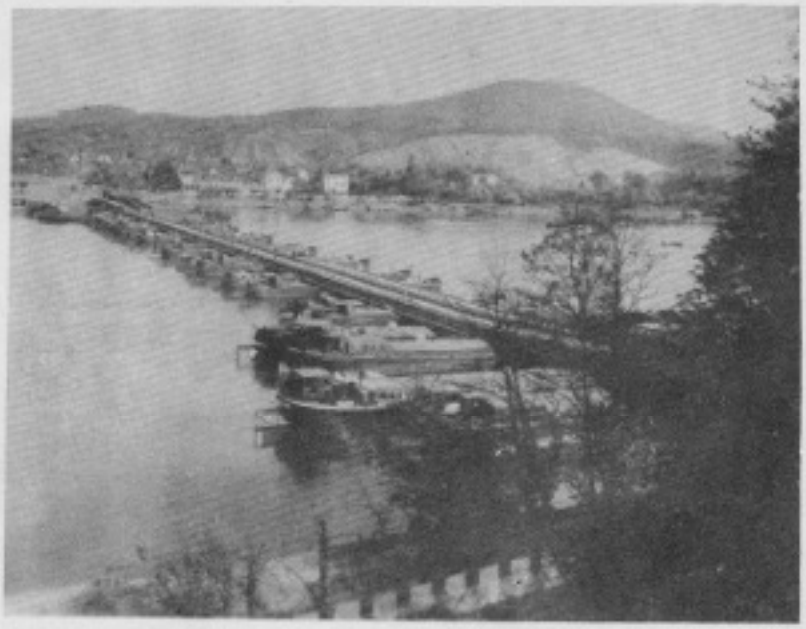
REPORT
ON
CONSTRUCTION
OF
DUAL CARRIAGE-WAY
BAILEY BARGE BRIDGE
ACROSS
THE RHINE RIVER
AT
BAD GODESBERG, GERMANY



26 MARCH 1945 TO 5 APRIL 1945

1110 ENGINEER COMBAT GROUP

FIRST U. S. ARMY

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DUAL CARRIAGE-WAY BAILEY BARGE BRIDGE REPORT

1. PURPOSE. This report has been prepared with a twofold purpose in mind; (1) to show the materials, equipment, and construction methods used, and (2) to serve as a guide and future reference in the construction of dual carriage-way Bailey barge bridges. This bridge was constructed in accordance with design and procedure developed while experimenting with Bailey barge bridging on the Meuse River at Liege, Belgium, during November and December 1944.

2. ORIENTATION.

a. Tactical Situation. Prior to start of construction of the Bailey barge bridge, seven vehicle bridges (1 Cl 40 Bailey, 4 Treadway and 2 Heavy Ponton) were across the Rhine River in First U. S. Army area. These bridges were temporarily adequate for First U. S. Army traffic except for loads above Cl 40, however the heavy ponton and steel treadway installations both being tactical bridges, their early removal was desired so that they would be available for use beyond the Rhine River.

A Cl 70 crossing was not available along the river which necessitated that loaded M19 and M25 tank transporters be unloaded before making the crossing.

In order that the First U. S. Army could remove these tactical bridges and eliminate the necessity for burdensome maintenance, some type of semi-permanent structure was required. A pile bent bridge would have been difficult to construct in such swift current and would have consumed considerable time and supplies. Since considerable experimental work had already been conducted with Bailey barge bridges on the Meuse River in the vicinity of Liege, Belgium, construction could proceed without necessity of further experimentation.

Reconnaissance to locate necessary barges started immediately after the capture of the Remagen railroad bridge, however, the barges could not be assembled for necessary modification work because of the proximity of the enemy until a much later date.

b. Site Reconnaissance and Selection. The Engineer, First U. S. Army, selected the town of Bad Godesberg, approximately 5 miles South of Bonn, as being the most suitable location for the crossing and an immediate reconnaissance was made of this locality. For a barge bridge, a site with the following characteristics was considered necessary:

(1) Reasonably short approach roads.

(2) Minimum possible span length.

(3) Reasonably steep banks where the water gap would not be materially changed by a change in water level.

(4) Depth of water 90 feet from abutment should be ten feet or more so that pier barges would remain floating at low water level.

Such a site was located in vicinity of a ferry landing in the town of Bad Godesberg.

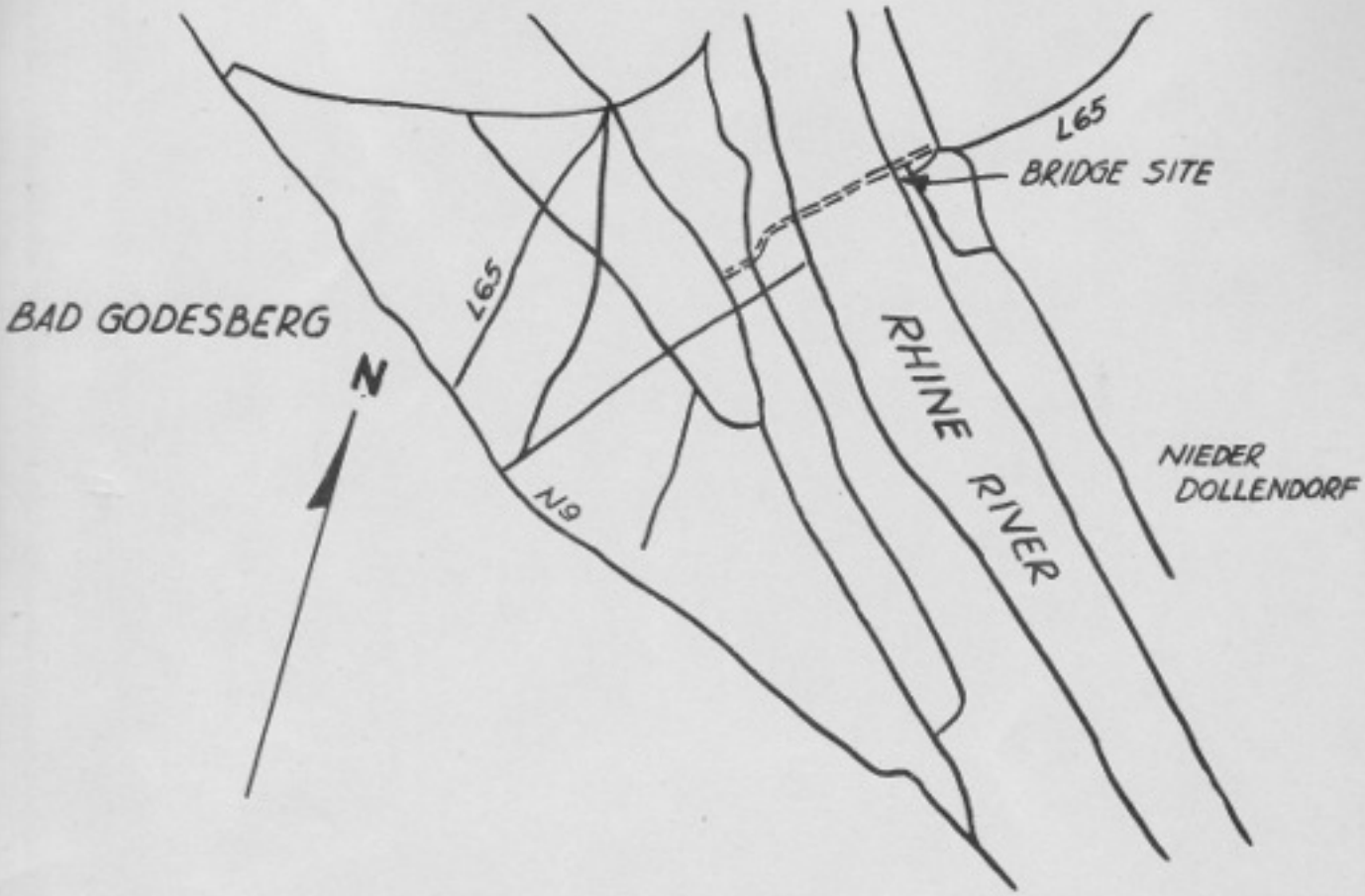

Fig. 1.
SKETCH OF BRIDGE SITE

The water gap of 1140 feet could be spanned by a 1172 foot truss, and the water was approximately 10 feet deep at a distance of 70 feet from the bank. With 110 foot landing bays it would be possible to obtain the desired 10 foot water depth for the pier barges. However, the most undesirable features of this site were the bridge approaches which required the movement of 35,000 cubic yards of earth and construction of 1700 feet of approach road. Sites with much better approaches were available but it was necessary to sacrifice good approaches for high banks and reasonably deep water near the shore.

c. Barges Available. Approximately 35 barges were located between Bonn and Remagen. Other barges were located upstream of the Remagen railroad bridge, but after its collapse on 17 March 1945 no navigable gap remained through which to move them downstream. Barges located were of cargo type and are listed as follows:

Number	Beam	Length	Capacity
20	17' average	125' to 130'	250 tons
8	27' average	220' to 270'	1500 to 2000 tons

Four medium size barges loaded with scrap and pig iron were located for use as anchor barges. Other barges in the vicinity were either loaded, or too large, and were not moved to the construction site.

d. Work Required. Having selected a suitable site it was determined that approximately 1173 feet of bridge and 1700 feet of approach road with movement of 35,000 cubic yards of earth would be required.

e. Terminology. For the purpose of this report the following definitions will be used: (See Fig. 2.)

(1) Shore Landing Bay: The section of the bridge extending from each shore to the first pier.

(2) River Landing Bay: The section of the bridge extending from the first pier to each landing bay pier.

(3) Intermediate Landing Bay Pier: The first pier from each shore supporting the river end of the shore landing bay and the shore end of the river landing bay.

(4) Landing Bay Pier: Supports the river end of the river landing bay and the shore end of each end floating bay.

(5) End Floating Bay: 80 foot floating section with shore end supported by each landing bay pier and the river end connecting with the first standard floating bay.

(6) Floating Bay: A section of bridge 100 feet long symmetrically supported by two floating bay piers placed 70 feet on centers.

(7) Floating Bay Pier: A barge with a prepared flat deck to provide direct support to the Bailey truss of floating bays.

(8) Special Connecting Posts: Special manufactured posts to connect sections of the bridge by use of pins thereby permitting articulation at the joints. These posts are male-male and female-female and cannot be used to connect two male ends of panels together. A bearing to fit over a standard Bailey bearing plate was manufactured on the end of all male-male posts used over the intermediate or landing bay piers.

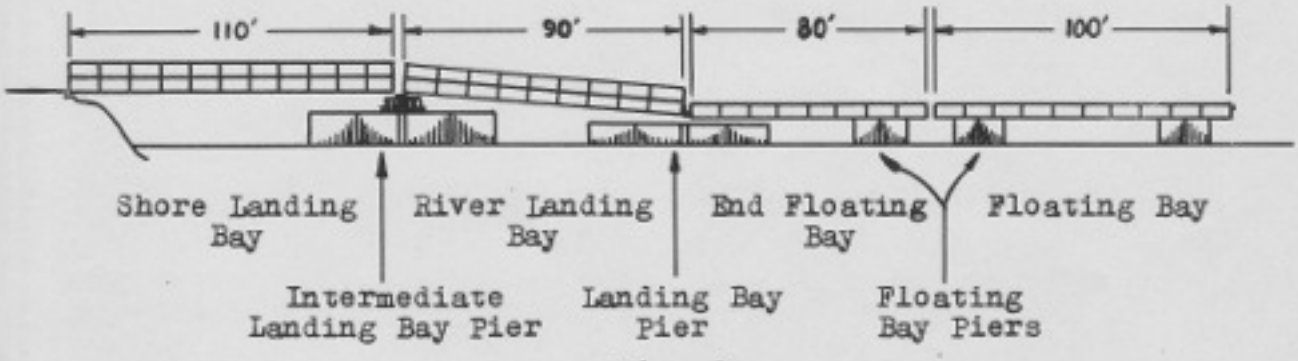

Fig. 2.

f. Design Adopted. The Engineer, First U. S. Army, specified that a dual carriage-way Bailey barge bridge would be constructed. With the assortment of large and small barges available, the barges were placed in the bridge to give the most homogeneous effect by using the large barges for intermediate and river landing bay piers and the smaller barges for floating bay piers. The large barges provide more stability for the landing bay piers, thereby permitting a constant slope to be maintained by the landing bay trusses under the maximum loads. The displacement of the small barges in the floating bays under load produces negligible wave action. The distance between barge piers was determined in all cases by the design of the most economical type of construction for the Cl 70 lane. The elevation of the bottom of the Bailey truss was set at 7' 6" above water line for all floating sections and the elevation of the bottom of truss over the intermediate landing bay pier was set at 12' 6". The bottom of the truss over the abutment was set at 12' 6" above mean water.

(1) Floating Bays. The length of floating bays was limited to 70 feet center to center of barges by design of a triple-single Bailey truss for Cl 70 loads.

Fig. 3.
FLOATING BAYS NEARING COMPLETION

Double story construction would have lengthened the span but would have reduced the bearing area of the truss on the top of the barge and increased the Bailey bridge parts necessary for construction of the bridge. By constructing the floating bays 100 feet long a maximum economy in use of Bailey bridge was obtained and maximum of bridge stability resulted.

The barges used in these floating piers were in most cases prepared by the Germans for use in a barge bridge and

Fig. 4.
FLOATING BAY PIERS PRIOR TO LAUNCHING OF TRUSS

were equipped with square steel reinforcing trusses which could easily be adapted to carry the load from the Bailey trusses by installation of vertical members in the truss directly under the panels (see plan sheet 11 of 18). I-beams were placed across the top of these barge reinforcing trusses. Wood blocks were bolted on top of the I-beams so as to rest directly under vertical members of the Bailey panels providing a seat for the Bailey truss.

(2) End Floating Bay. The end floating bay was designed with 80 feet of Bailey truss. (See Fig. 5.) This bay is supported through a bearing constructed on the bottom of the special connecting posts over the landing bay pier and rested directly on its floating bay pier at the river end with customary 15 feet cantilever overhang.

(3) River Landing Bays. The elevation of the bottom of the Bailey panels having been set at 7' 6" above water line for floating sections and 12' 6" above water over the intermediate landing bay pier, it was determined that approximately 90 feet of river landing bay would be required so that the rise would not appreciably exceed 1 in 20 feet as recommended for Cl 70 carriageways. (See Fig. 6.)

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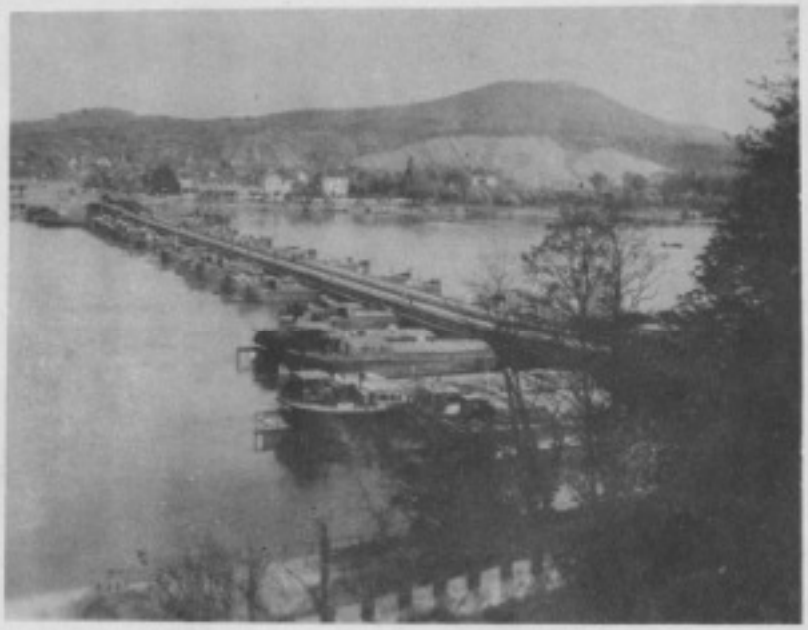

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Fig. 5.
END FLOATING BAY BEING LAUNCHED.
NOTE BEARING ON BOTTOM OF CONNECTING POSTS

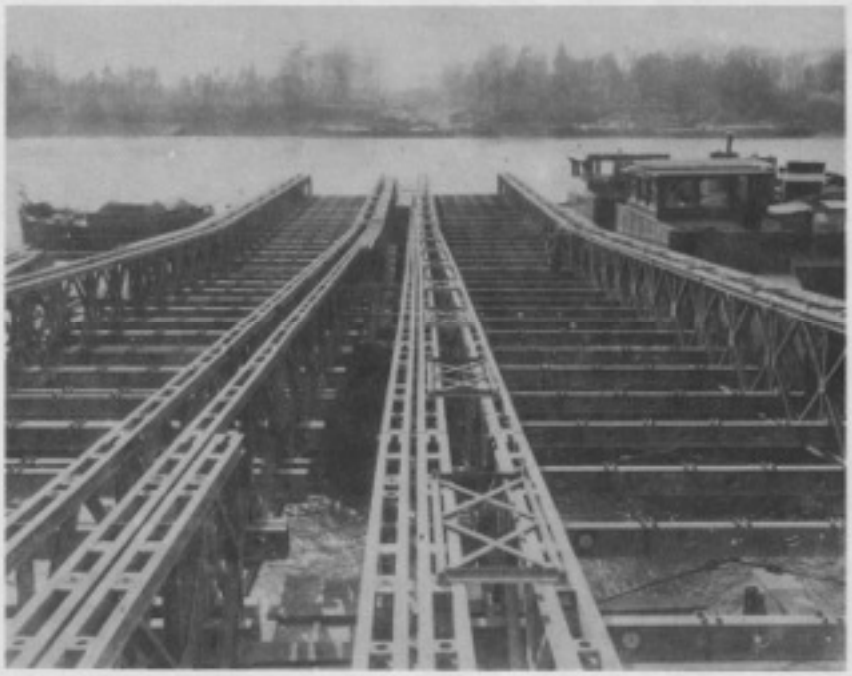


Fig. 6.
RIVER LANDING BAY AND END FLOATING BAY.
THE DECK AND SECOND STORY OF CL 70
TRUSS (LEFT) TO BE COMPLETED.

