

Chapter 2: Restrictions

Emergency Conditions

Immediate action shall be taken to ensure that the safety of the traveling public is maintained. The Team Leader on-site has the authority to make obvious emergency bridge or lane closures however they should reach verbal consensus with the Control Authority before closing a bridge or lane of traffic. The initial consensus may be verbal, however, it is recommended that confirmation or follow-up is made in writing.

Critical Findings

The following critical finding flowchart establishes **personnel** and **time frames** for reporting critical findings. Follow-up action shall be recorded by the Reviewer in the Structure Management System (SMS) Critical Finding Form during the normal inspection report approval/review process.

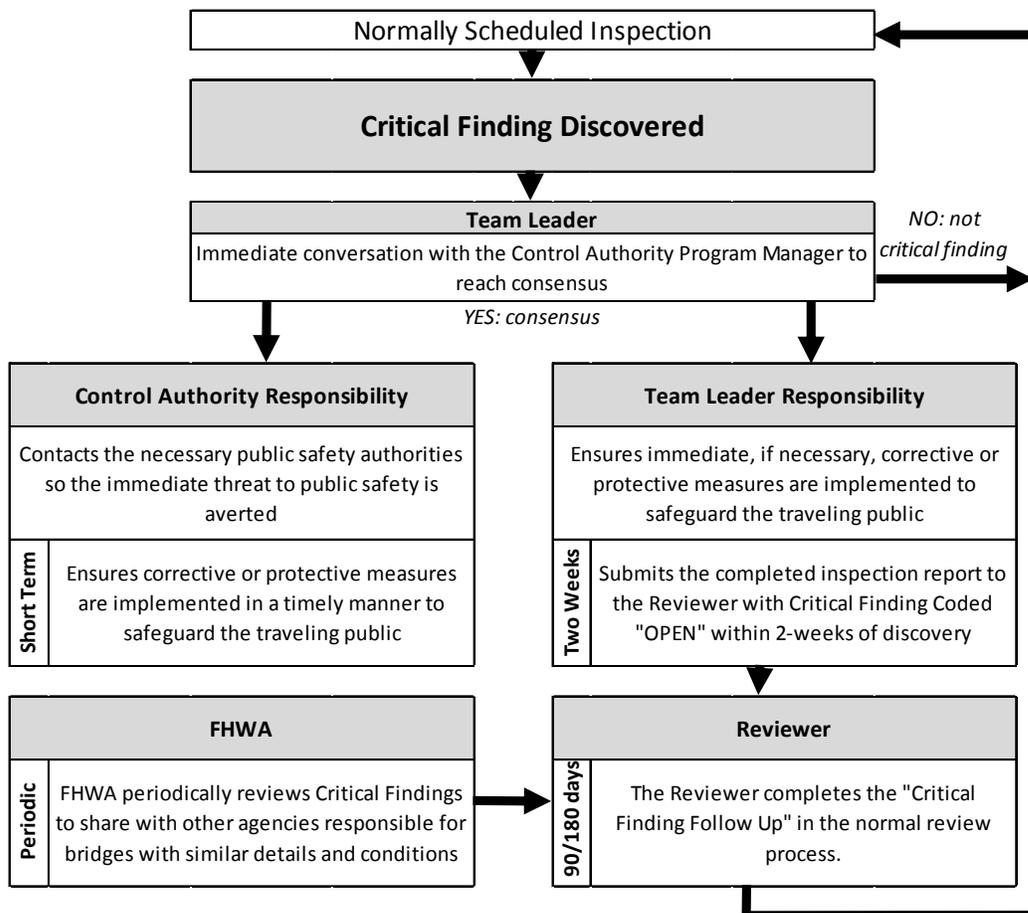


Figure 10 - Critical Finding Flowchart

Team Leader resets Critical Finding to "No Critical Finding Discovered" at the next scheduled inspection.

