TB 5-271-5

WAR DEPARTMENT TECHNICAL BULLETIN

USE OF 1/4-TON AMPHIBIAN TRAILER AS STREAM-CROSSING EXPEDIENT

Ref: TM 5-271, Light Stream-Crossing Equipage

War Department, Washington 25, D. C., *June 1945*

Pending incorporation in TM 5-271, Light Stream-crossing Equipage, 27 March 1944, the following is published for information and guidance of all concerned.

1. SCOPE. This Technical Bulletin describes the use of ¼-ton two-wheel amphibian trailers as expedient ferries and rafts.

2. DESCRIPTION OF TRAILER. *a.* The ¼-ton amphibian two-wheel trailer weighs 1,047 pounds loaded and carries a 500-pound pay load. It has an amphibian-type cargo body with about 25 cubic feet of cargo space (⅘-ship ton). The body is waterproof and has a spring-loaded drain cock in the right rear corner. The trailer tongue can be removed in a few minutes for attaching two trailers close together in tandem. Dimensions and weight distribution of the loaded and unloaded trailer are given in figure 1.

b. The ¼-ton trailer can remain in water for 24 hours without leaking. Its flat bow causes considerable resistance when towed or pushed through water, and its shape makes it unstable unless it is used in combination with other trailers. Freeboard is affected by nature of the load and method of propulsion. With an inert, evenly distributed cargo, a 3-inch minimum freeboard is sufficient if the trailer is ferried carefully in still water. However, with a personnel load, a 6-inch freeboard is required. When towed in the wake of a powerboat, freeboard is generally less than when the trailer is pushed. Turbulence of stream and skill of operating personnel critically affect safe operation, and may cause wide variance from normal performance described in this bulletin.

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c. Trailers are used singly, combined in series, or assembled in a square to form a raft. The square raft is the most stable combination. Construction of the different combinations is described in paragraph 3.

d. Trailers can be propelled by any of the following methods:

(1) Trail ferry.
(2) Pushed by M2 assault boat with 22-hp outboard motor.
(3) Towed by M2 assault boat with seven men paddling.
(4) Towed by 18-foot power utility boat.
(5) Pushed by 22-hp outboard motor mounted on rear trailer.
(6) Paddled by men in trailer.

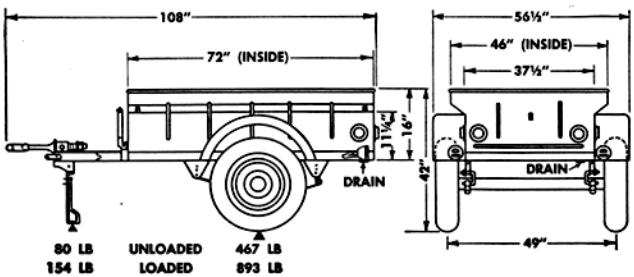

Figure 1.— Dimensions and weight distribution of ¼-ton trailer.

These methods and their limitations are discussed in paragraph 4.

3. TRAILER COMBINATIONS. *a. Trailers in series* (figs. 2, 3, and 4). A satisfactory stream-crossing expedient can be formed by lashing two to four trailers together in series. In addition to lashings, the following timbers are required:

Number of trailers	Materials	Construction time (using two men)	Figure
2	2, 4" x 6" x 10' 0" timbers or 10-ton trestle balk.	17 min	2
3	2, 4" x 6" x 21' 0" timbers or 10-ton ponton balk.	37 min	3
4	2, 4" x 6" x 21' 0" timbers	54 min	4
	2, 4" x 6" x 12' 0" timbers or 10-ton trestle balk.		

Additional freeboard and speed are obtained if trailer tongues are removed and the trailers tied close together.

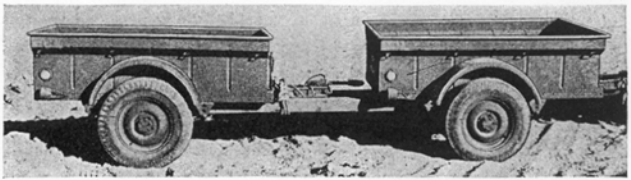

Figure 2.—Two ¼-ton trailers lashed in series.

