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FM 5-36

DEPARTMENT OF THE ARMY FIELD MANUAL

ROUTE RECONNAISSANCE AND CLASSIFICATION

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DEPARTMENT OF THE ARMY • APRIL 1955

FIELD MANUAL

ROUTE RECONNAISSANCE AND CLASSIFICATION

FM 5–36
CHANGES No. 1 } DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *February 1956*

FM 5–36, 26 April 1955, is changed as follows:

7. Route Classification

e. Relation of Route Classification to Vehicle and Bridge Classification. Route classification utilizes * * * in crossing it. This effect depends upon the gross weight of the vehicle and its weight distribution to the axles or tracks, **the out to out distance of tires or tracks, tire size and tire pressure.** The bridge classification * * * on the route.

18. Bridge Reconnaissance

a. The purpose of * * * of a route. These limiting features include **clear roadway width, horizontal clearance above curbs,** overhead clearance, length (if a bottleneck), load-carrying capacity, traffic movement possibilities, estimated amount of repair or reinforcement required, and posting needs. There are two * * * for the reconnaissance.

* * * * * * *

19. Bridge Classification

* * * * * * *

Table VII. Minimum Widths of Bridges Used in Bridge Class Computations
(Superseded)

Bridge class range	Minimum widths between curbs	
	One-lane	Two-lane (ft)
4–12	9 ft	18
13–30	11 ft	18
31–60	13 ft 2 in.	24
61–	14 ft 9 in.	27

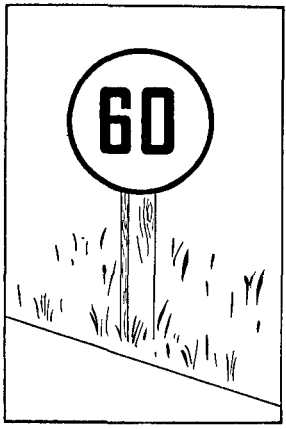
* * * * * * *

21. Bridge Marking

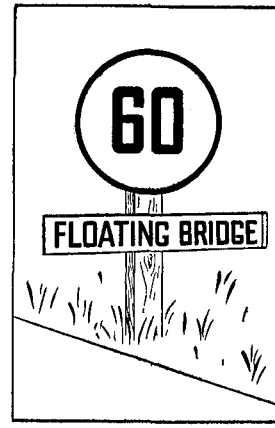
* * * * * * *

b. Types. The two general types of bridge signs are circular signs and rectangular signs.

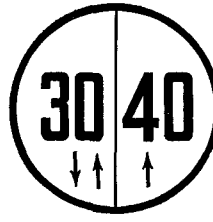
(1) *Circular signs.* The bridge classification * * * over two lanes (fig. 15③). **Double arrows and a single arrow are shown immediately beneath the two-way and one-way classification numbers respectively.** A typical dual class sign is shown in figure



1



2



3

1 For single lane fixed bridge

2 For floating bridge

3 Indicating the limiting vehicle classes of a two lane bridge when used as a two lane bridge or as a single lane bridge

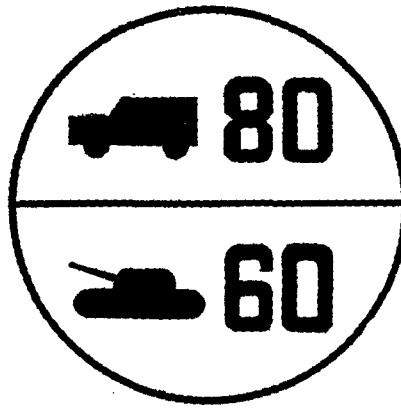
Figure 15. (Superseded) *Typical bridge class and information signs.*

16①. **Wheeled and tracked vehicle symbols are placed on the signs in connection with the appropriate class numbers.** Figure 16② illustrates * * * for each lane (fig. 17).

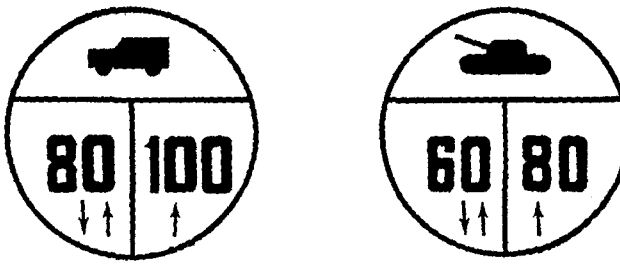
(2) *Rectangular signs.* Additional instructions and * * * information are needed. **Bridges with smaller widths than those shown for bridge classes in table VII will require width signs. Classes of multilane bridges above class 30 will be reduced when the lane width required by table VII is not available.** Their size is * * * are sufficiently clear. The rectangular signs **may include data in the English or metric system or both based on the decision of the local commander. Additionally one of these systems may be replaced by another system. The signs will include the following data:**

(*a*) Width limitations for abnormally narrow bridges. The inscription on the rectangular sign consists of two horizontal arrows with the limiting widths given in feet **or meters (fig. 17.1 ②).**

(*b*) Height limitation for * * * above class 70. The inscription on the rectangular sign consists of two vertical arrows with the limiting height given in feet **or meters (fig. 17.1 ①).** In addition a * * * reaching the bridge.



1



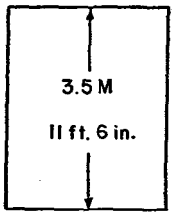
2

1 Indicating the limiting wheeled vehicle class and the limiting tracked vehicle class.

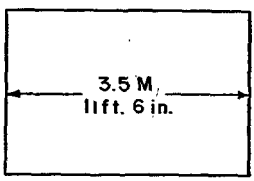
2 Indicating combination of dual class and two-way bridge class signs.

Figure 16. (Superseded) *Typical dual class bridge signs.*

* * * * * * *



①



②

1 Height sign
2 Width sign

Figure 17.1 (Added) *Height and width signs.*

c. Location. Bridge signs are * * * are as follows:

* * * * * * *

(2) Bridge information (rectangular) signs are placed immediately below the bridge classification (circular) signs (fig. 15②). **However, height restriction signs are normally placed centrally on the overhead obstruction itself.**

* * * * * * *

c.1 (Added) *Restricted Lanes.*

(1) Where it is necessary to confine traffic to restricted lanes on damaged bridges, physical barriers such as posts, barrels, etc. are used to define the lane. Whenever necessary such barricades will extend throughout the length of the bridge and along the approach roadways in such a manner as to prevent traffic congestion. Adequate warning signs are also to be used.

(2) In the case of certain bridges, heavier loads can be taken on a restricted lane (such as center line of the bridge or the line of the rails on a road and rail bridge) than on other lanes. These restricted lanes are to be marked by painted lines, studs, etc. and rectangular explanatory signs will be placed at approaches to the bridge.

d. Examples. Example of bridge markings and guide signs are given in illustrations as follows:

* * * * * * *

(3.1) (Added) Typical height and width restriction signs are indicated in figure 17.1.

* * * * * * *

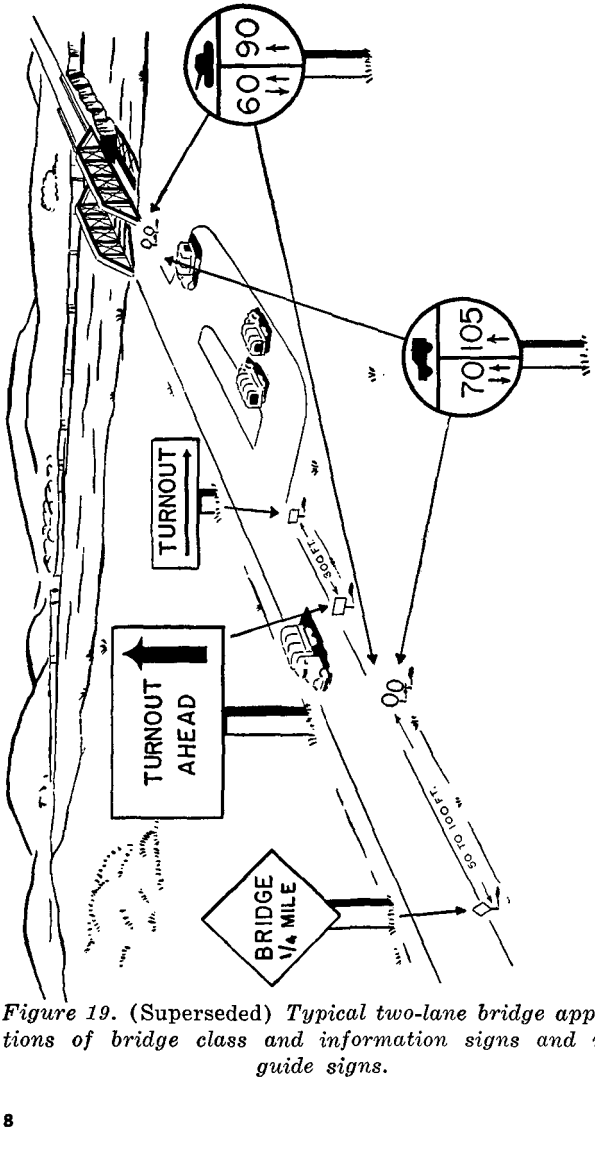


Figure 19. (Superseded) *Typical two-lane bridge applications of bridge class and information signs and road guide signs.*

30. General

a. The basis of * * * crossing the bridge. The effect is the result of a combination of factors which includes the gross weight of the vehicle, the **out-to-out distance of tires or tracks, tire size and pressure,** the distribution of this weight, the speed at which the vehicle crosses the bridge, and the resulting impact on the bridge. The excessive loads * * * must be evaluated.

* * * * * * *

c. Narrow vehicles having an outside to outside tire width, or track width, narrower than that of the hypothetical vehicles of the classes which would otherwise apply are given a higher vehicle classification, **and vice versa for wider outside to outside tire or track widths.**

* * * * * * *

e. (Added) Each single vehicle or combination of vehicles should have a classification for (a) empty, (b) cross country, and (c) on-highway loading.

31. Vehicles Which Are Classified

a. Standard military vehicles * * * and combination vehicles.

* * * * * * *

(2) A combination vehicle is a military vehicle consisting of two or more single

vehicles, **connected together,** which move as one unit. Examples include prime * * * 30 yards apart.

b. Classification numbers are * * * exceeding 1½ tons.

(1) (Superseded) *Separate classification* numbers are assigned to each single vehicle when one tows another and the distance between them is greater than 30 yards. If the vehicles are closer than 30 yards and both are on one bridge span at the same time then they are classed as a combination vehicle. In this case the class of the combination is the sum of the classification numbers of the two vehicles.

* * * * * * *

32. Data Required for Vehicle Classification

a. The single vehicle * * * vehicles are shown.

(1) (Added) Vehicles are to be classified for empty, cross country, and on-highway loading when possible.

(2) (Added) Other data required for vehicle classification is as follows:

(*a*) Total loads, axle loads, track loads, fifth wheel loads, pintle and lunette loads for empty cross country, and on-highway loading.

(*b*) Tire size, number of tires per axle, tire

pressure, and maximum load on one tire.

(*c*) Distance from nearest axle to lunette or pintle.

b. The trailer dimensional * * * trailers are shown. **For other data required for trailer classification see a(1) above.**

33. Marking of Vehicles

* * * * * * *

b. Marking of vehicles is accomplished by front vehicle classification signs and by side vehicle classification signs (fig. 28). These signs have a yellow background with black numerals; **however, they may be made in other contrasting colors consistent with camouflage requirements.**

* * * * * * *

(2) Side vehicle classification * * * them from view. **A side vehicle sign is placed on the right-hand side of classified towing vehicles and trailers only.** Side vehicle signs * * * capacity exceeding 1½ tons.

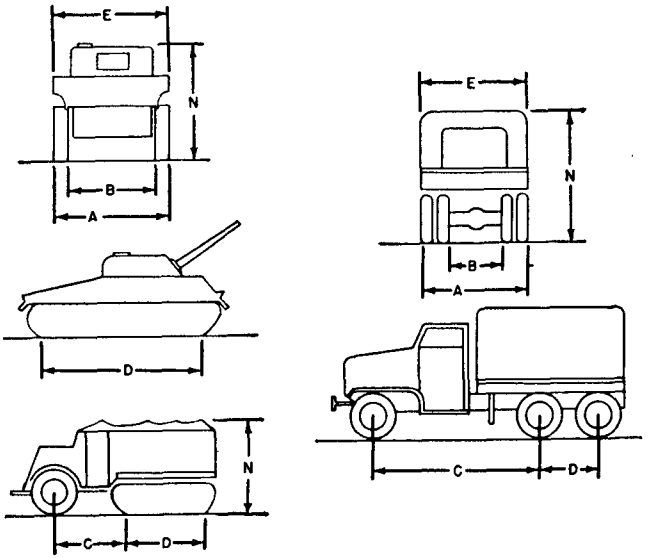
c. Other uses of * * * special purpose vehicles.

* * * * * * *

(2) (Superseded) In the case of towed vehicles, where the vehicles are less than 30 yards apart and both are on one bridge

span at one time, they are classed as combination vehicles. In these cases the classification of the combination is the sum of the classification numbers of the separate vehicles. This combination classification number is shown on a temporary front sign (fig. 30③).

* * * * * * *



1 Single vehicles

Figure 27. (Superseded) *Dimension data required for vehicle classification.*

A Out-to-out track or tire width (inches)

B In-to-in track or tire width (inches)

C Distance from front axle to first rear axle or track (inches)

D Ground contact of track or distance between rear axles (inches)

E Overall width (inches)

F Net weight (tons)

G Gross weight: 1. Off-highway
2. On-highway

H Axle loads: 1. Empty
2. Off-highway
3. On-highway

I Tire size

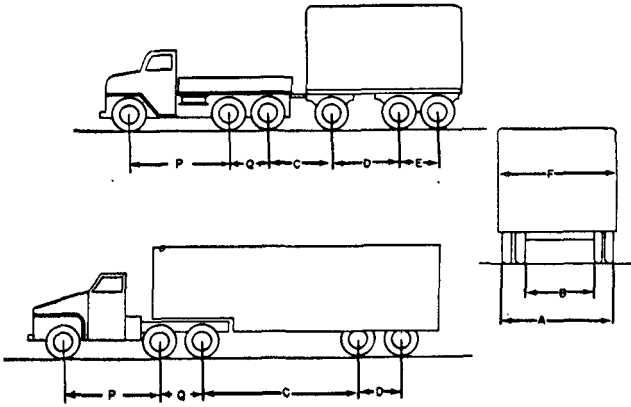
J Tire pressure

K Dimension from rear tire to towing pintle or lunette

L Track width and track load

M Pay loads: 1. Off-highway
2. On-highway

N Overall height



2 Trailers

Figure 27. (Superseded) *Dimension data required for vehicle classification*—Continued.

A Out-to-out tire width of trailer (inches)

B In-to-in tire width of trailer (inches)

C Distance from rear axle of towing vehicle to first axle of trailer (inches)

D Distance from first to second axle of trailer (inches)

E Distance from second to third axle of trailer (inches)

F Overall width of trailer (inches)

G Gross weight of trailer (tons)

H Net weight (tons)

I Axle loads: 1. Empty
2. Off-highway
3. On-highway

J All spacing between tires

K Tire sizes

L Tire pressure

M Trailer load distribution to tractor

N Pay load: 1. Off-highway
2. On-highway

O Dimensions from nearest tire to lunette

P Distance between front axle and first rear axle of towing vehicle

Q Distance between dual axles of towing vehicle

APPENDIX III
BRIDGE SPANS

4. Beam Bridges

a. The majority of * * * are as follows:

* * * * * * *

(2) Steel stringers.

* * * * * * *

(*e*) (Added) Plate girder.

* * * * * * *

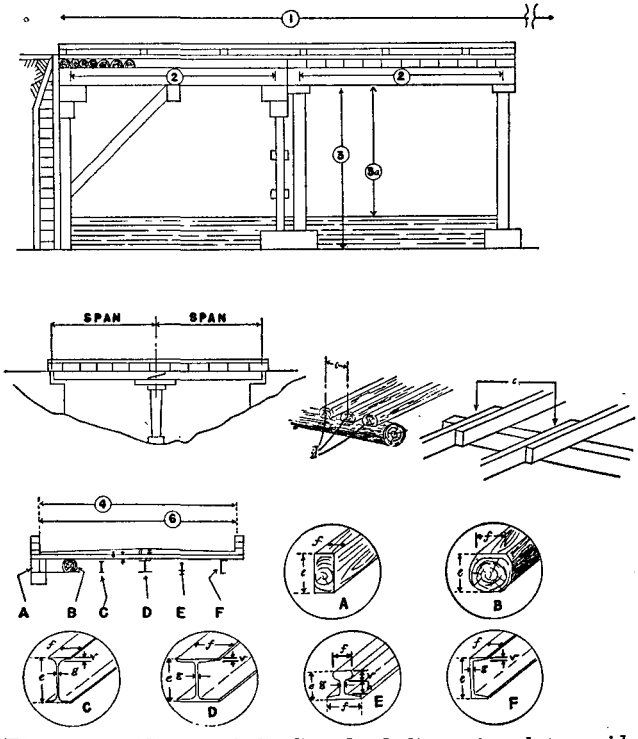


Figure 41. (Superseded) *Standard dimension data guide for simple stringer bridges.*

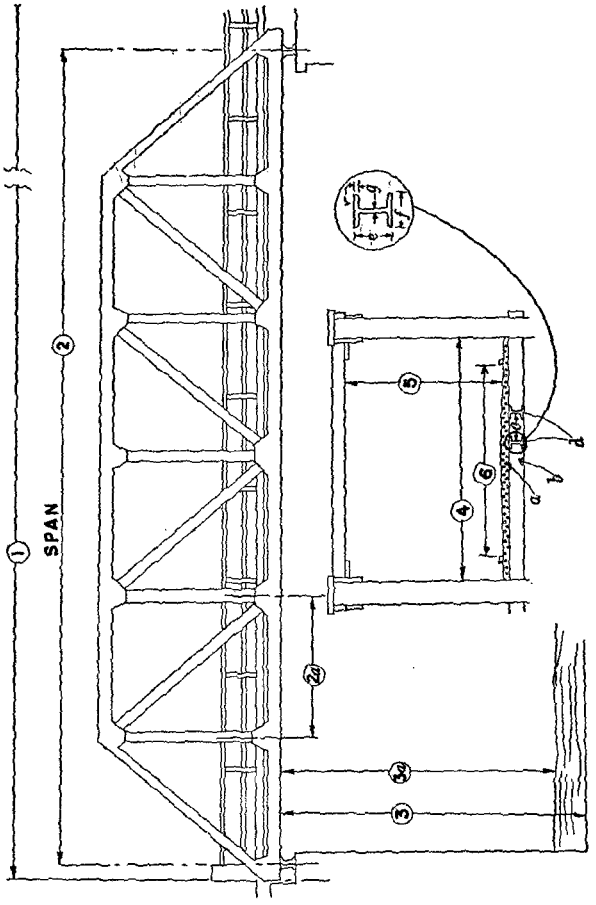


Figure 49. (Superseded) *Standard dimension data guide for steel truss bridges.*

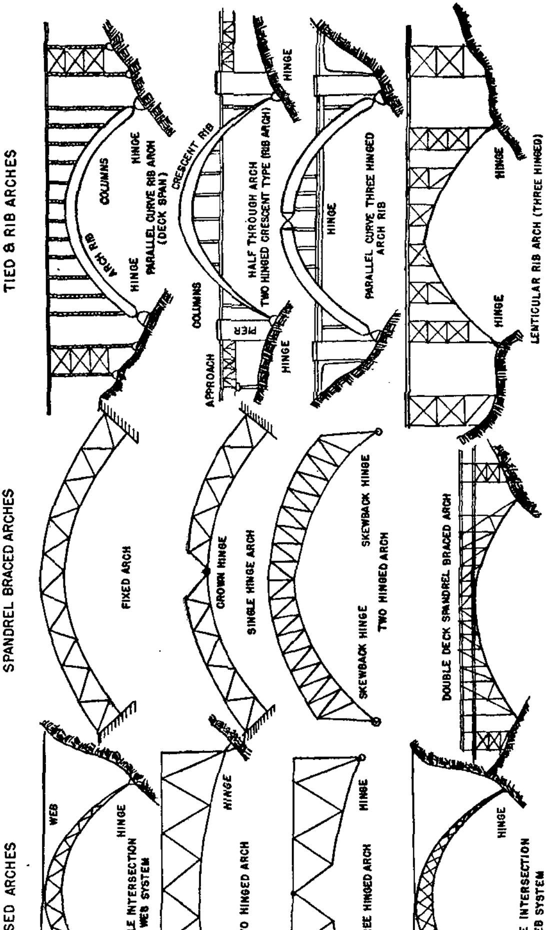


Figure 60. (Superseded) *Common types of arch construction.*

Figure 67. Steel arch bridge, through type.

Figure 69. Suspension bridge with steel cable, steel reinforcing truss, steel floor beams, and external sway bracing.

APPENDIX IX

CLASSIFICATION TABLES FOR STANDARD PREFABRICATED RAFTS, FIXED BRIDGES, AND FLOATING BRIDGES

Table XXII.	(Superseded)	Dual Classification Floating Bridge Capacities.
Table XXIII.	(Superseded)	Dual Classification Raft Capacities.
Table XXIV.	(Superseded)	Dual Classification of Panel Bridge, Bailey Type, M_2 (150 inch roadway).

* * * * * * *

Table XXVI.	(Superseded)	Dual Classification Capacities, Short Fixed Spans of M_2 Steel Treadway.
Table XXVII.	(Added)	Dual Classification of M_4 Deck Balk Fixed Span Class.
Table XXVIII.	(Added)	Dual Classification of Class 60 Floating Bridge, Steel Superstructure Fixed Spans.

Table XXII. (Superseded) *Dual Classification—Floating Bridge Capacities*

Bridge	Type of construction	Safe (normal)						Caution						Risk					
	FPS	3	5	7	8	9	11	3	5	7	8	9	11	3	5	7	8	9	11
M2 Assault Boat Bridge *	Normal	8	6	5	2	..	..	8	6	5	3	..	..	9	7	6	4	..	..
	Reinf.	13	9	7	3	..	..	13	11	8	4	..	..	14	12	9	5	..	..
M2 Widened Steel Treadway Bridge (w/plyw'd tdwy)[1]		(45) 50	(45) 50	(35) 40	(30) 35	(25) 30	(12) 15	(48) 51	(47) 50	(43) 46	(39) 42	(31) 34	(16) 19	(55) 58	(54) 57	(52) 55	(48) 51	(41) 44	(25) 28
Class 60 Floating Bridge	Normal	(60) 65	(55) 65	(45) 55	(40) 50	(35) 45	(22) 25	(65) 70	(62) 67	(56) 61	(52) 56	(45) 49	(34) 37	(75) 79	(72) 77	(67) 72	(62) 67	(57) 62	(46) 50
	Reinf.[2]	(85) 85	(85) 85	(85) 85	(70) 75	(65) 70	(30) 35	(90) 90	(90) 90	(90) 90	(80) 84	(75) 79	(47) 51	(100) 100	(100) 100	(100) 100	(95) 98	(90) 93	(70) 74
M4 Floating Bridge	Normal [3]	(60) 60	(60) 60	(45) 50	(40) 45	(30) 35	(18) 20	(68) 68	(65) 65	(58) 59	(52) 53	(44) 46	(29) 31	(72) 72	(68) 68	(61) 62	(58) 59	(53) 54	(37) 39
	Reinf.[4]	(100) 100	(100) 100	(100) 100	(85) 85	(70) 70	(35) 40	(105) 105	(105) 105	(105) 105	(95) 95	(85) 85	(55) 55	(110) 110	(110) 110	(110) 110	(105) 105	(100) 100	(70) 70
50 T. Airborne Div. Bridge		(35) 40	(30) 35	(25) 30	(18) 20	(10) 10	(..) ..	(46) 48	(40) 42	(33) 35	(27) 29	(15) 15	(..) ..	(56) 58	(50) 52	(44) 46	(34) 36	(23) 25	(5) 5
M4 Balk on 24 T. Float. Br. (M4T6)		(50) 55	(45) 55	(40) 50	(35) 45	(30) 40	(25) 30	(60) 61	(58) 59	(54) 55	(49) 51	(45) 47	(35) 37	(68) 69	(66) 67	(62) 63	(59) 60	(54) 56	(43) 45

Notes. 1. * Wheeled and track vehicles have the same rating.
2. Upper figure represents wheel load class. Lower figure represents tracked load class. } Example: $\frac{(43)}{45}$
3. [1] Vehicles required to use plywood treadway lane limited to Class 16 Safe, Class 18 Caution, Class 24 Risk.
4. [2] Ratings given are for floating portion of bridge. End span ratings with present superstructure limited to Class 70 Safe, Class 80 Caution, and Class 90 Risk. Development of satisfactory landing bay not yet complete.
5. [3] Ratings given are for an 18 balk roadway and a 22 balk deck.
6. [4] Ratings given are for a 20 balk roadway and a 24 balk deck in the floating portion, and a 20 balk roadway and a 22 balk deck with a superimposed deck in the end span.

Table XXIII. (Superseded) *Dual Classification Raft Capacities*

Raft	No. of floats	Type of construction	Normal					Risk				
			FPS 3	5	7	9	11	3	5	7	9	11
Infantry Support Rafts	3	Normal	8	8	4	..	..	10	9	5	2	..
	5	Reinf.	13	10	5	..	..	15	13	8	3	..
	7	Reinf.**	13/21	13/21	8/13	..	..	16/23	15/23	10/16	5/8	..
M2 Widened Steel Treadway Rafts [1]	4	Reinf.	(30) 35	(30) 35	(30) 35	(15) 20	(..) ..	(40) 45	(40) 45	(35) 40	(20) 25	(..) ..
	5	Reinf.	(40) 45	(40) 45	(40) 45	(20) 25	(..) ..	(45) 50	(45) 50	(45) 50	(25) 30	(..) ..
Class 60 Rafts	4	Normal	(40) 45	(40) 45	(40) 45	(35) 40	(25) 30	(50) 55	(50) 55	(50) 55	(45) 50	(35) 40
	5	Normal	(50) 55	(50) 55	(50) 55	(40) 45	(30) 35	(60) 65	(60) 65	(60) 65	(50) 55	(40) 45
	5	Reinf.	(55) 60	(55) 60	(50) 55	(45) 50	(35) 40	(60) 70	(60) 70	(60) 65	(55) 60	(45) 50
	6	Reinf.	(65) 75	(65) 75	(65) 75	(60) 65	(50) 55	(80) 90	(80) 90	(80) 90	(70) 80	(60) 70

Table XXIII. (Superseded) *Dual Classification Raft Capacities*—Continued

Raft	No. of floats	Type of construction	Normal					Risk				
			FPS 3	5	7	9	11	3	5	7	9	11
M4 Rafts	4	Normal	(50) 55	(50) 55	(50) 55	(50) 55	(40) 45	(55) 60	(55) 60	(55) 60	(55) 60	(45) 50
	6	Reinf.	(70) 75	(70) 75	(70) 75	(65) 70	(50) 55	(75) 80	(75) 80	(75) 80	(75) 80	(55) 60
	7	Reinf.	(85) 90	(85) 90	(85) 90	(80) 85	(55) 60	(90) 95	(90) 95	(90) 95	(90) 95	(65) 70
50 T. Div. Airborne Rafts	4	Normal	(30) 35	(30) 35	(25) 30	(15) 20	(..) ..	(40) 45	(40) 45	(35) 40	(20) 25	(..) ..
	6	Reinf.	(50) 55	(45) 50	(40) 45	(..) ..	(..) ..	(60) 65	(55) 60	(45) 50	(10) 15	(..) ..
M4T6 Rafts	4	Normal	(50) 55	(50) 55	(45) 50	(35) 40	(30) 35	(60) 65	(60) 65	(55) 60	(45) 50	(35) 40
	5	Reinf.	(60) 65	(60) 65	(60) 65	(55) 60	(45) 50	(70) 75	(70) 75	(70) 75	(65) 70	(55) 60

Notes. 1. * Wheeled and track vehicles have the same rating.
2. ** 13/21—First figure is single vehicle rating, second figure is double vehicle rating.
3. Upper figure represents wheel load class. Lower figure represents tracked load class. EXAMPLE: (30) 35
4. [1] Plywood treadway lane limited to Class 16 Safe, Class 18 Caution, Class 24 Risk

Table XXIV. (Superseded) *Dual Classification of Panel Bridge, Bailey Type, M2 (150 in. Roadway)*
(Class by type of construction and type of crossing)

Span in feet	SS			DS			TS			DD			TD			DT			TT		
	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R
30	(30) 30	(42) 37	(47) 42																		
40	(27) 28	(36) 34	(40) 38																		
50	(23) 24	(33) 31	(36) 35	(75) 70	(83) 76	(88) 84															
60	(22) 23	(30) 29	(33) 32	(65) 65	(77) 73	(85) 79															
70	(20) 22	(26) 27	(30) 30	(60) 60	(68) 69	(78) 75															
80	(17) 18	(22) 23	(25) 26	(50) 55	(60) 60	(66) 64	(85) 80	(95) 90	(*100) *90												
90	(12) 14	(17) 18	(19) 21	(40) 45	(50) 50	(55) 55	(65) 65	(74) 75	(82) 82												
100	(9) 10	(12) 14	(14) 16	(29) 30	(37) 39	(42) 44	(50) 55	(57) 60	(64) 66	(80) 80	(86) 90	(96) *90									
110				(23) 26	(30) 32	(34) 36	(35) 40	(47) 49	(52) 54	(65) 70	(72) 76	(80) 83	(90) *90	(*100) *90	(*100) *90						
120				(18) 21	(23) 26	(27) 30	(30) 35	(38) 41	(43) 45	(45) 55	(57) 61	(64) 68	(75) 80	(83) *90	(91) *90						

Table XXIV. (Superseded) *Dual Classification of Panel Bridge, Bailey Type, M2 (150 in. Roadway)*—Continued
(Class by type of construction and type of crossing)—Continued

Span in feet	SS			DS			TS			DD			TD			DT			TT		
	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R
130				(14) 15	(18) 21	(21) 24	(23) 27	(31) 33	(35) 38	(35) 45	(47) 50	(53) 56	(55) 60	(65) 72	(74) 80	(70) 80	(80) *90	(90) *90			
140				(10) 12	(14) 16	(17) 19	(18) 21	(24) 27	(29) 31	(30) 35	(39) 42	(44) 48	(45) 55	(57) 62	(64) 70	(70) 80	(80) *90	(88) *90			
150							(14) 19	(18) 22	(22) 25	(24) 27	(32) 35	(36) 40	(35) 45	(47) 51	(54) 58	(60) 60	(77) 85	(85) *90			
160							(10) 12	(15) 17	(17) 20	(18) 22	(25) 28	(30) 33	(30) 35	(37) 41	(45) 48	(55) 55	(69) 78	(80) 89	(80) 75	(100) *90	(*100) *90
170							(7) 8	(10) 12	(13) 15	(14) 16	(19) 22	(24) 27	(23) 26	(31) 34	(36) 40	(45) 50	(57) 64	(64) 74	(70) 70	(80) *90	(90) *90
180										(10) 11	(15) 17	(18) 21	(17) 20	(24) 27	(29) 32	(35) 45	(48) 53	(55) 60	(55) 60	(66) 75	(77) 87
190													(11) 13	(18) 20	(22) 25	(30) 35	(39) 43	(46) 51	(45) 55	(59) 66	(68) 77
200																(23) 25	(32) 36	(38) 43	(35) 40	(48) 52	(55) 62
210																(17) 18	(25) 28	(31) 35	(29) 29	(38) 43	(46) 51

Notes. 1. * Limited by roadway width.
2. Bridges which have a normal rating of Class 75 or over must be constructed with double transoms.
3. Upper figure represents wheel load class. Lower figure represents tracked load class. } Example: (46) / 51

Table XXVI. (Superseded) *Dual Classification Capacities Short Fixed Spans of M2 Steel Treadway*

Type of construction	No. of treadways	Clear span	Normal	Caution	Risk
Widened Bridge [1]	[2] 2	20	90	* 110	* 140
		22	80	95	* 120
	3	24	70	80	* 100
		26	60	70	90
		28	55	60	81
		30	50	55	73
		32	45	50	65
		34	40	45	57
Plywood Treadway Lane (Spans up to 34 ft.)			16	18	24
M2 Bridge (Narrow spacing)	4	36	(35) 30	(45) 34	(68) 50
		38	(28) 27	(35) 31	(60) 46
		40	(25) 25	(29) 28	(53) 43
		42	(22) 23	(26) 26	(47) 40
		44	(20) 21	(23) 24	(42) 37
		46	(19) 20	(22) 23	(37) 34
	5	48	(18) 19	(21) 22	(32) 31
		50	(17) 18	(20) 21	(29) 30
		52	(17) 18	(19) 20	(27) 28
		54	(16) 17	(18) 19	(25) 27
		56	(15) 16	(17) 18	(23) 25
		58	(15) 16	(17) 18	(22) 24

Notes. 1. * Limited by roadway width.
2. Upper figure represents wheel load class. Lower figure represents tracked load class. } EXAMPLE: (35) 30
3. [1] No truck ratings given for regular steel treadway lanes of widened bridge, since spacing is normally too wide for trucks.
4. [2] For 2-treadway span bridges without transverse stiffeners, use 0.8 of class given in table.

Table XXVII. (Added) *Dual Classification of M4 Deck Balk Fixed Span Class By Type of Construction and Type of Crossing.*

Span in feet	Type of construction	Normal	Caution	Risk
30	22 Balk Deck 18 Balk Roadway	(80) 60	(100) 80	(100) 90
38	22 Balk Deck 18 Balk Roadway	(45) 35	(70) 55	(80) 60
	22 Balk Deck 16 Balk Roadway	(50) 40	(70) 55	(80) 60
45	22 Balk Deck 18 Balk Roadway	(23) 25	(45) 40	(55) 45
	22 Balk Deck 16 Balk Roadway	(30) 30	(45) 40	(55) 45

Note. 1. Upper ratings represent wheel load class.
Lower ratings represent tracked load class.
} EXAMPLE: $\frac{(0)}{60}$

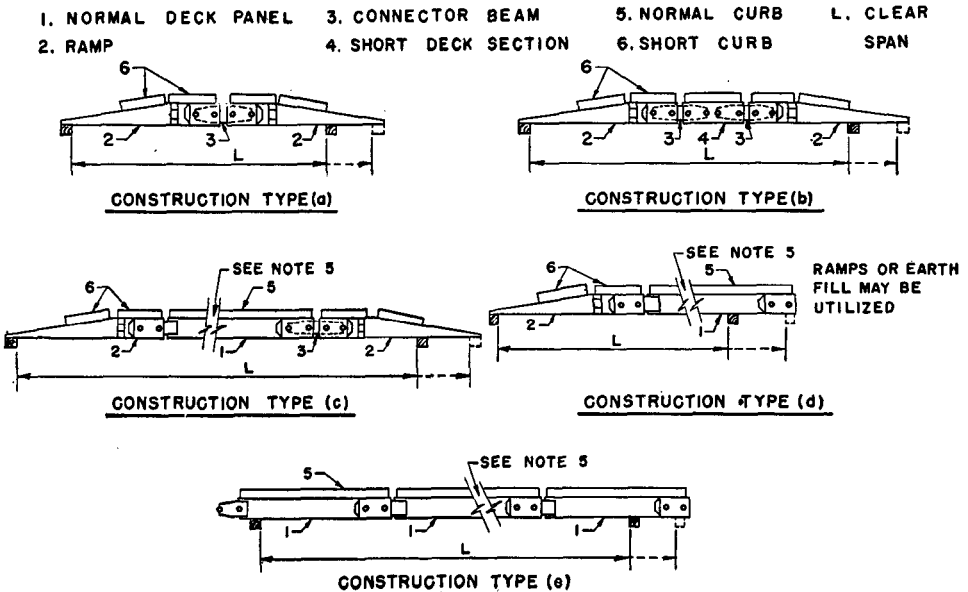


Figure 102. (Added) *Construction types for the class 60 floating bridge, steel superstructure, fixed spans*

Table XXVIII. (Added) *Dual Classification of Class 60 Floating Bridge, Steel Superstructure, Fixed Spans*

Clear Span (Feet)	Capacities for fixed spans			
	Construction type	Normal	Caution	Risk
24	abcde	(*120) *100	(*120) *100	(*120) *100
26	abcd	(*120) 95	(*120) 100	(*120) 100
	e	(*120) 100	(*120) *100	(*120) *100
28	abcd	(115) 80	(*120) 87	(*120) 100
	e	(120) 85	(*120) 92	(*120) *100
30	abcd	(105) 65	(110) 75	(*120) 90
	e	(110) 70	(120) 80	(*120) 95
32	bcde	(95) 60	(105) 70	(120) 85
34	bcde	(85) 55	(90) 63	(110) 75
36	bcde	(75) 50	(81) 58	(100) 68
38	cde	(65) 45	(75) 53	(90) 65
40	cde	(60) 40	(68) 50	(83) 60
50	cde	(30) 30	(36) 36	(50) 45
60	cde	(20) 22	(22) 25	(28) 30

Notes. 1. Upper figure represents wheel load class / Lower figure represents track load class } e.g. Wheel (75) / Track 50

2. These capacities for most critical position of abutments.
3. For symmetrical construction of type b, with respect to abutments, the stated capacities may be increased by 10 tons.
4. *—Limited by roadway width.
5. Number of normal deck panels utilized depends on span length desired.
6. For construction types see figure 102.

APPENDIX X
GLOSSARY

* * * * * * *

Gross weight of a vehicle. The weight of * * * cross-country (off-highway) operation. **Highway gross weight of a vehicle is that weight of the vehicle when fully equipped and serviced for operation, including the crew and the maximum pay load of cargo and personnel for on-highway operation.**

* * * * * * *

Rated pay load of a military vehicle. The total load * * * of the crew. **Highway pay load is the maximum pay load a vehicle can carry on highways, exclusive of crew.**

* * * * * * *

Stringers. (Superseded) A system of longitudinal members supporting the deck.

Stringer bridge. (Superseded) A bridge designed with a stringer system, which is a system of longitudinal beams supporting the deck.

* * * * * * *

[AG 253 (22 Dec 55)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
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Engr Sch (135)
Inf Sch (100)
TC Sch (100)
PM Sch (15)
PMST Engr ROTC Units (2)
Div Engr (1)
Engr Dist (1)
Mil Dist (1)
Units organized under following TOE:
  7–11R, Inf Regt (2)
  17–51R, Armd Regt (2)
  19–55R, MP Bn (1)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

*FM 5-36

FIELD MANUAL
No. 5-36

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *26 April 1955*

ROUTE RECONNAISSANCE AND CLASSIFICATION

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*This manual supersedes TC 24, 21 October 1953, TC 7, 26 March 1954, and those portions of FM 5-10, 18 August 1948, FM 5-34, 30 August 1947, and FM 5-35, 4 September 1952 pertaining to route reconnaissance and classification.

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SECTION I
INTRODUCTION

1. Purpose

This manual provides, in a single volume, the information necessary for troops of all branches to understand the technical aspects of the reconnaissance and classification of existing routes of communication in order to achieve full and proper utilization in military operations. Methods of survey and reconnaissance for new routes are found in other manuals.

2. Scope

This manual covers the collection, compilation, and dissemination of technical information concerning existing routes of communication, including roads, bridges, and other crossing means, which are needed to plan or execute movement of military vehicles. The manual discusses the information needed, the methods for obtaining it, how compiled, how it relates to the vehicle and bridge classification system, and methods of dissemination to the user. Such information would include the indicating of obstructions and classifications of routes on maps and the use of road signs.

3. References

Pertinent manuals and other military publications are listed in appendix I.

SECTION II
ROUTES

4. General

A route is considered the road or roads, including tracks and bridges, used when moving from one place to another. It includes those roads, bridges, tunnels, fords, and ferries selected from a network in a given area for the movement of troops, equipment, and supplies from one place to another. A route may also include the use of navigable waters, rail transportation facilities, and airplane landing facilities.

5. Route Reconnaissance

a. Route reconnaissance is a special type of engineer reconnaissance, although it is governed by the same fundamentals that apply to all reconnaissance. It is usually made on the ground because of the need for close physical inspections at, for example, bridge and drainage sites. Aerial reconnaissance, however, is often useful and should supplement ground reconnaissance when this is practicable. Aerial photographs and ground photographs save time and increase the value of reconnaissance reports.

b. The purpose of route reconnaissance is to gain information which will aid in the selection of a route to be used for the movement of troops, troop equipment, and military supplies in tactical and strategic operations.

c. Instructions for making a route reconnaissance should be simple, clear, and comprehensive. They should state when, where, and to whom the reports are to be submitted. They should specify the points between which the route is to extend, the area to be reconnoitered, and the items of information considered particularly important. The information includes the roads available; their physical characteristics; their estimated load-bearing capabilities (app. II); and the tunnels, bridges, fords, ferries, and obstructions on the routes reconnoitered. The obstructions include single lane roads; one-way bridges; bridges of limited load-carrying capacity; and overhead obstructions such as low hanging trees, low tunnels, low bridge heights, limited stream-crossing facilities, and other passage limitations.

d. General assignment limitations for making a route reconnaissance include the points between which the route is to extend and the area in which it is to be located.

e. Specific assignment limitations for making a route reconnaissance include the maximum weight, maximum width, and maximum height of vehicles to be moved; the classification of the vehicles to be moved; the approximate number of each class to be moved per hour; and the approximate length of time the route is to be used.

f. Information which should be obtained by a route reconnaissance includes the nature of the terrain, existing roads and their lengths, bridges and other stream-crossing means, obstructions, and bottlenecks. Obstructions are classified as natural and artificial. The natural obstructions include water-

courses, slopes, untrafficable areas, timber areas, and swamps. The artificial obstructions include low hanging trees, low underpasses, and low hanging wires. Bottlenecks include road gradients of more than 6 percent, narrow bridges, narrow tunnels, and densely populated areas.

g. Sources of information for route reconnaissance include interrogation of local personnel, prisoners of war, and deserters; ground maps; ground photographs; ground reconnaissance; aerial photographs; and aerial reconnaissance.

6. Route Reconnaissance Report

a. The route reconnaissance report should be accurate, clear, concise, relevant, and specific. The preferable method of preparing this report is in simplified map form (fig. 1) with symbols indicating the limiting features. It is accompanied by a road reconnaissance report (par. 13) and such bridge, tunnel, ferry, and ford reconnaissance reports as are necessary. The route report is supported by military sketches of limiting features; by local maps; and by photographs showing the terrain, the roads, tunnels, bridges, ferries, fords, and other stream-crossing means.

b. Symbols used in preparing route reconnaissance map reports are given in figure 2 and in paragraph 7*b*.

c. A checklist for use in obtaining the data from which to prepare a route reconnaissance report follows:

(1) Length between well-marked points, in either miles or kilometers and decimal fractions thereof.

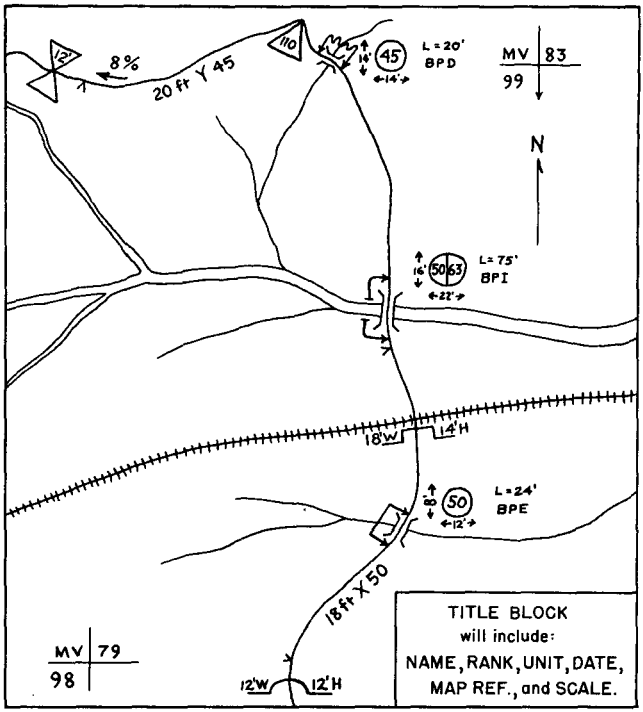


Figure 1. Example of a route reconnaissance report.

(2) Sharp curves, each with its radius in feet or meters.

(3) Steep grades, each with its maximum gradient in percent and length of any grade greater than 6 percent.

(4) The road width of bottlenecks, each with the width of its traveled way in feet or meters, and its length in either miles or kilometers and decimal fractions thereof.

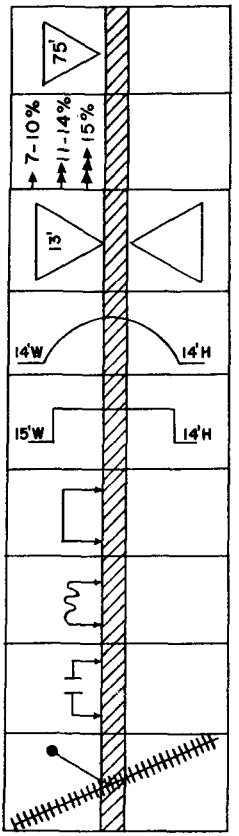


Figure 2. Symbols used to represent obstructions.

(5) Underpass limitations, each with its limiting height and width in feet or meters.
(6) Bridge bypasses, each classified as easy, difficult, or impossible.

7. Route Classification

a. General. Route classification is the simple classification of a route to assist staff officers in planning a normal road movement. It includes minimum widths of roads, types of roads, load-carrying capacity of roads and bridges on the route, and the existence and effect of obstructions or other limiting factors. It is not as detailed as the classification of a road (par. 14), which is used mainly for engineer purposes. Road classification includes width, length, alinement, drainage, foundation, surface, and details of specific obstructions, but does not include bridge classification.

b. Basis of Route Classification. The basis of route classification is the road classification and the load-carrying capacity of the roads and bridges along the route. Bridge classification is discussed in paragraph 19. The route classification includes factors as follows:

(1) Width—expressed in feet (ft) or meters (m).

(2) Type—categorized, for the purpose of route classification, as all-weather (*X*), limited all-weather (*Y*), or fair-weather (*Z*). These types of roads are defined in paragraph 11. This information permits the type of road to be intelligently described in making route reconnaissance reports and interpreting them.

(3) Load-carrying capacity—determined by the classification number of the highest class vehicle that can use the route in convoy. This is normally governed by the classification of the weakest bridge on the route as

determined by methods outlined in appendix VII, VIII, and TM 5–260, and described briefly in paragraph 19 of this manual.

(4) Load-bearing capacity—determined from design curves for flexible road pavements and for concrete road pavements given in appendix II. Such capacity does not necessarily preclude the use of vehicles of a heavier classification, as does the carrying capacity described above. It is merely an indication of the type of traffic which the road will bear in continual use.

c. Route Classification Formula. The route classification formula is developed from route classification symbols arranged in sequence as follows: width of road, type of road, and load-carrying capacity.

(1) *Examples.*

(*a*) A route having a traveled roadway of 20 feet, a limited all-weather type with a load-carrying capacity of class 50, would be expressed by the following formula:

$$20\text{ft}Y50$$

(*b*) A route having a traveled roadway width of 10.5 meters, an all-weather type with a load-carrying capacity of class 70, would be expressed by the following formula:

$$10.5\text{m}X70$$

(2) *Obstructions.* Obstructions or bottlenecks occurring singly or of a temporary nature are not the limiting factor for classifying a route. They are noted in the formula and

described completely in the accompanying report or on an overlay. Where such an obstruction exists, the route classification formula is followed by the symbol (*Ob*), for example—

20ft*Y*50(*Ob*)

(3) *Snow blockage.* The effects of snow blockage on military traffic depend upon the amount of snow clearance that is feasible. This, in turn, depends upon the availability of labor and equipment. Where snow blockage is a regular, recurrent, and serious factor, the route classification formula is followed by the symbol (*T*), for example—

20ft*Y*50(*T*)

d. Structures Classification Symbols. Structures classification symbols are to be used on maps and overlays to indicate the trafficability of structures encountered on the route being classified:

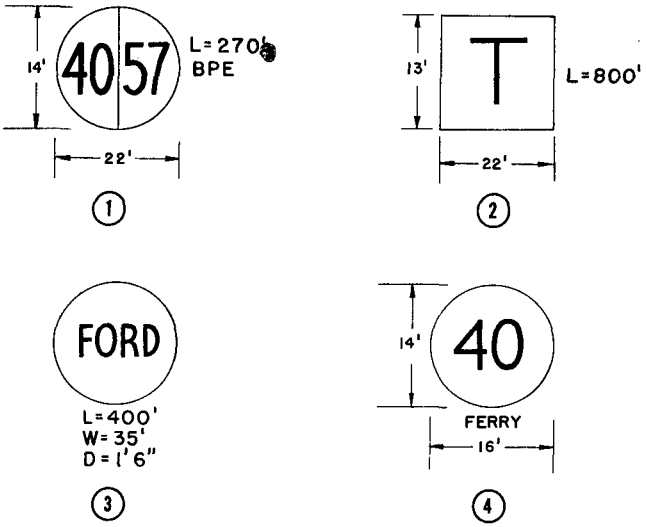
(1) The bridge classification symbol consists of a miniature reproduction of the bridge class sign of the bridge concerned. Figures to the left of the sign between vertical arrows indicate the overhead clearance, figures between horizontal arrows below the sign indicate width of roadway, figures to the right indicate length of bridge, letters *BP*— indicate bypass conditions (fig. 3 ①).

