N-5019 Sep '44

Engineer Technical Bulletin # 23

N-5019 4 Sep '44

ENGINEER HEADQUARTERS, FIFTH ARMY
A. P. O. #464, U. S. ARMY

R-5019

4 September 1944

ENGINEER TECHNICAL BULLETIN NO. 23

INDEX

I. MINES, BOOBY TRAPS, AND DEMOLITIONS

1. Beach Bombing: A group of Marauders recently bombed VIAREGGIO, one of pre-war Europe's elite summer resorts. After a few bombs, the whole beach seemed to leap into the air. Evidently the Germans realized VIAREGGIO's beachhead possibilities, but in their zeal to defend it laid many too many mines. Air Corps photographs of row upon row of mines going up in smoke re-emphasize the fact that mines buried in sand are especially sensitive to sympathetic detonation. (Source: Air Intelligence Weekly Summary No. 91, Headquarters, Mediterranean Allied Air Forces, Intelligence Section, 14 August 1944)

2. Use of Detonating Cord Against Anti-personnel Mines:

a. Tests.

(1) Schu mines. Preliminary tests, using from 1 to 15 strands of detonating cord bound together with tape or string, were made at Fort Belvoir against American facsimiles of German Schu mines. Mines were buried flush with the surface in hard clay at distances from the charge varying from zero to 30 inches. Further tests were undertaken at A. P. Hill Military Reservation against [illegible] buried at different depths in ground of varying compactness and [illegible]. Based on results obtained at Fort Belvoir, 13 strands of detonating cord were used as the

[redacted]

optimum combination for effect and ease of launching over the minefield. The mines were laid so that two were under the line of detonation cord, two 6 inches away (one on each side), two at 12 inches, two at 24 inches, and two at 30 inches. A similar pattern was used in all tests.

(2) "S" Mines. German "S" mines were simulated by inserting the 3-prong igniter used in the American type bounding-mine into cans filled with inert material. Operating characteristics of this device and the area subject to blast are essentially the same as with the German type. Multiple strands of detonating cord were tried against fields of these mines, some laid with common small-gauge trip wires and some without. As this method did not prove feasible for clearing "S" mines, a double layer of detonating cord net as specified for the carpet roll torpedo was tried. Much better results were obtained.

(3) Trip Wires. The effect of 13 and 21 strands of detonating cord was tested in cutting different size trip wires. These wires were attached to the pull ring of the 3-prong bounding-mine igniters, and to M-1 and M-2 pull type firing devices.

(4) Launching. To place the multiple strands of detonating cord across the minefields, tests were conducted using the M9A1 anti-tank grenade fired from the M-1 rifle, the bazooka rocket, and the firing chamber from the Blast Driven Earth Rod, T-1. The latter method was the only one successful in launching 13 strands for any appreciable distance. (As yet this headquarters has received no detailed information on the Blast Driven Earth Rod.)

b. Results of Tests.

(1) Schu Mines. Tests for the clearance of Schu mines with 13-strand detonating cord were performed in two types of ground conditions. In the first case discussed below, the mines were tested at varying depths in soft soil which had been plowed, leaving alternate ridges and depressions, and overgrown with weeds varying in height from 6 inches to 18 inches. In the second case, the site selected consisted of hard compacted clay and was somewhat rough.

Schu mines which were buried flush with the surface in the softer type of soil were 89% cleared for 30 inches on either side of the main line of a 13-strand detonating cord. At 24 inches on either side of the main line, 93.8% were either detonated or destroyed to the point where the mines were considered disarmed. It was determined that mines buried 1/8 inch below the surface were also effectively disarmed with 13 strands of detonating cord. In this case, 93.7% at 30 inches each side of the main line, and 97.5% at 24 inches each side of the main line were destroyed. Additional tests performed on Schu mines, either half buried or laid on the ground surface, indicated 100% destruction in both the 30-inch and 24-inch areas.

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Tests performed on Schu mines placed in level, hard compacted clay indicated that 13-strand detonating cord will successfully remove 96.8% of the mines at a distance of 48 inches on either side of the main line. Vegetation in this case had little or no effect. Under similar soil conditions, but where the mine is protected by a natural barricade such as a ridge of clay three inches high or more, the detonating cord is ineffective. However, if the mines are not protected by a nearby ridge, but the terrain is generally rough, the detonating cord will disarmy 91.8% of the mines at 30 inches on either side of the main line and 92.5% at 24 inches.

(2) "S" Mines. Tests with multiple strands of detonating cord against simulated "S" mines showed that it is ineffective against them unless the cord is resting on the 3-prong igniter. The type of ground seems to have no effect. Standard American type trip wires from the M-1 Pull Type Firing Device attached to the ring of the 3-prong igniter were cut in every case, but only one mine out of 50 was detonated by the cutting of the trip wires when 13 strands were used. When 21 strands of detonating cord were used, 2 mines out of 20 were detonated by the cutting of the trip wires. Simulated "S" mines were buried in the ground and barbed wire trip wires attached to the ring of the 3-prong igniter. Two layers of primacord net placed over the field caused the detonation of all mines. Each net was 36 inches wide, had an explosive density of 1/6 lb/sq. ft., and was of the same type described in Engineer Board Report 776, Carpet Roll Torpedoes for Destruction of Enemy Mines, dated 19 October 1943. In similar tests, but without barbed wire attached to the igniter, 66% of the mines were detonated.

(3) Trip Wires. In the tests of the effect of multiple strands of detonating cord against American type trip wire, 13 strands cut the wire every time. When standard issue wire was attached to the M-1 pull type firing device, in no case was one detonated. The wire was cut and thrown clear, but did not activate the firing device. However, if barbed wire were attached to the firing devices, either 13 or 21 strands of detonating cord caused 100% detonation.

(4) Launching. Tests were made to launch 13 strands of detonating cord with the M9A1 anti-tank grenade fired from the M-1 rifle, and a distance of 21 feet was obtained. Shots using the bazooka rocket averaged 86 feet. In each case the projectile was erratic and deflected approximately 30 degrees from its intended course of flight. Thirteen strands of detonating cord can be successfully projected in a straight line and in the desired direction by attaching the detonating cord to the firing chamber of the Blast Driven Earth Rod, T-1. The distance attained is 325 to 340 feet. (Source: Engineer Board Report 282, Equipment for the Passage of Enemy Minefields, dated 15 July, 1944)

3. Cylindrical Cardboard Encased Charges: The IV Corps Engineer reports his units finding cylindrical cardboard encased charges of varying

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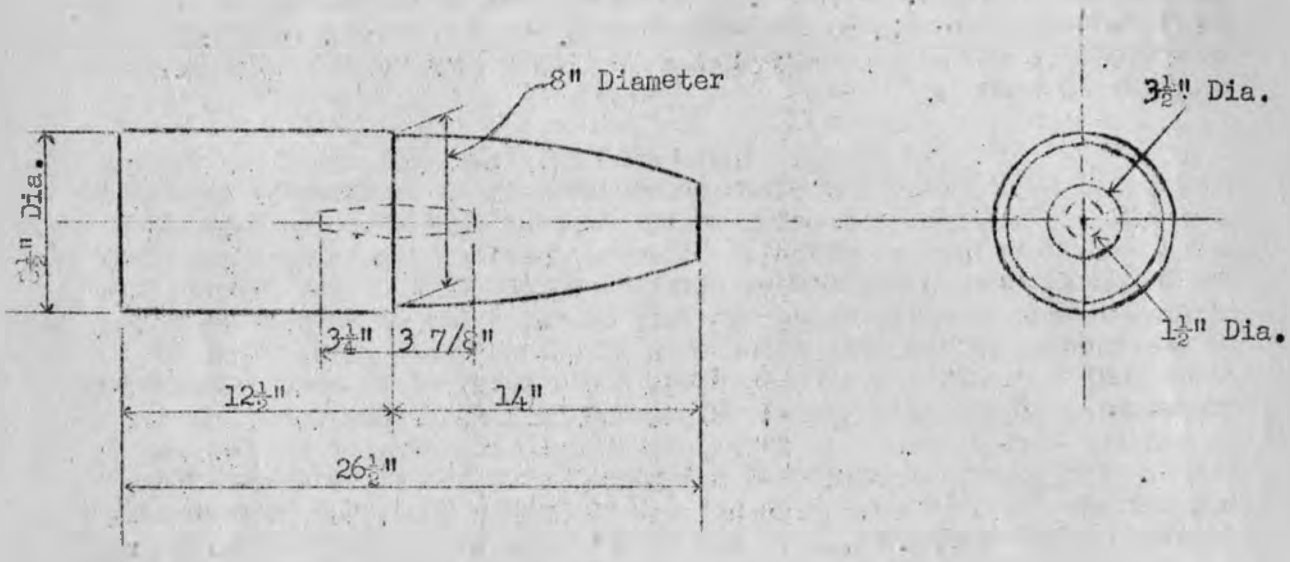
sizes (from a few pounds in weight up to one hundred or more pounds), which are being used by the Germans in their normal demolition work. The charges appear to be shell fillings. A sketch of one of these charges, weighing approximately 75 pounds, is given below.



CARDBOARD TYPE OF CONTAINER
LOADED WITH TNT

4. Mine Clearance Operations on Airfields from AQUINO to ROME Area:

a. Mines.

(1) Tellermines. In recent mine clearance operations on airfields from AQUINO to the ROME area, only T.Mi.43 (Mushroom) Tellermines were found. None was found to be booby-trapped, nor were any used as anti-personnel only. At LITTORIA, despite the fact that minefields were clearly marked with wire and notices, many Tellermines were found not fused, with wooden plugs still in place in the fuse chamber.

(2) Holzmines. These were found and removed at FROSINONE, again with no attempt having been made to booby-trap them.

(3) Italian Wooden Box Mines. These were found at OSA, LITTORIA and GUIDONIA in the ROME area. At the last place, only 2 bakelite igniters were used in each mine, fitted in diagonally opposite corners.

(4) Stockmines. A few stockmines were found on AQUINO Airfield, particularly around bomb craters and wreckage, but they appeared to

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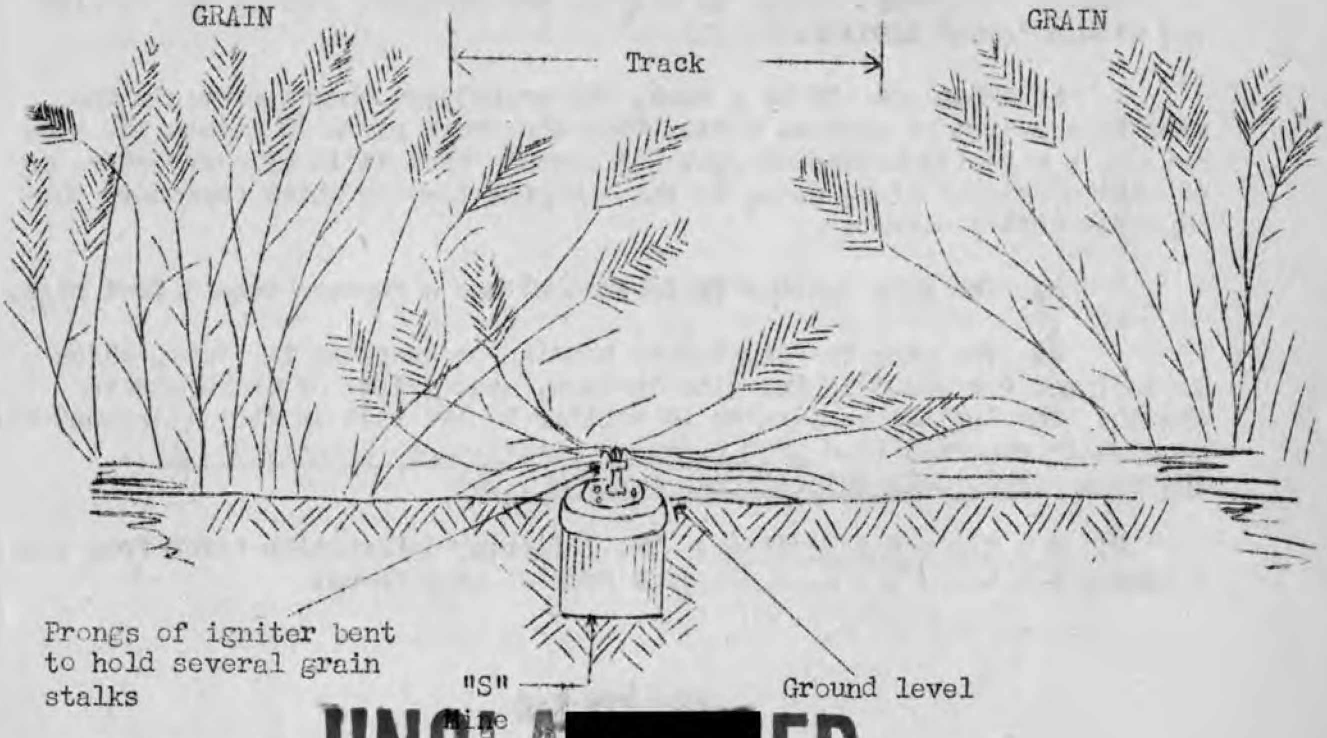
be in no set pattern. At AQUINO large numbers of "S" mines, still in boxes, were found on the airfield, but none had been laid.

b. Minefields.

(1) Marking. With the exception of AQUINO, where mines were laid in long grass without markings, and FROSINONE, where they were found to be merely a belt covering an approach road, fields were clearly marked with a single strand barbed wire on wooden pickets, approx. 12" above the ground, surrounding each belt. Prominent "MINEN" notices were posted in most cases, and little difficulty was found in detection.

(2) Mine patterns. Mine panels were in most cases laid to a clearly defined pattern. The almost universal pattern was four rows of six mines, four yards between mines and four yards between rows. On the airfields cleared, panels did not appear to be laid to any particular system of belts except at AQUINO, where they formed the perimeter of a strong point (part of the HITLER line) on the edge of the airfield; in this case they were set out in a semi-circular ring of 300 yards radius. (Source: Eighth Army Engineer Intelligence Summary No. 8)

5. "S" Mines Concealed in Grainfields: The following sketch illustrates how "S" mines were concealed in grainfields in the area of CETONA (A3085). The mines were laid at odd intervals quite far apart, mostly on or by the existing farm tracks along the edges of the fields. In one place, a vehicle had been run through a field and then "S" mines were laid in the tracks. The mines were laid with strands of grain pressed across the top of the 3-prong igniter and the prongs bent over them. (Source: Eighth Army Engineer Intelligence Summary No. 8)



"S" Mines laid in farm tracks.

