EXPEDIENT SUSPENSION BRIDGES

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SECTION I

THREE-ROPE BRIDGE

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78 CAPACITY.—The three-rope bridge (fig. 41) will carry five men under full field pack at 5-pace intervals.

79 SPAN.—The bridge can span gaps up to 150 feet. Longer spans are unsafe, being unstable when loaded at midspan.

80 SAG RATIO.—A 5 percent sag ratio is used, the dip in the main-cable ropes being one-twentieth of the span length. Example:

Span length = 120 feet
Sag ratio = 5 percent
$D = \frac{1}{20} \times 120 = 6$ feet

FIGURE 41. *Three-rope bridge. An expedient used to cross foot troops.*

81 MATERIALS REQUIRED.—The cables consist of one 1-inch tread rope and two ¾-inch hand ropes. The suspenders are ½-inch rope. A set of blocks is required to erect bridges with spans exceeding 100 feet.

82 TIME AND PERSONNEL.—One squad of 12 trained men can cut and whip all ropes and construct a 100-foot bridge in 45 minutes. If the suspender ropes have been previously cut and whipped the bridge can be built in 30 minutes.

83 BRIDGE SITE.—The completed span must be less than 150 feet from anchorage to anchorage.

Trees of 10-inch minimum diameter are required as anchorages for the tread rope; 8-inch trees are necessary for the hand ropes.

When the bridge crosses a stream the anchorages must be high enough to keep the middle of the span above water.

84 RECOMMENDED ERECTION PROCEDURE (fig. 42).—A The length of the required span is measured by tying a piece of tracing tape to the far-and near-side anchorages and allowing it to sag 5 percent. The tread and hand ropes are sufficiently longer than the span to allow for the lashings tied to the anchorages.

B The tread and hand ropes are laid out as shown in figure 42 (1). The 1-inch rope is between the two ¾-inch ropes. The ropes are placed 3 feet apart.

C The suspender ropes are cut 12 feet long and placed on the tread and hand ropes at 2-pace intervals. The end suspenders are placed far enough from the ends of the ropes to allow enough rope to make the ties at the anchorages.

D The suspenders are tied to the 1-inch tread rope with a clove hitch. The two ends of the suspender ropes pass under the tread rope as shown in figure 42 (2).

E Each hand rope is then lifted elbow-high as shown in figure 42 (3) and the suspender is tied to it by a clove hitch or a rolling hitch. The running end may be tied back to the standing part with two half hitches. The other suspenders are attached in the same manner.

F The squad ties the first 12 suspenders simultaneously. If more suspenders are used, they are tied in the same man-

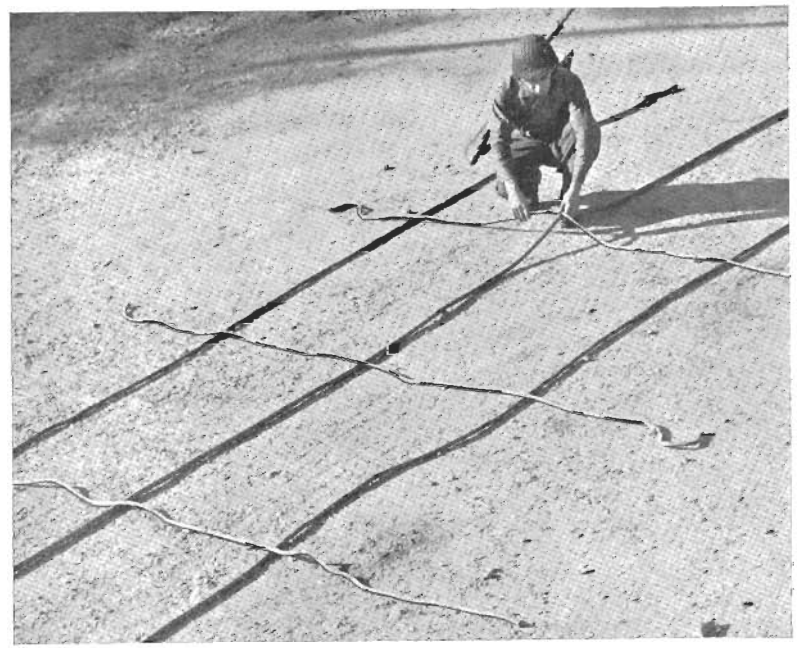

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FIGURE 42. *Erection of three-rope bridge.* (1) *Ropes are laid out on ground near site.* (2) *Suspenders are tied to tread rope.*

