with the responsibility of bridge inspection.

J. Phillip Richley, Director

Bridge Inspection Manual
Ohio Department of Transportation
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Acknowledgments

The following publications were used as a guide in preparing this manual and their use as a reference by Bridge Inspectors is recommended.

"Manual for Maintenance Inspection of Bridges, 1970"


1.1 Objectives. The purpose of systematic periodic bridge inspections and supplemental inspections immediately following any natural or accidental occurrence which might lessen the integrity of a bridge is to:

(1) Provide an information base for immediate action to limit use of or close to traffic any bridge which is revealed by inspection to be hazardous to public safety.
(2) Determine the extent of any weakness or structural damage, critical or minor, resulting from normal deterioration or any other cause.
(3) Enable bridge maintenance, repair or replacement to be programmed more effectively through early detection of structural deficiencies by which the public investment in the highway system will be safeguarded and repair cost minimized.

Thorough inspection and careful analysis of the facts obtained by the inspection will disclose the true condition of a bridge, but only adequate maintenance will guarantee uninterrupted traffic flow with maximum safety. The latter actually is the ultimate goal of any bridge inspection program.

1.2 Definitions. The following definitions shall apply as used in this Manual:

Bridge: Any structure, including supports, of 10 feet or more clear span or 10 feet or more in diameter on, above or below a highway. The span of all bridges shall be measured along the centerline of the highway.

Multiple cell culverts under a fill with a distance of 10 feet or more between extreme ends of openings, measured normal to the axis of the culvert, including multiple pipes where the clear distance between openings is less than half of the diameter of the smaller opening, shall be regarded as a bridge.

Highways: Those highway systems named in Section 5535.01 of the Revised Code, highways, streets and roads within municipalities, and any other highway, street, and road used for public conveyance.

Inspection: The detailed physical examination of a structure, using such tools and instruments as are necessary to determine the actual condition of the various elements that make up the structure, and recording the information on approved forms.

Maintenance: The preservation and upkeep of a bridge, including all of its appurtenant facilities, in its original condition or as subsequently improved, insofar as practicable.

Measurement: Checking location, dimension, size and shape of all members of a bridge, including all of its appurtenant facilities, to determine if there has been movement, distortion, deterioration, or other change in the structure.
Responsibility For Inspection

2.1 State Highways (Section 5501.23 RC). The Director of Transportation is responsible for inspection of all bridges on the State Highway system inside and outside of municipalities, all bridges connecting Ohio with another State for which the Department has inspection authority, and all other bridges or portions of bridges for which responsibility for inspection is by law or agreement assigned to the Department, except where such responsibilities are by agreement transferred to another authority. The Director shall inspect any bridge on a highway, with a designated representative of the owner, where he has reason to believe that the report of inspection does not reflect the condition of such bridge or that the inspection did not accord with the standards contained in the manual of bridge inspection.

2.2 County Highways (Section 5543.20 RC). The County Engineer shall inspect all bridges or portions thereof on the County highway system inside and outside of municipalities, bridges on township roads, and other bridges or portions of bridges for which responsibility for inspection is by law or agreement assigned to the County, except where such responsibilities are by agreement transferred to another authority. If the responsibility for inspection of a bridge is not fixed by law or agreement and the County performs the largest share of maintenance on a bridge, inspection shall be made by the County Engineer.

2.3 Township Roads (Section 5543.20 RC). The County Engineer shall inspect all bridges or portions thereof on Township roads. The Board of Township Trustees is not prohibited from inspecting bridges within a Township.

2.4 Municipal Roads and Streets (Section 723.54 RC). The legislative authority of a municipality shall designate a municipal official to have responsibility for inspection of all bridges or portions thereof within such municipality, except for bridges on the State highway system and the County highway system. The municipality is not prohibited from inspecting any bridge within its limits.
3.1 Bridge Inventory. Each political subdivision responsible for the inspection of bridges shall maintain a complete inventory of all bridges for which it has responsibility for inspection except that municipalities shall maintain an inventory of all bridges within (or partially within) the municipality. The inventory shall contain a complete material and dimensional description of the bridge; the structure type, span(s), overall and detailed dimensions, load carrying capacity, date of construction, and other pertinent data, including a description of any repairs or alterations made subsequent to initial construction.

The inventory shall name the political subdivision, commission, or company responsible for inspection, and the party responsible for or the parties sharing in the maintenance.

The legal authority for both inspection and maintenance responsibilities shall also be listed.