Figure 3.—Three ¼-ton trailers lashed in series.

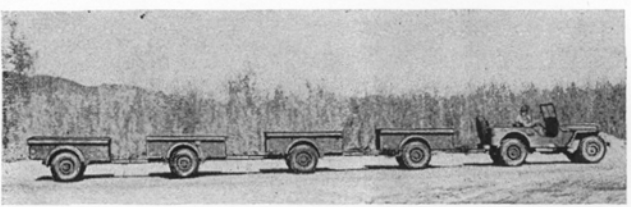

Figure 4.—Four ¼-ton trailers lashed in series and pulled on land by a ¼-ton truck

b. Trailers in a square (figs. 5, 6, and 7). A raft of four trailers assembled in a square is much more stable than four trailers in series, but the wide, flat bow reduces the maximum speed. In addition to lashings and spikes, the following timbers are required to construct the raft:

Quantity	Size of timber	Use
6	2″ x 6″ x 9′0″	Transverse deck members.
6	2″ x 6″ x 9′0″	Side beams, treadways, and ramps.
2	4″ x 4″ x 8′0″	Wheel blocks and side blocking.
4	4″ x 6″ x 12′0″	Members connecting trailers in series.
2	4″ x 4″ x 8′0″	Members connecting trailers side-by-side.

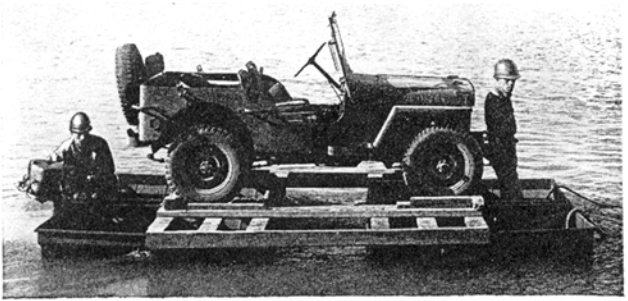

Figure 5.—Four-trailer raft propelled by 22-hp outboard motor and carrying ¼-ton truck

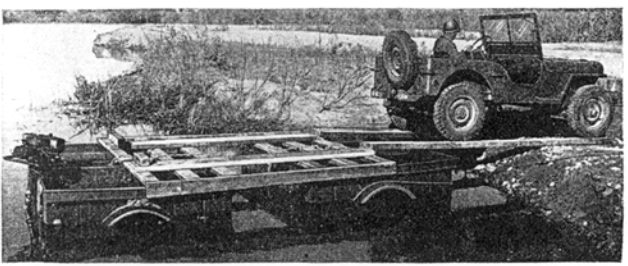

Figure 6.—Unloading ¼-ton truck from four-trailer raft.

Figure 7.—Four-trailer raft with 55-gallon drums as auxiliary flotation.

Fifty-five-gallon drums lashed to the outside corners of the raft give additional buoyancy and increase freeboard about 2½ inches. Five-gallon gasoline or water cans fastened under the trailers can also be used to improve flotation.

4. METHODS OF PROPULSION. *a. Trail ferry.* (1) A single trailer can be used as a trail ferry on a ¼-inch cable. Under favorable conditions, 15 minutes are required for two men to cross a 600-foot stream with 5-fps current, disconnect the hauling line; and hook the trailer to a ¼-ton truck. Disadvantages of the single trailer are its instability, and slow speed because of its short side presented to the current.

(2) Several trailers lashed close together in series make a much better trail ferry because they present a long side to the current. They can be used in currents up to 5 fps.

b. M2 assault boat with 22-hp outboard motor (fig. 8). An M2 assault boat with 22-hp outboard motor can be used to *push* one to four loaded trailers in series. Pushing is better than towing because the wake of a towing boat reduces freeboard more than when the trailers are pushed. It is impractical to lash trailers alongside an assault boat because the ferry is difficult to steer and the low height of the trailers makes attachment to the assault boat difficult. Maximum propulsion speeds and minimum freeboards for different trailer combinations are given in tables II and III.