(2) The tunnel classification symbol consists of a hollow square inclosing the letter "*T*." Figures to the left between vertical arrows

indicate overhead clearance at critical point (usually the springing line for an arched tunnel); figures between horizontal arrows below the square indicate roadway width; figures to the right indicate length (fig. 3 ②).

(3) The ford classification symbol consists of a circle enclosing the word FORD. Figures below the circle indicate length, usable width and depth at normal water level (fig. 3 ③).

(4) The ferry classification symbol consists of



1 For bridge
2 For tunnel
3 For ford
4 For ferry

Figure 3. Typical structures classification symbols.

circle enclosing the class number. The word FERRY is placed just below the circle. Figures to the left between vertical arrows indicate overhead clearance. Figures between horizontal arrows below the word FERRY indicate width at critical point (fig. 3 ④).

e. Relation of Route Classification to Vehicle and Bridge Classification. Route classification utilizes the vehicle class numbers and the bridge class numbers to determine the safe load-carrying capacity of a route and its branches. The vehicle classification system represents, by a whole number, the effect a vehicle will have on a bridge in crossing it. This effect depends upon the gross weight of the vehicle and its weight distribution to the axles or tracks. The bridge classification system represents, by a whole number, the safe load-carrying capacity of a bridge under normal crossing conditions. As mentioned in *b*(3) above, the load-carrying capacity of a route is expressed by the classification number of the highest class vehicle that can use the route in convoy, taking into consideration the classification of the weakest bridge on the route.

f. Responsibility for Route Classification. Route classification is the responsibility of the appropriate engineer officer.

8. Route Numbering

a. One route number is used to designate each main supply route and each lateral route throughout the entire length of each.

b. Main supply routes and axes are given odd numbers.

c. Lateral routes are given even numbers.

d. Responsibility for allotting blocks of route numbers to army groups and other units operating in any theater rests with the theater commander.

9. Route Signs

a. Route signs (fig. 4) indicate location, distance, direction, route numbers, and similar information to help drivers. In order to differentiate between route signs and guide signs along a road, which may be only a segment of a given route (par. 15*d*), the route signs are rectangular in shape and are placed with the long axis vertical. If signs are manufactured locally and availability of material is critical, alternative circular signs as illustrated in figure 4 may be used. Route signs have a white background on which the legend or symbol is superimposed in black. The legend on a route sign consists of—

(1) The route number.

(2) The appropriate directional disk marking.

b. The direction of traffic may also be shown on route signs. In the case of main supply routes, there are no standard terms to indicate which stream of traffic is moving to the front and which is moving to the rear. But, as shown in figure 4, indications may be used depending upon the language and the sign adopted. On route signs of lateral routes, the standard letters N, E, S, W, NE, SE, NW, and SW are used to indicate the general direction of movement of each traffic stream.

c. Additional route signs may be erected when moves take place within other friendly national areas. However, the erection of these additional signs must

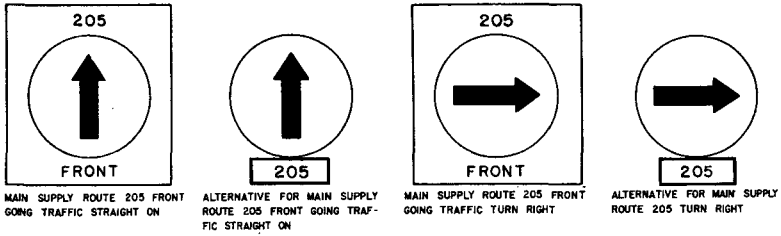


Figure 4. Examples of route signs.

be arranged mutually between the commanders concerned.

d. Objective of this system of route signing is to enable Allied Armies to move freely in each other's territory. The system is capable of being superimposed on any existing civil system of route signing.

SECTION III

ROADS

10. General

a. A road is an open way provided for the convenient passage of personnel and vehicles. Selected roads with selected tracks, bridges, and other stream-crossing means form a route which is used when moving personnel, vehicles, and animals from place to place.

b. Types of roads vary through wide limits. The permanent all-weather road is the highest type. A cleared way through timber is probably the lowest type. Types of existing roads are briefly classified and described, from the standpoint of trafficability, in paragraph 11.

c. Road reconnaissance (par. 12*a*) is primarily concerned with obtaining information about existing roads which is necessary for the selection of a route. The information required, the methods used, and the obstructions to be observed and recorded are discussed in paragraph 12*b* and *c*.

d. The road reconnaissance report is made on a Standard Road Reconnaissance Report form which is described and illustrated in paragraph 13.

e. Road classification considers two groups of road characteristics—elements and attributes—and is expressed in fraction form (par. 14). It does not

include a description of the bridge classification system which is described in paragraph 19.

f. Road signs are classified in four groups: stop, warning, regulatory, and guide (par. 15). The use of directional disks (par. 16) is supplementary to the use of other guide signs.

11. Types of Roads

Road types, for the purpose of route classification, are defined below. They are classified from the standpoint of trafficability. The examples given are based on materials used and can be shifted from one category to another by the theater commander to fit local conditions.

a. All-weather road (*X*)—any road which, with reasonable maintenance, is passable throughout the year to a volume of traffic never appreciably less than its maximum dry-weather capacity. This type of road has a waterproof surface and is only slightly affected by rain, frost, thaw, or heat. At no time is it closed to traffic by weather effects other than snow blockage. Examples of roads in this category are—

(1) Concrete.

(2) Bituminous surface.

(3) Brick or stone pavement.

b. Limited all-weather road (*Y*)—any road which, with reasonable maintenance, can be kept open in bad weather to a volume of traffic which is considerably less than its maximum dry-weather capacity. This type of road does not have a waterproof surface and is considerably affected by rain, frost, or thaw. Traffic may be completely halted for short periods of a day or so at a time. Heavy use during adverse

weather conditions may lead to a complete collapse of the road. Examples of this category are—

(1) Crushed rock or waterbound macadam.

(2) Gravel or lightly metaled surface.

c. Fair-weather road (*Z*)—a road which quickly becomes impassable in bad weather and which cannot be kept open by normal maintenance. This type of road is so seriously affected by rain, frost, or thaw that traffic is brought to a complete halt for long periods. Examples of this category are—

(1) Natural or stabilized soil.

(2) Sand-clay.

(3) Shell.

(4) Cinders.

(5) Disintegrated granite.

d. The symbols *X*, *Y*, and *Z* are used only in the route classification formula.

12. Road Reconnaissance

a. Road reconnaissance is reconnaissance made to obtain information about existing roads, primarily to permit establishment of a route. It is concerned with the conditions of existing roads for immediate use and not for maintenance operations. The information obtained is used to estimate the quantity and kind of traffic and loads that a route can accommodate in its present condition. Road reconnaissance may also include estimates of the practicability of improvement and the engineer work involved in conditioning a route to accommodate specified traffic and loads.

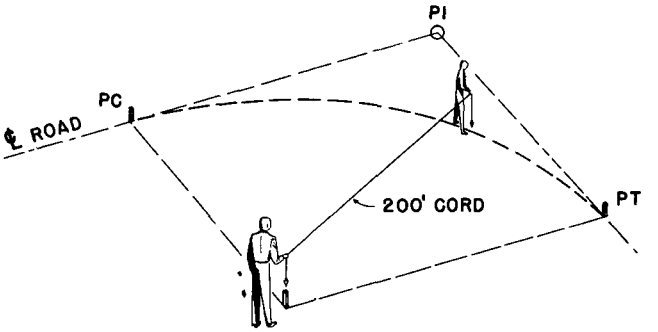
b. Information required for the reconnaissance report of an existing road includes the following:

(1) Local name of the road.

(2) Local road designation and number.
(3) Location of the road by map grid reference.
(4) The length of the road between specified and readily identifiable points.
(5) The normal width of the road:
  (*a*) Between fences.
  (*b*) Between drainage ditches.
  (*c*) Between edges of pavement; that is, traveled way.
(6) Alinement of the road.
(7) Drainage, including culverts.
(8) Foundation.
(9) Surface.
(10) Obstructions, including kinds and locations. (Obstructions include, but are not limited to, underpasses, fords, large tree limbs, craters, projecting buildings, etc.)
(11) Reductions in width.
(12) Excessive gradients; locations and grades of all over 6 percent.
(13) Sharp curves; location and radius of all shorter than 150 feet.
(14) Bridge locations. (Bridge reconnaissance is described in paragraph 18.)
(15) Underpass locations together with their limiting lengths, limiting widths, and limiting heights.
(16) Tunnel locations together with their limiting lengths, limiting widths, and limiting heights.
(17) Ford locations. (Ford reconnaissance is described in paragraph 24.)

(18) Ferry locations. (Ferry reconnaissance is described in paragraph 26.)
(19) Snow shed locations and estimated coverage.
(20) Snow gallery locations together with their limiting lengths, limiting widths, and limiting heights.

c. The radii of short radius curves may be estimated by using a cord to swing an arc. This method is shown in figure 5. The curves are staked as arcs



℄	Centerline
PC	Point of curvature
PI	Point of intersection
PT	Point of tangency

Figure 5. A curve staked by using a cord.

of circles by swinging an arc with tracing tape or cord from the experimentally determined center of a circle which is tangential to the relatively straight approaches to the curve being measured. The length of the tape or cord from the center of the circle to its circumference is the radius of the curve. This method is practical for curves having a radius up to 250 feet and located on relatively level ground.

d. A more practical method for measuring the radii of curves in any type of terrain, especially rough wooded or built-up areas, is based on the formula—

$$C=2\sqrt{m(2R-m)}$$

where: C = length of a chord subtended by an arc of a circle

m = the perpendicular distance from center of chord to the circle or centerline of the road, and

R = the radius of the circle.

This method is illustrated in figure 6.

Solving for R the above formula becomes—

$$R=C^2/8m+m/2$$

By fixing m at any convenient distance, such as 5 feet, the formula becomes—

$$R=C^2/40+2.5$$

In the practical application of the formula, m is measured from the centerline of the curve toward the estimated center of the circle and then C is

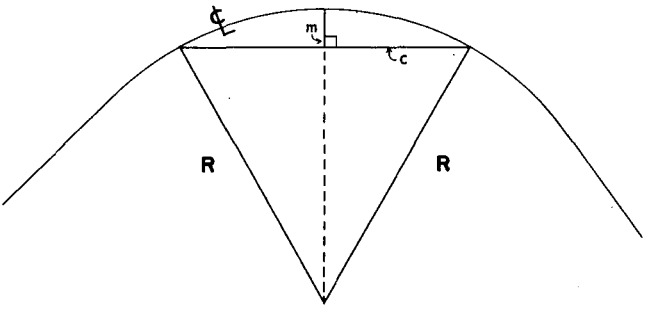


Figure 6. Measuring a curve using $R=C^2/8m+m/2$.

measured perpendicularly to m, making sure that C is centered on m.

Example: If C is measured to be 58 feet, from formula—

$$R=C^2/40+2.5, \text{ then}$$
$$R=86.6 \text{ feet}$$

Note that when m equals 5 feet and R equals 150 feet, C must equal 77.46 feet. Thus when measuring C any value greater than 77.46 feet will give a value of R greater than 150 feet and therefore the curve need not be reported.

13. Road Reconnaissance Report

a. The Standard Road Reconnaissance Report, (DA Form 1248) (fig. 7) is used to report all road information. Short forms or work sheets for rapid field work may be designed and produced by the unit making the reconnaissance.

b. Method of Use. All of the blank spaces on DA Form 1248 are to be filled in. When it is impossible to determine any item required by the report, the appropriate space should be marked NOT KNOWN. If the width of the roadway varies, paragraph 4 of the form should indicate the lower and upper limits of the width and the stretches of roadway of different widths should be indicated on the mileage chart. Similarly, if the data for items 9, 10, 11, and 12 of the form are different for various stretches of road, they should be so indicated by placing the appropriate road classification fraction (par. 14*b*) on the mileage chart opposite the stretch of road to which the classification applies. Obstructions are listed and described in section III of the form, and indi-

STANDARD ROAD RECONNAISSANCE REPORT (FM 5-36)

DATE: 29 Sept 1953

TO: (Headquarters ordering reconnaissance): S-2, 185th ECB

FROM: (Name, grade and unit of officer or NCO making reconnaissance): 1st Lt John J. Smith 185th ECB

1.	a. COUNTRY	b. SCALE	c. SHEET NUMBERS OF MAPS	2. DATE/TIME GROUP (Of signature)
MAPS	Virginia, Annandale	1:25000	US Sheet 5561 ISW ANS NF34	101630R

SECTION I - GENERAL ROAD INFORMATION

3. ROAD GRID REFERENCE: FROM 305034-294100 TO 315060-294750

4. ROAD MARKING (Civilian or Military number of road): Fairfax 644

5. LENGTH OF ROAD (Miles or kilometers, specify): 6.7 miles

6. WIDTH OF ROADWAY (Feet or meters, specify): 14-20 feet

8. WEATHER DURING RECONNAISSANCE (Include last rainfall, if known): Hot, dry, 95°F, Last rain about 15 June 1953

7. RECONNAISSANCE: DATE 10 JULY 1953; TIME 0800-1200

SECTION II - DETAILED ROAD INFORMATION (When circumstances permit more detailed information will be shown in an overlay or on the mileage chart on the reverse side of this form. Standard symbols will be used.)

9. ALINEMENT (Check one ONLY)
- (1) FLAT GRADIENTS AND EASY CURVES
- (2) STEEP GRADIENTS (Excess of 6 in 100)
- (3) SHARP CURVES (Radius less than 150 ft (46 m).)
- ✓ (4) STEEP GRADIENTS AND SHARP CURVES

10. DRAINAGE (Check one ONLY)
- ✓ (1) ADEQUATE DITCHES, CROWN/CAMBER WITH ADEQUATE CULVERTS IN GOOD CONDITION
- (2) INADEQUATE DITCHES, CROWN/CAMBER OR CULVERTS ITS CULVERTS OR PITCHES ARE BLOCKED OR OTHERWISE IN POOR CONDITION

11. FOUNDATION (Check one ONLY)
- ✓ (1) STABILIZED COMPACT MATERIAL OF GOOD QUALITY
- (2) UNSTABLE, LOOSE OR EASILY DISPLACED MATERIAL

12. SURFACE DESCRIPTION (Complete items 12a and b)

a. THE SURFACE IS (Check one ONLY)
- ✓ (1) FREE OF POTHOLES, BUMPS, OR RUTS LIKELY TO REDUCE CONVOY SPEED
- (2) BUMPY, RUTTED OR POTHOLED TO AN EXTENT LIKELY TO REDUCE CONVOY SPEED

b. TYPE OF SURFACE (Check one ONLY)
- (1) CONCRETE
- ✓ (2) BITUMINOUS (Specify type where known): See Mileage Chart
- (3) BRICK (Pave)
- (4) STONE (Pave)
- (5) CRUSHED ROCK OR CORAL
- (6) WATERBOUND MACADAM
- (7) GRAVEL
- (8) LIGHTLY METALLED
- (9) NATURAL OR STABILIZED SOIL, SAND CLAY, SHELL, CINDERS, DISINTEGRATED GRANITE, OR OTHER SELECTED MATERIAL
- (10) OTHER (Describe):

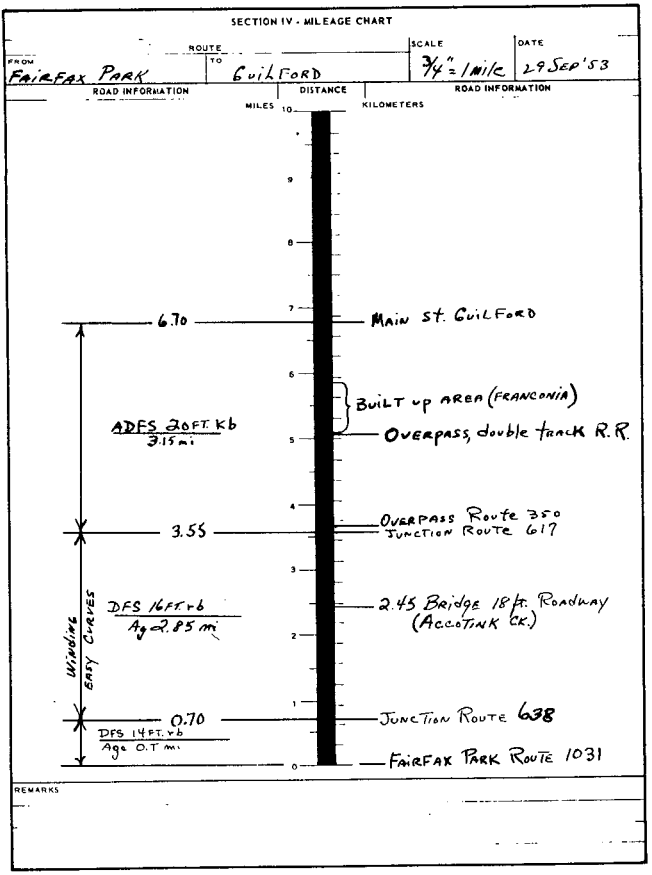
SECTION III - OBSTRUCTIONS (List in the columns below particulars of the following obstructions which affect the traffic capacity of a road. If information of any factor cannot be ascertained, insert "NOT KNOWN")
(a) Overhead obstructions, less than 14 feet or 4.25 meters, such as tunnels, bridges, overhead wires and overhanging buildings.
(b) Reductions in road widths which limit the traffic capacity, such as craters, narrow bridges, archways, and buildings.
(c) Excessive gradients (Above 6 in 100)
(d) Curves less than 150 feet (46 meters) in radius)
(e) Fords

SERIAL NUMBER a	PARTICULARS b	GRID REFERENCE c	REMARKS d
1	Steep GRADE - 8% UPHILL GOING EAST, 02 Mile LONG	305200-294250	
2	Series OF Sharp CURVES	305200-294250 TO 305500-294300	
3	Steep Grade - 7% DOWN HILL GOING EAST	308000-293850	

DA FORM 1 JAN 53 1248

1 Front of form

Figure 7. Example of a Standard Road Reconnaissance Report.



2 Back of form

Figure 7—Continued.

cated on the map or overlay by appropriate symbols (fig. 2). The mileage chart is on the reverse side of DA Form 1248. This chart is used to show the location of the salient features and classification elements of the road, starting at the bottom of the page and proceeding up the chart at the desired scale. If the English system of measurement (miles, yards, feet) is used, the opposite metric side of the chart may be used for additional information.

14. Road Classification

a. Characteristics Considered in Road Classification. The classification of a road considers two groups of characteristics. The first group, called *elements*, consists of alinement (*A*), drainage (*D*), foundation (*F*), and surface (*S*). Rating of elements used in road classification is given in table I. The second group, called *attributes*, consists of the length of the stretch of road to be classified, the width of the traveled way at its narrowest point, the type of surface material, the presence of gradients in excess of 6 percent, and the presence of obstructions. Symbols for the length and width of the road, and for types of road surfaces are given in table II.

b. Road Classification Fraction. Road classification is determined from general or hasty reconnaissance and is expressed in the form of a fraction. The road classification fraction is used on maps, overlays, and mileage charts for convenience and ready reference in preparing a hasty reconnaissance. The more deliberate reconnaissance is performed when time and the availability of qualified personnel permits. The resulting detailed information is

Table I. Ratings of Elements Used in Road Classification

Rating	Meaning	Symbol
	ALINEMENT	
Good	Flat gradients and easy curves	"*A*" in numerator.
Fair	Steep gradient (in excess of 6 percent)	"*Ag*" in denominator.
	Sharp curves with radius less than 150 ft	"*Ac*" in denominator.
Bad	Steep gradients and sharp curves	"*Agc*" in denominator.
	DRAINAGE	
Good	Adequate crown or superelevation with adequate ditches and culverts in good condition.	"*D*" in numerator.
Bad	Inadequate crown or superelevation; ditches or culverts blocked or otherwise in poor condition.	"*D*" in denominator.
	FOUNDATION	
Good	Stabilized, compact material of good quality	"*F*" in numerator.
Bad	Unstable, loose, or easily displaced material	"*F*" in denominator.
	SURFACE	
Good	Free of potholes, bumps, or ruts likely to reduce convoy speed.	"*S*" in numerator.
Bad	Bumpy, rutted, potholed, or excessively cracked to an extent likely to reduce convoy speed.	"*S*" in denominator.

Table II. Symbols for Length and Width of Road, and for Types or Road Surfaces

Symbol	Meaning
mi	Preceded by a numeral, indicates length of road in miles between two points identified by dots on the map or overlay.
km	Preceded by a numeral, indicates length of road in kilometers.
ft	Preceded by a numeral, indicates width of traveled way in feet at the narrowest point.
m	Preceded by a numeral, indicates width of traveled way in meters.
k	Concrete.
b	Bituminous surface treatment. The symbol "*b*" may be used with any of the other surface symbols to denote a waterproof bituminous skin. For example: *kb*—bituminous concrete.
p	Paving brick or stone.
r	Crushed rock, coral, or waterbound macadam.
gl	Gravel or lightly metaled surface.
n	Natural or stabilized soil, sand-clay, shell, cinders, disintegrated granite, or other selected material.
v	Various other types not itemized above (to be described in reconnaissance report).

recorded on the road reconnaissance report described in paragraph 13. The position of the symbols (*a* above) for the elements in the road classification fraction indicates their rating. Elements which are rated good, have their symbols placed in the numerator. Elements which are rated fair or bad, have their symbols placed in the denominator. The numerator contains, in addition to the "good" elements, the road width and the surface type; and the denominator contains the "fair" or "bad" elements and the road length, as shown below:

"good" elements, road width, surface type
"fair" elements or "bad" elements, road length

(1) An example of a classification fraction follows:

$$\frac{FD\ 20\ ft\ rb}{Agc\ S\ 6.4\ mi}$$

This fraction describes a stretch of road 6.4 miles long and 20 feet wide at the narrowest point in the traveled way. The road has a good foundation and drainage system, but bad alinement, with grades in excess of 6 percent and sharp curves with radii less than 150 feet. The road also has a bituminous macadam surface in bad condition.

(2) When factors cannot be determined, their symbols are omitted.

(3) Electric transmittal of the road classification fraction requires that the numerator be separated from the denominator by a slant, for example—

FD 20 ft rb/Agc S 6.4 mi

c. Obstructions. Obstructions which affect the traffic capacity of the road are not shown in the classification fraction, but are indicated on a map or overlay by the appropriate symbols selected from figure 2 and by placing a comprehensive description of them in section III of DA Form 1248 (fig. 7). Obstructions to be indicated in the road reconnaissance report include the following:

(1) Overhead obstructions—bridges, wires, overhanging buildings, or similar obstructions having a vertical clearance of less than 14 feet.

(2) Reductions in width such as craters, narrow bridges, archways, underpasses, and buildings projecting into the roadway.
(3) Steep gradients—in excess of 6 percent.
(4) Sharp curves which large combination vehicles may have difficulty negotiating—radius less than 150 feet.
(5) Fords.

d. Shoulders. Where shoulders are of appreciable width and usable in an emergency, they are covered by a separate note in the road report, giving width, type of surface (grass, gravel, etc.), and general condition.

e. Responsibility for Road Classification. Road classification is a responsibility of the engineer staff at the headquarters which arranged the required road reconnaissance.

15. Road Signs

Road signs are classified according to use as stop, warning, regulatory, and guide. Their sizes, shapes, colors, and markings are summarized in table III. Some of their applications are listed in table IV.

Table III. Road Signs—Shapes and Colors

Type	Shape	Position	Color	
			Background	Legend or symbol
Stop	Octagonal	Upper and lower sides of octagon horizontal.	Yellow	Black.
Warning	Square	One diagonal vertical	Yellow	Black.
Regulatory	Rectangular	Long axis vertical	White	Black.
Guide	Rectangular	Long axis horizontal	White	Black.

Note. Sizes of signs must be sufficiently large to be easily read under adverse light conditions.

Table IV. Road Signs—Applications

Type	Application
Stop	All vehicles stop.
Warning	Advance warning of stop signs and traffic signals. Bumps. Changes in road width. Cross road. Curves. Danger or hazard. Dangerous corner. Dips. Junction T. Junction Y. Level railroad crossing, advance warning. Men working. Railroad crossing. Road construction or repairs. Road narrows. Slippery road. Steep grades. Steep hill. Turns.
Regulatory	No entry. One way. Parking restriction. Specific regulations for vehicles. Speed limit.
Guide	Detour. Detour begins. Detour ends. Directions. Distances. Information to help driver. Locations. Route number.

a. Stop Signs. Stop signs (fig. 8) are octagonal in shape and require all vehicles to stop. They have a yellow background, on which the word "stop" is superimposed in black. The letters should be at least one-third the height of the sign. They are erected so that the upper and lower sides of the octagon are horizontal.

Figure 8. Stop sign.

b. Warning Signs. Warning signs (fig. 9) are used to indicate traffic hazards. They are square in shape and are erected on a diagonal. They have a yellow background on which the legend or symbol is superimposed in black. They are used to indicate turns, curves, intersections, steep grades, bumps, changes in road widths, railroad crossings, and other road hazards.

c. Regulatory Signs. Regulatory signs (fig. 10) are used to regulate and control traffic by legal authority. They are rectangular in shape and are placed with the long axis vertical. They have a white background on which the legend or symbol is

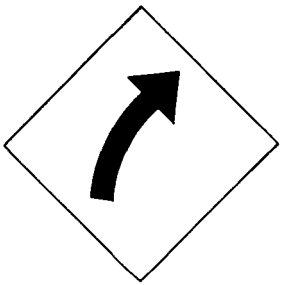
superimposed in black. They are used to indicate speed limits, one way, parking restrictions, and other specific regulations for vehicles except bridge classifications, which are discussed in paragraph 21.

d. Guide Signs. Guide signs (fig. 11) are used to indicate locations, distances, directions, route numbers, and similar information of help to drivers. In order to distinguish road guide signs from route guide signs (par. 9*a*), the road signs are rectangular in shape and are placed with the long axis horizontal to the ground. They have a white background on which the legend or symbol is superimposed in black.

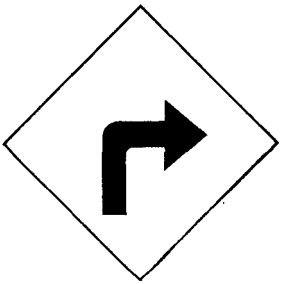
e. Exceptions. Exceptions to the signs described above include directional disks (par. 16), alternative route signs (fig. 4), and bridge markings (par. 21).

f. Night Signing. Night signing is not standardized. Each army provides lighting or reflecting devices where deemed necessary. Only the most important signs, or those indicating extremely hazardous conditions, should be lighted.

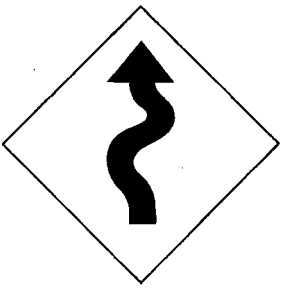
g. Road Signs in Arctic Regions. Arctic conditions require special attention to posting road signs. Permanent routes are designated by durable markers. In open country, poles about 8 feet high with direction markers, snow markers, wisps of straw, brushwood, rock cairns, or flags serve the purpose. Numbering the markers sequentially and placing them at equal distances from each other on tangents, with closer spacing on curves, are effective safety measures. Markers should be erected at least 3 feet off the traveled road to avoid damage by the traffic. If complete road marking is impossible, arrow sign posts should be erected at prominent points to indi-



CURVE TO RIGHT

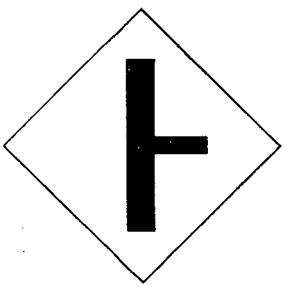


SHARP CURVE TO RIGHT

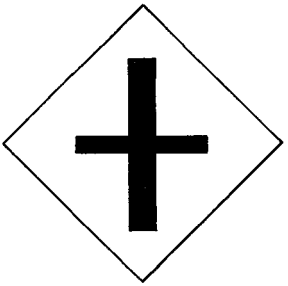


WINDING CURVES

RAILROAD CROSSING



T-JUNCTION



PRIMARY ROAD CROSSING
SECONDARY ROAD

Figure 9. Warning sign examples.

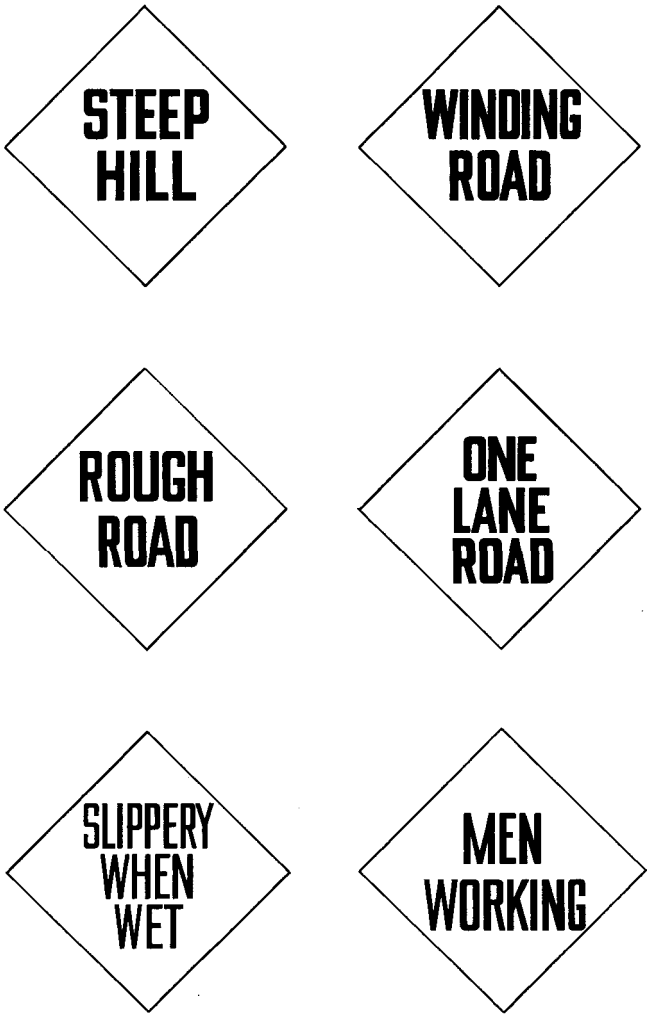


Figure 9—Continued.

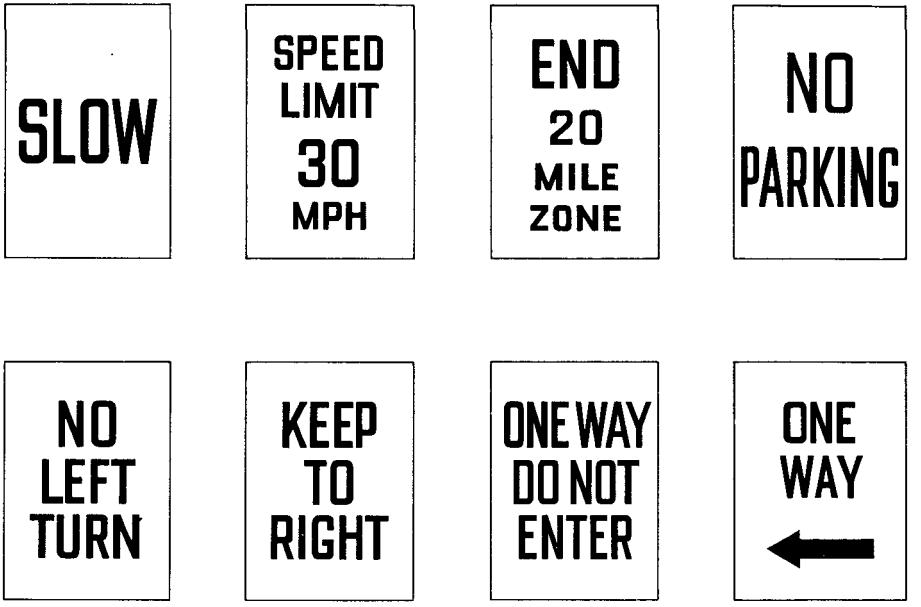


Figure 10. Regulatory sign examples.

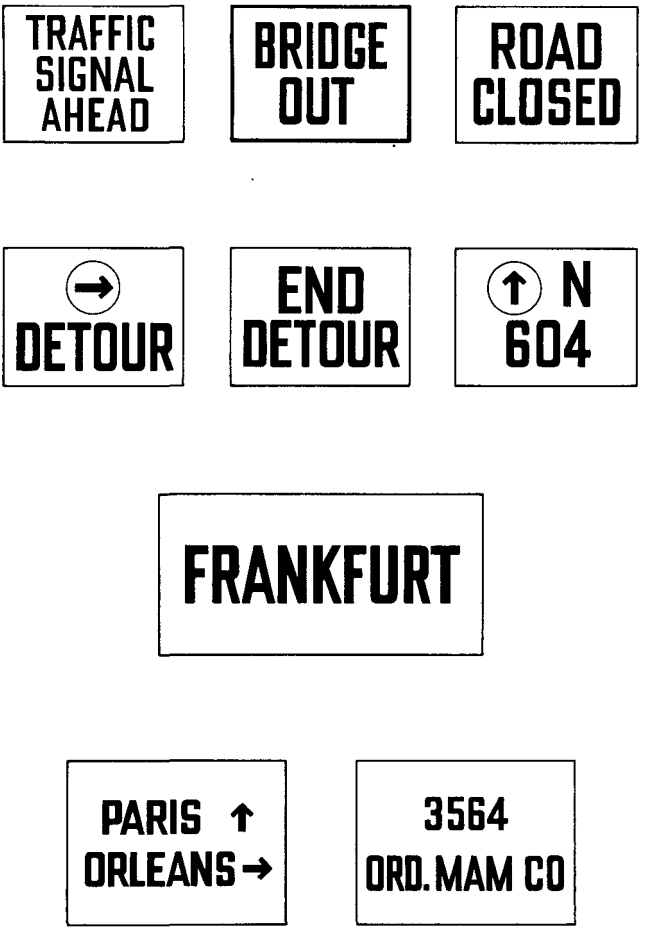


Figure 11. Guide sign examples.

cate the direction of the road or the route and the distance to the objective. Road markers used for long periods in arctic regions are checked frequently because their positions can be altered readily by an enemy.

h. Responsibility for Road Signs. Design and specifications for materials of road signs are responsibilities of the Chief of Engineers. Making road signs is an engineer responsibility. Posting road signs is an engineer responsibility coordinated with the appropriate provost marshal and the highway traffic regulation officer of the Transportation Corps regarding location and the number used. Operational responsibility for road signing is a command function.

16. Directional Disks

a. Directional disks (fig. 12) are used to supplement other guide signs to indicate the direction of a route. In addition they are used as an appendage to any major unit or formation sign indicating the route to that unit.

b. Details of the directional disk are as follows:

(1) The disk is a circle with a minimum diameter of 1 foot. The normal disk consists of a fixed black arrow on a white background. The disk used on detours has a fixed white arrow on a red background.

(2) The disk has eight equally spaced holes around the edge of the circumference to allow it to be erected with its surface vertical and with the arrow pointing in the appropriate direction.

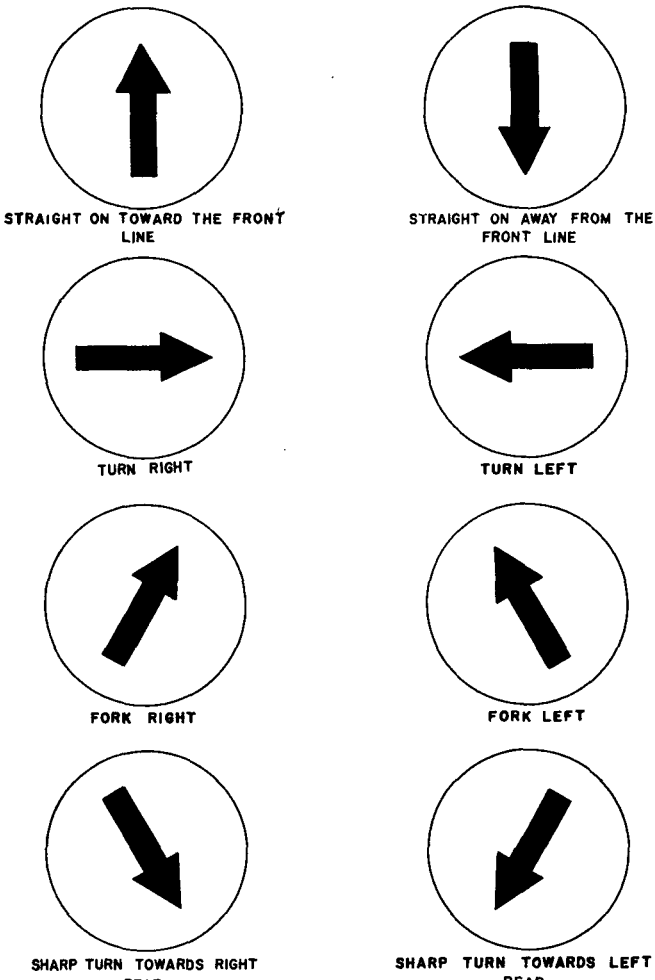


Figure 12. Directional disk markings.

c. Restrictions on the use of the directional disk are as follows:

(1) The directional disk is restricted for use on main supply routes, lateral routes, and main axes. Battalions and lower units are not permitted to erect directional disks on their own initiative. The object of this restriction is to insure that minor units do not make indiscriminate use of directional disks because of the resulting confusion which might occur.

(2) Units not allowed to erect directional disks can use arrow signs, providing they are of different coloring and shape from directional disks.

d. Application of directional disks is given in figure 12. These applications in no way supersede the use of regulatory signs listed in paragraph 15*c*.

SECTION IV

BRIDGES AND OTHER CROSSING MEANS

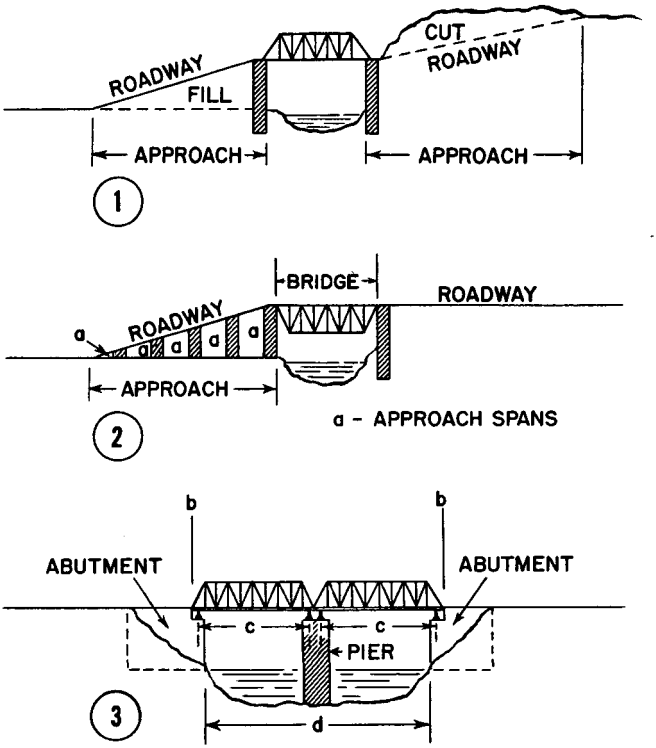
17. General

a. Crossing Means. Crossing means discussed in section IV are as follows:

(1) *Bridges.* A highway bridge (fig. 13) is a structure erected over a river, a chasm, or a gorge, which carries a roadway for vehicular or foot traffic. (Railway bridges are often decked over to serve as highway bridges.) Bridge reconnaissance is discussed in paragraph 18, and bridge classification is described in paragraph 19. Bridges generally consist of three elements, as follows:

(*a*) *Spans.* Types of spans are illustrated in appendix III. They are classified as slab, beam (stringer, either simple or continuous), girder, truss, cantilever, arch, suspension, or ponton (floating). If movable, spans are further classified as swing, bascule, retractile, or lift.

(*b*) *Intermediate supports.* Intermediate supports are illustrated in appendix IV. They are classified by types as trestle



b-b OVERALL LENGTH

c-c LENGTH, BEARING TO BEARING

d LENGTH, ABUTMENT TO ABUTMENT

1 Typical bridge with fill approach at one end and cut approach at other end
2 Typical bridge with approach spans at one end
3 Typical bridge, consisting of two spans and a pier support, illustrating length measurement bases

Figure 13. Typical bridge approaches, abutments, and pier.

bents, pile bents, crib piers, and solid piers.

(c) *Abutments.* Abutments are the ground supports at each end of a bridge. They are illustrated in appendix V. Abutments are classified as straight, wing, U-type, and T-type. Construction of approaches to these abutments varies from simple fill method to detailed bridge type construction.

(2) *Tunnels.* Tunnels are illustrated in appendix VI. Their reconnaissance and related details are discussed in paragraph 22 and appendix VI. Tunnels are classified, by types of bore, as semicircular, eliptical, horseshoe, and square with arched ceiling.

(3) *Causeways, snowsheds, and galleries.* Causeways, snowsheds, and galleries are crossing means which may be less frequently encountered in route reconnaissance than others discussed in this section. Each should be judged on its own merits, as to the necessity of making a report on reconnaissance of the structure.

(4) *Fords.* Fords are classified by their trafficability for personnel, trucks, and tanks. Their reconnaissance and associated details are discussed in paragraph 24.

(5) *Crossings on ice.* In estimating the load-carrying capacity of ice, for use as a stream crossing, both the thickness and the condition of the ice must be taken into considera-

tion. This is discussed in further detail in paragraph 25.

(6) *Ferries.* Ferries are classified as powered ferries, cable ferries, or current operated ferries. Their reconnaissance and associated details are discussed in paragraph 26.

b. Bypass Information. For the purpose of route reconnaissance information, bypasses are divided into four categories. These categories, together with their symbols, are discussed in detail in paragraph 27. They are as follows:

(1) Bypass exists.
(2) Bypass readily constructed.
(3) Bypass difficult.
(4) Bypass impossible.

c. Administrative Procedure and Traffic Control. Responsibility for the various procedures involved in the marking of bridges and other crossing means is discussed in paragraph 28. Traffic control includes the supervision of special crossings of bridges or other crossing means. Traffic control responsibility and special crossings are discussed in detail in paragraph 29.

18. Bridge Reconnaissance

a. The purpose of bridge reconnaissance is to determine limiting features of a bridge used as a portion of a route. These limiting features include limiting width, overhead clearance, length (if a bottleneck), load-carrying capacity, traffic movement possibilities, estimated amount of repair or reinforcement required, and posting needs. There are two approaches to bridge reconnaissance, depend-

ing upon the amount of time and qualified personnel available for the reconnaissance.

(1) *Hasty reconnaissance.* Hasty reconnaissance is made to determine the immediate trafficability of the bridge. The information to be obtained from this type of reconnaissance is similar to that for deliberate reconnaissance, except that time and other limitations preclude a complete coverage. Therefore, hasty reconnaissance attempts only to gain exact information necessary to allow immediate use of the bridge with reasonable safety. A temporary bridge classification may be computed from the information obtained by hasty reconnaissance by the use of appendix VIII.

(2) *Deliberate reconnaissance.* Deliberate reconnaissance is made when time and qualified personnel are available to determine all of the features necessary to a thorough analysis and classification or to determine necessary repairs or demolition procedures. The information to be obtained by deliberate reconnaissance is detailed. It includes the approach roadway, the identification of the bridge by its name or number, class, name of the geographical feature it crosses, its location by highway number, and other distinguishing details. It includes also a description of the bridge by type, its principal dimensions, its general condition, and, where required, sufficient detailed dimensions to permit calculating its load-carrying

capacity. It finally includes site features; bypass information; the repairs and reinforcement needed; a rough estimate of the time, labor, and material needed to effect the repairs and the reinforcement; and a demolition estimate. Sketches of sufficient detail to illustrate the written report should be included.

b. The Bridge Reconnaissance Report (DA Form 1249) is used to report bridge information. The instructions for making the reconnaissance should indicate the amount of detail required so as to guide the reconnaissance party. Short forms or work sheets for rapid field work may be designed and produced by the unit making the reconnaissance.

c. Details to be entered on DA Form 1249 in the order of items follow:

(1) *Identification* (*items 1–11*). Enter all data which establish positive identification of the bridge by reference to route, map sheet, grid reference, bridge name or number, class, geographic location, and crossing.

(2) *General reconnaissance* (*Section I, items 12–17*). Record the temporary class (app. VIII), roadway width, overhead clearance, condition, total length, and bypass information.

(3) *Detailed reconnaissance* (*Section II, items 18–20*). Enter the principal dimensions of the bridge as indicated in table V, the site features, and the condition of approaches. In item 18c, circle appropriate letters (NESWN) to indicate location of each

abutment, i. e., NE for northeast, S for south, etc.

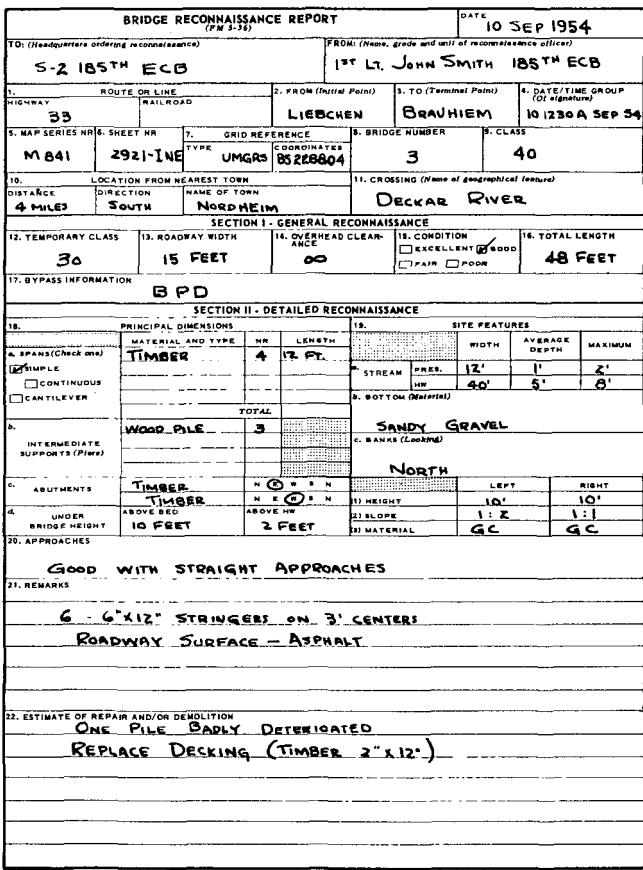
(4) *Remarks* (*item 21*). Note any additional pertinent data, not specifically covered elsewhere on the report.

(5) *Estimate of repair and/or demolition* (*item 22*). Record, where necessary, the repairs and reinforcement needed. Give a rough estimate of the time, labor, and material needed to effect the repairs and reinforcements. Include a demolition estimate.

(6) *Sketches* (*item 23*). Make two-dimensional sketches of the bridge, consisting of a side elevation, a cross section of the critical span, a cross section of the critical member, and a site plan.

(*a*) The side elevation shows the general features of the structure including the number of spans, piers, abutments, and their types. Dimensions, such as span length, height above streambed, water level, and panel length, are also noted on the side elevation.

(*b*) The cross section of the critical span shows sufficient information regarding the detail of construction to allow calculations for its classification, maintenance, reinforcement requirements, and destruction. This includes items such as: width of span, type of construction, and design detail. Tables V and VI outline necessary dimension requirements for each type of bridge.