All structures located on Federal-aid Systems shall have an Inventory and Appraisal Form, completed and filed with the Bridge Inventory Engineer, Department of Transportation, Division of Highways.

3.2 Bridge Inspection Report. The Inspection report for a bridge shall be prepared by the inspector during examination of the bridge at the site. The reporting Form BR-86, Appendix A, complete with all inspection notations comprises the Bridge Inspection Report. This report should be sufficiently complete that it can be ascertained from the information by analytical procedures whether or not loads currently permitted can be allowed to continue to operate over the structure with safety until the time of the next scheduled inspection. If possible, the report should be complete enough to enable preparation of plans for minor maintenance work which the inspection discloses to be needed.

Each structure shall be classified and numbered, where applicable, using the coding nomenclature as set forth in Appendix B. This numbering and classification provides a uniform nomenclature for all governmental agencies inventorying and inspecting bridges and systemizes the classification information to permit rapid assemblage by data processing equipment of any summary report which may become necessary.
5.1 Qualifications. The inspector shall be a registered professional engineer who has expertise in the field of bridge design, construction, and maintenance, or a technician who has general knowledge of structural behavior, experience with bridges, attended a bridge inspectors training course, and who works under the direct supervision of a professional engineer qualified to perform inspections.

5.2 Skills. The inspector should be capable of climbing structural steel without difficulty. He should have the ability to letter legibly and to read bridge plans, visualize details, draw technical sketches, and operate a camera. He should possess a mechanical aptitude and a working knowledge in the use of measuring devices such as rules, tapes, protractors and calipers. The inspector should have an awareness of potential hazards and exhibit a serious attitude toward safety precautions to be taken while climbing and inspecting bridges. The inspector must approach each task critically and with the proper motivation to do a good job. He is relied upon to guarantee public safety and to protect public investment with respect to bridges.

5.3 Equipment. The inspector should be equipped with pocket tapes, folding rules, 50 ft. tape, calipers, chipping hammer, scraper, sounding line, binoculars, camera, safety lines, small magnifying glass, small mirror, flashlight and marking equipment.

Difficulty of access to any portion of the structure should not be allowed to prevent a thorough inspection. However, the inspector should not unnecessarily jeopardize his safety, but should arrange for ladders, scaffold and assistance as he deems necessary.

6.1 Periodic Inspections. Each bridge shall be inspected at least once each year.

6.2 Special Inspections. Any bridge experiencing known or suspected damage as a result of collision, fire, major flood, earth shift, or other cause shall be inspected as soon as conditions permit. When it is evident that such damage is localized, only the damaged portion need be inspected.
7.1 General. The field investigation of a bridge should be conducted in a systematic and organized procedure that will be efficient and minimize the possibility of any item being overlooked.

During the initial inspection of a structure, the Bridge Inventory Data (Section 3.1) should be checked in the field to reflect the “as built” conditions. Before making subsequent inspections the previous Bridge Inspection Report (Section 3.2) should be reviewed to ascertain extent of previous deficiencies that may have progressed sufficiently to require immediate attention.

Deteriorated or damaged members which might establish the load carrying capacity of the bridge should be measured for loss of section and evaluated for condition. The measurements and physical evaluation should be in sufficient detail to enable an engineer to calculate the probable strength of the member.

The items listed in Section 8.2 through Section 8.9, should be used as a guide to assure reasonably complete inspections, but the inspector is cautioned that the list may not be complete and that the inspection should not be restricted by it.

The report should not be regarded as a check list.

Inasmuch as the report provides space for evaluation by code of the frequently encountered principal structure members or elements only, other items to complete the inspection should be described on the back of the report. In addition to the code evaluation, a work description should be used to describe any defect or damage.

7.2 Materials. To ascertain the extent of deterioration, materials of construction should be examined as follows:

7.2.1 Concrete. Concrete surfaces should be examined for spalling, scaling, cracking, inadequate cover or exposure of reinforcement, loss of section or broken reinforcement, and other defects.

7.2.1.1 Scaling. The gradual and continuing loss of surface mortar and aggregate.

7.2.1.2 Spalling. The separation and removal of a portion of the surface concrete revealing a fracture roughly parallel, or slightly inclined to the surface.

7.2.1.3 Cracks. A Crack is a linear fracture in the concrete and may extend partially or completely through a member. Cracks are classified as transverse, longitudinal, diagonal, pattern or map, D-cracking, or random. Excess cracking at area of maximum moment or any shear cracking should be noted.

