Chapter 4.
Improved Float Bridge (Ribbon)

The ribbon bridge is a floating, modular asset with an integral superstructure and floating supports. Individual bays are joined to form rafts or bridges in support of river crossing operations. Ribbon bridges and rafts provide the maneuver commander with a reliable and responsive means to cross wet gap obstacles from the march. Ribbon equipment was actually reverse engineered at the United States Army Mobility Equipment Research and Development Command (MERADCOM) at Fort Belvoir, Virginia from photographs and drawings of the Soviet PMP Bridge. The ribbon bridge system was type classified in June 1972, and is currently the United States Army's primary assault floating bridge. For additional information, consult *TM 5-5420-209-12*.

COMPONENTS

The ribbon bridge system consists of three major components:

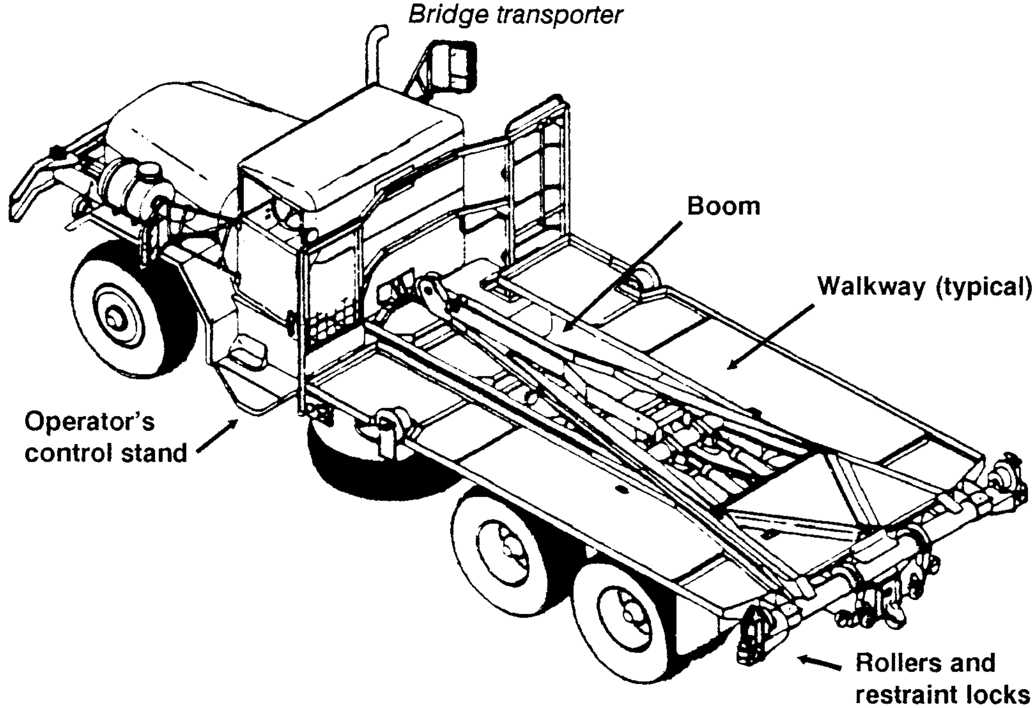
- Bridge transporters
- Interior bays
- Ramp bays

Although BEBs are not a component of the ribbon bridge system, boats are required for the propulsion of ribbon rafts, as well as for the assembly and anchorage of ribbon rafts and bridges.

Bridge Transporter

The standard bridge transporter is a modified US Army M812 5-ton truck chassis which provides a self-contained unit for transporting, launching, and retrieving the bridge bays. Modifications of the truck chassis include the addition of three bay supports with associated rollers, restraint locks, vertical tie-down locks, bay support stops, two steel grating walkways, and a hydraulically operated boom. The operator's control stand is located to the left rear of the truck cab. An 11,000-pound capacity winch works in conjunction with the boom to provide loading and unloading capabilities. Because of the weight of the bridge bays, extreme caution should be exercised by vehicle operators during overland transportation to prevent damage to the truck's suspension system. The modified M812 bridge transporter is a Military Load Class (MLC) 17 vehicle when transporting a bridge bay. A 10-ton cargo pallet

Bridge transporter



may be allocated to each transporter for hauling materiel. The M812 can also transport all US Army BEBs when fitted with a special cradle.

Interior Bay

The interior bay is the primary load carrying component of a ribbon bridge or raft. Each interior bridge bay is a four-ponton, folding module consisting of two roadway pontons and two bow pontons. The interior roadway pontons are joined to each other and to the adjacent bow pontons by hinges and pins along their adjacent edges. The roadway is welded to the roadway pontons, thus eliminating the need for separate intermediate pneumatic supports. One interior bay provides a roadway that is approximately 13.4 feet wide (13 feet 5 inches). The two bow pontons aid in flotation and provide walkways for personnel on both sides of the roadway.

Ramp Bay

The ramp bay is similar in construction to the interior bay, except that the bay's shore end is tapered. Ramps are always attached to both ends of a ribbon raft or bridge. A hydraulic system located within the ramp bay permits the ramp to be raised to accommodate bank heights of up to 42 inches. Two 7-foot extensions which serve as approach ramps are hinged to the roadway ponton on the shore side of the ramp to allow for ease of loading and unloading vehicles from bridges or rafts.

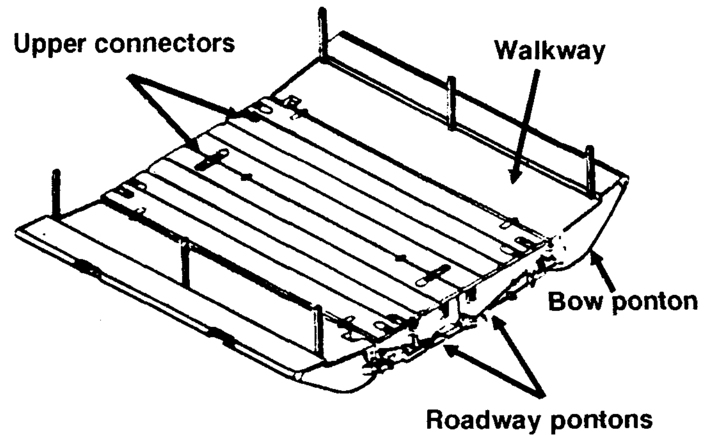
ALLOCATION OF RIBBON EQUIPMENT

The ribbon equipment is currently authorized in all Divisional Bridge Companies and all active duty Corps Assault Float Bridge Companies. The J-series Table of Organization and

Interior bay

Dimensions

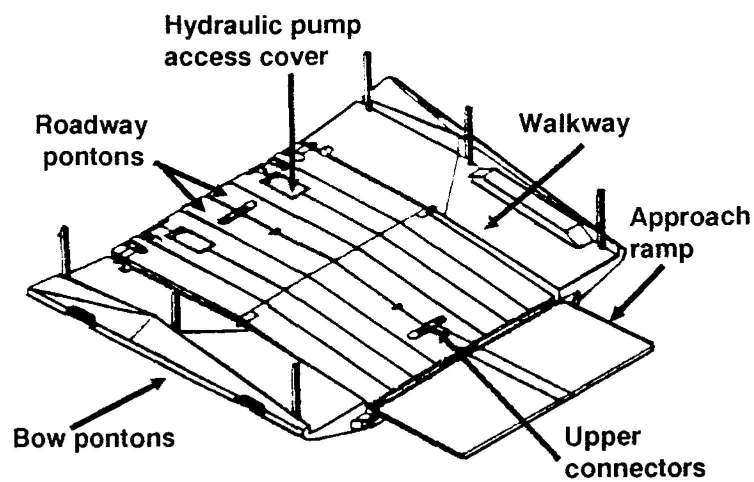
Length (overall)	22 ft 8.5 in
Length (effective)	22 ft
Width (folded)	10 ft 6.6 in
Width (unfolded)	26 ft 8 in
Height (folded)	7 ft 7 in
Height (unfolded)	3 ft 8 in
Weight	12,000 lb



Ramp bay

Dimensions

Length	19 ft .7 in
Length (approach ramp extended)	25 ft 4 in
Width (folded)	10 ft 6 in
Width (unfolded)	26 ft 8 in
Height (folded)	7 ft 10.1 in
Height (unfolded)	3 ft 7 in
Weight	11,700 lb



Equipment (TOE) allocates ribbon equipment as shown in Table 6.

CONSIDERATIONS FOR THE TACTICAL EMPLOYMENT OF RIBBON EQUIPMENT

Ribbon equipment is designed for use, primarily, during the rafting and bridging phases of the deliberate river crossing. Because ribbon bridges and rafts are significantly faster to construct with fewer personnel than other floating bridges, they are heavily relied upon in this capacity. Site considerations are of primary importance when ribbon equipment is to be used for rafting or bridging operations. Both the launch sites and actual bridge or raft sites should be considered.