(4) Shore Landing Bays. The shore landing bays were constructed 110 feet long so that the intermediate landing bay pier would be located over deeper water and also to secure additional length of bridge. With the maximum anticipated rise or fall in water level being 8 feet from mean, a slope in excess of 1 in 14

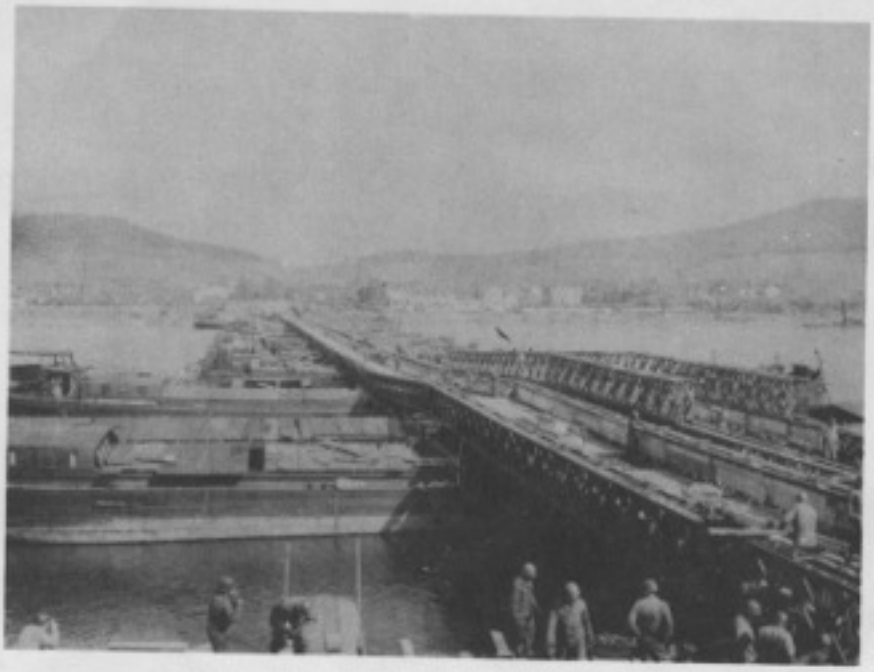


Fig. 7.
WEST SHORE LANDING BAY BEING COMPLETED
AFTER FINAL JOINING OF BRIDGE

feet would not be expected, however over the period which the bridge is to remain in place the slope of the shore landing bay should not exceed 1 in 20 feet.

(5) Intermediate Landing Bay Pier. (See plan sheets 6 of 18 and 7 of 18.) Piers were built up on two barges by use of I-beam cribbing. (See Fig. 8.) Two different types of gunwale reinforcing were used, one of which employed the use of a wood bent in the center of each barge while the other has the reinforcing directly under each gunwale. (See Fig. 9.) Either method produces the same result, however in both cases maximum use of the barge gunwales was made in addition to the bents. To insure that I-beams of piers remain in place they were welded to barge gunwales and bolted into place.

Fig. 8.
I-BEAM CRIBBING OF WEST SHORE
INTERMEDIATE LANDING BAY PIER

Fig. 9.
GUNWALE REINFORCING USED IN
WEST SHORE LANDING BAY PIERS

(6) Landing Bay Piers. The landing bay piers and intermediate landing bay piers were of similar construction. The height of Bailey truss over the pier was 7' 6" above the water line.

Fig. 10.
LANDING BAY PIER AS CONSTRUCTION
OF END FLOATING BAY STARTS

(See plan sheets 8 of 18 and 9 of 18.) I-beams were both welded and bolted to boat gunwales to prevent sliding.

(7) Floating Bay Piers. The elevations of barge gunwales were built up so that a flat surface was obtained 7' 6" above the water line. Blocks were installed so that a support was provided under the truss at each vertical member of the Bailey panels. (See plan sheet 11 of 18.)

(8) Special Connecting Posts. Special male-male and female-female posts were used. (See Fig. 11.) These posts serve the same purpose as the Bailey span junction posts and were designed to overcome a weakness that had developed in Bailey span junction posts on Cl 70 trusses. These posts were used on the Cl 70 experimental Bailey barge bridge constructed on the Meuse River at Liege, Belgium, and have proved satisfactory.

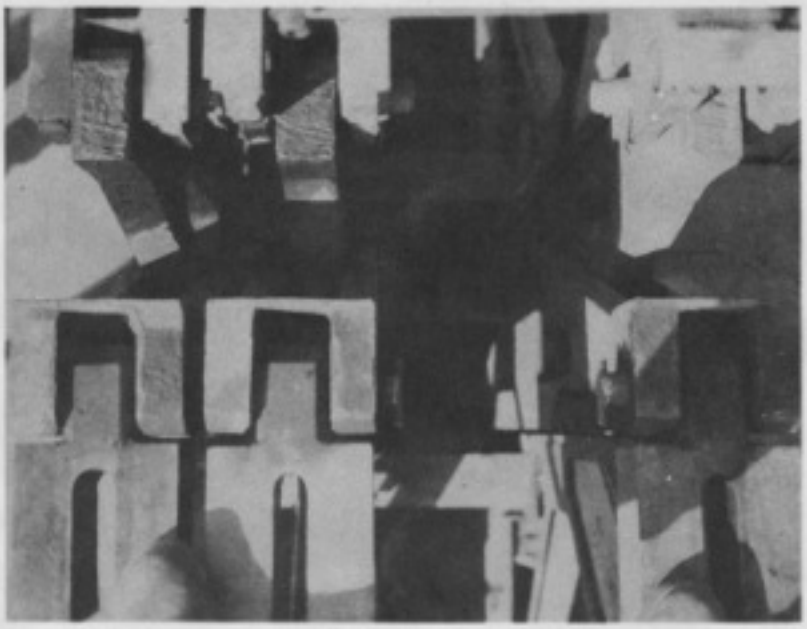


Fig. 11.
SPECIAL CONNECTING POSTS IN PLACE

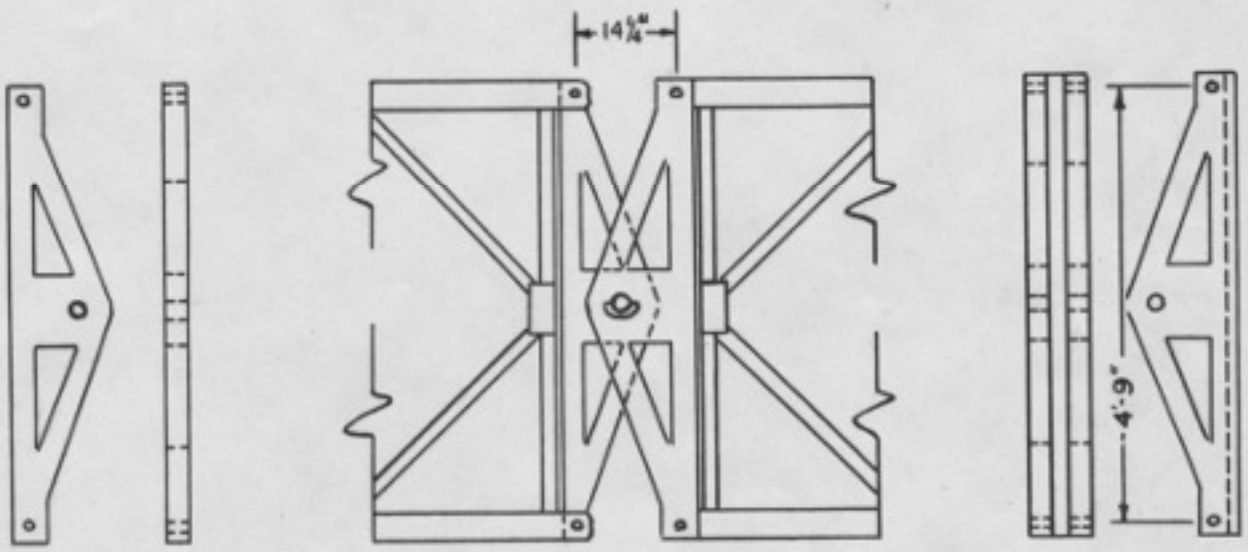


Fig. 12.
SKETCH OF SPECIAL CONNECTING POSTS

(9) Telescoping Ramp and Sliding Base Plate. During periods of high or low water the shore landing bay will assume an inclined position. In either case the actual length of the bridge will shorten. To allow for this contraction of the bridge, rollers were placed under the base plate of the East end of the bridge.

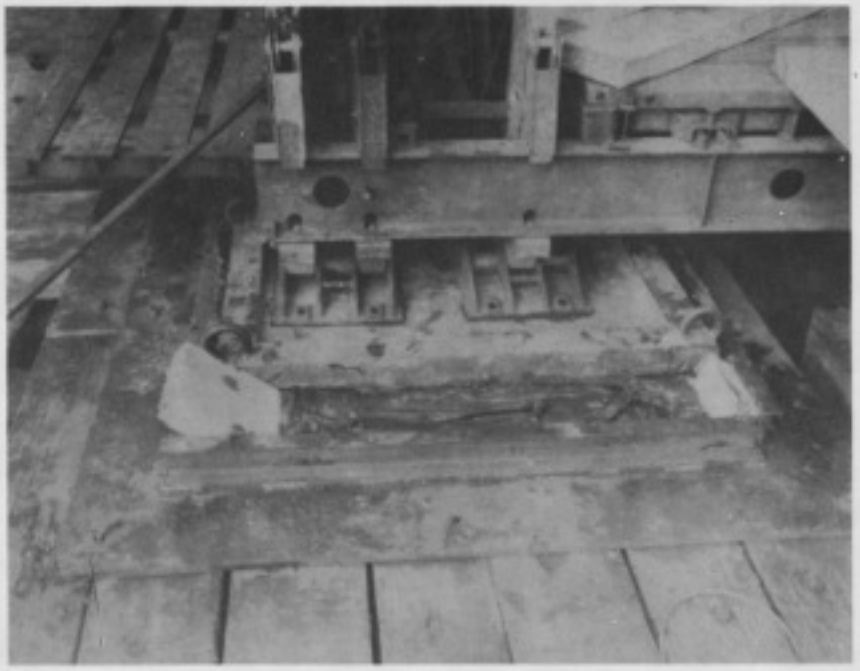


Fig. 13.
EAST SHORE SLIDING BASE PLATE IN PLACE

(See plan sheet 4 of 18.) Should the elevation of the water rise or fall 11 feet the bridge could be expected to shorten approximately

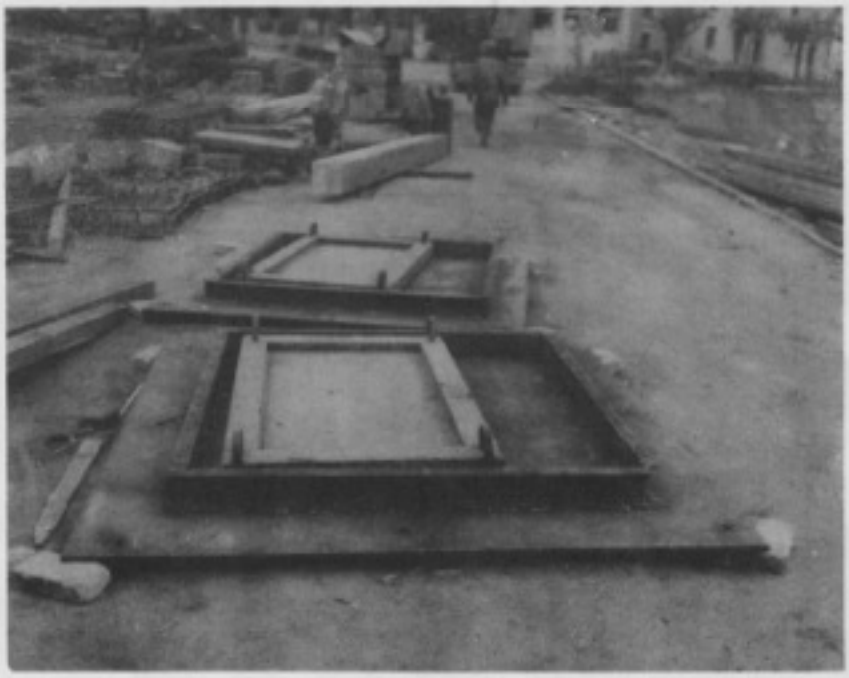


Fig. 14.
SLIDING BASE PLATE ASSEMBLY PRIOR TO INSTALLATION

8 inches on each end, therefore, provisions were made for the East shore base plate to roll toward the river 16 inches. It was also necessary to construct a telescoping ramp (see plan sheet 5 of 18) so that the ramp deck would not tear away from the abutment.

3. CONSTRUCTION. The general plan for construction of the Dual Carriage-Way Bailey Barge Bridge was reasonably well established by 22 March 1945. Arrangements were made with VII Corps for

Fig. 15.
GENERAL VIEW OF BRIDGE FROM WEST BANK

movement of the barges through the heavy ponton bridge at Konigswinter and the steel treadway bridge at Rolandseck on 24 and 25 March 1945 so that construction of the bridge could actually begin on the morning 26 March 1945. The CO 148 Engineer Combat Bn was assigned as the officer in charge of movement of all barges through the bridges. The CO 207 Engineer Combat Bn coordinated the movement of his barges with the 148 Engineer Combat Bn. The barges were moved through the bridges on schedule.

a. Work Assignments. The 148 and 207 Engineer Combat Bns were each assigned construction of one 110 foot shore landing bay, one 90 foot river landing bay, one 80 foot end floating bay, and three 100 foot floating bays. The 148 Engineer Combat Bn constructed from the East shore and the 207 Engineer Combat Bn constructed from the West shore. The East approach was originally assigned to the 148 Engineer Combat Bn while the West approach went to the 207 Engineer Combat Bn. The 1264 Engineer Combat Bn assumed responsibility for construction of the approach roads starting on the morning of 28 March 1945. Permission was granted for use of lights at night so that work could proceed on all phases of the operation 24 hours per day. (See Fig. 16.) Coast defense lights mounted on tanks and search lights were made available for illumination and security on a combined mission. The bridge opened for traffic 052400B April 1945.

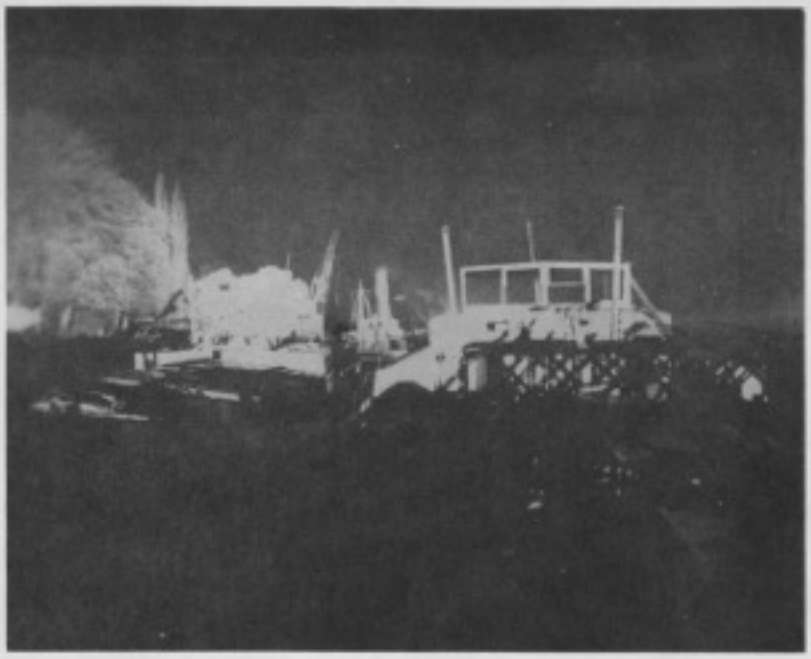


Fig. 16.
NIGHT CONSTRUCTION WITH ARTIFICIAL ILLUMINATION

b. Special Equipment Assigned.

	148	207	1264
Cranes	4	5	0
Shovels	1+	1+	5
Draglines	0	0	1
D-7 Tractors	2+	5+	11
Carryall Pans	1+	3+	4
Graders	1+	0	3
Tar Distr, Trk Mtd, 800 gal	0	0	2
Tar Distr, Trailer Type	0	0	2
Rollers	0	0	3
Acetylene Torches	4	5	0
Electric Arc Welders	4	5	0
Tug, Steam, 150 HP	1	0	1
Tug, Steam, 75 HP	1	0	0
Tug, Diesel, 800 HP	1	0	0
Tug, Steam, 600 HP	0	1	0
Tug, Diesel, 200 HP	0	1	0
Sea Mules	1	3	0
Storm Boats	2	2	0
*Divers	0	4	0

+ Used only while employed on construction of approaches.
* Used to investigate river bottom and place demolition charges on sunken debris being removed.

Four coast defense lights mounted on tanks and four AAA search lights were made available for illumination and security by 49 AAA Brigade who were responsible for area close-in security for all Rhine River installations.

Fig. 17.
ARTIFICIAL ILLUMINATION FOR NIGHT CONSTRUCTION

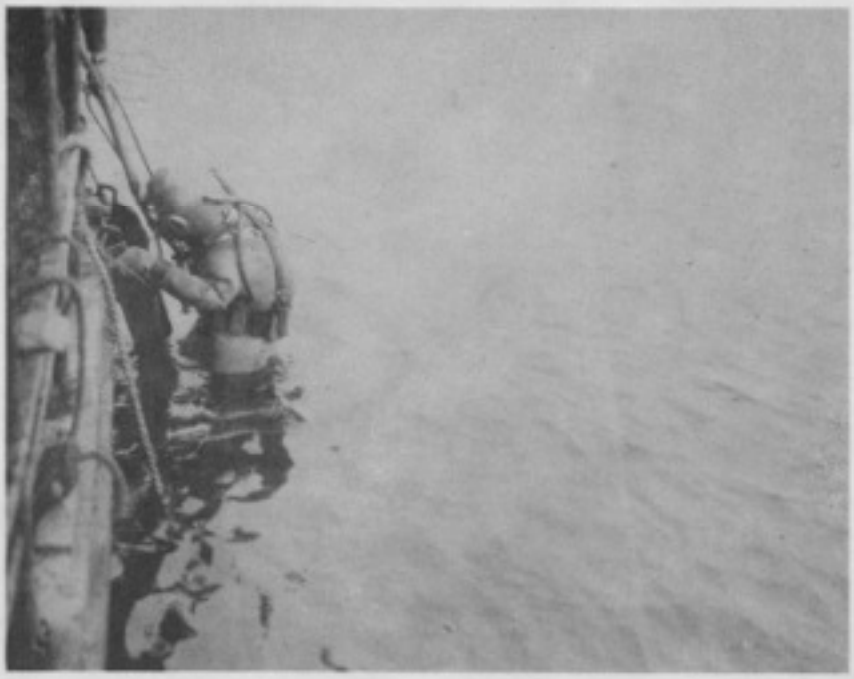


Fig. 18.
DIVER CHECKING FOR UNDERWATER OBSTACLES

c. Preparation of Barges.