7.2.2 Steel. Structural steel should be examined for rust, cracks, bends or kinks, and stress concentrations. Connections and connectors should be carefully examined for proper functioning. Inspect structural steel partially encased in concrete at the face of exposure for deterioration and movement.

7.2.2.1 Rust. The decomposition of steel by oxidation from exposure to air moisture, deicing agents and industrial fumes. Areas of severe rusting should be cleaned and measured for loss of section.

7.2.2.2 Cracks. Cracks in structural steel may vary from hairline to complete fractures. Any type of crack is obviously serious and should be reported immediately. Welds and base metal in regions of stress reversal should be examined closely for evidence of fatigue cracking. Look for cracks radiating from cuts or notches.

7.2.2.3 Bends and Kinks. These conditions develop because of damage arising from thermal strain, overload or collision. Note the members damaged, the type, location, extent of damage and amount of deformation.

7.2.2.4 Stress Concentrations. Observe the paint film around connections for fire cracks which are indications of large strains due to stress concentrations. Be alert for sheared or deformed bolts and rivets and fractured welds.

7.2.3 Timber. Timber should be examined for decay, crushing, splitting, insect damage and condition of connections.
7.2.3.1
Decay. Damage from decay may not be visible at the surface as it can be confined to the interior of the member. Check around connections, splices, bolt holes and other areas where moisture can penetrate.

7.2.3.2
Crushing and Splitting. Damage caused by collision or overloads.

7.2.4
Stone. Stones should be examined for cracks, spalls, crushing, splitting, displacement or other deterioration. Mortar joints should be checked for cracking and to see that the pointing is in good condition.

7.3
Condition Rating. The inspector should use his best judgment in rating the condition of an item. He should analyze the effect of the individual item in its relationship to the safety of the traveling public, the integrity of the structure, to other items and the amount of repair necessary to restore the member to good condition.

7.3.1
Individual Items. Individual items shall be rated by the inspector at the site using the following code:
(1) Good Condition — No repair required.
(2) Fair Condition — Minor deficiency, item still functioning as designed.
(3) Poor Condition — Major deficiency, item in need of repair to continue functioning as designed.
(4) Critical Condition — Item no longer functioning as designed.

7.3.2
Summary Items. Items 8, 36, 44, 48, 52 and 60, are summary items to be rated by the reviewer after careful analysis of the inspectors report using the following codes:
(9) New condition
(8) Good condition — No repair necessary
(7) Minor items in need of repair by maintenance forces
(6) Major items in need of repair by maintenance forces
(5) Major items in need of repair by contract
(4) Minimum adequacy to tolerate present traffic, immediate repair or rehabilitation required
(3) Inadequate to tolerate present heavy loads warrants closing the bridge to trucks
(2) Inadequate to tolerate any live load warrants closing the bridge to all traffic
(1) Bridge repairable, if desirable to reopen to traffic
(0) Bridge beyond repair

7.3.3
General Appraisal. Item 66 to be rated by the reviewer indicating an appraisal of the structure condition using the following code:
(9) New condition
(8) Good condition — No repair necessary
(7) Good condition — Housekeeping necessary
(6) Good condition — Preventative maintenance required
(5) Fair condition — Minor repair necessary
(4) Minimum tolerable limits, repair or rehabilitation required
(3) Basically intolerable condition high priority repair
(2) Basically intolerable condition high priority replacement
(1) Immediate repair necessary to put back in service
(0) Immediate replacement necessary to put back in service
8.1 General. The following elements or members of one or more of the aforementioned materials are common to most bridges and should be inspected individually and the type and condition recorded. The elements or members listed may not be complete for every structure and the inspection should not be limited to these items.

8.2 Deck. The primary function of the bridge deck is to provide a riding surface and to transmit the wheel loads to the supporting members.

8.2.1 Floor. The floor slab is the primary load carrying member of the deck and should be inspected top and bottom for evidence of leakage, deterioration, and structural inadequacy.

Type Code.
1. Reinforced Concrete
2. Laminated Timber Strip
3. Timber Plank
4. Filled Steel Grid
5. Open Steel Grid
6. Corrugated Steel Plate
7. Steel Buckle Plate
8. Steel Checker Plate
9. Steel Jack Arch
10. Other

8.2.2 Wearing Surface. The primary function of a wearing surface is to provide a smooth riding surface and to protect the underlying floor. It should be examined for smoothness, cracks, drainage, debris and signs of deterioration.