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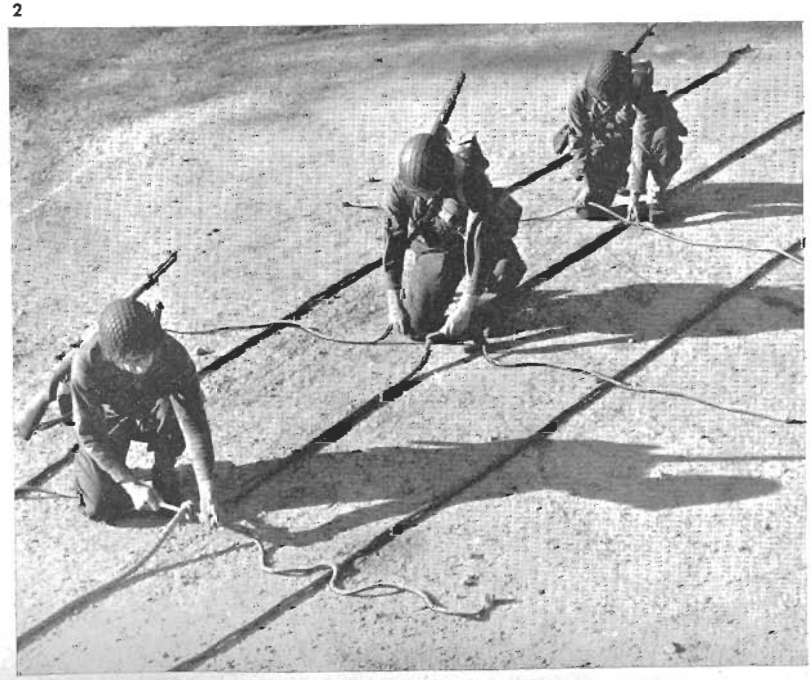

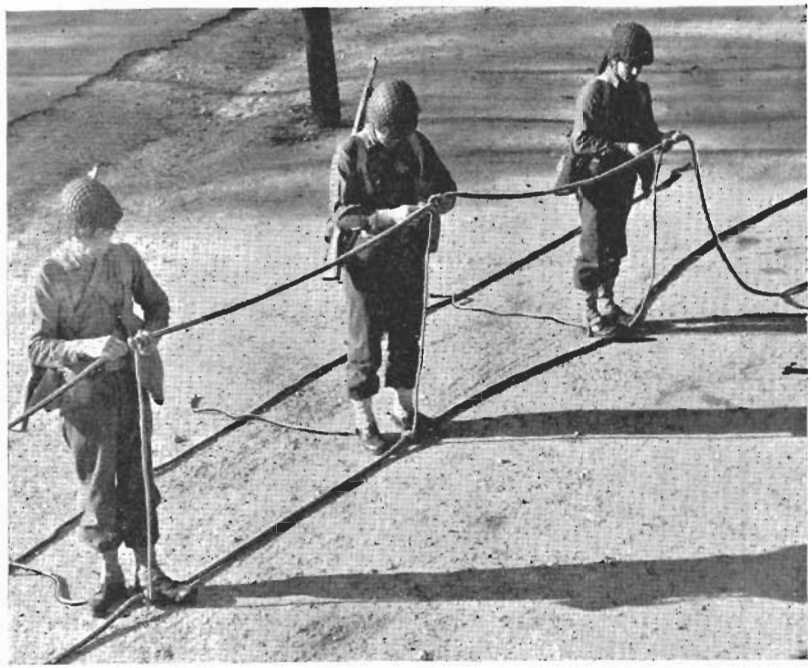

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FIGURE 42. *Erection of three-rope bridge.* (3) *Suspenders are tied to hand rope. Note that hand rope is elbow-high.* (4) *Assembled bridge is carried into position.*