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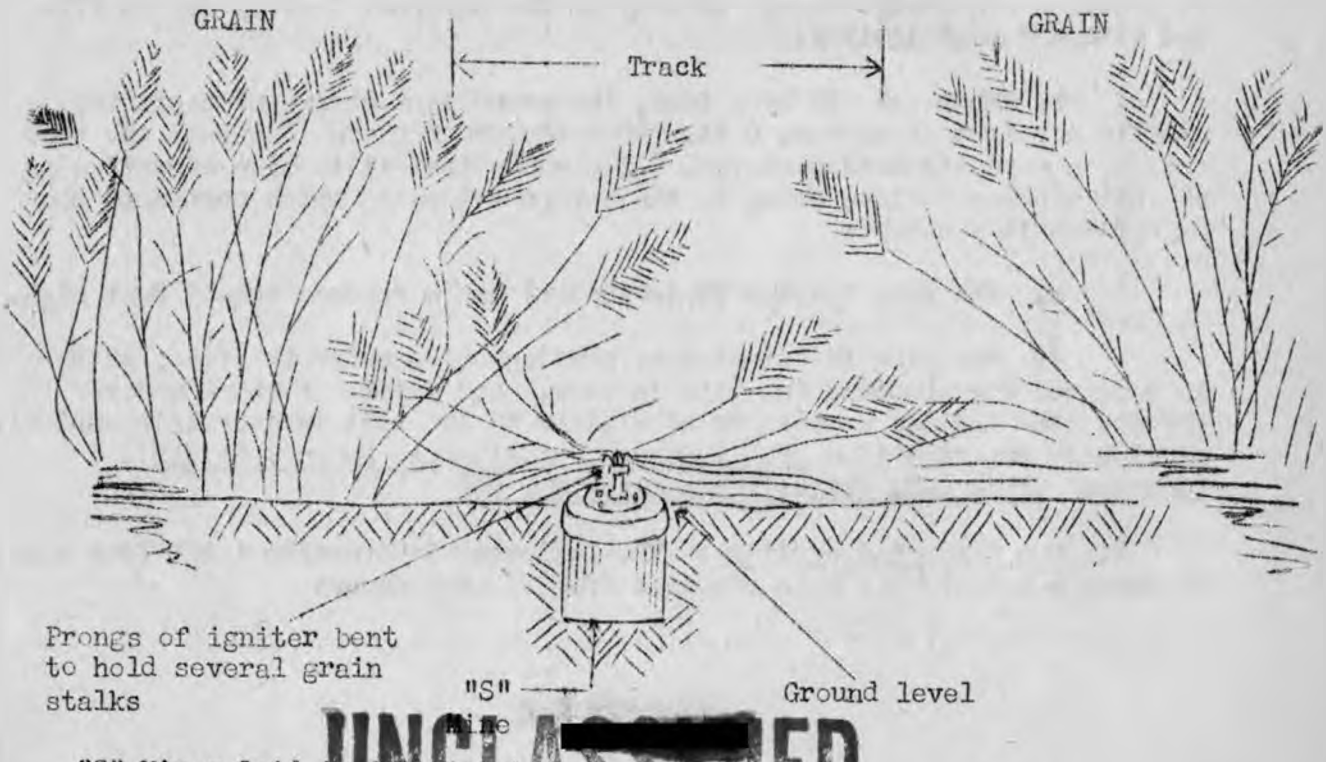

"S" Mines laid in farm tracks

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6. <u>R Mine 43 - New Type</u>: A new type of Riegelmine (see para I, 5, Fifth Army Engineer Technical Bulletin No. 21), the Spreng Riegel 8 kg (17.6 lbs) has recently been found in N. FRANCE. The following are the chief points of interest:

a. No lid is provided. The mine consists of an encased charge and box tray only.

b. Four igniter sockets are provided - two end sockets for Z.Z.42 igniters and two auxiliary sockets also in the ends of the charge. The latter are closed by screw plugs.

c. The method of supporting the stirrups of the main Z.Z.42 igniter varies considerably. On the outside of the tray there is a rotatable arrow which can be set to UNSCHARF (unarmed) or SCHARF (armed). This arrow rotates an actuating plate for the stirrup of the igniter.

d. There is no shear bar on the charge as on the R.Mi.43. The shear wires are consequently liable to sag without being really sheared.

e. It would appear that this mine is an early model of the Riegelmine 43, as technically it is inferior to the standard type. (Source: <u>AFHQ, G-2, Intelligence Notes No. 70</u>)

7. <u>Panzermine 43</u>:

a. The existence of a new anti-tank mine, the Panzermine 43, has been identified from some notes captured in N. FRANCE. The mine appears to be made in two parts and is similar to the "S" mine. However, it contains a magnetic charge as well as the shrapnel loading and is fitted with a "snap" igniter.

b. When set off by a tank, the propellant charge protects the mine to a height of approx. 6 ft. When the armor plate is struck the mine acts as a magnetic hollow charge. It appears that it is also effective as an anti-personnel mine, owing to the shrapnel loading which surrounds the magnetic hollow charge.

c. The snap igniter (Knickzunder) has a rupture tube 3 feet high.

d. The mine is actuated by bending or snapping the tube, which is designed for use with the mine in snow, sand drifts or thick undergrowth. The igniter appears to be similar to the tilt igniter (Kippzunder) previously reported (See <u>AFHQ Engineer Intelligence Summary No. 45</u>). (Source: <u>AFHQ, G-2, Intelligence Notes No. 70</u>)

8. <u>New Mines and Igniters</u>: The following information taken from some captured notebooks has been received from 21 Army Group:

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a. L-Mine (Landsitz Mine). This mine has not yet been issued. It is intended, according to the writer of the notebook, to replace the Riegelmine 43.

b. Z.Z.43 Igniter. Similar to the Z.Z.42 igniter but has a safety device. Made of bakelite, the igniter can be used for a tension wire alarm. (Source: AFHQ, G-2, Intelligence Notes No. 70)

9. Booby-trapped Tellermines: The 337th Engineer G.S. Regt. reports finding Tellermines alongside roads, appearing as if they had been lifted by our troops and deliberately thrown there, but actually laid intentionally in this manner by the Germans, and booby-trapped.

10. Minefield Marking by Tripods: Several cases have been reported where tripods of stakes, bound together at the top with grass or wire, have been used to mark the area in which mines have been laid. The tripod is about four feet high and is always placed conspicuously. (Source: Fifth Army G-2 Report, dated 8 August)

11. LEGHORN Deloused: Up to 1 September 1944, 3689 Holzmines, 3337 Tellermines, 673 "S" mines, 1056 Schu mines, 261 depth charges and 186 miscellaneous demolition charges have been removed in the Port of LEGHORN (LIVORNO).

12. Mine Clearance Along Roads: On the following page is a sketch showing mines which were removed from road verges by the 337th Engineer G.S. Regt. after they were reported cleared by tactical units. This appears to indicate that a single sweeping cannot always be relied upon to remove all mines.

13. German R Mine 43: The following report has been received from the 39th Engineer Combat Regt.:

a. R mines are shipped with igniters and detonators already in position. The mines carry a paper label warning "ATTENTION - DO NOT DROP - DANGER OF EXPLOSION."

b. The detonators could not be removed from any of the mines examined by this headquarters. It is not known whether the detonator is intentionally molded into the booster charge or if the binding action is caused by the swelling of the explosive due to weather. The fact remains that when the igniters were removed the detonators remained in the mines.

c. It is advised that this mine be detonated in place, as careless handling has in several instances resulted in activation of the mine.

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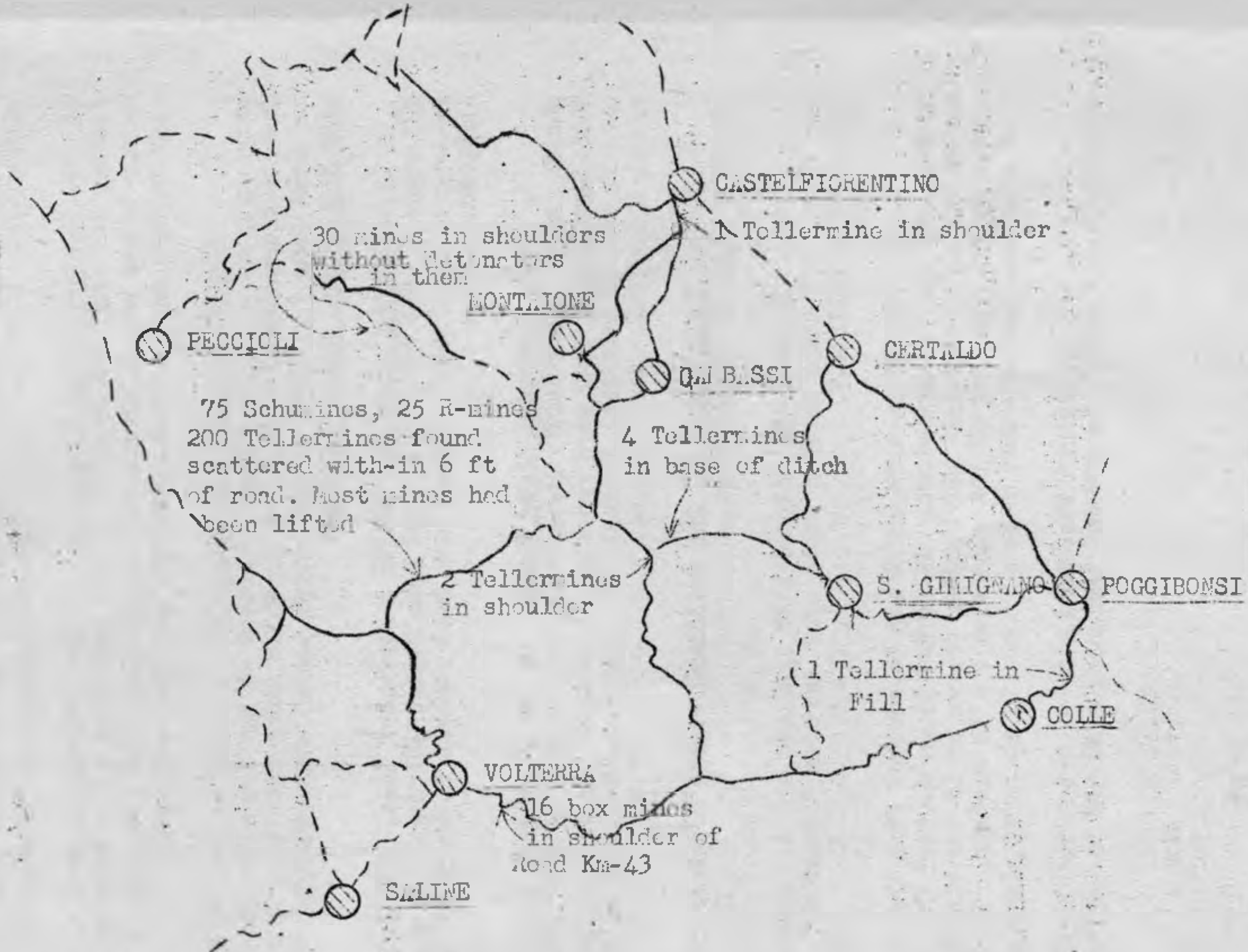


[redacted]

________ Roads swept by Corps Engineers and reswept by 337 Engr GS Regt
- - - - - Roads swept once by Corps Engineers.
SCALE - 1:250,000

II. OTHER FIELD DEFENSE WORKS

1. Enemy Pillboxes: The following information, concerning types of enemy pillboxes and machine-gun emplacements encountered in ITALY up to the "Adolf Hitler Line", has been taken from the Chief Engineer, AAI, report, Engineer Operations in ITALY - Notes No. 18.

a. General. Many pillboxes and road blocks, Italian and German, have been met. Until the start of the offensive on 11 May, pillboxes met guarded the coastline or, singly or in groups, defiles on roads and railways. In the recent offensive, for the first time, a long belt of German pillboxes was encountered, forming the core of the Adolf Hitler Line.

b. Pillboxes on the Coast. Scattered Italian concrete pillboxes were met along the west coast of ITALY. At NETTUNO, in the ANZIO beachhead, fifteen circular steel pillboxes were found in a belt parallel to the coast and a mile deep. Some were mounted on concrete towers 15 to 20 feet high.

c. Pillboxes in Defiles:

(1) Guarding roads and railways leading to NAPLES, in the narrow cultivated strip between VESUVIUS and the sea.

(2) Guarding roads and railways in the vicinity of CANCELLO ARNONE on the River VOLTURNO. (See sketch, "Enemy Defense Position - VOLTURNO River")

(3) Guarding roads through villages.

d. Pillboxes in Adolf Hitler Line. Pillboxes occupied a belt about 10 miles long by ½ mile deep, stretching from 3 miles south of PONTECORVO across the LIRI valley to AQUINO and thence to PIEDMONTE. Three types were encountered:

(1) M.G. Post with steel cylinder dugout, consisting of a 10½' long by 3' diameter 1 5/8" steel cylinder, providing sleeping accommodation for 6 persons, sunk 3½' below the ground surface and surrounded with reinforced concrete. The cylinder, which is set horizontally in the ground, has a 27" semicircular escapeway at the one end and at the other end leads to a reinforced concrete M.G. Post adjoining it. The Germans used a similar design at TOBRUK.

(2) Mobile Steel Pillbox. Sunk well into the ground with only 3' projecting; well covered with earth and camouflaged.

(3) Pillbox with Panther tank turret. 11' by 7' 6" by 9' 3" steel chamber, with 2" walls, sunk into the ground with 4' projecting above. The projecting part supports a Panther tank turret mounting a 75 mm. gun. (Drawing No. Fort/120/44 illustrates the layout where the line

crossed Route 6. It appears that the posts are placed in pairs for mutual fire support, the distance between them varying from 30 to 60 yards, whereas the distance between consecutive pairs may be anything up to 270 yards.)

e. Types of Pillboxes - Italian.