Type Code.
1. Concrete
2. Asphalt
3. Block or Brick
4. Open Grid
5. Wood Plank
6. Asphalt with Known membrane
7. Other

8.2.3 Curbs & Sidewalks. Curbs and sidewalks do not contribute to the structural strength of a bridge. They are provided mainly for safety and pedestrian protection. They should be examined for deterioration, security of connection and hazards to pedestrians.

Type Code.
1. Concrete
2. Steel
3. Timber
4. Other

8.2.4 Median. The primary function of a median is to separate oncoming traffic traveling in the opposite direction. It may be level or raised and may or may not have barrier guard rail. It may be closed or have an open expansion or construction joint. Examine for deterioration, damage and security of connection of the guard rail.

8.2.5 Railing. Safety is the primary function of railings and they should be sufficient to protect both pedestrians and vehicles. Examine for deterioration, damage, security of connections and safety hazards.

Type Code.
1. Reinforced Concrete Parapet
2. Reinforced Concrete and Steel
3. Reinforced Concrete and Aluminum
4. Concrete Post & Steel Panel
5. Concrete Panel & Post
6. Steel Panel & Post
7. Steel Guard Rail
8. Timber
9. Other
8.2.6 Drainage. Effective drainage is essential for proper maintenance of a bridge. Examine the drainage system for clogging, ponding, deterioration and adequacy.

Type Code.
1. Over the side
2. Opening thru curbs or wheelguards
3. Scuppers with downspouts
4. Inlets with drain pipes
5. Drain trough under open joints
6. Other

8.2.7 Expansion Joints. Provide for the expansion and contraction of the bridge superstructure. Examine carefully for proper opening, leakage, anchorage, and deterioration.

Type Code.
1. Steel Finger Joint
2. Sliding Steel Plate or Angle
3. Compression Seals
4. Poured Joint
5. Open Joint
6. Other

8.3 Superstructure. The entire portion of a bridge which receives the deck loads and transmits the reaction therefrom to the substructure.

8.3.1 Beams or Girders. Longitudinal members transferring deck or floor system loads directly to substructure. Examine carefully for deterioration, loose connections, overloading, and damage.

Type Code.
1. Rolled Steel
2. Riveted Built-up Steel
3. Welded Built-up Steel
4. Concrete Tee Beam
5. Concrete Girder
6. Prestressed Concrete Box Beam
7. Prestressed Concrete I Beam
8. Timber
9. Other

8.3.2 Diaphragms or Crossframes. Secondary members in beam bridges placed to distribute stresses and improve rigidity. Examine for condition and security of connections.

8.3.3 Floor System. A system of joist and floor beams which transfers the deck load to the main girders or trusses. The joist are sometimes omitted on short panel lengths and the floor spans longitudinal between floor beams. Check all members for condition, alignment and security of connection. The end connection of floor beams on trusses is particularly critical where they are exposed to moisture and deicing chemicals.

8.3.3.1 Joist. The longitudinal member supporting the floor and framed into or on the floor beam.

8.3.3.2 Floor Beam. The transverse member which supports the joist or floor and transmits the load to the girder or truss.

8.3.4 Truss Members. A truss is a joined structure having an open built web construction whose members are generally under axial loading, i.e. tension or compression. The configuration of trusses varies widely; the members may be timber, built-up steel sections, rolled shapes, eyebars or rods and connected together with rivets, bolts, pins or by welding. Check each member for condition, alignment, overstresses, collision damage and security of connection.

8.3.4.1 Chords. The upper and lower longitudinal members of a truss extending full length and carrying the tensile or compressive forces of the internal resisting moments.

8.3.4.2 End Post. The end compression member of a truss, either vertical or inclined extending between chords, functioning to transmit the truss end shear to its end bearing.

8.3.4.3 Verticals. An intermediate web member of a truss extending vertically between chords. A vertical member in compression is commonly designated a post, while one in tension is designated a hanger.
8.3.4.4 Diagonals. An inclined intermediate web member of a truss extending between chords. Diagonals in tension are designated a tie, while one in compression is designated a brace or strut. A counter is a diagonal which functions only in tension when the span is partially loaded and shear stresses are opposite in sign to the normal conditions.

8.3.5 Bracing. A secondary system of members designed to distribute wind, dynamic and torsional loadings, prevent buckling of compression chords and give rigidity throughout the complete assemblage. Check all members for condition, alignment, collision damage and security of connection.

8.3.5.1 Lateral Bracing. A system of diagonal bracing in plane with the lower and top chord of a truss and bottom flange of girders.