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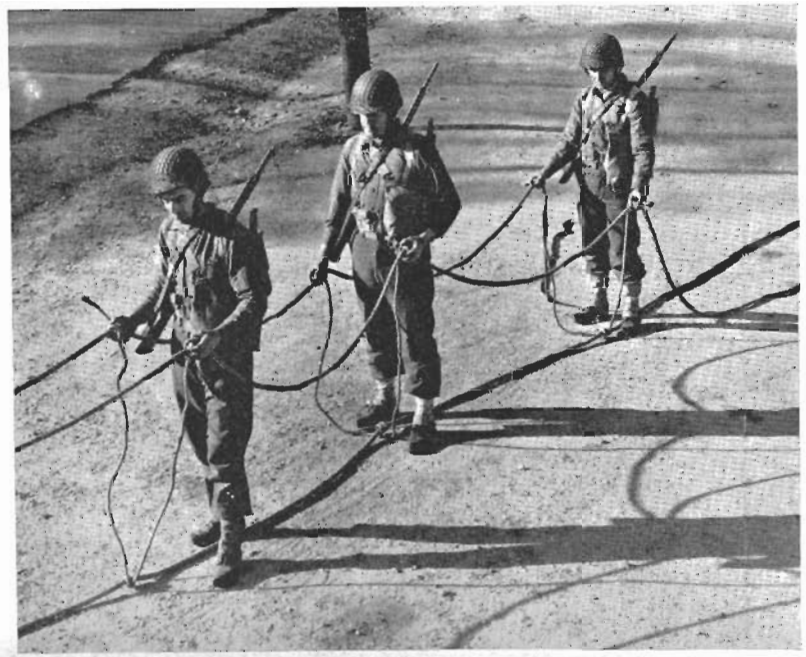

ner. The assembly then is carried to the bridge site as shown in figure 42 (4).

G The three cables are pulled to the far side by a ½-inch line and tied to the far-side anchorages with a bowline or a mooring knot. If the bowline is used an extra turn is taken around the anchorages at the far side. The running ends are tied back to the standing parts with two or three half hitches.

H When all ropes are anchored on the far side a ½-inch line is tied to the tread rope on the near side and its sag is adjusted. The tread rope is then tied to its anchorage with a mooring hitch. The hand ropes are pulled tight in the same way and are made fast with mooring hitches (fig. 43).

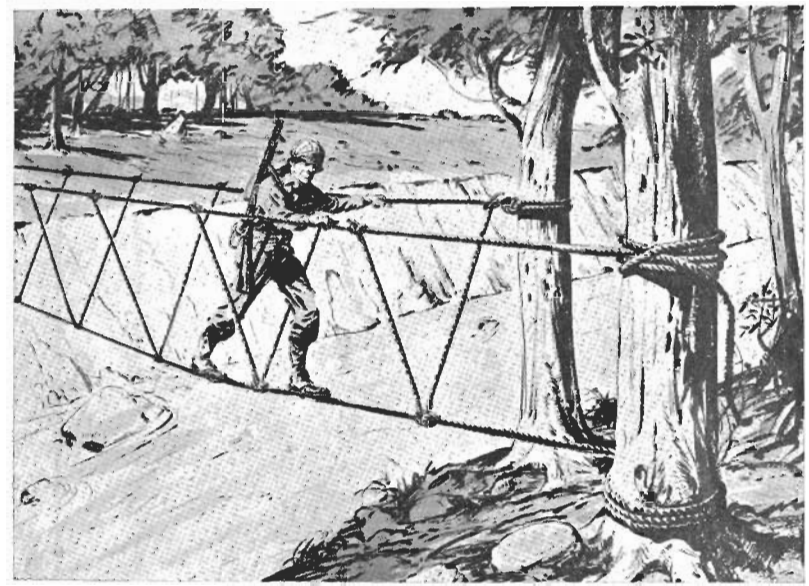

FIGURE 43. *Expedient-bridge anchorage. Anchorage is made to trees on either bank.*

85 COMPLETED BRIDGE.—When the bridge is complete (fig. 44) it is tested to see that all knots and ties are properly made and suspender ropes are adjusted. Frequent inspection and adjustment of knots and ties is necessary.