Critical Findings are situations discovered at a regularly scheduled inspection (Do not consider damage inspections that are discovered by the traveling public, law enforcement or anyone else other than a bridge inspector NOT during a normally scheduled bridge inspection). Critical findings include but are not limited to:

- Substantial problem (crack, tearing, missing connections, abrupt change in condition etc.) with a Fracture Critical Member
- Scour or Hydraulic problem

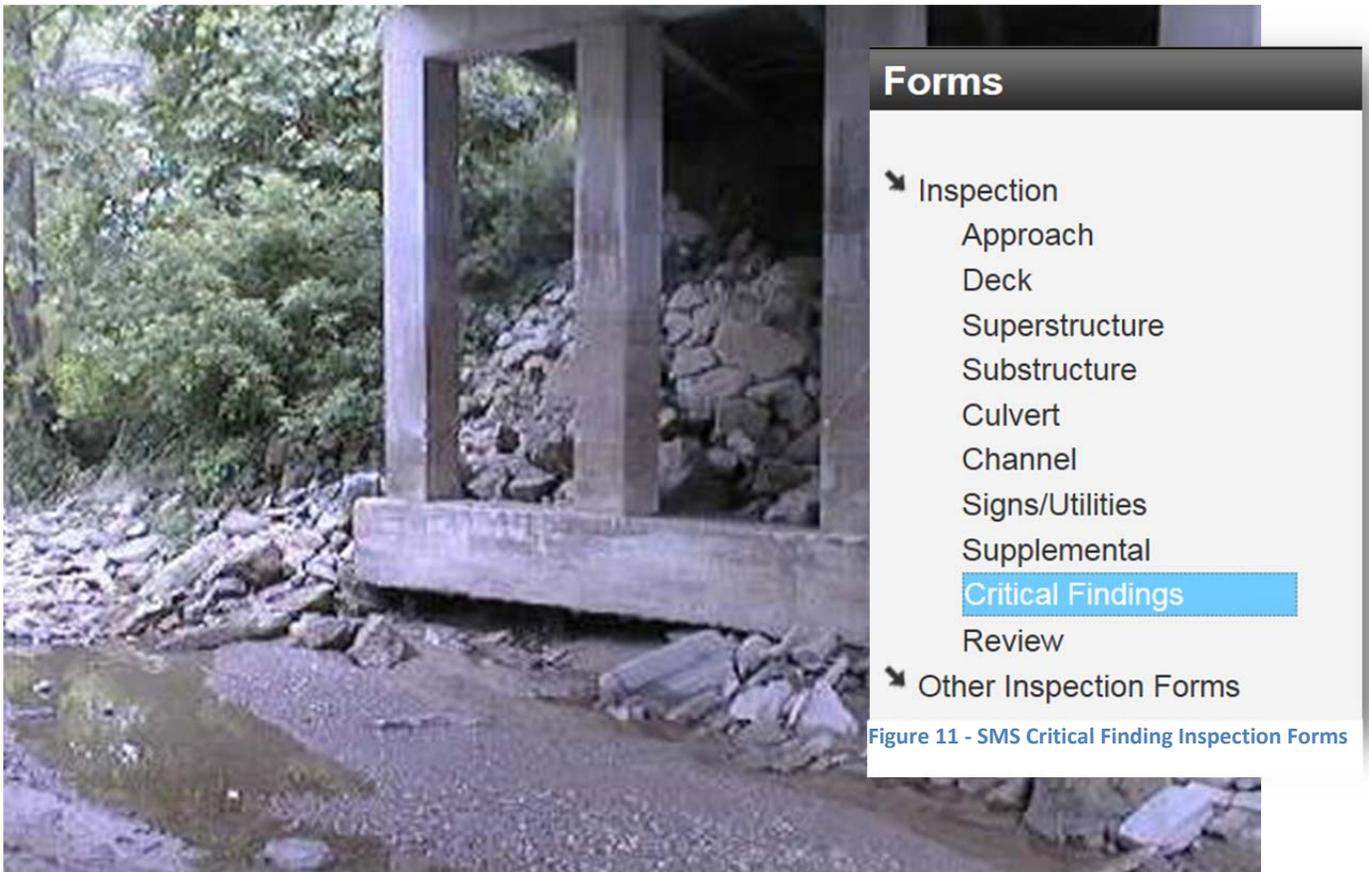


Figure 11 - SMS Critical Finding Inspection Forms

Figure 12 - Critical Finding of Undermined Pier

- Substantial traffic safety hazard
- Substantial reduction in Load Capacity OR
- A "2-Critical" Summary Condition rating (note that a "2-Critical" is generally associated with a safety or weight restriction on the bridge) that requires immediate protective or corrective action

Actions

When a bridge is no longer able to carry its intended loads, or an unsafe condition exists at the site, it is imperative to prevent further damage or collapse by controlling traffic on and/or below the bridge.

Protective or corrective actions will vary depending upon many factors. The remedy may involve several steps to regain the serviceability of the structure.