(1) Circular, steel pillbox, 10' 2" inside diameter, with a slightly domed steel roof, the whole built of 1" steel plate with riveted joints. (Drwg. No. P/128/44)

(2) Free standing, circular, domed, concrete pillbox, 6' - 12' inside diameter, with walls 3' 3" - 5' thick, built for all round fire. (Drwg. No. F/109/44)

(3) Similar to (2) but semi-circular and built up against a wall or bridge face. (Drwg. No. P/125/44)

(4) Free standing, irregularly shaped, domed, concrete pillboxes of lengths up to 40' with walls about 5' thick, built for fire in two or more directions, sometimes for all round fire. Protected by a wing wall or by opening on to a baffle wall inside. The interiors are divided by baffle walls into several chambers of all shapes. (Drwg. No. P/125/44 and P/124/44)

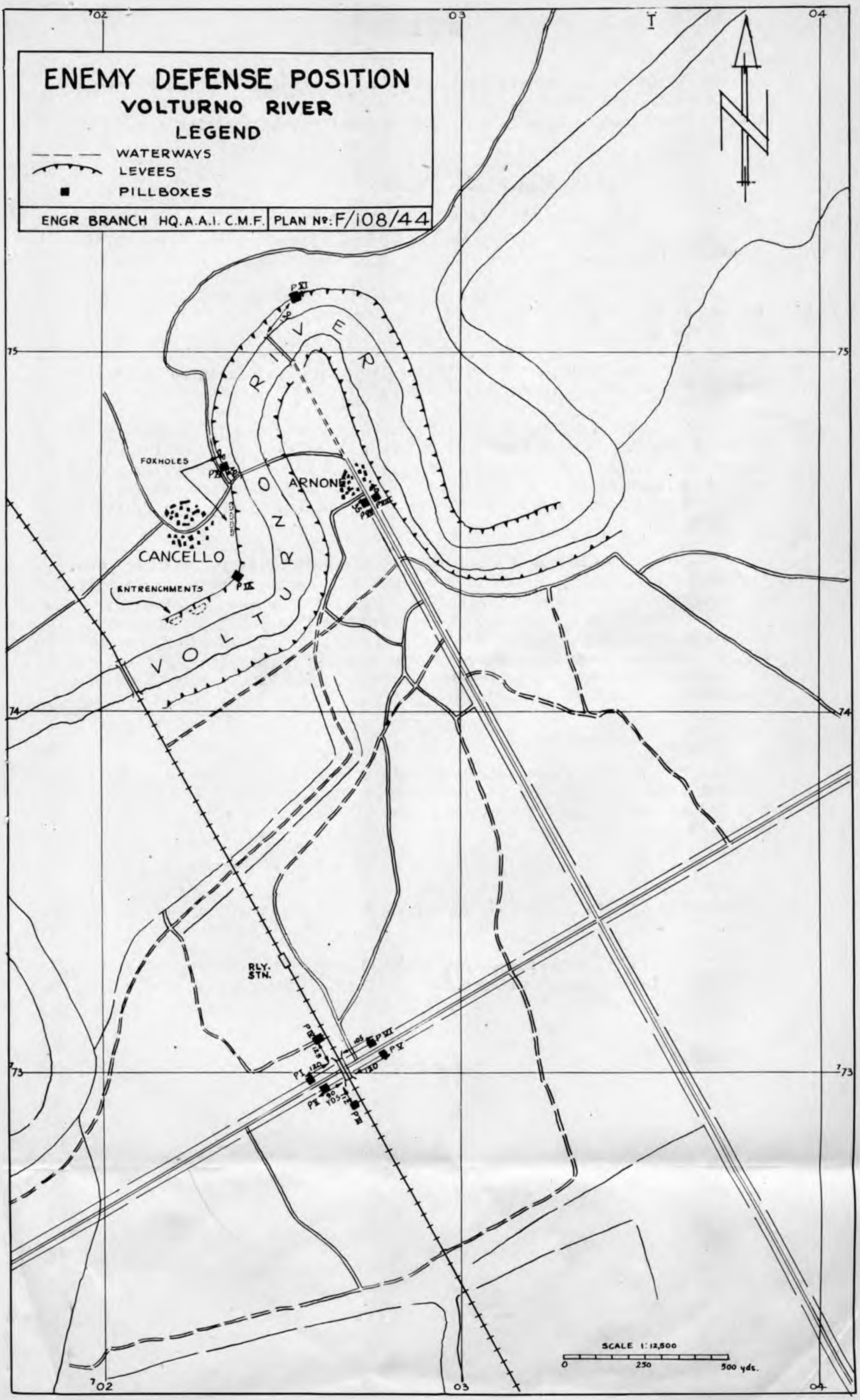
All these Italian pillboxes were built for machine guns. At GAMALDOLI di TERRE, at the foot of VESUVIUS, however, there was a pillbox constructed for heavier weapons. It was sited on the hillside and covered the POMPEII autostrada. It was irregular in plan and comprised a vaulted chamber 17' 6" by 12' for the gun, with a basement under, and two chambers reached from the basement, each with 180 degree arcs of fire. In the vaulted chamber there were three ammunition niches and three large fire slits. (Drwg. No. P/126/44)

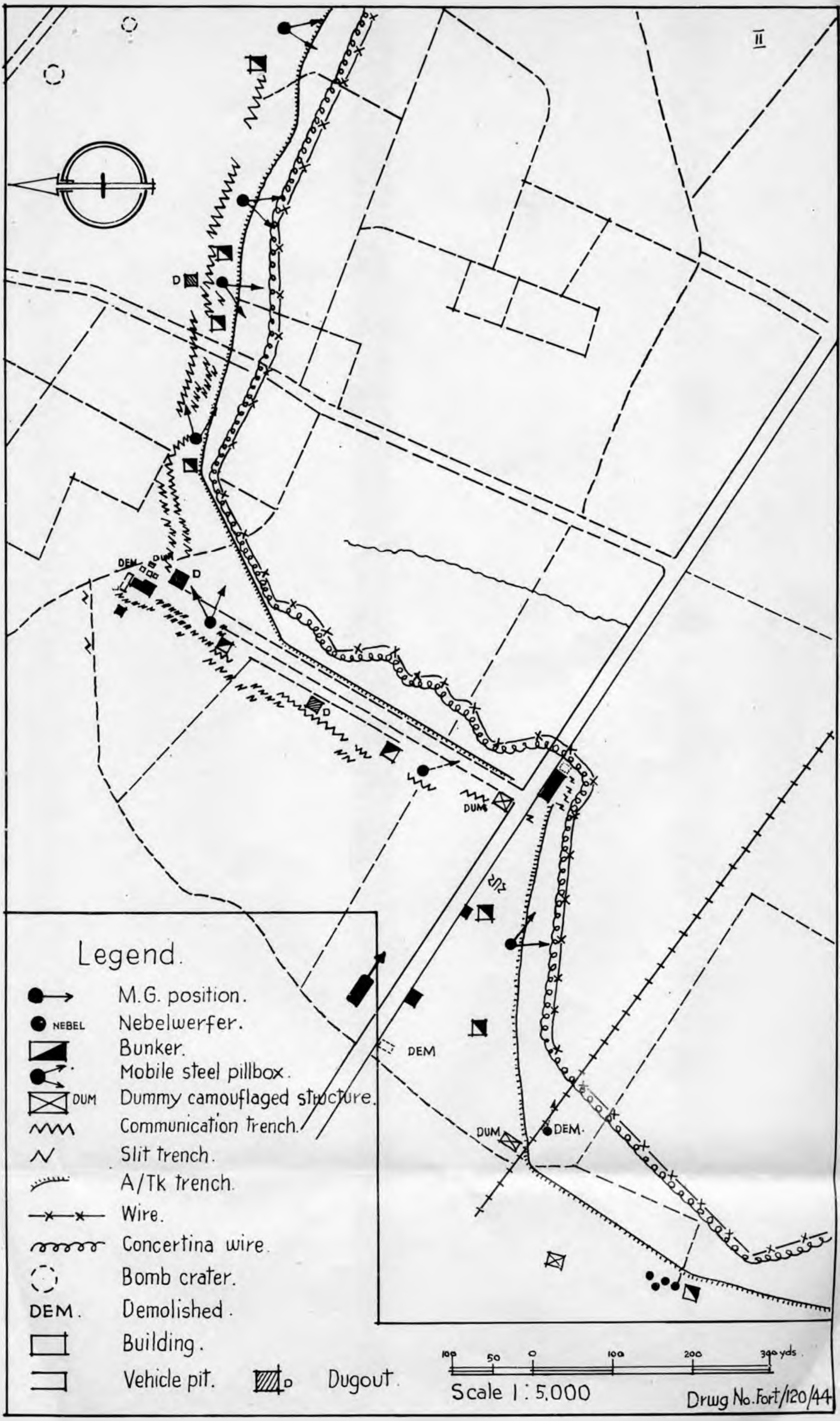
f. Road Blocks.

(1) Concrete tetrahedra of various mixes, fine and coarse, and with faces measuring 3' 6", were met on Route 7 (NAPLES - ROME via West Coast) and elsewhere. They were usually associated with fixed road blocks as described below.

(2) Rectangular concrete blocks 7' by 5', sited in pairs so as partially to block roads, were met on the road between CASTEL VOLTURNO and CANCELLO ARNONE. These blocks can be closed by inserting bars in slots.

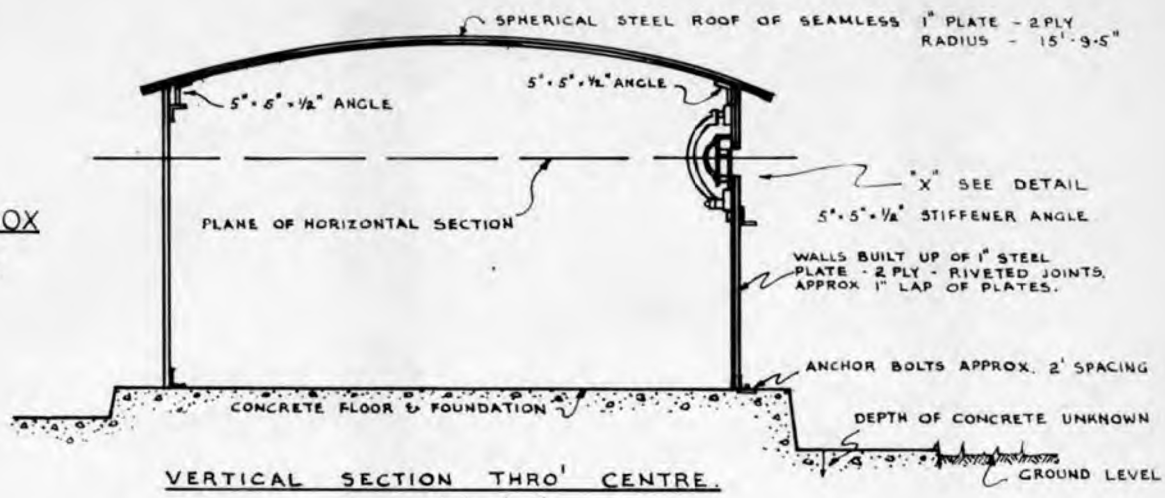
(3) A concrete block, with firestep incorporated, was met at a crossroad in CERCOLA, 5 miles East of NAPLES. (Drwg. No. R/109/44)


ENEMY DEFENSE POSITION
VOLTURNO RIVER
LEGEND
WATERWAYS
LEVEES
PILLBOXES
ENGR BRANCH HQ.A.A.I. C.M.F.
PLAN No: F/108/44
FOXHOLES
CANCELLO
ARNONE
ENTRENCHMENTS
VOLTURNO RIVER
RLY. STN.
SCALE 1:12,500
0
250
500 yds.
02
03
04
75
74
73

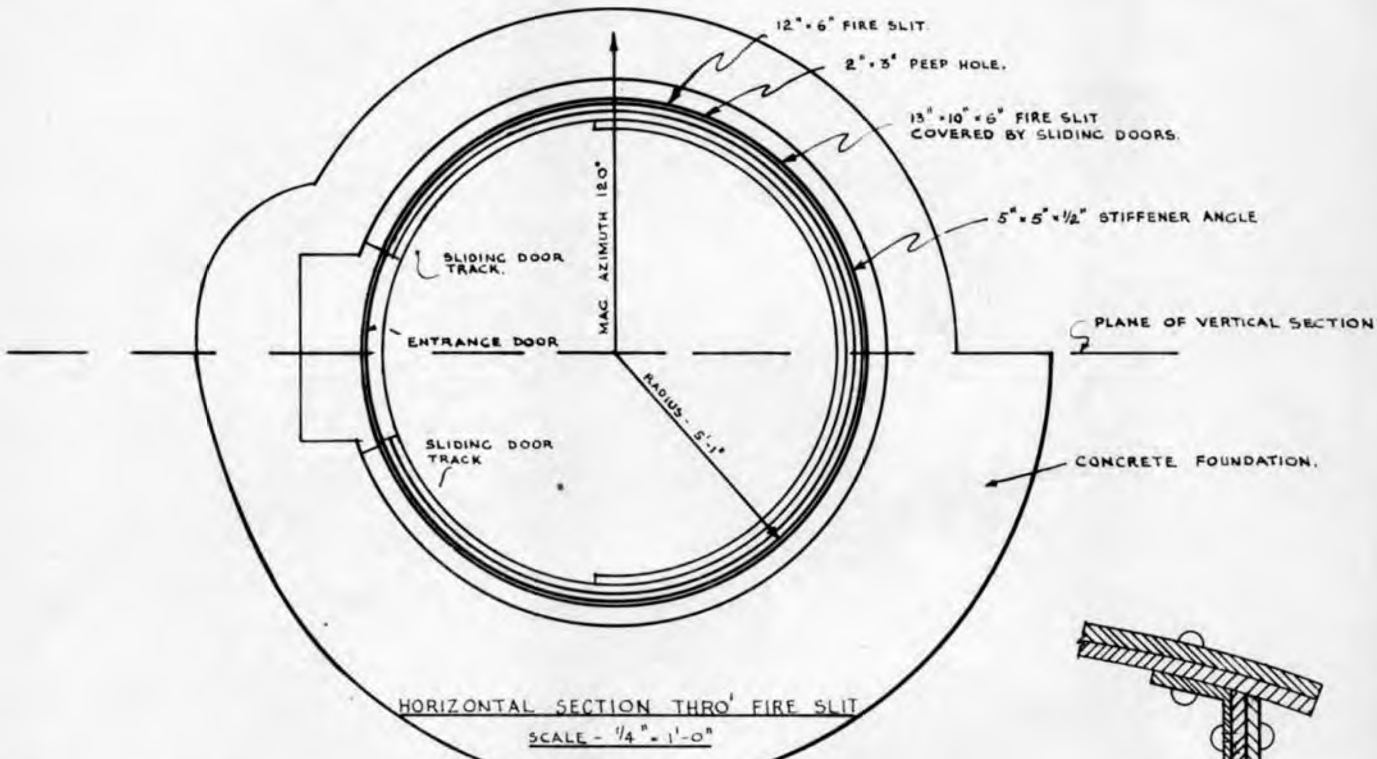

II
Legend.
M.G. position.
NEBEL Nebelwerfer.
Bunker.
Mobile steel pillbox.
DUM Dummy camouflaged structure.
Communication trench.
Slit trench.
A/Tk trench.
Wire.
Concertina wire.
Bomb crater.
DEM. Demolished.
Building.
Vehicle pit.
D Dugout.
100 50 0 100 200 300 yds
Scale 1 : 5,000
Drwg No. Fort/120/44
DEM
DUM
D
DEM.