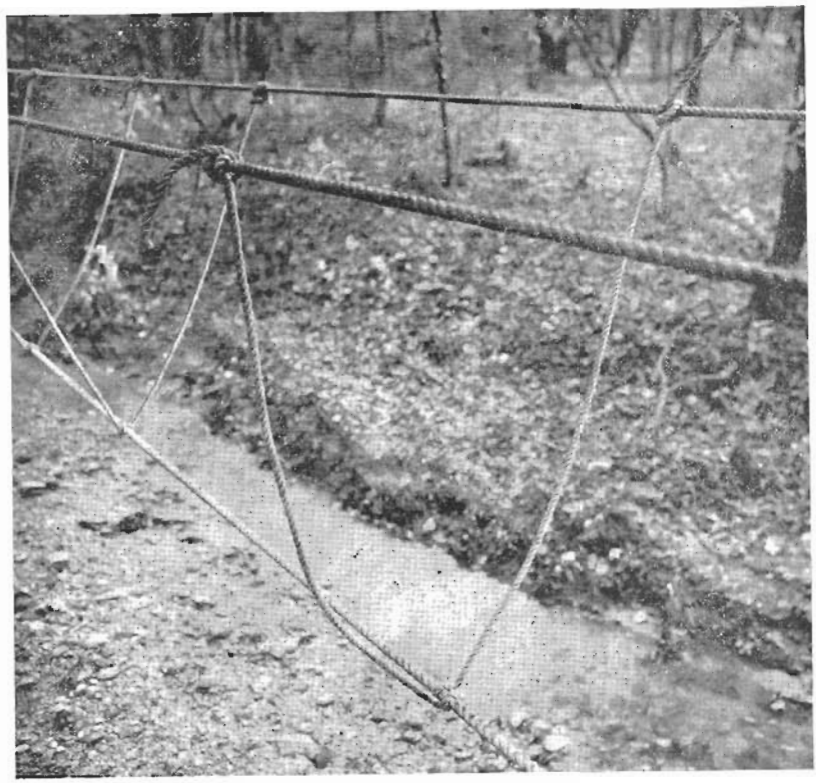

FIGURE 44. *Suspender detail of three-rope bridge.*

SECTION II

EXPEDIENT FOOTBRIDGE

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86 CAPACITY.—This bridge (fig. 45) will carry foot troops with full field pack, or pack mules and handlers, as follows:

A *Foot troops.*—Seven men under full field pack maintaining 5-pace intervals and crossing at route step in single file.

B *Pack mule.*—One pack mule and handler.