Launch Sites

Site selection depends upon several factors. Generally, ribbon equipment is launched downstream from bridge or rafting sites to allow for ease of construction and to prevent runaway bridge bays from damaging other equipment or injuring personnel. Other selection criteria include the height of the banks, the bank slopes, and the depth of the water at the site. There are four methods of launching ribbon equipment:

- Free launch
- Controlled launch
- High bank launch
- Helicopter delivery

These launches and their applicable site restrictions are discussed under Ribbon Launches on page 22.

Raft and Bridge Sites

The tactical plan plays a major role in the selection process. The considerations discussed in Chapter 1 are critical to the selection of these sites. Some additional factors which apply to ribbon equipment are as follows:

Water depth (draft) restrictions

Water depth restrictions are shown below.

EQUIPMENT	RESTRICTION
Ribbon raft (fully loaded)	24"
Ribbon bridge	24”
BEB-SD	22"
27-foot BEB	40"

Bank restrictions

The ribbon ramp bay can articulate a maximum of 20 degrees from its horizontal position. This means that the maximum allowable bank height for the loading or unloading of ribbon rafts or bridges is approximately 3.5 feet. The shore leading to the raft or bridge ramp should be gently sloping (no more than a 20 percent slope), generally free of rocks or other debris, and firm.

Current velocity

The velocity of the river’s current can impact significantly upon all float bridging operations. Ribbon equipment can be used in currents of O to 10 FPS. Rafting and bridging operations can become quite difficult in currents greater than 5 FPS unless the boat operators and bridge crewmen have experience working in swift currents. For raft sites on rivers with currents greater than 5 FPS, the unloading site on the far shore should be located downstream of the loading site on the near shore to allow for downstream drift. Some recommended site layouts are shown on pages 32, 33 and 34.

	Divisional Ribbon Company	Corps Assault Float Bridge Company
Number of bridge platoons	2	2
Number of interior bays	20	30
Number of ramp bays	8	12
Number of BEBs	12	14
Longest bridge that can be constructed	485 ft	705 ft

GENERAL CONSTRUCTION
Ribbon Launches

As discussed earlier, there are four methods of launching bridge bays. Table 7 provides the launch site restrictions for these launches. These restrictions are discussed further in the following paragraphs. *TM 5-5420-209-12* lists the actual steps performed when conducting a free, controlled, or high bank launch.

Free

The free launch method is the preferred means of launching ribbon equipment from the M812 bridge transporter. This method allows the bay to roll off the truck and unfold upon entering the water. When adequate preparation is performed in the engineer equipment park, this launch is the fastest method, requiring only a few seconds once the truck backs up to the edge of the water. Ribbon bays can be launched from banks up to 5 feet high with slopes up to 30 percent. The free launch of an interior bay requires a minimum of at least 36 inches of water, while a ramp bay requires at least 44 inches of water. These depths apply when the truck is backed into the water (no bank height) and when bank slopes are 10 percent or less. When free launching a ribbon bay from a bank height of 5 feet and a slope of 30 percent, approximately 72 inches of water is needed.

Controlled

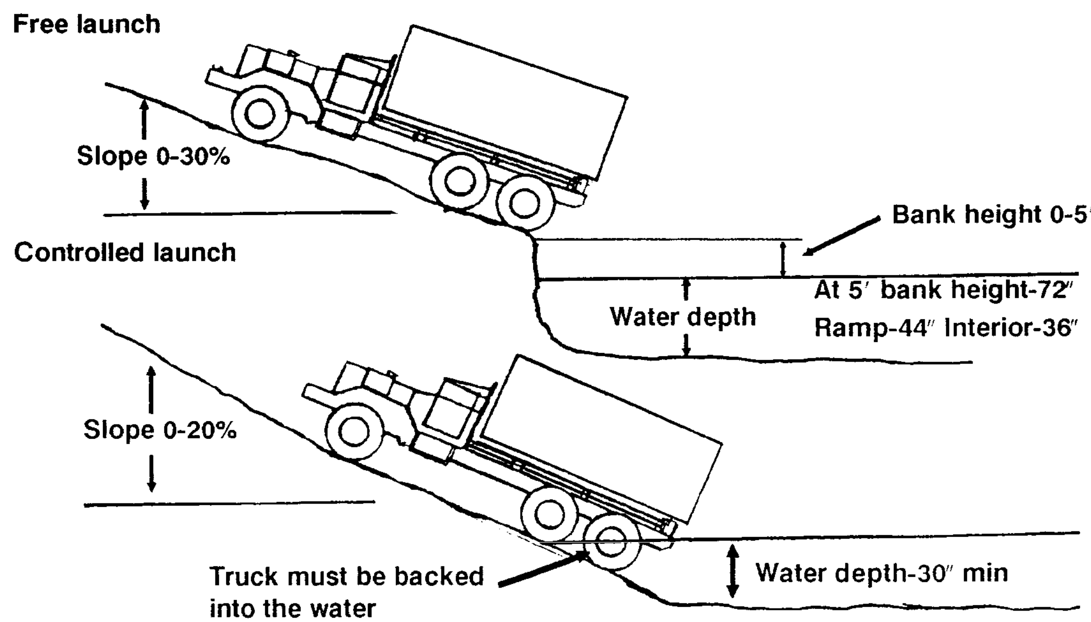
The controlled launch of ribbon bridge bays is recommended when water depth is limited or when shortage of BEBs may exist. When conducting a controlled launch, the transporter operator backs the truck into the water and winches the bay slowly into the water. The bay is allowed to unfold at the operator's discretion.

Table 7. Launch restrictions [4]

Restriction	Free Launch [1]	Controlled Launch	High Bank Launch
Minimum depth of water required	Ramp bay – 44″ [2] interior bay – 36″ [2]	30″ [3]	30″ [3]
Bank height restrictions	0 – 5′	0′	5 – 28′
Bank slope restrictions	0 – 30%	0 – 20%	Level ground unless the front of the truck is restrained

Notes.
1. The free launch is the fastest method of launch from the bridge truck. It is, therefore, the preferred method.
2. The water depth given for a free launch is based upon a 10 percent slope with the transporter backed into the water. The required water depth at a site with a 5-foot bank height and a 30 percent slope is 72 inches. Interpolate between these values if necessary.
3. This is a recommended water depth. Launch could technically be conducted in 17 inches of water.
4. Recommended water depth for helicopter deployment of ribbon bays is also 30 inches.

Methods of launching a ribbon bay



The recommended depth of water at the controlled launch site is 30 inches. This method however, can be used in only 17 inches of water when extreme care is used. (A ribbon bay requires 17 inches of water to unfold.) It is also important to note that the BEB-SD must have 22 inches of water available if it is to be used to maneuver the bay. A controlled launch is normally conducted on banks with a gradual slope (0 to 20 percent) and with no bank height since the truck must back into the water to launch its bay. Execution of the controlled launch normally requires approximately 10 minutes.

High bank

The high bank launch must be used when the bank height at the launch site is between 5 and 28 feet. This method is normally used only when a more desirable site is unavailable. This process has two distinct phases:

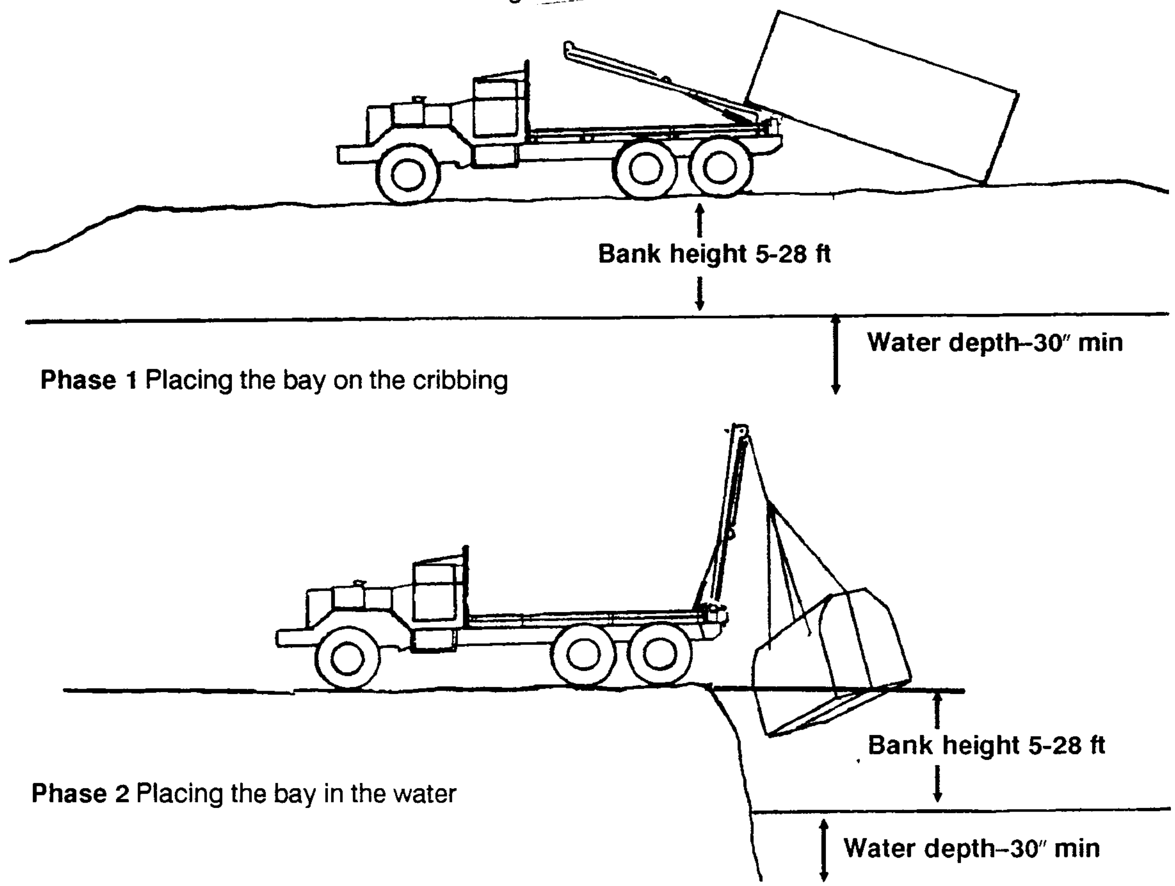
The **first phase** is the off-loading of the bay onto the ground. The transporter is maneuvered parallel to the bank and the bay is lowered onto the ground. Cribbing is used to prevent damage to the bay.