(1) Intermediate Landing Bay Piers. Two of the larg barges were selected for each of the two intermediate landing bay

Fig. 19.
FLOATING CRANE BEING USED TO PLACE I-BEAMS
ON AN INTERMEDIATE LANDING BAY PIER

piers. These barges vary in size from 250 to 270 feet with an average beam width of 27 feet. The superstructure was removed from the center of these barges down to the level of the gunwales to permit the placing of I-beams transversely. The I-beams were bolted to the barge gunwales to prevent sliding. (See plan sheets 6 of 18 and 7 of 18.) Additional I-beam cribbing was added building the top of the pier to the desired elevation on which standard Bailey

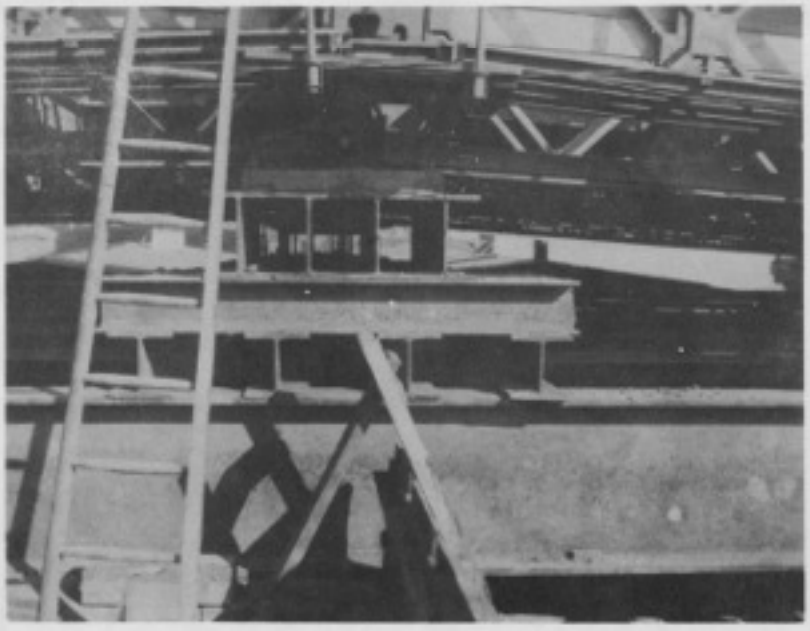


Fig. 20.
INTERMEDIATE LANDING BAY PIER

base plates were welded to support a standard Bailey bearing plate. For added stability, the bearing plates were welded to the base plates.

(2) Landing bay piers were constructed along the same plan as intermediate landing bay piers except that barges with low gunwales were selected and small I-beams used so that height of pier was not materially increased. Barges were ballasted with sand gravel until the desired height was obtained.

Fig. 21.
LANDING BAY PIER AND END FLOATING BAY PIER
READY FOR INSTALLATION OF END FLOATING BAY

(3) Floating bay piers were of very simple construction. Since the German army had already prepared a steel reinforcing truss in sufficient barges it was only necessary to cut away the superstructure, build up barge gunwale, and build up a support from the steel crib to fit under the Bailey truss at each vertical member of the panel. (See Fig. 21.) To accomplish this, I-beams were welded across the crib and wooden blocks placed at the desired points. (See plan sheet 11 of 18.)

d. Construction of Bridge Sections. The elevations of Bailey trusses having been set, it was necessary to devise a template for accurate spacing of trusses if panels were to meet. That distance was set as the length of one Bailey bracing frame between the outside panel of T/S Cl 70 truss and outside panel of D/S Cl 40 truss.

(1) Shore landing bays were constructed by two methods and approximately the same results were obtained. The 148 Engineer Combat Bn constructed the river landing bay from the intermediate landing bay pier booming out between the two piers as required. The width of the barges of the two piers totaling approximately 60 feet made it necessary to boom out only 30 feet.

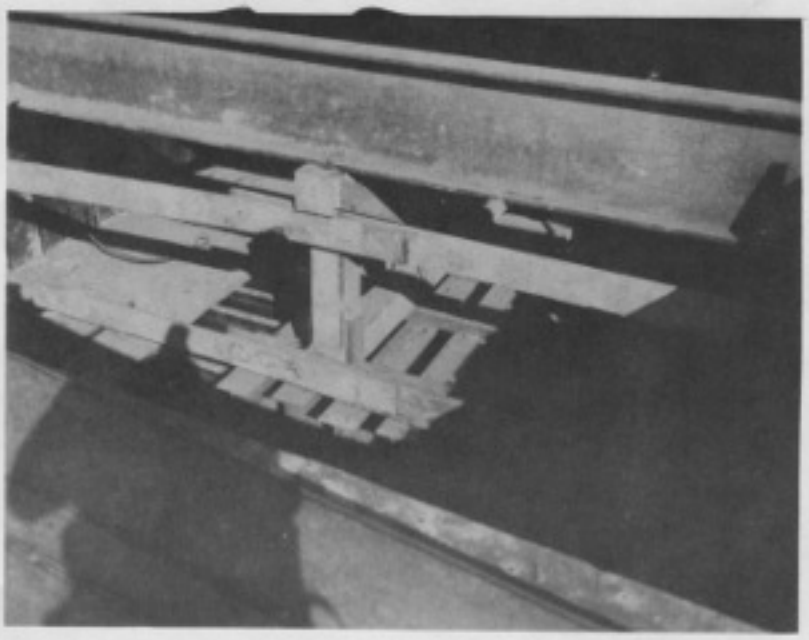


Fig. 22.
GUNWALE REINFORCING BENT IN WEST SHORE
INTERMEDIATE LANDING BAY PIER

Fig. 23.
SEA MULE MOVING BARGES TO CONSTRUCTION SITE
FOR PREPARATION AS FLOATING BAY PIERS

Piers were constructed on the West shore and moved to approximate position before starting the construction of the truss. The shore landing bay was constructed on shore and launched into position on top of the pier.

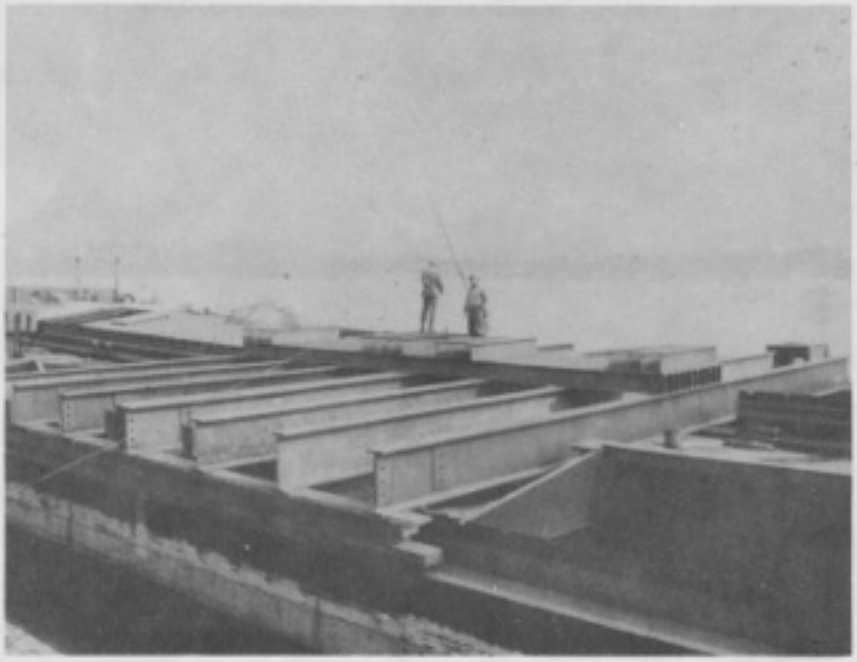


Fig. 24.
INTERMEDIATE LANDING BAY PIER READY FOR MOVEMENT TO CENTER LINE OF BRIDGE.
BASE PLATES YET TO BE INSTALLED.

Fig. 25.
SHORE AND RIVER LANDING BAYS CONSTRUCTED TOGETHER

The bays were constructed together on shore by the 207 Engineer Combat Bn and rolled into position. The shore landing bay was then disconnected from the river landing bay and pulled back two feet at which time special connecting posts were installed.

In both cases the bays were launched in skeleton form and built up to the desired structure after being in position.

(2) Floating bays were all constructed in skeleton form (less stringers and deck) on shore as triple-single for Cl 70 and double-single for Cl 40. When completed the trusses were launched into position on river side barge and boomed out until in position on the shore side barge. Rods and string lines were used to line up the panel pin holes but it was found that the trusses could be set sufficiently close by eye.

e. Construction of Bridge Approaches. (See plan sheets 16 of 18 and 17 of 18.)

(1) Grading. Construction of bridge approaches began on the morning of 24 March with one carryall pan being placed in use on each approach. The small amount of equipment was satisfactory for the East approach where only 5,000 cubic yards of fill had to be placed, however with 30,000 cubic yards of excavation on the West approach, sufficient equipment was not obtained for the project to proceed at the same rate as the bridge itself.

Fig. 26.
GRADING AT WEST APPROACH. LANDING BAYS UNDER CONSTRUCTION IN BACKGROUND.

When the approaches were turned over to the 1264 Engineer Combat Bn on the morning of 28 March the grading of the East approach was approximately complete, and an additional carryall scraper was moved to the West approach.

Fig. 27.
CARRYALL PANS AT WORK ON WEST APPROACH

In addition, two more scrapers with tractors were obtained from Engineer units of First U. S. Army. The rush to get down to grade was so great that extra earth along the back slope could not be removed. In order to get the approach open for traffic a rock base course of 30 inches was placed before all the excavation was complete.

Fig. 28.
BASE COURSE BEING PLACED BEFORE
COMPLETION OF EXCAVATION

Carryall scrapers were able to work along the back slope and take out sufficient earth to complete the cut, however, with not too much efficiency. Bull dozers were very valuable throughout the entire project to keep the road smooth, assist in loading the carryall scrapers, and in excavating, where the earth could be disposed of within a short distance. Carryall pans proved to be very satisfactory for this project as the haul was not in excess of 100 yards at any point.

Fig. 29.
CARRYALL PAN IN OPERATION

Fig. 30
LOADED CARRYALL PAN LEAVING CUT

(2) Base Course. The plans called for 30 inches of 8 to 10 inch rock covered with 1 1/2 inch crushed stone on the West approach as a base course.

Fig. 31.
LOADING BASE COURSE MATERIAL

Normally this quantity of rock is excessive but in this case it worked out well since so little time was available for compacting the subgrade or removal of unstable clays. Where this 30 inch base course was placed, no indication of rolling was evident. In a few spots where the base course was not placed to full thickness, some indication of rolling was observed.

On the East approach the fill had been largely built from a stock pile of brick which lay adjacent to the approach. On this approach only 18 inches base course was placed, which under normal circumstances would have been adequate, however the short time available for compaction and the very heavy traffic using the road caused some defects to develop.

(3) Wearing Surface. The wearing surface presented a problem almost impossible to handle in that it began raining when the unit was ready to prime the surface. (See Fig. 33.) The East approach had been surfaced when the bridge was opened for traffic but it was wet most of the time and the bond between the tar and the aggregate was very poor. It was also necessary to place traffic on the road before the mat had been able to set up. Maintenance was continuous to keep the surface smooth. Rolling of the surface continued to keep the surface smoothed out.

Fig. 32.
PLACING 1 1/2 INCH WEARING COURSE
OVER BASE COURSE ON EAST APPROACH

Fig. 33.
PRIMER COAT OF TAR BEING APPLIED TO EAST APPROACH

For the West approach, traffic continued so heavy during daylight hours that it became necessary to place the bituminous wearing surface at night. The moisture on the surface at this time of the day and the wet rock which was used resulted in a poor bond, however, with the excellent base course and with minor repairs continuing for a 30 day period the wearing surface should set up satisfactorily.

Fig. 34.
COMPLETED WEST SHORE APPROACH

f. Anchorage. The rate of flow of the Rhine River at the construction site was approximately 6.5 feet/second at mean water. With an anticipated rise of 8 feet during the late Spring and early Summer the speed of the current could be expected to increase materially. With such a current, more than normal anchorage was necessary.

Three types of anchorage were designed to hold the bridge rigidly in place. (See plan sheet 2 of 18.)

(1) Barge anchors were dropped both upstream and down.

(2) Anchor barges, loaded with scrap iron, were sunk 450 feet upstream of bridge on approximately 250 foot centers. (See Fig. 35.) Anchor lines were then run from these barges to the bridge barges.

(3) Guy lines were placed upstream from fifth points along the bridge truss to dead men on shore, and downstream at 1/4 points. To insure that the barges remain stable, diagonal cables were run from bow to stern of all barges in each bay or landing bay piers. Cables were also run for the full length of the bridge tying all barge bows and all barge sterns in position.

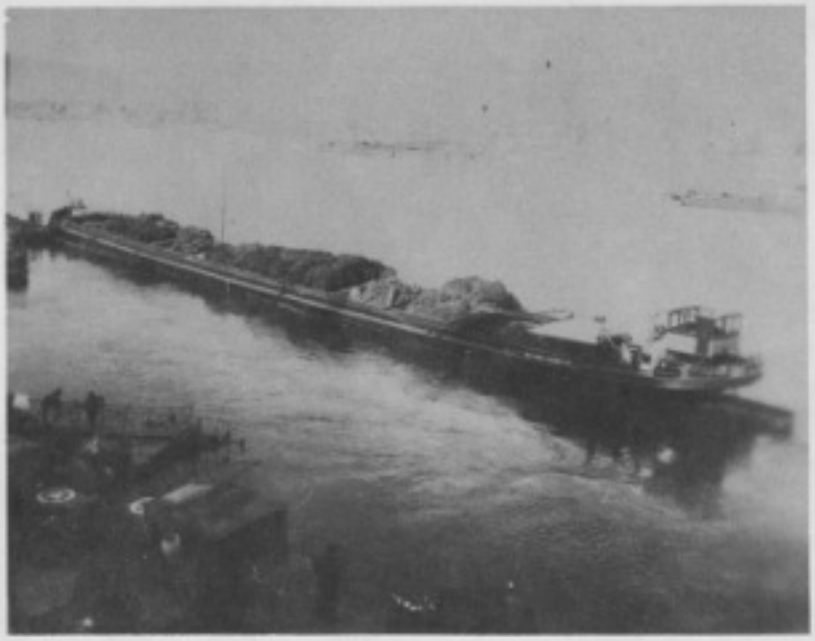


Fig. 35.
CLOSE UP VIEW OF ANCHOR BARGE
LOADED WITH SCRAP METAL

Fig. 36.
FULL VIEW OF BRIDGE SHOWING
GUY AND ANCHOR LINES

In all, approximately 40,000 lin. feet of one inch cable was used in anchoring and bracing the bridge.

Fig. 37.
VIEW FROM BRIDGE LOOKING UPSTREAM SHOWING TIE CABLES, ANCHOR CABLES, AND ANCHOR TUG WHICH RESTS IN SHALLOW WATER ABOVE THE JETTY

4. JOINING THE BRIDGE.

a. Movement into Place and Connecting of Bays. Joining of landing and end floating bays presented no problem as they were constructed and erected together from the approach. However, the connection of the 100 foot floating sections was difficult. The 100 foot floating bays were towed into place by an 800 HP Diesel tug from downstream and moved upstream of the bridge at which point the tug dropped its anchors. (See Fig. 38.) Barge anchors were dropped at the same time. Following this, the sections were moved into place by letting out on anchor lines of the barges and tow lines of the tug. One small steam tug was used to push the section into place from the side. In some cases Sea Mules were used for pushing the sections into place. In most cases the truss had to be jacked into place so that the M-2 treadway pins could be driven through the holes in the special connecting posts.

Fig. 38.
100 FOOT FLOATING BAY BEING TOWED
INTO PLACE BY AN 800 HP TUG

Fig. 39.
REMOVING CHAIN HOISTS FOLLOWING
CONNECTION OF TWO BAYS OF BRIDGE

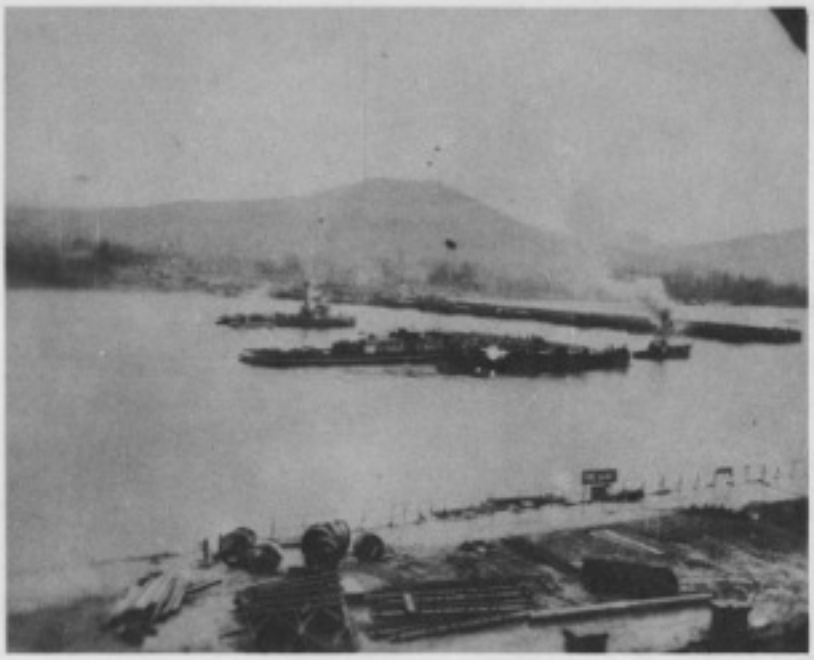


Fig. 40.
PUSHING LAST FLOATING BAY INTO PLACE WITH
800 HP DIESEL TUG AND SMALL STEAM TUG

Fig. 41.
LAST FLOATING BAY BEING JOINED TO BRIDGE.
TUGS HAVE NOT BEEN CUT LOOSE.

b. Anchorage During Joining. Pier barge anchors were sufficient to hold the newly attached section in place until the barge anchor lines and guy cables could be installed.

