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Construction Engineering
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Development Center

Military Training Lands Historic Context

Large Arms Ranges

Dan Archibald, Adam Smith, Sunny Adams, and Manroop Chawla

March 2010









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Final Report

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Abstract: This work provides an historic context for military training lands, written to satisfy a part of Section 110 of the National Historic Preservation Act (NHPA) of 1966 as amended. Cultural resources personnel at the installation level and their contractors will use this historic context to determine whether military training resources are eligible for the National Register of Historic Places (NRHP), and whether an adverse effect will take place. This overall project covered five types of military training: small arms ranges, large arms ranges, training villages and sites, bivouac areas, and large-scale operation areas. This document provides an historic context of large arms ranges on military training lands for the U.S. Army, U.S. Navy, U.S. Army Air Corps/U.S. Air Force, and the U.S. Marines, with a focus on the landscape outside the developed core of military installations. This work determined that that military training lands are significant enough in our nation's history to be surveyed for eligibility to the NRHP. However, training lands must be viewed as a whole; individual buildings on a training range are rarely eligible for the NRHP; buildings in their larger context (and the integrity of that larger context) are important.

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Preface

This study was conducted for the Legacy Resource Management Program, Cultural Resources Management, under project "Activity A1450-MIPR to ERDC PN05-265." Funding was provided by Military Interdepartmental Purchase Request (MIPR) W31RYO51541162. The Legacy Resource Management Program technical monitor was Hillori Schenker, Cultural Resources Specialist.

The work was performed by the Land and Heritage Conservation Branch (CN-C) of the Installations Division (CN), Construction Engineering Research Laboratory (CERL). The CERL Project Manager was Adam Smith. Daniel Archibald, was primary compiler of the historical information; Sunny Adams was assistant architectural historian; Manroop Chawla was environmentalist, and Daniel Smith (IMCOM) was the military training history expert. Special thanks are owed to those that assisted with the development of this historic context: Holly Reed, Teresa Roy, and Donna Larker in the Still Pictures Room at the National Archives in College Park, Maryland; Andrew Knight, Priscilla Dyson, and Ivy Yarbough in the Cartographic and Architectural Record Room at the National Archives in College Park, Maryland; Pat Lacey, ERDC-CERL Librarian; Michelle Michael at Fort Bragg, NC; John Doss at Fort Bragg, NC; Laurie Rush at Fort Drum, NY; Ruth Lewis at Fort Gordon, GA; Pam Anderson at Naval Base, Norfolk, Virginia; Jim Dolph at Portsmouth Navy Yard; and Brian Lione, former Deputy Federal Preservation Officer, Office of the Secretary of Defense. Dr. Christopher White is Chief, CN-C, and Dr. John T. Bandy is Chief, CN. The Director of CERL is Dr. Ilker R. Adiguzel.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL Gary E. Johnston, and the Director of ERDC is Dr. Jeffery P. Holland.

Unit Conversion Factors

Multiply	By	To Obtain
acres	4,046.873	square meters
degrees Fahrenheit	(F-32)/1.8	degrees Celsius
feet	0.3048	meters
gallons (U.S. liquid)	3.785412 E-03	cubic meters
horsepower (550 foot-pounds force per second)	745.6999	watts
inches	0.0254	meters
miles (U.S. statute)	1,609.347	meters
square feet	0.09290304	square meters
square miles	2.589998 E+06	square meters
square yards	0.8361274	square meters
yards	0.9144	meters

1 Introduction

Through the years, laws have been enacted to preserve our national cultural heritage. The Antiquities Act of 1906, which was the first major Federal preservation legislation to be enacted, was instrumental in securing protection for archeological resources on Federal property. The benefits derived from this Act and subsequent legislation precipitated an expanded and broader need for the preservation of historic cultural resources. This growing awareness was codified in the most sweeping legislation to date, the National Historic Preservation Act of 1966 (NHPA).

The NHPA was created to provide guidelines and requirements aimed at preserving tangible elements of our past primarily through the creation of the National Register of Historic Places (NRHP). Contained within this piece of legislation (Sections 110 and 106) are requirements for Federal agencies to address their cultural resources, defined as any prehistoric or historic district, site, building, structure, or object. Section 110 requires Federal agencies to inventory and evaluate their cultural resources. Section 106 requires the determination of effect of Federal undertakings on properties listed on, deemed eligible for, or potentially eligible for the NRHP, and requires Federal agencies to take into account the effect of a project on a property and to afford the State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO) a reasonable opportunity to comment on the undertaking.

According to National Register Bulletin #15, "How to Apply the National Register of Criteria for Evaluation," and National Register Bulletin #16a, "How to Complete the National Register Registration Form define historic contexts," for a building, structure, object, or a district to be eligible for the National Register, it must:

> represent a significant part of the history, architecture, archeology, engineering, or culture of an area, and it must have the characteristics that make it a good representative of properties associated with that aspect of the past. The significance of a historic property can be judged and explained only when it is evaluated within its historic context. ... Historic contexts are those patterns or trends in history by which a specific occurrence, property, or site is understood and its meaning (and ultimately its significance) within history or prehistory is made clear.

> A historic context is necessary to help researchers and persons involved in inventorying buildings for eligibility to the National Register, address these five factors:
>
> 1. The facet of prehistory or history of the local area, State, or the nation that the property represents
> 2. Whether that facet of prehistory or history is significant
> 3. Whether it is a type of property that has relevance and importance in illustrating the historic context
> 4. How the property illustrates that history
> 5. Whether the property possesses the physical features necessary to convey the aspect of prehistory or history with which it is associated.
>
> *National Register Bulletin #15*

This project work was undertaken to develop a historic context for the development of military training lands used by the U.S. Department of Defense (DOD) and its forerunners.

Objectives

The initial objective of this project was to develop a historic context for the development of military training lands used by the DOD and its forerunners.

Approach

This work was performed in four steps:

1. A literature review was done in the area of military training.
2. Original photographs and training plans were gathered from a variety of archival centers.
3. A site visit was made to a large-scale training installation to photograph extant training facilities.
4. Data was collected and analyzed, and conclusions were drawn.

Literature review

The research team used secondary literature to determine the general history of military training throughout the development of War Department and the Navy Department (and subsequently the DOD—Army, Navy, and Air Force). The military literature review consisted of reading the various training manuals pushed out by those departments and a variety of military training histories published by and for those departments.

Archival research

The research team then located primary research materials and additional secondary materials to establish a strategy to best use these resources. The research team conducted four visits to the National Archives in Washington, DC and the National Archives at College Park, MD. They occurred during the weeks of 6 February 2006, 27 February 2006, 17 April 2006, and 22 May 2006. Other archival depositaries visited were the Library of Congress, 27 February 2006; the Naval Photo Library at the Washington Navy Yard, 17 April 2006; the History Office at the Corps of Engineers, Alexandria, VA, 17 April 2006; and a variety of installation museums, cultural resources offices, and archives across the country.

Site visits

Two members of the research conducted a site visit to Fort Bragg, NC. Fort Bragg was chosen for the site visit because it had one of the largest groupings of different training lands in the DOD; the complexity of its training lands; and the level of historical background that Fort Bragg had on its training lands.

Analysis

After the initial research was complete, the team analyzed the gathered information. The researchers outlined the historical context for military training, identified changes in history and use over time, identified important chronological periods, established a geographical context, and identified historical themes. The analysis resulted in an outline of military training divided into eight significant periods:

- Pre-Civil War (up to 1861)
- Civil War (1861-1865)
- National Expansion (1865-1916)
- World War I (1917-1920)
- Interwar (1921-1940)
- World War II (1941-1945)
- Early Cold War (1946-1955)
- Late Cold War (1956-1989).

Scope

Military training that occurred inside buildings and the Cold War missile programs are not part of this historic context.

The complexity of military training across the services required four historic contexts to be developed, each geared to a particular type of training:

1. Small arms ranges
2. Large arms ranges
3. Training villages, mock sites, and large-scale operation areas
4. Miscellaneous training sites.

This report details the history of large arms ranges.

Mode of technology transfer

This report will be made accessible through the World Wide Web (WWW) at URL:

http://www.cecer.Army.mil

2 Large Arms Ranges

Large arms training ranges have a long history of use in the U.S. military. Soldiers were trained on these ranges to fire large arms weapons from stationary and moving positions at stationary and moving targets. Anti-aircraft guns, anti-armor guns, field artillery weapons, recoilless rifles, grenade launchers, medium caliber rockets, mortars, and tank guns were some of the weapons used on these ranges.

A range typically had a set of cleared and leveled firing points laid out on a firing line, or sections of a course or road on which firing was completed. Firing points were sometimes fitted with foxholes, trenches, or sandbags for positional support. A range also typically had stationary targets or moving target systems (cables, pulleys, tracks, pop-up targets, miniature airplanes, etc). Ranges may have had embankments or walls built up behind targets (to catch ammunition), in front of targets or target tracks (for concealment and protection), at firing lines (for firing support or to stabilize firing positions), or between ranges (to protect from adjacent fire). Ranges also had trenches or foxholes on some firing lines (for firing support) and on some target lines (for partial concealment of targets). Ranges often had a control or observation tower (for fire directing officers), bleachers (for observers), latrines, target storage buildings, ammunition storage buildings, and a variety of other buildings to support general range functions. A range may also have been part of a larger installation range complex that contained these buildings.

Some typical features of many large arms ranges including multiple range layouts, firing lines, targets, embankments/trenches/etc., and buildings are more fully illustrated in the “General Information” section that follows. Large arms ranges are then discussed individually in detail. Under each range heading, information on historical backgrounds, training procedures, layouts, firing lines, targets, embankments/trenches/etc., and buildings associated with the range is listed. Construction drawings and historic photographs are also included where available. Plan drawings are colored according to the key below (Figure 1) to more clearly show a range’s typical features. Present-day photographs and evaluation material follow the list of ranges.

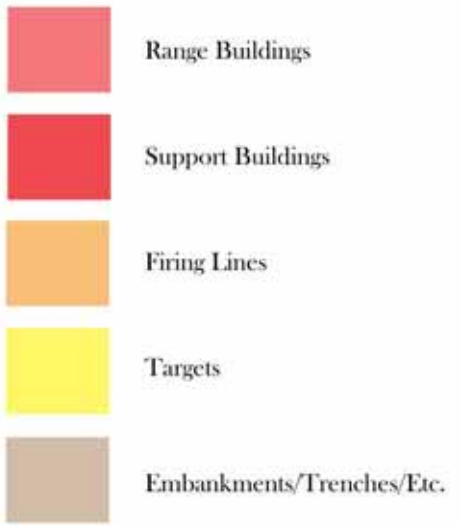


Figure 1. Color key for plan drawings.

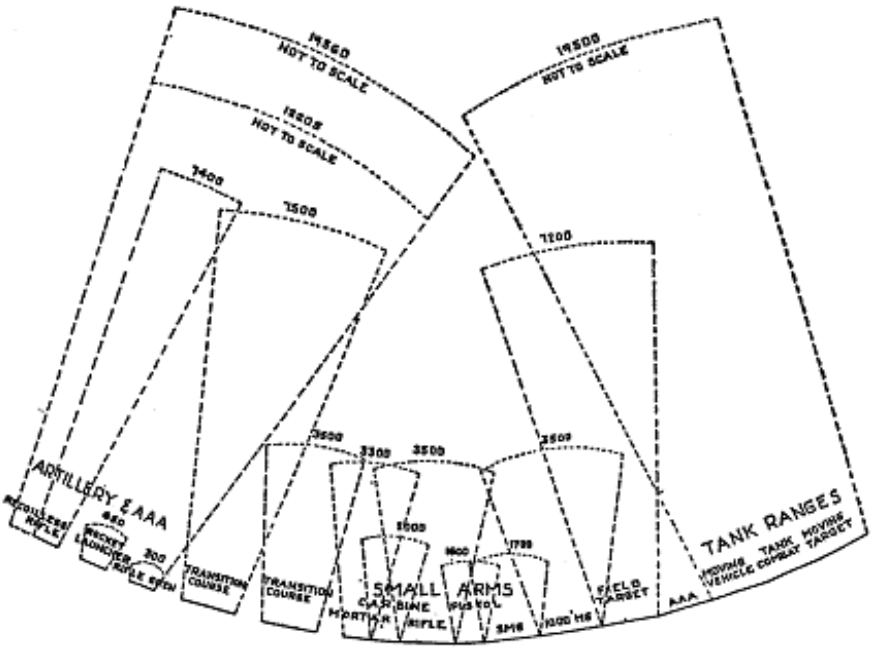
General information

Multiple range layouts

Large arms ranges could have been stand-alone ranges or shared with other ranges on a Ground Forces Training Center. The integration of a typical large arms range into a range layout for a division-training site that accommodated numerous weapons is depicted in Figures 2 and 3 below. The range layouts show several stand-alone large arms ranges with overlapping cell boundaries covering other ranges ("RO-3" pp 17-18).

The division training range layouts and the large arms range locations depicted in Figures 2 and 3 are examples of the many variations of division and large arms ranges that were built. The Figures do not represent the standard range configuration, and they are not representative of the entire period of use. Division training ranges varied or evolved based on unit training needs, terrain considerations, and also with the evolution of the different types of large arms" ("RO-1," p 16).

Figures 4 through 7 show an example of how spaces for large arms ranges are combined at Fort Riley.



Recommended range lay-out for infantry, airborne, and armored division training sites. While the positioning and relationship of the various arms ranges are intended as a guide only, the principle of having the firing point on the arc of a circle with directions of fire converging toward the center should be adhered to wherever possible.

Figure 2. Typical division range layout, circa 1950 (SR 210-20-20, *Installations training areas and facilities for ground troops*, 23 May 1950, p 4).

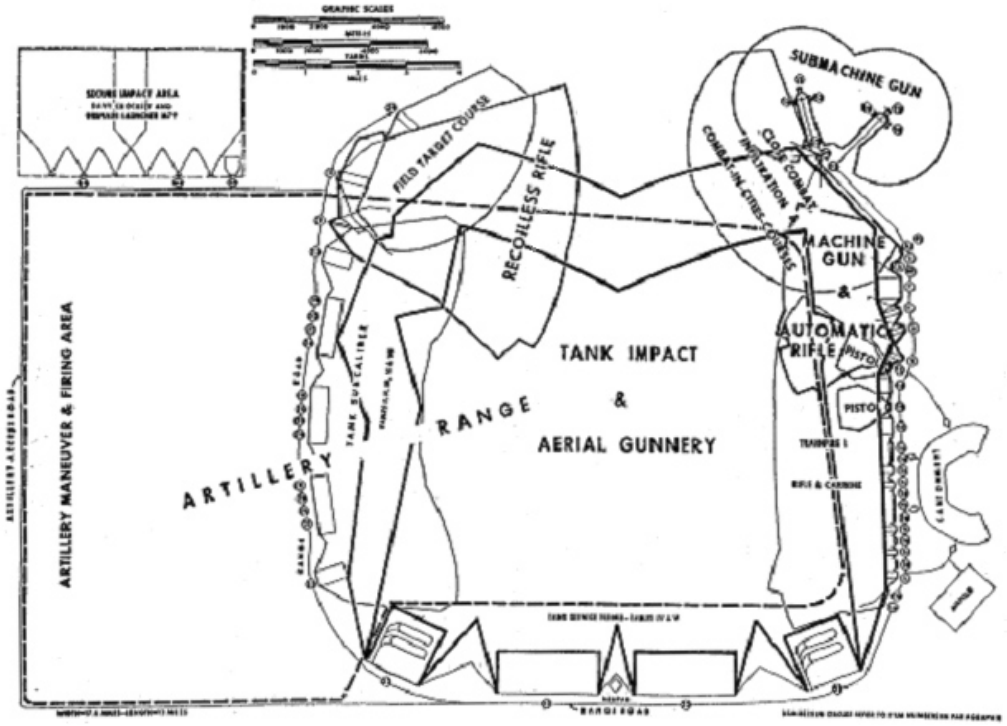


Figure 3. Typical division range layout, circa 1964 (AR 210-21, *Training areas and facilities for ground troops*, 18 December 1964, p.10).

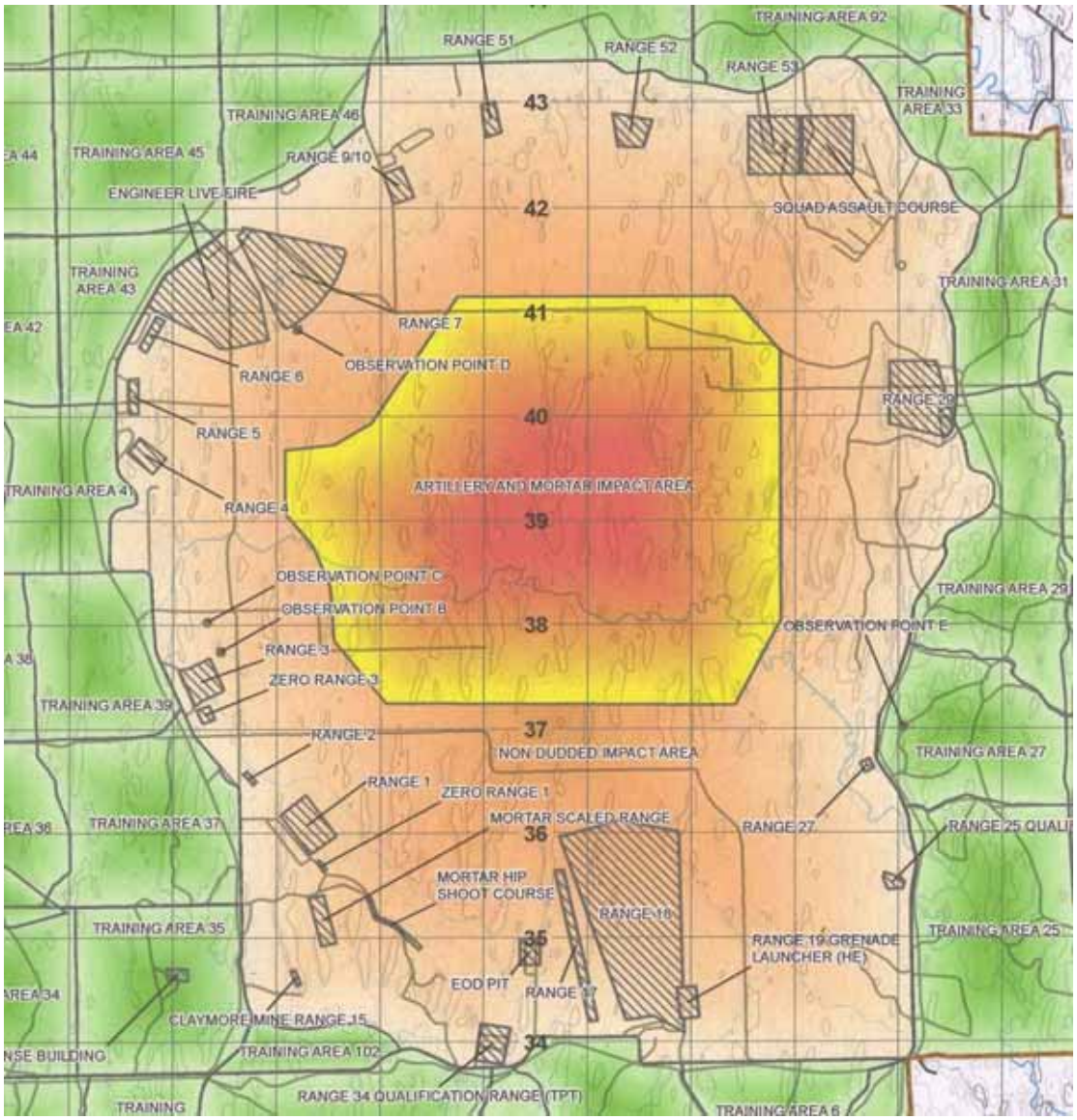


Figure 4. Operational range inventory sustainment (ORIS) map, close up view, Fort Riley, KS, 2005 (Map provided by CALIBRE Systems, Inc.; Funding was provided by the Operational Range Inventory—U.S. Army Environmental Center [USAEC] DAAD13_00_D_5003; 31 December 2005).

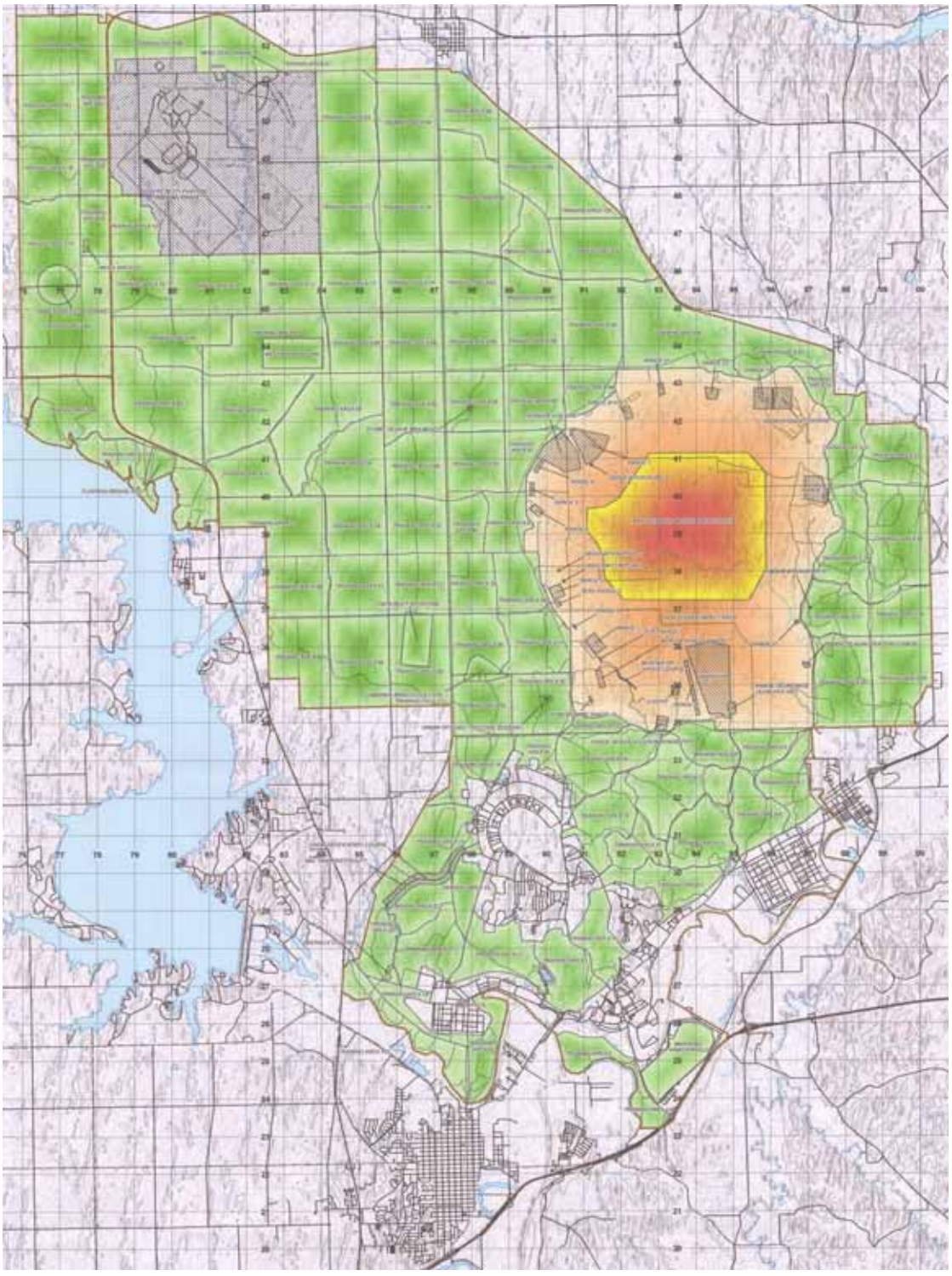


Figure 5. ORIS Map, Fort Riley, KS, 2005 (Map provided by CALIBRE Systems, Inc.; funding provided by the Operational Range Inventory—USAEC DAAD13_00_D_5003; 31 December 2005).

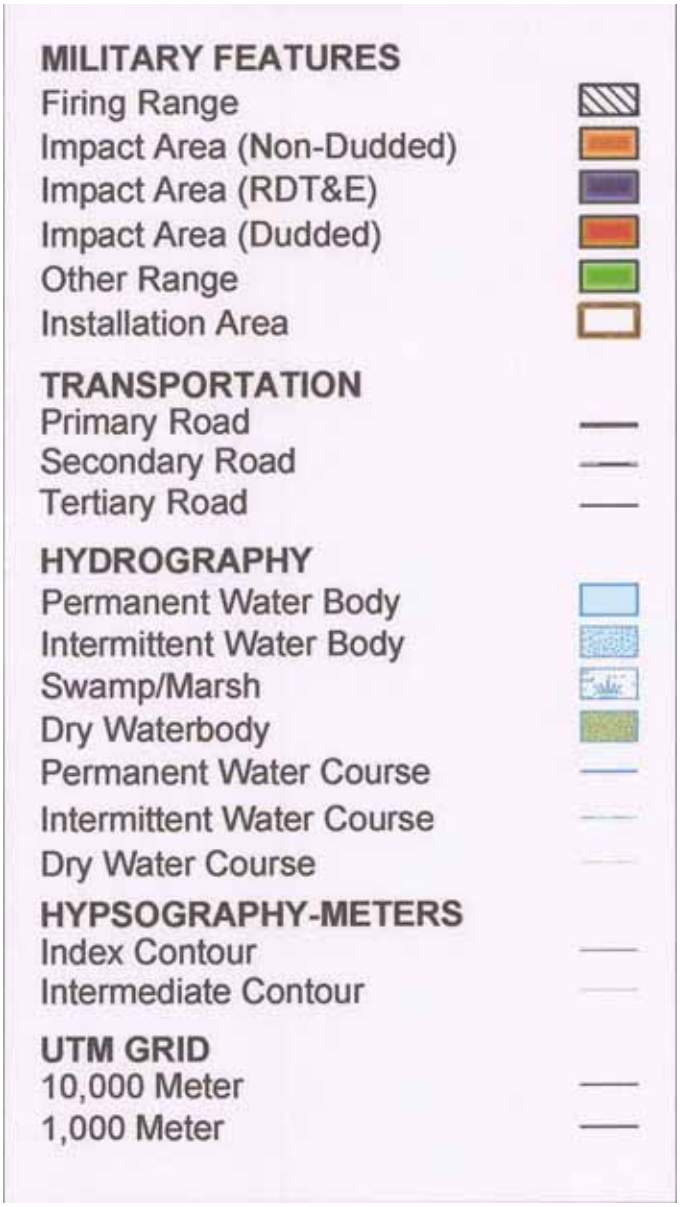


Figure 6. ORIS Map Key, Fort Riley, KS, 2005 (Map provided by CALIBRE Systems, Inc.; funding provided by the Operational Range Inventory–USAEC DAAD13_00_D_5003; 31 December 2005).

RANGE (FCC)	GRID
ARTILLERY AND MORTAR IMPACT AREA (17730)	937391
CLAYMORE MINE RANGE 15 (17885)	912346
COMBINED ARMS COLLECTIVE TRAINING FACILITY (17901)	883354
CREW PROFICIENCY COURSE (17866)	868299
DIGITAL MULTI-PURPOSE TRAINING RANGE (17865)	801480
DOUTHIT GUNNERY COMPLEX (17868)	816488
ENGINEER LIVE FIRE (17889)	904411
EOD PIT (17886)	934349
FARRP (17911)	822509
FLOATING BRIDGE SITE (17976)	797409
MARSHALL ARMY AIRFIELD (11120)	935251
MILFORD DROPZONE (17991)	832438
MOCK AIRFIELD (17901)	777467
MORTAR HIP SHOOT COURSE (17852)	921351
MORTAR SCALED RANGE (17851)	914352
MOUT SITE (17995)	873259
MPRC (17868)	812491
MPRC ZERO RANGE (17801)	831512
NBC TRAINING FACILITY (17170)	861297
NEW RILEY DROPZONE (17991)	885362
NON DUDDED IMPACT AREA (17731)	937387
OBSERVATION POINT B (17971)	905377
OBSERVATION POINT C (17971)	903380
OBSERVATION POINT D (17971)	912408
OBSERVATION POINT E (17971)	970370
OBSTACLE COURSE (17994)	858273
PYGMY VILLAGE MINI-MOUT (17995)	880424
RANGE 1 (17806)	913361
RANGE 17 (17863)	939349
RANGE 18 (17865)	944352
RANGE 19 GRENADE LAUNCHER (HE) (17884)	950344
RANGE 2 (17822)	907365
RANGE 25 QUALIFICATION COURSE (17882)	969355
RANGE 27 (17821)	967366
RANGE 29 (17855)	972402
RANGE 3 (17806)	903375
RANGE 34 QUALIFICATION RANGE (TPT) (17884)	931340
RANGE 4 (17802)	897396
RANGE 5 (17801)	896402
RANGE 51 (17841)	931428
RANGE 52 (17885)	944427
RANGE 53 (17894)	958426
RANGE 6 (17801)	896408
RANGE 7 (17833)	911414
RANGE 9/10 (17801)	922422
SQUAD ASSAULT COURSE (17894)	963426
STATIONARY GUNNERY RANGE (17863)	829505
TIMBER CREEK DROPZONE (17991)	769457
TRAINING AREA 1 (17710)	926240
TRAINING AREA 10 (17710)	942310
TRAINING AREA 100 (17720)	909480
TRAINING AREA 101 (17720)	789472
TRAINING AREA 102 (17720)	913339
TRAINING AREA 103 (17720)	864258
TRAINING AREA 11 (17720)	923309
TRAINING AREA 12 (17720)	930322
TRAINING AREA 13 (17720)	912314
TRAINING AREA 14 (17720)	915331
TRAINING AREA 15 (17720)	897331
TRAINING AREA 16 (17720)	881328
TRAINING AREA 17 (17710)	887278
TRAINING AREA 18 (17710)	883253
TRAINING AREA 19 (17720)	858268
TRAINING AREA 2 (17710)	910252
TRAINING AREA 20 (17720)	857287
TRAINING AREA 21 (17720)	869281
TRAINING AREA 22 (17720)	866292
TRAINING AREA 23 (17720)	879297
TRAINING AREA 24 (17720)	872309
TRAINING AREA 25 (17720)	979351
TRAINING AREA 26 (17720)	995351
TRAINING AREA 27 (17720)	977369
TRAINING AREA 28 (17720)	995369
TRAINING AREA 29 (17720)	980387
TRAINING AREA 3 (17710)	905275
TRAINING AREA 30 (17720)	994389
TRAINING AREA 31 (17720)	980413
TRAINING AREA 32 (17720)	993411
TRAINING AREA 33 (17720)	975428
TRAINING AREA 34 (17720)	883345
TRAINING AREA 35 (17720)	899345
TRAINING AREA 36 (17720)	882361
TRAINING AREA 37 (17720)	897361
TRAINING AREA 38 (17720)	880377
TRAINING AREA 39 (17720)	893377
TRAINING AREA 4 (17710)	914284
TRAINING AREA 40 (17720)	879393
TRAINING AREA 41 (17720)	889393
TRAINING AREA 42 (17720)	881409
TRAINING AREA 43 (17720)	894411
TRAINING AREA 44 (17720)	881425
TRAINING AREA 45 (17720)	897426
TRAINING AREA 46 (17720)	911428
TRAINING AREA 47 (17720)	835358
TRAINING AREA 48 (17720)	850356
TRAINING AREA 49 (17720)	866357
TRAINING AREA 5 (17710)	934298
TRAINING AREA 50 (17720)	834376
TRAINING AREA 51 (17720)	850376
TRAINING AREA 52 (17720)	866377
TRAINING AREA 53 (17720)	829393
TRAINING AREA 54 (17720)	849392
TRAINING AREA 55 (17720)	865392
TRAINING AREA 56 (17720)	865408
TRAINING AREA 57 (17720)	821406
TRAINING AREA 58 (17720)	840421
TRAINING AREA 59 (17720)	847409
TRAINING AREA 6 (17720)	958334
TRAINING AREA 60 (17720)	796425
TRAINING AREA 61 (17720)	819423
TRAINING AREA 62 (17720)	864425
TRAINING AREA 63 (17720)	796406
TRAINING AREA 64 (17720)	773423
TRAINING AREA 65 (17720)	772446
TRAINING AREA 66 (17720)	800442
TRAINING AREA 67 (17720)	827440
TRAINING AREA 68 (17720)	849441
TRAINING AREA 69 (17720)	864441
TRAINING AREA 7 (17720)	965324
TRAINING AREA 70 (17720)	792456
TRAINING AREA 71 (17720)	811456
TRAINING AREA 72 (17720)	832457
TRAINING AREA 73 (17720)	848457
TRAINING AREA 74 (17720)	864457
TRAINING AREA 75 (17720)	767468
TRAINING AREA 76 (17720)	779472
TRAINING AREA 77 (17720)	847477
TRAINING AREA 78 (17720)	863477
TRAINING AREA 79 (17720)	767488
TRAINING AREA 8 (17720)	955316
TRAINING AREA 80 (17720)	779488
TRAINING AREA 81 (17720)	767504
TRAINING AREA 82 (17720)	779504
TRAINING AREA 83 (17720)	846501
TRAINING AREA 84 (17720)	863500
TRAINING AREA 85 (17720)	770520
TRAINING AREA 86 (17720)	797521
TRAINING AREA 87 (17720)	832517
TRAINING AREA 88 (17720)	880441
TRAINING AREA 89 (17720)	896441
TRAINING AREA 9 (17720)	943330
TRAINING AREA 90 (17720)	912446
TRAINING AREA 91 (17720)	934444
TRAINING AREA 92 (17720)	961438
TRAINING AREA 93 (17720)	880457
TRAINING AREA 94 (17720)	895455
TRAINING AREA 95 (17720)	880480
TRAINING AREA 96 (17720)	896467
TRAINING AREA 97 (17720)	914466
TRAINING AREA 98 (17720)	879503
TRAINING AREA 99 (17720)	895488
URBAN OFFENSE / DEFENSE BUILDING (17878)	900347
ZERO RANGE 1 (17801)	914357
ZERO RANGE 3 (17801)	903371

Figure 7. ORIS Map, range list, Fort Riley, KS, 2005 (Map provided by CALIBRE Systems, Inc.; funding provided by the Operational Range Inventory—USAEC DAAD13_00_D_5003; 31 December 2005).

Firing lines

Firing lines on large arms ranges usually consisted of multiple cleared and leveled areas for firing positions (Figures 8-10). Holes and/or trenches were dug at some firing positions to support weapons and protect the firing crew (Figure 11). Some firing positions were fitted with foxholes, trenches, sandbags, concrete walls, or embankments for firing crew support and protection (Figures 12-14), or to simulate firing from a fortified position (Figure 15). Some had markers for left and right firing positions and may have been built up with sandbags or other embankments when located on a beach (Figure 16). Some firing lines were covered (Figure 17). Simulated airplane turrets were also constructed for some firing lines (Figures 18-24). Weapons were fired from prone, kneeling, standing, foxhole, tripod, vehicle mounted, or other positions.

Cleared and leveled firing positions

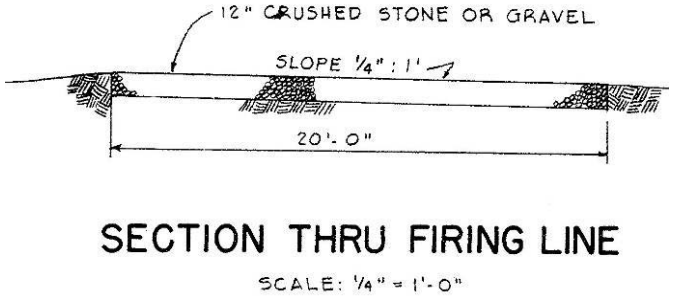


Figure 8. Tank Subcaliber moving target range section through firing line, Fort Bragg, NC, 1951 (Standard Drawing 28-13-15 Sheet 1, "Range, moving target, tank subcaliber, plan and details," 7 December 1951).



Figure 9. A gun crew practices gunnery on the 8-in. Howitzer at Fort Knox, KY, February 1947 (NARA College Park, RG 111-SC WWII, box 593, photo SC296576).



Figure 10. Tanks in line with Cadets observing subcaliber firing exercise at Finney Tank Range at Fort Knox, KY, 21 June 1961 (NARA College Park, RG 111-SC post 1955, box 364, photo SC583683).

Holes and trenches dug at firing positions



Figure 11. CMTC students practice with 75 mm guns at Fort Benjamin Harrison, IN, 1927 (NARA College Park, RG 111-SC WWI, box 700, photo 94932).

Foxholes, trenches, and sandbags for firing support and protection



Figure 12. A ROTC cadet prepares to fire a rocket launcher at Fort Bragg, NC, 19 July 1954 (NARA College Park, RG 111-SC WWII, box 283, photo SC465007).



Figure 13. Firing a 3.5 rocket launcher "Tank Killer" at Fort Campbell, KY, 13 August 1962 (NARA College Park, RG 111-SC post-1955, box 373, photo SC594126).



Figure 14. Marines firing the 3.5 rocket launcher during live firing Snow Fex exercise at Camp Drum, NY, 27 January 1964 (NARA College Park, RG 127-GG-590, box 24, photo A19365).

Firing from a fortified position

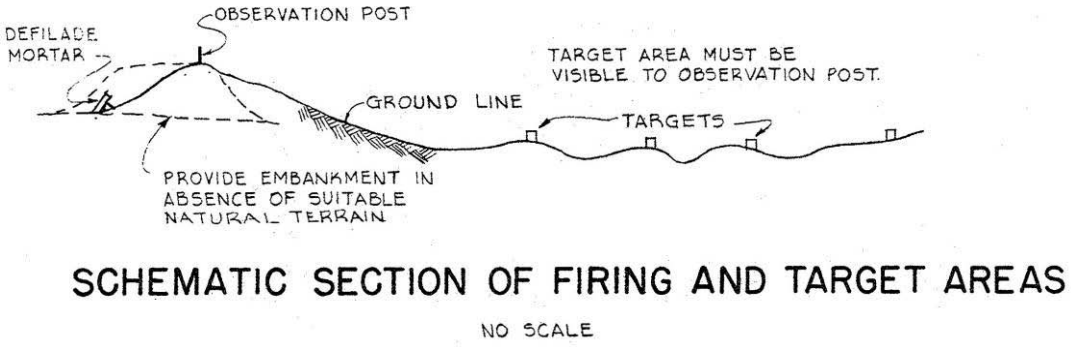


Figure 15. Mortar range schematic section of firing and target areas, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 1 of 2, "Mortar training, shell range, plan and danger area, 5 January 1952).

Embankments at beach firing ranges



Figure 16. Machine gun crews in action on range at MCAS Cherry Point, NC, 21 August 1943 (NARA College Park, RG 80-G, box 1360, photo 358873).

Covered firing lines

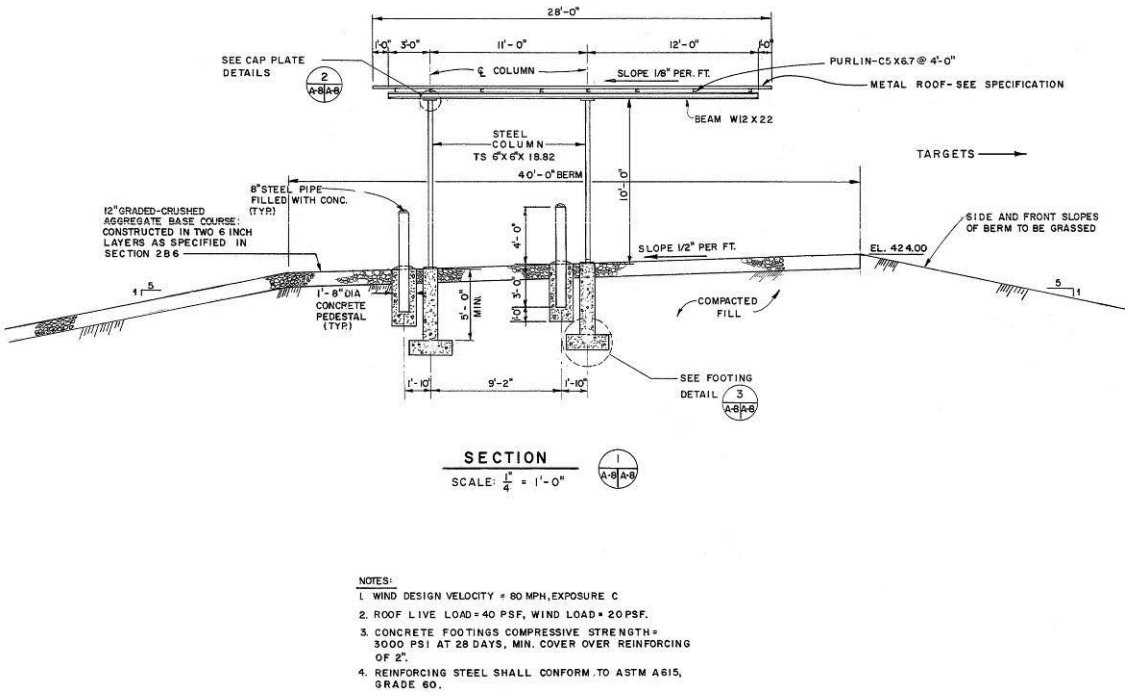


Figure 17. Anti-Armor range, covered firing line section, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 28; "Anti-armor range, covered firing line, plan and section," 28 February 1990).

Turrets

The War Department acquired Sahuarita Air Force Range, AZ in 1942 to support Davis-Monthan Field, AZ as a pattern bombing range. Improvements consisted of 12 buildings, observation towers, a 5,400-ft runway, miscellaneous structures, utilities, an OQ range, four bomb targets, and air-to-ground targets. Types of ordnance relative to training activities on this site included .50 caliber and 20mm projectiles, 100 lb. M38-series Practice Bombs, and 100 lb. M30 General Purpose HE Bombs. With these guns, B-29 and B-20 gunners sharpened their sighting and their trigger fingers by firing at a radio-controlled target plane on the OQ (radio-controlled gunnery range). The sighting position was located in the blisters of the building in the rear of the turrets (Figure 18).



Figure 18. B-29 and B-20 turret line on the radio-ontrolled OQ gunnery range at Sahuarita Air Force Range, AZ, 9 September 1952 (NARA College Park, RG 342-FH, box 2230, photo 4A-24136).



Figure 19. Machine gun turret at Davis-Monthan Field (Tucson), AZ, 2 November 1942 (NARA College Park, RG 342-FH, box 2202, photo 4A-17352).



Figure 20. Consolidated gun turret on machine gun range at Davis-Monthan Field (Tucson), AZ, 2 November 1942 (NARA College Park, RG 342-FH, box 2202, photo 4A-17357).

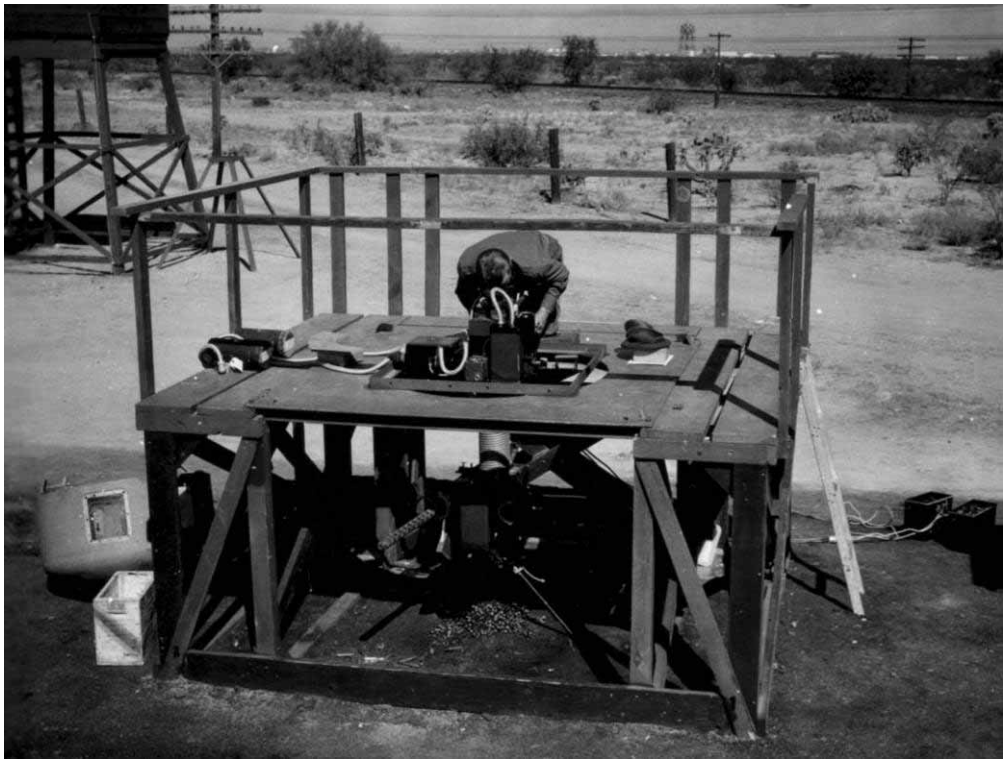


Figure 21. Installation of consolidated gun turret on machine gun range at Davis-Monthan Field (Tucson), AZ, 2 November 1942 (NARA College Park, RG 342-FH, box 2202, photo 4A-17356).



Figure 22. From turrets mounted on trucks, aerial gunnery students fire at stationary and moving targets at Harlingen Army Air Field, TX, June 1943 (NARA College Park, RG 342-FH, box 2202, photo 4A-17282).



Figure 23. Beach firing range at NAS Fort Lauderdale, FL, 28 February 1944 (NARA College Park, RG 80-G, box 1513, photo 388274).

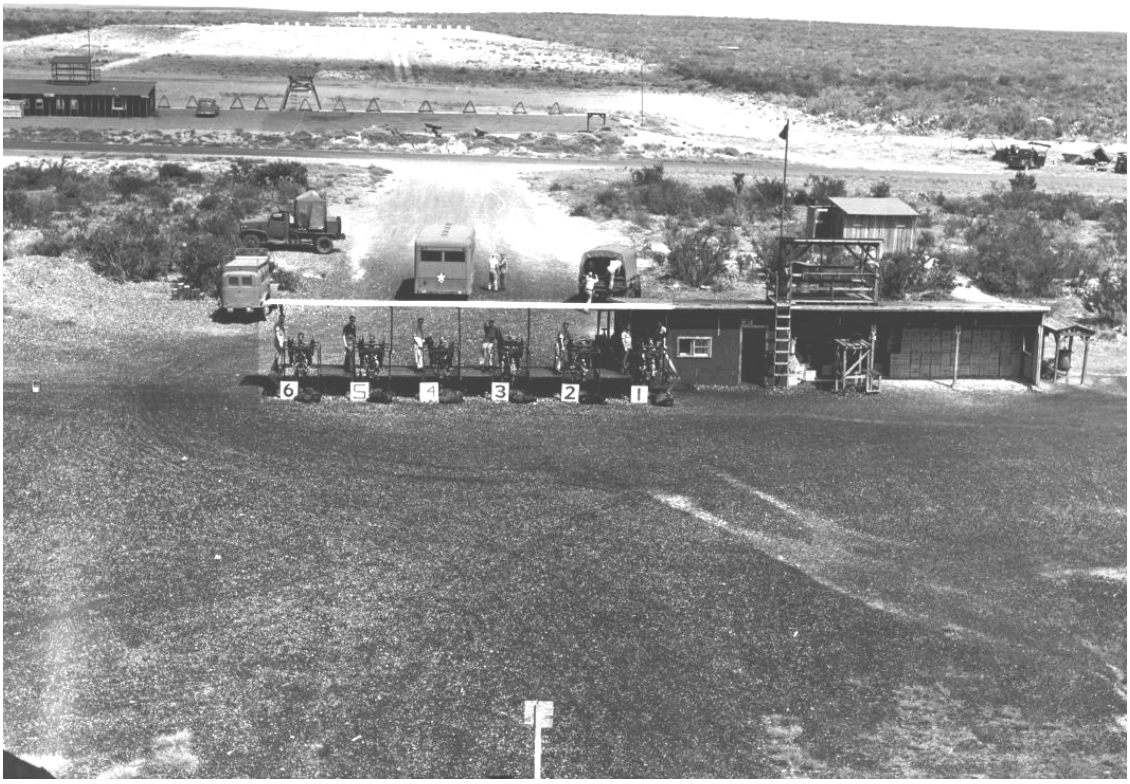


Figure 24. Students get set to fire at targets during ground training at Laredo Army Air Field, TX, 20 September 1944 (NARA College Park, RG 342-FH, box 2202, photo 4A-17275).

Targets

A variety of stationary, moving ground, and aerial targets were used in training on large arms ranges.

Stationary targets

Stationary F, E, and M-type silhouette targets were used along target lines, or in groups in the landscape to represent infantry (Figure 25). These targets were sometimes placed inside a circle of target stakes. A variety of stationary panel targets with multiple aiming points were used along target lines (Figures 26-28). Panels representing tanks and other moving vehicles were placed randomly in the landscape as targets (Figures 29, 30). These targets were often camouflaged and placed in realistic tactical locations while demolitions, simulators, and blank ammunition were used to simulate enemy fire. Concrete and logs were used to construct heavy-duty log targets and simulated pillbox targets (Figures 31-33). Surplus, obsolete, and condemned materiel such as caissons, limbers, tank hulls, salvaged vehicles, etc. were used as targets; often with an "X" marking the center of the mass. Features of the natural terrain were also used as targets (Figure 34). Other targets included zeroing targets, point targets (enemy bunkers, windows, doors, weapons emplacements, light-skinned vehicles, and troops with a single aiming point), area targets (objects or outlines of men irregularly spaced along covered and concealed areas such as ground folds, hedges, borders of woods), and BMPs (combination of an armored personnel carrier and light tank). Lighted aiming posts were often used for night firing.

Bore sight targets (three sectors or aiming points for light weapons and two for the heavy weapons) were placed randomly throughout some ranges. A testing target could be improvised for use when no distant aiming point was visible for bore sighting. A flat piece of masonite, wallboard, or similar material covered with a sheet of weather resistant paper was used. The target could be fastened to a wooden stand to stabilize it.

Miniature 1,000-in. ranges used 5 x 5-in. target cards mounted on staves on a target line (Figure 35). Bottle caps, chips of wood, cartridge cases, and other small objects were also placed throughout the landscape as targets on these ranges (Figure 36). Miniature buildings were used for sight adjustment and range calculations on miniature ranges (Figure 37).

F, E, and M-type silhouette targets

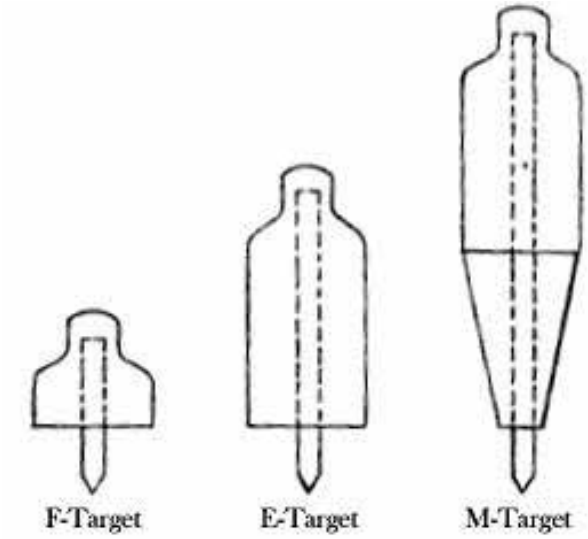


Figure 25. Silhouette targets for prone (F), kneeling (E), and standing (M) positions, circa 1943 (FM 23-41, Basic field manual, submachinegun caliber .45, M3, 30 October 1943, p 60).

Target Line panel targets

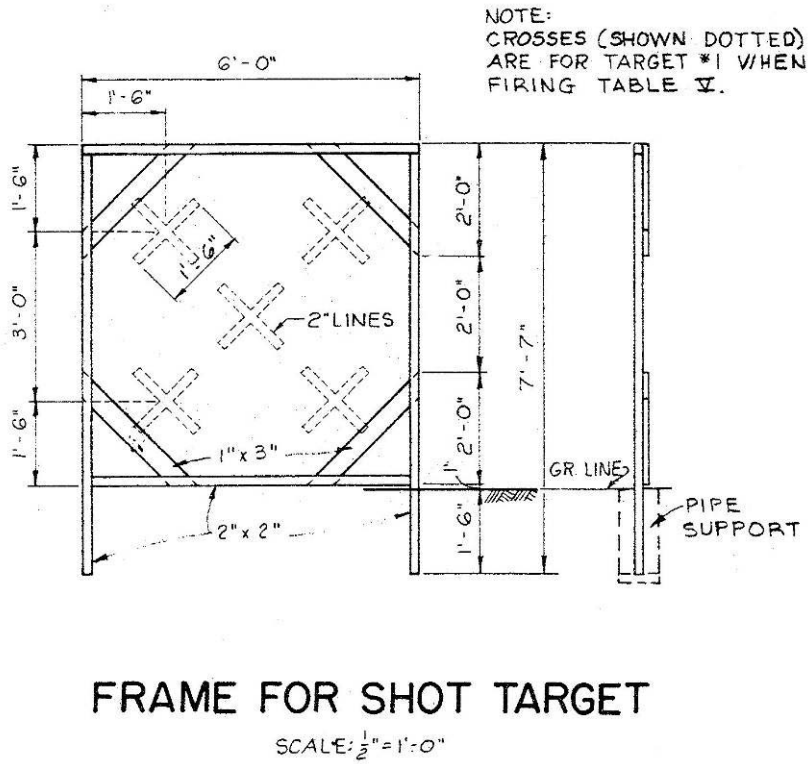


Figure 26. Individual tank combat firing range frame for shot target, Fort Bragg, NC, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

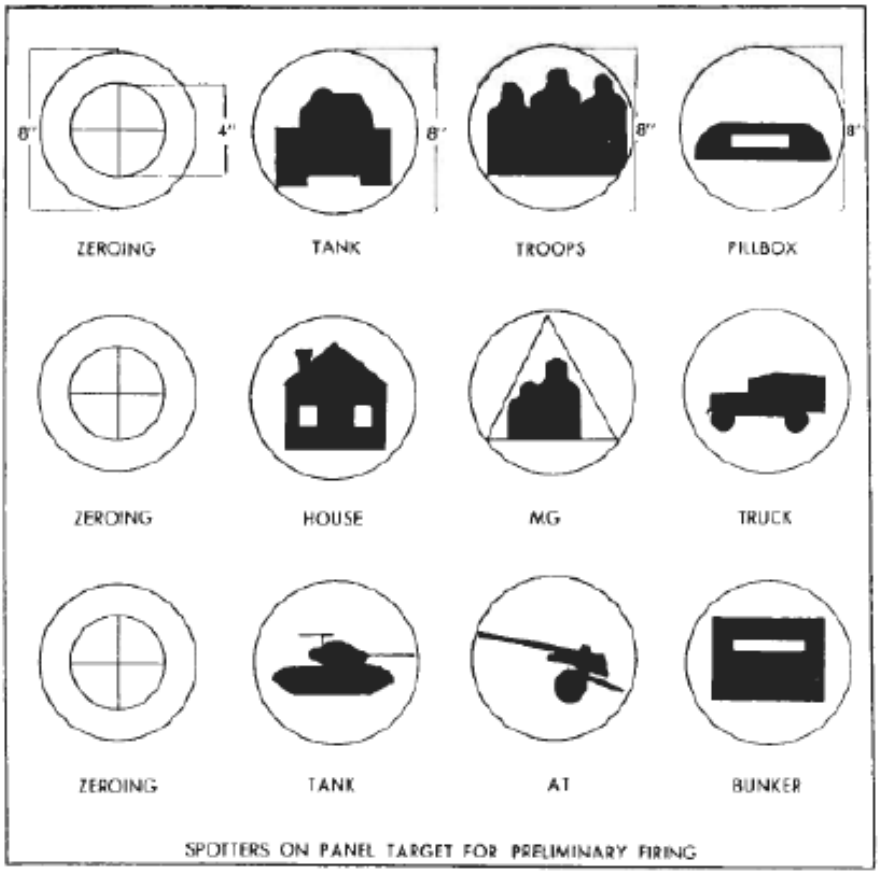


Figure 27. Spotters on panel target, circa 1957-1961 (FM 17-12, Tank gunnery, 21 May 1957, pp 197-200).

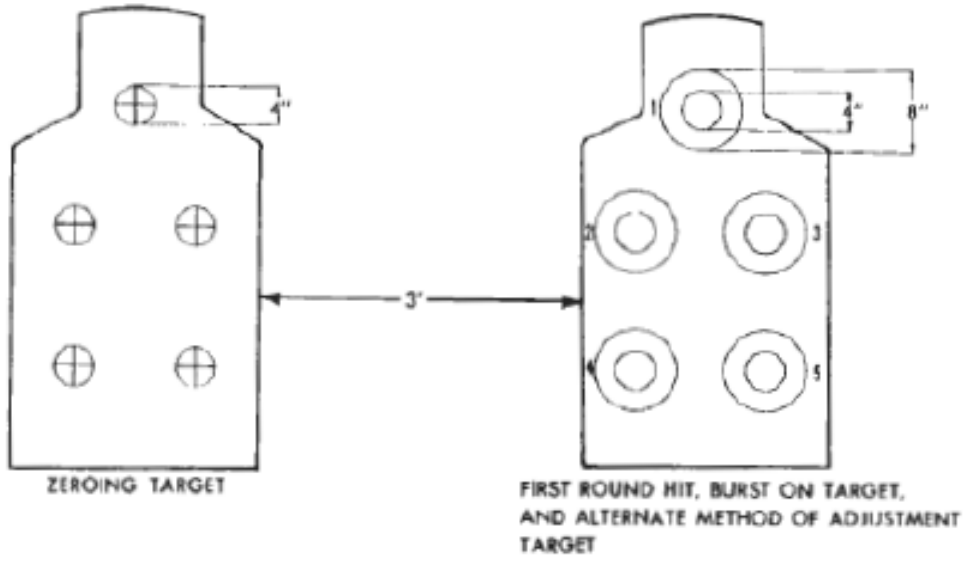


Figure 28. Targets for subcaliber 200-ft firing, circa 1957-1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 356, 357).

Silhouette panel targets

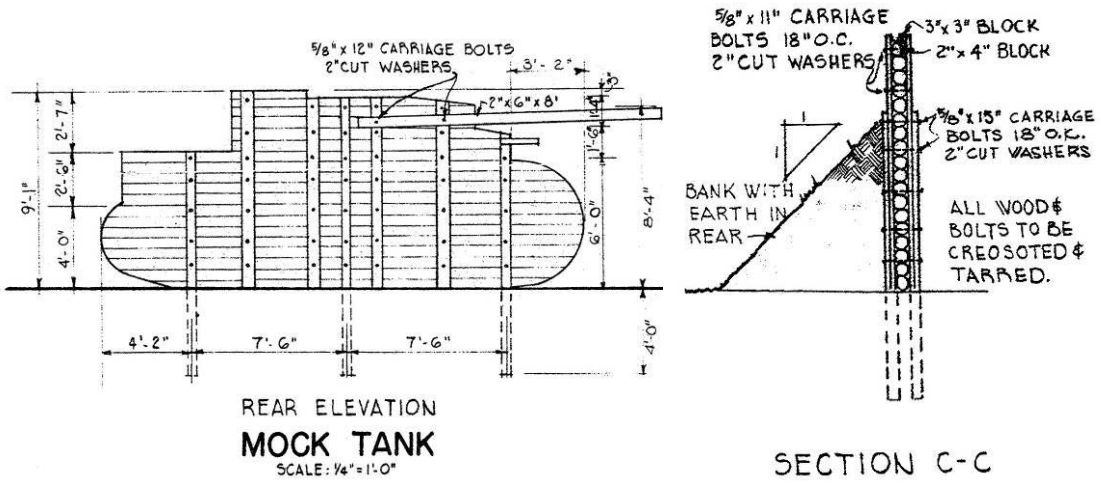


Figure 29. Recoilless rifle field target range, mock tank elevation and section, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans and details," 7 December 1951).

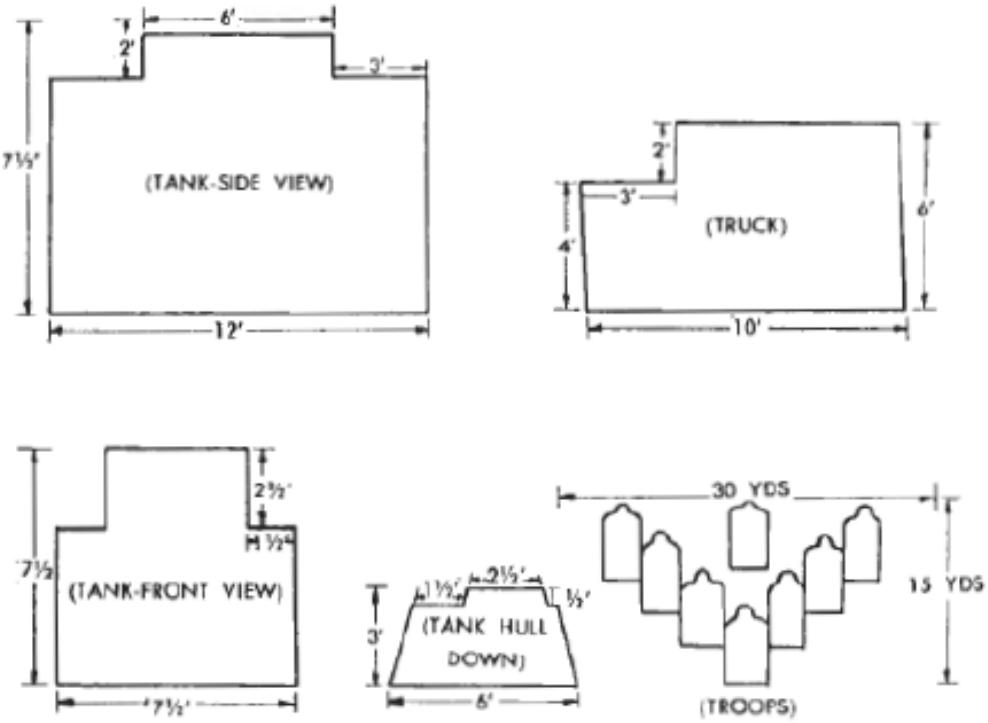


Figure 30. Panel-type targets for service ammunition firing, circa 1943 ("RO-10," p 67).

Log targets

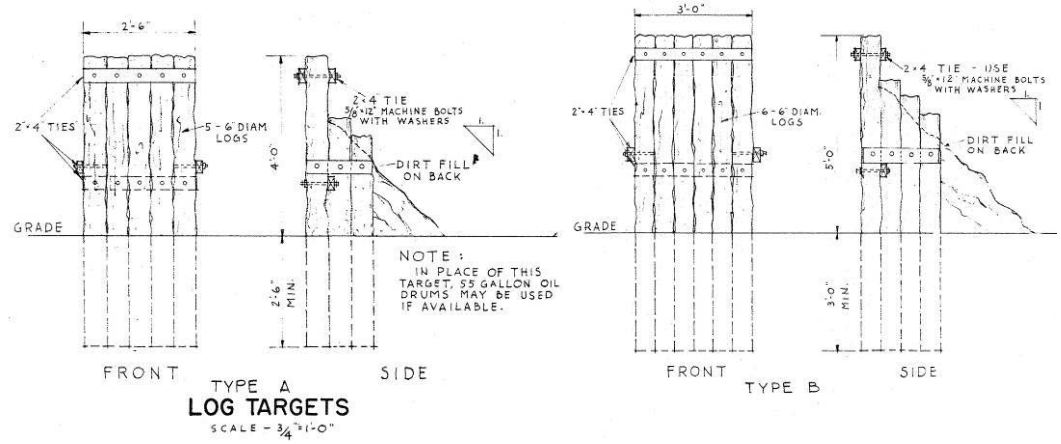


Figure 31. Recoilless rifle range log targets, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance, service practice, plan and details," 7 December 1951).

Pill boxes

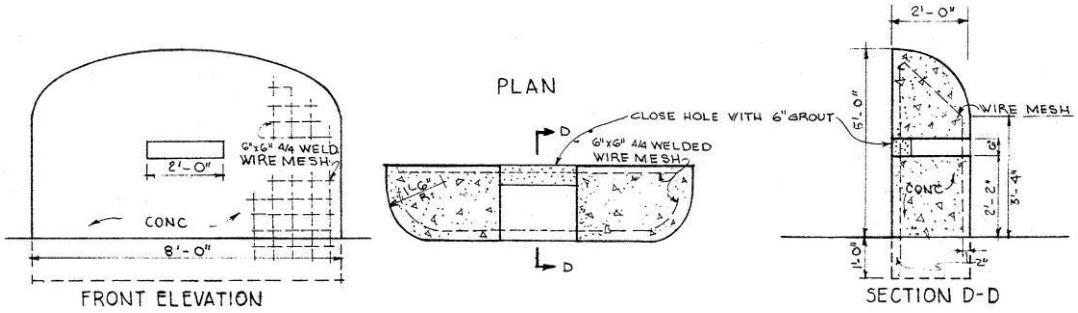


Figure 32. Recoilless rifle field target range, concrete pill box plan, section and elevation, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans and details," 7 December 1951).

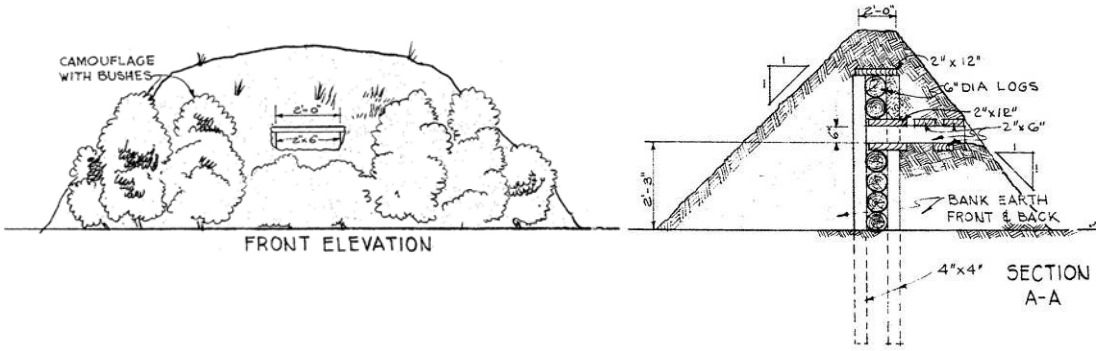


Figure 33. Recoilless rifle field target range, log and earth pill box front and rear elevation, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans and details," 7 December 1951).

Terrain targets

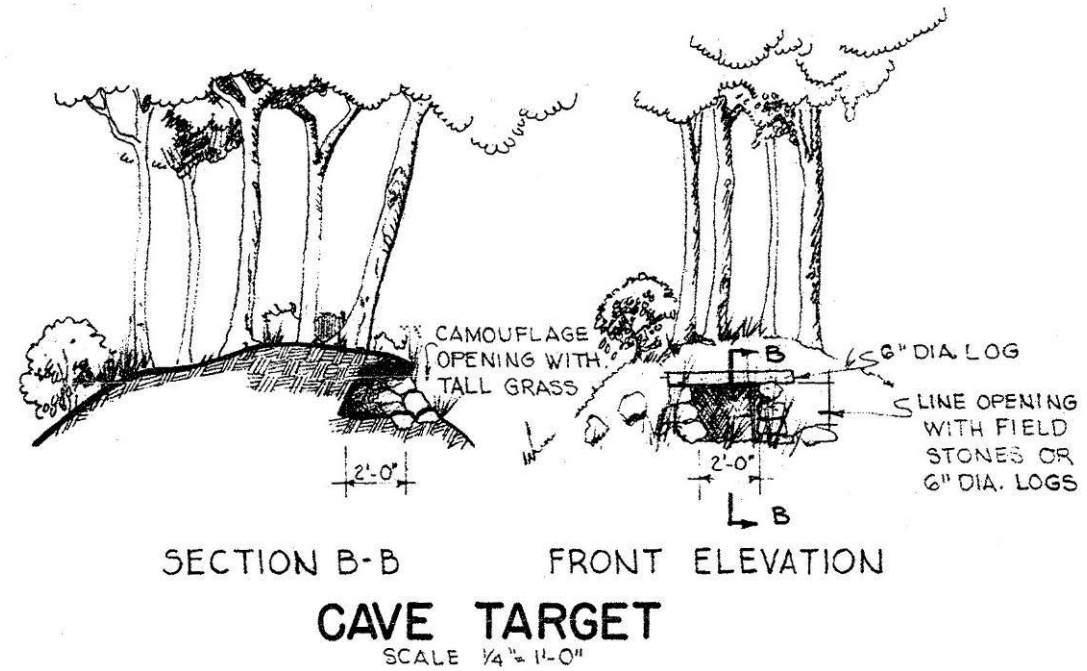


Figure 34. Recoilless rifle field target range, cave target, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans and details," 7 December 1951).

1,000-in. range stationary targets

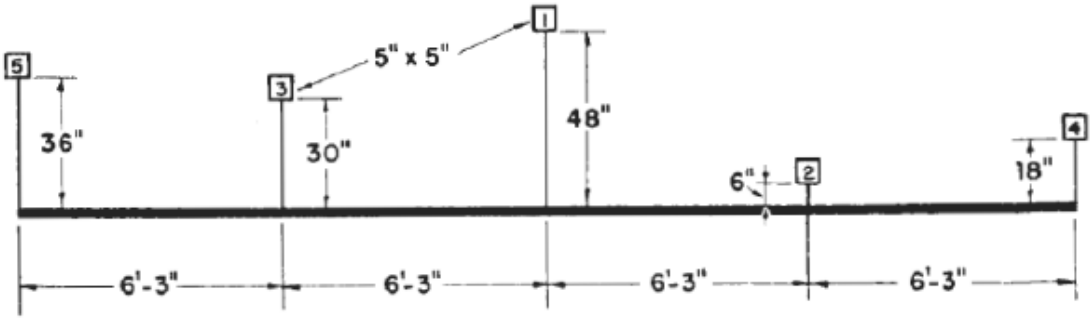


Figure 35. 1,000-in. Range subcaliber firing exercise target layout, circa 1950 (FM 17-12, Tank gunnery, 30 November 1950, pp 434-436).

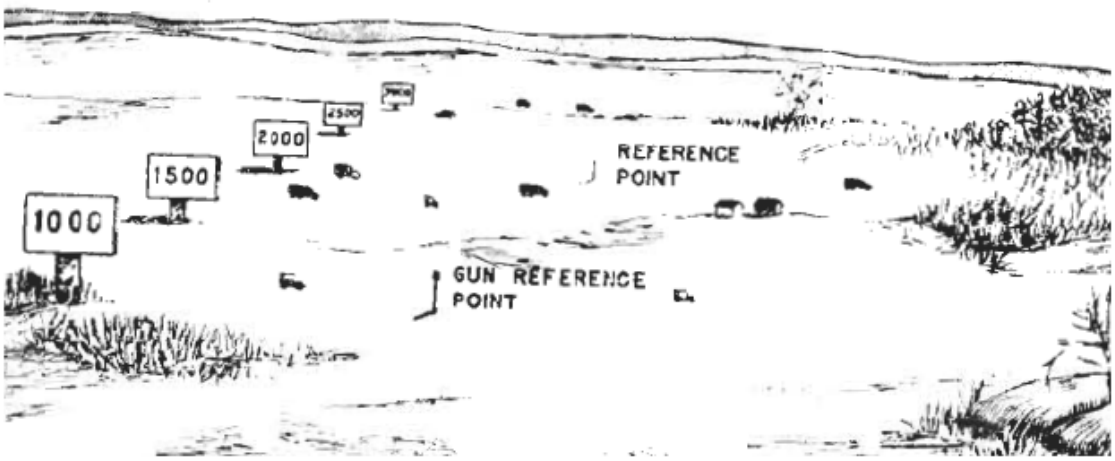


Figure 36. HE miniature range exercise target layout, circa 1950 (FM 17-12, Tank gunnery, 30 November 1950, pp 456-459).



Figure 37. Miniature villages are used on the 1000-in. mortar range to give the trainee practical experience in sight adjustment and range calculation at Fort Leonard Wood, MO, no date (NARA College Park, RG 111-SC WWII, box 200, photo SC361913).

Moving ground targets

Moving ground targets included targets mounted on metal sleds towed behind trucks with a cable system (Figures 38-42). Other ranges used target

tracks on which moving target cars were pulled. Mounted on the cars were panel silhouette targets of tanks, trucks, armored vehicles, and other panels with multiple aiming points (Figures 43-45). 1,000-in. ranges used target sleds that moved on hilly and level target tracks by a hand operated drum and pulley system (Figures 46-50). Targets were typically painted gray, brown, or olive drab. Tanks (with additional armor added to vulnerable points) were also used as moving targets for training.

Target sleds

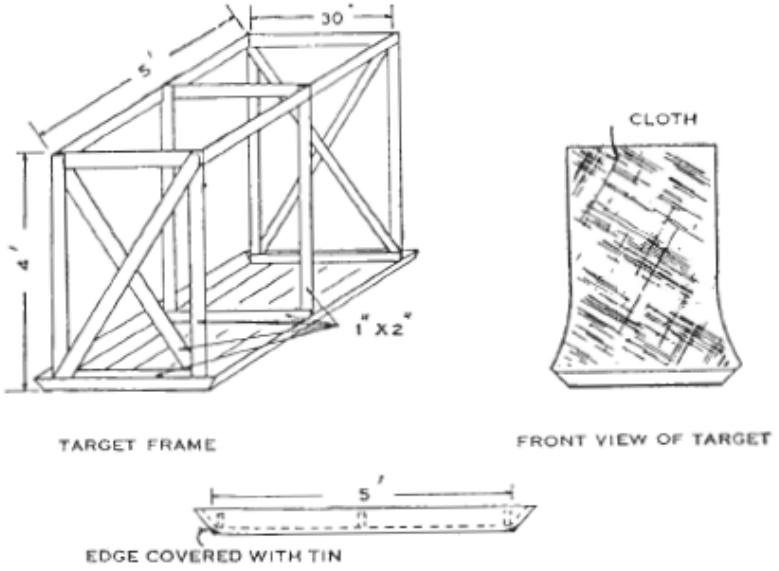


Figure 38. A .30 caliber standard range moving target construction details, circa 1940-1944 (FM 23-70, Basic field manual, 37mm Anti tank gun, M3, 1 October 1940, pp 165-167, 170; FM 23-70, Basic field manual, 37mm Anti tank gun, M3, 28 November 1942, pp 174-176, 178; FM 23-75, Basic field manual, 57mm Anti tank gun, M1, 15 June 1944, p 123).

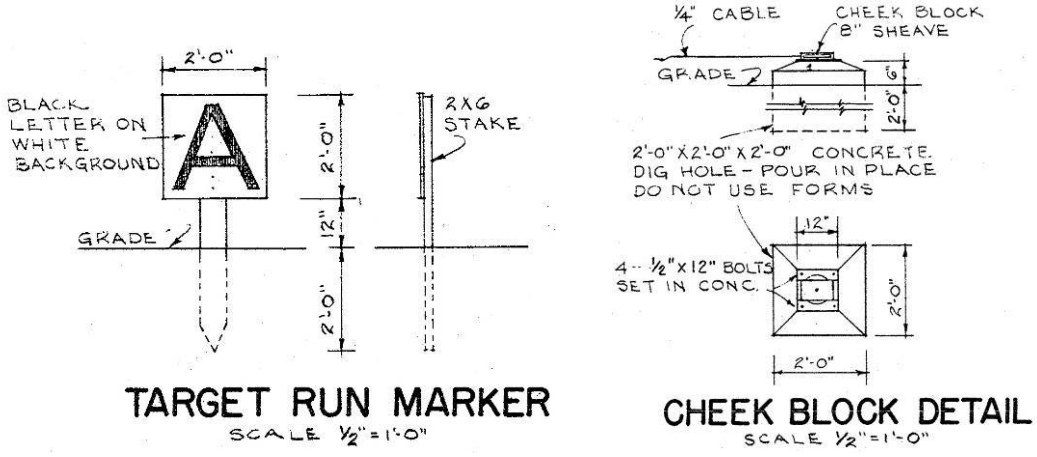


Figure 39. Rocket launcher range, target run marker and cheek block detail, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans and details," 21 November 1951).

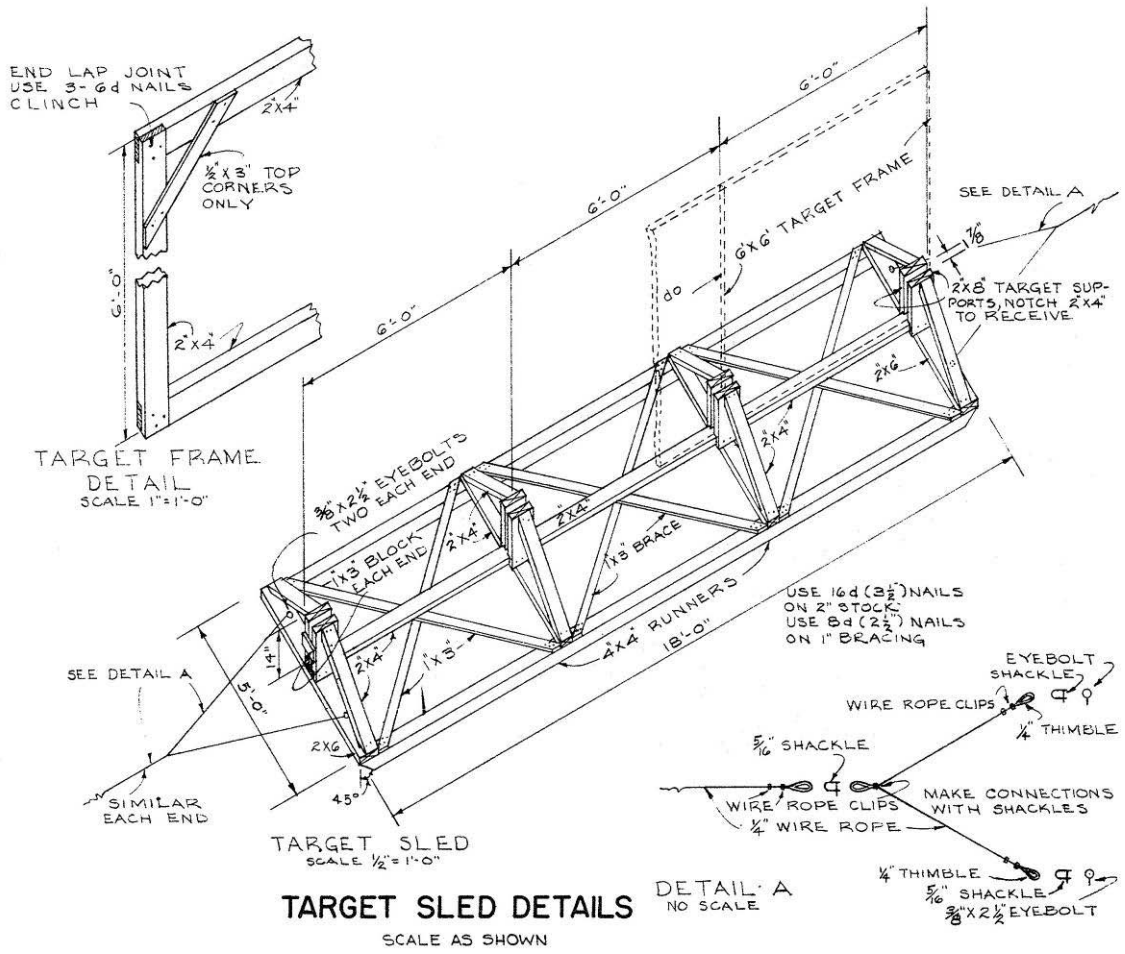


Figure 40. Rocket launcher range, target sled details, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2; "Range, rocket launcher, plans and details," 21 November 1951).

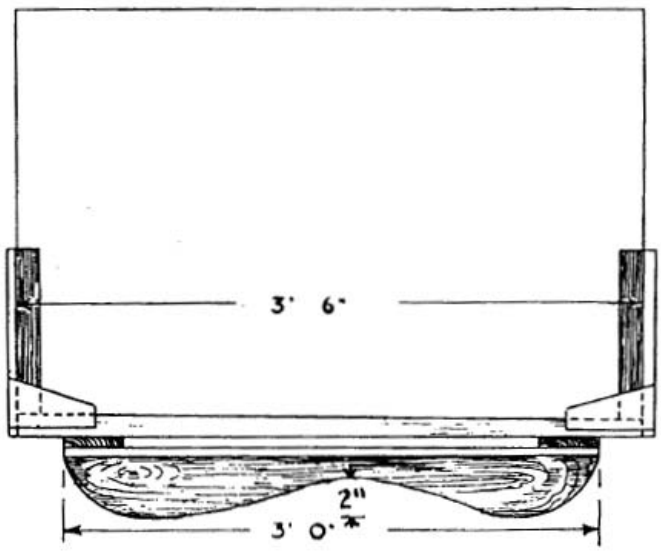


Figure 41. Moving target and sled, side view, circa 1944 (FM 23-75, Basic field manual, 57mm Anti tank gun, M1, 15 June 1944, p 138).

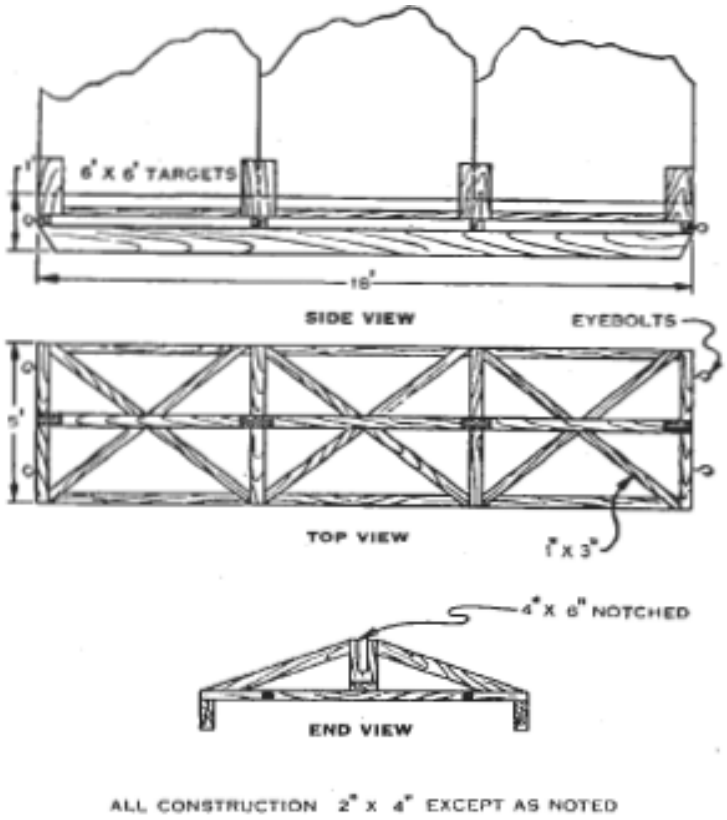


Figure 42. Wooden frame moving target, circa 1955 (FM 23-32, 3.5-in. rocket launcher, 26 April 1955, pp 105, 106).

Target tracks, cars, and panels

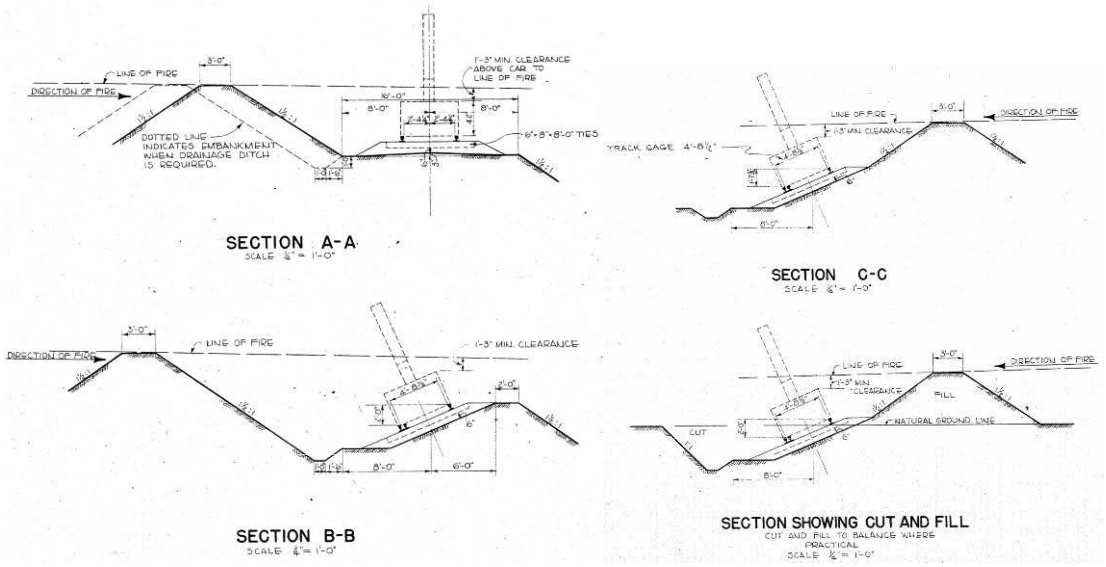


Figure 43. Tank or anti-aircraft moving target range (for guns to include 120mm), track sections, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 2 of 4; "Range, moving target, tank or anti-aircraft (for guns to include 120mm), ammunition house and track sections," 4 August 1952).

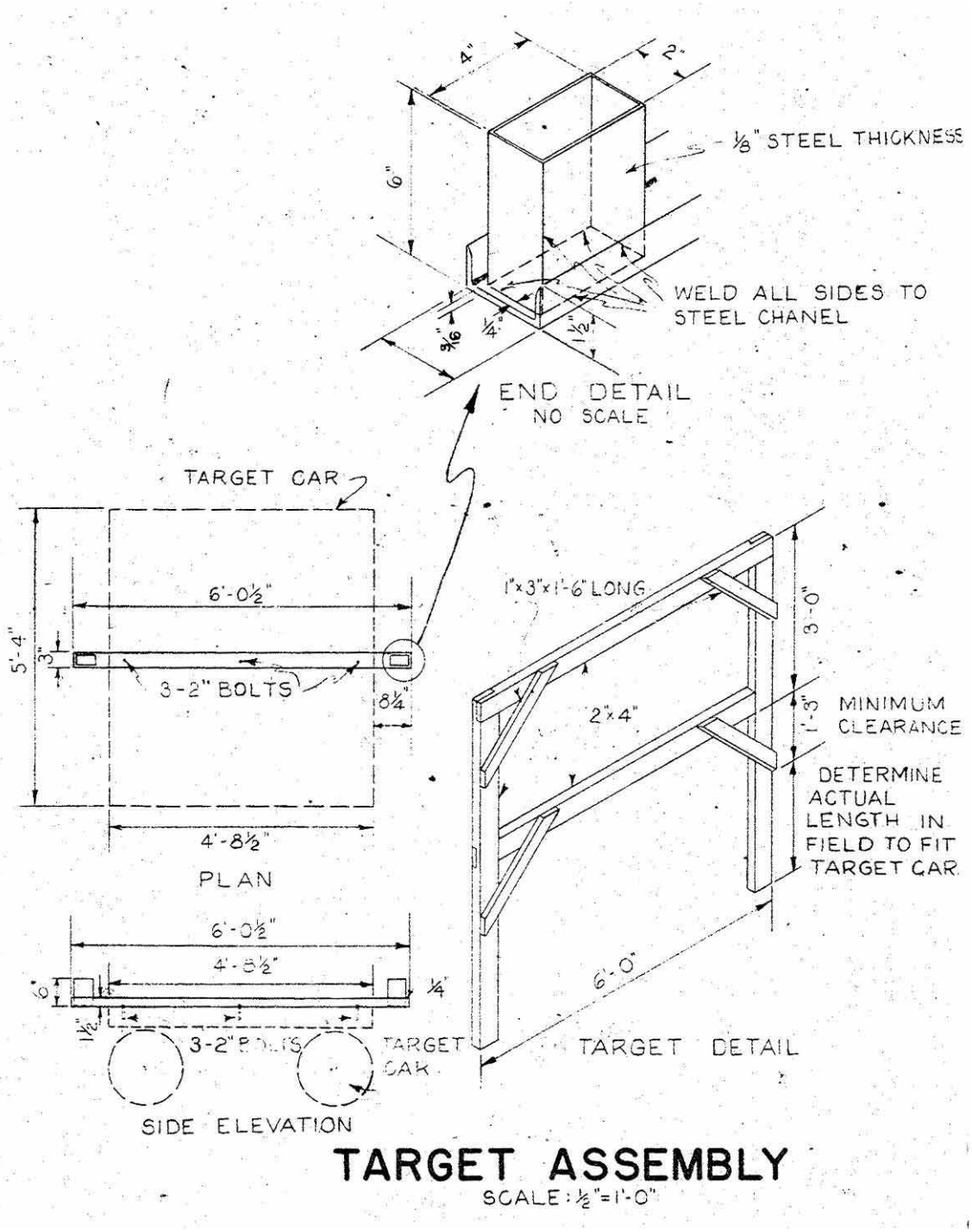


Figure 44. Tank or anti-aircraft moving target range (for guns to include 120mm), Target assembly, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 1 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), plans," 4 August 1952).

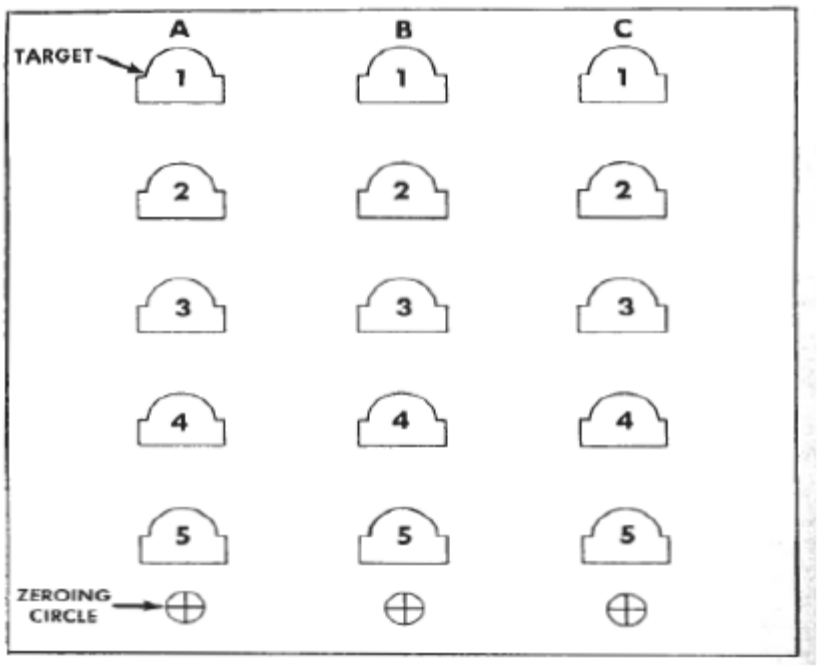


Figure 45. Subcaliber moving panel target, circa 1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 298-301, 329).