8.3.5.2 Sway Bracing. A system of bracing in plane with the vertical members of a thru truss.

8.3.5.3 Portal. A heavy sway frame across the top of the end post of a thru truss to transmit the torsional and lateral forces thru the end post to the substructure.

8.3.6 Bearings. Bearings transmit and distribute the superstructure loads to the substructure, and they also permit the superstructure to undergo necessary movements without developing harmful significant stresses from temperature changes. Check all components of a bearing for deterioration, movement, alignment, contact, security of connection and lubrication where necessary.

8.3.6.1 Fixed Bearing. Fixed bearings resist longitudinal movement while permitting slight rotation of the superstructure.

8.3.6.2 Expansion Bearing. Expansion bearings permit both longitudinal movement and rotation of the superstructure.

Type Code.
1. Rollers
2. Rocker
3. Sliding
4. Elastomeric
5. Other

8.3.7 Arch. In general, any structure having throughout its length a curved shape. It may be elliptical, circular, parabolic or a combination of curves. The most common types are the Filled Spandrel Arch, Open Spandrel Arch, Open Spandrel Ribbed Arch and Thru Arch. Check all members for deterioration, alignment and signs of failure.

8.3.8 Suspension Bridges. A bridge in which the floor system and its incidental parts are suspended from cables or chains which are supported at two or more locations upon towers and are anchored at their extreme ends. Check all members carefully for deterioration, alignment, security of connections, movement or signs of distress.

8.3.9 Movable Bridge. Three basic types of movable bridges are Swing, Bascule and Vertical Lift. The basic structural elements will require normal inspection procedures for each member. Additional inspection will be required for the bridge machinery. All elements of the operating mechanism should be carefully checked for smoothness of operation, unusual noises, looseness in shafts, bearings and gears, excessive wear and proper lubrication.

Also check the operation of safety gates, barriers and warning signals for proper functioning and adequacy of warning.
8.3.10
Paint. Painting is the primary means by which steel is protected from corrosion and it is imperative that the condition of the paint film be thoroughly inspected. Careful examination of the paint may reveal other structural defects such as movement in joints and overloading of a member. Indicate the year of the last painting and condition of the paint film.

8.3.11
Live Load Response. Observe the bridge during the passage of heavy vehicles for excessive deflection, vibration, unusual noises and other indications of structural defects.

8.4
Substructure. The abutments, piers or other constructions built to support the span or spans of the superstructure and to receive and transmit the loads or reactions therefrom to the subsoil.

Material Code.
1. Stone
2. Concrete
3. Concrete & Stone
4. Timber
5. Steel
6. Steel & Timber
7. Steel & Concrete
8. Other

8.4.1
Abutment. A substructure supporting the ends of a single span or the extreme ends of a multispansuperstructure and, in general, retaining or supporting the approach embankment. Examine abutment for condition, movement, bulging, cracking and settlement.

Type Code.
1. Gravity
2. Cantilever
3. Solid Wall
4. Cellular or "U"
5. Stub - Gravity
6. Stub - Capped Pile
7. Integral
8. Pedestal
9. Capped Pile Bent
10. Other

8.4.1.1
Abutment Seat. Check bearing areas for cracking, spelling and other signs of failure. The edges are particularly critical under beams or bearing devices.

8.4.1.2
Backwalls. The topmost portion of an abutment above the elevation of the bridge seat, functions primarily as a retaining wall for the approach embankment. It may also serve as a support for the approach slab. Check backwalls for condition and space between beam ends which may indicate abutment movement or pavement pressure.

8.4.1.3
Wingwalls. Extensions of abutments to retain approach embankment. Check for condition and evidence of movement.

8.4.2
Pier. A substructure supporting the ends of the spans of a multispansuperstructure at an intermediate location between the abutments. Examine for condition, movement or settlement.

Type Code.
1. Gravity
2. Cantilever (Tee) — Open Panel
3. Cantilever (Tee) — Solid Panel
4. Pedestal
5. Capped Pedestal
6. Open Bent
7. Capped Open Bent
8. Capped Pile
9. Tower
10. Other

8.4.2.1
Pier Seat. See 8.4.1.1, Abutment Seat.

8.4.3
Fenders and Dolphins. Fenders and dolphins around piers or abutments protect the substructure against collision by vessels. They are designed to absorb the energy of physical contact with the vessel. Check for condition, damage and security of connection.
8.5 Culverts. A structure constructed entirely below the elevation of the roadway surface and having no part or portion integral therewith. Structures over 20 feet in clear span parallel to the centerline of the roadway are usually called bridges and structures 20 feet or less in clear span are usually called culverts even though they support traffic loads directly.