III

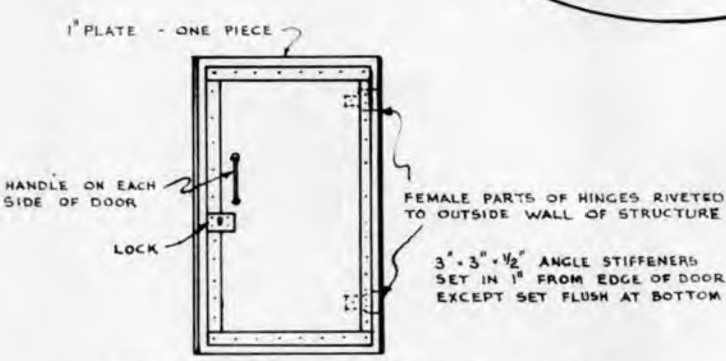
ENEMY PILLBOX ON NETTUNO BEACH



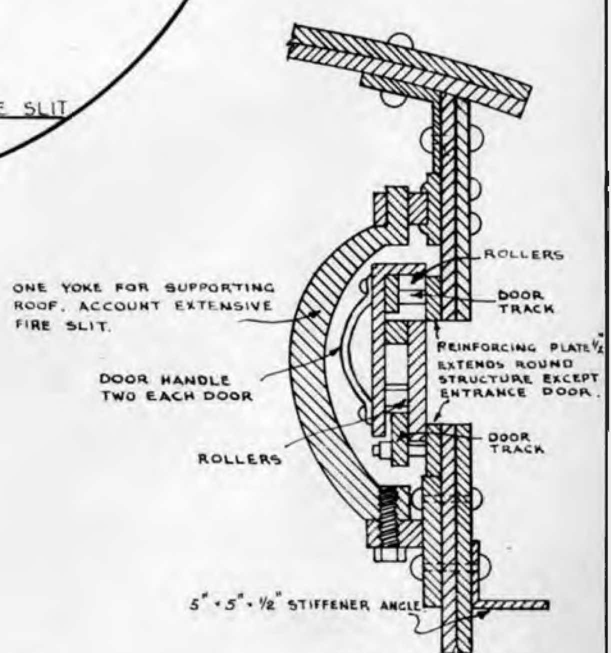
VERTICAL SECTION THRO' CENTRE.
SCALE - 1/4" = 1'-0".



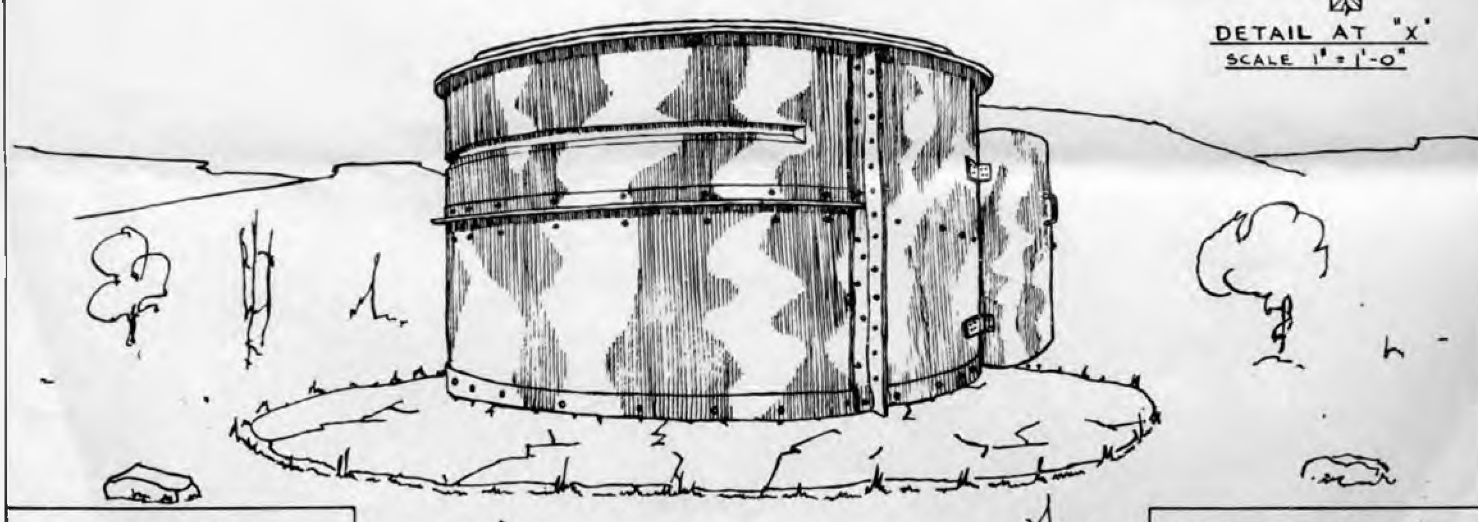
HORIZONTAL SECTION THRO' FIRE SLIT
SCALE - 1/4" = 1'-0"



DETAIL OF ENTRANCE DOOR (INSIDE VIEW)
SCALE 1/4" = 1'-0"



DETAIL AT "X"
SCALE 1" = 1'-0"



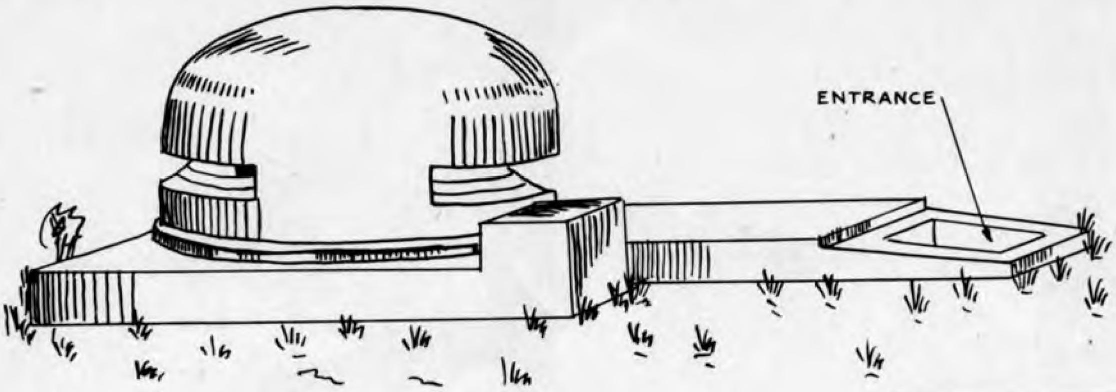
PERSPECTIVE VIEW FROM PHOTOGRAPH

ENGINEER BRANCH,
H.Q., A.A.I.
C.M.F.

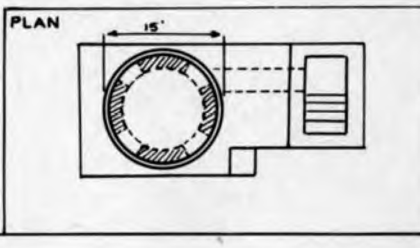
DRAWING Nº P/128/44
DRAWN BY. N.O. COOPER. CPL. R.E.
DATE 4-5-44.

