Federal Bridge Gross Weight Formula

The purpose of the Federal bridge weight formula is to protect bridges on the Interstate System by controlling the number and spacing of truck axles. For a step-by-step way to check vehicle weight and exceptions to the formula, go to **www.mcra.randmcnally.com** and download the Federal Bridge Gross Weight Formula page. It's available as a Portable Document Format (PDF) file.

The weight of groups of two or more axles must be checked against the bridge formula to ensure that they meet Federal weight limit requirements and that the allowable gross and axle weights are correlated with the spacing and number of axles to prevent severe overstressing of highway bridges. Compliance with bridge formula weight limits may require axle weights lower than the standard Interstate System weight limits of 20,000 pounds for a single axle and 34,000 for a tandem axle set. It may also require a gross weight lower than the standard 80,000-pound Interstate System limit. Weight allowed under the bridge formula can be increased up to these limits by adding axles or positioning them farther apart.

Since states may retain higher bridge formula weight limits than were in effect in 1975 (i.e., "grandfathered" bridge formula weight limits), the limits may be higher in some states than in others. Questions about the bridge formula can be directed to the Federal Highway Administration, Office of Freight Management & Operations, HOFM-1, 400 Seventh St., S.W., Washington, DC 20590.

Checking a vehicle

A tractor-semitrailer combination is used to illustrate a bridge formula check. The example vehicle has a 12,000-pound steering axle (axle 1), a 34,000-pound tandem axle set on the tractor (axles 2 and 3), and a second 34,000-pound tandem axle set on the trailer (axles 4 and 5).

Before beginning to check your vehicle, be sure that single axle 1 and any other single axle weight does not exceed 20,000 pounds, that tandem axles 2–3 and 4–5 do not exceed 34,000 pounds each, and that the gross vehicle weight does not exceed 80,000 pounds If these weight requirements are satisfactory, the following combinations should be checked as follows:

5-axle Tractor and Semitrailer
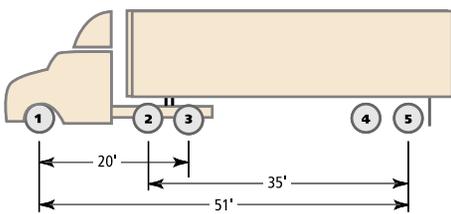
Axle 1 is 12,000 lb.
Axles 2, 3, 4, and 5 are 17,000 lb. each and show a spacing violation.

Check axles 1 through 3 using the illustration and table.

W (actual weight)
   = 12,000 + 17,000 + 17,000
   = 46,000 lb.
N = 3 axles
L = 20 feet
W maximum

$$= 500 \left(\frac{LN}{N-1} + 12N + 36 \right)$$

$$= 500 \left(\frac{20 \times 3}{3-1} + (12 \times 3) + 36 \right)$$

= 51,000 lb.

The actual weight of axles 1 through 3 in the example combination is 46,000 pounds so the bridge formula requirement is satisfied.

To use the Bridge Formula Table to obtain the maximum load allowed on axles 1–3, read down the left column (Distance in feet between…axles) to L = 20 and across the number of axles to the right to N = 3 (axles).

Now check axles 1 through 5 using the illustration and table.

W (actual weight)
   = 12,000+17,000+17,000+
     17,000+17,000
   = 80,000 lb.
N = 5 axles
L = 51 feet
W maximum from the table for L of 51 feet and N
of 5 axles = 80,000 pounds. This axle spacing is satisfactory.

Now check axles 2 through 5 using the illustration and table.

W (actual weight)
   = 17,000 + 17,000 + 17,000 + 17,000
   = 68,000 lb.
N = 4 axles
L = 35 feet
W maximum from the table for L = 35 feet and N = 4 (axles) = 65,500 pounds. This means the illustration shows a violation; the actual weight of 68,000 pounds exceeds the maximum allowable weight of 65,500 pounds for the given axle spacing. To correct the situation, some load must be removed from the vehicle or the 35-foot axle spacing must be increased.

Exception to formula

There is one exception to the use of the formula and table: two consecutive sets of tandem axles may carry a gross load of 34,000 pounds each—providing the overall distance between the first and last axles of such consecutive sets of tandem axles is 36 feet or more. For example, a 5-axle tractor-semitrailer may be used to haul a full 34,000 pounds on the tandem of the tractor (axles 2 and 3) and the tandem of the trailer (axles 4 and 5), providing there is a spacing of 36 or more feet between axles 2 and 5. A spacing of 36 feet or more for axles 2 through 5 is satisfactory for an actual W of 68,000 pounds even though the formula or table computes W maximum to be 66,000 to 67,500 pounds for spacings of 36 to 38 feet. This special exception is stated in the Federal law. ■