BRIDGE RECONNAISSANCE REPORT (FM 3-36)

DATE: 10 SEP 1954

TO: (Headquarters ordering reconnaissance): S-2 185TH ECB

FROM: (Name, grade and unit of reconnaissance officer): 1ST LT. JOHN SMITH 185TH ECB

1. ROUTE OR LINE — HIGHWAY: 33 — RAILROAD:

2. FROM (Initial Point): LIEBCHEN

3. TO (Terminal Point): BRAUHIEM

4. DATE/TIME GROUP (Of signature): 10 1230A SEP 54

5. MAP SERIES NR: M 841

6. SHEET NR: 2921-INE

7. GRID REFERENCE — TYPE: UMGRS — COORDINATES: 85 2268804

8. BRIDGE NUMBER: 3

9. CLASS: 40

10. LOCATION FROM NEAREST TOWN — DISTANCE: 4 MILES — DIRECTION: SOUTH — NAME OF TOWN: NORDHEIM

11. CROSSING (Name of geographical feature): DECKAR RIVER

SECTION I - GENERAL RECONNAISSANCE

12. TEMPORARY CLASS: 30

13. ROADWAY WIDTH: 15 FEET

14. OVERHEAD CLEARANCE: ∞

15. CONDITION: ☐ EXCELLENT ☑ GOOD ☐ FAIR ☐ POOR

16. TOTAL LENGTH: 48 FEET

17. BYPASS INFORMATION: BPD

SECTION II - DETAILED RECONNAISSANCE

18. PRINCIPAL DIMENSIONS

	MATERIAL AND TYPE	NR	LENGTH
a. SPANS (Check one) ☑ SIMPLE ☐ CONTINUOUS ☐ CANTILEVER	TIMBER	4	12 FT.
b. INTERMEDIATE SUPPORTS (Piers)	WOOD PILE	3	
		TOTAL	
c. ABUTMENTS	TIMBER	N (W) S N	
	TIMBER	N E (W) S N	
d. UNDER BRIDGE HEIGHT	ABOVE BED: 10 FEET	ABOVE HW: 2 FEET	

19. SITE FEATURES

		WIDTH	AVERAGE DEPTH	MAXIMUM
a. STREAM	PRES.	12'	1'	2'
	HW	40'	5'	8'

b. BOTTOM (Material): SANDY GRAVEL

c. BANKS (Looking): NORTH

	LEFT	RIGHT
1) HEIGHT	10'	10'
2) SLOPE	1 : 2	1 : 1
3) MATERIAL	GC	GC

20. APPROACHES: GOOD WITH STRAIGHT APPROACHES

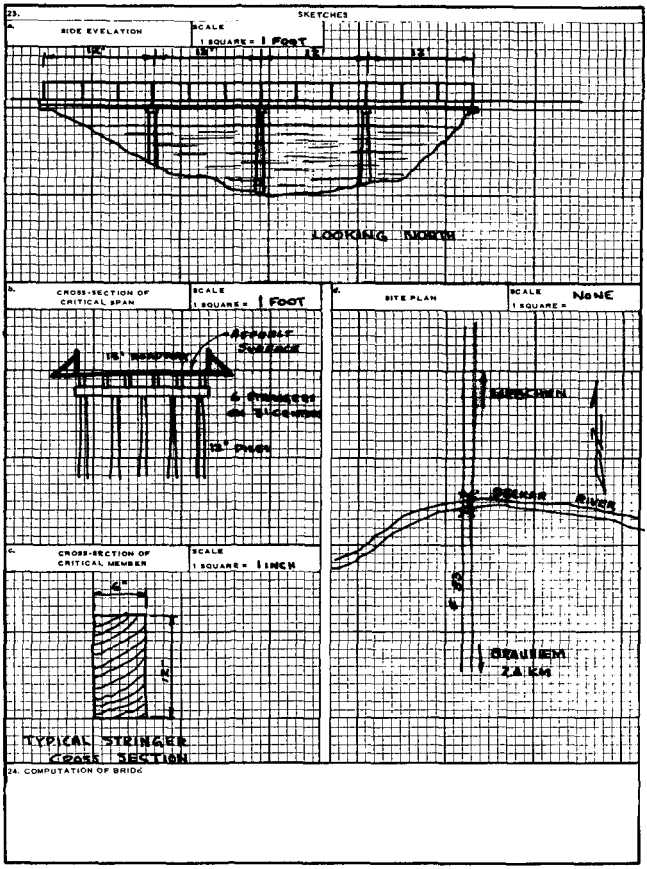
21. REMARKS: 6 - 6"X12" STRINGERS ON 3' CENTERS
ROADWAY SURFACE - ASPHALT

22. ESTIMATE OF REPAIR AND/OR DEMOLITION: ONE PILE BADLY DETERIORATED
REPLACE DECKING (TIMBER 2" X 12")

DA FORM 1 JAN 56 1249

1 Front of form

Figure 14. Bridge Reconnaissance Report form.



2 Back of form

Figure 14—Continued.

(*c*) The cross section of the critical member shows sufficient dimensions to allow mathematical development of its strength. Detailed dimensions are furnished to meet the requirements for any given type of bridge, as indicated in table VI.

(*d*) The site plan sketch shows location, length, and width of the bridge; the dimension and gradient of the roadway approach and departure from the structure; terrain topography of sufficient detail to trace waterways; fording possibilities; and other pertinent details.

(7) *Computation of bridge class* (*item 24*). Using the information obtained above, compute the bridge classification by methods described in appendixes VII, VIII, and IX, or in TM 5–260.

(8) *Photographs.* Wherever possible, photographs should be included to show side view, view from traveled way, and a view underneath the deck, where applicable.

19. Bridge Classification

a. Bridge classification is the military method of grouping bridges by their safe load-carrying capacity under normal crossing conditions. For normal military convoy movements within the United States it is not necessary to establish bridge classes, because the approval of the appropriate state highway department must be obtained prior to the movement of vehicles which exceed the legal load limit. In a

Table V. General Dimension Data Required for Each of the Seven Basic Types of Bridges

Number on figure	Dimension data	Basic type of bridge						
		Simple stringer (fig. 41)	Slab (fig. 39)	T-beam (fig. 39)	Truss (fig. 49)	Girder (fig. 56)	Arch (fig. 59)	Suspension (fig. 68)
1	Overall length	x	x	x	x	x	x	x
2	Number of spans	x	x	x	x	x	x	x
2	Length of spans	x	x	x	x	x	x	x
2a	Panel length				x			x
3	Height above stream bed	x	x	x	x	x	x	x
3a	Height above estimated normal water level.	x	x	x	x	x	x	x
4	Width of roadway	x	x	x	x	x	x	x
5	Vertical clearance (over)				x			x
6	Horizontal clearance	x	x	x	x	x	x	x

Notes:

1. The figures referred to are outline drawings of the basic types of bridges.
2. The letter "x" indicates that the dimension is required.

Table VI. Capacity Dimension Data Required for Each of the Seven Basic Types of Bridges

Letter designation	Capacity [a] dimension data	Basic type of bridge									
		Simple stringers (fig. 41)					Slab (fig. 39)	T-beam (fig. 39)	Truss (fig. 49)	Girder (fig. 56)	Arch (fig. 59)	Suspension (fig. 68)
		Timber		Steel								
		Rectang.	Log	I-beam	Channel	Rail						
a	Thickness of wearing surface	x					x	x	x	x	x	x
b	Thickness of flooring, deck, or depth of fill at crown.	x					x	x	x	x	x	x
c	Distance, c-to-c, between T-beams, stringers, or floor beams.	x	x [b]	x	x	x	------	x	x	x	x	x
d	Number of T-beams or stringers	x	x	x	x	x	------	x	x	x	--------	x
e	Depth of each T-beam or stringer	x	[b]	x	x	x	------	x	x	x	--------	x
f	Width of each T-beam or stringer	x	------	[c]	[c]	[c]	------	x	x	x	--------	x
g	Thickness of web of I-beams, WF-beams, channels, or rails.	------	------	x	x	x	------	--------	x	x	--------	x
h	Sag of cable	------	------	--------	------	------	------	--------	--------	--------	--------	x
i	Number of each size of cable	------	------	--------	------	------	------	--------	--------	--------	--------	x
j	Thickness of arch ring	------	------	--------	------	------	------	--------	--------	--------	x	--------
k	Rise of arch	------	------	--------	------	------	------	--------	--------	--------	x	--------
l	Diameter of each size of cable	------	------	--------	------	------	------	--------	--------	--------	--------	x
m	Depth of plate girder	------	------	--------	------	------	------	--------	--------	x	--------	--------

n	Width of flange plates									x			
o	Thickness of flange plates									x			
p	Number of flange plates									x			
q	Depth of flange angle									x			
r	Width of flange angle									x			
s	Thickness of flange angle									x			
t	Depth of web plate									x			
u	Thickness of web plate									x			
v	Average thickness of flange			x									

Note. "x" indicates required dimension.

[a] Capacity is computed by the use of formulas and data in bridge manuals.

[b] Diameter.

[c] Width of flange.

state of emergency, bridge classes are established by the engineer of the command that is to use the bridge.

b. The bridge class number is a whole number ranging from 4 to 150. It is determined by an engineering analysis according to principles described in TM 5–260 and is placed on a standard sign used to mark a bridge. Methods of determining a temporary classification number are given in appendix VIII. The bridge class number may be either single or dual.

(1) A single class number is the bridge class number that will permit the crossing of *either* wheeled *or* tracked vehicles whose vehicle class numbers are equal to or less than the bridge class number.

(2) A dual class number is a dual number which indicates one normal class number for wheeled vehicles and another normal class number for tracked vehicles. Dual class numbers may be used only when the span length is approximately 95 feet or less, and when the bridge is capable of carrying tracked vehicles whose vehicle class numbers are 50 or larger. Typical dual class numbers are: 70/50, 80/60, 100/60, and 50/70. The wheeled vehicle class number is always shown above the tracked vehicle class number. A bridge may be posted with a *single class number* even though a *dual class number* is authorized.

c. The *normal bridge class number* is a whole number which represents the highest class vehicle permitted to cross the bridge under normal crossing

conditions; that is, vehicles maintain a 30-yard convoy spacing, for floating bridges speed is limited to 25 miles per hour, and sudden stopping or acceleration is not permitted. If the class number is not dual, the number is the maximum class for wheeled vehicles or the maximum class for tracked vehicles, whichever is the smaller. If the bridge class number is a dual class number, wheeled and tracked vehicles are considered separately and both numbers are posted. The normal class number of a multilane bridge may be a combination of class numbers indicating the normal class for two lane traffic and the computed class number for one-way traffic using two lanes without the restrictions imposed by controlled crossing rules (par. 29*b*(1)).

d. A *special class number* is a number which represents the load-carrying capacity of a bridge under special crossing conditions. Under exceptional operating conditions in the field, the theater commander or local civil authorities, in areas under their control, *may authorize* vehicles to cross bridges when the bridge classification number is less than the vehicle classification number. *Special class numbers* are never posted on standard bridge marking signs, but may be posted on supplementary signs. Special class numbers may be for either controlled, caution, or risk crossings (par. 29*b*).

(1) A *controlled class number* is the number obtained, for multilane bridges only, by multiplying the *normal class number* (either single or dual) of the weakest lane of the multilane bridge by the factor 1.5.

(2) A *caution class number* is the number ob-

tained by multiplying the normal single lane crossing class number of either a single lane or multilane nonstandard bridge by 1.25. For standard prefabricated bridges, the caution class number is obtained from appendix IX or the appropriate technical manual.

(3) A *risk class number* is a number which pertains only to standard prefabricated fixed or floating bridges and is obtained from classification data given in appendix IX and appropriate technical manuals.

e. Computation of bridge class numbers is described in appendixes VII, VIII, and TM 5–260. For each standard class, both a bending moment class curve and a shear class curve have been drawn. All bending moments have been computed in millions of inch-pounds. The curves were determined by plotting the maximum bending moment and the maximum shear force, induced in simple spans, by the hypothetical vehicles, representative of actual military vehicles of the United States and NATO nations, against the span length in feet. In computing the bending moment curves and the shear class curves, no allowance was made for impact, and it was assumed that all vehicles would maintain the normal convoy distance of thirty yards from the rear of one vehicle to the front of the following vehicle.

f. Assumptions made in calculating bridge class numbers include working stresses for timber, steel, and concrete; impact; and widths of roadway between curbs.

(1) The working stresses are shown in paragraphs 164, 180*c*, and 189, FM 5–35.

(2) The lateral distribution factor of 1.5 is taken from paragraph 156*a*, FM 5–35.

(3) The allowance for impact is 15 percent of the live load stresses for steel superstructures. No allowance is made for impact in timber structures (par. 159, FM 5–35).

(4) Computations and classifications are based on minimum widths of roadway between curbs, as given in table VII. Single-lane bridges with less roadway width than that given in the table must be posted with appropriate warning signs (par. 21*b*(2)), but do not require reduction in bridge class. The multilane class number will be reduced when the lane width required is not available.

Table VII. Minimum Widths of Bridges Used in Bridge Class Computations

Bridge class range	Minimum width between curbs	
	One lane (ft)	Two lane (ft)
4–30	11	18
31–60	13½	24
61–100	15	27

(5) The minimum vertical clearance above the bridge deck is 14 feet for bridges of class 70 and below, and 15 feet 6 inches for bridges above class 70. Less headroom does not

require reduction of bridge class, but does require marking with *telltales*, as described in paragraph 21*b*(2)(*b*).

(6) Bridges with spans of less than 25 feet, require special attention during classification if the computed class, due to shear, is higher than the computed class due to bending moment (TM 5–260).

g. Masonry, brick, and concrete arch bridge classifications are determined in accordance with the procedures given in appendix VII and TM 5–260.

h. Foreign civilian and foreign military bridges require classification in accordance with the procedures given in TM 5–260.

20. Responsibility for Bridge Classification

a. Standard equipment bridges, intended for vehicular use, are classified by the Chief of Engineers.

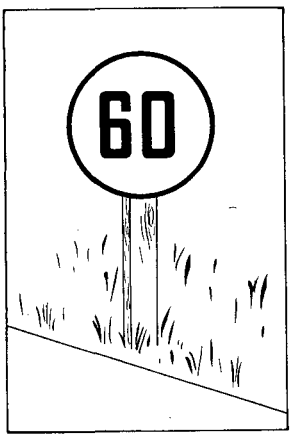
b. Classes of standard equipment bridges for normal, caution, and risk crossings are given in appendix IX and appropriate technical manuals.

c. A bridge designed in the field is classified by the engineer unit which designed it.

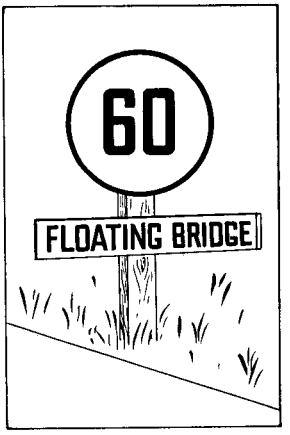
d. Existing domestic bridges, foreign civilian bridges, and foreign military bridges are classified by the engineer unit supporting the units using the bridges.

21. Bridge Marking

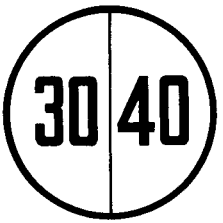
a. Purpose. Bridge marking provides a convenient means for indicating the bridge class and for giving other limiting information about the bridge to drivers and others (fig. 15).



(1)



(2)



(3)

1 For single lane fixed bridge
2 For floating bridge
3 Indicating the limiting vehicle classes of a two lane bridge when used as a two lane bridge or as a single lane bridge

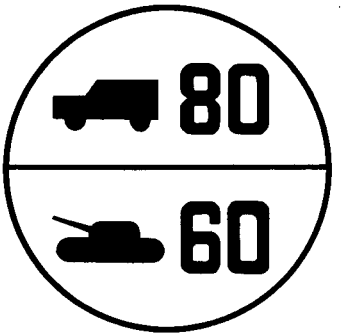
Figure 15. Typical bridge class and information signs.

b. Types. The two general types of bridge signs are circular signs and rectangular signs.

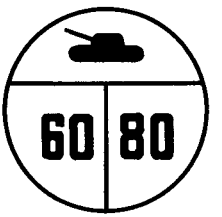
(1) *Circular signs.* The bridge classification is inscribed on circular signs. Such signs are

placed at all bridges to indicate the bridge classification. These signs have a yellow background with a 1½-inch black border, and the bridge classification and appropriate symbols are inscribed thereon in black. The legend should be as large as the diameter of the sign permits. Circular bridge signs with a single class number (fig. 15 ① and ②) have a minimum diameter of 16 inches, and those with dual class numbers (fig. 15 ③) have a minimum diameter of 20 inches. The bridge class number may be either a single lane, multilane, dual class or multilane dual class number or combination of numbers. Bridges which do not require a dual classification are marked with signs as shown in figure 15 ① and ②. A multilane single class bridge sign has the normal class number for two lane traffic on the left, and has on the right the computed class number for one-way traffic centered over two lanes (fig. 15 ③). A typical dual class sign is shown in figure 16 ①. Figure 16 ② illustrates the combination of dual class and two-way bridge class signs. In this application the wheeled vehicle sign will be placed above or to the left of the tracked vehicle sign. A multilane bridge having lanes of different classes will be posted with a separate class sign for each lane (fig. 17).

(2) *Rectangular signs.* Additional instructions and technical information are inscribed on rectangular signs. Such signs are placed



1



2

1 Indicating the limiting wheeled vehicle class and the limiting tracked vehicle class
2 Indicating combination of dual class and two-way bridge class signs

Figure 16. Typical dual class bridge signs.

at all bridges where additional restrictions and certain technical information are needed. Their size is a minimum of 16 inches in height or width, but at least as wide as the circular bridge sign with which they are associated. They have a yellow back-

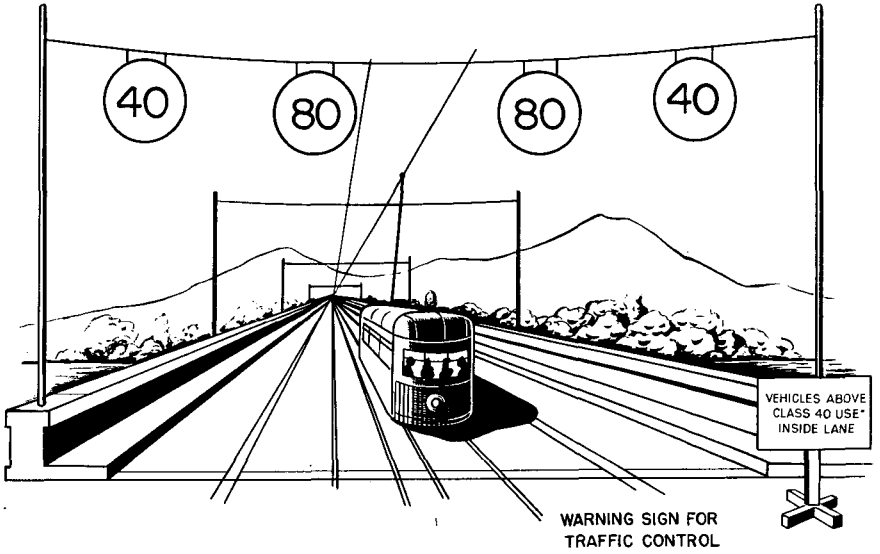


Figure 17. Typical multilane bridge applications of bridge class signs and road regulatory signs.

ground with a 1½-inch black border. The appropriate inscription on the sign should be as large as the dimensions of the sign permit, but the letters of the inscription must be at least 4 inches high. Separate rectangular signs are used to give certain technical information, except where existing civilian bridge signs are sufficiently clear. The rectangular signs include the following data:

(*a*) Width limitations for abnormally narrow bridges. The inscription on the rectangular sign consists of two horiozntal arrows with the limiting width given in feet.

(*b*) Height limitation for every bridge which has overhead bracing, trolley wires, or other features which limit the vehicle clearance to less than 14 feet for bridges of class 70 and below, and 15 feet 6 inches for bridges above class 70. The inscription on the rectangular sign consists of two vertical arrows with the limiting height given in feet. In addition, a *telltale*, usually a piece of timber suspended above the roadway at a height of 3 inches less than that of the bridge, is provided on the approach road, well in advance of the bridge (fig. 18). Vehicles which touch the telltale are diverted before reaching the bridge.

c. Location. Bridge signs are positioned so as to facilitate maintaining an uninterrupted flow of

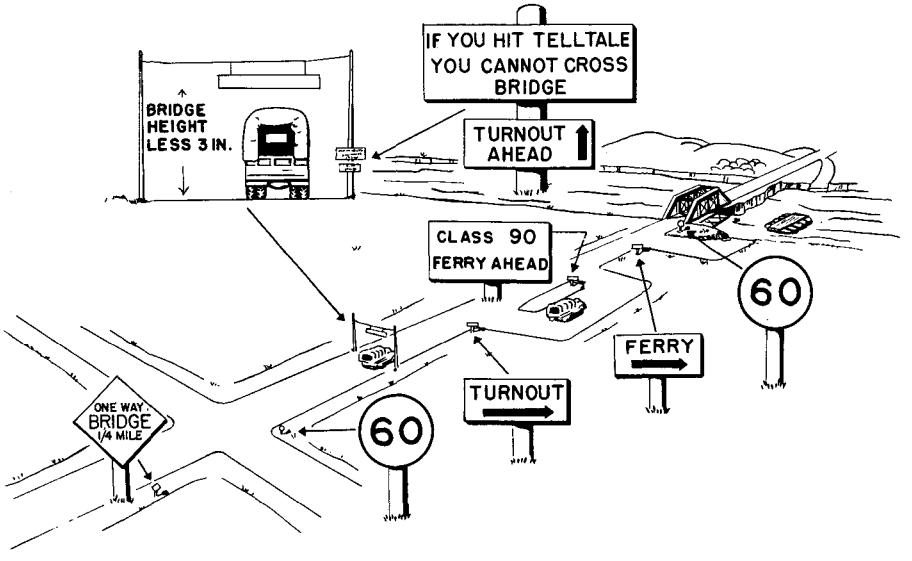


Figure 18. Typical single lane bridge applications of bridge class and information signs and road guide signs.

traffic over the bridge. The locations of circular and rectangular bridge signs and appropriate warning signs are as follows:

(1) Bridge classification (circular) signs (fig. 15 ①) are placed at both ends of each bridge in such a position as to be clearly visible to the drivers of all oncoming traffic.

(2) Bridge information (rectangular) signs are placed immediately below the bridge classification (circular) signs (fig. 15 ②).

(3) Bridge guide signs, such as the ones in figure 11, are placed at approaches to the bridge and at appropriate distances from the bridge, as required.

d. Examples. Example of bridge marking and guide signs are given in illustrations as follows:

(1) Typical bridge class and information signs are shown in figure 15.

(2) Typical dual class bridge sign for the limiting wheeled vehicle class and for the limiting tracked vehicle class is shown in figure 16 ①.

(3) Typical dual class bridge signs indicating combination of dual class and two-way bridge class signs are shown in figure 16 ②.

(4) Typical use of single lane bridge class and information signs and road guide signs is illustrated in figure 18.

(5) Typical use of two lane bridge class and information signs and road guide signs is illustrated in figure 19.

(6) Typical bridge class and road regulatory signs for multilane bridges are illustrated in figure 17.

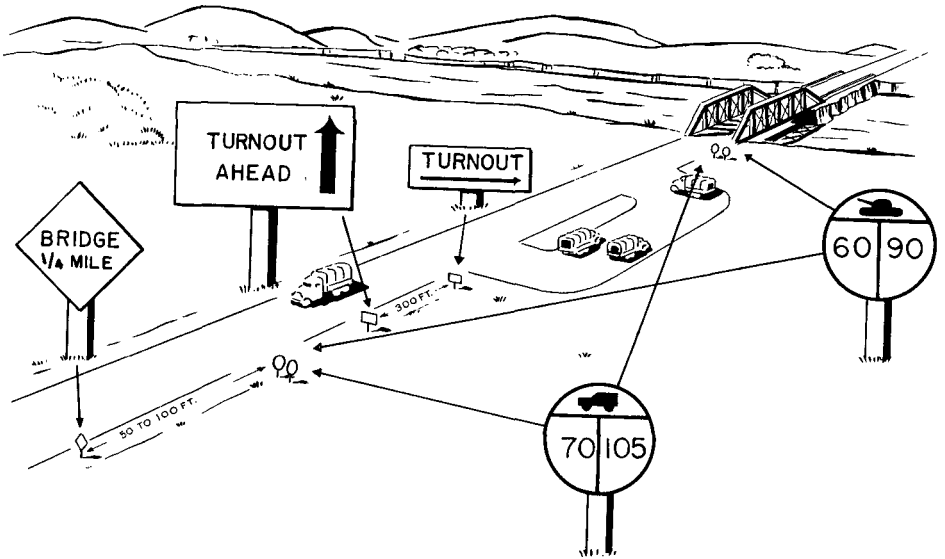


Figure 19. Typical two lane bridge applications of bridge class and information signs and road guide signs.

22. Tunnels

A tunnel is an underground passageway which is approximately horizontal and is open at both ends, providing for a road, a railroad, or a canal. The discussion of tunnels in this paragraph is confined to their reconnaissance and marking.

a. Tunnel Reconnaissance.

(1) The purpose of tunnel reconnaissance is to determine the limiting features of a tunnel used as a portion of a route and sometimes used for storage purposes.

(2) Information to be obtained by tunnel reconnaissance is detailed. It includes the approaches, the identification of the tunnel by its map location, its name, the name of the terrain feature it passes, its location by highway name and number or by railroad line, and other distinguishing features. It includes also a description of the tunnel by type of cross section of its bores, the bore lining, the portals, the kind of earth or rock through which it passes, its principal and also its limiting dimensions, and the clearance. It finally includes a description of its physical condition, and repairs if any needed for its effective use.

b. Tunnel Reconnaissance Report. DA Form 1250 (fig. 20) Tunnel Reconnaissance Report is used to report tunnel information. The instructions for making the reconnaissance should indicate the amount of detail required so as to guide the reconnaissance party. Short forms or work sheets for rapid field work may be designed and produced

TUNNEL RECONNAISSANCE REPORT (FM 5-36)

DATE: 12 Aug 54

TO: (Headquarters ordering reconnaissance) S-2 185TH ECB

FROM: (Name, grade and unit of reconnaissance officer) 1ST LT. J.J. SLOUGH 185TH ECB

1. ROUTE OR LINE		2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of signature)
HIGHWAY: 20Z	RAILROAD:	TOLZ	LUDWIG	12 1100A Aug 54

5. MAP SERIES NR	6. SHEET NUMBER	7. GRID REFERENCE		8. TUNNEL NUMBER
		TYPE	COORDINATES	
M 841	2624-II SE	UMGRS	BS 636 402	T-17

9. LOCATION FROM NEAREST TOWN			10. TYPE (Subaqueous, Rock, Soil)
DISTANCE	DIRECTION	NAME OF NEAREST TOWN	
1 MILE	SOUTHEAST	MATANG	ROCK

11. NAME (Mountain or Water feature)	12. LENGTH	13. NUMBER OF TRACKS	14. ROADWAY WIDTH
TARIS MOUNTAIN	120 Ft.	NA	21'-0"

15. CLEARANCE		16. GRADE (Percent)	17. ALINEMENT (Straight or radius of curve)
VERTICAL	HORIZONTAL		
23'-6" center 13'-6" o/s	26'-0"	4%	STRAIGHT

18. LINING (Material)	19. PORTALS (Material)	20. VENTILATION (Type)
CONCRETE	STONE	NATURAL

21. DRAINAGE: EXCELLENT

22. CHAMBERED FOR DEMOLITION	23. COMPLETED (Year)	24. CONDITION (Check appropriate box)
☐ YES ☑ NO	1872	☐ EXCELLENT ☐ GOOD ☑ FAIR ☐ POOR

25. BYPASSABILITY: BY PASS IMPOSSIBLE

26. ALTERNATE CROSSING: HWY 206 TO PRESTLY & HWY 93 TO KUNE

27. APPROACHES: FAIR

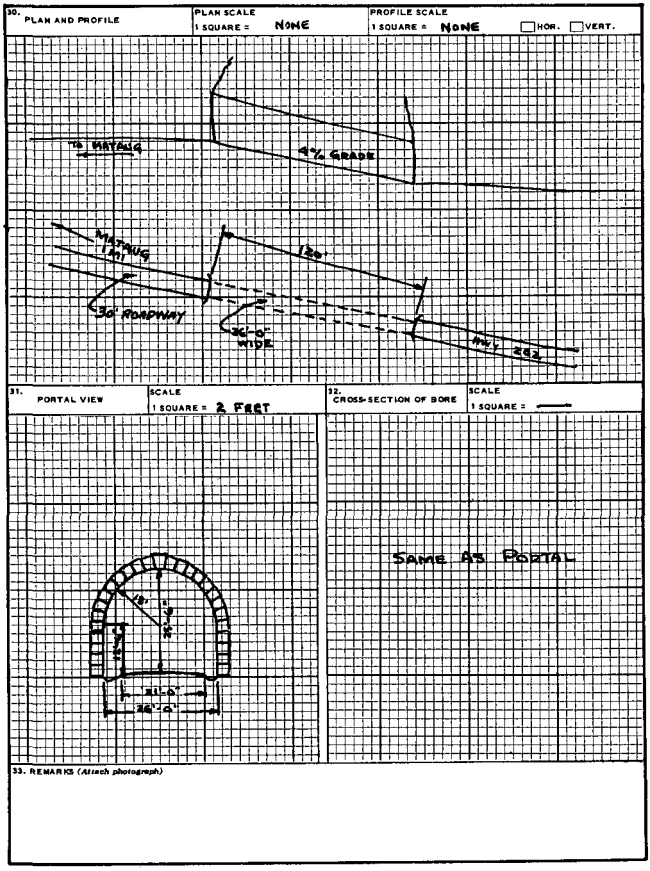
28. IN-TUNNEL RESTRICTIONS: NONE

29. GEOLOGIC DATA: GRANITE

DA FORM 1 JAN 58 1250

1 Front of form

Figure 20. Tunnel Reconnaissance Report form.



2 Back of form

Figure 20—Continued.

by the units making the reconnaissance. Unless otherwise directed, data are entered on the tunnel reconnaissance form as follows:

(1) *Identification* (*items 1–11*). Enter all information which establishes positive identification of the tunnel by route number, route location, map series and sheet numbers, grid reference, tunnel number, type of tunnel, and geographic reference name.

(2) *Dimensions* (*items 12–17*). Enter overall tunnel dimensions as indicated in figure 21. Design characteristics and guides for measuring tunnel dimensions are given in appendix VI.

(3) *Specifications* (*items 18–21*). Enter the type of lining material, type of portal material, type of ventilation, and drainage means.

(4) *Special considerations* (*items 22–29*). Enter here whether the tunnel is chambered for demolition, the date of completion of the tunnel, and its present condition. Enter also bypassability; opportunities for alternate crossing; the gradient and passability of the approaches; in-tunnel restrictions; and any geologic data pertinent to maintenance, improvement, or safety.

(5) *Sketches* (*items 30–32*). Draw a plan and profile, a portal view, and a cross section of the bore.

(*a*) The plan includes geographic positioning of the tunnel, approach and departure routes, and terrain features in the immediate area of the tunnel with emphasis on

special features which may affect alternate crossings. Tunnel alinement must be shown, including straight sections, angles, and curves. The profile shows the gradient to and from the tunnel, the gradient of the tunnel floor (designating any change in grade), and the relation of the tunnel to the terrain through which it passes.

(*b*) The portal view shows the mouth of the tunnel, the material of which it is constructed, and its position in relation to the surrounding terrain. It further shows a limited section of the approaching route.

(*c*) The cross section of the tunnel bore shows detailed information regarding the allowable traffic width, the shape of the bore as it may affect load heights and widths, and possible manmade or natural obstructions.

(6) *Remarks* (*item 33*). Include here any pertinent information not covered above and attach photograph.

c. Tunnel Marking. Marking of tunnels is done in accordance with the appropriate and applicable instructions for marking bridges as given in paragraph 21.

23. Causeways, Snowsheds, and Galleries

Causeways, snowsheds, and galleries are not usually encountered as often in route reconnaissance as other crossing means discussed in this section.

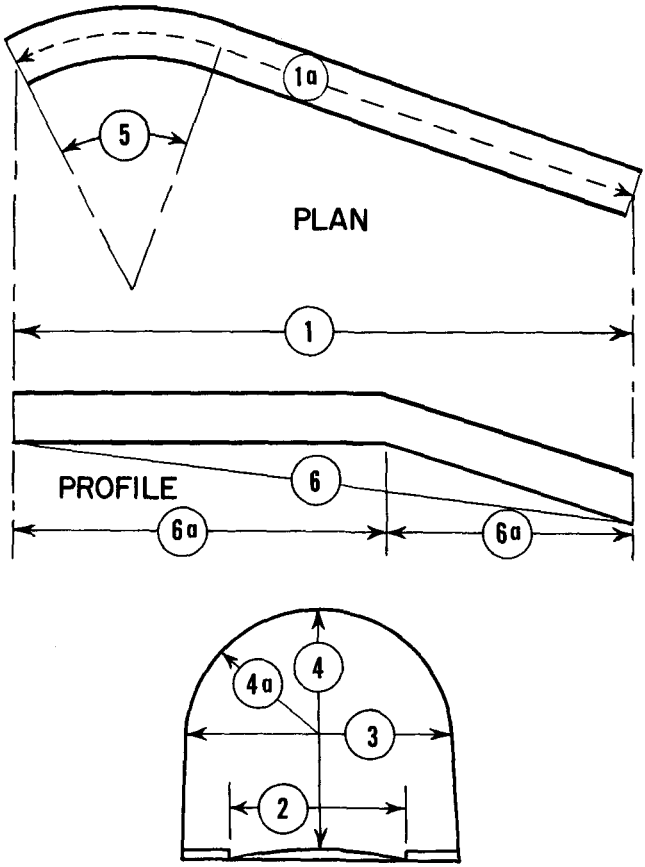


Figure 21. Standard dimensional data for tunnels.

EXPLANATION SHEET

1 - Portal-to-portal length of tunnel.

1a - Centerline distance of tunnel.

2 - Effective width of the roadway, curb-to-curb.

3 - Horizontal clearance, being the minimum width of the tunnel bore measured at least four feet above the roadway.

4 - Vertical clearance, being the distance between the top of the roadway and the lower edge of the tunnel ceiling or any obstruction below the ceiling, such as trolley wires or electric light wires.

4a - Rise of tunnel arch (radius of curved portion)

5 - Radius of curvature of the roadway either measured or estimated.

6 - Gradient, being the percentage of rise of the roadway between portals.

6a - Change in gradient within the tunnel (percentage of rise each way from break of grade).

Figure 21—Continued.

When such structures constitute an obstruction to the movement of traffic along the route, a reconnaissance report is made. Data required for such a report is limited to clearances and load-carrying capacity. The data are supported by photographs or a sketch of each structure. Sufficient descriptive information is also included in the reconnaissance report, if accomplished, to permit an evaluation of the structures in respect to their strengthing or removal.

a. A causeway is a raised way across wet or unstable ground. When a causeway is considered an obstruction, reconnaissance is reported as outlined above.

b. A snowshed is a shelter to protect from snow, as a long structure over an exposed part of a road or railroad. A reconnaissance report, when necessary, is completed as detailed above.

c. A gallery is any sunk or cut passageway covered overhead as well as at the sides. A gallery may, in some cases, constitute an obstruction to the movement of traffic along the route; and, if so, a reconnaissance report should be made as specified above. However, in the combat area, a gallery may become important not because it is an obstruction but for the additional protection it may afford.

24. Fords

A ford is a shallow place in a stream where the bottom permits the passage of personnel and vehicles.

a. Ford Reconnaissance.

(1) *Trafficability.* Fords are classified according to their passability for foot traffic (pedes-

trians), wheeled vehicles (trucks), and tracked vehicles (tanks). Their trafficability is established from the data given in table VIII.

Table VIII. Trafficability of Fords

Type of traffic	Fordable depth (feet)	Minimum width (feet)	Type bottom	Maximum allowable slope on approaches*
Foot	3½	3- (single file) 7- (column of 3's).	Firm enough to prevent sinking.	1:1
Trucks	2	12	Firm and smooth.	3:1
Light tank	1 to 3	14		2:1
Medium tanks	2 to 4	14		2·1
Heavy tanks	4 to 6	14		2·1

* Based on hard dry surface. If wet and slippery, slope must be less.

(2) *Approaches.* Approaches may be paved with concrete or a bituminous surface material but are usually unimproved, consisting of sand and gravel. The composition and the slope of the approaches to a ford should be carefully noted to permit a determination of its trafficability in bad weather.

(3) *Stream bottom.* The composition of the stream bottom of a ford determines its passability. It is important, therefore, to indicate if it is composed of sand, gravel, silt, clay, rock, or other material.

(4) *Ford bottom.* In some cases, the natural river bottom at a ford has been paved to

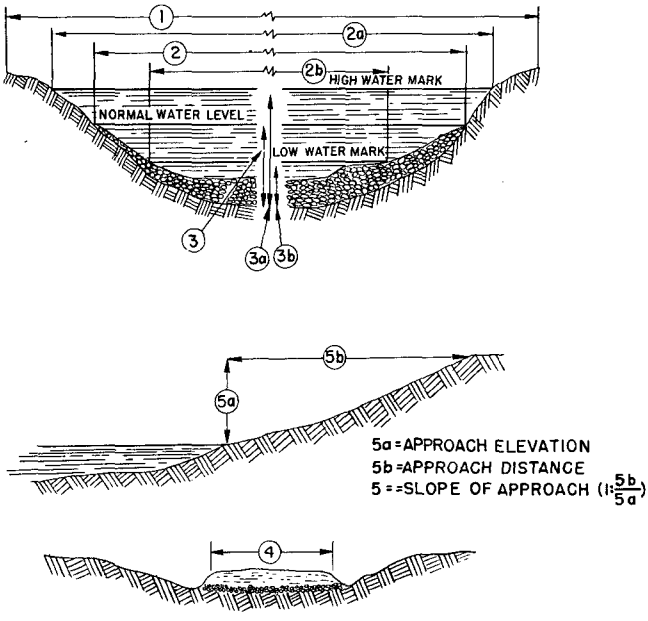


Figure 22. Standard dimensional data for fords.

improve its load-bearing capacity, and to reduce the depth of the water. Improved fords may have gravel or concrete floors, layers of sand bags, steel mats, or wooden planking.

(5) *Climatic conditions.* Seasonal floods, excessive dry seasons, freezing, and other such extreme weather conditions materially affect the fordability of a stream. For this reason the effect of climatic conditions on a ford should be recorded.

(6) *Current.* The swiftness of the current and the presence of debris are recorded in order

EXPLANATION SHEET

1 - The width of stream bed from bank to bank.

2 - The actual width of the water measured at normal stage. In addition, maximum width (2a) and minimum width (2b) are estimated, based on local observations or records of high water and low water, and then recorded.

3 - The actual depth of the stream at normal water level.

3a - Estimated maximum water depth based on local observations or records.

3b - Estimated minimum water depth based on local observations or records.

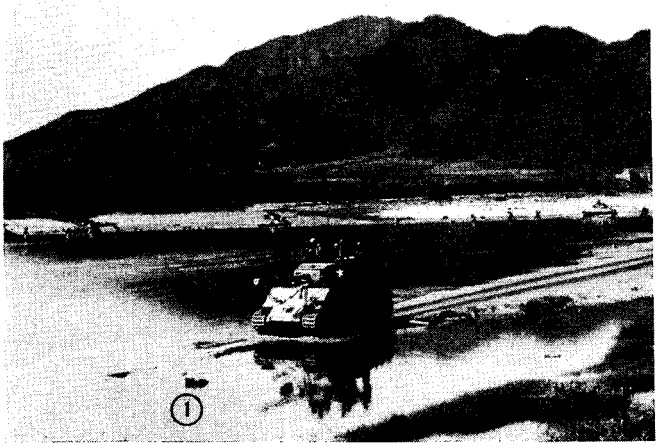
4 - The width of the approach. It is the effective width of the traveled way of the roads leading to the ford.

5 - The slope of the approaches. It is the shape of the stream banks through which the approach roads are cut. This is expressed as the ratio between elevation (5a) and distance (5b). For example, a slope of 1:1 means that the approach road drops one foot for every foot of length.

Figure 22—Continued.

to determine their effect on the condition and passability of the ford. The speed of the current is estimated as swift, moderate, or slow.

(7) *Dimensions.* The standard dimensional data used in describing fords are illustrated in figure 22.

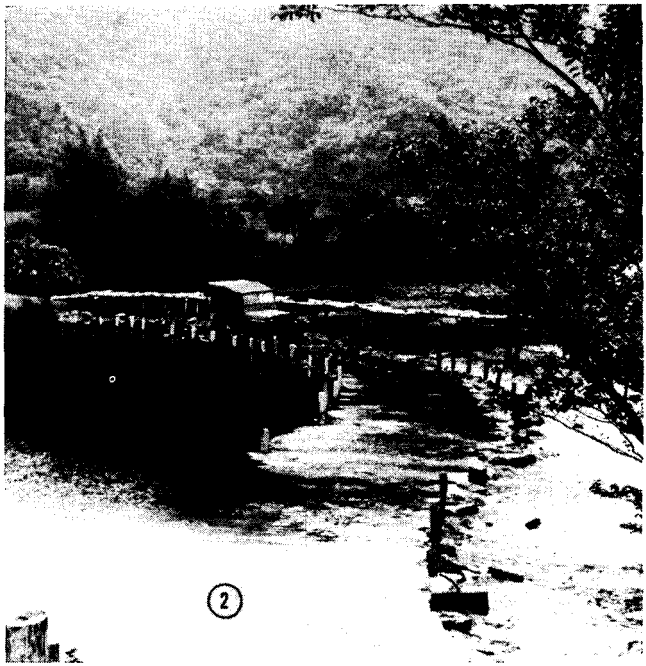


1 Typical ford

Figure 23. Ford crossing

(8) *Photographs.* Whenever a ford is reconnoitered, it is photographed. Photographs should show the banks, the approaches, and the stream, in one view. The photograph should be taken while a vehicle, preferably a military vehicle, is crossing, to give an indication of water depth and the location of the ford (fig. 23).

b. Ford Reconnaissance Report DA Form 1251. A report of each ford reconnaissance will be made on DA Form 1251, (fig. 24). Short forms or work sheets for rapid field work may be designed and produced by the unit making the reconnaissance.



2 Typical reconnaissance photograph of a ford
Figure 23—Continued.

Details to be entered on the Ford Reconnaissance Report form follow:

(1) *Identification* (*items 1–10*). Enter all data which will establish positive identification of the ford as to route, map sheet, grid reference, ford number, geographic location, and name of stream or crossing.

(2) *Characteristics of crossing* (*item 11*). Record the width and depth of the crossing and the

velocity of the stream at present water level and at low, mean, and high level. Also give date, season, or month(s) for each of these. Figure 22 indicates the dimensions to be recorded at each water level.

(3) *Description* (*items 12–17*). Record the composition of the stream bottom, composition and slope ratio of approaches, type of pavement (if any) of approaches and ford, usable width of approaches and ford, and any hazards, such as flash floods or quicksand, which would affect the trafficability of the ford. Figure 22 illustrates the method of computing slope ratio of approaches.

(4) *Remarks* (*item 18*). Enter here any other pertinent data not recorded elsewhere on the report. This should include description of approach roads, guide markers, depth gages, and any other information which may assist in the trafficability classification of the ford.

(*5*) *Sketches* (*items 19 and 20*). Draw military sketches of the ford, showing both a profile and a site plan.

(*a*) The profile sketch indicates the water level and the elevation of the stream bottom and approaches.

(*b*) The site plan gives the alinement of the ford and its approaches, with appropriate dimensions. Terrain and other site features in the immediate area of both banks should be shown. Also indicate the

north arrow and the direction of flow of the stream.

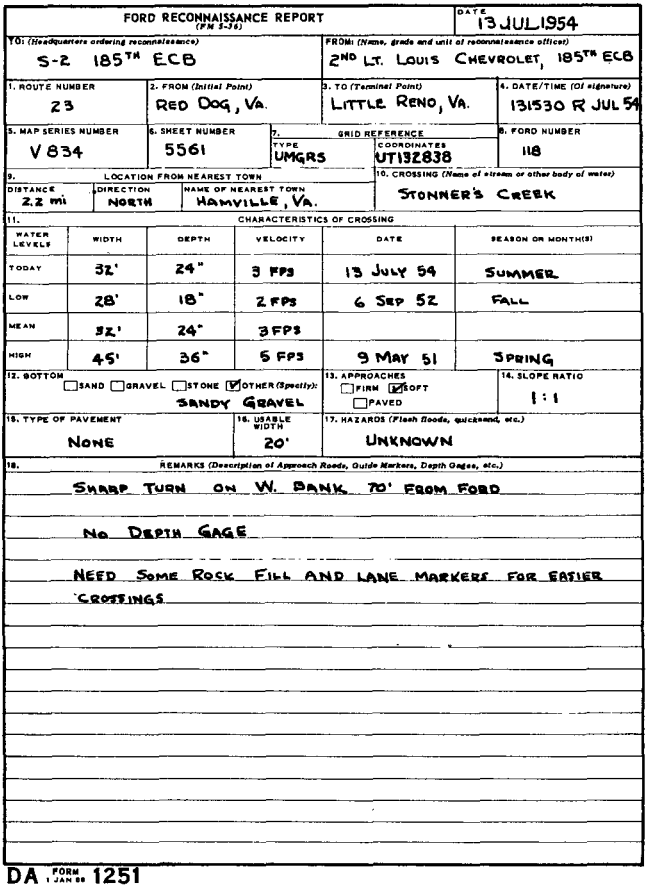
(6) *Remarks* (*item 21*). Attach photographs, as specified in *a*(8) above, to the Ford Reconnaissance Report.

c. Ford Marking. Marking of fords is done in accordance with the appropriate and applicable instructions for marking bridges as given in paragraph 21. In addition, the width of the ford is marked by suitable posts erected on the shores at high water level on both sides of the stream. Maximum depth of the ford should also be posted on both shores. Warning signs are erected on both shores to remind drivers that the brakes of vehicles driven through the ford are wet and must be appropriately dried.

25. Crossings on Ice

a. Conditions Governing Crossings on Ice. Crossing a stream on ice depends on settled weather and absence of enemy opposition. Sudden rises in temperature may weaken the ice. Enemy artillery fire or bombing may break the ice. However, under favorable conditions, crossing streams on ice is practicable, and can be successful for large bodies of troops and for heavy equipment.

b. Load-Carrying Capacity of Ice. The load-carrying capacity, or bearing power, of ice varies with its thickness and its condition. Clear, newly frozen ice is stronger than old, porous ice. Ice coatings are stronger when the ice is in intimate contact with the water underneath. Warm weather quickly reduces the carrying capacity of an ice layer, even



FORD RECONNAISSANCE REPORT (FM 5-36)

DATE: 13 JUL 1954

TO: (Headquarters ordering reconnaissance): S-2 185TH ECB

FROM: (Name, grade and unit of reconnaissance officer): 2ND LT. LOUIS CHEVROLET, 185TH ECB

1. ROUTE NUMBER	2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of signature)
23	RED DOG, VA.	LITTLE RENO, VA.	131530 R JUL 54

5. MAP SERIES NUMBER	6. SHEET NUMBER	7. GRID REFERENCE TYPE	GRID REFERENCE COORDINATES	8. FORD NUMBER
V 834	5561	UMGRS	UT192838	118

9. LOCATION FROM NEAREST TOWN: DISTANCE	DIRECTION	NAME OF NEAREST TOWN	10. CROSSING (Name of stream or other body of water)
2.2 mi	NORTH	HAMVILLE, VA.	STONNER'S CREEK

11. CHARACTERISTICS OF CROSSING

WATER LEVELS	WIDTH	DEPTH	VELOCITY	DATE	REASON OR MONTH(S)
TODAY	32'	24"	3 FPS	13 JULY 54	SUMMER
LOW	28'	18"	2 FPS	6 SEP 52	FALL
MEAN	32'	24"	3 FPS		
HIGH	45'	36"	5 FPS	9 MAY 51	SPRING

12. BOTTOM: ☐ SAND ☐ GRAVEL ☐ STONE ☑ OTHER (Specify): SANDY GRAVEL

13. APPROACHES: ☐ FIRM ☑ SOFT ☐ PAVED

14. SLOPE RATIO: 1 : 1

15. TYPE OF PAVEMENT: NONE

16. USABLE WIDTH: 20'

17. HAZARDS (Flash floods, quicksand, etc.): UNKNOWN

18. REMARKS (Description of Approach Roads, Guide Markers, Depth Gages, etc.)

SHARP TURN ON W. BANK, 70' FROM FORD

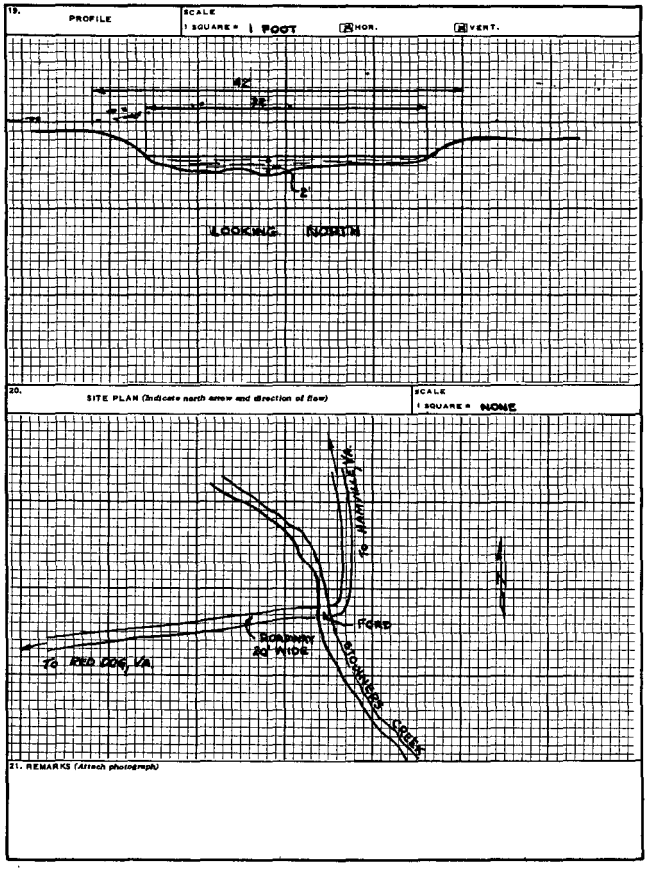
NO DEPTH GAGE

NEED SOME ROCK FILL AND LANE MARKERS FOR EASIER CROSSINGS

DA FORM 1 JAN 88 1251

1 Front of form

Figure 24. Ford Reconnaissance Report form.