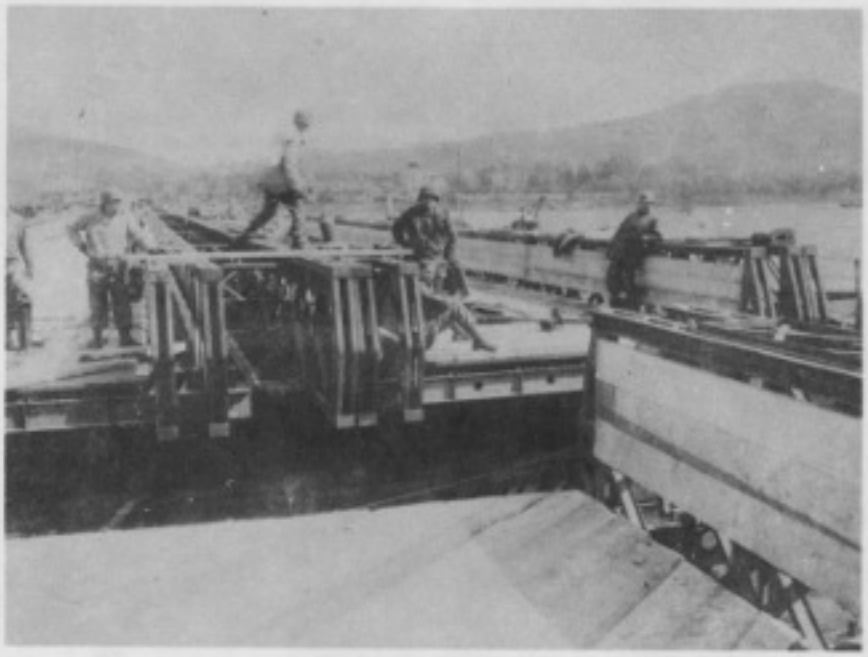


Fig. 42.
WEST END FLOATING BAY BEING PUSHED
OUT FOR FINAL JOINING OF BRIDGE

5. SPECIAL FEATURES OF CONSTRUCTION.

a. Deck.

(1) A diagonal tread placed at an angle of 50 degrees with the longitudinal axis of the bridge was used. This tread is capable of distributing the wheel load over more area of the bridge, increases traction and gives a smoother riding surface for narrow gauge vehicles. Experience has shown that this tread is much superior to longitudinal tread for increasing traction.

Fig. 43.
INSTALLATION OF DIAGONAL TREAD

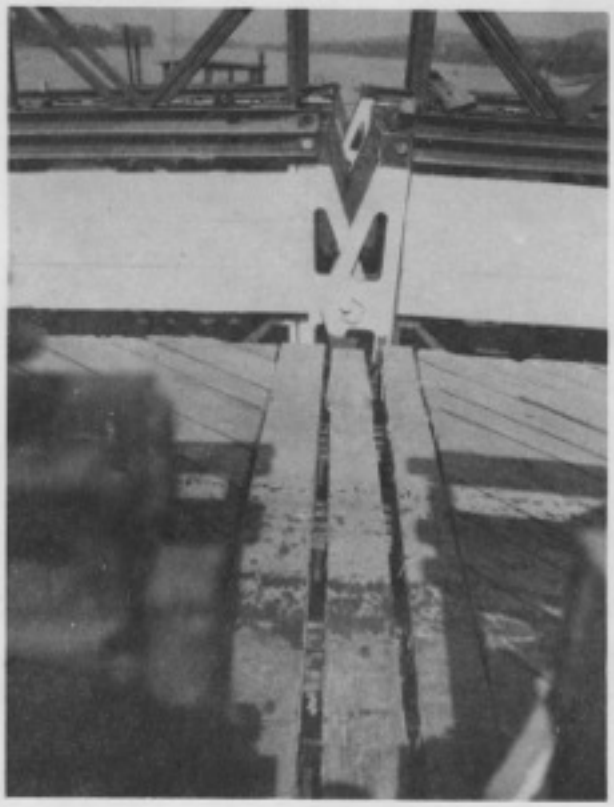


Fig. 44.
DETAIL OF CONNECTION BETWEEN BAYS. NOTE SPECIAL CONNECTING POSTS, HUB GUARD, STRINGERS, AND DECK OVER GAP.

(2) The use of special connecting posts makes it impossible to install transoms between bays and fill the gap by use of junction chess. 4 inch I-beams which were the same thickness as the bridge stringers were used, and short lengths were placed over the transoms of the two bays. These stringers were then covered by two thicknesses of 3"x12" nailed together and fastened to the end of a transom by use of a 3/8 inch cable. (See plan sheet 5 of 18.)

(3) Non Skid Landing Bay Deck. Two methods of improving traction on landing bays were tried. On the West approach 2 inch angle irons were laid over the deck with one edge of the angle placed between the planks. These angle irons were nailed in place with 60d spikes. The traction was improved on the East landing bay by placing strips of 3 1/4"x3/8" sheet steel on edge between the planks so that they would extend 1/4 inch above the deck level. (See Fig. 45.) The angle iron under heavy traffic proved much more durable as wheel action did not cause it to kick out of place.

b. Guard Rail.

(1) Ribands were eliminated from the Bailey deck. A 2"x24" hub guard starting 6 inches above the deck level was attached to the side of the Bailey panels to prevent damage to the truss from wheel hubs. These guard rails so placed and painted white provide an excellent guide for vehicles moving over the bridge at night when not using lights.

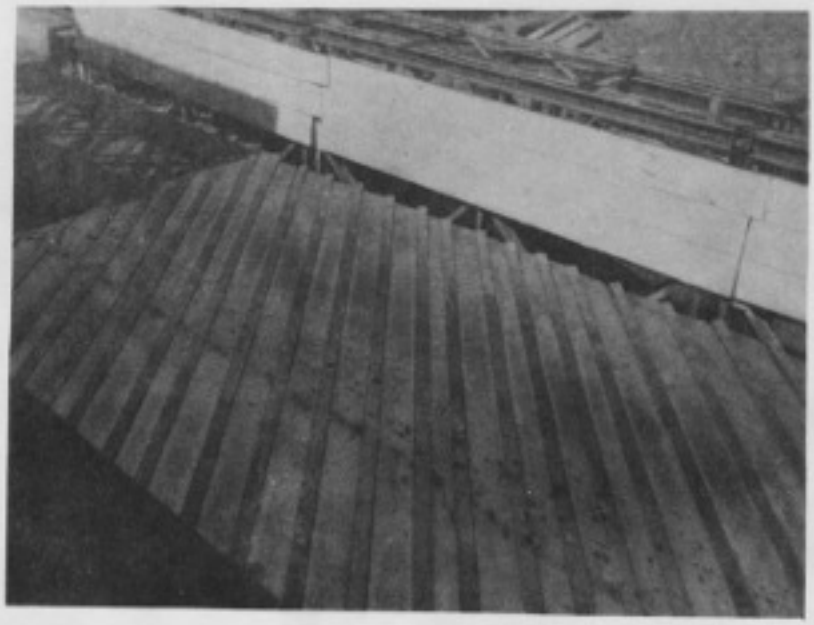


Fig. 45.
ANGLE IRONS INCREASE TRACTION ON LANDING BAYS

(2) Nailers for these guard rails were made by placing a piece of 2"x8" plank sawed to fit through the top of the panel so as to rest in a diagonal position against the diagonal brace of the panel and vertical strut. The hub guards were then nailed to the nailers.

Fig. 46.
NAILERS FOR HUB GUARD IN PLACE
ON SIDE OF BAILEY PANEL

c. Immediate Bridge Approaches. Guard rails of 12"x12" timbers with 8"x8" posts nailed to the inside were extended 50 feet beyond the end of ramp to channel traffic onto the bridge. (See plan sheet 12 of 18.) The width and spacing of trusses separated the lanes of traffic 8' 4".

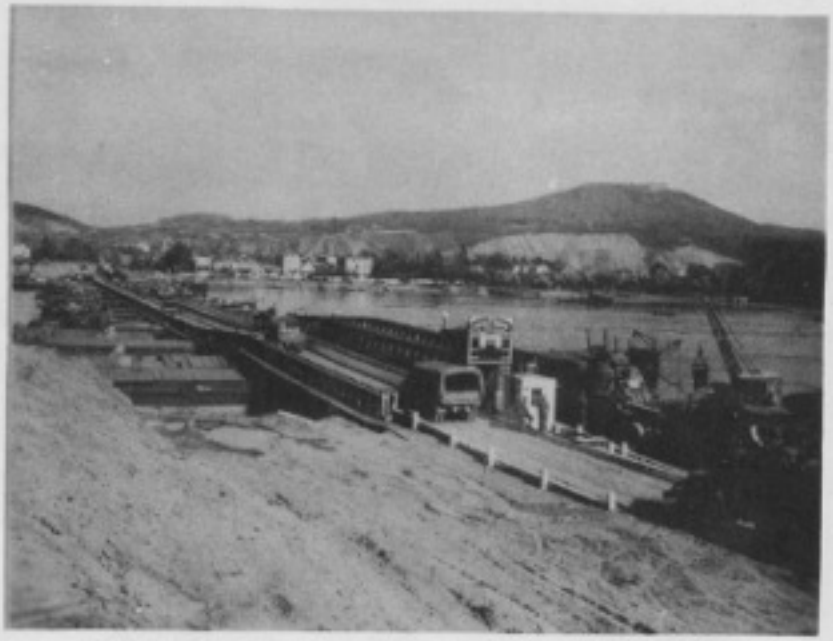


Fig. 47.
WEST BRIDGE APPROACH SHOWING CURBS

Within the island developed by the guard rails a 6'x6' sentry house (see plan sheet 13 of 18) was constructed for the guard during bad weather and to house the telephone.

d. Fire Protection.

(1) A fire pump was installed in a 40 foot German launch and used as a fire boat during construction. (See Fig. 48.) This fire boat remained at the bridge site for use of the security detachment. Two foam type fire extinguishers and six 14 quart pails of dry sand were installed on each barge. (See Fig. 49.) (See plan sheet 14 of 18.)

e. Luminous Markers. Luminous markers were installed every 10 feet on both traffic lanes so as to be visible to traffic moving in either direction. (See plan sheet 14 of 18.)

f. Electric Lighting System. One electric outlet box was installed along the side walk on each barge. Two trouble lamps with sufficient electric cord to reach from an outlet to any portion of the barge were placed at each end of the bridge and made available to the maintenance crew. A 110 volt generator was installed to keep power available for any emergency until arrangements could be completed to get civilian power on the line. (See plan sheet 15 of 18.)

6. MAINTENANCE.

a. Size of Maintenance Detail. A minimum of one Engineer Combat Company is required for maintenance of a structure of this type, which requires continuous 24 hour attention. Generally two squads will be sufficient to tighten bolts, check anchor cables,

keep deck repaired, and signs in place. For 24 hours operation a total of six squads are required. The remainder of 3 squads can be used for maintenance of approach roads, and as reserve in event that any major repairs are required. Sufficient personnel from this company would also be available to act as traffic guides for tank transporters and trailer mounted D-7 tractors while moving across the bridge.

Fig. 48.
FIRE BOAT BEING TESTED

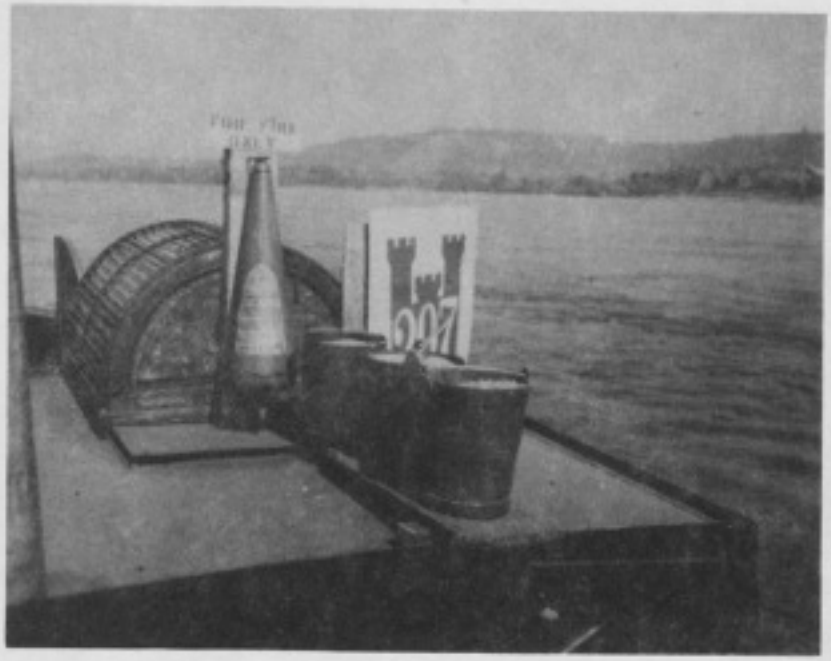


Fig. 49.
FIRE PROTECTION EQUIPMENT INSTALLED
AT END OF EACH BARGE

b. Duties. An officer to remain on duty at the bridge 24 hours each day. This officer should insure that the following regulations are in force at all times.

(1) That communication is maintained between ends of the bridge at all times.

(2) That a wrecker is kept available on call at all times to remove disabled vehicles from the bridge.

(3) That guides are available to lead all tank transporters, D-7 tractors, on or off trailers (D-7s must have blades angled), or other vehicles with less than 1 foot clearance, across the bridge. Standard hand signals to be used.

(4) That all guides know standard hand signals.

(5) That traction strips on landing bays are maintained.

(6) That nail heads holding treadway are kept flush.

(7) That all cable connections are inspected twice daily.

(8) That alignment of bridge is maintained.

(9) That tension in anchor lines is kept uniform.

(10) That all pins, bolts, and clamps are inspected daily.

(11) That barges are inspected daily, bailed out, and leaks repaired.

(12) That tugs are alert and available upstream of bridge.

(13) That tugs are alert and available downstream of bridge.

(14) That a source of power is available on the bridge electric circuit for operation of trouble lights.

(15) That all signs in vicinity of bridge are maintained.

(16) That immediate approach roads are maintained.

(17) That buffers are maintained between all anchor and guy line cables that rub against metal.

(18) That base plates are inspected daily to insure freedom of movement.

Companies charged with maintenance should be billeted in the vicinity of the bridge so that reserve will be readily available on short notice.

c. Security. Responsibility for security of the bridge was delegated to Hq, 1110 Engineer Combat Group.

7. CONCLUSIONS. Experience gained from construction and operation of a dual carriage-way Bailey barge bridge shows that the following conclusions are in order:

a. That a dual carriage-way Bailey barge bridge is practical where large cargo type barges are available.

b. That 1200 feet of dual carriage-way Bailey barge bridge can be constructed by two Engineer Combat Bns in 8 days after barges have been assembled.

Fig. 50.
UNITS PARTICIPATING IN THE PROJECT

c. The following man and equipment hours were used in construction of 1173 feet of dual carriage-way bridge:

(1) Man Hours.

Assembly of barges, tugs & equipment	7864	M/Hrs
Construction of 6 floating bays	23160	"
Construction of 2 end floating bays	7822	"
Joining bridge, including landing & floating bays	3531	"
Construction of Double Landing Bays	22530	"
Painting & incidental work to completion	3136	"
Signing	1296	"
Grading approach road	7874	"
Placing of base course on rock	15800	"
Placing of wearing surface	4000	"
Traffic guides	2005	"
Total	99018	"

(2) Equipment Hours.

Cranes	1380	Equip/Hrs
Shovels	563	"
Draglines	30	"
D-7 Tractors	1464	"
Carryalls	695	"
Graders	255	"
Tar Distr, Trk Mtd, 800 gal	50	"
Tar Distr, Trailer Type	50	"
Rollers	240	"
Acetylene Torches	1176	"
Electric Arc Welders	1156	"
Tugs	506	"
Sea Mules	430	"
Power Utility Boats	990	"
Storm Boats	75	"
Diver	15	"

d. That the bridge offers the stability of a fixed bridge under normal traffic and little noticeable waving under Cl 70 loads.

e. That the special connecting posts built to join the bays are very practical.

f. That the bridge is capable of heavy Army traffic with a minimum of maintenance.

g. That double landing bays providing for 22 feet rise and fall in water level are practical and are not difficult to install.

8. RECOMMENDATIONS.

a. Bailey bridge on barges should be constructed in preference to standard floating Bailey for crossings over fast-flowing and hazardous streams.

b. Troops should not be employed on construction of the Bailey barge bridge until they are thoroughly trained on erection of the standard Bailey bridge.

c. Erection of the bridge should take place during periods of normal weather conditions. Currents in excess of 10 mph, heavy ice floes, and high winds would render the construction almost impossible.

d. All barges should be assembled and plans for bridge prepared on basis of available barges before construction begins.

e. In streams subject to fast currents, anchorage should be given maximum study. If necessary, heavy anchors, sunken barges filled with concrete, and guy lines should be used. Downstream anchorage should be provided to protect the bridge against winds in excess of 40 miles per hour.

f. Special connecting posts should be secured for all Cl 70 bridges to permit articulation under load. In case of a dual carriage-way bridge the special connecting posts should be used on both lanes.

g. That sloping sections of bridge be constructed with 2 inch angle iron placed between the diagonal tread so that the back of the angle faces toward the shore end of the landing bay to increase traction.