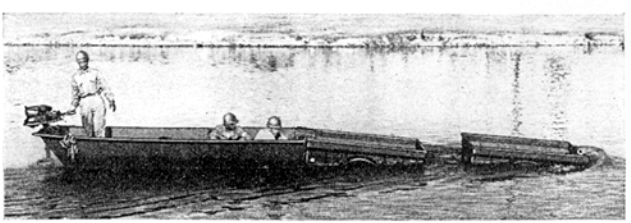

Figure 8.—M2 assault boat with 22-hp outboard motor pushing two ¼-ton trailers. Load in front trailer is 250 pounds; load in rear trailer is 750 pounds.

c. M2 assault boat paddled by seven men (fig. 9). Seven men paddling and one man steering an M2 assault boat can *tow* combinations of one to four trailers connected in series. Since speed is determined by strength of the paddlers rather than freeboard of the trailers, towing is better than pushing. Maximum speed varies from 1.2 to 2.1 fps with different combinations and loads up to 500 pounds. Average minimum freeboard is 7 inches.

Figure 9.—Four ¼-ton trailers containing a 500-pound, evenly distributed load towed by M2 assault boat with seven men paddling and one man steering.

d. Eighteen-foot power utility boat (fig. 10). An 18-foot power utility boat can *tow* combinations of one to four trailers in series or a square raft of four trailers connected in pairs. By fastening the tongue of the front trailer or trailers close to the stern of the powerboat, the freeboard is increased by the upward pull of the powerboat, and also because the trailer is not in the wake. Maximum propulsion speeds and minimum freeboards for different combinations are given in tables II and III.

Figure 10.—Four ¼-ton trailers in series towed by 18-foot power utility boat. Front trailer is attached close to stern of powerboat so upward pull will increase freeboard.

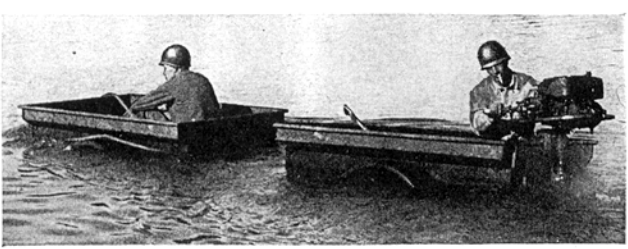

Figure 11.—Two ¼-ton trailers propelled by 22-hp outboard motor on rear trailer.

e. Twenty-two-hp outboard motor (figs. 7, 11, 12, and 13). A 22-hp outboard motor can be mounted on the *rear* trailer of a combination of trailers in series, or on either rear trailer in a square raft of trailers. A simple wood bracket is used to mount the motor (fig. 13). It is impractical to use an outboard motor on a single trailer as a ferry because the weight of the motor plus the operator prohibits carrying much additional load. To obtain maximum freeboard and stability, trailer combinations are *pushed*, not towed. Maximum speeds and minimum freeboards for different combinations are given in tables II and III.

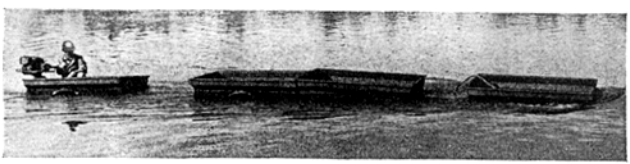

Figure 12.—Four ¼-ton trailers propelled by 22-hp outboard motor on rear trailer.

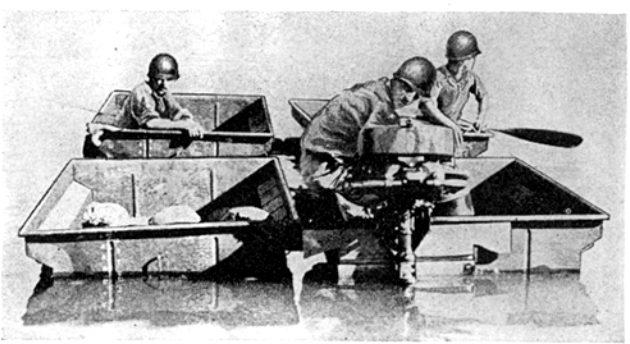

Figure 13.—Four trailer square raft propelled by 22-hp outboard motor.

f. Men paddling trailer. A single trailer can be propelled by four men paddling with a fifth man steering. Minimum freeboard with five men is about 4 inches. This is a "risk" crossing because a single trailer is unstable when loaded with unevenly distributed moving objects.