2 Back of form

Figure 24—Continued.

though the thickness remains the same. The warm weather makes the ice layer porous and lowers its bearing capacity. Estimates of the loads which can be supported by undamaged ice layers in direct contact with the water beneath are presented in table IX.

Table IX. Estimated Load-Carrying Capacity of Ice Layers in Direct Contact With Water Beneath

Thickness of ice layer (in.)	Estimated load-carrying capacity
1½	Individual soldiers.
2	Infantry in open order.
6	Infantry in march column with light motor transport.
8	4-ton wheeled vehicles. Maximum axle load—7 tons. Minimum distance between vehicles—65 feet.
12	10-ton wheeled vehicles. Maximum axle load—7 tons. Minimum distance between vehicles—65 feet.
14	20-ton wheeled vehicles. Minimum distance between vehicles—65 feet.

26. Ferries

a. General. A ferry site is a place or passage where traffic and cargo are conveyed across a river or other water obstacle by a water vehicle which is called a ferry or ferryboat. Ferries encountered in route reconnaissance may vary widely in physical appearance and capacity, depending upon the width, depth, and current of the stream or body of water, and the character of the traffic to be moved. Propulsion of ferries may be by oars, by poles, or by steam, gaso-

line, or diesel engines. They may also be propelled by a cable stretched across the stream or body of water, by hand, or by power-operated winches. A trail ferry consists of a cable stretched across the stream and properly anchored on each bank. The assembly includes necessary hauling and maneuvering lines. The raft or rafts to be ferried are attached to the ferry cable, usually by a bicycle traveler, for ease and safety of movement. The method of construction and operation of a trail ferry is illustrated in figure 25. Construction of ferryboats varies through wide limits. They may be made of wood or metal, and range from expedient rafts to ocean-going vessels. A flying ferry is a current-operated ferry held in the stream by an anchor well upstream from the crossing site; as the ferry moves from shore to shore it describes an arc of a circle, the center of which is the anchor.

b. Ferry Reconnaissance.

(1) The capacity of a ferryboat is given in tons and in the total number of passengers and vehicles it can safely transport. When more than one ferryboat is employed for a given route, the capacity of each is given individually.

(2) Climatic conditions, from season to season, have a marked effect on ferry operations. Fog and ice substantially reduce the total traffic-moving capacity of the ferry route. Therefore, data on tide fluctuations, freezing periods, floods, excessive dry spells, and their effects on ferry operation are ascertained and recorded.

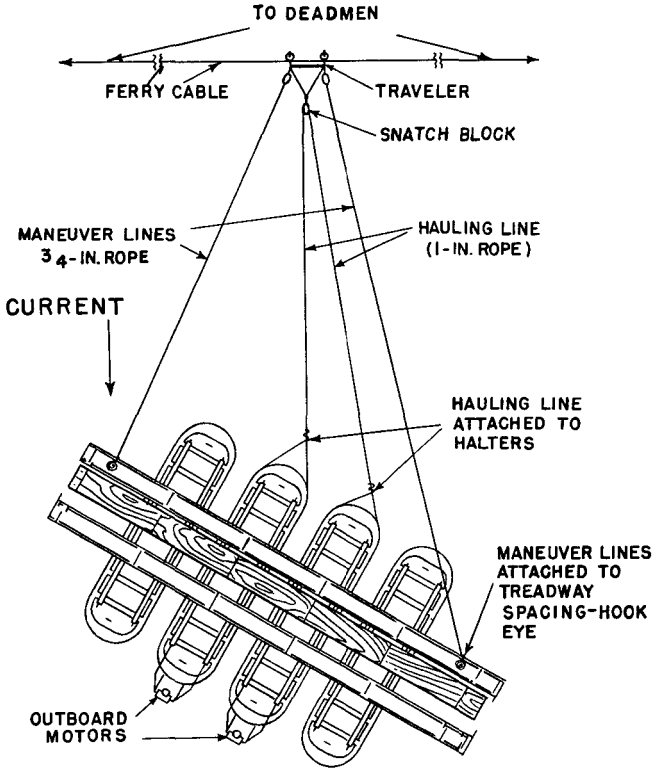


Figure 25. Trail ferry.

(3) Ferry slips, or piers, are provided at landing places on the shore to permit easy loading of passengers, cargo, and vehicles. The slips may vary from simple log or plank piers on wooden piles or trestle bents to elaborate terminal buildings, constructed of concrete or masonry and containing facilities

such as ticket offices, waiting rooms, and cargo and freight-handling equipment. The distinguishing characteristic of a ferry slip is the floating pier which can be quickly adjusted to the height of the ferryboat deck above the stream surface. This permits prompt loading and unloading of the ferryboat. The load-carrying capacity of the ferry slip determines the maximum weight of individual loads that can be moved across it and onto the ferry boat.

(4) Approach roads to ferry slips have an important bearing on the use of the ferry route. Therefore, the carrying capacity and condition of the approach roads must be ascertained and recorded.

(5) Dimensions of certain limiting features of ferries are necessary for adequate reconnaissance.

(*a*) Width of the stream or body of water from bank to bank at normal water level, is ascertained and recorded. In cases where the ferryboat does not cross at the narrowest point, the distance in miles traveled by the ferryboat from the ferry slip on one side to the ferry slip on the other side is ascertained and recorded.

(*b*) Depth of the stream at estimated normal water level at each ferry slip is ascertained and recorded.

(*c*) Width of traveled way of approach roads is measured and recorded.

(6) Photographs are taken of all ferries recon-

noitered. These photographs should include the ferry site, the ferry slips, the ferryboats, and the approach roads. If the ferryboats are not self-propelled, the photographs should include auxiliary equipment such as cables, towers, and winches. If photographic equipment is not available, sketches showing the same items are made.

c. Ferry Reconnaissance Report DA Form 1252. For each ferry reconnoitered a DA Form 1252 is completed (fig. 26). Short forms or work sheets for rapid field work may be designed and produced by the unit making the reconnaissance. Details to be entered on DA Form 1252 follow:

(1) *Identification (items 1–11).* Enter all information which establishes positive identification of the ferry by route, map sheet, grid reference, ferry number, class, geographic location, and the name of the stream or body of water the ferry crosses.

(2) *Limiting features (item 12).* Enter any limiting features which would affect ferry operations, such as condition of vessels, terminals, floods, low water, freezing and tides. Also give seasons and dates for any such limiting climatic conditions.

(3) *Description (items 13–15).* Record the depth of the stream or body of water at low, mean, and high water levels; the crossing time; and the length of the course.

(4) *Vessel features (item 16).* Record the pertinent design features of the vessel(s) used. This information includes the number and

construction type of units, the method and power of propulsion, length, beam, draft, gross net tonnage, and capacity.

(5) *Terminal features* (*item 17*). Designate the geographic direction of the banks by circling the appropriate letters (NESWN). Enter the name, the dimensions of the slips, and specific docking facilities. For highway approaches, note the type of surface, the number of lanes leading into the slip, and the class. Enter any additional pertinent information in item 18. For railroad approaches, give the number of tracks approaching the slip and the number of sidings. Facilities for transferring freight and detailed information, in exceptional cases where railroad cars are loaded directly on the ferry, should be given in item 18.

(6) *Remarks* (*item 18*). Use this space to amplify details given in paragraphs above. Note obstructions, navigational aids, and any other pertinent data not recorded elsewhere. Where special facilities are available, it is important to emphasize their presence for use in logistical planning.

(7) *Sketches* (*items 19 and 20*). Draw a sketch showing the route alinement plan and two sketches showing terminal views on both sides of the crossing.

(*a*) The route alinement plan indicates the geographical course of the ferry, terminals and approaches to the slips. Particular care is taken in recording obstructions.

FERRY RECONNAISSANCE REPORT
(FM 5-36)

DATE: 31 JUL 1954

TO: (Headquarters ordering reconnaissance): S-2 10TH ECB

FROM: (Name, grade and unit of reconnaissance officer): LT. G.G. GOSH 10TH ECB

1. ROUTE OR LINE		2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of Signature)
HIGHWAY: 17 W	RAILROAD:	ANGEL'S PT, MD.	LITTLE RENO, VA	31 1000 R JUL 54

5. MAP SERIES NR	6. SHEET NUMBER	7. GRID REFERENCE		8. FERRY NR	9. CLASS
		TYPE	COORDINATES		
V 834	5551-IV NW	UMGRS	UT134830	3	40

10. LOCATION FROM NEAREST TOWN			11. CROSSING (Name of stream or body of water)
DISTANCE	DIRECTION	NAME OF NEAREST TOWN	
7 MILES	EAST	LORTON, VA.	POTOMAC RIVER

12. LIMITING FEATURE (Condition of vessels, terminals, floods, low water, freezing, tides etc.) (Seasons and Dates)
CAPACITY OF LANDING PIER, ANGEL'S PT.

13. WATER LEVELS (Depths)			14. CROSSING TIME	15. LENGTH
LOW	MEAN	HIGH		
-2'	—	+2'	11 MINUTES	3/4 MILE

16. VESSEL FEATURES (Attach photographs)

UNITS	CONSTRUCTION TYPE	PROPULSION METHOD			LENGTH	BEAM	DRAFT	TONNAGE		CAPACITY		
		TYPE	UNITS	HP				GROSS	NET	PASS	VEHICLE	R.R. CARS
2	OPEN	DIESEL	2	210	65'	33'	5'	160	85	200	8 MAX	NA

17. TERMINAL FEATURES

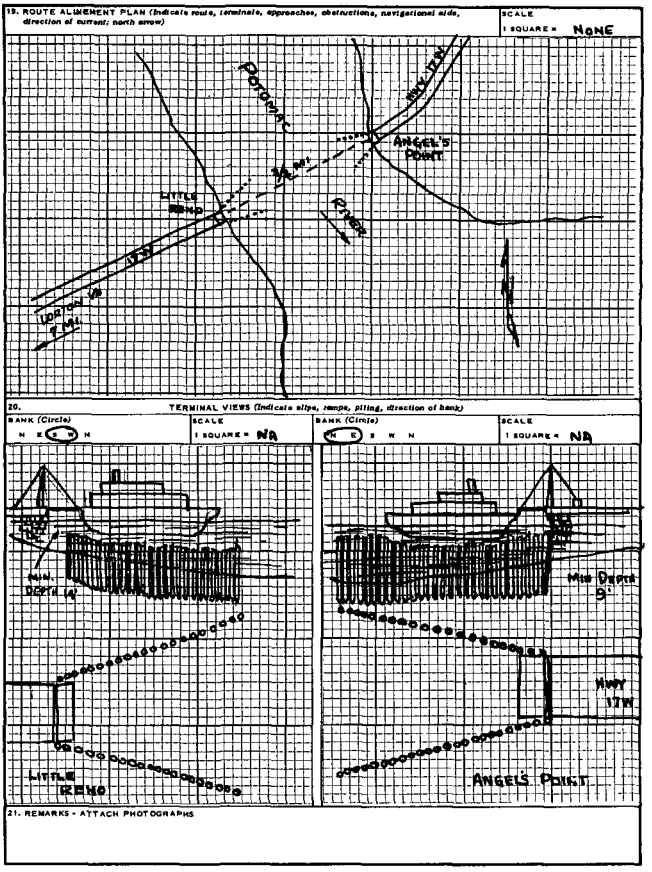
DIRECTION OF BANK	NAME	SLIP			DOCKING FACILITIES	APPROACHES				
						HIGHWAY			RAILROAD	
		WIDTH	DEPTH	CAPACITY		SURF	LANES	CLASS	TRACKS	SIDING
N E (S) W N	L RENO	37'	9'	1 BOAT	GOOD	ASPH	2	45	NA	—
(N) E S W N	ANGEL'S PT	38'	14'	1 BOAT	GOOD	CONC	2	55	NA	—

18. REMARKS (Amplify above details. Note obstructions, navigational and other pertinent data)

DA FORM 1 JAN 59 1252

1 Front of form

Figure 26. Ferry Reconnaissance Report form.



2 Back of form

Figure 26—Continued.

Navigational aids such as buoys and lights are shown. The position of the highway or rail approaches, including surrounding terrain features, should be included in this sketch.

(*b*) Two separate sketches are made showing each terminal. These sketches show the geographical position of each bank and include details of the slips, ramps, and bumper piles.

(8) *Remarks* (*item 21*). In addition to photographs of vessels called for in item 16 of this form, any other photographs which illustrate details given in the report should be attached.

d. Ferry Marking. Marking for ferries is done according to the appropriate and applicable instructions for marking bridges, as given in paragraph 21. Stop, warning, regulatory, and guide signs, as appropriate and applicable, are posted on approach roads and at ferry slips.

27. Bypass Information

A bypass, for the purpose of route reconnaissance information, is a local detour required to circumvent an obstruction to military traffic along the normal course of a route. Bypasses are classified as: bypass easy, bypass difficult, and bypass impossible.

a. Bypass Easy. The *bypass easy* classification (indicated by BPE) requires consideration of three distinct types of conditions:

(1) A normal bypass is considered in existence if a detour can be made by all types of vehicles in less than 15 minutes at an aver-

age rate of speed, utilizing any of the following means:

(*a*) Alternate route including alternate bridge.

(*b*) Offroad movement including alternate bridge.

(*c*) Alternate roads and ford or ferry.

(*d*) Offroad movement and ford or ferry.

(2) An emergency bypass assumes alternate bridges have been destroyed and alternate roads are not usable. Therefore an emergency or combat bypass is considered to exist if a detour can be made in the immediate vicinity by all types of vehicles, utilizing any of the following means:

(*a*) Existing tracks or trails and ford.

(*b*) Offroad movement and ford.

(*c*) Offroad movement and dry crossing.

(3) A readily constructed bypass is said to exist whenever it is possible to construct a bypass or local detour in four hours or less, using one engineer platoon and its organic equipment.

b. Bypass Difficult. The *bypass difficult* classification (indicated by BPD) is used when construction of a bypass or local detour will take more than four hours, using one engineer platoon and its organic equipment. If it is determined that the construction of a bypass will be difficult, reconnaissance parties determine the necessary requirements to bypass the obstruction.

c. Bypass Impossible. The *bypass impossible* classification (indicated by BPI) is used when any one of the following conditions prevails:

(1) Terrain absolutely prohibits offroad movement.

(2) Width and depth of the stream to be spanned absolutely prohibits fording or the construction of temporary crossing means.
(3) Depth or slope of the gorge or chasm absolutely prohibits construction of temporary approaches to the crossing site.
(4) No alternate road or railroad bridge exists within a reasonable distance.

d. Limiting Bypass Factors. Limiting bypass factors must be considered. These include:

(1) Condition of the terrain.
(2) Ability of bypass, without improvement, to sustain heavily loaded military vehicles over a considerable length of time.
(3) Ability of bypass to sustain only a few vehicles, before becoming impassable.
(4) Effects of climatic or seasonal changes (rain, freezing, snow, etc.) on cross-country movement.

28. Administrative Procedures

a. Design and specifications for materials of signs for bridges and other crossing means are responsibilities of the Chief of Engineers. The supply of signs for marking bridges and other crossing means is an engineer responsibility. Posting signs, regarding location and the number to be used, for bridges and other crossing means is an engineer responsibility coordinated with the appropriate provost marshal and the highway traffic regulation officer of the Transportation Corps. Operational responsibility for the marking of bridges and other crossing means is a command function.

29. Traffic Control Over Bridges and Other Crossing Means

Traffic control over bridges and other crossing means is needed to prevent failure of bridges and ferries and the blocking of tunnels, fords, causeways, snowsheds, and galleries.

a. Traffic Control Responsibility.

(1) Engineer responsibility for traffic control over bridges and other crossing means is limited to the supply and posting of appropriate markings after the completion of the necessary reconnaissance and the resulting evaluations.

(2) Provost marshal responsibility for traffic control over bridges and other crossing means includes the following:

(*a*) Establishment of traffic control policies.

(*b*) Performance of traffic control reconnaissance.

(*c*) Establishment of traffic control posts.

(*d*) Operation of traffic control posts.

(e) Enforcement of traffic regulations.

(*f*) Local rerouting in emergencies.

(3) Military police responsibility for traffic control over bridges and other crossing means includes the following:

(*a*) Enforcing traffic regulations.

(*b*) Enforcing speed regulations.

(*c*) Enforcing vehicle interval limits.

(*d*) Enforcing crossing limitations such as weight of vehicles, lanes to be used, priority on crossing single lane bridges, priority on crossing two lane bridges

when a single lane crossing is required by vehicle weight.

(*e*) Supervising special crossings described in *b* below.

b. Special Crossings. Special crossings are classified as controlled crossings, caution crossings, and risk crossings. A special crossing may be authorized under exceptional operating conditions in the field by the theater commander or local civil authorities to permit a vehicle to cross a bridge or other crossing means whose class number is less than that of the vehicle.

(1) A controlled crossing is a crossing over a multilane bridge in which the vehicle classification number is not more than 50 percent greater than the bridge classification number for one lane and where the vehicle must be centered over two or more lanes carrying one-way traffic. When the bridge class number is not the same for all lanes so used, the lane with the lowest bridge class number determines the controlled rating. The subject of a controlled class number is discussed in paragraph 19*d*(1).

(2) A caution crossing is a bridge crossing where vehicles with a classification up to 25 percent above the posted bridge loading are allowed to proceed cautiously across the span. A caution class number is the number obtained by multiplying the normal crossing class number of either a single lane or multilane nonstandard bridge by 1.25. For standard prefabricated bridges, the

vehicle class number must not exceed the published caution bridge class number. The caution class number is obtained from appendix IX or the appropriate technical manual. Caution crossings apply to single lane bridges and to multilane bridges when the vehicle remains on the centerline of the bridge, maintains a 50-yard distance from the vehicle in front, does not exceed a speed limit of 8 miles per hour, does not stop, is not accelerated, and does not have its gears shifted on the bridge or other similar crossing means.

(3) A risk crossing may be made only on prefabricated fixed and floating bridges. Risk crossings may be made only in the gravest emergencies where excessive losses will otherwise result and where the vehicle remains on the centerline of the bridge, does not exceed a speed limit of 3 miles per hour, is the only vehicle on the span, does not stop, is not accelerated, and does not have its gears shifted. Tanks, on risk crossings, must be steered by using their clutches only. Risk crossings, under these conditions, are permitted only if the vehicle class number does not exceed the published risk class. The subject of a risk class number is discussed in paragraph 19*d*(3).

c. Examples of Special Crossings.

(1) A tracked vehicle with classification 73 approaches the bridge shown in figure 16, which has a tracked vehicle classification of

60. The vehicle is allowed to cross, using the bridge as a single lane bridge, being centered on the two lanes.

(2) A tracked vehicle with classification 73 approaches an aluminum deck-balk fixed bridge, components of which are found in the M4 floating bridge sets and in the airborne 50-ton divisional floating bridge sets. The overall span of the bridge is 30 feet. The normal crossing classification is 60. The caution crossing classification is 80. Therefore, the vehicle is allowed to cross; but it must remain on the centerline of the bridge, must not exceed a speed limit of 8 miles per hour, must not be stopped or accelerated, and must not have its gears shifted while on the bridge.

(3) A tracked vehicle with classification 73 approaches a bridge with classification 50. It is allowed to cross, using the bridge as a single lane bridge under the conditions of 29*b*(1) above.

(4) A tracked vehicle with classification 73 approaches an 80-foot span panel bridge, Bailey type, M2 with 150-inch roadway. The risk crossing classification of this bridge is 75. The vehicle may be allowed to cross this bridge in a grave emergency if the vehicle remains on the centerline of the bridge, does not exceed a speed of 3 miles per hour, is the only vehicle on the span, is not stopped or accelerated, does not have its gears shifted while on the bridge, and is steered by the use of its clutches.

SECTION V
VEHICLE CLASSIFICATION

30. General

a. The basis of the vehicle classification system is the effect a vehicle has on a bridge while crossing the bridge. The effect is the result of a combination of factors which includes the gross weight of the vehicle, the distribution of this weight, the speed at which the vehicle crosses the bridge, and the resulting impact on the bridge. The excessive loads common to military vehicles, such as heavy artillery, tanks, and heavy engineer equipment, make vehicle classification an extremely important factor in determining the suitability of a given route. These critical loads are applicable not only to individual wheeled vehicles, but involve also consideration of track-laying vehicles, towed vehicles, and vehicles being moved by transporter. In order to compute the total classification of some of these combinations, each separate vehicle must be evaluated.

b. Classification numbers assigned to vehicles are whole numbers ranging from 4 to, and including, 150. These classification numbers have been developed from studies of hypothetical vehicles having characteristics approximately the same as those of actual United States and NATO nations military vehicles.

c. Narrow vehicles having an outside-to-outside

tire width, or track width, narrower than that of the hypothetical vehicles of the classes which would otherwise apply are given a higher vehicle classification.

d. Unloaded vehicles are sometimes given temporary classification numbers. Unloaded combination vehicles, where the payload is a substantial amount of the vehicle weight, may also be given a temporary classification number.

31. Vehicles Which are Classified

a. Standard military vehicles include all items of equipment which habitually move on land and which are mounted on wheels, tracks, or combinations of wheels and tracks. Therefore, military vehicles are further described as wheeled, tracked, or halftracked. For classification purposes, military vehicles are divided into two categories: single vehicles and combination vehicles.

(1) A single vehicle is any military vehicle which has only one frame or one chassis. Examples include prime movers, tanks, halftracks, full trailers, and gun carriages.

(2) A combination vehicle is a military vehicle consisting of two or more single vehicles, spaced less than 30 yards apart, which move as one unit. Examples include prime movers pulling semitrailers supported on the "fifth wheel" of the prime mover, prime movers or trucks towing full trailers, gun carriages, and tongue or pole trailers; or any single vehicle towing any other single vehicle at a distance of less than 30 yards apart.

b. Classification numbers are assigned to all single vehicles in military use which have a gross weight exceeding 3 tons, and to all trailers in military use which have a rated payload exceeding 1½ tons.

(1) *Separate classification* numbers are assigned to each single vehicle when one tows another, unless the distance between them is less than 30 yards and both are on one bridge span at the same time. In such a case they are classed as a combination vehicle, and the class of the combination is the sum of the classification numbers of the two vehicles. C/ dated FEB 56.

(2) *Temporary classification* numbers may be assigned under special conditions.

(*a*) When two single vehicles, one towing the other, are classed as a combination vehicle ((1) above), a temporary classification sign is then carried by the leading vehicle.

(*b*) When cargo vehicles used exclusively on highways are permitted increased payloads (TM 9–2800–1), the commander authorizing the increased loads is responsible for replacing the vehicle classification signs with *temporary* vehicle classification signs which increase the classification number by the amount of the authorized overload in tons. For example, a 2½-ton truck with classification number 8, carrying an authorized on-highway load of 4½ tons, has a 2-ton overload and is therefore given a *temporary* classification number 10.

(*c*) Unloaded single vehicles may be given a temporary classification number. It is computed by subtracting the rated payload in tons from the normal classification number. For example, a 6-ton truck with classification number 16 is given a *temporary* classification number 10 when unloaded.

(*d*) Combination vehicles, where the payload is a substantial part of the gross weight, are assigned unloaded classification numbers (Table X). The unloaded classification number is shown on a detachable classification sign (par. 33*b*(1)) when the combination is unloaded.

(3) *Optional* classification numbers may be assigned to baggage and other pole type trailers with a rated payload capacity of 1½ tons or less, although the gross weights of such trailers are usually combined with their respective towing units for vehicle classification purposes.

32. Data Required for Vehicle Classification

a. The single vehicle dimensional data required for vehicle classification are indicated in figure 27 ①. Dimensional data required for both single wheeled vehicles and single tracked vehicles are shown.

b. The trailer dimensional data required for vehicle classification are indicated in figure 27 ②. Only wheeled trailers are shown.

33. Marking of Vehicles

a. The purpose of marking vehicles is to afford immediate recognition of the classification of each vehicle in order to aid in traffic control at bridges and other crossing means (par. 29).

b. Marking of vehicles is accomplished by front vehicle classification signs and by side vehicle classification signs (fig. 28). These signs have a yellow background with black numerals.

(1) Front vehicle classification signs are circular and are 9 inches in diameter (fig. 29 ①). The numerals are as large as the diameter of the sign will permit. The front vehicle signs are placed above the vehicle bumper to the driver's right and below his line of vision. Heavy, cargo carrying vehicles, having a standard vehicle classification number larger than 30, carry also a readily detachable front vehicle classification sign inscribed with the unloaded classification number of the vehicle. Front vehicle classification signs are placed on each single vehicle with a gross weight exceeding 3 tons. Front vehicle classification signs of combination vehicles are marked with the letter *C*, in red, above the classification number. When it is not possible to determine the classification number of a combination vehicle from the tables or by computation, a safe field method of classifying the combination is to add the class numbers of the towing and the towed vehicles. The sum is the temporary classi-

A. OUT-TO-OUT TRACK OR TIRE WIDTH (INCHES)

B. IN-TO-IN TRACK OR TIRE WIDTH (INCHES)

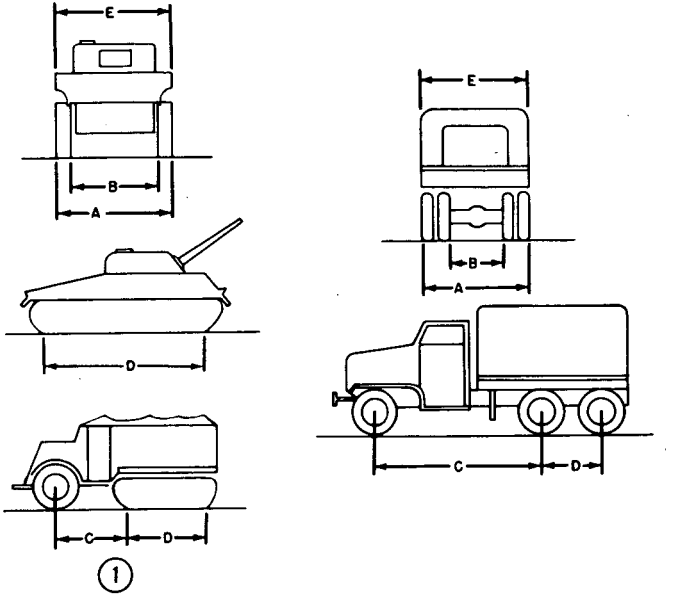
C. DISTANCE FROM FRONT AXLE TO FIRST REAR AXLE OR TRACK (INCHES)

D. GROUND CONTACT OF TRACK OR DISTANCE BETWEEN REAR AXLES (INCHES)

E. OVERALL WIDTH (INCHES)

F. NET WEIGHT (TONS)

G. GROSS WEIGHT (TONS)



1 Single vehicles

Figure 27. Data required for vehicle classification.

A. OUT-TO-OUT TIRE WIDTH OF TRAILER (INCHES)

B. IN-TO-IN TIRE WIDTH OF TRAILER (INCHES)

C. DISTANCE FROM REAR AXLE OF TOWING VEHICLE TO FIRST AXLE OF TRAILER (INCHES)

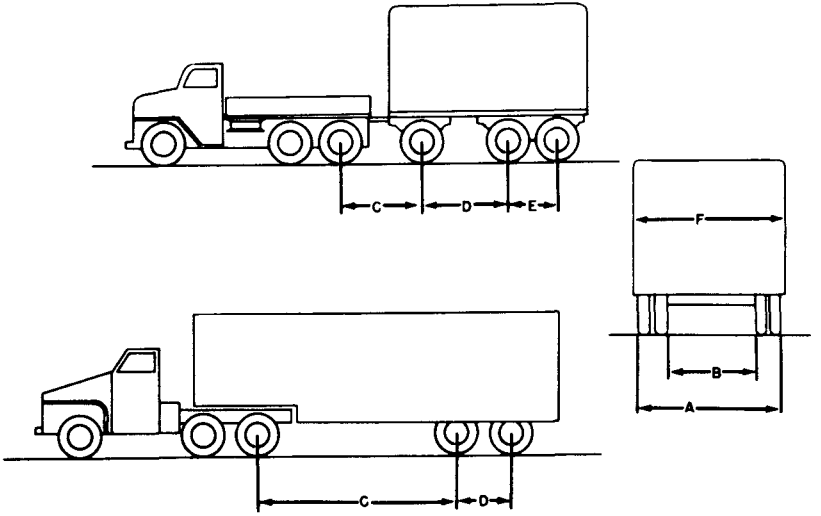
D. DISTANCE FROM FIRST TO SECOND AXLE OF TRAILER (INCHES)

E. DISTANCE FROM SECOND TO THIRD AXLE OF TRAILER (INCHES)

F. OVERALL WIDTH OF TRAILER (INCHES)

G. GROSS WEIGHT OF TRAILER (TONS)

H. NET WEIGHT (TONS)



(2)

2 Trailers

Figure 27—Continued.

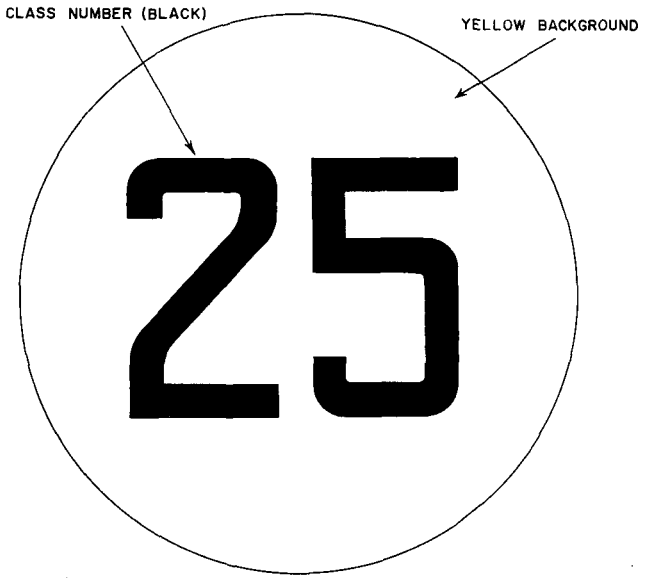


Figure 28. Typical vehicle classification sign.

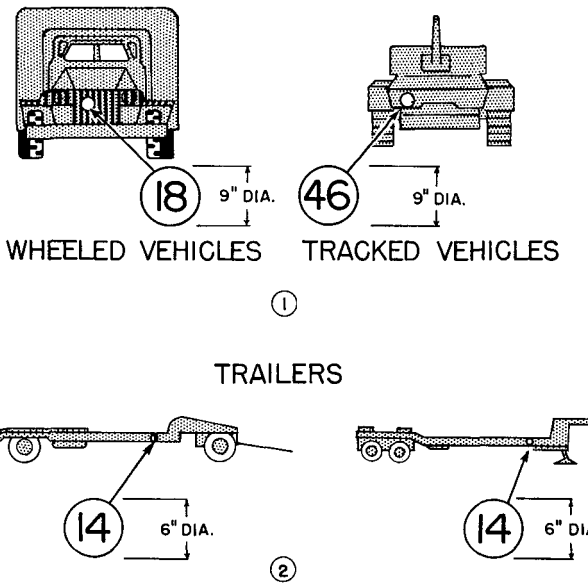
fication number of the combination and is to be placed on the front sign.

(2) Side vehicle classification signs are circular and are 6 inches in diameter (fig. 29 ②). They have a yellow background with black numerals superimposed, and are located where normal use of the vehicle will not conceal them from view. Side vehicle signs are placed on each trailer having a rated payload or capacity exceeding 1½ tons.

c. Other uses of front and side vehicle classification signs include the marking of combination vehicles, towed vehicles, and special purpose vehicles.

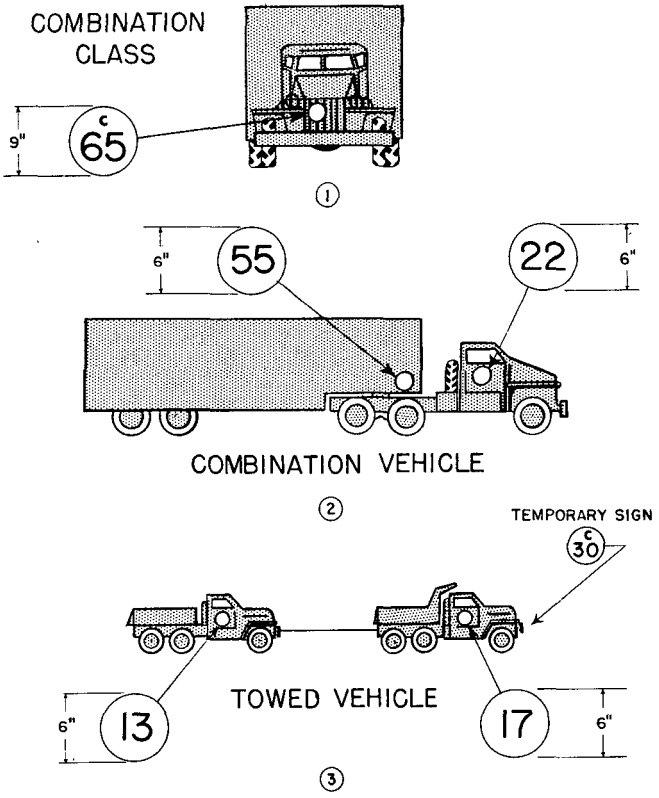
(1) For combination vehicles, each leading vehicle in the combination carries a front vehicle classification sign. It is inscribed with the classification number of the combination with the letter *C* in red above the classification number (fig. 30 ①). In addition, each vehicle in the combination carries a side vehicle classification sign inscribed with its classification as a single vehicle (fig. 30 ②).

(2) For towed vehicles, each vehicle is classed



1 Front vehicle classification signs
2 Side vehicle classification signs

Figure 29. Markings and typical locations of classification signs for single vehicles.



1 Front classification sign for combination vehicle
2 Side classification signs for combination vehicle
3 Classification signs for towed vehicle

Figure 30. Markings and typical locations of classification signs for combination towed vehicles.

as a separate vehicle unless both are *on one bridge span* at the same time and the distance between them is less than 30 yards. In such a case they are classified as a combination vehicle, and the classification of

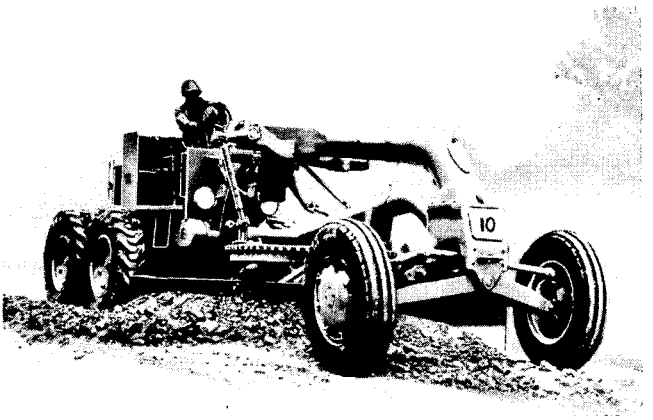


Figure 31. Location of classification sign on grader, road, motorized.

the combination is the sum of the classification numbers of the separate vehicles. This combination classification number is shown on a temporary front sign (fig. 30 ③).

(3) Special purpose vehicles are equipped with front classification signs or side classification signs, depending upon their means of propulsion. The locations of classification signs on several special purpose vehicles are shown in figures 31, 32, and 33.

34. Responsibility for Vehicle Classification

a. Standard Army vehicles are classified by the Chief of Engineers. Their classifications are given in paragraph 36.

b. Nonstandard vehicles, which include enemy vehicles and other nonstandard vehicles obtained in the field, are classified by the engineer of the nearest division or higher headquarters.

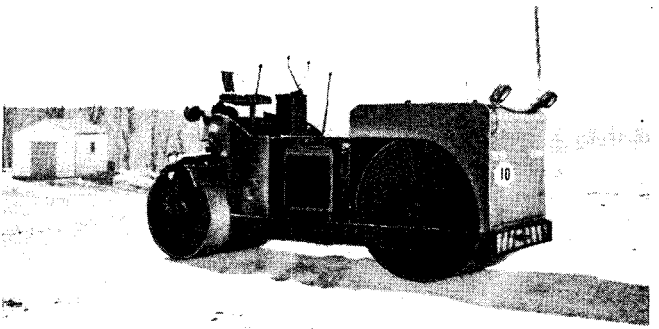


Figure 32. Location of classification sign on roller, road, engine-driven.

Figure 33. Location of classification sign on scraper, road, motorized.

c. Temporary classification of a vehicle, in an emergency, may be made by the using unit. This is done by comparing the gross weight, axle loads, and dimensions of the unclassified vehicle with those of a similar classified vehicle and applying, temporarily, the classification number thus obtained. At the same

time the using unit initiates the classification procedure in *b* above.

35. Administrative Procedures

a. Design and specification for materials of vehicle classification signs are responsibilities of the Chief of Ordnance.

b. Initial application or attachment of vehicle classification signs is a responsibility of the Chief of Ordnance.

c. Procurement of vehicle signs is on a regular ordnance item-of-supply basis.

d. Maintenance of vehicle classification signs and marking of them is a command responsibility.

e. Replacement of lost or destroyed vehicle classification signs is governed by existing supply and maintenance regulations, as most of them are detachable. However, this does not relieve the commander of the responsibility for maintaining vehicle classification signs for all vehicles in his command. Therefore, use of expedient materials and local fabrication of expedient signs may become necessary.

36. Classification of Standard Military Vehicles

The classification of standard military vehicles is given in table X, as follows:

a. Single vehicles.
  (1) Wheeled.
  (2) Tracked.
  (3) Halftracked.
  (4) Trailers, wheeled, full.
  (5) Trailers, tracked.

d. Combination vehicles.
  (1) Wheeled.
  (2) Tracked.
  (3) Semitrailer.

Table X. Vehicle Classification Data

Single vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Ambulance, metropolitan, ¾-ton, 4-litter	3. 86	3
Ambulance, metropolitan, 1½-ton, 12-litter, M423	4. 75	4
Auger, earth, skid mtd. gasoline-driven	8. 08	8
Automobile, limousine, heavy, 7-passenger, 4 x 2	3. 35	3
Bus, ambulance, 18-litter, 4 x 2	11. 04	10
Bus, body on chassis, 29-passenger, 4 x 2	7. 47	8
Bus, body on chassis, 37-passenger, 4 x 2	9. 00	10
Bus, integral, 37-passenger, 4 x 2	11. 35	11
Bus, integral, 2½-ton, 4 x 2	11. 95	12
Bus, integral, 37-passenger, 4 x 2	12. 16	11
Bus, integral, 37-passenger, 4 x 2	12. 50	13
Bus, 29-passenger, 4 x 2	7. 75	8
Bus, 37-passenger, 2½-ton, 4 x 2	9. 54	10
Bus, 37-passenger, 4 x 2	11. 22	10
Bus, 37-passenger, 5- to 6-ton, 4 x 2	12. 70	13
Car, armored, light, M8	8. 60	8

Car, armored, utility, M20	7. 83	7
Compressor, air, truck mtd, gasoline-driven, 105 cfm	7. 15	7
Compressor, air, truck mtd, 210 cfm capacity	8. 33	8
Crane, truck mtd, M2	26. 75	30
Crane-shovel, power unit, revolving, truck mtd, pneumatic tires, 6 x 6, 2-engine drive, 2-ton capacity at 15-ft radius	9. 20	8
Crane-shovel, power unit, revolving, truck mtd, pneumatic tires, gasoline-driven, 2-engine drive, 4- to 8-ton, ⅜ cu yd	16. 55	14
Crane-shovel, power unit, revolving, truck mtd, pneumatic tires, 6 x 6, 2-engine drive, 10-ton capacity at 10-ft radius, ½ cu yd	18. 44	18
Crane-shovel, power unit, revolving, truck mtd, pneumatic tires, 6 x 6, 2-engine drive, 20-ton capacity at 10-ft radius, ¾ cu yd	31. 48	35
Crane-shovel, power unit, revolving, truck mtd, pneumatic tires, 6 x 4, 2-engine drive, 145-ton capacity at 12-ft radius, 2 cu yd, diesel-driven	68. 33	103
Distributor, water, truck mtd, 1,000-gallon	13. 25	12
Distributor, bituminous material, truck mtd, 800-gallon	15. 05	14
Grader, road, motorized, diesel-driven, 12 ft moldboard	12. 03	10
Hearse, ¾-ton, 4 x 2	3. 62	3
Mixer, rotary tiller, soil stabilization, self-propelled, diesel-driven, 7-ft mixing width	6. 40	7
Plow, snow, rotary, gasoline-driven, truck mtd	16. 76	23

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Table X. Vehicle Classification Data—Continued

Single vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Reproduction equipment, topographic, motorized, mtd on a 2½-ton, 6 x 6, standard truck chassis w/van-type body, carrying one of the following sections	8. 55	8
Laboratory section, set No. 2.		
Photographic section, set No. 2.		
Plate grainer section, set No. 2.		
Plate process section, set No. 2.		
Press section, set No. 1, 17 x 19 inches.		
Press section, set No. 3, 20 x 22½ inches.		
Rapid projection printer section, set No. 1.		
Reproduction equipment, topographic, motorized, mtd on a standard truck chassis w/van-type body, carrying one of the following sections	12. 13	11
Camera section, set No. 7.		
Laboratory section, set No. 3.		
Map layout section, set No. 2.		
Photographic section, set No. 3.		
Plate grainer section, set No. 3.		
Plate process section, set No. 3.		
Press section, set No. 7.		

Reproduction equipment, topographic, motorized, mtd on a 4-ton, 6 x 6, standard truck chassis w/van-type body, carrying one of the following sections	13. 55	12
Camera section, set No. 6, 24 x 30 inches.		
Press section, set No. 4, 20 x 22½ inches.		
Press section, set No. 6, 22 x 29 inches.		
Roller, road, gasoline-driven, tandem, 2-axle, 5- to 8-ton	8. 82	10
Roller, road, gasoline-driven, tandem, 3-axle, 9- to 14-ton	14. 18	19
Scraper, road, motorized, cable-operated, 12 cu yd	28. 88	33 *(16)
Shop equipment, motorized, emergency repair, M2	3. 88	4
Shop equipment, motorized, welding	7. 70	8
Shop equipment, motorized, heavy machine shop	7. 70	8
Shop equipment, motorized, general purpose repair	8. 44	8
Shop equipment, motorized, small tool repair	8. 44	8
Shop equipment, motorized, tool and bench	8. 44	8
Tank, asphalt, steel, truck mtd, w/heating flues 800-gallon	13. 15	12
Tractor, wheeled-type, pneumatic tires, gasoline-driven, 5,200- to 7,775-lb drawbar pull	3. 43	4
Trailer, dump, motorized, cable-operated, 11½ cu yd	29. 95	36 *(12)
Trailer, dump, motorized, cable-operated, 13 cu yd	36. 16	39 *(14)
Truck, ambulance, ¾-ton, 4 x 4	3. 86	4
Truck, ambulance, ¾-ton, 4 x 4, (KD)	4. 25	5
Truck, ambulance, ¾-ton, 4 x 4, M43	4. 45	4

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Single vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, cargo, ¾-ton, 4 x 4, M37, w/winch	3. 96	4
Truck, carryall, ¾-ton, 4 x 4	3. 77	4
Truck, chassis, ¾-ton, 4 x 4, M53 (empty)	2. 68	3
Truck, command, ¾-ton, 4 x 4, M42	3. 77	4
Truck, command reconnaissance, ¾-ton, 4 x 4, w/winch	3. 74	4
Truck, light maintenance and installation, ¾-ton, 4 x 4, K50	3. 31	4
Truck, telephone maintenance and installation, ¾-ton, 4 x 4, K50B	3. 35	4
Truck, weapons carrier, ¾-ton, 4 x 4, w/winch	3. 87	4
Truck, carryall, 1-ton, 4 x 4	3. 64	3
Truck, panel, 1-ton, 4 x 2	3. 50	4
Truck, pickup, 1-ton, 4 x 4, w/winch	4. 35	5
Truck, bomb service, 1½-ton, 4 x 4, M6	4. 16	4
Truck, cargo, 1½-ton, 4 x 2	6. 25	8
Truck, cargo, 1½-ton, 4 x 4, w/winch	6. 47	7
Truck, dump, 1½-ton, 4 x 2	6. 25	7
Truck, dump, 1½-ton, 4 x 2	6. 75	8
Truck, dump, 1½-ton, 4 x 4, w/winch	6. 48	7
Truck, earth auger, 1½-ton, 4 x 4	6. 27	6
Truck, personnel and cargo, 1½-ton, 6 x 6, w/winch	5. 43	5

Truck, stake and platform, 1½-ton, 4 x 2	6. 25	8
Truck, stake and platform, 1½-ton, 4 x 4	6. 48	6
Truck, telephone construction and maintenance, 1½-ton, 4 x 4, K43 and K44	6. 24	6
Truck, tractor, 1½-ton, 4 x 2	3. 05	3
Truck, tractor, 1½-ton, 4 x 4	4. 70	4
Truck, bolster body, 2½-ton, 6 x 6	7. 89	7
Truck, bomb service, 2½-ton, 6 x 6, M27 and M27B1	9. 64	9
Truck, cargo, 2½-ton, 4 x 2	9. 62	10
Truck, cargo, 2½-ton, 6 x 6, SWB or LWB, w/winch	8. 20	8
Truck, cargo, 2½-ton, 6 x 6, 17 ft, M427	8. 65	8
Truck, cargo, 2½-ton, 6 x 6, w/winch	10. 23	11
Truck, cargo, 2½-ton, 6 x 6, M34, w/winch	11. 27	11
Truck, cargo, 2½-ton, 6 x 6, M35, w/winch	11. 69	11
Truck, cargo, 2½-ton, 6 x 6, M36, w/winch	11. 96	11
Truck, cargo, 2½-ton, 6 x 6, M135, w/winch	11. 55	11
Truck, cargo dump, 2½-ton, 6 x 6, LWB, w/winch	8. 65	8
Truck, cargo and dump, 2½-ton, 6 x 6, w/winch	10. 23	9
Truck, chassis, 2½-ton, 4 x 2, (loaded)	8. 75	10
Truck, chassis, 2½-ton, 6 x 6, w/winch, (empty)	4. 40	4
Truck, chassis, 2½-ton, 6 x 6, M44, (empty)	5. 34	5
Truck, chassis, 2½-ton, 6 x 6, M133, (empty)	5. 58	5
Truck, dump, 2½-ton, 4 x 2	7. 75	9
Truck, dump, 2½-ton, 4 x 2, (GMC)	9. 00	11

Table X. Vehicle Classification Data—Continued

Single vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, dump, 2½-ton, 6 x 6, M47, w/winch	11. 93	11
Truck, earth auger, 2½-ton, 6 x 6, V18, MTQ	7. 63	7
Truck, gasoline tank, 2½-ton, 6 x 6, 750-gallon	8. 05	8
Truck, gasoline tank, 2½-ton, 6 x 4, 1,350-gallon	9. 74	9
Truck, shop van, 2½-ton, 6 x 6	7. 55	7
The same chassis and body is also used in the following vehicles:		
Artillery Repair, M9.		
Artillery Repair, M9A1.		
Automotive Repair, Load A, M48.		
Automotive Repair, Load B, M48.		
Electrical Repair, M18.		
Instrument Repair, Load A, M10.		
Instrument Repair, Load B, M10.		
Instrument Repair, Load A, M10A1.		
Instrument Repair, Load B, M10A1.		
Machine Shop Load A, M16.		
Machine Shop Load B, M16.		
Machine Shop Load B1, M16.		
Machine Shop Load B2, M16.		

Machine Shop Load C, M16.		
Machine Shop Load D, M16.		
Machine Shop Load F, M16.		
Small Arms Repair, M7.		
Small Arms Repair (Signal Corps), M7.		
Spare Parts, Load A, M14.		
Spare Parts, Load B, M14.		
Welding, M12.		
Truck, shop van, 2½-ton, 6 x 6, M535	7. 55	7
The same chassis and body is also used in the following vehicles:		
Automotive Repair, Load A, M8A1.		
Automotive Repair, Load B, M8A1.		
Electrical Repair, M18A1.		
Electrical Repair, M18A2.		
Instrument Bench, M23.		
Machine Shop, Load A, M16A1.		
Machine Shop, Load B, M16A1.		
Machine Shop, Load B1, M16A1.		
Machine Shop, Load B2, M16A1.		
Machine Shop, Load C, M16A1.		
Machine Shop, Load D, M16A1.		
Machine Shop, Load F, M16A1.		
Machine Shop, Load A, M16A2.		
Machine Shop, Load B, M16A2.		