- Examples of appropriate "Immediate" actions may include, but are not limited to, any combination of the following:
 - Immediate permanent closure,
 - immediate temporary bridge or lane closure,
 - emergency repairs,
 - prohibiting trucks (fire trucks, buses etc.) from using the bridge or
 - establish interim inspection intervals.
- Examples of appropriate "Short Term" actions may include, but are not limited to, any combination of the following:
 - Load rating with posting for reduced loads,
 - Temporary shoring,
 - Emergency repairs,
 - Contract for permanent repairs,
 - Follow up inspections.

Load Rating

Each structure carrying vehicular traffic shall be rated, by or supervised by a Professional Engineer, to determine its safe load carrying capacity in accordance with Bridge Design Manual. If it is determined that the maximum legal load configurations exceeds the load allowed at the Operating Rating level, then the structure shall be posted for load restriction. There are four legal trucks that determine whether a structure is restricted for weight: 2F1, 3F1, 4F1 and 5C1. Load rating and posting data is regularly checked to assure bridges are properly posted to carry the maximum load determined by load rating. Any bridges found not to be able to carry at least 3 tons for any one of the 4 Ohio legal loads must be closed immediately and correctly entered into SMS.

OHIO LEGAL LOADS		
Load Designation	Load Configuration	Gross Weight
2F1		15 Tons
3F1		23 Tons
4F1		27 Tons
5C1		40 Tons

Table 29- Ohio Legal Loads

For an existing or in-service bridge, the bridge shall be load rated based on current dead loads and the last field inspection report. The current operating status, inspection comments, photographs, and condition rating of structural elements shall also be considered in the load rating. It is imperative that the actual field conditions are represented in the analysis. The inspector and the load rater must communicate the actual conditions explicitly and quantitatively.

The load rating of a bridge should be revised when

- A. Deterioration where capacity reduction is in question
 - There is a physical change in the condition of a structural member of the bridge
 - Rusting or damage to a slab, beam, girder or other structural element that has resulted in section loss
- B. There is structural damage to steel, like a hit by a vehicle, excessive deflection or elongation under temperature or highway loads
- C. When the inspection General Appraisal (GA) rating of the superstructure of a bridge drops below 5-Fair.
- D. There is an addition of a new beam or girder
- E. A new deck is added or the existing deck width is changed
- F. There is a change in the dead load on the superstructure (only when the change is more than 10 pounds per foot), like addition or removal of wearing surfaces 1" or more, addition or removal of sidewalks, parapets, railings, etc.

The load rating of a bridge does not need to be revised when:

1. The change in the thickness of external wearing surface is less than 1 inch [2.54 cm]
2. The change in the dead load on a beam member is not more than 10 pounds per foot.

Signage

Inspectors shall verify that the restriction signing is visible at the bridge site, correctly represented in the inventory and effective. To be effective, a traffic control device should meet five basic requirements:

1. Fulfill a need;
2. Command attention;
3. Convey a clear, simple meaning;
4. Command respect from road users; and
5. Give adequate time for proper response.

When the necessary information is not communicated to the traveling public or the posting recommended in



Figure 13 - Silhouetted Weight Limit Sign

the inventory by the load rating engineer is less than the actual field conditions i.e., no signs exist when a posting is recommended or the posting in the field does not match with the inventory, the inspector shall ensure proper action is taken as soon as possible. When the posting is correct but the sign is noncompliant or out-of-date with the OMUTCD inspectors shall not code B. Inspectors shall code the Operational Status “B” and the weight restriction signs shall be remedied at the bridge site **no later than 90 days from the date of discovery**. It will be the responsibility of the Program Manager (Reviewer of the Inspection Report) to verify that posting signs are in place and the inspector will update the Operational Status at the next regularly scheduled inspection.

Weight Limit sign shall be located in advance of the applicable section of highway or structure. If used, the Weight Limit sign with an advisory distance ahead legend should be placed at approach road intersections or other points where prohibited vehicles can detour or turn around.

The Weight Limit signs with one-tonnage number, for example R12-1, are not an option for bridges on State routes. Ohio requires a posting when, after rounding, any one of the four Ohio legal trucks’ has a rating factor less than 100%. When determining the tonnage that is placed on the R12-1 sign, the Load Rating Engineer shall first verify the truck configuration(s) that is(are) governing the posting requirement. Then, the engineer should use the first Legal Load % below 100%, starting with the 2F1 and moving down to the 5C1 truck, as the maximum tonnage to be allowed.