5. CAPACITY. *a. General.* The many variables in using ¼-ton trailers for ferrying operations make its performance frequently unpredictable and hazardous. Capacity, freeboard, and maximum

speed data given are only approximate indications of behavior under favorable conditions, and are subject to the stated limitations. Allowance must be made for the following:

(1) Variations in turbulence of stream.

(2) Skill of operating personnel.

(3) Spacing and method of attaching trailers together and to the propulsion equipment.

(4) Type of propulsion.

(5) Type, distribution, and weight of load.

(6) Relative stream velocity and number of trailers.

b. Connection between trailers and to propulsion equipment. To reduce wake, trailers in series are spaced close to each other and to the towing boat. This increases freeboard and speed and improves trail-ferrying characteristics of the combination. Lashing the trailers in series with timbers adds rigidity to the combination and helps distribute the load to all the trailers.

c. Load distribution. When trailers are connected in series, additional freeboard and capacity are obtained by placing the greater load in the rear trailers. For example, a good distribution of load in two trailers pushed by an M2 assault boat with a 22-hp outboard motor is 250 pounds in the front trailer and 750 pounds in the rear trailer (fig. 8).

d. Type of load. If care is used, 750 pounds of inert, evenly distributed cargo can be ferried in still water by a single trailer with a minimum freeboard of three inches. However, with personnel, minimum freeboard must be not less than 6 inches. Freeboard with five men is 4 inches in still water when the trailer is used *alone*.

e. Amount of load. Recommended average pay load per trailer is 500 pounds. Tables II and III give freeboards and maximum speeds of various combinations and means of propulsion for 500-pound increments of load. These tables show that pay loads greater than the recommended average can be carried only with less safety and speed. Table I gives maximum distributed inert loads for each trailer combination and means of propulsion, with minimum safe freeboard of 6 inches in still water. *These represent the absolute maximum capacity of the combinations and apply only to ferrying at slow speed in still water.*

Table I. Maximum loads for ¼-ton trailer combinations in still water

Trailer combination	Maximum load (lb)[1]
Single trailer	750.
Two trailers	1,300.
Three trailers	1,900.
Four trailers (series)	3,200.
Four trailers (pairs)	3,200.

[1] Maximum load is assumed to be inert and evenly distributed. Minimum freeboard is 6 inches at zero speed in still water. Freeboard is approximately zero at speed of 3 fps. Weight of outboard motor (if used) and operator are part of pay load.

f. Freeboard. Free boardsof various trailer combinations and propulsion equipment in relative stream velocities up to 6 fps with 500-pound increments in load are given in table II.

Table II. Freeboards of ¼-ton trailer combinations

Trailer combination	Freeboard (in.)											
Load (lb.)	Empty[1]			500			1,000			1,500		
Relative velocity (fps.)	0	3	6	0	3	6	0	3	6	0	3	6
¼-ton trailer combinations pushed by M2 assault boat with 22-hp outboard motor												
Single trailer	16	9	3	11	5	---	2	---	---	---	---	---
Two trailers	13	10	5	12	6	---	10	4	---	4	---	---
Three trailers	13	12	7	12	10	4	11	7	---	9	4	---
Four trailers (series)	15	13	4	13	11	4	13	10	---	10	9	---
Four trailers (pairs)	15	8	2	13	7	2	13	7	1	11	6	1
¼-ton trailer combinations towed by 18-foot power utility boat												
Single trailer	16	12	5	11	6	---	2	---	---	---	---	---
Two trailers	13	10	5	12	8	2	10	6	---	4	---	---
Three trailers	13	11	5	12	10	3	11	8	---	9	6	---
Four trailers (series)	15	13	4	13	11	---	13	9	---	10	7	---
Four trailers (pairs)	15	12	3	13	10	---	13	8	---	10	6	---
¼-ton trailer combinations pushed by 22-hp outboard motor mounted on rear trailer[2]												
Single trailer	16	9	---	11	5	---	2	---	---	---	---	---
Two trailers	13	10	5	12	9	4	10	6	---	4	---	---
Three trailers	13	12	6	12	10	4	11	7	---	9	5	---
Four trailers (series)	15	12	2	13	11	2	12	10	---	10	9	---
Four trailers (pairs)	15	8	---	13	7	2	12	7	1	11	6	1