Table X. Vehicle Classification Data—Continued

Single vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, shop van, 2½-ton, 6 x 6, M535—Continued		
The same chassis and body is also used in the following vehicles—Con.		
Signal Corps General Repair, M30.		
Signal Corps General Repair, M31.		
Small Arms Repair, M7A1.		
Small Arms Repair, M7A2.		
Tire Repair, Load A, M32.		
Tire Repair, Load B, M32.		
Welding, M12A1.		
Truck, stake and platform, 2½-ton, 4 x 2	7. 66	8
Truck, stake and platform, 2½-ton, 4 x 2	9. 50	11
Truck, telephone construction and maintenance, 2½-ton, 4 x 2	7. 60	8
Truck, telephone construction and maintenance, 2½-ton, 6 x 6, V/17, MTQ	7. 80	7
Truck, tractor, 2½-ton, 4 x 2, (GMC)	4. 33	4
Truck, tractor, 2½-ton, 4 x 2, (I. H.)	4. 79	5
Truck, tractor, 2½-ton, 6 x 6, M48, w/winch	5. 92	6
Truck, water tank, 2½-ton, 6 x 6, 700-gallon	8. 64	8
Truck, van, 2½-ton, 6 x 6, K53	7. 79	7
Truck, van, 2½-ton, 6 x 6, K60	7. 79	7

Truck, cargo, 4-ton, 6 x 6	13. 20	12
Truck, cargo, 4-ton, 6 x 6, LWB, w/winch	13. 60	12
Truck, cargo, 4-ton, 6 x 6, w/winch	17. 25	17
Truck, dump, 4-ton, 6 x 6	13. 20	12
Truck, flat bed, 172-inch wheelbase, w/A-frame, cab protector and winch, front mtd, 4-ton, 6 x 6, 4DT	12. 39	10
Truck, ponton, 4-ton, 6 x 6, w/winch	17. 25	17
Truck, wrecker, 4-ton, 6 x 6, w/winch	10. 85	10
Truck, tractor, 4- to 5-ton, 4 x 4, C. O. E	6. 18	6
Truck, cargo, 5-ton, 6 x 6, M41	17. 60	17
Truck, cargo, 5-ton, 6 x 6, M54	15. 14	14
Truck, cargo, military bridging, 5-ton, 6 x 6	21. 00	20
Truck, chassis, 5-ton, 4 x 2, (empty)	4. 73	4
Truck, chassis, w/cab, 5-ton, 4 x 2, (empty)	7. 68	8
Truck, chassis, 5-ton, 6 x 6, M39, (empty)	8. 78	8
Truck, chassis, 5-ton, 6 x 6, M40 Modified for M62, (empty)	9. 20	8
Truck, chassis, 5-ton, 6 x 6, M139, (empty)	9. 80	9
Truck, dump, 5-ton, 4 x 2	11. 97	14
Truck, dump, 5-ton, 6 x 6, M51	21. 51	20
Truck, medium wrecker, 5-ton, 6 x 6, M62	20. 52	21
Truck, tractor, 5-ton, 4 x 2, (I. H. Model KR11)	5. 11	6
Truck, tractor, 5-ton, 4 x 2, (Federal Model 45M2)	5. 38	6
Truck, tractor, 5-ton, 4 x 2, (Diamond T)	5. 47	6

Table X. Vehicle Classification Data—Continued

Single vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, tractor, 5-ton, 4 x 2, (White)	5. 82	6
Truck, tractor, 5-ton, 4 x 2, M425	6. 25	6
Truck, tractor, 5-ton, 4 x 2, M426	6. 70	6
Truck, tractor, 5-ton, 6 x 6, M52, w/winch	9. 93	11
Truck, ponton tractor, 5- to 6-ton, 4 x 4, C. O. E	9. 09	8
Truck, cargo, 6-ton, 6 x 6, w/winch	20. 98	19
Truck, cargo treadway, 220-inch wheelbase, w/front mtd winch, w/hydraulic crane 7½-ton, 6-ton, 6 x 6, 4DT	19. 25	17
Truck, crane chassis, 6-ton, 6 x 6	16. 48	16
Truck, gasoline tank, 6-ton, 6 x 6, 2,000-gallon	17. 91	18
Truck, heavy wrecker, 6-ton, 6 x 6, M1 and M1A1	19. 00	20
Truck, prime mover, 6-ton, 6 x 6, w/winch	17. 21	15
Truck, tractor, 6-ton, 6 x 6	9. 48	9
Truck, prime mover, 7½-ton, 6 x 6, w/winch	22. 77	20
Truck, heavy wrecker, 10-ton, 6 x 6, M1A1	19. 75	18
Truck, prime mover, 12-ton, 6 x 4, M20	22. 50	21
Truck, tractor, 12-ton, 6 x 6, M26 and M26A1	24. 45	28

Single vehicle (tracked)	Gross weight (tons)	Vehicle classification number
Carriage, motor, twin 40-mm gun, M19	18. 48	18
Carriage, motor, twin 40-mm gun, M19A1	20. 58	20
Carriage, motor, 76-mm gun, M18	18. 78	19
Carriage, motor, 90-mm gun, M36	30. 50	30
Carriage, motor, 90-mm gun, M36B1	34. 00	35
Carriage, motor, 90-mm gun, M36B2	33. 00	34
Carriage, motor, 105-mm howitzer, M7	26. 00	25
Carriage, motor, 105-mm howitzer, M7B1	25. 00	24
Carriage, motor, 105-mm howitzer, M37	23. 00	23
Carriage, motor, 155-mm howitzer, M41	21. 25	21
Carriage, motor, 155-mm gun, M40	40. 50	40
Carriage, motor, 8-inch howitzer, M43	40. 00	40
Carrier, cargo, amphibious, T46E1	6. 08	6
Carrier, universal, T16	4. 72	5
Crane-shovel, power unit, revolving, crawler, gasoline driven, 3- to 4-ton, ⅜ cu yd	11. 25	12
Crane-shovel, power unit, revolving, crawler, gasoline driven, 5- to 6-ton, ½ cu yd	14. 75	15
Crane-shovel, power unit, revolving, crawler, gasoline driven, 10-ton capacity at 12-ft radius, ¾ cu yd	21. 15	21

Table X. Vehicle Classification Data—Continued

Single vehicle (tracked)	Gross weight (tons)	Vehicle classification number
Crane-shovel, power unit, revolving, crawler, diesel-driven, 30- to 40-ton, 1¾ to 2 cu yd	67. 00	102
Finisher, asphalt, crawler mtd, gasoline-driven, 12 ft	16. 50	15
Gun, twin 40-mm, self-propelled, T141	21. 50	21
Gun, 155-mm, self-propelled, T97	45. 00	44
Howitzer, 155-mm, self-propelled, T99E1	30. 00	30
Landing vehicle, tracked, MK4, LVT (4)	18. 20	17
Landing vehicle, tracked, armored, MK4, LVT (A) (4) and MK5, LVT (A) (5)	20. 00	19
Tank, light, M24	20. 25	20
Tank, light, T37	25. 00	25
Tank, medium, 75-mm gun, M4A1	33. 85	34
Tank, medium, 75-mm gun, M4A3	34. 78	35
Tank, medium, 76-mm gun, M4A1	36. 79	37
Tank, medium, 76-mm gun, M4A3	37. 06	37
Tank, medium, 105-mm howitzer, M4	34. 69	35
Tank, medium, 105-mm howitzer, M4A3	36. 43	36
Tank, medium, M26 and M26A1	46. 00	48
Tank, medium, M45	46. 25	47

Tank, medium, M46 and M46A1	48. 50	49
Tank, 76-mm gun, T41E1	25. 39	25
Tank, 90-mm gun, M47	48. 60	49
Tank, 90-mm gun, M48	49. 20	50
Tractor, cargo, M8E2	27. 50	26
Tractor, crawler type, gasoline driven, 8,600- to 12,000-lb drawbar pull	5. 30	6
Tractor, crawler type, diesel driven, 8,600- to 12,000-lb drawbar pull	5. 36	7
Tractor, crawler type, diesel driven, 8,600- to 12,000-lb drawbar pull, w/artillery towing attachments	6. 36	7
Tractor, crawler type, diesel driven, 12,100- to 17,000-lb drawbar pull, w/artillery towing attachments, and winch, nonreversible, front mtd, 1-drum	6. 89	8
Tractor, crawler type, diesel driven, 8,600- to 12,000-lb drawbar pull, w/bulldozer, tilting, cable operated, power-control unit, cable-operating, rear mtd, 1-drum, and winch, reversible, rear mtd, 1-drum; or power-control unit, cable-operating, rear mtd, 2-drum	7. 98	10
Tractor, crawler-type, diesel-driven, 8,600- to 12,000-lb drawbar pull, w/rigid frame; loader, cable operated, front mtd, w/¾ cu yd bucket and dozer attachment, and winch, reversible, rear mtd, 1-drum	8. 50	10
Tractor, crawler-type, diesel-driven, 12,100- to 17,000-lb drawbar pull	8. 83	9
Tractor, crawler-type, diesel-driven, 8,600- to 12,000-lb drawbar pull, w/crane, revolving, tractor mounting, center, 5,000-lb capacity at 7-ft radius, 12- to 18-ft telescopic boom	9. 50	10

Table X. Vehicle Classification Data—Continued

Single vehicle (tracked)	Gross weight (tons)	Vehicle classification number
Tractor, crawler-type, diesel-driven, 17,100- to 22,500-lb drawbar pull, w/artillery towing attachments, and winch, nonreversible, front mtd, 1-drum	10. 66	12
Tractor, crawler-type, diesel-driven, 12,100- to 17,000-lb drawbar pull, w/bulldozer, tilting, cable-operated, power-control unit, cable operating, front mtd, 1-drum; or power-control unit, cable operating, rear mtd, 2-drum	11. 79	13
Tractor, crawler type, diesel-driven, 12,100-ton to 17,000-lb drawbar pull, w/crane, revolving, tractor mounting, center, 6,000-lb capacity at 8-ft radius, 12- to 18-ft telescopic boom	12. 00	13
Tractor, crawler-type, diesel-driven, 17,100- to 22,500-lb drawbar pull	12. 74	14
Tractor, crawler-type, diesel-driven, 17,100- to 22,500-lb drawbar pull, w/angledozer, cable-operated, power-control unit, cable operating, front mtd, 1-drum; or power-control unit, cable operating, rear mtd, 1-drum, and w/winch, reversible, rear mtd, 1-drum	16. 05	17
Tractor, crawler-type, diesel-driven, 17,100- to 22,500-lb drawbar pull, w/bulldozer, cable-operated, power-control unit, cable operating, front mtd, 1-drum; or power-control unit, cable operating, rear mtd, 1-drum, and w/winch, reversible, rear mtd, 1-drum	16. 05	17

Tractor, crawler-type, diesel-driven, 17,100- to 22,500-lb drawbar pull, w/crane, revolving, tractor mounting, center, 12,000-lb capacity at 12-ft radius, 30-ft boom	16. 05	17
Tractor, crawler-type, diesel-driven, 28,100- to 38,000-lb drawbar pull	18. 28	19
Tractor, crawler-type, diesel-driven, 28,100- to 38,000-lb drawbar pull, w/artillery towing attachments and winch, nonreversible, front mtd, 1-drum; or power-control unit, cable operating, rear mtd, 2-drum; or winch, reversible, rear mtd, 1-drum	18. 28	19
Tractor, high-speed, 13-ton, M5	14. 28	15
Tractor, high-speed, 13-ton, M5A1	15. 20	15
Tractor, high-speed, 13-ton, M5A2	13. 07	13
Tractor, high-speed, 13-ton, M5A3	15. 18	15
Tractor, high-speed, 18-ton, M4, M4A1, M4A1C and M4C	15. 70	15
Tractor, high-speed, 38-ton, M6	38. 00	37
Vehicle, armored, utility, M39	17. 75	18
Vehicle, armored, infantry, full track, T18E1	21. 00	21
Vehicle, tank recovery, M32 series	30. 85	30

Table X. Vehicle Classification Data—Continued

Single vehicle (halftracked)	Gross weight (tons)	Vehicle classification number
Car, halftrack, M2A1	9. 80	9
Carriage, motor, combination gun, M15A1	10. 40	9
Carriage, motor, multiple gun, M16	10. 82	10
Carrier, 81-mm mortar, halftrack, M4	8. 93	8
Carrier, 81-mm mortar, halftrack, M4A1	10. 07	9
Carrier, 81-mm mortar, halftrack, M21	10. 00	9
Carrier, personnel, halftrack, M3	10. 00	9
Carrier, personnel, halftrack, M3A1	10. 25	9

Single vehicle (trailers, wheeled, full)	Gross weight (tons)	Vehicle classification number
Carriage, 8-inch gun, M2, on wagon, carriage transport, M3A1	25. 55	24
Carriage, 240-mm howitzer, M1, on wagon, carriage transport, M3A1	25. 55	24
Compressor, air, trailer mtd, 4W, steel tires, diesel- or gasoline-driven, 315 cfm	4. 04	4
Compressor, air, trailer mtd, 4W, pneumatic tires, diesel-driven, 630 cfm	5. 30	5
Compressor, air, trailer mtd, 4W, pneumatic tires, diesel-driven, 315 cfm	6. 88	7

Compressor, air, trailer mtd, 4W, steel tires, diesel-driven, 500 cfm	6. 88	6
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57 ft, Barber-Greene, Model N	4. 10	5
Crushing and screening plant, 2-unit, gasoline-driven, semitrailer mtd, w/dolly, 25 cu yd per hr, unit No. 1, jaw crusher	16. 25	14
Crushing and screening plant, 2-unit, gasoline-driven, semitrailer mtd, w/dolly, 25 cu yd per hr, unit No. 2, roll crusher	17. 70	17
Distributor, bituminous material, trailer mtd, 1,250-gallon	10. 50	11
Dryer, aggregate, dual drum, 80 to 150 TPH, trailer mtd	21. 70	18
Generator and charging plant, acetylene gas, semitrailer mtd, van-type, 750 cu ft per hr, w/dolly	17. 86	12
Generator and charging plant, hydrogen and carbon dioxide, trailer mtd, Girdler, Model 2657	18. 42	17
Grader, road, towed-type, leaning wheel, hand-controlled, 6½-ft moldboard	. 93	----------
Grader, road, towed-type, leaning wheel, hand-controlled, 10-ft moldboard	4. 38	4
Gun, 40-mm, M1, on carriage, gun, 40-mm (AA), M2A1	2. 93	----------
Gun, 90-mm, M2, on mount, AA gun, 90-mm, M2	16. 15	16
Gun, 120-mm, M1, on mount, gun, 120-mm, M1	31. 00	39
Gun, 155-mm, M2, on carriage, gun, 155-mm, M1 w/limber	15. 75	14
Gun, 8-inch, M1, on wagon, cannon transport, M1A1	26. 31	23
Howitzer, 8-inch, M2, on carriage, howitzer, 8-inch, M1	16. 00	13
Howitzer, 240-mm, M1, on wagon, cannon transport, M2A1	23. 86	20
Mixer, asphalt, diesel-driven travel or central plant, trailer mtd, 110 to 200 TPH	17. 60	18

Table X. Vehicle Classification Data—Continued

Single vehicle (trailers, wheeled, full)	Gross weight (tons)	Vehicle classification number
Mixer, concrete, gasoline-driven, trailer mtd, 14 cu ft	3. 99	4
Roller, road, towed-type, wheeled, *13 pneumatic tires*	8. 40	8
Scraper, road, towed-type, cable-operated, 3½ cu yd	8. 10	8
Scraper, road, towed-type, cable-operated, 8 cu yd	17. 53	22
Scraper, road, towed-type, cable-operated, 12 cu yd	24. 78	36 *(9)
Semitrailer, 15-ton gross, 4W, w/dolly, 2W, V9/MPG1	14. 36	13
Semitrailer, low-bed, rear loading, 20-ton, w/dolly	28. 40	46
Semitrailer, low-bed, front loading, 20-ton, w/dolly	34. 13	29
Semitrailer, low-bed, rear loading, 25-ton, M172, w/dolly, M199	35. 61	31 *(9)
Semitrailer, van, 7-ton, 4W, M26, w/dolly, trailer converter	14. 75	14
Semitrailer, van, 12-ton gross, 2W, K78, w/dolly	10. 76	12
Semitrailer, low-bed, rear loading, 60-ton, M160, w/dolly, M309	79. 38	92 *(17)
Tank, asphalt, steel, trailer mtd, w/steam, coils, 1,500-gallon	11. 38	11
Trailer, ammunition, 8-ton, 4W, M23	13. 00	12
Trailer, bomb, 2½-ton, 3W, M5	4. 10	5
Trailer, cryptographic, 4W, K65, OA73, MSC1	5. 75	5
Trailer, director, 2-ton, 4W, M13	3. 93	5
Trailer, director, 2-ton, 4W, M14 and M22	4. 45	6
Trailer, full, low-bed, 8-ton	12. 50	11

Trailer, full, low-bed, 60-ton	77. 00	115	*(14)
Trailer, generator, 2-ton, 4W, M7	4. 22	5	
Trailer, generator, 2-ton, 4W, M18	4. 10	5	
Trailer, house, 1½-ton payload, 6-ton gross, 4W, K65 and K35	6. 00	7	
Trailer, low-bed, tandem axle, antenna mount, 7-ton gross, 4W, K84	6. 58	7	
Trailer, operations center, 4W, K68, OA74, MSC1	5. 25	5	
Trailer, pole type, flat-bed, 7-ton, 4W, w/9.00 x 20 tires, ⅜ or ¾ cu yd truck crane shovel attachments	9. 05	9	
Trailer, pole-type, flat-bed, 7-ton, 4W, w/11.00 x 20 tires, ⅜ or ¾ cu yd truck crane shovel attachments	15. 10	18	
Trailer, searchlight, tilting-type, 60-inch, 4W, M1	4. 59	5	
Trailer, special tandem, 7- to 14-ton, 4W, 4DT	18. 00	20	
Trailer, transporter, 45-ton, 12W, M9	55. 00	92	*(9)
Welding equipment, set No. 1, electric arc, 300-amp trailer mtd	1. 89	----------	

Single vehicle (trailers, tracked)	Gross weight (tons)	Vehicle classification number
Arch, logging, towed type, crawler mtd, w/boom, 99-inch gage	3. 70	4
Trailer, cargo, 6-ton, tracked	9. 15	10
Trailer, cargo, 6-ton, tracked	10. 27	11
Trailer, cargo, 20-ton, tracked	27. 35	41

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Crane, truck mtd, M2, towing trailer, clamshell, 3-ton, 2W, M16	30. 87	30
Shop equipment, motorized, emergency repair, M2, towing welding equipment, set No. 1, electric arc, 300-amp, trailer mtd	5. 77	5
Tractor, MRS 190, towing semitrailer, low-bed, rear-loading, 60-ton, M160, w/dolly, M309	97. 21	92 *(31)
Truck, ambulance, ¾-ton, 4 x 4, M43, towing:		
Trailer, cargo, ¼-ton, 2W, M100	5. 11	5
Trailer, cargo, ¾-ton, 2W, M101	6. 25	6
Truck, cargo, ¾-ton, 4 x 4, M37, w/winch, towing:		
Trailer, cargo, ¼-ton, 2W, M100	4. 62	4
Trailer, cargo, ¾-ton, 2W, M101	5. 76	5
Trailer, water tank, 1½-ton, 2W, M106	6. 78	6
Trailer, cargo, 1½-ton, 2W, M104	7. 91	7
Truck, command, ¾-ton, 4 x 4, M42, towing:		
Trailer, cargo, ¼-ton, 2W, M100	4. 43	4
Trailer, cargo, ¾-ton, 2W, M101	5. 57	5
Trailer, water tank, 1½-ton, 2W, M106	6. 59	6
Trailer, cargo, 1½-ton, 2W, M104	7. 72	7

Truck, light maintenance and installation, ¾-ton, 4 x 4, K50, towing trailer, telephone cable splicer, ⅜-ton payload, 2W, K38A	3. 97	4
Truck, weapons carrier, ¾-ton, 4 x 4, w/winch, towing:		
Trailer, cargo, 1-ton, 2W	5. 02	5
Trailer, water tank, 1-ton, 2W, 250-gallon	6. 69	6
Truck, telephone construction and maintenance, 1½-ton, 4 x 4, K43 and K44, towing:		
Trailer, pole hauling and cargo, 2-ton payload, 2W, K36	9. 05	8
Trailer, pole hauling and cargo, 3½-ton payload, 2W, V13/GT	10. 94	9
Truck, personnel and cargo, 1½-ton, 6 x 6, w/winch, towing:		
Pump, water, trailer mtd, w/distributor attachments	6. 55	6
Pump, centrifugal, gasoline-driven, trailer-mtd, 4-inch discharge, 4-inch suction, 500 gpm at 20-ft head normal discharge	7. 18	6
Truck, tractor, 1½-ton, 4 x 2, towing:		
Semitrailer, 32-passenger bus chassis, 3-ton, 2W	9. 69	8
Semitrailer, van, 3-ton, 2W	10. 99	9
Semitrailer, stake and platform, 3½-ton, 2W	11. 70	10
Truck, tractor, 1½-ton, 4 x 4, towing:		
Semitrailer, van, 6-ton gross, 4W, K55	10. 74	9
Semitrailer, van, 3-ton, 2W	12. 64	10
Truck, bolster body, 2½-ton, 6 x 6, w/11.00 x 18 tires, towing trailer, slip-pole type, w/bolster, 2½-ton, 2W	11. 76	9

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, cargo, 2½-ton, 6 x 6, SWB, w/winch, towing howitzer, 105-mm, M2A1, on carriage, howitzer, 105-mm, M2A2	14. 05	12
Truck, cargo, 2½-ton, 6 x 6, M34, w/winch, towing:		
Trailer, water tank, 1½-ton, 2W, M106	14. 09	12
Trailer, cargo, 1½-ton, 2W, M104	15. 22	12
Truck, cargo, 2½-ton, 6 x 6, M36, w/winch, towing:		
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 4, elevator, bucket, trailer mtd	13. 46	11
Mixer, rotary tiller, soil stabilization, self-powered, trailer-mtd	14. 86	12
Mixer, concrete, gasoline-driven, trailer-mtd, 14 cu ft	15. 95	13
Compressor, air, trailer-mtd, 4W, steel tires, diesel- or gasoline-driven 315 cfm	16. 00	13
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model N	16. 06	12
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model 374	16. 90	13
Compressor, air, trailer-mtd, 4W, pneumatic tires, diesel-driven, 315 cfm	18. 34	16

Truck, cargo, 2½-ton, 6 x 6, M135, w/winch, towing:		
Trailer, water tank, 1½-ton, 2W, M106	14. 37	12
Trailer, cargo, 1½-ton, 2W, M104	15. 50	12
Truck, cargo, 2½-ton, 6 x 6, SWB or LWB, w/winch, towing:		
Gun, 57-mm, M1, on carriage, gun, 57-mm, M1A3	9. 63	8
Gun, 40-mm, M1, on carriage, gun, 40-mm (AA), M2A1	11. 13	9
Trailer, ammunition, 2-ton, 2W, M10	11. 33	10
Trailer, generator, 2-ton, 4W, M7	12. 42	10
Trailer, director, 2-ton, 4W, M14 and M22	12. 65	11
Trailer, operations center, 4W, K68, OA74, MSC1	13. 45	11
Trailer, cryptographic, 4W, K65, OA73, MSC1	13. 95	11
Trailer, house, 1½-ton payload, 6-ton gross, 4W K65 and K35	14. 20	11
Trailer, low-bed, tandem axle, antenna mount, 7-ton gross, 4W, K84	14. 78	12
Truck, cargo dump, 2½-ton, 6 x 6, LWB, w/winch, towing:		
Kettle, asphalt repair, trailer mtd, w/motor driven hand spray, 110-gallon capacity	9. 83	9
Kettle, asphalt repair, trailer-mtd, w/motor driven hand spray, 165-gallon capacity	10. 15	9
Lubricator, trailer-mtd	10. 65	9
Trailer, utility, pole-type, 2½-ton, 2W, 16-ft utility powerboat	10. 80	9
Trailer, utility, pole-type, 2½-ton, 2W, 19-ft bridge erection boat	11. 65	10
Heater, asphalt, trailer-mtd, 3-car capacity, 42 HP	11. 35	9
Trailer, utility, pole-type 2½-ton, 2W, infantry raft equipment and/or pneumatic bridge equipment	12. 35	9

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, cargo dump, 2½-ton, 6 x 6, LWB, w/winch, towing—Continued		
Trailer, utility, pole-type, 2½-ton, 2W, trestle bay load, 10-ton ponton bridge	12. 35	9
Trailer, searchlight, tilting-type, 60-inch, 4W, M1	13. 24	10
Trailer, utility, pole-type, 2½-ton, 2W, triangulation tower	13. 40	11
Trailer, full, low-bed, 8-ton	21. 15	16
Truck, dump, 2½-ton, 6 x 6, M47, w/winch, towing:		
Kettle, asphalt repair, trailer-mtd, w/motor-driven hand spray, 165-gallon capacity	13. 43	12
Heater, asphalt, trailer-mtd, 3-car capacity, 42 HP	14. 63	12
Trailer, water tank, 1½-ton, 2W, M106	14. 75	13
Trailer, cargo, 1½-ton, 2W, M104	15. 88	13
Trailer, searchlight, tilting-type, 60-inch, 4W, M1	16. 52	14
Trailer, utility, pole-type, 2½-ton, 2W, triangulation tower	16. 68	14
Semitrailer, stake and platform 3½-ton, 2W, w/dolly, trailer converter, 6-ton, 2W, M364	21. 58	19
Trailer, full, low-bed, 8-ton	24. 43	21

Truck, telephone construction and maintenance, 2½-ton, 6 x 6, V/17, MTQ, towing trailer, cable hauler, 5-ton payload, 2W, K37 and K37A	14. 31	11
Truck, tractor, 2½-ton, 4 x 2, (GMC), towing:		
Semitrailer, van, 3-ton 2W	12. 27	10
Semitrailer, stake and platform, 3½-ton, 2W	12. 98	11
Truck, tractor, 2½-ton, 4 x 2, (I. H.), towing:		
Semitrailer, 32-passenger bus chassis, 3-ton, 2W	11. 43	10
Semitrailer, van, 3-ton, 2W	12. 73	12
Truck, tractor, 2½-ton, 6 x 6, M48, w/winch, towing:		
Semitrailer, van, 6-ton, 2W, (American Body)	18. 77	17
Semitrailer, low-bed, rear-loading, 12-ton, M130	21. 42	18
Truck, cargo, 4-ton, 6 x 6, towing:		
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 1, mixer, bituminous, trailer mtd, complete, Barber-Greene, Model 840	18. 50	16
Trailer, full, low-bed, 8-ton	25. 70	17
Trailer, special tandem, 7- to 14-ton, 4W, 4DT	31. 20	27
Truck, cargo, 4-ton, 6 x 6, LWB, w/winch, towing:		
Trailer, operations center, 4W, K68, OA74, MSC1	18. 85	15
Trailer, cryptographic, 4W, K65, OA73, MSC1	19. 35	16
Howitzer, 155-mm, M1, on carriage, howitzer, 155-mm, M1A2	19. 95	15
Trailer, cable hauler, 5-ton payload, 2W, K37 and K37A	20. 11	17
Trailer, low-bed, tandem axle, antenna mount, 7-ton gross, 4W, K84	20. 18	17
Semitrailer, van, 12-ton gross, 2W, K78, w/dolly	24. 36	19

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, dump, 4-ton, 6 x 6, towing:		
Scraper, road, towed-type, cable-operated, 3½ cu yd	21. 30	17
Trailer, full, low-bed, 8-ton	25. 70	17
Scraper, road, towed-type, cable-operated, 8 cu yd	30. 73	22
Trailer, special tandem, 7- to 14-ton, 4W, 4DT	31. 20	27
Scraper, road, towed-type, cable-operated, 12 cu yd	37. 98	36 *(14)
Truck, tractor, 4- to 5-ton, 4 x 4, C. O. E., towing:		
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 4, elevator, bucket, trailer mtd	7. 68	7
Trailer, director, 2-ton, 4W, M14 and M22	10. 63	9
Semitrailer, teletype operations, OA78, MSC1	12. 18	10
Trailer, house, 1½-ton payload, 6-ton gross, 4W, K65 and K35	12. 18	10
Semitrailer, van, 6-ton gross, 4W, K55	12. 22	10
Semitrailer, teletype switchboard, OA76, MSC1	12. 69	10
Semitrailer, 32-passenger bus chassis, 3-ton, 2W	12. 82	11
Trailer, ammunition, 4-ton, 2W, M21	12. 83	11
Semitrailer, telephone, MDF, OA77, MSC1	12. 88	11
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 1, mixer, pugmill, semitrailer mtd	13. 17	11
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 2, dryer, aggregate, semitrailer mtd	13. 48	11

Semitrailer, carrier equipment, OA75, MSC1	13. 68	11
Semitrailer, telephone switchboard, OA79, MSC1	13. 83	11
Semitrailer, van, 3-ton, 2W	14. 12	12
Semitrailer, stake and platform, 3½-ton, 2W	14. 83	12
Semitrailer, van, 12-ton gross, 2W, K78	15. 44	14
Semitrailer, gasoline tank, 6-ton, 2W, 2,000-gallon, M30	15. 66	13
Tank, water, steel, semitrailer mtd, 1,500-gallon	16. 03	14
Semitrailer, animal and cargo, 6-ton, 2W (Highway)	16. 58	14
Semitrailer, van, 6-ton, 2W (Gerstenslager)	16. 73	14
Semitrailer, van, 6-ton, 2W (Gramm DF 75)	17. 12	14
Semitrailer, van, 6-ton, 2W (Highway SKD 2215)	17. 22	14
Reproduction equipment, topographic, mtd on a 10-ton semitrailer w/van-type body, carrying one of the following sections	17. 93	15
Camera section, set No. 4, 24 x 24 inches.		
Camera section, set No. 5, 24 x 30 inches.		
Combination section, set No. 1A.		
Combination section, set No. 2B.		
Laboratory section, set No. 1.		
Plate grainer section, set No. 1.		
Plate process section, set No. 1.		
Press section, set No. 2, 20 x 22½ inches.		
Press section, set No. 5, 22 x 29 inches.		
Semitrailer, van, 7-ton, 4W, M26	19. 70	17

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, cargo, 5-ton, 6 x 6, M41, towing:		
Mixer, concrete, gasoline-driven, trailer-mtd, 14 cu ft	21. 59	18
Compressor, air, trailer-mtd, 4W, steel tires, diesel or gasoline driven, 315 cfm	21. 64	18
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model N	21. 70	18
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 2, dryer, aggregate, trailer-mtd, complete, Barber-Greene, Model 830	21. 95	18
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model 374	22. 54	18
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 1, mixer, bituminous, trailer-mtd, complete, Barber-Greene, Model 840	22. 90	21
Compressor, air, trailer-mtd, 4W, pneumtaic tires, diesel-driven, 315 cfm	24. 48	21
Compressor, air, trailer-mtd, 4W, steel tires, diesel-driven, 500 cfm	24. 48	21
Trailer, pole-type, flat-bed, 7-ton, 4W, w/9.00 x 20 tires, ⅜ or ¾ cu yd truck crane shovel attachments	26. 65	21
Distributor, bituminous material, trailer-mtd, 1,250-gallon	28. 10	24

Semitrailer, van, 6-ton, 2W (Highway SKD 2270), w/dolly, trailer converter, 6-ton, 2W, M364	30. 24	24	
Crushing and screening plant, 2-unit, gasoline driven, semitrailer mtd, w/dolly, 25 cu yd per hour, unit No. 1, jaw crusher	33. 85	26	
Mixer, asphalt, diesel-driven, travel or central plant, trailer-mtd, 110 to 200 TPH	35. 20	28	
Crushing and screening plant, 2-unit gasoline-driven, semitrailer mtd, w/dolly, 25 cu yd per hr, unit No. 2, roll crusher	35. 30	28	
Dryer, aggregate, dual drum, 80 to 150 TPH, trailer mtd	39. 30	31	
Semitrailer, low-bed, rear-loading, 25-ton, M172 w/dolly, M199	51. 21	41	*(22)
Truck, cargo, 5-ton, 6 x 6, M54, towing:			
Compressor, air, trailer-mtd, 4W, steel tires, diesel- or gasoline-driven, 315 cfm	19. 18	16	
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 2, dryer, aggregate, trailer-mtd, complete, Barber-Greene, Model 830	19. 49	16	
Grader, road, towed-type, leaning wheel, hand-controlled, 10-ft moldboard	19. 52	16	
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 1, mixer, bituminous, trailer-mtd, complete, Barber-Greene, Model 840	20. 44	17	
Compressor, air, trailer-mtd, 4W, pneumatic tires, diesel-driven, 315 cfm	22. 02	18	
Compressor, air, trailer-mtd, 4W, steel tires, diesel-driven, 500 cfm	22. 02	18	
Distributor, bituminous material, trailer-mtd, 1,250-gallon	25. 64	21	

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, cargo, 5-ton, 6 x 6, M54, towing—Continued		
Tank, asphalt, steel, trailer-mtd, w/steam coils, 1,500-gallon	26. 52	21
Trailer, full, low-bed, 8-ton	27. 64	21
Generator and charging plant, acetylene gas, semitrailer-mtd, van-type, 500 cu ft per hr, w/dolly, trailer converter, 8-ton, 2W	32. 66	24
Mixer, asphalt, diesel-driven, travel or central plant, trailer-mtd, 110 to 200 TPH	32. 74	29
Crushing and screening plant, 2-unit, gasoline-driven, semitrailer mtd, w/dolly, 25 cu yd per hr, unit No. 2, roll crusher	32. 84	25
Dryer, aggregate, single-drum, central plant, diesel-driven, trailer-mtd, 80 to 120 TPH, Barber-Greene, Model 837, w/dolly, trailer converter, 6-ton, 2W, M364	34. 99	27
Dryer, aggregate, dual-drum, 80 to 150 TPH, trailer-mtd	36. 84	29
Semitrailer, low-bed, rear-loading, 25-ton, M172, w/dolly, M199	50. 75	25
Truck, cargo, military bridging, 5-ton, 6 x 6, towing:		
Trailer, utility, pole-type, 2½-ton, 2W, 19-ft bridge erection boat	24. 00	20
Trailer, utility, pole-type, 2½-ton, 2W	24. 70	20
Truck, chassis, 5-ton, 6 x 6, M40, w/body, logging, w/bolster, towing trailer, special tandem, 7- to 14-ton, 4W, 4DT	38. 25	31

Truck, chassis, 5-ton, 6 x 6, M139, towing semi-trailer, van, 6-ton, 2W, w/dolly, trailer-converter, 6-ton, 2W, M364	27. 09	20
Truck, dump, 5-ton, 6 x 6, M51, towing:		
Mixer, concrete, gasoline-driven, trailer mtd, 14 cu ft	25. 50	22
Compressor, air, trailer-mtd, 4W, steel tires, diesel- or gasoline-driven, 315 cfm	25. 55	21
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model N	25. 61	21
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 2, dryer, aggregate, trailer-mtd, complete, Barber-Greene, Model 830	25. 86	22
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model 374	26. 45	21
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 1, mixer, bituminous, trailer-mtd, complete, Barber-Greene, Model 840	26. 81	23
Compressor, air, trailer-mtd, 4W, pneumatic tires, diesel-driven, 315 cfm	28. 39	24
Compressor, air, trailer-mtd, 4W, steel tires, diesel-driven, 500 cfm	28. 39	24
Trailer, pole-type, flat-bed, 7-ton, 4W, w/9.00 x 20 tires, ⅜ or ¾ cu yd truck crane shovel attachments	30. 56	25
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 2, dryer, aggregate, trailer-mtd, complete, Barber-Greene, Model 839	30. 66	26
Distributor, bituminous material, trailer-mtd, 1,250-gallon	32. 01	27
Tank, asphalt, steel, trailer-mtd, w/steam coils, 1,500-gallon	32. 89	28
Trailer, full, low-bed, 8-ton	34. 01	28

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number	
Truck, dump, 5-ton, 6 x 6, M51, towing—Continued			
Semitrailer, van, 6-ton, 2W, (Trailmobile), w/dolly, trailer converter, 6-ton, 2W, M364	34. 44	28	
Trailer, pole-type, flat-bed, 7-ton, 4W, w/11.00 x 20 tires, ⅜ or ¾ cu yd truck crane shovel attachments	36. 61	29	
Crushing and screening plant, 2-unit, gasoline-driven, semitrailer-mtd, w/dolly, 25 cu yd per hr, unit No. 1, jaw crusher	37. 76	30	
Mixer, asphalt, diesel-driven, travel or central plant, trailer-mtd, 110 to 200 TPH	39. 11	34	
Crushing and screening plant, 2-unit, gasoline-driven, semitrailer-mtd, w/dolly, 25 cu yd per hr, unit No. 2, roll crusher	39. 21	31	
Semitrailer, low-bed, rear-loading, 25-ton, M172, w/dolly, M199	57. 12	45	*(26)
Truck, tractor, 5-ton, 4 x 2, (Diamond T), towing:			
Semitrailer, 32-passenger bus chassis, 3-ton, 2W	12. 11	10	
Semitrailer, van, 3-ton, 2W	13. 41	11	
Semitrailer, stake and platform, 3½-ton, 2W	14. 12	12	
Semitrailer, gasoline tank, 6-ton, 2W, 2,000-gallon, M30	14. 95	13	
Semitrailer, animal and cargo, 6-ton, 2W, (Highway)	15. 87	13	
Semitrailer, stake and platform, 5-ton, 2W	16. 29	15	

Semitrailer, van, 6-ton, 2W, (Gramm DF 75)	16. 41	14
Semitrailer, van, 6-ton, 2W, (Highway SKD 2215)	16. 51	14
Semitrailer, van, 6-ton, 2W, (Gramm)	16. 67	14
Semitrailer, van, 6-ton, 2W, (Highway SKD 2270)	17. 11	15
Semitrailer, van, 6-ton, 2W, (Trailmobile)	17. 40	15
Semitrailer, animal and cargo, 6-ton, 2W	17. 77	16
Semitrailer, van, 6-ton, 2W, (Utility)	18. 25	16
Semitrailer, van, 6-ton, 2W, (American Body)	18. 32	16
Semitrailer, van, 6-ton, 2W, (Olson)	18. 37	16
Semitrailer, stake and platform, 6-ton, 2W	18. 45	16
Semitrailer, van, 7-ton, 4W, M26	18. 99	17
Semitrailer, van, 11-ton, 2W	20. 87	18
Semitrailer, stake and platform, 10-ton, 2W	21. 19	18
Truck, tractor, 5-ton, 4 x 2, (White), towing:		
Semitrailer, gasoline tank, 6-ton, 2W	15. 30	13
Semitrailer, animal and cargo, 6-ton, 2W, (Highway)	16. 22	13
Semitrailer, van, 6-ton, 2W, (Gramm DF 75)	16. 76	14
Semitrailer, van, 6-ton, 2W, (Highway SKD 2215)	16. 86	14
Semitrailer, van, 6-ton, 2W, (Gramm)	17. 02	15
Semitrailer, van, 6-ton, 2W, (Highway SKD 2181)	17. 41	15
Semitrailer, animal and cargo, 6-ton, 2W	18. 12	15
Semitrailer, stake and platform, 10-ton, 2W	21. 54	18

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, tractor, 5-ton, 4 x 2, (I. H. Model KR11), towing:		
Semitrailer, animal and cargo, 6-ton, 2W, (Highway)	15. 51	13
Semitrailer, stake and platform, 5-ton, 2W	15. 93	15
Truck, tractor, 5-ton, 4 x 2, (Federal Model 45M2), towing:		
Semitrailer, van, 6-ton, 2W, (Gerstenslager)	15. 93	13
Semitrailer, van, 6-ton, 2W, (Gramm DF 75)	16. 32	14
Semitrailer, van, 6-ton, 2W, (Highway SKD 2215)	16. 42	14
Semitrailer, van, 6-ton, 2W, (Gramm)	16. 58	14
Semitrailer, van, 6-ton, 2W, (Highway SKD 2270)	17. 02	15
Semitrailer, animal and cargo, 6-ton, 2W	17. 68	15
Semitrailer, stake and platform, 10-ton, 2W	21. 10	18
Truck, tractor, 5-ton, 4 x 2, M425, towing:		
Semitrailer, animal and cargo, 6-ton, 2W, (Highway)	16. 65	14
Semitrailer, van, 6-ton, 2W, (Gerstenslager)	16. 80	14
Semitrailer, van, 6-ton, 2W, (Highway SKD 2215)	17. 29	15
Semitrailer, van, 6-ton, 2W, (Highway SKD 2181)	17. 84	16
Semitrailer, van, 6-ton, 2W, (Highway SKD 2270)	17. 89	16
Semitrailer, animal and cargo, 6-ton, 2W	18. 55	16
Semitrailer, stake and platform, 10-ton, 2W	21. 97	19

Truck, tractor, 5-ton, 4 x 2, M426, towing:			
Semitrailer, teletype operations, OA78, MSC1	12. 70	10	
Semitrailer, teletype switchboard, OA76, MSC1	13. 21	10	
Semitrailer, telephone, MDF, OA77, MSC1	13. 40	11	
Semitrailer, carrier equipment, OA75, MSC1	14. 20	11	
Semitrailer, telephone switchboard, OA79, MSC1	14. 25	11	
Semitrailer, animal and cargo, 6-ton, 2W, (Highway)	17. 10	14	
Semitrailer, van, 6-ton, 2W, (Gerstenslager)	17. 25	15	
Semitrailer, van, 6-ton, 2W, (Gramm DF 75)	17. 64	15	
Semitrailer, van, 6-ton, 2W, (Highway SKD 2215)	17. 74	15	
Semitrailer, van, 6-ton, 2W, (Gramm)	17. 90	16	
Semitrailer, van, 6-ton, 2W, (Highway SKD 2270)	18. 34	16	
Semitrailer, animal and cargo, 6-ton, 2W	19. 00	16	
Semitrailer, stake and platform, 10-ton, 2W	22. 42	19	
Truck, tractor, 5-ton, 6 x 6, M52, w/winch, towing:			
Semitrailer, low-bed, rear-loading, 12-ton, M130	25. 43	20	
Semitrailer, low-bed, rear-loading, 25-ton, M172	41. 16	35	*(12)
Truck, ponton tractor, 5- to 6-ton, 4 x 4, C. O. E., towing:			
Grader, road, towed-type, leaning wheel, hand-controlled, 6½-ft moldboard	10. 02	9	
Grader, road, towed-type, leaning wheel, hand-controlled, 10-ft moldboard	13. 47	11	
Tank, water, steel, semitrailer-mtd, 1,500-gallon	18. 94	17	

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (wheeled)	Gross weight (tons)	Vehicle classification number
Truck, ponton tractor, 5- to 6-ton, 4 x 4, C. O. E., towing—Continued		
Reproduction equipment, topographic, mtd on a 10-ton semitrailer w/van-type body, carrying one of the following sections	20. 84	17
Camera section, set No. 4, 24 x 24 inches.		
Camera section, set No. 5, 24 x 30 inches.		
Combination section, set No. 1A.		
Combination section, set No. 2B.		
Laboratory section, set No. 1.		
Plate grainer section, set No. 1.		
Plate process section, set No. 1.		
Press section, set No. 2, 20 x 22½ inches.		
Press section, set No. 5, 22 x 29 inches.		
Semitrailer, 15-ton gross, 4W, V9/MPG1	22. 18	20
Generator and charging plant, acetylene gas, semitrailer mtd, van type, 750 cu ft per hr	25. 11	20
Generator and charging plant, oxygen-nitrogen gas, semitrailer-mtd, van-type, 500 cu ft per hr	27. 00	21

Truck, prime mover, 6-ton, 6 x 6, w/winch, towing:			
Grader, road, towed-type, leaning wheel, hand-controlled, 6½-ft moldboard	18. 14	16	
Grader, road, towed-type, leaning wheel, hand-controlled, 10-ft moldboard	21. 59	17	
Trailer, full, low-bed, 8-ton	29. 71	22	
Generator and charging plant, acetylene gas, semitrailer-mtd, van-type, 750 cu ft per hr, w/dolly	35. 07	25	
Semitrailer, low-bed, rear-loading, 20-ton, w/dolly	45. 61	46	*(15)
Trailer, full, low-bed, 60-ton	94. 21	115	*(20)
Truck, tractor, 6-ton, 6 x 6, towing semitrailer, low-bed, front-loading, 20-ton	41. 43	34	*(18)
Truck, prime mover, 7½-ton, 6 x 6, w/winch, towing trailer, ammunition, 8-ton, 4W, M23	35. 77	32	*(20)
Truck, prime mover, 12-ton, 6 x 4, M20, towing trailer, transporter, 45-ton, 12W, M9	77. 50	92	*(21)
Truck, tractor, 12-ton, 6 x 6, M26 and M26A1, towing:			
Semitrailer, transporter, 45-ton, 8W, M15A1	92. 38	77	*(37)
Semitrailer, low-bed, rear loading, 60-ton, M160	99. 21	97	*(30)
Transporter, T10, w/carriage, T72, and gun, 280-mm, T131	85. 64	98	

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (tracked)	Gross weight (tons)	Vehicle classification number
Tractor, crawler type, diesel driven, 28,100- to 38,000-lb drawbar pull, towing arch, logging, towed-type, crawler-mtd, w/boom, 99-inch gage	21. 98	20
Tractor, high-speed, 13-ton, M5A3, towing:		
Gun, 90-mm, T8, on carriage, gun, 90-mm, T5E2	18. 73	16
Howitzer, 155-mm, M1, on carriage, howitzer, 155-mm, M1A2	21. 53	18
Tractor, high-speed, 18-ton, M4, towing:		
Semitrailer, 15-ton gross, 4W, w/dolly, 2W, V9/MPG1	30. 06	28
Gun, 155-mm, M2, on carriage, gun, 155-mm, M1, w/limber	31. 45	26
Howitzer, 8-inch, M2, on carriage, howitzer, 8-inch, M1	31. 70	25
Gun, 90-mm, M2, on mount, AA gun, 90-mm, M2	31. 85	27
Tractor, high-speed, 38-ton, M6, towing:		
Howitzer, 240-mm, M1, on wagon, cannon transport, M2A1	61. 86	54
Carriage, 8-inch gun, M2, on wagon, carriage transport, M3A1	63. 55	54
Carriage, 240-mm howitzer, M1, on wagon, carriage transport, M3A1	63. 55	54
Gun, 8-inch, M1, on wagon, cannon transport, M1A1	64. 31	54
Gun, 120-mm, M1, on mount, gun, 120-mm M1	69. 00	59

Combination vehicle (semitrailer)	Gross weight (tons)	Vehicle classification number
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 1, mixer, bituminous, trailer-mtd, complete, Barber-Greene, Model 840	5. 30	8
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 2, dryer, aggregate, trailer-mtd, complete, Barber-Greene, Model 830	4. 35	6
Asphalt plant, gasoline-driven, 10 to 30 TPH, unit No. 2, dryer, aggregate, trailer-mtd, complete, Barber-Greene, Model 839	9. 15	11
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 1, mixer, pugmill, semitrailer-mtd	6. 99	8
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 2, dryer, aggregate, semitrailer-mtd	7. 30	6
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 3, stabilizer, soil, semitrailer-mtd	6. 99	7
Asphalt and soil aggregate mixing plant, gasoline-driven, 25 TPH, unit No. 4, elevator, bucket, trailer-mtd	1. 50	----------
Conveyor, belt, transfer, gasoline-driven, 24-inch x 57-ft, Barber-Greene, Model 374	4. 94	7
Dolly, trailer converter, light duty, 3-ton, 2W, M363	. 88	----------
Dolly, trailer converter, 6-ton, 2W, M364	1. 00	----------
Dolly, trailer converter, 8-ton, 2W	1. 50	----------
Dolly, trailer converter, 10-ton, 2W, M365	1. 69	----------

Table X. Vehicle Classification Data—Continued

Combination vehicle (semitrailer)	Gross weight (tons)	Vehicle classification number
Dolly, trailer converter, 30-ton, 4W, 4DT, M309	4. 10	5
Dolly, trailer converter, 4W, tandem, 4DT, M1	4. 23	5
Dryer, aggregate, single drum, central plant, diesel-driven, trailer-mtd, 80 to 120 TPH, Barber-Greene, Model 837	18. 85	17
Generator and charging plant, acetylene gas, semitrailer-mtd, van-type, 750 cu ft per hr	16. 02	12
Generator and charging plant, oxygen-nitrogen gas, semitrailer-mtd, van-type, 500 cu ft per hr	17. 90	16
Gun, 57-mm, M1, on carriage, gun, 57-mm, M1A3	1. 43	----------
Gun, 90-mm, T8, on carriage, gun, 90-mm, T5E2	3. 55	6
Heater, asphalt, trailer mtd, 3-car capacity, 42HP	2. 70	4
Howitzer, 155-mm, M1, on carriage, howitzer, 155-mm, M1A2	6. 35	9
Kettle, asphalt repair, trailer-mtd, w/motor-driven hand spray, 110-gallon capacity	1. 18	----------
Kettle, asphalt repair, trailer-mtd, w/motor-driven hand spray, 165-gallon capacity	1. 50	----------
Lubricator, trailer-mtd	2. 00	----------
Pump, water, trailer-mtd, w/distributor attachments	1. 12	----------

Pump, centrifugal, gasoline-driven, trailer-mtd, 4-inch discharge, 4-inch suction, 500 gpm at 20-ft head normal discharge	1. 75		
Reproduction equipment, topographic, mtd on a 10-ton semitrailer w/van-type body, carrying one of the following sections	11. 75	12	
Camera section, set No. 4, 24 x 24 inches.			
Camera section, set No. 5, 24 x 30 inches.			
Combination section, set No. 1A.			
Combination section, set No. 2B.			
Laboratory section, set No. 1.			
Plate grainer section, set No. 1.			
Plate process section, set No. 1.			
Press section, set No. 2, 20 x 22½ inches.			
Press section, set No. 5, 22 x 29 inches.			
Semitrailer, animal and cargo, 6-ton, 2W, (Highway)	10. 40	10	
Semitrailer, animal and cargo, 6-ton, 2W	12. 30	11	
Semitrailer, carrier equipment, OA75, MSC1	7. 50	5	
Semitrailer, gasoline tank, 6-ton, 2W, 2,000-gallon, M30	9. 48	9	
Semitrailer, low-bed, rear-loading, 12-ton, M130	15. 50	16	
Semitrailer, low-bed, front-loading, 20-ton	31. 95	27	
Semitrailer, low-bed, rear-loading, 25-ton, M172	31. 81	24	
Semitrailer, low-bed, rear-loading, 60-ton, M160	75. 28	92	*(12)
Semitrailer, stake and platform, 3½-ton, 2W	8. 65	7	
Semitrailer, stake and platform, 5-ton, 2W	10. 82	9	

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (semitrailer)	Gross weight (tons)	Vehicle classification number	
Semitrailer, stake and platform, 6-ton, 2W	12. 98	11	
Semitrailer, stake and platform, 10-ton, 2W	15. 72	14	
Semitrailer, telephone, MDF, OA77, MSC1	6. 70	8	
Semitrailer, telephone switchboard, OA79, MSC1	7. 55	7	
Semitrailer, teletype operations, OA78, MSC1	6. 00	7	
Semitrailer, teletype switchboard, OA76, MSC1	6. 51	7	
Semitrailer, 32-passenger bus chassis, 3-ton, 2W	6. 64	6	
Semitrailer, transporter, 40-ton, 8W, M15	61. 19	45	*(16)
Semitrailer, transporter, 45-ton, 8W, M15A1	66. 19	49	*(16)
Semitrailer, van, 3-ton, 2W	7. 94	7	
Semitrailer, van, 6-ton, 2W, (Gerstenslager)	10. 55	11	
Semitrailer, van, 6-ton, 2W, (Gramm DF 75)	10. 94	11	
Semitrailer, van, 6-ton, 2W, (Highway SKD 2215)	11. 04	11	
Semitrailer, van, 6-ton, 2W, (Gramm)	11. 20	11	
Semitrailer, van, 6-ton, 2W, (Highway SKD 2181)	11. 59	11	
Semitrailer, van, 6-ton, 2W, (Highway SKD 2270)	11. 64	11	
Semitrailer, van, 6-ton, 2W, (Trailmobile)	11. 93	11	
Semitrailer, van, 6-ton, 2W, (Utility)	12. 78	11	
Semitrailer, van, 6-ton, 2W, (American Body)	12. 85	11	

Semitrailer, van, 6-ton, 2W, (Olson)	12. 90	11
Semitrailer, van, 6-ton gross, 4W, K55	6. 04	5
Semitrailer, van, 7-ton, 4W, M26	13. 52	12
Semitrailer, van, 11-ton, 2W	15. 42	14
Semitrailer, van, 12-ton gross, 2W, K78	9. 26	9
Semitrailer, 15-ton gross, 4W, V9/MPG1	13. 09	12
Tank, water, steel, semitrailer-mtd, 1,500-gallon	9. 85	9
Trailer, ammunition, 2-ton, 2W, M10	3. 13	4
Trailer, ammunition, 4-ton, 2W, M21	6. 65	10
Trailer, cable hauler, 5-ton payload, 2W, K37 and K37A	6. 51	10
Trailer, cargo, ¼-ton, 2W	0. 78	----------
Trailer, cargo, ¼-ton, 2W, M100	0. 66	----------
Trailer, cargo, ¾-ton, 2W, M101	1. 80	----------
Trailer, cargo, 1-ton, 2W	2. 15	----------
Trailer, cargo, 1½-ton, 2W, M104	3. 95	6
Trailer, chassis, generator, w/30 KW generator	2. 95	5
Trailer, chassis, generator, heavy, M200 w/60 KW generator	4. 35	7
Trailer, clamshell, 3-ton, 2W, M16	4. 12	5
Trailer, pole hauling and cargo, 2-ton payload, 2W, K36	2. 90	5
Trailer, pole hauling and cargo, 3½-ton payload, 2W, V13/GT	4. 70	7
Trailer, telephone cable splicer, ¼-ton payload, 2W, K38	. 40	----------
Trailer, telephone cable splicer, ⅜-ton payload, 2W, K38A	. 66	----------
Trailer, tire repair, 1-ton, 2W, load A, M25	1. 90	----------

*Figures in parentheses indicate unloaded classification.