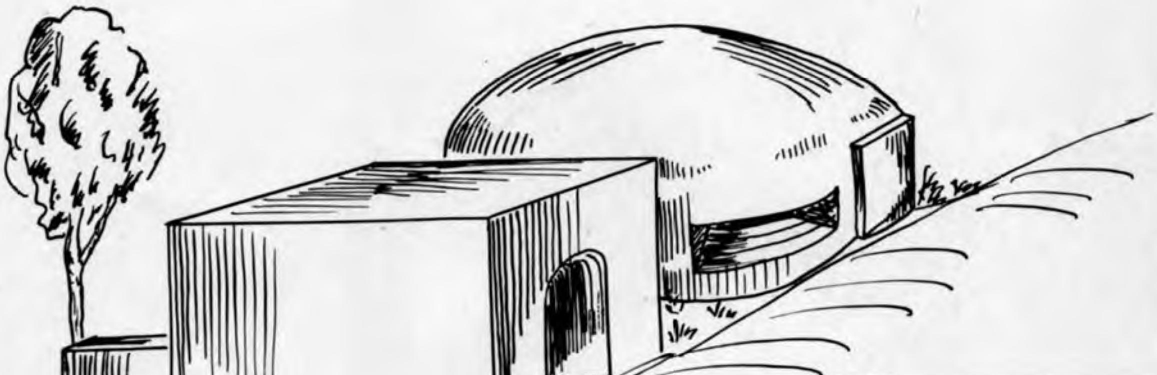
ENEMY FIELD FORTIFICATIONS

IV

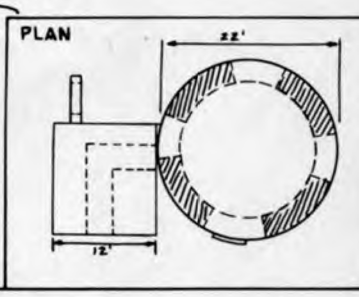


P I

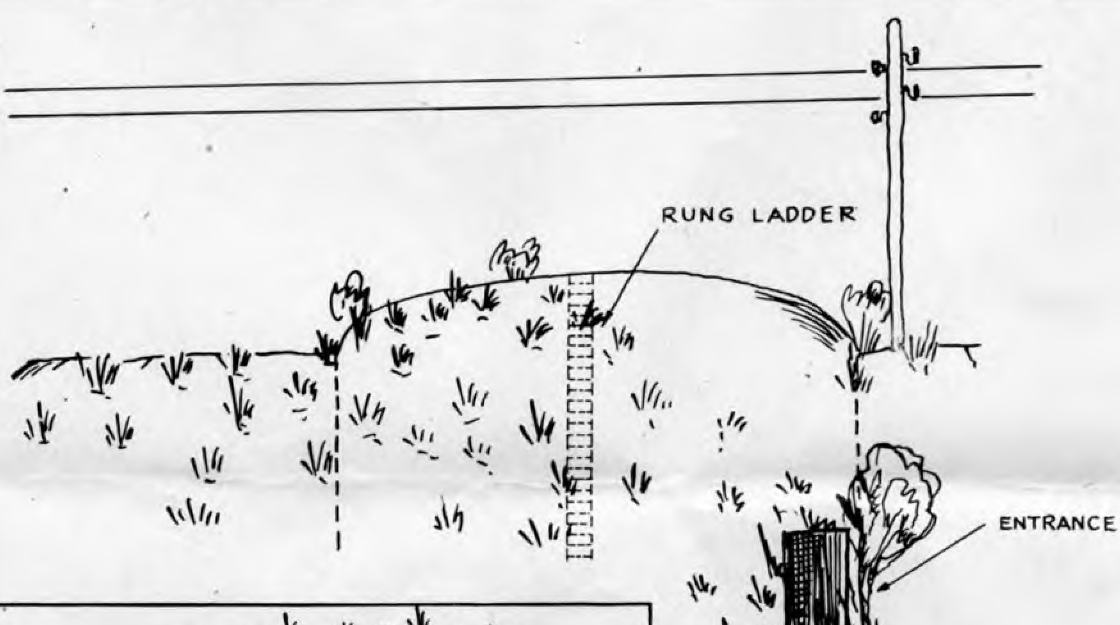


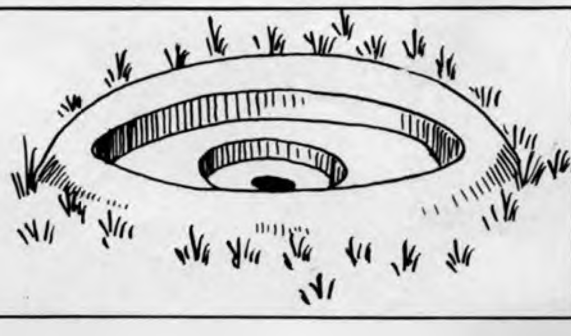


P II



P III & IV

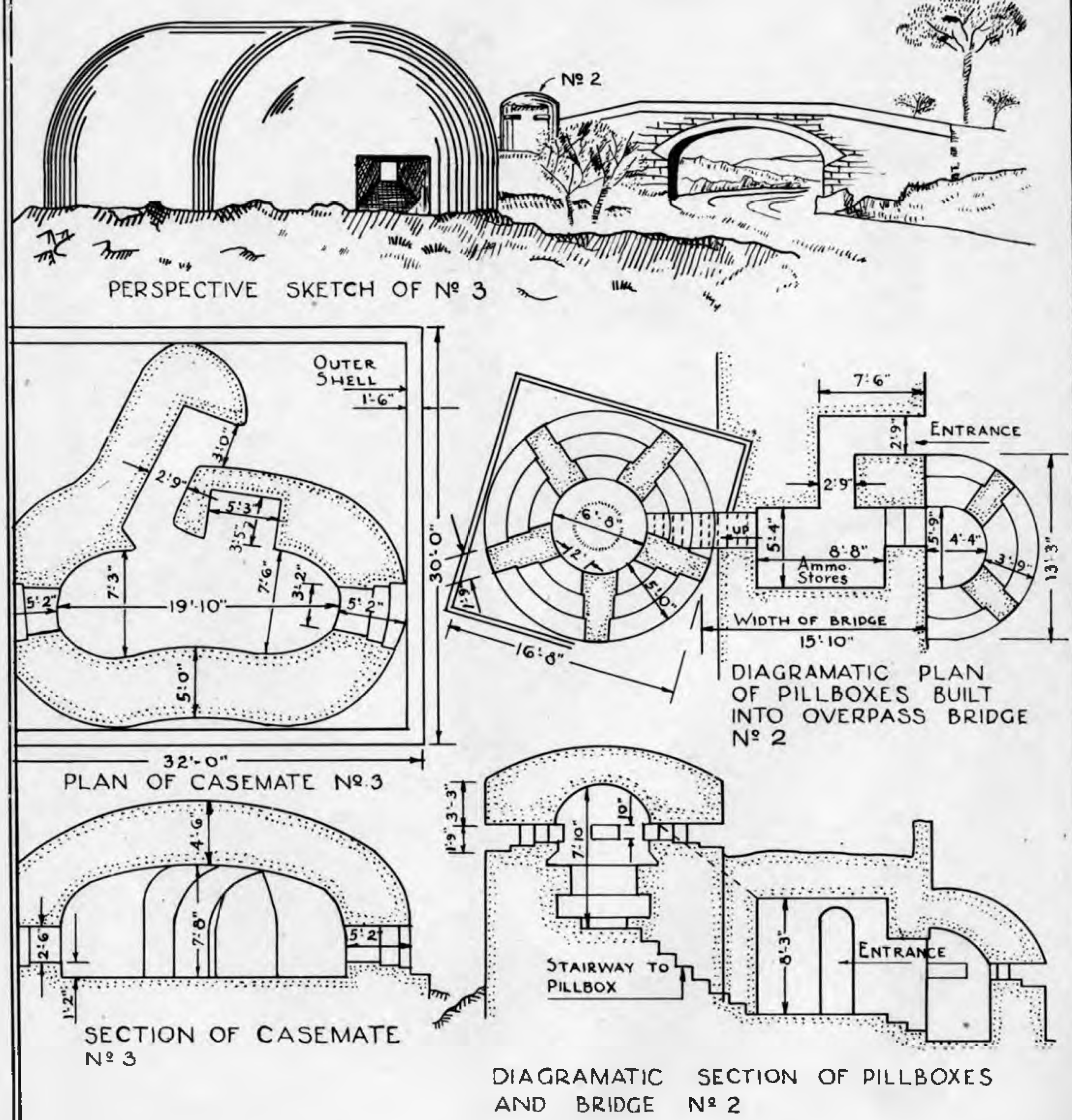




FOR LOCATION SEE MAP APP. "A"

DRWG Nº F/109/44
ENGR BRANCH
HQ. A.A.I. C.M.F.

V

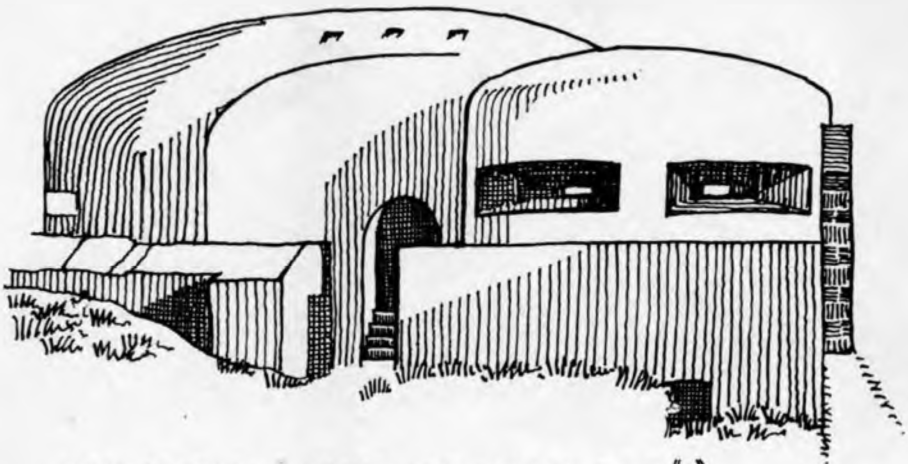


CASEMATE AND PILLBOXES GUARDING AUTOSTRADA NEAR TORRE DEL GRECO

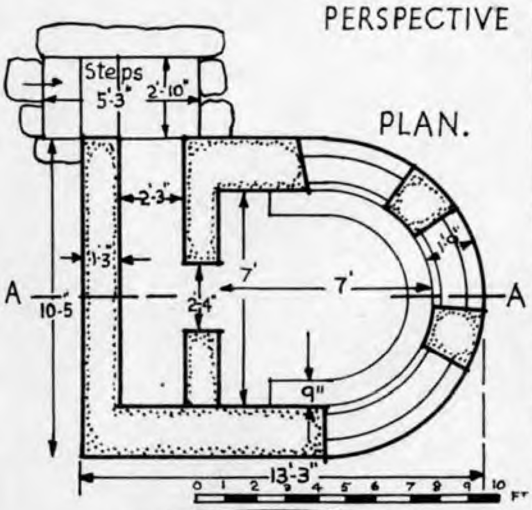
MAP REF: G.S.G.S. 4229 SH. 184/II 331420

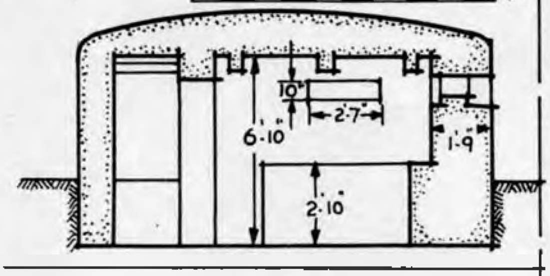
ENGR. BRANCH
H.Q. A.A.I. C.M.F.

TRACED BY M.S.
PLAN Nº P/125/44

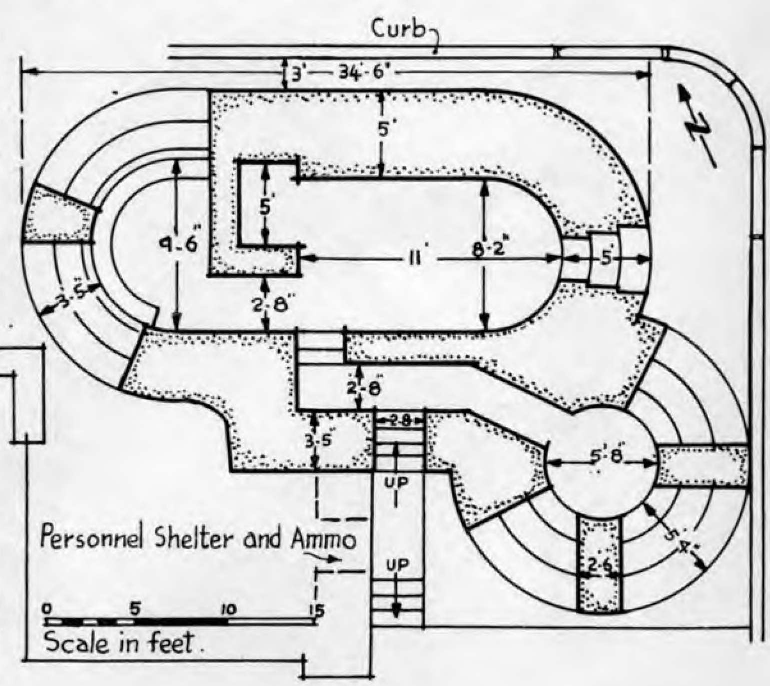


PERSPECTIVE SKETCH OF CASEMATE "B".





SECTION "A-A"



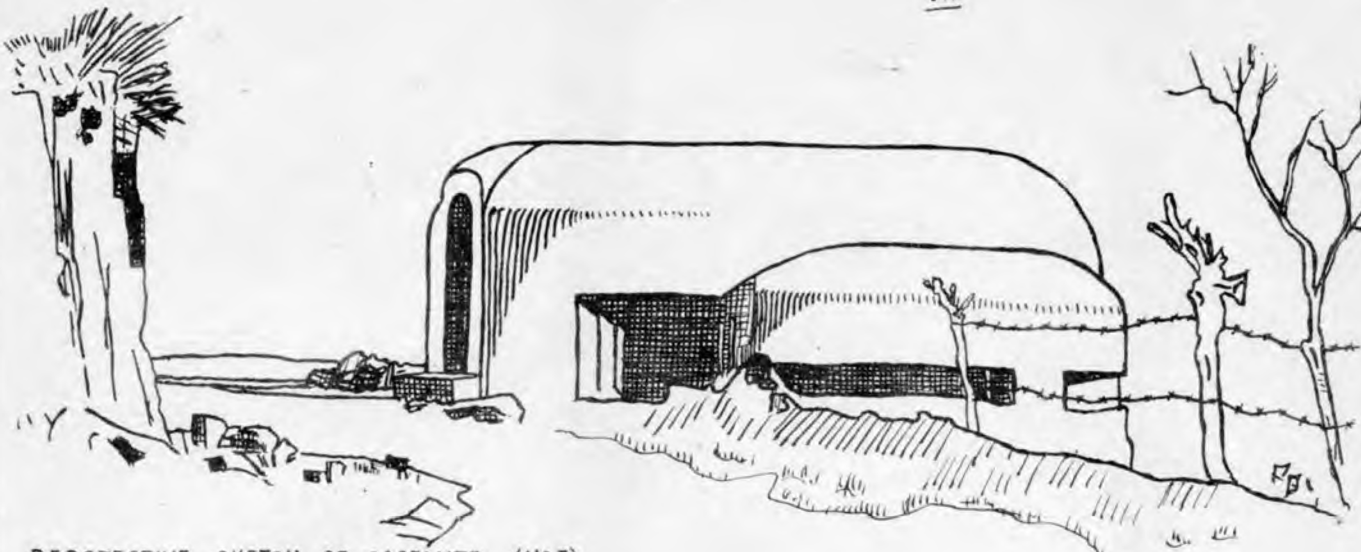
PLAN OF "B"

CONCRETE PILLBOX GUARDING THE SHORE AT SANTA MARIA-
- LA BRUNA (Italy).
Map ref. G.S.G.S.-4229 sh 184/II - 337395.

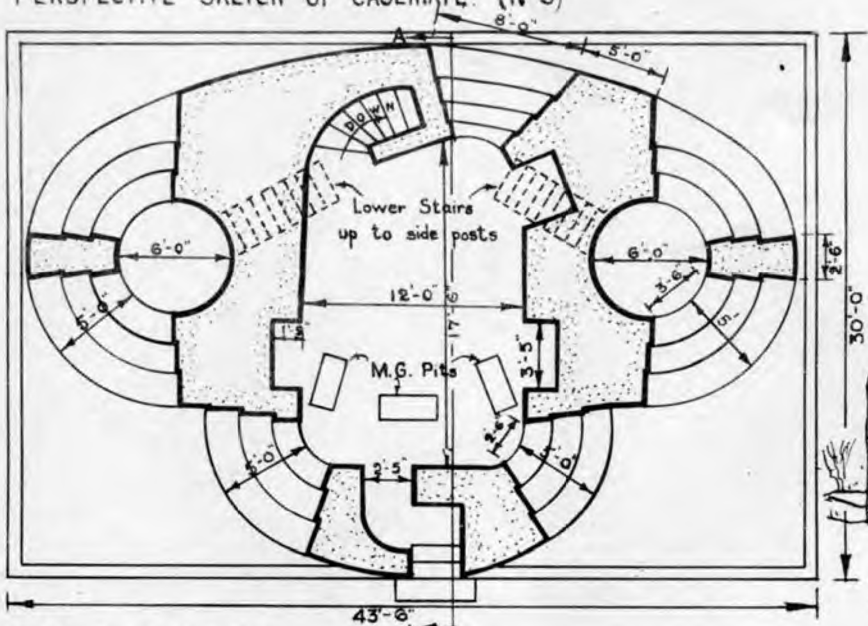
CONCRETE CASEMATE GUARDING ROAD Nº 18 NEAR TORRE DEL GRECO (Italy).
Map ref. G.S.G.S - 4229 sh 184/II - 331415.

Engineer Branch
H.Q. A.A.I., C.M.F.

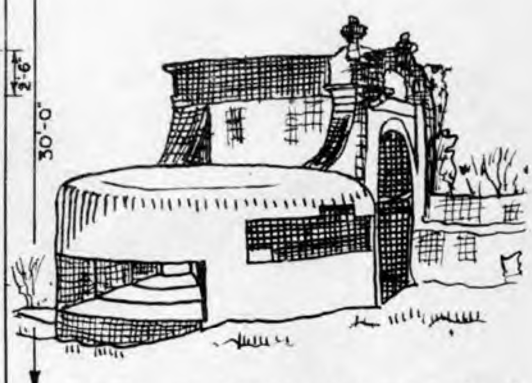
Traced by. R.G.
Plan Nº P/124/44.