[1] Freeboard of empty combinations varies because of different methods of hook up.
[2] Weight of outboard motor and operator considered part of pay load.

g. Speed. Maximum propulsion speeds for various trailer combinations and propulsion equipment with 500-pound load increments are given in table III.

Table III. Propulsion speeds of ¼-ton trailer combinations

Trailer combination	Maximum speed (fps) relative to water [1]		
Load (lb)	Empty	500	1,000
¼-ton trailer combinations pushed by M2 assault boat with 22-hp outboard motor [1]			
Single trailer	5	3	
Two trailers	5	4	2
Three trailers	6	5	4
Four trailers (series)	6	6	5
Four trailers (pairs)	5	5	4
¼-ton trailer combinations towed by 18-foot power utility boat			
Single trailer	6	3	
Two trailers	5	4	3
Three trailers	6	5	4
Four trailers (series)	5	5	4
¼-ton trailer combinations pushed by 22-hp outboard motor mounted on rear trailer [2]			
Single trailer	5	3	
Two trailers	6	5	3
Three trailers	6	5	4
Four trailers (series)	6	6	5
Four trailers (pairs)	5	5	4

[1] Speed is at minimum 6-inch freeboard in still water, and with inert evenly distributed load.
[2] Weight of outboard motor and operator are part of pay load.

6. OPERATION

a. General. The ¼-ton trailer is used in stream-crossing operations *as an expedient only.* Because of its instability, poor bow characteristics, and square shape, such operations involve *risk.*

b. Training. Operating personnel should have experience with the trailer combinations before using them in a combat operation. This includes construction of the trailer combinations as well as operation in current and under unfavorable landing conditions.

c. Crossing times. Average crossing times under favorable conditions across sluggish streams of widths up to 1,000 feet are given in table IV. These times do not include loading and unloading.

Table IV. Crossing times of ¼-ton trailer combinations

Trailer combination	Load (lb)	Time for trip across sluggish stream (min)[1]		
		300 ft	500 ft	1,000 ft
Single trailer	500			
18-foot power utility boat		2	3	6
M2 assault boat w/22-hp outboard motor		2	3	6
M2 assault boat paddled by seven men		6	9	18
Two trailers	1, 000			
18-foot power utility boat		2	3	6
22-hp outboard motor on rear trailer		2	4	7
M2 assault boat with 22-hp outboard motor		2	4	7
M2 assault boat paddled by seven men		7	12	23
Three trailers	1, 500			
18-foot power utility boat		2	3	6
22-hp outboard motor on rear trailer		2	4	7
M2 assault boat with 22-hp outboard motor		2	4	7
M2 assault boat paddled by seven men		12	19	38
Four trailers (series)	2, 000			
18-foot power utility boat		2	4	7
22-hp outboard on rear trailer		2	4	7
M2 assault boat with 22-hp outboard motor		2	4	7
M2 assault boat paddled by seven men				42
Four trailers (pairs)	3, 000			
22-hp outboard motor on rear trailer		3	5	10

[1] Times do not include loading and unloading.

d. Land transportation. Four trailers connected in series with timbers for rafting can be towed limited distances on land by a ¼-ton truck without removing the timbers (fig. 4),

e. Operation in water. The standard grease recommended for the trailers is satisfactory for use in water. When freeboard is critical, canvas cargo covers are lashed securely over the trailers to protect the cargo.

[AG 300.5 (18 May 45)]

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