Bridge Formula Table

Distance in feet between the extremes of any group of 2 or more consecutive axles	Maximum load in pounds carried on any group of 2 or more consecutive axles*							
	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles	8 axles	9 axles
4	†34,000							
5	†34,000							
6	†34,000							
7	†34,000							
8 and less	†34,000	34,000						
more than 8	38,000	42,000						
9	39,000	42,500						
10	40,000	43,500						
11		44,000						
12		45,000	50,000					
13		45,000	50,500					
14		46,500	51,500					
15		47,000	52,000					
16		48,000	52,500	58,000				
17		48,500	53,500	58,500				
18		49,500	54,000	59,000				
19		50,500	54,500	60,000				
20		51,000	55,500	60,500	66,000			
21		51,500	56,000	61,000	66,500			
22		52,500	56,500	61,500	67,000			
23		53,000	57,500	62,500	68,000			
24		54,000	58,000	63,000	68,500	74,000		
25		54,500	58,500	63,500	69,000	74,500		
26		55,500	59,500	64,000	69,500	75,000		
27		56,000	60,000	65,000	70,000	75,500		
28		57,000	60,500	65,500	71,000	76,500	82,000	
29		57,500	61,500	66,000	71,500	77,000	82,500	
30		58,500	62,000	66,500	72,000	77,500	83,000	
31		59,000	62,500	67,500	72,500	78,000	83,500	
32		60,000	63,500	68,000	73,000	78,500	84,500	90,000
33			64,000	68,500	74,000	79,000	85,000	90,500
34			64,500	69,000	74,500	80,000	85,500	91,000
35			65,500	70,000	75,000	80,500	86,000	91,500
36			‡ 66,000	70,500	75,500	81,000	86,500	92,000
37			‡ 66,500	71,000	76,000	81,500	87,000	93,000
38			‡ 67,500	71,500	77,000	82,000	87,500	93,500
39			68,000	72,500	77,500	82,500	88,500	94,000
40			68,500	73,000	78,000	83,500	89,000	94,500
41			69,500	73,500	78,500	84,000	89,500	95,000
42			70,000	74,000	79,000	84,500	90,000	95,500
43			70,500	75,000	80,000	85,000	90,500	96,000
44			71,500	75,500	80,500	85,500	91,000	96,500
45			72,000	76,000	81,000	86,000	91,500	97,500
46			72,500	76,500	81,500	87,000	92,500	98,000
47			73,500	77,500	82,000	87,500	93,000	98,500
48			74,000	78,000	83,000	88,000	93,500	99,000
49			74,500	78,500	83,500	88,500	94,000	99,500
50			75,500	79,000	84,000	89,000	94,500	100,000
51			76,000	80,000	84,500	89,500	95,000	100,500
52			76,500	80,500	85,000	90,500	95,500	101,000
53			77,500	81,000	86,000	91,000	96,500	102,000
54			78,000	81,500	86,500	91,500	97,000	102,500
55			78,500	82,500	87,000	92,000	97,500	103,000
56			79,500	83,000	87,500	92,500	98,000	103,500
57			80,000	83,500	88,000	93,000	98,500	104,000
58				84,000	89,000	94,000	99,000	104,500
59				85,000	89,500	94,500	99,500	105,000
60				85,500	90,000	95,000	100,500	105,500

Permissible Federal gross loads for vehicles in regular operation is based on weight formula

$$W = 500 \left(\frac{L N}{N - 1} + 12N + 36 \right)$$

W = the maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds
L = spacing in feet between the outer axles of any two or more consecutive axles
N = number of axles being considered

*   The permissible loads are computed to the nearest 500 pounds
†   Tandem axle by definition
‡   Exception to Bridge Formula Table and Law. See text for explanation
Weights shown in red are over the Federal gvw on the Interstate System

Source: U.S. DOT Federal Highway Administration, *Bridge Formula Weights*, January, 1994

Bridge formula definitions

The following definitions are used in conjunction with the Bridge Formula Table.
Gross Weight:
The weight of a vehicle combination without load plus the weight of any load thereon (The Federal gross weight limit on the Interstate System and reasonable access thereto is 80,000 pounds.)
Single Axle Weight:
The total weight transmitted to the road by all wheels whose centers may be included between two parallel transverse vertical planes not more than 40 inches apart, extending across the full width of the vehicle (The Federal single axle weight limit on the Interstate System and reasonable access thereto is 20,000 pounds.)

Tandem Axle Weight:
The total weight transmitted to the road by two or more consecutive axles whose centers may be included between parallel vertical planes spaced more than 40 inches and not more than 96 inches apart, extending across the full length of the vehicle (The Federal tandem axle weight limit on the Interstate System and reasonable access thereto is 34,000 pounds.)
Consecutive Axle Weight:
The Federal law states that any consecutive two or more axles may not exceed the weight as computed by the formula even though the single axles, tandem axles, and gross weights are within the legal requirements.