87 SPAN.—The bridge can span gaps up to 100 feet.

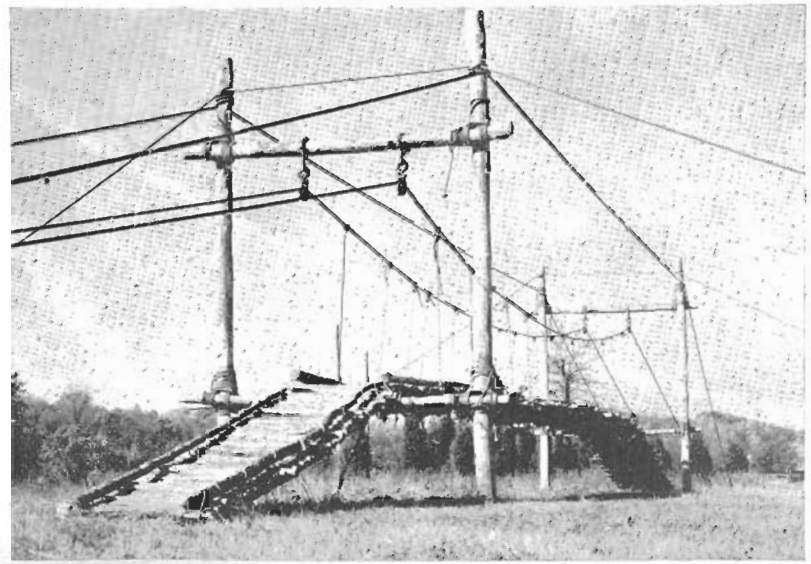
88 SAG RATIO.—A 5 percent sag ratio is used.

89 MATERIALS REQUIRED.—The materials used for the bridge illustrated in figure 45 are given below. Dimensions and amount of materials will vary with the span and site.

A *Main cable.*—The main cables are 1-inch rope. Two 250-foot coils are required.

B *Suspenders.*—The suspenders are ¾-inch rope. Two are used at each panel point. Panel points are 6 feet apart. Effective and cut suspender lengths are given for each panel point in Table VII.

FIGURE 45. *Expedient footbridge. Bridge built using manila rope and material found at the site. Erection will be rapid if troops are first trained by dry-land erection.*



C *Tower guys.*—1 - Side guys require two 150-foot coils of ¾-inch fiber rope.

2 - Tower-to-tower back guys require two 250-foot coils of ¾-inch rope.

D *Tower lashings.*—1 - Four 50-foot lengths of ¾-inch rope are required to lash cap to tower uprights.

2 - Tower floor-beam lashings, if used, require four 70-foot lengths of ¾-inch rope.

E *Floor lashing.*—Four 75-foot lengths of ¾-inch rope are used on the approach ramps. Two 35-foot lengths of ¾-inch rope are used in each panel to hold flooring.

F *Main-cable saddle assembly.*—Four 8-inch snatch blocks and four 8-foot lengths of 1-inch rope are used as main-cable saddles.

G *Deadman.*—A suitable log is used as a deadman.

H *Towers.*—

1 - *Posts.*—Two 10-inch, 20-foot posts.

2 - *Cap.*—An 8-inch log 10 feet long.

3 - *Tower floor beam.*—An 8-inch log 10 feet long is used to support the first panel and the approach ramp.

4 - *Sill and footings.*—Sills, if used, are notched 12-inch timbers. Footings are of split logs. Rock and boulders placed in a hole 4 feet square and 4 feet deep furnish adequate tower-upright foundations.

I *Floor system.*—

1 - *Floor beam.*—A 6-inch log 5 feet long is used at each panel point as a floor beam.

2 - *Stringers.*—Two 6-inch logs 8 feet long are used in each panel as stringers.

3 - *Curbs.*—Two 5-inch logs are used in each panel as curbs.

4 - *Flooring.*—Four-inch logs 5 feet long are used as flooring.