1,000-in. targets and tracks

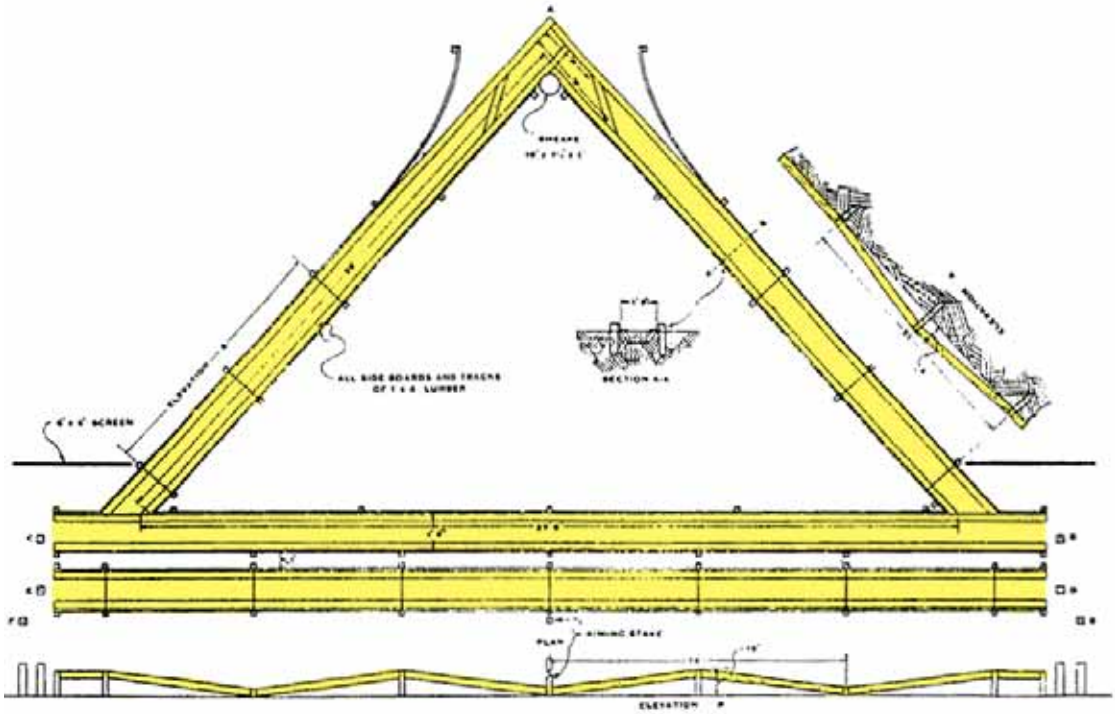


Figure 46. Triangular 1,000-in. range moving target layout, circa 1941 (FM 23-80, Basic field manual 37mm gun, tank, M5 (mounted in tanks), 25 June 1941, pp 105-111).

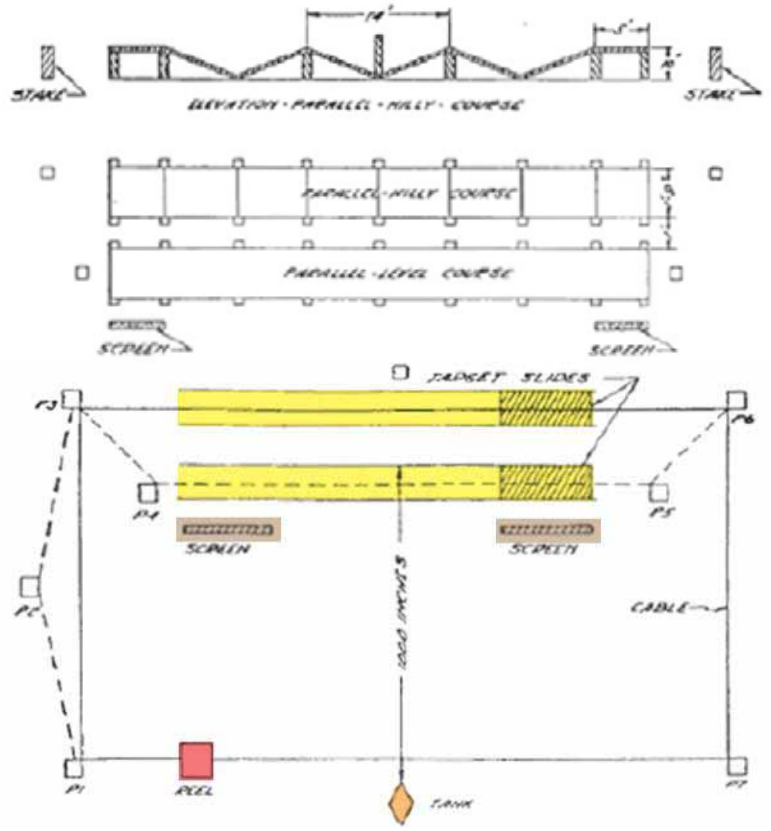


Figure 47. Parallel 1,000-in. range moving target layout and construction details, circa 1942 (FM 23-81, Basic field manual 37mm gun, tank, M6 (mounted in tanks), 3 April 1942, pp 84-86; FM 23-95, Basic field manual, 75mm tank gun M2 (mounted in medium tank M3), 4 May 1942, pp 107).

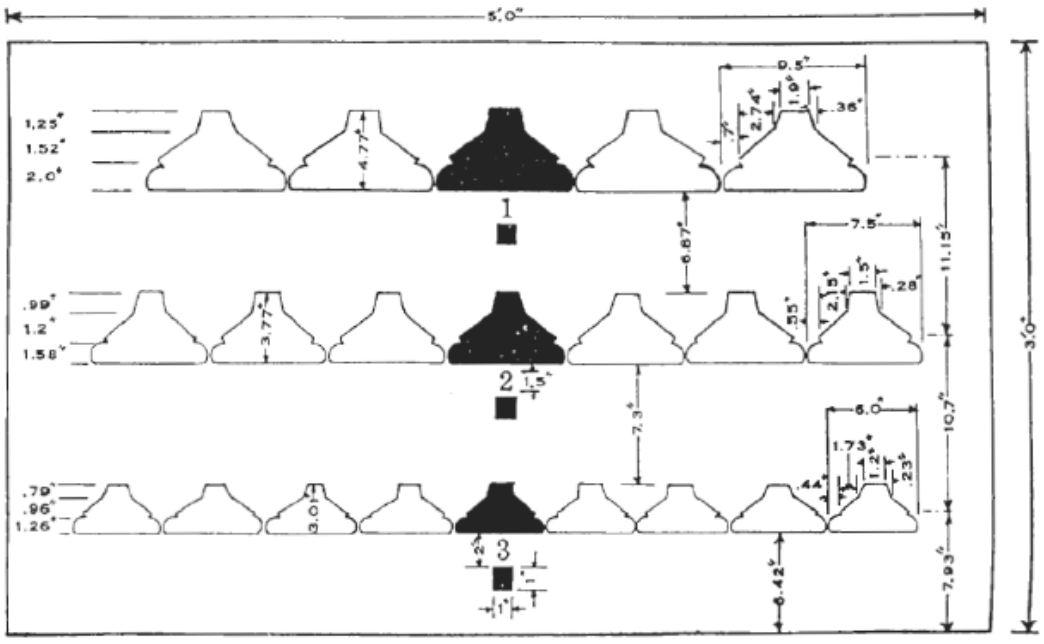


Figure 48. 1,000-in. Range moving target, circa 1942 (FM 23-81, Basic field manual 37mm gun, tank, M6 (mounted in tanks), 3 April 1942, p 83).

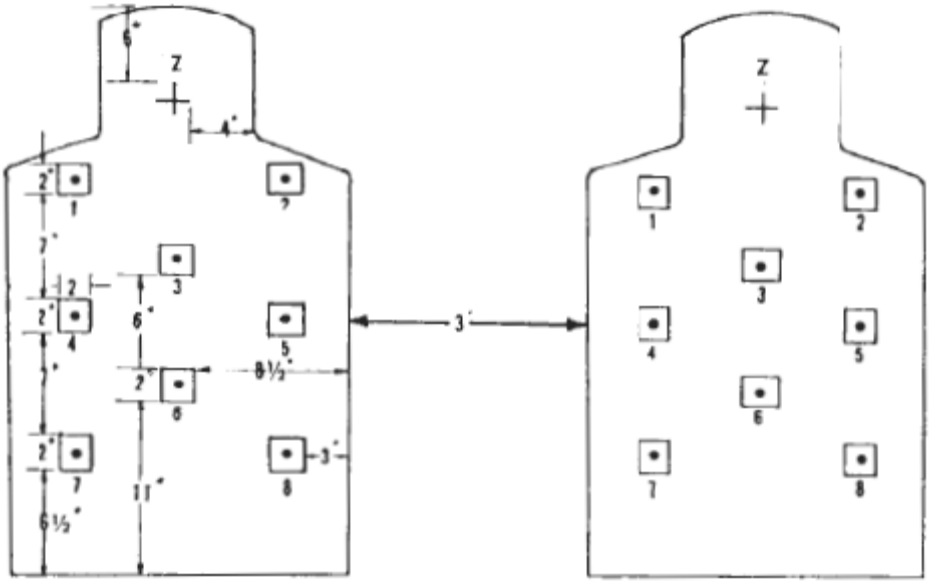


Figure 49. Targets for Subcaliber 1,000-in. firing, circa 1957-1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 356, 357).

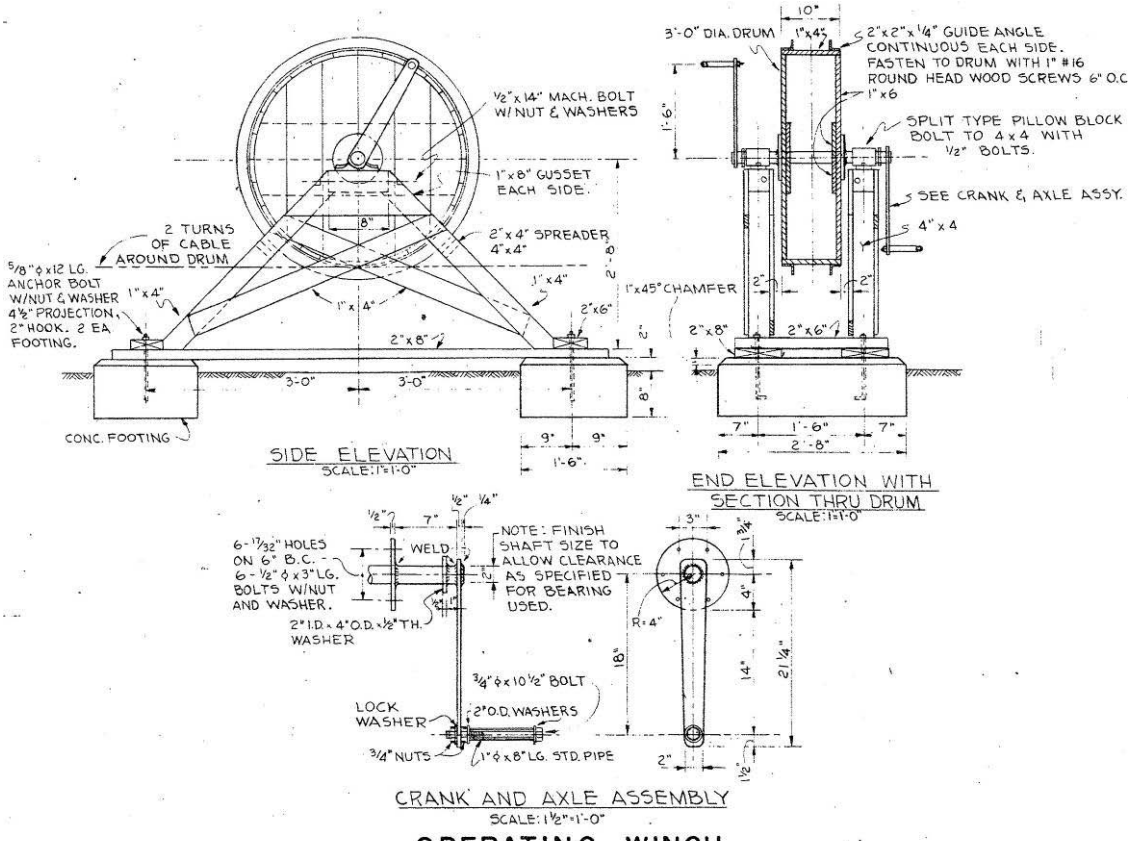


Figure 50. A 1000-in. recoilless rifle moving target range, operating winch, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000-in. moving target for recoilless rifle, plans and details," 20 June 1952).

Aerial targets

Aerial targets included balloons, kites (Figure 51), miniature remote controlled aircrafts (Figures 52-53), rockets (Figures 54), Ballistic Aerial Target Systems (BATS) (Figure 55), and flares, flags, or sleeves of cloth towed by aircraft.

Target kites

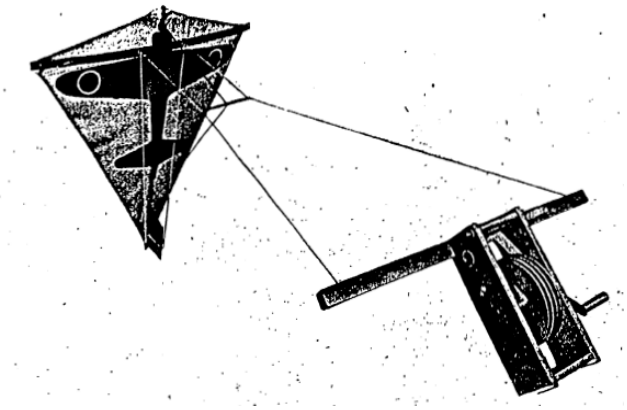


Figure 51. Target kite kit, M9, circa 1944 (TR 140-5, TM 9-855, Targets, target material, and training course layouts, 17 August 1944, pp 119 -121).

Remote controlled aircraft targets



Figure 52. Radio-controlled airplane target OQ-2A taking off from catapult at the AA range at Fort Jackson, SC, 1 November 1943 (NARA College Park, RG 111-SC WWII, box 415, photo SC246692).

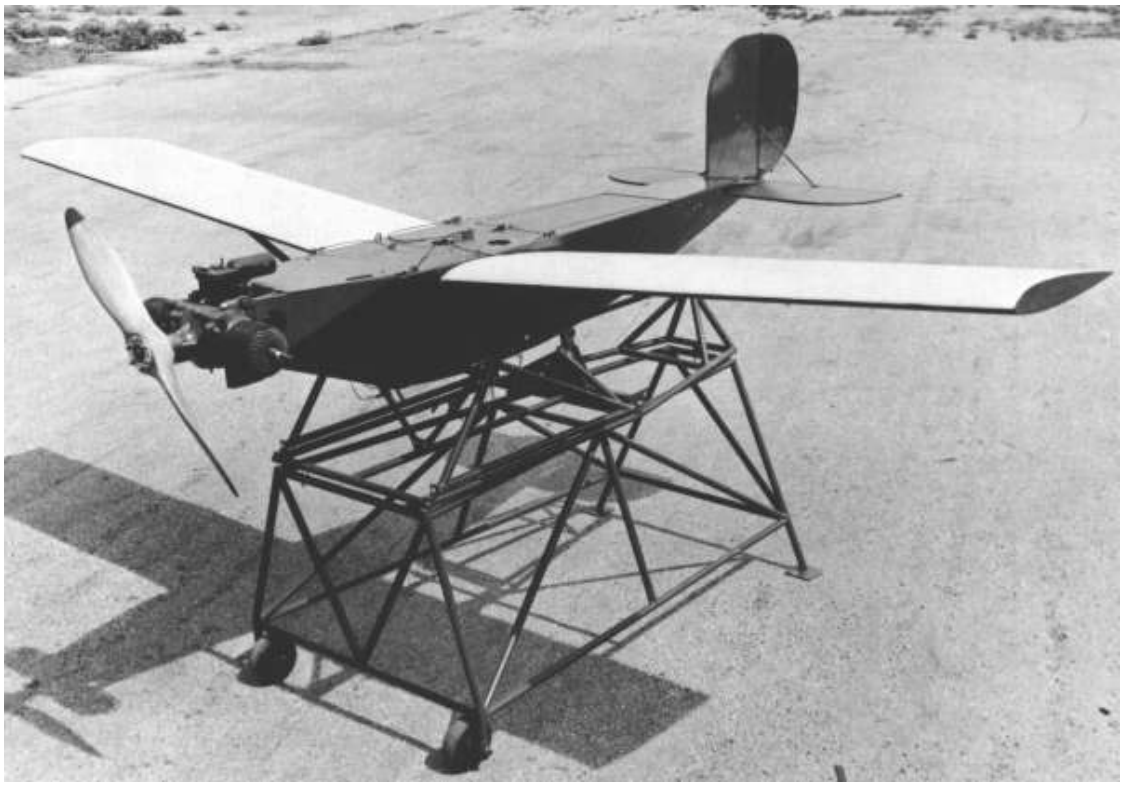


Figure 53. OQ-14/TDD-3/TDD-4 Radioplane, Circa 1944 ("RO-13," p 40; TR 140-5, Internet, http://www.designation-systems.info/dursm/app1/oq-14.html.

Target rockets

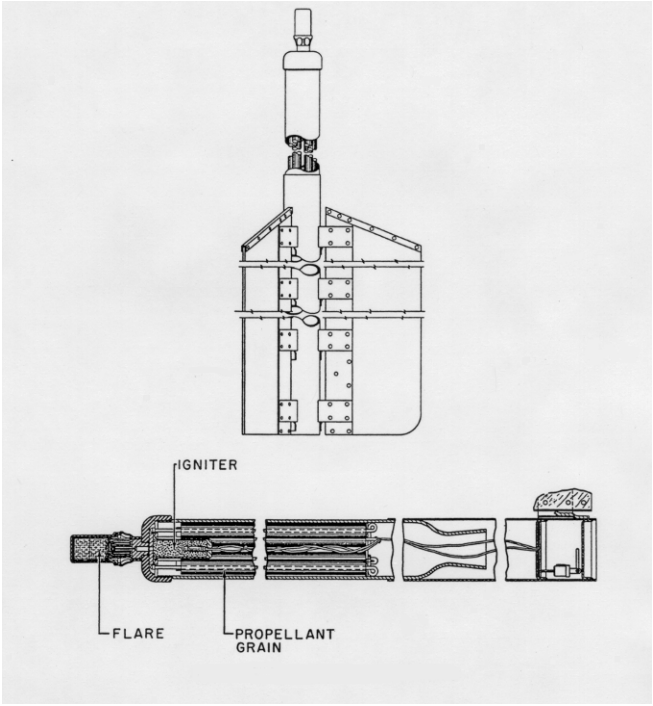


Figure 54. Rocket, target, 3.25-in., M2, circa 1947 ("RO-13," p 16; NAVSEA OP 1664, U.S. Explosive Ordnance, 28 May 1947, p 153).

Ballistic aerial target systems (BATS)

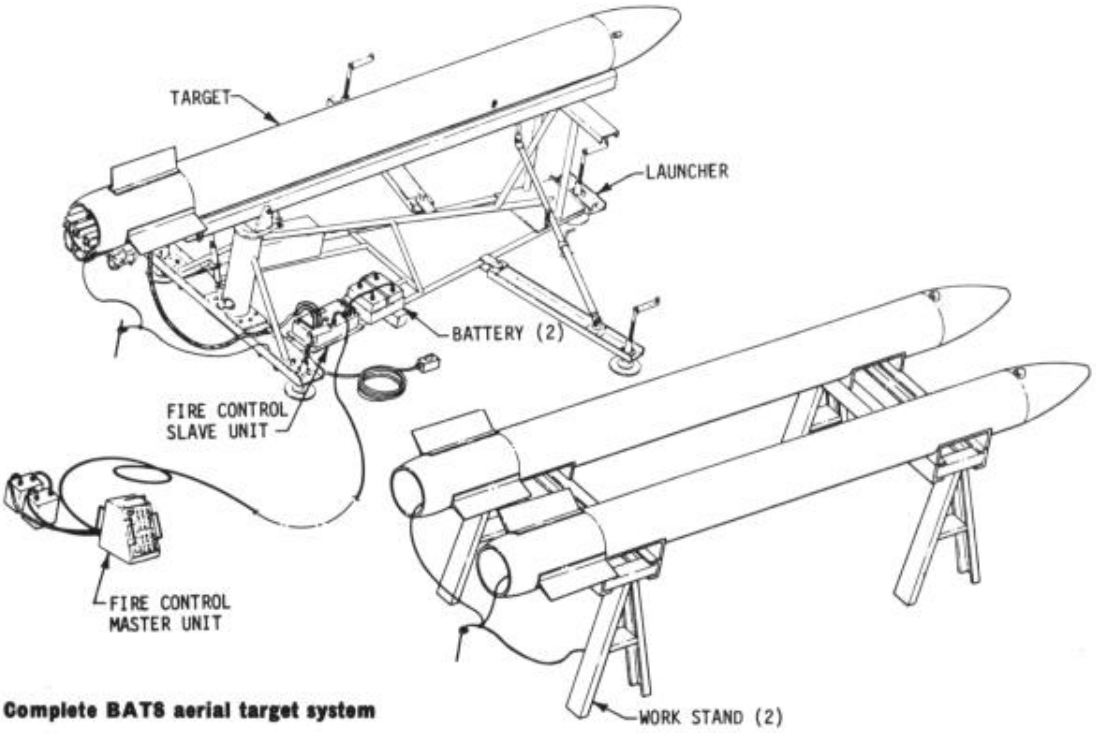


Figure 55. BATS system, circa 1972-2005 ("RO-13," p 17, http://www.designation-systems.info/dusrm/r-15.html).

Embankments/trenches/etc.

Ranges may have had embankments or walls built up behind targets (to catch ammunition [see Figure 56]), in front of targets or target tracks (for concealment and protection [see Figure 57]), at firing lines (for firing support or to stabilize firing positions [see Figure 58]), or between ranges (to protect from adjacent fire). Some ranges also had embankments in front of firing positions to simulate firing from an indirect fortified position (Figures 59 and 60). Ranges also had trenches or foxholes on some firing lines (for firing support [see Figure 61]) and on some target lines (for partial concealment of targets).

Embankments behind target lines (to catch fired ammunition)

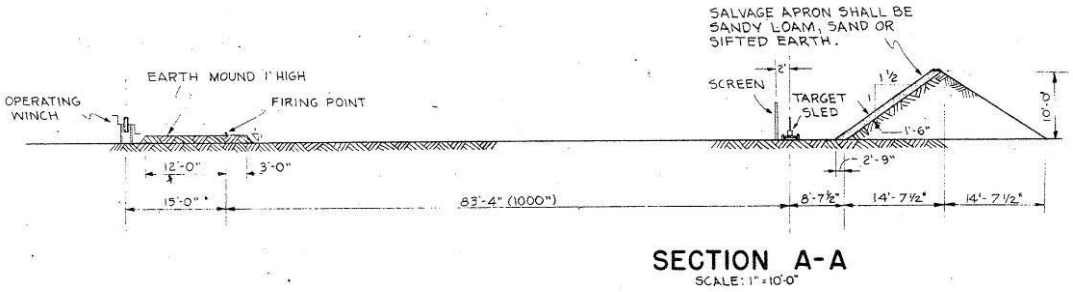


Figure 56. A 1000-in. recoilless rifle moving target range, section, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000-in, moving target for recoilless rifle, plans and details," 20 June 1952).

Embankments in front of target tracks (for concealment and protection)

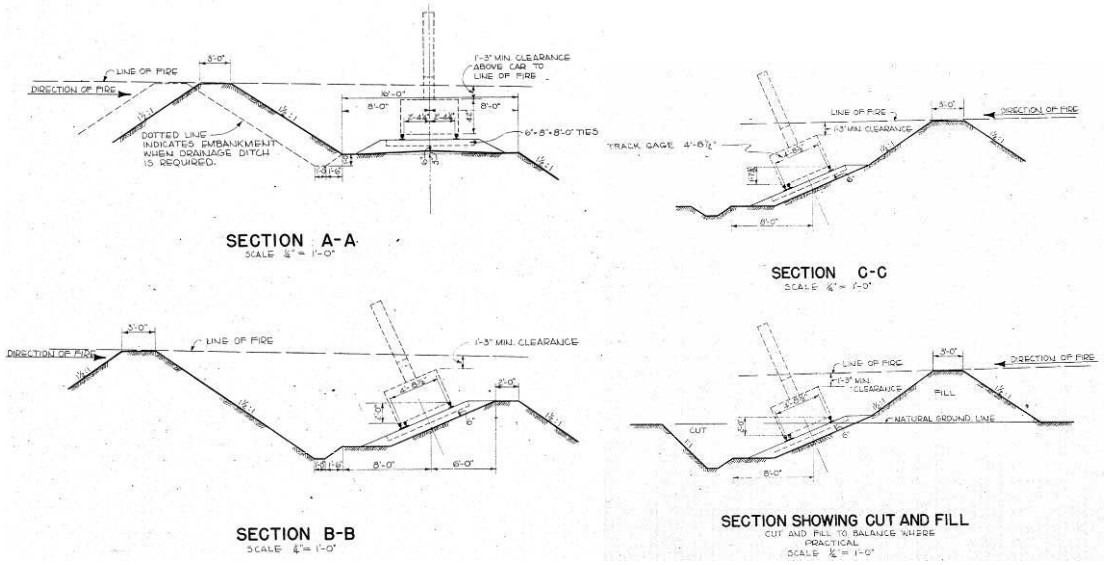


Figure 57. Tank or anti-aircraft moving target range (for guns to include 120mm), track sections, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24, Sheet 2 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), ammunition house and track sections," 4 August 1952).

Embankments at firing lines (for support or to stabilize firing positions)



Figure 58. Machine gun crews in action on range at MCAS Cherry Point, NC, 21 August 1943 (NARA College Park, RG 80-G, box 1360, photo 358873).

Embankments in front of firing lines (simulating a fortified position)

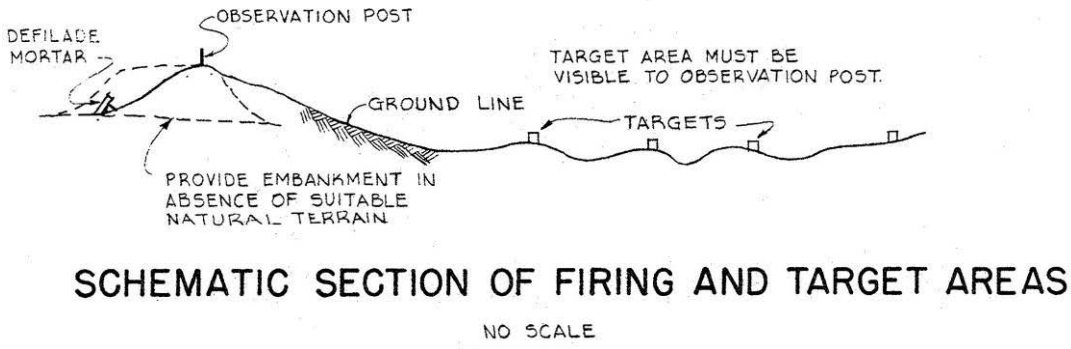


Figure 59. Mortar range schematic section of firing and target areas, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17, Sheet 1 of 2, "Mortar training, shell range, plan and danger area," 5 January 1952).

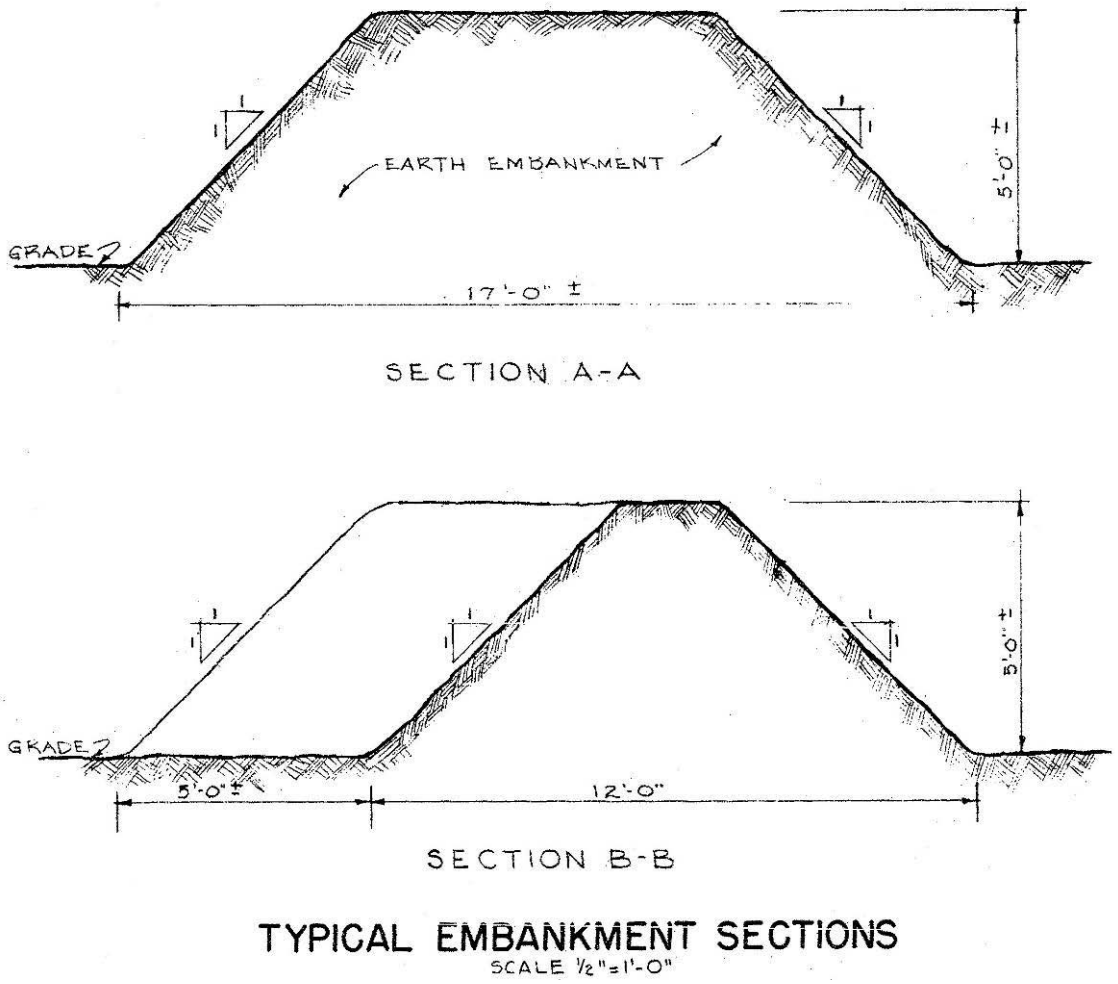


Figure 60. Mortar range typical embankment sections, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17, Sheet 2 of 2, "Mortar training, shell range, details," 5 January 1952).

Foxholes at firing lines



Figure 61. Firing a 3.5-in. rocket launcher "tank killer" at Fort Campbell, KY, 13 August 1962 (NARA College Park, RG 111-SC post-1955, box 373, photo SC594126).

Buildings

A range may have had control/observation towers, bleachers, latrines, target storage buildings, ammunition storage buildings, and other storage sheds and administrative/maintenance buildings to support general range functions. The range may also have been part of a larger installation range complex that contained these buildings. Figures 62–103 show examples of several buildings associated with large arms ranges.

Multiple range buildings



Figure 62. Firing range at Anti-Aircraft Training and Test Center Dam Neck, VA, December 1943 (NARA College Park, RG 80-G, box 8, photo 2316).

Control/observation towers



Figure 63. Artillery observation tower at unknown location, circa 1917 (New York Public Library, Digital No. 117077).

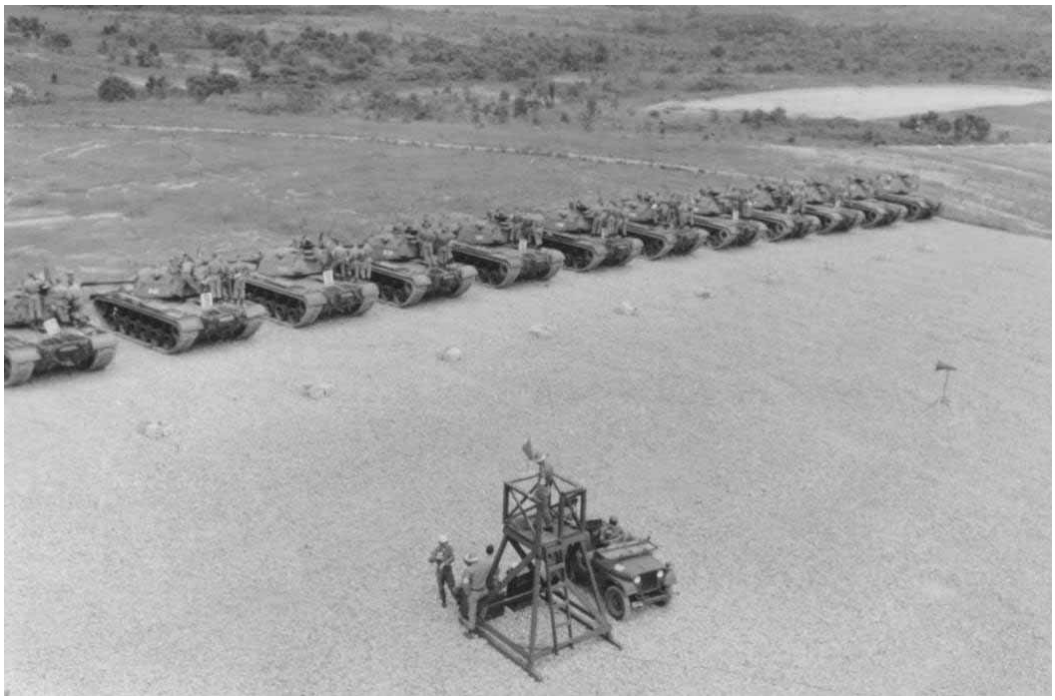


Figure 64. Caliber .50 firing orientation for USMA Cadets at Lawley Range at Fort Knox, KY, 9 June 1959 (NARA College Park, RG 111-SC post 1955, box 346, photo SC550418).

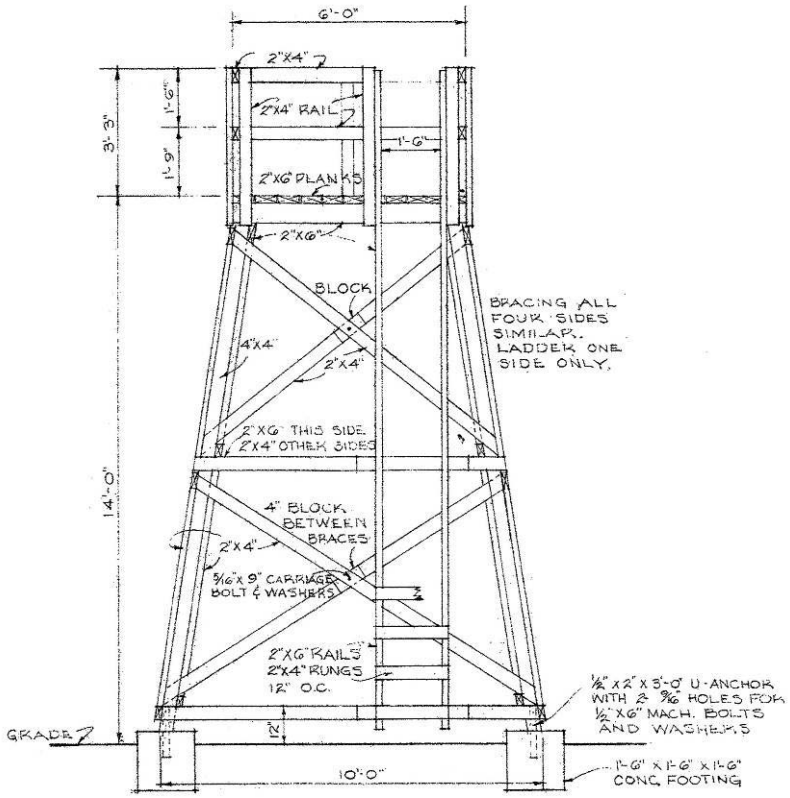


Figure 65. Mortar range observation tower elevation, Fort Bragg, NC, 1952 (Standard Drawing No. 28-13-09A, Drawing 4 of 4, "Range, rifle, known distance, observation tower and latrine," 5 January 1952).

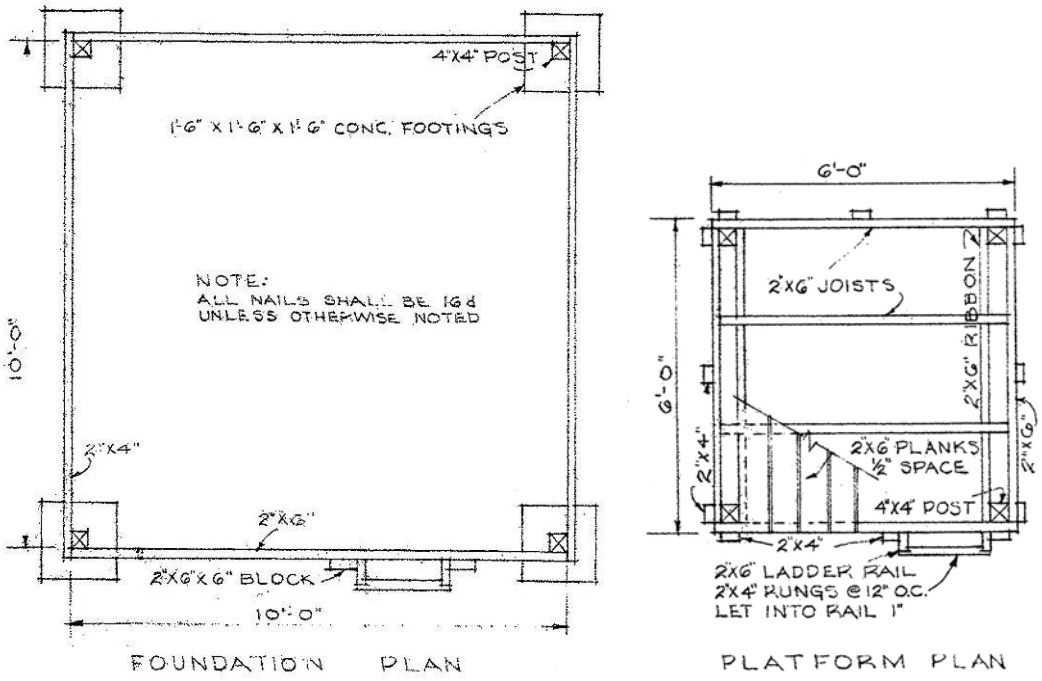


Figure 66. Mortar range observation tower foundation and platform plans, Fort Bragg, NC, 1952 (Standard Drawing No. 28-13-09A, Drawing 4 of 4, "Range, rifle, known distance, observation tower and latrine," 5 January 1952).

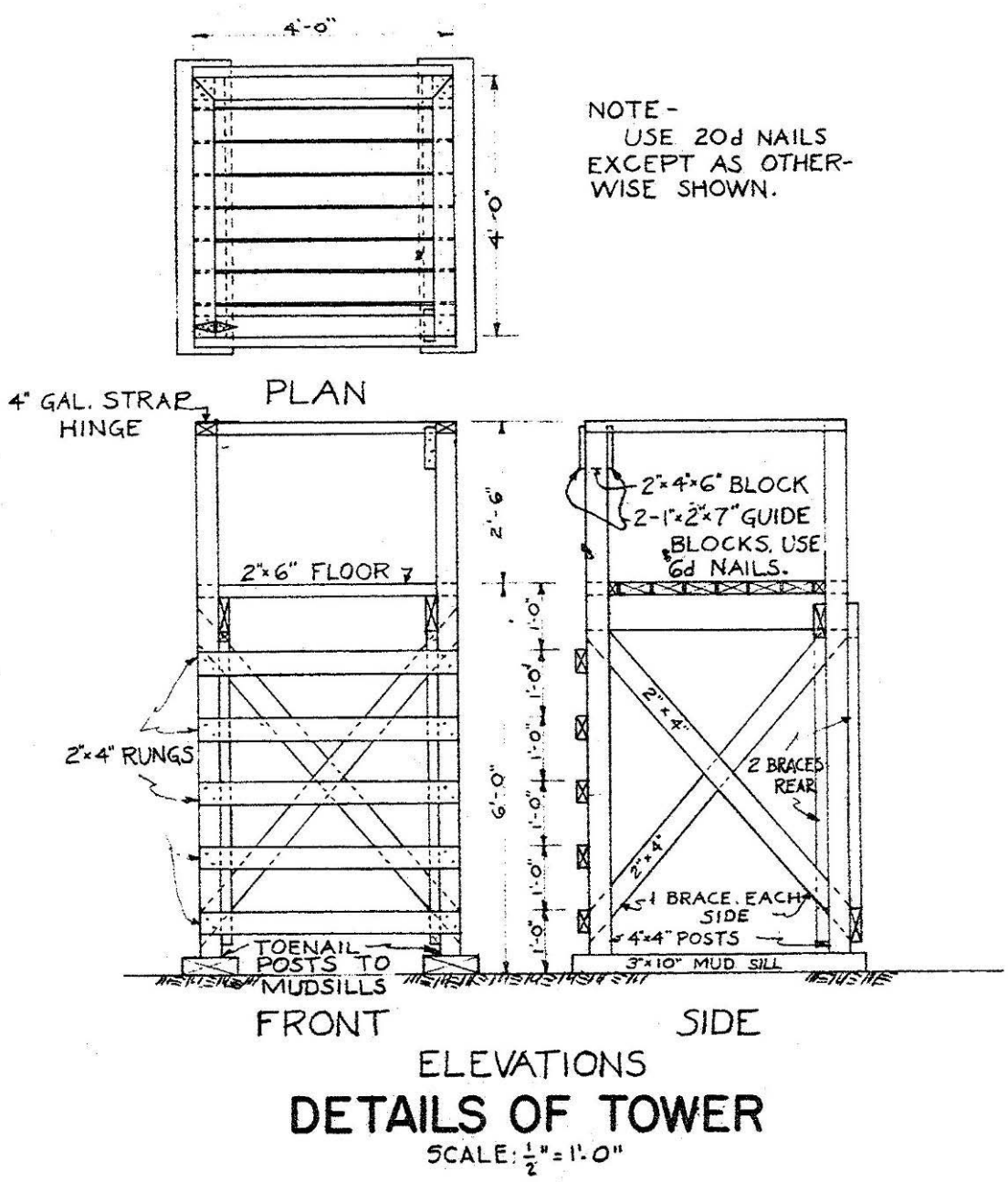


Figure 67. Recoilless rifle range details of tower, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance, service practice, plan and details," 7 December 1951).

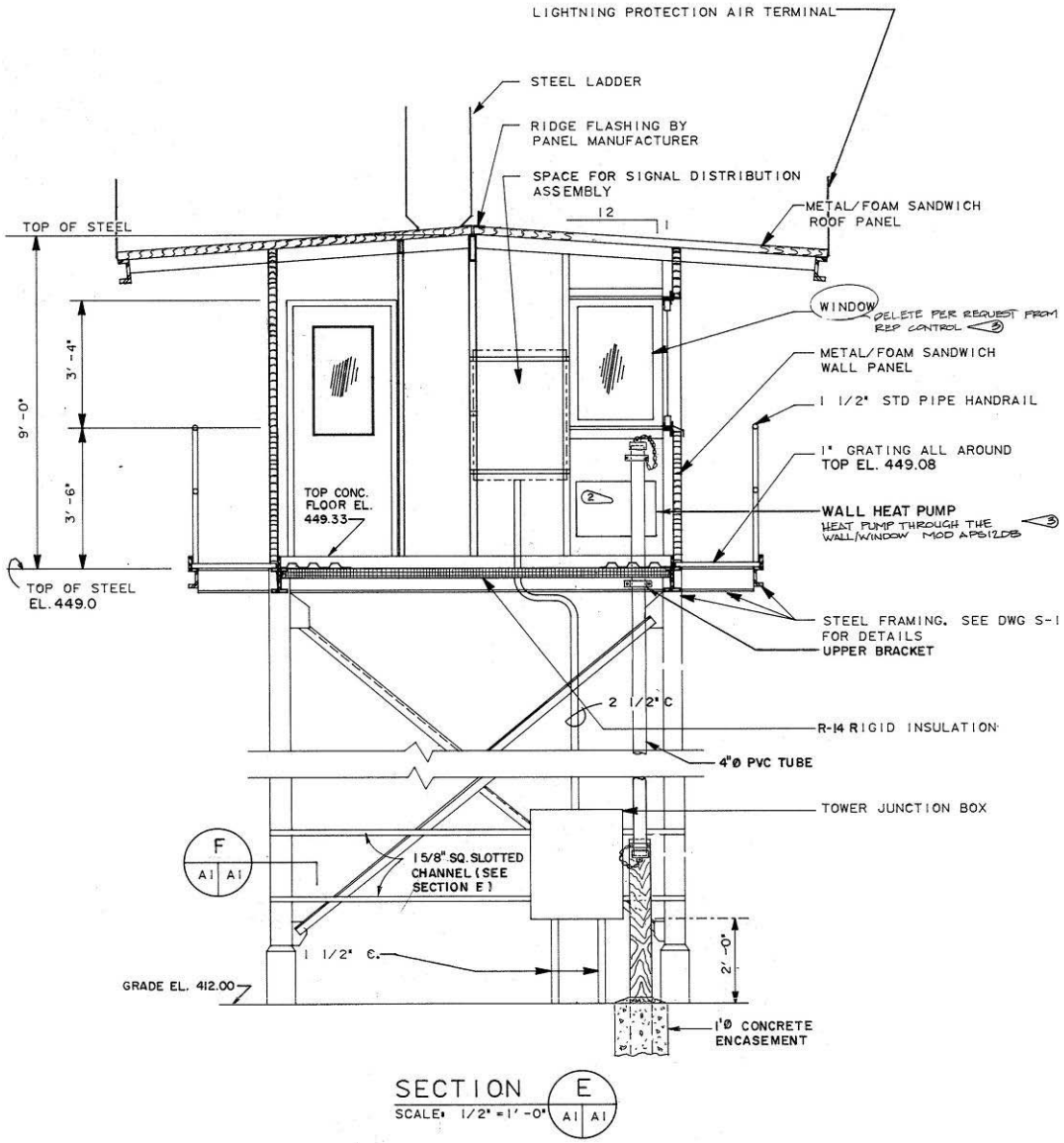


Figure 68. Anti-armor range, control tower section, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01, Sheet 21, "Anti-armor range, control tower plan and elevations," 28 February 1990).

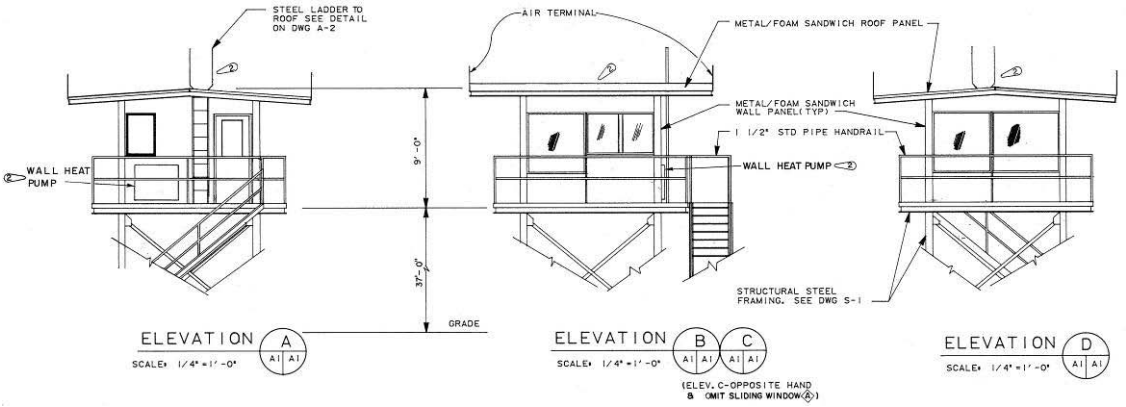


Figure 69. Anti-armor range, control tower elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01, Sheet 21, "Anti-armor range, control tower plan and elevations," 28 February 1990).

Bleachers

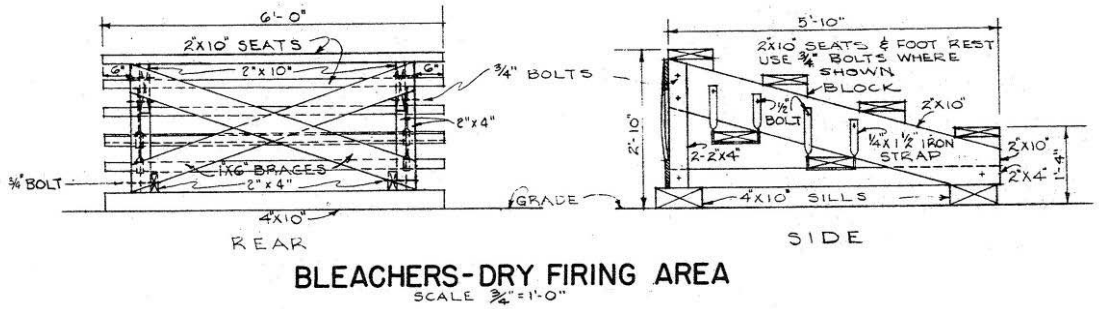


Figure 70. Mortar range dry firing area bleachers, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17, Sheet 2 of 2, "Mortar training, shell range, details," 5 January 1952).

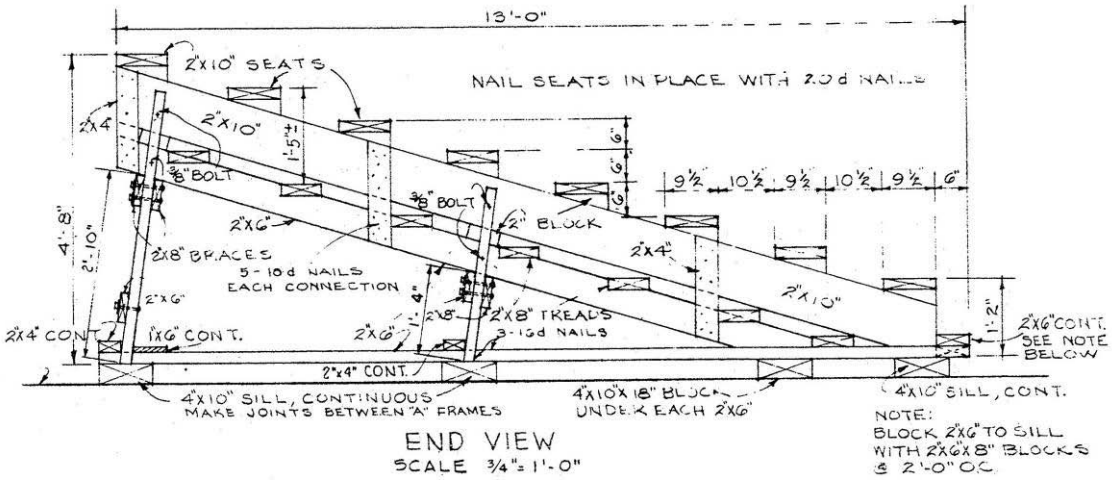


Figure 71. Mortar range demonstration area bleachers end view, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17, Sheet 2 of 2, "Mortar training, shell range, details," 5 January 1952).

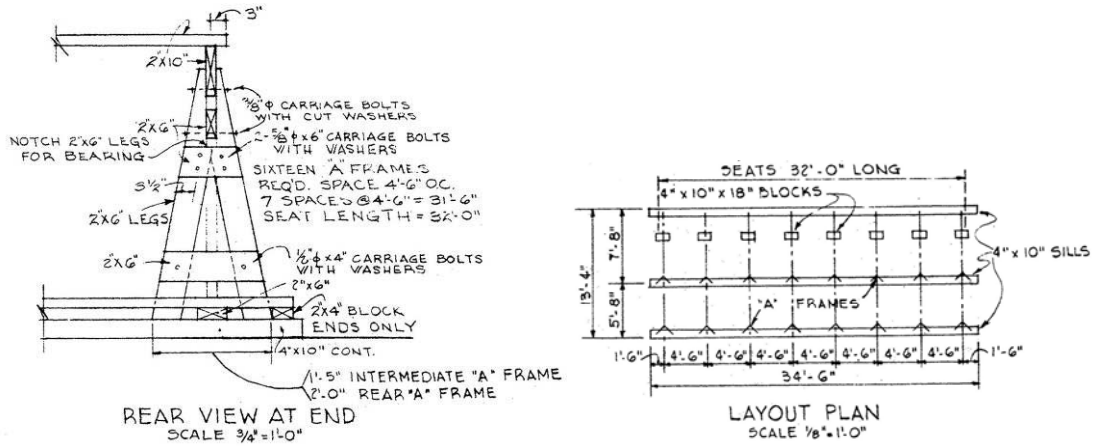


Figure 72. Mortar range demonstration area bleachers rear view at end and sill splice, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17, Sheet 2 of 2, "Mortar training, shell range, details," 5 January 1952).

Latrines

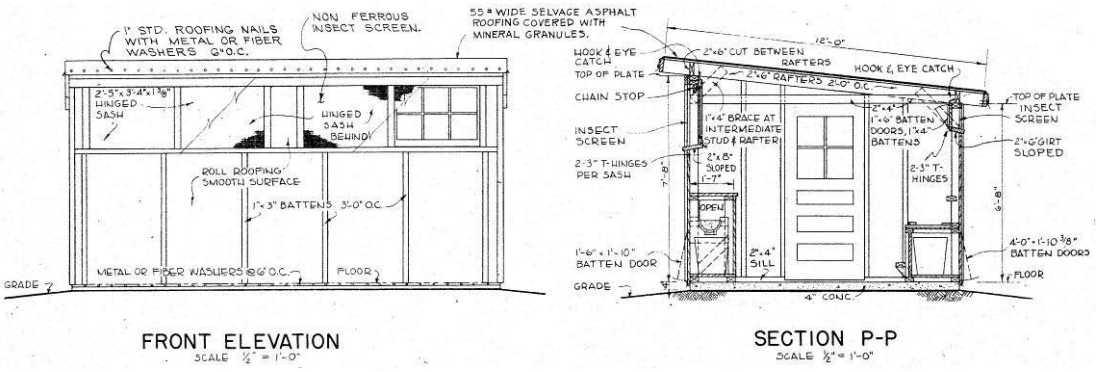


Figure 73. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, front elevation and section, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24, Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

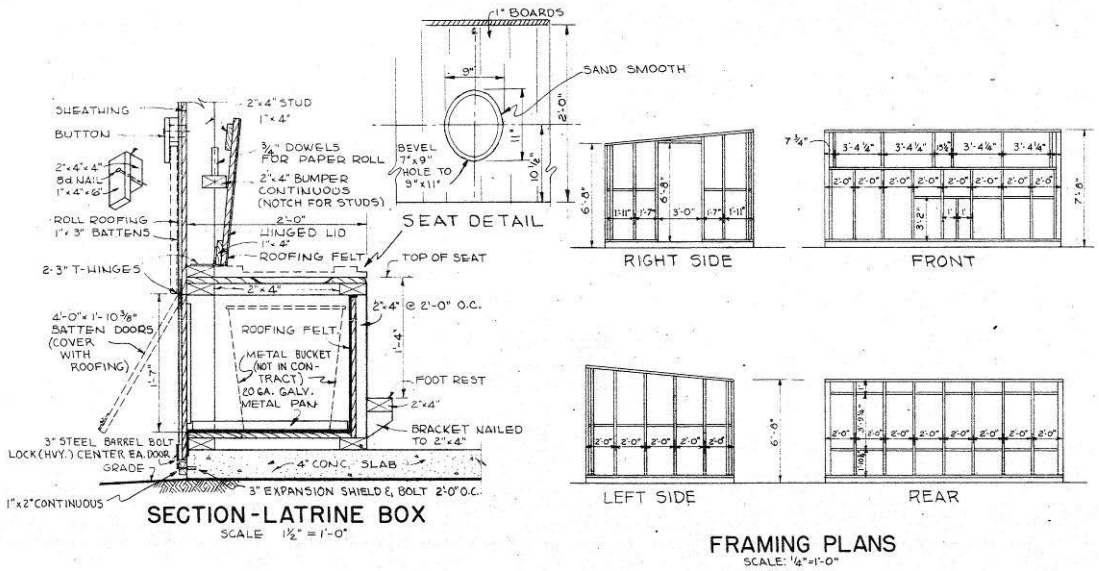


Figure 74. Tank or anti-aircraft moving target range (for guns to include 120mm), Latrine, Section through box and framing plans, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24, Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

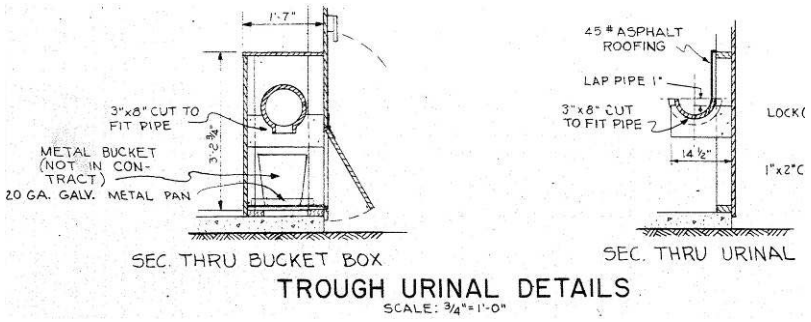


Figure 75. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, section through urinal details, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24, Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

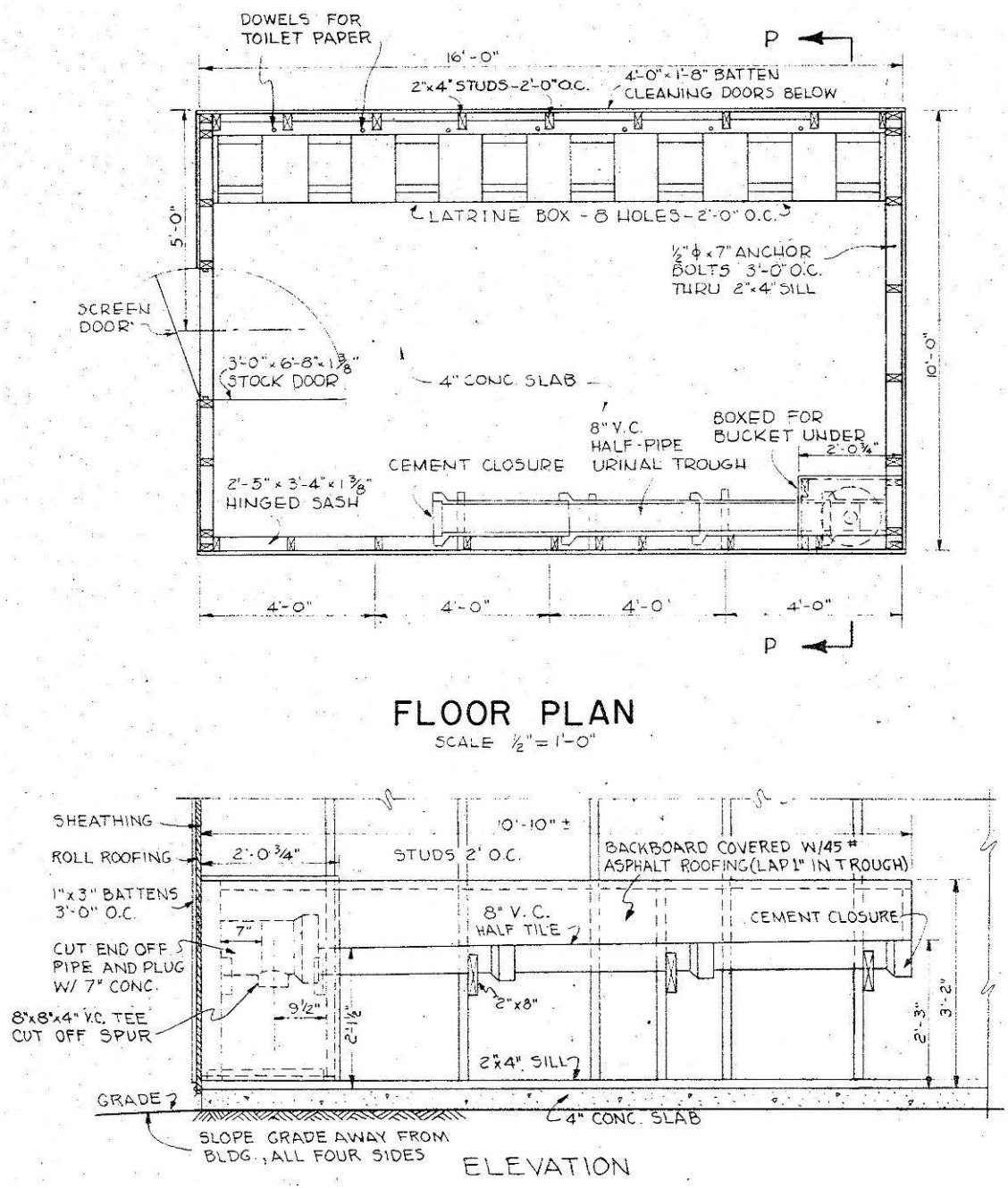


Figure 76. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, floor plan and elevation, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24, Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

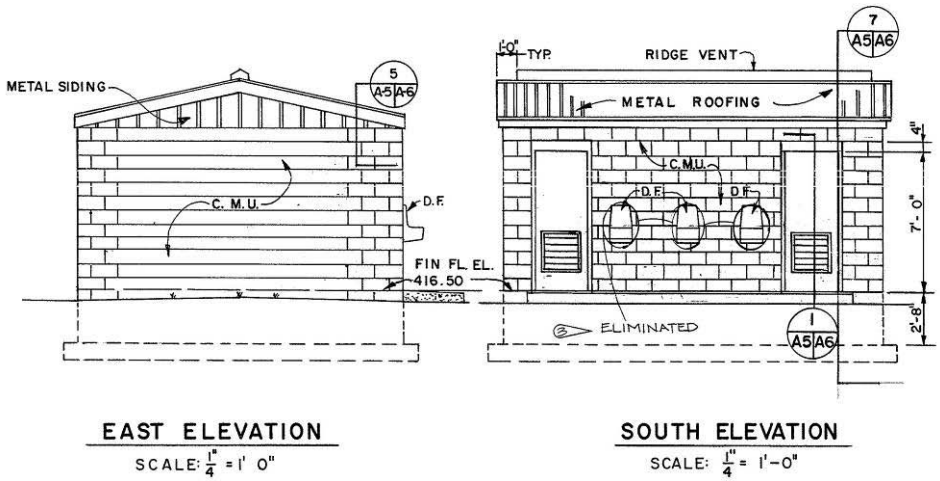


Figure 77. Anti-armor range, latrine east and south elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01, Sheet 25, "Anti-armor range, latrine and pumphouse, plans, elevations and sections," 28 February 1990).

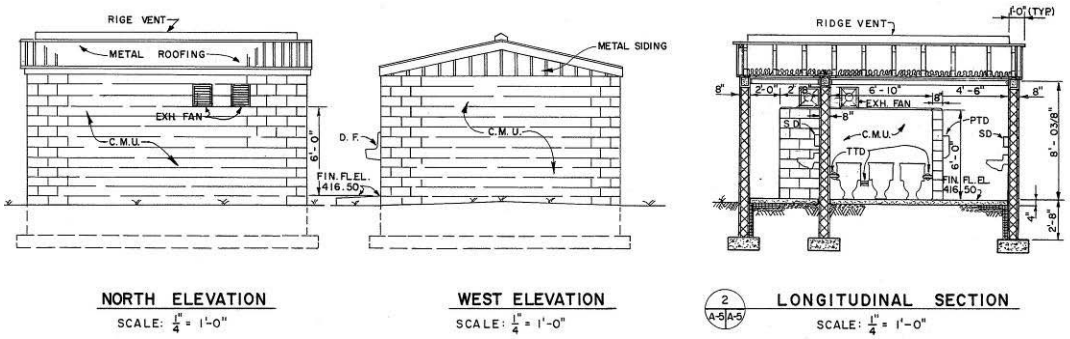


Figure 78. Anti-armor range, latrine, north and west elevations and longitudinal section, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01, Sheet 25, "Anti-armor range, latrine and pumphouse, plans, elevations and sections," 28 February 1990).

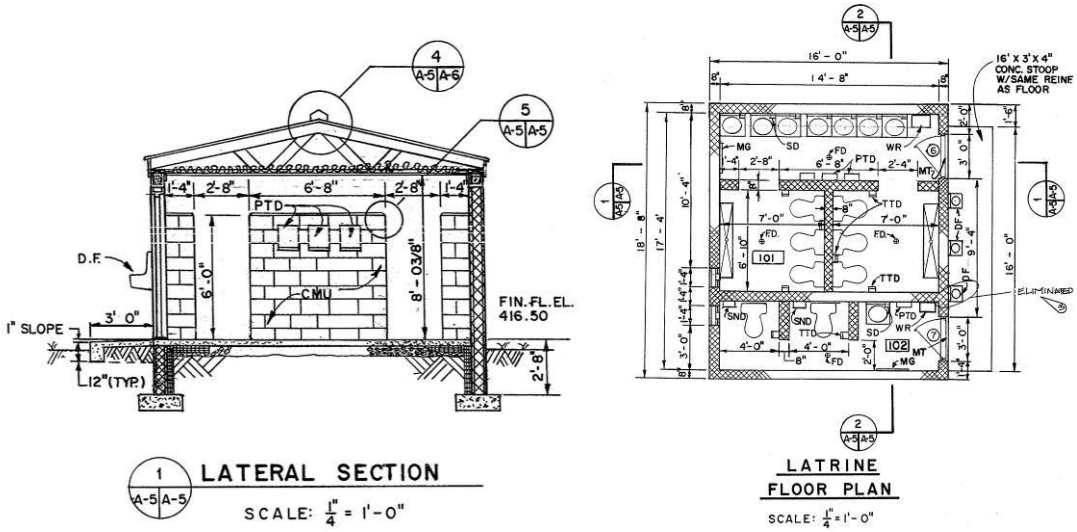


Figure 79. Anti-armor range, latrine, lateral section and floor plan, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01, Sheet 25, "Anti-armor range, latrine and pumphouse, plans, elevations and sections," 28 February 1990).

Target storage buildings

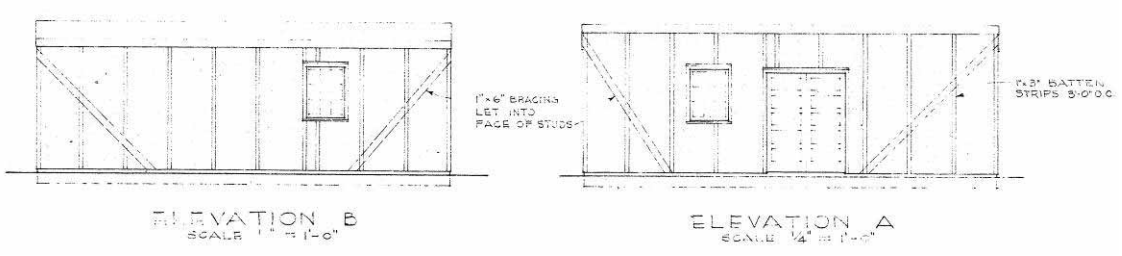


Figure 80. Individual tank combat firing range target house elevations A and B, Fort Bragg, NC, 1952 (Standard Drawing 28-13-23, Sheet 2, "Range, Individual tank combat firing details," 4 August 1952).

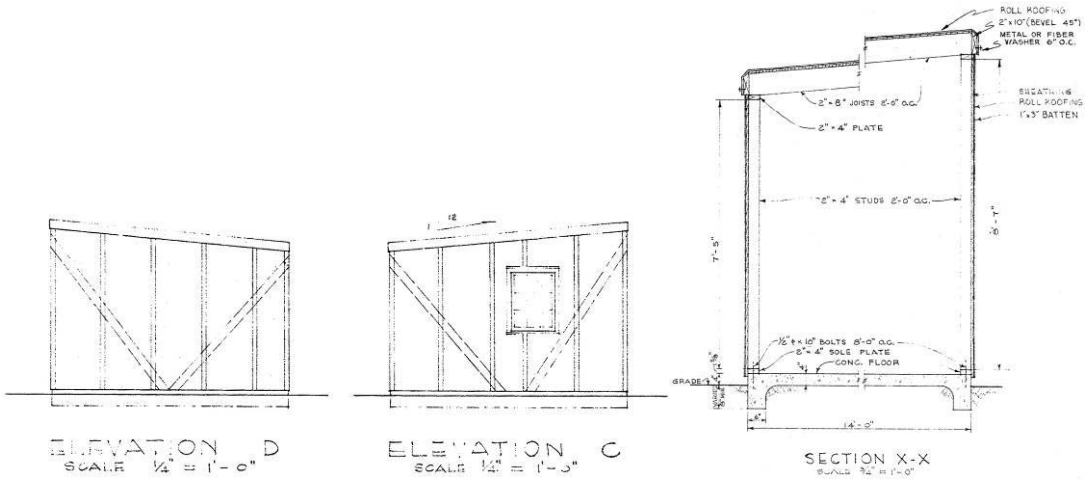


Figure 81. Individual tank combat firing range target house elevations D, C, and section X, Fort Bragg, NC, 1952 (Standard Drawing 28-13-23, Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

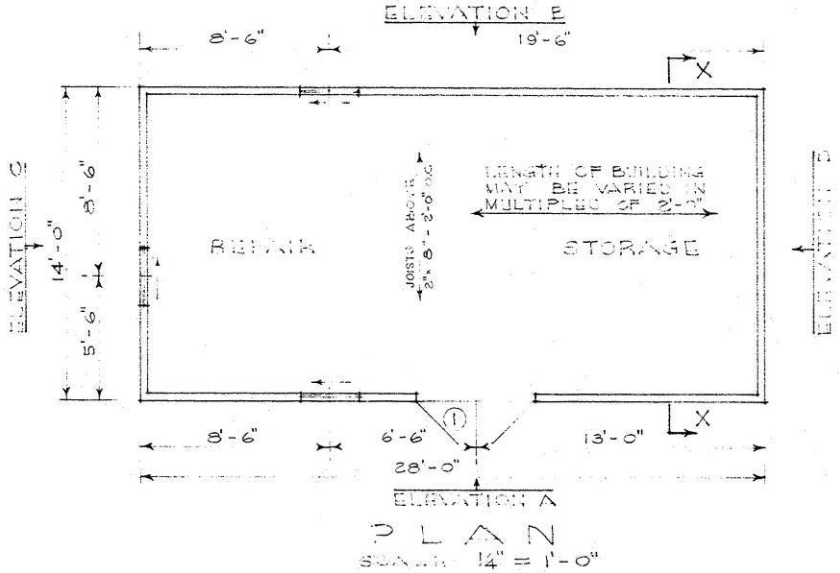


Figure 82. Individual tank combat firing range target house plan, Fort Bragg, NC, 1952 (Standard Drawing 28-13-23, Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

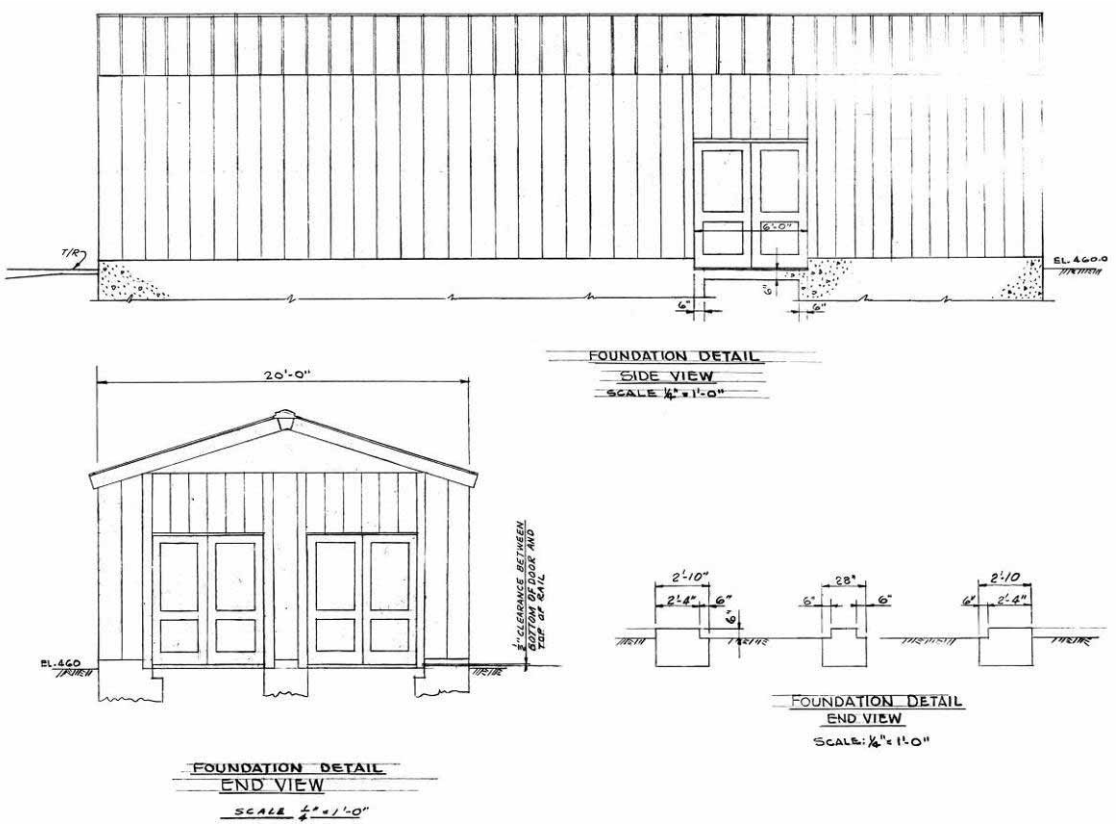


Figure 83. Moving tank and combat firing range target storage building details, Fort Knox, KY, 1956 (Standard Drawing 84-10-01, Sheet 12, "Moving tank and combat firing range, target storage building—firing area," 23 March 1956).

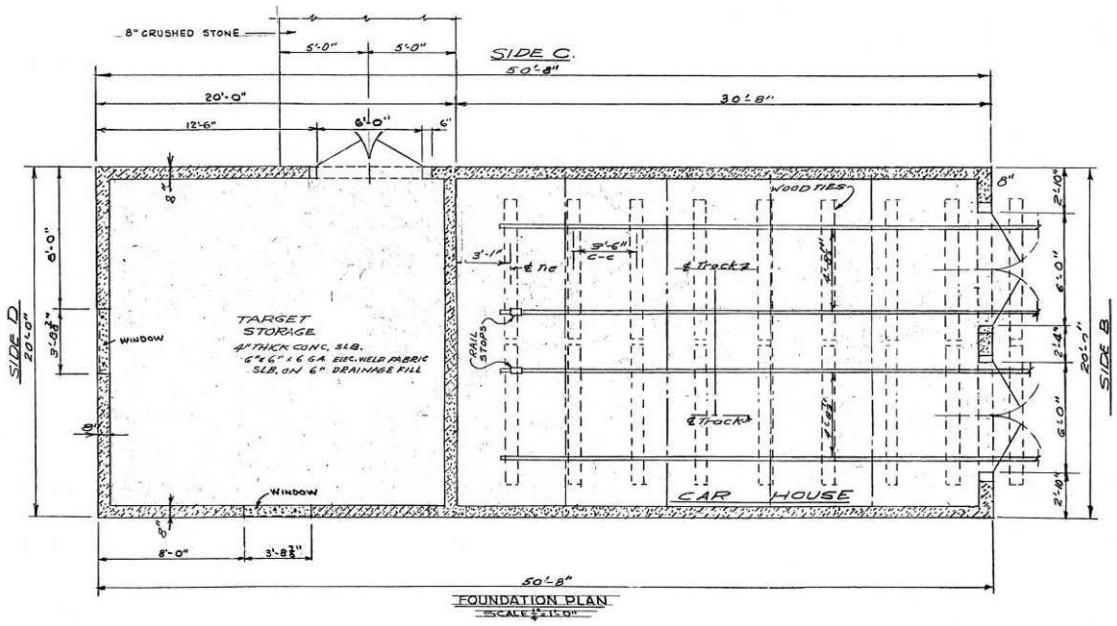


Figure 84. Moving tank and combat firing range target storage building details, Fort Knox, KY, 1956 (Standard Drawing 84-10-01, Sheet 12, "Moving tank and combat firing range, target storage building—firing area," 23 March 1956).

Storage and maintenance buildings for OQ-19 Targets

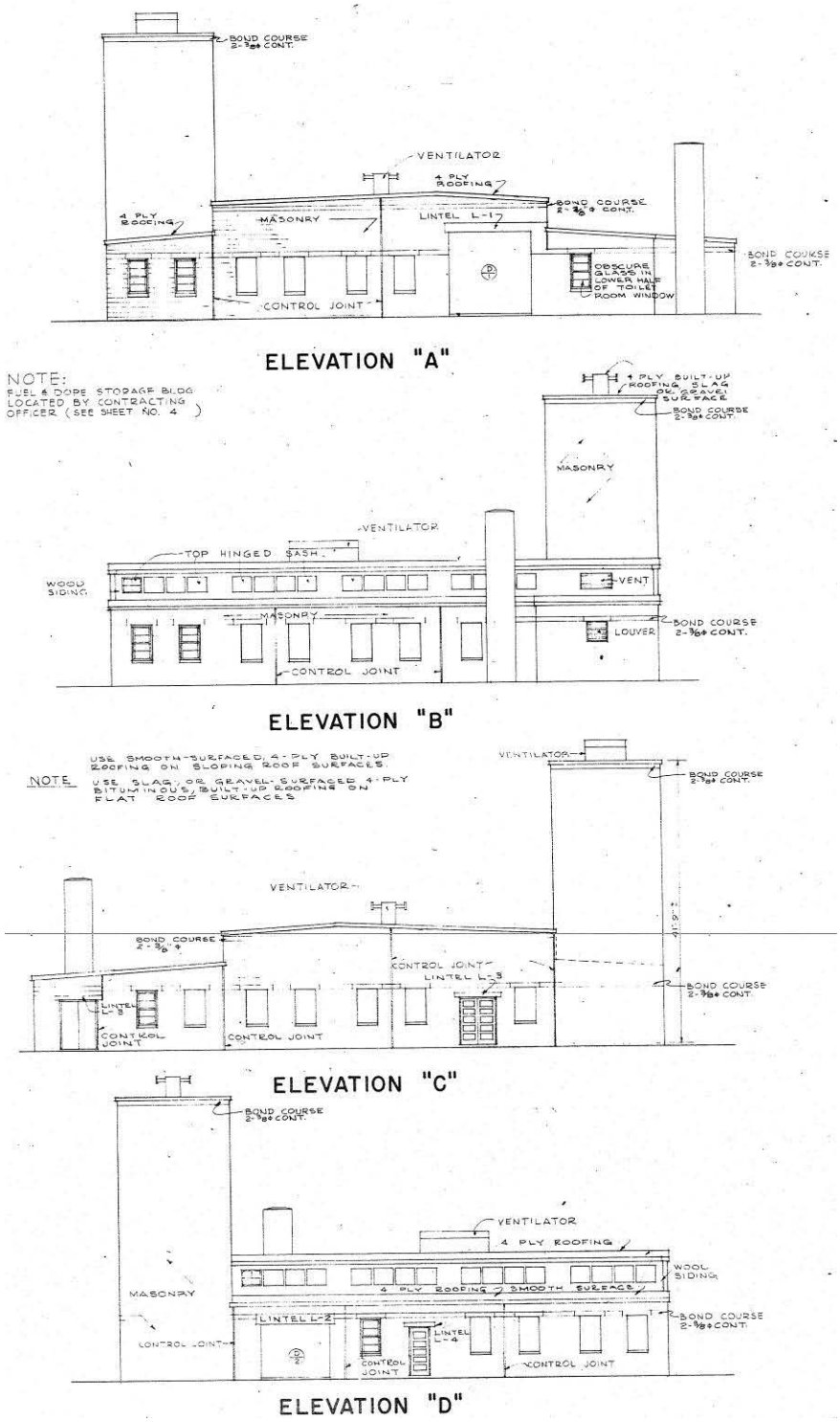


Figure 85. Storage buildings for OQ-19 targets, elevations, Fort Bragg, NC, 1952 (Standard Drawing 28-13-30, Sheet 1 of 6, "Storage and maintenance building for OQ-19 Targets, plans and elevations," 20 June 1952).

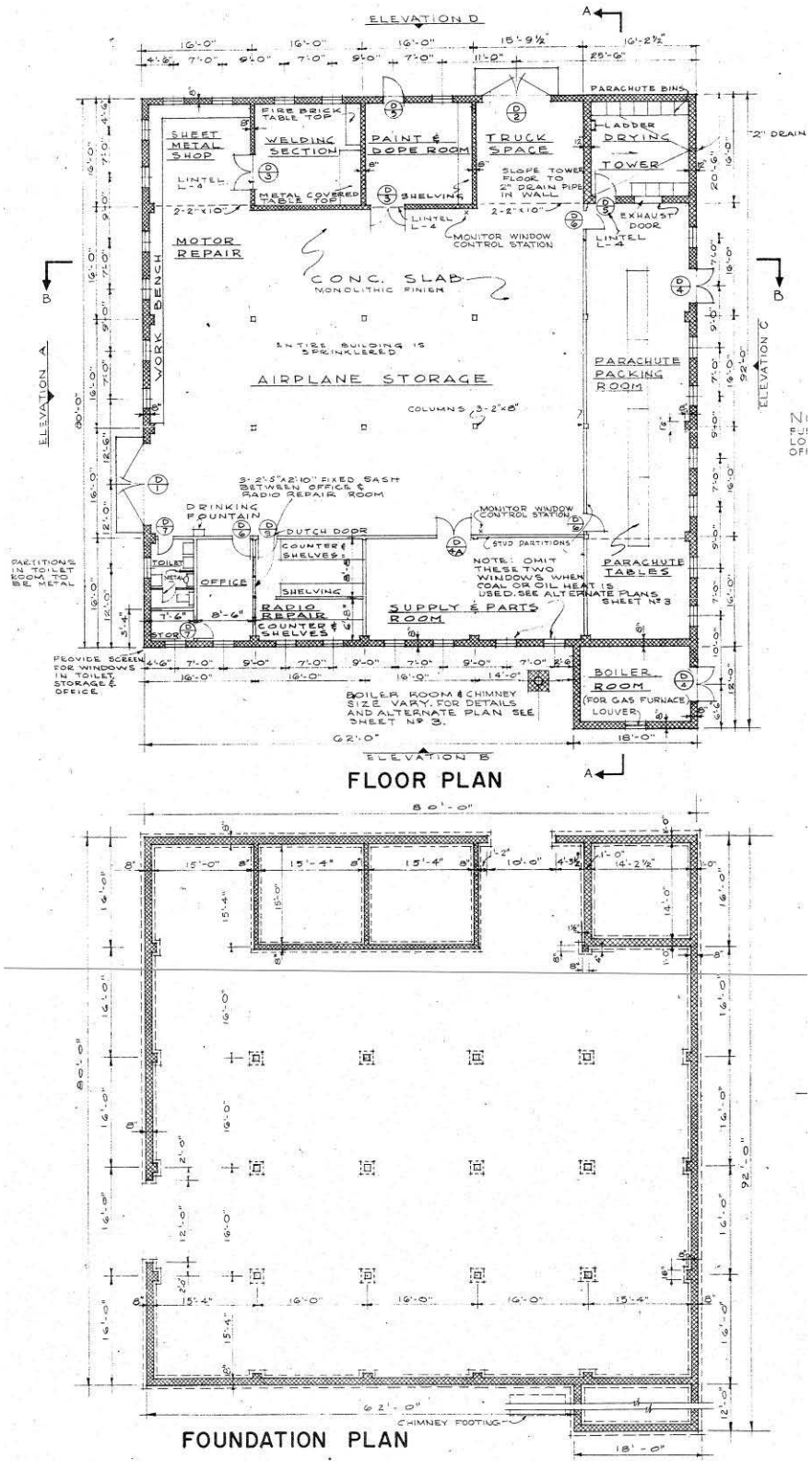


Figure 86. Storage buildings for OQ-19 targets, foundation and floor plans, Fort Bragg, NC, 1952 (Standard Drawing 28-13-30 Sheet 1 of 6, "Storage and maintenance building for OQ-19 targets, plans and elevations," 20 June 1952).

Target repair and car storage house

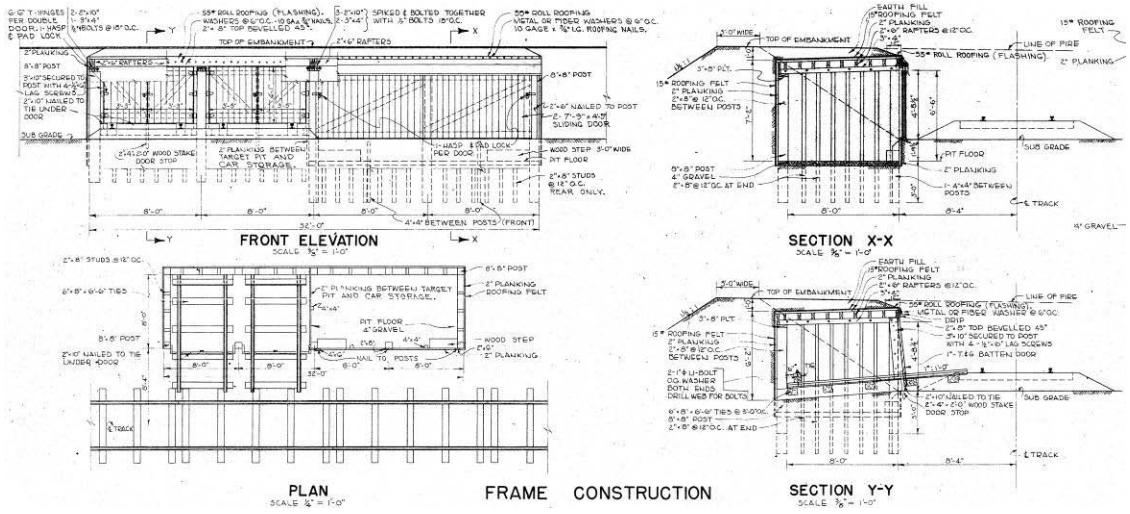


Figure 87. Tank or anti-aircraft moving target range (for guns to include 120mm), target repair & car storage house, frame construction, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 3 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), target repair & car storage house," 4 August 1952).

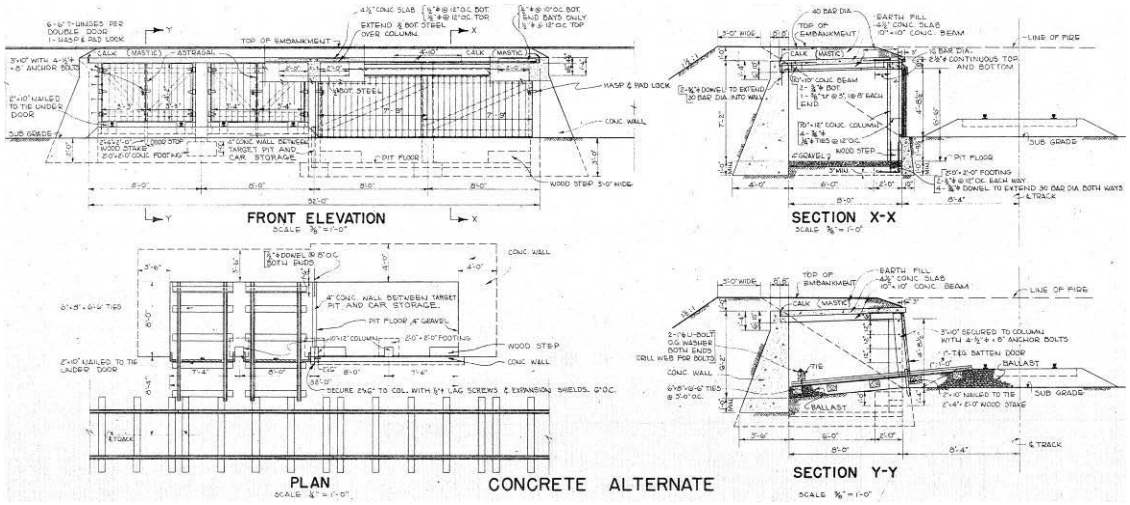


Figure 88. Tank or anti-aircraft moving target range (for guns to include 120mm), target repair & car storage house, concrete alternate, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 3 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), target repair & car storage house," 4 August 1952).