Table X. Vehicle Classification Data—Continued

Combination vehicle (semitrailer)	Gross weight (tons)	Vehicle classification number
Trailer, tire repair, 1-ton, 2W, load B, M25	1. 18	
Trailer, utility, pole-type, 2½-ton, 2W	3. 70	6
Trailer, utility, pole-type, 2½-ton, 2W, 16-ft utility power boat	2. 15	
Trailer, utility, pole-type, 2½-ton, 2W, 19-ft bridge erection boat	3. 00	5
Trailer, utility, pole-type, 2½-ton, 2W, infantry raft equipment and/or pneumatic bridge equipment	3. 70	6
Trailer, utility, pole-type, 2½-ton, 2W, trestle bay load, 10-ton ponton bridge	3. 70	6
Trailer, utility, pole-type, 2½-ton, 2W, triangulation tower	4. 75	7
Trailer, water tank, 1-ton, 2W, 250-gallon	1. 75	
Trailer, water tank, 1½-ton, 2W, M106	2. 82	4

APPENDIX I

REFERENCES

1. Field Manuals

5–5—Engineer Troop Units
5–6—Operations of Engineer Troop Units
5–9—Elementary Bridging
5–10—Routes of Communication
5–34—Engineer Field Data
5–35—Engineers' Reference and Logistical Data
19–5—Military Police
19–25—Military Police Traffic Control
20–100—Army Aviation
21–30—Military Symbols
25–10—Motor Transport
30–5—Title Classified
31–71—Operations in the Arctic
100–5—Field Service Regulations; Operations
100–10—Field Service Regulations; Administration
101–5—Staff Officers' Field Manual; Staff Organization and Procedure
101–10—Staff Officers' Field Manual; Organization, Technical, and Logistical Data

2. Technical Manuals

5–240—Aerial Photography
30–246—Tactical Interpretation of Air Photos

5–260—Principles of Bridging
9–2800—Military Vehicles
9–2800–1—Military Vehicles (Ordnance Corps Responsibility)

3. Other Military Publications

TB 5–253–1—Soil Testing Set No. 1 and Expedient Tests
SR 320–5–1—Dictionary of United States Army Terms

4. U. S. Department of Commerce

Public Roads Administration. Manual on Uniform Traffic Control Devices for Streets and Highways. G. P. O., 1948.

APPENDIX II

GUIDES FOR DETERMINING LOAD-BEARING CAPACITY OF ROADS

1. General

a. Guides for determining the load-bearing capacity of roads require an elementary knowledge of the structure and the design of roads.

b. A road is an open way provided for the convenient passage of personnel, vehicles, and animals. It usually consists of a surface or pavement, a base course, and a subgrade or foundation.

c. The load-bearing capacity of a road is its ability to support traffic. It is expressed in the same manner that vehicle classification numbers are expressed.

2. Roads

The component parts of a road are usually a pavement or surface, a base course, and a subgrade (fig. 34).

a. The surface or pavement of a road is the top portion of the road structure. It comes into direct contact with the wheel load or tracked load. It is intended to resist traffic wear and dusting and to prevent surface water from infiltrating into the road structure. It may consist of—

(1) Earth,

(2) Sand-clay,

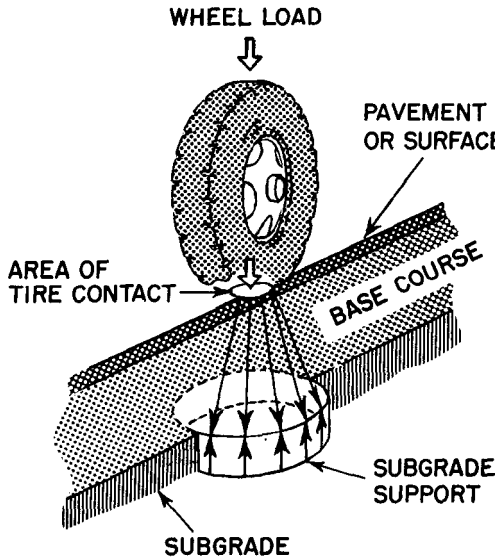


Figure 34. Section of road and wheel loading.

(3) Gravel,
(4) Bituminous mixes,
(5) Concrete, or
(6) Paving brick, block, or stone.

b. The base course of a road is the intermediate portion of a road structure which distributes the induced stresses from the wheel or tracked load so that they will not exceed the strength of the subgrade. Base courses are usually made from selected gravel or crushed rock.

c. The subgrade is the foundation of a road structure. It supports the load placed upon the surface of the road. Improved roads usually have a subgrade composed of selected material found in the immediate vicinity of the road.

3. Surfaces

Surfaces of roads may be flexible or rigid.

a. Flexible road surfaces may be composed only of the natural earth material of which the road is constructed; may be composed of this earth material stabilized with oil, cement, or other material; or may be a bituminous pavement.

b. Rigid road surfaces are usually made of portland cement concrete. Brick, block, and stone may also be considered rigid surfaces.

4. Soils

Soils form the basis for the vast majority of roads. Elevated roadways are a notable exception. Soils, briefly, are considered here according to their type, their classification, and their allowable foundation bearing pressure. Soil types are listed and described in table XI. A soil classification chart is given in table XII. Allowable foundation bearing pressures for various kinds of soil under specified conditions are given in table XIII.

Table XI. Principal Soil Types

Name	Description
Gravel	A mass of detached rock particles, generally water-worn, ranging in size from ¼ inch to about 4 inches.
Sand	Granular material composed of rock particles ranging in diameter from 0.25 inch to 0.002 inch which will not pass through a No. 270 sieve. It is difficult to distinguish sand from silt when the particles are uniformly small. Dried sand, however, differs from silt in that it has no cohesion and feels gritty.
Silt	A fine granular material composed of particles ranging in diameter from 0.002 inch to 0.0002 inch. It will pass through a No. 270 sieve. It lacks plasticity and has little dry strength. To identify: prepare a pat of wet soil and shake it horizontally in the palm of the hand. With typical inorganic silt, the shaking action causes water to come to the surface of the sample, making it appear glossy and soft. Repeat test with varying moisture contents. Squeezing the sample between the fingers causes the water to disappear from the surface and the sample quickly stiffens and finally cracks or crumbles. Allow sample to dry, and test its cohesion and feel by crumbling with the fingers. Typical silt shows little or no dry strength and feels smooth in contrast to the grittiness of fine sand.

Table XI. Principal Soil Types—Continued

Name	Description
Clay	Extremely fine-grained material composed of particles smaller than 0.0002 inch in diameter. To identify: work a sample with the fingers, adding water when stiffness requires. Moist sample is plastic enough to be kneaded like dough. Make further test by rolling ball of kneaded soil between palm of hand and a flat surface. Clay can be rolled to a slender thread, about ⅛ inch in diameter, without crumbling; silt crumbles, without forming a thread. Measure hardness of dry clay by finger pressure required to break a sample. It requires much greater force to break dry clay than dry silt.
Organic	Soil composed of decayed or decaying vegetation; sometimes mixed with fine-grained mineral sediments, such as peat or muskeg. Identified by coarse and fibrous appearance and odor. Odor may be intensified by heating. Plastic soils containing organic material can be rolled into soft, spongy threads.

Table XII. Soil Classification Chart

Major divisions	Subdivisions	Soil groups and typical names	Group symbols	Dry strength	Value as foundation when not subject to frost action
Coarse-grained soils.	Gravels and gravelly soils.	Well-graded gravel and gravel-sand mixtures; little or no fines.	GW	None	Excellent.
		Well-graded gravel-sand-clay mixtures, excellent binder.	GC	Medium to high.	Excellent.
		Poorly graded gravel and gravel-sand mixtures, little or no fines.	GP	None	Good to excellent.
		Gravel with fines, very silty gravel, clayey gravel, poorly graded gravel-sand-clay mixture.	GF	Very slight to high.	Good to excellent.
	Sands and sandy soils.	Well-graded sands and gravelly sands, little or no fines.	SW	None	Good to excellent.
		Well-graded sand-clay mixtures, excellent binder.	SC	Medium to high.	Good to excellent.
		Poorly graded sands, little or no fines.	SP	None	Fair to good.

		Sand with fines, very silty sands, clayey sands, poorly graded sand-clay mixtures.	SF	Very slight to high.	Fair to good.
Fine-grained soils containing little or no coarse-grained material.	Fine-grained soils having low to medium compressibility (low liquid limit).	Silts (inorganic) and very fine sands, Mo, rock flour, silty or clayey fine sands with slight plasticity.	ML	Very slight to medium.	Fair to good.
		Clay (inorganic) of low to medium plasticity, sandy clays, silty clays, lean clays.	CL	Medium to high.	Fair to poor.
		Organic silts and organic silt-clays of low plasticity.	OL	Slight to medium.	Poor.
	Fine-grained soils having high compressibility (high liquid limit).	Micaceous or diatomaceous fine sandy and silty soils, elastic silts.	MH	Very slight to medium.	Poor.
		Clays (inorganic) of high plasticity, fat clays.	CH	High	Poor to very poor.
		Organic clays of medium to high plasticity.	OH	High	Very poor.
Fibrous organic soils with very high compressibility.		Peat, humus, and other organic swamp soils.	Pt	Readily identified.	Not suitable.

Note. C—clay; F—fines-material less than 0.1 mm; G—gravel; H—high compressibility; L—low to medium compressibility; M—very fine sand, silt, rock flour; Mo—fine-grained sand with little or no plasticity; O—organic matter; P—poorly graded; Pt—peat; S—sand; W—well-graded.

Table XIII. Allowable Foundation Bearing Pressures

Soil			Safe allowable pressure (lb per sq ft)
General description	Classification	Condition	
Fine grained soils		Soft, unconsolidated, having high moisture content.	1,000
Clay, silts, very fine sands or mixtures of these containing a few coarse particles of sand or gravel.	MH, CH OH, ML	Stiff, partly consolidated, medium moisture content.	4,000
	CL, OL	Hard, well consolidated, low moisture content, slightly damp or dry.	8,000
Sands and well-graded sandy soils, containing some silt and clay.	SW, SC	Loose, not confined	3,000
	SP	Loose, confined	5,000
	SF	Compact	10,000
Gravel and well-graded gravelly soils containing some sand, silt, and clay.	GW	Loose, not confined	4,000
	GC	Loose, confined	6,000
	GP	Compact	12,000
	GF	Cemented sand and gravel	16,000
Rock		Poor quality rock- soft and fractured, also hardpan.	10,000
		Good quality; hard and solid.	[1] 20,000

[1] Minimum.

5. Load-Bearing Capacity

a. The load-bearing capacity of a road, considered by itself, is measured in pounds of allowable wheel load. It is expressed in a series of whole numbers between 4 and 150 in the same manner that vehicle classification numbers are expressed. These numbers and their significance are given in table XIV.

Table XIV. Hypothetical Vehicle Classification Numbers and Their Significance

Hypothetical vehicle classification number	Maximum single axle load (tons)	Maximum single wheel load (pounds)
4	2. 5	2, 500
8	5. 5	5, 500
12	8. 0	8, 000
16	10. 0	10, 000
20	11. 0	11, 000
24	12. 0	12, 000
30	13 5	13, 500
40	17. 0	17, 000
50	20. 0	20, 000
60	23. 0	23, 000
70	25. 5	25, 500
80	28. 0	28, 000
90	30. 0	30, 000
100	32. 0	32, 000
120	36. 0	36, 000
150	42. 0	42, 000

b. An approximation of the load-bearing capacity of a road with a flexible pavement may be obtained from the data in figure 35.

c. Computation of the approximate load-bearing capacity of a road, considered by itself, can be made from a determination of the thickness of the surface course or pavement, the thickness of the base course, and the type of subgrade material. By applying this information to tables XI, XII, and XIII and the curves in figure 35, the approximate load-bearing capacity is obtained. The accuracy of this method is entirely dependent on the experience and judgment of the reconnaissance personnel.

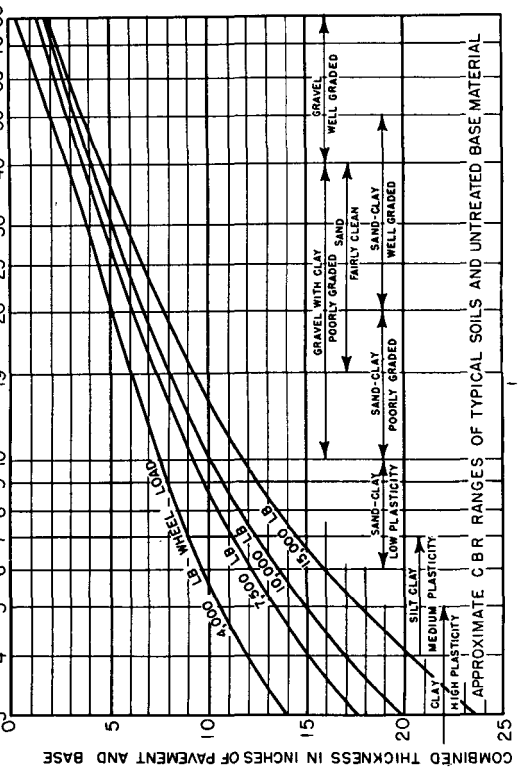


Figure 35. Load-bearing capacity of roads with flexible pavements.

d. An example of the computation of the load-bearing capacity of a road follows.

(1) By field inspection, it is determined that the road has a 10-inch compacted gravel base course and a 3-inch bituminous surface course or pavement. This is a combined thickness of 13 inches. By use of the identification method given in table XI it is determined that the subgrade consists of well-consolidated, fairly dry clay.

(2) Fairly dry clay, well-consolidated, is shown in table XII to be in the ML–CL range of soil groupings.

(3) Experience with similar soils indicates that a safe CBR (California Bearing Ratio) value is approximately 8 percent.

(4) Reference to figure 35 shows that for a 13-inch combined thickness of pavement and base course the permissible wheel load is about 13,000 pounds.

(5) Reference to table XIV shows that this wheel load corresponds to a vehicle classification number 30.

(6) The road is given a classification number 30.

e. Limitation of the load-bearing capacity of a high type road is the classification of the weakest bridge in the route.

APPENDIX III
BRIDGE SPANS

1. General

Bridge spans may be divided into two general classes: fixed bridges and movable bridges, as enumerated below:

a. Fixed bridge spans (fig. 36) are further divided into eight types, according to structure design.

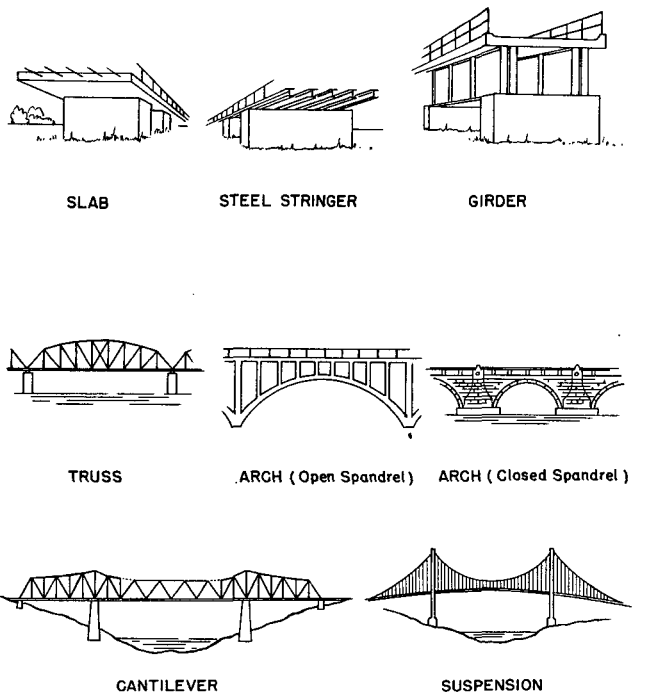
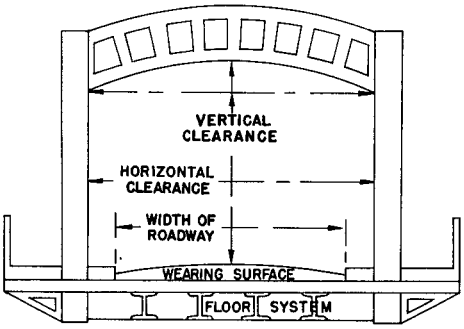


Figure 36. Classification of fixed bridges by type of fixed structure.

These types, which are discussed in more detail in paragraphs 2 through 9 of this appendix, are cantilever, slab, beam (simple or continuous stringer), truss, girder, arch, suspension, and ponton (floating).

b. Movable bridges are discussed in paragraph 10 of this appendix.

c. Principal bridge span dimensional data are



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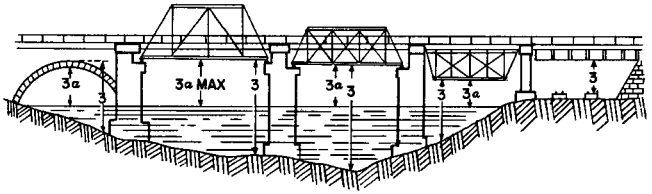

DIMENSION 3 - HEIGHT ABOVE STREAMBED (GROUND)
DIMENSION 3a - HEIGHT ABOVE NORMAL WATER LEVEL

②

1 Measuring width of roadway and clearances
2 Measuring height above streambed and normal water level

Figure 37. Principal bridge span dimensional data.

illustrated in figure 37, and principal dimensional requirements are given in table V.

d. Capacity dimension data requirements are presented in table VI.

2. Cantilever Bridges

A cantilever bridge is one in which two self-supporting beams, or trusses, project from piers toward each other, with no intermediate support. These beams are either joined directly to one another or are connected by a suspended span. Figure 38 illustrates a cantilever bridge and designates its sections.

3. Slab Bridges

a. Slab bridges are short span bridges consisting primarily of a reinforced concrete slab resting directly on the abutments or intermediate supports. A wearing surface of bituminous material, gravel, or wooden planks is usually laid over the concrete, but sometimes the upper side of the slab is the wearing surface.

b. A standard dimension data guide for concrete bridges is given in figure 39. A typical concrete slab bridge is illustrated in figure 40.

4. Beam Bridges

a. The majority of all bridges with short spans are simple stringer bridges. Stringers are generally constructed of steel, concrete, or wood. A standard dimension data guide for simple stringer bridges is given in figure 41. The most common types of stringers are as follows:

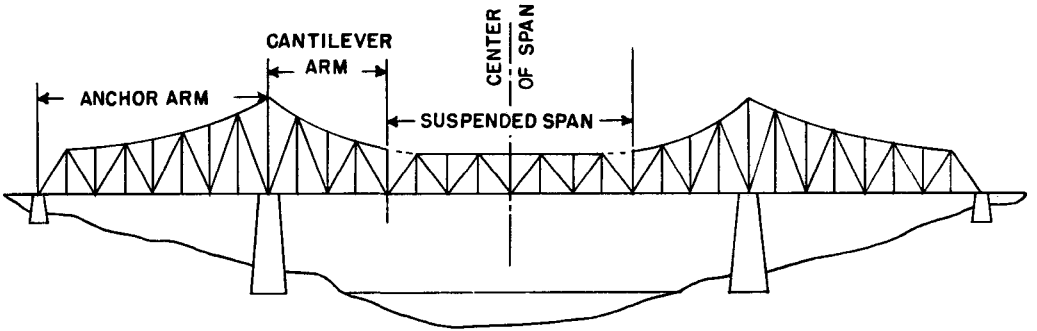

Figure 38. Typical cantilever bridge.

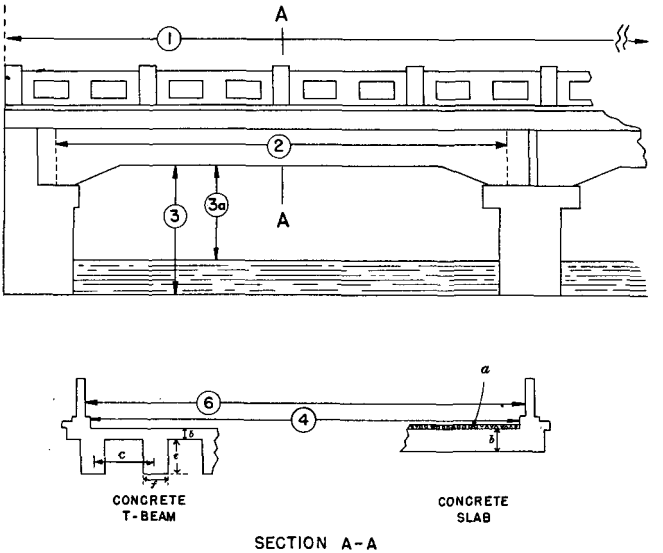

Figure 39. Standard dimension data guide for concrete bridges.

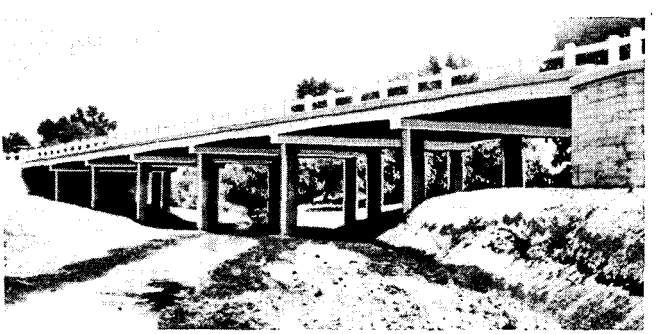

Figure 40. Typical concrete slab bridge.

(1) Wooden stringers.
  (*a*) Rectangular timber (fig. 42).
  (*b*) Log (fig. 43).

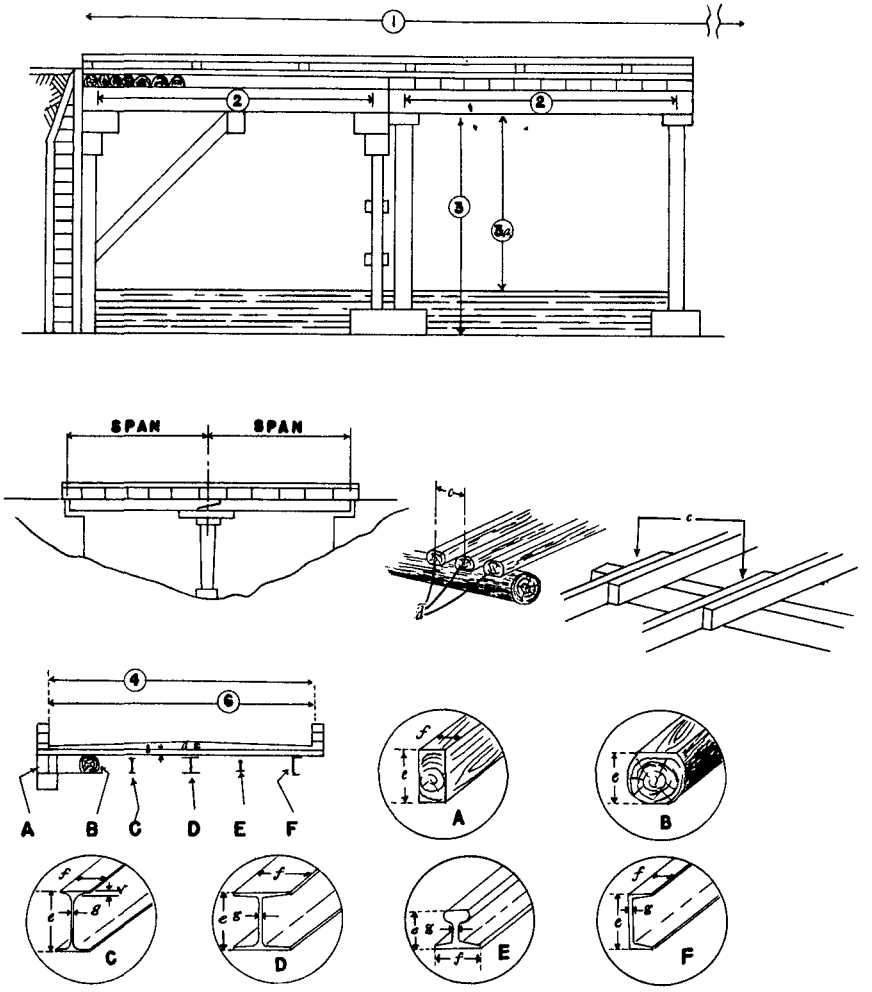

Figure 41. Standard dimension data guide for simple stringer bridges.

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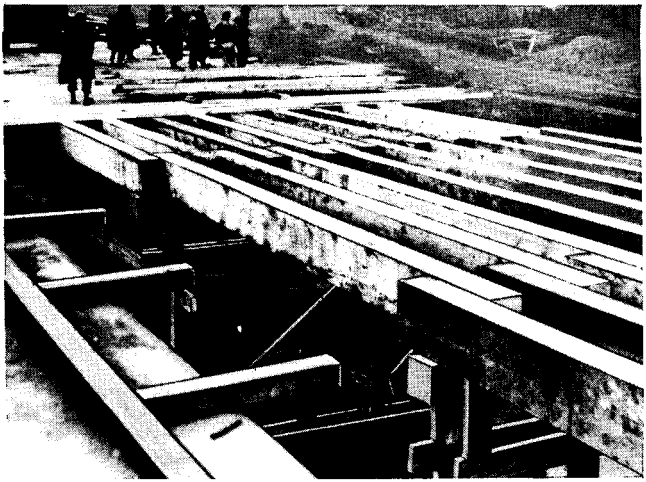


Figure 42. Simple stringer bridge with rectangular timber stringers.

(2) Steel stringers.
  (*a*) I-beam (figs. 44 and 45).
  (*b*) Wide flange (WF) beam.
  (*c*) Channel.
  (*d*) Rail.

b. Beam span bridges are reinforced concrete bridges in the form of slabs resting on a series of rectangular beams. Beams and slabs are poured integrally. The beams may be reinforced with standard rods, steel T-beams, I-beams, or channels. The wearing surface of the roadway may consist of bituminous material or wooden planking laid on top of the concrete slab. A standard dimension data guide for concrete bridges is given in figure 39. Typical single span and multispan concrete bridges are illustrated in figures 46, 47, and 48.

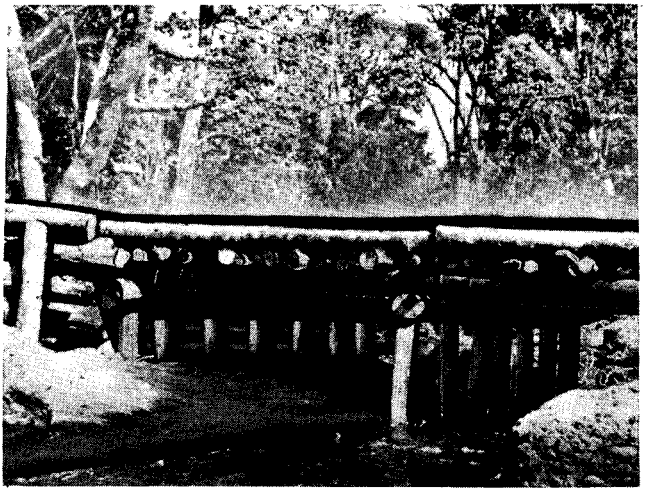


Figure 43. Simple stringer bridge with log stringer.

5. Truss Bridges

a. Truss span bridges are used for spans which are too long for simple stringer or girder bridges. The truss is a compound beam in which the parts are arranged to form one or more triangles in the same plane. It carries the roadway loads, transmitted from the bridge flooring to the abutments and intermediate supports. Trusses are usually constructed of steel, although wood truss bridges are found in or near areas where timber is abundant.

b. A standard dimension data guide for truss bridges is given in figure 49.

c. Classification of truss types, by the position of the roadway (fig. 50), follows:

(1) Deck truss. The roadway is located above or on the top chord.

Figure 44. Simple stringer bridge with steel **I***-beams and timber flooring.*

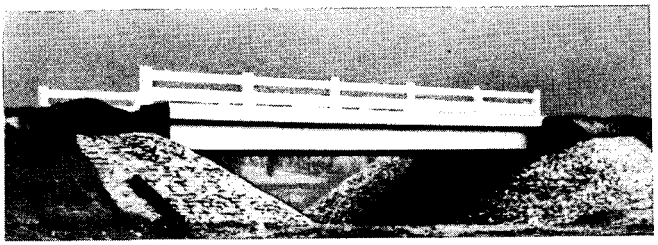


Figure 45. Simple stringer bridge with steel **I***-beams and concrete slab flooring.*

(2) Through truss. The roadway is situated near the bottom chord, and overhead bracing (crosswise) is frequently provided.

(3) Pony (half-through) truss. The roadway is located close to the top chord, and no overhead bracing (crosswise) is provided.

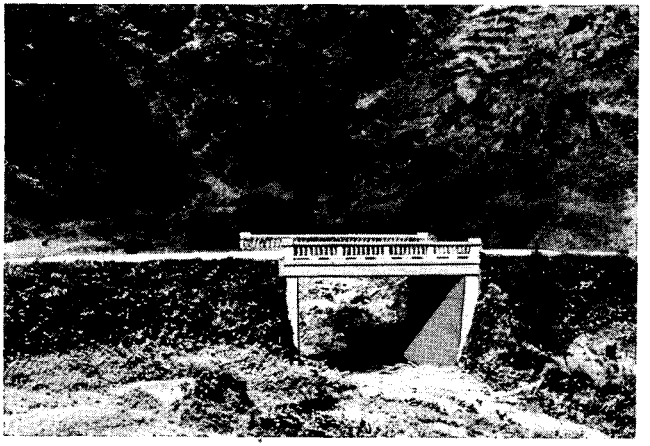


Figure 46. Typical single span concrete bridge.

Figure 47. Typical concrete bridge.

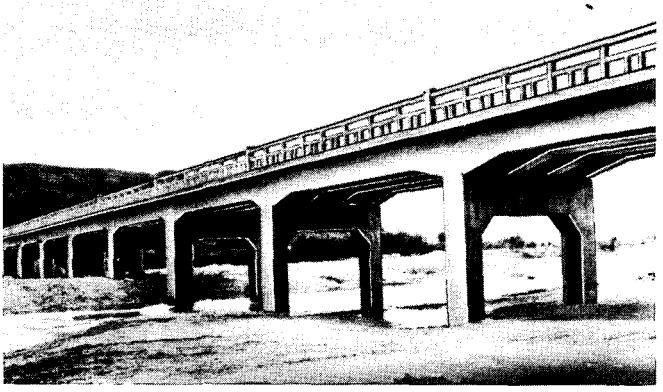


Figure 48. Typical multispan concrete T-beam bridge.

d. Common types of bridge trusses are illustrated in figure 51, but it is not generally necessary to include their names in bridge reconnaissance reports.

e. Typical truss bridges are illustrated as follows:

(1) Typical steel deck truss bridge (fig. 52).

(2) Typical timber truss bridge (fig. 53).

(3) Typical steel through truss bridge (Warren type) (fig. 54).

(4) Typical steel pony truss span on combination streetcar and highway bridge (fig. 55).

6. Girder Bridges

a. Girder span bridges are composed of girders and a floor system. The girder is a compound steel beam, built up of plates, shapes (such as angles, channels, and Z-sections), lattice work, bars, and other elements, which transmits the roadway loads to the intermediate supports and abutments. The

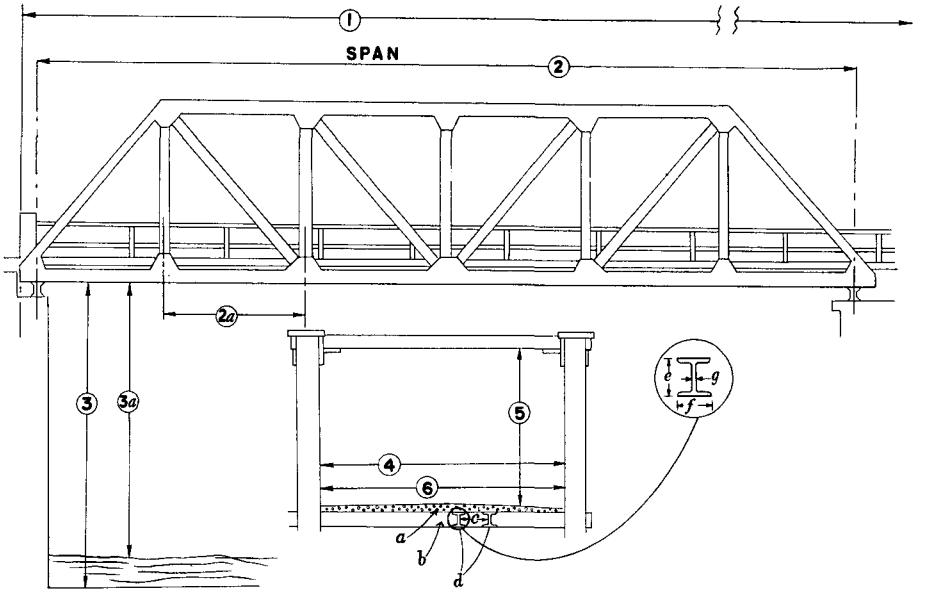
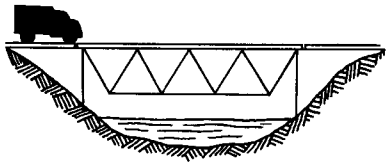
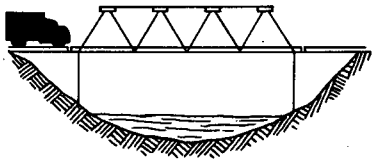


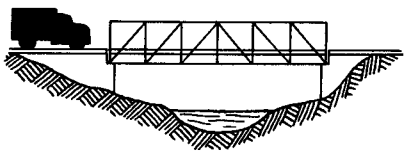
Figure 49. Standard dimension data guide for steel truss bridges.



DECK TYPE



THROUGH TYPE



HALF-THROUGH OR PONY TYPE

Figure 50. Classification of truss types by position of roadway.

floor system is composed of stringers, floor beams, flooring, and a roadway. Normally, girder spans are constructed of steel, but occasionally they are made of prestressed concrete.

b. A standard dimension data guide for plate girder spans is given in figure 56.

c. Identification of girder bridges is difficult. They may be mistaken for truss bridges or simple stringer bridges. Therefore, it is important to make close inspection of girder bridges and to identify their component parts accurately when capacity

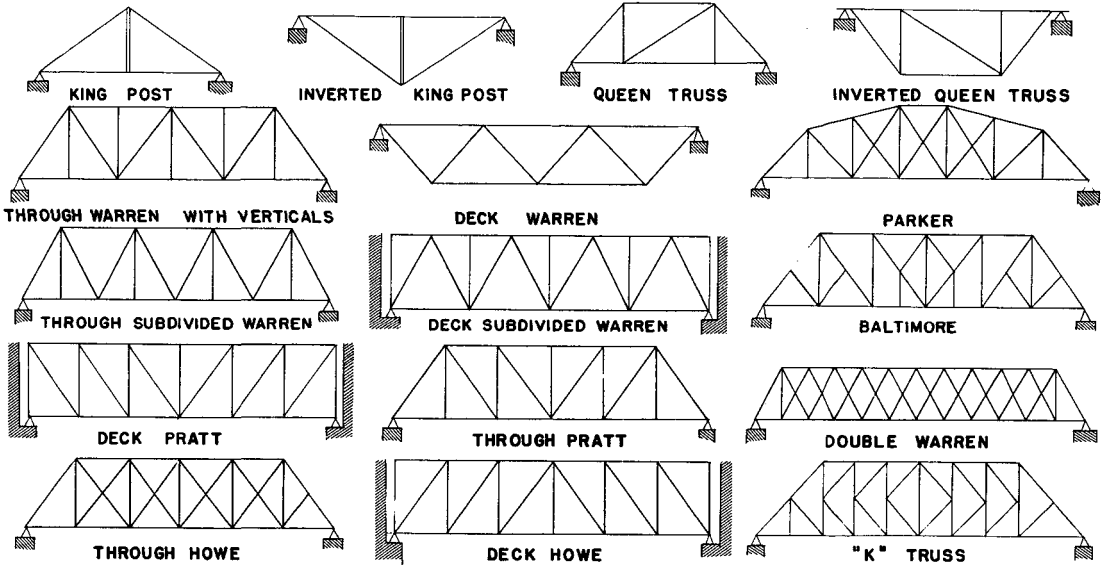


Figure 51. Common types of bridge trusses.

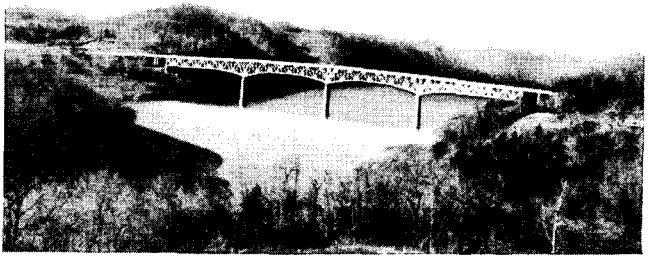


Figure 52. Typical steel deck truss bridge.

Figure 53. Typical timber truss bridge.

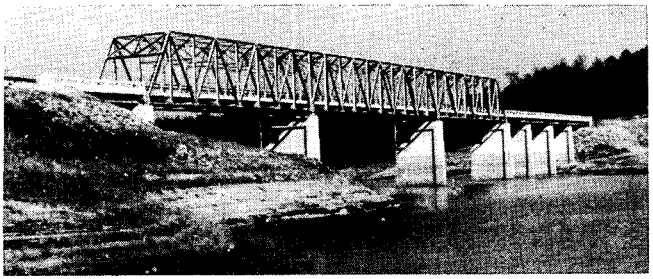


Figure 54. Typical steel through truss bridge (Warren type).

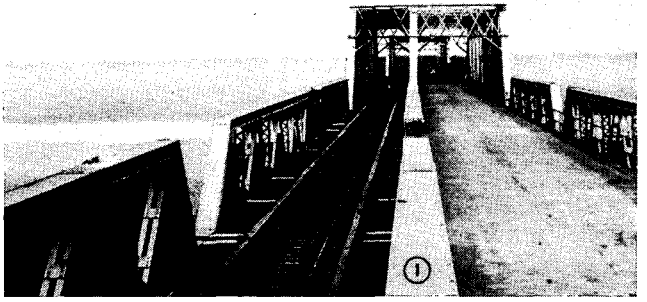
calculations are involved. The common types of plate girders are single plate or box type girders. The bridges constructed of these girders are deck plate girder bridges or through plate girder bridges.

(1) *Plate girder span.* The plate girder span is the most common type. The roadway is usually located above the top flange plate of the girder. A typical multispan plate girder bridge is illustrated in figure 57.

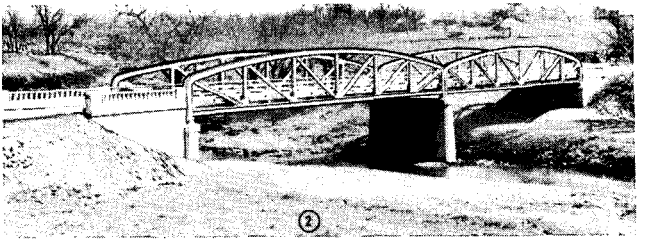
(2) *Through type girder span.* If the floor system is carried at or near the level of the lower chords so that the traffic passes between or through the girder, the structure is called a through type girder bridge. This type is illustrated in figure 58.

7. Arch Bridges

a. Arch span bridges are constructed in many types and variations. Basically, an arch bridge consists of an arch (including an arch ring), a crown, a fill and hinges, and a floor system. A standard



1 Pony truss and through truss forming combination bridge



2 Pony truss highway bridge

Figure 55. Typical pony truss spans.

dimension data guide for arch bridges is given in figure 59. Common types of arch construction used in bridges are illustrated in figure 60. Nomenclature of arch bridges is given in figure 61.

b. Classification of arch spans, for reconnaissance report purposes, may be given as follows:

(1) Masonry arch (solid earth-filled and deck type (fig. 62)). Appendix VII describes in

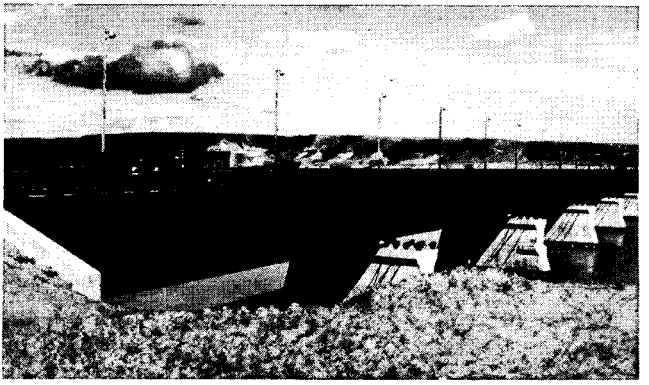


Figure 57. Typical multispan plate girder bridge.

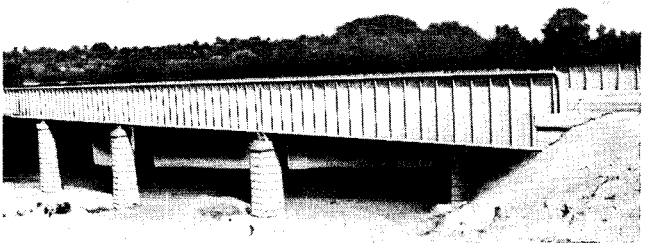


Figure 58. Through type girder bridge.

detail the requirements for classifying masonry arch bridges.

(2) Concrete arch, either solid (earth-filled) or open (spandrel) type, with the roadway usually supported above the arch ring by a series of columns, posts, or small arches (figs. 63 and 64).

(3) Steel arch, either deck type with the roadway resting on the top (horizontal) member

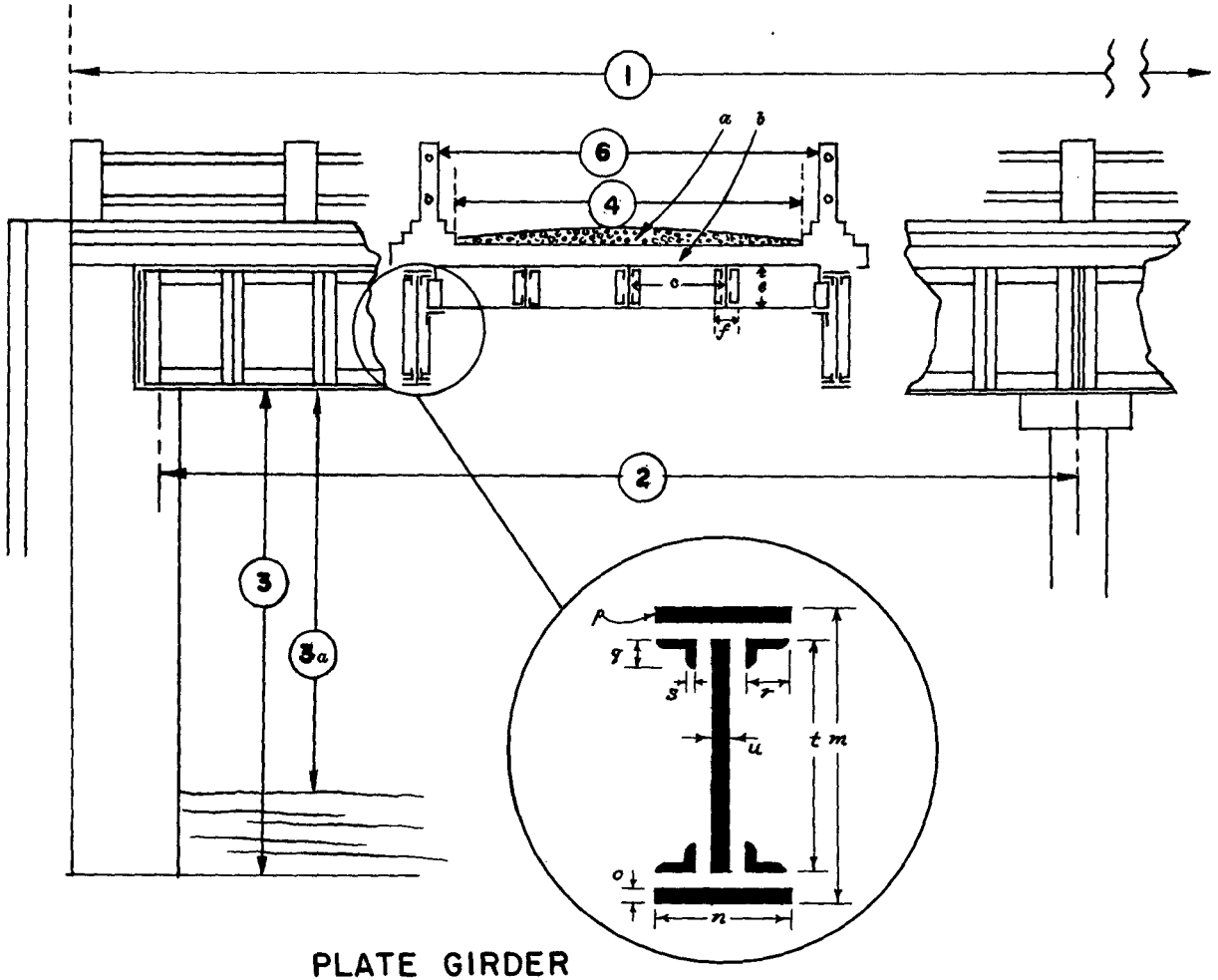


Figure 56. Standard dimension data guide for plate girder bridges.