The **second phase** of the launch requires the transporter to be backed perpendicular to the bay. Chains are attached to the four lift points on the bay and the transporter cable is run through the snatch block and attached to the truck's boom. The boom can then be used to lift the bay off the ground and place the bay in the water. If the bank is not completely level, some means of restraining the front end of the truck should be used to prevent the truck from overturning. Thirty inches of water is desired for the high bank launch although the launch can be carefully conducted in 17 inches of water. A BEB is required to secure the bay once it is in the water. The boat operator allows the bay to unfold by opening the downstream travel latch.

Deployment by helicopter

Ribbon bridge bays and BEBs are helicopter transportable. Medium and heavy lift helicopters can be used by the tactical commander to fly rafting and bridging equipment to the crossing sites. Interior bays can be flown at air speeds of up to 80 knots, but must have a drogue parachute attached when flying at speeds greater than 40 knots, to prevent the bay from spinning. Ramp bays can be flown at air speeds of up to 100 knots. Like the high bank launch, a BEB is needed to secure the bay and allow it to unfold. At least 30 inches of water is recommended for such a site. Appendix B provides additional information concerning airlift operations.

High bank launch



Securing Bridge Bays

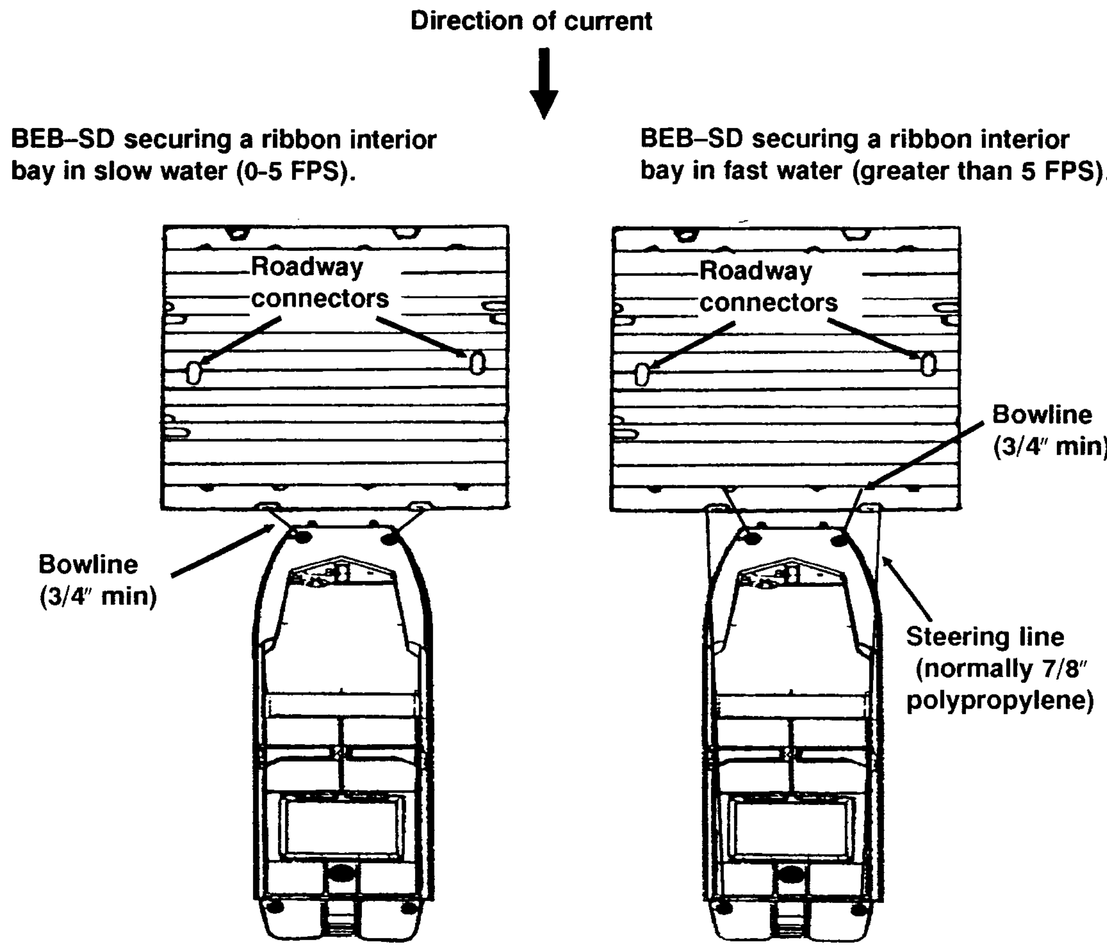
The securing of bridge bays must be completed as quickly as possible so that the bays may be moved from the launching area to the actual raft or bridge site. After the bridge bay has been launched and unfolded, a BEB will approach from the downstream direction. The front pushing knees of the boat are placed against the downstream bow and centered on the bay. The assistant boat operator secures one bowline (at least 3/4 inch in diameter) to each of the anchoring pins on the downstream bow ponton of the ribbon bay. The assistant will then pull each line tight and secure it to the bow bollard on its respective side of the boat. In currents greater than 5 FPS, the bowlines may be attached to the bay cleats. Steering lines can then be attached from the stern bollard to the anchoring pin on the bay. In currents of 5 FPS or less, the steering lines may be omitted. After the bridge bay is connected to the boat, the bridge crew secures the bay as follows:

1. Engage the roadway/roadway ponton upper connectors (dogbones) on the bay. It may be necessary to use the roadway ponton connector tool when engaging the roadway/roadway upper connectors on the ramp bay.

2. Check to ensure that the lower lock drive screw turns freely and the connecting pins are fully retracted.

3. Engage the four roadway/bow ponton bridge latches. The backs of the latches are painted yellow to allow for a visual check on engagement.

Securing bridge bays



CAUTION

If the roadway/bow ponton bridge latches are not engaged, the bow ponton will fold up when a vehicle crosses the bridge.