Ammunition storage buildings

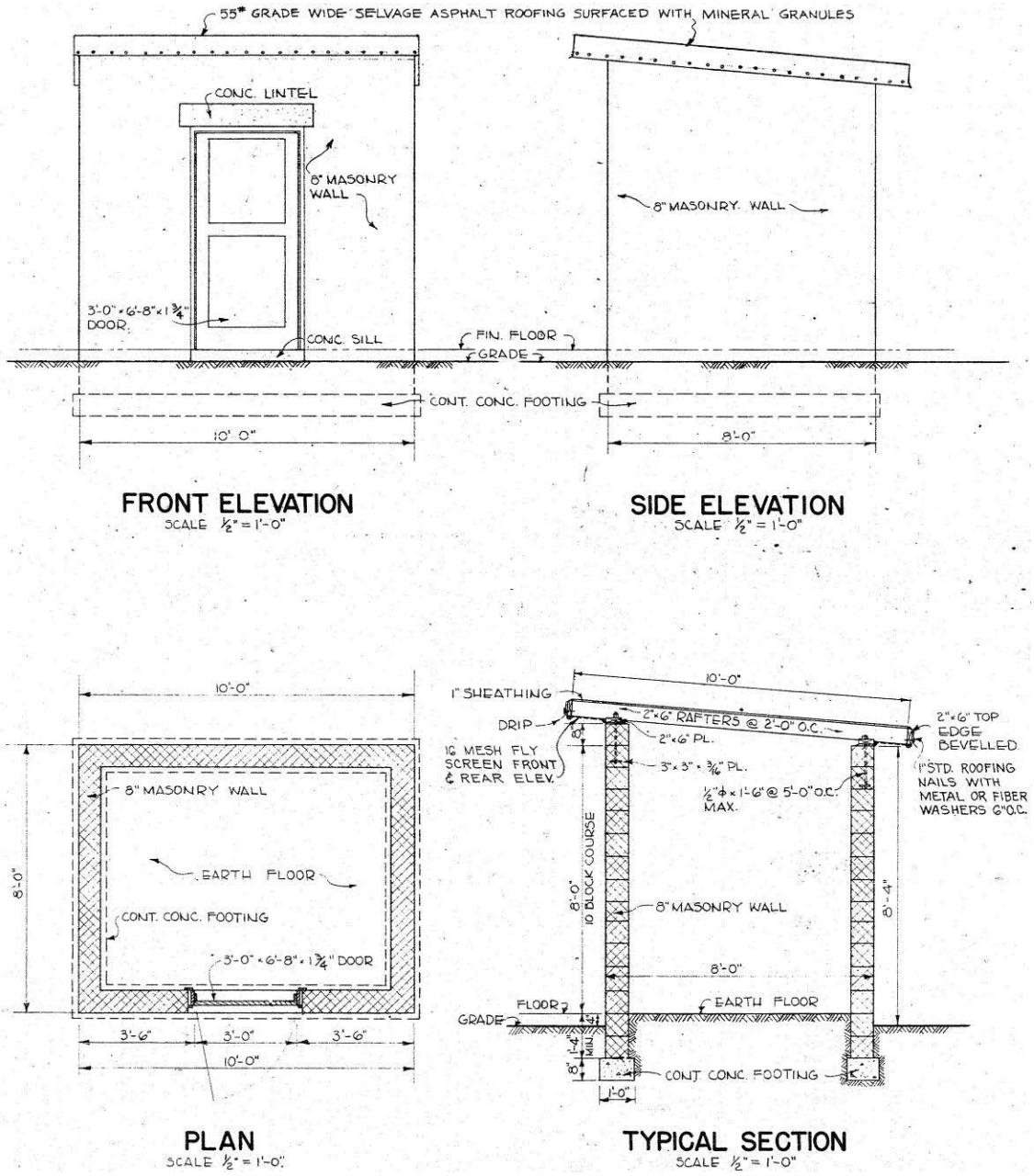


Figure 89. Tank or anti-aircraft moving target range (for guns to include 120mm), ammunition house, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 2 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), ammunition house and track sections," 4 August 1952).

Ammo loading and unloading pads

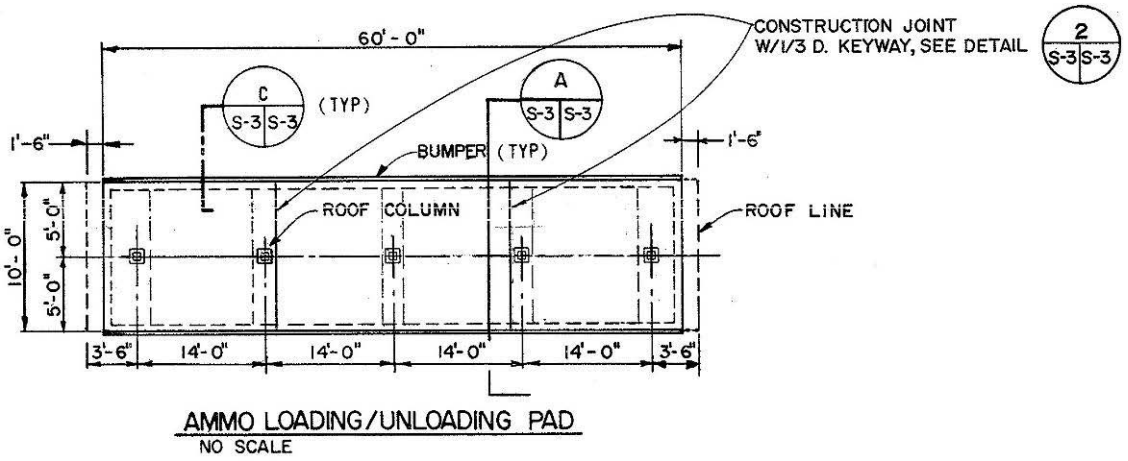


Figure 90. Anti-armor range, ammo loading and unloading pad plan, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 33, "Anti-armor range, retaining wall, ammo loading and unloading, structural details," 28 February 1990).

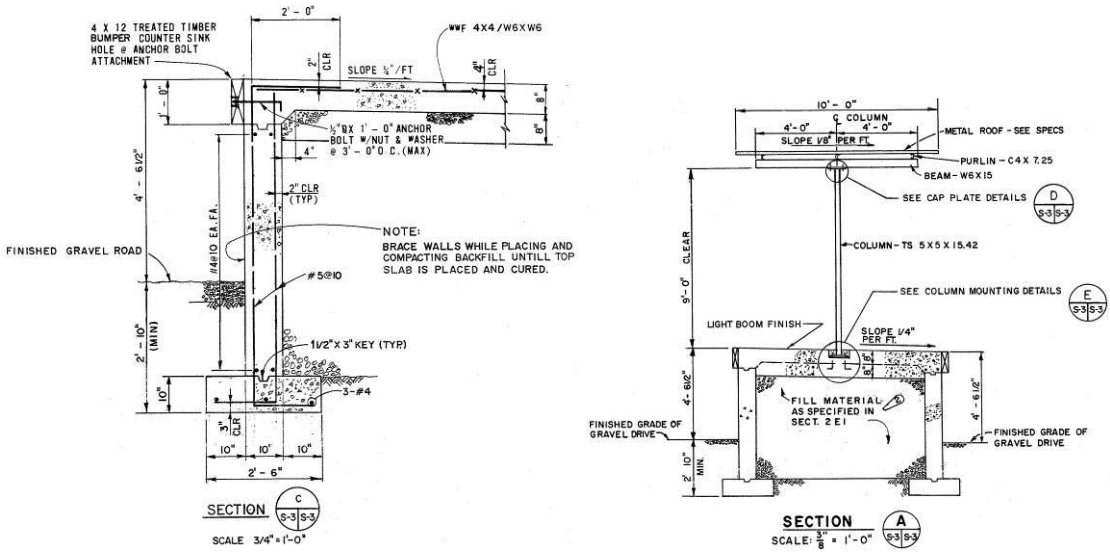


Figure 91. Anti-armor range, ammo loading and unloading pad sections, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 33, "Anti-armor range, retaining wall, ammo loading and unloading, structural details," 28 February 1990).

Pump houses

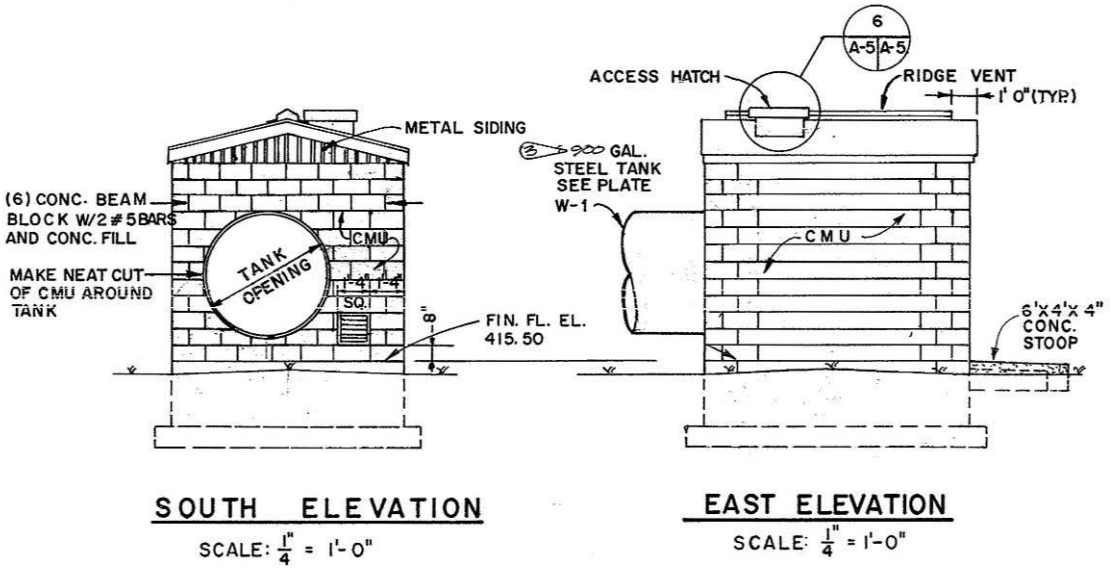


Figure 92. Anti-armor range, pump house south and east elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 25, "Anti-armor range, latrine and pumphouse, plans, elevations and sections," 28 February 1990).

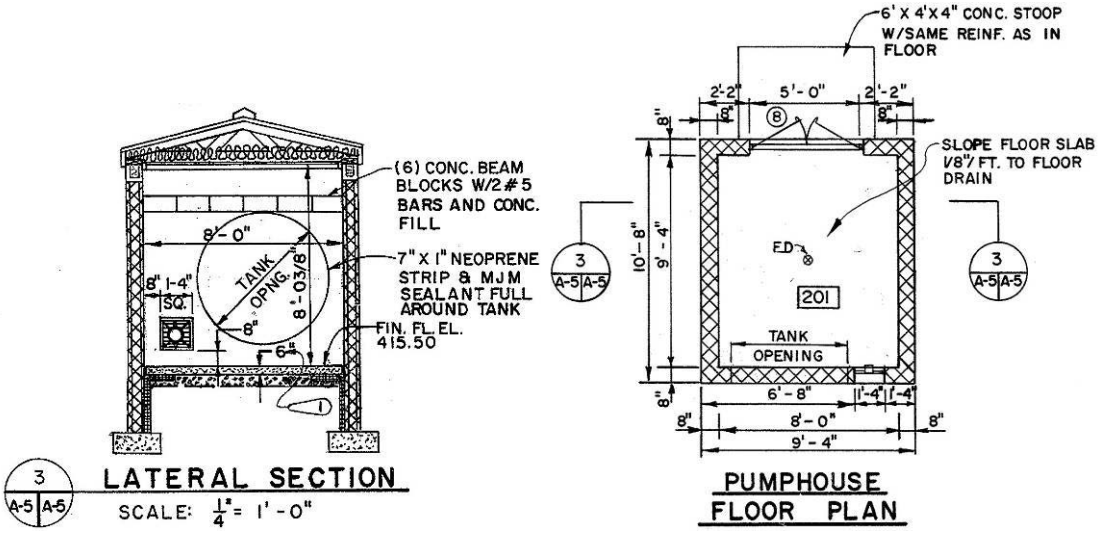


Figure 93. Anti-armor range, pump house lateral section and floor plan, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 25, "Anti-armor range, latrine and pumphouse, plans, elevations and sections," 28 February 1990).

Covered mess hall

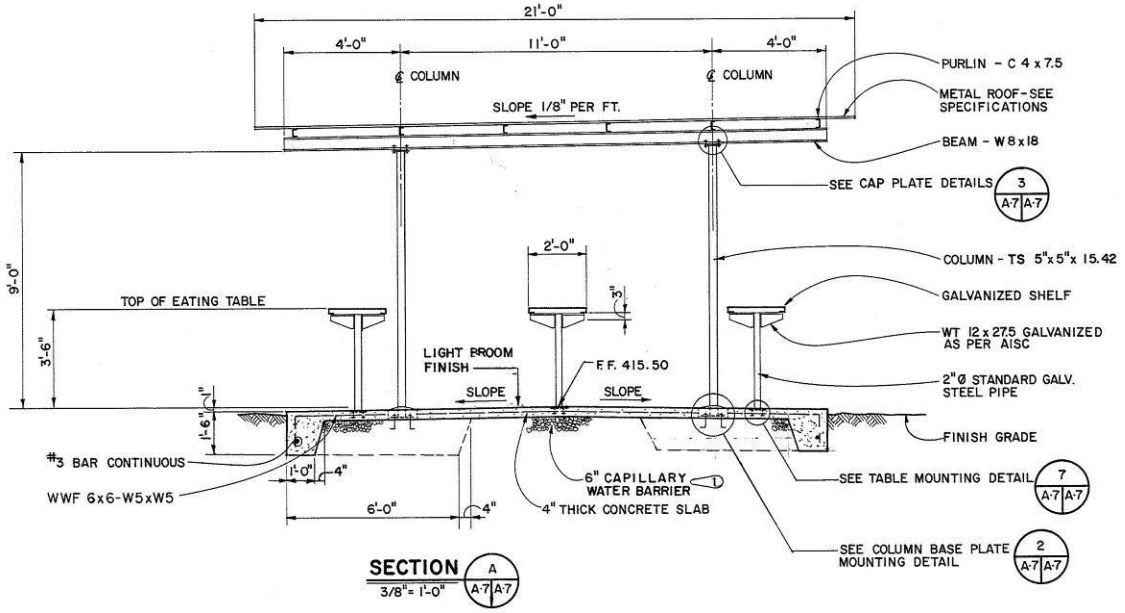


Figure 94. Anti-armor range, covered mess hall, section, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 27, "Anti-armor range, covered mess, plans, sections and details," 28 February 1990).

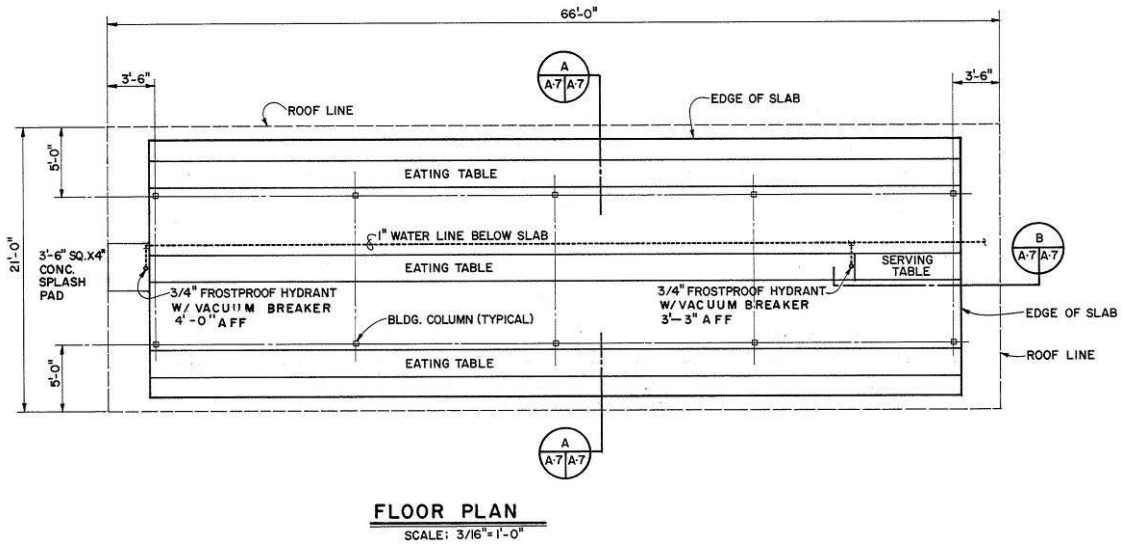


Figure 95. Anti-armor range, covered mess hall, floor plan, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 27, "Anti-armor range, covered mess, plans, sections, and details," 28 February 1990).

Training building

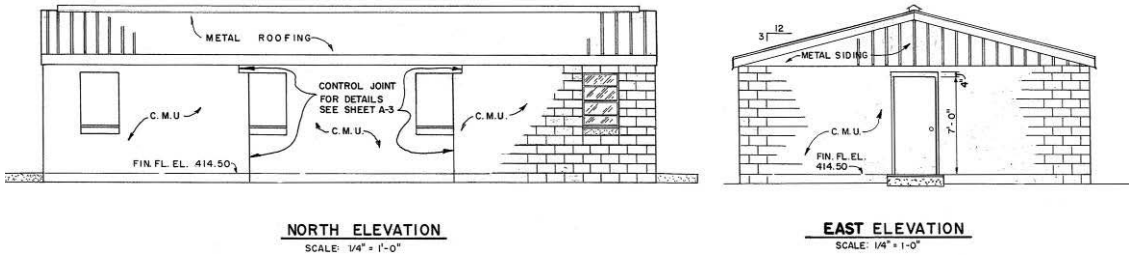


Figure 96. Anti-armor range, training building, north and east elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 24, "Anti-armor range, training building, plans, elevations, and sections," 28 February 1990).

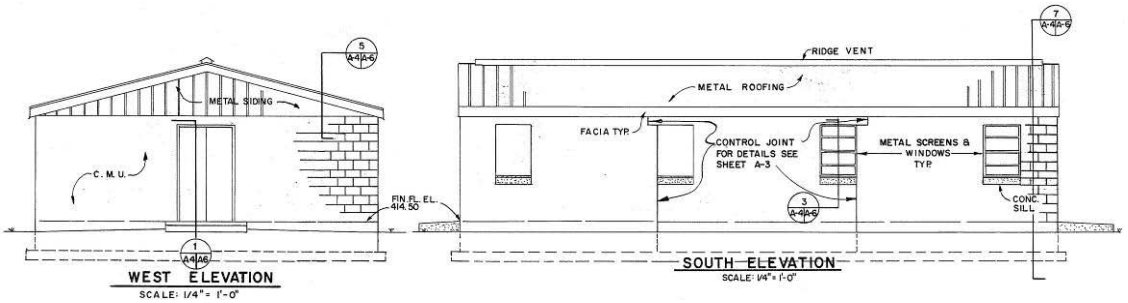


Figure 97. Anti-armor range, training building, west and south elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 24, "Anti-armor range, training building, plans, elevations, and sections," 28 February 1990).

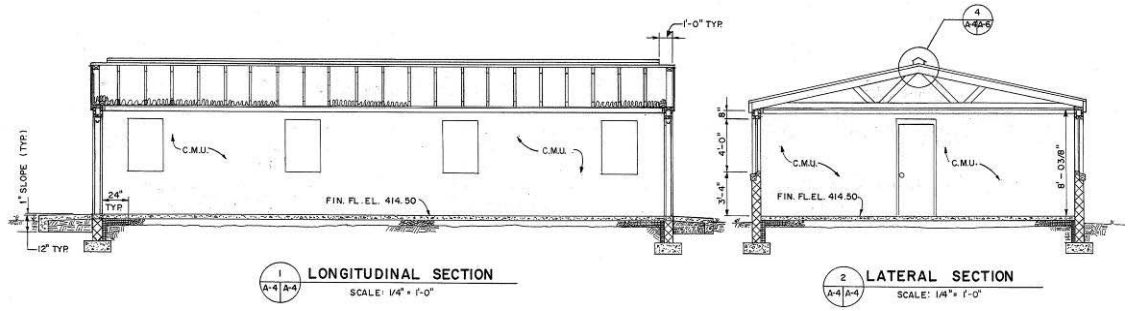


Figure 98. Anti-armor range, longitudinal and lateral sections, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 24, "Anti-armor range, training building, plans, elevations, and sections," 28 February 1990).

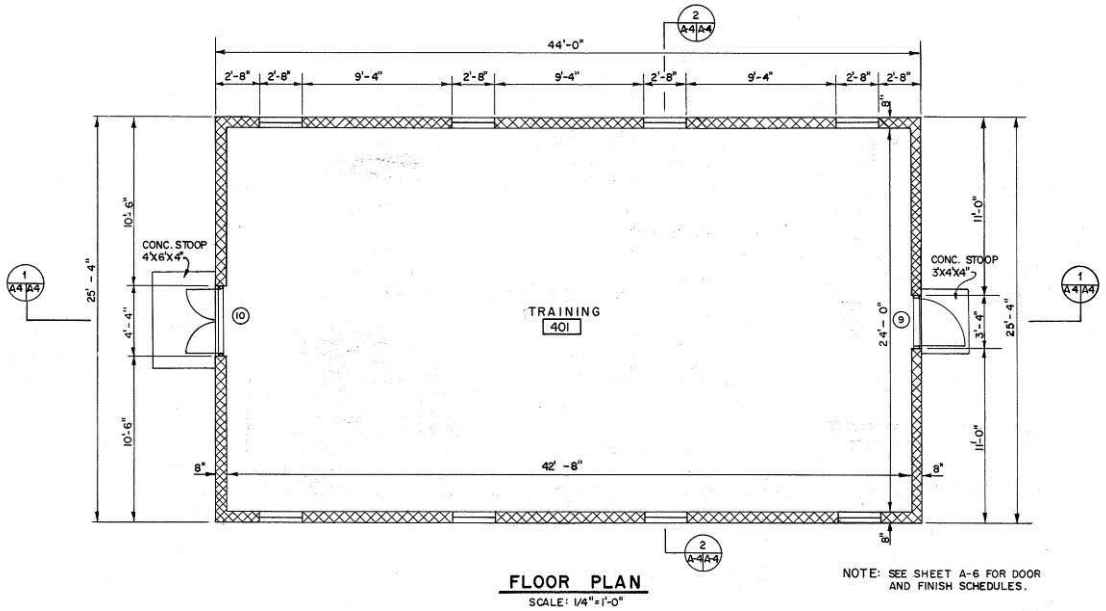


Figure 99. Anti-armor range, training building, floor plan, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 24, "Anti-armor range, training building, plans, elevations, and sections," 28 February 1990).

Office/storage building

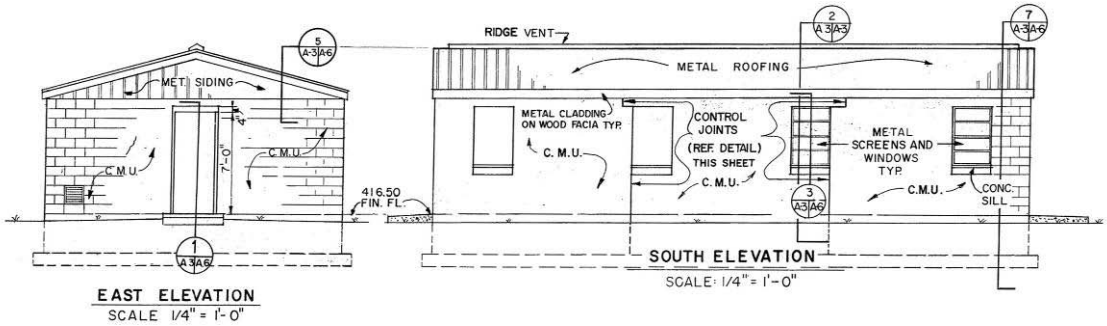


Figure 100. Anti-armor range, office/storage building, east and south elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 23, "Anti-armor range, office/storage building, plans, elevations, and sections," 28 February 1990).

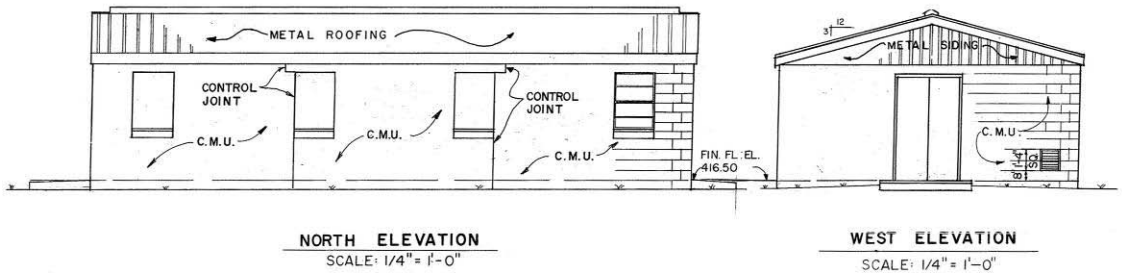


Figure 101. Anti-armor range, office/storage building, north and west elevations, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 23, "Anti-armor range, office/storage building, plans, elevations, and sections," 28 February 1990).

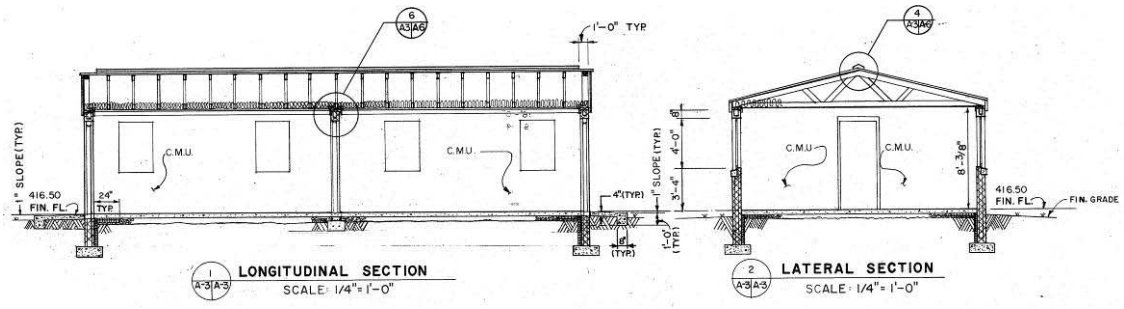


Figure 102. Anti-armor range, office/storage building, longitudinal and lateral sections, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 23, "Anti-armor range, office/storage building, plans, elevations, and sections," 28 February 1990).

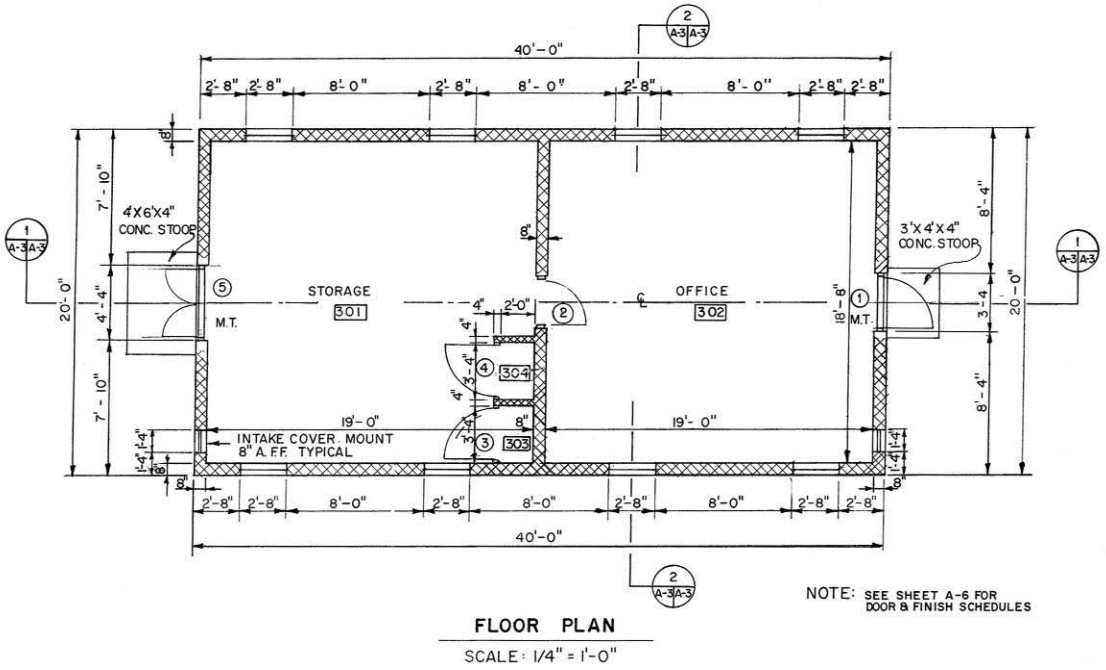


Figure 103. Anti-armor range, office/storage building, floor plan, Fort Bragg, NC, 1990 (Standard Drawing 179-20-01 Sheet 23, "Anti-armor range, office/storage building, plans, elevations, and sections," 28 February 1990).

Large arms ranges

Anti-aircraft artillery range

Anti-aircraft artillery (AAA) crews were trained on these ranges to fire AAA weapons at aerial targets. AAA ranges usually consisted of a cleared and leveled area for a line of firing positions and markers for left and right firing limits. Gunner crews fired at targets towed by aircraft, miniature remote controlled aircrafts, rockets, kites, and balloons. Both small and large arms were fired on these ranges (see "Weapons" below).

Historical background

"Anti-aircraft weapons have existed as long as there have been aircraft to shoot at" ("RO-13," pp 1-2). "The use of balloons by the Union Army during the American Civil War compelled the Confederates to develop methods of combating them. These included the use of artillery, small arms, and saboteurs. These measures were unsuccessful, but internal politics led the Union's Balloon Corps to be disbanded in mid-war" (Horky). "Anti-aircraft artillery was considered part of the coast artillery, which was a distinct branch within the Army (like field artillery or infantry) from 1901 through WWII. As the threat of invasion of the United States faded during WWII, anti-aircraft artillery units were attached to various levels of the mobile ground forces (i.e., Army, corps, and division levels). These AAA units remained primarily as an attached unit rather than an assigned unit at all levels. Smaller caliber AAA weapons (i.e., machine guns, 37mm guns, and 40mm guns), however, were organic to divisional units and part of small arms training involved their use against aerial targets. Every Ground Forces Training Center would likely have had anti-aircraft ranges for small arms and guns up to 40mm (see Vol.1 Small Arms Ranges: Anti-Aircraft Towed Target Range). It is less likely, but possible, that a ground forces training center would have had a range for the larger caliber AAA guns" ("RO-13," pp 1-2).

"There were two types of AAA ranges based on the permanence of the units utilizing the range and the equipment utilized on the range. The range fans, ammunition fire, and equipment used were the same for both types of ranges. The first type of AAA range was at a fixed anti-aircraft site (such as a coastal defense site). On this type of range, the weapons crew was permanently stationed at the range location and the equipment, such as radars and power generation equipment, was more or less permanently positioned. The second type of AAA range was the more traditional range where the units moved to the range, conducted training, and then departed from the range with the weapons and all of their equipment. This second type of range had minimal permanently installed equipment (usually limited to such things as telephone lines). The following information focuses on the traditional, second type of AAA ranges" ("RO-13," p 8).

Training procedures

"Prior to moving to an AAA range, weapons were drawn from the armory or artillery park and munitions were drawn from the ammunition supply point (ASP). Both were normally transported to the range by the weapons

crew using organic (integral) vehicles. Movement to the range also included the transportation of auxiliary equipment used in weapons firing such as radar, searchlights, and power generators. The weapons crew took the anti-aircraft weapon from its travel configuration and placed it at the firing point in preparation for firing. At the gun commander's command PREPARE FOR ACTION, the gun section dismounted from the truck and placed the 90mm anti-aircraft gun. A weapons crew for the anti-aircraft machine gun contained a squad leader and three gunners. The machine gun ammunition came assembled as a complete round. Anti-aircraft machine-gun ammunition was issued by the machine-gun platoon to the squad as individual rounds. It was the responsibility of each machine-gun squad to load the ammunition into belts, inspect it, and place it in ammunition chests. The squad leader gave the command LOAD and each gunner participated in the un-packaging, handling, and loading of ammunition" ("RO-13," pp 8-10).

"A weapons crew for the 37mm anti-aircraft gun consisted of eight enlisted men: the gun commander, the gunner, the lateral gun pointer, the assistant loader, the loader, the relayer, the ammunition detail, and the chauffeur/ammunition detail. The gun commander gave the command to LOAD and the loaded ammunition clip was fed to the gun. Additional ammunition clips were fed to the gun as required. Each 40mm anti-aircraft gun weapons crew consisted of a range section and a gun section under the command of a chief of section. The range section consisted of the range setter, elevation tracker, azimuth tracker, power plant operator, and chauffeur of the fire control truck, and the telephone operator and alternate tracker. The gun section consisted of the gunner, two machine gunner and anti-aircraft lookouts, loader and firer, two anti-aircraft lookout and lateral gun pointers, ammunition relayer, and ammunition detail and chauffeur of the gun prime mover. The chief of section gave the command TARGET and two ammunition clips were inserted into the autoloader. Additional ammunition clips were loaded if necessary. The 90mm anti-aircraft gun section consisted of a gun squad and an ammunition squad. The gun squad consisted of 10 enlisted men that included the gun commander, the gunner, the fuze range setter, the assistant gunner, and six cannoneers. The ammunition squad consisted of the chief of ammunition, four ammunition privates, and one chauffeur" ("RO-13," p 10).

"At the command COMMENCE FIRING, the assistant gunner pressed the trigger of the anti-aircraft machine gun and tracked the target. The ammunition chest was replaced with additional chests as required. For the

37mm anti-aircraft gun, the COMMENCE FIRING command was given and the trigger pedal was depressed and maintained depression until the command SUSPEND FIRING or CEASE FIRING was given. Additional loaded ammunition clips were fed to the gun as required. Empty ammunition clips were placed in a container clear of the gun. At the command FIRE from the range setter, the firing pedal of the 40mm anti-aircraft gun was pressed, released, and pressed again at the rate of one shot per second. If automatic fire was used, the firing pedal was pressed down for the duration of the firing. Ammunition was passed up and placed in the autoloader as necessary. For the 90mm anti-aircraft gun, the COMMENCE FIRING command was given and the loader placed a round into the loading position. The gunner then rammed the round home and fired the gun. The gunner continued ramming and firing until SUSPEND FIRING or CEASE FIRING was ordered. The members of the ammunition squad continued to supply ammunition to the gun position on the command" ("RO-13," pp 10-11).

"After the firing mission was complete, the squad leader for the anti-aircraft machine gun gave the command CEASE FIRING. The trigger was released, the gun was unloaded, and the ammunition belt was placed in the ammunition chest. Empty cartridge cases were collected and placed in suitable receptacles. Any empty ammunition chests were replaced with full ones. At the command CEASE FIRING, the trigger pedal for the 37mm anti-aircraft gun was released, the gun was unloaded, and the unfired ammunition and clip were returned to the ammunition chest for reloading. The supply of loaded ammunition clips was replenished. At the command CEASE FIRING, the firer removed his foot from the 40mm anti-aircraft gun firing pedal and empty clips and cartridges were cleared from the gun mechanism and firing platform. Additional ammunition was passed up and loaded clips were placed in the autoloader. The gun section returned the empty cartridge cases to the ASP. Whenever possible and practicable, empty brass cases were replaced in the original boxes, marked, and turned in to the ordnance officer as soon as possible after firing. It was the responsibility of the Chief of Ammunition for the 90mm anti-aircraft gun to direct the ammunition squad to secure the ammunition after firing, making sure fuses that were set but not fired were set back to the "safe" position. The ammunition squad collected the empty shell cases. The Chief of Ammunition also supervised the ammunition squad in repackaging and loading unused ammunition. After firing, first echelon (Operator) maintenance was performed. However, if the crew was immediately returning to the garrison after firing, first echelon (Operator) maintenance may have

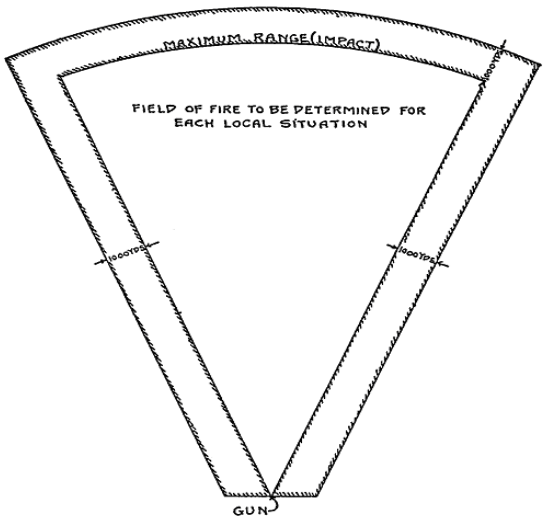
been postponed until the crew arrived at their destination" ("RO-13," pp 11-12).

"Misfires of 40mm ammunition were not to be handled by the weapons crew but disposed of as directed in accordance with TM 9-1900. In the case of a misfire for the 90mm and 3-in. anti-aircraft guns, the gunner called "misfire." At least three attempts were made to fire the primer were made. The breechblock was not opened until at least 2 minutes after the last attempt to fire. If the misfired round could not be extracted in the normal manner, it was removed under the direct supervision of an officer using a rammer." After policing the area and gathering trash, troops either carried the trash off the training site to a landfill, or buried the trash in a foxhole if they were on their way to do more training ("RO-13," pp 12-13).

Weapons and danger areas

"The use of anti-aircraft artillery followed two approaches to the problem of attacking aircraft. The first approach was the use of machine gun and small-caliber rapid-fire cannons that relied on a large volume of projectiles to increase the chances of hitting the target. The second approach was the use of high explosive munitions fused to detonate near the aircraft and relied on the fragmentation from the explosive shell to down the target. The common anti-aircraft artillery used by the United States consisted of the following calibers: 20mm, 37mm, 40mm, 75mm, 3-in., 90-meeexm, and 120mm (4.7-in.)" ("RO-13," pp 1-2).

'The AAA range safety fan depicted in Figure 104 below was established by Training Regulation (TR) 140-5. The following maximum range for small arms ammunition was established in TR 1350-A: Cartridge, Ball, Caliber .50, M1- 7,500 yd. The maximum ranges for 3-in. guns were established in TR 1360-3A and are presented in Table 1 below. The width of the range was determined locally and was developed by examining locations of fixed targets (such as a balloon target) and local conditions that would determine left and right limits of fire for moving targets (such as target rockets)" ("RO-13," pp 17-18).



Danger area for antiaircraft cannon firing at towed targets

Figure 104. AAA range safety fan, circa 1931 (TR 140-5, Range regulations for firing ammunition in time of peace, 20 November 1931, pp 5 and 6).

Table 1. Maximum ranges for 3-in. anti-aircraft guns in 1936.

Table of maximum ranges—3-inch antiaircraft guns

Guns	Ammunition							
	Shrapnel, Mk. I, with 21-second fuze, Mk. IIIA1		Shell, H. E., Mk. I, with 21-second fuze, Mk. IIIA2		Shell, H. E., Mk. IX or M42, with 21-second fuze, Mk. IIIA2		Shell, H. E., M42, with mechanical time fuze, M43	
	Maximum vertical range (yards)[1]	Maximum horizontal range (yards)[2]	Maximum vertical range (yards)[1]	Maximum horizontal range (yards)[2]	Maximum vertical range (yards)[1]	Maximum horizontal range (yards)[2]	Maximum vertical range (yards)[1]	Maximum horizontal range (yards)[2]
MOBILE								
M1918	7, 900	11, 800	7, 900	11, 800	7, 600	11, 000	------	------
M1918MI								
M1918A1								
M1918MIA1								
M1918A2	7, 900	11, 800	------	------	7, 600	11, 000	8, 740	13, 800
M1918MIA2								
M1	8, 600	12, 600	------	------	8, 200	11, 800	9, 300	14, 200
M3								
FIXED								
M1917	8, 600	12, 600	8, 600	12, 600	8, 200	11, 800	------	------
M1917MI								
M1917A1								
M1917MIA1								
M1917A2	8, 600	12, 600	------	------	8, 200	11, 800	9, 300	14, 200
M1917A3								
M1917MIA2								
M1917MIA3								
M1917MII								
M1925MI								
M2								
M4								

[1] Maximum vertical ranges are limited by action of the time fuze. Ranges shown are obtained with fuze set for maximum time action; gun at maximum elevation.
[2] Horizontal ranges shown are the maximum ground impact ranges obtained without the limiting factor of the time fuze.

Source: TR 1360-3A, Anti-aircraft ammunition, ammunition for 3-in. and 105mm anti-aircraft guns, 31 July 1936, p 42.

"The 1942 edition of AR 750-10 utilizes the same range safety fan presented in Figure 104 above, but lists the following maximum ranges for anti-aircraft guns as presented in Tables 2 and 3 below" ("RO-13," p 20).

Table 2. Maximum ranges for anti-aircraft guns in 1942.

Weapon	Ammunition	Elevation		Muzzle velocity	Approximate maximum range
		°	′	*f/s*	*Yards*
Cal. .22	Cartridge, ball, cal. .22, long rifle	30	00	1, 100	1, 500
Field artillery trainer, M2.[1]	Cartridge, blank, cal. .22, field artillery trainer, M2 and 1-inch steel ball.	42	11	100	90
	Cartridge, blank, cal. .22, short and 1-inch steel ball.	42	11	100	90
Cal. .30	Cartridge, armor piercing, cal. .30, M2.	31	45	2, 800	4, 000
	Cartridge, ball, cal. .30, M1	34	10	2, 600	5, 500
	Cartridge, ball, cal. .30, M2	31	45	2, 800	4, 000
	Cartridge, tracer, cal. .30, M1	31	45	2, 700	3, 500
Cal. .45	Cartridge, ball, cal. .45, M1911	30	00	802	1, 600
Cal. .50	Cartridge, armor piercing, cal. .50, M2.	32	00	2, 900	7, 600
	Cartridge, ball, cal. .50, M2	32	00	2, 900	7, 600
	Cartridge, tracer, cal. .50, M1	32	00	2, 800	7, 125
		°	′	*f/s*	*Yards*
37-mm antitank gun, M3, and 37-mm tank guns, M5 and M6.	Shot, fixed, armor piercing, M51; and practice, M51.	15	00	2, 600	8, 500
		45	00	2, 600	12, 750
	Shell, fixed, H. E., antitank M63	45	00	2, 700	12, 000
	Shell, fixed, H. E., Mk. II (range estimated).	15	00	2, 750	5, 300
		45	00	2, 750	8, 000
37-mm antiaircraft guns M1A1 and M1A2.	Shell, fixed, H. E., M54; and shell, fixed, practice, M55.	45	00	2, 600	9, 300
	Shot, fixed, armor piercing, M59	45	00	2, 050	6, 000

[1] Data shown are for simulation of 75-mm gun, M1897. A range of 150 yards, however, is practicable. See Supplement SNL L–4, Part 1.

Weapon	Ammunition	Elevation	Muzzle velocity	Approximate maximum range
		° ′	f/s	Yards
75-mm gun, M1916 (when used as antiaircraft gun).	Shrapnel, fixed, Mk. I, antiaircraft 75-mm gun.	42 32	1, 825	10, 450
3-inch antiaircraft guns, M1917, M1917MI, M1917A1, and M1917MIA1 (fixed mount).	Shell, fixed, H. E., Mk. IX, 3-inch antiaircraft guns, M1917, M1925-MI, M2, and M4.	45 00	2, 800	11, 800
	Shell, fixed, H. E., M42, 3-inch antiaircraft guns, M1917, M1925MI, M2, and M4.	45 00	2, 800	11, 800
3-inch antiaircraft guns, M1917A2, M1917A3, M1917MIA2, M1917MIA3, M1917MII, M1925MI, M2, and M4 (fixed mount).	Shell, fixed, H. E., Mk. IX, 3-inch antiaircraft guns, M1917, M1925-MI, M2, and M4.	45 00	2, 800	11, 800
	Shell, fixed, H. E., M42 (with 21-second fuze, Mk. IIIA2), 3-inch antiaircraft guns, M1917, M1925-MI, M2, and M4.	45 00	2, 800	11, 800
	Shell, fixed, H. E., M42 (with mechanical time fuze, M43) 3-inch antiaircraft guns, M1917, M1925-MI, M2, and M4.	45 00	2, 800	14, 200
	Shrapnel, fixed, Mk. I, 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 600	12, 600
3-inch antiaircraft guns, M1918A2, and M1918MIA2 (mobile mount).	Shell, fixed, H. E., Mk. IX, 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 600	11, 000
	Shell, fixed, H. E., M42 (with 21-second fuze, Mk. IIIA2), 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 600	11, 000
	Shell, fixed, H. E., M42 (with mechanical time fuze), M43, 3-inch antiaircrat guns, M1918, M1, and M3.	45 00	2, 600	13, 800
	Shrapnel, fixed, Mk. I, 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 400	11, 800
	Shot, fixed, armor piercing, M62_____	45 00	2, 400	15, 300
3-inch antiaircraft guns, M1 and M3 (mobile mount).	Shell, fixed, H. E., Mk. IX, 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 800	11, 800
	Shell, fixed, H. E., M42 (with 21-second fuze, Mk. IIIA2), 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 800	11, 800
	Shell, fixed, H. E., M42 (with mechanical time fuze, M43), 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 800	14, 200
	Shrapnel, fixed, Mk. I, 3-inch antiaircraft guns, M1918, M1, and M3.	45 00	2, 600	12, 600
	Shot, fixed, armor piercing, M62_____	45 00	2, 600	16, 200
90-mm antiaircraft gun, M1.	Shell, fixed, H. E., M71_____	45 00	2, 700	18, 000
	Shell, fixed, H. E., M58_____	45 00	2, 700	17, 850
105-mm antiaircraft gun, M3.	Shell, fixed, H. E., M38, 105-mm antiaircraft gun.	45 00	2, 800	20, 000
	Shell, fixed, M38, 105-mm antiaircraft gun, practice loaded.	45 00	2, 800	20, 000

Source: AR 750-10, Range regulations for firing ammunition for training and target practice, 14 February 1942, pp 26 - 28

"The 1949 edition of SR 385-310-1 utilizes the same range safety fan presented in Figure 104 above and provides the maximum range information presented in Table 3 below" ("RO-13," p 22).

Table 3. Maximum ranges for anti-aircraft guns in 1949.

TABLE X
ANTIAIRCRAFT CANNON

Weapons	Ammunition	Elevation	Muzzle velocity	Approximate maximum ordinate (90°)	Approximate maximum Range
		Meters	*Foot-seconds*	*Yards*	*Yards*
37-mm automatic gun M1A2.	Shell, HE-T, SD, M54	800	2,600	6,300	9,050
	Shell, TP-T, M55A1	800	2,600	6,300	9,050
	Shot, APC-T, M59 and M59A1.	800	2,050	4,000	5,790
40-mm automatic gun M1 and dual automatic gun M2.	Cartridge, HE-T, SD, MK2.	800	2,870	7,800	11,000
	Cartridge, AP-T, M81 and M81A1.	800	2,870	6,800	9,600
90-mm guns M1, M1A1, and M2.	Shell, HE, M71	811	2,700	13,426	[6]19,560
	Projectile, APC-T, M82	800	2,800	14,600	21,400
		800	2,670	13,700	20,400
	Shell, smoke, WP, M313	811	2,700	13,426	19,560
	Shot, HVAP-T, M304	800	3,350	11,800	15,700
120-mm gun M1.	Shell, HE, M73 with fuze, MT, M61.	800	3,100	20,100	28,275

[6] Data shown are for the shell fitted with fuzes other than fuze, CP, M78. The ranges with fuze, CP, M78 are approximately the same or slightly less.

Source: SR 385-310-1, Regulations for firing ammunition for training, target practice, and combat, 4 March 1949, p 48.

"In 1955, maximum ranges for anti-aircraft artillery included the new 75mm anti-aircraft weapon. These ranges are presented in Table 4 below" ("RO-13," p 23).

Table 4. Maximum ranges for anti-aircraft guns in 1955.

Table XI. Antiaircraft Cannon

Weapons	Ammunition	Elevation (mils)	MV f/s	Approximate maximum[a]	
				Ordinate[b] (yards)	Range (yards)
37-mm Automatic Gun, M1A2	Shell, HE-T, SD, M54	800	2,600	6,300	9,050
	Shell, TP-T, M55A1	800	2,600	6,300	9,050
	Shot, APC-T, M59 and M59A1	800	2,050	----------	5,790
40-mm Automatic Gun M1 and M1A1 and dual automatic M2 guns.	Shell, HE-T, MK 2	800	2,870	7,800	11,000
	Shell, TP-T, MK 2	800	2,870	7,800	11,000
	Shot, AP-T, M81 and M81A1	800	2,870	----------	9,600
	Shell, TP-T, M91	800	2,870	----------	9,600
75-mm Gun, T83E1	Shell, HE, T50E2	758	2,825	10,000	15,000
90-mm Guns, M1, M1A1, M1A2, M1A3, M2A1, M2A2.	Shell, HE, M71	811	2,700	13,426	19,560
	Shell, TP, M71	811	2,700	13,426	19,560
	Shell, HE, Red Marker and Green Marker, M71.	811	2,700	13,426	19,560
	Shell, Smoke, WP, M313	811	2,700	----------	19,560
	Projectile, APC-T, M82	800	2,800	----------	21,400
	Projectile, AP-T, M77	800	2,700	----------	12,325
	Shot, HVAP-T, M332 and M332B1	800	3,875	----------	15,000
	Shot, HVTP-T, M333	800	3,875	----------	15,000
	Shot, HVAP, M304	800	3,350	----------	15,700
	Shot, HVTP, M317A1, M317	800	3,350	----------	15,700
	Projectile, AP-T, M318	800	2,800	----------	21,400
120-mm Guns, M1 and M1A2	Shell, HE, M73	800	3,100	20,100	28,275

[a] Data given for that charge and fuse combination which will yield maximum range.
[b] Maximum ordinates given for ammunition directly employed in antiaircraft use. These munitions may also be employed against terrestrial targets. Additional munitions as listed are capable of being fired from these weapons but are employed only against terrestrial targets.

Source: AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 5 December 1955, p 82.

"In the 1968 edition of AR 385-63, the range safety fan had been revised to that shown in Figure 105 below" ("RO-13," p 24).

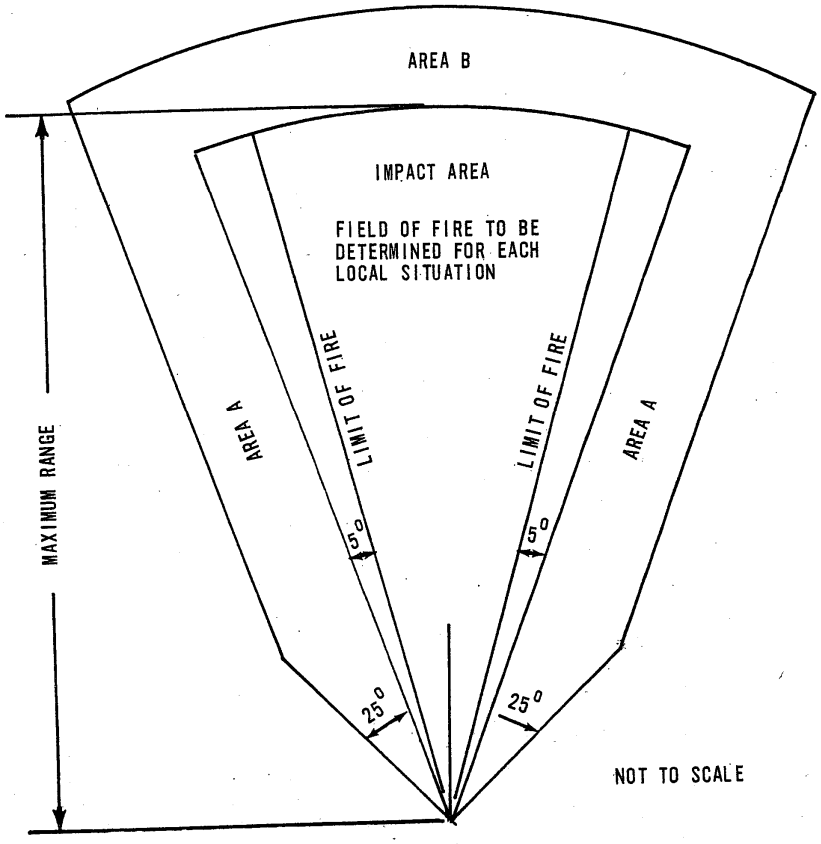


Figure 105. AAA range safety fan, circa 1968 (AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 17 June 1968, Ch 16).

"The 1968 edition of AR 385-63 also provides the following dimensions listed in Table 5 below for determining the Area A and B distances. Note that, by this time (1968), the large caliber AAA weapons were no longer in use" ("RO-13," p 24).

Table 5. AAA Range danger area dimensions (distance in meters).

Caliber	Dimensions of Area in Meters	
	A	B
Small arms	100	100
20mm gun	200	200
40mm gun	500	500
Source: "RO-13".		

"The 1983 edition of AR 385-63 presents revised Area A and B distances and adds maximum range distances as shown in Table 6 below" ("RO-13," p 25).

Table 6. AAA Range danger area dimensions (distance in meters, rev. 1983).

Caliber	A	B	C[1]	Distance X
Small arms	100	100	100	
20mm gun	300	400	600	5000m[2]
30mm gun	300	400	600	4100m
40mm gun	300	400	600	9800m

Source: "RO-13"; AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 15 October 1983, Ch 14

[1] This column represents minimum aerial target engagement distances when personnel at the firing position are unprotected.

[2] When firing the 20mm M139 system, distances X will be increased to 5800m.

Layouts

AAA ranges usually consisted of a cleared and leveled area for a line of firing positions and markers for left and right firing limits (Figure 106). "The width of the range was determined locally and was developed by examining locations of fixed targets (such as a balloon target) and local conditions that would determine left and right limits of fire for moving targets (such as target rockets)" ("RO-13," pp 17-18).

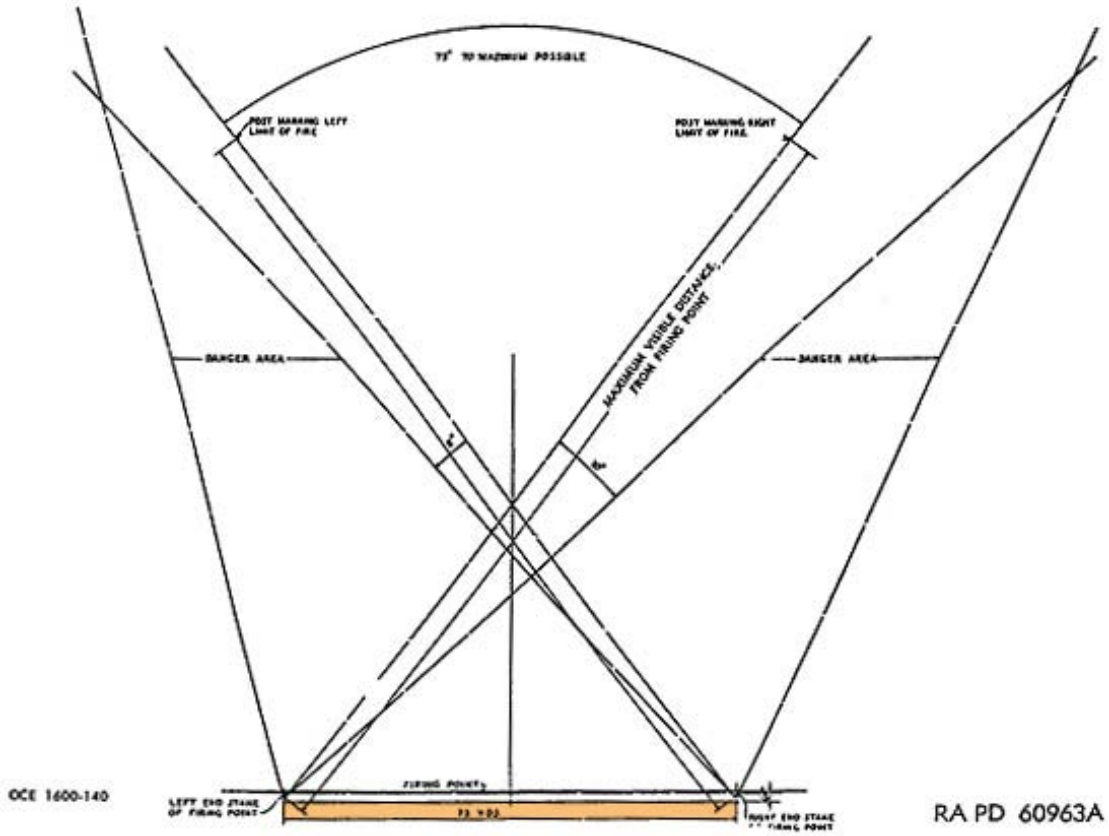


Figure 106. Anti-aircraft towed target range, circa 1942 (Standard Drawing No. 1600-140, "Field target range A-A towed target range," 17 November 1942).



Figure 107. Firing range at Anti-Aircraft Training and Test Center Dam Neck, VA, December 1943 (NARA College Park, RG 80-G, box 8, photo 2316).



Figure 108. Beach firing range at NAS Fort Lauderdale, FL, 28 February 1944 (NARA College Park, RG 80-G, box 1513, photo 388275).



Figure 109. Aerial of machine gun range at MCAS Cherry Point, NC, 9 August 1943 (NARA College Park, RG 80-G, box 1495, photo 384685).

Firing lines

Firing lines consisted of a cleared area for firing positions. If located on a beach, these firing positions were often stabilized with embankments or sandbags.



Figure 110. Gunnery instruction for enlisted personnel at Amphibious Training Base Fort Pierce, FL, 1 December 1943 (NARA College Park, RG 80-G, box 861, photo 264382).



Figure 111. Beach firing range at NAS Fort Lauderdale, FL, 28 February 1944 (NARA College Park, RG 80-G, box 1513, photo 388274).



Figure 112. Sailors at gunnery range at NAS Wildwood, New Jersey, 30 May 1944 (NARA College Park, RG 80-G, box 1487, photo 383360).



Figure 113. Machine gun crews in action on range at MCAS Cherry Point, NC, 21 August 1943 (NARA College Park, RG 80-G, box 1360, photo 358873).



Figure 114. Marines operating machine gun at MCAS Cherry Point, NC, 21 August 1943 (NARA College Park, RG 80-G, box 1360, photo 358872).

Targets

AAA targets included balloon targets, target rockets, Ballistic Aerial Target Systems (BATS), target kites, targets towed by planes, and miniature remote controlled aircraft targets. "Because the gunners were firing at these targets, there was a potential for damaged targets to crash on the range" ("RO-13," p 36).

Balloon target M1

"This was a rubber balloon of high elasticity and strength. It was spherical in shape when inflated. This target was used with small arms weapons for training in firing at aerial targets" ("RO-13," p 36).

Target rockets

"The 3.25-in. AAA target rocket, M2 was the standard target rocket in use during WW II. This target rocket was designed to simulate low flying aircraft for training anti-aircraft gun crews. The large fins acted as a target. This rocket was fired from a Target Rocket Projector, M1. This target was used primarily for small arms anti-aircraft training. The 3.25-in. target rocket is shown in Figure 115 below" ("RO-13," p 37).

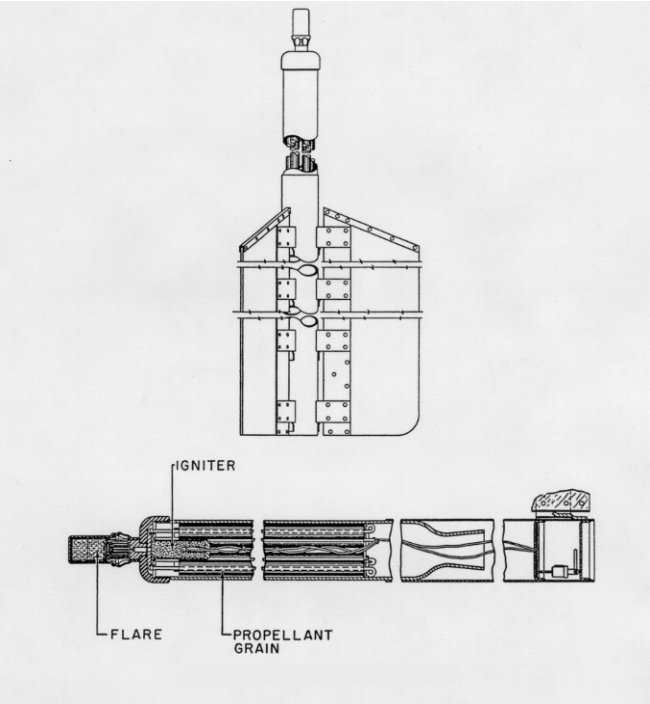


Figure 115. Rocket, target, 3.25-in., m2, circa 1947 (NAVSEA OP 1664, U.S. Explosive Ordnance, 28 May 1947, p 153).

Ballistic aerial target system (BATS), MTR-15

"This was a low-cost system for troop training with low- and medium-altitude air-defense systems. The system consisted of a ballistic shell that could be fitted with two to five 2.75-in. rocket motors for propulsion. The system became operational in 1972 and was used for training Vulcan, Chaparral, and Redeye gunners. This system is still in use today. The BATS system is depicted in Figure 116 below" ("RO-13," p 38).

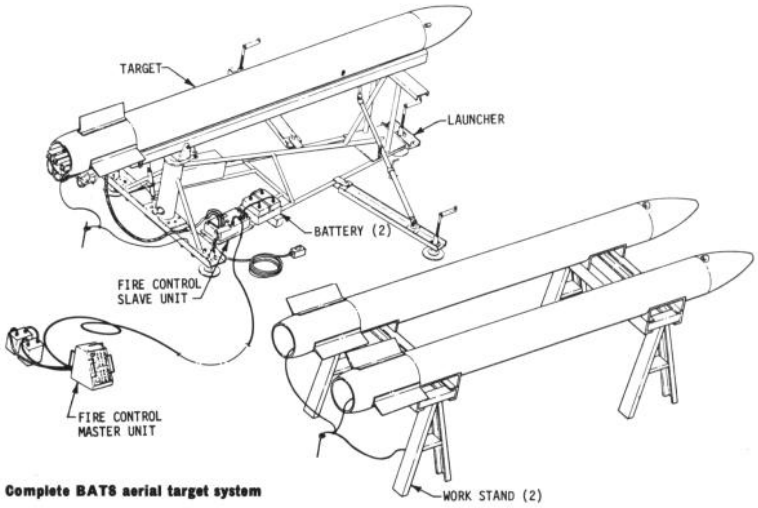


Figure 116. BATS system, circa 1972-2005 ("RO-13," p 38; Internet: http://www.designation-systems.info/dusrm/r-15.html).

Target kite kit, M9

"This system, used for small arms training, consisted of a 5-ft span kite flown at a range of 150 to 200 yd. Operation of the kite allowed for maneuvering of the target. The target kite kit is depicted in Figure 117 below" ("RO-13," p 39).

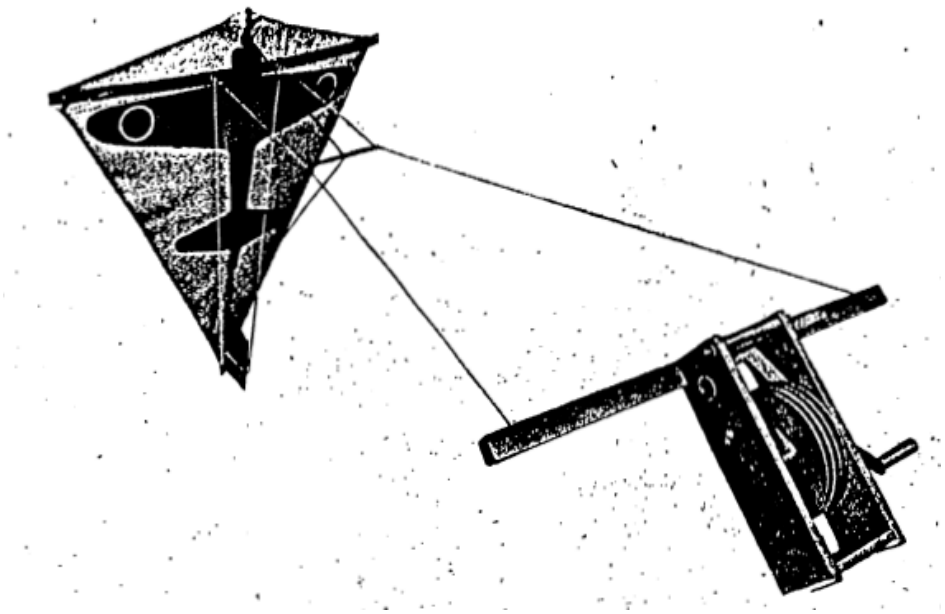


Figure 117. Target kite kit, M9, circa 1944 (TR 140-5, TM 9-855, Targets, Target material, and training course layouts, 17 August 1944, pp 119 -121).

Tow target

"This was a flare, flag, or sleeve of cloth towed behind an aircraft and used as an anti-aircraft target. This target could be augmented with a flare(s) to allow night firing or a radar reflector for radar-controlled guns. This type of target was used for every caliber of AAA weapon. Manuals on the construction and use of this type of target have not been uncovered. When machine guns were fired at a towed target, there was often more than one gun firing at the target. In order to score each machine gun, the bullets for the guns were coated with a color material to leave a colored mark on the target when the bullet hit it" ("RO-13," p 39).

Remote controlled aircraft

"An entire series of remote controlled aircraft were developed for use as AAA targets. These aircraft were normally smaller than normal aircraft and could be launched either from a catapult (Figure 118) or from an airfield like a normal aircraft. During World War II, the Radioplane Company built several thousand small radio-controlled model planes for use as ae-

rial targets by the armed services. There were various models, which received designations in the USAAF's OQ-series and the U.S. Navy's TDD series. The history of Radioplane's targets began in 1935, when the RP-1, a radio-controlled wooden model plane with a span of 2.7 m (9 ft), was constructed. One type of Radioplane is depicted in Figure 119 below" ("RO-13," p 40).



Figure 118. Radio-controlled airplane target OQ-2A taking off from catapult at the AA Range at Fort Jackson, SC, 1 November 1943 (NARA College Park, RG 111-SC WWII, box 415, photo SC246692).



Figure 119. OQ-14/TDD-3/TDD-4 Radioplane, circa 1944 ("RO-13," p 40; TR 140-5, Internet, http://www.designation-systems.info/dursm/app1/oq-14.html).

Embankments/trenches/etc.

Embankments of sandbags or other materials were sometimes built to create stable firing positions (such as those shown on the beach firing range in Figures 113 and 114 above).

Buildings

No buildings are mentioned in the standard plans for these ranges. However, a range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings in support of general range functions (see Figure 120 below). The range may also have been part of a larger installation range complex that contained these buildings. "Investigations performed at numerous closed and active installations indicate that support facilities such as aircraft and airfields were required to support towed targets (towed by service aircraft) or remotely piloted target aircraft" ("RO-13," p 16).



Figure 120. Firing range at Anti-Aircraft Training and Test Center Dam Neck, VA, December 1943 (NARA College Park, RG 80-G, box 8, photo 2316).

Anti-tank gun range

Anti-tank gun crews were trained on these ranges to estimate speeds and distances at which moving tanks were traveling, and to fire anti-tank guns at fixed and moving targets. A range usually had a line of cleared firing positions (holes were dug for some guns). Stationary targets included panel targets, improvised log pillbox targets, screen targets, or various features of the natural terrain. Moving targets included moving vehicles (scout cars, tanks, etc.) or sled targets mounted on tracks moved with a pulley

system (often a 5- by 8-ft or larger light-colored plain panel mounted on a sled or carriage). A 1,000-in. miniature range was also used primarily with subcaliber ammunition. These ranges consisted of cleared firing positions and standard 1,000-in. stationary frame targets, or target sleds on hilly and level target tracks moved by a pulley system. On both ranges, gun crews prepared their weapons and took turns firing at targets from their stationary positions on the firing line. Service and subcaliber ammunition were fired on these ranges (see "Weapons" below).

Historical background

"Military knowledge and experience have indicated that, initially, infantry units identified the need for a small artillery piece that would belong to the infantry unit and be controlled by the infantry commander. For the U.S. military, this was the 37mm gun, M1916. The primary mission of this gun was to aid in reducing enemy hard points such as machine gun nests or bunkers. With the emergence of tanks as a threat to infantry units, the 37mm gun was used against tanks. As tank threats increased, other weapons (such as field artillery and anti-aircraft artillery) were given a secondary mission of anti-tank weapons. WW II brought about a rapid increase in the armor of tanks, and the infantry cannon, the M1916 gun, was soon insufficient to defeat enemy tanks. This led to the development of purpose-built anti-tank guns. The lethality of these guns was increased by either increasing the velocity of the projectile or developing a larger caliber weapon. It must be remembered that anti-tank weapons must be transportable and usable by the infantry. If the weapon became too large, it no longer met this requirement. As a rule of thumb, the caliber of weapon needed to defeat a tank was roughly equal to the caliber of the main gun of the tank. The need for powerful weapons that were still infantry transportable led to the development of anti-tank rockets and recoilless rifles, which eventually replaced the anti-tank guns" ("RO-11," pp 1-2).

"Anti-tank guns were organic to infantry and armored divisions in the early 1940s. Therefore, every Ground Forces Training Center would likely have had an anti-tank gun range. Reference material from 1942 indicates anti-tank gun ranges were normally established within the boundaries of the artillery range" ("RO-11," p 1). "A miniature 1,000-in. range was utilized for several subcaliber firing exercises" ("RO-11," p ES2).

Training procedures

"Prior to the movement to the anti-tank gun range, weapons were drawn from the armory and munitions were drawn from the ammunition supply point (ASP). Both were normally transported to the range using organic vehicles. The 37mm gun squad was equipped with a ½-ton, 4 x 4 truck or other vehicle for towing the gun and transporting the gun squad, accessories, and ammunition. The 37mm anti-tank gun motor carriage, M3 and 75mm anti-tank gun motor carriage, M3 were likely driven to the range under their own power. In readiness for action, the gun was uncoupled from the prime mover. The gun squad was charged with routine cleaning, lubrication, and preservation. The gun was moved by hand to the location designated by the squad leader and prepared for firing. Holes were dug for the trail spades of the 37mm and 57mm guns" ("RO-11," pp 9-10).

"Ammunition for the anti-tank guns was issued as a complete round. Loading ammunition into the anti-tank gun involved removing the ammunition from the prime mover, removing the packaging, placing the ammunition at appropriate staging locations, and then transferring the ammunition from the staging locations to the gun. The 75mm anti-tank gun motor carriage M3 had stowage space for 59 rounds of ammunition. On the command COMMENCE FIRING from the squad leader, the gunner pushed down sharply on the trigger actuator plunger or pulled the trip lever and quickly released it. The gunner continued to fire until he had disabled or neutralized the target, or until he received an order to cease or suspend firing. On the command CEASE FIRING, firing was stopped and the gun, if loaded, was unloaded. The members of the squad could leave their firing positions. When firing the .30 caliber subcaliber rifle from the 37mm gun, all rounds were ejected from the chamber and receiver, and the bolt left open after ejecting the last round. When firing the .22 caliber subcaliber rifle from the 37mm gun, the ammunition magazine was removed, the chamber emptied, and the bolt left open. Rounds prepared for firing, but not fired, were returned to their original packages and appropriately marked. After firing, first echelon (Operator) maintenance was performed. However, if the squad was immediately returning to the garrison after firing, first echelon (Operator) maintenance may have been postponed until the squad arrived at their destination. When a misfire occurred, at least three attempts were made to fire the round." Misfired rounds were then placed in a safe area (to allow gunners to continue training), and were later disposed of on site, or taken to a proper disposal facility. After policing the area and gathering trash, troops either carried the

trash off the training site to a landfill, or buried the trash in a foxhole if they were on their way to do more training ("RO-11," pp 10-12).

Weapons

Standard firing

"The anti-tank artillery consisted of four service ammunition calibers: 37-millimeter (mm), 57mm, 75mm, and 3-in. Reference material available for this report indicates the 37mm and 75mm guns were mounted on motor carriages and all of the guns were mounted on carriages towed behind vehicles" ("RO-11," p 1).

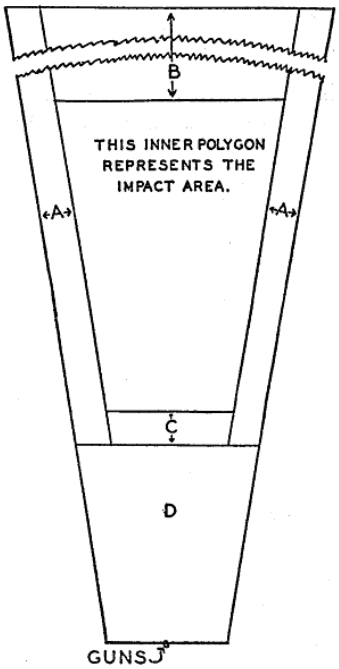
Subcaliber firing

"The subcaliber ammunition for the 37mm and 75mm anti-tank guns consisted of .22 caliber, .30 caliber, and 12-gage shotgun shells. For training purposes only, the 37mm subcaliber gun, M1916, was used to provide practice in laying and firing the 75mm anti-tank gun" ("RO-11," p ES2).

Danger areas

Standard range

"A typical anti-tank gun range layout is presented in Figure 121 below. The range was divided into six areas (A, B, C, D, E, and the Impact Area). All firing was planned for the Impact Area. Areas A, B, and C are danger areas that served as buffer zones for the Impact Area. The A, B, and C distances are established by using the data provided in Table 7 below and measuring out from the Impact Area. No firing into the buffer zones was planned. One of the restrictions on the occupation of Area D by troops was that the trajectory must clear any personnel or material objects in the area by at least 5 yd. For anti-tank guns, this would preclude the occupation of Area D. Distance X was the maximum range of the weapon" ("RO-11," p 16).



Danger area for all cannon firing, except antiaircraft firing at towed targets.

Figure 121. Typical anti-tank gun range layout, circa 1942 (AR 750-10, Range regulations for firing ammunition of training and target practice, 14 February 1942, p.6).

"Investigations performed at numerous closed and active installations indicate that, in practice, at ground forces training installations, the Impact Area and Areas A, B, and C of a range would fall within an established impact area. The installation range regulation specified firing restrictions for the specific firing point to ensure that all rounds fired would land within the established impact area. The dimensions of the danger areas (A, B, C) and maximum range (X) during various time periods are provided in Table 7 below" ("RO-11," p 17).

Table 7. Anti-tank gun range danger area dimensions.

Year	Anti-Tank Gun Caliber	Ammunition Type	Danger Area Dimensions (yd)			
			X (<15°)	A	B	C
1942	37mm	All	8500	600	2000	200
	75mm	All	8740	600	2000	400
	3-in.	All	10720	600	2000	400
1944	37mm	All	9575	600	1000	100
	57mm	All	6955	600	1000	200
	75mm	All	8920	600	1000	200
	3-in.	All	11020	600	1000	200

Source: "RO-11," p 17; AR 750-10, Range regulations for firing ammunition of training and target practice, 14 February 1942, p.5,6,27,28; AR 750-10, Range regulations for firing ammunition of training and target practice, 22 January 1944, pp 3, 23.

Applicable parameters of the anti tank guns fired on a typical anti-tank range are contained in Table 8 below ("RO-11," p 17).

Table 8. Anti-tank weapons service ammunition data.

Data Source/Year	Gun Caliber	Gun Designation	Ammunition Type	Ammunition Designation	Max range (yd)
FM 23-70/1940	37mm	M3, M5	AP	M51	Not given
		M3, M5	HE	MkII	Not given
		M3, M5	TP	M51	Not given
FM 23-70/1942	37mm	M3, M5	AP	M51	Not given
		M3, M5	HE	M63	Not given
		M3, M5	TP	M51	Not given
AR 750-10/1942	37mm		APC	M51	8,770
			AP	M74	6,290
	75mm		APC	M61	8,740
			AP	M72	7,060
	3-in.		AP	M62	10,720
FM 23-75/1944					
	57mm	M1	APC	M86	13,555
		M1	AP	M70	9,275
Catalogue of Standard Ordnance Items/1945	37mm	M3	All	All	12,850
	57mm	M1	All	All	10,260
	75mm	M1897	All	All	13,950
	3-in.	M5	All	All	16,100
AR 750-10/1944 (15° Elevation)	37mm	M3	APC	M51	9,575
			AP	M74	6,550
			HE	M63	7,220
	57mm	M1	AP	M70	6,955
			APC	M86	9,840
	75mm	M1897	HE	M48	8,950
			APC	M61	6,950
			AP	M72	7,140
	3-in.	M5	APC	M62	11,020
			HE	M42	10,650

Source: "RO-11," p 17,18; AR 750-10, Range regulations for firing ammunition of training and target practice, 22 January 1944, pp 23; Catalogue of standard ordnance items, volume 2, 1 June 1945. pp 156-158, 166, 167, 169; FM 23-70, Basic field manual, 37 mm gun, anti tank, M3, 1 October 1940, p 56; FM 23-70, Basic field manual, 37mm anti tank gun, m3, 28 November 1942, p 60; FM 23-75, Basic field manual, 57mm anti tank gun, M1, 15 June 1944, pp 76, 77

AP = armor piercing, APC = armor piercing capped, HE = high explosive, TP = target practice

The maximum range (X) provided in Table 9 above is that achieved when firing at less than 15 degrees elevation. The maximum range at any elevation available to a specific gun is provided in Table 9 above. Since the same gun may have been used in different mounts (for use as field artillery or tank main gun) that allowed different maximum elevations, the tables contain different maximum ranges. Military knowledge and experience have indicated that anti-tank weapons were normally fired at less than 15 degrees ("RO-11," p 18).

1,000-in. miniature anti-tank gun range

"Another range used in training anti-tank gun crews was the 1000-in. miniature anti-tank range. This range was used primarily as a subcaliber range. However, investigations performed at numerous closed and active installations indicate that 37mm rounds may have also been fired on this range. A typical danger area layout for the 1,000-in. range is depicted in Figure 122 below" ("RO-11," p 19).

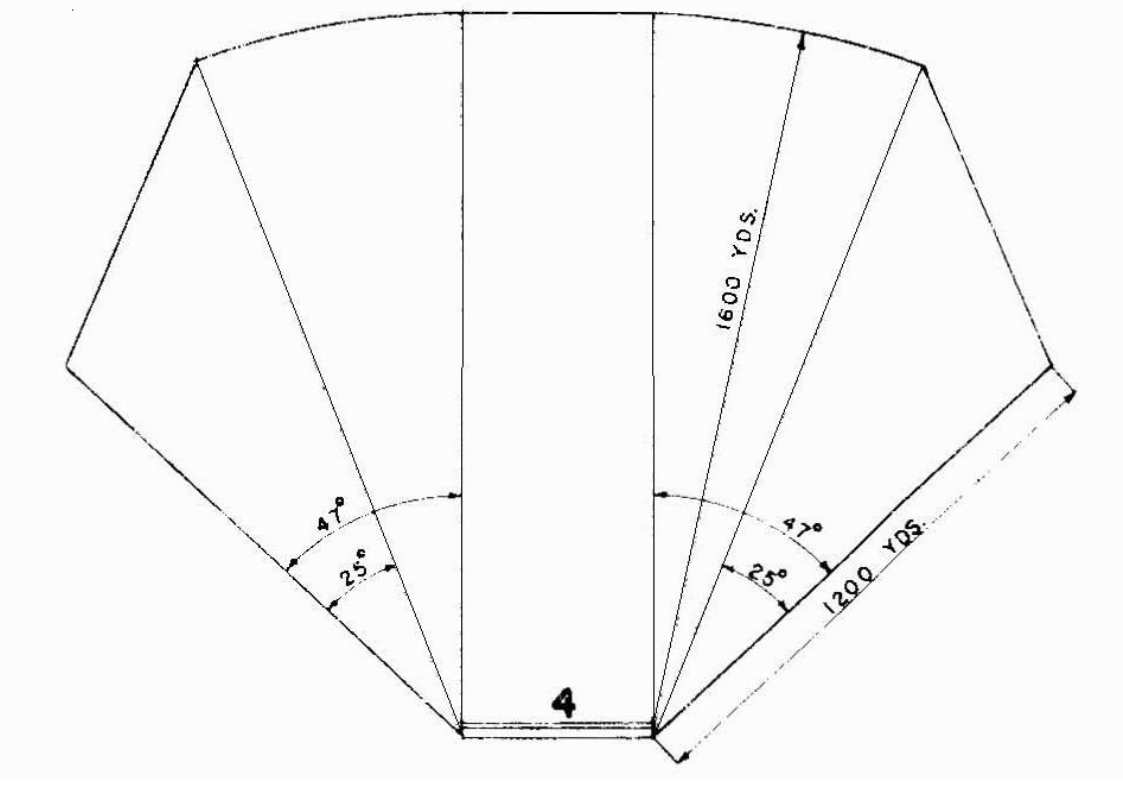


Figure 122. A 1,000-in. Miniature Anti-tank Range Layout, Circa 1943 (War Department, General Drawings, 1600-Series, Training Aids, Small Arms Ranges Including Field Target Ranges, Drawing No. 1600-100, 15 January 1943).

Layouts and targets

Standard range

Service ammunition preparatory exercises

"In these exercises, the gunner was trained to estimate the ranges and speeds of vehicles. Various types of combat vehicles, including scout cars and tanks, were operated over the range at constant speeds through known distances" ("RO-11," p 40).

Firing at screen targets

"This firing included firing on screen targets approximately the size of a tank and at natural features of the terrain. Stationary targets also consisted of panels and improvised log pill boxes" ("RO-11," p 33).

.30 caliber firing at moving targets

"The target configuration for .30 caliber firing at moving targets on a standard range consisted of a 5 x 8 ft plain, light-colored panel mounted on a sled or carriage. A larger target, more nearly corresponding to the size of a tank, could be used. The configuration for the .30 caliber standard range moving target and the target construction details are depicted in Figures 123 and 124 below" ("RO-11," p 39).

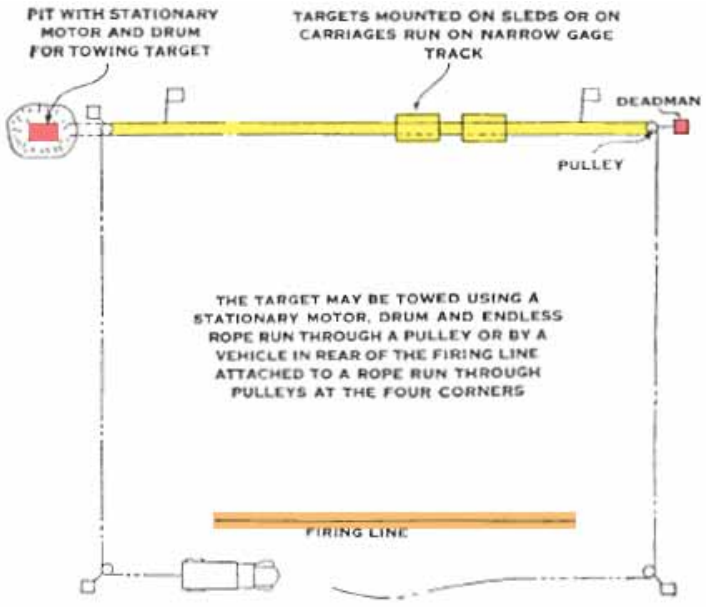


Figure 123. A .30 caliber Standard Range Moving Target Configuration, Circa 1940-1944 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 1 October 1940, pp 165-167, 170; FM 23-70, Basic field manual, 37mm anti tank gun, M3, 28 November 1942, pp 174-176, 178; FM 23-75, Basic field manual, 57mm anti tank gun, M1, 15 June 1944, p 123).

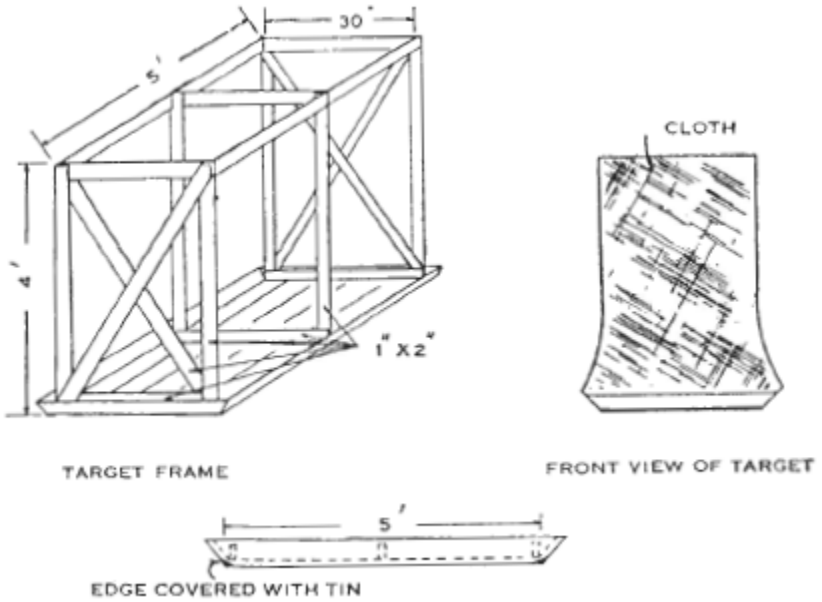


Figure 124. A .30 caliber standard range moving target construction details, circa 1940-1944 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 1 October 1940, pp 165-167, 170; FM 23-70, Basic field manual, 37mm anti tank gun, M3, 28 November 1942, pp 174-176, 178; FM 23-75, Basic field manual, 57mm anti tank gun, M1, 15 June 1944, p 123).

1,000-in. miniature anti-tank gun range

Firing at stationary targets

"Two types of stationary aiming targets were used for aiming and live fire exercises conducted on the 1,000-in. range. Each type was placed on a standard 1,000-in. frame adapted to provide identical targets on both sides. To make the double-sided frame, two standard 1,000-in. frames could be bound together back to back or one frame could be covered with target cloth on both sides. The target frame was made of ¾-in. by 1 ½-in. lumber, halved, and joined squarely at the corners. Both target surfaces were covered with blank white paper. The frame was placed on a portable stand to hold it vertically when placed on the ground. For one type of aiming target, a single aiming silhouette of the prescribed size was cut out and pasted in the center of the blank white paper on each face of the target. For the other type of aiming target, three rows of three aiming silhouettes each, or nine silhouettes, were equally spaced on the blank white paper on each face of the target frame" ("RO-11," p 32).

Improvised stationary target

"Another type of stationary target used on the 1,000-in. range was improvised locally. The target consisted of 5-in. squares of numbered pasteboard mounted on uprights at the same height from the ground as the level of

axis of the gun. Although the intervals between the targets varied, the overall width did not exceed 25 ft. The configuration of the improvised stationary target is depicted in Figure 125 below" ("RO-11," p 33).

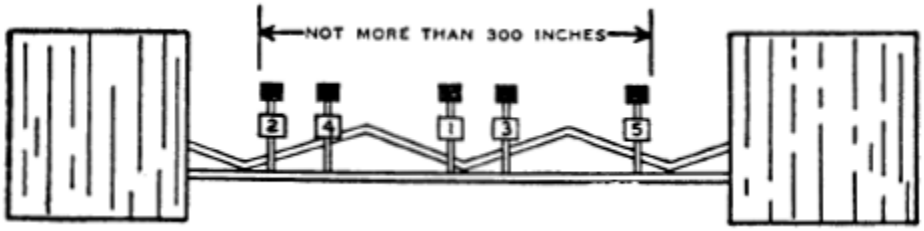


Figure 125. Improvised 1000-in. range stationary target, circa 1944 (FM 23-75, Basic field manual, 57mm anti tank gun, M1, 15 June 1944, p 108).

Firing at moving targets

Firing was completed from a stationary position at target sleds running on a target track 1,000 in. from the firing line (Figure 126). "The sled was pulled over three runways (i.e., parallel level, parallel hilly, and oblique) situated in a triangular configuration (Figure 127). Movement of the sled was actuated by a wire cable that ran from a hand-operated drum through a system of pulleys. A commercial wooden cable drum was used to make the reel" ("RO-11," p 35).

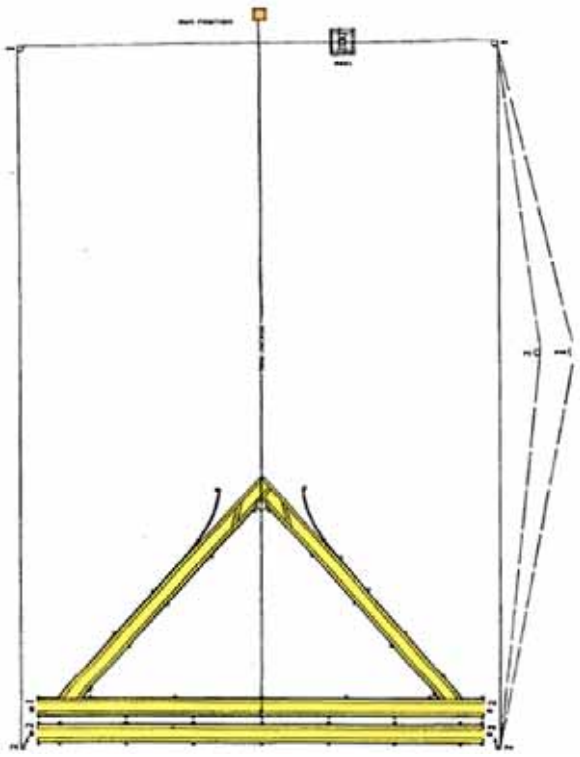


Figure 126. 1,000-in. Moving target three-runway configuration, circa 1940 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 1 October 1940, pp 136).

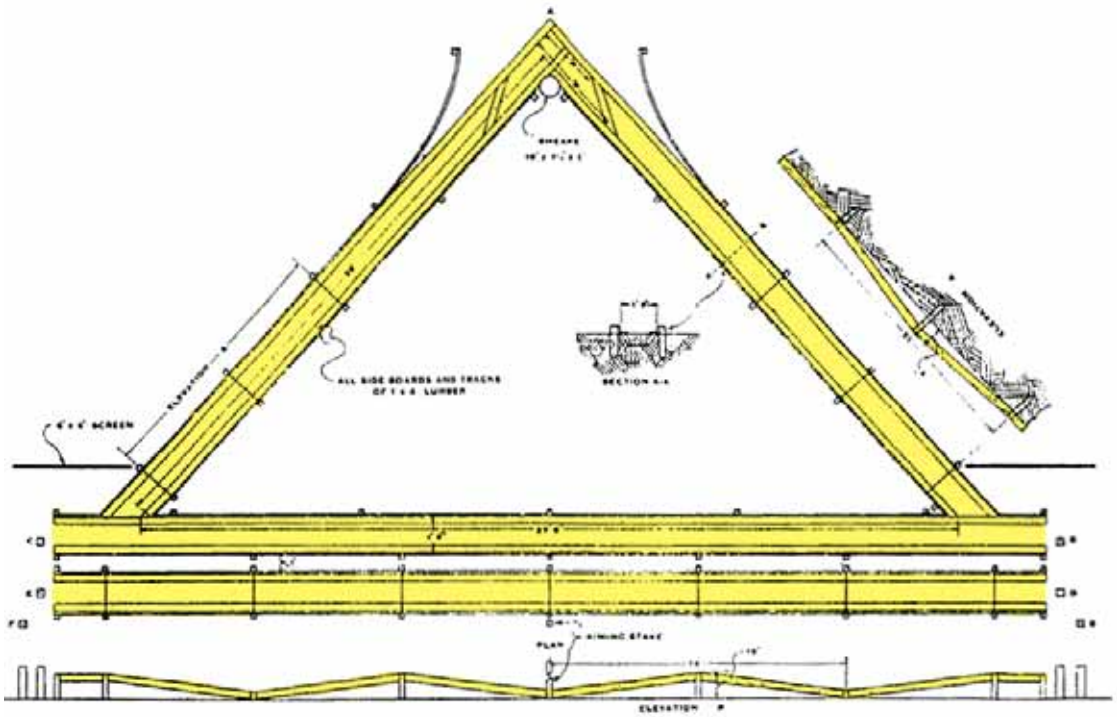


Figure 127. 1,000-in. Range three-runway configuration, circa 1940 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 1 October 1940, pp 132-134).