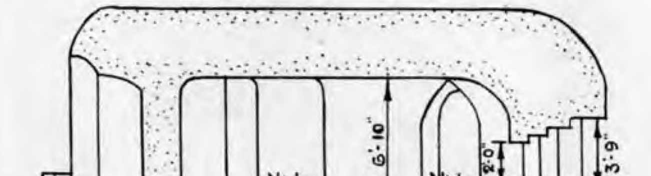
PERSPECTIVE SKETCH OF CASEMATE (Nº 3)



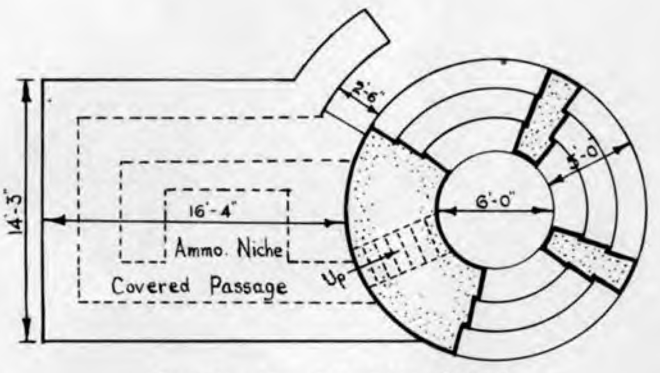
PLAN OF CASEMATE



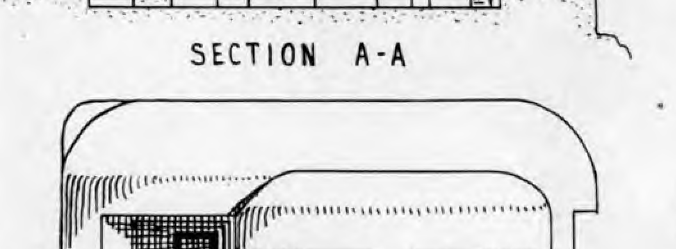
PERSPECTIVE SKETCH OF PILLBOX (Nº 4)



SECTION A-A



PLAN OF PILLBOX (Nº 4)



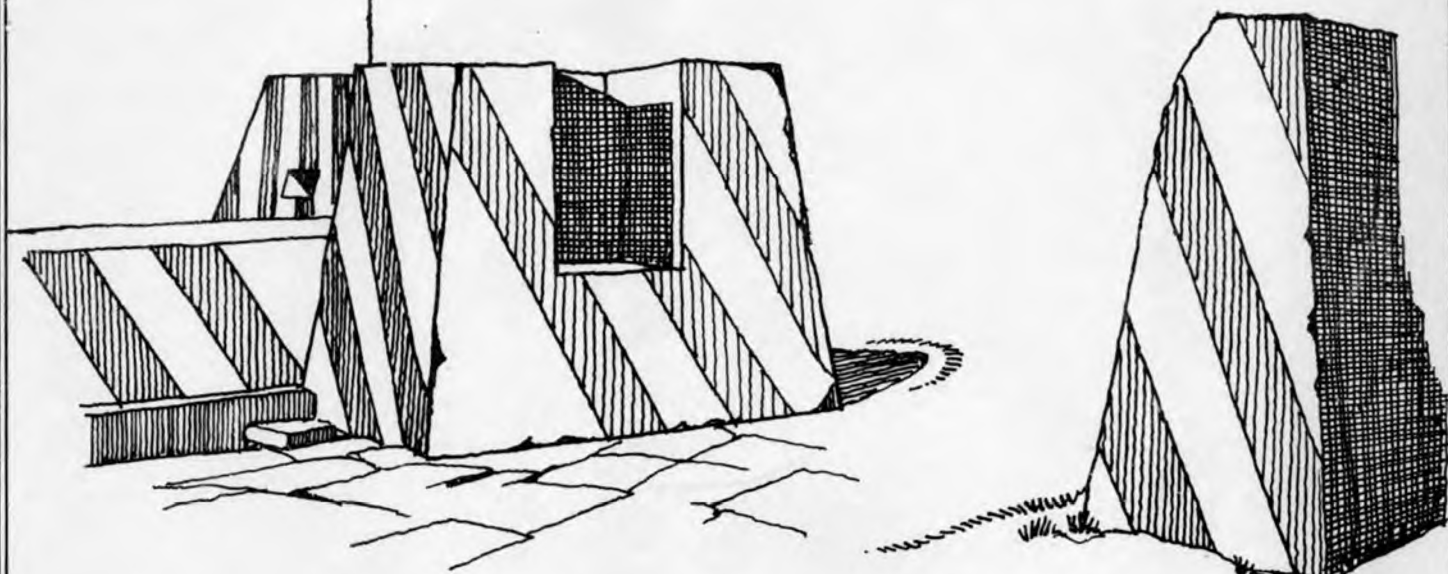
WEST ELEVATION OF CASEMATE (Nº 3)

CASEMATE AND PILLBOX AT CAMALDOLI DI TORRE, NEAR TORRE DEL GRECO, ITALY.

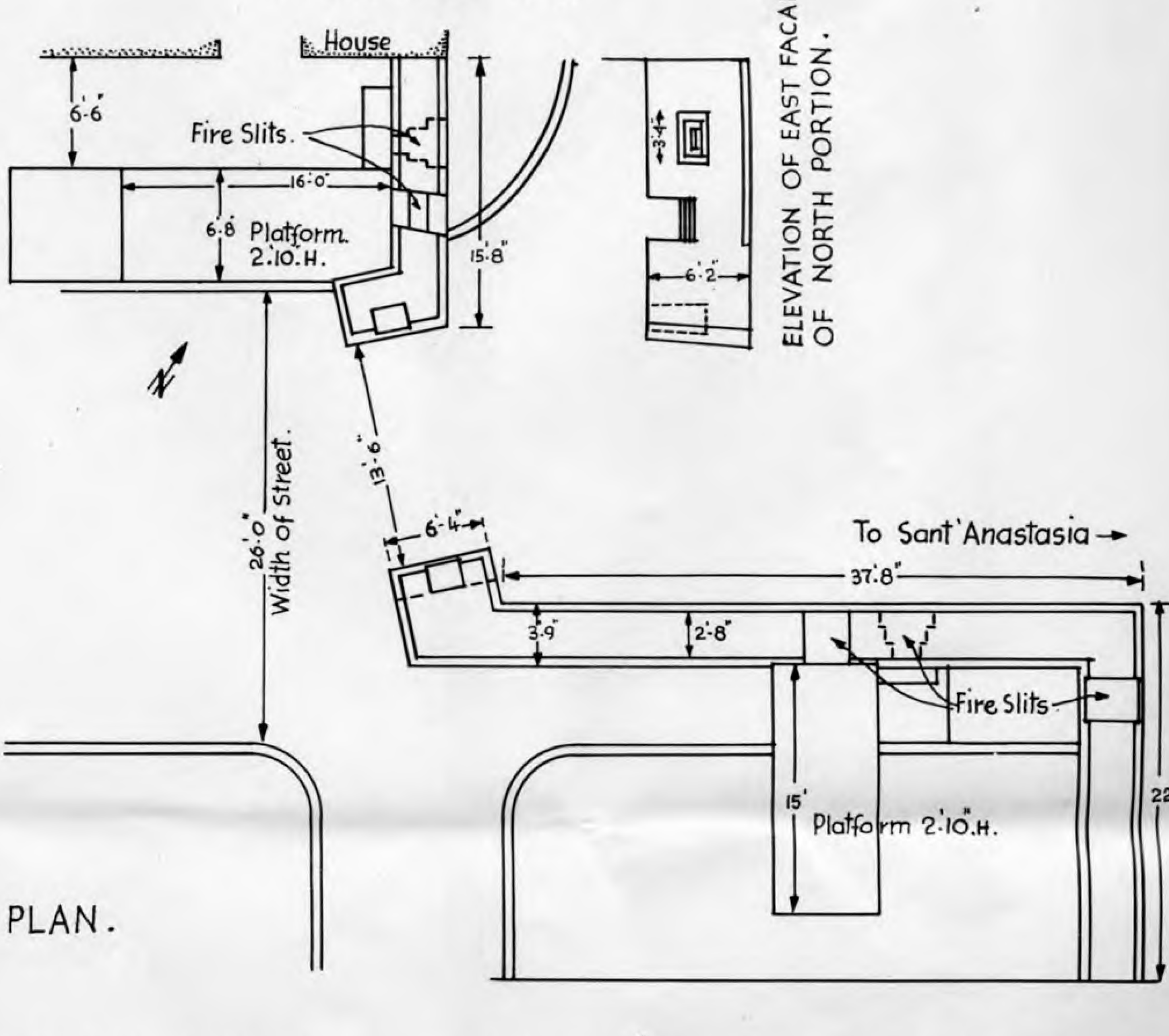
MAP REF. GSGS - 4229 - SH. 184/II - 343418,345419.

Engineer Branch
H.Q., A.A.I., C.M.F.

Traced by G.E.H.
Plan Nº P/126/44



PERSPECTIVE VIEW



PLAN.

ROADBLOCK AT CÉRCOLA (Italy)

Map ref. G.S.G.S. 4229. Sh 184/I. 304509.

Engineer Branch.
H.Q. A.A.I., C.M.F.

Traced by R.G.
Plan No R/109/44.

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III. COMMUNICATIONS (ROADS & RAILROADS)

1. Cement Road Patches: A cement road patch for road maintenance has been successfully used by the 61st Engineer Combat Battalion. Holes to be patched were dug to a depth of 5 to 6 inches, with the sides left rough to secure a good bond. They were then filled with a 1-2-3 concrete mix and continually moistened for 5 to 6 hours, during which period no traffic was permitted. At the end of this time traffic was resumed, and daily inspection of the patches indicated no wear. (Source: Engineer Intelligence Memorandum No. 19, Headquarters, First United States Army)

IV. BRIDGES (FIXED & FLOATING)

1. Correction: Bailey crib piers, referred to in Section IV, Paragraph 5, Engineer Technical Bulletin No. 22, dated 8 August 1944, are actually steel cube cribs, 6" x 2" x 2", and have nothing to do with the Bailey Bridge.

V. WATER SUPPLY

1. Maintenance of Canvas Tanks: The supply of 3000-gallon canvas water tanks in this theater has been severely reduced, and all units must recognize the importance of giving adequate attention to those tanks now at the units' disposal. For the purpose of preserving the life of the canvas the following suggestions are given:

a. Do not set a canvas tank directly on the ground. Air circulation beneath the tank will greatly increase its life, and a sectional platform for all units, including divisions, will prove beneficial.

b. Apply coatings of a waterproof solution for fabrics to keep the tank impervious. V-110 is available at engineer supply depots, and this product will stop seepage.

c. Give immediate attention to small rips or punctures. Cemented patches sewed in place will soon plug minor leaks before they are major rips.

d. Properly adjust the tank ropes to relieve undue strain on the fabric or seams.

2. Purification of Turbid Water: In view of the approaching wet season a refresher hint on turbid water operation is given. The streams during the late October and November period will have a turbidity of 2000 - 3000 parts per million. This water can be handled by portable filter units if the following plan is adhered to: Arrange one 3000-gallon canvas tank as a settling basin prior to filtration, and apply a 9 grain per gallon

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dosage of ammonium aluminum sulphate to the turbid water entering the tank. This is equivalent to a steel helmetful of crystals to each full tank of water. If a pH adjustment is necessary, soda ash must be added in addition to the alum crystals. The precipitated "floc" thus formed will settle sufficiently after a one-hour retention period. After that time, the portable filter is capable of handling the settled raw water, and at least 3000 gallons is available every two hours. This is definitely better than having the unit out of service when it is needed most.

VI. CAMOUFLAGE

Nothing

VII. GENERAL CONSTRUCTION

1. Siphon for Malaria Control: A siphon was constructed by the 175th Engineer General Service Regiment on the military railway line between SPARANISE and TEANO, northeast of FRANCOLISE at NO55881. Purpose of the siphon was to drain a pool dammed up by a railway fill and culvert on the site of a bridge demolished by the enemy. The pool was caused by the inlet elevation of the culvert being about 8 feet above the elevation of the original stream bed.

a. Description of Conditions. (See Fig. #1)

Area of Culvert Opening............................	75 sq. ft.
Three (3) steel pipes, 6'-5", 5'-7", and 4'-9" in diameter, internally braced with vertical timber posts with caps and sills. Each pipe had such a timber structure running the full length of the pipe.	
Drop in Head through Culvert......................	3 ft.
Existing Flow through Culvert.....................	88 sec. ft.
Existing Flow in Leaks through Base of Fill.......	5 sec. ft.
Approximate Capacity of Existing Culvert Opening..	1663 sec. ft.
Computed by Manning's Formula (Not accurate because of non-uniformity of internal pipe diameters, distortion of pipes and internal timber bracing.)	
Area of Pool......................................	5 acres
Volume of Pool....................................	875,000 cu. ft.
Watershed Area....................................	30 sq. mi.
Area of Opening Required..........................	1,550 sq. ft.
Computed by Talbot's Formula.	
Maximum Expected Storm Flow.......................	3,800 sec. ft.

b. Description of Siphon Construction.

(1) After considering the data given above and five possi-

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(1) After considering the data given above and five possi-

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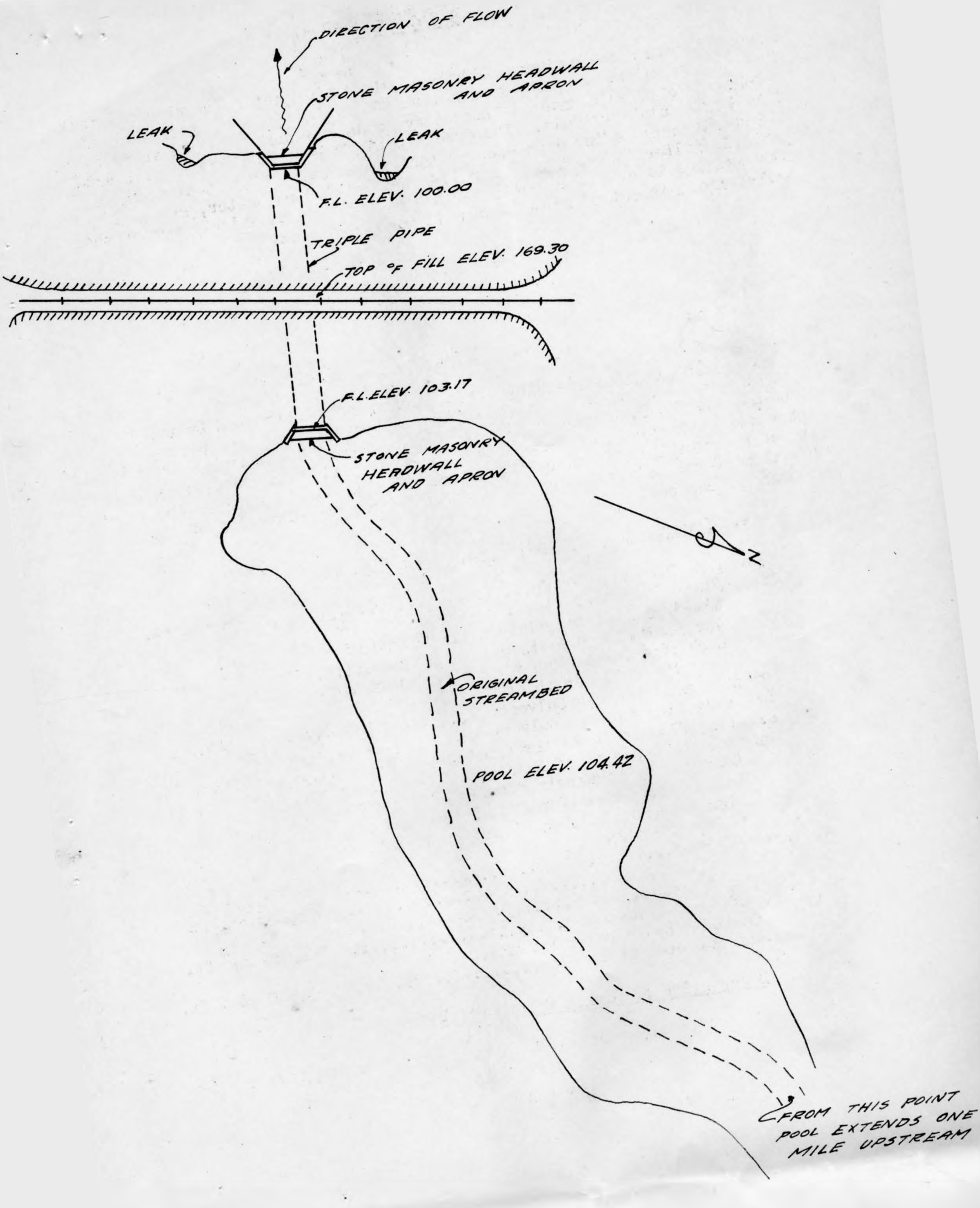