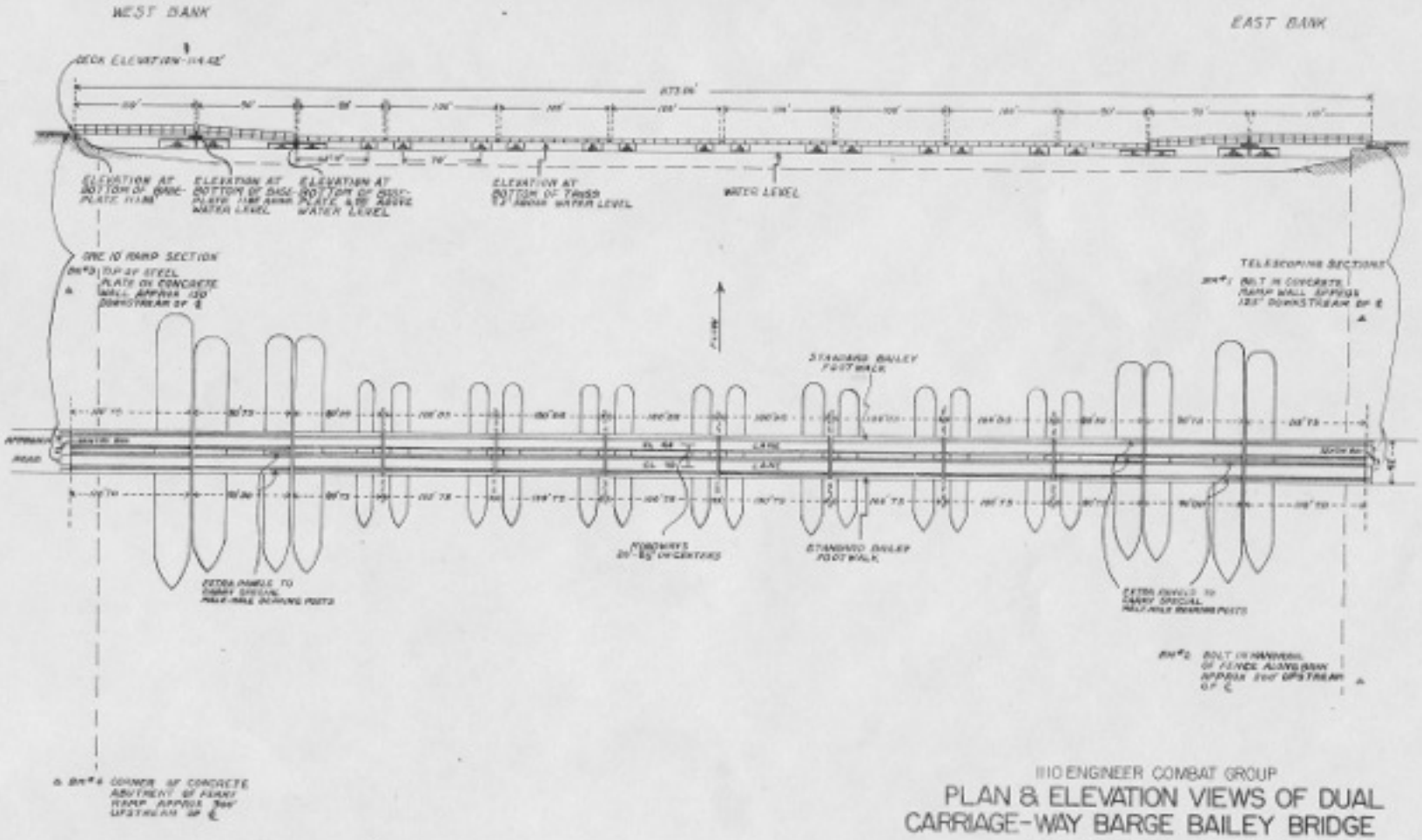
h. Ribands are not necessary where the chess of standard Bailey bridge are covered with diagonal 3" treadway nailed in place.

i. Slope of landing bays should not exceed 1' in 20', however, slopes in excess of this up to 1' in 10' are satisfactory where traction is increased by use of small angle irons between diagonal treadway of bridge.

j. Permanent maintenance crews should be taken from construction personnel who are familiar with the bridge.

k. A minimum of one tug boat upstream and one downstream should remain at bridge site available to maintenance crew.

John T. O'Neill
JOHN T. O'NEILL,
Colonel, Corps of Engineers,
Commanding.



CONFIDENTIAL

111D ENGINEER COMBAT GROUP

PLAN & ELEVATION VIEWS OF DUAL CARRIAGE-WAY BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

SHEET 1 OF 18 SHEETS 30 MARCH 1945

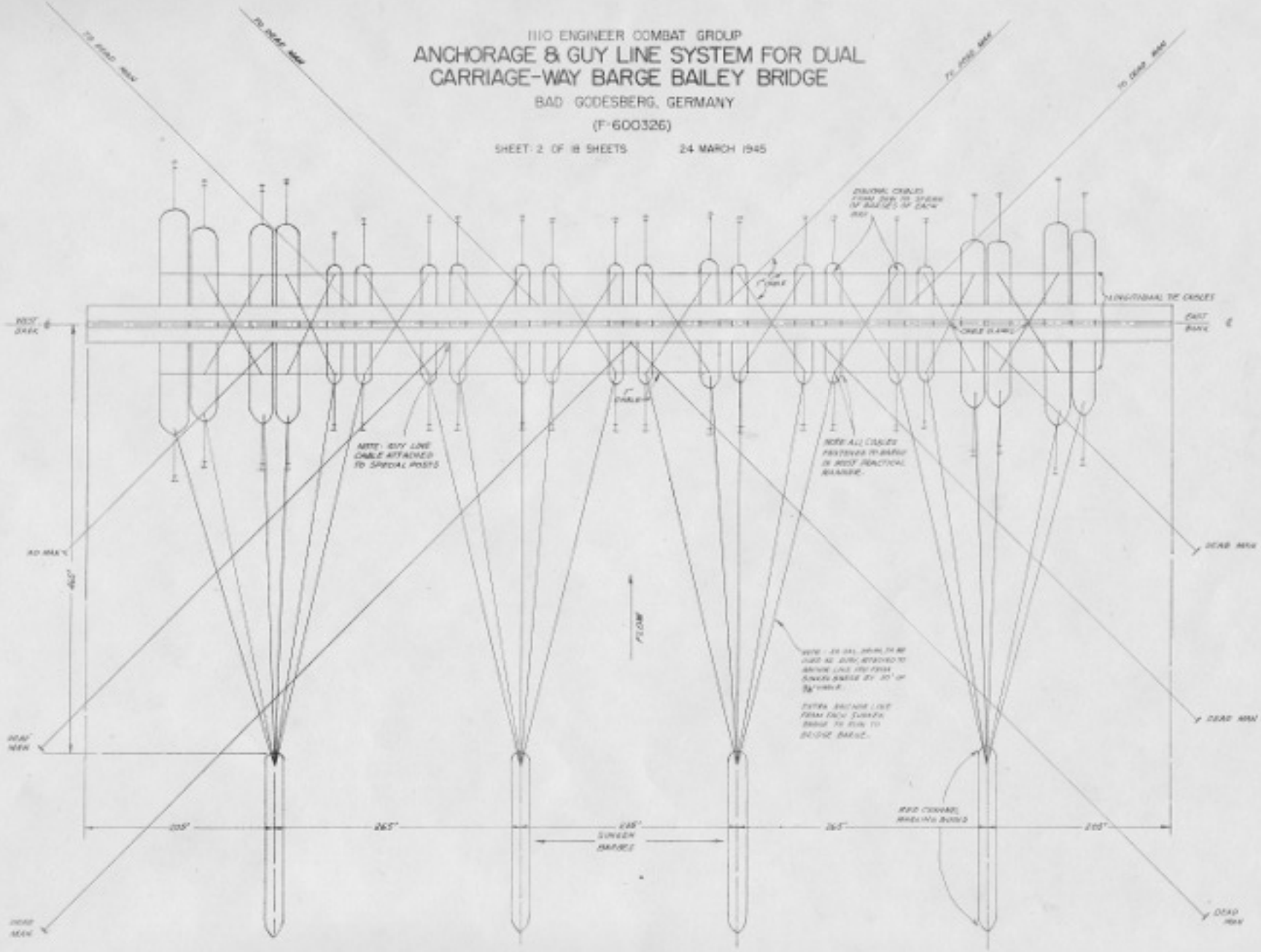
1110 ENGINEER COMBAT GROUP

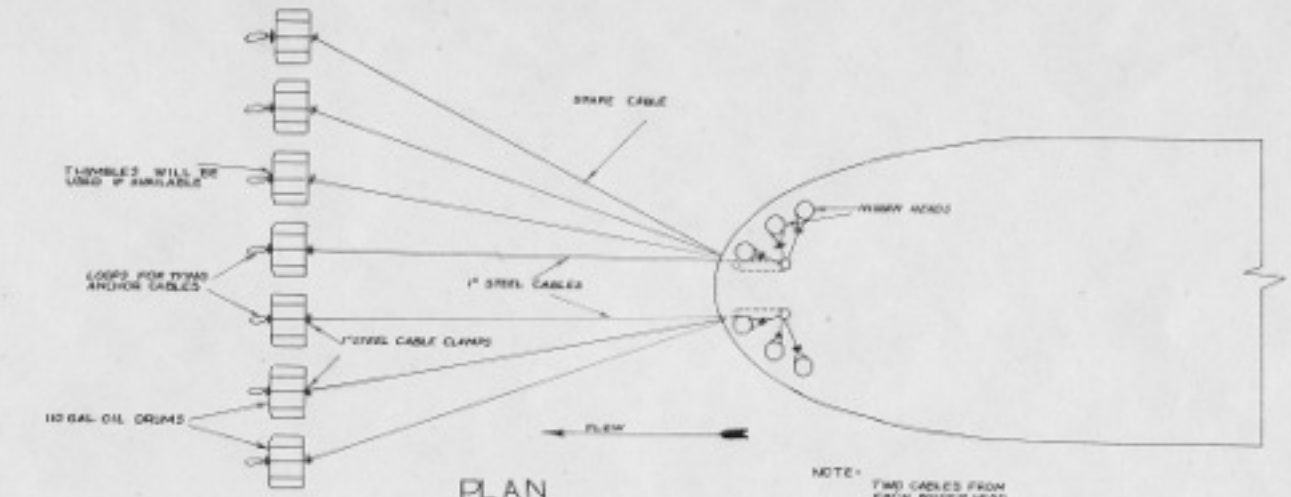
ANCHORAGE & GUY LINE SYSTEM FOR DUAL CARRIAGE-WAY BARGE BAILEY BRIDGE

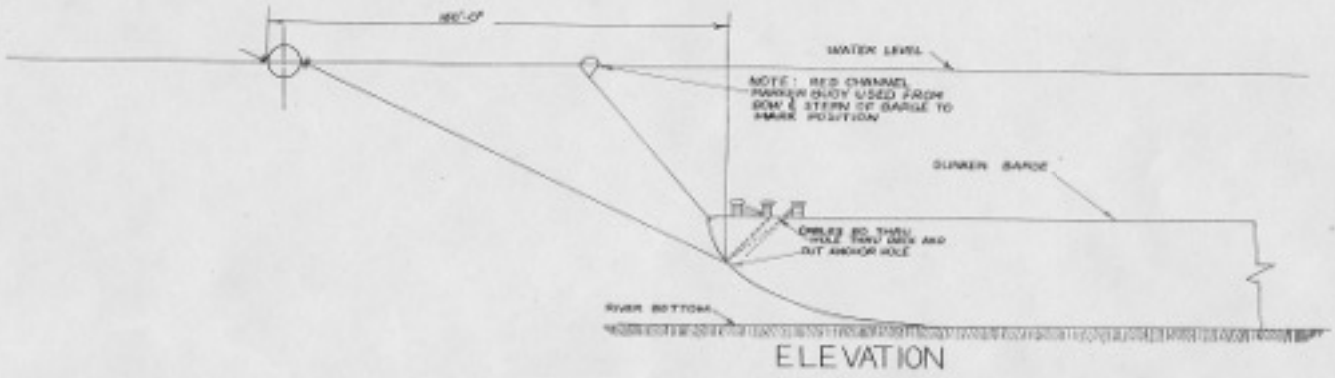
BAD GODESBERG, GERMANY

(F-600326)

SHEET 2 OF 18 SHEETS 24 MARCH 1945







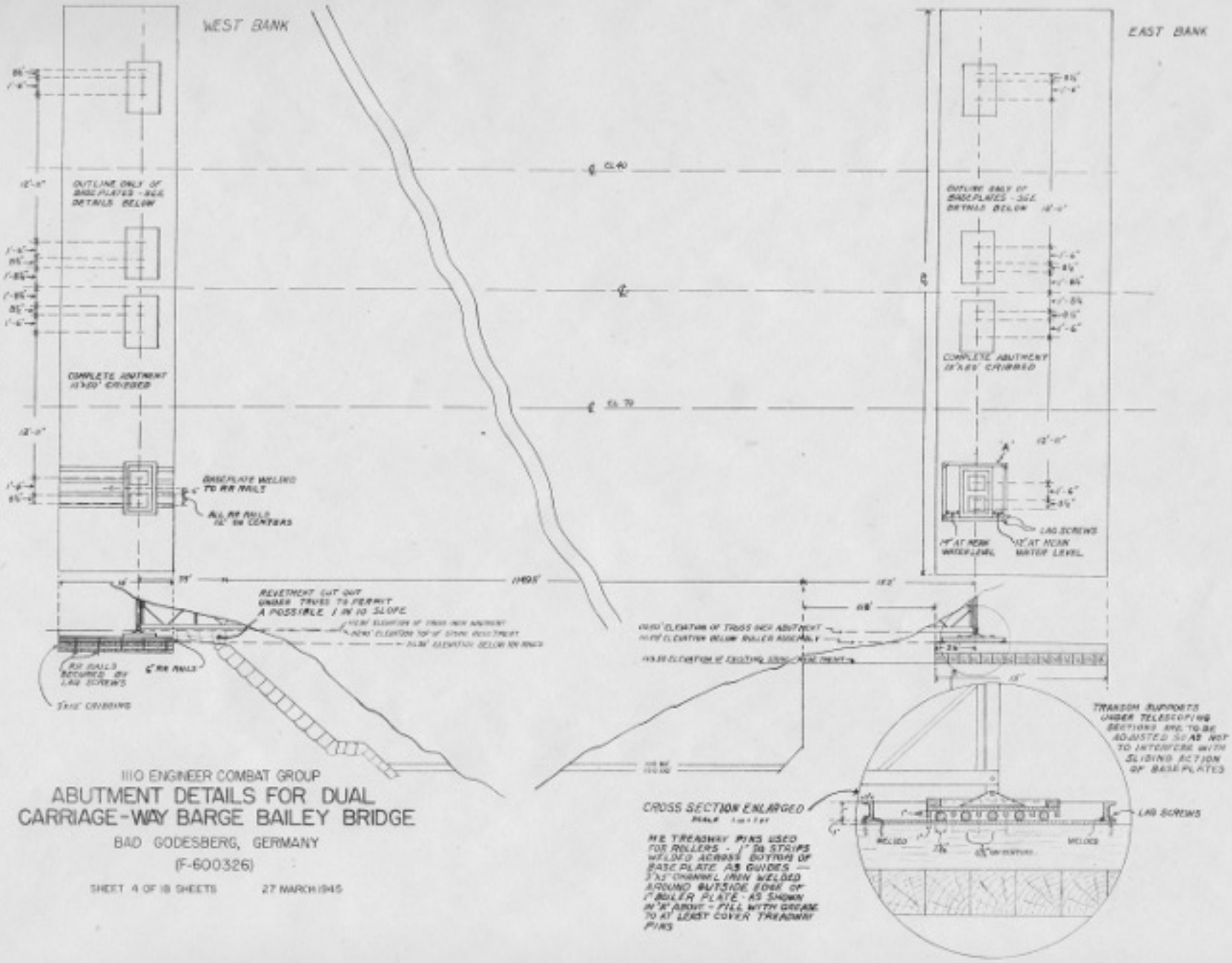
1110 ENGINEER COMBAT GROUP

PLAN FOR ANCHOR BARGE DETAIL FOR DUAL CARRIAGE BAILEY BARGE BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

SHEET 3 OF 18 SHEETS DATE 30 MARCH 1945



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1110 ENGINEER COMBAT GROUP

ABUTMENT DETAILS FOR DUAL CARRIAGE-WAY BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

SHEET 4 OF 18 SHEETS 27 MARCH 1945

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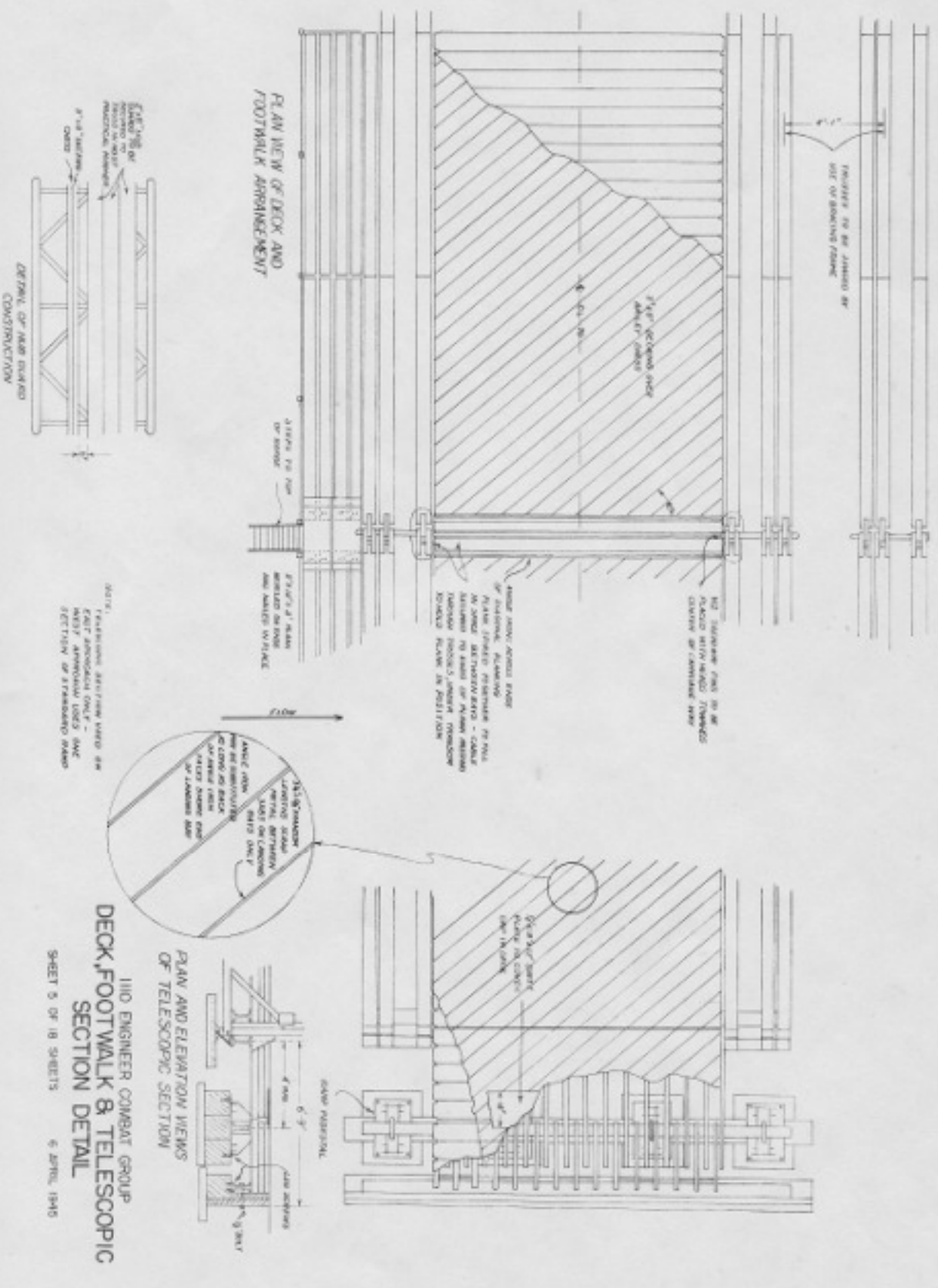