"By 1942, the configuration of the 1,000-in. moving target range appears to have changed to a two-runway (i.e., level and hilly) configuration. The configuration of the two runways and cable system is depicted in Figure 128 below" ("RO-11," p 38).

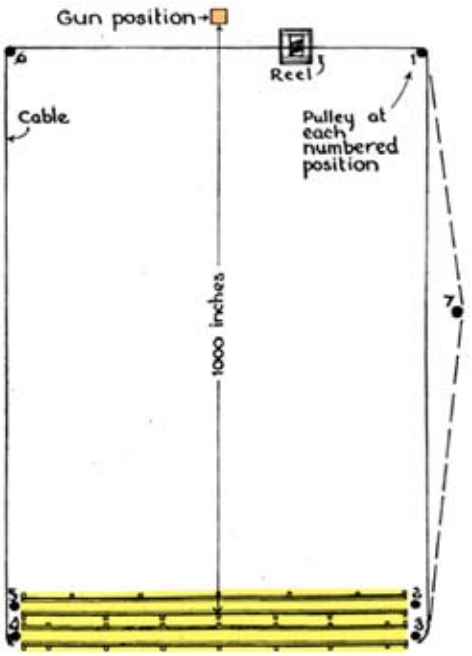


Figure 128. 1,000-in. moving target two-runway configuration, circa 1942 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 28 November 1942, pp 139-141).

"Two types of moving targets were used for aiming and live fire exercises conducted on the 1,000-in. range. One target type (Type A) was used for both the parallel and parallel-hilly courses, and one type (Type B) was used on the oblique course only. Both types of targets had black aiming silhouettes representing the apparent size of a tank at a distance of 800 yd. Tank silhouettes outlined with black lines were the scoring spaces. The two types of targets are depicted in Figures 129 and 130 below" ("RO-11," p 33, 34). "Both target types were mounted in a frame and secured to a sled. The target frame was made of ¾-in. by 1 ½-in. lumber, halved, and joined squarely at the corners. The sideboards that formed the body of the sled were made of 2 x 4 lumber. The weight of the heavy lumber in the body provided the low center of gravity necessary for smooth operation of the sled. The bottom surface of the sled was covered with tin so it would slide easily in the runways of the 1,000-in. range. The target and target sled are depicted in Figure 131 below" ("RO-11," p 35).

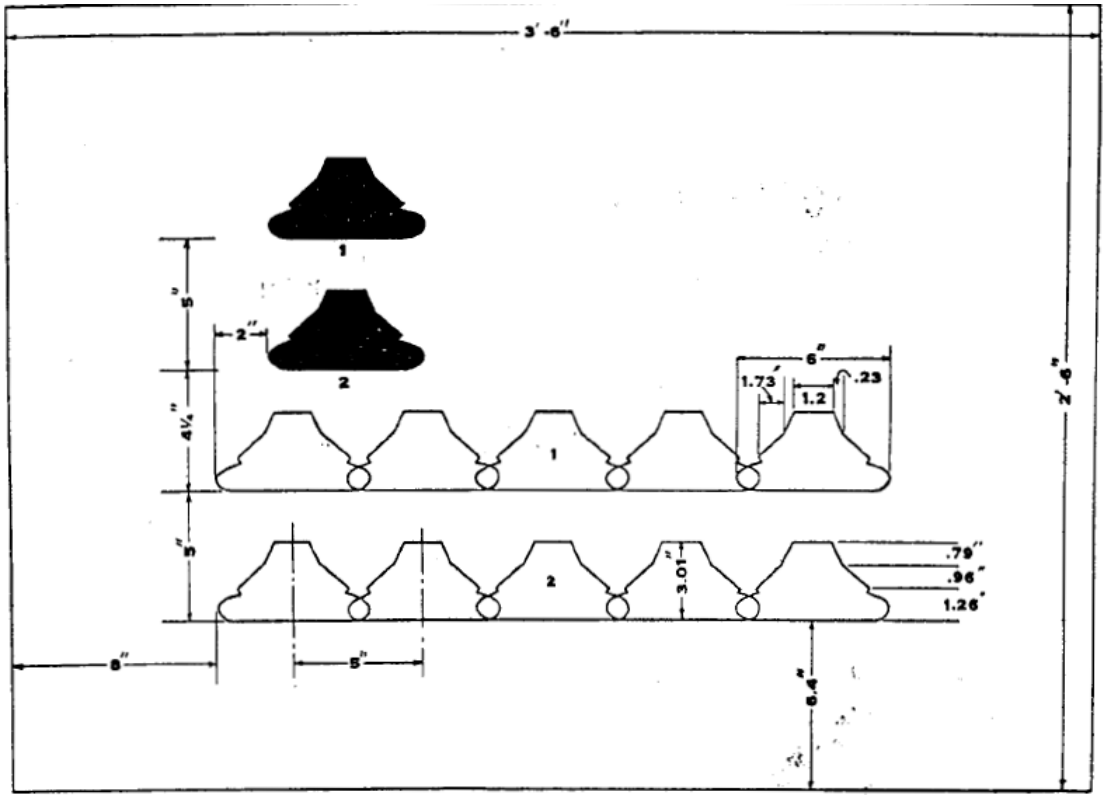


Figure 129. Type A moving 1,000-in. range target, circa 1940 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 1 October 1940, pp 140, 141).

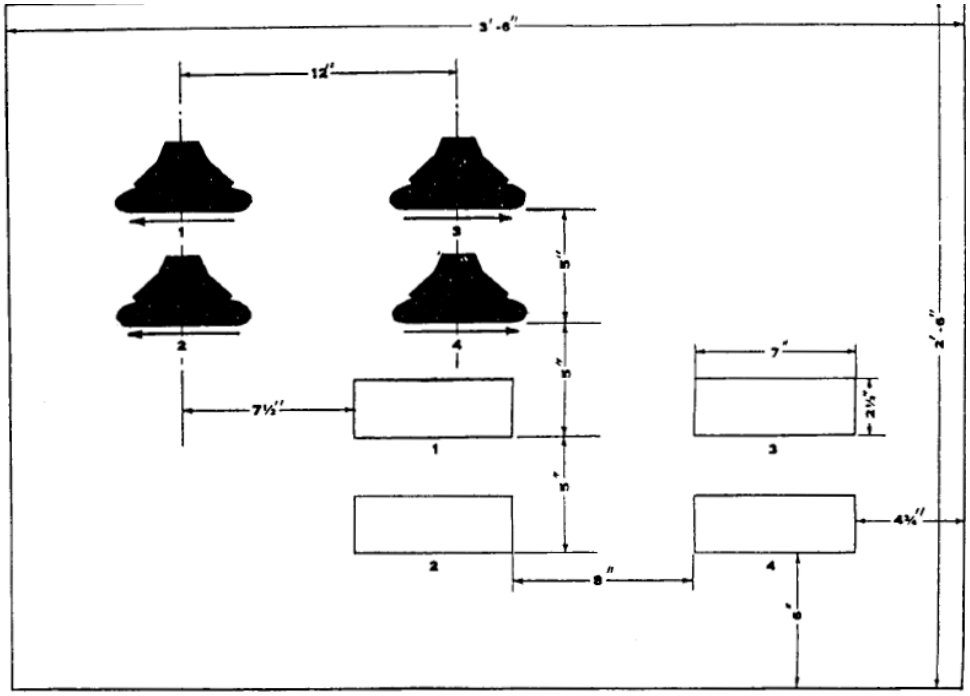


Figure 130. Type B moving 1,000-in. range target, circa 1940 (FM 23-70, Basic field manual, 37mm anti tank gun, M3, 1 October 1940, pp 140, 141).

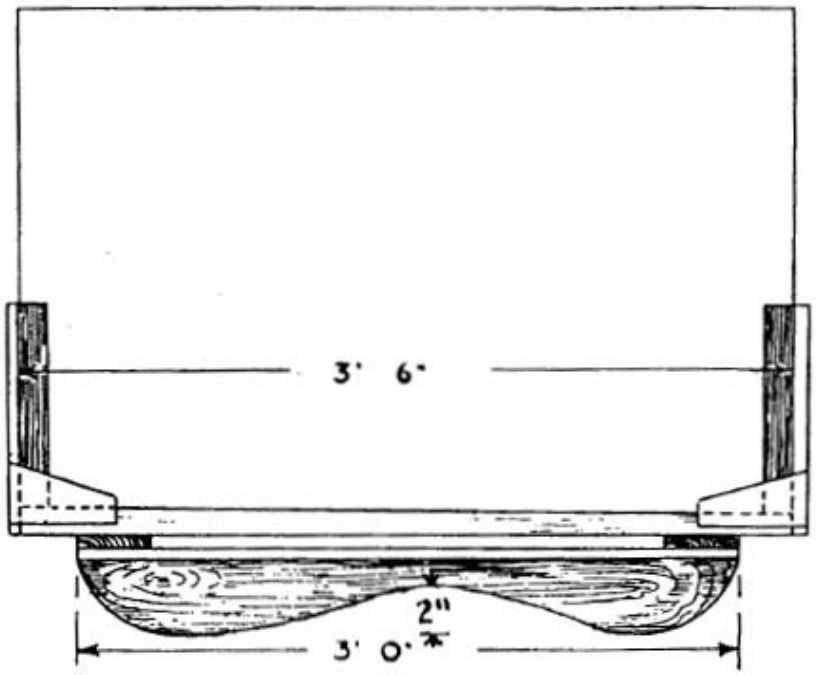


Figure 131. Moving target and sled, side view, circa 1944 (FM 23-75, Basic field manual, 57mm anti tank gun, M1, 15 June 1944, p 138).

Firing lines

Firing lines consisted of an area of cleared firing positions. “Holes were dug for the trail spades of the 37mm and 57mm guns” (“RO-11,” pp 9-10).



Figure 132. Members of gun crew prepare to fire a self-propelled 155 mm gun at Fort Knox, KY, 1947 (NARA College Park, RG 111-SC WWII, box 602, photo SC299050).



Figure 133. A gun crew practices gunnery on the 8-in. Howitzer at Fort Knox, KY, February 1947 (NARA College Park, RG 111-SC WWII, box 593, photo SC296576).

Embankments/trenches/etc.

None.

Buildings

No buildings are mentioned in the standard plans for these ranges. However, a range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings ("RO-11," p 14).

Davy Crockett weapon system range

Three man weapon crews were trained on these ranges to fire the Davy Crockett Weapon System at fixed targets. Ranges consisted of three firing positions, near and far aiming posts and bore sight targets (three sectors or aiming points for the light weapon and two for the heavy weapon) placed randomly throughout the range. After firing spotting rounds to obtain the proper aim, crews fired the XM28 or XM29 main round at targets.

Historical background

"The Davy Crockett weapon system was a battalion level weapon organic to infantry, armored, and mechanized divisions during the 1960s. Ranges for training personnel on this weapons system would be expected to be found at Ground Forces Training Centers. The Davy Crockett weapon system used conventional and training warheads, and was known to have been used at Fort Benning, Fort Lewis, Fort Hood, Fort Campbell, Fort Knox, and Fort Riley. However, the weapons system, used between 1959 and 1968, could also have been used at other training centers where ground units trained" ("RO-9," p ES2). "The Davy Crockett Weapon System Range is discussed separately from other recoilless rifle ranges because the weapon system was nuclear capable and, because access to its capabilities was restricted, it required a Arizona secure range" ("RO-9," pp 1-2).

Training procedures

On arrival at the range, troops met organic vehicles carrying weapons drawn from the armory and munitions from the ammunition supply point. "The gunner conducted safety checks before firing. Before firing, the bores

of the XM28 and XM29 weapons were cleaned to remove dirt and oil. The XM69 spotting rifle was disassembled, cleaned, and a light coat of oil applied to the metal parts. The weapon could be placed into action in either a direct or indirect fire mode. The fire command issued by the squad leader indicated the method of employment. Placing the weapon system in action by the squad included mounting, laying for direction, loading, and fire adjustment. The assistant gunner selected the correct propellant charge and loaded the charge. On receipt of the fire command, the assistant gunner fired the spotting rifle and immediately extracted the expended round. Spotting rounds were fired and corrections made until fire was adjusted on target. The assistant gunner then made a final inspection of the main round. If the spotting round was on target, the main round was fired" ("RO-9," p 7). "After completing a fire mission, the squad leader commanded 'End of Mission.' At that point, the squad reinstalled safeties, reset fuses on unfired munitions to safe, repacked propellant and projectiles, disassembled the weapon, and placed the components in their travel configuration" ("RO-9," p 8). If a misfire occurred, powder and rounds were placed in a safe area (to allow gunners to continue training), and were later disposed of on site, or taken to a proper disposal facility. After policing the area and gathering trash, troops either carried the trash off the training site to a landfill, or buried the trash in a foxhole if they were on their way to do more training ("RO-9," pp 8-9).

Weapons

The XM28 was an open-breech, recoilless, smooth bore, single shot, low-angle fire, muzzle loaded weapon. It consisted of a 120-millimeter (mm) barrel with a 20mm spotting rifle attached. The XM29 was an open-breech, recoilless, smooth bore, single shot, low-angle fire, muzzle loaded weapon. It consisted of a 155mm barrel mounted on a tripod for ground use. Each weapon system utilized its own set of standard ammunition" ("RO-9," p ES2). "The M28 was a 120-millimeter (mm) recoilless rifle with a maximum range of 2,000 meters, and the M29 was a 155mm recoilless rifle with a maximum range of 4,000 meters" ("RO-9," pp 1-2).

Layouts

"The Davy Crockett Weapons System required a stand-alone, secure range area that was separately located from other ranges at the Ground Forces Training Center. This weapon required a secure range area because access to its capabilities was restricted. Davy Crockett Weapon System units were authorized two firing ranges that had three firing positions on each range.

A typical range layout for the Davy Crockett weapon system is depicted in Figure 134 below" ("RO-9," pp 13-14).

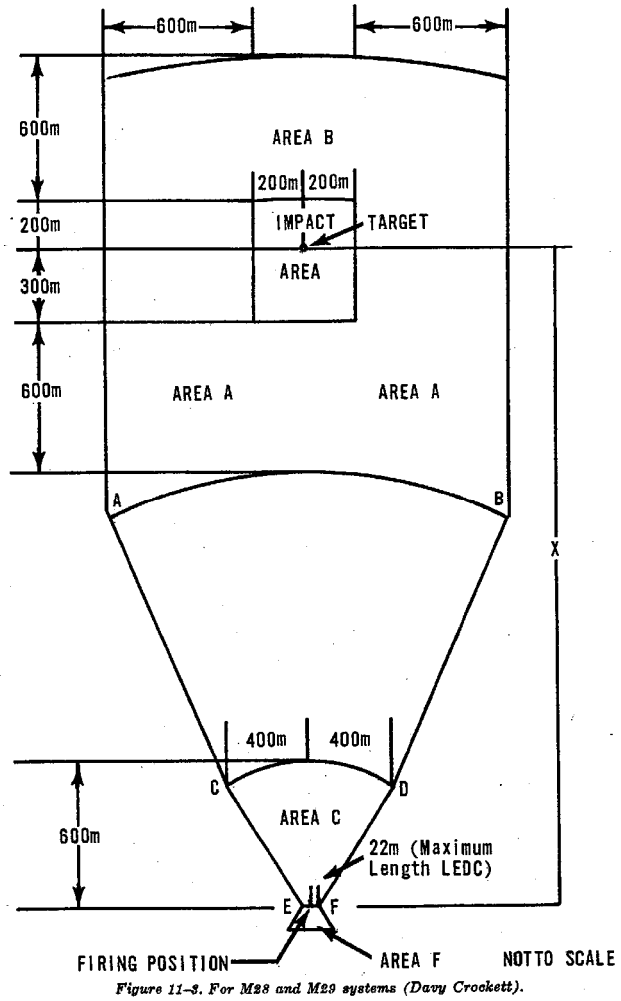


Figure 11–3. For M28 and M29 systems (Davy Crockett).

Figure 134. Typical Davy Crockett Weapon System Range Layout, Circa 1968 (AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 17 June 1968, p 11-4).

"Area E represents the firing position. Area F is the back blast danger area and had a base of 200 meters and a height of 100 meters. Area C is the area where the launch piston was expected to impact. Areas A and B constitute the danger area around the impact area. The length "X" is the distance from the firing position to the target/impact area. The XM28 weapon system had a maximum range, or X distance, of 2,000 meters, and the XM29 weapon system had a maximum range of 4,000 meters" ("RO-9," p 14).

"Investigations performed at numerous closed installations indicate that multiple targets were normally located in the impact area to allow for vari-

ety in training firing squads. The targets may not have been located in a straight line from the firing point. The location of target(s) was an installation (range control) decision and it is likely that the target distance was set at the respective maximum ranges of the Davy Crockett weapon system (2,000 and 4,000 meters). However, actual ranges may have been shorter and off the centerline to accommodate a greater variety of training. By developing a layout for each of the three firing positions for each range and combining or overlaying the three range layouts, a "master" safety fan for a Davy Crockett weapon system range can be determined" ("RO-9," p 15).

Firing lines

Firing lines consisted of three firing positions per range ("RO-9," p 13).

Targets

Targets consisted of aiming posts and bore sight targets. "Two aiming posts were provided to establish aiming or reference lines. These posts were placed on a line from the weapon position. The far aiming post was set out approximately 100 meters and the near post was set out approximately 50 meters. In all cases, the near aiming post was approximately half way between the weapon and the far aiming post. No information was obtained regarding the construction details for the aiming posts" ("RO-9," p 25). "The bore sight target was issued with the weapon and consisted of three sectors (aiming points) for the light weapon and two for the heavy weapon ("RO-9," p 26).

Embankments/trenches/etc.

None.

Buildings

No buildings are mentioned in the standard plans for these ranges. However, a range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings ("RO-9," p 12).

Field artillery range

These ranges were used to train field artillery crews to fire field and heavy mobile artillery weapons at fixed and moving targets ("RO-3," p 2). A range usually consisted of a line of firing positions (sometimes fitted with sandbags, trenches, concrete walls, and other embankments for firing crew protection); aiming posts with lights for night use, and fixed targets and metal sled targets pulled behind trucks. "An artillery range contained multiple firing points and multiple targets. The range was to be used by artillery, anti-tank weapons, infantry cannon, mortars, and tank guns" ("RO-3," p 18).

Historical background

"Field artillery had two principle missions in combat: (1) support infantry (armored) units by fire, and (2) provide depth to combat by counter battery fire, fire on hostile reserves, movement restriction, and disruption of hostile command agencies. The primary characteristic of field artillery is its great firepower. Every Ground Forces Training Center would likely have had a field artillery range" ("RO-3," p ES2). "In 1944, one artillery range (approximately 4 x 9 mi) per division was constructed" ("RO-3," p 18).

Training procedures

Weapons and ammunition were transported to the range from the artillery park and ammunition supply point, some partially prepared for action. "The firing unit removed the artillery piece from its travel configuration and emplaced it at the firing point. Activities included assembling the weapon, placing firing stakes, and digging a firing position. After the range was prepared and the weapons serviced, the using unit was issued the ammunition to be used during the training. Crews removed packaging and assembled a number of rounds during their preparation to fire the weapon. After firing, the field artillery weapons were inspected and first echelon (Operator) maintenance, cleaning, and lubrication (as specified in appropriate manuals) was conducted. The weapon was then disassembled and placed in its travel configuration; unused ammunition and ammunition prepared for firing, but not fired (including removed propellant increments), were repackaged and returned to Ordnance or the appropriate storage facility. A common practice was to place a misfired round in a pit at a safe distance from the firing position (to ensure the safety of the crew) and allow the crew to continue firing pending proper disposal of the mis-

fire." Unused propellant increments and other materials were also placed in pits, and all these were either burned at the site, or taken to a proper disposal center. Trash was gathered by the firing unit and taken to a land-fill or placed in a foxhole if the unit was on its way to other training ("RO-3," pp 10-14).

Layouts, danger areas, and weapons

"A typical artillery range layout is shown in Figure 135 below. The range was divided into six areas (A, B, C, D, E, and the Impact Area). Area A was the lateral danger area of the surface danger zone. Area B was the down range danger area of the surface danger zone beyond the impact area. Area C was the danger area adjacent to the near edge of the danger area. Area D was the danger area located between danger Areas C and E. Area E was the danger area located immediately in front of the firing position" ("RO-3," p 18).

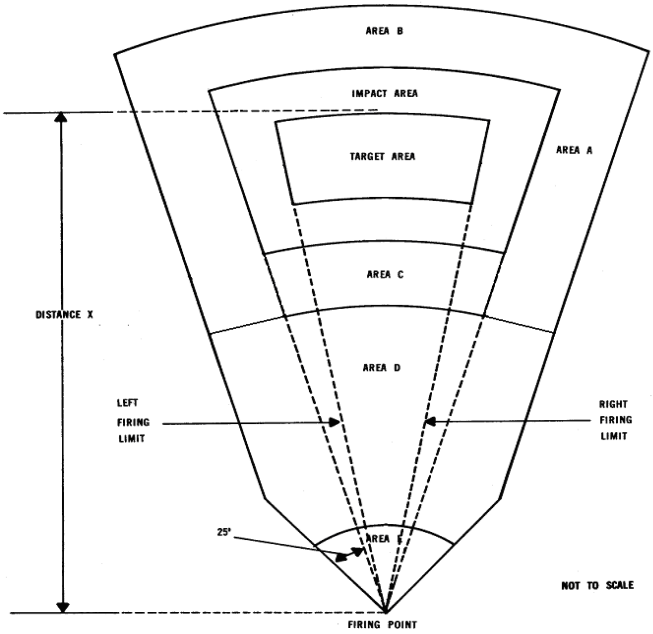


Figure 135. Typical artillery range danger areas, circa 1983 (AR 385-63/ MCO P3570.1A, Policies and procedures for training, target practice, and combat, 15 October 1983, p 11-7).

"The size of Areas A, B, and C varied for the different calibers as shown in Table 9 below. When firing at moving targets, an additional 5o limit angle was provided on each side between the outer limits of the impact area and the inner limits of Area A. Area D was a safe area for troops and existed when Area C exceeded Area A by 12 range probable errors at target range.

Table 9. Artillery range danger area dimensions.

Year	Artillery Caliber	Danger Area Dimensions [yd or meters (m)]			
		A	B	C	E
1942	37mm or less	600 yd	2,000 yd	200 yd	--
	40mm to 75mm	600	2,000	400	--
	90mm to 155mm	800	2,000	600	--
	7-in. to 240mm	1,000	3,000	1,000	--
1949	37mm or less	600 yd	1,000 yd	300[a] yd	--
	40mm to 105mm	600	1,000	600[a]	--
	120mm to 155mm	800	1,000	800[a]	--
	8-in. to 240mm	1,000	3,000	1,000[a]	--
1955	37mm and 40mm	300 yd	600 yd	300[a] yd	--
	75mm and 76mm	500	1,000	600[a]	--
	90mm and 105mm	600	1,000	600[a]	--
	120mm and 155mm	800	1,000	700[a]	--
	8-in. and 240mm	1,000	3,000	1,000[a]	--
	280mm	1,500	3,000	1,500[a]	--
1968	105mm	550 m	900 m	350 m	400m
	120mm and 155mm	750	900	550	450
	175mm	800	900	600	550
	8-in.	900	900	900	450
1973	90mm	600m	700m	600m	--
	105mm	650	750	650	--
	120mm	700	800	700	--
	155mm	775	875	775	--
	175mm	850	950	850	--
	8-in.	900	1,000	900	--
1980	105mm	550m	550m	350m	550m
	155mm	725	725	550	725
	175mm	745	745	600	745
	8-in.	830	830	800	830
1983	105mm	550m	550m	350m	550m
	155mm	725	725	550	725
	175mm	745	745	600	745
	8-in.	830	830	800	830

Source: ("RO-3," pp 21-22; AR 750-10, Range regulation for firing ammunition for training and target practice, 14 February 1942, p 5; SR 385-310-1, Regulations for firing ammunition for training, target practice, and combat, 4 March 1949, p 6; AR 385-63, Regulation for firing ammunition for training, target practice, and combat, 5 December 1955, p 9; AR 385-63, Regulation for firing ammunition for training, target practice, and combat, 17 June 1968, p 13-7; AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 28 February 1973, p 12-5.; AR 385-63/MCO P3570.1A, Change 1, policies and procedures for training, target practice, and combat, 1 December 1980, p 11-11; AR 385-63/ MCO P3570.1A, Policies and procedures for training, target practice, and combat, 15 October 1983, p 11-14)

In 1981, the dimensions of Area D are described as varying in accordance with the required dimensions for the target area, Impact Area, and danger areas A, C, and E. Area D could be occupied by troops if specific safety precautions were followed. Distance X was determined by the installation based on the available terrain. However, it would not exceed the maximum range or be less than the minimum range of the weapon to be fired. To ensure compliance with local range regulations, general regulations often specified the maximum and minimum elevations permitted and the maximum or minimum number of propellant charges authorized. When firing at less than 15o quadrant elevation, Distance X was not to be less than the range of the weapon corresponding to an elevation of 15o for the charge used. The dimensions of the Impact Area depended on the nature of the firing planned. In no case were the dimensions of the impact area to be smaller than plus 8 and minus 12 range probable errors in depth by right 8 and left 8 deflections probable errors in width measured from the outside or perimeter of the target area. Range probable errors and deflection probable errors are provided in the firing table for the weapon and ammunition being fired. If open burning of propellant bags was done, investigations performed at numerous closed and active installations indicate that it would have occurred in the vicinity of the firing points or in Area E" ("RO-3," p 19).

"Investigations performed at numerous closed and active installations indicate that a general impact area and individual firing points were displayed on an installation map. The impact area and Areas A, B, and C of a range fell within an established impact area. Although firing points were identified, Areas D and E were not normally shown on installation range maps. Installation range regulations specified firing restrictions (such as left and right limits, maximum/minimum charge or limits on elevation of the gun) for firing points to ensure all rounds fired would land within the established impact area. The dimensions of the danger areas (A, B, C, and E) during various time periods for various weapons are provided in Table 10 below" ("RO-3," pp 20, 21). The ARs list distances for low-angle, high-angle and direct fire. The distance given in Table 10 represents the largest of these values.

Table 10. Table of ranges.

Weapon	Ammunition	Elevation	Muzzle Velocity (fps)	Max (approx) Range (yd)
37mm gun	Fixed, HE, MkII	22° 10’	1,276	4,300
	Practice, MkII	22° 10’	1,276	4,300
75mm gun	HE, M48, normal	43° 00’	1,500	11,195
	HE, M48, supercharged	44° 00’	1,950	13,595
	HE, M48, reduced	44° 00’	950	6,960
	Shot, AP, M61	44° 00’	2,000	13,650
	Shrapnel, MkI	43° 40’	1,755	9,750
75mm pack Howitzer	HE, M48	44° 00’	1,250	9,800
105mm Howitzer, M2	HE, M1	44° 00’	1,550	12,150
	Smoke, M84	43° 40’	1,550	12,210
105mm Howitzer, M3	HE, M1	45° 00’	1,020	8,490
	Smoke, M84	45° 00’	1,020	8,490
155mm Howitzer, M1917-18	HE, M105	44° 16’	1,476	12,775
	Sand-loaded, MkI	44° 23’	1,479	12,300
	Shrapnel, MkI	47° 26’	1,434	10,850
155mm Howitzer, M1	HE, M107	44° 00’	1,850	16,000
	HE, M101	47° 00’	2,800	25,400
	Smoke, M116	45° 00’	1,850	16,200
4.5-in. Gun, M1	HE	45° 00’	2,275	21,125
8-in. Howitzer	HE, MkI	42° 30’	1,305	10,900
	Sand-loaded, MkI	43° 45’	1,525	12,700
240mm Howitzer	HE, MkII	45° 10’	1,700	16,400
	Sand-loaded, MkIII	45° 10’	1,700	16,400

Source: “RO-3,” pp 22-23; AR 385-63/MCO P3570.1A, Policies and procedures for firing ammunition for training, target practice, and combat, 15 November 1983, p 11-2; AR 750-10, Range regulations for firing ammunition for training and target practice, 22 January 1944, pp 20, 21; SR 385-310-1, Regulations for firing ammunition for training, target practice, and combat, 4 March 1949, pp 46, 47; AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 5 December 1955, pp 80, 81; FT 155-V-2, Firing table for howitzer, 155mm, M1917, M1917A1, and M1918 firing shell, HE, M102, 16 November 1943.

"If information concerning the elevation and charge to be used was not known, the impact area was extended to the maximum range of the weapon. Determining right and left limits of fire was the responsibility of gun crews and range personnel. These limits of fire were not found in the available documents. Safety limits for cannon positions applied to individual cannon, except in the case of a battery, where the limits were measured from the flank cannon.

The width of the impact area was eight deflection probable errors left of the left most target and eight deflection probable errors right of the right most target. Deflection probable errors are found in the range tables for each weapon/model of ammunition" ("RO-3," p 22).

"The information presented in Table 11 can be used to estimate safety zones. It was common for restrictions to be placed on gun elevations and propelling charges to reduce maximum ranges and comply with local restrictions. For example, the maximum range for a 155mm, HE, M102 fired with charge 1 at 367 mils (20.6°) elevation was 3,000 yd. The same round fired with charge 7 at 843.8 mils (47°) elevation had a maximum range of 12,700 yards" ("RO-3," p 22).

Table 11. Surface danger area dimensions for the M31, 14.5mm field artillery trainer.

Impact Area Condition	Range to Target	Maximum Ricochet Downrange (Area B)	Distance Lateral (Area A)
Soft Soil	100	470	75
	150	420	75
	200	375	75
	250	330	75
	300	305	75
	350	290	75
	400	285	75
	450	80	25
	500	80	25
	550	80	25
	600	80	25
	650	80	25
	700	80	25
	730	80	25
Medium Soil	100	490	75
	150	455	75
	200	410	75

Impact Area Condition	Range to Target	Maximum Ricochet Downrange (Area B)	Distance Lateral (Area A)
	250	370	75
	300	355	75
	350	350	75
	400	350	75
	450	80	25
	500	80	25
	550	80	25
	600	80	25
	650	80	25
	700	80	25
	730	80	25
Macadam/Concrete	100	1345	120
	150	1310	135
	200	1265	145
	250	1215	195
	300	1165	205
	350	1120	245
	400	1070	250
	450	1020	285
	500	965	310
	550	910	310
	600	855	325
	650	790	315
	700	710	310
	730	590	280

Source: "RO-3," p 25; AR 385-63, Policies and procedures for firing ammunition for training, target practice, and combat, 15 October 1983, Ch 11; AR 385-63, Policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, Ch 11.

"Minimum ranges for the various field artillery weapons are not provided in general safety manuals. Investigations performed at numerous closed and active installations indicate that, in practice, the installation determined the minimum and maximum ranges for the installation, and then determined firing positions that complied with those distances. Firing tables were published for each type of weapon and ammunition fired. The various firing tables provided the information necessary to determine the minimum and maximum distances" ("RO-3," p 23).

M31 trainer firing a 14.5mm projectile artillery Range

"A special sub-set of the artillery range is that for the M31 Trainer firing a 14.5mm projectile. This weapon was developed for use as a reduced range trainer for artillery personnel. The range surface danger area drawing for the M31 Trainer is depicted in Figure 136 below. This figure is used with Table 12 to determine the distances associated with this range" ("RO-3," p 24).

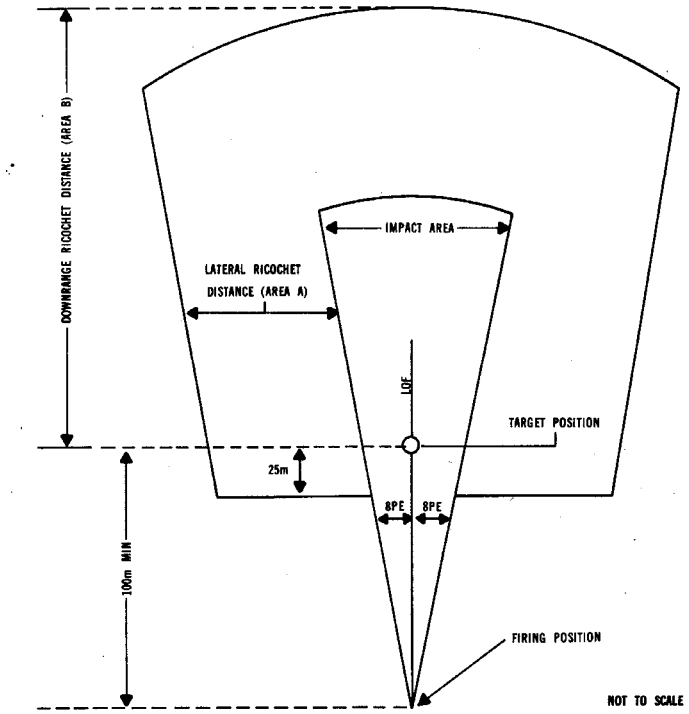


Figure 136. Surface danger area for 14.5mm field artillery trainer, circa 1978 (AR 385-63, Policies and procedures for firing ammunition for training, target practice, and combat, 15 October 1983, Ch 11; AR 385-63, Policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, Ch 11).

Firing lines

Firing lines consisted of firing positions that may have been protected by sandbags, trenches, walls, or other embankments. "In practice, the installation determined the minimum and maximum ranges for the installation and then determined firing positions that complied with those distances" ("RO-3," p 23). "The firing unit removed the artillery piece from its travel configuration and emplaced it at the firing point. Activities included assembling the weapon, placing firing stakes, and digging a firing position" ("RO-3," pp 10-14).



Figure 137. CMTC students practice with 75 mm guns at Fort Benjamin Harrison, IN, 1927 (NARA College Park, RG 111-SC WWI, box 700, photo 94932).

Targets

Metal sleds holding cloth targets were attached to trucks with wire, and pulled at various speeds to provide moving targets. Two aiming posts were used for each artillery piece. Each post was equipped with a light for use at night ("RO-3," pp 54-58).

Embankments/trenches/etc.

"Protective facilities were constructed to provide positive protection of the gun crew. These facilities could be of several types. One type consisted of two or four thicknesses of sand bags. Another type consisted of a narrow trench with sufficient depth to properly cover the cannon crew in the rear and to the sides of the cannon. Yet another type consisted of concrete walls at least 1 ft thick and of sufficient height. Other forms of protection equivalent to these three types were also allowed" ("RO-3," p 17).

Buildings

No buildings are mentioned in the standard plans for these ranges. However, a range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administra-

tive/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings ("RO-3," p 16).



Figure 138. Artillery observation tower at unknown location, circa 1917 (New York Public Library, Digital No. 117077).

Flame thrower range



Figure 139. 50 flamethrowers were used simultaneously to create 2,700-degree heat at Fort Bragg, NC, 29 August 1952 (NARA College Park, RG 111-SC WWII, box 249, photo SC423550).

"Flame thrower weapons were developed and used during World War I by the British, French, and German armies. The earliest U.S. document on flamethrowers uncovered was a TM from 1943. The exact dates for the start of use of flamethrowers by the U.S. military has not been determined but, based on the dates of the manuals recovered, it is assumed to be during WWII. These weapons were still in use in 1986, the end date for installations to come under the FUDS program. Flamethrowers had several uses:

1. Penetrate openings, such as embrasures and gun ports, and fill the fortifications with flame and smoke;
2. Burn, asphyxiate, and blind enemy personnel, causing casualties, shock, panic, and abandonment of a fortified position;
3. Ignite combustible parts of shelters and material, and start detonation of sensitive ammunition and explosives;
4. Shoot around corners, when fuel was fired from dead or blind angles;
5. Cause the enemy to close ports, temporarily putting the emplacement out of action and, thus, protecting the demolition party;
6. Mop up dug-in personnel; and
7. Eliminate enemy nests in street or jungle fighting" ("RO-16," p 2).

"Familiarization and qualification firing of flamethrowers was conducted along with the training required to gain proficiency in the use of the weapons. Additionally, the flame thrower weapons were used in combined arms exercises such as training on attacking a fortified position" ("RO-16," pp 12-13).

"Every Ground Forces Training Center would likely have had flame thrower ranges" ("RO-16," p ES2). "The flame thrower was a special purpose weapon that was not normally carried by combat troops but was issued for use as the tactical situation dictated. Portable flamethrowers were operated by selected individuals, thoroughly trained, and held personally responsible for his particular flamethrower. A mechanized flamethrower had a full time crew assigned to operate the equipment. Infantrymen were trained in the construction, installation, and use of flame field expedients. Installations involved with training of ground combat troops can be expected to have flamethrower ranges. Regulations on installation training areas do not specify a location for flame thrower ranges" ("RO-16," p 12).



Figure 140. Marines wait for a flame-throwing tank to demolish a pillbox before moving in and "mopping up" at Camp Lejeune, NC, 12 May 1961 (NARA College Park, RG 127-GG-598, box 24, photo A19094).

Weapons

In general, there were two types of standard flame thrower weapons: portable and mechanized" ("RO-16," p ES2). "The difference between the portable and the mechanized flamethrowers was strictly a matter of size. The mechanized flamethrower could project burning fuel farther and, therefore, required a larger range" ("RO-16," p 8). "Variations and adaptations of the basic field expedients, to meet existing combat situations, were limited only by the imagination and initiative of combat personnel. Standard flamethrowers did not use ammunition, but rather were locally filled with bulk materials. The associated materials used with flamethrowers included gasoline and Diesel oil, and coconut fatty acids, oleic acids, and naphthenic acids used in thickeners. Cresylic acid was used as a peptizer to aid in thickening the fuel mixture in cold weather. Flame field expedient devices often used explosives to disperse the fuel and white phosphorus (WP) munitions to ignite the fuels. In the 1970s, a variation of the 66mm rocket system utilized warheads with a flame producing mixture" ("RO-16," p ES2). "Because of a similarity of weapons, this range could also be used for flame field expedient weapons. Flame field expedients included exploding flame devices, flame fougasses, and flame illuminators. The M74 incendiary rocket fired from the M202 rocket launcher was used on a special variation of the standard flamethrower range. This rocket was used against targets similar to those for standard flamethrowers, but required

an expanded range area because it used a rocket to launch the flame weapon" ("RO-16," pp 1-2).

Training procedures

"Fuel was sent forward in ready-to-go weapons or in individual containers from which it was transferred to the fuel tanks by service personnel or the user. Investigations performed at numerous closed and active installations indicate that weapons and fuel were normally transported to the range by the unit using organic (integral) vehicles. The tanks for the portable flamethrower were supported on the firer's back and secured to it by straps. The straps were adjusted until the unit was carried with the bottom of the fuel tanks at the small of the operator's back. The manifold portable flamethrower was carried by at least four soldiers. One soldier carried the gun, another the hose, another the manifold assembly, and others to carry each loaded and charged portable flamethrower (one soldier was required to carry each loaded and charged portable flamethrower). If it was desired to fire the weapon at more targets than could be attacked with six flamethrower tank groups, extra fuel could be brought up in 5-gallon cans lashed to pack boards together with replacement pressure tanks and ignition cylinders. Movement to the range also included the transportation of auxiliary equipment used in weapons firing, such as fire-extinguishing equipment" ("RO-16," p 8).

The weapon was then cleaned, fueled, and inspected. "The weapon assembly area for the manifold portable flamethrower was to be level but not cleared more than was necessary to permit handling of the equipment. The manifold assembly was placed on the ground. The flamethrower tank fuel units were placed in two parallel rows adjacent to the manifold assembly. If the ground was uneven, the fuel units were propped up with stones or sticks to keep them upright" ("RO-16," p 9).

"The portable flamethrower could be fired from the kneeling, prone, or standing position. In the standing position, the gun was held waist or chest high. At the direction of the Officer in Charge or the instructor, the weapon was fired. To fire the portable flamethrower, the trigger safety key was vigorously struck with the heel of the left thumb and held. When the ignition 'pop' was heard or flash was observed, the fuel discharge valve was squeezed wide open with the right hand. It may have been desirable to soak the target with fuel first and ignite it afterward. With the master switches 'on', the E1-7R1 mechanized flamethrower gunner pushed the ignition and fuel firing safety switches on and released the mechanical fuel

firing safety lock. He then pressed his left foot down on the foot control igniter pedal and kept it there. The main fuel firing button was pushed with the right foot, firing the ignited main fuel from the gun. For the M3-4-E6R3 mechanized flamethrower, the gunner unlocked the trigger and pulled it all the way to the rear. This fired the flamethrower. In the case of field flame expedient weapons, the weapons in a training environment were normally command detonated using standard demolition procedures. For the M202 rocket launcher, the gunner, on command, would fire the weapon" ("RO-16," pp 9-10).

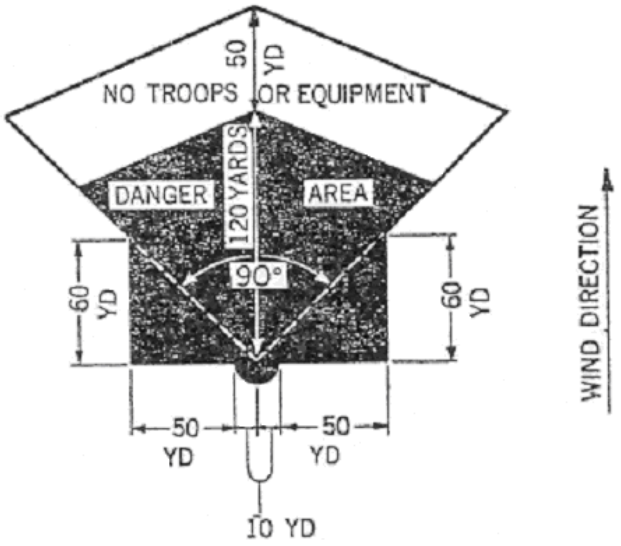
"After the firing was completed, the portable flamethrower was emptied of unexpended fuel, the pressure cylinders were emptied, and the weapon was disassembled and prepared for transport and storage. This may have been performed prior to leaving the range. For the M3-4-E6R3 mechanized flamethrower, the remaining fuel was fired if almost all the fuel had been expended. If most of the fuel had not been expended, the blow-out lever was depressed to clear the gun. After firing, the fuel firing safety lock was locked and the ignition and fuel firing safety switches were turned off on the E12-7R1 mechanized flamethrower. After firing, first echelon (Operator) maintenance was performed. If the squad was immediately returning to the garrison after firing, first echelon (Operator) maintenance may have been postponed until the squad arrived at their destination." Troops then policed the area and buried trash in a foxhole, if they were on their way to do more training, or took the trash offsite to a proper disposal facility ("RO-16," pp 11-12).

Layouts and danger areas

"A practice range free of vegetation and other inflammable matter must be available. For portable flamethrowers, the minimum area was 120 yd by 100 yd. For mechanized flamethrowers, the minimum area was 300 x 120 yd" ("RO-16," pp 13-14). "In 1945, a range that provided at least 125 yd for range and 30 yd for spread was required for the portable flamethrower. The standard range layouts for a portable flamethrower range and mechanized flamethrower range are depicted in Figures 142 and 143 below, respectively" ("RO-16," p 16). "Beginning in 1968, these two range drawings were combined into one drawing with variable boundaries as shown in Figure 144 below" ("RO-16," p 17).



Figure 141. Portable flamethrowers at the Munroe Impact Area at Fort Bragg, NC, 5 June 1951 (NARA College Park, RG 111-SC WWII, box 212, photo SC376203).



Surface danger areas when firing portable flame thrower.

Figure 142. Portable flamethrower surface danger area, circa 1949-1955 (SR 385-310-1, Regulations for firing ammunition for training, target practice, and combat, 4 March 1949, para 34).

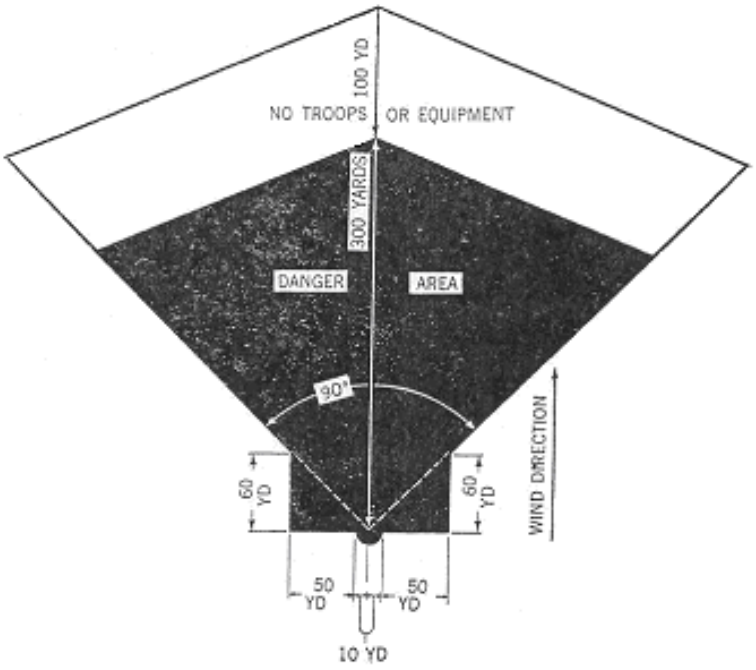


Figure 143. Mechanized flamethrower surface danger area, circa 1949 (AR 385-63/AFR 50-13, Regulations for firing ammunition for training, target practice, and combat, 5 December 1955, pp 53, 54).

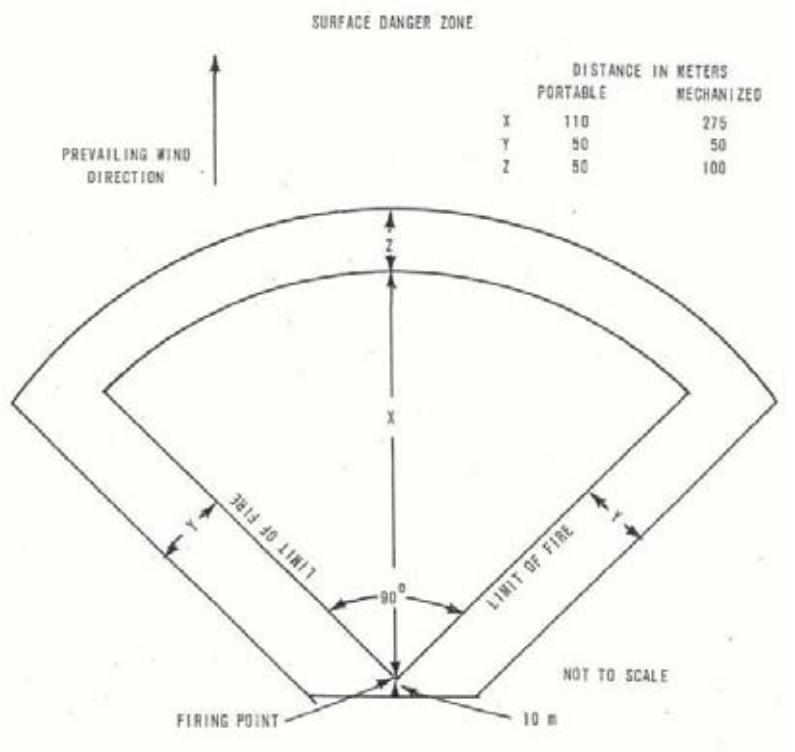


Figure 144. Flamethrower surface danger areas, circa 1968 – 1983 (AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 17 June 1968, Ch 17).

"Field flame expedient weapons could be used on flamethrower ranges because they were designed to attack the same types of targets as standard flamethrowers. If field flame expedient weapons were used, the safety requirements for demolition areas also applied to the range. This was accomplished by overlaying a demolition area safety fan over the existing standard flamethrower safety fan with the total safety fan being a combination of the two fans. A demolition range safety fan was a circle of a specified radius centered on the demolition site. In 1955, the range safety requirements for mines, booby traps, and demolition materials were combined, and the radius used was dependent on the total net explosive weight (NEW) being used. For a NEW less than 27 pounds, a safety distance of 300 yd was used. For a NEW between 27 pounds and 500 pounds, the safety distance was equal to the cubed root of the NEW multiplied by 100 yd. For a NEW over 500 pounds, the safety distance was 800 yd. By 1968, the dimensions were changed from yd to meters (e.g., 800 yd became 800 meters), thus somewhat increasing the size of the danger area" ("RO-16," p 18).

"The M202 rocket launcher firing the M74 incendiary rocket was also designed to attack targets similar to those for flamethrowers. If the physical location of the flamethrower range permitted, a rocket range was overlaid on the flamethrower range to allow the use of the same targets. The rear danger zone for the M202 rocket launcher was 40 meters in 1970. The minimum safe range was approximately 20 meters. The effective range for point targets was approximately 200 meters, while the maximum range was approximately 750 meters. The 1978 edition of AR 385-63 is the first range safety regulation to mention the M74 rocket. The surface danger area for the M74 rocket in 1978 is shown in Figure 145 below. The dimensions for a rocket range firing the M74 rocket in 1978 and 1983 are provided in Table 12 below. Selected data regarding the various rocket calibers and their performance are presented in Table 13 below" ("RO-16," pp 18-20).

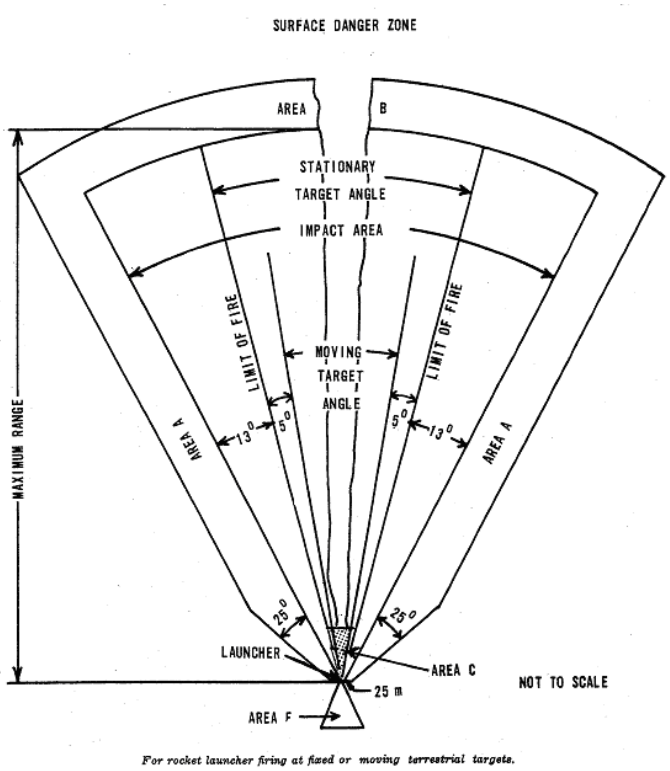


Figure 145. M74 66mm shoulder-launched rocket range, circa 1978 ("RO-16" Fig.6, p 19).

Table 12. Performance data for 66mm M74 rocket.

Year	Rocket Caliber	Ammunition Type	Danger Area Dimensions (meters)					
			X	A	B	C	F (base)	F (height)
1978	66mm	Incendiary, M74	--	100	100	50	38	40
1983	66mm	Incendiary, M74	1000	100	100	50	38	40

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
AR 385-63/1978	66mm	M74	Incendiary	Not identified	Not given
TM 43-0001-30/1981	66mm	M74	Incendiary	M202A1	825
AR 385-63/1983	66mm	M74	Incendiary	Not identified	1,000

Source: RO16 tab3 pg20, AR 385-63/MCO P3570.1A, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, p 8-1, TM 43-0001-30, Army ammunition data sheets for rockets, rocket systems, rocket fuses, rocket motors (Federal supply class 1340), 1 December 1981, pp 2-11 – 2-25, AR 385-63/MCO P3570.1A, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 15 November 1983, p 8-1.

Table 13. Flamethrower targets.

Table I. Flame Targets and Selection of Flamethrower Fuel for Firing Against Specific Targets

Target	Thickened fuel	Unthickened fuel*
Pillboxes, bunkers, covered foxholes, and fortifications having small gun ports:		
Ventilated	Excellent	Poor.
Poorly ventilated	do	Excellent.
Enemy personnel in open foxholes, trenches	Good	Do.
Enemy personnel in built-up areas	Excellent	Do.
Armored vehicles:		
Open ports, hatches	do	Good.
Engine air intake ports	Poor	Excellent.
Supplies, all types, general	Good	Poor.
Unarmored vehicles:		
Carrying personnel	do	Excellent.
Unoccupied	do	Poor.
Gun positions	Excellent	Good.
Wires and cables	do	Do.
Small arms ammunition	do	Do.

Source: FM 20-33, ground flame warfare, 23 May 1960, p 5, FM 20-33, Combat flame operations, 17 March 1965, p 8, FM 20-33, Combat flame operations, 2 June 1967, p 4, FM 20-33, Combat flame operations, 16 July 1970, p 1-3.

Targets

"No specific information on targets used on flamethrower ranges has been uncovered. Investigations performed at numerous closed and active installations indicate that items such as metal drums and concrete bunkers have been used on some installations. The types of targets against which portable and mechanized flamethrowers were employed are identified in Table 15 below. It is possible that training exercises with the flamethrower utilized these targets or simulated versions of these targets" ("RO-16," pp 34-35).

Buildings

"No specific buildings were directly associated with the flamethrower range." ("RO-16," p 15).

40mm grenade launcher and machine gun ranges

These ranges were used to train individuals, crews, squads, platoons, and mechanized, motorized, combat support, and combat service support units to fire 40mm grenade launchers and machine guns at realistic fixed targets. Ranges usually consisted of a line of firing positions each with its own

firing lane of close, mid- and long-range targets. These included zeroing targets, point targets (enemy bunkers, windows, doors, weapons emplacements, light-skinned vehicles, and troops with a single aiming point), area targets (objects or outlines of men irregularly spaced along covered and concealed areas such as ground folds, hedges, and borders of woods), BMPs, thin-skinned vehicles, simulated dismounted troops, and others. Groups of soldiers took turns firing stationary positions on the firing line, including prone, kneeling, foxhole, standing, tripod, and vehicle mounted positions.

Historical background

"Every Ground Forces Training Center would likely have had a 40mm grenade launcher range. It is unclear if the 40mm grenade machine gun was organic to ground troops. Therefore, installation-specific information should be obtained to determine if training was conducted on the 40mm grenade machine gun at a particular installation. Initially, the 40mm grenade launcher weapon system was classified and the range for its use was located in a secure impact area shared with the Davy Crockett weapon system. After 1968, the 40mm grenade launcher range appeared as a separate range. By 1973, the 40mm grenade launcher range was treated as a normal range, indicating that it no longer required a secure impact area. However, due to the hazards associated with 40mm grenade duds, the 40mm grenade launcher range was normally kept separate from other ranges on a Ground Forces Training Center. The 40mm grenade machine gun could be used with other weapons on a 40mm grenade launcher range and a multipurpose range complex, or exclusively on a separate 40mm grenade machine gun range" ("RO-15," p ES2). "Because of initial classified nature of the 40mm grenade weapons systems and unique hazards associated with the weapons systems, this range is discussed separately from hand grenades, rifle grenades, and those small arms caliber machine guns. This section is not applicable to the 40mm grenade machine gun mounted on helicopters" ("RO-15," pp 1-2).

Training procedures

"Prior to the movement to the 40mm grenade launcher and machine gun range, weapons were drawn from the armory and munitions were drawn from the ammunition supply point (ASP). Both were normally transported to the range using organic (integral) vehicles. The ground-mounted MK 19 had three crew members: the gunner, the assistant gunner, and the ammunition bearer. In addition to individual weapons and equipment, each

crew member carried specific equipment used with the tripod-mounted MK 19. Grenadiers were authorized to disassemble, check, and inspect the 40mm grenade launcher. To prepare for firing, the bore of the launcher was checked to ensure it was clear and dry, the launcher checked to ensure it was clean, and the launcher inspected for defective parts. Grenadiers were authorized to clear, inspect, disassemble, load, and charge the 40mm grenade machine gun" ("RO-15," p 8).

"On command from the officer in charge, the M203 and M79 grenadier moved to his station and took a firing position. The most commonly used firing positions were the prone, kneeling, foxhole, and standing positions. The MK 19 crew leader commanded and signaled GUN TO BE MOUNTED, and pointed to the position where the gun was to be mounted. At the command or signal ACTION, the assistant gunner dragged the tripod to the firing position and the gunner carried the MK 19 40mm machine gun receiver to the tripod. After mounting the weapon on the tripod, the gunner opened the top cover and the assistant gunner inserted the first round into the feeder. The gunner closed the top cover and charged the weapon. The gunner pressed the trigger, which placed the lead round in the bolt extractor. He charged the weapon a second time, forcing the lead round from the bolt extractors into the bolt fingers. The weapon was then ready to fire. For the 40mm grenade launcher, an ammunition point was established at each lane of the firing range and supervised by a noncommissioned safety officer. Ammunition was drawn and issued by the assistant instructor at each station. The ammunition point for the 40mm grenade machine gun was at least 75 meters behind the firing line, and 50 meters from all weapons" ("RO-15," pp 8-9).

"For immediate engagement of the target with the 40mm grenade machine gun, the crew leader gave the command FIRE. The gunner placed the safety switch on FIRE and pressed the trigger. At the command, READY ON THE FIRING LINE, COMMENCE FIRING, the 40mm grenade launcher was fired. At the command, OUT OF ACTION, the gunner raised the top cover of the 40mm grenade machine gun; the assistant gunner released the ammunition belt from the feed tray and placed it in the ammunition can. The gunner placed the round or spent cartridge case in the ammunition can, and closed the top cover. The assistant gunner released the gun from the gun cradle and lifted the gun off the mount. The ammunition bearer came forward and collected the ammunition can(s) or any other loose equipment. 40mm machine gun grenadiers were authorized to clean and lubricate their weapons after firing and before returning

them to storage. After firing, the 40mm grenade launcher grenadier cleared his weapon and moved off the firing line. During training, moving parts on the 40mm grenade machine gun were lubricated. If the 40mm grenade launcher failed to fire, the breech was opened to remove the misfired round after a wait of 30 seconds. Local regulations and safety concerns would determine if the item was destroyed in place or transported to a disposal area." Troops then policed the area, taking trash to an offsite disposal area, or burying trash in a fox hole if they were on their way to do more training ("RO-15," pp 8-11).

Weapons

"The earliest reference to 40mm grenade launchers is in a 1964 edition of AR 210-21. The first weapon deployed was the M79 40mm grenade launcher, a single-shot, break open, breech-loading, shoulder-fired weapon, followed by the M203, a light-weight, single-shot, breech loaded, pump action (sliding barrel), shoulder-fired weapon attached to the M16/M16A1 rifle. The 40mm grenade machine gun, MK 19 followed a separate line of development. Development of the MK19 began in 1963. The first version was a hand-cranked multiple grenade launcher called the MK 18. In 1976, a complete redesign resulted in the MK 19 MOD 3, which the Army adopted in 1983. The Army used the MK 19 within the tactical environment for defense, retrograde, patrolling, rear area security, military operations on urbanized terrain (MOUT), and special operations" ("RO-15," p 2).

"There were several types of 40mm grenade launcher and machine gun ammunition: high explosive (HE), HE air burst, HE smokeless and flashless, HE dual purpose (HEDP), star parachute, star cluster, ground marker smoke, CS, and practice. Ammunition used with the 40mm grenade machine gun included HEDP, HE, and dummy rounds" ("RO-15," p ES2)

Layouts

40mm grenade launcher range

"Reference to construction of a separate range accommodating the 40mm grenade launcher was located in the 1964 and 1968 editions of AR 210-21. Firing the launcher was not feasible from artillery firing positions and a separate range was necessary due to the requirement for a secure impact area. Subsequent editions of AR 210-21 make no mention of 40mm grenade launchers or separate ranges. The 1964 edition of AR 210-21 listed the required number of 40mm grenade launcher ranges as one. The 1968

edition divided the range for grenade launcher ranges further as shown in Table 14 below" ("RO-15," p 15).

Table 14. Firing range requirements for 40mm grenade launcher, circa 1968.

(2)	(3)	(4)	(5)	(6) Number of Ranges Required for										(7)	(8)
Type *	OCE Folio No 1 Drawing No	References	Positions, Points or Lanes per Range	Inf	Inf Mech	Abn	Armor	Air Mbl	Armd Cav	FA	AD	Sig	Engr	Cmbt Serv Spt	Size Unit	Remarks
Grenade, Launcher, M-79		FM 23-31 TC 23-9	8	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1	1	1	1	1	Co Bn Bde/ Regt Div	Separate range required because of secure impact area requirements. 4 pts for Armor Bde.

Soure: AR 210-21, Installations, Training Areas and Facilities for Ground Troops, 18 December 1964, p 3, 6.

"A layout of surface danger areas for 40mm grenade launchers was provided in the 1973 and 1978 editions of AR 385-63 and is reproduced as Figure 146 below. The 1983 edition of AR 385-63 increased the 100-meter dimension in the 1973 and 1978 editions to 130 meters" ("RO-15," p 16).

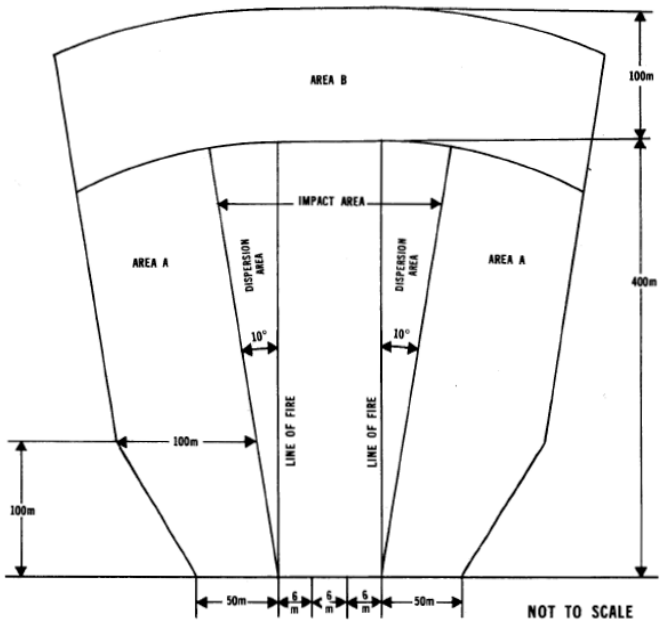


Figure 146. Surface danger areas, 40mm grenade launchers, circa 1973-1978 (AR 385-63, Safety, regulations for firing ammunition for training, target practice, and combat, 28 February 1973, p 8-4; AR 385-63/Marine Corps Order (MCO) P3570.1, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, p 7-4).

"The 40mm grenade launcher range consisted of one or more lanes, and each lane was complete within itself. A minimum width of 30 meters and maximum depth of 500 meters was provided. Targets were grouped and

spaced within the lane so the grenadier could fire at close range, mid-range, and long-range targets, in that order. A number of parallel lanes could be established on the range depending on the terrain. Station 1 was a prone firing position with a log or sandbag support and a zeroing target. Station 2 was an upright log or log wall-firing point about 4 ft high and two point-type targets. Station 3 was a foxhole firing point and two targets. Station 4 was a prone firing point with a log or sandbag support and two area targets. A schematic illustration of one lane of a grenade launcher range is presented in Figure 147 below" ("RO-15," p 17).

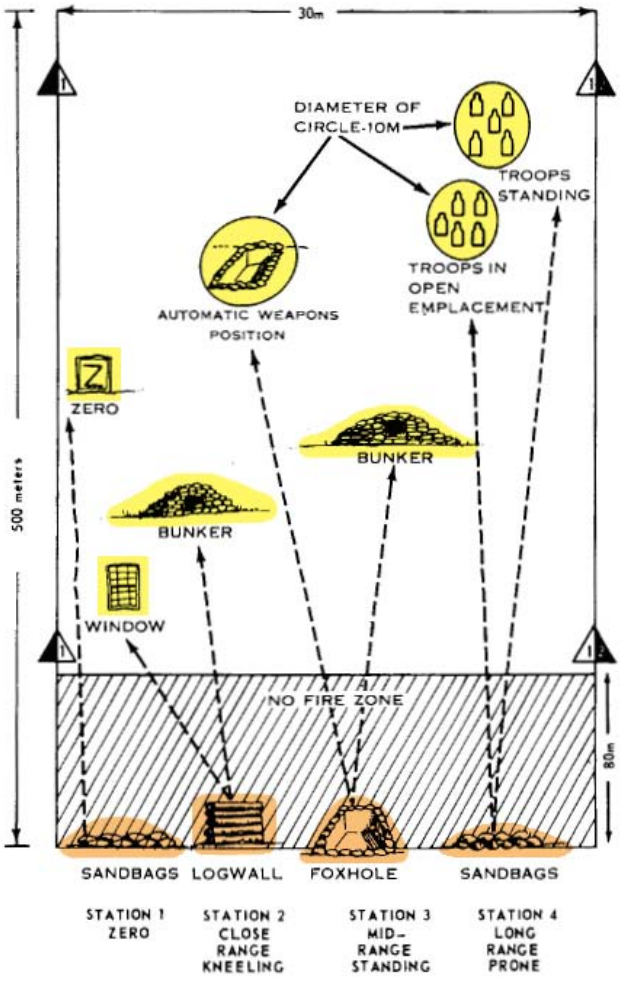


Figure 147. Lane schematic for live fire 40mm grenade launcher range, circa 1972 (FM 23-31, 40mm grenade launchers M203 and M79, 1 May 1972, pp 7-1, 7-2).

"Slight modifications to the range design had occurred by 1994. Accordingly, the range had four self-contained stations, was 30 meters wide by 500 meters deep, and had a no-HE fire zone out to 165 meters. Grenadiers could fire HE only at Stations 1, 3, and 4 and a HE no-fire zone was incorporated into the range. The configuration of the four stations, however,

was the same as in the 1974 edition. A schematic illustration of the modified grenade launcher range is presented in Figure 148 below. It is unclear when these modifications went into effect" ("RO-15," p 18).

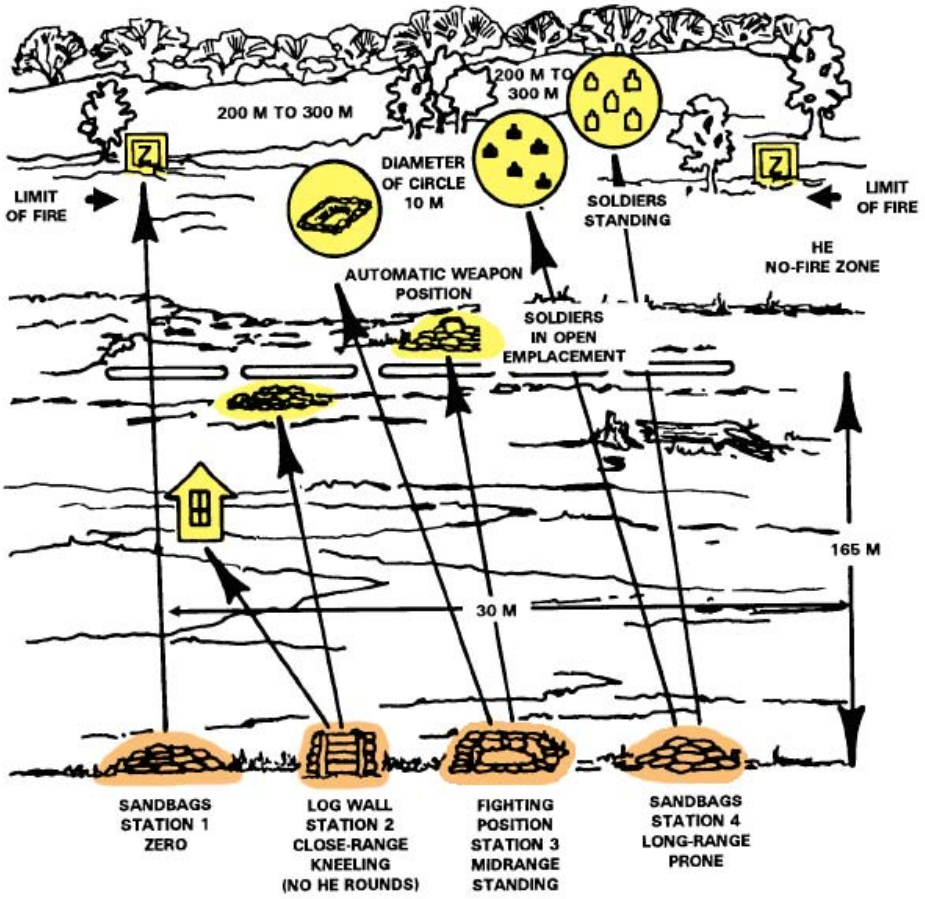


Figure 148. 40mm grenade launcher range, circa 1994 (FM 23-31, 40mm grenade launchers M203 and M79, 30 September 1994, p 5-13).

"Both point and area targets were placed on the 40mm grenade launcher range. Point targets included enemy bunkers, windows, doors, weapons emplacements, light-skinned vehicles, and troops with a single aiming point. The point zeroing target was constructed of logs or other suitable material. It had a surface at least 2 meters high by 2 meters wide (6 x 6 ft). The target was clearly marked with a large "Z" painted in a color that contrasted with the surrounding background and was visible in different sun or glare conditions. The enemy bunker and weapons emplacements were constructed of logs, sandbags, or other suitable material.

Area targets consisted of objects or outlines of men irregularly spaced along covered and concealed areas (ground folds, hedges, and borders of woods). These targets may have had considerable width and depth, and

required extensive right or left and searching fire. A deployed platoon is one example of an area target. One area-type target was constructed of logs, sandbags, or other suitable material to represent an automatic weapon position. E-type and F-type silhouettes were used to represent a deployed platoon. Most of the area-type targets were detected by smoke, flash, dust, noise, or movement, and were visible only for a moment. The E- and F-type silhouette targets are shown in Figure 149 below" ("RO-15," pp 32-34).

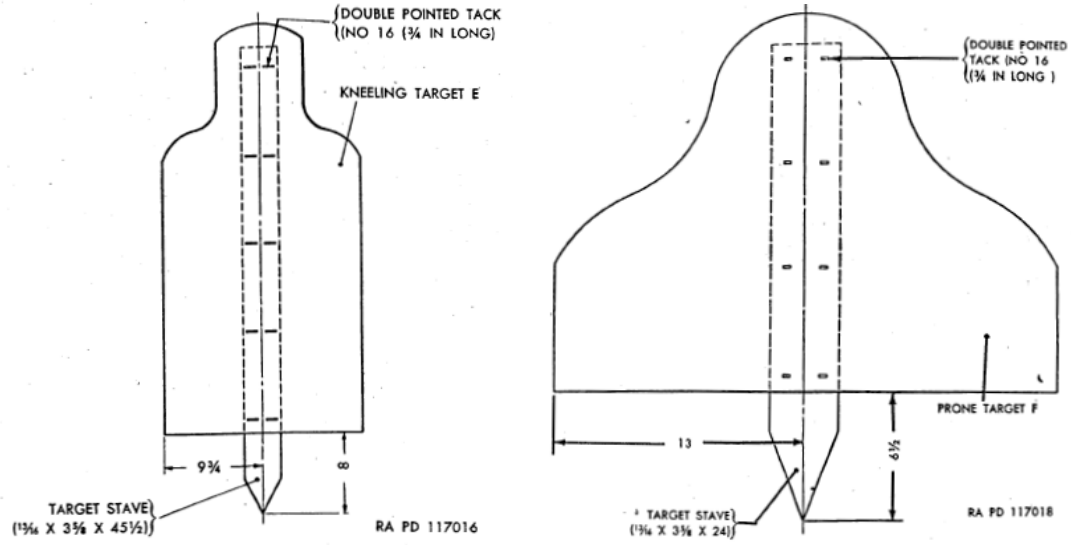


Figure 149. Kneeling pasteboard target e and prone pasteboard target F, circa 1951 (TM 9-855, Targets, target materials, and rifle range construction, 17 November 1951, pp 174, 176).

40mm grenade machine gun range

"The 40mm machine gun could be used with other weapons on a 40mm grenade launcher range, a multipurpose range complex (MPRC), or exclusively on a crew gunnery range. An MPRC was the range suggested for live-fire training. When an MPRC was not available, a gun crew gunnery range was used. The 1983 edition of AR 385-63 was the first edition of this regulation to mention the 40mm grenade machine gun. The range layout for the gun was the same as that for the 40mm grenade launcher, except the maximum range (Distance X) was established at 2,200 meters and could not be reduced (see Figure 146 above)" ("RO-15," p 18).

"The 40mm grenade machine gun gunnery range was designed only for 40mm machine gun firing. Individual, squad or platoon exercises and qualifying could be conducted at this range. The gun target engagement area had uniformly level or upward-sloping terrain with targets such as BMPs, thin-skinned vehicles, or simulated dismounted troops. The two

types of targets on the range were area and point targets. Point targets included troop targets with four or less silhouettes or BMP targets at less than 1,100 meters. Area targets included troop targets with more than four silhouettes or BMPs at greater than 1,100 meters" ("RO-15," pp 32-34).

"Three types of ranges were used for 40mm grenade machine gun live-fire training. Regardless of which range was used, the gun could be fired from a tripod or a vehicle. The first type of range was a 40mm grenade machine gun range designed for individual firing exercises and qualifying. The second type of range was the MK 19 crew gunnery range. When a MPRC was not available, the gun crew gunnery range was used. The gun crew gunnery range was designed only for 40mm machine gun firing. Individual, squad or platoon exercises and qualifying could be conducted at this range. The firing line had six positions, 50 meters apart. The control tower was 20 meters behind the firing line and tower control personnel could observe the entire firing line. The layout for this range is shown in Figure 150 below and schematic details in Figure 151 below" ("RO-15," p 19).

"The third type of range was the MPRC. The MPRC was the range suggested for 40mm grenade machine gun live fire training. It was used to train mechanized, motorized, combat support, and combat service support units. The design and characteristics of this range were described in FM 25-7. Only M385 or M918 practice rounds were used at this range" ("RO-15," p 20).

Firing lines

"The most commonly used firing positions were the prone (sometimes with a log or sandbag support), kneeling, foxhole, and standing positions (sometimes with an upright log or log wall support)" ("RO-15," pp 8-9). On the 40mm grenade machine gun range, MK 19 crew gunnery range, and MPRC, the gun could be fired from a tripod or a vehicle ("RO-15," p 19).

Embankments/trenches/etc.

Firing lines may have included foxholes, log walls, and other firing position supports. Targets (including mock enemy bunkers and weapons emplacements) were also created with and/or partially concealed by logs, sandbags, and embankments.

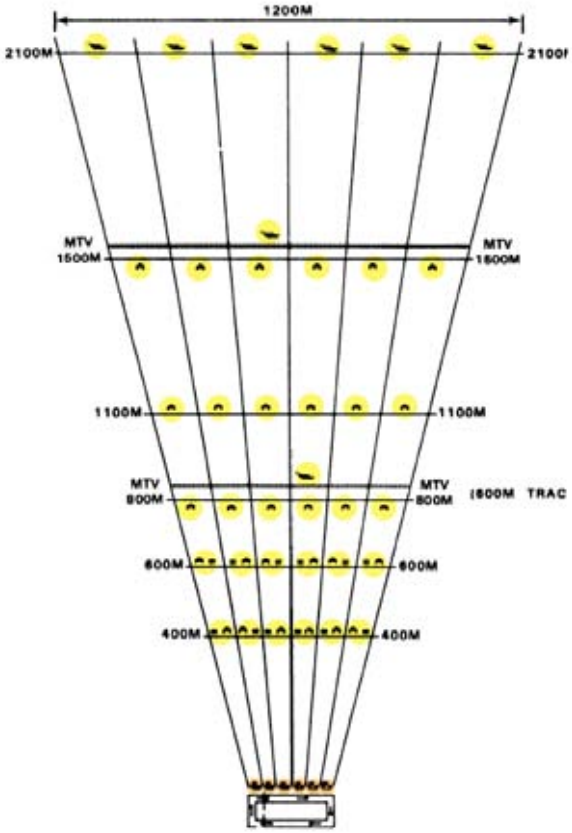


Figure 150. 40mm machine gun crew gunnery range, circa 1988 ("RO-15," p 19).

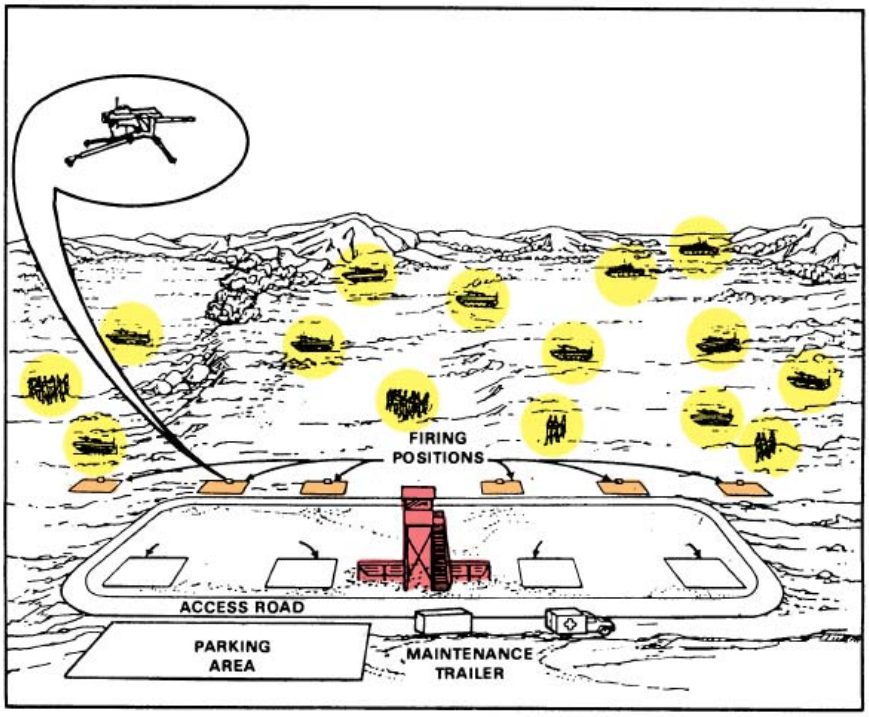


Figure 151. Schematic of 40mm grenade machine gun range, circa 1988 ("RO-15," p 20).

Buildings

Control and observation towers, bleachers, and maintenance trailers are mentioned in the drawings for these ranges. A range may also have had a latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings ("RO-15," p 13).

Mortar range

Mortar crews were trained on these ranges to fire mortar rounds at fixed targets. Ranges usually consisted of a firing line of multiple firing positions (sometimes with an embankment directly in front of it to simulate firing from a fortified position), lighted aiming stakes, and natural terrain targets or silhouette targets placed inside a circle of target stakes. Crews took turns firing high explosive, chemical, and practice mortar rounds from their fixed position on the firing line.

Historical background

"Mortar ranges would have been found on Ground Forces Training Centers where infantry, armored, and mechanized units were garrisoned and conducted training with organic weapons. Two ranges per division were typical. The 4-in. and 4.2-in. mortars were controlled by the Chemical Warfare Service (CWS) and were operated by chemical warfare units. Training on the use of these weapons was conducted at locations where Chemical Schools were established. The 4.2-in. mortar was initially a CWS weapon but was later found to be so effective that it was eventually provided to divisions as an organic weapon" ("RO-4," p ES2).

Training procedures

On arrival at the Mortar Range, troops received weapons from the armory and ammunition from the ammunition supply point. "The mortar squad removed the mortar from its travel configuration and emplaced it at the firing point in preparation for firing. This activity included assembling the weapon, placing firing stakes, and possibly digging a firing position. Before firing the 4.2-in. mortar, the mortar squad leader supervised the crew members to make sure safety checks were conducted. In preparation for firing, metal moving parts were cleaned and lightly oiled to ensure efficient functioning of the mortar. Additionally, the assistant gunner checked the

4.2-in. mortar to ensure the bore was clean and the barrel free from oil or water" ("RO-4," p 8).

"The 4.2-in. mortar rounds were delivered to the mortar position packed in waterproof containers. The rounds were unpacked, the required number of propellant charges prepared, and the charges fastened firmly between the striker nut and the propellant holder. The rounds were staged at the mortar position. A ready supply of ammunition was available to the 81mm mounted mortar squad. Because the 3-in. mortar ammunition was issued disassembled, it was necessary to assemble the ammunition in preparation for firing. As part of the assembly, the number of powder rings required for the zone to be fired was added. Although the 81mm and 60mm mortars were issued as complete rounds, it was necessary to adjust the number of propellant increments (bundles of sheet powder or capsules of granular powder) for the zone to be fired" ("RO-4," p 9).

"After firing, the mortar was inspected, and after firing, first echelon (Operator) maintenance activities were conducted. This normally consisted of cleaning and lubricating the weapon as specified in the appropriate manual. The mortar squad disassembled the weapon and placed it in a travel configuration. Unused ammunition was repackaged and returned to the appropriate storage facility" ("RO-4," p 9). Misfired rounds were either fixed or destroyed by ordnance personnel, propellant increments were burned or returned to the ammunition supply point for disposal, and troops policed the area and either took trash to a disposal or put it in a foxhole if they were on their way to do more training ("RO-4," pp 9-11).

Weapons

"The 60mm, 81mm, 3-in., 4-in., 4.2-in., and 6-in. mortar rounds, in many variants and with different fillers, were used on mortar ranges. There were generally three types of mortar rounds: high explosive, chemical, and practice. Chemical rounds for training consisted of smoke and illumination. For mortar rounds with fins, propellant increments were small bags attached between the fins using clips. For mortar rounds without fins, the propellant increments were slipped over the igniter tube. Practice rounds did not have propellant increments" ("RO-4," p ES2).

Layouts and danger areas

"A typical mortar range layout was divided into six areas (A, B, C, D, E, and the Impact Area) as shown in Figure 152 below. All firing was planned

for the Target Area that was within the Impact Area. Areas A, B, and C were danger areas that served as buffer zones for the impact area. The A, B, and C distances were established by using the data provided in Table 15 below and measuring out from the Impact Area. No firing into the buffer zones was planned. With proper safety precautions, troops could occupy Area D. Distance X was determined by the installation based on available terrain. It could not exceed the maximum range of the weapon. If the X distance was less than the maximum range of the weapon, the installation would ensure safe operation by limiting the number of propellant charges authorized for the range. Area E was the area immediately forward of the weapon where the actual firing of the weapon presented a hazard to unprotected personnel. If open burning of propellant bags was conducted, it would normally have occurred in Area E" ("RO-4," pp 15, 16)

"Investigations performed at numerous closed and active installations indicate that, in practice at ground forces training installations, the target area and areas A, B, and C of a range would fall within an established impact area. The firing points were identified; however, Area D was normally not shown on installation range maps. Installation range regulations specified firing restrictions for the specific firing point to ensure that all rounds fired would land within the established impact area" ("RO-4," p 17).

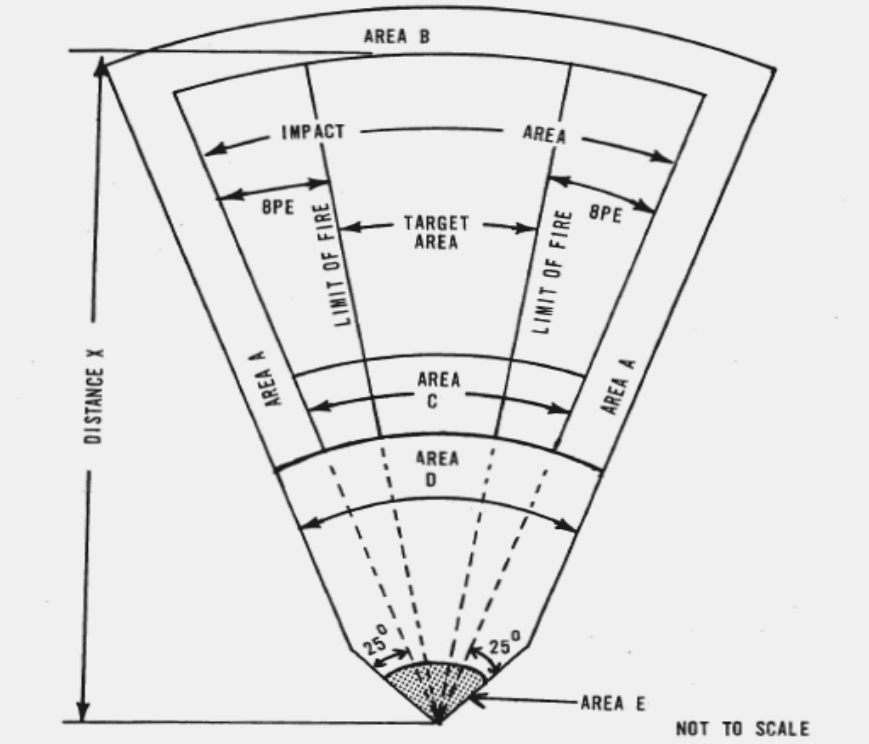


Figure 152. Typical mortar range layout, circa 1942 - 1983 ("RO-4," p 16).

Table 15. Mortar range danger area dimensions.

Year	Mortar Caliber	Ammunition Type	Danger Area Dimensions*		
			A	B	C
1931	Not specified	Chemical	600	2,000	2,000
	4”	Chemical	1500	500	200
	4.2”	Chemical	3000	600	200
1939	81mm	High Explosive (HE)	600	2,000	800
		Other than HE	600	2,000	2,000
	3”	HE	600	2,000	800
		Other than HE	600	2,000	2,000
	4”	Chemical	1500	500	200
	4.2”	Chemical	3000	500	200
1942	4”	Chemical	1500	500	200
	4.2”	Chemical	3000	600	200
	60mm	HE	600	600	600
		Chemical & Practice	300	300	300
	81mm	HE	600	600	600
		Chemical & Practice	300	300	300
1944	60mm	All	300	300	150
	81mm	All	300	300	250
	4.2”	Chemical	300	600	500
		HE	600	800	800
1949	60mm	All	300	300	150
	81mm	All	300	500	400
	4.2”	Chemical	300	600	300
		HE	600	800	300
1955	60mm	All	300	300	150
	81mm	All	400	500	400
1968	60mm	All	274	328	150
	81mm	All	383	438	400
	4.2”	All	438	547	400
1973	60mm	All	492	602	NA
	81mm	All	520	629	NA
	4.2”	All	656	766	NA
1978	60mm	All	274	328	NA
	81mm	All	383	438	NA
	4.2”	All	438	547	NA
1983	60mm	All	274	328	NA
	81mm	All	383	438	NA
	4.2”	All	438	547	NA

Source: (“RO-4,” pp 21-22; AR 750-10, Range regulations for firing ammunition for training and target, 14 February 1942, pp 6, 9; SR 385-310-1, Safety regulations for firing ammunition for train-

ing, target practice and combat, 4 March 1949; AR 385-63, Policies and procedures for firing ammunition for training, target practice and combat, 15 October 1983; TR 140-5, Range regulations for firing ammunition in time of peace, 20 November 1931, pp 4, 5; AR 750-10, Range regulations for firing ammunition in time of peace, 22 May 1939, pp 5, 6; AR 750-10, Range regulations for firing ammunition for training and target, 22 January 1944, pp 6, 12, 18; AR 385-63, Regulations for firing ammunition for training, target practice and combat, 5 December 1955, p 10; AR 385-63, Regulations for firing ammunition for training, target practice and combat, 17 June 1968, Ch.12; AR 385-63, Safety regulations for firing ammunition for training, target practice and combat, 1 May 1973, Ch 11; AR 385-63, Safety, policies and procedures for firing ammunition for training, target practice and combat, 22 February 1978, Ch 10). ("RO-4," pp 21-22; AR 750-10, Range regulations for firing ammunition for training and target, 14 February 1942, pp 6, 9; SR 385-310-1, Safety regulations for firing ammunition for training, target practice and combat, 4 March 1949; AR 385-63, Policies and procedures for firing ammunition for training, target practice and combat, 15 October 1983; TR 140-5, Range regulations for firing ammunition in time of peace, 20 November 1931, pp 4, 5; AR 750-10, Range regulations for firing ammunition in time of peace, 22 May 1939, pp 5, 6; AR 750-10, Range regulations for firing ammunition for training and target, 22 January 1944, pp 6, 12, 18; AR 385-63, Regulations for firing ammunition for training, target practice and combat, 5 December 1955, p 10; AR 385-63, Regulations for firing ammunition for training, target practice and combat, 17 June 1968, Ch.12; AR 385-63, Safety regulations for firing ammunition for training, target practice and combat, 1 May 1973, Ch 11; AR 385-63, Safety, policies and procedures for firing ammunition for training, target practice and combat, 22 February 1978, Ch 10).

*Dimensions are in yd.

Note: Not applicable (NA) because area C was no longer a separate danger area dimension for mortar ranges construction during 1978 and thereafter.