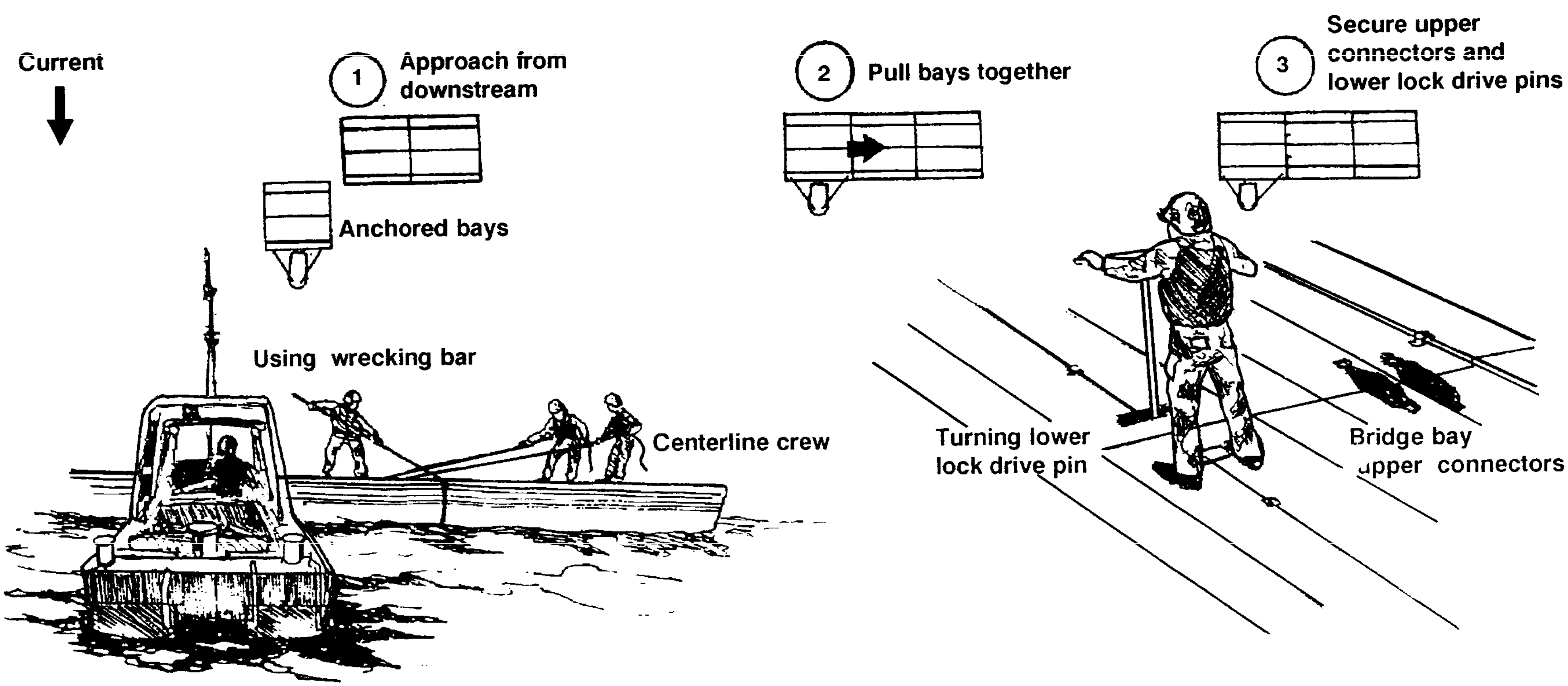
Interior Bay to Interior Bay Connections

1. The boat with the interior bay connected approaches the stationary interior bay from the downstream side.
2. When the bays are as close as possible, the bridge centerline crew tosses the tag lines to the boat crew which connects the lines to the bay rope cleats. The bays are then pulled together. Boat hooks may also be used.
3. The securing crew engages the bridge bay/bridge bay upper connectors.
4. The bridge centerline crew secures the lower lock drive pins by turning the T-bar connecting wrench in the clockwise direction. If connection is difficult, the bridge boat can apply power in forward and reverse to adjust the bay's position. Wrecking bars may also be used to apply an up and down force to the joint by inserting them between the top of the bow walkway of one bay and the bottom of the roadway of the other bay.

Note. The top of the lower lock drive pin is 3/4 inch below the deck when lower lock drive is fully engaged.

5. Disconnect the boat if it is not needed for bridge anchorage or raft propulsion.

Connecting interior bay to interior bay

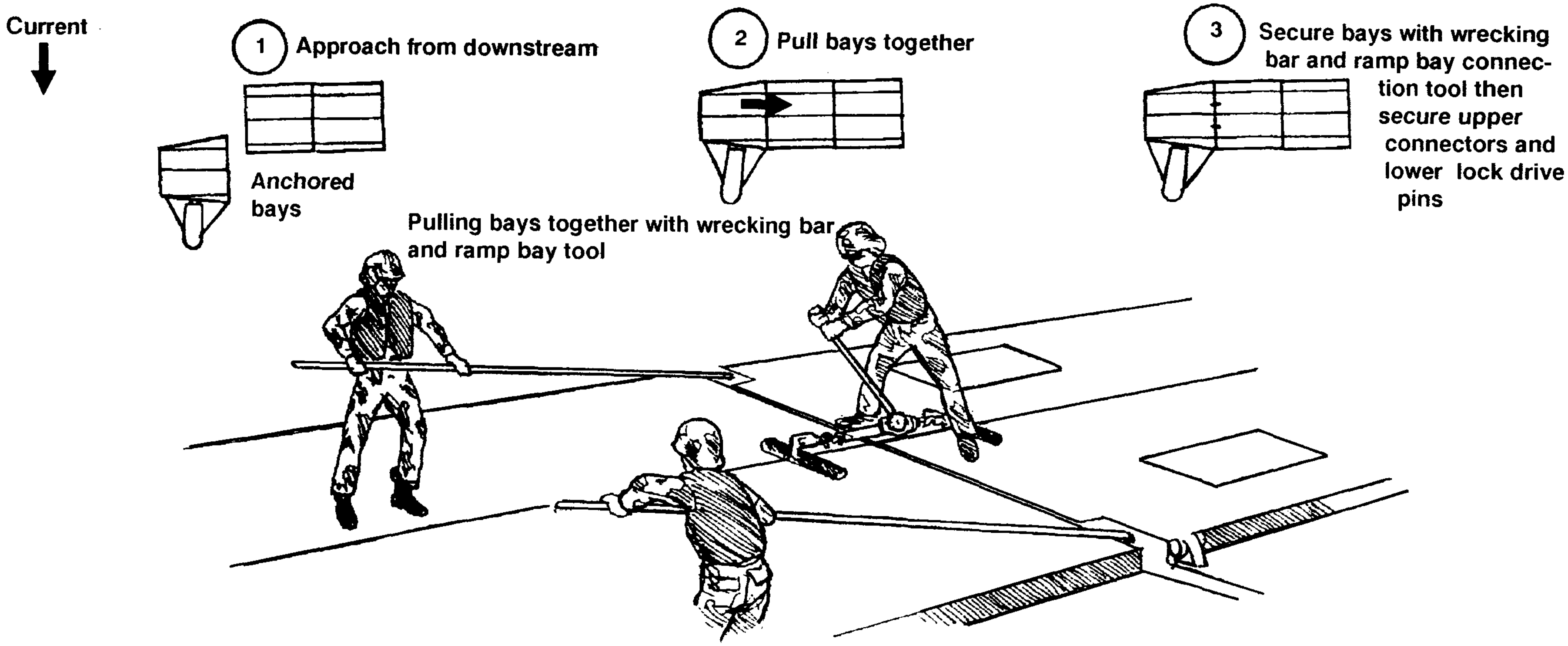


Ramp to Interior Bay Connections

1. The boat which secured the ramp bay approaches two or more connected and anchored interior bays from the downstream side.
2. When the ramp bay has been brought as close as possible to the interior bays, the bridge crew secures it using tag lines and boat hooks. The crew next attaches the ramp connection tool hooks to the roadway/ponton upper connectors of the adjacent interior bay and the ramp bay.
3. The bridge centerline crew aboard the interior bay raises the ramp bay, using the 60-inch wrecking bar. This is done by inserting the bar into the holes in the ramp bay bow hinge blocks using the interior bay roadway as a pivot point, and applying a downward force to the top end of the bar.
4. As force is applied to the wrecking bars, the bays are pulled together by ratcheting the ramp bay connection tool. As soon as the bays are together, engage the bridge bay/bridge bay upper connectors.
5. The lower lock drive pins are then driven by turning the T-bar wrench in the clockwise direction. If the connection is difficult, the ramp pumps may be pumped to raise the connector yoke while force is applied to the T-bar.

   Note. The top of the lower lock drive pins are approximately 3/4 inch below the deck when the pin is fully engaged.
6. Disconnect the boat if it is not needed for anchorage.

Connecting interior bay to ramp bay



RIBBON RAFTING OPERATIONS

Raft Design Criteria

Ribbon rafts may be used during both the hasty and deliberate river crossing to project combat firepower across a water obstacle as rapidly as possible. The type of raft to be constructed depends upon the MLC of the equipment to be rafted, the length of the vehicles, and the current velocity of the river. As a general rule, the number of armored tracked vehicles that can be placed on a ribbon raft will be limited by the load classification of that raft, whereas the number of wheeled vehicles that can be placed on a raft will be limited by the length (load space) of the raft. Table 8 provides the means for designing ribbon rafts, to include a determination of assembly time, load space, rafting method, number of boats required for raft propulsion, and classification for all types of ribbon rafts.

Types of Ribbon Rafts

Ribbon rafts can be constructed in a three-, four-, five-, or six-bay configuration. Tests are being conducted on the use of a seven-bay raft. This information will be made available to commanders in the field upon completion of these tests. The type of raft needed is based upon the MLC required, the length (load space) needed, and the current velocity of the river. A three-bay ribbon raft would consist of one ribbon interior bay and two ribbon ramp bays. This same principle applies for all ribbon rafts. Every ribbon raft will have two ramp bays and either one, two, three, or four interior bays. For example, a six-bay raft would be constructed of four ribbon interior bays and two ramp bays. The six-bay raft provides the greatest MLC and load space.