IIID ENGINEER COMBAT GROUP
DECK, FOOTWALK & TELESCOPIC SECTION DETAIL

SHEET 5 OF 18 SHEETS 6 APRIL 1945

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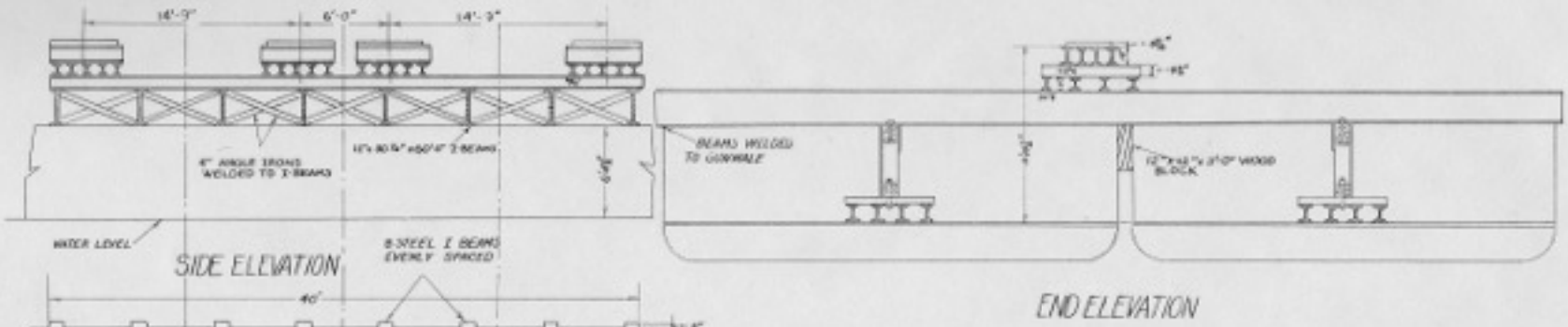
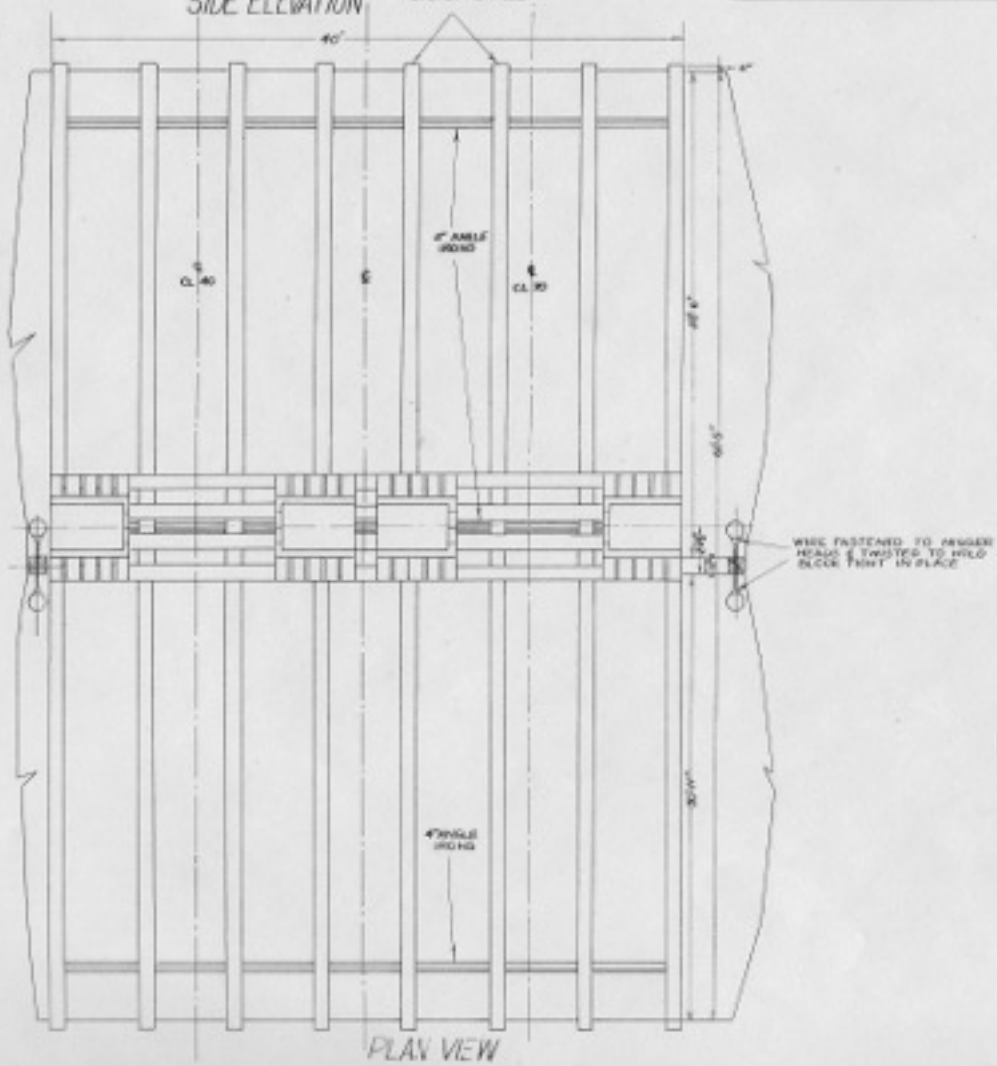


SIDE ELEVATION

END ELEVATION



PLAN VIEW

1110 ENGINEER COMBAT GROUP

PLAN FOR WEST SHORE INTERMEDIATE LANDING BAY PIER FOR DUAL CARRIAGE-WAY BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

SHEET 6 OF 18 SHEETS 31 MARCH 1945

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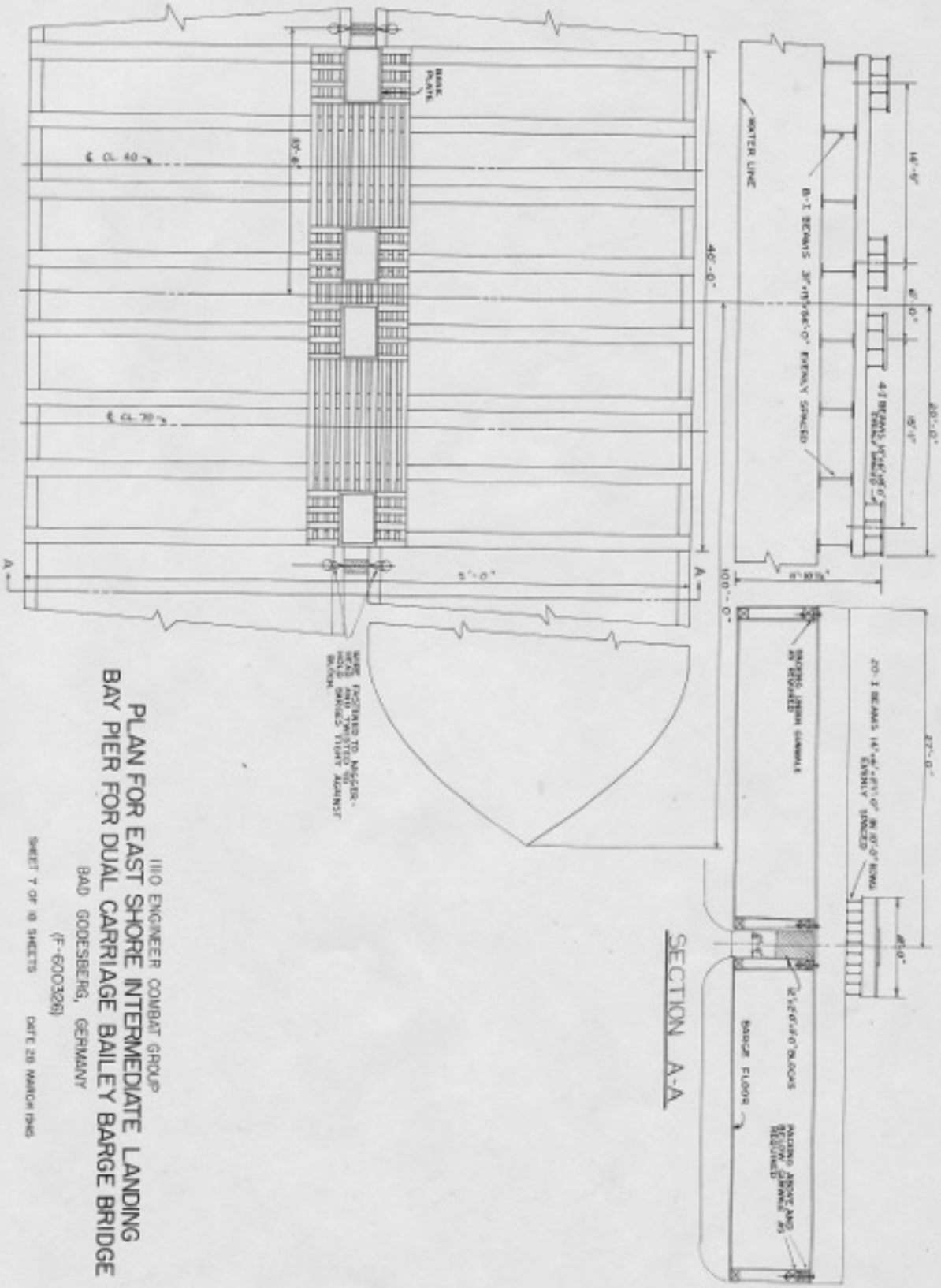

PLAN FOR EAST SHORE INTERMEDIATE LANDING BAY PIER FOR DUAL CARRIAGE BAILEY BARGE BRIDGE

IIIO ENGINEER COMBAT GROUP
BAD GODESBERG, GERMANY
(F-600326)

SHEET 7 OF 18 SHEETS DATE 28 MARCH 1945

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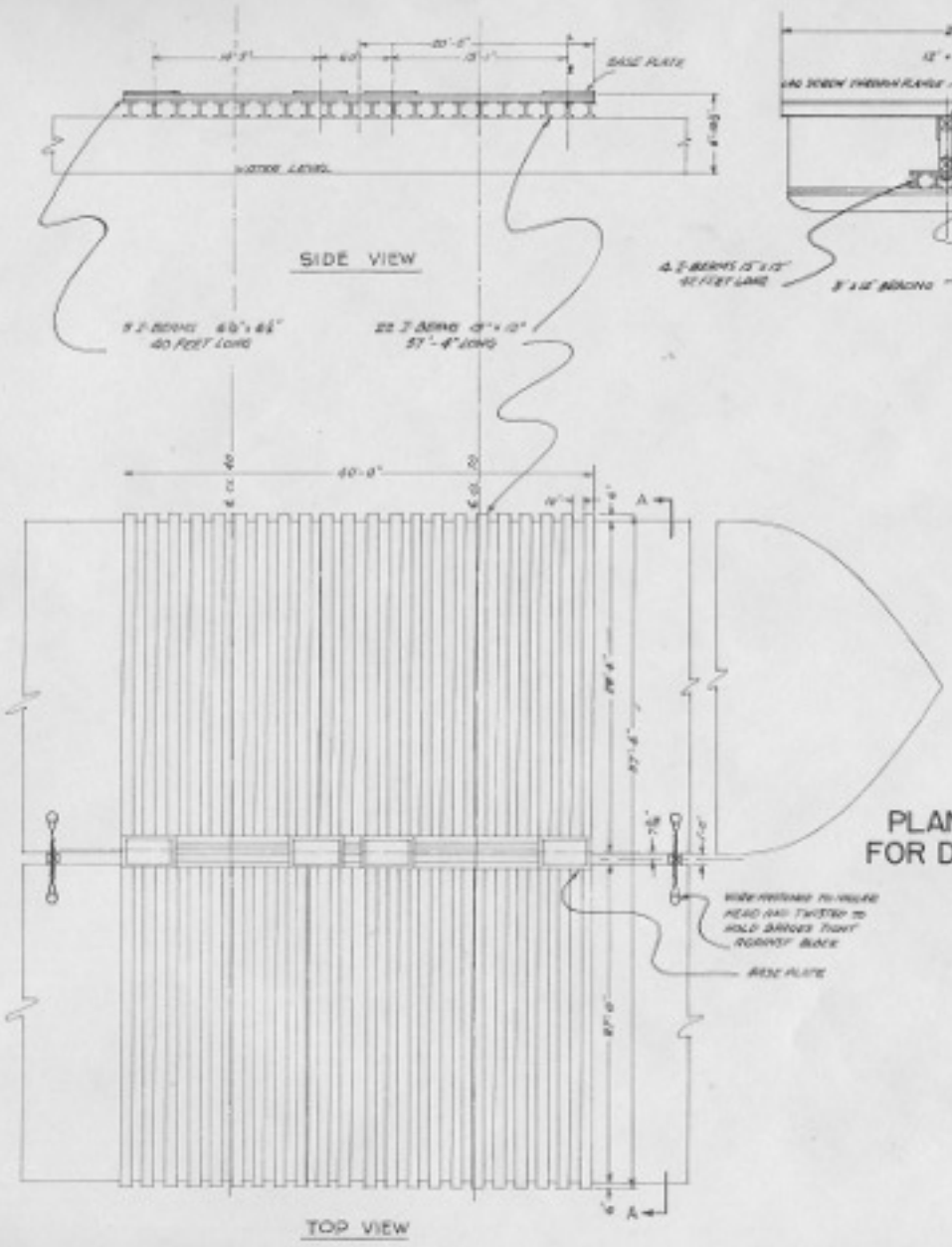

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1110 ENGINEER COMBAT GROUP

PLAN FOR WEST SHORE LANDING BAY PIER FOR DUAL CARRIAGE-WAY BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

SHEET 8 OF 18 SHEETS DATE 30 MARCH 1945

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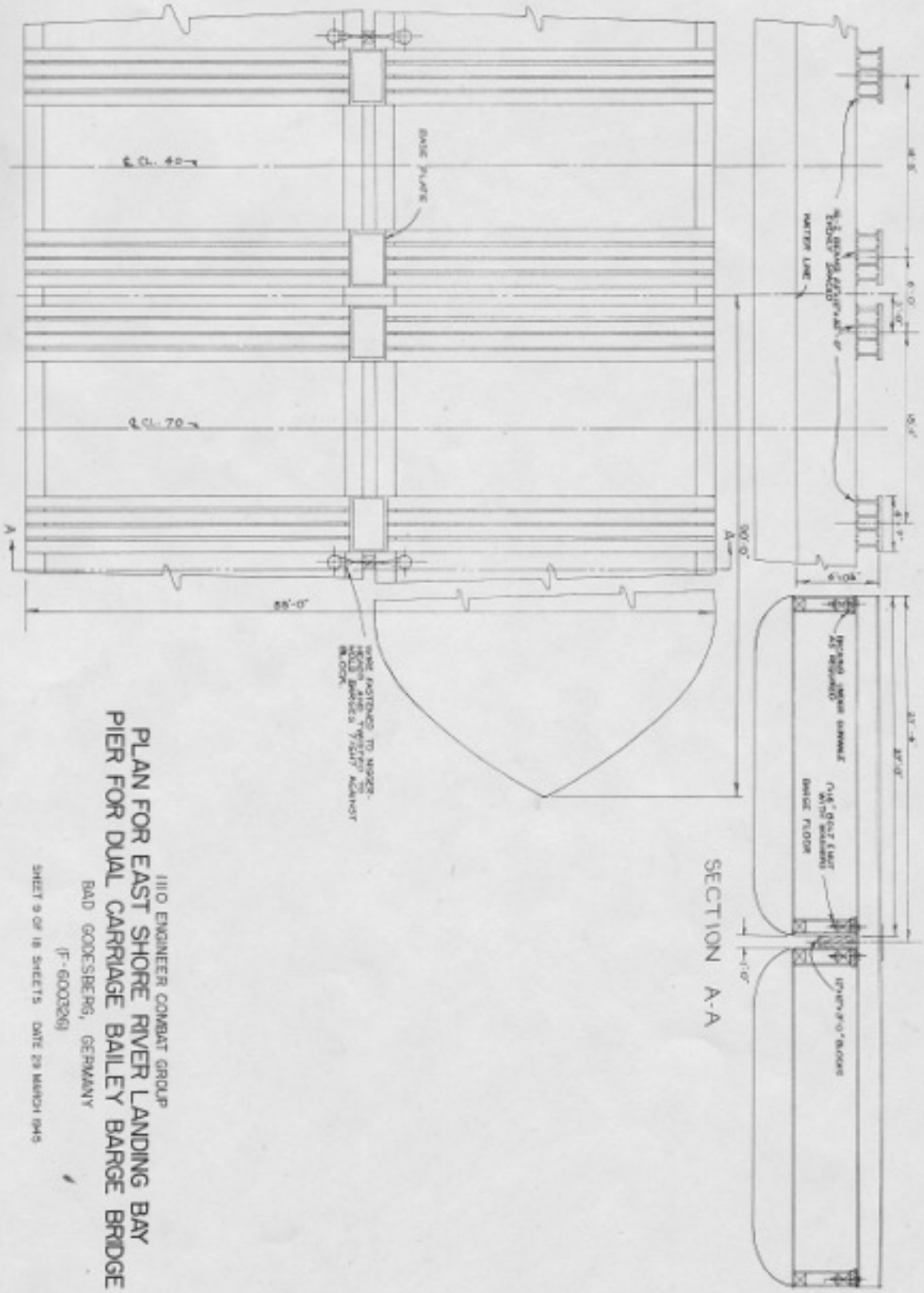