Check all culverts for deterioration, settlement, open joints, plugging, cracks or signs of movement.

Type Code.
1. Slab
2. Box
3. Pipe
4. Pipe—Arch
5. Pipe—Elliptical
6. Arch
7. Other

8.5.1 Alignment. Note alignment of culvert barrel with stream alignment and waterway adequacy.

8.5.2 Headwalls & End Walls. Check all culvert headwalls or end walls for deterioration, settlement, undercutting and signs of failure.

Type Code.
1. Concrete
2. Stone
3. Other

8.6 Channel. Waterways should be examined to determine whether any condition exists that could cause damage to the bridge, embankment or other areas surrounding the bridge. Note the alignment, protection and adequacy of all waterways.

Check for scour of stream beds and banks, sandbars or debris which could change the direction of flow, or other obstructions which could influence the adequacy of the waterway. Note the type and condition of all protection and spur dikes.

Type Code for Channel Protection.
1. Concrete
2. Stone
3. Sheet Piling
4. Piling
5. Rip Rap
6. Other

8.7 Approach. A smooth transition between approach pavement and the bridge deck is important in reducing the impact forces on the bridge and for driving safety.

8.7.1 Pavement. The approach pavement should be checked for condition, smoothness and driving safety.

Type Code.
1. Concrete
2. Bituminous
3. Other

8.7.2 Alignment & Grade. Note the effect of the alignment and grade of the approach pavement on impact to the bridge and safety to the vehicle.

8.7.3 Approach Slab. Note the condition, settlement or other signs of failure of the approach.

8.7.4 Relief Joints. Note the presence of and condition of relief joints in concrete pavements.
8.7.5
Guard Rail. Note the type and condition of the approach guard rail.
Type Code.
1. Steel Beam
2. Flexible Steel Plate
3. Steel Cable
4. Steel Tape
5. Timber Rail
6. Timber with Steel Cable
7. Other
8. None (If guard rail is needed code 4 in condition block.)

8.7.6
Embankment. Note the general condition of the approach embankment for indications of settlement, bulging, stream scour and saturation from entrapped water.

8.8
Navigation Lights. Determine whether all required navigation lights are operating and properly located. Examine the lighting fixtures for condition, visibility, electrical connections and security of attachment to insure uninterrupted service.

8.9
Warning Signs. All signs required to indicate restricted load limits, restricted width, restricted vertical clearance and reduced speed limits are to be inspected for legibility and condition, including any necessary advance warning signs.

8.10
Vertical Clearance. On all structures with restricted vertical clearance, measure and record the minimum vertical clearance in feet and inches. On structures with multiple openings, record the minimum opening and note on back of report the measurement of other openings.
Example:
Measured 14’-6”, Code 1406

8.11
Inspection Responsibility. Indicate by code the agency responsible for inspection.
Code.
1. State Highway
2. Other State Agency
3. County
4. Municipality
5. Federal
6. Railroad
7. Other Private
8. Combination
9. Unknown

8.12
Maintenance Responsibility. Indicate by code, the agency responsible for maintenance. Use the codes in 8.11.
9.1 State Highways. The District Deputy Director shall be responsible for inspection of all bridges prescribed in Sec. 2.1 that are within or contiguous to the District.

The District Highway Bridge Engineer shall:
(1) Perform, or supervise the inspector who performs, the inspection of each bridge except as set forth in Sec. 11.
(2) Prepare, or review and approve, each Bridge Inspection Report.
(3) Report immediately to the District Highway Operations Engineer concerning any structure for which the State has inspection or maintenance responsibility, which he believes to be an immediate danger to life and property, and requires emergency action. The report is to enable the Operations Engineer to provide quickly the necessary protection and to notify the Central Office Bureau of Maintenance of the situation. See Departmental Directive OP–17D and Supplement.
(5) Forward a copy of the Bridge Inspection Report to:
(a) Bridge Inspection Engineer, Bureau of Maintenance (original).
(b) Party or parties having responsibility for the maintenance when the State has no responsibility or shares responsibility for the maintenance.
(c) The legislative authority of each municipality in the District for each bridge in such municipality for which the State has inspection responsibility.

(6) Maintain a file of the current Bridge Inspection Reports.
(7) Revise the posting for reduced load limits, and the Bridge Inventory and Appraisal if any change is noted in the structure which warrants such action and send copies of records revised to Bridge Inventory Engineer, Bureau of Bridges.