FIGURE-1
PLAN
1" = 100'
EXISTING CONDITIONS
21 APRIL 44
ARBITRARY DATUM

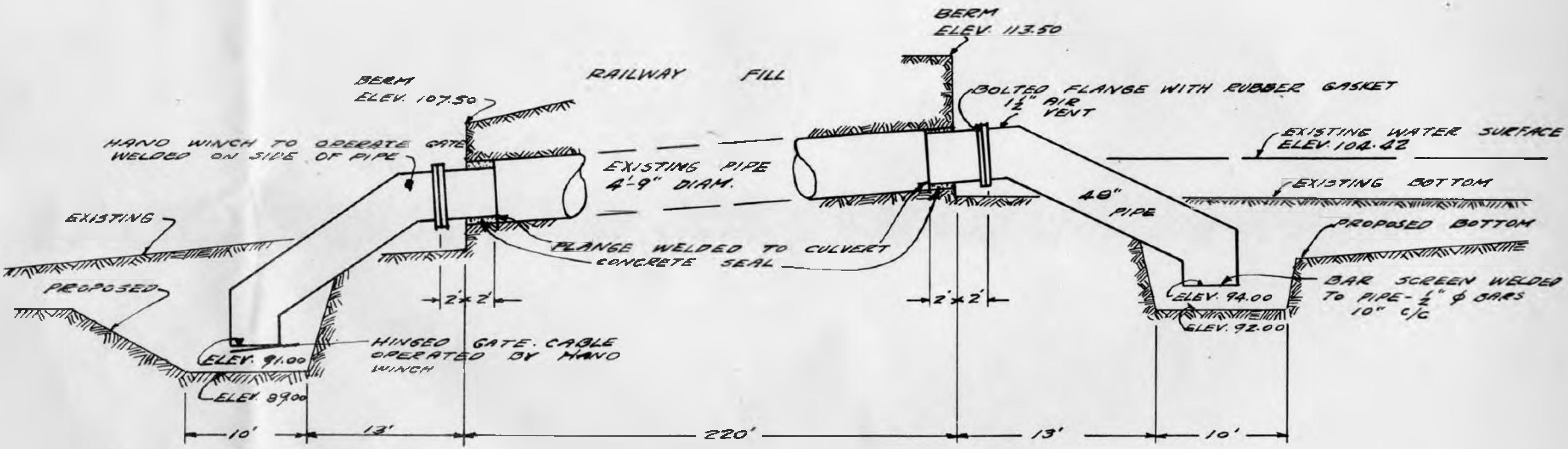

FIGURE - 2

SECTION

1" = 10'

27 APRIL 44

ARBITRARY DATUM

Figure 3
Fabrication of Bent Section of Siphon by Arcwelding.

Figure 4
Gate on Outlet end of Siphon before Installation.

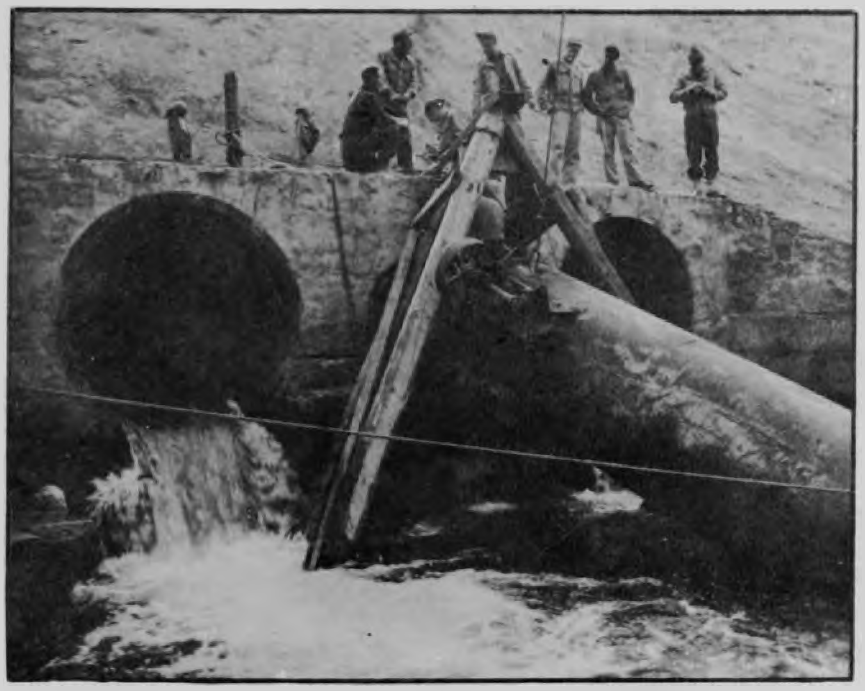

Figure 5
Placing of Outlet Section and Supporting A-Frame
Showing Gate-opening Winch.

Figure 6
Placing of Outlet Section and A-Frame.

Figure 7
Placing of Inlet Connection to Existing Pipe Culvert by Arcwelding and Grouting.

Figure 8
View of Outlet End of Existing Pipe Culvert. Pipe Being Prepared for the Installation of Siphon Connection.

Figure 9
View of Outlet Section with Siphon in Operation

Figure 10
View of Inlet Section with Siphon in Operation
Water level in Pool Lowered about one foot.

ble methods of draining the pool, it was decided to construct a siphon, using the center pipe of the existing triple pipe culvert as part of such a siphon, and fastening 48-inch pipe bends to each end of said pipe to form the inlet and outlet of the proposed siphon. Each end of the siphon was to be submerged in a pit excavated in the stream bed at either end of the culvert. Details of such construction are shown in Figure 2.

(2) The center pipe was unwatered by construction of a sand-bag dam and sump at the upstream end of the center pipe. Three 55 g.p.m. centrifugal pumps were used for the unwatering and then worked continuously until all the pipe connections were made. Upon unwatering the center pipe, many bad leaks were found, principally at the pipe joints. To make the proposed siphon as efficient as possible, these leaks had to be stopped. This was done by caulking the openings with jute, jacking strips of steel plate against the joints, and arc welding the plate to the body of the pipe. This proved to be the most difficult feature of the job, as considerable water pressure existed at the pipe joints, particularly near the bottom of the pipe. This welding and caulking consumed two weeks and 100 pounds of welding rod.

(3) While the welding was being done inside the pipe, the inlet and outlet pools were excavated by clamshell crane, and the bent sections were fabricated at the regimental motor pool. These bent sections were connected to the center pipe by welding and bolting, details of which are shown in Figure 2.

c. Operation. To start the flow of water through the siphon, the remaining two pipes of the culvert were dammed, the gate on the outlet end of the siphon closed, the air vent opened, and the pool allowed to rise to about elevation 106.00. The gate was then opened, the air vent was closed, and water began to flow through the siphon. The siphon continued in operation for several days and the pool level dropped to about elevation 102.00, at which time numerous air leaks developed at many different places. It became necessary to install an ejector operated by a mobile air compressor to evacuate the air which was drawn in by the leaks, and which in gathering at the high point of the siphon caused enough friction to slow the flow of water and eventually stop it. The ejector worked satisfactorily and the operation of the siphon continued until the pool level dropped to about elevation 98.00, where it remained for several days. With the pool level at elevation 98.00 the siphon had accomplished its purpose in draining the pool, and although it probably lost its prime after the regiment moved elsewhere, it could be placed back in operation at any time. (For photographs of siphon see Figs. 3 - 10.)

VIII. ENGINEER SUPPLY

1. Armor Suits and Aerial Tramways:

a. Currently arriving in the theater are sufficient suits of flying armor to equip each bulldozer operator and to provide 4 other

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suits per line company of all Engineer Combat Regiments, Combat Battalions and Armored Battalions in the theater. Each suit consists of 1 armor, flyers vest, M-1 and [illegible] armor, flyers apron, M-4. This armor is an Ordnance item of issue and may be requisitioned on the above basis as Class IV equipment.

b. The supply status of aerial tramways is as follows:

(1) 3 Tramways, special purpose, M-1 (3000 lbs.), are in the theater, two of which have been issued to Fifth Army and the third is still in P. B. S. depots, available for issue.

(2) 19 Tramways, light, M-2 (350 lbs.), are expected to arrive in the theater starting in late September or October. Four of these are allocated to Seventh Army and the remainder are unallocated. Fifth Army may receive some of them.

IX. EQUIPMENT

1. Test of Vehicular Anti-tank Mine Detector Set: The 19th Engineer Combat Regiment has conducted tests with the Vehicular Anti-tank Mine Detector Set and has noted the following results:

a. Assembly of Detector Set.

(1) Following the instructions as set forth in the Technical Manual for Detector Set, no difficulties were encountered in assembling Front End Detector Assembly Boom and the Automatic Brake and Declutching mechanism, which were mounted on a ¼-ton truck.

(2) Assembly of the Control Box frequently went out of balance and had to be reset often. It is very sensitive and cannot take repeated punishment by sudden stops and rough roads.

b. Sensitivity of Detector on Mines.

(1) Tests were conducted on British Mark II Mines, German Tellermines 42 and 43, "S" Mines, Italian Box Mines, German Holzmines, and Schu mines to determine the sensitivity of the mine detector. The tests were conducted in hard clay soil with a sprinkling of rock and stones. The best results were obtained when the vehicle speed was kept below 3 M.P.H. The set was adjusted to normal operating condition.

(2) Experiments showed that British Mark II Mine could be detected to a depth of 15 inches. When the detector was run over the mines up to 10 M.P.H., the mine tripped the mechanism and stopped the vehicle.

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(a) When the coils were tested from either side of the front assembly, speed and depth had a definite effect on the reaction. At two inches in depth at the side of the coil, the detector tripped when the mine was 8 inches away from the coil; at 5 inches in depth it tripped the mechanism 4-½ inches from the mine; at a depth of 7 inches the coils did not pick up the mine from the sides but when run over near the center of the coils the mechanism tripped instantly. The speed at which the above figures were obtained was 3 M.P.H. When the speed was greater, the detector in many cases failed to pick up the mines from either side of the coils. It was noticed also that both meter deflection and earphones gave indication of a metallic object when the mine was 12 inches away from the detector and the speed was greater than 3 M.P.H., but the trip mechanism failed to function.

(3) Tellermines 42 and 43 were next tried on the detector. It was found that from 3 M.P.H. to 10 M.P.H., when the coils were run over the mine, the stop mechanism tripped when the mines were buried to a depth of 24 inches.

(a) When the coils were tested from either side of the Front End Assembly, speed of vehicles and depth of mine again showed marked effect on the detector set. The figures for the Tellermines and British Mark II mine were practically the same when the mines were buried at 2 inches and 5 inches in the ground, but at an 8-inch depth the detector set could pick up and trip the mechanism at not over 2 inches away from the edge of the mine, on either side of the coils. At a depth of 12 inches, the detector failed to trip or register on the control meter or earphones.

(4) The "S" mine, two inches below the surface, with one inch of dirt over the top of the prongs, tripped the stop mechanism. A speed of 3 M.P.H. was effective, but when the speed was increased to 10 M.P.H. or more the detector often failed to trip the stop mechanism. When the gain control was adjusted to bring the detector to finer sensitivity than normal the stop mechanism failed to operate. The stop mechanism often tripped when the automatic stop switch was turned on. Also rough roads, sudden stops of the vehicle, variation of the soil, or pieces of metal called for adjustments of the controls after every stop. It was noted that when the wheels of the vehicle hit a rut or a dip in the road and lifted the coils above their normal height over the "S" mine, the detector failed to trip the stop mechanism.

(a) The side of the coils could be brought 4½ inches from the prongs (actually only 2½ inches from the mine), and the detector set tripped the stop mechanism. The best speed was 3 - 4 M.P.H. At greater speeds, the vehicle went by without the stop mechanism tripping.

(5) Tests conducted on the Italian Box Mine showed that when the mine was placed on the surface or one inch below the surface the trip mechanism stopped the vehicle. At a depth of over one inch, with or without dirt cover, the trip mechanism failed to work. A speed of 3 M.P.H.

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tripped the stop mechanism, but at 4 M.P.H. the vehicle did not stop, and no sound or meter deflection was noticed. The mine had to be under the coils to be picked up. At any distance from the side of mine the mechanism failed to work. Adjusting the gain control to finer sensitivity brought the same negative results as with the experiments on the "S" mine.

(6) Experiments with the Hölzmine showed that when this mine was exposed on the surface of the ground, and when the vehicle was going between 3 and 4 M.P.H., the stop mechanism tripped. When the vehicle was driven over 3 or 4 M.P.H., the mine was not detected. When the mine was flush with the surface of the earth, with or without dirt cover, it was not detected. The coils have to be over the Holzmine to trip the stop mechanism. Adjusting the set to finer sensitivity brought negative results. The same trouble occurred as in previous experiments.