PLAN FOR EAST SHORE RIVER LANDING BAY
PIER FOR DUAL CARRIAGE BAILEY BARGE BRIDGE

III ENGINEER COMBAT GROUP
BAD GODESBERG, GERMANY
(F-600326)

SHEET 9 OF 18 SHEETS DATE 29 MARCH 1945

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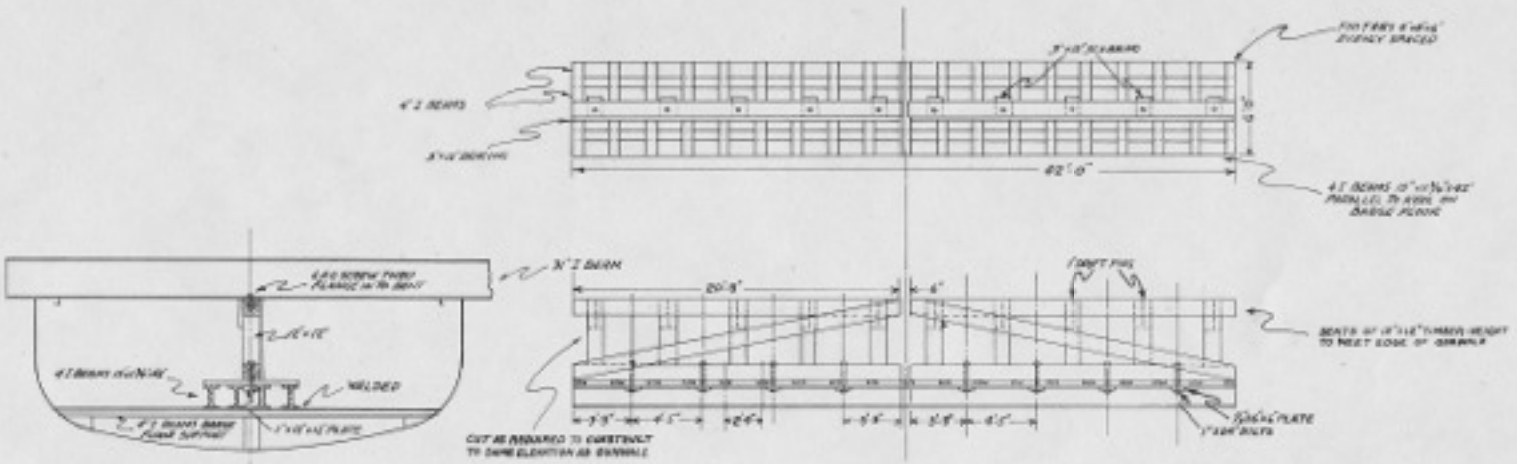
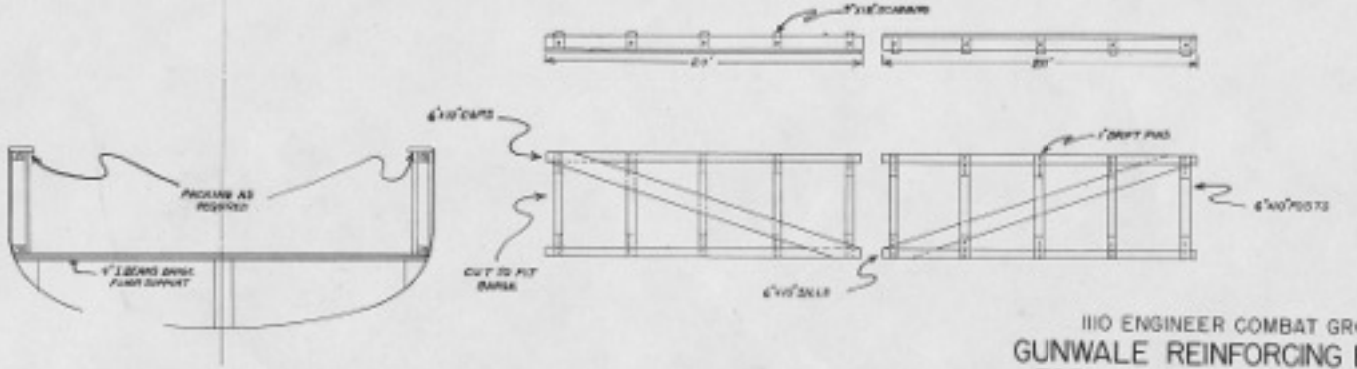


GUNWALE REINFORCING BENTS AND
LANDING BAY PIERS ON WEST SHORE



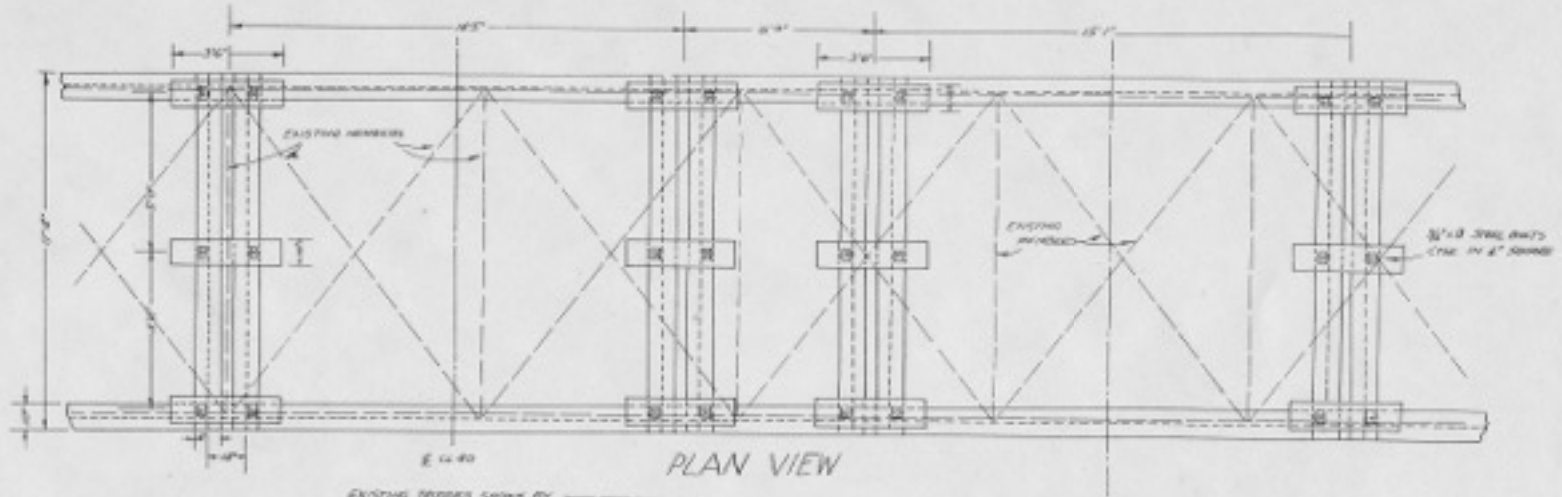
REINFORCING FOR GUNWALE FOR
EAST SHORE LANDING BAY PIERS

IIIO ENGINEER COMBAT GROUP

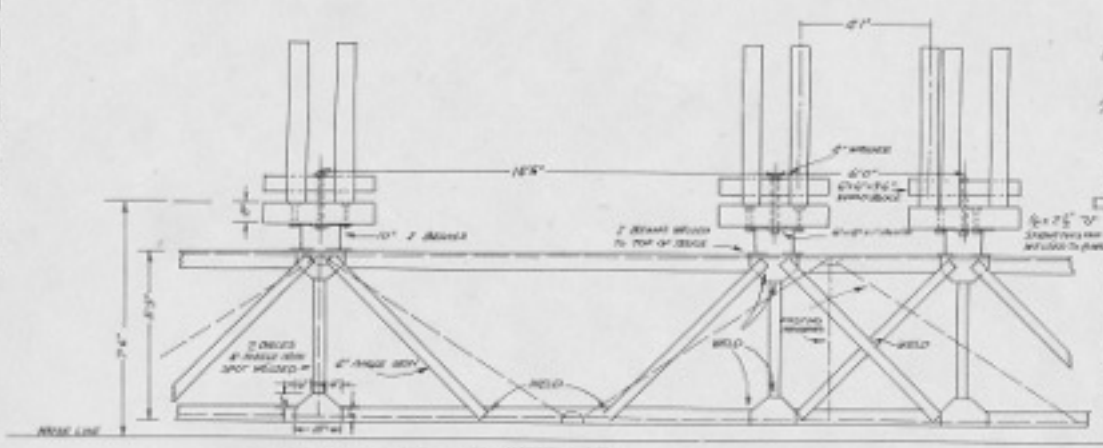
GUNWALE REINFORCING BENTS FOR INTERMEDIATE AND END FLOATING BAY PIERS DUAL CARRIAGE-WAY BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY
(F-600326)