9.2 County Highways. The County Engineer shall:
(1) Perform, or supervise the inspector who performs, the inspection of each bridge except as set forth in Sec. 11.
(2) Prepare, or review and approve, each Bridge Inspection Report.
(3) Report immediately to the Board of County Commissioners concerning any bridge, for which he has inspection or any maintenance responsibility, which is in a condition that he believes to be an immediate danger to life and property.
(4) Report to the Board not later than 60 days after his annual inspection (more frequently if the Board so requires) the following:
(a) The condition of all bridges he is required to inspect.
(b) The identity of any bridge that is in a condition which he believes to be a potential danger to life or property.

(5) Forward a copy of each pertinent Bridge Inspection Report to:
(a) The party or parties having responsibility for the maintenance when the County has no responsibility or shares responsibility for the maintenance.
(b) The Board of Township Trustees of each township for each bridge on the township road system of such township.
(c) The legislative authority of each municipality in the county for each bridge in such municipality for which the County Engineer has inspection responsibility.
(d) The Ohio Department of Transportation, Division of Highways, for each structure on the Federal-aid-Secondary System.

(6) Update the Bridge Inventory.

9.3 Township Roads. Inspection of bridges on Township roads is the responsibility of the County Engineer. See Sec. 9.2 and especially 9.2(5)(b).
9.4 Municipal Roads and Streets. The municipal official responsible for inspection of bridges shall:
(1) Perform, or supervise the inspector who performs, the inspection of each bridge except as set forth in Sec. 11.
(2) Prepare, or review and approve, each Bridge Inspection Report.
(3) Report immediately to the legislative authority concerning any bridge, for which the municipality has inspection or any maintenance responsibility, which is in a condition that he believes to be an immediate danger to life and property.
(4) Report to the legislative authority not later than 60 days after his annual inspection (more frequently if the authority so requires) the following:
(a) The condition of all bridges he is required to inspect.
(b) The identity of any bridge that is in a condition which he believes to be a potential danger to life or property.
(5) Forward a copy of each pertinent Bridge Inspection Report to:
(a) The party or parties having responsibility for maintenance when the municipality has no responsibility or shares the responsibility for maintenance.
(b) The Ohio Department of Transportation, Division of Highways, for each structure on the Federal-aid Secondary System.
(6) Update the Bridge Inventory.

Forms proposed for Bridge Inventory and Appraisal and Bridge Inspection Report are shown in the Appendix. These forms must be used for all structures on the Federal-aid System. The Director of Transportation may approve forms to be used in lieu of these forms for structures not on the Federal-aid System.
The Director of Transportation will assist and cooperate with governmental units in the development of inspection procedures upon written request.

The State, counties, and municipal corporations may contract with Consulting Engineers experienced in this field for inspection services. If such Engineers are retained to make the inspection, the work need not be supervised by the governmental authority so long as the inspection is made in conformance with this Bridge Inspection Manual, the findings are recorded on approved forms, and the Bridge Inspection Report is turned over to the authority for approval and processing.

If the inspection is performed by Consulting Engineers, and form BR-86, Appendix A, is used, the firm name is to appear in the "Reviewed by" blank.

Nondestructive testing (NDT) procedures provide a means by which the extent of cracks and flaws either on the surface or suburface can be detected. The use of NDT to examine structural members where damage is suspected, but cannot be seen, is advisable if the structure is vulnerable to complete collapse by failure of the suspect member. NDT also may be advisable for testing suspect members whose failure would render the bridge unable to carry traffic.

For steel members, radiographic techniques employed in conjunction with ultrasonic testing procedures likely will prove to be most effective. Magnetic particle inspection and dye penetrants also are useful in disclosing surface cracks and discontinuities and are, therefore, effective preliminary procedures. However, magnetic particle inspection in the field might prove to be impractical.

For concrete members the sonoscope, reinforcing steel indicator, rebound hammer, and sounding bar may be utilized.

Equipment for ultrasonic testing, radiography, and for examination with the sonoscope is relatively expensive, and considerable training in the techniques of testing is necessary to obtain satisfactory results. For this reason, the retention of a service company that specializes in such work probably will prove to be most economical where such NDT is deemed necessary.
The inspection of a bridge can provide no more than a record of current structural condition and, therefore, the inspection by itself is insufficient to guarantee continued safe service of the bridge. If the ultimate goal of the inspection program is to be achieved it becomes necessary to:

(1) Make a structural analysis of the bridge to ascertain its safe load capacity for its current condition.
(2) Restrict loads crossing the bridge so that its computed safe capacity is not exceeded.
(3) Perform all maintenance necessary to prevent a decline in the load capacity of the bridge or to increase the bridge capacity to an essential minimum level.