Table 8. Ribbon raft capabilities

Type of raft	Assembly[1] (min)	Load space[2] (ft)	Method of rafting[3]	Classification based upon current velocity (wheel/track)							
				0-3 fps	4 fps	5 fps	6 fps	7 fps	8 fps	9 fps	10 fps
3–bay	8	22	Longitudinal	45	45	45	40	40	35	30	25
			Conventional	45	45	35	25	15	10	0	0
4–bay	12	44	Longitudinal	70	70	70	60	60	60	55	45
			Conventional	60	60	60	55*	40*	30*	15*	0
5–bay	15	66	Longitudinal	75	75	75	70	70	70	60	60
			Conventional	75	70	70	70*	60*	50*	25*	0
6–bay	20	88	Longitudinal	W96/T80	W96/T80	W96/T80	W96/T70	W96/T70	W96/T70	W70/T70	W70/T70
			Conventional	W96/T75	W96/T70	W96/T70	W70*/T70*	W70*/T70*	W55*/T55*	W30*/T30*	0

Notes.

1. Assembly times are based upon construction during daylight hours. Construction times increase by 50 percent at night.
2. Only interior bays are loaded. Roadway width is 13 feet, 5 inches.
3. If the current velocity in the loading/unloading area is greater than 5 FPS, then conventional rafting must be used.

*Three BEBs are required for conventional rafting of 4-, 5-, and 6-bay rafts in current greater than 5 FPS. In all other cases, conventional rafting is conducted with two boats.

This raft, therefore, provides the greatest flexibility to the maneuver commander.

Assembly Times for Rafts

Table 8 provides the assembly time for each type of ribbon raft. The assembly times provided are based upon construction by a trained bridge section during ideal, daylight conditions. Assembly times will increase by 50 percent for construction at night.

EXAMPLE: What is the planned assembly time for a six-bay ribbon raft to be constructed at night?

SOLUTION: Refer to Table 8. For a six-bay ribbon raft, the given assembly time is 20 minutes. This time represents the required assembly time for daylight construction, at night, add 50 percent. Therefore, the assembly time at night is 20 minutes plus 10 minutes, or a total of 30 minutes.

Load Space of Ribbon Rafts

Table 8 provides the load space for each type of ribbon raft. Each ribbon interior bay provides 22 feet of effective load space and a roadway width of approximately 13.5 feet. Ramp bays are not loaded and, therefore, not considered when determining available load space. Similarly, the bow pontons are designed as walkways on either side of the roadway and are not loaded.

EXAMPLE: What is the planned load space of a six-bay ribbon raft?

SOLUTION: Refer to Table 8. Load space for a six-bay ribbon raft is given as 88 feet. The roadway width is 13 feet 5 inches.

Classification of Ribbon Rafts

The determination of the MLC of a ribbon raft is based upon the river's current velocity and the method of rafting. The current velocity is determined by conducting a reconnaissance at the proposed rafting site. The process for selecting the method of rafting is described below.

Methods of rafting

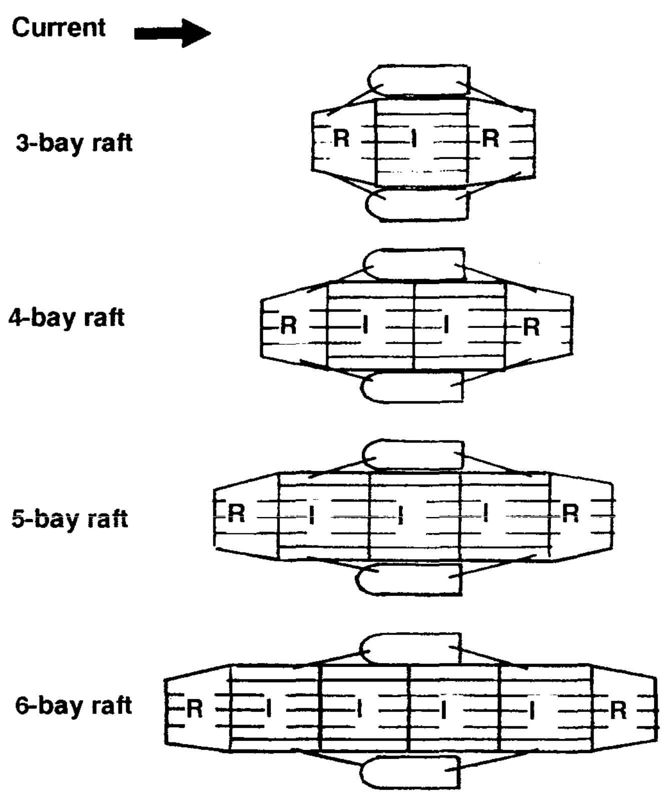
As discussed in Chapter 2, the two methods of rafting ribbon equipment are conventional and longitudinal rafting. Each method has its advantages and disadvantages. The selection of either depends upon the current velocity, the number of BEBs available, and the MLC of the vehicles to be crossed.

Longitudinal. This method is generally the preferred method of rafting heavy equipment. The longitudinal method typically provides a higher raft classification. When rafting longitudinally, two BEBs are tied off parallel to the raft's roadway (one on each side of the raft). The longitudinal method should not be used when the current velocities in the loading or unloading areas exceed 5 FPS. In these instances, conventional rafting should be used.

Conventional. When rafting conventionally, the BEBs are tied off perpendicular to the raft and on the downstream side. The number of boats required when rafting conventionally depends upon the type of raft and the river's current velocity. A three-bay raft always requires two boats for propulsion. When propelling a four-, five-, or six-bay ribbon raft, two boats can be used in currents of O to 5 FPS. Three boats must be used when these rafts are propelled in currents greater than 5 FPS.

EXAMPLE: Given a raft site with a current velocity of 8 FPS in the main channel and 6 FPS in the loading area, what method of rafting will be used and how many boats are required to

BEB-SD connections to ribbon rafts using the longitudinal method



Notes.

1. I represents an interior bay
2. R represents a ramp bay
3. Rafting brackets must be utilized and secured with 1/2-inch lines to boat cleats.
4. Stern line connections run from anchor pins, through the capstan, and the free end of the rope is secured to one of the stern bollards.
5. Bowline connections run from anchor pins to the bow bollard.

propel a six-bay ribbon raft? What is the classification of this raft?

SOLUTION: Given a current velocity greater than 5 FPS in the loading area, CONVENTIONAL rafting should be used. Since the highest current velocity expected is 8 FPS and a six-bay ribbon raft is used three boats are required for conventional rafting. Next, refer to Table 8. Given a six-bay ribbon raft, rafting conventionally in a current of 8 FPS, the MLC of the raft is Class 55 for both wheeled and tracked vehicles.

Note. The asterisk by this classification reaffirms the fact that three boats are required for propulsion of this raft.

Ribbon Raft Construction

Construction of ribbon rafts is generally accomplished in four steps:

1. Launching bays
2. Securing bays
3. Connecting bays
4. Securing the raft

Procedures for the launching, securing, and connecting of bays, are discussed in this chapter under General Construction. Raft construction and the securing of rafts to boats are discussed in the following paragraphs.

Raft assembly

Rafts are generally assembled as follows:

1. Launch all boats required to construct and propel the raft.

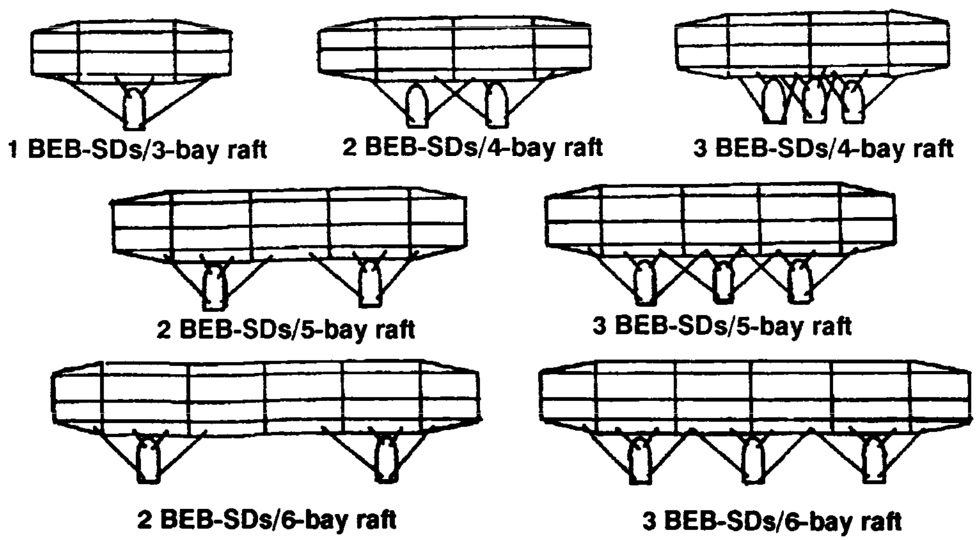
2. Launch a ribbon interior bay. Secure the bay and move it upstream to the construction site (when applicable).

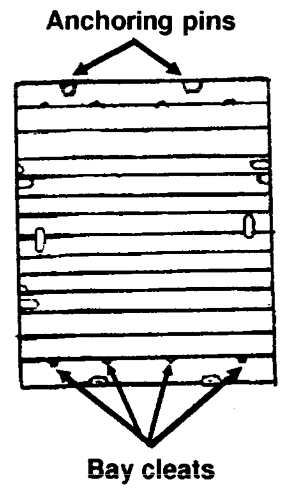
3. Launch all other interior bays as required for the type or size of the raft to be built. Secure these bays and move them upstream to the assembly area.