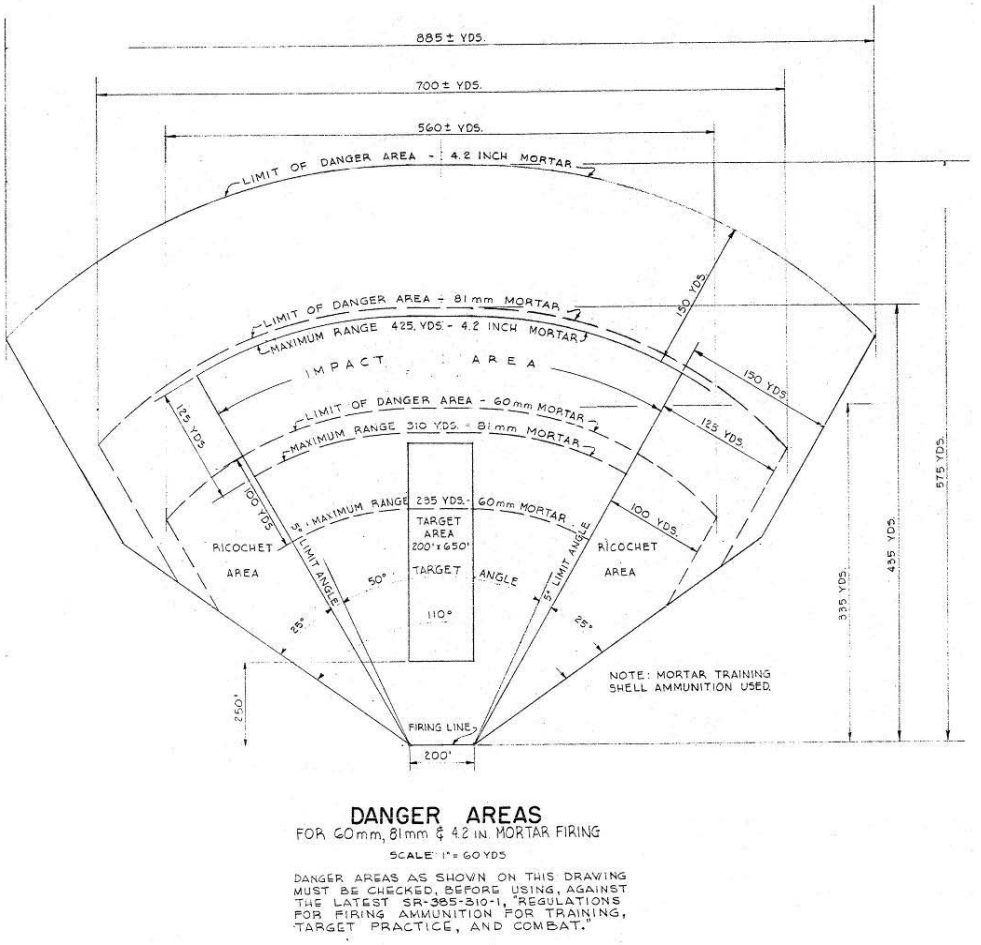


Figure 153. Danger areas, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 1 of 2, "Mortar training, shell range, plan and danger area," 5 January 1952).

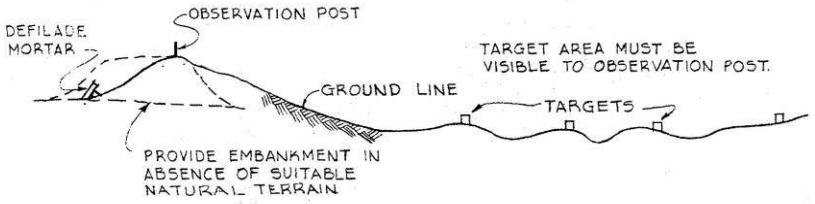


Figure 154. Mortar range schematic section of firing and target areas, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17, Sheet 1 of 2, "Mortar training, shell range, plan and danger area," 5 January 1952).

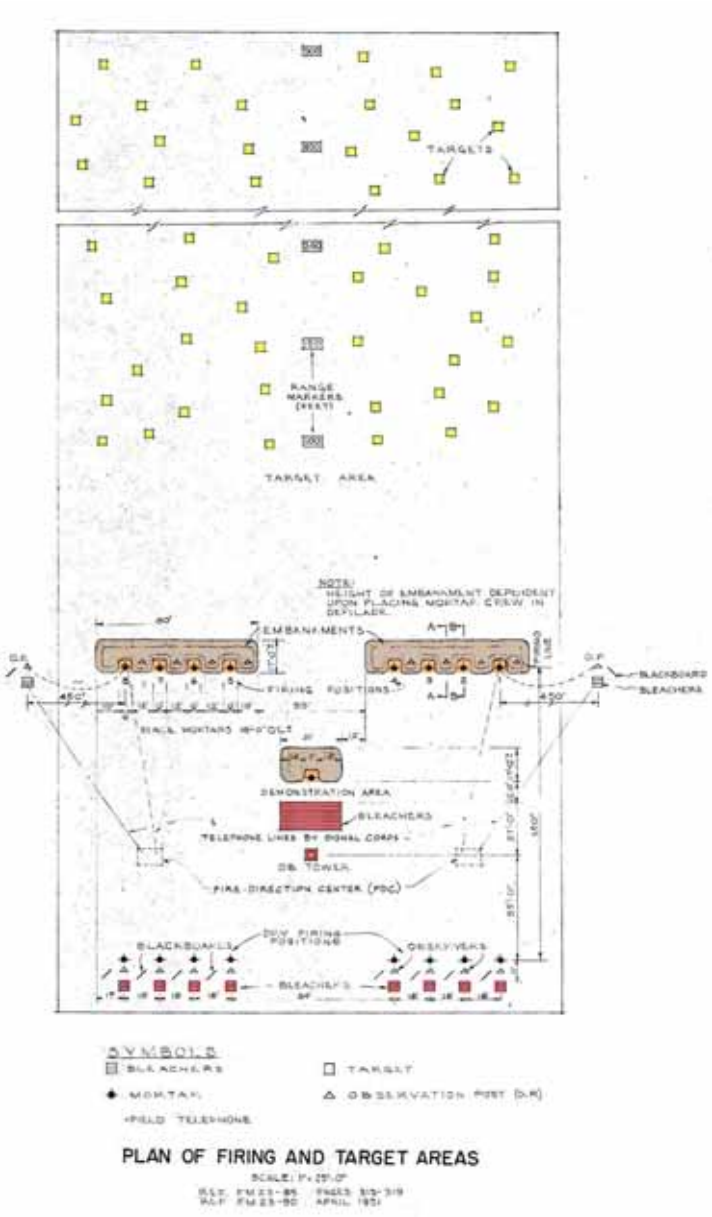


Figure 155. Mortar range plan of firing and target areas, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 1 of 2, "Mortar training, shell range, plan and danger area," 5 January 1952).

"A more detailed 'typical' configuration was introduced in 1955 and is depicted in Figure 156 below" ("RO-4," p 19).

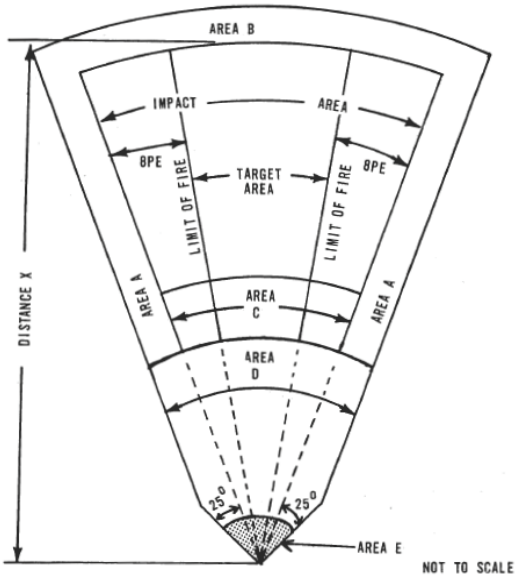


Figure 156. Typical mortar range layout, circa 1955 (AR 385-63, Regulations for firing ammunition for training, target practice and combat, 5 December 1955, p 21).

"By 1973, danger area dimensions C and D had been eliminated from the range configuration as shown in Figure 157 below. The typical range layout depicted in Figure 156 remained in effect through 1986 to the present. The dimensions of the danger areas (A, B, C) during various time periods are provided in Table 15 above" ("RO-4," pp 20-21).

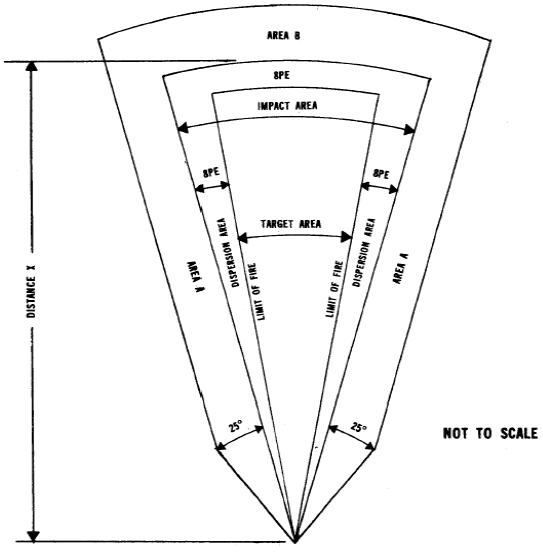


Figure 157. Typical mortar range layout, circa 1973-1986 (AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 28 February 1973, Ch 11).

Non-chemical and chemical mortars

"Range configurations for non-chemical and chemical mortars were not only noticeably different but also changed over time. The earliest configurations located in the available documentation are rectangular. These configurations are presented in Figures 158 and 159 below" ("RO-4," p 17).

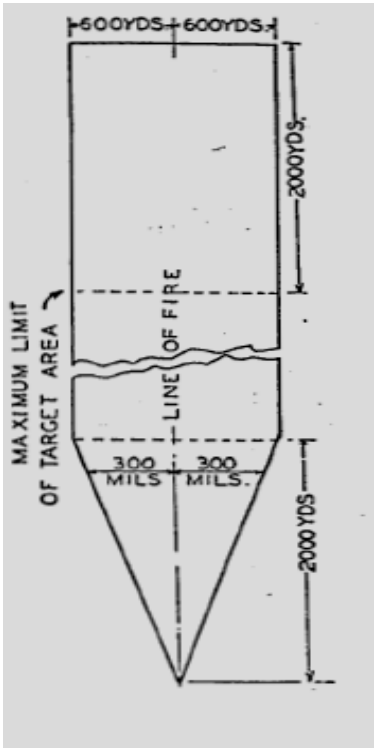


Figure 158. Range layout for non-chemical 81mm and 3-in. mortars, circa 1931 (TR 140-5, Range regulations for firing ammunition in time of peace, 20 November 1931, pp 4-6).

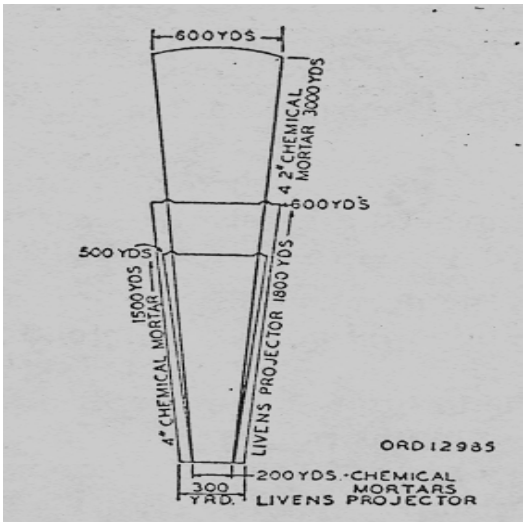


Figure 159. Range layout for 4-in. and 4.2-in. chemical mortars, circa 1931 (TR 140-5, Range regulations for firing ammunition in time of peace, 20 November 1931, pp 4-6).

"The configurations presented in Figures 158 and 159 remained in effect until 1942, when a more fan-shaped configuration was introduced as shown in Figure 160 below. This same fan-shaped configuration was also introduced for the chemical mortar in 1944" ("RO-4," p 18).

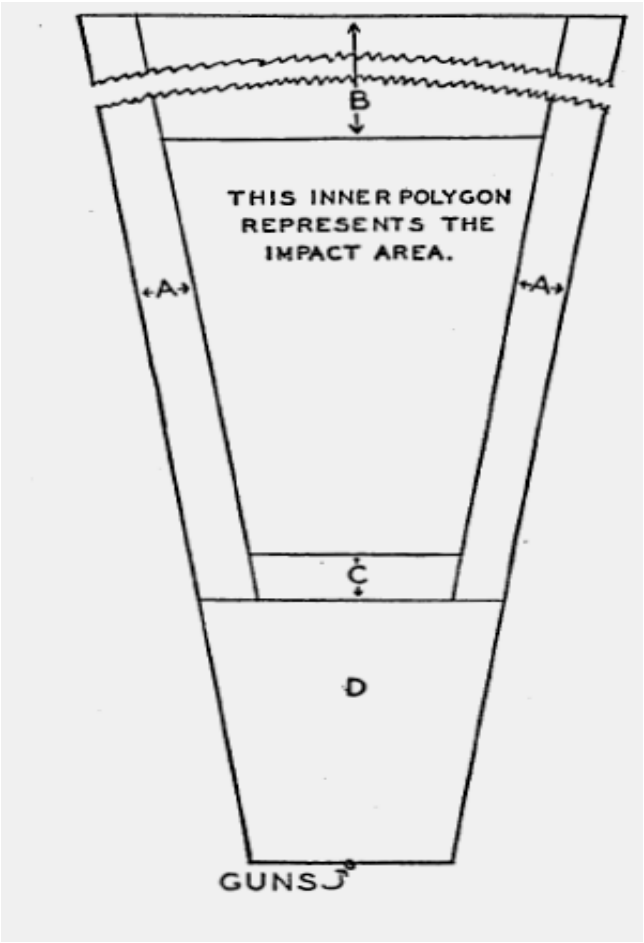


Figure 160. Range layout for non-chemical and chemical mortars, circa 1942-1944 (AR 750-10, Range regulations for firing ammunition for training and target, 14 February 1942, pp 6, 9).

1,000-in. range

One thousand inch miniature ranges with miniature villages were used to teach sight adjustment and range calculation.



Figure 161. Miniature villages are used on the 1000-in. mortar range to give the trainee practical experience in sight adjustment and range calculation at Fort Leonard Wood, MO, no date (NARA College Park, RG 111-SC WWII, box 200, photo SC361913).

Firing lines

Ranges had a line of multiple firing positions. At their individual firing position, mortar crews "placed firing stakes, and possibly dug a firing position" ("RO-4," p 8).



Figure 162. 75 mm infantry mortars, M2 in action at Aberdeen Proving Ground, MD, 8 October 1931 (NARA College Park, RG 111-SC WWI, box 712, photo 96144).



Figure 163. Mortar crew of the 60 mm mortar firing on the range at Fort Knox, KY, August 1942 (NARA College Park, RG 111-SC WWII, box 85, photo SC144291).



Figure 164. Soldiers fire an 81 mm mortar at Fort Bragg, NC, 14 February 1974 (NARA College Park, RG 111-SC post-1955, box 429, photo SC669353).

Targets

"Because the mortar is an indirect fire weapon, the actual target was not normally visible to the firing crew, and the crew had to employ target stakes as an aid to aiming the weapon." These stakes were lighted on the top to allow for night firing. Natural features of the landscape were used, when possible, as reference targets, but if none were available, intersecting silhouette targets were placed in a circle with a 1-yard radius, surrounded by stakes in a circle with a 25-yard radius ("RO-4," pp 39-40).

Embankments/trenches/etc.

Embankments were often built directly in front of firing positions to simulate firing from an indirect fortified position and to protect firing crews from flying debris.

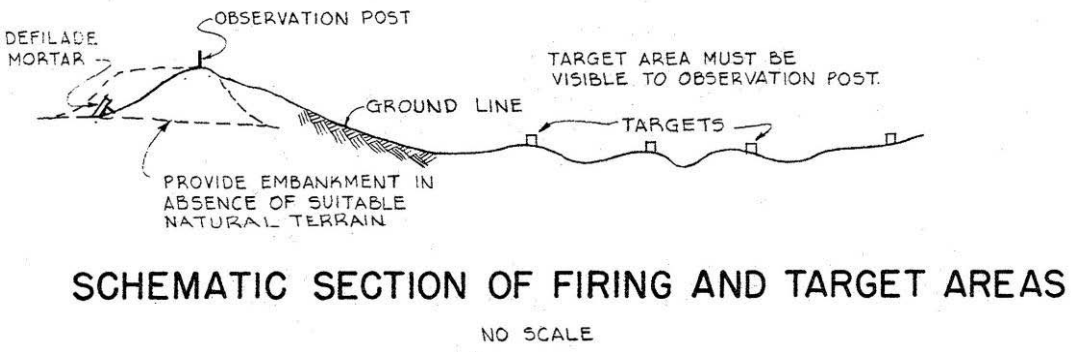


Figure 165. Mortar range schematic section of firing and target areas, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 1 of 2, "Mortar training, shell range, plan and danger are," 5 January 1952).

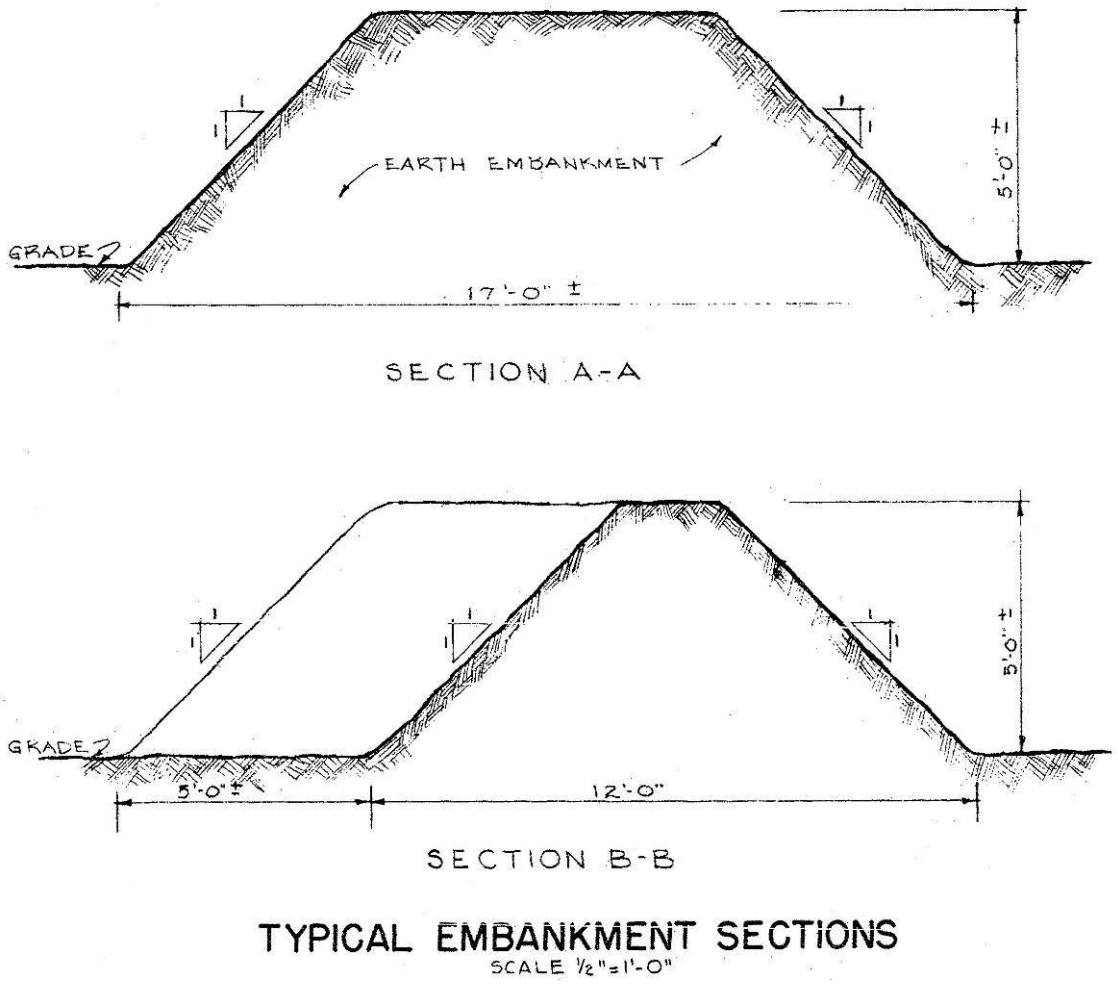


Figure 166. Mortar range typical embankment sections, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 2 of 2, "Mortar training, shell range, detail," 5 January 1952).

Buildings

A range may have had a control or observation tower, bleachers, latrine, target storage building, ammunition storage building, other storage sheds, and administrative or maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings. Some facilities such as target butts, target pits, and drainage facilities also supplemented range functions ("RO-4," p 14).

Observation tower

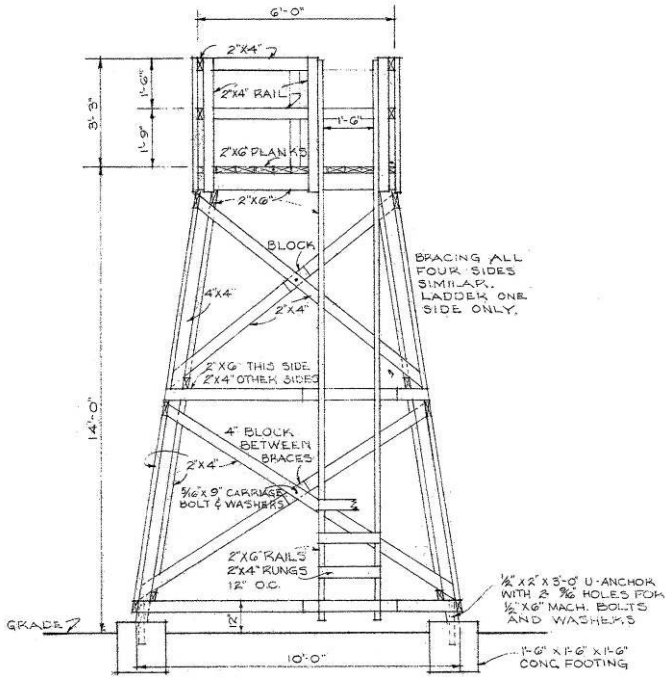


Figure 167. Mortar range observation tower elevation, Fort Bragg, NC, 1952 (Standard Drawing No. 28-13-09A drawing 4 of 4, "Range, rifle, known distance, observation tower and latrine," 5 January 1952).

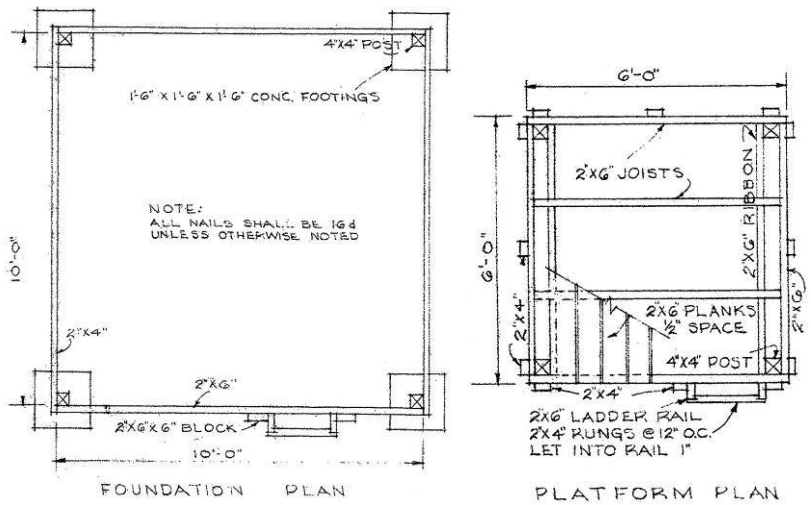


Figure 168. Mortar range observation tower foundation and platform plans, Fort Bragg, NC, 1952 (Standard Drawing No. 28-13-09A drawing 4 of 4, "Range, rifle, known distance, observation tower and latrine," 5 January 1952).

Bleachers

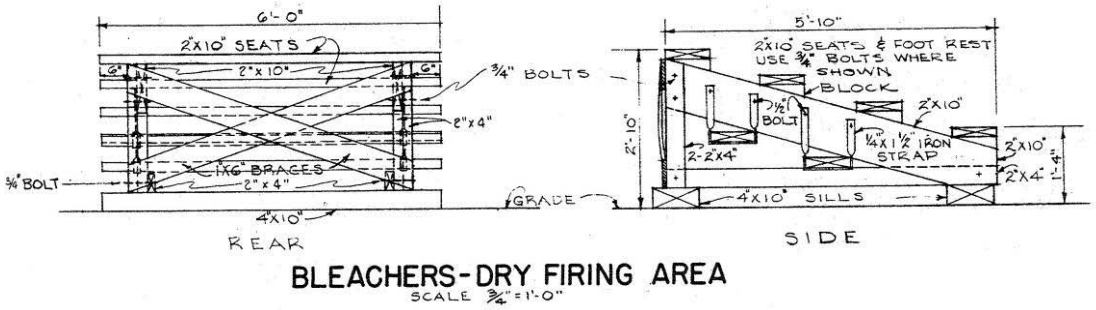


Figure 169. Mortar range dry firing area bleachers, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 2 of 2, "Mortar training, shell range, details," 5 January 1952).

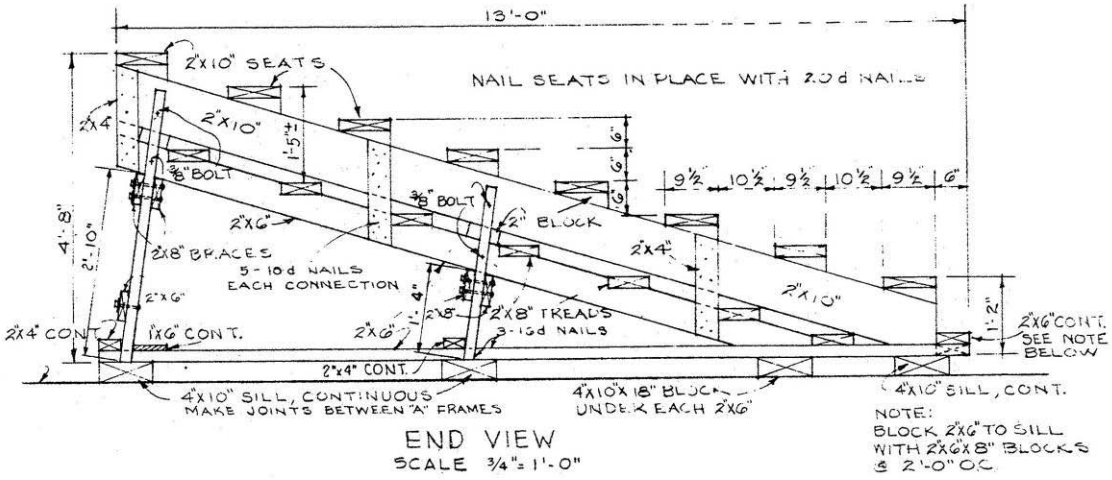


Figure 170. Mortar range demonstration area bleachers end view, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 2 of 2, "Mortar training, shell range, detail," 5 January 1952).

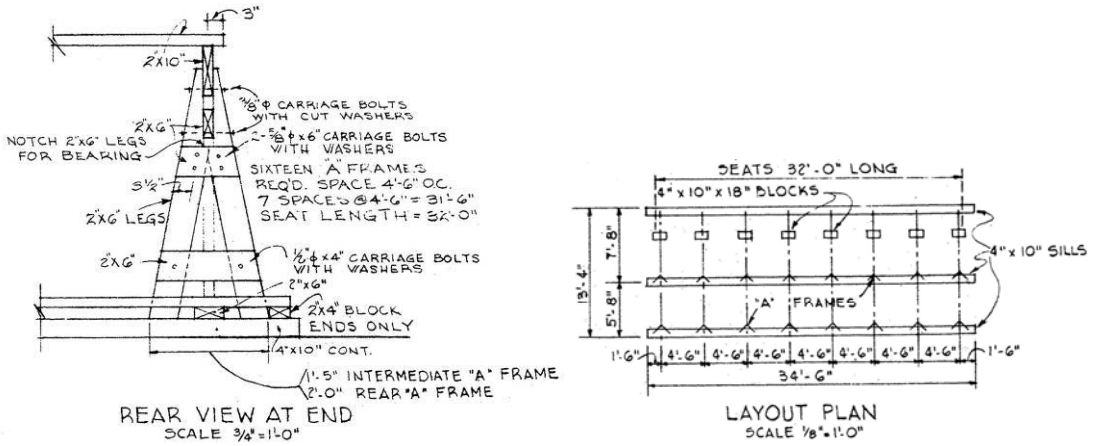


Figure 171. Mortar range demonstration area bleachers rear view at end and sill splice, Fort Bragg, NC, 1952 (Standard Drawing 28-13-17 Sheet 2 of 2, "Mortar training, shell range, details," 5 January 1952).

Poorman range

Bomber crew ball turret gunners trained on these ranges to fire at moving targets. The range consisted of a firing line for turrets, targets that moved toward and away from the firing position, and a continuous embankment behind target lines (see Figure 172). Gunners shot at targets as they moved toward and away from the firing position.

Layouts

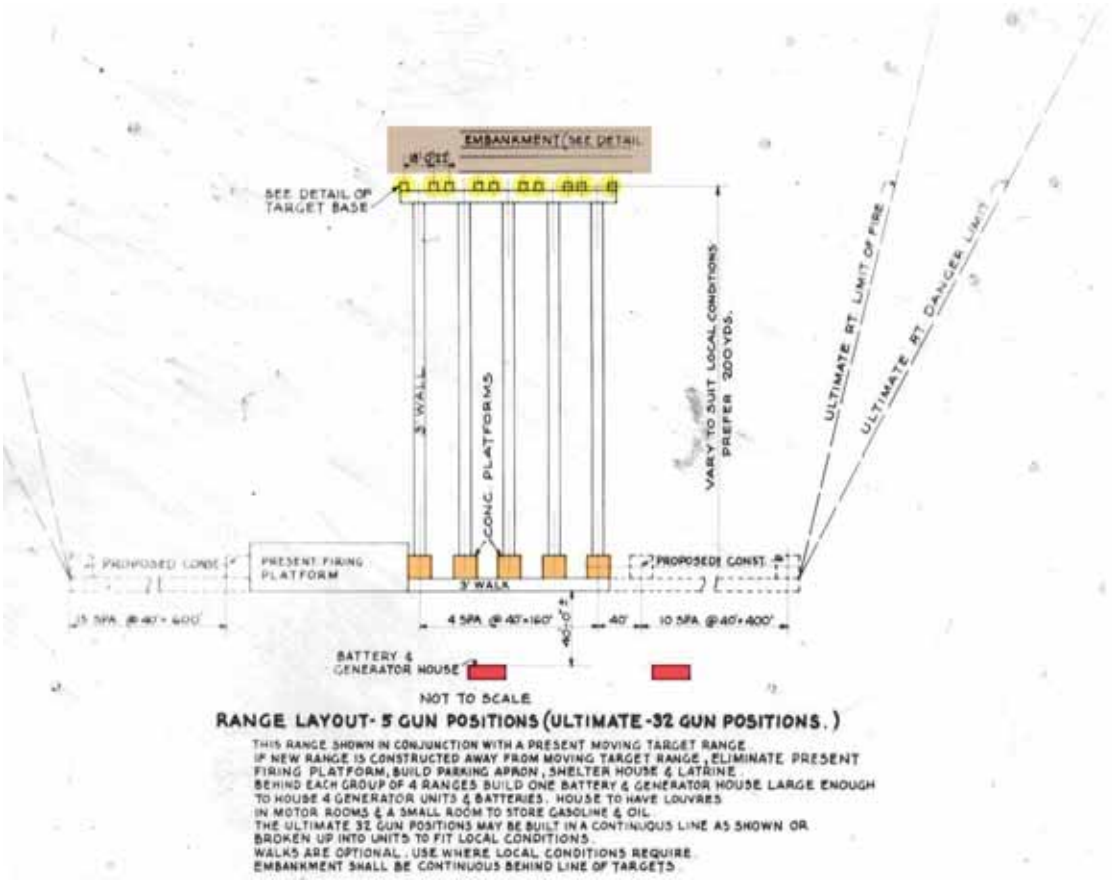


Figure 172. Poorman Range, Circa 1943 (Standard Drawing No. 1600-220/221/222, "Poorman Flexible Gunnery Range," 13 December 1943).

Firing line

A continuous firing line was built for up to 32 turret gunners. A sidewalk ran behind the firing line if made necessary by soil conditions.

Targets

Targets moved toward and away from gunners.

Embankments/trenches/etc.

A continuous embankment was built behind target lines.

Buildings

"A battery and generator house was constructed behind each group of four ranges. The house was large enough to contain four generator units and a small room to store gas and oil" ("RO-1," p 66). The ranges also had a "breakdown site which contained a table or bench with an awning or cover where bulk ammunition was opened and weapon magazines were loaded with the number of rounds required for training" ("RO-1," p 9). A range may also have had a control tower, target storage building, ammunition storage building, latrine, bleachers, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings.

Recoilless rifle range

Gun crews were trained to fire recoilless rifles on 1,000-in., subcaliber, and service recoilless rifle ranges. 1,000-in. and subcaliber ranges consisted of a line of level firing positions, a target track and cable system on which moving target sleds were pulled, and embankments behind target lines. Service ranges consisted of a line of 12 x 12 ft level firing positions and stationary silhouette targets with embankments behind target lines. Field firing targets were mock tank or tank chassis, camouflaged log and earth pillboxes, and surplus, obsolete, and condemned materiel, such as caissons, limbers, and wheeled and tracked vehicles. At each range, crews took turns firing at targets from stationary positions on the firing line.

Historical background

"Recoilless rifle ranges would have been found on Ground Forces Training Centers where infantry, armored, and mechanized units were present and conducted training with organic weapons. Recoilless rifle ranges could have been stand-alone ranges, or could have been shared with an artillery range, or other ranges, on a Ground Forces Training Center" ("RO-8," p ES2). "Recoilless rifles were organic to infantry divisions beginning in 1945. Armored divisions began using recoilless rifles by 1948. Therefore, every Ground Forces Training Center would likely have had an antitank gun range. Reference material from 1947 indicates that only one recoilless rifle range per division was constructed. Smaller installations at which

ground forces training may have not been its primary mission could have constructed a recoilless rifle range" ("RO-8," p 12).

"The recoilless rifle gave the infantry a portable weapon with the hitting power of a medium caliber artillery piece that could also be used as an anti-tank cannon. A recoilless rifle nearly eliminated recoil by venting propellant gases through a venturi at the rear of the weapon. However, this created a danger area to the rear during firing. The weapon required a larger propellant charge than a comparable caliber artillery weapon, yet had a reduced muzzle velocity. During the 1980s, guided weapons such as the Dragon and tube-launched optically tracked wire-guided (TOW) weapons replaced recoilless rifles in most units, and the recoilless rifle was only retained for a small group of special units such as Navy SEALS (Sea, Air, Land)" ("RO-8," p 2).

Training procedures

On arrival at the range, troops met organic vehicles carrying weapons drawn from the armory and munitions from the ammunition supply point, and the equipment and ammunition were checked. "The rifle squad secured the 57mm rifle, ammunition, and ancillary equipment (e.g., binoculars, compass) and followed the squad leader. At the command ACTION, the squad moved into position. The gunner adjusted the bipod of the 57mm rifle. The rifle was loaded as soon as the type of ammunition was designated. The 75mm rifle squad took the recoilless rifle from its travel configuration and placed it at the firing point in preparation for firing. The tube was placed on the tripod, the sight was placed on the rifle; the rifle was readied for loading and placed through the front mounting bracket. The tripod was stamped firmly into the ground. The traveling lock for the truck-mounted 106mm rifle was disengaged, the breech opened, and the ammunition loaded. The spotting rifle was loaded and laid on the target. To fire from a ground position, the tripod for the 106mm rifle was disengaged from the vehicle, the rifle was lowered to the ground, and the rifle was rolled or 'wheel barrowed' into the desired position. The rifle was then mounted on the tripod" ("RO-8," p 8).

"The rifle squad normally contained a squad leader, gunner, an assistant gunner/loader, and one or more ammunition bearers. Ammunition for recoilless rifles came assembled as a complete round. The squad leader determined the type of ammunition to be loaded. The ammunition bearer unpackaged the ammunition and handed it to the loader (for setting fuses, if required), who then loaded the round into the recoilless rifle. On com-

mand from the squad or team leader, the gunner fired the weapon. The squad leader then issued the command to reload, if required. After firing, the squad leader gave the command 'Out of Action.' The loader then opened the breech and cleared the weapon. Unused ammunition was then repackaged and the crew prepared for movement. After-firing maintenance was then performed. If the crew was returning to garrison immediately after firing, maintenance may have been postponed until they arrived at their destination. If a misfire occurred, rounds were placed in a safe area (pit) to allow gunners to continue training, and were later disposed of on site by detonation, or taken to a proper disposal facility. After policing the area and gathering trash, troops either carried the trash off the training site to a landfill, or buried the trash in a foxhole if they were on their way to do more training ("RO-8," pp 9-10).

Weapons

"The U.S. Military developed five different recoilless rifle weapon systems for use. These systems were the 57mm, 75mm, 90mm, 105mm, and 106mm recoilless rifles. Each weapon system utilized its own set of standard ammunition" ("RO-8," p ES2). "Subcaliber devices were used with various calibers of recoilless rifles to simulate firing full caliber rounds. These devices were actually a small arms barrel attached and aligned along the centerline of the projectiles' path ("RO-1").

Danger areas, layouts, and targets

"The first phase of training was the qualification course. There were three types of qualification courses for the recoilless rifle. Course A was used at posts, camps, and stations with range facilities that permitted firing service ammunition in accordance with the provisions of AR 750-10. Course B was used where range facilities prohibited the firing of service ammunition. Course C was employed where range facilities included only indoor ranges or miniature outdoor ranges. In theory, the goal was to have Type A courses on all installations. However, for already established installations that did not have enough land to accommodate a Course A, a Course B was the second choice, and a Course C was the last option.

Course A consisted of firing Tables I through IV three times for practice, and Tables I through V once for record. Course B was the same as Course A except Table V was not fired. For Course C, Tables III through V were not fired. The firing tables were as follows:

- **Table I** - 1,000-in. subcaliber firing, stationary target (could be fired on the Small Arms Range - Machine Gun, 1,000-in. Range)
- **Table II** - 1,000-in. subcaliber firing, moving target (level track) [could be fired on the Small Arms Range - 1,000-in. (Track Type)]
- **Table III** – Known distance subcaliber firing, stationary target (could be fired on the Recoilless Rifle Known Distance Range or on the Small Arms Range - Rifle Range, firing points at 100, 200, 300, 500 yd)
- **Table IV** – Known distance subcaliber firing, moving target
- **Table V** – Service firing, known distance (on Recoilless Rifle Range – Known Distance)" ("RO-1").

"After completing the qualification course (Phase 1), crews would normally fire on a landscape course (Phase 2). This was done at a 1000-in. small arms range using a landscape target and subcaliber rounds. Practice at this course allowed a gun crew to develop skills learned during the qualification phase of training. This training phase normally contained three exercises.

The third training phase was Transition Firing (Phase 3), and was conducted on a small arms transition range. This training gave gun crew practice in searching areas, estimating ranges, firing rapidly, and developing accuracy. This phase also used a subcaliber device. The final or Field Firing phase (Phase 4) developed individual and crew proficiency in all phases of combat at the section and platoon level. This phase, which included both direct and indirect firing, was fired on the recoilless rifle range and used service ammunition. For qualification training, service ammunition was only fired on Table V. For other training, service ammunition was normally only fired in Phase 4 (Field Firing)" ("RO-8," pp 21-22).

Known distance range

"A typical Known Distance Recoilless Rifle Range as illustrated in standard drawings is displayed in Figure 173. This range was used for firing Table V of the weapons crew qualifications tables" ("RO-8," p 16). "Although no specific construction details are provided for recoilless rifle ranges in the 1944 edition of TM 9-855, the requirements for a known-distance range may be applicable to a recoilless rifle range. In 1941, target butts on permanent ranges were to consist of a retaining wall backed with earth next to the firing points and a target pit on the opposite side. The butts could be constructed of plain or reinforced concrete. In those locales where rock was plentiful, rubble masonry laid up in cement mortar could be used. The designs included plain concrete, multi-target reinforced con-

crete wall with integral target pit and storeroom, layouts of target frame support piers, and rubble masonry. For a known-distance range, a crib-type parapet could be constructed using either raw wood or treated wood (i.e., creosote, various salts, or pentachlorophenol), where appropriate (e.g., areas with termite infestations or excessive rainfall). Concrete parapets on temporary projects were to be provided only under very adverse conditions" ("RO-8," pp 35-36).

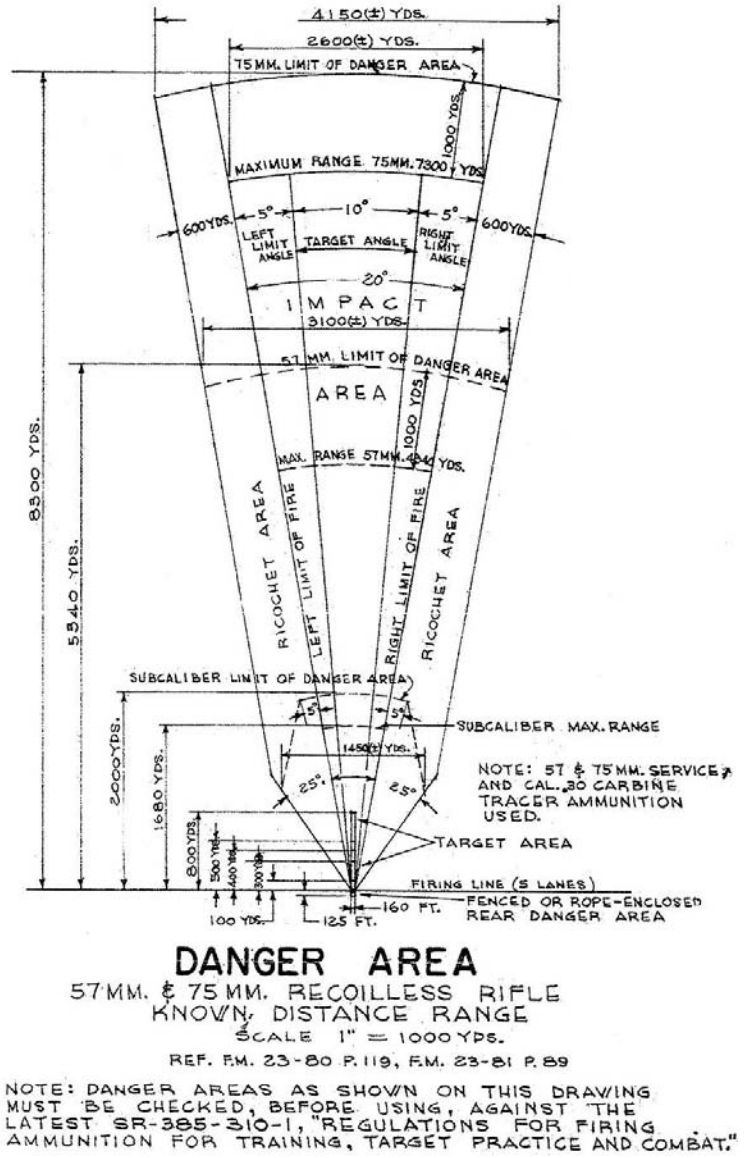


Figure 173. Recoilless rifle known distance range, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance service practice," 7 December 1951).

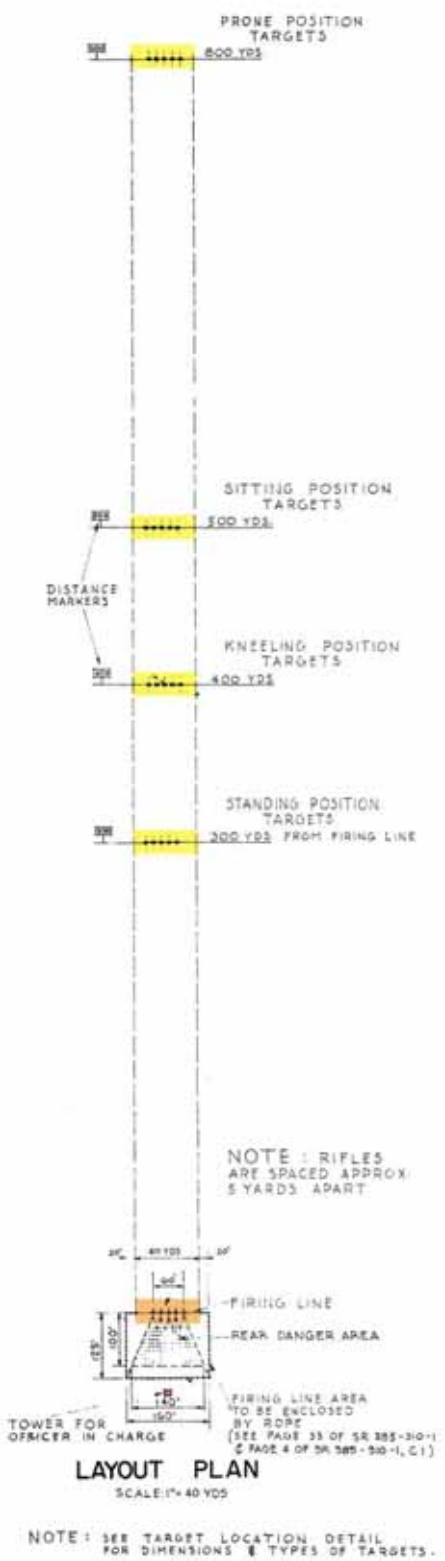


Figure 174. Recoilless rifle range layout plan, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance, service practice, plan and details," 7 December 1951).

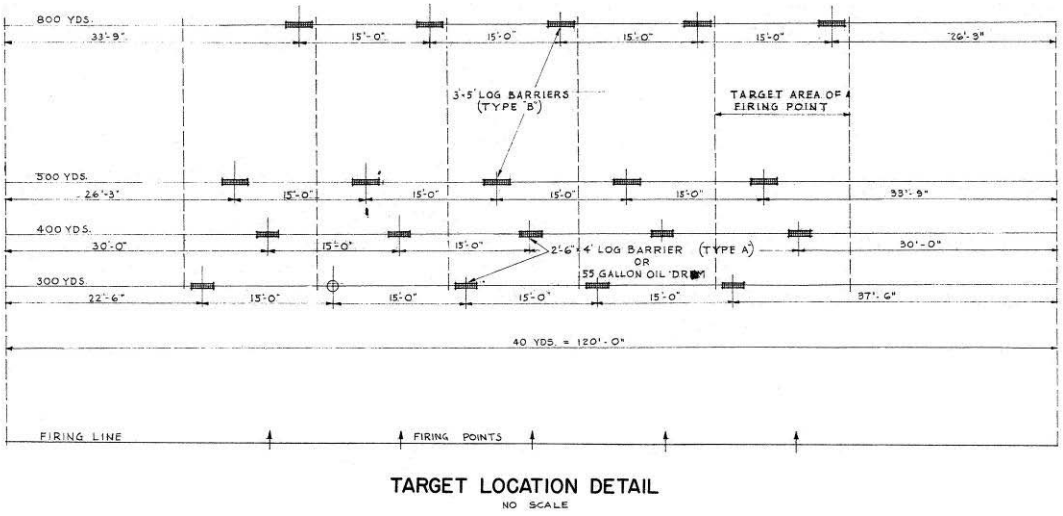


Figure 175. Recoilless rifle range target location detail, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance, service practice, plan and details," 7 December 1951).

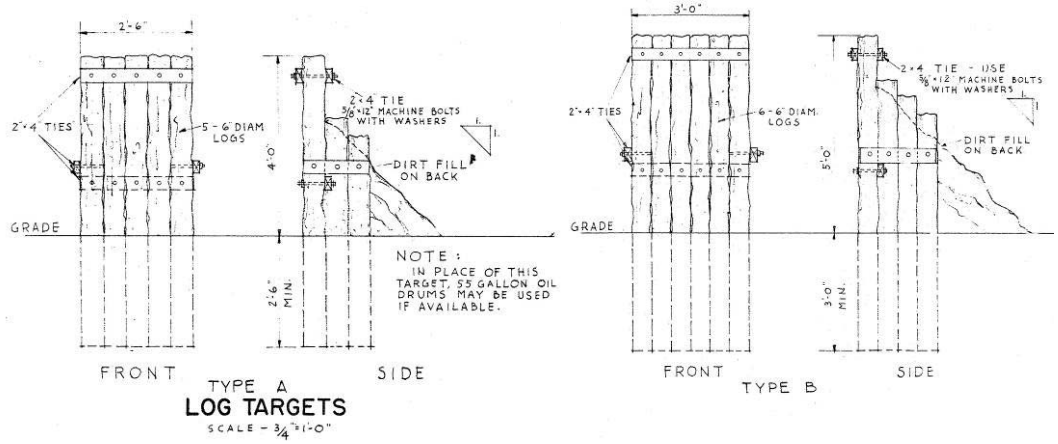


Figure 176. Recoilless rifle range log targets, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance, service practice, plan and details," 7 December 1951).

Field target range

"A Recoilless Rifle Field Target Range is depicted in Figure 177" ("RO-8," p 17). "For 'field firing' of recoilless rifles, some possible targets were cave type fortifications (cave opening 2 x 1 ft), mock tank or tank chassis, and camouflaged log and earth pill boxes. In general, surplus, obsolete, and condemned material, such as caissons, limbers, and wheeled and tracked vehicles, or suitable mock-ups, may have been used as targets" ("RO-8," pp 35-36).

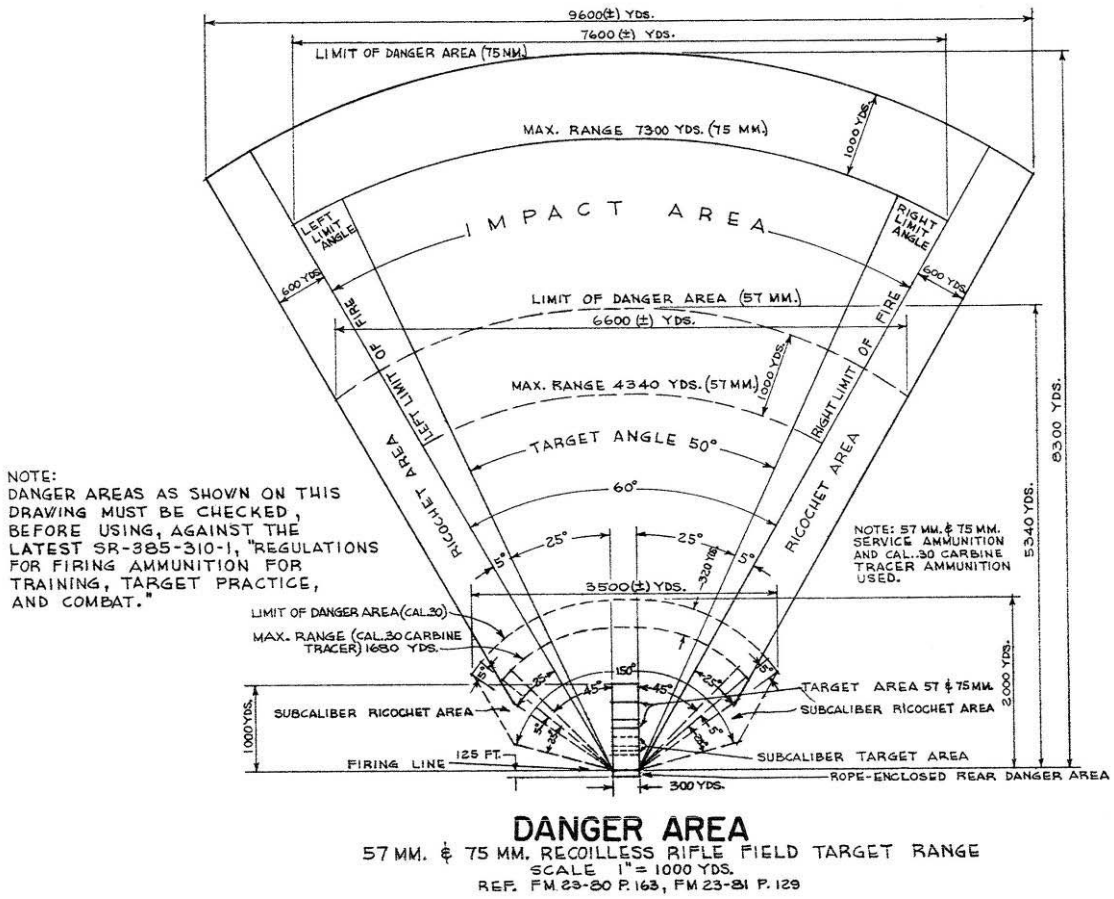


Figure 177. Recoilless rifle field target range, circa 1951 (Standard Drawing No. 28-13-11, "Range, recoilless rifle, field target," 7 December 1951).

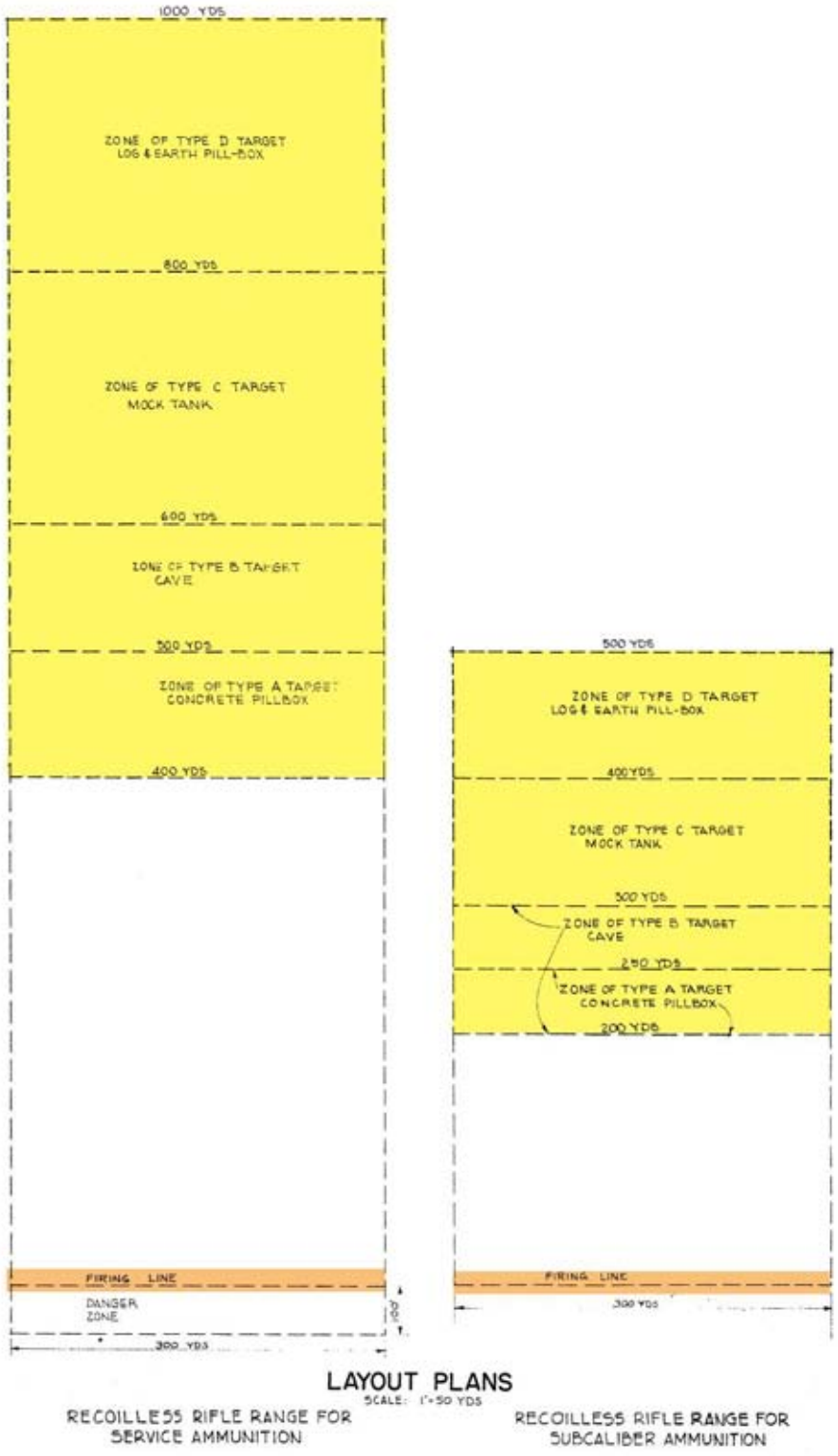


Figure 178. Recoilless rifle field target range layout plans, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans and details," 7 December 1951).

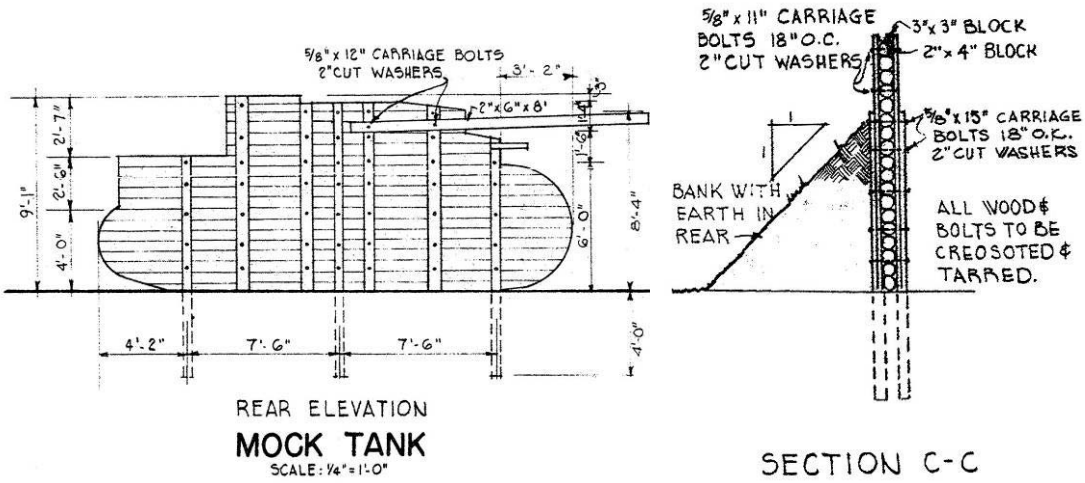


Figure 179. Recoilless rifle field target range, mock tank elevation and section, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, Recoilless rifle, field target, plans, and details," 7 December 1951).

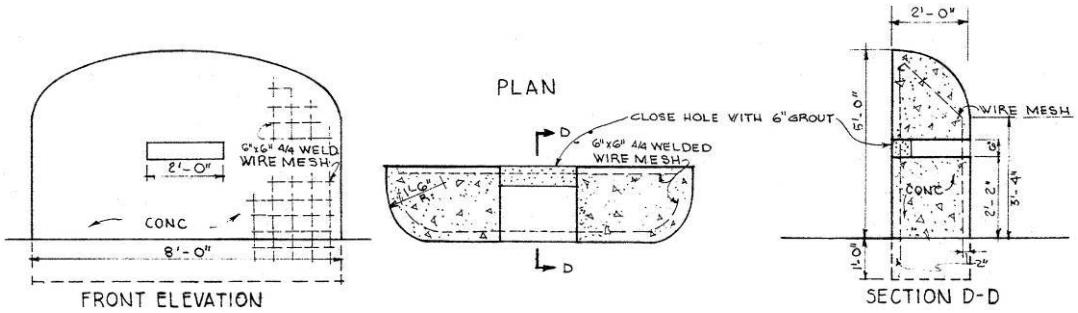


Figure 180. Recoilless rifle field target range, concrete pill box plan, section and elevation, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans, and details," 7 December 1951).

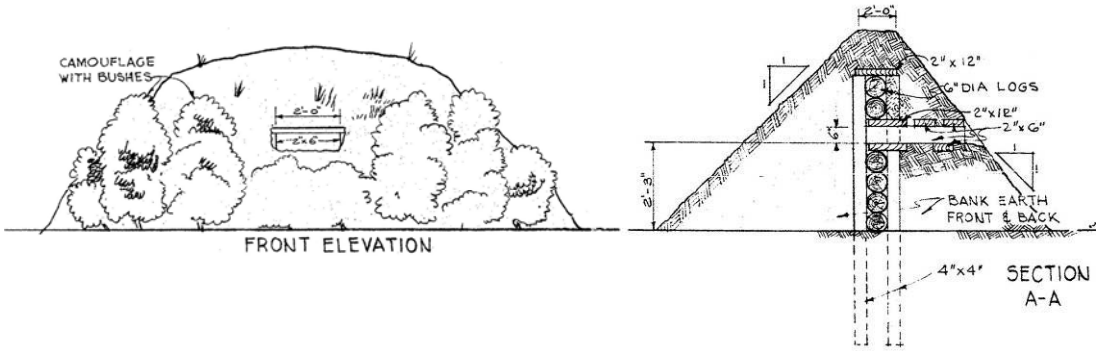


Figure 181. Recoilless rifle field target range, log and earth pill box front and rear elevation, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans, and details," 7 December 1951).

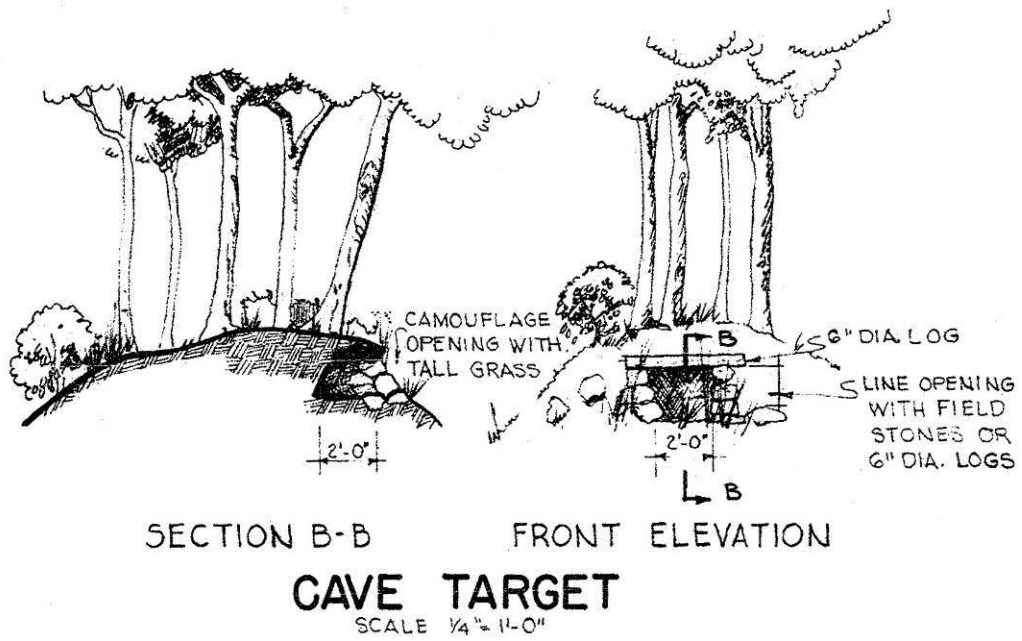


Figure 182. Recoilless rifle field target range, cave target, circa 1951 (Standard Drawing No. 28-13-11 Sheet 1 of 1, "Range, recoilless rifle, field target, plans, and details," 7 December 1951).

Sub caliber recoilless rifle moving target range

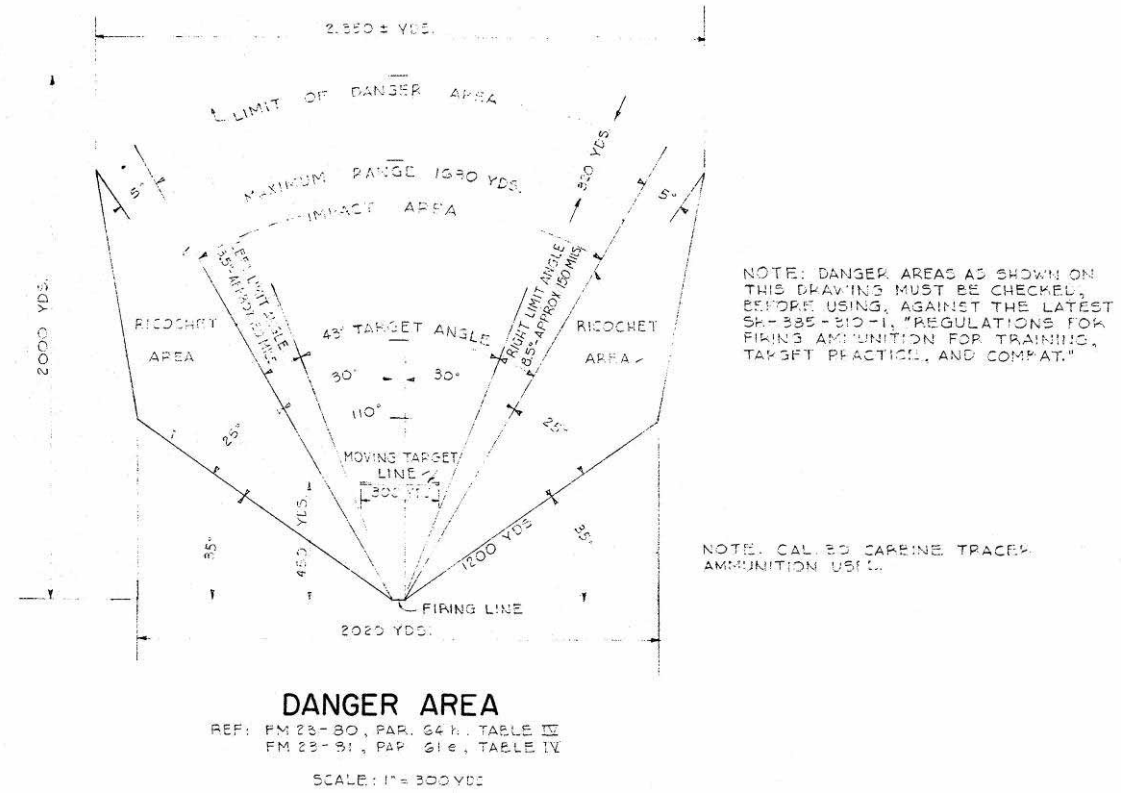


Figure 183. Sub caliber recoilless rifle moving target range danger area, circa 1952 (Standard Drawing No. 28-13-16, "Range, moving target, recoilless rifle, subcaliber, plan, and details," 5 January 1952).

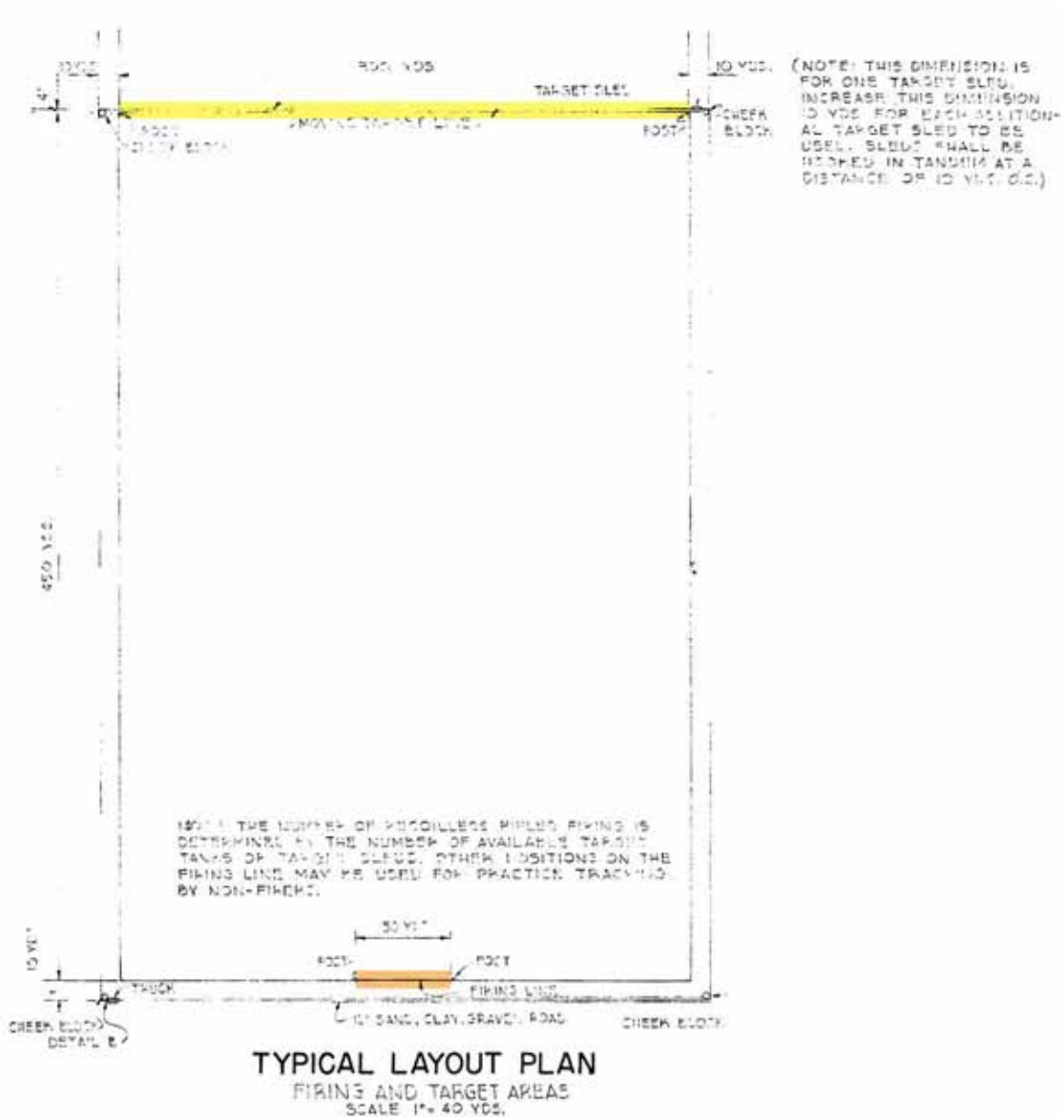


Figure 184. Sub caliber recoilless rifle moving target range typical layout plan, circa 1952 (Standard Drawing No. 28-13-16, "Range, moving target, recoilless rifle, subcaliber, plan, and details," 5 January 1952).

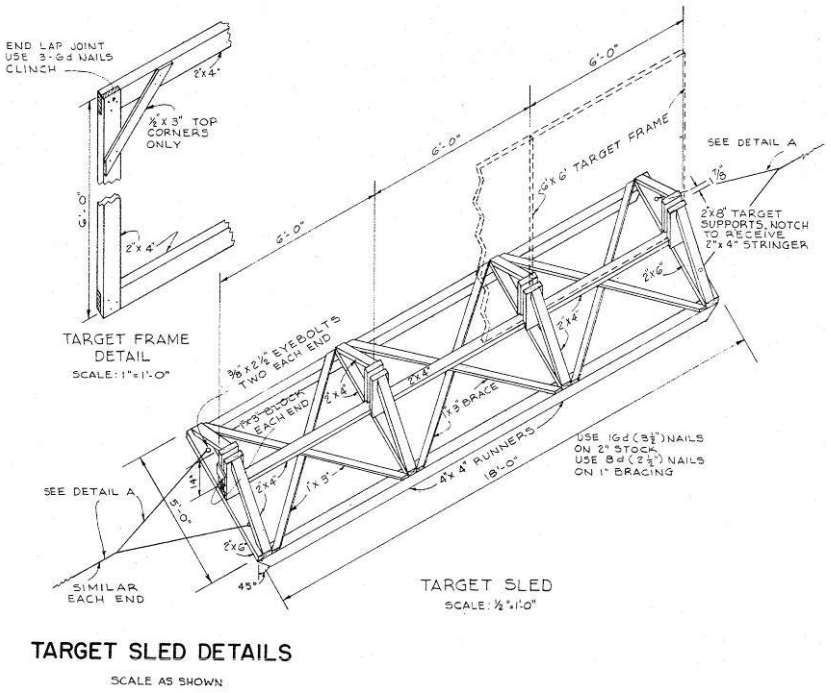


Figure 185. Sub caliber recoilless rifle moving target range target sled details, circa 1952 (Standard Drawing No. 28-13-16, "Range, moving target, recoilless rifle, subcaliber, plan, and details," 5 January 1952).

1,000-in. moving target range for recoilless rifles (landscape course)

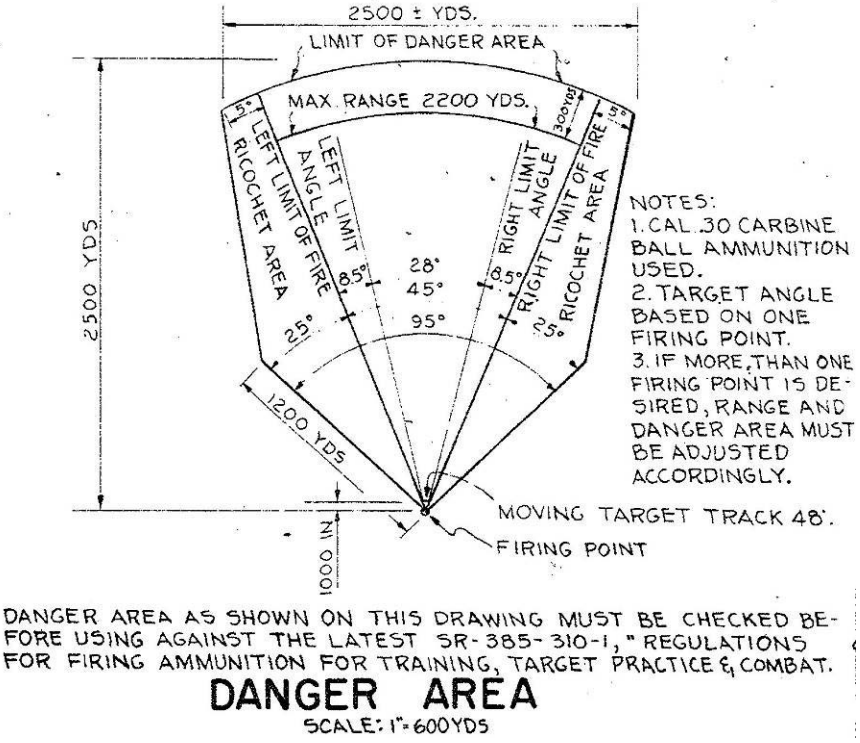


Figure 186. A 1000-in. recoilless rifle moving target range, danger area, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000in. moving target for recoilless rifle, plans, and details," 20 June 1952).

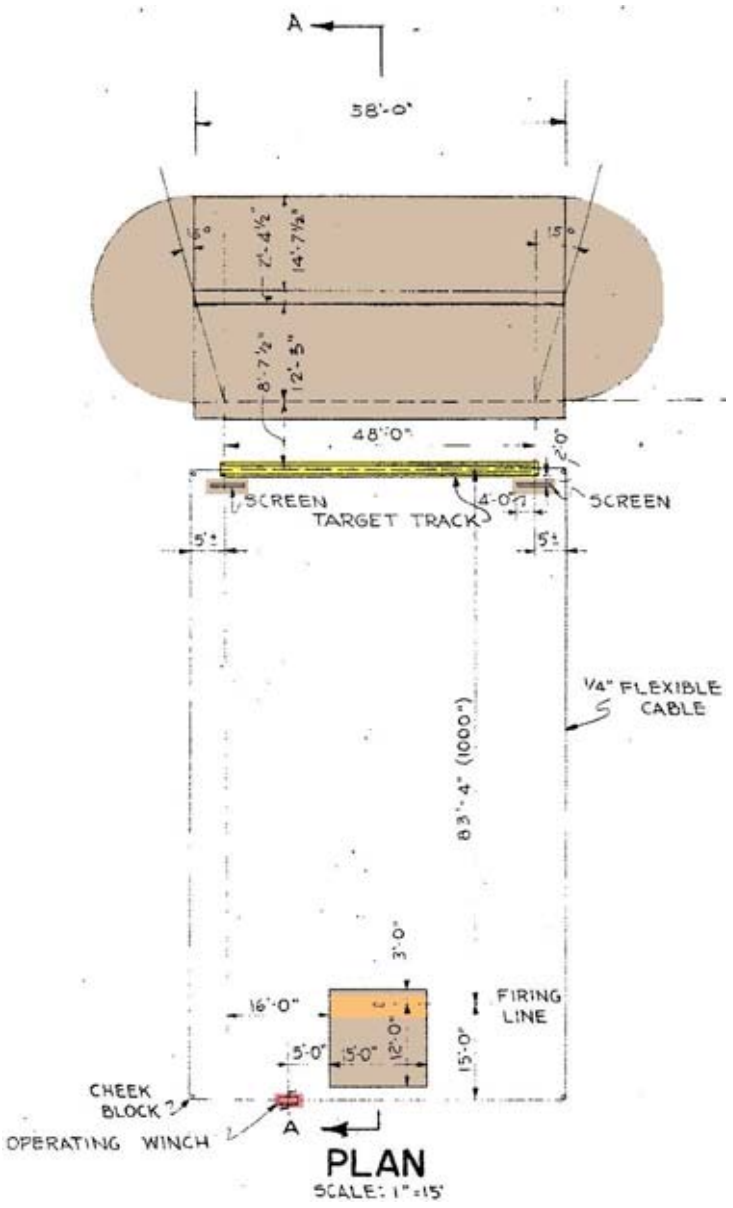


Figure 187. A 1000-in. recoilless rifle moving target range, plan, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000-in. moving target for recoilless rifle, plans, and details," 20 June 1952).

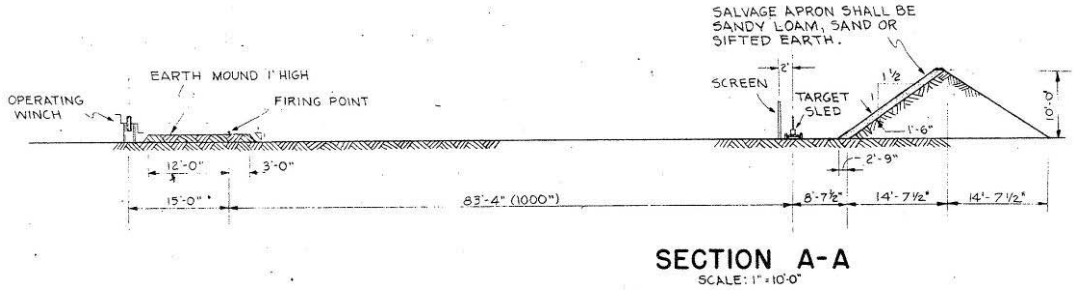


Figure 188. A 1000-in. recoilless rifle moving target range, section, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000-in. moving target for recoilless rifle, plans, and details," 20 June 1952).

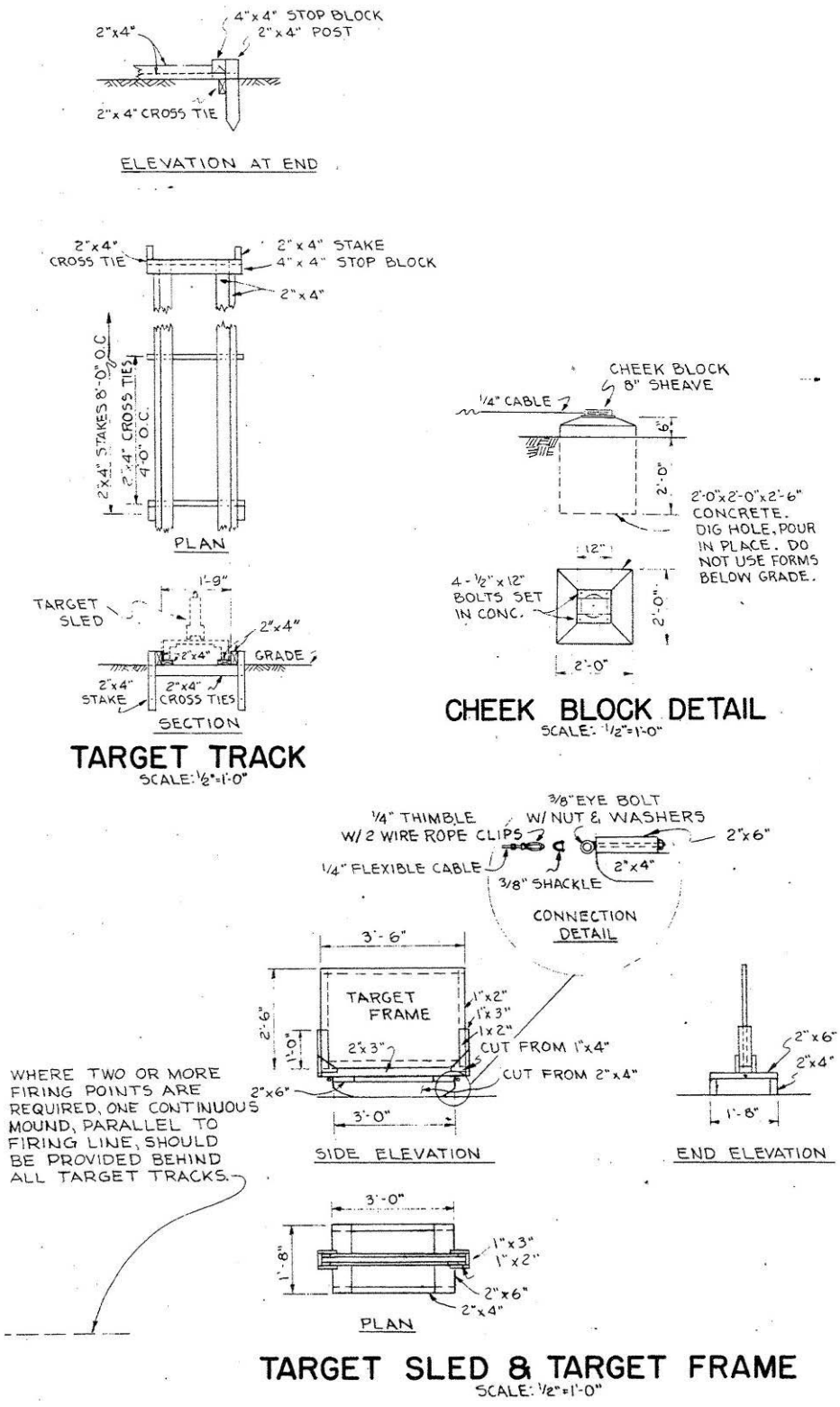


Figure 189. A 1000-in. recoilless rifle moving target range, target track, sled and target frame details, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000-in. moving target for recoilless rifle, plans, and details," 20 June 1952).

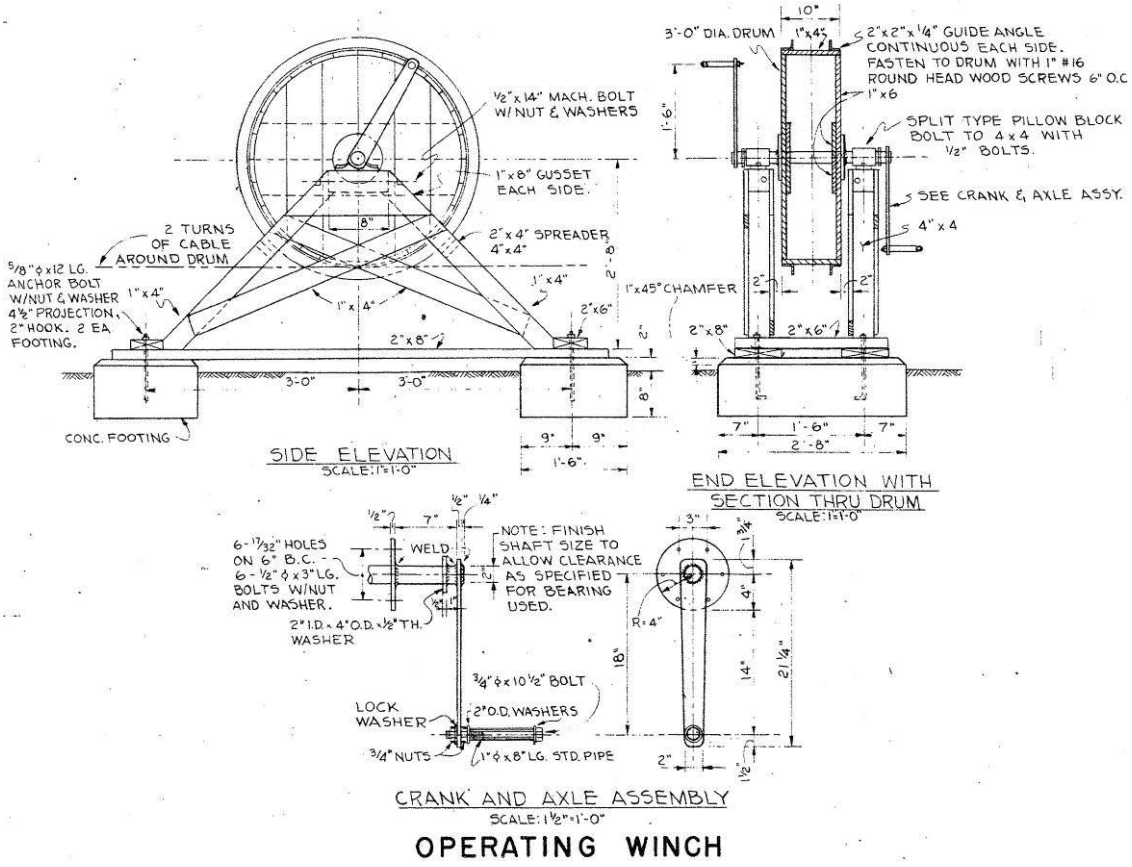


Figure 190. A 1000-in. recoilless rifle moving target range, operating winch, 1952 (Standard Drawing No. 28-13-06 Sheet 2 of 2, "Range, 1000-in. moving target for recoilless rifle, plans, and details," 20 June 1952).

Modern ranges

"In 1955, the range layout shown in Figure 191 below was adopted and is applicable to the 57mm, 75mm, 105mm, and 106mm recoilless rifles. Modern versions of a recoilless rifle range (1968 and later) fell into one of two categories: elevations of 15 degrees and less, or elevations greater than 15 degrees. Low angle fire, or those less than 15 degrees, had a greater problem with ricochets, requiring the inclusion of a ricochet area. As illustrated in Figure 191, Areas A and B are safety areas expressed in yards and measured perpendicular to the inner boundary. Distance X (or Line of Fire Distance) was the maximum range of the weapon. Area F was the back blast danger area. In practice, training requirements likely demanded multiple targets and firing points. In developing a range, the 'Line of Fire' line began at the firing point(s) and extended to each target. As a result, the overall range size was a combination of the individual range fan layouts" ("RO-8," p 17).

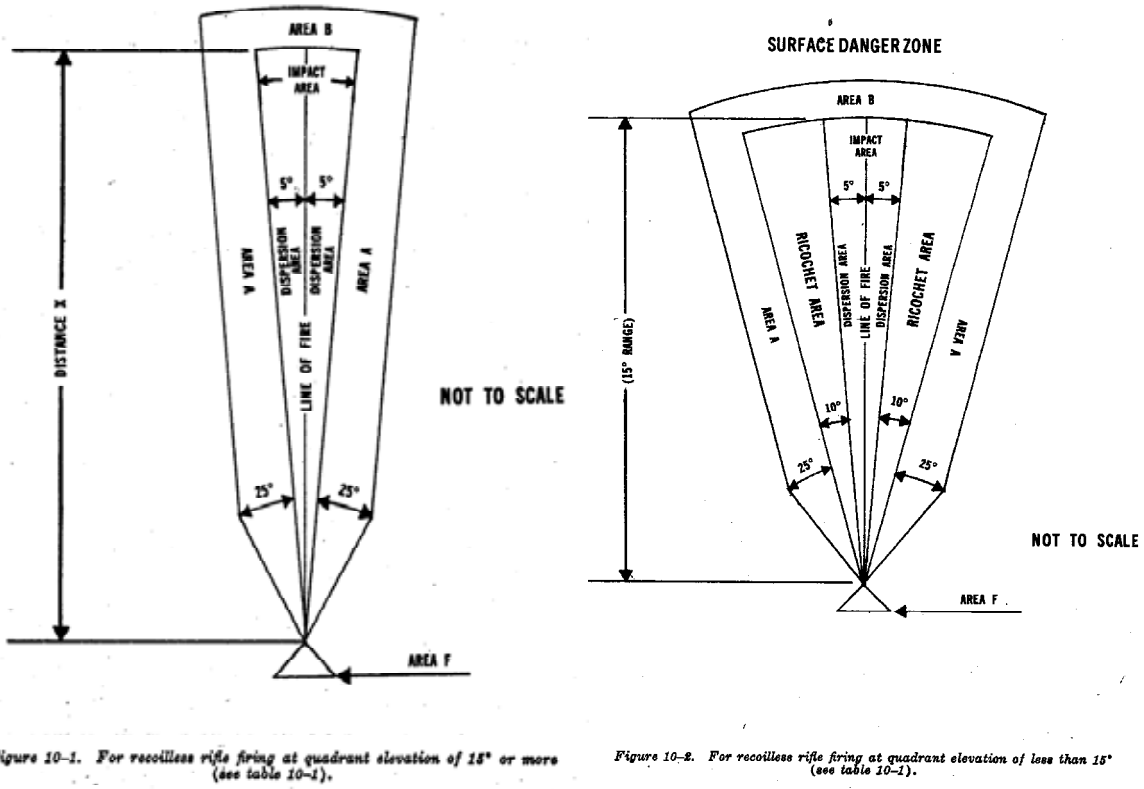


Figure 10–1. For recoilless rifle firing at quadrant elevation of 15° or more (see table 10–1).

Figure 10–2. For recoilless rifle firing at quadrant elevation of less than 15° (see table 10–1).

Figure 191. Modern recoilless rifle ranges greater and less than 15º elevation, Circa 1955 (AR 385-63, Regulations for Firing Ammunition for Training, Target Practice, and Combat, 5 Dec 55, p 26; AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 28 February 1973, Ch 10).

"Table 16 is used with Figure 191 to determine the size of a range based on the type of weapon being fired. If more than one type of weapon was fired (57mm, 75mm, and also the 105mm and 106mm recoilless rifles), the largest area required was used" ("RO-8," p 20).

Table 16. Recoilless rifles range danger area dimensions (distance in yards).

Year	Caliber	A	B	Minimum Range to Impact (C)	X	15° Range	F Depth	F Base
1955	57mm	600	1000	400	--	--	80	92
	75mm	600	1000	500	--	--	130	150
	105mm	600	1000	600	--	--	130	150
1968	57mm	250	300	250	4500	3200	15	30
	75mm	300	350	300	6600	4300	25	50
	90mm	300	350	300	2200	1500	25	50
	106mm	300	350	300	6900	4800	25	50

Year	Caliber	A	B	Minimum Range to Impact (C)	X	15° Range	F Depth	F Base
1973	57mm	375	475	375	4600	3200	15	30
	75mm	550	650	550	6600	4300	45	50
	90mm	550	650	550	2200	1500	45	50
	105mm	550	650	550	8600	4900	45	50
	106mm	550	650	550	6900	4800	45	50
1978	57mm	250	300	250	4600	3200	15	30
	75mm	300	350	300	6600	4300	45	50
	90mm	300	350	300	2200	1500	45	50
	105mm	300	350	300	8600	4900	45	50
	106mm	300	350	300	6900	4800	45	50
1983	57mm	250	300	250	4600	3200	15	30
	75mm	300	350	300	6600	4300	45	50
	90mm	300	350	300	2200	1500	45	50
	105mm	300	350	300	8600	4900	45	50
	106mm	300	350	300	6900	4800	45	50

Source: "RO-8," p 20; AR 385-63, Safety, regulations for firing ammunition for training, target practice, and combat, 5 December 1955, p 15, AR 385-63, Safety, regulations for firing ammunition for training, target practice, and combat, 17 June 1968, Ch 11, AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 28 February 1973, Ch 10, AR 385-63, Policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, Ch 9, AR 385-63/MCO P3570.1A, Policies and procedures for firing ammunition for training, target practice, and combat, 15 October 1983, Ch 9.