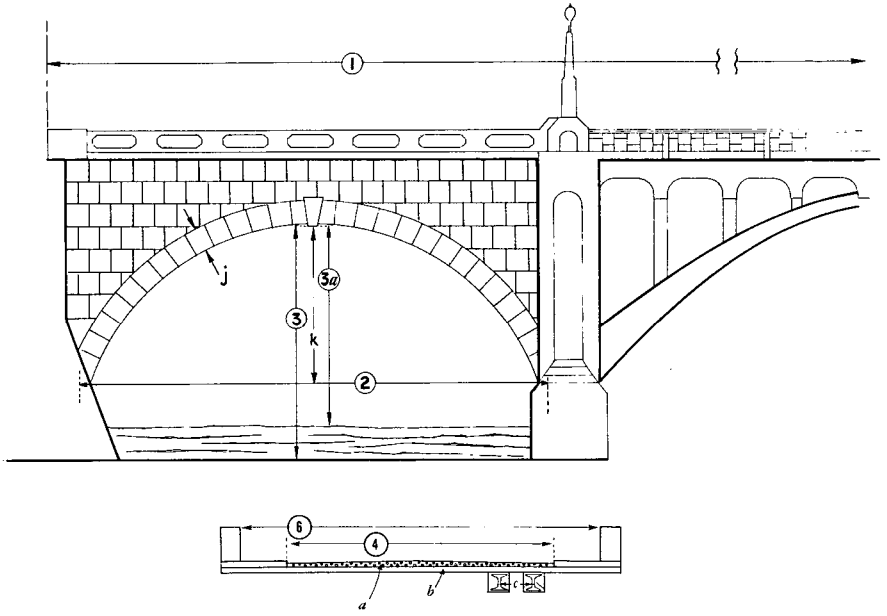


Figure 59. Standard dimension data guide for arch bridges.

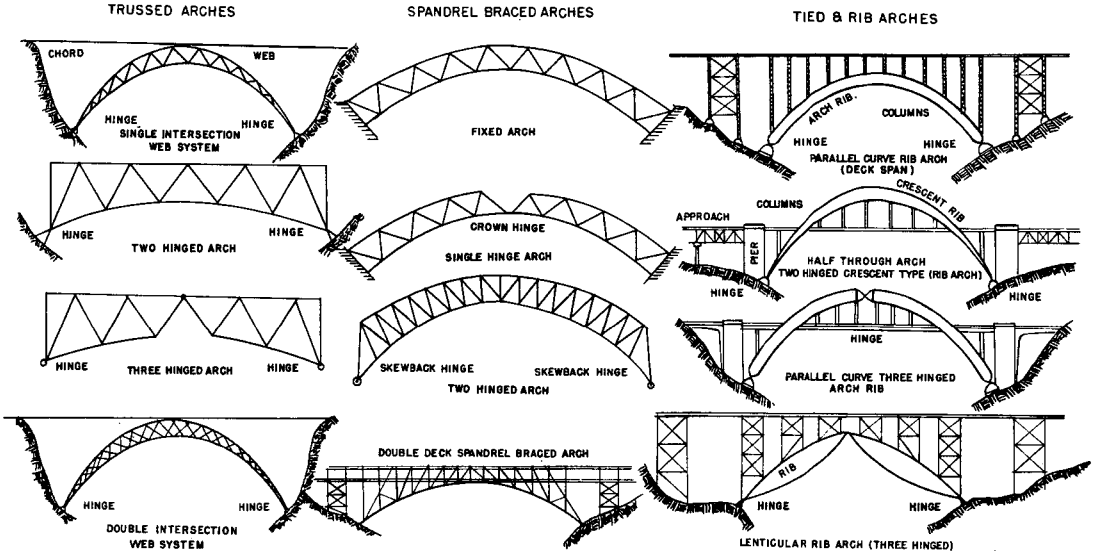
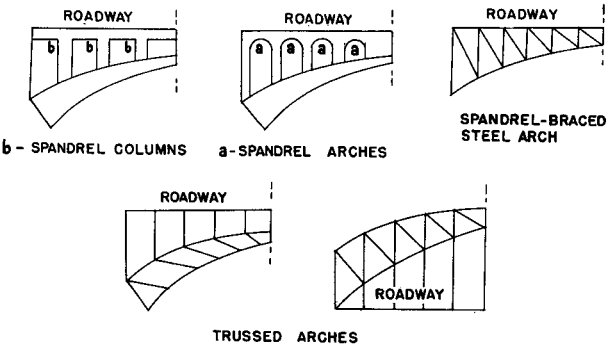


Figure 60. Common types of arch construction.



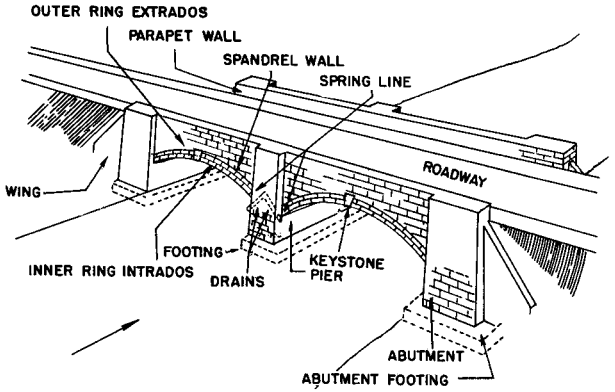


Figure 61. Nomenclature of arch bridges.

of a trussed steel arch, or through type (tied arch) with the roadway suspended from the arched member (truss or beam) by a series of bars, I-beams, or webbed (latticed) vertical members (figs. 65, 66, and 67).

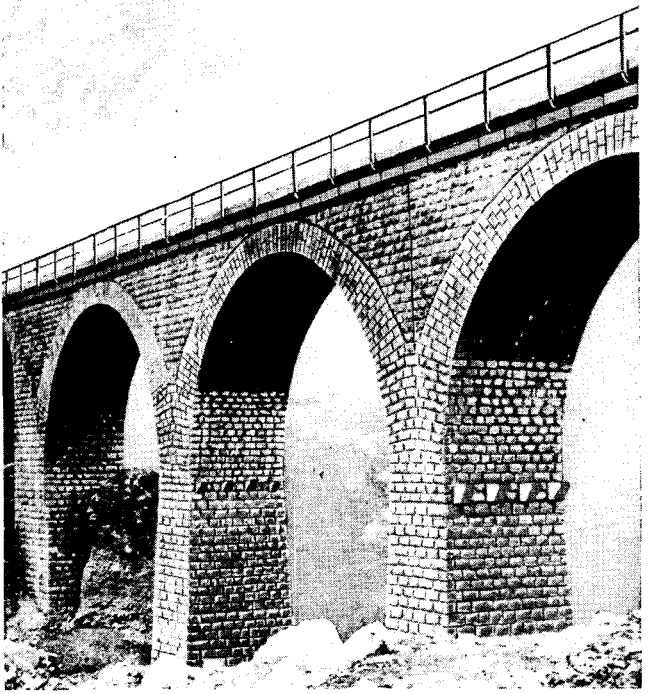


Figure 62. Typical solid masonry arch bridge.

8. Suspension Bridges

a. Suspension spans have the bridge roadway suspended by means of vertical cables or ropes from two or more suspension cables, which pass over towers and are anchored at the ends. Suspension

Figure 63. Typical solid concrete arch bridge.

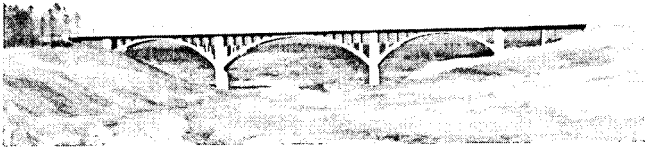


Figure 64. Typical open type (spandrel) concrete arch bridge.

bridges are usually employed where the construction of intermediate supports is impracticable due to the depth of the bridge gap, or where navigation must pass under the bridge.

b. A standard dimension data guide for suspension bridges is given in figure 68. Typical suspension bridges are illustrated in figures 69, 70, and 71.

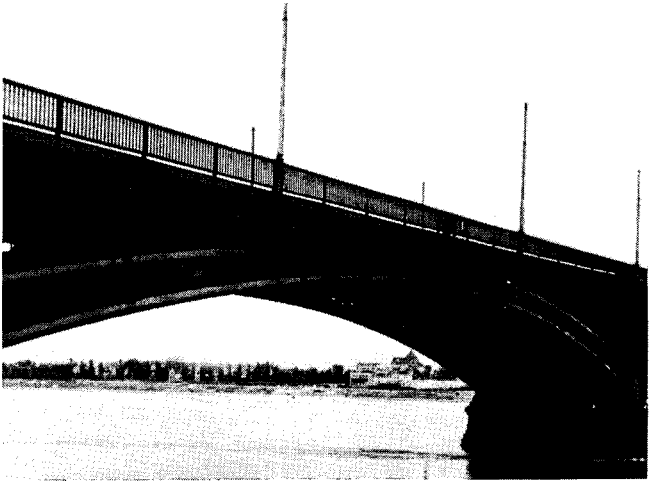


Figure 65. Parallel curve, steel rib, arch bridge.

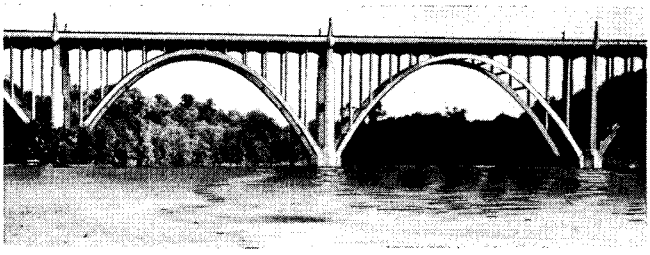


Figure 66. Steel trussed deck arch bridge.

9. Ponton (Floating) Bridges

A ponton (floating) bridge (fig. 72) is a temporary bridge which is supported by low, flat-bottomed boats or other floating structures. The major components are the floats, saddle assembly, and the superstructure which carries the roadway. Some

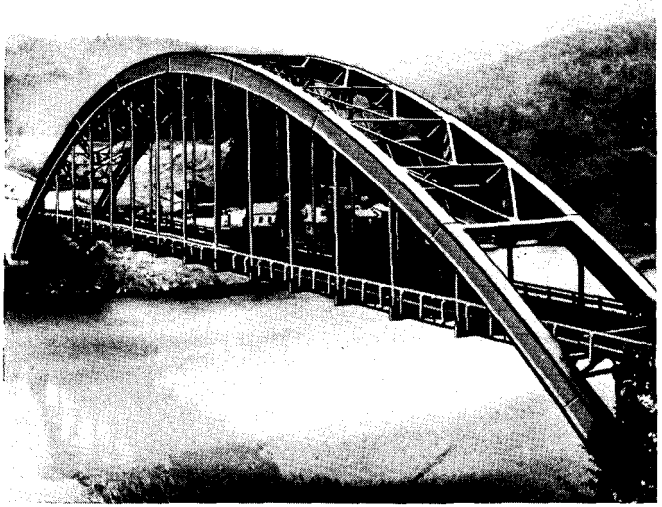


Figure 67. Steel tied arch bridge, through type.

types of military bridges are provided with a ramp or trestle to facilitate the approach. Ponton bridges should be replaced as soon as possible by more permanent structures. Although they are essentially fixed bridges of a temporary nature, they may be released at one end to allow passage of ships.

10. Movable Bridges

a. Movable bridges (fig. 72) may be classified as follows:

(1) Swing bridges.
(2) Lift bridges.
(3) Bascule bridges.
(4) Retractile bridges.

b. Reconnaissance of movable bridges requires the assignment of a special engineer detail.

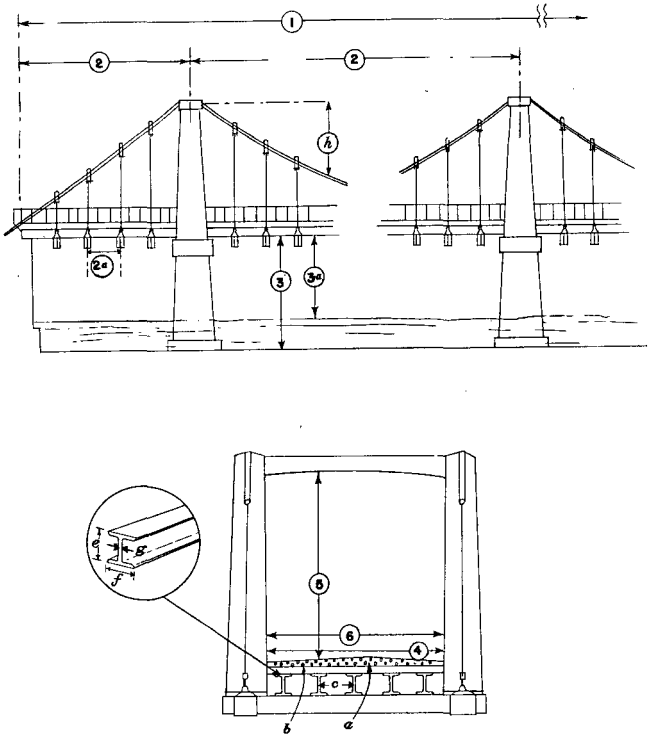


Figure 68. Standard dimension data guide for suspension bridges

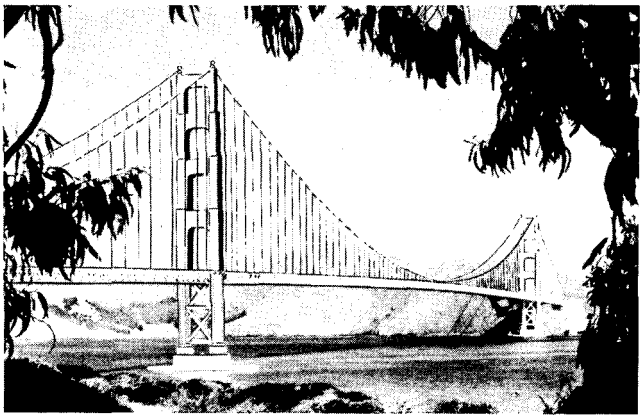


Figure 69. Suspension bridge with steel cable, timber reinforcing truss, steel floor beams, and external sway bracing.

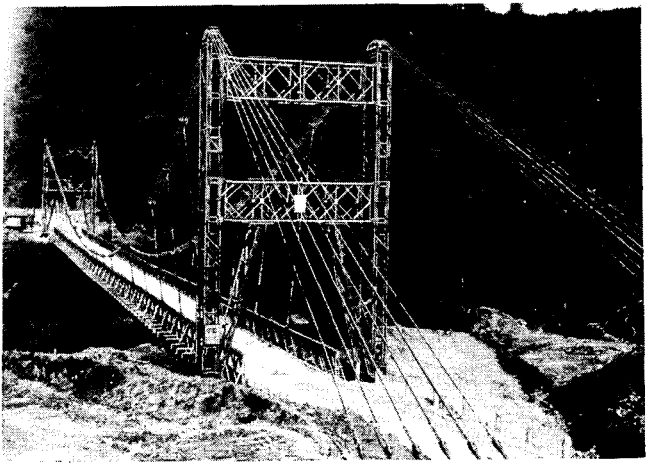


Figure 70. Bailey type suspension bridge.

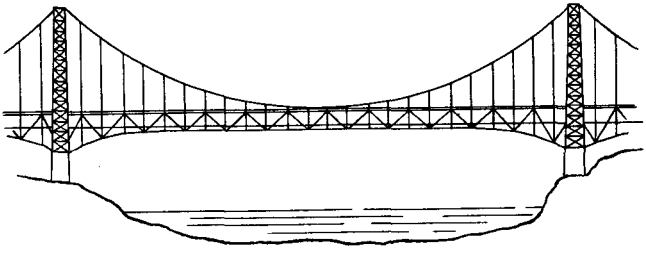
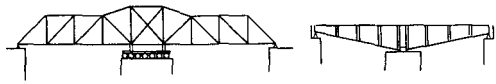
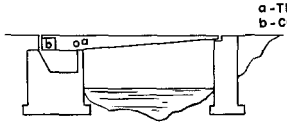


Figure 71. Steel suspension bridge.

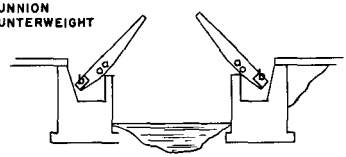


SWING BRIDGES

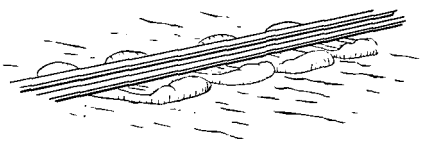
a-TRUNNION
b-COUNTERWEIGHT



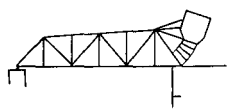
SINGLE LEAF, TRUNNION TYPE
BASCULE BRIDGE



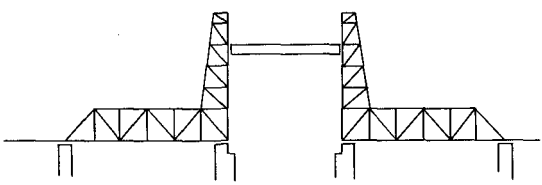
DOUBLE LEAF, TRUNNION TYPE
BASCULE BRIDGE



FLOATING BRIDGE



ROLLING LIFT TYPE
BASCULE BRIDGE



VERTICAL LIFT BRIDGE

Figure 72. Classification of movable bridges (by type of movable structure) and ponton (floating) bridge.

APPENDIX IV

BRIDGE INTERMEDIATE SUPPORTS

Intermediate supports for bridges are ground supports between abutments. They may be log trestle bents (fig. 73), timber trestle bents (fig. 74), crib piers (fig. 75), masonry piers (fig. 76), prefabricated steel trestle piers (fig. 77), open type concrete piers (fig. 78), or solid concrete piers (fig. 79).

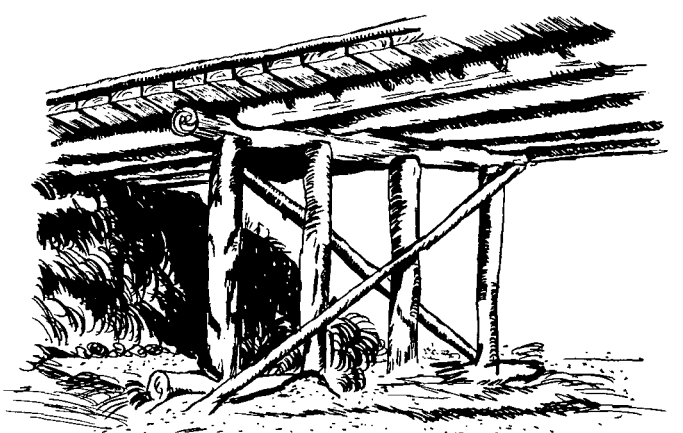


Figure 73. Typical log trestle bent.

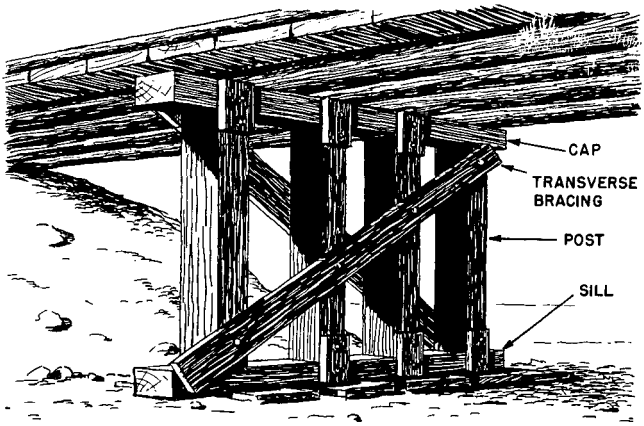


Figure 74. Shaped timber trestle bent.

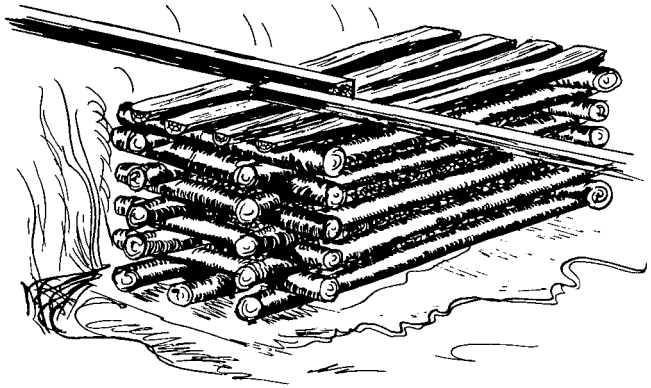


Figure 75. Typical crib pier.

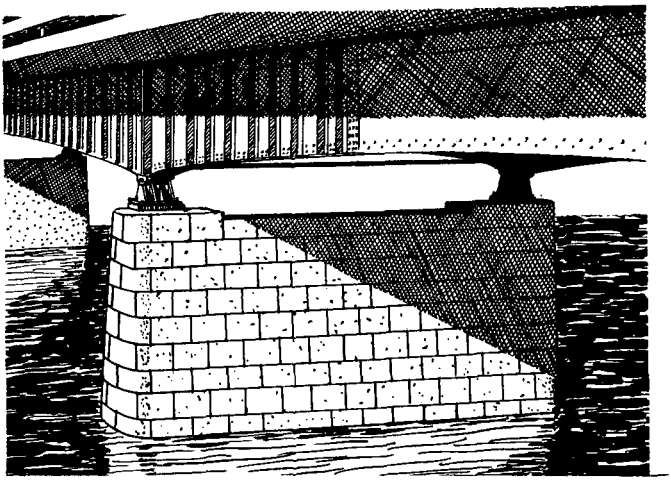


Figure 76. Typical masonry pier.

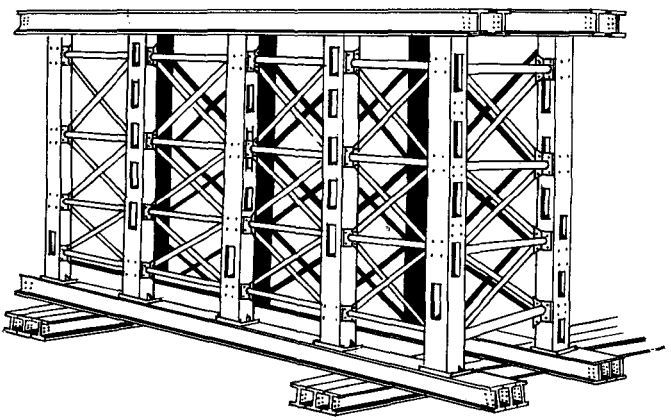


Figure 77. Typical prefabricated steel trestle pier.

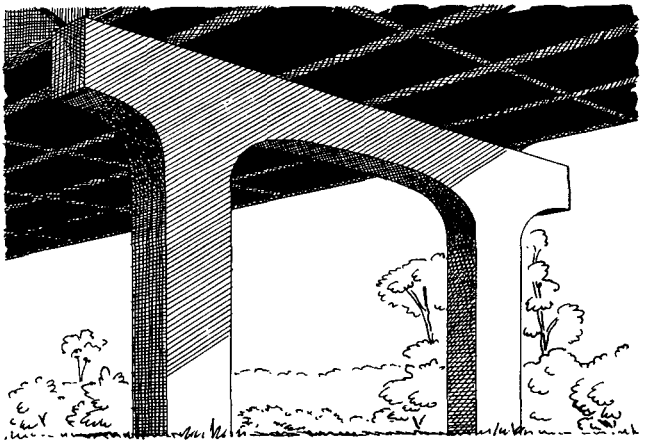


Figure 78. Typical open type concrete pier.

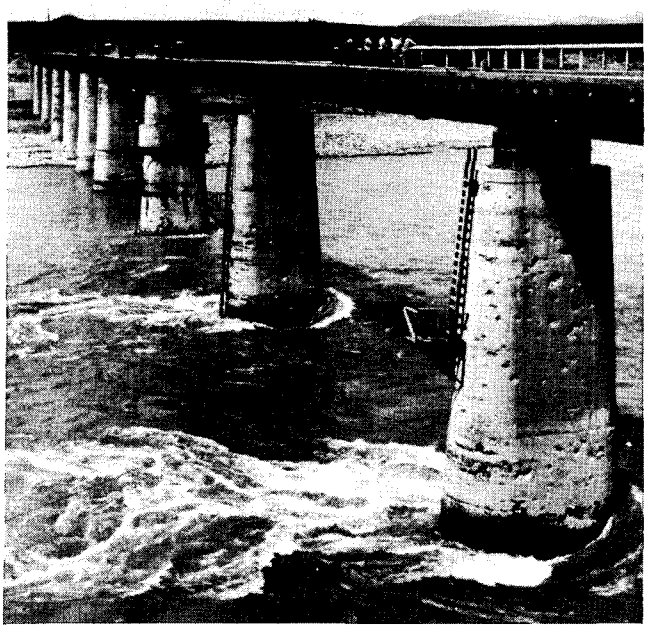


Figure 79. Typical solid concrete pier.

APPENDIX V

BRIDGE ABUTMENTS

Bridge abutments (fig. 80) are the ground supports at the shore ends of a bridge. They may be constructed of concrete, masonry, or earth with a wooden

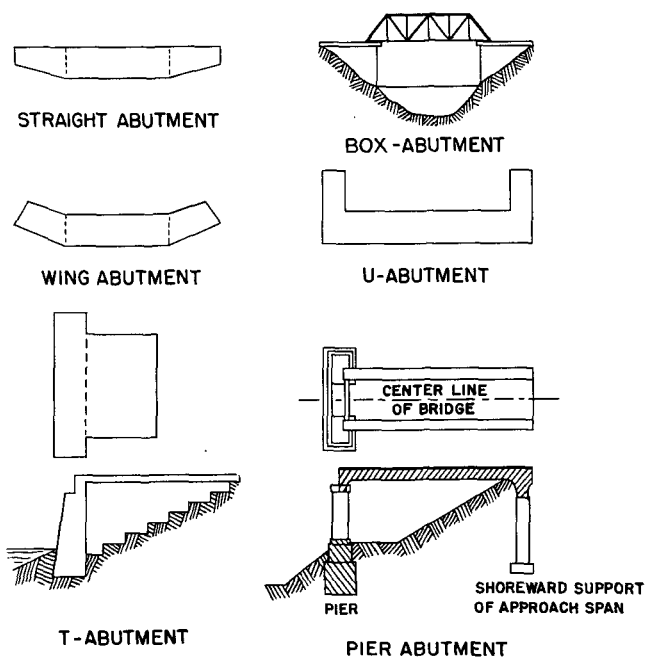


Figure 80. Types of common abutments.

end wall and abutment sill. Typical abutments are as follows:

a. Straight abutment (fig. 81).

b. T-type abutment (fig. 82).

c. U-type abutment (fig. 83).

d. Wing type abutment (fig. 84).

e. Earth abutment, with timber abutment sill and end wall (fig. 85).

f. Pier abutment (fig. 80).

g. Box abutment (fig. 80).

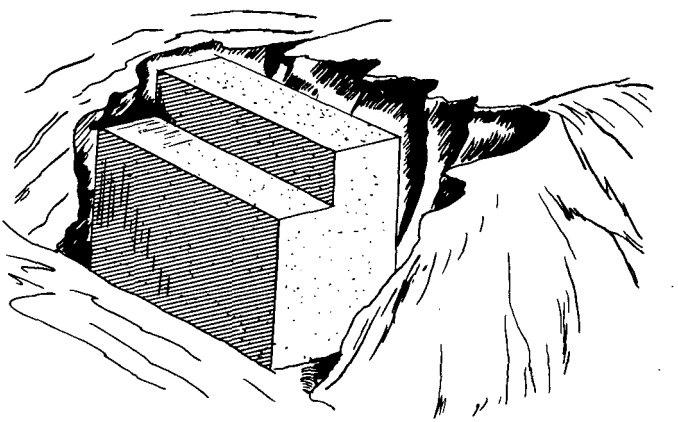


Figure 81. Typical straight abutment.

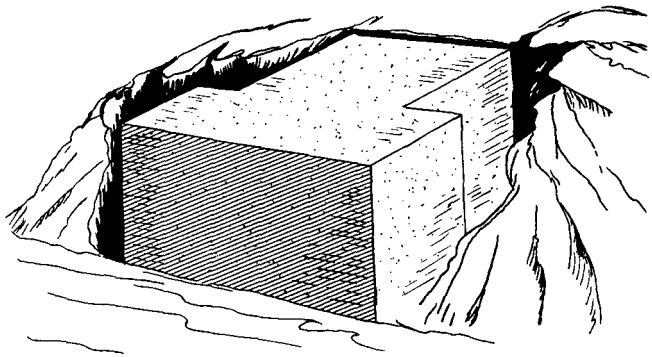


Figure 82. Typical T-type abutment.

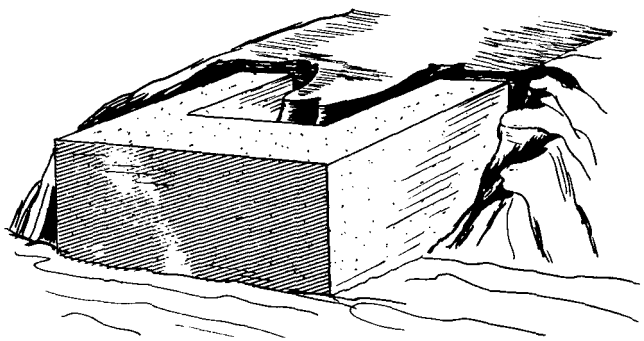


Figure 83. Typical U-type abutment.

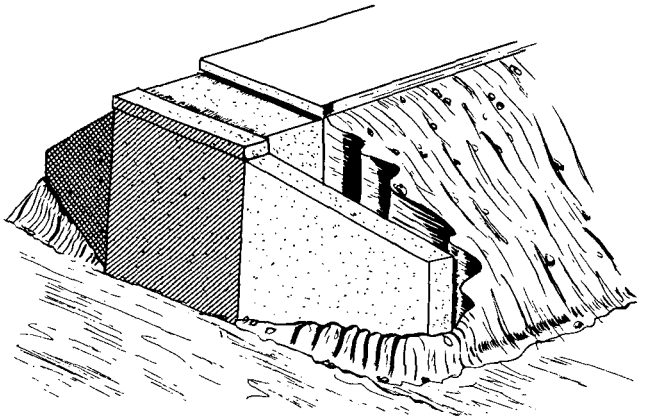


Figure 84. Typical wing type abutment.

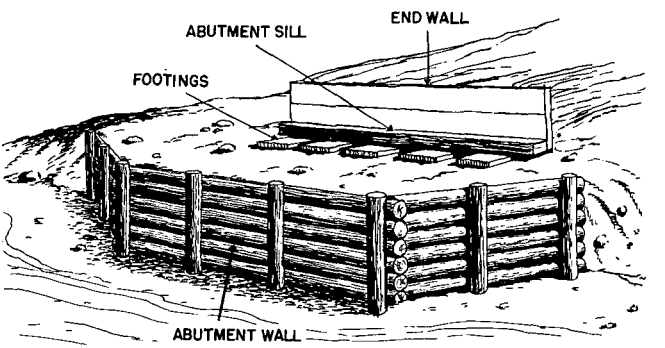


Figure 85. Typical earth abutment, with timber abutment sill and end wall.

APPENDIX VI
TUNNELS

A tunnel consists of a bore, a tunnel liner, and a portal. Common shapes of tunnel bores (fig. 86) are semicircular, elliptical, horseshoe, and square

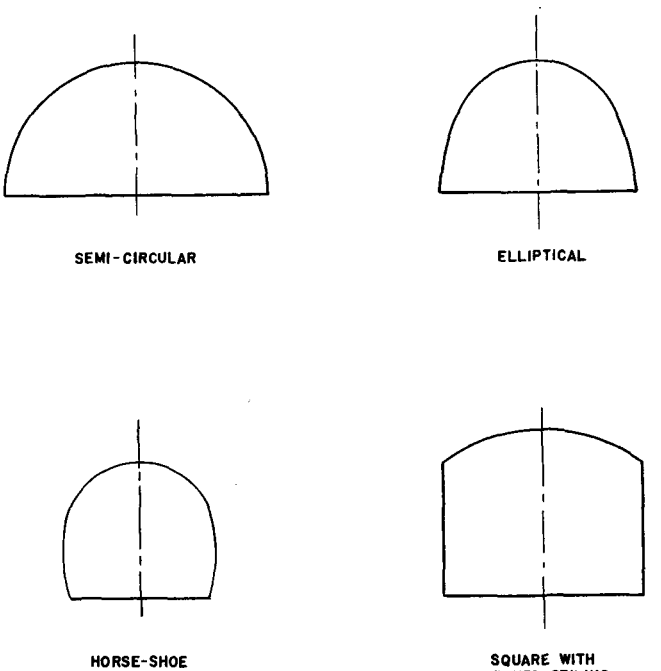


Figure 86. Common types of tunnel bores or cross sections.

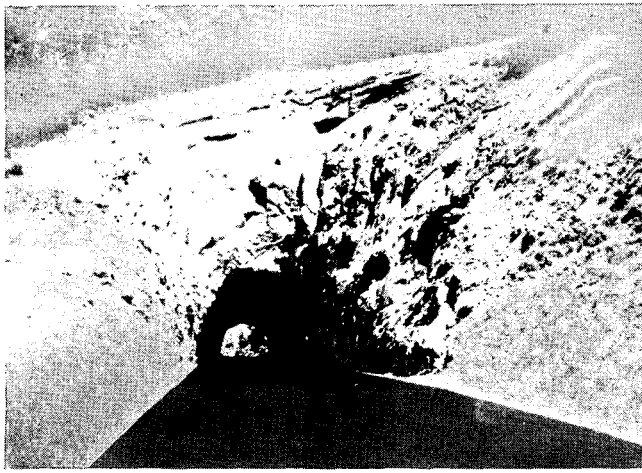


Figure 87. Typical unlined tunnel.

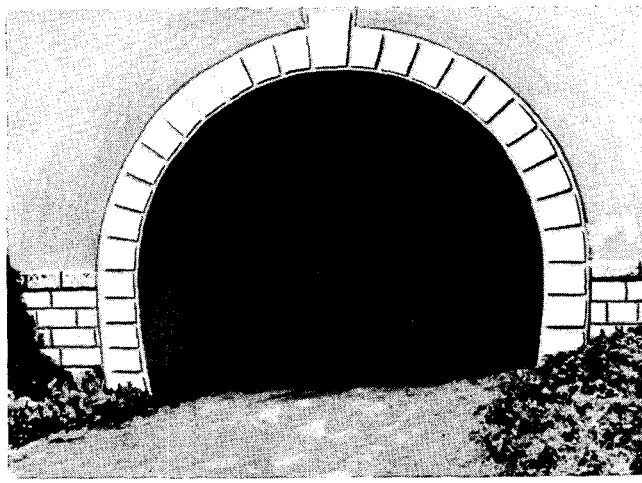


Figure 88. Typical masonry lined tunnel.

with arched ceiling. Tunnels may be unlined (fig. 87), masonry lined (fig. 88), and concrete lined (fig. 89). Portals may be made of masonry (fig. 90) or of concrete (fig. 91). Alinement of tunnels may be straight (fig. 92) or curved (fig. 93).

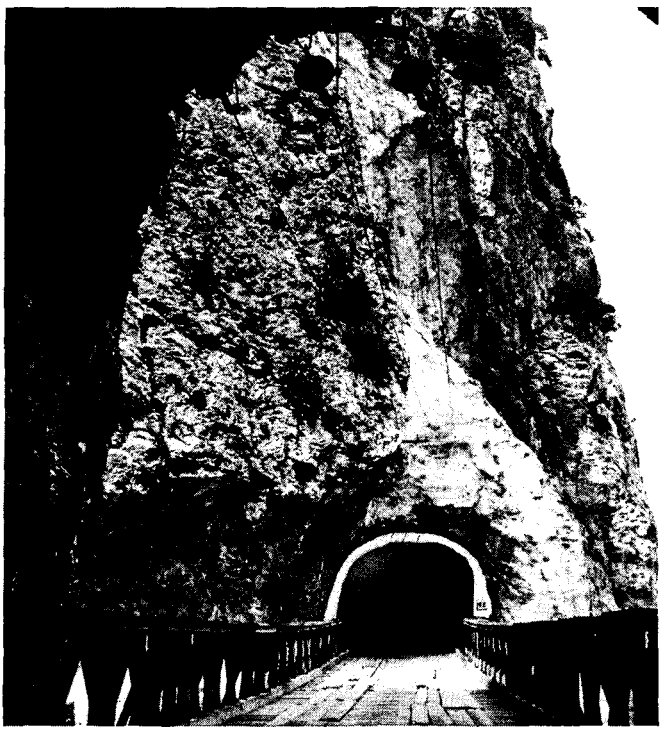


Figure 89. Typical concrete lined tunnel.

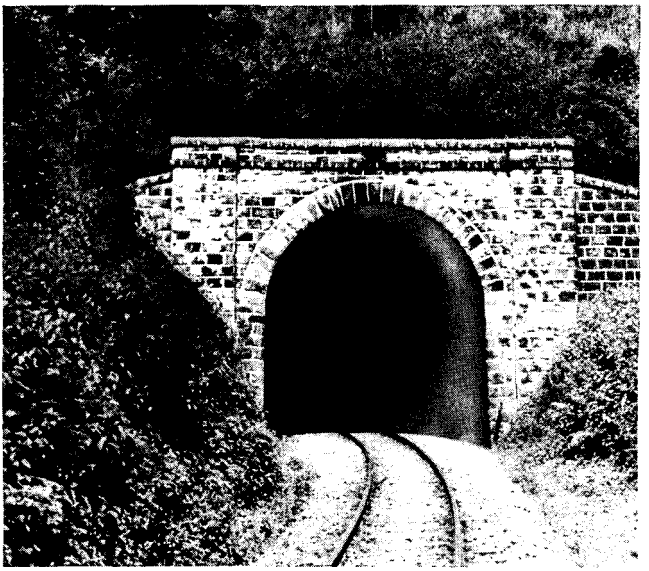


Figure 90. Typical masonry tunnel portal.

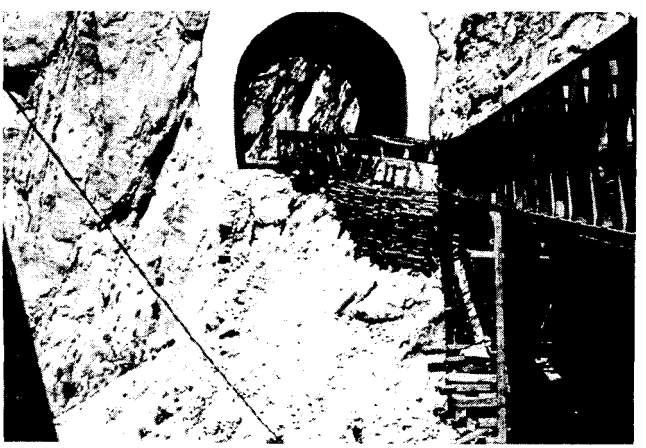


Figure 91. Typical concrete tunnel portal.

Figure 92. Tunnel with straight horizontal alinement.

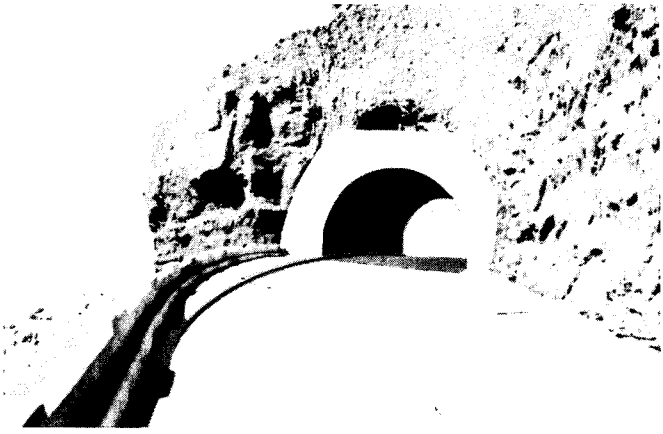


Figure 93. Tunnel with curved horizontal alinement.

APPENDIX VII

DETAILED REQUIREMENTS FOR CLASSIFICATION OF MASONRY ARCH BRIDGES

1. Measurement and Inspection

There are two things to be done:

a. Measure the leading dimensions of the bridge.

b. Examine the bridge to determine its condition, construction, and the state of the abutments.

2. Measurement

The following dimensions must be measured (fig. 94):

The span (clear span)_____ ② feet

Note. In the case of skew spans, measure parallel to the axis of the roadway.

The rise of the arch ring at the crown_____*k* feet

The thickness of the arch ring at the crown__*j* feet

The depth of fill between the road surface and the arch ring at the crown_____*b* feet

The width of the bridge between parapets (roadway width)_____④ feet

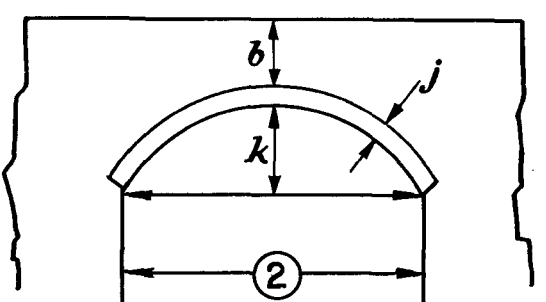


Figure 94. Measurement of masonry arch bridge.

3. Inspection

a. Normally, only outward appearances can be examined. Probing into the construction will be necessary only on important routes where the strength of the bridge is in doubt.

b. Visible signs can be misleading, for the following reasons:

(1) The thickness of the arch ring under the parapet can be measured, but it does not follow that this thickness obtains under the roadway.

(2) Some old bridges have been strengthened by removing the fill and replacing it with concrete.

(3) The depth and nature of the backfill to the abutment plays a large part in the stability of the arch.

(4) The arch ring may have dropped away from the fill, so that the latter alone carries the load.

c. Attention must be paid to the following:

(1) *The arch ring.*

(*a*) Nature and condition of the brickwork or masonry.

(*b*) Thickness of the joints.

(*c*) Condition of the mortar.

(*d*) Deformation of the arch ring from its original shape.

(*e*) Presence of cracks—their width, length, number, and position.

(2) *Parapet and spandrel walls.*

(*a*) Sagging of the parapet.

(*b*) Cracks.

(*c*) Outward movement of the parapet relative to the arch ring.

(3) *Abutments.*

(*a*) Failure of the abutment walls by cracking, settlement, or movement.

(*b*) Adequacy of the abutments to resist horizontal arch thrust.

(*c*) Adequacy of the wing walls to restrain the spread of the backfill.

(*d*) Nature of the backfill. This can be discovered only by probing.

(*e*) Nature of the foundation—discovered only by probing.

4. Classification Procedure

A provisional load class based solely on span and thickness of the crown is first obtained. This is then modified by various factors, selected in accordance with the dimensions, construction, and condition of the bridge. The result, termed the *adjusted load class*, is modified to the nearest standard load class to give the *final load class*.

5. Provisional Load Class

Refer to the nomograph figure 95. Mark the bridge span (1) on column A and the total crown thickness ($j+b$=ring+fill) on column B. Line through these points to column C, and read off the provisional load class.

6. Profile Factors

Flat arches are not so strong under a given loading as those of steeper profile. A very large rise, how-

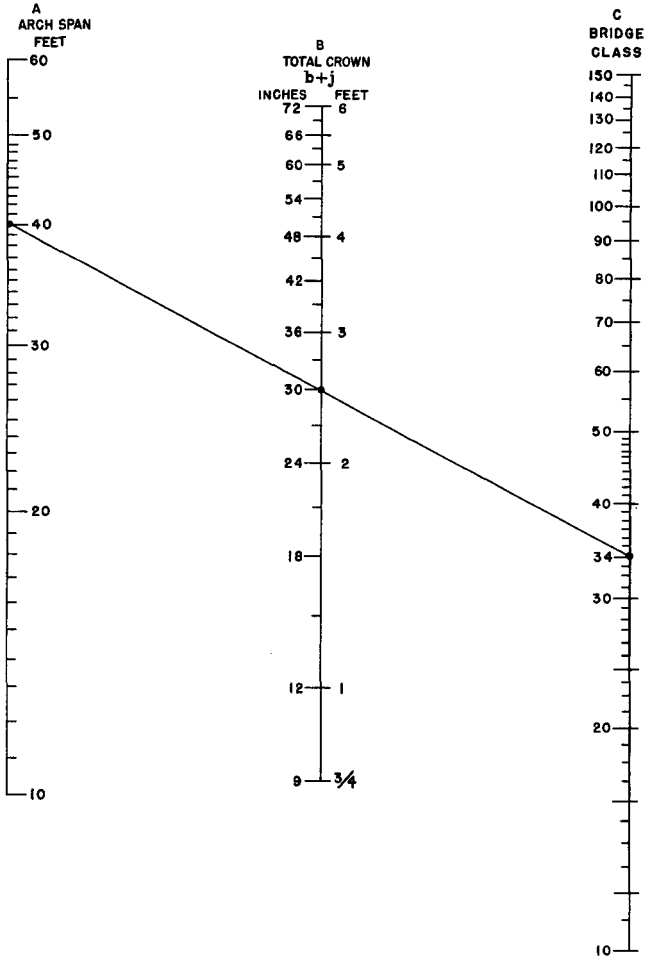


Figure 95. Nomograph for determining the provisional load classification of masonry arch bridge.

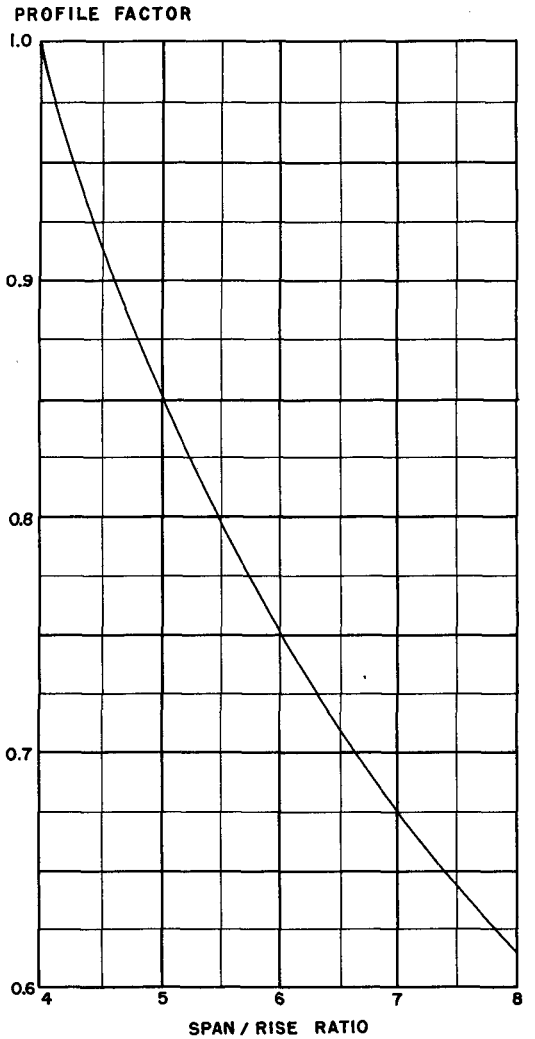


Figure 96. Profile factors for masonry arch bridges.

ever, does not necessarily add to the strength, as failure can occur through the crown of the arch, acting as a smaller arch of flatter rise. For this reason, a span-rise ratio of 4 and less is assumed to give optimum strength, and has a profile factor of 1. When the span-rise ratio is greater than 4, reference is made to figure 96, which gives the appropriate profile factor for the different ratios.

7. Material Factors

To determine material factors (table XV), the following must be noted:

a. The material used for the ring.

b. The type of construction—i. e., whether the voussoirs are in courses or laid at random.

c. The condition of the material—i. e., whether there is much spalling, and whether the voussoirs are sound or deteriorating due to weathering.

d. Examine the soffit, and look for signs of disintegration and cracks. Usually the first signs of failure occur at the quarter-points on the intrados.

Table XV. Material Factors for Masonry Arch Bridges

Condition	Material factor
1. Granite, whinstone, and built-in-course masonry with large shaped voussoirs	1. 5
2. Concrete or blue engineering bricks	1. 2
3. Limestone, good random masonry, and building bricks in good condition	1. 0
4. Masonry of any kind or brickwood in poor condition (many voussoirs flaking or badly spalling, shearing, etc.). Some discretion is permitted if the dilapidation is only moderate	0. 7–0. 5

8. Joint Factors

The strength and stability of the arch ring depend to a large extent on the size and condition of the joints. In this connection, it is necessary to distinguish between cement and lime mortar as a jointing material (table XVI). Lime mortar is commonly used in brick construction, particularly on old bridges, and although it is softer than cement mortar and has less strength, this is compensated for by better joint-filling properties and good distributing power under load. Partially-deteriorated cement mortar must not be confused with lime mortar in good condition.