R12-1

Figure 14 - Weight Limit Sign (not permitted on State routes)

Discretion and engineering judgment must be applied in signing a lesser tonnage depending on site conditions and lane/bridge/deficiency configurations. Factors such as school, emergency and industry vehicles must be considered.

Weight Limit signs with silhouetted trucks are recommended, but not required, on local routes as they communicate the rating factor for each truck from the Load Rating Engineer to the traveling public.

State Bridges: Procedures for Posting Restrictions

Bridges shall be posted for weight restriction when, after rounding, the rating factor for any one of the four Ohio Legal Trucks drops below 100%. The bridge shall be closed for individual truck configurations when the rating factor for that specific truck drops below 30%. Bridges that are not capable of carrying 3-Tons GVW, for any truck, shall be closed to all traffic.

Truck	Gross Vehicle Weight (GVW)	All Bridges: At a minimum Post When Operating Rating Factor <100% (close Bridge when < 3T)	State Bridges: Close for Each Truck When The RF <30% (close the bridge when < 3T)
2 F1	15T	< 15T	< 4.5 T
3 F1	23T	< 23T	< 6.9 T
4 F1	27T	< 27T	< 8.1 T
5 C1	40T	< 40T	< 12.0 T

Table 30 - Rating Factors and Posting or Closing (Ref. BDM 900)

When the Operating Rating of the bridge is determined to be less than 100% of legal loads and the bridge cannot be strengthened immediately to a rating of 100% or above, the District Bridge Engineer shall establish a rating and submit to the Structure Rating Engineer in the Office of Structural Engineering, a written request for the bridge posting. The Load Rating Engineer shall prepare a memo for entry into the Director's journal. *The following minimum information is required on all State DOT post, rescind and change requests.*

A. Posting Request (Reduction in Load Limits)

- *County in which bridge is located*
- *Current Bridge Number*
- *Structure File Number*
- *Feature intersected (over or under bridge)*
- *Tonnage unit requested for the four typical legal vehicles*
- *Existing rating of bridge expressed as a percent of legal load or tons*
- *Explanation as to why posting is required*
- *Attach copies of all official documentation for any associated actions by involved agencies other than the state*

B. Rescinding Request (Removal of Existing Load Limits)

- *County in which bridge is located*
- *Current Bridge Number*
- *Structure File Number*
- *Feature intersected (over or under bridge)*
- *Existing posting (% reduction or weight limit currently in effect)*



Figure 15 - Bridge Must be Closed for loads less than 3T and fractions or decimals shall not be used.

- *Date existing posting was effective*
- *Explanation as to why posting restrictions can now be removed (show contract project numbers or indicate force account or other work method used to correct problem)*
- *New load rating for the rehabilitated or new structure*

C. Change Request (Revision of Existing Posted Limits)

- *County in which bridge is located*
 - *Current Bridge Number*
 - *Structure File Number*
 - *Feature intersected (over or under bridge)*
 - *Existing posting (weight limit currently in effect)*
 - *Revised posting request*
 - *Date of existing posting*
 - *Explanation as to why posting changed*
- After the Director, or his/her designee, signs the posting request, the District shall prepare, erect and maintain all necessary signs until the bridge is either strengthened or replaced.
 - After the posting request is signed, the Structure Rating Engineer shall send a copy to the: District Bridge Engineer; Manager of Hauling Permits Section of the Office of Highway Management; Superintendent of State Highway Patrol; Executive Director of Ohio Trucking Association; the Board of County Commissioners; and the County Engineer where the structure is located.
 - The District Bridge Engineer shall update all Bridge Inventory and Inspection records to show the latest official posted capacity.

Where posting of a bridge is deemed necessary and no unusual or special circumstance at the bridge dictates otherwise, Ohio standard regulatory signs shall be placed in sufficient numbers and at the specific locations in advance of the bridge and at the bridge.

- Bridge Ahead signs shall be erected at intersecting state roads located just prior to the bridge to allow approaching vehicles to by-pass the bridge or turn around safely with a minimum of interference to other traffic.
- Bridge Weight Limit signs shall be erected at each end of the structure.

Procedure for Rescinding Posting

When a posted bridge has been strengthened or replaced and no longer needs posting, the Program Manager shall forward to the attention of the Load Rating Engineer in the Office of Structural Engineering a written request to rescind the existing signed posting. The request shall include a complete statement of the reason for the action as specified.