Firing lines

"The various approved designs for firing points are included in the 1941 edition of TM 9-855. On a range with more than one target, the firing point consisted of a level space 12-ft deep and running for a length of 12-ft for each target in the direction parallel to the line of targets. For example, a range with three targets would have a firing point 36-ft in length and 12-ft in width. In some cases, it was necessary to build up the firing point with earth, depending on the terrain. The sides of the firing line could be either sodded or sown with grass seed to prevent erosion. In 1947, it was recommended that a bituminous strip 15 yd wide, running the length of the firing line, be constructed to prevent the occurrence of dust. It was also recommended that a waist-high, two-strand wire fence be constructed to enclose the back blast area. This information was restated in the 1951 version of TM 9-855." ("RO-8," pp 35-36).

Embankments/trenches/etc.

Embankments on recoilless rifle ranges include those built as target butts behind target lines in addition to those built to create realistic and heavy-duty targets such as pillboxes, log targets, mock tanks, and cave targets.

Buildings

No buildings are mentioned in the standard plans for these ranges. However, a range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings ("RO-8," p 14).

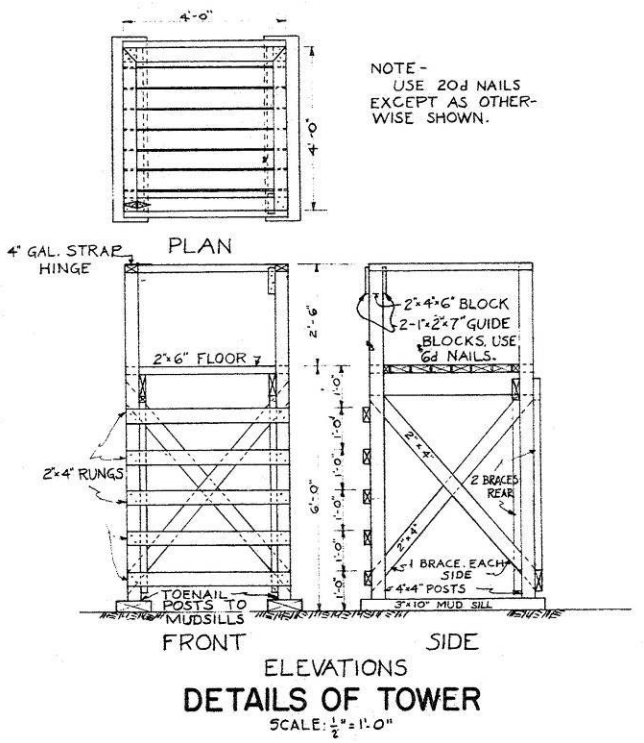


Figure 192. Recoilless rifle range details of tower, circa 1951 (Standard Drawing No. 28-13-10, "Range, recoilless rifle, known distance, service practice, plan, and details," 7 December 1951).

Shoulder launched small rocket ranges

Gun crews were trained on these ranges to fire shoulder launched small rocket weapons at fixed and moving targets. Ranges usually consisted of a firing line with firing positions that often included foxholes, sandbags, or other firing supports, and heavy duty reinforced stationary targets and

target butts, moving sled targets, and light or medium tank targets. Gun crews took turns firing at fixed and moving targets from their stationary positions on the firing line.

Historical background

"The shoulder-type small rocket launcher was organic to infantry, cavalry, and armored divisions since the early 1940s. In addition, the 2.36-in. anti-tank (AT) practice rocket was included in the ammunition allowance for officers attending service schools, including armored force, cavalry, coast artillery, engineer, field artillery, infantry, military intelligence, and tank destroyer schools. Therefore, ranges for training personnel on the use of the shoulder-type rocket launcher would be expected on Ground Forces Training Centers where infantry, cavalry, armored, and mechanized units were present and conducted training with organic weapons. Additionally, bases such as airfields that required base defense forces may have had this type of range" ("RO-5," p ES2). "In 1947, an infantry division training post was authorized to have at least three rocket launcher ranges" ("RO-5," p 15). "The shoulder-launched small rocket range is discussed separately from the medium caliber and heavy rocket and large guided missile ranges because the weapon system had a unique rocket delivery system (shoulder launcher) and was used on a shorter range" ("RO-5," pp 1-2).

Training procedures

On arrival at the range, troops met organic vehicles carrying weapons drawn from the armory and munitions from the ammunition supply point. "Before firing the 2.36-in. rocket, a clean, dry wiping cloth was run through the launcher barrel unit until the film of oil was removed from the bore. The firing unit removed the rocket launcher from its travel configuration and placed it at the firing point in preparation for firing. The crew for the 2.36- and 3.5-in. rocket launchers consisted of a gunner and a loader" ("RO-5," p 9). "The gunner determined the type of ammunition to be used, and the loader unpackaged it and loaded it into the launcher. Ammunition was issued only on the ready line. For the M72 LAW, the gunner was the only crew member, and placing the launcher in action, unpacking ammunition, and preparing for firing were the same action. On command, the gunner fired the weapon. After firing, the bore of the rocket launcher was cleaned, and the firing mechanism, barrel coupling lock, and portions of the bipod were lubricated. If the crew was immediately returning to garrison after firing, however, maintenance may have been postponed until the crew arrived at their destination" ("RO-5," p 10). After

waiting for fifteen seconds, and retrying three more times, misfires (or the whole launcher if an M72 LAW) were placed in a pit at a safe distance until training was over. It was then taken to ordnance officers for proper disposal or fixing. After policing the area and gathering trash, troops either carried the trash off the training site to a landfill, or buried the trash in a foxhole if they were on their way to do more training ("RO-5," p 10).

Weapons

"The shoulder-launched small rocket weapon system consisted of three rocket sizes: the 2.36-in., 3.5-in., and 66-millimeter (mm) M72" ("RO-5," p 1). "Subcaliber devices (27mm and 35mm) were available for training individuals on the use of the 3.5-in. rocket launcher and the 66mm M7 series. These devices allowed for smaller, less expensive rockets to be used during training" ("RO-5," p 3).

Layouts and danger areas

"In 1944, the Corps of Engineers was charged with range construction. This construction included the necessary clearing, excavating, and grading as well as construction of target butts, target pits, drainage facilities, storeroom or range house, and firing points. Although no specific construction details are provided for shoulder-launched small rocket ranges in the 1944 edition of TM 9-855, the requirements for a known-distance range may be applicable to a shoulder-launched small rocket range" ("RO-5," p 30).

"Danger areas for firing shoulder-launched rockets are contained in a 1949 safety regulation. These danger areas are illustrated in Figure 193. The maximum ranges associated with these danger area drawings are provided in Table 17 below" ("RO-5," p 15).

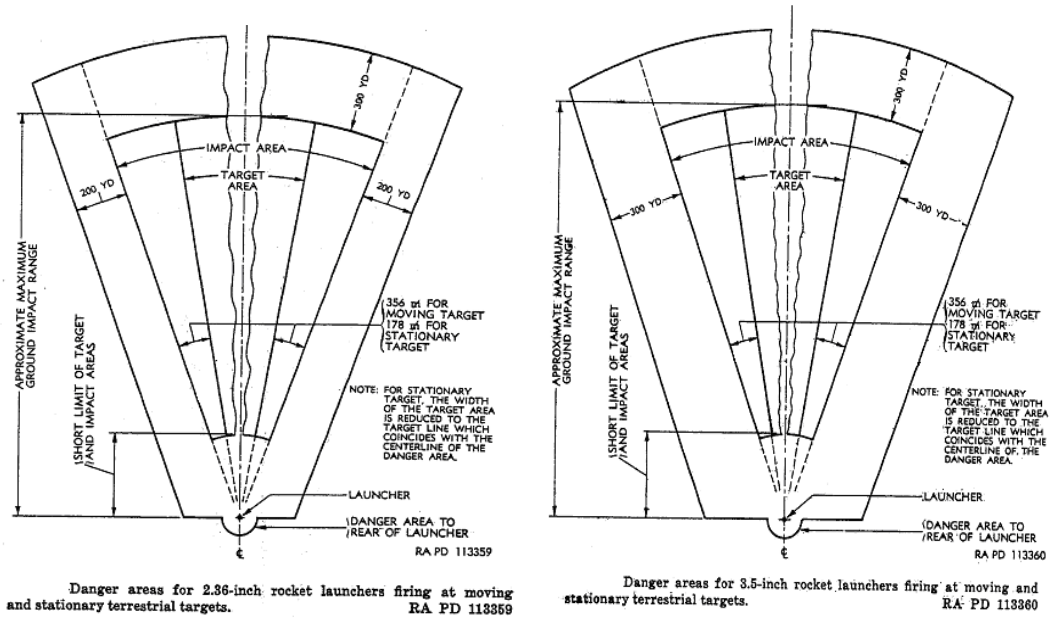


Figure 193. Range layout for 2.36-in. and 3.5-in. shoulder-launched rocket moving and stationary terrestrial targets (War Department Memorandum No. 210-20-5, Procedure for selection of training areas and construction of training facilities for ground troops, 1 July 1947, p 8).

Table 17. Rocket velocities and maximum ranges.

Weapon	Ammunition	Burnt Velocity (feet per second)	Maximum Range (yd)
2.36-in. M9, M9A1, M18	Rocket, HE, AT, M6A3 Rocket, HE, AT, M6A5 Rocket, Practice, M7A3 Rocket, Practice M7A5 Rocket, WP, M10, M10A1, M10A2, and M10A3	270	700
3.5-in. M20	Rocket, HE, AT, M29 Rocket, Practice, M29	340	1000
Source: "RO-5," p 16; SR 385-310-1/AR 50-13, Safety regulations for firing ammunition for training, target practice, and combat, 4 March 1949, pp 16, 17. WP = white phosphorus HE = high explosive AT = antitank			

"TM 9-855 was substantially revised in 1951. For the first time, rocket launcher ranges are specifically identified and discussed" ("RO-5," p 30). Figures 194 through 200 below show danger areas and layout plans for 2.36- and 3.5-in. rocket launcher ranges with stationary and moving targets.

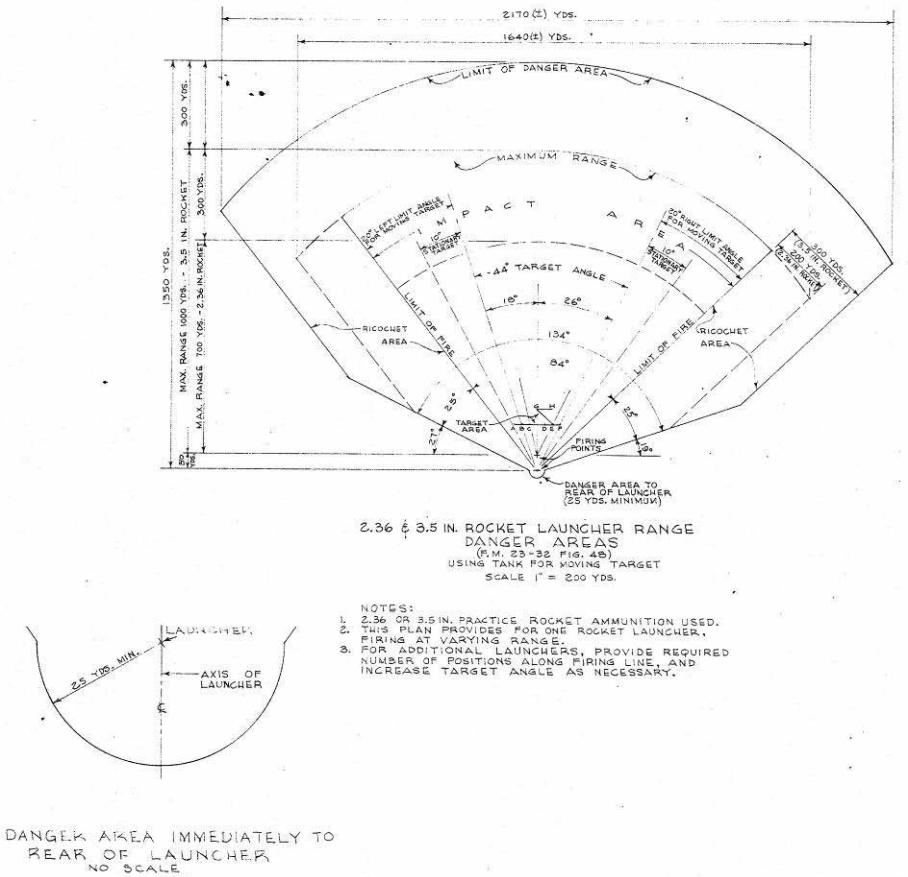


Figure 194. Rocket launcher range, 2.36- and 3.5-in. rocket launcher range danger areas, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 2 of 2, "Range, rocket launcher, danger areas," 21 November 1951).

Stationary target range

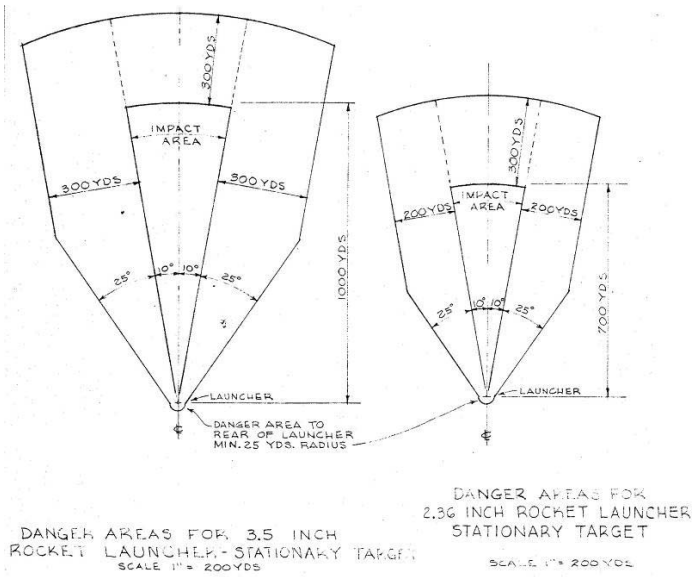


Figure 195. Rocket launcher range, 2.36- and 3.5-in. stationary target rocket launcher range danger areas, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 2 of 2, "Range, rocket launcher, danger areas," 21 November 1951).

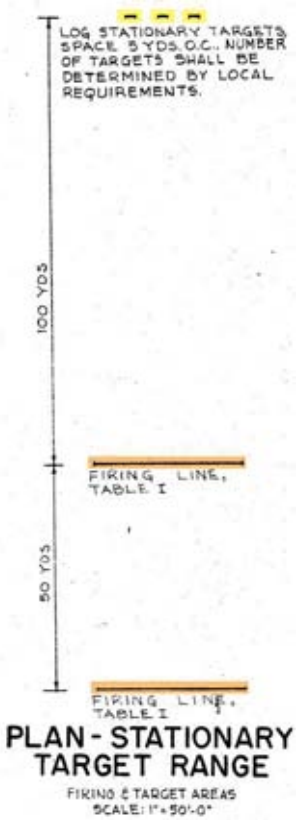


Figure 196. Rocket launcher range, plan-stationary target range, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans, and details," 21 November 1951).

Moving target ranges

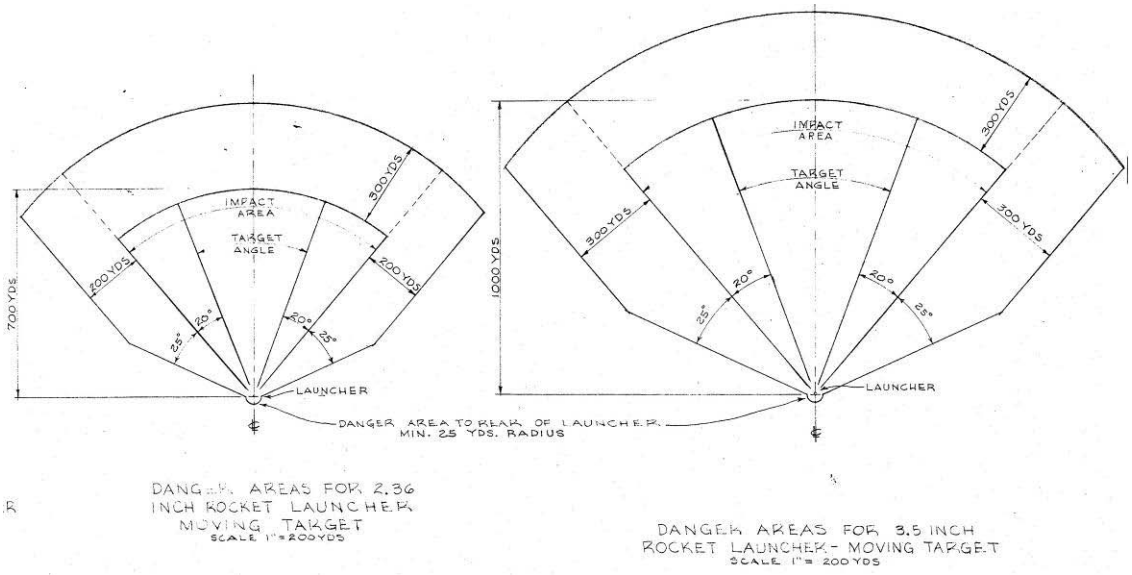


Figure 197. Rocket launcher range, 2.36 and 3.5-in. moving target rocket launcher range danger areas, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 2 of 2, "Range, rocket launcher, danger areas," 21 November 1951).

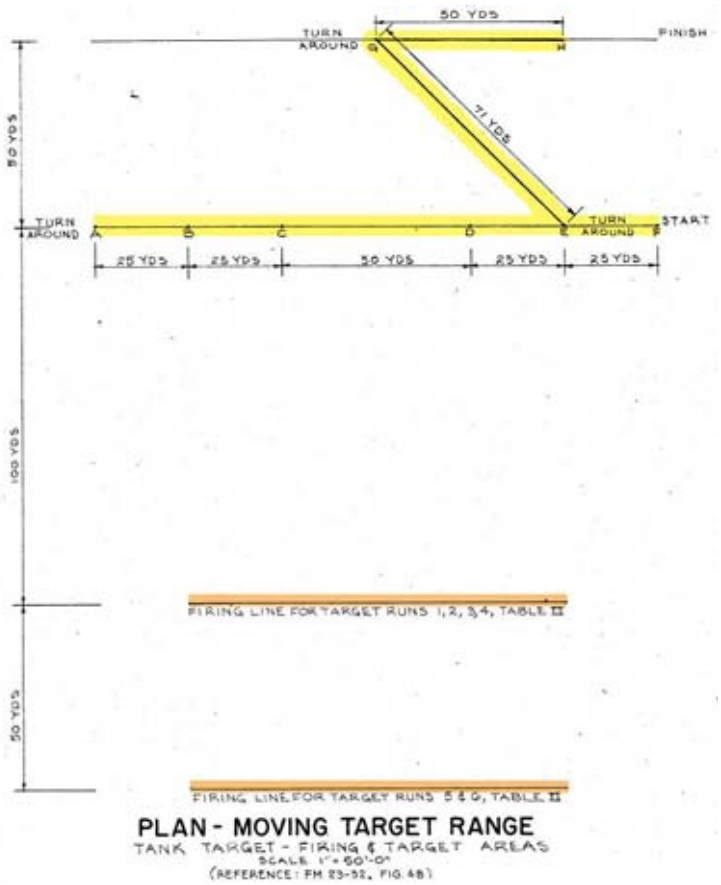


Figure 198. Rocket launcher range, plan-moving target range, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans, and details," 21 November 1951).

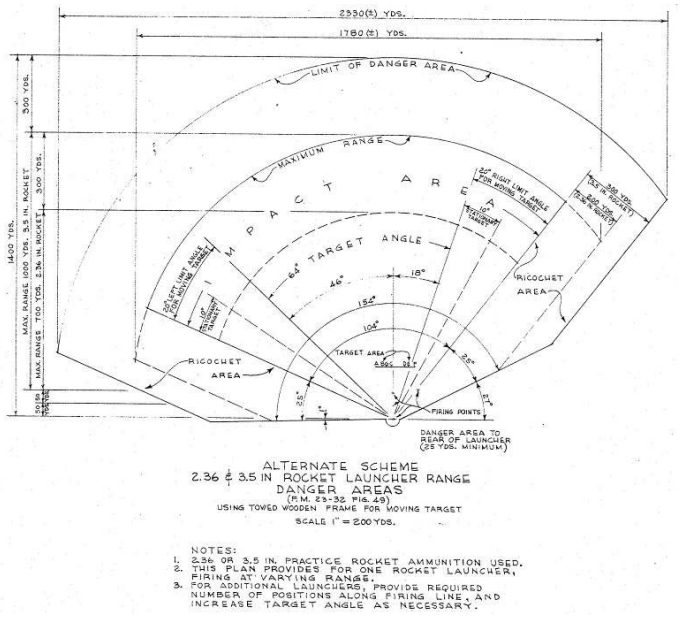


Figure 199. Rocket launcher range, alternate 2.36 and 3.5-in. rocket launcher range danger areas, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 2 of 2, "Range, rocket launcher, danger areas," 21 November 1951).

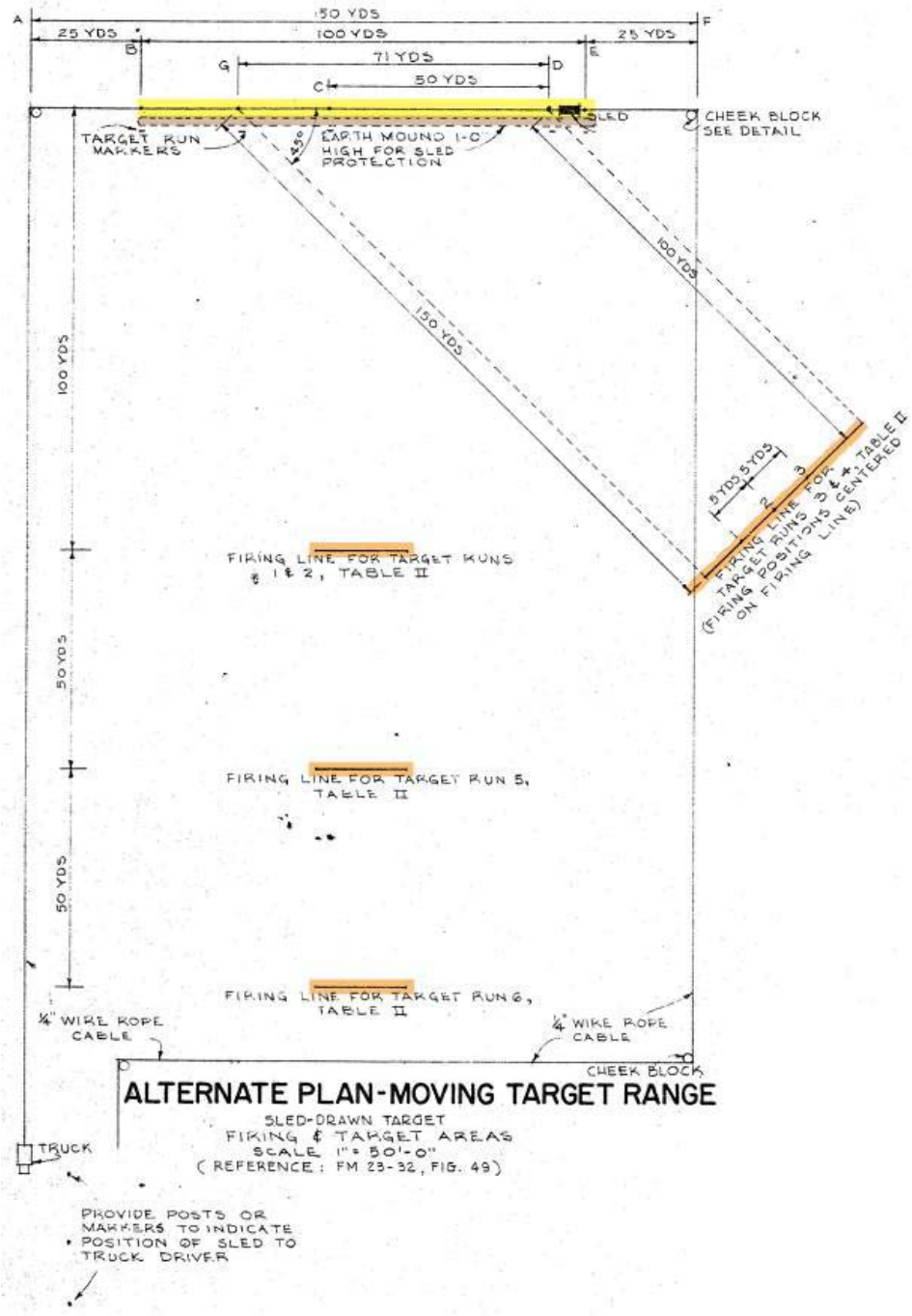


Figure 200. Rocket launcher range, alternate plan-moving target range, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans, and details," 21 November 1951).

"Newer models of the 2.36-in. rocket (M6A6, M7A7, and M10A4) had an increased burnt velocity of 335 ft per second (fps) and maximum range of 840 yd. The 1968 edition of AR 385-63 contains no reference to the 2.36-in. rocket, but has a reference to the 66mm LAW M72. Additionally, the range layout for the 3.5-in. shoulder-launched rocket was modified as shown in Figure 201 below" ("RO-5," p 16).

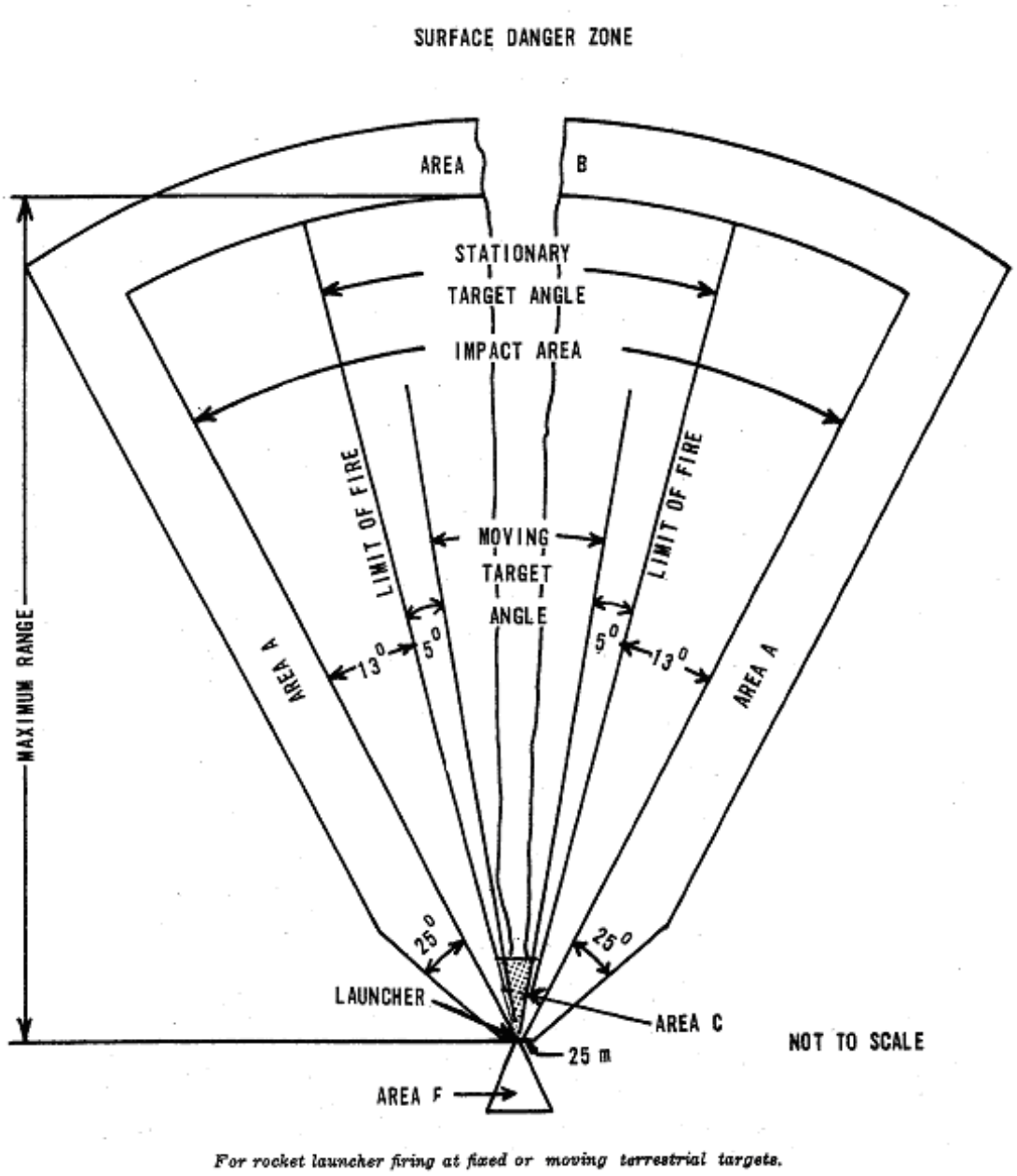


Figure 201. 3.5-in. and 66 mm shoulder-launched rocket range, circa 1968 (AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 17 June 1968, p 2).

"Provided in Table 18 below are the distances to be used with Figure 201 above to determine areas A, B, C, and F" ("RO-5," p 17).

Table 18. Shoulder-launched rocket range danger area dimensions.

Year	Rocket Caliber	Ammunition Type	Danger Area Dimensions (meters)				
			A	B	C	F (base)	F (height)
1949	2.36-in.	Not identified	200	300	ND	25	25
	3.5-in.	Not identified	300	300	ND	25	25
1955	2.36-in.	Not identified	200	300	150	25	25
	3.5-in.	1	300	300	150	25	25
1968	66mm	LAW M72	250	250	75	25	50
	3.5-in.	Not identified	250	260	250	25	25
1973	35mm	Subcaliber practice, M73	100	100	100	25	40
	66mm	Law HEAT M72	250	250	250	25	40
	3.5-in.	All	250	250	250	25	25
1983	35mm	Subcaliber practice, M73	100	100	50	25	40
	66mm	LAW HEAT M72	250	250	75	25	40
	66mm	Incendiary, M74	100	100	50	38	40
	3.5-in.	All	250	250	250	25	25

Source: "RO-5," p 18, SR 385-310-1/AFR 50-3, Safety, regulations for firing ammunition for training, target practice, and combat, 4 March 1949, p 12, AR 385-63/AFR 50-13, Safety, regulations for firing ammunition for training, target practice, and combat, 5 December 1955, p 14, AR 385-63, Safety, regulations for firing ammunition for training, target practice, and combat, 17 June 1968, pp 9-1, 9-2, AR 385-63, Safety, regulations for firing ammunition for training, target practice, and combat, 28 February 1973, pp 9-1, 9-2, AR 385-63/Marine Corps Order (MCO) P3570.1, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, p 8-1, AR 385-63/MCO P3570.1A, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 15 November 1983, p 8-1.

Firing lines

Firing lines consisted of firing positions that often have included foxholes, sandbags, or other firing supports (see Figures 202-204). They may have been built up with earth depending on the terrain (see "Firing Lines" in the "Embankments" section). "On a range with more than one target, the firing point consisted of a level space 12 ft deep and running for a length of 12 ft for each target in the direction parallel to the line of targets. For example, a range with three targets would have a firing point 36 ft in length and 12 ft in width. The various approved designs for firing points are included in the 1941 edition of TM 9-855. This information was restated in the 1951 version of TM 9-855" ("RO-5," p 29).



Figure 202. A ROTC cadet prepares to fire a rocket launcher at Fort Bragg, NC, 19 July 1954 (NARA College Park, RG 111-SC WWII, box 283, photo SC465007).



Figure 203. Firing a 3.5 rocket launcher "Tank Killer" at Fort Campbell, KY, 13 August 1962 (NARA College Park, RG 111-SC post-1955, box 373, photo SC594126).



Figure 204. Marines firing the 3.5 Rocket Launcher during live firing Snow Fex exercise at Camp Drum, NY, 27 January 1964 (NARA College Park, RG 127-GG-590, box 24, photo A19365).

Targets

Targets for shoulder-launched small caliber rockets included heavy duty reinforced stationary targets, moving sled targets, and light or medium tanks. "Some specific target information for shoulder-launched small caliber rockets is provided in FM 23-30" ("RO-5," p 30).

Stationary targets

"The target used for stationary firing of the 2.36-in. rocket launcher was at least 10 ft square. When firing the M6A1 or M6A3 HE rocket, the target was heavily constructed of either wood or metal. Cloth targets would not cause the round to explode. Stationary targets for the 3.5-in. rocket launcher were 6 ft square and constructed of logs, armor plate, or light wooden frames covered with target cloth. Logs were up to 10 in. in diameter. These log targets are depicted in Figure 205 below" ("RO-5," p 30).

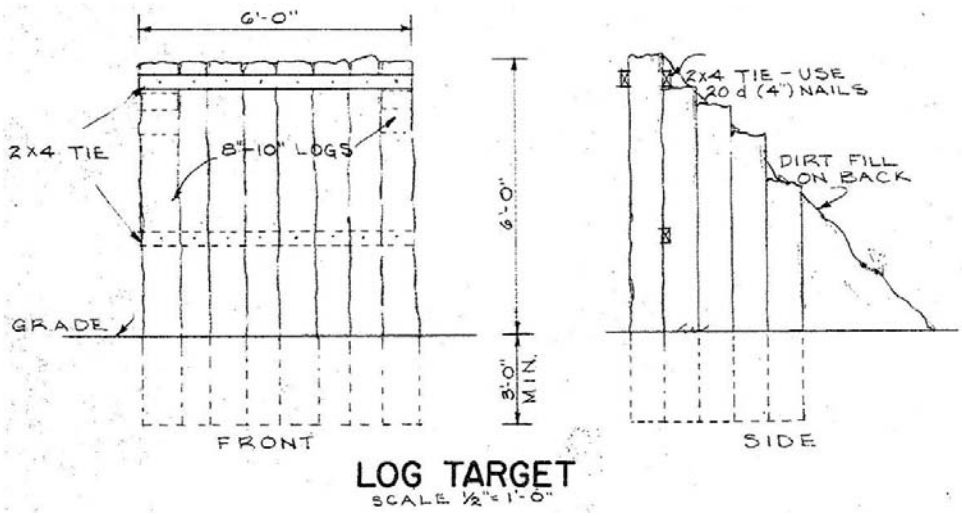


Figure 205. Rocket Launcher range, log target, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans, and details," 21 November 1951).

Moving targets

"Light or medium tanks could be used as moving targets. For the 66mm LAW, tanks were to be used as targets whenever possible. When a tank was not available, a wooden frame target, 6 ft by 19 ft, covered with target cloth or heavy paper could be used. This frame target was mounted on a sled and towed by a vehicle. Other moving targets were 15 to 18 ft long by 6 to 8 ft high and were towed up to speeds of 20 miles per hour (mph). Wooden frame moving targets are shown in Figures 206 and 207 below" ("RO-5," pp 29-31).

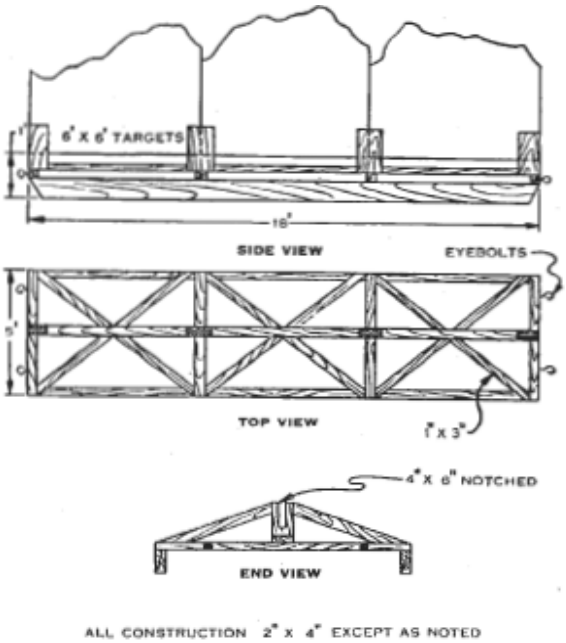


Figure 206. Wooden frame moving target, circa 1955 (FM 23-32, 3.5-in. Rocket launcher, 26 April 1955, pp 105, 106).

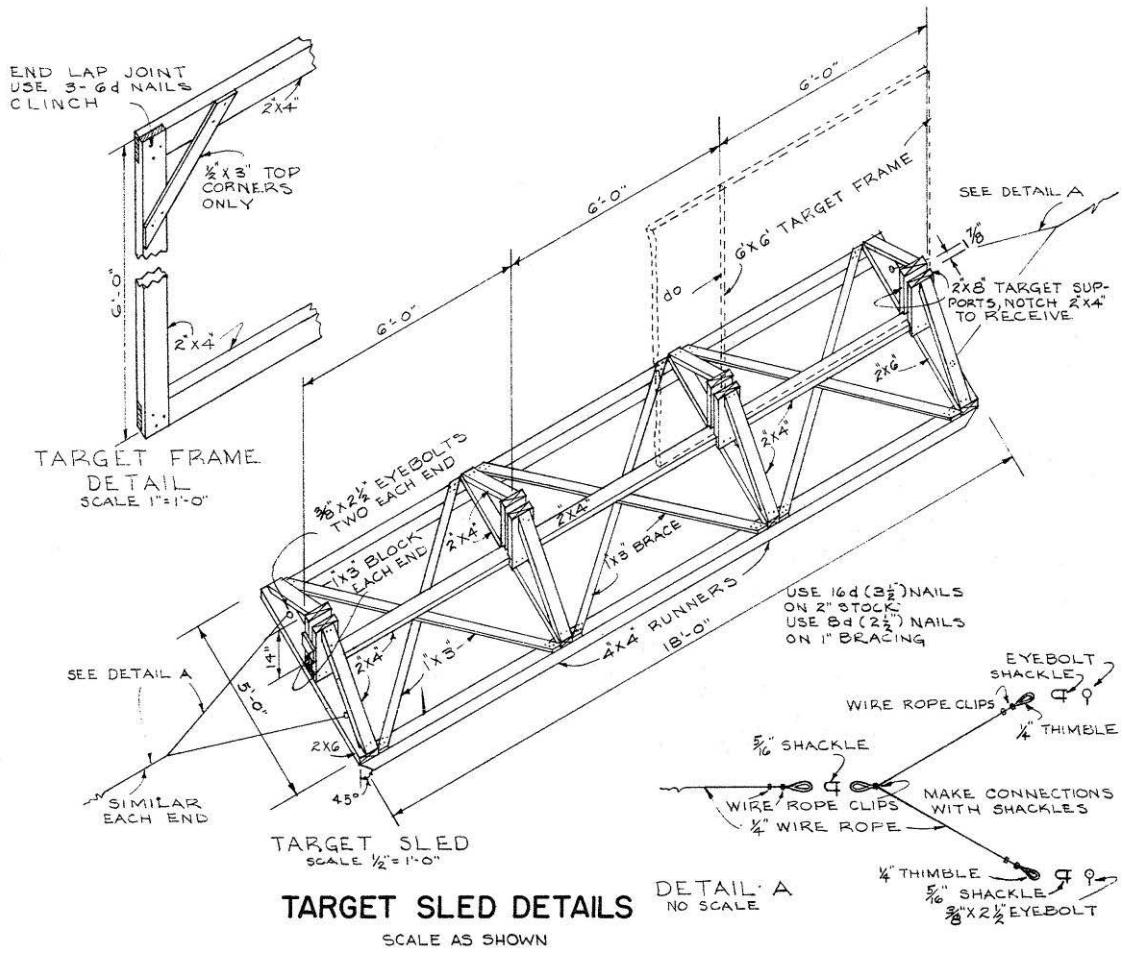


Figure 207. Rocket launcher range, target sled details, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans, and details," 21 November 1951).

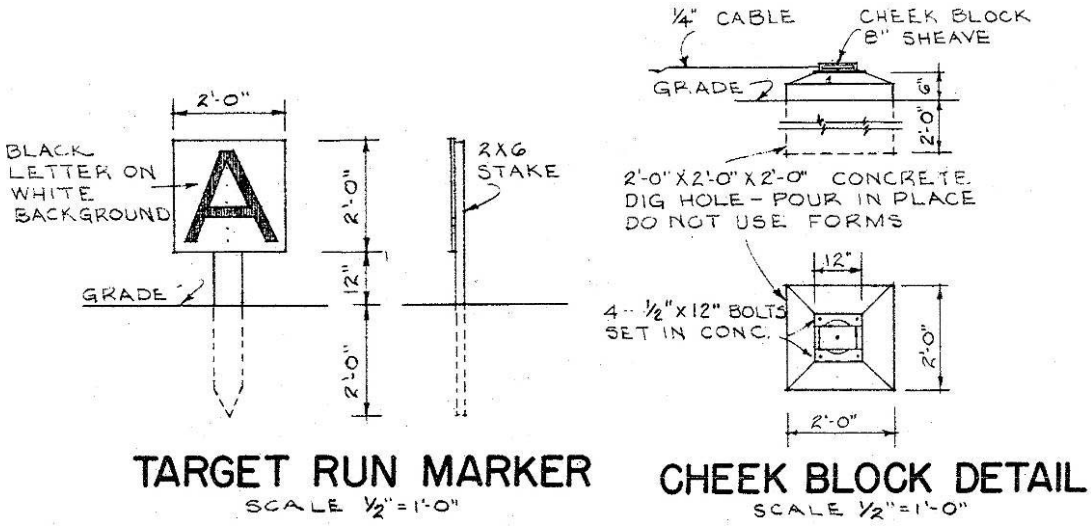


Figure 208. Rocket launcher range, target run marker, and cheek block detail, Fort Bragg, NC, 1951 (Standard Drawing 28-13-19 Sheet 1 of 2, "Range, rocket launcher, plans, and details," 21 November 1951).

Embankments/trenches/etc.

Firing lines

"In some cases, it was necessary to build up the firing point with earth, depending on the terrain. The sides of the firing line could be either sodded or sown with grass seed to prevent erosion. In 1947, it was recommended that a bituminous strip 15 yd wide, running the length of the firing line, be constructed to prevent the occurrence of dust. It was also recommended that a waist-high, two-strand wire fence be constructed to enclose the back blast area" ("RO-5," p 29).

Target lines

An earth mound 1 ft tall was built in front of target lines on moving target ranges to protect sleds on which targets were being pulled (see Figure 200). "In 1941, target butts on permanent ranges were to consist of a retaining wall backed with earth next to the firing points and a target pit on the opposite side. The butts could be constructed of plain or reinforced concrete. In those locales where rock was plentiful, rubble masonry laid up in cement mortar could be used. The designs included plain concrete, multi-target reinforced concrete wall with integral target pit and storeroom, layouts of target frame support piers, and rubble masonry. A crib-type parapet could be constructed using either raw wood or treated wood (i.e., creosote, various salts, or pentachlorophenol), where appropriate (e.g., areas with termite infestations or excessive rainfall). Concrete parapets on temporary projects were to be provided only under very adverse conditions. The various approved designs for target butt retaining walls are included in the 1941 edition of TM 9-855" ("RO-5," pp 29-30).

Buildings

A range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings. Some facilities such as target butts, target pits, and drainage facilities also supplemented range functions ("RO-5," p 14).

Medium caliber rocket range

Gun crews were trained on these ranges to fire medium caliber rockets at fixed and moving targets. Ranges usually consisted of a firing line with multiple cleared firing positions, and heavy-duty stationary frame targets,

moving sled targets, and light or medium tank targets. Gun crews took turns firing at fixed and moving targets from their stationary positions on the firing line.

Historical background

"Medium caliber rockets were considered a type of field artillery and probably used the same type of ranges on a Ground Forces Training Center. Documents reviewed suggest that separate ranges for medium caliber rockets were not established" ("RO-6," p ES2). "Although the multiple rocket launcher was organic (integral) to ground troops, it may have been assigned to echelons above the division level. Information regarding ammunition allowances for troop training indicates that medium caliber rockets and rocket launchers were issued to field artillery units or to the Commanding General, Army Ground Forces, for special purposes such as demonstrations. Some 4.5-in. rockets were included in ammunition allowances for officers attending the Armored School, Ground General School, and Artillery School. Therefore, ranges for training personnel in using medium-caliber rocket launchers would be expected on Ground Forces Training Centers, where ground field artillery units were present and conducted training" ("RO-6," p 12).

Training procedures

"Prior to movement to a medium caliber rocket range, weapons were drawn from the armory and munitions were drawn from the ammunition supply point (ASP). The M55 115mm gas rocket, in particular, was issued from ASPs designated by the field Army commander. Both the 4.5-in. multiple rocket launcher and ammunition were normally transported to the range by the unit using organic vehicles. Pre-firing checks included checking electrical contacts and verification of proper placement and seating of the rounds. First Echelon (Operator) Field Maintenance included cleaning live electrical contacts in the tubes, testing circuit batter power, and installation of instrument light batteries" ("RO-6," p 8).

After receiving their equipment, "the firing unit uncoupled the medium caliber rocket launcher from its prime mover and moved the 4.5-in. multiple launcher by hand to the firing point in preparation for firing. The needed ammunition, tools, and accessories were unloaded. Trail spade holes were dug for seating the launcher. To prevent fires, inflammable material was cleared from a fan-shaped zone ahead of and behind the 4.5-in. launcher. The area to be cleared extended 50 yd to the front and 50 yd to

the rear of the launcher, and fanned out from the launcher in a radius of 50 yd. If there was a possibility of direct fire being delivered, a trench was dug adjacent to the left side of the launcher to provide protection. The trench was L-shaped such that the chief of the section would have an earth barrier between his position and the launcher when it was fired. The blast deflector was secured to the launcher by means of five chain hooks wrapped around the axel. The blast deflector is a toboggan-shaped metal sheet that deflected the blast of firing at the most concentrated area beneath the launcher" ("RO-6," pp 8-9).

"A 4.5-in. multiple rocket launcher weapons crew normally contained a squad leader, gunner, a driver/loader, and one or more ammunition bearers/loaders. Medium caliber rocket ammunition was issued as a complete round. In using the 4.5-in. expendable launcher, the covers were removed and the rocket was fused. The tripod was then set up and adjusted, and the launcher attached and aimed. The lead wires were unraveled to reach a safe firing position. Some medium caliber rockets were packed unfused. The 4.5-in. ammunition was prepared, fused, and loaded. After the 4.5-in. round was loaded, it was attached to the launcher firing mechanism" ("RO-6," p 9)

"On command from the squad leader, the gunner fired the weapon. The 4.5-in. expendable rocket launcher was fired alone or in salvo by means of batteries or a magneto-type firing device. After firing, the crew prepared the weapon for movement to either a new firing position or return to storage. Rounds prepared for firing, but not fired, were returned to their original packings and appropriately marked. After-firing maintenance was then performed. The 4.5-in. rocket launcher was immediately given whatever servicing and maintenance was needed to prepare it for further sustained action or determine the need for maintenance by higher echelons. This servicing and maintenance included lubrication. However, if the crew was returning to garrison immediately after firing, maintenance may have been postponed until they arrived at their destination" ("RO-6," p 9).

"Unless the cause of the rocket malfunction was evident without moving the dud (e.g., failure to remove safety pin or fuze dropping off in flight), rocket duds were not to be moved. They were destroyed in place by authorized and experienced personnel in accordance with TM 9-1900 or TM 9-1903" ("RO-6," p 13). After policing the area and gathering trash, troops either carried the trash off the training site to a landfill, or buried the trash

in a foxhole if they were on their way to do more training ("RO-6," pp 10-11).

Weapons

"Medium caliber rockets include 4.5-in., 7.2-in., 8-in., and 115-millimeter (mm) rockets. Both the Army and Navy developed multiple launch rocket systems. The Army developed an expendable single rocket launcher (M12) and a multiple rocket launcher for the 4.5-in. rocket. The Navy also developed a 4.5-in. rocket system, although it used a different type of rocket. Both the Army and Navy 4.5-in. rockets were used to attack lightly fortified ground targets and enemy personnel. The 7.2-in. rocket system was developed by the Navy during WWII and later modified for Army use as a chemical weapon delivery system. The 8-in. rocket was developed by the Army toward the end of WWII and saw limited deployment. The 115mm rocket was developed in the 1950s to provide units with the ability to conduct large area gas attacks with minimum logistic effort" ("RO-6," pp 1-2).

Layouts and danger areas

"As illustrated in Figure 209, Areas A, B, and C were safety areas expressed in yards and measured from the inner impact area boundary. Distance X (or Line of Fire Distance) was the maximum range of the weapon. In a medium caliber rocket range, the 'Line of Fire' line began at the firing point(s) and extended to each target. In practice, training requirements likely required multiple targets and firing points. As a result, the overall range size was a combination of the individual range fan layouts. Area D was the firing area in which troops were positioned" ("RO-6," p 16). "The 1951 edition of TM 9-855/TO 28-10-26 includes a reference to SR 385-310-1/AFR 50-13 for establishing danger areas with specific mention of a 4.5-in. multiple rocket launcher range and reference to Figure 209" ("RO-6," p 15).

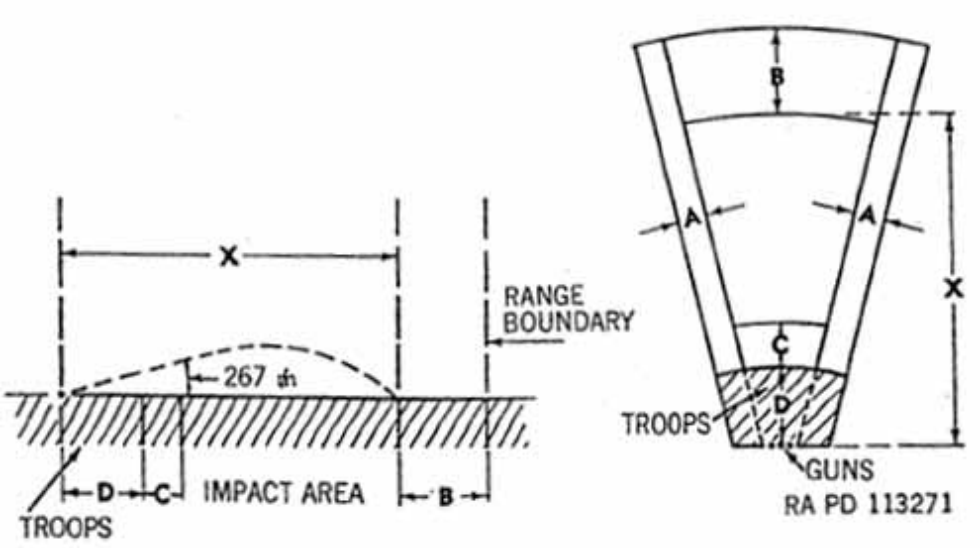


Figure 209. Areas for 4.5-in. multiple launcher range, circa 1949-1951 (TM 9-855/TO 28-10-6, Targets, target material, and training course layouts, November 1951, pp 84, 85, 94; SR 385-310-1/AFR 50-13, Safety, regulations for firing ammunition for training, target practice, and combat, 4 March 1949, pp 10, 12, 13).

"Another layout of surface danger areas for rocket launchers is provided in the 1955 edition of SR 385-310-1/AFR 50-13 and reproduced as Figure 210" ("RO-6," p 16).

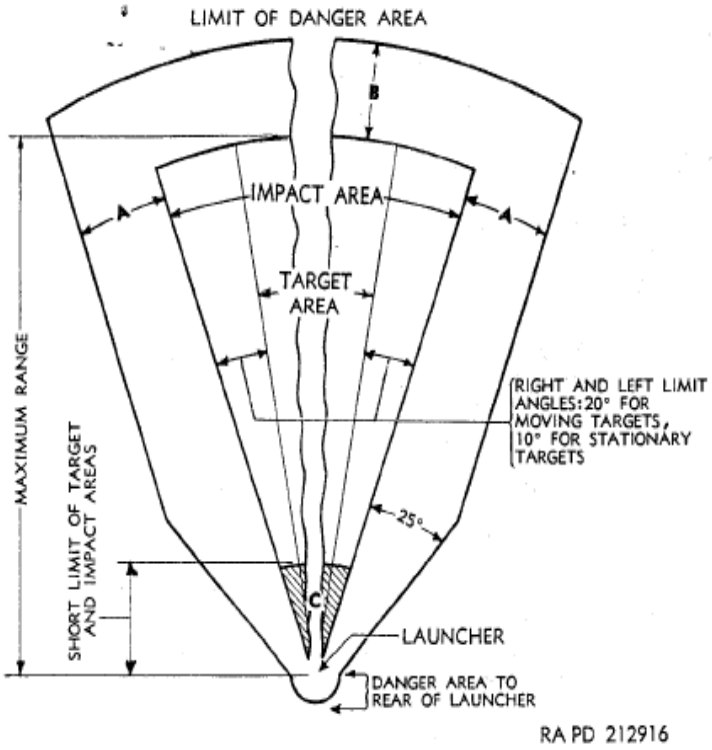


Figure 210. Surface danger areas for rocket launcher firing, circa 1955 (SR 385-310-1/AFR 50-13, Safety, regulations for firing ammunition for training, target practice, and combat, 5 December 1955, p 25).

"Danger areas provided in editions of SR 385-310-1/AFR 50-13 (renumbered as AR 385-63/AFR 50-13) are variations of the same configuration presented in the 1955 edition of the document. Dimensions of danger areas (identified as Areas A, B, and C in Figure 212) correspond to distances shown in Table 19. Table 20 in conjunction with Figure 210 above, can be used to determine the size of a medium caliber rocket range based on the type of weapon being fired. If more than one type of weapon was fired (e.g., 4.5-in. and 7.2-in. rockets), the largest area required was used" ("RO-6," p 17).

Table 19. Rocket range danger area dimensions.

Year	Rocket Caliber	Maximum Range	Danger Area Dimensions		
			A	B	C
1949	4.5-in.	T22/T46 – 4,600 yds M16/M17 – 5,300 yds M20/M21 – 4,000 yds	800 yds	1000 yds	600 yds
	7.2-in.	3,200 yds	800 yds	1000 yds	800 yds
1955	4.5-in.	M20/M21 – 4,000 yds M16/M17 – 6,330 yds M32/M33 – 8,890 yds	800 yds	1,000 yds	600 yds
1968	115mm	10,970 m	750 m	950 m	950 m
1973	115mm	10,970 m	750 m	950 m	750 m
1978	115mm	10,970 m	750 m	950 m	750 m
Source: "RO-6," p 17.; yds = yards m = meters					

"Various editions of TM 9-1950 provide specific information regarding weapon and ammunition designations. Specifics maximum range data for various medium caliber rockets are presented in Table 20. Ammunition designations followed by A1, A2, etc., refer to a modification of the basic model" ("RO-6," p 17).

Table 20. Rocket weapons/ammunition performance data.

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
Catalogue/1944	4.5"	M8, M8A1, M8A2	HE	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,000

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
	4.5”	M8A3	HE	M10, M12, M14, T27, T27E1, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,000
	4.5”	T3	HE	M10, M12, M14, T27, T27E1, T31, T33, T34, T34E1, T36, T38, T46, T46E1, T47, T57, T58, T60, T61, T65	4,600
	4.5”	T22E1	HE	M10, M12, M14, T27, T27E1, T27E2, T33, T34, T34E1, T36, T38, T46, T47, T57, T58, T60, T61	4,300
	4.5”	T29	HE	M10, M12, M14, T27, T27E1, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	3,500
	4.5”	T38	HE	T62, T63	5,600
	4.5”	T41 (limited procurement)	HE	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,500
	4.5”	T48	HE	M10, M12, M14, T27, T27E1, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,600
	4.5”	T67	HE	To be developed	5,000
	4.5”	T47	WP Smoke	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,600
	4.5”	T64	FM Smoke	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,600

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
	4.5”	T61	Chemical (CG)	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,600
	4.5”	M9, M9A1, M9A2	Practice	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,000
	4.5”	M9A3	Practice	M10, M12, M14, T27, T27E1, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,000
	4.5”	T39	Practice	T62, T63	5,600
	4.5”	T42 (limited procurement)	Practice	M10, M12, M14, T27, T27E1, T27E2, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,500
	4.5”	T49	Practice	M10, M12, M14, T27, T27E1, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,600
	4.5”	T56	Practice	M10, M12, M14, T27, T27E1, T31, T33, T34, T34E1, T36, T38, T46, T46E1, T47, T57, T58, T60, T61, T65	4,600
	4.5”	T46E1	Practice	M10, M12, M14, T27, T27E1, T27E2, T33, T34, T34E1, T36, T38, T46, T47, T57, T58, T60, T61	4,300
	4.5”	T49	Practice	M10, M12, M14, T27, T27E1, T31, T33, T34, T36, T38, T46, T46E1, T47, T57, T58, T60, T61	4,600
	4.5”	T68	Practice	To be developed	5,000
	7.2”	T14 (Limited procurement)	HE	T51, T53, T56	5,700
	7.2”	T17 (Limited procurement)	Practice	T51, T53, T56	5,700

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
	7.2”	T15	WP Smoke	T51, T52, T56	5,700
	7.2”	T16	HEAT	T51, T53, T56	5,700
	7.2”	T21 (Limited procurement)	Chemical (CG)	T28, T32, T40, T54, T64	3,300
	7.2”	T24	HE	T28, T32, T40, T54, T64	3,300
	7.2”	T28	HE	T28, T40, T54, T64	3,000
	7.2”	T40	Practice	T28, T40, T54, T64	3,000
	7.2”	T37	HE	T28, T40, T54, T64	230
	7.2”	T44, T44E1	Practice	T28, T40, T54, T64	230
	7.2”	T50	WP Smoke	T28, T32, T40, T54, T64	3,300
	7.2”	T51	FS Smoke	T28, T32, T40, T54, T64	3,300
	7.2”	T52	Chemical (CC)	T28, T32, T41, T54, T64	3,300
	7.2”	T53	Chemical (AC)	T28, T32, T40, T54, T64	3,300
	7.2”	T57	HE	T28, T40, T54, T64	3,000
	7.2”	T58	Practice	T28, T40, T54, T64	3,000
	7.2”	T63	HE	T51, T52, T56	TBD
	7.2”	T69	HE	T28, T40, T54, T64	230
	7.2”	T25	HE	T37, T53	550
	8”	T34	Incendiary	T37, T53	550
	21 cm”	T36	HE	T49, T50	9,000
TM 9-1950/1945	4.5”	M8A1	HE	Not identified	6,000
	4.5”	M9A1	Practice	Not identified	6,000
	4.5”	M8	HE	Not identified	6,000
	4.5”	M9	Practice	Not identified	6,000
	4.5”	M8A2, M8A3	HE	Not identified	4,600
	4.5”	M9A2, M9A3	Practice	Not identified	4,600
	4.5”	T22	HE	Not identified	4,600
	4.5”	M16	HE	Not identified	Not given
	4.5”	T46	Practice	Not identified	4,600
	7.2”	T37	HE	Not identified	230
	7.2”	T44E1	Practice	Not identified	3,300
	7.2”	T24	HE	Not identified	3,300
	7.2	T21	Chemical	Not identified	3,300
	8”	T25	HE	Expendable	550

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
AR 775-10/1947	4.5”	Not identified	HE	Expendable	Not given
	4.5”	Not identified	HE	Multiple	Not given
	4.5”	Not identified	Practice	Multiple	Not given
SR 385-310-1/AFR 50-13/1949	4.5”	T66, T66E2	All	M21	Not given
TM 9-1950/1950	4.5”	M16 (T38E3)	HE	Not identified	5,210
	4.5”	M17	Practice	Not identified	5,210
	4.5”	M16A1 (M16E5), M16A2 (M16E4)	HE	Not identified	6,300
	4.5”	M17A1, M17A2	Practice	Not identified	6,300
	4.5”	M16E1 (T38E2, T38E8)	HE	Not identified	5,210
	4.5”	M17E1	Practice	Not identified	5,210
	4.5”	M20 (T38E7)	HE	Not identified	5,210
	4.5”	M21	Practice	Not identified	5,210
	4.5”	M20E1, M20E2	HE	Not identified	6,300
	4.5”	M21E1, M21E2	Practice	Not identified	6,300
	4.5”	M24	Drill	Not identified	Not given
	7.2”	M25 (T21)	Chemical (CG)	Not identified	3,430
	7.2”	M27 (T52)	Chemical (CK)	Not identified	3,430
AR 385-63/AFR 50-13, 1955	4.5”	M20	HE	M21, M12A1, M12A2	4,000
	4.5”	M21	Practice	M21, M12A1, M12A2	4,000
	4.5”	M16A1, M16A2	HE	M21,	6,330
	4.5”	M17A1, M17A2	Practice	M21	6,330
	4.5”	M32	HE	M21	8,980
	4.5”	M33	Practice	M21	8,980

Data Source/Year	Rocket Caliber	Ammunition Designation	Ammunition Type	Launcher Designation	Max Range (yd)
TM 9-1900/TO 11A-1-20/1956	4.5”	T160E5, M16A2	HE	T66, M21	10,000
	4.5”	T161E5, M17A2	Practice	T66, M21	10,000
	4.5”	T162	Smoke	T66, M21	10,000
	4.5”	T164E1, T165E1, T166E1	Chemical	T66, M21	10,000
	4.5”	M24	Drill	T66, M21	10,000
TM 9-1950/1958	4.5”	M24	Inert	Not identified	Not given
	4.5”	T16E1	Gas	Not identified	Not given
	4.5”	M16, M16A1	HE	Not identified	6,000
	4.5”	M17, M17A1	Practice	Not identified	6,000
	4.5”	M32	HE	Not identified	9,100
	4.5”	M33	Practice	Expendable	9,100
	4.5”	M20	HE	M12A1, M12A2	Not given
	4.5”	M21	Practice	M12A1, M12A2	Not given
TM 9-1055-215-12/1961	115mm	M55 (T238)	Chemical (GB or VX)	M91	10,970 m
AR 385-63/1968	115mm	M61	All	Not identified	750 (minimum)
AR 385-63/1973	115mm	M61	All	Not identified	750 (minimum)
AR 385-63/1978	115mm	M61	All	Not identified	750 (minimum)

Source: “RO-6,” pp 18-23; SR 385-310-1/AFR 50-13, Safety, regulations for firing ammunition for training, target practice, and combat, 4 March 1949, p 13; AR 385-63/AFR 50-13, Safety, regulations for firing ammunition for training, target practice, and combat, 5 December 1955, p 14; AR 385-63, Safety, regulations for firing ammunition for training, target practice, and combat, 17 June 1968, pp 9-1, 9-2; AR 385-63/Marine Corps Order (MCO) P3570.1, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 22 February 1978, p 8-1; AR 385-63/MCO P3570.1A, Safety, policies and procedures for firing ammunition for training, target practice, and combat, 15 November 1983, p 8-1

Notes: HE– high explosive; LAW – light anti-tank weapon; AT – anti-tank; TBD – to be determined

Targets

"Targets for the direct laying of the 4.5-in. multiple launcher usually consisted of hostile vehicles, tanks, and personnel threatening the position. No other information was obtained regarding targets specific for medium caliber rocket ranges. A testing target could be improvised for use when no distant aiming point was visible for bore sighting. A flat piece of masonite, wallboard, or similar material covered with a sheet of weather resistant paper was used. The target could be fastened to a wooden stand to stabilize it" ("RO-6," p 33).

Embankments/trenches/etc.

At firing positions, "trail spade holes were dug for seating the launcher. If there was a possibility of direct fire being delivered, a trench was dug adjacent to the left side of the launcher to provide protection. The trench was L-shaped such that the chief of the section would have an earth barrier between his position and the launcher when it was fired" ("RO-6," pp 8-9).

Buildings

A range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings. Some facilities such as target butts, target pits, and drainage facilities also supplemented range functions ("RO-6," p 14).

Tank ranges

Tank crews were trained on these ranges to fire tank-mounted weapons and to operate as a team in a variety of combat situations. Ranges usually consisted of a firing line with multiple cleared firing positions or a firing course, which tanks traveled down. Targets included stationary E, F, and M-type silhouette targets, panel targets, frame targets, moving target sleds mounted on target tracks, log targets, natural terrain targets, material targets, target vehicles, and others. Tank crews took turns firing at fixed and moving targets from their stationary positions on the firing line, or as such targets appeared, while the tank moved across the range. A variety of subcaliber and 1,000-in. miniature ranges were used for familiarization training with tank mounted weapons.

Historical background

"Tank ranges were located at Ground Forces Training Centers where infantry, armored, and mechanized ground units conducted training. Tanks were organic to infantry divisions beginning in 1945, although armored divisions always had them. Therefore, every Ground Forces Training Center would likely have had a tank range. Reference material from 1947 indicates at least two to three tank ranges per division were constructed" ("RO-10," p 14).

"The tank was developed to initially to give the infantry a means to breach defensive lines, such as those encountered in the static warfare of WWI. During World War II (WWII), an additional mission of defeating enemy armored forces was added to the armored force tasks. A miniature 1,000-in. range was utilized for several subcaliber firing exercises" ("RO-10," p ES2).

"The factors that affected a tank range layout were: (1) fixed firing point versus firing from a moving vehicle and (2) fixed versus moving targets. Firing at different configurations on ranges produced three major benefits: (1) individuals and crews were trained how to use weapons on a tank, (2) qualification tests for the individuals and crews were done, and (3) tank crews were taught how to operate as an integrated unit in a larger organization. The qualification course consisted of multiple tables of fire that tested crews and individuals to perform necessary tasks. Tables were scored and a designated minimum was required before a crew was certified as being qualified" ("RO-10," p 17).

"Tank crews were positioned on the range to observe an enemy area where various types of targets were emplaced. These targets included representations of tanks, antitank guns, recoilless rifles, machine guns, and infantry. The weapons were positioned to indicate fire from different angles and at ranges from 800 to 3,500 yd. Targets were camouflaged and placed in realistic tactical locations. Demolitions, simulators, and blank ammunition were used to simulate enemy fire. As training progressed, moving and surprise targets were introduced" ("RO-10," p 62).

"Tank range operations involved training individual crew members in technical proficiency with tank-mounted weapons, and training crews to operate as a team in a variety of situations on a range. The following is a list of training steps that were required for tank crews:

Basic training period (first 15 weeks)

1. Operation and handling of equipment
2. Care and maintenance
3. Crew drill
4. Simulated firing, direct laying
5. Range and speed estimation
6. Ammunition
7. Proficiency test (on 1,000-in. range)
8. Basic firing, direct laying (on standard firing range).

Unit (crew) training period (second 12 weeks)

1. Platoon drill, direct laying
2. Platoon firing, direct laying (on standard firing range)
3. Drill, indirect laying, single tank
4. Firing, indirect laying, single tank (on standard firing range)
5. Drill, indirect laying, two or more tanks
6. Firing, indirect laying, two or more tanks (on standard firing range)
7. Combat firing of small units (on standard firing range)
8. Combat firing of large units (on standard firing range).

The list of training activities above illustrates the variety of tasks and activities that were required to train tank crews at ranges. Non-firing exercises were conducted to prepare tank crew members for firing exercises. These non-firing exercises were designed to develop firing skills, a thorough understanding of the operation and functioning of the tank turret and weapons, familiarization with crew duties, and conduct-of-fire procedures for engaging targets. Applicable non-firing exercises were conducted before range firing. Classroom and practical work were also given on prepare-to-fire checks, safety precautions, handling, loading, and stowing ammunition, and misfire and stoppage procedures. It appears likely that some of the practical exercises (e.g., range estimation training and range-finder training) could have been conducted on the tank range" ("RO-10," p 9).

Training procedures

Weapons and ammunition were transported to the range from the armory/motor pool and ammunition supply point in organic vehicles. "Prior to firing, the gun was released from its traveling position and the telescopic sight was installed. Pre-firing checks" of equipment were then performed. "Loading ammunition on tanks involved removing it from the

ammunition supply vehicle, removing the packaging, placing the ammunition at appropriate staging locations, and then transferring the ammunition from the staging locations to the tank. On the command COMMENCE FIRING or FIRE from the appropriate authority, the gunner fired the weapon. In emergencies, anyone could give the command CEASE FIRING" ("RO-10," pp 10-11).

"In response to the command OUT OF ACTION, the loader unloaded the gun, if loaded, and closed the breech. The gunner released the trigger and called CLEAR. The gunner then manipulated the gun so the loader could lock the gun in the traveling lock. The gunner then removed the sight (if so directed) and replaced it in the carrying case. In the meantime, the loader moved the ammunition clear of the gun and replaced the unused rounds into the ammunition containers" ("RO-10," p 11). Misfired ammunitions were either disposed of at the site by an ordnance officer, or taken offsite for proper disposal. Troops policed the area, and either buried their trash in a foxhole if they were on their way to do more training, or transported it off the range for proper disposal ("RO-10," pp 12-13).

Subcaliber ranges

"Subcaliber firing was part of tank crew training. Subcaliber firing was conducted on 1,000-in. ranges, subcaliber firing ranges, and standard ranges. The purpose of subcaliber firing was to develop the accuracy, speed, and confidence of the crew. Subcaliber firing also conserved service ammunition without detracting from the value of training. For qualification, the tank crew was required to fire a series of tables. Some of these tables were fired using subcaliber ammunition. Tank crews were not to fire service ammunition until they had thoroughly learned the technique of fire with subcaliber equipment. In the description of the various ranges below, if a table is listed, it means that the table was fired on that range" ("RO-10," p 17).

1,000-in. range

"During the Subcaliber Manipulation Exercise (Table III), the gunner fired at targets on a 1,000-in. range that were located fairly close to one another and at various heights. Ammunition was loaded with alternate dummy rounds. A typical danger area layout for the 1,000-in. range is depicted in Figure 211 below" ("RO-10," p 18).

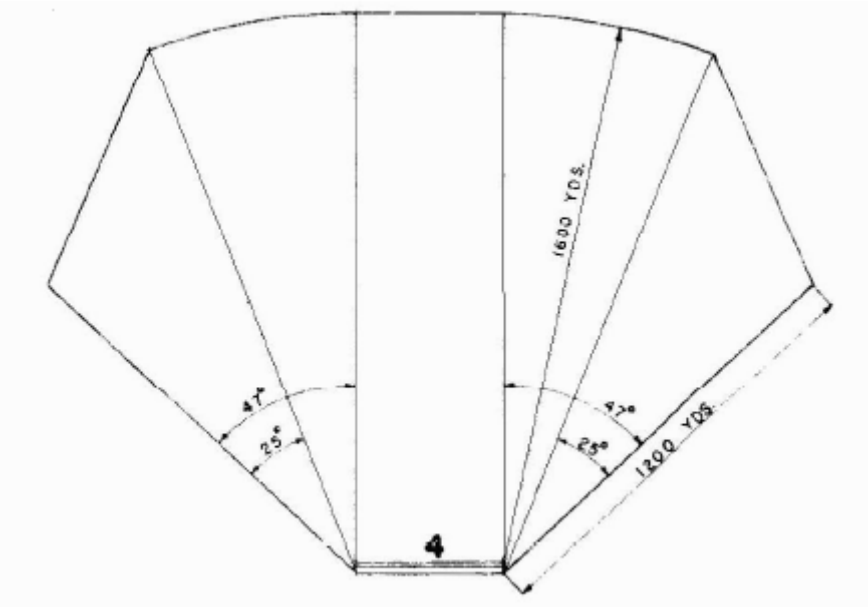


Figure 211. Typical 1,000-in. range danger area layout, circa 1943 (War Department, general drawings, 1600-series, training aids, Small arms ranges including field target ranges, drawing No. 1600-100, 15 January 1943).

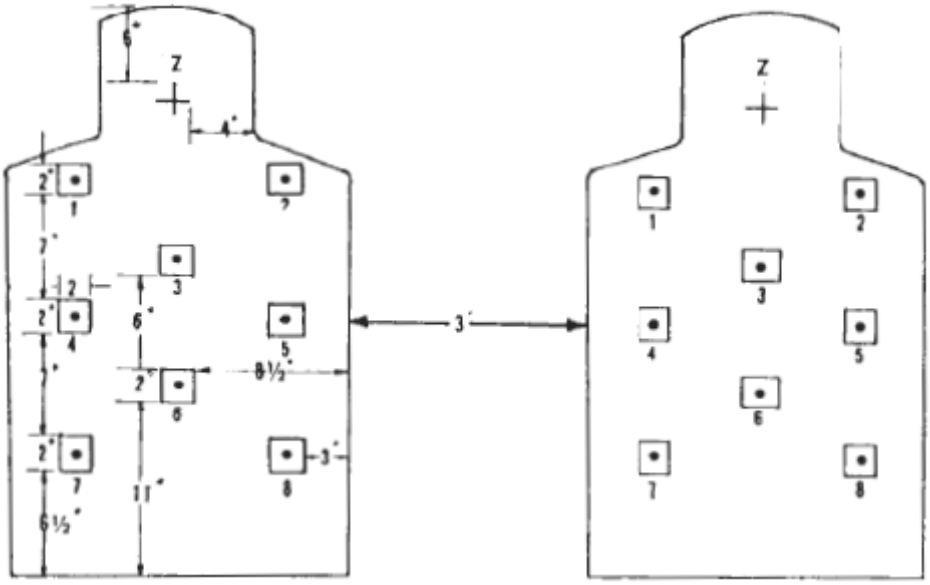


Figure 212. Targets for subcaliber 1,000-in. firing, circa 1957-1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 356, 357).

"The Triangular 1,000-in. Moving Target layout consisted of three runways in which a sled target moved to simulate various direction of movement and speeds of probable combat targets. The three runways and sideboards were constructed of 1 ¼-in. lumber. The sled was constructed of heavy lumber to provide a low center of gravity. The target holder was constructed of ¾-in. material and the bottom surface of the sled was cov-

ered with tin so that it would slide easily in the runways. Movement of the sled was actuated by a wire cable that ran from a hand-operated drum through a system of pulleys. A commercial wooden cable drum was used to make the reel. The 1,000-in moving target layout is presented in Figures 213 and 214 below (best available figure)" ("RO-10," p 71).

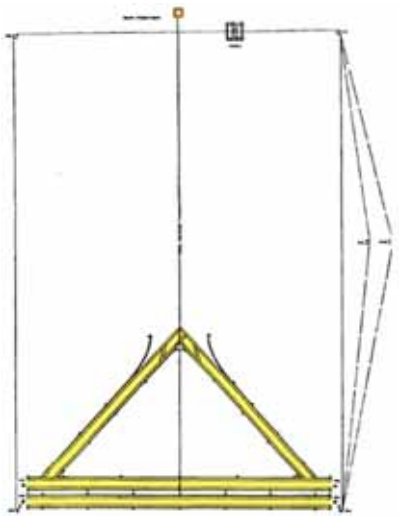


Figure 213. 1,000-in. moving target three-runway configuration, circa 1940 (FM 23-70, Basic field manual, 37mm anti tank gun, m3, 1 October 1940, pp 136).

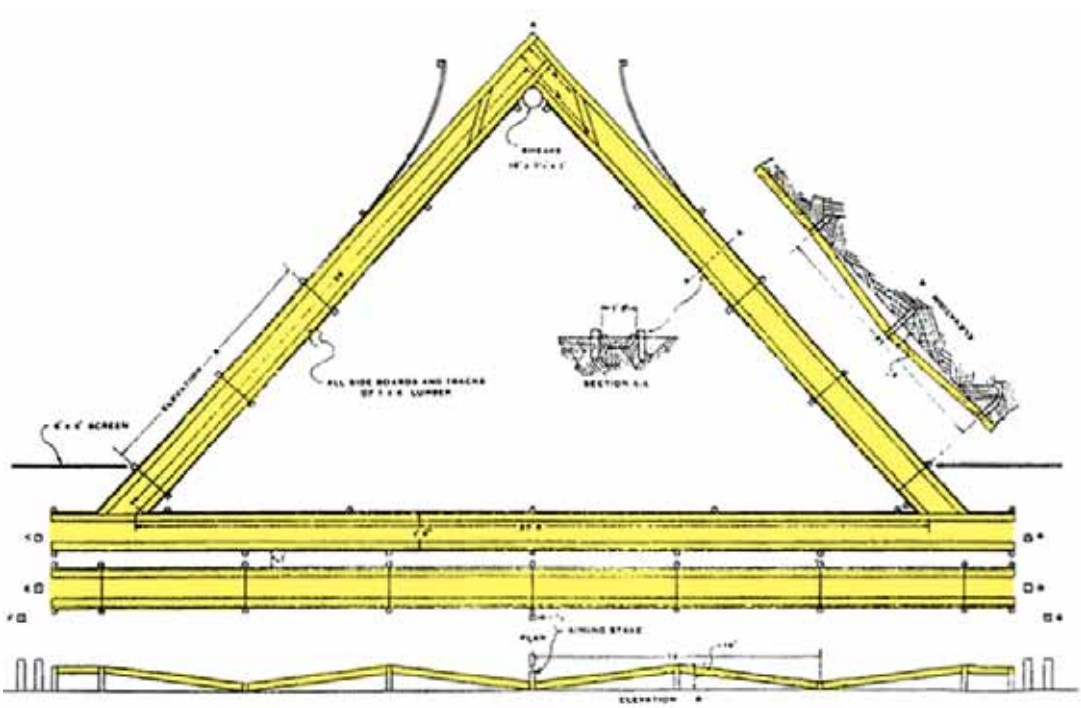


Figure 214. Triangular 1,000-in. range moving target layout, circa 1941 (fm 23-80, Basic field manual 37mm gun, tank, m5 (mounted in tanks), 25 June 1941, pp 105-111).

"The Parallel 1,000-in. Range Target layout was of similar construction to the triangular layout, except there were two parallel runways. The construction of the runways and moving target, as well as how the target was moved along the runways, was the same as for the triangular layout. The 1,000-in. range 37mm M6 tank gun moving target layout and construction details are depicted in Figure 215 below" ("RO-10," p 72).

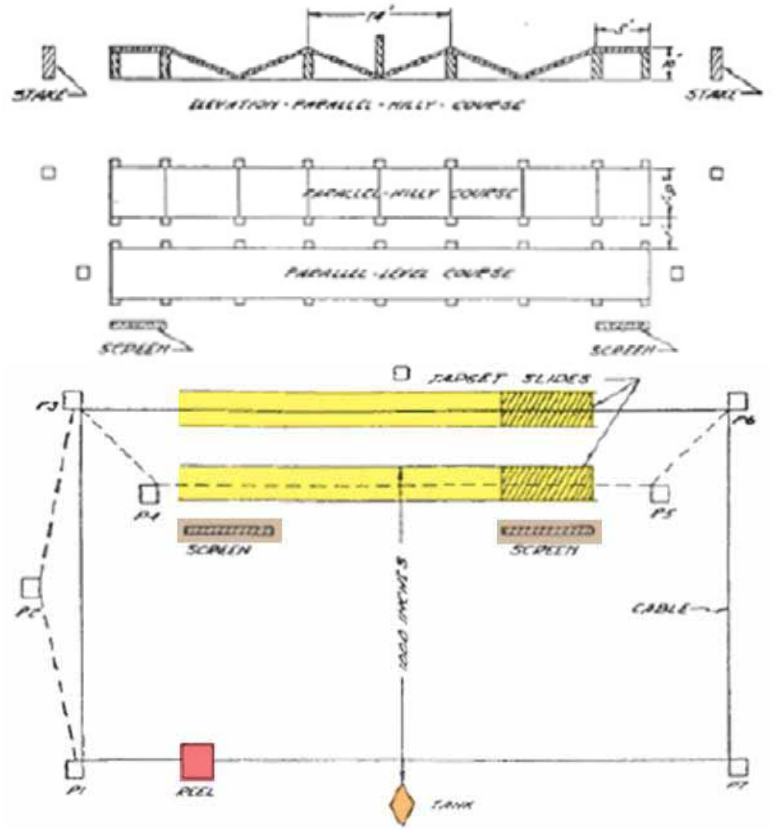


Figure 215. Parallel 1,000-in. range moving target layout and construction details, circa 1942 (FM 23-81, Basic field manual 37mm gun, tank, m6 (mounted in tanks), 3 April 1942, pp 84-86; FM 23-95, Basic field manual, 75mm tank gun m2 (mounted in medium tank M3), 4 May 1942, pp 107).

"The 1,000-in. Range Moving Target itself was 3 ft 6 in. by 2 ft 6 in. and made of ¾ by 1 ½-in. lumber, halved and joined squarely at the corners. The frame was covered with target cloth to provide a bearing surface for the paper target. Silhouette Nos. 1, 2, and 3 represented the size of tanks at approximately 300 yd, 600 yd, and 900 yd, respectively. The 1,000-in. range moving target is depicted in Figure 216 below" ("RO-10," p 73).

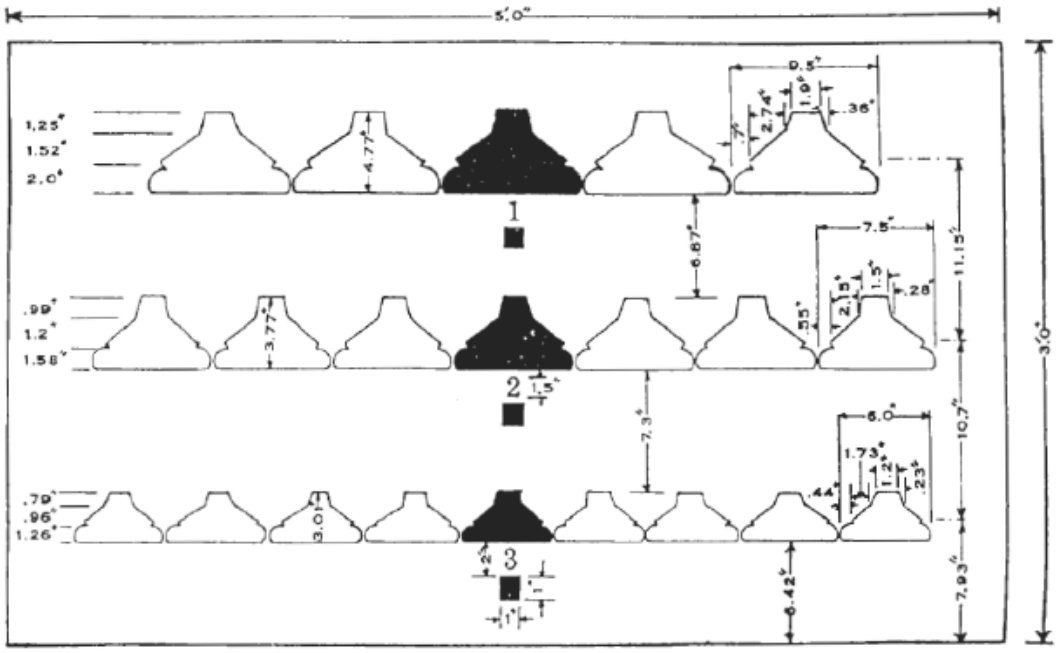


Figure 216. 1,000-in. range moving target, circa 1942 (FM 23-81, Basic field manual 37mm gun, tank, m6 (mounted in tanks), 3 April 1942, p 83).

"For 1,000-in. Range Subcaliber Firing Exercises, a series of target cards were situated fairly close to one another and at varying heights. The 5-in. by 5-in. target cards were made of white cardboard, numbered in black, and stapled or tacked onto staves. A typical 1,000-in. range subcaliber firing exercise target layout is depicted in Figure 217 below" ("RO-10," p 62).

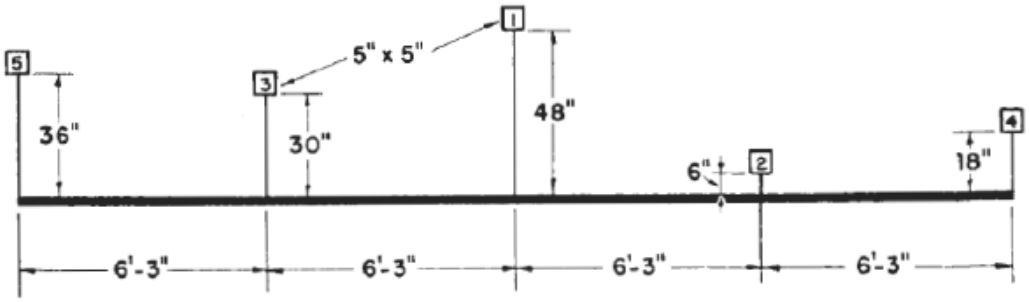


Figure 217. A 1,000-in. range subcaliber firing exercise target layout, circa 1950 (FM 17-12, Tank gunnery, 30 November 1950, pp 434-436).

Subcaliber range

"Subcaliber exercises on this range were fired at a distance of 60 meters. A single range site could be established to facilitate the firing of all subcaliber tables at one location. An example of a single subcaliber range layout is presented in Figure 218 below" ("RO-10," p 19).

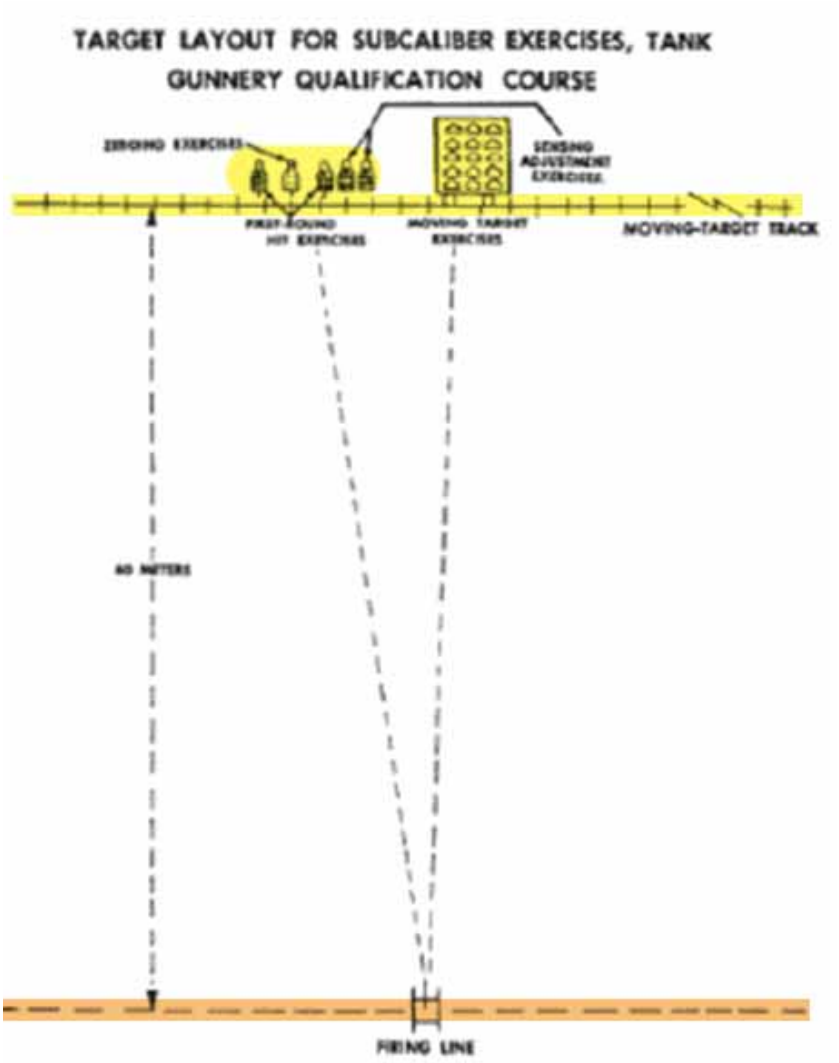


Figure 218. Single subcaliber range layout, circa 1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 339, 342).

"For the Subcaliber Moving Target Exercise, Field Range, a moving tank or panel was used as the target on a standard range. The target tank could be any armored vehicle with sufficient protection against .30 caliber ammunition. Additional armor was usually added at vulnerable points for safety. The target tank moved at speeds of 5, 10, and 15 mph on the first, second, and third runs, respectively. The target panel was 6 x 6 ft in size on which several 6-in. by 8-in. tank silhouettes were drawn. The panel moved at approximately 3 mph so the crew member could track the target and engage it within the safety limits. The panel target is depicted in Figure 219 below" ("RO-10," p 70).

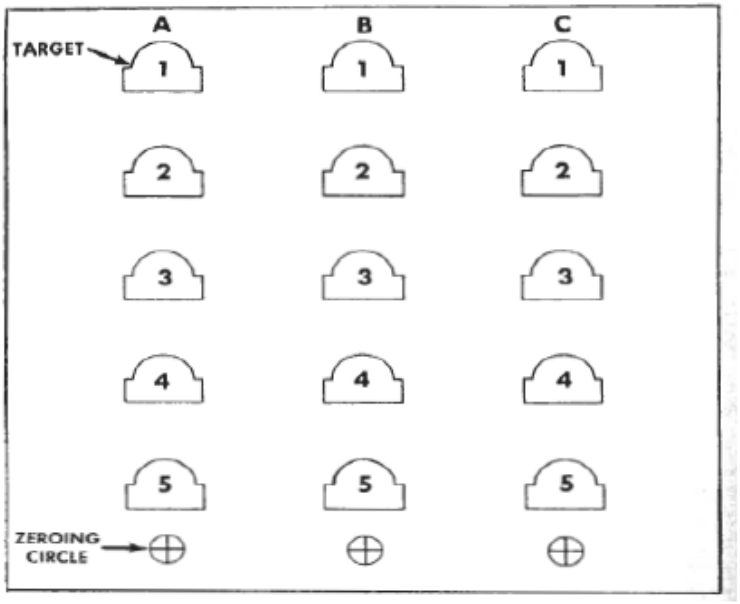


Figure 219. Subcaliber moving panel target, circa 1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 298-301, 329).