Table XVI. Joint Factors for Masonry Arch Bridge

Type of joint	Joint factor
1. Thin joints, 1/10 inch or less in width	1. 25
2. Normal joints, with width up to 1/4 inch, regular, straight with mortar in good condition and well pointed	1. 00
3. Ditto, but with mortar unpointed	. 90
4. Wide joints, generally over 1/4 inch wide and usually irregular; mortar in good condition	. 80
5. Ditto, but with mortar containing voids deeper than one-tenth of the ring thickness	. 70
6. Very wide joints, 1/2 inch or more in width, with poor mortar having voids deeper than one-tenth of the ring thickness, and so deteriorated that it has the properties of sand alone	. 50

9. Crack Factors

a. General. The age of cracks is of great importance. Old cracks no longer operating, and which

probably occurred soon after the bridge was built, can be ignored. Recent cracks, on the other hand, usually show clean faces, with perhaps small loose fragments of masonry. Although cracks may appear as shear of the bricks or masonry, they normally follow an irregular line through the mortar; care must be taken to observe whether they are cracks and not merely deficiencies of the pointing material.

b. Types of Cracks. Crack factors are given in table XVII. The following are the more important types:

(1) Longitudinal cracks within 2 feet of the edge of the arch, caused by lateral spread of the fill, producing an outward force on the parapet walls and pushing the outer portion of the ring away from the center portion (fig. 97).

Table XVII. Crack Factors in Masonry Arch Bridges

Type of crack	Crack factor
1. Small longitudinal cracks within 2 feet of the edge of the arch, i. e., less than ⅛ inch in width and less than one-tenth of the span in length.	1.0.
2. Large longitudinal cracks within 2 feet of the edge of the arch, i. e., greater than ¼ inch in width and longer than one-tenth of the span in length: For bridges having widths greater than 20 feet.	1.0.

Table XVII. Crack Factors in Masonry Arch Bridges—Con.

Type of crack	Crack factor
3. Longitudinal cracks within the center third of the bridge.	0.9–0.7.
a. One small crack less than ⅛ inch in width and less than one-tenth of the span in length.	1.0.
b. One large crack greater than ¼ inch in width and longer than the above.	0.5.
c. Several narrow cracks—i. e., three or more.	0.5.
4. Small lateral and diagonal cracks, i. e., less than ⅛ inch in width and shorter than one-tenth of the arch width.	1.0.
5. Large lateral and diagonal cracks greater than ¼ inch in width and longer than the above.	Maximum load class: 12; or the figure derived by calculation, using the other factors, whichever is the less.
6. Cracks between the arch ring and parapet wall greater than one-tenth of the span, due to lateral spread of the fill.	0.9.
7. Cracks between the ring and spandrel, due to a dropped ring.	Reclassify from the nomograph, on the assumption that the crown thickness is that of the ring alone.

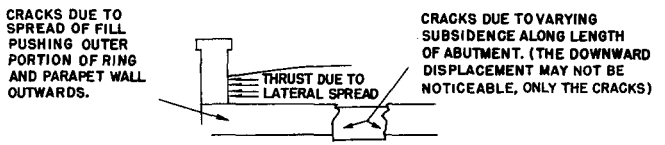


Figure 97. Longitudinal cracks in arch ring.

(2) Longitudinal cracks within the center third of the bridge, due to varying amounts of subsidence in different places along the length of the abutment. These are dangerous if large, because they indicate that the ring has broken up into narrower independent rings (fig. 97).

(3) Lateral cracks, usually found near the quarter-points, due to permanent deformation of the arch, which may be caused by partial collapse of the arch or movement at the abutments.

(4) Diagonal cracks, normally starting near the sides of the arch at the springing and spreading towards the center of the bridge at the crown. They are probably due to subsidence at the sides of the abutment, and indicate that the bridge is in a dangerous state.

(5) Cracks between the arch ring and the spandrel or parapet walls. These are due to two causes:

(*a*) Spread of the fill, so that the parapet wall is pushed out relative to the arch ring (fig. 98).

(*b*) Movement of a flexible ring away from a stiff fill, so that the two act independently.

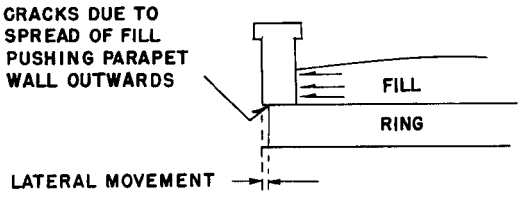


Figure 98. Cracks between arch ring and parapet wall.

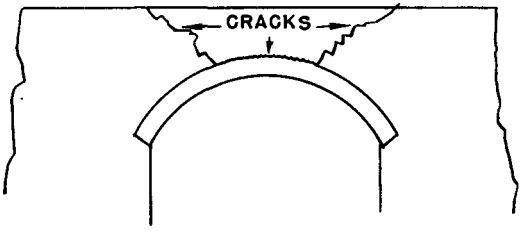


Figure 99. Movement of arch ring away from stiff fill.

This type of failure frequently produces cracks in the spandrel wall near the quarter-points (fig. 99).

10. Deformation Factors

a. General. Failure of the arch ring is observed in the ring itself, and is frequently accompanied by a sag of the parapet over approximately the same length (fig. 100). Deformation of the arch ring may be due to two causes:

(1) Partial failure of the arch ring.

(2) Movement at the abutment.

b. Deformation Factors. Deformation factors are given in table XVIII.

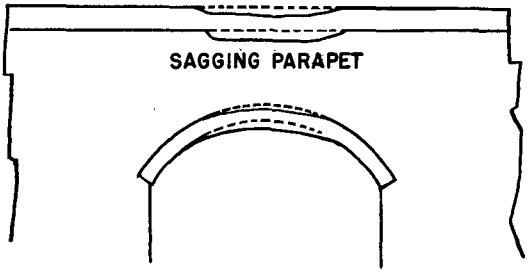


Figure 100. Deformation of arch ring.

Table XVIII. Deformation Factors for Masonry Arch Bridges

Degree of deformation	Deferred factor
1. Deformation limited so that the rise over the affected portion is always positive.	Discard profile factor already calculated and apply span-rise ratio of affected portion to the whole arch.
2. Distortion so that there is a flat section of profile.	Maximum load class: 12.
3. Large deformation so that a portion of the ring is sagging.	Maximum load class: 5; but only if fill at crown exceeds 18 inches.

11. Abutment Factors

a. General. In the assessment of the abutments it is necessary to apply two factors. The first takes account of the size and shape of the abutment as an adequate support for the arch, and always applies. The second applies to faults in the abutment, i. e., cracks, movements, etc.

b. Abutment Size Factors. Abutment size factors are given in table XIX. One or both of the abutments

may be considered inadequate to resist the full thrust of the arch. This may occur when:

(1) The bridge is on a narrow embankment, particularly if the approaches slope down steeply from the bridge;

(2) The bridge is on an embanked curve;

(3) The abutment wing walls are very short and suggest little solid fill behind the arch;

(4) In the case of multispan bridges, each span is considered separately and abutment factors are applied in accordance with whether the arch is supported on one abutment and one pier, or on two piers.

c. Abutment Fault Factors. Abutment fault factors are given in table XX.

Table XIX. Abutment Size Factors for Masonry Arch Bridges

Condition	Abutment size factor
1. Both abutments satisfactory	1.00
2. One unsatisfactory abutment	.95
3. Both abutments unsatisfactory	.90
4. Both abutments massive, but a clay fill is suspected	.70
5. Arch supported on one abutment and one pier	.90
6. Arch supported on two piers	.80

Table XX. Abutment Fault Factors for Masonry Arch Bridges

Nature of fault	Abutment fault factor
1. *Inward movement of one abutment*, shown by hogging of the arch ring and the parapet at the crown, and, possibly, open cracks in the intrados between the quarter-point and the springing. Old movement, with well-consolidated fill and slight hogging of the ring.	0.75–0.50 (depending on degree). Not more than class 30 or class 12, according to degree.
2. *Outward spread of abutments.* This usually causes change in the profile. If the movement has not been excessive and appears to have ceased, determine the nature of the fill behind the abutments and allow factors varying from 1 to 0.5, according to the nature and condition of the fill.	
3. *Vertical settlement of one abutment.* Investigate the ground under each abutment, and apply factors ranging from 0.9 for slight movement to 0.5 where the materials under each abutment are dissimilar.	

12. Application of the Factors

The profile, material, and joint factors, together with the abutment size factor, are applied in every case. The remaining three factors, namely those for cracks, deformation and faults in the abutments,

are applied with discretion. Clearly, if the arch has deformed and cracked due to a fault in the abutments, it is unrealistic to downgrade the bridge for all three of the latter factors operating together. In such a case, the load class is worked out by applying these factors in turn to the provisional load class (as modified by the first four factors) and adopting the lowest figure so obtained. After applying the various factors to the provisional load class, the figure obtained is rounded off to the nearest standard load class, to give the final classification.

13. Two-Way Classification

Bridges which are wide enough to accept two lanes of traffic may be given a two-way load class equal to 0.9 of the one-way class.

14. Example

a. Data.

Span	40 feet
Rise	8 feet
Arch ring thickness	18 inches
Depth of fill at crown	12 inches
Width between parapets	15 feet
Material	Limestone in good condition.
Joints	Mortar, with some deterioration and small voids; close joints.
Cracks	There is a large longitudinal crack in the arch under one parapet wall.
Abutments	One approach is up a narrow embankment.

b. Provisional Load Class.

Mark span 1=40 feet on column A, figure 95. Total crown thickness (ring + cover) = 2.5 feet. Mark this on column B, figure 95.

Line through these two points across column C, and read off the provisional load class, which in this instance is 34.

c. Adjusted Load Class. The provisional class is now amended by the various factors, as follows:

(1) *Profile factor.*

$$\text{Span-rise ratio} = \frac{40}{8} = 5.$$

From figure 96 the profile factor is 0.86.

(2) *Material factor.* From table XV, for limestone in good condition, the material factor is 1.0.

(3) *Joint factor.* From table XVI, the joint factor is between 0.80 and 0.70 —say 0.75.

(4) *Crack factor.* From table XVII, the one large longitudinal crack at the edge of the ring, for a bridge of this width, gives a crack factor of 0.9.

(5) *Abutment factor.* One abutment is considered unsatisfactory, owing to the narrow and steep approach. From table XIX, this gives a factor of 0.95.

Hence,

$$\text{Adjusted load class} = 34 \times 0.86 \times 1.0 \times 0.75 \times 0.90 \times 0.95$$
$$= 19 \text{ for one-way traffic.}$$
$$\text{and } 19 \times 0.9 = 17 \text{ for two-way traffic.}$$

d. Summary. From figure 95, column D, the nearest bridge classes are 16 and 20, and it is reasonable to say that the bridge is class 20 for one-way traffic, and class 16 for two-way traffic.

APPENDIX VIII

ANALYSIS OF SUPERSTRUCTURE BY A NOMOGRAPHIC METHOD

1. General

Determination of bridge class numbers for simple span timber or steel stringer bridges is made by use of the chart in figure 101. By the application of special empirical formulae, this method is also applied to simple span reinforced concrete bridges. Lateral distribution, dead load, and impact have been taken into account. The maximum lane width which is considered effective for a one-way crossing of a two-lane bridge, or for a single-lane bridge, is 15 feet. The determination of the class number per lane of a two-lane bridge is based on a lane width equal to one-half the roadway width up to a maximum of 15 feet.

2. Class Determination

a. Steel Stringers. The span length in feet, number of stringers per lane, and the section modulus in inches, of one stringer is needed to enter on the chart. Knowing the beam depth (in inches) and the flange width (in inches), the section modulus may be picked from table XXI. Where measured dimensions fall between two given sizes, always use the lighter section. The values in this table are for the lightest U. S. sections for the given dimensions. Values for heavier U. S. sections are found in the A. I. S. C. Handbook. FM 5–35 gives values for common U. S. and foreign shapes. To use the chart (fig. 101), line up a straightedge through the values for number of

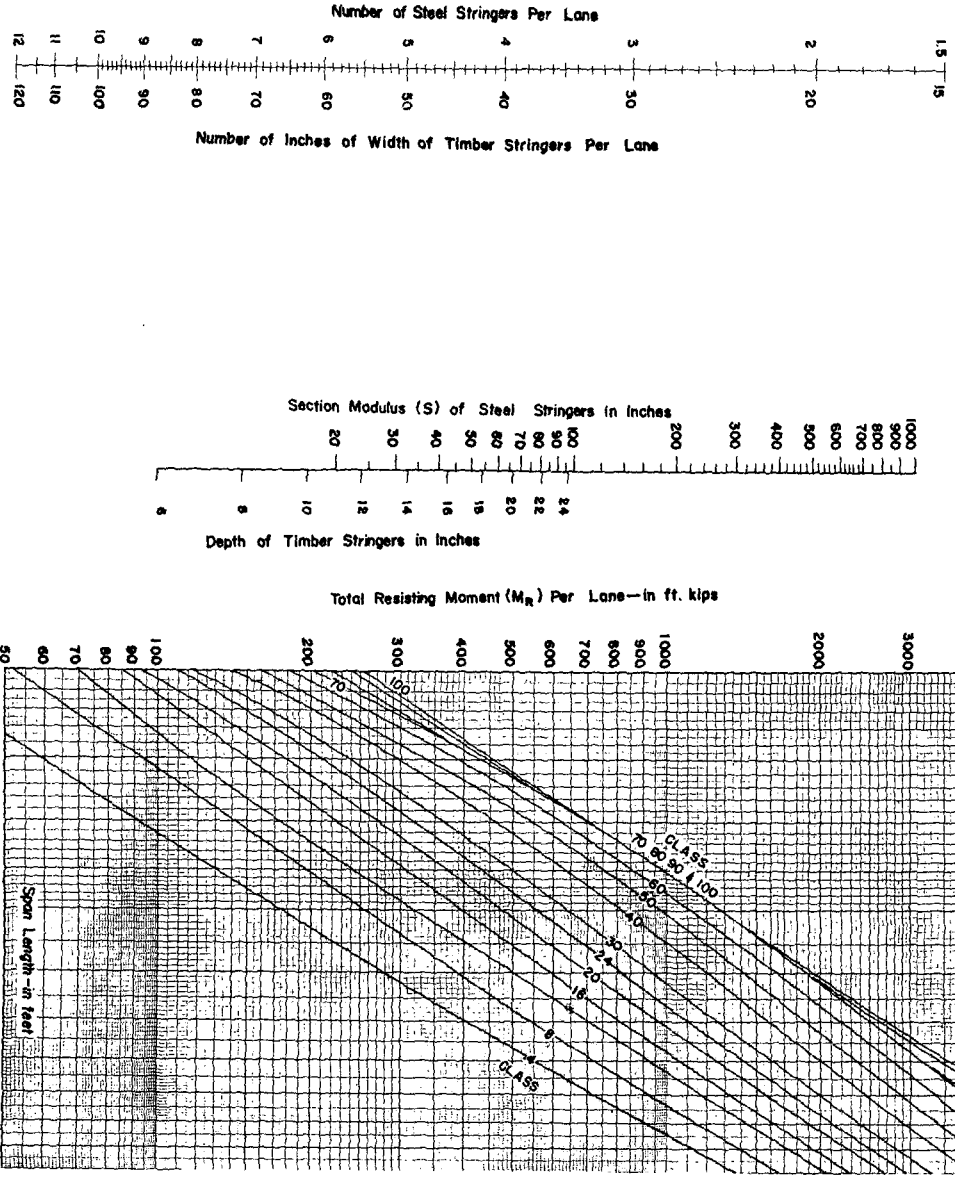


Figure 101. Nomograph for determining bridge class number.

Table XXI. Properties of Steel Beams

Nominal size	Actual depth (in.)	Actual width (in.)	Section modulus (in.)	Nominal size	Actual depth (in.)	Actual width (in.)	Section modulus (in.)
39WF211*	39¼	11¾	787	24I106	24	7⅞	234
37WF206*	37¼	11¾	736	24I100	24	7¼	198
36WF300	36¾	16⅝	1105	24I80	24	7	174
36WF194	36½	12⅛	664	24WF76	23⅞	9	175
36WF160	36	12	541	24WF153*	23⅝	11¾	368
36WF230	35⅞	16½	836	24I134*	23⅝	8½	282
36WF201*	35⅜	11¾	687	22I75*	22	7	137
33WF196*	33⅜	11¾	637	21WF139*	21⅝	11¾	311
33WF130	33⅛	11½	405	21I112*	21⅝	7⅞	220
33WF200	33	15¾	670	21I77*	21⅝	6½	140
31WF180*	31½	11¾	559	21WF62	21	8¼	126
30WF108	29⅞	10½	299	20I85	20	7⅛	150
30WF175*	29½	11¾	514	20I65	20	6½	109
27WF171*	27½	11¾	471	20WF134*	19⅝	11¾	276
27WF102	27⅛	10	266	18WF114	18½	11⅞	220
26WF157*	25½	11¾	407	18WF60	18¼	7½	108
24WF94	24¼	9	221	18I86*	18¼	7	145
24WF100	24	12	249	18I80*	18	8	130

Table XXI. Properties of Steel Beams—Continued

Nominal size	Actual depth (in.)	Actual width (in.)	Section modulus (in.)	Nominal size	Actual depth (in.)	Actual width (in.)	Section modulus (in.)
18WF50	18	7½	89	12WF92	12⅝	12⅛	125
18I70	18	6¼	102	12I41	12⅝	5⅛	48
18I55	18	6	88	12WF79	12⅜	12⅛	107
18[58	18	4¼	75	12WF50	12¼	8⅛	65
18[46	18	4	64	12WF36	12¼	6⅝	46
18WF122*	17¾	11¾	228	12WF65	12⅛	12	88
18I62*	17¾	6⅞	106	12I65*	12	8	81
18I77*	17¾	6⅝	125	12WF27	12	6½	34
16WF112*	16¾	11¾	200	12I50	12	5½	50
16I70*	16¾	6½	106	12I41	12	5¼	45
16WF64	16	8½	104	12I31.8	12	5	36
16I50*	16	6	69	12[30	12	3¼	27
16WF36	15⅞	7	56	12[21	12	2⅞	21
16WF110*	15¾	11¾	185	12I34*	11½	4¾	36
16I62*	15¾	6⅛	89	11WF76*	11	11	90
16I45*	15¾	5⅝	67	10I29*	10⅝	4¾	30
15WF103*	15	11¾	164	10WF60	10¼	10⅛	67
15I56*	15	5⅞	77	10WF45	10⅛	8	49

15I43	15	5½	59	10I40*	10	6	41
15[50	15	3¾	54	10I35	10	5	29
15[34	15	3⅜	42	10I25	10	4⅝	24. 4
14WF101*	14¼	11¾	153	10H42	9¾	10⅛	43
14I40*	14¼	5⅜	53	10WF59*	9½	9½	59
14I51*	14⅛	5⅝	67	9I25*	9½	4½	23. 3
14I70*	14	8	91	9WF50*	9	7	46
14I57*	14	6	68	8WF48	8½	8⅛	43
14I40*	14	5½	54	8WF35*	8	6	29
14WF30	13⅞	6¾	42	8WF28*	8	5	22. 4
14I59*	13¾	5⅞	78	8WF44*	7⅞	7⅞	36
14WF92*	13⅜	11¾	132	7WF35*	7⅛	7⅛	26
14I46*	13⅜	5⅜	56	6WF31*	6¼	6¼	20
13I35*	13	5	38				

*Nominal sizes have been arbitrarily assigned; no similar U. S. section.

When in doubt as to beam identity, compute section modulus or use lower value from table.

steel stringers per lane and section modulus of one steel stringer in inches (table XXI, col. 4). Note the point where the straightedge intersects the line labeled "Total Resisting Moment per Lane-in foot kips." From this latter point, follow across horizontally on the chart on the line representing the total resisting moment until it intersects the value for the span length-in feet of the bridge. This point is the class number of the bridge. If the point does not fall on a class curve, the value may be interpolated between the curves by estimation.

b. Timber Stringers. The span length in feet, depth of timber stringers in inches, and the number of inches of width per lane is needed to use the chart. The number of inches of width per lane is the sum of the widths of all the stringers in the lane. To use the chart, line up a straightedge through the values for "Number of Inches of Width of Timber Stringers per Lane" and "Depth of Timber Stringers in Inches." Note the point where the straightedge intersects the line labeled, "Total Resisting Moment per Lane-in foot kips." From this latter point, follow across horizontally on the chart on the line representing this total resisting moment until it intersects the value for the span length-in feet. If the point does not fall on a class curve, the value may be interpolated between the curves by estimation.

c. Reinforced Concrete. The capacity of reinforced concrete spans may be determined from the chart in figure 101 when the total resisting moment per lane, in foot kips, and span length in feet are known. The total resisting moment is estimated by use of the following formulas:

SLABS

$$M_R=\frac{16DW(116D-L^2)}{9000}+\frac{L^2}{10}$$

M_R = total resisting moment per lane in feet kips
W = width of lane in feet
D = depth of concrete in inches
L = span length in feet

T-BEAMS

$$M_R=\frac{N}{1000}\left[1.72\ St\left(49D-98t+40\frac{t^2}{D}\right)-0.113\ L^2(St+bd)\right]+\frac{L^2}{10}$$

Where:

M_R = total resisting moment per lane in foot kips.
N = number of T-beams in span per lane.
S = c to c spacing of T-beams in inches (must not exceed $16t+b$).
b = width of stem of typical interior beam in inches.
D = total depth of typical interior beam from top of slab in inches.
t = thickness of slab in inches.
d = depth of typical interior beam from bottom of slab in inches.
L = span length in feet.

Enter the right-hand chart of figure 101 with the "Total Resisting Moment per lane in ft kips" and the "Span Length in feet." Intersect the span length with the resisting moment and read the class number directly from the chart. When the point does not fall on a class curve, the value may be interpolated between the curves by estimation.

3. Posting the Bridge

a. Single-Lane Bridge. By use of the nomograph for a single-lane bridge, the single-lane class number is determined, as in 2 above. This is posted as in figure 15 or as a dual class number, figure 16. To determine the dual class number, see *c* below.

b. Multilane Bridge. For a multilane bridge, the multilane class number is determined by use of the nomograph. This allows for normal operation for all the bridge lanes. This number is posted on the left-hand side of the bridge sign (fig. 15③). A single-lane class number is posted on the right-hand side of the bridge sign. It is computed considering only the number of stringers effective under a 15-foot width of roadway. A simple method is as follows: The value of total resisting moment per lane (M_R), as used in the initial class determination, is read from the chart. This is multiplied by 15 feet times the number of lanes and divided by the roadway width in feet.

$$M_{R(S)}=\frac{M_R\times 15\times N}{W}$$

N=number of lanes
W=roadway width in feet

The single lane class number is then determined from the chart (fig. 101), using the single-lane

resisting moment ($M_{R(S)}$) and the span length in feet.

c. Dual Class Numbers. A dual class number indicates one class number for wheeled vehicles posted above another class number for tracked vehicles (fig. 16①). If the span length is 95 feet or less, and if the bridge class number is 50 or above, then a dual class number is determined from the dual classification curves (TM 5–260). (This step is not mandatory, even if the bridge class number is 50 or above, since a dual class number need not necessarily be used even though authorized.) Enter the dual classification curves with the span length in feet, proceed up the span length line to the class value for tracked vehicles (solid lines) that is equal to the bridge class determined from the nomograph (fig. 101). This point of intersection represents the bridge under consideration. Using the dashed lines (wheeled vehicle class curves), read the wheeled vehicle class at this point. If this point does not fall on a wheeled vehicle class curve, the value may be interpolated between the curves by estimation.

APPENDIX IX

CLASSIFICATION TABLES FOR STANDARD PREFABRICATED RAFTS, FIXED BRIDGES, AND FLOATING BRIDGES

Table XXII	Floating Bridge Classification
Table XXIII	Raft Classification
Table XXIV	Classification of Panel Bridge, Bailey Type, M2, (150-inch roadway)
Table XXV	Classification of Portable Steel Highway Bridge, H20
Table XXVI	Classification of Steel Treadway Fixed Bridges, M2 and Widened

Table XXII. Floating Bridge Classification

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Type of bridge		Stream velocities in feet per second for specified crossings														
		Normal					Caution					Risk				
		3	5	7	9	11	3	5	7	9	11	3	5	7	9	11
M2 assault-boat bridge	Normal	8	6	5	----	----	8	6	5	----	----	9	7	6	----	----
	Reinforced	13	9	7	----	----	13	11	8	----	----	14	12	9	----	----
Widened steel treadway		50	50	40	30	15	50	50	45	35	20	55	55	50	45	30
M4 bridge	Normal	55	55	55	45	30	60	60	60	50	40	65	65	65	55	45
	Reinforced	95	95	95	70	40	100	100	100	85	55	105	105	105	100	70
Airborne division bridge		*45	*35	30	10	----	50	*40	35	15	----	55	50	45	25	----
Class 60 floating bridge		60	60	55	50	18	65	65	60	55	30	75	75	70	65	45

*These classes do not govern the crossing of the M4A3, M26, M45, and M46 tanks. These tanks may make a normal crossing in currents up to 5 feet per second, even though they have a vehicle class number greater than 35, because they have a greater out-to-out tread width than the hypothetical vehicles of their class. The out-to-out tread width of the M4A3, M26, M45, and M46 tanks forces them to very nearly straddle the centerline of the airborne division bridge approximating a caution crossing, whereas the out-to-out tread widths of the hypothetical vehicles permit an eccentric loading which was taken into consideration in establishing the classes given. These exceptions do not apply to other bridges or to other vehicles whose class numbers are greater than 35.

Table XXIII. Raft Classification

	1	2	3	4	5	6	7	8	9	10
	Type of raft	No. of pontons or floats	Stream velocities in feet per second for specific crossings							
			Normal				Risk			
			3	5	7	9	3	5	7	9
1	Infantry support	3	8	8	4		10	9	5	2
		5	13	10	5		15	13	8	3
		*7	13/21	13/21	8/13	/	16/23	15/23	10/16	5/8
2	Widened steel treadway	4	35	35	35	20	45	45	40	25
		5	45	45	45	25	50	50	50	30

3	M4	4	55	55	55	55	60	60	60	60
		6	75	75	75	70	80	80	80	80
		7	90	90	90	85	95	95	95	95
4	Airborne division	4	35	35	30	20	45	45	40	25
		6	55	50	45	----	65	60	50	15

*Classes are based on loading rafts with center of gravity 6 inches downstream of centerline of raft, on properly inflated floats.

Key:

Single-vehicle class—  —Two-vehicle class (vehicles approximately the same weight).

Table XXIV. Classification of Panel Bridge, Bailey Type, M2 (150-inch roadway)

Span in feet	Class by type of construction and type of crossing																				
	SS			DS			TS			DD			TD			DT			TT		
	N	C	R*	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R	N	C	R
30	30	40	45																		
40	26	35	40																		
50	23	30	35	65	70	95															
60	22	30	35	60	70	85															
70	21	28	30	55	65	80															
80	17	22	26	50	60	75	75	95	100												
90	11	17	19	40	45	55	60	65	80												
100	10	12	16	28	35	45	45	50	60	75	85	100									
110				21	29	35	35	40	50	60	70	80	90	100	100						
120				16	22	29	26	35	40	50	55	65	65	80	100						
130				12	18	22	20	28	35	35	45	55	55	65	80	80	90	100			
140				10	13	18	16	22	28	29	35	50	45	50	65	65	75	95			

150				11	17	22	23	30	35	35	45	55	60	65	80		
160				9	12	17	18	24	30	27	35	45	50	60	75	75	85	100
170							13	18	25	20	28	35	45	55	65	65	75	95
180							9	13	19	15	21	30	35	45	55	55	65	90
190										10	15	22	30	35	50	45	55	70
200													22	30	40	35	45	55
210													16	22	30	27	35	45

*N—Normal; C—Caution; R—Risk.

Table XXV. Classification of Portable Steel Highway Bridge, H20

1	2	3	4	5	6	7	8	9	10
Span in feet	2-truss construction			3-truss construction			4-truss construction		
	Normal	Caution	Risk	Normal	Caution	Risk	Normal	Caution	Risk
37.5	70	80	90	80	80	90	80	80	90
50	55	65	75	60	80	90	75	80	90
62.5	45	55	65	60	65	75	65	75	85
75	50	50	60	55	60	70	60	70	80
87.5	40	45	55	50	55	65	55	65	75
100	35	40	50	45	50	60	50	60	70
112.5	30	35	40	40	45	55	50	55	65
125	20	24	30	35	40	50	45	50	60
137.5	16	20	24	30	35	45	35	40	50
150	12	16	20	24	30	35	30	35	40

Table XXVI. Classification of Steel Treadway Fixed Bridges, M2 and Widened

	1	2	3	4	5	6
	Type	Number of treadways in span	Clear span	Class		
				Normal	Caution	Risk
1	Widened bridge	[a] 2	20	90	[b] 110	[b] 140
			22	80	95	[b] 120
		3	24	70	80	[b] 100
			26	60	70	90
			28	55	60	80
			30	50	55	75
			32	45	50	65
			34	40	45	55
2	Plywood treadway lane (spans up to 34 feet)	------	------	16	18	24
3	M2 bridge	4	36	30	35	50
			38	27	30	45
			40	25	28	40
			42	23	26	40
			44	21	24	35
			46	20	23	35
		5	48	19	22	30
			50	18	21	30
			52	18	20	28
			54	17	19	27
			56	16	18	25
			58	16	18	24

[a] For 2-treadway span bridges without transverse stiffeners use 0.8 of class given in table.

[b] Width controls.

APPENDIX X

GLOSSARY

Abutment. The support at each end of a bridge which supports the dead weight of the bridge and prevents lateral movement of the earth embankment.

Aggregate. Natural or processed material, such as crushed rock, gravel, slag, and shell, used with or without artificial binder as material for the subbase, base, or wearing course of a road. Aggregate, in a surface course, is often called road metal.

All-weather road. Any road which, with reasonable maintenance, is passable throughout the year to a volume of traffic never appreciably less than its dry-weather capacity. This type of road has a waterproof surface and is only slightly affected by rain, frost, thaw, or heat. At no time is it closed to traffic by weather effects other than snow blockage. Included in this category are concrete, bituminous surface, brick, or stone pavement.

Approach. Applies generally to the immediate section of roadway leading to a bridge. It is constructed to provide access to a bridge, as a fill that rises to a bridge or a cut that slopes down to a bridge. The term is also used in

describing the relative direction or ease of approach, though no special structure or construction is required for that purpose. For example, "a direct approach," or "right-angle approach."

Approach span. That portion of the roadway approach to a bridge which is supported on piers.

Arch bridge. A haunched structure (arch) which spans an opening and which transmits any load placed on it in the form of an inclined thrust to the supports (piers, abutments).

Arch culvert. An arched structure through a railroad or highway embankment to carry a small stream or provide for the passage of water; under its own load, and all loads imposed upon it, it produces an inclined thrust at the supports.

Attachable vehicle (class) classification sign. Front vehicle (class) sign for use on cargo-carrying vehicles having a standard vehicle classification number larger than 30, which gives the unloaded classification number of the vehicle.

Bascule bridge. A movable span bridge in which the movable span moves in a vertical plane, rotating about a horizontal axis (trunnion type), or rolling back from the opening in the bridge (rolling lift type).

Base course. The portion of a road structure between the subgrade and the surface course or pavement which distributes the induced stresses from the wheel load or tracked load to the subgrade.

Beam. A horizontal load-bearing member of a structure, long in proportion to its thickness.

Beam bridge. A short span bridge, always deck type, with steel, concrete, or timber beams, extending between abutments or piers.

Box culvert. A culvert with a rectangular water passage.

Bridge. A structure erected over a river, chasm, or gorge, which carries a roadway for vehicular or foot traffic. Bridges are classified, according to structure, as follows:

a. Cantilever.
b. Slab.
c. Beam.
  (1) Simple stringer.
  (2) Concrete.
d. Truss.
e. Girder.
f. Arch.
g. Suspension.
h. Ponton (floating).
i. Swing.
j. Lift.
k. Bascule.
l. Retractile.

See also Arch bridge; Bascule bridge; Beam bridge; Cantilever bridge; Deck bridge; Dual class bridge; Ferry bridge; Floating bridge; Girder bridge; Half-through bridge; Lift bridge; Movable bridge; Multilane bridge; Retractile bridge; Single lane bridge; Skew bridge; Slab bridge; Stringer bridge; Suspension bridge; Swing bridge; T-beam bridge; Through bridge; Treadway bridge; Trestle bridge; Truss bridge; Two lane bridge.

Bridge (class) classification number. Number which represents the safe load-carrying capacity of a bridge under normal crossing conditions.

Bridge length. The length of a bridge is expressed as the distance between the extreme ends (overall length) of the bridge. This should not be confused with span length which is defined in terms of the distance between bearings.

Bypass. A local detour required to circumvent an obstruction to military traffic along the normal course of a route.

California bearing ratio (CBR). A measure of the shearing resistance of a soil under carefully controlled density and moisture conditions, which is used with empirical curves for designing flexible road pavements. It is expressed as a ratio of the unit load required to force a piston into the soil to the unit load required to force the same piston the same depth into a standard sample of crushed stone.

Cantilever bridge. A bridge in which two self-supporting beams or trusses, projecting from piers toward each other, are either joined directly or connected by a suspended span.

Causeway. A raised way across wet or marshy ground, or across water.

Caution crossing. A crossing for which the vehicle class number is no more than 25 percent greater than the bridge single lane class number. Caution crossings require that the vehicle remains on the centerline of the bridge, maintains a 50-yard distance from the vehicle in front, does not exceed the speed limit of 8 miles per hour,

and does not stop, accelerate, or shift gears on the bridge.

Clay. A soil which contains colloidal scale-like particles which are the cause of plasticity. It is plastic when moist but permanently hard when baked or fired.

Clear span. The distance, face to face, of the supports (piers or abutments) of a bridge at mean water level.

Clearance. The clear space (horizontally or vertically) available in a structure such as a bridge or a tunnel to permit passage through; also the space between the water level and the under side of a bridge (under-bridge clearance).

Combination vehicle. A military vehicle consisting of two or more single vehicles, spaced less than 30 yards apart, which move as one unit.

Concrete. Artificial stone made by mixing cement and sand with gravel, broken stone, or other aggregate. The materials are mixed with sufficient water to cause the cement to set and bind the entire mass.

Controlled crossing. A crossing over a multilane bridge for which the vehicle classification number is not more than 50 percent greater than the bridge classification number for one lane, and where the vehicle must be centered over two or more lanes carrying one-way traffic, with a limitation of one vehicle on each span of the bridge. When the bridge class number is not the same for all lanes so used, the lane with the lowest bridge class number determines the controlled rating.

Critical span. In a multispan bridge, with individual spans of various dimensions or of different construction or material, the span with the least capacity.

Culvert. A structure through a railroad or highway embankment to carry a small stream or provide for the passage of water. The simplest form of culvert is a pipe. *See also* Arch culvert; Box culvert.

Deck bridge. A bridge in which the floor system is supported on or near the top chord (line of top members) of the bridge trusses or girders with no more than a guardrail at the sides.

Directional disc. A circular sign, used to supplement other road guide signs, which indicates the direction of a route. The disc is a circle having a minimum diameter of 1 foot. The normal directional disc has a fixed black arrow on a white background. The directional disc used on detours has a fixed white arrow on a red background. The disc has eight equally spaced holes around the edge of the circumference to allow the disc to be placed in a vertical plane with the disc arrow pointing in the appropriate direction.

Dual class bridge. A bridge having one class number for wheeled vehicles and another class number for tracked vehicles.

Engineer information. Information on topography and resources of the area in which operations are being or may be conducted and information of enemy installations and activities which may affect engineer operations.

Engineer reconnaissance. The operation of searching for engineer information in the field.

Fair-weather road. A road which quickly becomes impassable in bad weather and which cannot be kept open by normal maintenance. This type of road is so seriously affected by rain, frost, or thaw, that traffic is brought to a complete halt for long periods. Examples of this category are: natural soil, stabilized soil, sand-clay, shell, cinders, and disintegrated granite.

Ferry. A barge, boat, or other water vehicle used to convey traffic and cargo across a river or other water obstacle. Also called ferry boat or ferry craft.

Ferry bridge. A movable car, at roadway level, which is suspended from, and which moves back and forth under, an overhead fixed bridge supported on towers, the overhead portion being high enough above water level to afford adequate clearance for navigation.

Ferry site. A place or passage where traffic and cargo are conveyed across a river or other water obstacle by a water vehicle.

Ferry slip. The shore side of a ferry to facilitate the loading and unloading of ferry craft.

Floating bridge. A ponton bridge or any temporary bridge that is supported by low flat-bottomed boats or other floating structures.

Ford. A shallow place in a stream where the stream bottom permits the passage of personnel and vehicles.

Front vehicle classification sign. A circular sign which is 9 inches in diameter with black numerals, as

large as the sign will permit, on a yellow background, and which is placed on the vehicle above the bumper to the driver's right and below his line of vision.

Gallery. Any sunk or cut passageway covered overhead as well as at the sides.

Girder. A steel beam made in a single piece (I-beam) or built up of plates and shapes (angles, channels, Z-sections, etc.). The term also applies to reinforced concrete members which act as girders.

Girder bridge. A bridge with a structure composed of girders.

Gravel. A mass of detached rock particles, generally water-worn, ranging in size from ¼ inch to about 4 inches.

Gross weight of a vehicle. The weight of the vehicle when fully equipped and serviced for operations, including the crew and the rated payload of cargo and personnel for cross-country (off-highway) operation.

Guide sign. A rectangular highway sign erected in a vertical plane, with its long axis horizontal to indicate locations, distances, directions, route numbers, and other information of help to drivers.

Half-through bridge. A bridge which is shallow or whose floor is so near to the top chord that no overhead bracing can be used.

Halftracked vehicle. A combination wheeled and tracklaying vehicle in which the rear end is supported by a complete band track and the front end is supported on wheels. It is driven

by the track alone or by the wheels and track together.

Hazard sign. *See* Warning sign.

Headroom. The desirable minimum vertical clearance in a bridge structure, a tunnel, or an underpass.

Intermediate support of a bridge. A bent or pier between the abutments of a multispan bridge which supports the ends of two adjacent spans.

Lift bridge. A bridge of which a span can be raised horizontally.

Limited all-weather road. A road which, with reasonable maintenance, can be kept open in bad weather to a volume of traffic which is considerably less than its dry-weather capacity. This type of road does not have a waterproof surface and is considerably affected by rain, frost, or thaw. Traffic on it is completely halted for short periods of a day or so at a time. Heavy use during adverse weather conditions may lead to a complete collapse of the road. Examples are crushed rock or waterbound macadam, gravel or lightly metaled surface.

Military sketch. A hasty map or sketch of an area, especially one prepared in the field for a special tactical purpose.

Military vehicle. Any item of equipment which habitually moves on land and which is mounted on wheels, tracks, or combinations of wheels and tracks.

Movable bridge. A bridge of which one or more spans can be moved from their normal position to provide unobstructed passage for vessels.

Multilane bridge. A bridge with a roadway wide enough to pass two or more lanes of traffic simultaneously.

Normal crossing. A crossing in which the vehicle classification number is equal to or less than the bridge classification number, and where the vehicles maintain a 30-yard convoy spacing. For normal crossing on floating bridges the speed is restricted to 25 miles per hour without sudden stopping or acceleration.

Obstruction. Any obstacle that stops or slows down an advance. Obstructions may be natural (deserts, rivers, swamps, or mountains); or they may be artificial (barbed-wire, entanglements, pits, concrete or metal antimechanized traps).

Organic matter. Soil composed of decayed or decaying vegetation, sometimes mixed with fine-grained mineral elements. Examples are peat and muskeg.

Overpass. In common usage, a structure erected to permit a road or railroad route to pass over another route. However, in order to simplify structure numbering and identification, this term will not be used in route or road reconnaissance. Instead, any structure, along the course of a route, erected to permit crossing over another route will be designated as a *bridge.*

Pavement of a road. The top portion of a road structure, which comes into direct contact with the wheel load or the tracked load. It is intended to resist traffic wear and dusting, and to prevent surface water from infiltration into the road structure.

Payload of a military vehicle. The total load a vehicle is rated to carry, exclusive of the crew.

Pony truss. A half-through bridge truss.

Posting a sign. Erecting a highway sign at a designated location.

Prime mover. A vehicle possessing military characteristics, designed primarily for towing heavy wheeled weapons and frequently providing facilities for the transportation of the crew of, and ammunition for, the weapon.

Raft. The term used to describe the individual floating bays which are to be incorporated into a continuous bridge.

Rated payload of a military vehicle. The total load a vehicle is rated to carry exclusive of the crew.

Reconnaissance. A directed effort in the field to gather information of the enemy, terrain, or resources, which is undertaken by an appropriate element of the armed forces. Not to be confused with espionage.

Regulatory sign. A rectangular highway sign, erected in a vertical plane with its long axis vertical, which indicates speed limit, one-way passage, parking restrictions, and other specific regulations for vehicles.

Retractile bridge. A bridge which is supported on wheels resting on tracks on shore, and which is rolled horizontally back from the opening. This term is applicable to short spans only.

Risk crossing. A crossing over a prefabricated fixed or floating bridge, permitted only in the gravest emergency where excessive losses will otherwise result, and where the vehicle remains on the

centerline of the bridge, does not exceed a speed limit of 3 miles per hour, is the only vehicle on the span, and does not stop, is not accelerated, or does not have its gears shifted. Tanks must be steered by using clutches only. A crossing is permitted under these conditions only if the vehicle classification number does not exceed the published risk classification number of the bridge.

Road. An open way provided for the convenient passage of personnel and vehicles.

Road classification. The detailed classification of a road, mainly for engineer purposes. It includes width, length, alinement, drainage, foundation, surface, and any particular obstruction but excludes bridge classification.

Road classification fraction. The presentation of road classification information, excepting obstructions, by symbols arranged as a fraction, with symbols for elements rated "good" and symbols denoting road width and road surface being placed in the numerator, and symbols for those elements rated "fair" or "bad" and symbols for road length being placed in the denominator. For example—

$$\frac{\text{"good" elements, road width, surface type}}{\text{"fair" or "bad" elements, road length}}$$

Road Reconnaissance Report. The report of road reconnaissance containing the detailed information necessary for the classification of a road.

Road sketch. A military sketch of a road which has been reconnoitered.

Route. The road, or roads, including tracks and bridges, used when moving from one place to another.

Route classification. The simple classification of a route to assist staff officers in planning a normal road movement. It includes width of roads, types of roads, load-carrying capacity of roads, load-carrying capacity of bridges, and the presence of obstructions and other limiting factors.

Route classification formula. Route classification symbols arranged in order as follows: width of road, type of road, load-carrying capacity.

Route sign. A highway warning, regulatory, or guide sign.

Sand. Soil consisting of mineral grains varying from about ¼ inch to 0.002 inch.

Semitrailer. A vehicle designed to be towed by and attached to a tractor truck by means of a fifth wheel device, a portion of its weight being carried by the tractor truck. It is equipped with retractable gear to support the front end when detached.

Side vehicle (class) classification sign. A circular sign which is 6 inches in diameter with black numerals, as large as the sign will permit, on a yellow background, and which is placed on the right side of the vehicle in such a position that normal use of the vehicle will not conceal it from view.

Silt. Soil consisting of natural mineral grains smaller than 0.002 inch which lack plasticity and have little or no dry strength.

Single lane bridge. A highway bridge having a roadway of insufficient width to accommodate more

than one line of vehicular traffic of the class indicated by the bridge classification number.

Single vehicle. Any military vehicle which has only one frame or chassis, such as trucks, prime movers, tanks, halftracks, full trailers, and gun carriages.

Skew bridge. A bridge with one or both abutments placed at other than a right angle to the length of the bridge. If the piers and abutments are at right angles to the line of the bridge, the bridge is not skew, even though oblique to the line of the stream.

Slab bridge. A short-span bridge, always deck type, consisting of a reinforced concrete slab resting on abutments.

Snowshed. A shelter to protect from snow, as a long structure over an exposed part of a road or railroad.

Soil. The solid particles produced by mechanical and chemical disintegration of rocks with an admixture of organic matter and soluble salts.

Span. The center-to-center distance between supports (centers of bearing) of a bridge.

Standard vehicle. An item of equipment which habitually moves on land, and is mounted on wheels, tracks, or halftrack and wheels.

Stringer. A basic bridge member, usually a long horizontal beam which connects uprights and supports a floor.

Stringer bridge. A bridge designed with a stringer system, which is composed of longitudinal members (stringers) supported by and spanning

the distance between the transverse (intermediate) supports or end supports (abutments).

Subgrade. The foundation which supports the load placed upon a road surface.

Substructure. All of that part of the structure below the bridge seats or below the springing line of arches.

Superstructure. All of that part of the structure above the bridge seats or above the springing line of arches, or above the caps of timber trestle bents.

Surface course. The top portion of a road structure, which comes into direct contact with the wheeled load or tracked load. It is intended to resist traffic wear and dusting, and to prevent surface water from infiltration into the road structure.

Suspension bridge. A bridge which has its roadway suspended from two or more cables usually passing over towers and securely anchored at the ends.

Swing bridge. A bridge which revolves horizontally about a vertical axis, and generally consists of two or more plate girders or trusses supported on a pier in such a manner that they can be rotated on a circular track or pivot resting on or attached to the pier.

T-*beam bridge.* A short span bridge, always deck type, consisting of a reinforced concrete deck slab constructed as a monolith with supporting reinforced concrete beams. The slab and beams are thoroughly tied together by means of stirrups and bent-up bars. For this reason, part

of the slab acts to assist the upper part of the beams in resisting compressive stress.

Through bridge. A bridge in which the floor is on or near the bottom chord (line of bottom members), and which is provided with overhead bracing.

Towed vehicle. A single vehicle towed by another single vehicle.

Tracked vehicle. A single vehicle having tracks in place of wheels.

Tracklaying vehicle. A vehicle which travels upon two endless tracks, one on each side of the machine. Tanks are one type of tracklaying vehicle.

Tractor truck. A vehicle designed to tow a semitrailer by means of a fifth wheel attachment.

Traffic lane. A width of roadway or bridge assigned to a single line of vehicular traffic.

Trailer. A vehicle designed to be towed, and provided with a suitable drawbar or tongue for attachment to a pintle or other suitable coupling mounted on the towing vehicle.

Treadway bridge. A bridge whose roadway is formed by two tracks or treadways.

Trestle. A braced framework of timbers, poles, or steelwork. Used alone, the term is ambiguous. It should be expressed as a trestle bent or trestle bridge.

Trestle bent. A transverse frame which supports the ends of the stringers in adjacent spans of a trestle bridge. A trestle bent consists of vertical members, called posts; a top member which supports the superstructure, called a cap; a

bottom horizontal member, called a sill; and bracing.

Trestle bridge. A beam bridge commonly used in railroad construction. The spans are bridged with beams (stringers) on which the deck or ties are laid directly.

Truss. A structural element that acts like a beam, and is composed of a system of members jointed together at their ends to form a series of triangles, each member carrying primarily axial loads.

Truss bridge. A bridge in which the roadway loads are transmitted from the floor system to the bridge abutments or piers by means of trusses (generally one along each side).

Two lane bridge. A highway bridge having a roadway of sufficient width to simultaneously accommodate two lines of vehicular traffic of the class indicated by the bridge classification number.

Underpass, highway. A structure which permits a highway to pass below another road or a railroad route.

Vehicle. A general military term embracing all wheeled, tracklaying, combined wheeled and tracklaying equipment and chassis powered by a self-contained power unit, bicycles, and trailers or semitrailers towed by vehicles. *See also* Combination vehicle; Halftracked vehicle; Military vehicle; Semitrailer; Single vehicle; Standard vehicle; Towed vehicle; Tracked vehicle; Tracklaying vehicle; Tractor truck; Trailer; Wheeled vehicle.

Vehicle (class) classification number. A whole number which represents the effect a vehicle has on a bridge in crossing it. This effect depends upon the gross weight of the vehicle and its weight distribution to the axles or tracks.

Vehicle (class) classification sign. A sign placed on a classified vehicle to show its (class) classification number.

Viaduct. A term applied to multispan structures consisting of narrow reinforced concrete or masonry arches, or short steel spans supported on high towers or piers of concrete, masonry, or steel, for carrying a road or railroad over a valley.

Warning sign. A square highway sign with its diagonal in a vertical plane to indicate road hazards and conditions requiring special precaution.

Wheeled vehicle. A vehicle mounted on wheels as opposed to a full or partial tracklaying vehicle.

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[AG 253 (2 Aug 54)]

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SigC Bn (1)	PMST Engr ROTC units (2)
Engr Bn (3)	Engr Div (1)
FA Bn (3)	Engr Dist (1)
Inf Bn (3)	Mil Dist (2)
Ord Bn (3)	Units organized under following TOE's:
Armd Bn (3)	7-11, Inf Regt (2)
AAA Bn (3)	17-51, Armd Cav Regt (2)
TC Bn (3)	

NG: None.

USAR: None.

Unless otherwise noted, distribution applies to ConUS and overseas.

For explanation of abbreviations used, see SR 320-50-1.

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