The Structure Rating Engineer shall review the data submitted by the District Bridge Engineer and upon concurrence shall forward to the Director a request to rescind the posting. The Structure Rating Engineer shall distribute copies of the rescind notice.

Procedure for Changing Posting

Implementing a new posting and changing a posting are similar. There will be an additional step of rescinding the posting. These two steps are outlined previously in this chapter.

Procedures for Posting Restrictions on Locally-Owned Bridges

Local authorities in their respective jurisdictions shall place and maintain weight restriction signs in accordance with the OMUTCD to regulate, warn, or guide traffic (O.R.C. 4511.11). Bridges that are posted for weight restrictions must be in compliance or achieve timely compliance with the weight restriction signs in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

The purpose of weight restriction signs is to communicate regulation to the traveling public the bridges that, in accordance with standard engineering principles, are no longer capable of carrying legal loads.

The OMUTCD has a selection of signs (R5-2, R5-2a, , R12-1 through R12-4 and R12-H5) that entities may use to convey regulatory restrictions:

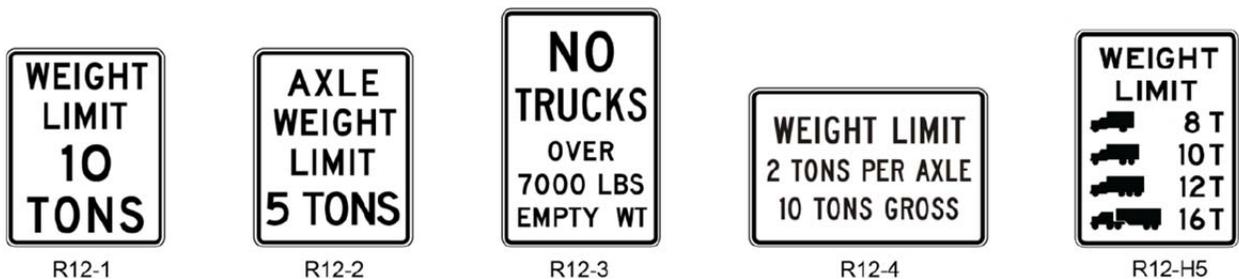


Figure 16 – Sign Examples from the OMUTCD 2B-29

In order to achieve timely compliance with the OMUTCD, Local authorities are to replace current non-compliant signs/series of signs when

- The bridge is replaced or strengthened; or
- The load rating of the bridge is revised; or
- The weight restriction sign is damaged, missing, or no longer serviceable for any reason (a non-compliant sign may be replaced in kind if engineering judgment indicates that one compliant sign in the midst of a series of adjacent non-compliant devices would be confusing to road users)

County engineers shall refer to the following are text from relevant ORC regulations:

5577.071 Reduction of weight of vehicle or load or speed on deteriorated or vulnerable

bridge. (A) When deterioration renders any bridge or section of a bridge in a county insufficient to bear the traffic thereon, or when the bridge or section of a bridge would be damaged or destroyed by heavy traffic, the board of county commissioners may reduce the maximum weight of vehicle and load, or the maximum speed, or both, for motor vehicles, as prescribed by law, and prescribe whatever reduction the condition of the bridge or section of the bridge justifies. This section does not apply to bridges on state highways.

(B) A schedule of any reductions made pursuant to division (A) of this section shall be filed, for the information of the public, in the office of the board of county commissioners in each county in which the schedule is operative. A board of county commissioners that makes a reduction pursuant to division (A) of this section shall, at least one day before a reduction becomes effective, cause to be placed and retained on any bridge on which a reduction is made, at both ends of the bridge, during the period of a reduced limitation of weight, speed, or both, signs of substantial construction conspicuously indicating the limitations of weight or speed or both which are permitted on the bridge and the date on which these limitations go into effect. No



Figure 17 – Example of % Reduced Sign. % Signs were Removed from the OMUTCD January 1, 1997

person shall operate upon any such bridge a motor vehicle whose maximum weight or speed is in excess of the limitations prescribed. The cost of purchasing and erecting the signs provided for in this division shall be paid from any fund for the maintenance and repair of bridges and culverts.