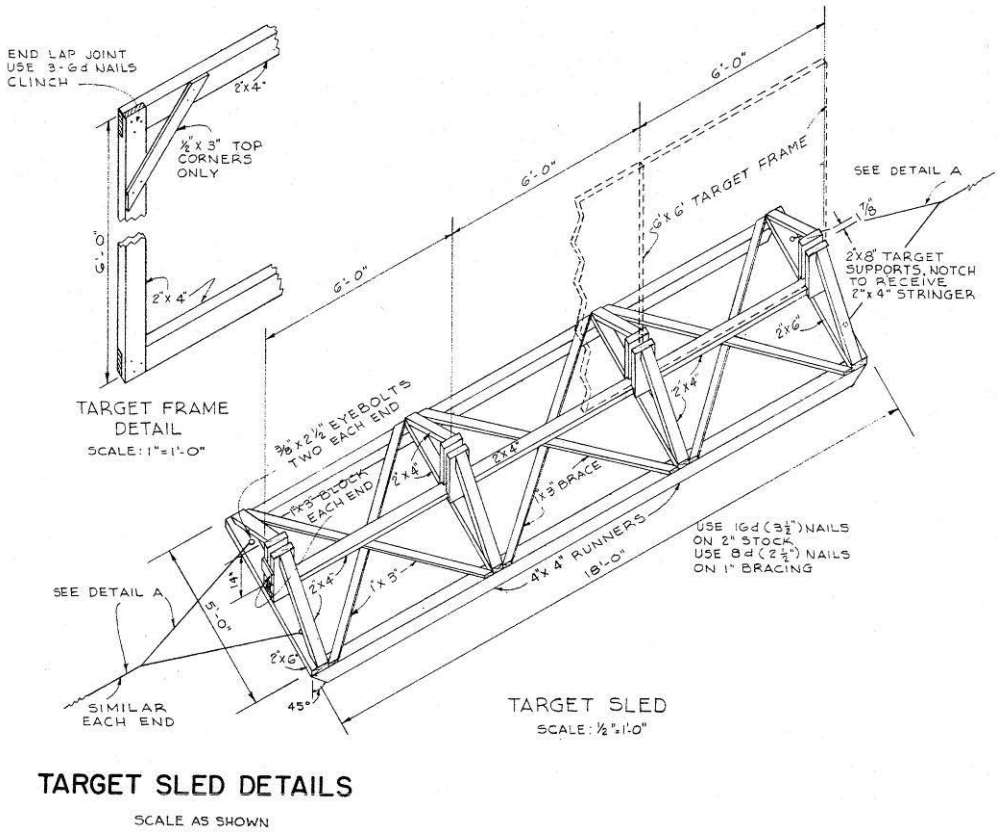


Figure 220. Tank subcaliber moving target range target sled and frame details, Fort Bragg, NC, 1951 (Standard Drawing 28-13-15 Sheet 1, "Range moving target, tank subcaliber, plan, and details," 7 December 1951).

Standard range

"Subcaliber manipulation and shot adjustment exercise firing was done using a .30 caliber machine gun, either a coaxial machine gun or one mounted on the main gun barrel. The purpose of this exercise was to develop the ability of the crew member to develop speed and precision in sensing. Tracer and dummy ammunition was used. Ammunition was loaded with alternate dummy rounds so that the crew member could fire single shots. These exercises were fired using Table II. The danger area for the subcaliber manipulation and shot adjustment exercise is depicted in Figure 221 below" ("RO-10," p 20).

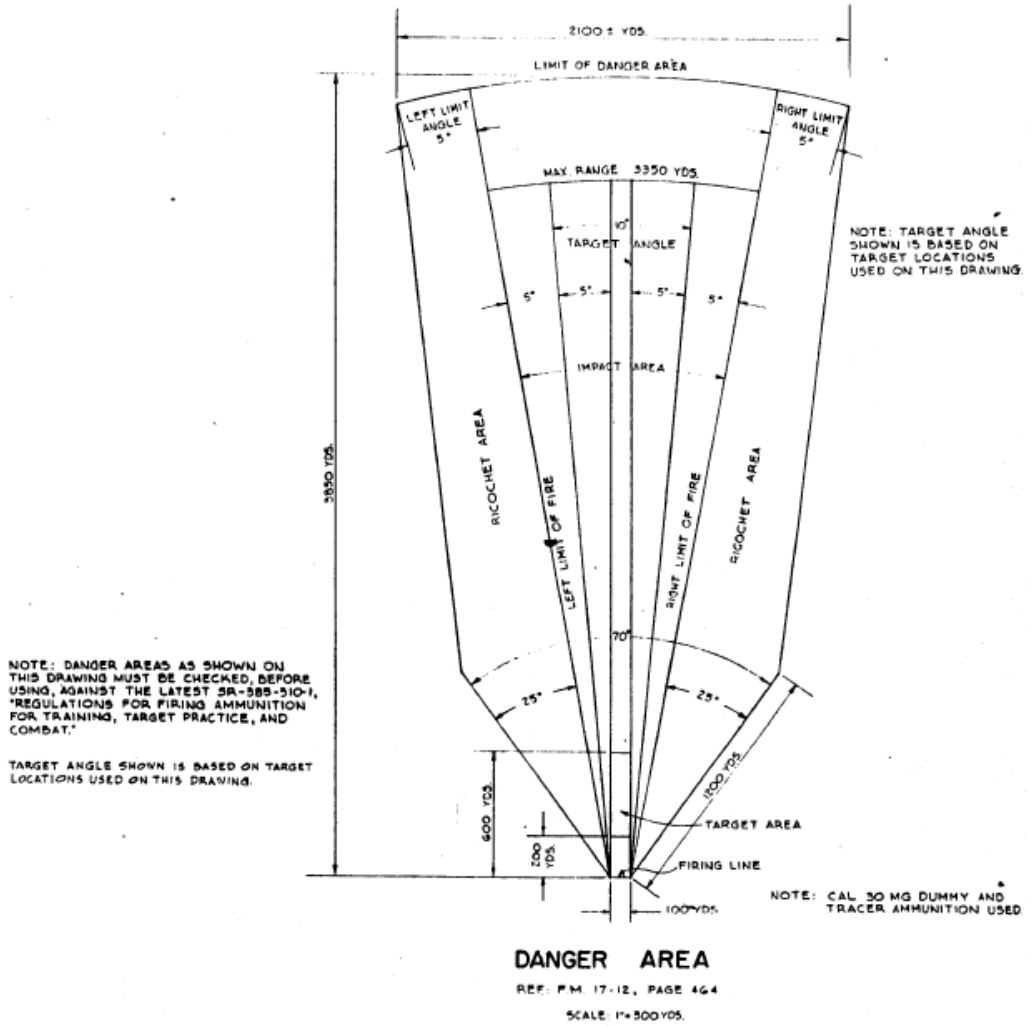


Figure 221. Danger area, tank subcaliber manipulation and shot adjustment, circa 1951 (Standard Drawing No. 28-13-26, "Range, tank subcaliber manipulation and shot adjustment," 21 November 1951).

"In the Subcaliber Shot Adjustment exercise conducted on a standard range, E-type silhouettes or other targets were placed in the impact area at ranges of from 200 to 600 yd from the firing line. The E-type silhouette target was constructed of 1/8-in. think pasteboard with a wooden stave attached to the back. The target was painted an olive drab color. The E-type silhouette target is represented in Figure 222 below" ("RO-10," p 64).

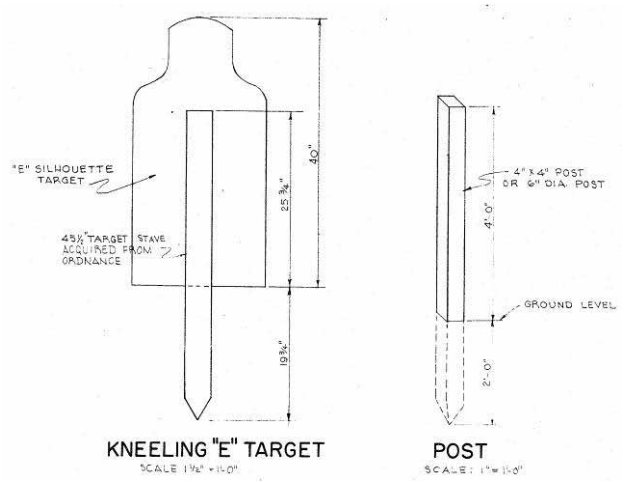


Figure 222. Subcaliber tank moving vehicle range, kneeling E target, Fort Bragg, NC, 1951 (Standard Drawing 28-13-20 Sheet 1 of 1, "Range, moving vehicle, tank subcaliber, plan, and details," 21 November 1951).

"Other examples of stationary subcaliber targets are depicted in Figures 223 and 224 below" ("RO-10," p 64).

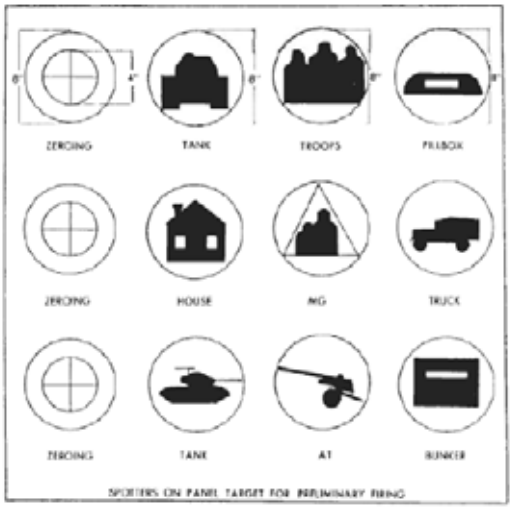


Figure 223. Spotters on panel target, circa 1957-1961 (FM 17-12, Tank gunnery, 21 May 1957, pp 197-200).

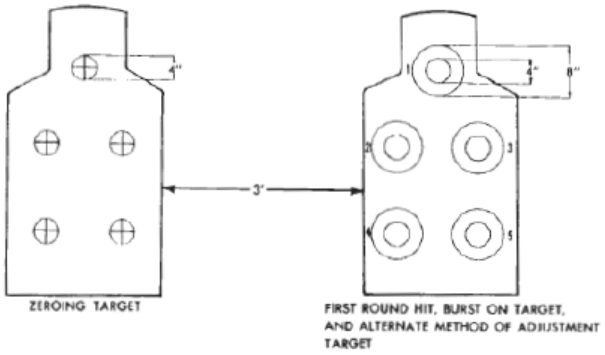


Figure 224. Targets for subcaliber 200-ft firing, circa 1957-1961 (FM 17-12, Tank gunnery, 3 April 1961, pp 356, 357).

HE miniature range

"In 1950, the Subcaliber High Explosive (HE) Adjustment Exercise (Miniature Range) was conducted using Table I. A crew member, acting as tank commander, facing the impact area, assumed a prone position directly under the coaxial machine gun, on the tarpaulin under the rear deck. The tank commander's orders were relayed to the gunner who then fired the coaxial machine gun in accordance with the commands. The tank commander was graded on giving correct commands and ability to adjust fire to achieve a positive range sensing. The danger area for the subcaliber HE miniature range is depicted in Figure 225 below" ("RO-10," p 21).

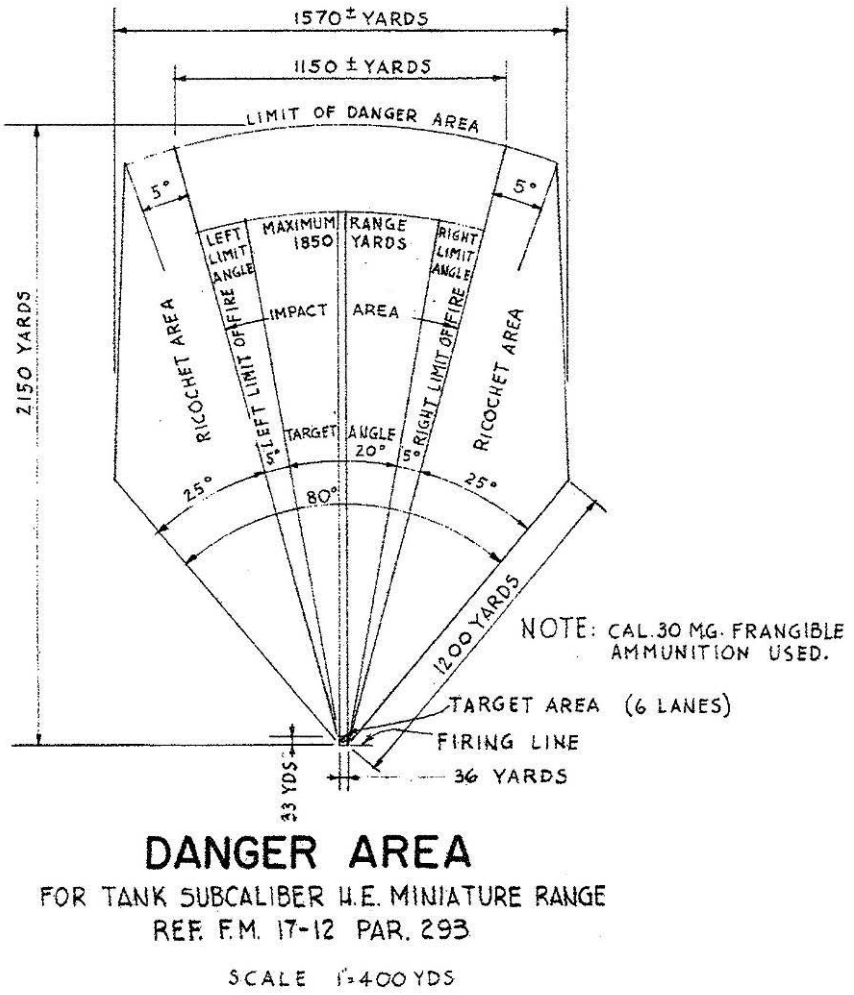


Figure 225. Tank subcaliber HE miniature range danger area, Fort Bragg, NC, 1951 (Standard Drawing 28-13-08 Sheet 1, "Range tank subcaliber, HE miniature, plan, and details," 21 November 1951).

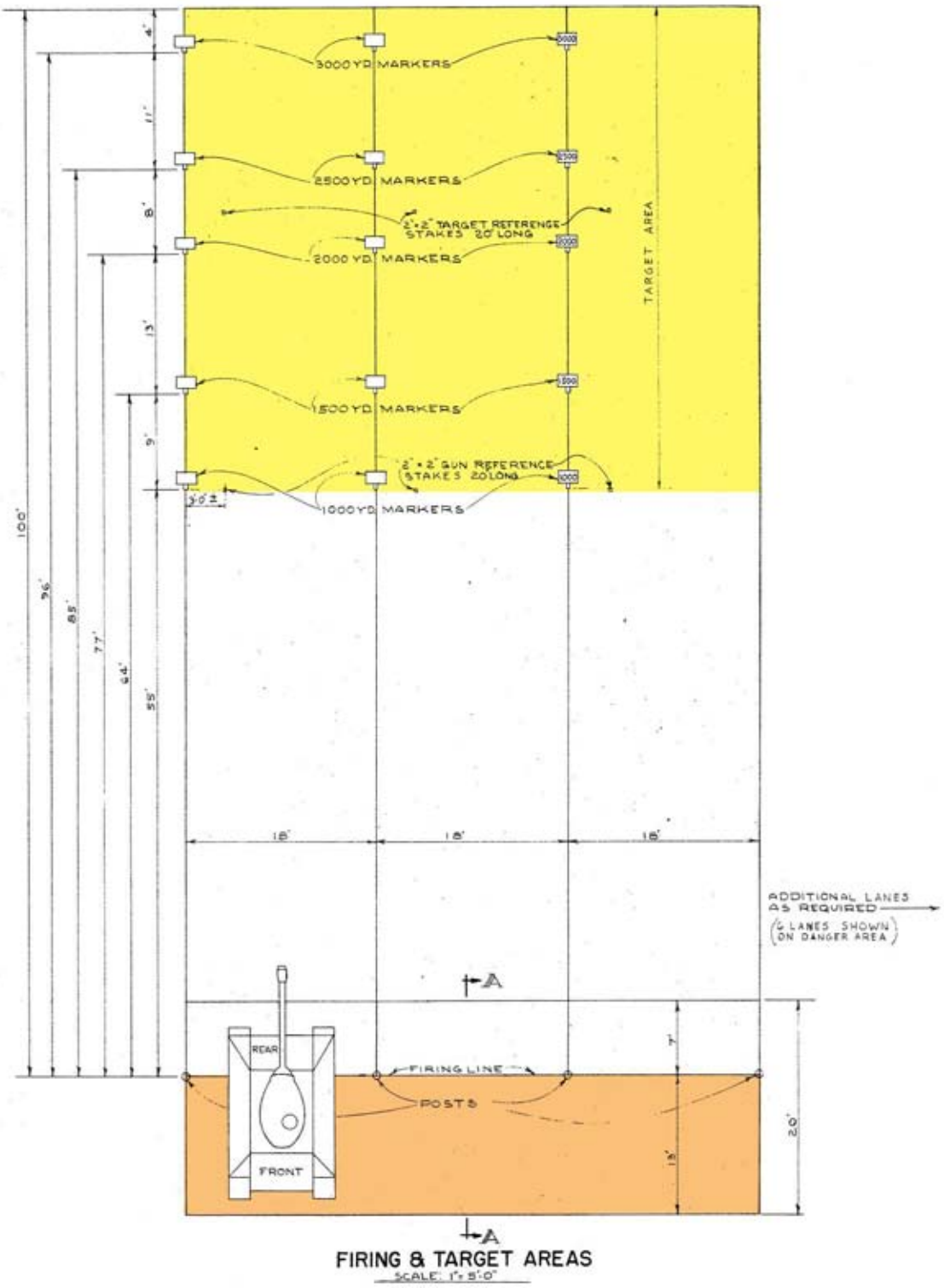


Figure 226. Tank subcaliber HE miniature range firing and target areas, Fort Bragg, NC, 1951 (Standard Drawing 28-13-08 Sheet 1, "Range tank subcaliber, HE miniature, plan, and details," 21 November 1951).

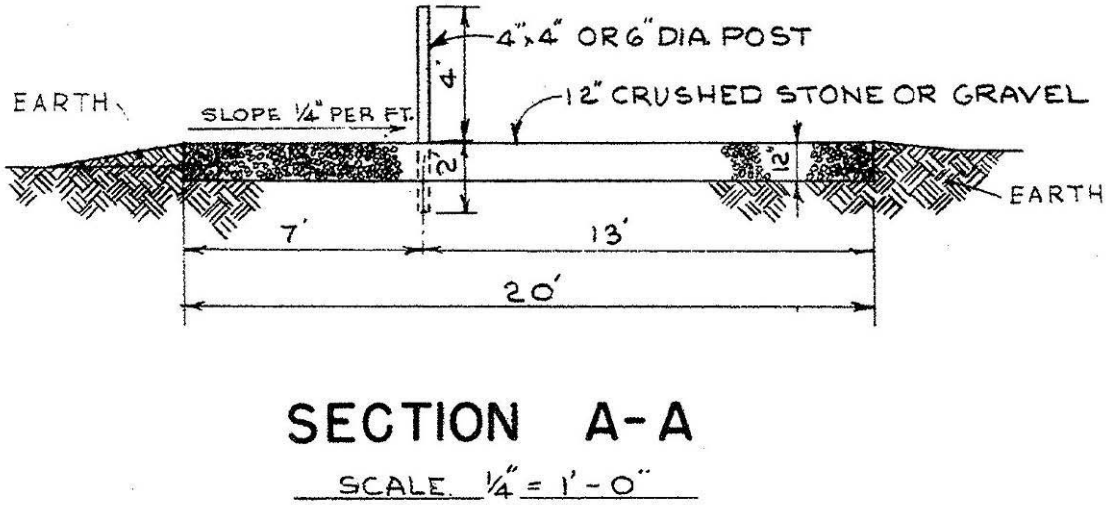


Figure 227. Tank subcaliber HE miniature range section AA, Fort Bragg, NC, 1951 (Standard Drawing 28-13-08 Sheet 1, "Range tank subcaliber, HE miniature, plan, and details," 21 November 1951).

"Another type of subcaliber firing exercise conducted on a standard range was the HE Miniature Range Exercise. Small markers were set out along the left edge of each impact area to indicate ranges of 1,000, 1,500, 2,000, 2,500, and 3,000 yd. Some easily discernable object was placed to serve as a gun reference point. At another point in the impact area, a second object was placed to serve as a reference point. Throughout the impact area, bottle caps, chips of wood, cartridge cases, or other small objects were placed to serve as targets. The HE miniature range target layout is depicted in Figure 228 below" ("RO-10," p 63).

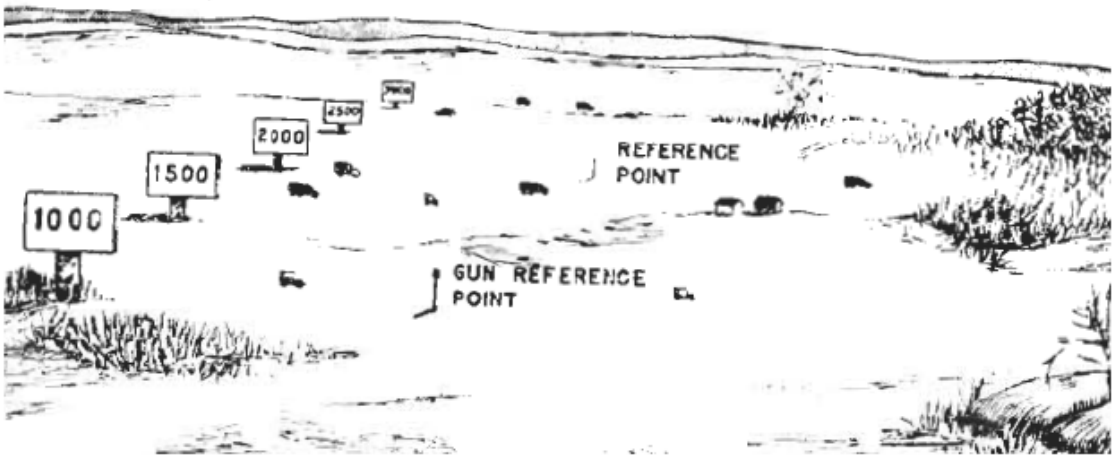


Figure 228. HE miniature range exercise target layout, circa 1950 (FM 17-12, Tank gunnery, 30 November 1950, pp 456-459).

Moving target range

"In the Subcaliber Moving Target Exercise, Field Range (Table IV in 1950, Table III in 1961) exercise, the gunner fired at either a moving target tank or a moving target panel. The exercise consisted of three runs of the target during which 15 rounds were fired. Alternate runs were made in opposite directions. The danger area layout for this exercise is presented in Figure 229 below" ("RO-10," p 22).

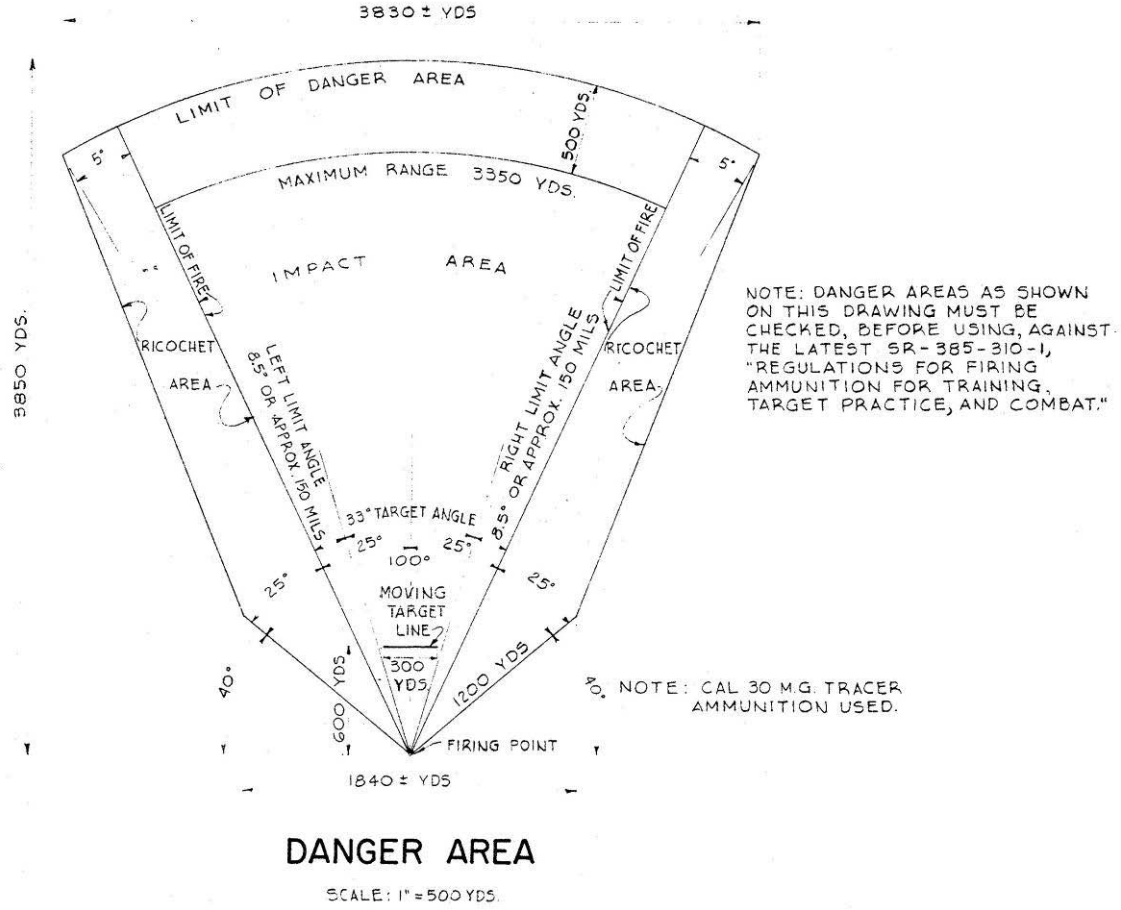
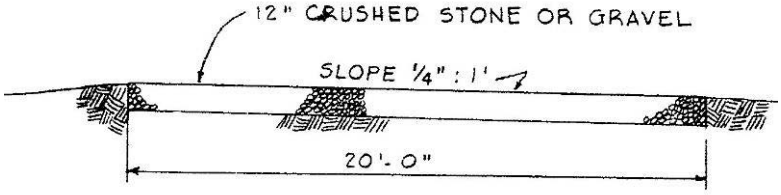


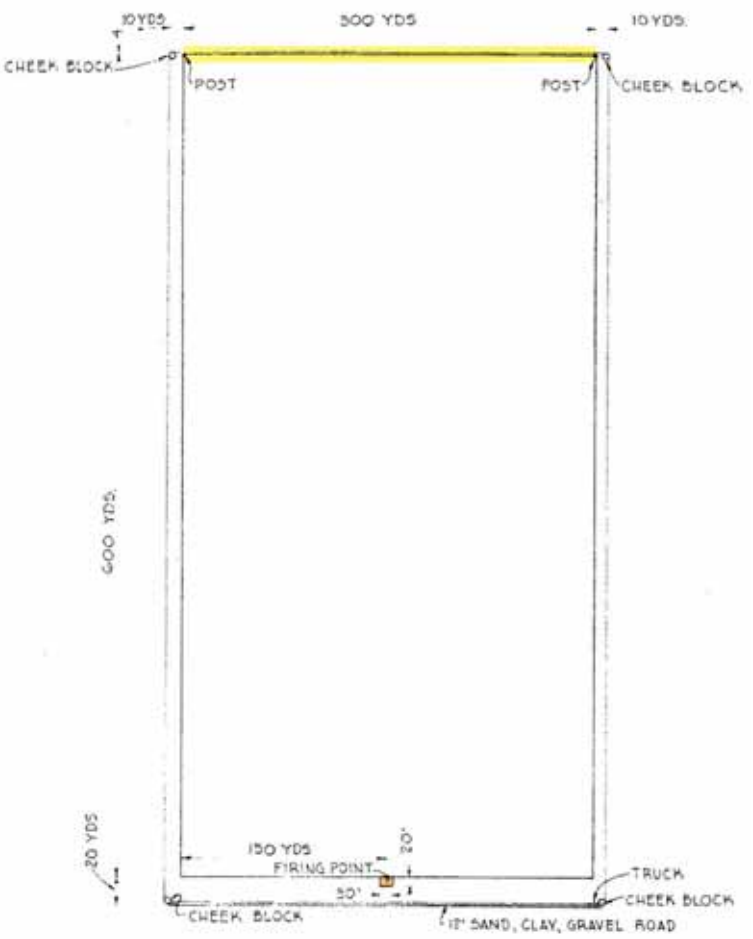
Figure 229. Tank subcaliber moving target range danger area, Fort Bragg, NC, 1951 (Standard Drawing 28-13-15 Sheet 1, "Range, moving target, tank subcaliber, plan, and details," 7 December 1951).



SECTION THRU FIRING LINE

SCALE: ¼" = 1'-0"

Figure 230. Tank subcaliber moving target range section through firing line, Fort Bragg, NC, 1951 (Standard Drawing 28-13-15 Sheet 1, "Range, moving target, tank subcaliber, plan, and details," 7 December 1951).



TYPICAL LAYOUT
PLAN
FIRING AND TARGET AREAS

SCALE 1" = 60 YDS.

Figure 231. Tank subcaliber moving target range typical layout plan, Fort Bragg, NC, 1951 (Standard Drawing 28-13-15 Sheet 1, "Range, moving target, tank subcaliber, plan, and details," 7 December 1951).

Wilson range

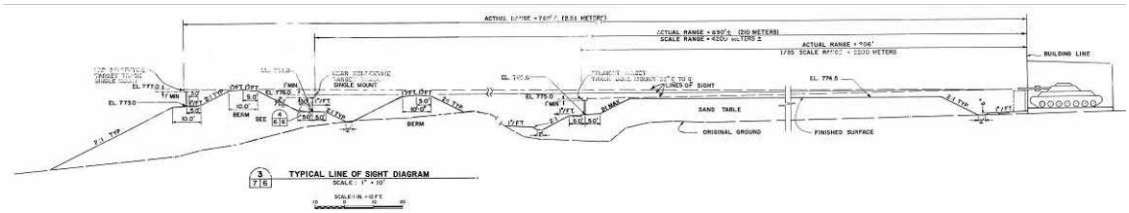


Figure 232. Typical line of sight diagram, Wilson Range, Fort Knox, KY, 1981 (Standard Drawing 28-13-13 Sheet 6, "Details, Wilson Range, Tables I, II, and III," September 1981).

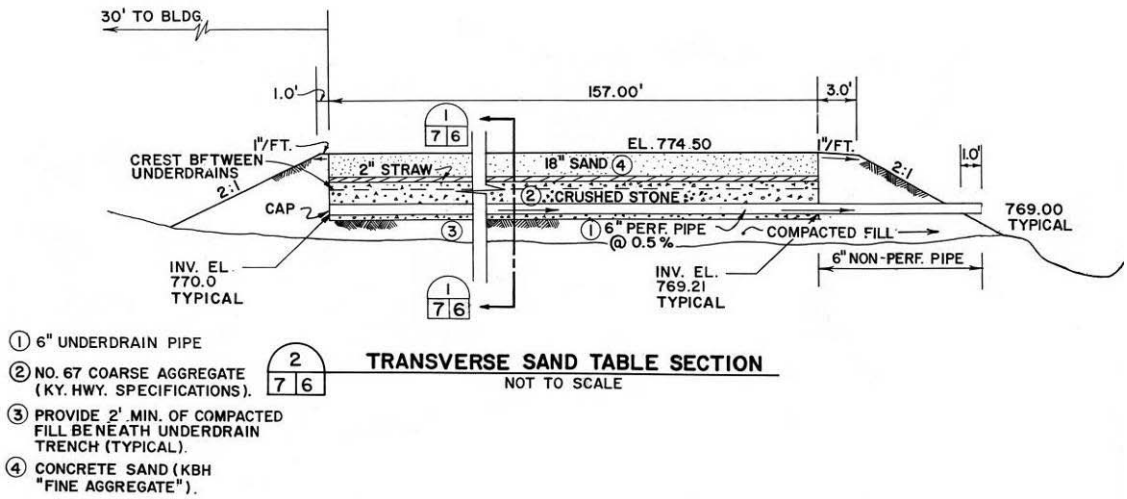


Figure 233. Traverse sand table section, Wilson Range, Fort Knox, KY, 1981 (Standard Drawing 28-1,-13 Sheet 6, "Details, Wilson Range, Tables I, II, and III," September 1981).

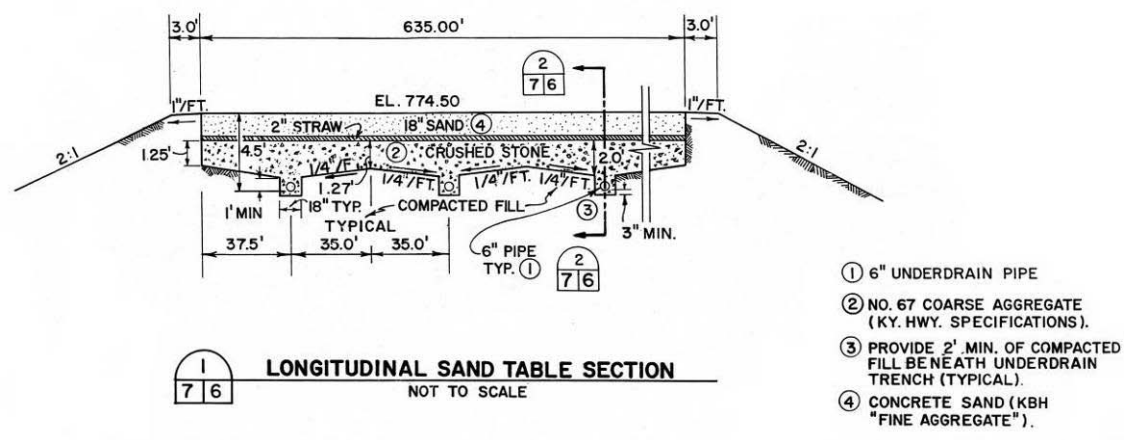


Figure 234. Longitudinal sand table section, Wilson Range, Fort Knox, KY, 1981 (Standard Drawing 28-13-13 Sheet 6, "Details, Wilson Range, Tables I, II, and III," September 1981).

Tank or anti-aircraft moving target range

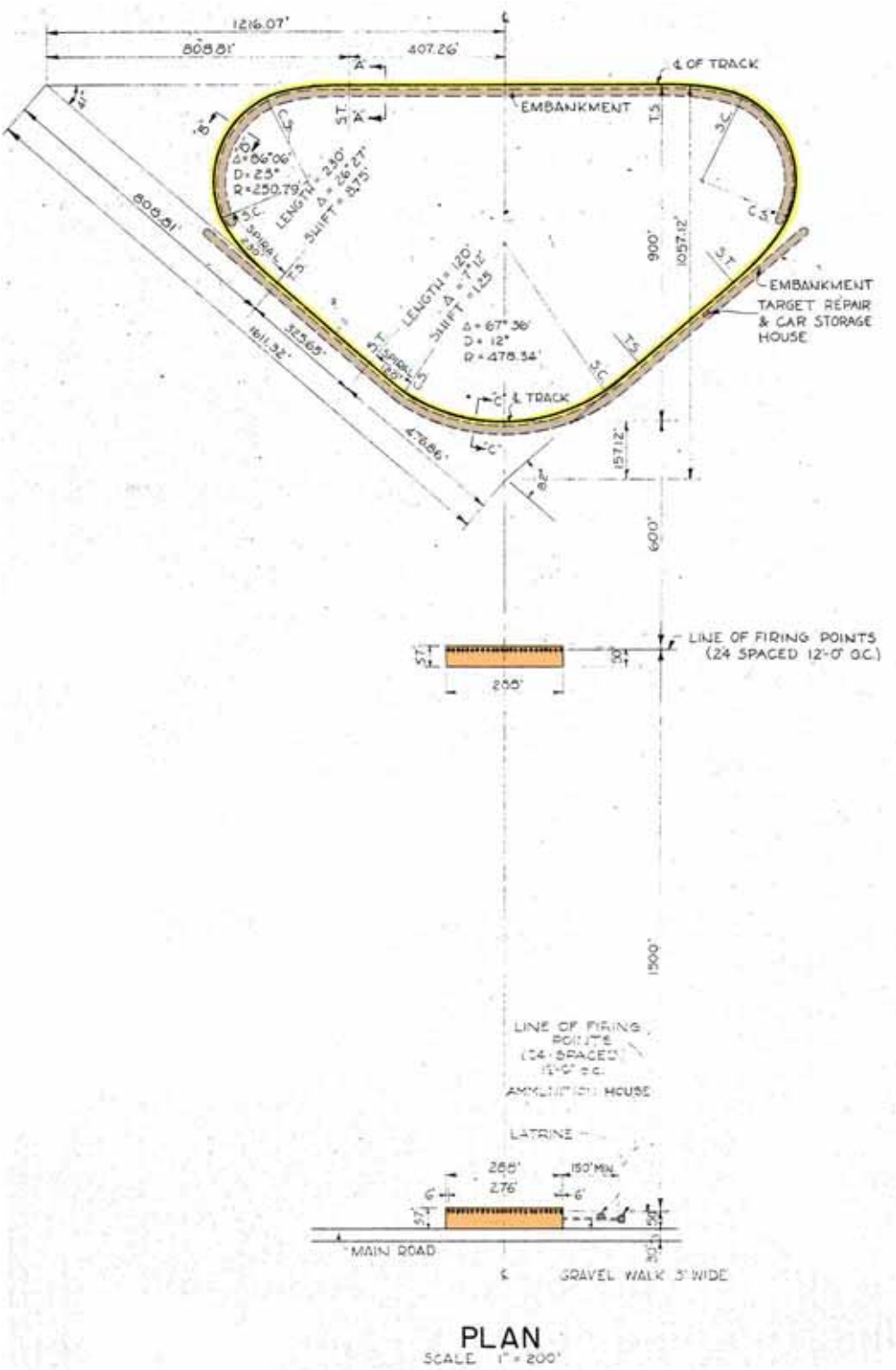


Figure 235. Tank or anti-aircraft moving target range (for guns to include 120mm), plan, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 1 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), plans," 4 August 1952).

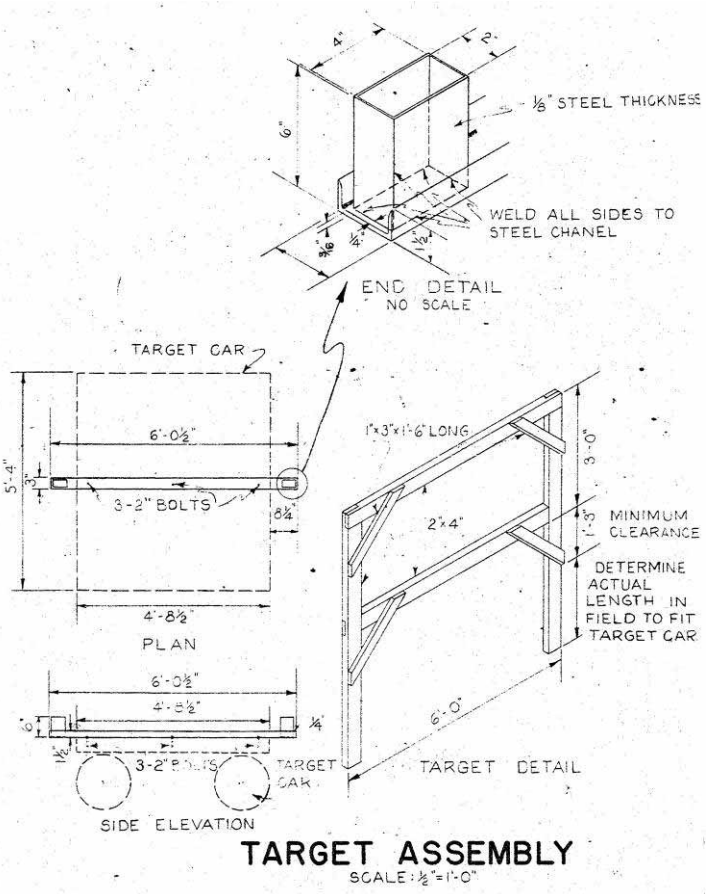


Figure 236. Tank or anti-aircraft moving target range (for guns to include 120mm), target assembly, Fort Bragg, NC, 1952 (Standard Drawing 28-13-24 Sheet 1 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), plans," 4 August 1952).

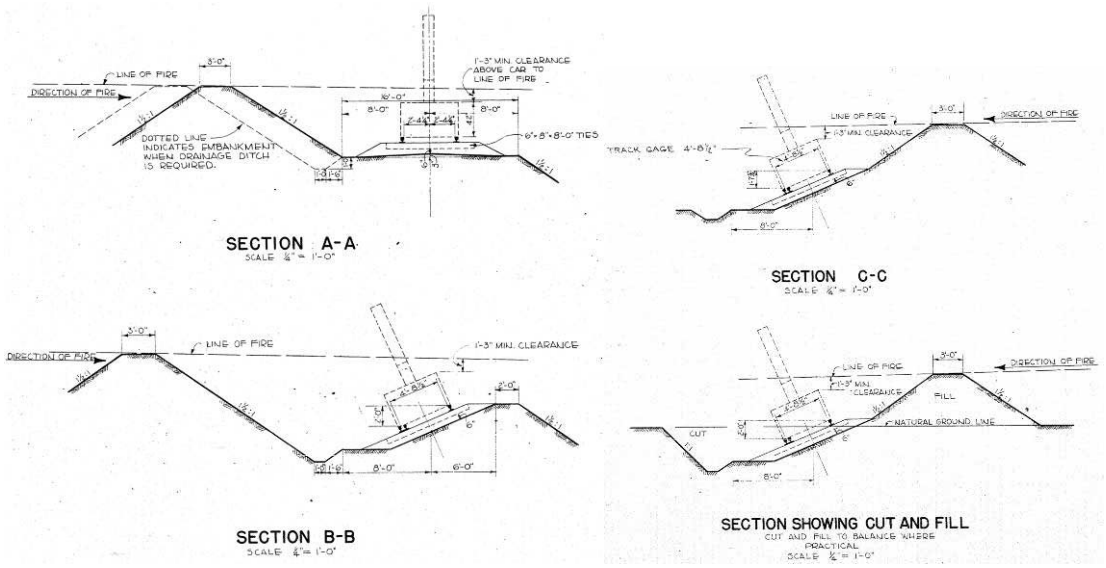


Figure 237. Tank or anti-aircraft moving target range (for guns to include 120mm), track sections, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 2 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), ammunition house and track sections," 4 August 1952).

Moving vehicle range

"In the Moving Tank Exercise (Table VII in 1950, Table IV in 1961), the gunner fired 150 rounds from the coaxial machine gun while moving. The targets consisted of kneeling type silhouettes that represented infantry. The length of the course was approximately 800 yd. The range layout and danger zones for this exercise are depicted in Figure 238 below" ("RO-10," p 23).

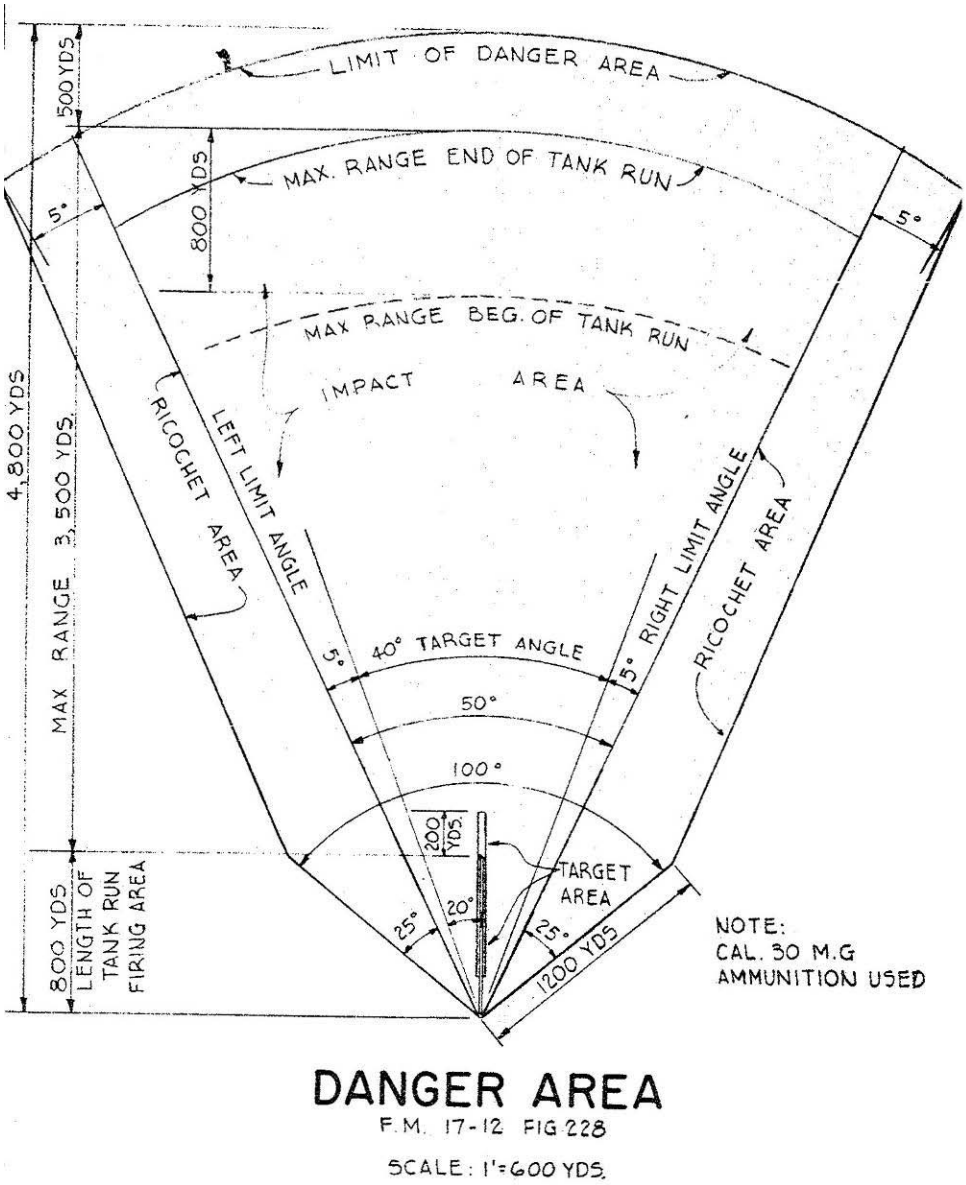


Figure 238. Tank subcaliber moving vehicle range danger area, Fort Bragg, 1951 (Standard Drawing 28-13-20 Sheet 1, "Range, moving vehicle, tank subcaliber, plan, and details," 21 November 1951).

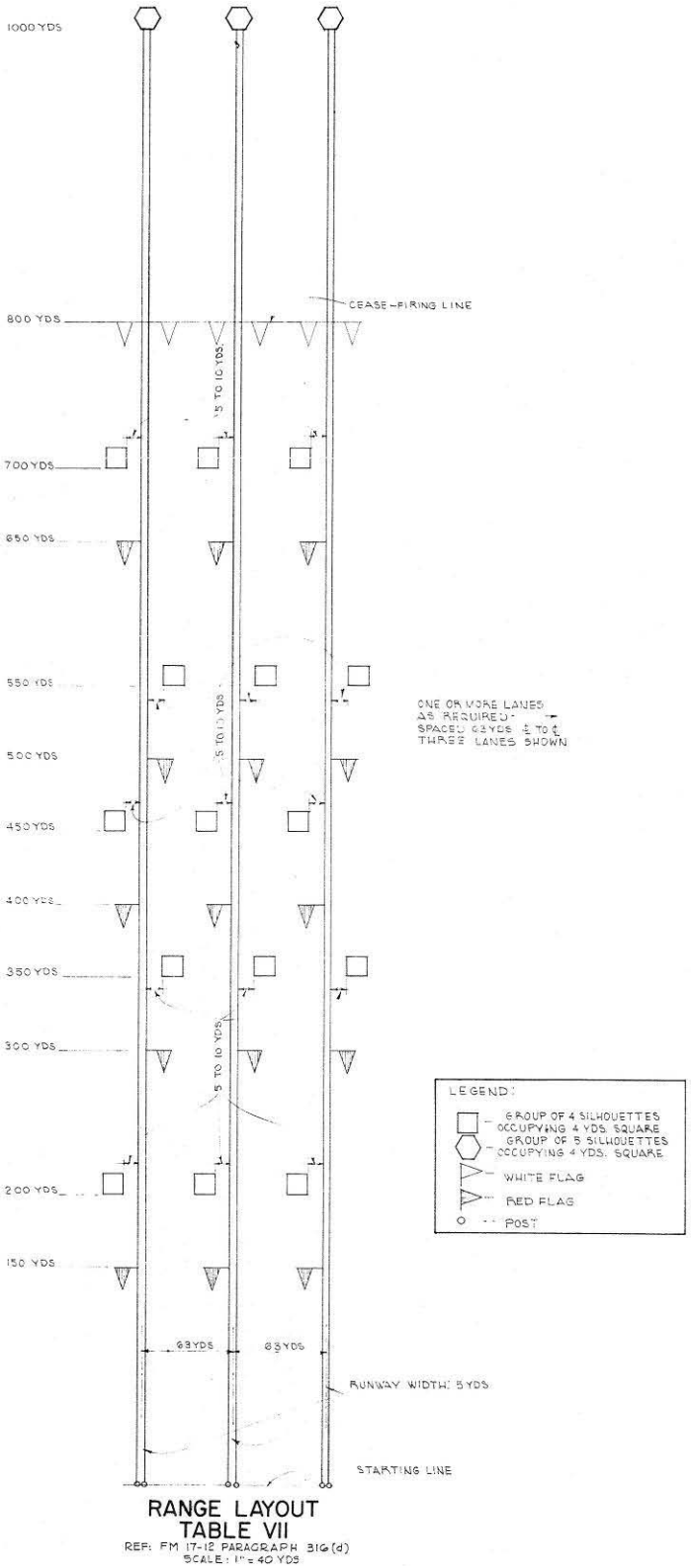


Figure 239. Tank subcaliber moving vehicle range layout table VII, Fort Bragg, 1951 (Standard Drawing 28-13-20 Sheet 1, "Range, moving vehicle, tank subcaliber, plan, and details," 21 November 1951).

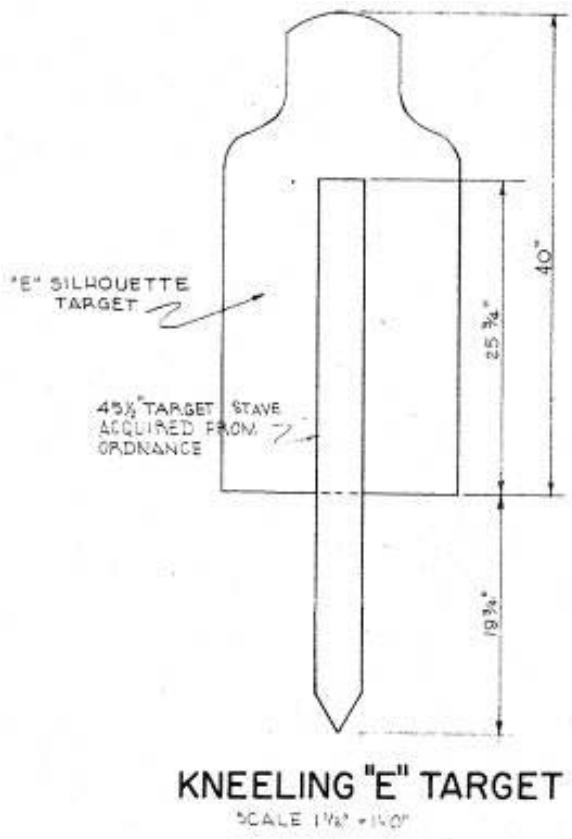


Figure 240. Tank Subcaliber moving vehicle range, kneeling "E" target, Fort Bragg, 1951 (Standard Drawing 28-13-20 Sheet 1, "Range, moving vehicle, tank subcaliber, plan, and details," 21 November 1951).

Tank obstacle course

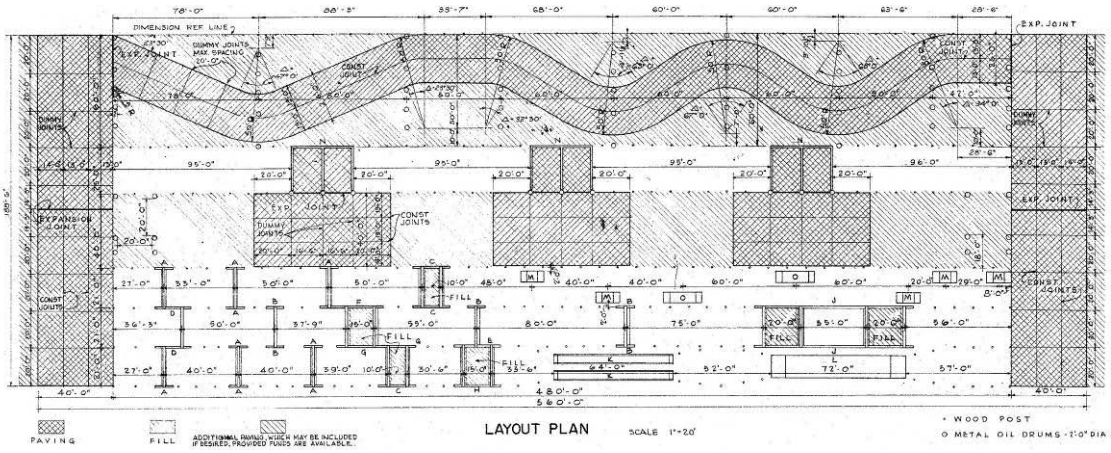


Figure 241. Tank obstacle course layout plan, Fort Bragg, 1951 (Standard Drawing 28-13-49 Sheet 1, "Tank obstacle course plan and details," 21 November 1951).

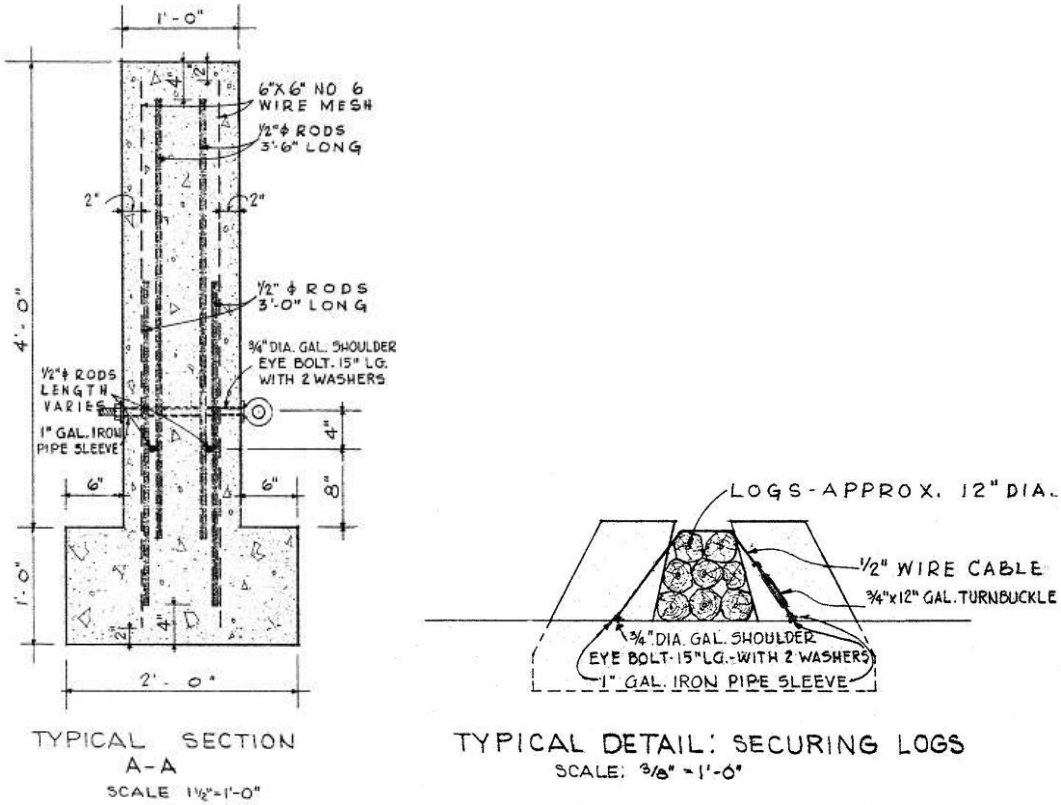


Figure 242. Tank obstacle course typical section aa and detail of securing logs, Fort Bragg, 1951 (Standard Drawing 28-13-49 Sheet 2, "Tank obstacle course details," 21 November 1951; Standard Drawing 28-13-49 Sheet 1, "Tank obstacle course plan and details," 21 November 1951).

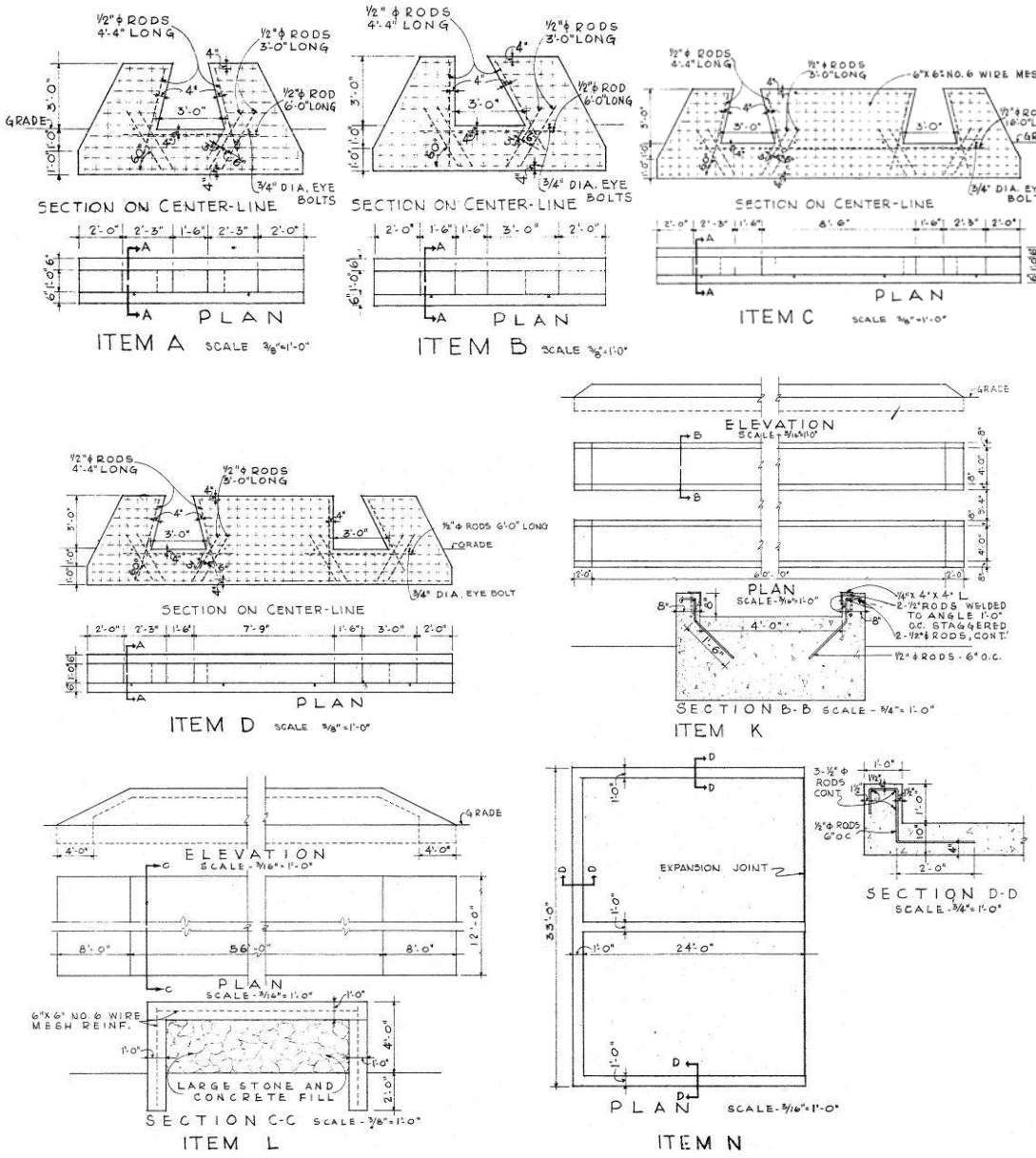


Figure 243. Tank obstacle course items A, B, C, D, K, L, and N, Fort Bragg, 1951 (Standard Drawing 28-13-49 Sheet 1, "Tank obstacle course plan and details," 21 November 1951).

Service ammunition ranges

"These are ranges where service ammunition for the weapons on a tank was fired, as opposed to subcaliber ammunition. Service ammunition exercises were fired only after the crew member had successfully completed all subcaliber courses. Service ammunition exercises were fired on standard ranges. Service exercises were fired at distances up to 3,500 meters.

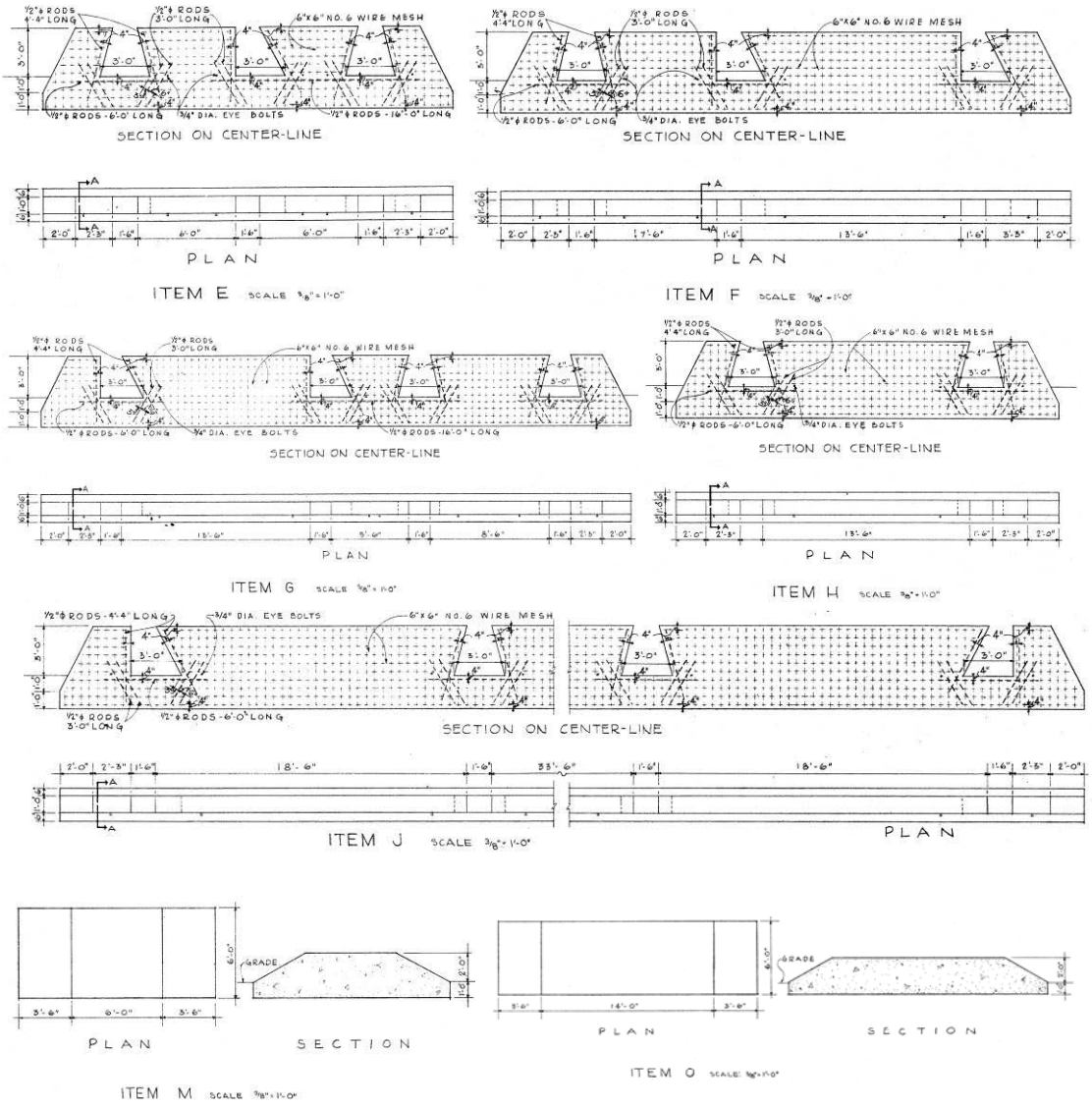


Figure 244. Tank obstacle course items E, F, G, H, J, M, and O, Fort Bragg, 1951 (Standard Drawing 28-13-49 Sheet 2, "Tank obstacle course details," 21 November 1951).

To meet the requirements of tank gunnery training, service ranges were of four basic types: (1) stationary target range, (2) moving target range, (3) crew field firing range, and (4) crew proficiency range. During the Service Ammunition Shot Group Exercise (Table V), the tank gunner fired four rounds of ammunition at a target panel and attempted to achieve a small shot group. The target was fired once for practice and once for record. The range layout and danger zones for this exercise are depicted in Figure 245 below" ("RO-10," p 24).

Individual tank combat firing range

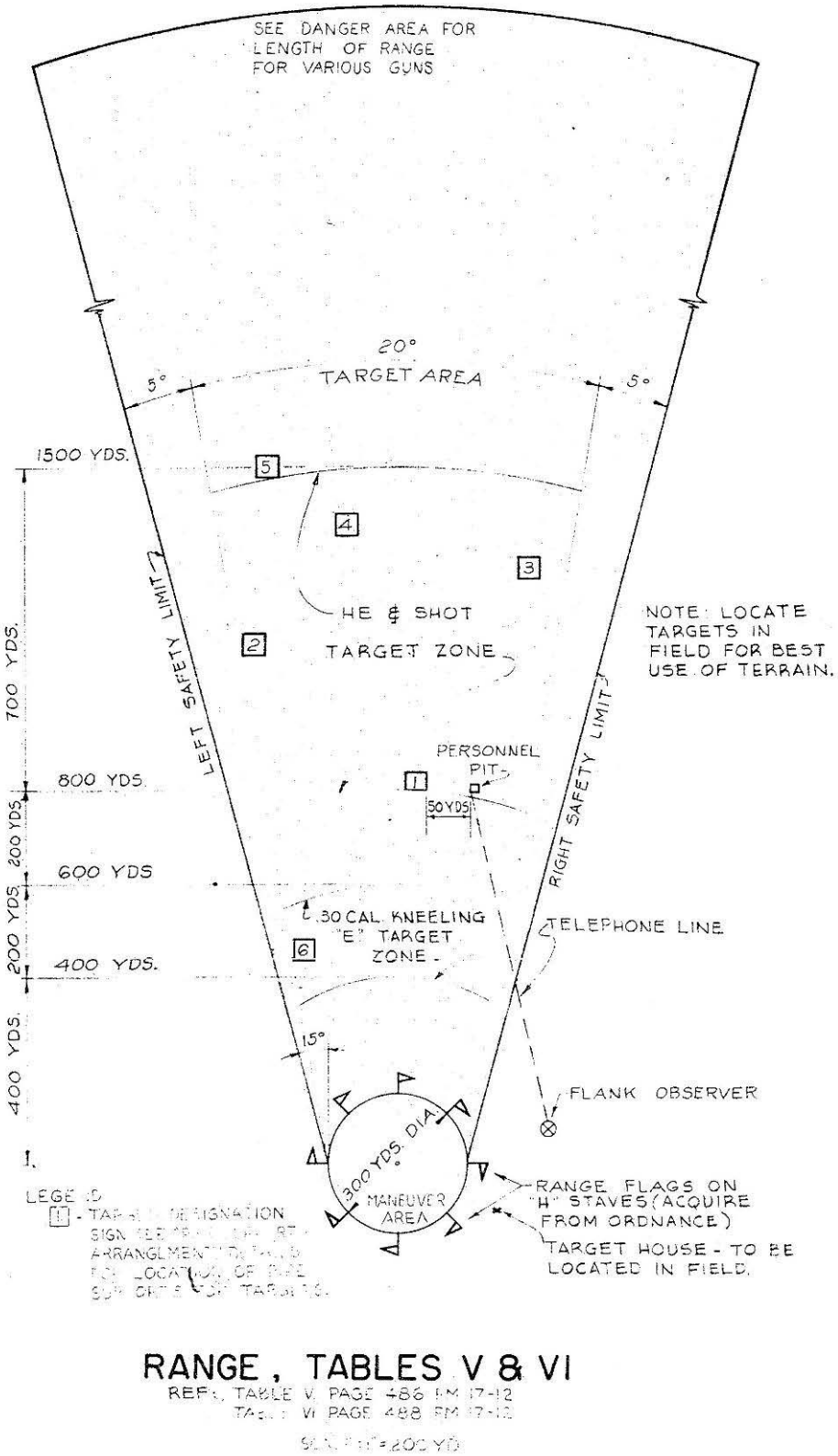


Figure 245. Individual tank combat firing range tables, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

"The HE, Shot, and Caliber .30 Adjustment Test (Combat Service Firing) (Table VI) determined the ability of tank crewmen to adjust HE, shot, and .30 caliber ammunition onto various targets from a moving tank. The crew member being tested acted as the tank commander. One problem was fired with HE ammunition, one with shot, and one with .30 caliber ammunition. Firing was done from a moving tank" ("RO-10," p 25).

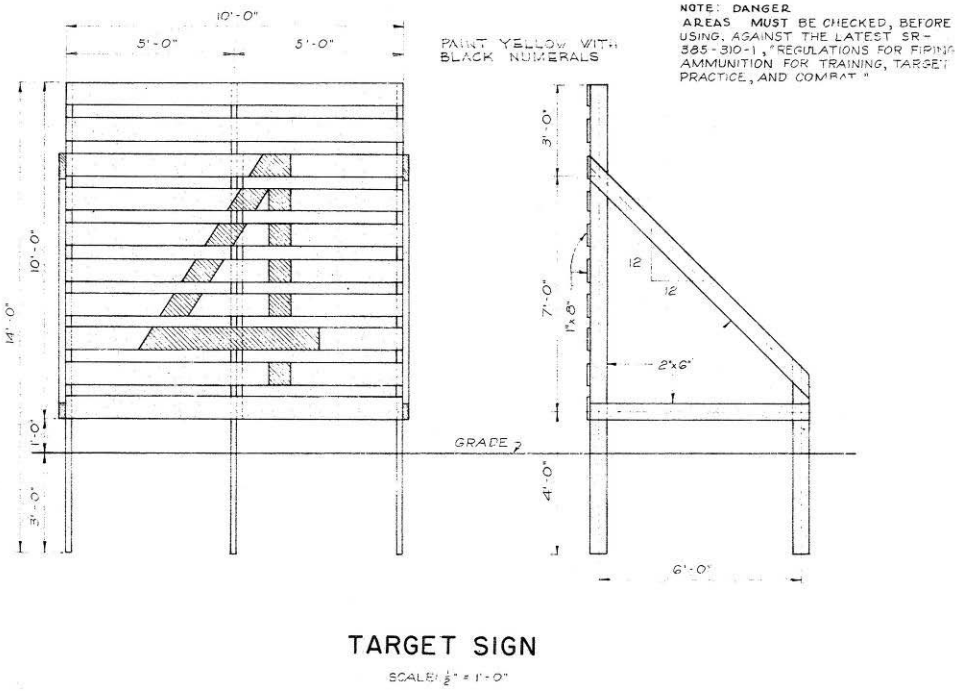


Figure 246. Individual tank combat firing range target sign, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

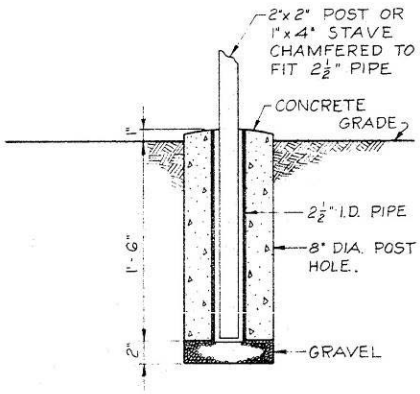


Figure 247. Individual tank combat firing range pipe support, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

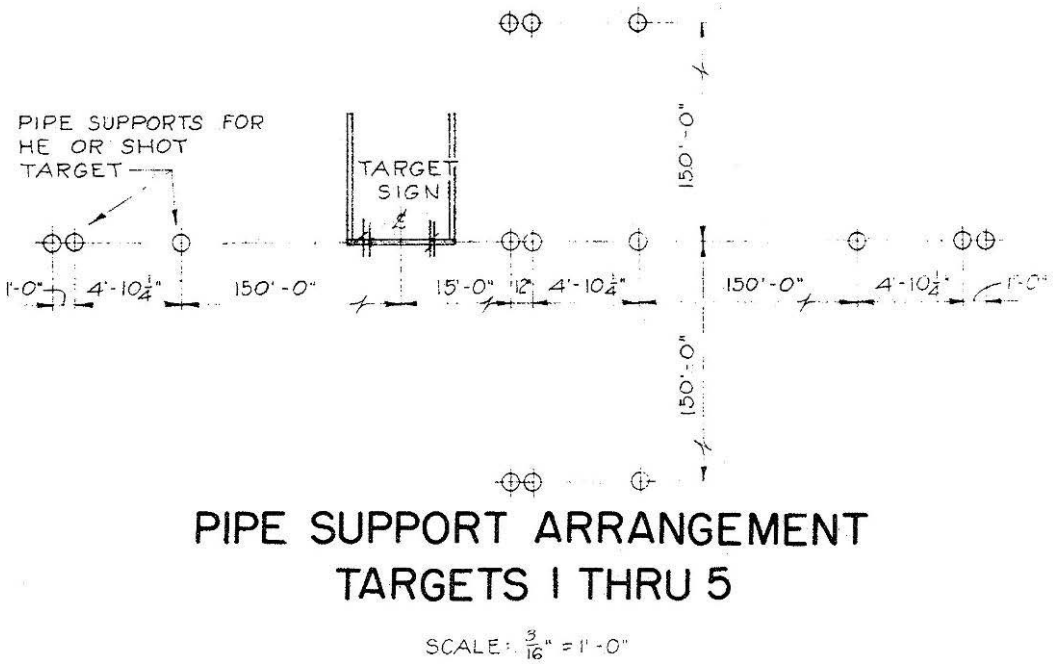


Figure 248. Individual tank combat firing range pipe support arrangement targets 1 thru 5, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

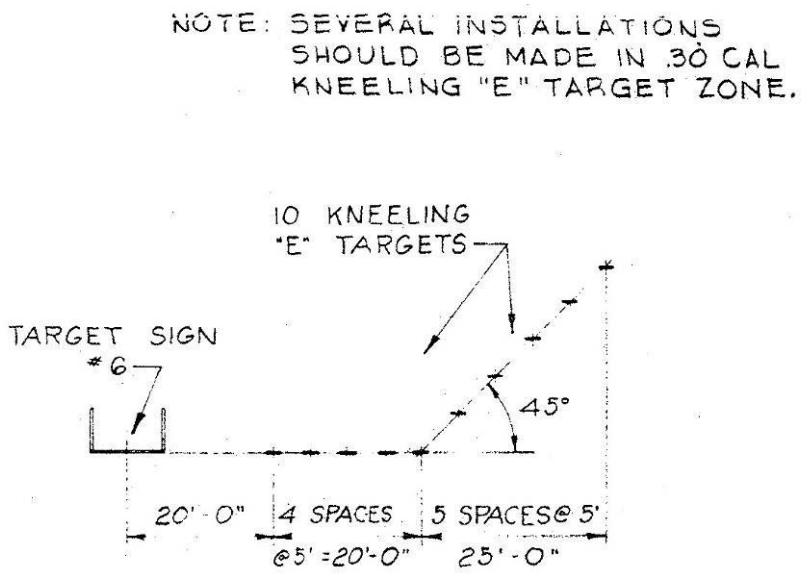


Figure 249. Individual tank combat firing range pipe support arrangement target No. 6, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

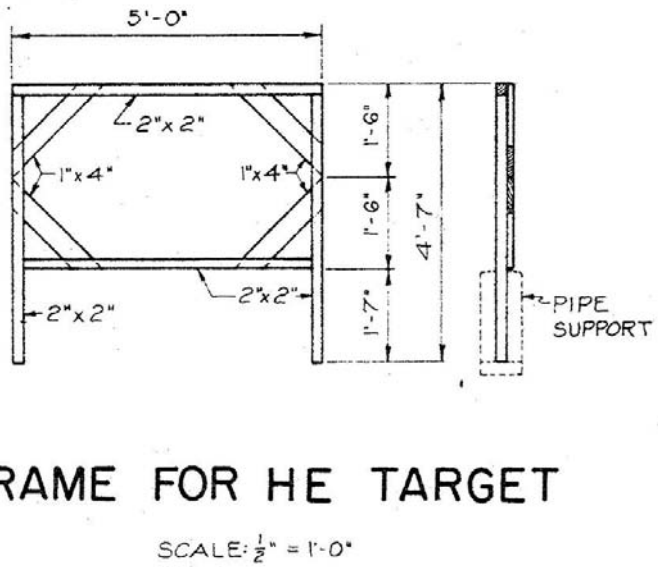
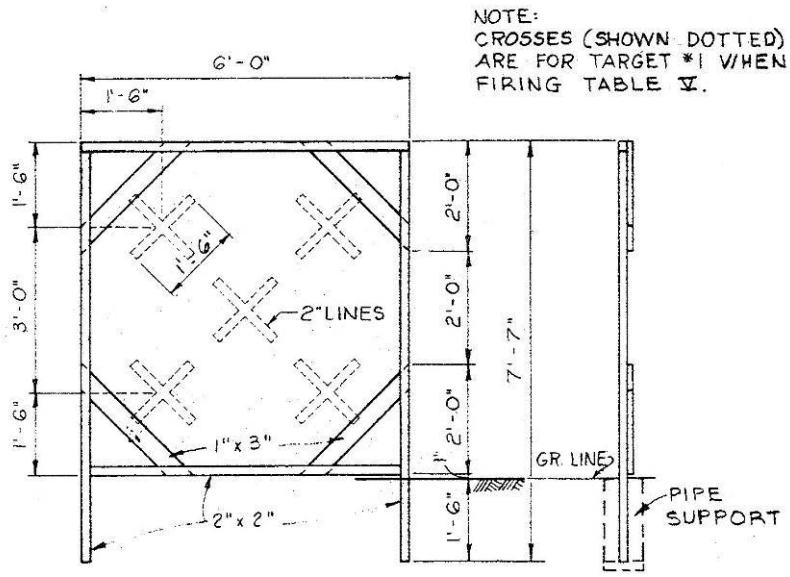


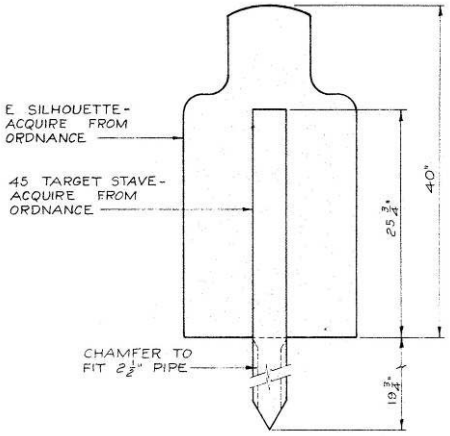
Figure 250. Individual tank combat firing range frame for HE Target, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).



FRAME FOR SHOT TARGET

SCALE: $\frac{1}{2}$"=1'-0"

Figure 251. Individual tank combat firing range frame for shot target, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).



KNEELING "E" TARGET

SCALE: $\frac{1}{2}$"=1'-0"

Figure 252. Individual tank combat firing range kneeling "E" target, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

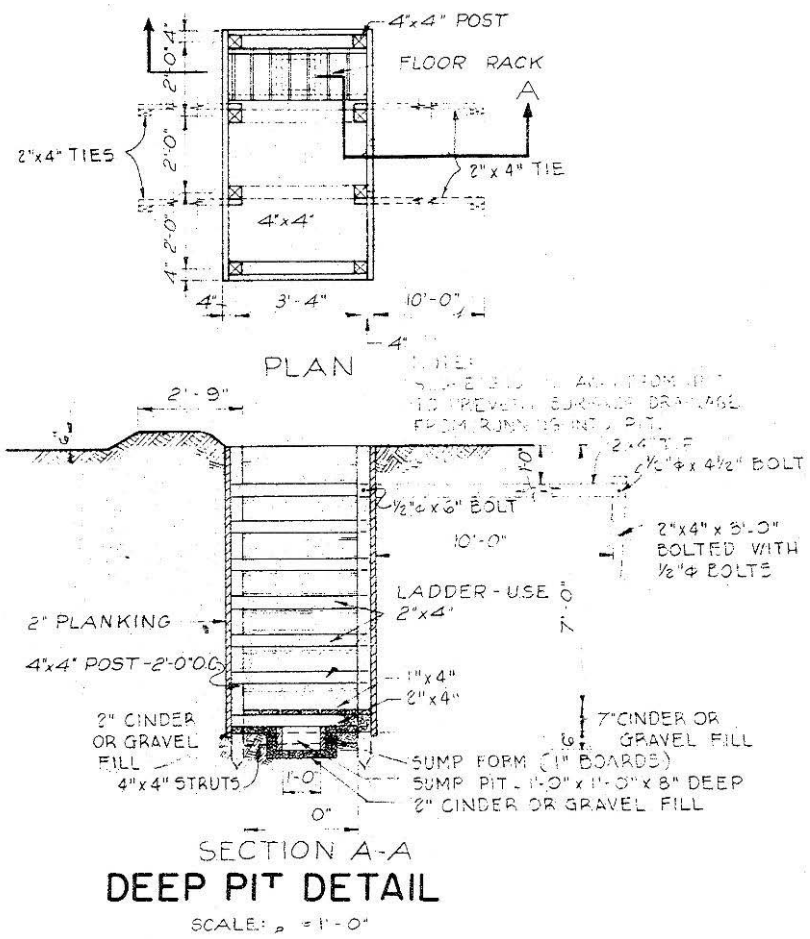


Figure 253. Individual tank combat firing range deep pit detail, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 1, "Range, individual tank combat firing plans and details," 4 August 1952).

Tank cannon range

"Presented in Figure 254 below is a range safety fan established for tank cannon in 1968" ("RO-10," p 25).

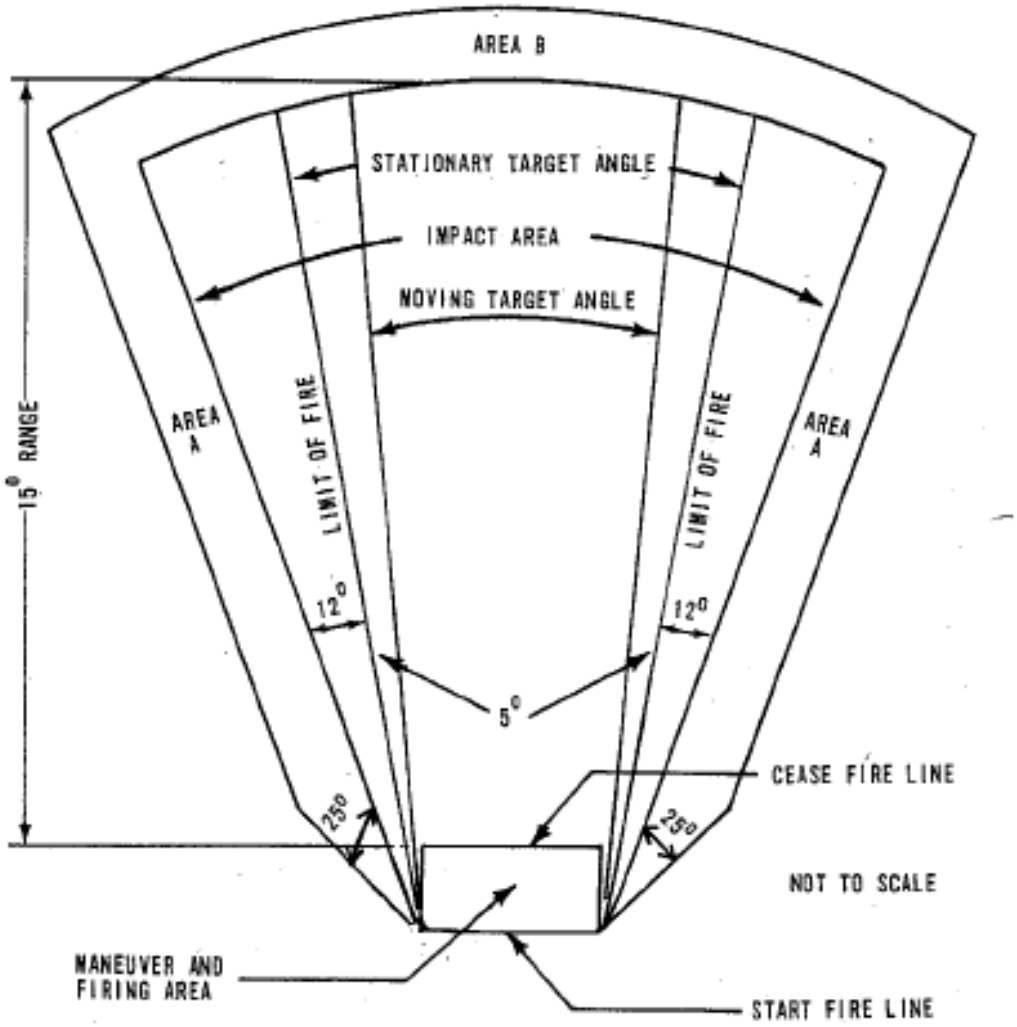


Figure 254. Tank cannon range, circa 1968 (AR 385-63, Regulations for firing ammunition for training, target practice, and combat, 17 June 1968, Ch 14).

"A '15-degree range' was the maximum range for tank cannon firing at 15-degree elevation (or less). Per Figure 254 above, the distances identified as A and B were measured from the impact area in meters. The information in Table 21 below was used to determine distances" ("RO-10," p 26).

Table 21. Tank cannon data.

Year	Tank Cannon Caliber	Ammunition Type	Danger Area Dimensions	
			A (meters)	B (meters)
1968[168]	76-mm	All	500	700
	90-mm	All	600	700
	105-mm	All	700	800
	152-mm	All	750	900
1973[169]	76-mm	All	550	650
	90-mm	All	600	700
	105-mm	All	650	750
	152-mm	All	675	775
	165-mm	All	725	825
1978[170]	90-mm	All	600	600
	105-mm	All	615	615
	152-mm	All	715	715
	165-mm	All	750	750
1983[171]	90-mm	All	600	600
	105-mm	All	615	615
	152-mm	All	715	715
	165-mm	All	750	750

Source: "RO-10," p 26; AR 385-63, Regulations for Firing Ammunition for Training, Target Practice, and Combat, 17 June 1968, Ch 14; AR 385-63, Regulations for Firing Ammunition for Training, Target Practice, and Combat, 28 February 1973; AR 385-63, Regulations for Firing Ammunition for Training, Target Practice, and Combat, 22 February 1978; AR 385-63, Regulations for Firing Ammunition for Training, Target Practice, and Combat, 15 October 1983.

"Maximum ranges are not provided in Table 22 above because the maximum range is a function of both the specific weapon and ammunition caliber. The following information is provided to give the user maximum ranges for the various ammunition calibers as extracted from TM 43-0001-28 (see Table 24)" ("RO-10," p 27). "When designing a range for an installation, the installation would determine what ammunition was authorized to be fired and set restrictions on maximum elevation for firing. Using the appropriate firing tables, a maximum range (X) would be determined and used with the range safety regulations in designing the appropriate range safety fans" ("RO-10," p 27).

Table 22. Calibers and Maximum Ranges.

Cartridge	Maximum Range
76-mm, HVAP-T, M319	9,885 meters
76-mm HVAP-DS-T, M331A1	21,607 meters
76-mm HE, M352	14,338 meters
90-mm HE, M71A1	15,800 meters
90-mm APC-T, M82	19,570 meters
90-mm HVAP-T, M332A1	14,456 meters
90-mm HEAT-T, M431A1	8,138 meters
105-mm APDS-T, M392A2	36,745 meters
105-mm HEAT-T, M456	8,200 meters
152-mm HEAT-T, M409A2	9,000 meters

APC-T = armor piercing capped, with tracer
APDS-T = armor piercing discarding sabot with tracer
HEAT-T = high explosive antitank with tracer
HVAP-DS-T = high velocity armor piercing, discarding sabot with tracer
HVAP-T = high velocity armor piercing with tracer

Source: "RO-10," p 27; AR 385-63 TM 43-0001-28, Artillery Ammunition, Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuses, 25 April 1977, Ch 2

Tank crew training

"After each member of a tank crew was 'qualified,' the crew trained as a team, such as a platoon or tank company. These exercises involved the tank crew firing at targets with all weapons on the tank. For example, targets simulating troops were fired on by the tank machine guns, and targets simulating tanks were fired on by the main gun. The range safety fan for these exercises was similar to that shown in Figure 254 above, with targets laid out to require engagement by different weapons in different situations. See Figure 255 below for an example of a target layout for this type of range" ("RO-10," p 28).