90 TIME AND PERSONNEL.—One platoon can erect a 100-foot bridge in 6 hours.

91 BRIDGE SITE.—The bridge site must meet the following requirements.

TABLE VII. *Effective and cut suspender lengths of expedient footbridge.*

Panel Point	Number Required	48 feet.		60 feet.		72 feet.		84 feet.		96 feet.		108 feet.	
		Effective	Cut	Effective	Cut	Effective	Cut	Effective	Cut	Effective	Cut	Effective	Cut
0	2	4″ 0″	10′ 0″	4″ 0″	10′ 0″	4″ 0″	10′ 0″	4″ 0″	10′ 0″	4″ 0″	10′ 0″	4″ 0″	10′ 0″
1	4	4″ 2″	10′ 2″	4″ 2″	10′ 2″	4″ 1½″	10′ 1½″	4″ 1½″	10′ 1½″	4″ 1″	10′ 1″	4″ 1″	10′ 1″
2	4	4″ 8½″	10′ 8½″	4″ 7″	10′ 7″	4″ 6″	10′ 6″	4″ 5″	10′ 5″	4″ 4½″	10′ 4½″	4″ 4″	10′ 4″
3	4	5″ 11½″	11″ 11½″	5″ 3½″	11″ 3½″	5″ 1″	11″ 1″	4″ 11″	10″ 11″	4″ 10″	10″ 10″	4″ 9½″	10″ 9½″
4	1	TOWER		6″ 3½″	12″ 3½″	5″ 11″	11″ 11″	5″ 8″	11″ 8″	5″ 5½″	11″ 5½″	5″ 3½″	11″ 3½″
5	4			TOWER		7″ 0″	13″ 0″	6″ 7″	12″ 7″	6″ 3″	12″ 3″	6″ 0″	12″ 0″
6	4					TOWER		7″ 8½″	13″ 8½″	7″ 3″	13″ 3″	6″ 9½″	12″ 9½″
7	4							TOWER		8″ 5″	14″ 5″	7″ 11″	13″ 11″
8	4									TOWER		9″ 1½″	15″ 1½″
9	–											TOWER	
Tower Height		6″ 10½″		7″ 7″		8″ 4″		9″ 0″		9″ 9″		10′ 6″	

A Have span length less than 100 feet.
B Have timber available near site.
C Provide solid sill and deadman foundations.

92 ERECTION PROCEDURE.—A The erection of the expedient footbridge follows in general the procedure used to erect the standard suspension footbridge. The bridge site and bridge center line are laid out. Sill and deadman excavations are staked out and dug. Tower logs are cut, dressed, and assembled on the ground. The lashings are as shown in figure 46.

The towers and deadmen are placed and the main cables are strung, set, and made fast.

Suspender and floor-beam assemblies are fabricated and placed. Stringers are lashed to the floor beams and the flooring of 1½-inch to 2½-inch poles is installed. Five-inch curb logs are placed on the flooring directly over the stringers. Then ¾-inch rope is wound around the curb logs and stringers to hold the flooring in place. See figure 45.

93 PACK-TRAIN FLOOR SYSTEM.—If the bridge is to carry mules the flooring is covered with a 2-inch layer of gravel and coarse sand. A siderail of 3-inch poles is lashed to the suspenders to guide the mules in crossing. Each mule is led across by a handler and only one mule is on the bridge at one time.

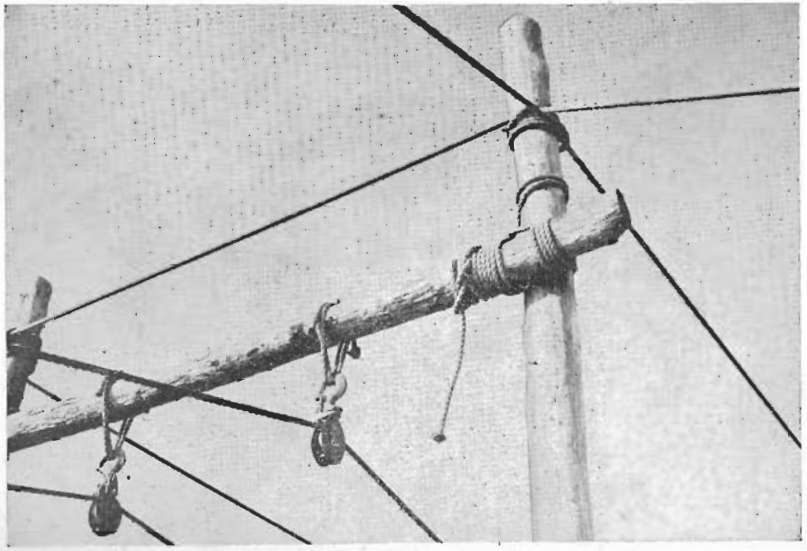


FIGURE 46. *Tower lashing. The strength of the bridge is determined by this tower lashing.*