(7) Knowing that it would be impossible to detect a Schu mine, an experiment was made to determine if the Schu mine could be brought close enough to trip the stop mechanism. When brought to within one inch of any of the coils in the Front End Assembly, it tripped the stop mechanism; but so would pieces of metal, shrapnel or an ordinary engineer knife.

c. <u>Operational Speed for Detector Set</u>. Experiments were made to determine the best operating speed of the vehicle. The detector was adjusted to normal operating conditions, and the trial runs were taken on a fairly smooth road made of hard clay and rock. The experiments showed that at 10 M.P.H., even though the road is hard and dry, a sudden stop skids the vehicle forward quite a distance, in some cases from 45 to 72 inches. At speeds of 5 to 7 M.P.H. the vehicle skidded from 6 inches to 3 feet, while at 4 M.P.H. the vehicle stopped dead in its tracks or skidded less than 6 inches. The safest speed was 3 M.P.H. At this speed the jeep stopped in its tracks or slid forward only slightly, even in a wet spot. The stopping of the vehicle was affected by rough roads, soft shoulders, and inability of driver to maintain a constant speed. In the trial runs, rough spots in the road threw the detector out of balance.

d. <u>Sturdiness</u>. The sturdy construction of the detector set anti-tank mine vehicular, M-1, meets the requirements of normal operating conditions.

e. <u>Operational Difficulties and Limitations</u>.

(1) Detector control is sensitive to sudden stops and rough roads.

(2) It is satisfactory for metallic mines only.

(3) Detector is limited in use in forward areas because it is too vulnerable to fire.

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(4) Detector is limited in use on sharp, steep winding roads.

(5) Detector is not very well suited for night work.

(6) It is limited to 3 M.P.H. for satisfactory results.

(7) It is limited in area clearance; overall clearance is not enough to permit other vehicles to follow with safety.

(8) Detector is not consistent in operation.

(9) It is unsuited for sweeping shoulders.

(10) Vehicular detector should carry Standard Mine Detector SCR 625 and operator to check areas which cannot be covered with vehicular detector, but there is not enough room in the vehicle for the Detector SCR 625 and its operator.

f. Suggestions for Improvement.

(1) Front Assembly should be made so that it can be lowered; as it is, it cannot be used for low sweeping.

(2) Detector control should be adjusted, or adjustments added, so that sensitivity can be synchronized with the raising or lowering of the coils.

(3) Front End Assembly, which houses the coils, should be made wider to provide overall clearance sufficient for a 2-½-ton vehicle.

(4) Governor control should be installed, so that sweeping speed is held constant.

g. Conclusions. Though the Vehicular Detector is a step in the right direction, it has very definite limitations for combat work. The use of box mines by the enemy prohibits the use of this detector, which will pick up only metallic mines. It cannot be brought close to combat areas and must be used in pairs in order to clear a usable lane in one trip. The detector cannot stand frequent jars and must be reset after each stop. The sensitivity of the detector to stops, bumps, etc., and its inconsistency in actual operations due to uneven ground, shrapnel, and other conditions, make it undependable.

X. PUBLICATIONS

Below is a list of recent acquisitions to the Engineer Headquarters Library. These documents are available on a loan basis to all engineer

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units for a period not to exceed five days. Only one copy of each is available, and prompt return of borrowed documents is necessary in order that all interested parties may benefit from available information. Requests for items should be accompanied by the document title, number and/or date.

ENGINEER BOARD REPORTS:		Date
No. 829	Italian Pneumatic Drill, Wood Boring	8 June 1944
No. 827	Passage of Beach and Underwater Obstacles - 12th Interim Report	1 June 1944
No. 837	Passage of Beach and Underwater Obstacles - 13th Interim Report	1 July 1944

XI. MISCELLANEOUS

1. Report of Engineer Operations (July 1 - 31): The following is extracted from a report submitted by the Engineer, IV Corps, dated 10 August, 1944:

a. Enemy Obstacles.

The 27-mile advance from the Cecina to the Arno River was over heavily accidented terrain. Elevations up to 1800 feet were frequently encountered. The entire area was cut up by small streams, the valleys of most of which had very steep slopes.

The system of roads was greater in extent than anything hitherto encountered, and there was a great increase in the number of structures that could be demolished (see map sketch). This situation, coupled with the fact that new and more active enemy units had arrived, resulted in a substantial intensification of the enemy demolition and minefield program.

In an area of approximately 1100 square miles, there were 341 demolitions and 194 minefields. The great majority of the demolitions were by-passed, because most of the streams were quite dry.

In 31 cases, due to deep ravines or unfordable canals, it was necessary to construct bridges. The total length of bridges constructed was 2,089 feet (72% Bailey, 23% Treadway and 5% Timber).

A unique operation was executed at the group of canals on Route #1, just north of LIVORNO. Here 5 Bailey bridges, totaling 510 feet, were constructed simultaneously within 18 hours. These bridges were about 100 yards apart, and in order to avoid the delay that would of been required by successive construction, material for the interior bridges was moved to the sites over Infantry Support bridges.

The total amount of road opened was 612 miles, of which 282 miles were 2-way and 330 miles 1½-way.

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In spite of the large number of demolitions and minefields encountered, it cannot be said that these offered any substantial delay to the advance, except where defended by fire. In some cases, due to existing natural defiles, mechanized vehicles and Engineer operations were held up by fire until Infantry and Artillery drove off the defenders. In most instances, had the demolitions not existed, the delay would have been approximately the same.

There is no known case of inadequate road facilities delaying in any way whatsoever the transportation of supplies.

The two things which made all this possible were the bulldozer and the Bailey bridge. Usually a 1-way passage was ready for use long before any serious demand.

This would not have been true in wet weather, as considerable delay would have been experienced in making fills and hauling and constructing culverts, which in some cases were omitted in the first hasty opening of the by-pass.

The time-honored principle, repeatedly confirmed, is that demolitions over dried-up water courses are a waste of explosives against a properly equipped enemy, unless adequately defended by fire.

b. Supply.

(1) Water: An average of 15 water points was in continuous operation. A total of 6,000,000 gallons was produced during the period. While there were several rumors of poisoned water supply, none was found. Each of the rumors was run down by laboratory tests.

(2) Maps: A total of 232,000 map sheets was supplied to the troops:

1:25,000	-------------	155,000 sheets
1:50,000	-------------	60,000 sheets
1:100,000	-------------	15,000 sheets
Miscellaneous	------------	2,000 sheets

c. Troops available.

During the period, due to the strategic situation, there was considerable substitution of divisions and of Corps Engineer units. In general, there were usually available for Engineer work approximately 6 Bns., 3 of which were non-divisional.

d. Control.

As can readily be seen, a very tight overall coordination was required to prevent duplication of effort and lost motion due to shift of responsibilities.

This was controlled by an informal nightly meeting of the Engineer Commanders at the office of the Corps Engineer. Here problems were discussed in detail and solved, and plans and dispositions made for the next day's work. Had this not been done, considerable confusion and lost motion would have resulted, especially when there was difficulty with regard to telephone communications.

In no case, under the conference system, were written Engineer orders necessary. From time to time, responsibilities for work were assigned by areas or by specific stretches of road. These were usually put out to units on the Ditto machine.

e. Bridge Train.

A Corps Bridge Train was used to great advantage. It was composed of one company of an Engineer GS Regiment with 130 ft of DD Bailey bridge on wheels, loaded American style. There were also 9 Brockways loaded with Steel Floating Treadway bridge. This unit delivered bridge materials to any point, on call through Corps Engineer. The unit did not construct bridges, as the personnel was completely occupied with loading and driving. As soon as any vehicle was empty, it went at once the nearest Army Dump, refilled and returned to bivouac.

Bridge Train vehicles were marked with signs and had priority on roads. Sometimes MP motorcycle escort was furnished during periods of congested traffic. This proved very useful.

f. Attachment of Engineers.

At the beginning of the operation, Engineer companies were removed from central control and attached to the various Task Forces that were created from time to time.

In each of those cases, the Company was usually lost for a week of Engineer work, as seldom did an appropriate task exist for it at the time in the zone of action of the Task Force concerned. Yet naturally the commanders wished to retain control for possible future needs. This was a substantial loss at critical phases, involving a reduction of 11% of the Corps Engineer strength in each case. In addition, parent units still had to supply and administer these companies.

When finally the principle of Engineer "Support" instead of attachment was put into operation, a substantial improvement was effected. Engineers were then allocated to the Task Forces on a daily basis.

It is impossible to forecast in advance the actual amount of Engineer work that will be required in inaccessible areas that lie ahead; therefore the attachment of any specific unit of Engineers is inevitably too large or too small. It is only by chance that it could be just right. Besides, the improvised Task Force and, in general, the RCT, have not the staff organization to handle Engineer work, so that much unnecessary confusion and lost motion invariably result from these attachments. Also a liaison officer is usually required, which makes an unnecessary drain upon officer strength.

g. Mine detectors.

There were not enough Engineers to do all of the mine sweeping required. All units, other than service installations (such as dumps), should be trained and equipped to sweep their own bivouac areas.

The mine detector is very fragile. At least 12 should be furnished each Engineer Company, with sufficient immediate replacements available from Signal sources.

The non-metallic mine was very prominent during the operation, and every effort should be made to develop a suitable detector. The existing type is quite unsatisfactory for this purpose.

h. Engineer support of tanks.

The following interesting official comment was made by an officer commanding an Engineer unit in support of tanks: "Tanks draw fire. It is best to request the tanks to remain under cover until the Engineers have completed the job. During the last operation, this method speeded up results because of less enemy interference and reduced Engineer casualties."

2. Air Photographs from Cub Planes. During the ANZIO beachhead stalemate (March, April 1944), the 16th Armored Engineer Battalion, in co-operation with the Air Photo Interpreter of the 1st Armored Division, developed the following method for taking photos from Cub planes for Engineer planning purposes:

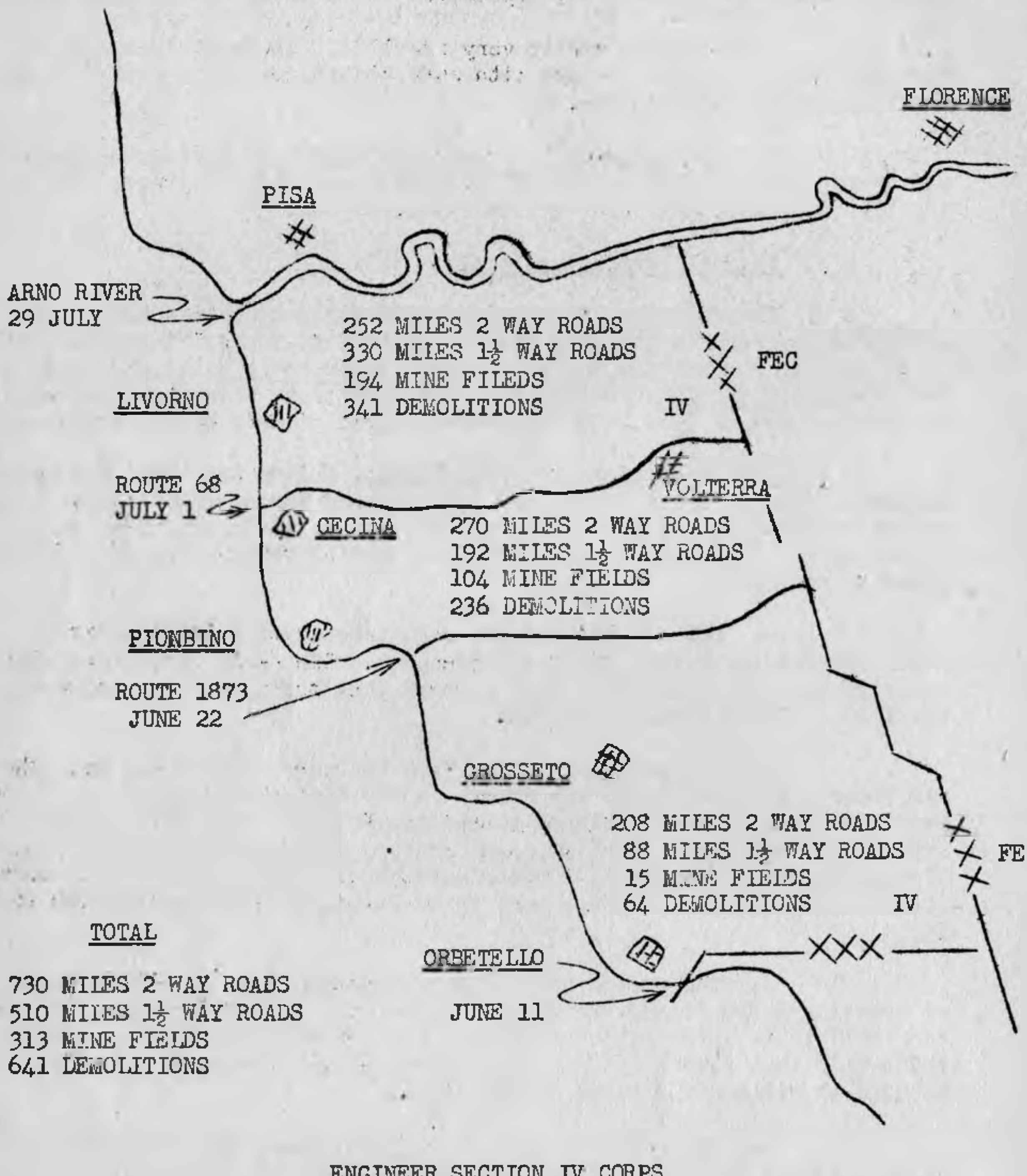
a. Cub air photographs were taken by the Division Air Photo Interpreter with a British F-24 camera. The F-24, which has a 14" cone, is far better for this type of work than its American counterpart, the K-20, which has only a 6" cone.

b. Pictures were taken from the rear seat of the Cub. The Air Photo Interpreter held the camera in his hands and pointed it out the window at the objects he wished to photograph. The film roll contained 120 exposures. Rolls were developed and printed by the photographer of the 16th Armored Engineer Battalion. Prints were usually ready for study 6 hours after the Cub landed. Photos were taken at heights varying from 100 to 3000 ft.

c. The photos were a help in determining in advance means of crossing large ditches or streams which were covered by enemy fire and too "hot" to be investigated personally. They were of particular value for the detail they gave in studies of half-demolished bridges, which could still be used as sites for Baileys or Treadways.

d. Cub photos showed areas just beyond the front, areas in which division engineers were always most interested. For this reason, they were of much greater help to the 16th Armored Engineer Battalion than the standard Air Corps verticals, which lacked detail and which scarcely ever covered No Man's Land.

[redacted]



ENGINEER SECTION IV CORPS

Diagram to accompany Report of Operations July 1-31, 1944; shows increase in density of enemy obstacles.

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