(C) Except as otherwise provided in this division, no reduction shall be made pursuant to division (A) of this section on a joint bridge as provided in section 5591.25 of the Revised Code unless the board of county commissioners of every county sharing the joint bridge agrees to the reduction, the amount of the reduction, and how the cost of purchasing and erecting signs indicating the limitations of weight and speed is to be borne. A board of county commissioners may make a reduction pursuant to division (A) of this section on a section of a joint bridge, without the agreement [of] any other county sharing the bridge, if the section of the bridge on which the reduction is to be made is located solely in that county.

5591.42 Carrying capacity of bridges - warning notice. The board of county commissioners together with the county engineer or an engineer to be selected by the board, or the director of transportation, may ascertain the safe carrying capacity of the bridges on roads or highways under their jurisdiction. Where the safe carrying capacity of any such bridge is ascertained and found to be less than the load limit prescribed by sections 5577.01 to 5577.12 of the Revised Code, warning notice shall be conspicuously posted near each end of the bridge. The notice shall caution all persons against driving on the bridge a loaded conveyance of greater weight than the bridge's carrying capacity.

Effective Date: 11-02-1989

Clearance

The Ohio Manual of Uniform Traffic Control Devices (OMUTCD) communicates ODOT policies, standards, guidelines, practices and procedures concerning the design, construction, operations and maintenance of various types of traffic control signing. The OMUTCD provides general information on the design of traffic control signs, including the basic concepts of shape and color. It provides specific information on the



Figure 18 - One Lane Bridge Sign

application of standard signs, location of signs, including height, lateral offset and longitudinal placement. The OMUTCD applies to all jurisdictions in the state.

Narrow and One-Lane Bridges

Narrow bridges on Highways shall be identified using the NARROW BRIDGE sign (W5-2) in accordance with OMUTCD Section 2C.14, and the ONE LANE BRIDGE sign (W5-3) shall be used at one-lane bridges in accordance with OMUTCD Section 2C.15.

The NARROW BRIDGE (W5-2) sign may be used on an approach to a bridge or culvert that has a clear width less than that of the approach roadway.

The ONE LANE BRIDGE (W5-3) sign should be used on low-volume two-way roadways in advance of any bridge or culvert:

- Having a clear roadway width of less than 16 feet; or
- Having a clear roadway width of less than 18 feet when commercial vehicles constitute a high proportion of the traffic; or
- Having a clear roadway width of 18 feet or less where the approach sight distance is limited on the approach to the structure

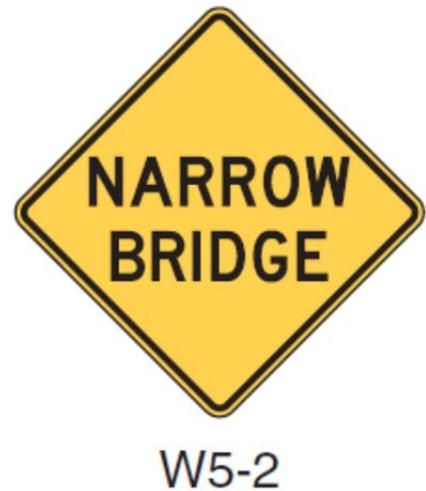


Figure 19 - Narrow Bridge Sign

OBJECT MARKERS (OM3) - Objects not actually in the roadway may be so close to the edge of the road that they need a marker to warn the driver of a potential danger. These include underpass supports, ends of bridges, handrails, and the concrete structure found at the end of a pipe. When used

for marking obstructions within the roadway or obstructions that are 8 feet or less from the shoulder or curb, the minimum mounting height, measured from the bottom of the object marker to the elevation of the near edge of the traveled way, should be 4 feet. When used to mark obstructions more than 8 feet from the shoulder or curb, the clearance from the ground to the



Figure 20 - Chevron Signs

bottom of the object marker should be at least 4 feet. OM3-L markers shall be placed on the Left of approaching traffic, OM3-C in the center for center obstructions and OM3-R shall be placed on the Right.

Vertical Clearance Restrictions

No vehicle shall exceed 13-feet and 6-inches vertical height (Ohio Revised Code reference for the vehicle height restriction ORC Section 5577.05(D)).

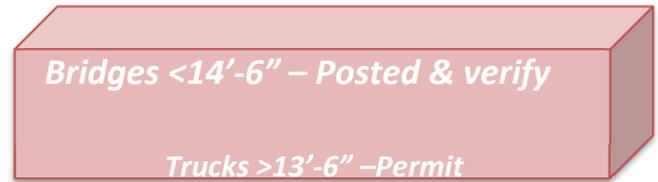


Figure 21 - 1-ft "No-Fly" Zone. Note 14'-6" moves up to 16' for certain routes.