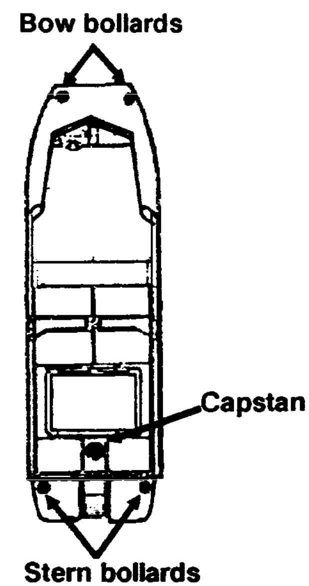
4. Check all bays prior to connection to ensure that the lower lockpin is in the OPEN position, the roadway/bow ponton bridge latches are engaged, and the roadway/roadway ponton travel latch is rotated down.

5. Connect all interior bays.

BEB-SD connections to ribbon rafts using the conventional method







6. Launch the first ramp bay and attach it to the raft on the near shore end of the raft.
7. Launch and attach the second ramp bay.
8. Tie off the boats to the raft.

Securing rafts

The manner in which boats are tied off to ribbon rafts depends upon the method of rafting that is selected. Refer to *TM 5-5420209-12* and *7345-1940-277-10* for additional guidance.

RIBBON BRIDGING OPERATIONS

Design of Ribbon Bridges

Ribbon bridges will initially be the primary crossing means during the bridging phase of a deliberate river crossing. When designing ribbon bridges, the quantity of ribbon equipment needed, the required assembly time, and the classification of the bridge are major considerations.

Determination of Equipment Requirements

The number of ribbon interior bays needed to bridge a given gap can be determined using the formula:

$$\text{Number of interior bays} = \frac{\text{Gap (in feet)} - 45}{22}$$

OR

$$\text{Number of interior bays} = \frac{\text{Gap (in meters)} - 14}{6.7}$$

Additionally, two ramps are required for every ribbon bridge (one at each end of the bridge).

EXAMPLE: How many ribbon interior bays are needed to bridge a gap across a 500-foot river?

Table 9. Classification of ribbon bridges

Type of crossing		Bridge classification based upon current velocity							
		0–3 fps	4 fps	5 fps	6 fps	7 fps	8 fps	9 fps	10 fps
Normal	Wheel	96	96	96	96	82	65	45	30
	Track	75	75	70	70	70	60	45	30
Caution	Wheel	105	105	100	100	96	75	50	35
	Track	85	85	80	80	80	65	50	35
Risk	Wheel	110	110	105	105	100	82	65	40
	Track	100	95	90	90	90	75	65	40

Notes.
1. For a normal crossing –
- The maximum safe speeds are:
  Class 0 to 40—15 mph on ramps and 25 mph on bridge.
  Over Class 40—5 mph on ramps and 15 mph on bridge.
- Vehicle spacing is a minimum of 100 ft (front to back)
- No sudden stopping or accelerating on the bridge

2. For a caution crossing –
- The maximum safe speed is 8 mph on ramps and bridge
- Vehicle spacing is a minimum of 150 ft (front and back)
- Vehicle must be centered on the centerline of the bridge
- No stopping, accelerating, or shifting gears on bridge

3. For a risk crossing –
- The maximum safe speed is 3 mph on ramps and bridge
- Only one vehicle is allowed on bridge at a time
- Vehicle must be centered on the centerline of the bridge
- No stopping, accelerating, or shifting gears on bridge
- A ground guide must be provided for each vehicle

SOLUTION: Number of interior bays

$$= \frac{500 - 45}{22} = 20.7$$

Round up to 21 interior bays.

Assembly Time for Ribbon Bridges

Ribbon bridges can be emplaced during daylight hours at the rate of 600 feet per hour or 200 meters per hour. Assembly times should be increased by 50 percent when construction is at night. These times are also based upon the use of art experienced bridge crew for bridge construction under ideal conditions.

EXAMPLE: How much time is required to construct a 500-foot ribbon bridge at night?

SOLUTION: Divide the required length of bridge by the assembly time (day) and then add 50 percent for night construction.

$$\frac{\text{500 feet of bridge}}{\text{600 feet per hour}} = .833 \text{ hours (day)}$$

$.833$ hours (day) x $1.5 = 1.25$ hours (night)

So it would take 1.25 hours or 1 hour and 15 minutes.

Classification of Ribbon Bridges

The classification of a ribbon bridge is based upon the current velocity at the bridge site. Table 9 gives bridge classifications for different current velocities.

EXAMPLE: What is the classification of a 500-foot ribbon bridge in a river with a current velocity of 7 FPS? Assume that a normal crossing will be conducted.

SOLUTION: Read Table 9. The length of the bridge has no impact upon the bridge's classification. Reading across the table, for a normal crossing a ribbon bridge constructed on a river with a current velocity of 7 FPS will be capable of crossing wheeled vehicles with an MLC of 82 (or less) and tracked vehicles with an MLC of 70 (or less).

Construction of Ribbon Bridges

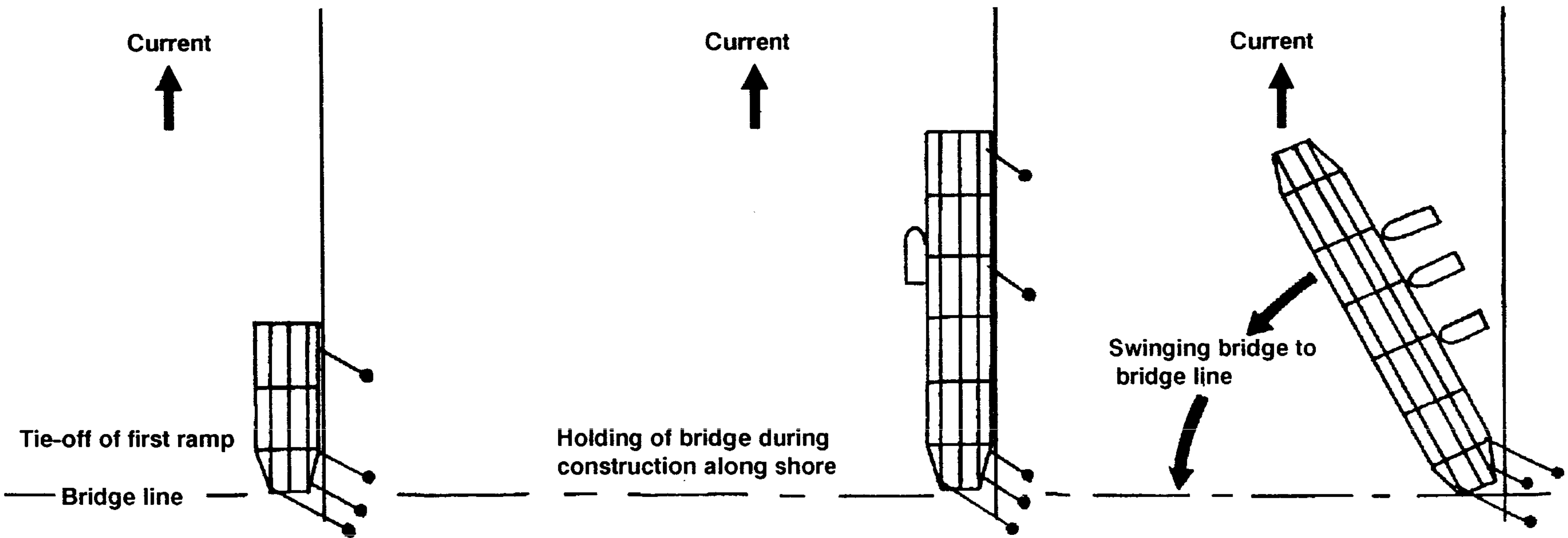
The two textbook methods of constructing ribbon bridges are the swinging bridge and the successive bay techniques. River conditions such as the current velocity and the existence of obstacles are the major considerations in the selection of either bridging method. The swinging bridge method is normally the fastest of the two procedures. It is recommended that this method be used only when currents are 5 FPS or less and when site conditions are nearly ideal (minimal debris in the water and no obstacles in the river). The successive bay method is therefore recommended in rivers with fast currents (greater than 5 FPS) and in situations where debris in the water is prevalent, or when obstacles such as sandbars or islands exist in the vicinity of the construction site.