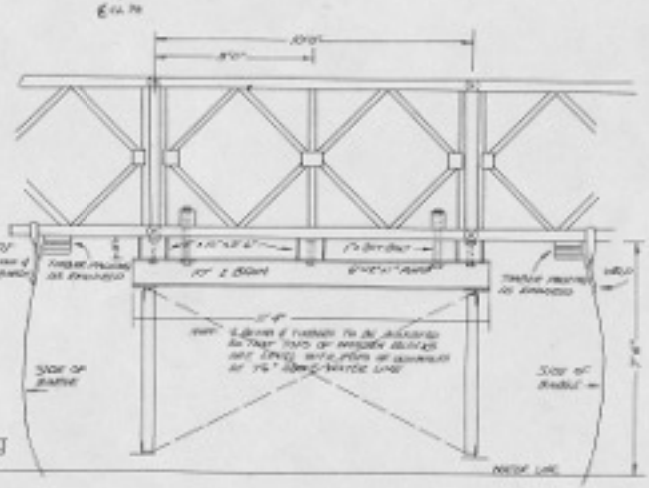
SHEET 10 OF 18 SHEETS 28 MARCH 1945



PLAN VIEW



ELEVATION

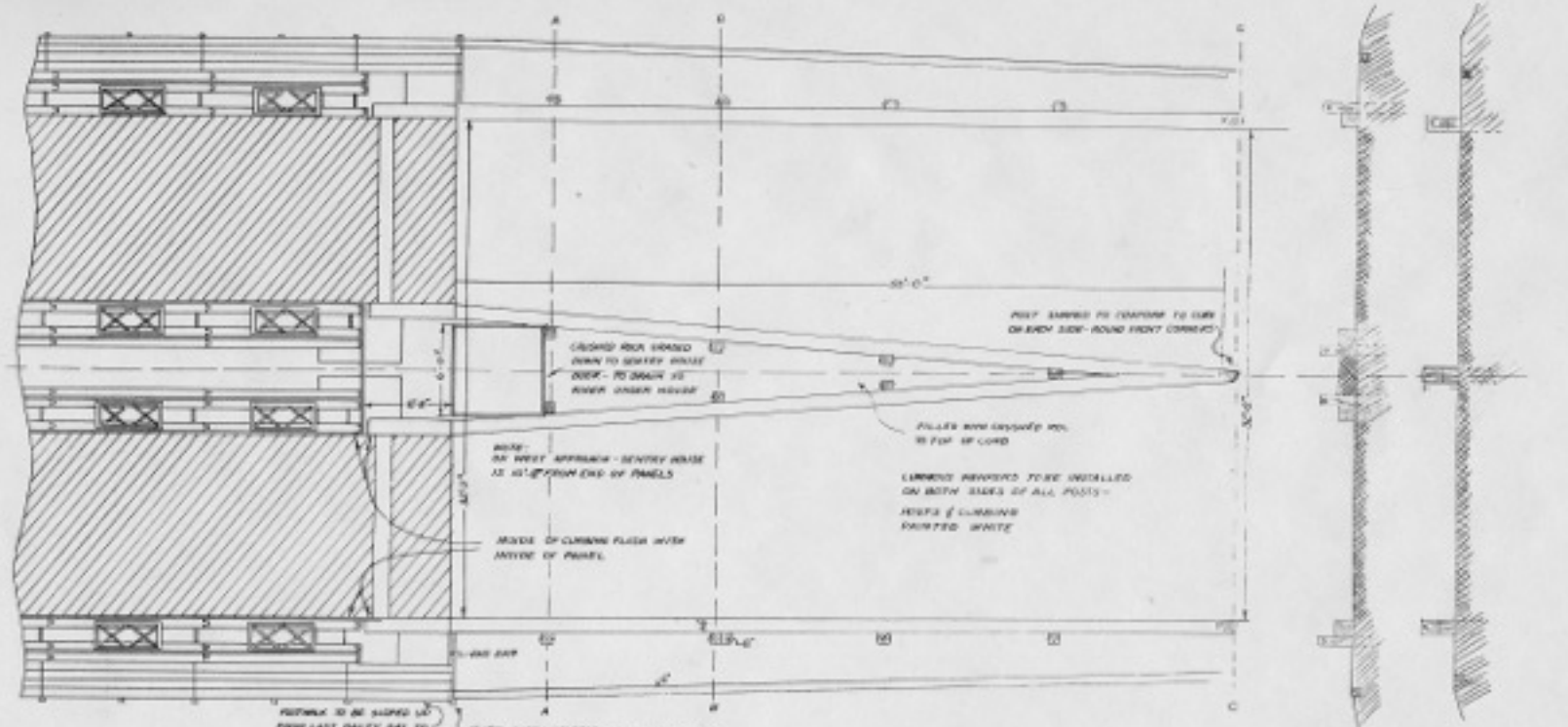


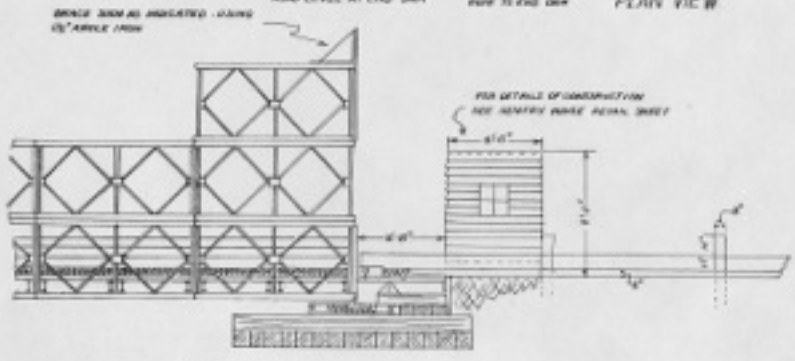
END VIEW

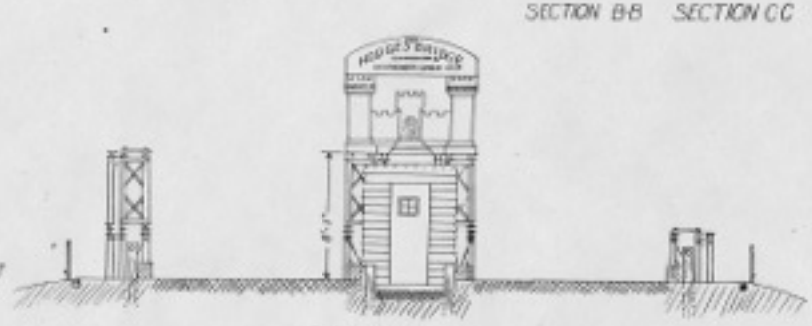
IIIO ENGINEER COMBAT GROUP

DETAIL OF BARGE PIER SUPPORTS FOR FLOATING BAYS

SHEET 11 OF 18 SHEETS 27 MARCH 1945







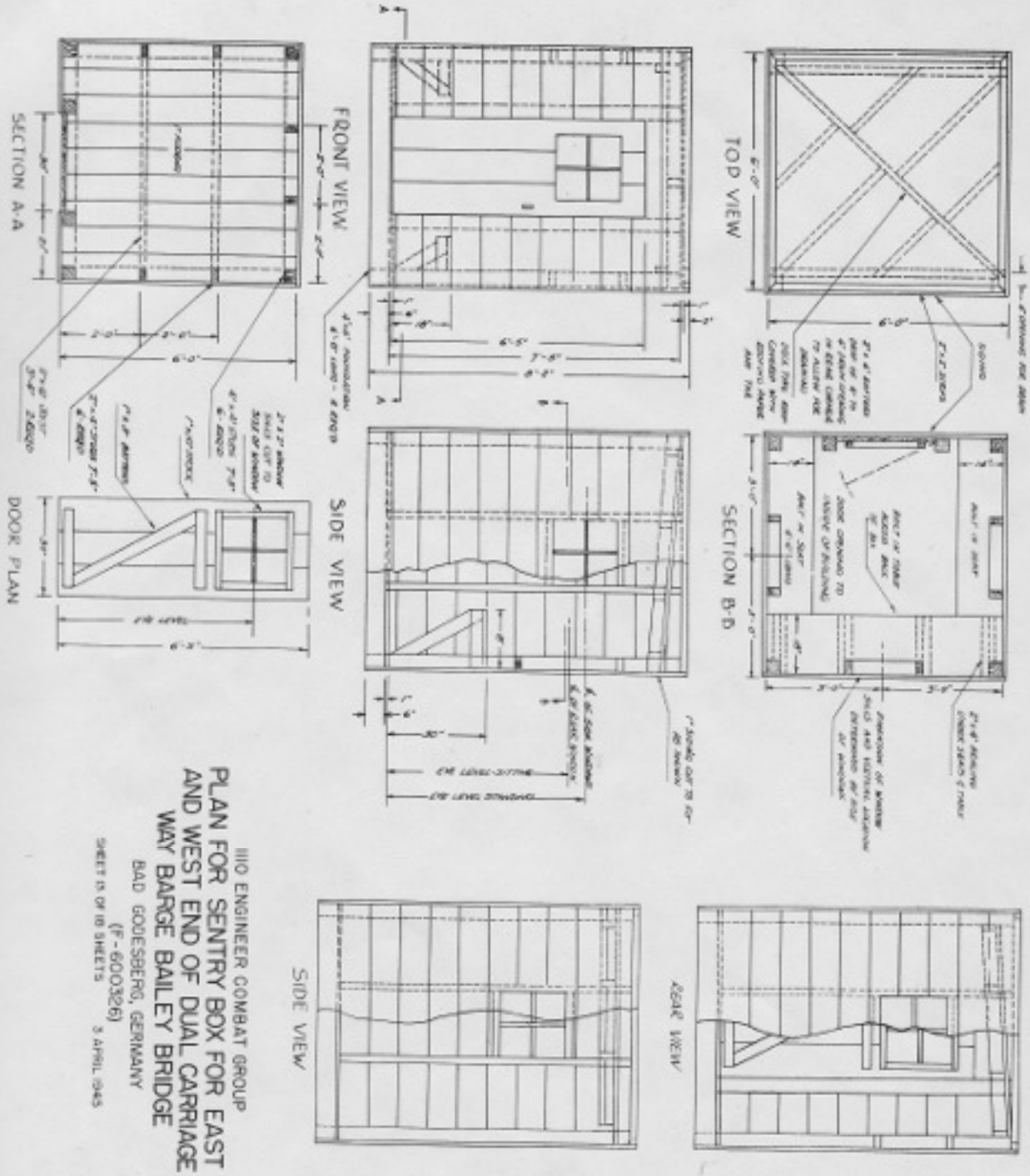
110 ENGINEER COMBAT GROUP

EAST APPROACH TO BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

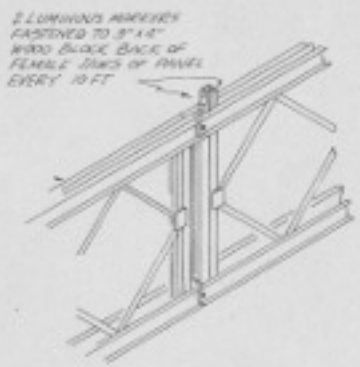
SHEET 12 OF 18 SHEETS 4 APRIL 1945

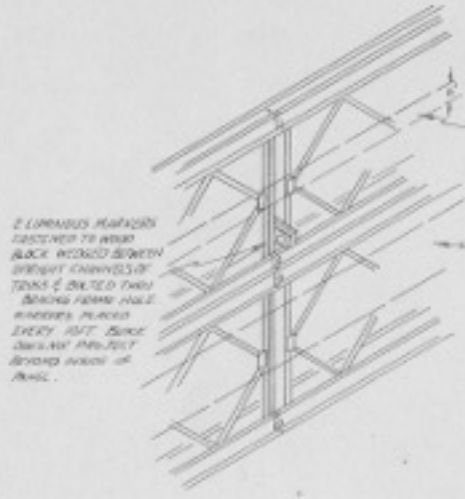


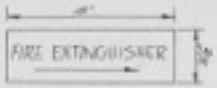
IIIO ENGINEER COMBAT GROUP

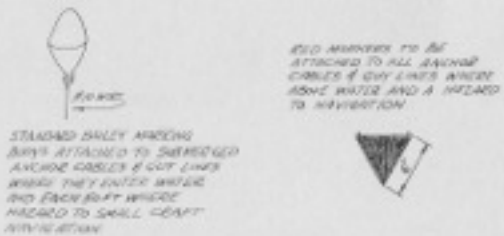
PLAN FOR SENTRY BOX FOR EAST AND WEST END OF DUAL CARRIAGE WAY BARGE BAILEY BRIDGE

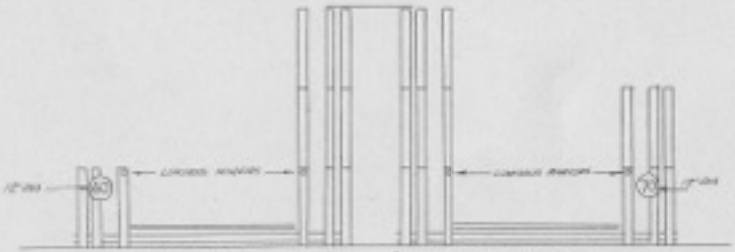
BAD GODESBERG, GERMANY
(F-600326)
SHEET 15 OF 18 SHEETS 3 APRIL 1945











DETAIL OF BARGE CLASSIFICATION & TRAFFIC LANE MARKERS

110 ENGINEER COMBAT GROUP

BRIDGE ATTACHMENTS OF BARGE BAILEY BRIDGE

BAD GODESBERG, GERMANY

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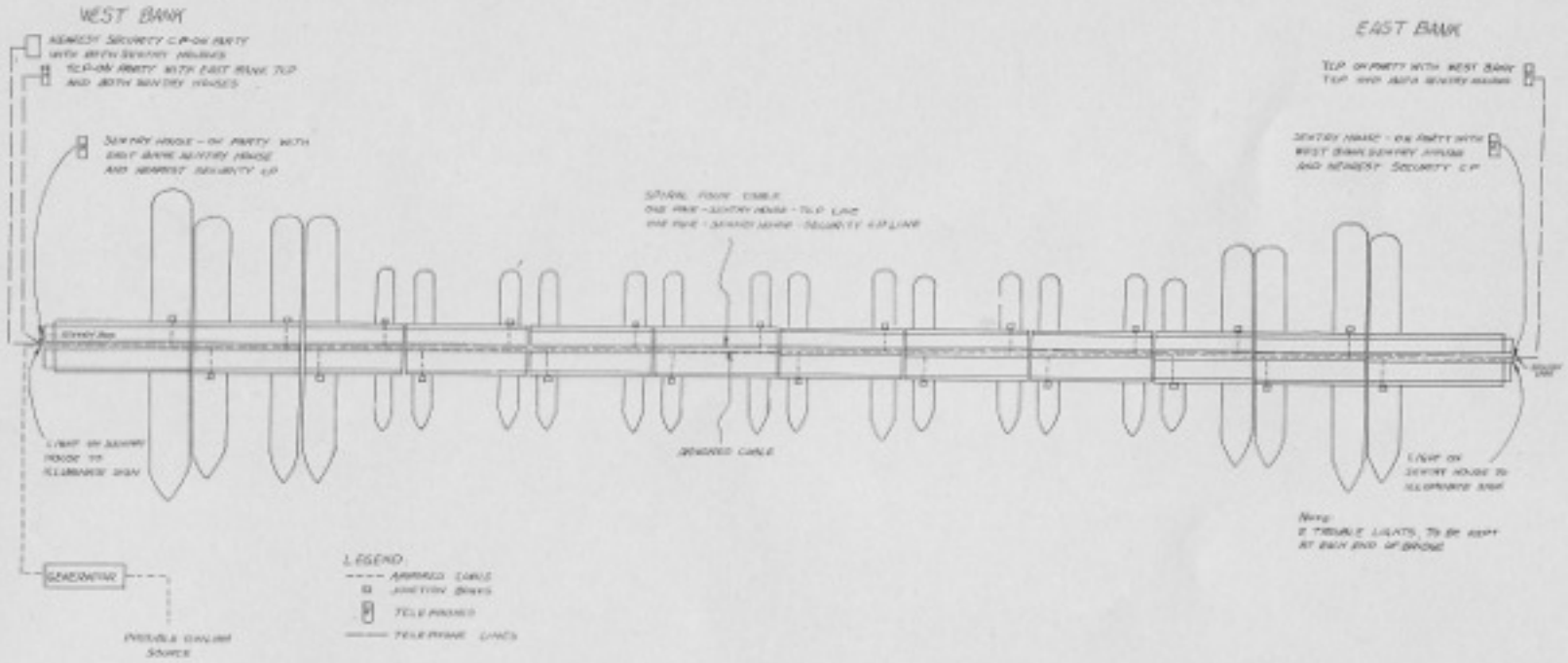
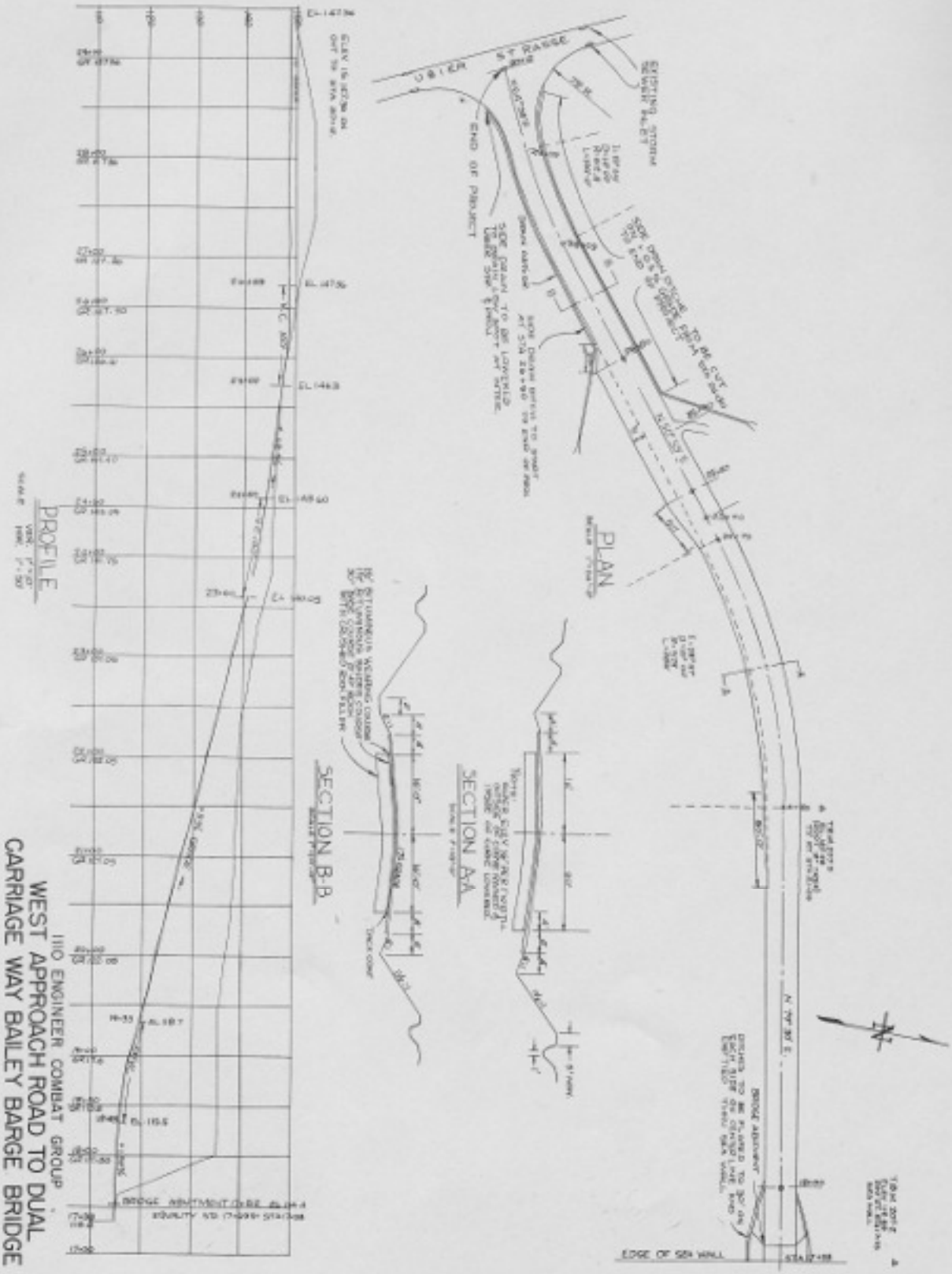


1110 ENGINEER COMBAT GROUP

COMMUNICATIONS & WIRE DIAGRAM FOR BRIDGE CONTROL

BAD GODESBERG, GERMANY

SHEET 15 OF 18 SHEETS 7 APRIL 1945



WEST APPROACH ROAD TO DUAL CARRIAGE WAY BAILEY BARGE BRIDGE

1110 ENGINEER COMBAT GROUP

BAD GODESBERG, GERMANY

(F-600326)

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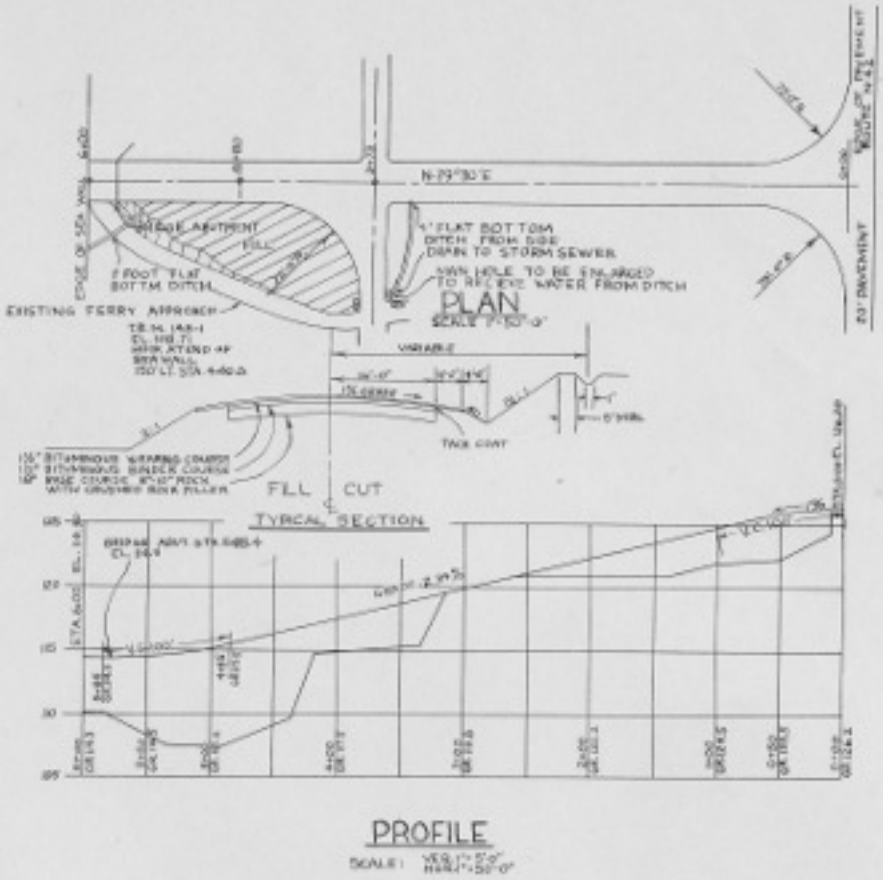


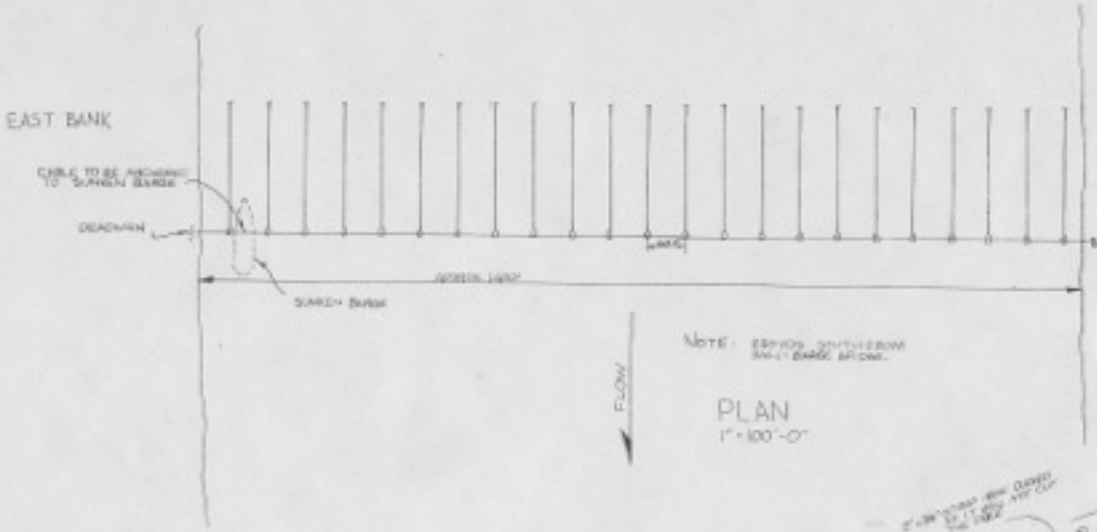
1110 ENGINEER COMBAT GROUP

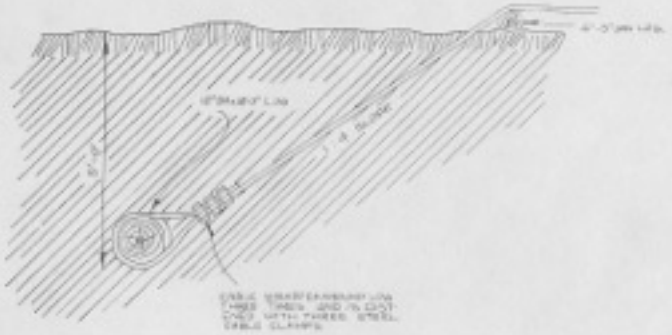
EAST APPROACH ROAD TO DUAL CARRIAGE WAY BAILEY BARGE BRIDGE

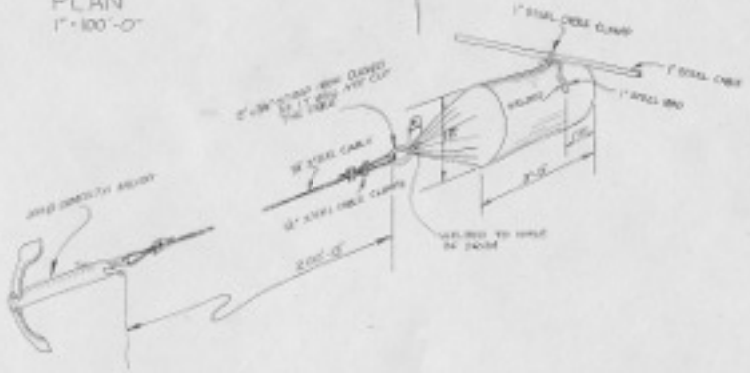
BAD GODESBERG, GERMANY

(F-600326)

SHEET 17 OF 18 SHEETS DATE 4 APRIL 1945







1110 ENGINEER COMBAT GROUP

CABLE BOOM FOR BAILEY BARGE BRIDGE

BAD GODESBERG, GERMANY

(F-600326)

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