Recommendations on Posting Low Clearance and Advance Warning Low Clearance Signs (note SMS data shall include the actual clearance rounded down to the nearest inch) are found in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) per ORC 4511.09 and 4511.11.

- All bridges, tunnels, overhead obstructions and openings for traffic that have the **actual minimum vertical clearance of 14'-6"** (4.4 meters) or less (rounded down to the nearest 1" or 25 mm) shall have Advance Warning Low Clearance signs (W12-2) and Structure-mounted low clearance signs (W12-2p) as per the



W12-2

Figure 22 - Vertical Clearance Sign

guidelines of the Traffic Engineering Manual (TEM) and OMUTCD Section 2C.27 to warn the road users. The actual clearance should be shown on the Low Clearance sign to the nearest 1 in not exceeding the actual clearance. However, in areas that experience changes in temperature causing frost action, a reduction, not exceeding 3 in, should be used for this condition.

- Ground posted Low Clearance signs (W12-2) may be used near the bridge in addition to Structure-mounted low clearance signs (W12-2p).
- All the Low Clearance signs (W12-2 & W12-2p) should display the same clearance height.
- Side Low Clearance signs (W12-H3) shall be used as per the guidelines of the TEM and Subtract 3" (75 mm) from the actual clearance (rounded down to nearest 1" or 25 mm) to display on the Low Clearance signs.



Figure 23 – Excessive Restriction Signing can be distracting

- On bridges, tunnels, overhead obstructions and openings for traffic, which have actual vertical under-clearance more than 14'-6" (4.4 meters) and get frequent hits or have special needs or if requested, Low Clearance signs per these guidelines may be used.
- Always input the actual clearance measurements in the respected SMS data fields, snowpack is included after the VC is recorded in SMS.

The Department's Permit Office relies on the bridge clearance information in the SMS for safe and uninterrupted operation. Bridge clearances shall be verified when performing routine inspections and updated accordingly.

(54) Minimum Vertical Clearance Under, Cardinal:	14.667	ft.	H - Highway beneath structure
(55) Minimum Lateral Clearance Under Right, Cardinal:	6.5	ft.	H - Highway beneath structure
(56) Minimum Lateral Clearance Under Left, Cardinal:	74	ft.	
(47) Minimum Horizontal Clearance On, Cardinal:	99.99	ft.	
(10) Minimum Vertical Clearance On, Cardinal:	99.99	ft.	

Figure 24 – SMS In-Progress Inspection Report > Review Form

UNDER CLEARANCES			
(325) Minimum Horizontal Clearance Under, Cardinal:	73	ft.	
(326) Minimum Horizontal Clearance Under, Non-Cardinal:	0	ft.	
(54) Minimum Vertical Clearance Under, Cardinal:	14.667	ft.	H - Highway beneath structure
(327) Minimum Vertical Clearance Under, Non-Cardinal:	14.583	ft.	
(328) Practical Maximum Vertical Clearance Under Bridge:	14.667	ft.	
(55) Minimum Lateral Clearance Under Right, Cardinal:	14	ft.	H - Highway beneath structure
(329) Minimum Lateral Clearance Under Right, Non-Cardinal:	14	ft.	
(56) Minimum Lateral Clearance Under Left, Cardinal:	6.5	ft.	
(330) Minimum Lateral Clearance Under Left, Non-Cardinal:	6.5	ft.	
ON CLEARANCES			
(47) Minimum Horizontal Clearance On, Cardinal:	74	ft.	
(335) Minimum Horizontal Clearance On, Non-Cardinal:	0	ft.	

Figure 25 - SMS Inventory > Clearances Form

Strategic Highway Network (STRAHNET)

The STRAHNET is a system of highways and connectors that provides defense access, continuity and emergency capabilities for movements of personnel and equipment in both peace and wartime. To meet the demands of military traffic on the Interstate System, ODOT has adopted FHWA standards for vertical clearance. A vertical clearance over the entire roadway width, including the useable width of shoulder, should be 16-feet (4.9 meters) for the rural Interstate. In urban areas, the 16-foot (4.9-meter) clearance is applied to a single route, with other Interstate routings in the urban area having at least a 14'-1" (4.3-meter) vertical clearance.