Swinging bridge method

The purpose of the swinging bridge method is to allow connection of the bays to be made along or near the shore, where the current will be considerably slower than in the main channel. This makes bay-to-bay connections easier. Once the connections are made, the bridge is swung into place using BEBs. An additional limitation is that the exact length of the bridge must be known to successfully use this assembly method. Note that the bridge must always be swung upstream, against the river's current. Assembly using this method is normally accomplished as follows:

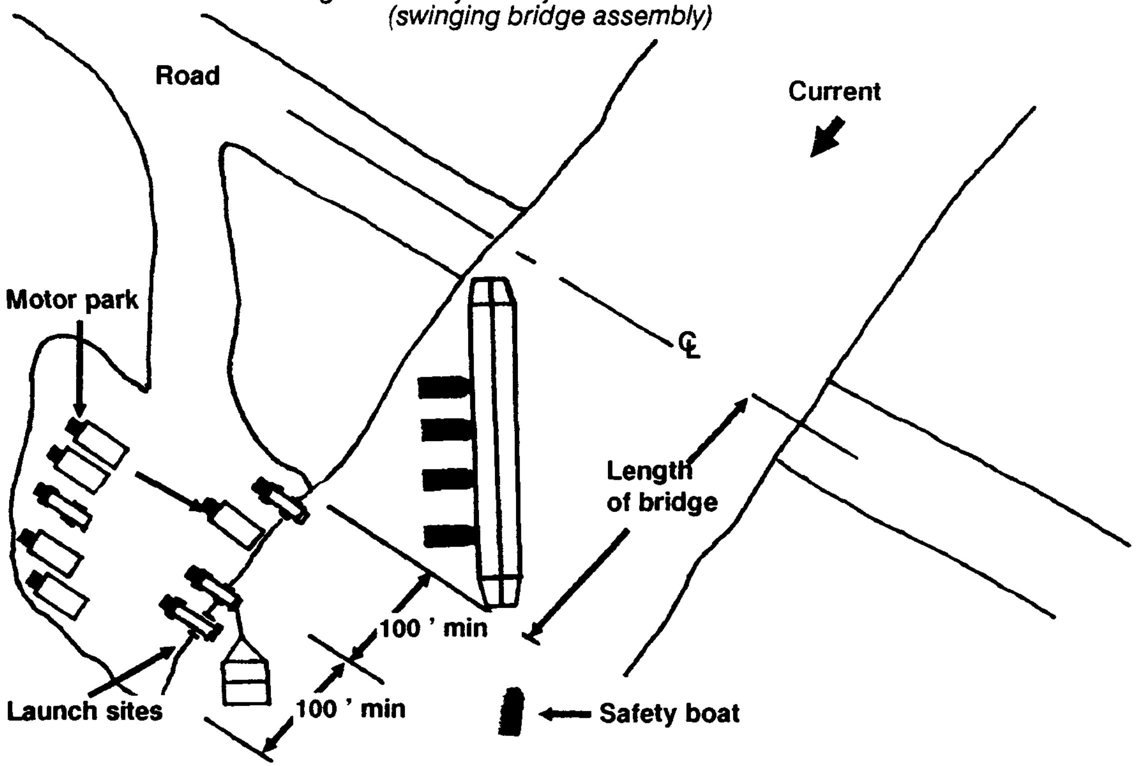
1. Launch the required number of BEBs.

Bridge assembly using the swinging method



2. Launch two interior bays. Secure these bays using two of the BEBs that were launched earlier.
3. Move the bays to the assembly area just below the bridge centerline and connect them.
4. Launch one ramp bay, secure it with a BEB and move the bay to the assembly area.
5. Connect the ramp bay to the interior bays forming the near shore end section.
6. Anchor the near shore end section to the shore temporarily. A bridge transporter may be used as temporary anchorage.
7. Once the ramp bay has been moved from the launch area, proceed to launch and connect the bays needed to complete the bridge. Hold the assembled bridge with BEBs as required.
8. After the connection of the final ramp bay, articulate the far shore ramp. This is done by setting the pump valve lever on the PUMP position, opening the reservoir vent valve and pumping to the desired elevation.
9. Swing the bridge until sufficient room is available to maneuver additional BEBs to the downstream side of the bridge. Swinging of the bridge can be started by attaching a boat to the end ramp bay and towing the bridge until additional boats can be connected.
10. Completely swing the bridge into position and adjust the anchorages as needed.
11. Lower the ramps for grounding and position the bridge transporters for end span anchorage.
12. Set the ramp pump valve levers to the TRAFFIC position and close the reservoir vent valves. Raise the handrails and move the bridge bay/bridge bay upper connectors to the UNLATCHED position, except for those connecting ramp bays to interior bays.

Bridge assembly site layout for multilaunch site (swinging bridge assembly)

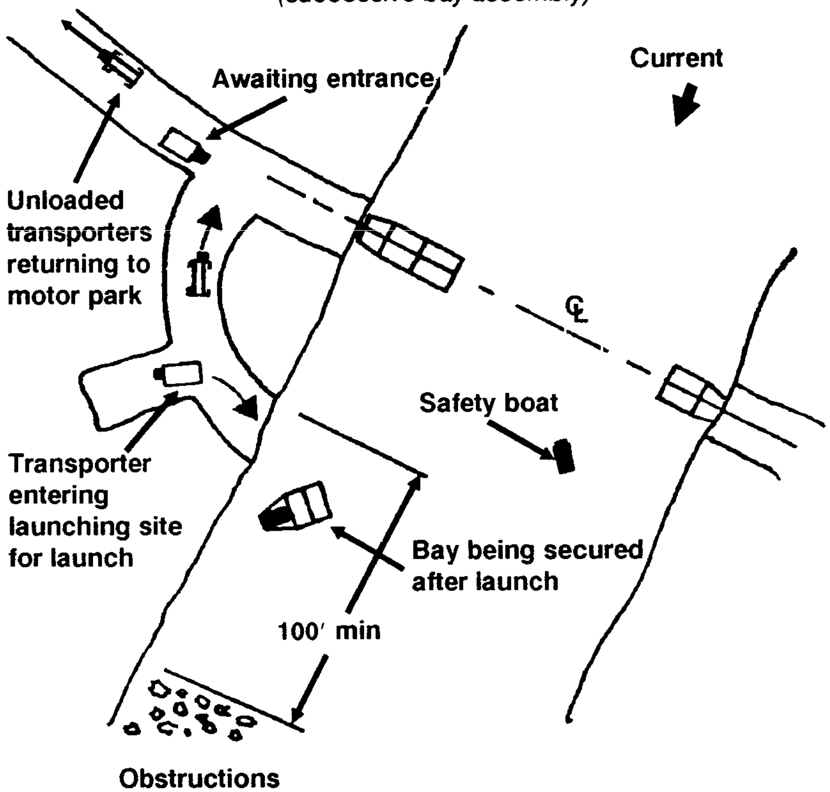


Successive bay method

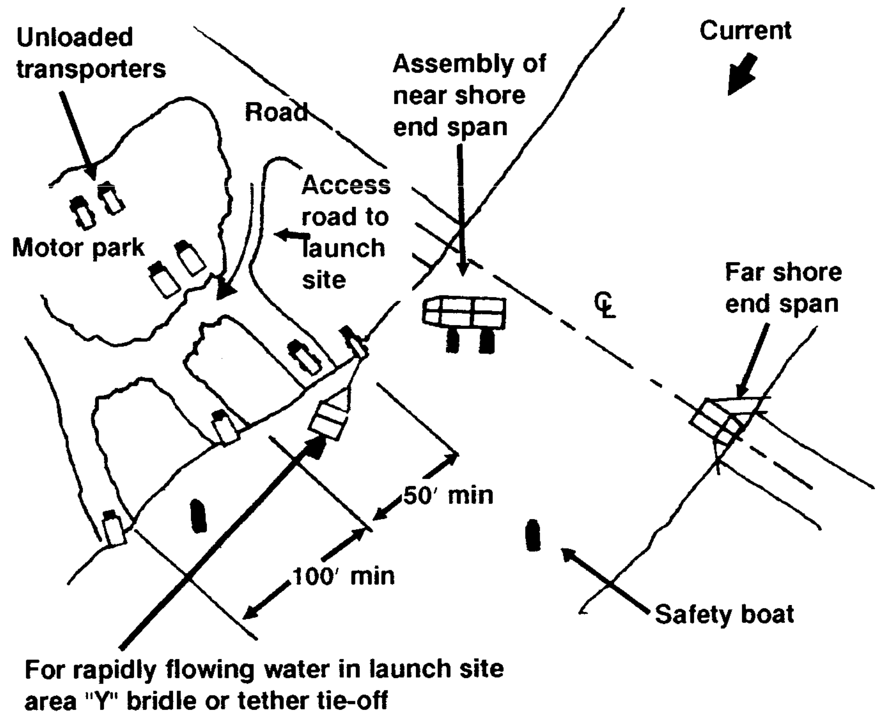
The assembly of a ribbon bridge by successive bays is accomplished by the consecutive addition of bays along the bridge centerline. This method is normally used in fast currents or when a number of river obstacles are present in the vicinity of the construction site. The construction of a ribbon bridge using this method is normally accomplished as follows:

1. Launch the required number of BEBs.
2. Launch two interior bays. Secure these bays using two of the BEBs that were launched earlier.
3. Move the bays to the assembly area located at the far shore end of the bridge centerline and connect them.