Safe load capacities should be calculated in accordance with Sec. 4 of "Manual for Maintenance Inspection of Bridges, 1970" published by the American Association of State Highway Officials*. Any structural member of a bridge reduced in effectiveness by damage or deterioration must, of course, be considered in this rating analysis.

Care should be exercised in selecting the allowable working stress for the material in older bridges because the values usually were lower than those of modern bridges.

### Bridge Inspection Report

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**Appendix A**

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### Bridge Inspection Report

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Appendix B

Bridge Inspection Report Coding Nomenclature

Structure File Number
This number is the key to processing all bridge data. It is the permanent identification number for the entire data file on any particular structure. The number consists of a seven (7) digit numeral, which is assigned by the appropriate control authority. The first two digits of the number is the numeric code for the Ohio county in which the structure is located. The next four (4) digits make up the specific number for that structure. The last or seventh digit is a computer calculated check number which has no particular sequence, but is an integral and necessary part of each file number. It is imperative that the Structure File Number be entered legibly and accurately so that data will be processed to the proper structure file. (See Bridge Inventory and Appraisal Coding Instructions for details.)

Bridge Number
The bridge number is made up of three separate parts, which are:

A three letter county or township abbreviation code, the complete route number description, and the unit number which consists of the bridge Straight Line mileage and any special designation codes for ramps, parallel structures, etc. (See Bridge Inventory and Appraisal Coding Instructions for details.) In particular, note that the route number description occurs in the instructions for "Inventory Route."

On divided highways with clearly separate and parallel structures for each direction of travel, each structure will carry the same Straight Line mileage designation, with the addition of the letter (L) for the left structure and (R) for the right or cardinal direction structure.

On divided highways, where the deck is continuous across both directions of travel and median (with a longitudinal joint near the center of the bridge) and where the type of superstructure is different in the two directions of travel, each side is considered a separate structure and shall be numbered (L) or (R) as previously described. If the superstructures are identical in both directions and the other above physical features exist, the bridge shall be considered as one structure and numbered accordingly.

Year Built
Record the year of construction and the latest year of major construction of the structure. Code the last two digits of the years in which construction or reconstruction of the structure was completed. A code of "00" in the first two positions should be used for years 1900 and earlier.

Example:
Built 1928, No reconstruction
Code: 2800
Built 1914, Reconstructed 1950
Code: 1460
Built 1898, Reconstructed 1948, 1964
Code: 0064
Bridge Type
Classification will be established by a three digit
code denoting the material, the overall type of
structure, and the special design configuration of
the main supporting member(s) of the
superstructure. The code shall be shown for the
main span(s) of a multispans structure.

1st Material
1  Concrete
2  Prestressed Concrete
3  Steel
4  Timber
5  Stone
6  Aluminum
7  Cast Iron
8  Wrought Iron
9  Other

2nd Type
1  Slab
2  Beam
3  Box Beam
4  Truss
5  Arch
6  Girder
7  Frame
8  Suspension
9  Culvert
0  Other

3rd Description
1  Simple Span
2  Continuous
3  Deck
4  Thru
5  Filled
6  Orthotropic
7  Moveable — Lift
8  Moveable — Bascule
9  Moveable — Swing
0  Other

Type Service
This classification is intended to show the type of
service on the bridge and the type of service under
the bridge using a three digit code.

The first digit indicates the route is on or under the
structure.
1  Route on structure
2  Route under structure

The second digit will indicate the type of service
on the structure.
1  Highway
2  Railroad
3  Pedestrian
4  Highway — Railroad
5  Highway — Pedestrian
6  Overpass structure at an interchange or second
   level of a multi-level interchange
7  Third level (Interchange)
8  Fourth level (Interchange)
9  Building, Plaza or industrial traffic
0  Other

The third digit will indicate the type of service
under the structure.
1  Highway
2  Railroad
3  Pedestrian exclusively
4  Highway — Railroad
5  Waterway
6  Highway — Waterway
7  Railroad — Waterway
8  Highway — Railroad — Waterway
9  Relief or industrial use
0  Other

Feature(s) Intersected
The name or names of the feature(s) intersected by
the route, abbreviated where necessary, to no more
than 25 characters.

All culverts designed to carry earth fill, including
filled arches up to spans of twenty feet, will be
coded as 195, 395, 495, or 595. All filled arches
over twenty-foot single span will be coded 155,
355, or 555.