Bridge assembly layout for single launch site (successive bay assembly)



Bridge assembly layout for multilaunch site (successive bay assembly)



4. Launch one ramp bay, secure it with a BEB and move the bay to the assembly area at the far shore.

5. Connect the ramp bay to the interior bays forming the far shore end section.

6. Anchor the far shore end section to the shore temporarily using approach guys attached to deadmen or some other form of holdfast. To accomplish this, the bridge centerline crew articulates the ramp bay enough to allow the ramp bay to ground. The bay is pulled shoreward, the approach guys tightened and the ramps lowered. Articulation of the ramp is accomplished by opening the reservoir vent valve, setting the pump valve lever in the PUMP position, and pumping.

7. As soon as the first ramp and interior bays are launched and moved from the launching area, repeat steps 2 through 4 for construction of the near shore end span.

8. Move the bays to the near shore bridge centerline and connect them. The near shore anchorage crew provides temporary anchorage, articulates the ramp, and with the use of a transporter pulls the bays shoreward to allow enough room for bridge closure.

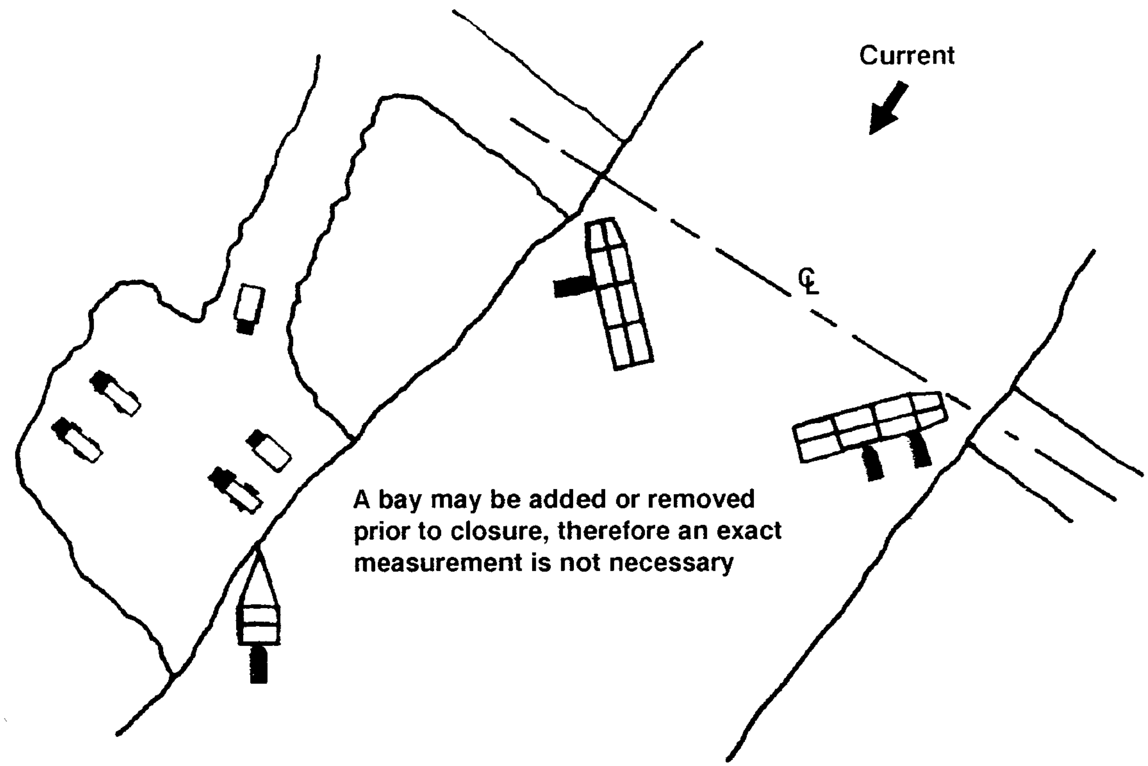
9. Launch the interior bays needed to complete the bridge. Move the bays to the far shore bridge centerline and connect the bays working from the far shore to the near shore.

10. After each connection, the BEBs not needed for bridge anchorage will return to the launch area to secure another interior bay until all bays have been secured.

11. When closing the bridge, the last interior bay will be moved into place and connected to the far shore centerline first. The near shore end span will then be pushed offshore by either the transporter rear winch and boom or manually until the final connection is made. The ramp must be articulated to allow for this offshore movement.

12. Set the ramp pump valve levers to the TRAFFIC position and close the reservoir vent valves. Raise the handrails and move the bridge bay/bridge bay upper connectors to the UNLATCHED position, except for those connecting ramp bays to interior bays.

Modified swinging bridge method



Alternative methods of bridge construction

In many cases, the textbook methods for constructing ribbon bridges may be infeasible or unacceptable. In these circumstances, the bridge officer in charge (OIC) and the noncommissioned officer in charge (NCOIC) must decide upon an original or expedient method of construction. It may be desirable, for example, to modify the swinging bridge method. This can be accomplished by building along both the near and far shore, and swinging the bridge closed against the current. This method prevents the need for an exact measurement along the bridge centerline, since a bay may be added or removed prior to closure. The successive bay method of construction may also be modified. Once the near and far shore ramp sections are installed it is possible to continue to add ribbon interior bays to both end sections, working towards the middle. After construction is finished, BEBs help maneuver the bridge sections together.

Anchorage of Ribbon Bridges

Because ribbon bridges are used primarily as assault bridges, the anchorage systems for these bridges are generally temporary in nature. Normally, anchorage of ribbon bridges is accomplished by tying BEBs to the downstream side of the bridge. The number of boats required depends primarily upon the river's current velocity as shown in Table 10.

When using BEBs as a system of a temporary anchorage, boats should be checked for fuel consumption at least every 2 hours and refueled as necessary. Standby boats should be available to replace disabled boats. Refer to Table 11 for planning figures for the consumption of fuel by boats.

In addition to the BEBs used to hold the bridge against the river's current, approach guys must be installed in accordance with (IAW) Chapter 8. Approach guys prevent the bridge from creeping away from the shore as a result of the impact of vehicles driving onto the bridge's ramps. If it is determined that the bridge will need to be in position for a long period of time, more permanent systems of anchorage should be considered (see Chapter 8).

OPERATIONAL MAINTENANCE

Operators and bridge crewman should refer to *TM 5-5420-209-12* when performing preventive maintenance checks and operator level services on any of the components of the ribbon equipment system.

Inspections

Preventive maintenance and frequent inspections of ribbon rafts and bridges, while they are in use, is an essential step in ensuring that the bridge is capable of performing its required mission. During a rafting operation, the raft commander is responsible for ensuring that these checks are made. In bridging operations, a maintenance crew, under the supervision of a noncommissioned officer (NCO), is normally assigned to the bridge. Some inspections which should be performed include--

Leakage

At least once every 3 hours during heavy traffic periods, the pontons should be inspected for leakage. If a significant amount of water is found, it should be pumped out using the bilge pump.

Table 10. Anchorage of ribbon bridges

Current velocity (FPS)	Number of boats	Number of bridge bays
0–6	1	6
7–8	1	3
9	1	2
Over 9	Bridge must be anchored using an overhead cable system (see Chapter 8).	

Table 11. Fuel consumption of bridge erection boats

BEB-SD	
Fuel capacity	75 gal
Fuel consumption (per engine)	
At 1,750 RPM	2.8 gal/hr
At 2,000 RPM	4.2 gal/hr
At 2,250 RPM	6.0 gal/hr
At 2,450 RPM	10.8 gal/hr
27-foot BEB	
Fuel capacity	90 gal
Fuel consumption	
At 2,400 RPM	5.0 gal/hr

Debris

Do not allow debris to build up against the upstream bow. Most debris should pass completely beneath the bridge, depending upon the size of the debris and the nature of the river's current.

Roadway

During periods of heavy traffic, debris such as mud, dirt, and rocks may be deposited on the bridge or raft roadway surface. Wash down the roadway surface with the bilge pump at frequent intervals (as permitted by the tactical situation and the need for operation of the bridge or raft).

Ramp cylinder controls

Prior to allowing vehicle traffic on the bridge, the NCOIC must check the ramp cylinder controls. The ramp cylinder pump valve lever will be placed in the TRAFFIC position. This will allow the ramp bay to automatically adjust to any rise in the water level. To compensate for falling water level, the pump valve must be placed in the PUMP position and pumped until the ramp bay reaches the lower water level. Once the ramp has been repositioned, place the lever in the TRAFFIC position before allowing additional traffic on the bridge.

Shore erosion

When bridges are subjected to heavy use, the wave action at each ramp may cause the shore to wash out. The end span anchorage system must be taut to keep the bridge movement to a minimum. If the erosion continues, the ramps should be raised and sandbags or other suitable fill material should be placed under the ramp roadways. This condition can often be eliminated by adding an interior bay and pulling the ramps further onto the shore.