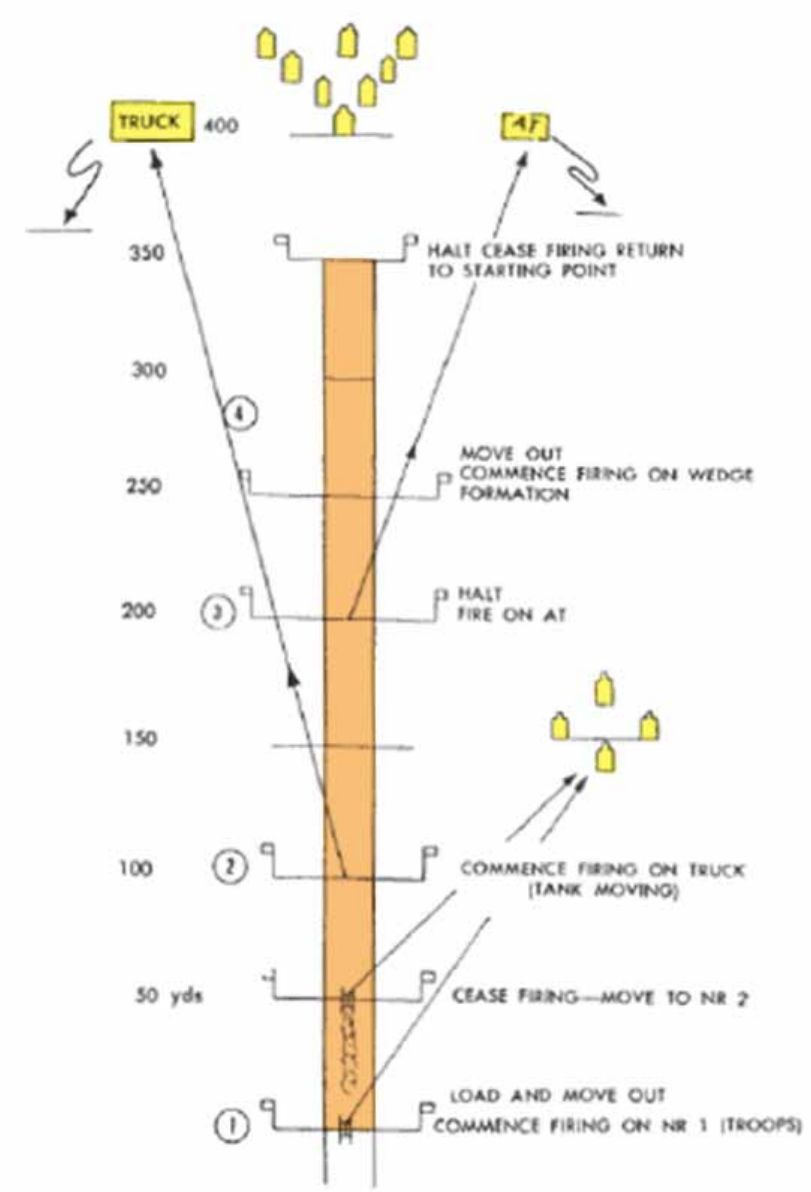


Figure 255. Course for crew moving tank exercise, circa 1957 (FM 17-12, Tank gunnery, 21 May 1957, pp 205-207).

Service ammunition targets

Stationary targets

"Targets of any kind, such as panels, E-type silhouettes, kneeling type silhouettes, materiel, or terrain targets were placed in depth in a selected impact area. Target panels were 5 ft wide and 3 ft high or 6 x 6 ft and constructed of any available material, including cloth, metal, plywood, or some type of artificial material. Target panels also consisted of a 5- by 8-ft panel representing a truck and a 3- by 5-ft panel representing an antitank

gun, painted to blend with the surrounding terrain. A 6 x 6-ft panel with aiming points is depicted in Figure 256 below" ("RO-10," p 66).

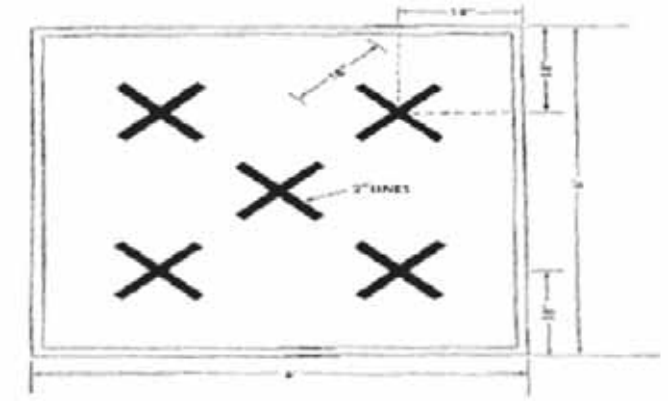


Figure 256. Target panel with aiming points, circa 1950 (FM 17-12, Tank gunnery, 30 November 1950, p 487).

"Other panel-type targets are depicted in Figure 257 below" ("RO-10," p 67).

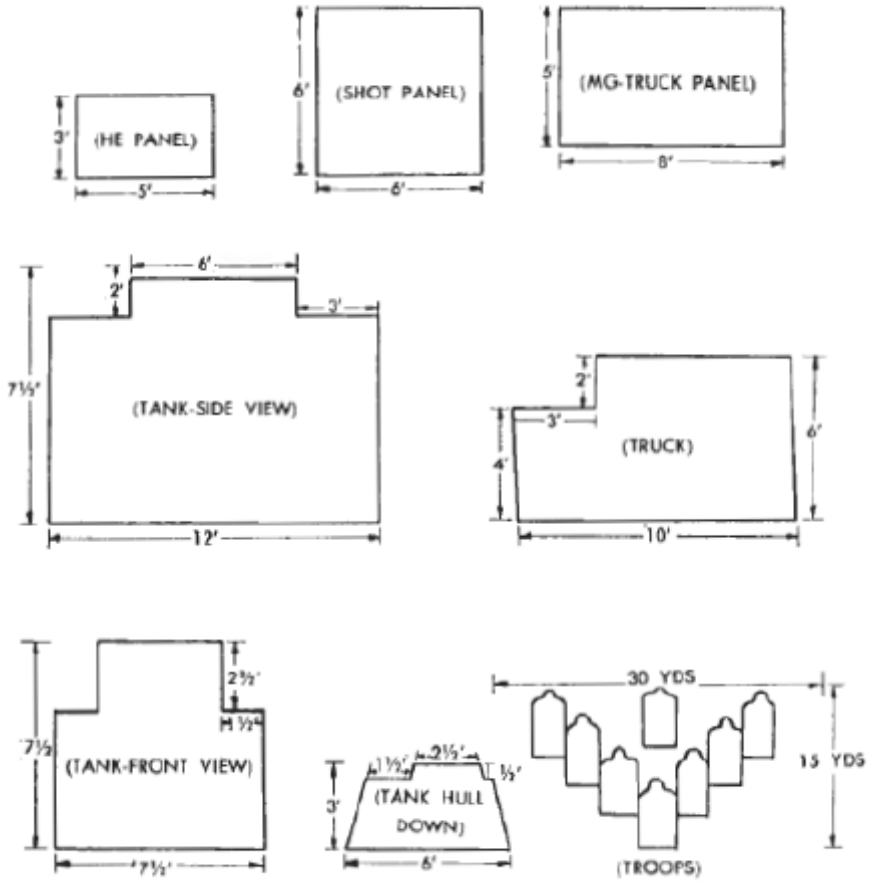


Figure 257. Panel-type targets for service ammunition firing, circa 1943 ("RO-10," p 67).

"Tanks were represented by full-size silhouettes painted field gray or brown and placed both in the open and in 'hull down' positions. Antitank guns were represented by small panel targets painted olive drab and placed in camouflaged positions. Two wooded frames were used to simulate pillboxes. Materiel targets included tank hulls, some with an X marking the center of mass, and other salvaged vehicles" ("RO-10," pp 68-69).

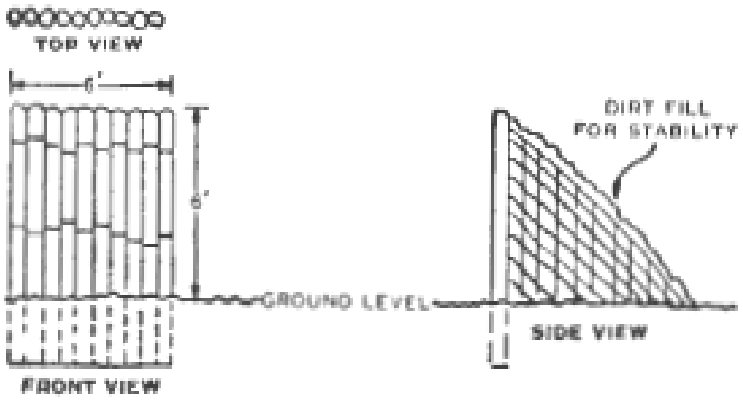


Figure 258. Stationary log target ("RO-5," p 30).

"Personnel were represented by standard drab silhouette targets E, F, and M. The E-type silhouette target is depicted in Figure 252 above. The F-type silhouette target was constructed of 1/8-in. thick pasteboard with a wooden stave attached to the back. The F-type silhouette target is represented in Figure 259 below" ("RO-10," p 68).

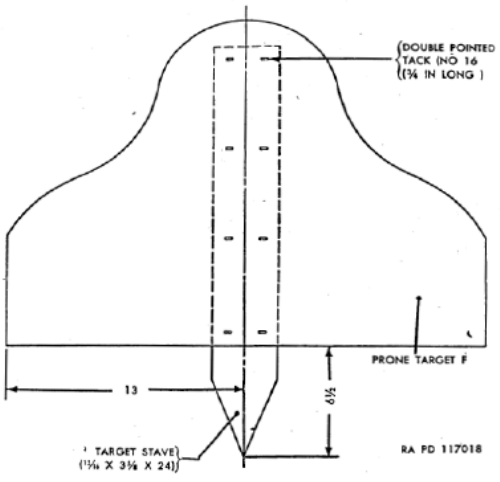


Figure 259. F-type silhouette target, circa 1951 (TM 9-855, Targets, target materials, and rifle range construction, 1 November 1951, pp 168,172,174,176, 177).

"Standing pasteboard target M was constructed by securing a kneeling target E and a trapezoidal target to a ¾- by 3 ½- by 84-in. long stave with double-pointed tacks. The M-type silhouette target is depicted in Figure 260 below" ("RO-10," p 69).

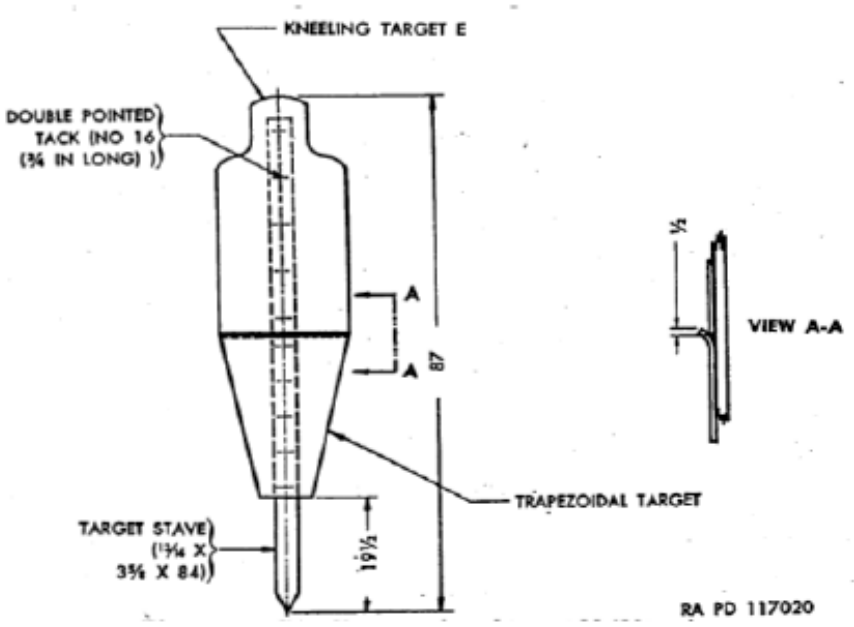


Figure 260. M-type silhouette target, circa 1951 (TM 9-855, Targets, target materials, and rifle range construction, 1 November 1951, pp 174, 177).

Moving targets

"Service ammunition target panels included a 7 ½ x 12-ft panel representing a tank and a 5 x 8-ft panel representing a truck. Targets also included a tank silhouette or a 6 x 6-ft shot panel painted to represent an armored vehicle or a truck silhouette painted to represent a cargo-type vehicle. The target was mounted on a moving rail car or a towed sled moving at 10 mph. Whatever targets were used were painted gray, brown, or olive drab" ("RO-10," p 74).

Aerial targets

"Aerial targets could be those that dove across the path of a tank or balloons. See the Anti-Aircraft Artillery Range Report (RO-13) for information on firing at aerial targets" ("RO-10," p 75).

Combined arms team training

"Finally, tank crews were trained as part of a larger combined arms team with infantry, support weapons (such as mortars), and other types of units

organic to an armored unit. The weapons training culminated in the training of personnel to operate in a combat type environment as part of a combined arms team involving all weapons available to the unit. The range safety fan used is similar to that shown in Figure 254 above with targets laid out to require engagement by different weapons in different situations. The following training problems were relevant in 1945" ("RO-10," p 28).

Tank section in attack

"This problem illustrated the actions of a tank section advancing as part of a tank platoon. Ranges were constructed on rolling terrain with a slight amount of cover for antitank gun positions and routes of advance. The range was a minimum size of 700 yd wide by 1,500 yd deep. Targets used included two model antitank guns, one model machine gun, and one towed tank target. Explosives and electrical detonation equipment were used to simulate enemy gunfire. This training problem is depicted in Figure 261 below" ("RO-10," p 29).

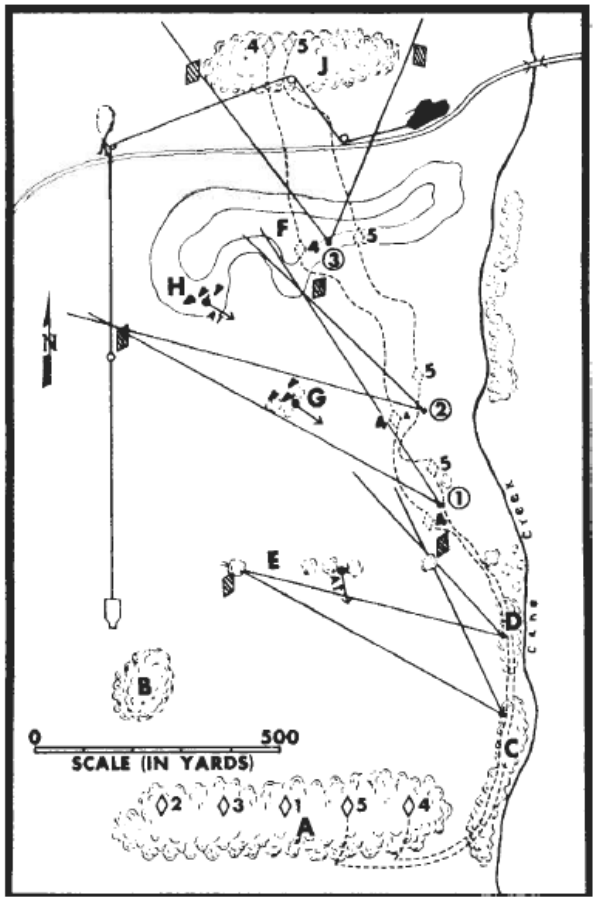


Figure 261. Tank section in attack, circa 1945 ("RO-10," p 29).

Tank platoon in attack

"The problem illustrated the action of a tank platoon employing fire and maneuver while advancing in an attack as part of a company. Ranges used for this problem had open, rolling terrain and were a minimum size of 1,000 yd wide by 2,000 yd deep. Targets used included two model antitank guns and one moving tank or armored car target. Explosives and electrical detonation equipment were used to simulate enemy antitank gunfire. This problem is illustrated in Figure 262 below" ("RO-10," p 30).

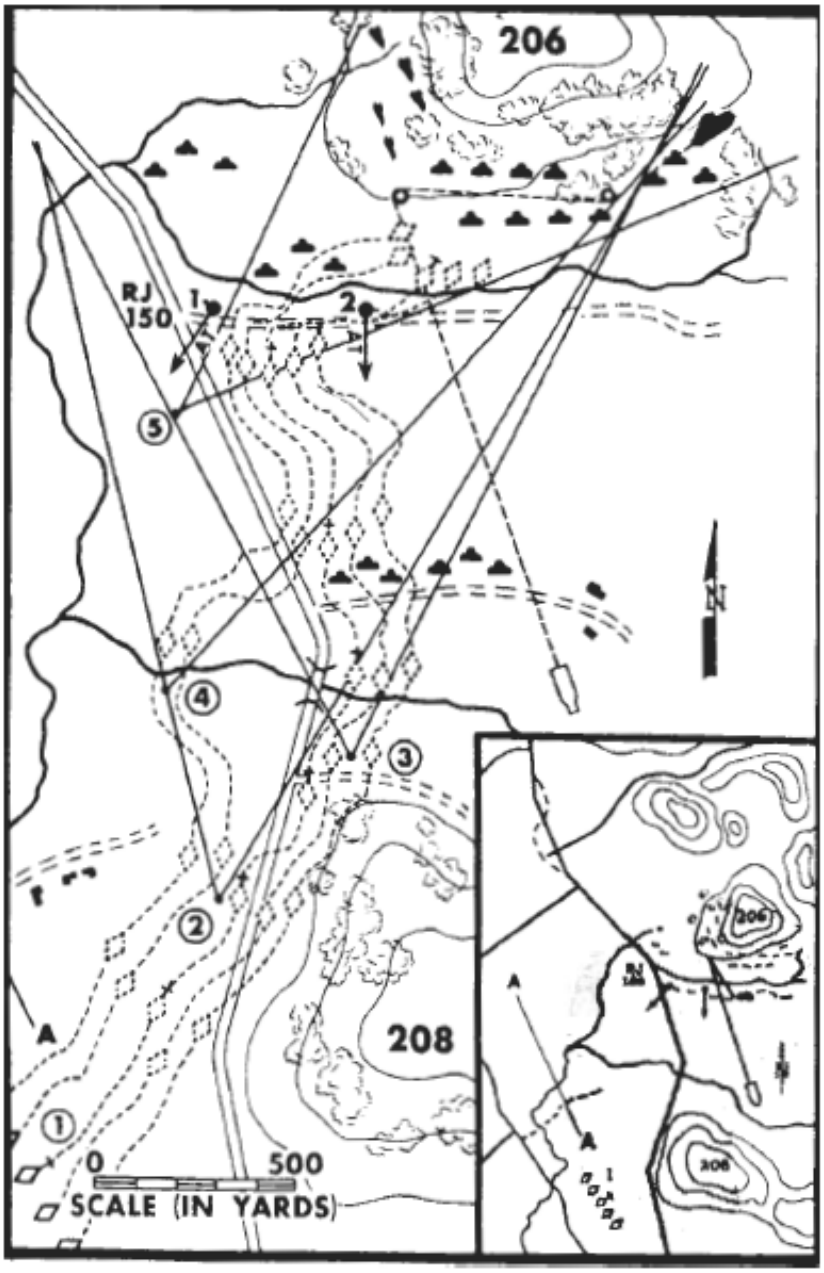


Figure 262. Tank platoon in attack, circa 1945 ("RO-10," p 30).

Tank platoon as an advance party

"This problem illustrated the actions of the advance party when enemy resistance is met and overcome. The range for this problem had rolling, partially covered terrain with suitable features for emplacing enemy antitank guns. The minimum size was 1,000 yd wide by 2,500 yd deep. Targets used included two model enemy antitank guns. Explosives and electrical detonation equipment were used to simulate enemy antitank gunfire. This problem is depicted in Figure 263 below" ("RO-10," p 31).

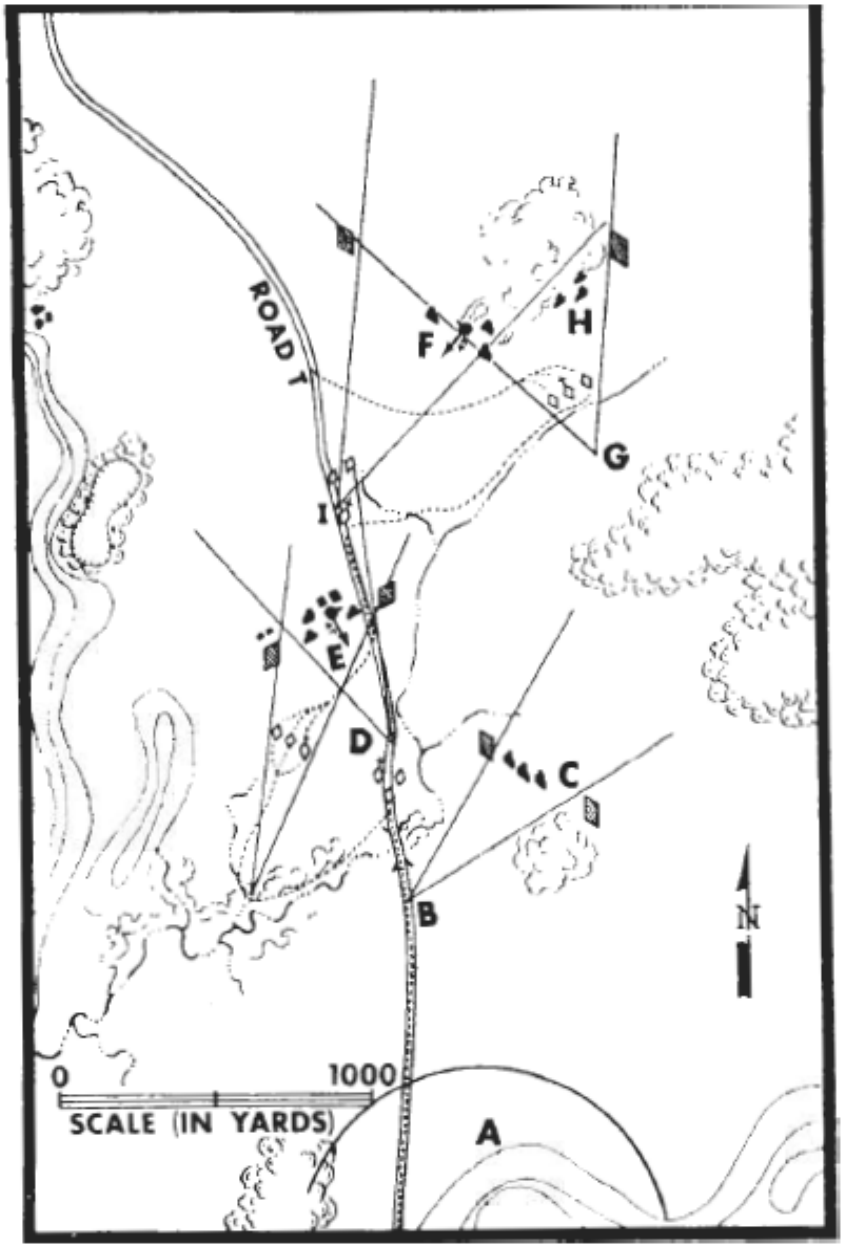


Figure 263. Tank platoon as an advance party, circa 1945 ("RO-10," p 31).

Tank platoon as a covering detachment

"This problem illustrated the action of a tank platoon acting as a covering detachment for the advance of a tank battalion. The range for this problem had fairly open rolling terrain at a minimum size of 1,000 yd wide by 2,000 yd deep. Targets used included two model antitank guns and three tank targets. Explosives and electrical detonation equipment were used to simulate enemy antitank gunfire. This problem is illustrated in Figure 264 below" ("RO-10," p 32).

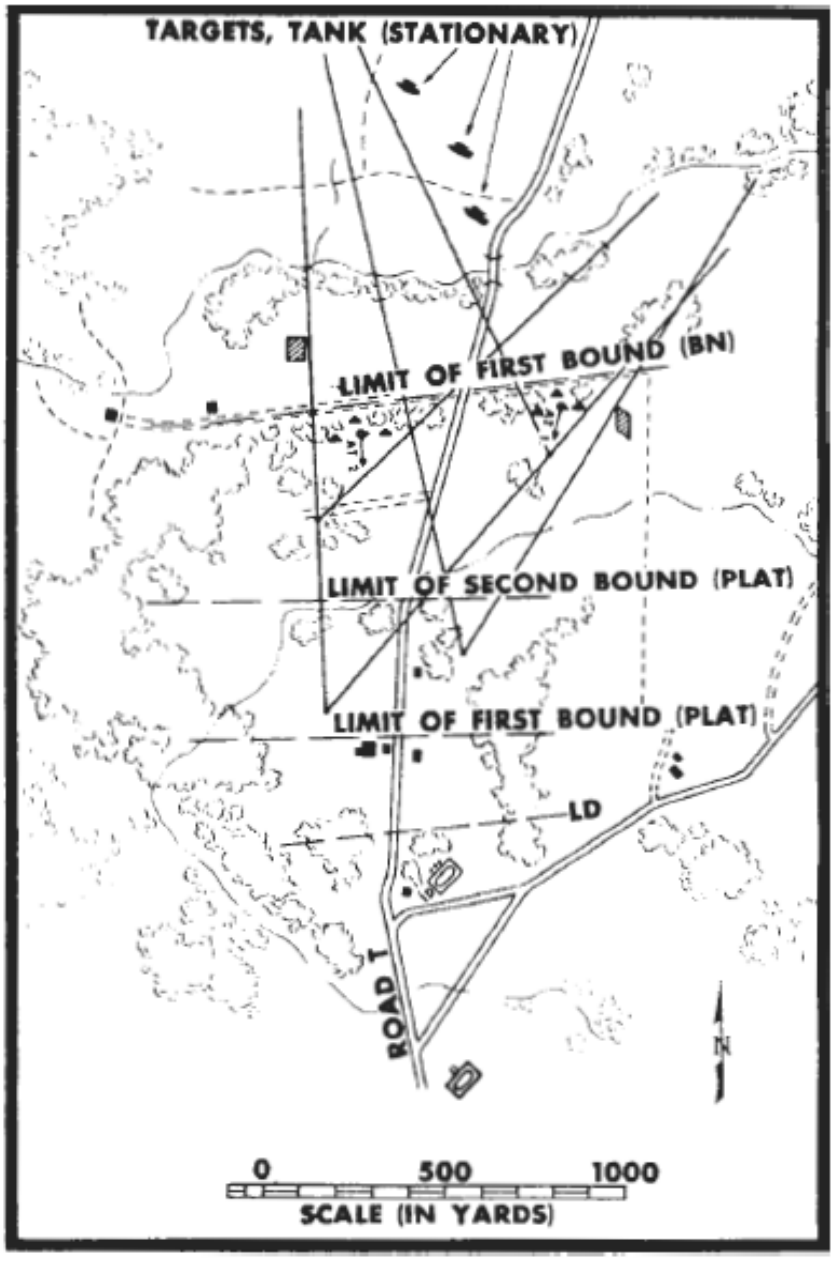


Figure 264. Tank platoon as a covering detachment, circa 1945 ("RO-10," p 32).

Tank platoon in withdrawal

"This problem illustrated the action of a tank platoon withdrawing in the face of superior enemy forces. The tank platoon fired only subcaliber fire against target tanks stripped of all external accessories. The enemy tanks did not fire during the problem. The range for this problem was open, rolling terrain with features suitable for successive delaying positions. The minimum area was 1,000 yd wide by 1,800 yd deep. The range used 10 target tanks stripped of exterior accessories. Firing was restricted to using .30-caliber subcaliber devices. This problem is depicted in Figure 265 below" ("RO-10," p 33).

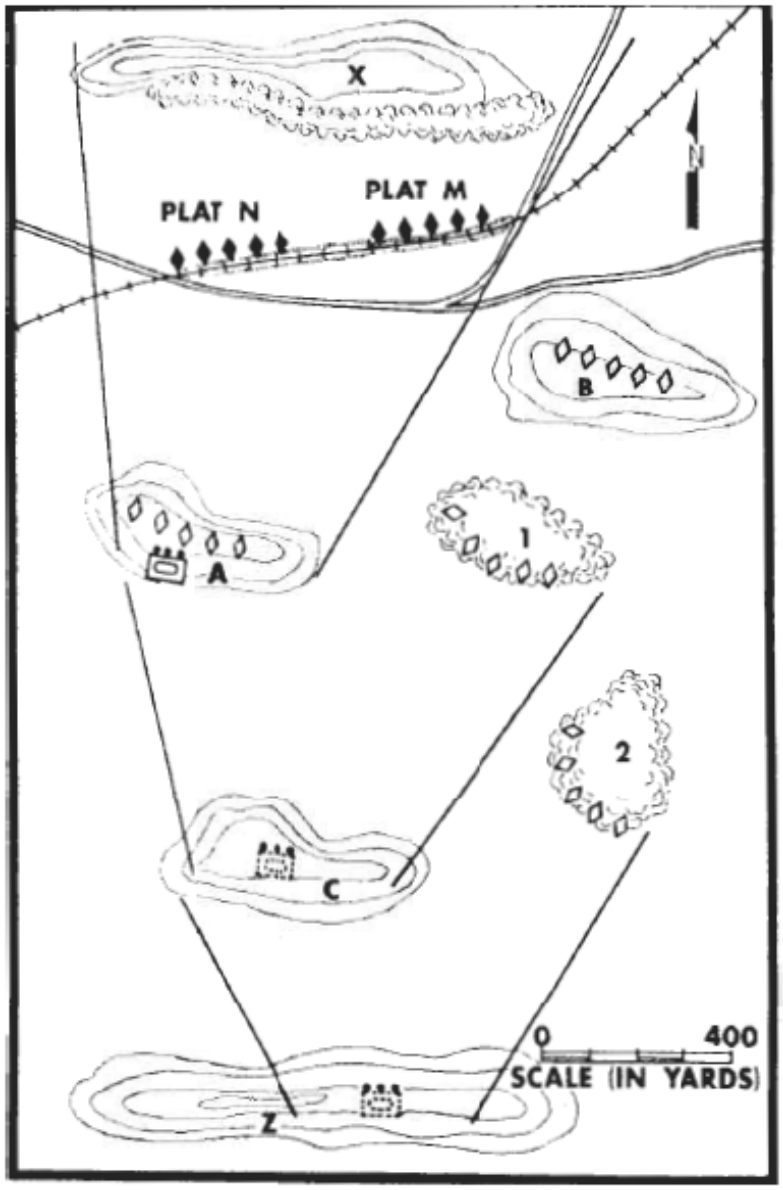


Figure 265. Tank platoon in withdrawal, circa 1945 ("RO-10," p 33).

Tank platoon in indirect fire support

"This problem illustrated the actions of a tank platoon employed to support attacking units by indirect fire. The problem was conducted on an artillery range with rolling terrain, a suitable firing position, and observation point. The range had a minimum area of 2,000 yd wide by 5,000 yd deep. This problem is illustrated in Figure 266 below" ("RO-10," p 34).

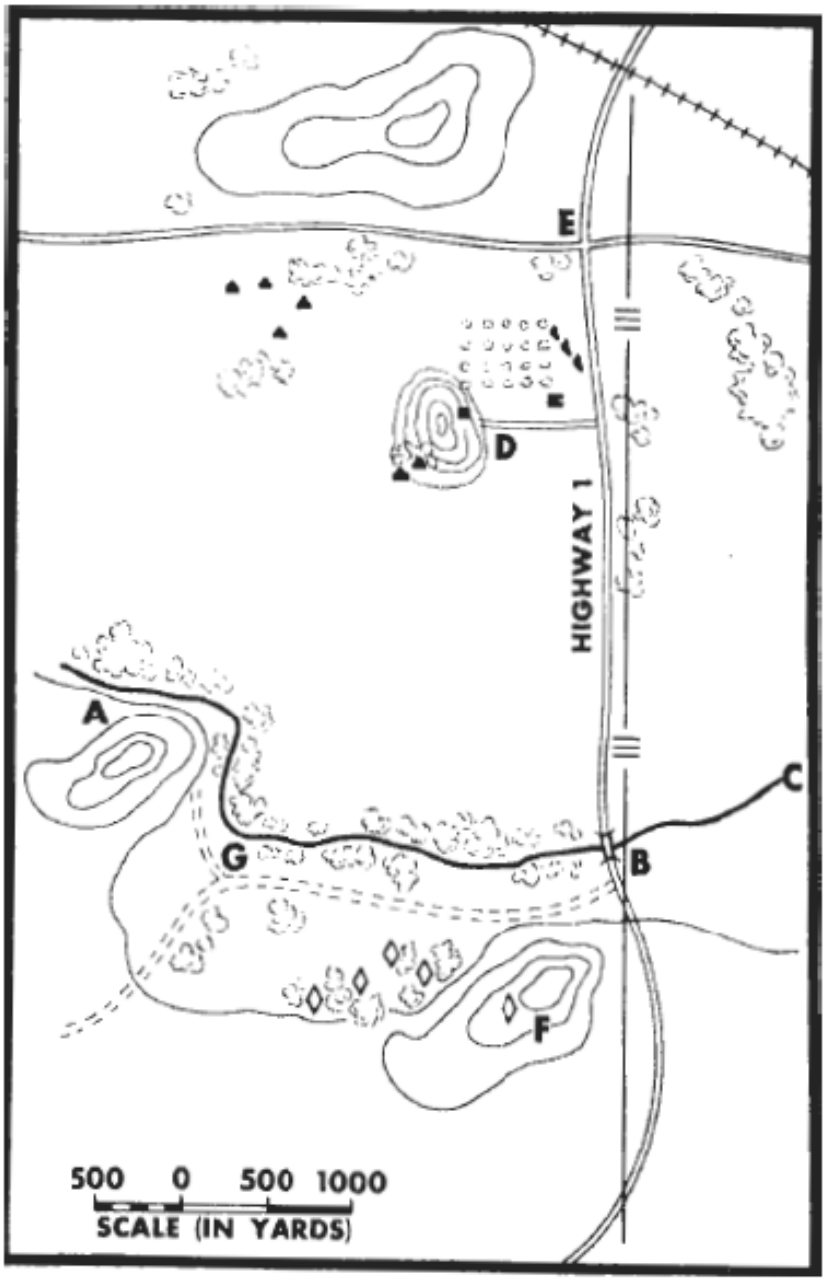


Figure 266. Tank platoon in indirect fire support, circa 1945 ("RO-10," p 34).

Tank platoon in night firing

"This problem brought out the actions of a tank platoon employing direct fire at night in support of a limited objective attack. The problem was conducted 2 hours during daylight and 2 hours during darkness. The range was on a rolling piece of terrain at least 500 yd wide and 2,000 yd deep. The targets used included two wooden frames simulating pillboxes. This problem is depicted in Figure 267 below" ("RO-10," p 35).

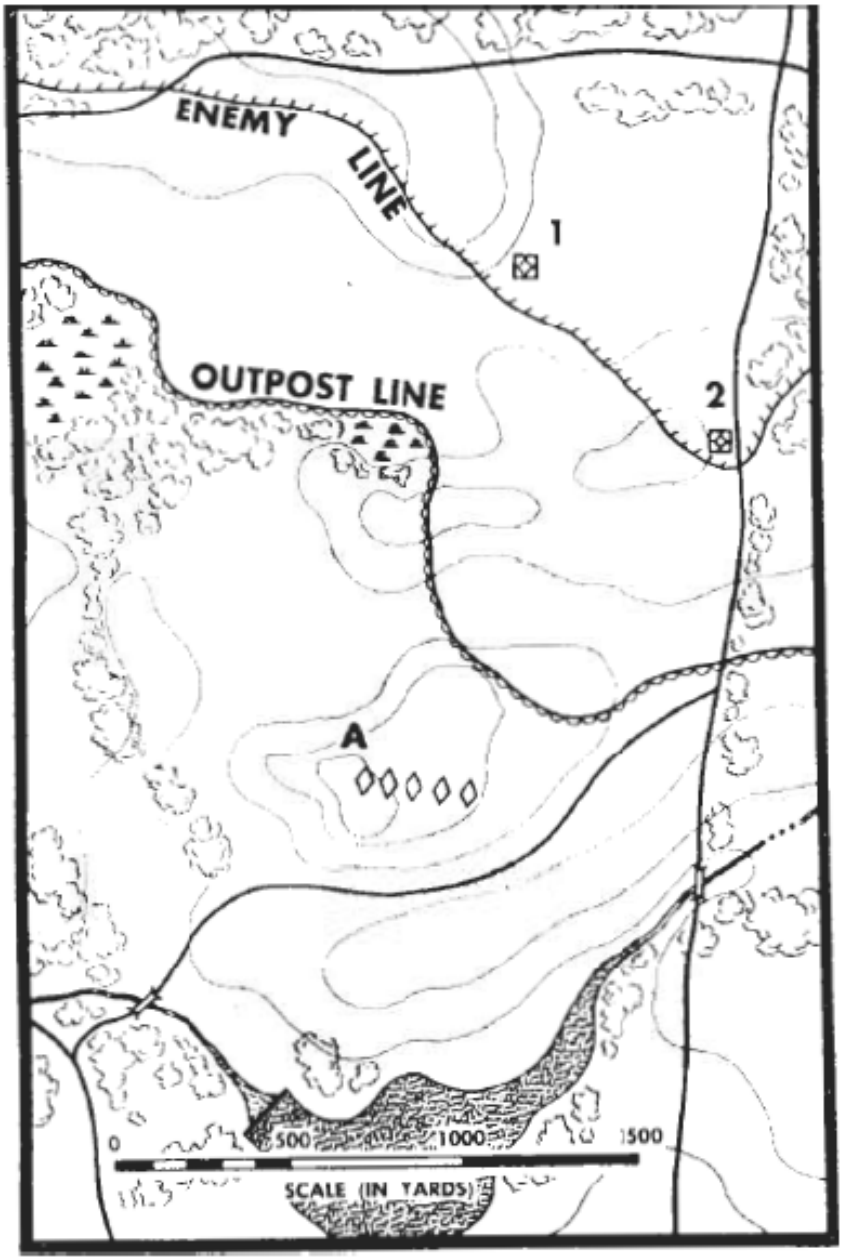


Figure 267. Tank platoon in direct fire support at night, circa 1945 ("RO-10," p 35).

Tank company in attack

"This problem illustrated the actions of a tank company with an attached infantry platoon in a rapidly executed attack against enemy rear guard elements. The range was on rolling, fairly open terrain at least 2,000 yd wide and 3,000 yd deep. Targets used included two model antitank guns. Explosives and electrical detonation equipment were used to simulate enemy antitank gunfire. This problem is illustrated in Figure 268 below" ("RO-10," p 36).

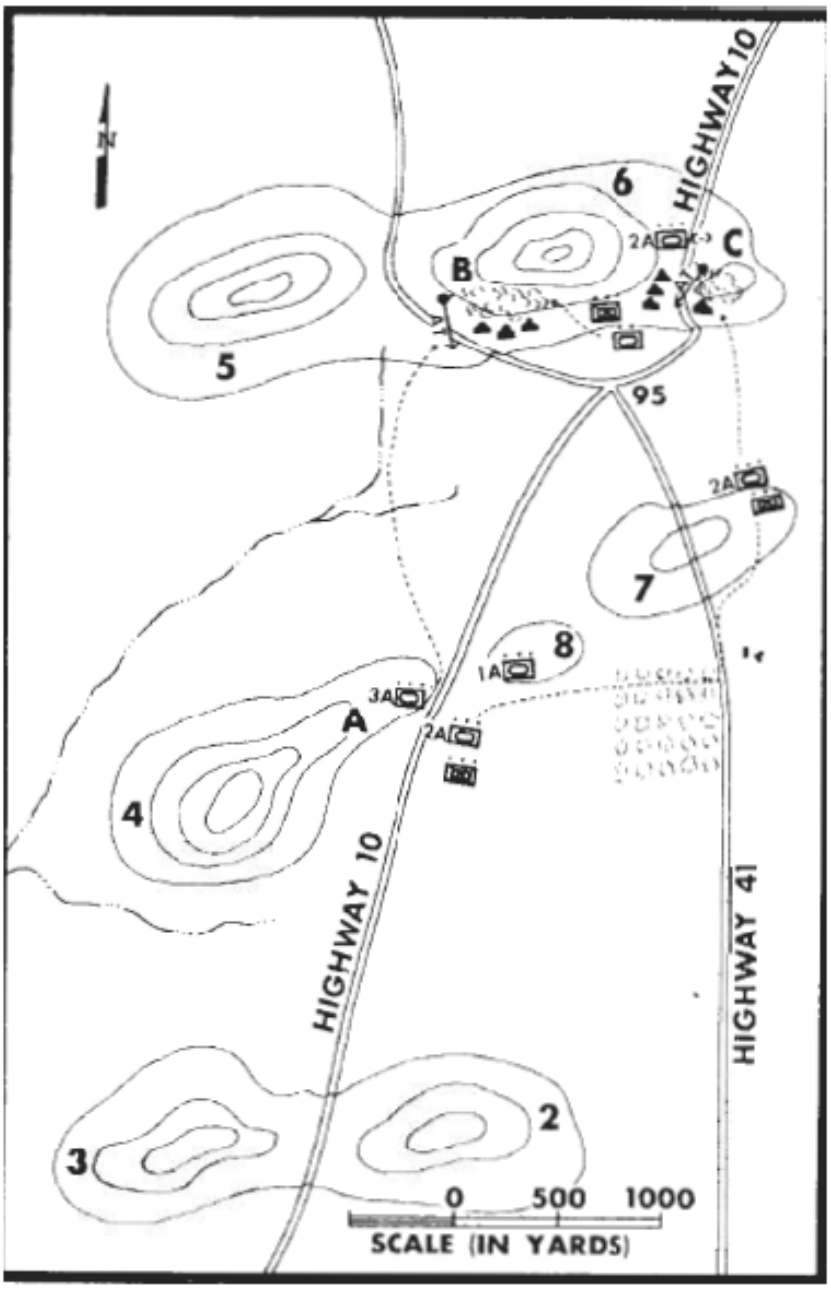


Figure 268. Tank company in attack, circa 1945 ("RO-10," p 36).

Infantry-tank attack

"This problem illustrated the coordination and cooperation necessary between tanks and the infantry for a successful infantry-tank attack. The range for this problem was rolling, partially covered terrain with suitable features for emplacing enemy antitank guns, surprise enemy infantry targets, and moving tank targets. The range was at least 1,500 yd wide by 4,000 yd deep. Explosives and electrical detonation equipment were used to simulate enemy antitank gunfire. This problem is depicted in Figure 269 below. Weapons authorized for units participating in these training exercises were sometimes restricted for safety reasons such as when a tank platoon was in a withdrawal mode and firing was being conducted against moving tanks " ("RO-10," p 37).

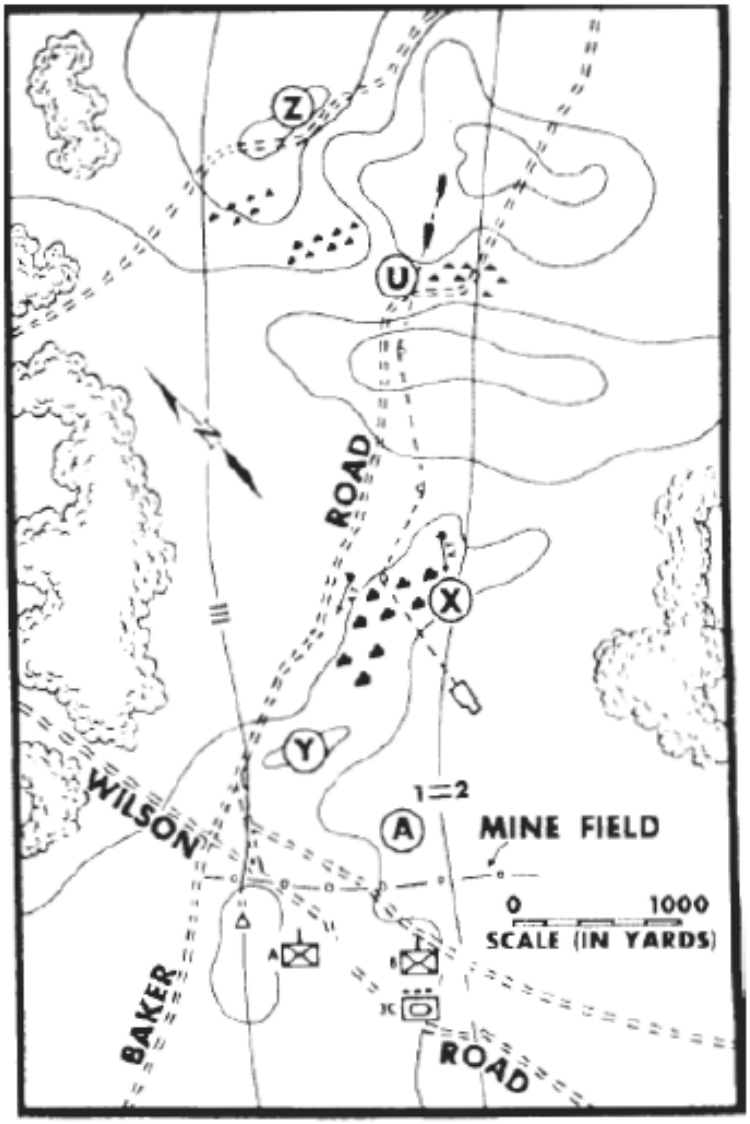


Figure 269. Infantry-tank attack, circa 1945 ("RO-10," p 37).

Historical photographs



Figure 270. Aerial photograph of Donnelly Tank Range, Fort Knox, KY, 1960 (Training 1a vol.1; stock shot # 242, Fort Knox, KY; Donnelly Tank Range, Fort Knox, photo by: SFC John A. Gilstrap, 23 May 1960, USAARMC photo branch, Fort Knox).



Figure 271. Aerial photograph of Boydston Tank Range, Fort Knox, KY, 1960 (Training 7 vol.1; stock shot # 246, Fort Knox; Boydston Tank Range, Fort Knox; photo by: SFC John A. Gilstrap, 23 May 1960, USAARMC photo Branch, Fort Knox).



Figure 272. Aerial photograph of Rolling Fork Tank Range, Fort Knox, KY, 1960 (training 8 vol.1; stock Shot # 267, Fort Knox; Rolling Fork Tank Range, Fort Knox, KY; photo by: SFC John A. Gilstrap, 23 May 1960, USAARMC photo branch, Fort Knox).

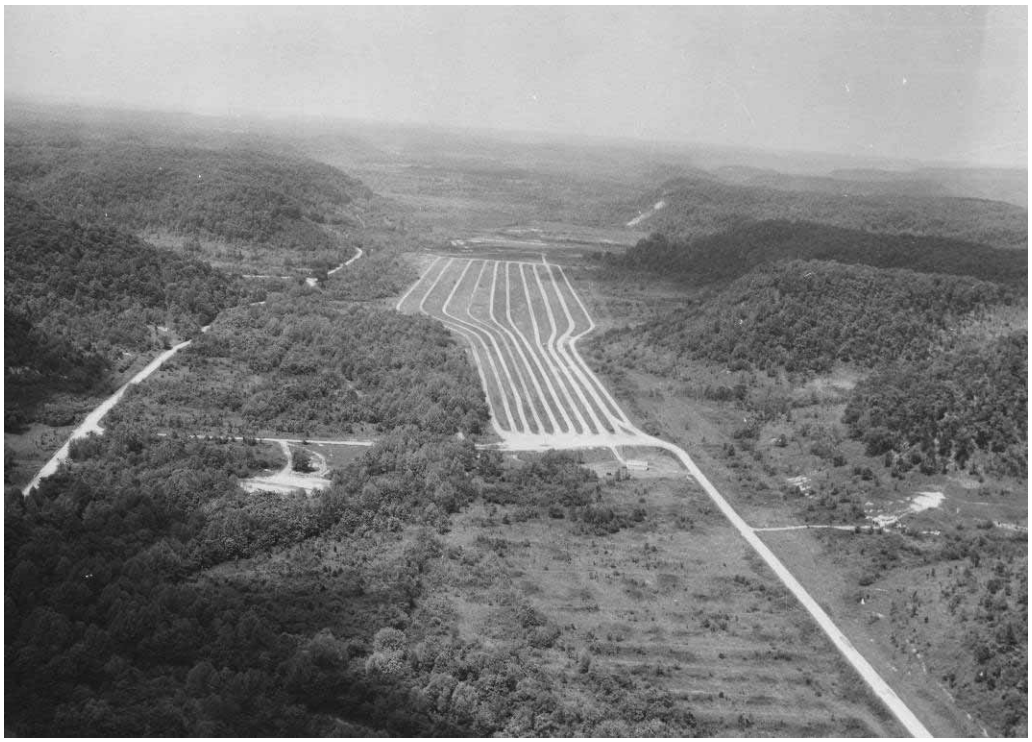


Figure 273. Aerial photograph of Cedar Creek Tank Range, Fort Knox, KY, 1960 (Training 9a vol.1; Stock Shot # 274, Fort Knox; Cedar Creek Tank Range, Fort Knox; photo by: SFC John A. Gilstrap, 23 May 1960, USAARMC photo branch, Fort Knox).



Figure 274. Aerial photograph of Dorrets Run Tank Range, Fort Knox, KY, date unknown (training 12 vol.1; stock shot # 291, Fort Knox; Dorrets Run Tank Range, Fort Knox; Photographer and date unknown, USAARMC photo branch, Fort Knox).



Figure 275. Aerial photograph of Steeles Tank Range, Fort Knox, KY, date unknown (training 16 vol.1; stock shot # 266, Fort Knox; Steeles Tank Range, Fort Knox; photo by: SFC John A. Gilstrap, Yr. Unk., USAARMC photo branch, Fort Knox).



Figure 276. Tanks in line with cadets observing subcaliber firing exercise at Finney Tank Range at Fort Knox, KY, 21 June 1961 (NARA College Park, RG 111-SC post 1955, box 364, photo SC583683).

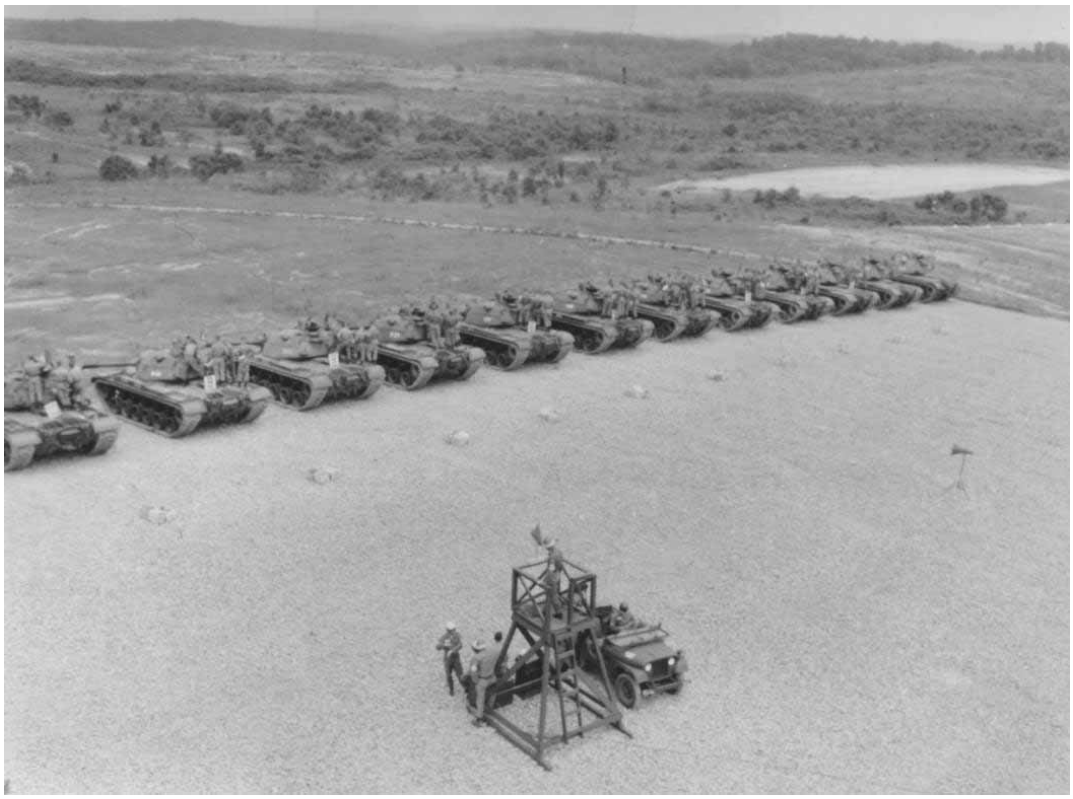


Figure 277. Caliber .50 firing orientation for USMA Cadets at Lawley Range at Fort Knox, KY, 9 June 1959 (NARA College Park, RG 111-SC post 1955, box 346, photo SC550418).

Buildings

A range may have had a control tower, latrine, target storage building, ammunition storage building, other storage sheds, and administrative/maintenance buildings supporting general range functions. The range may also have been part of a larger installation range complex that contained these buildings. Some facilities such as target butts, target pits, and drainage facilities also supplemented range functions ("RO-10," p 16).

Observation tower

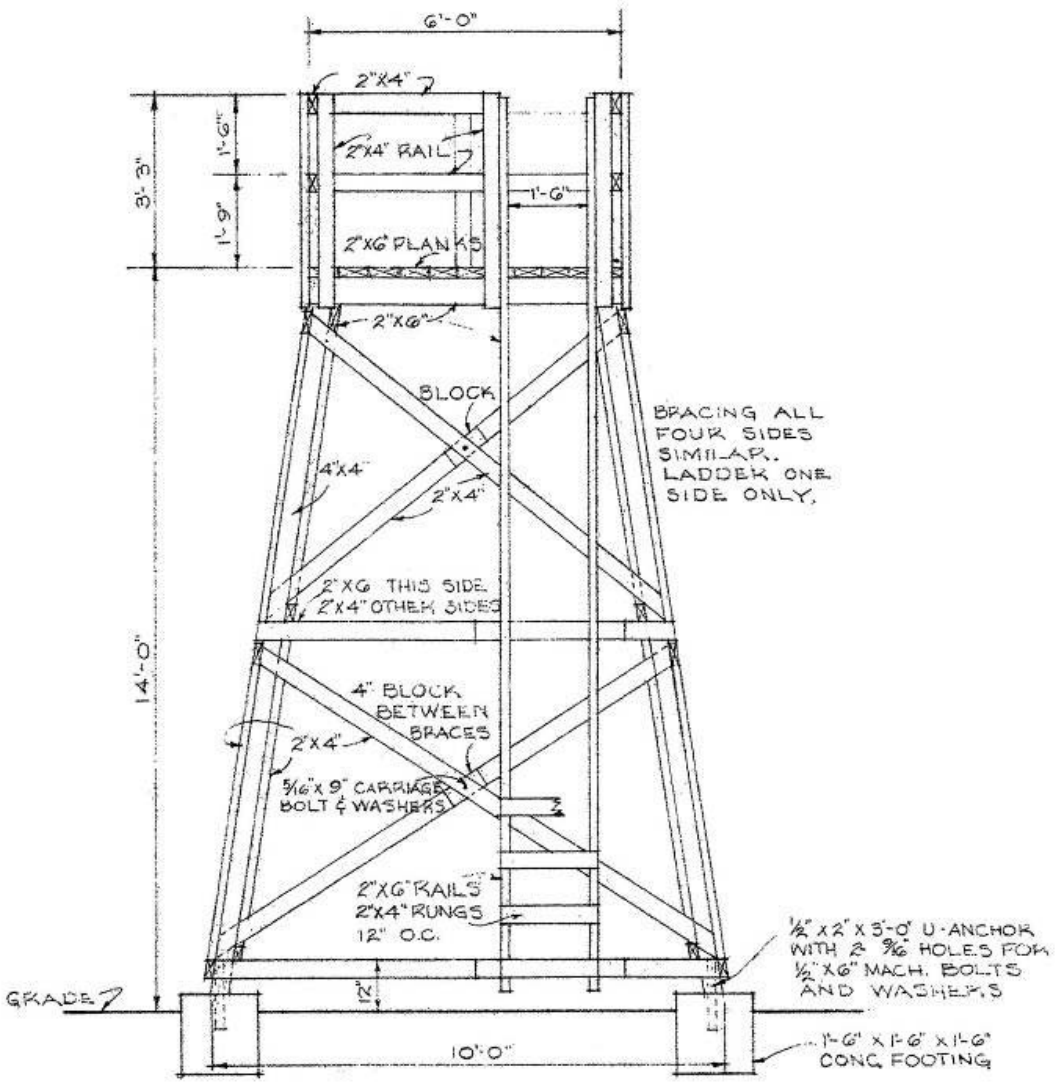


Figure 278. Individual tank combat firing range observation tower elevation, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

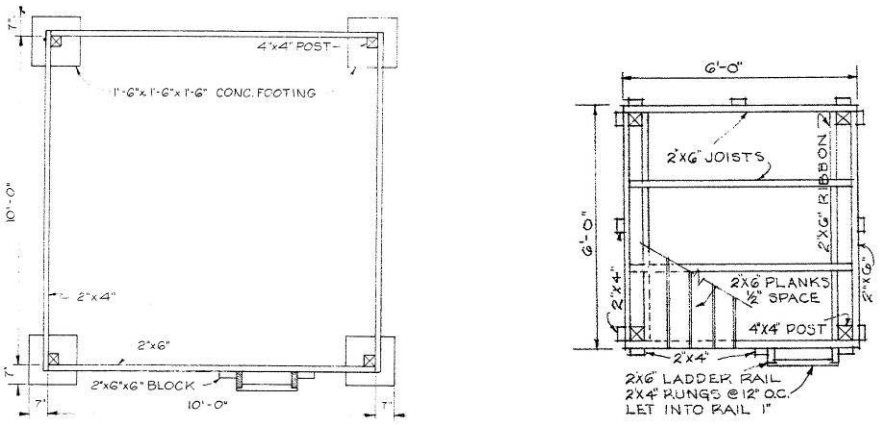


Figure 279. Individual tank combat firing range observation tower foundation and platform plan, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

Target house

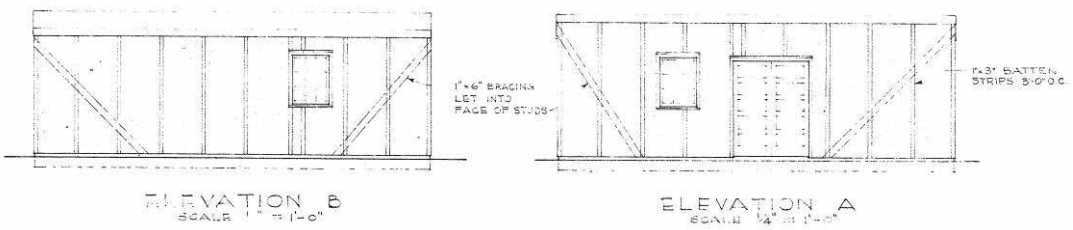


Figure 280. Individual tank combat firing range target house elevations A and B, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

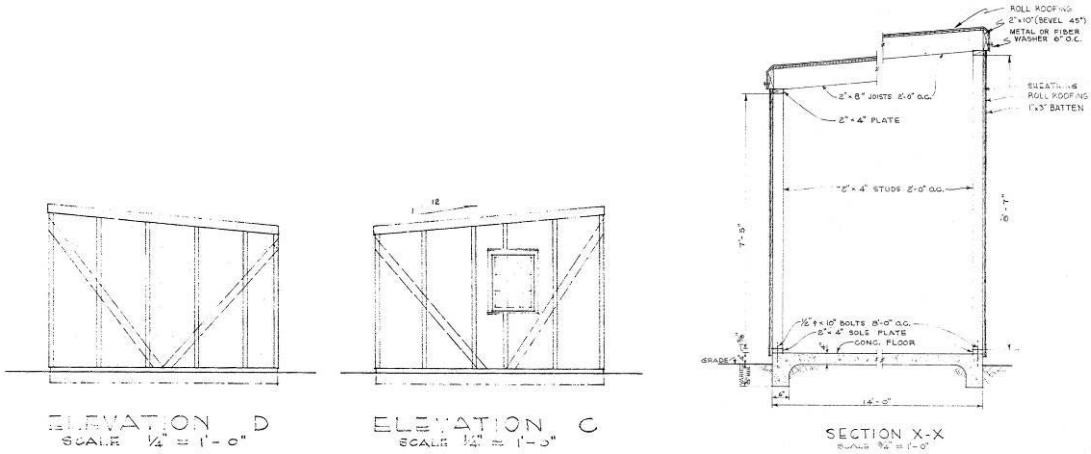


Figure 281. Individual tank combat firing range target house elevations D and C and section X, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

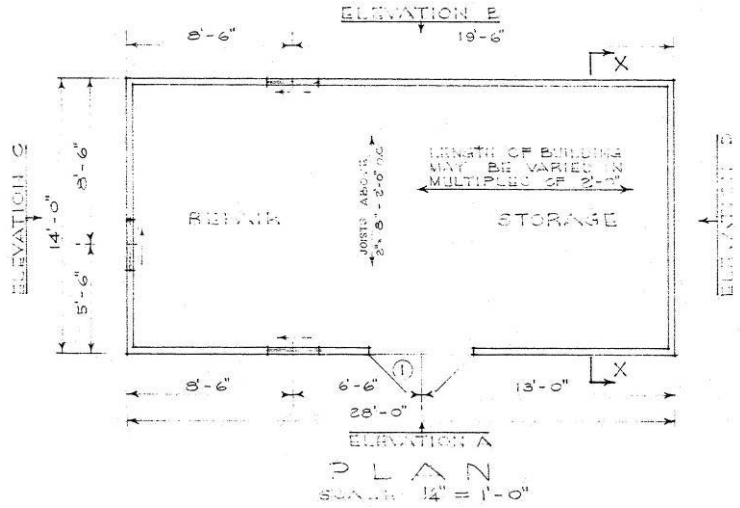


Figure 282. Individual tank combat firing range target house plan, Fort Bragg, 1952 (Standard Drawing 28-13-23 Sheet 2, "Range, individual tank combat firing details," 4 August 1952).

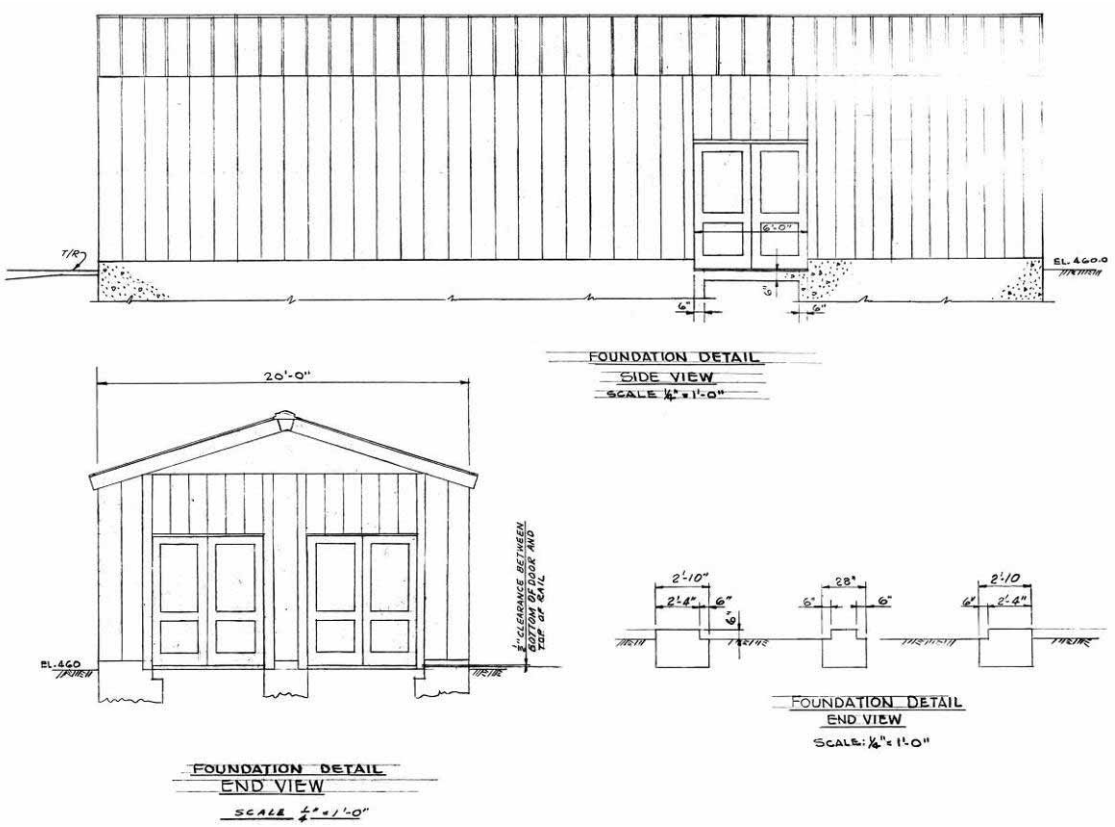


Figure 283. Moving tank and combat firing range target storage building details, Fort Knox, KY, 1956 (Standard Drawing 84-10-01 Sheet 12, "Moving tank and combat firing range, target storage building–firing area," 23 March 1956).

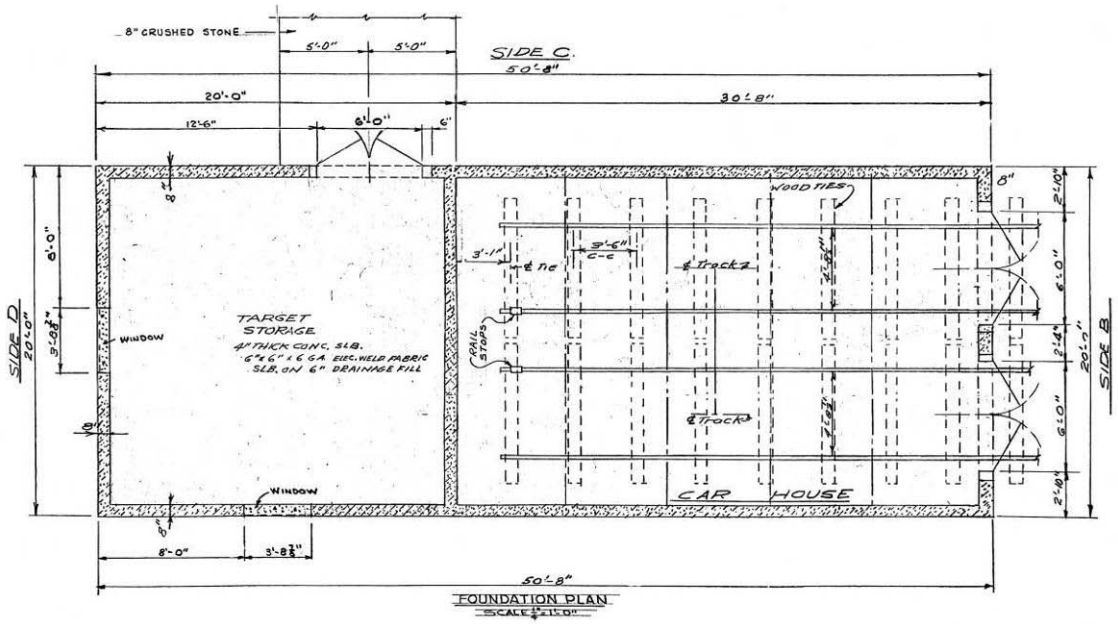


Figure 284. Moving tank and combat firing range target storage building details, Fort Knox, KY, 1956 (Standard Drawing 84-10-01 Sheet 12, "Moving tank and combat firing range, target storage building—firing area," 23 March 1956).

Tank or anti-aircraft moving target range

Ammunition house

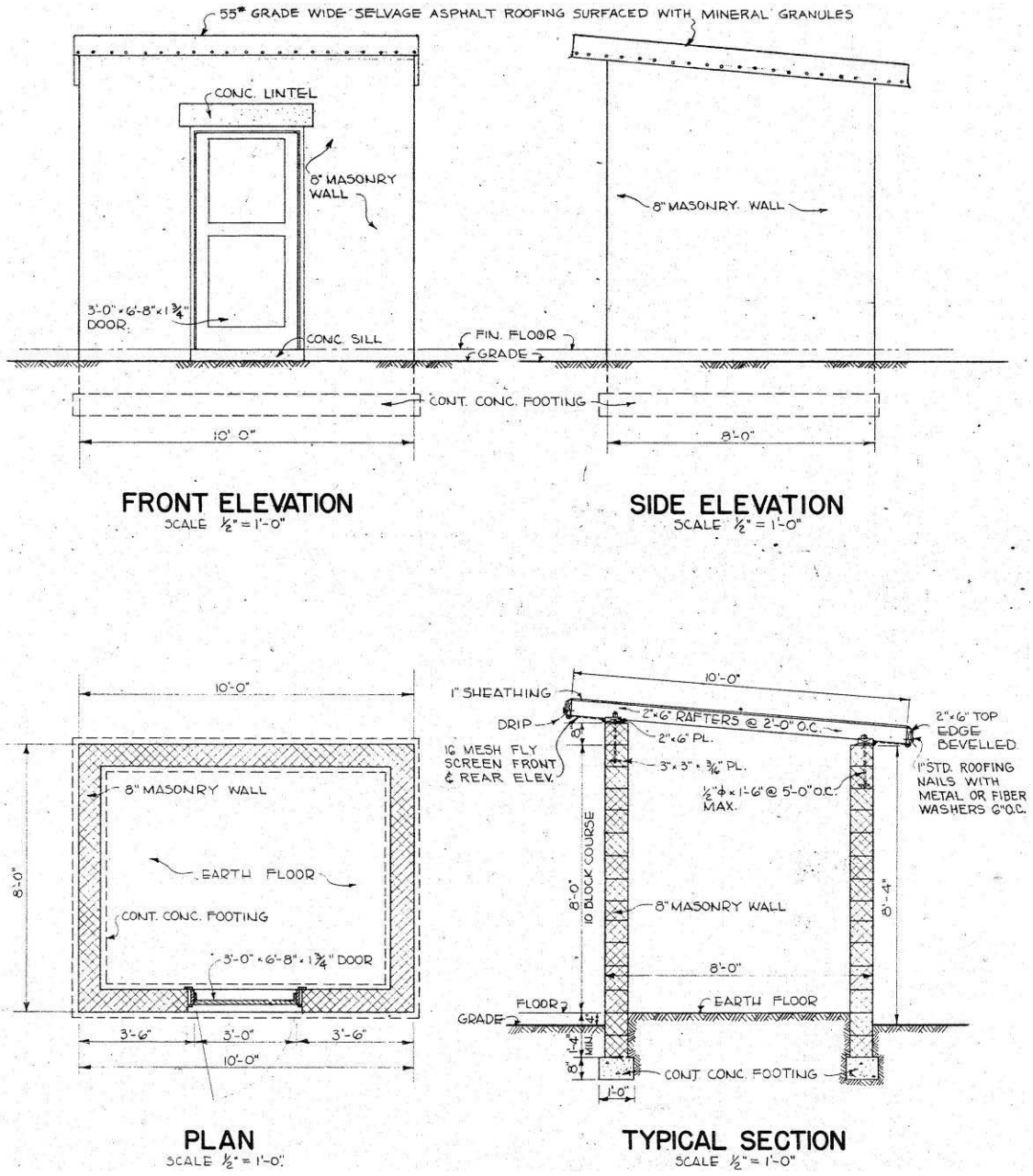


Figure 285. Tank or anti-aircraft moving target range (for guns to include 120mm), ammunition house, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 2 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), ammunition house and track sections," 4 August 1952).

Target repair and car storage house

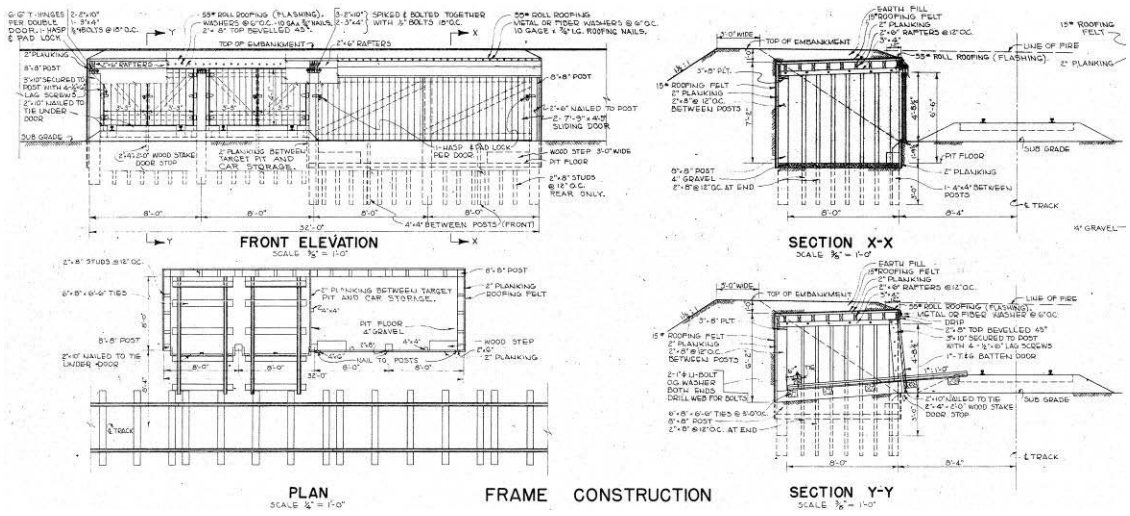


Figure 286. Tank or anti-aircraft moving target range (for guns to include 120mm), target repair & car storage house, frame construction, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 3 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), target repair & car storage house," 4 August 1952).

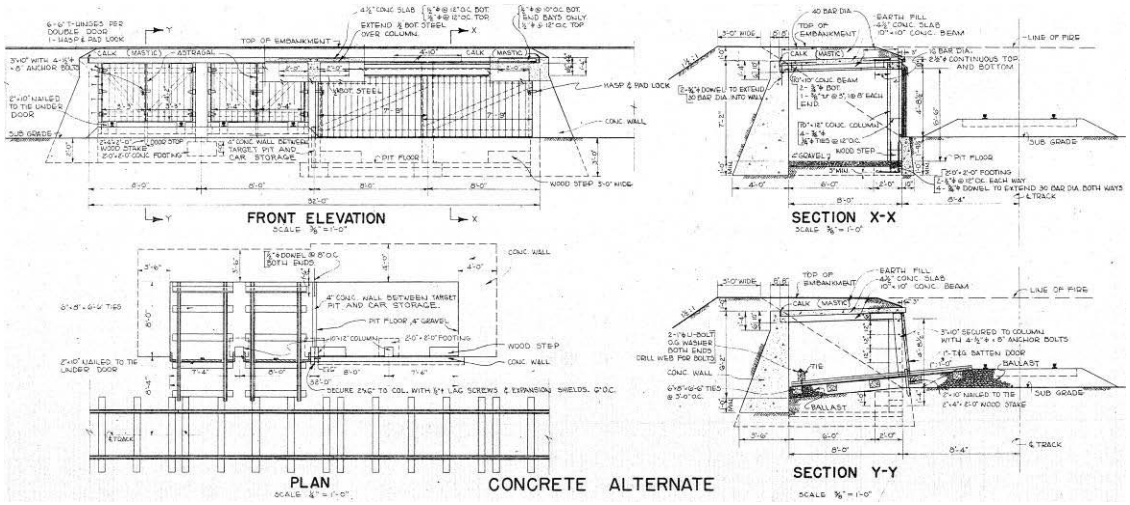


Figure 287. Tank or anti-aircraft moving target range (for guns to include 120mm), target repair & car storage house, concrete alternate, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 3 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), target repair & car storage house," 4 August 1952).

Latrine

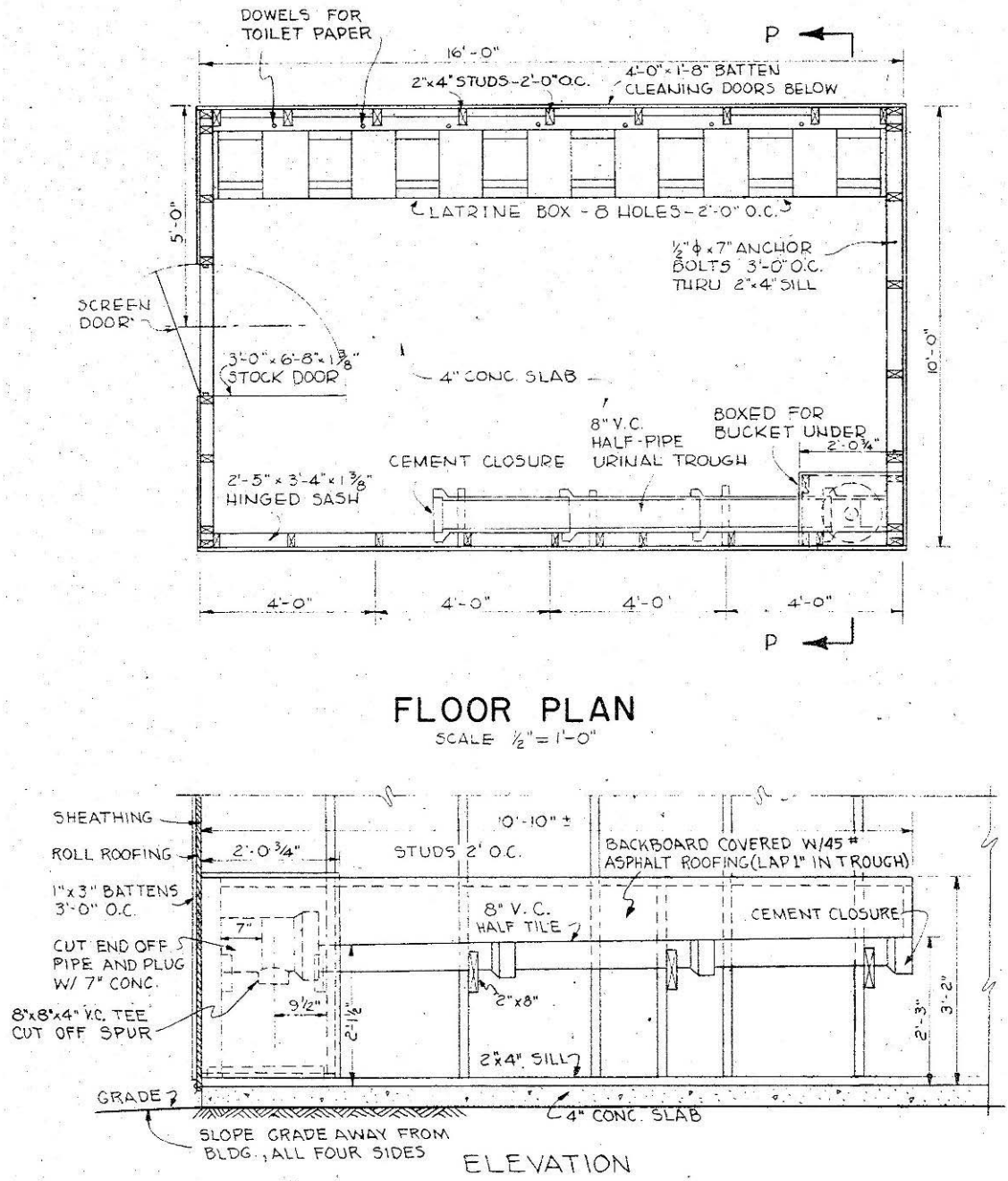


Figure 288. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, floor plan, and elevation, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

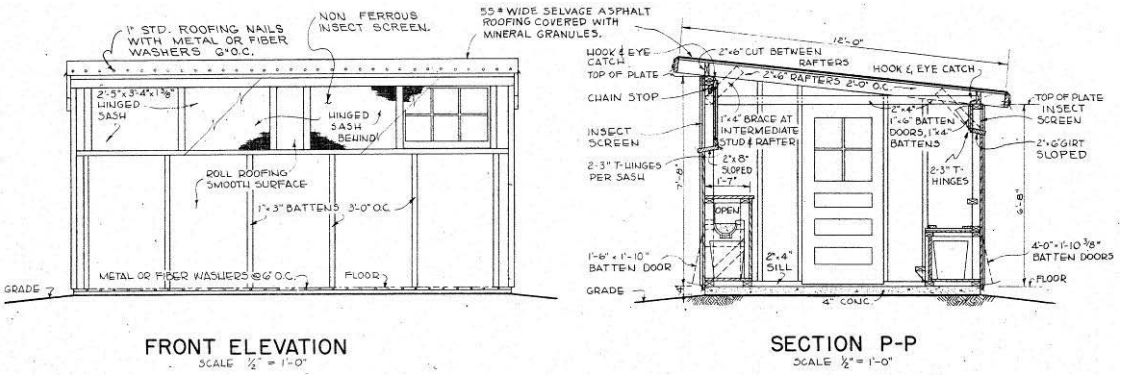


Figure 289. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, front elevation, and section, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

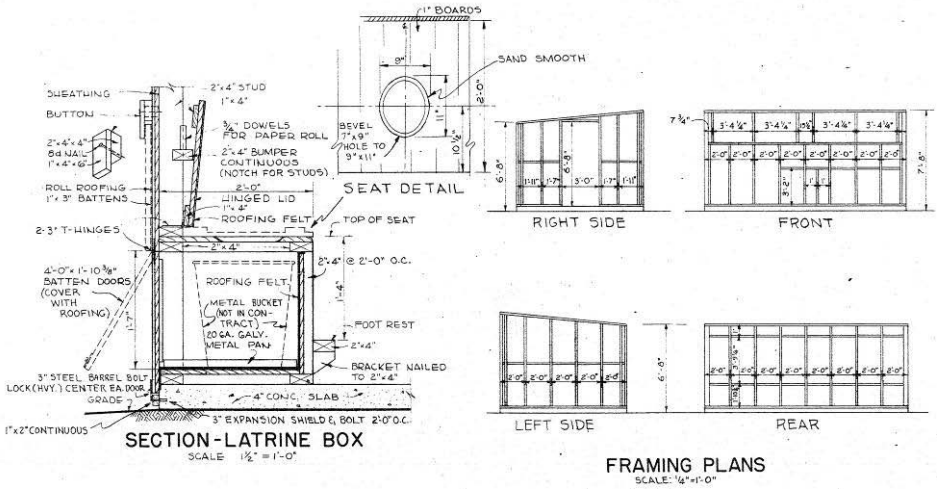


Figure 290. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, section through box and framing plans, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

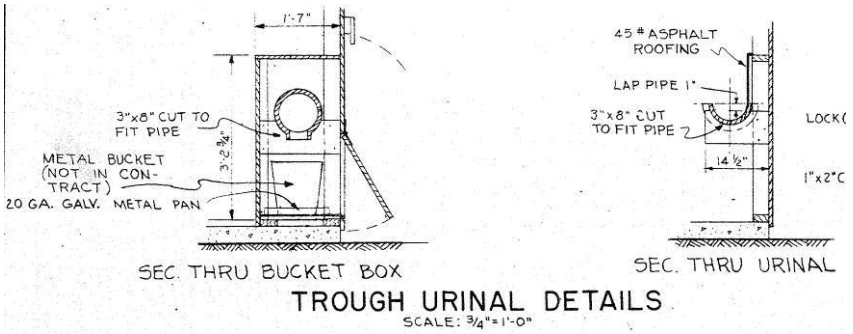


Figure 291. Tank or anti-aircraft moving target range (for guns to include 120mm), latrine, section through urinal details, Fort Bragg, 1952 (Standard Drawing 28-13-24 Sheet 4 of 4, "Range, moving target, tank or anti-aircraft (for guns to include 120mm), latrine," 4 August 1952).

Storage and maintenance buildings for OQ-19 Targets

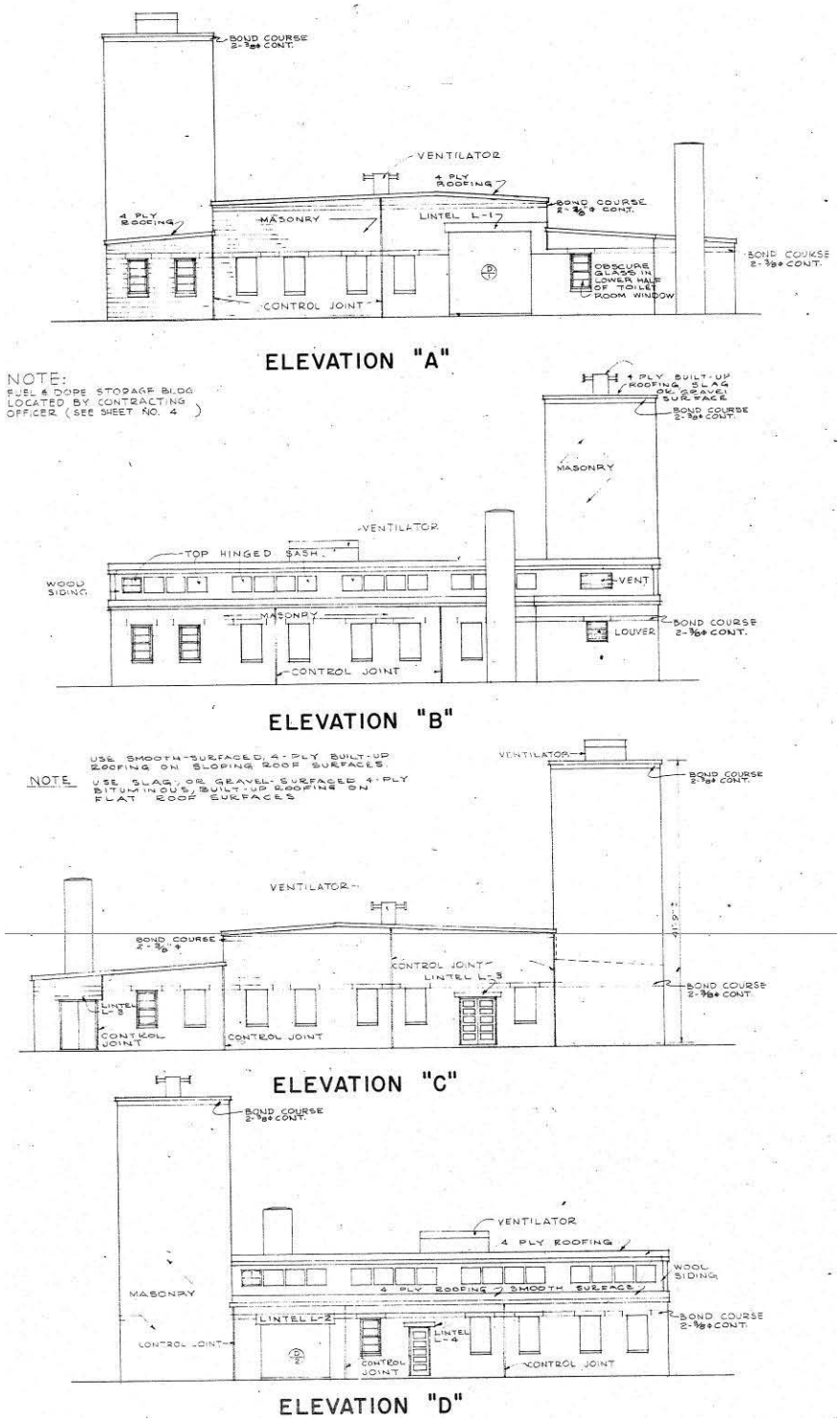


Figure 292. Storage buildings for OQ-19 targets, elevations, Fort Bragg, 1952 (Standard Drawing 28-13-30 Sheet 1 of 6, "Storage and maintenance building for OQ-19 targets, plans, and elevations," 20 June 1952).

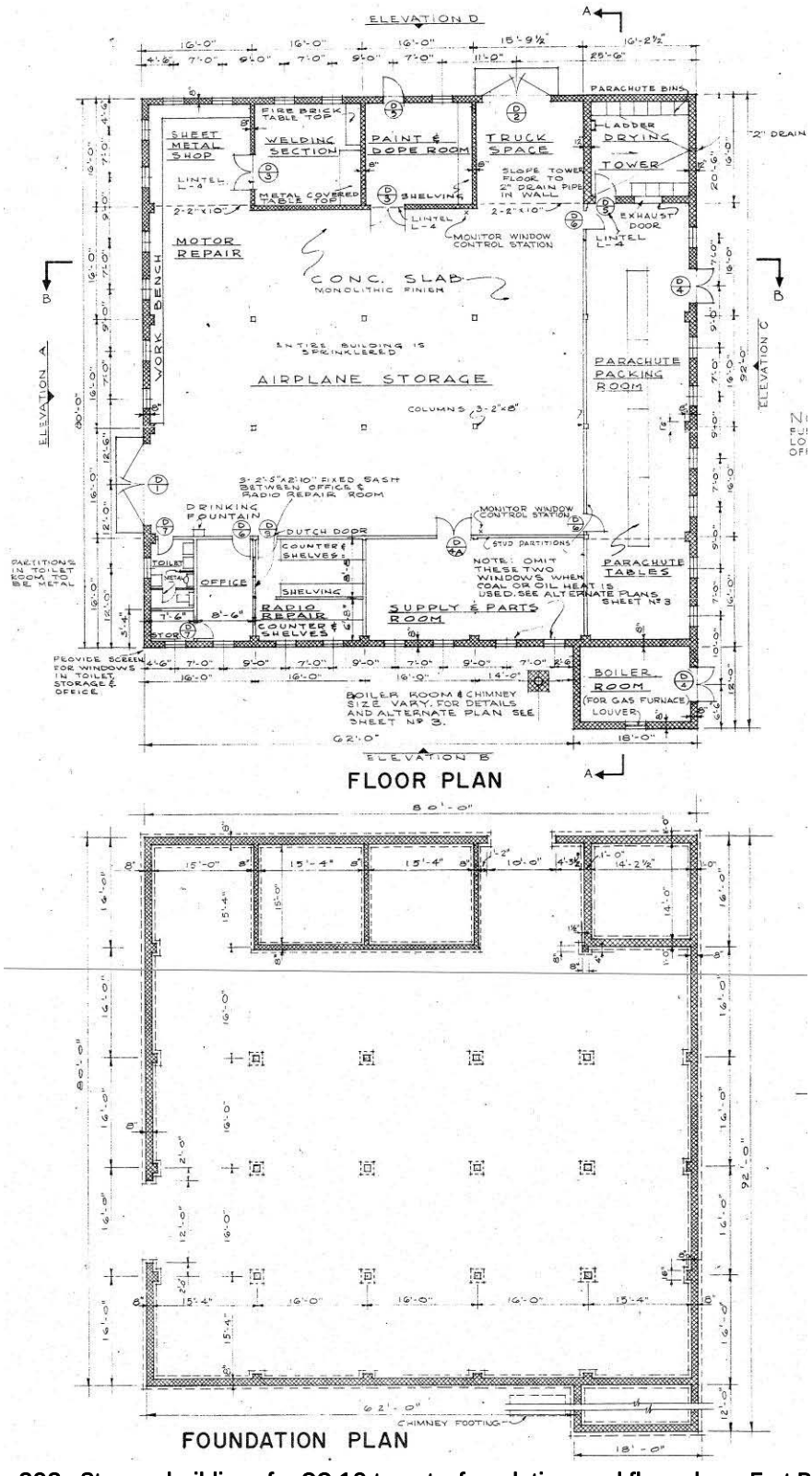


Figure 293. Storage buildings for OQ-19 targets, foundation, and floor plans, Fort Bragg, 1952 (Standard Drawing 28-13-30 Sheet 1 of 6, "Storage and maintenance building for OQ-19 targets, plans, and elevations," 20 June 1952).

3 Evaluating Properties Under the Military Training Lands Historic Context

Cultural resources are identified and managed within the Department of Defense (DoD) in accordance with Federal laws and military regulations. The identification of historically significant properties and resources can be achieved only through evaluation of their position within the larger historic context. According to the NRHP, historic contexts are defined as "... the patterns, themes, or trends in history by which a specific occurrence, property, or site is understood and its meaning (and ultimately its significance) within prehistory or history is made clear" (NRB #15, 7). A historic property is determined to be significant or not significant based on the application of standardized National Register Criteria within the property's historical context.

Criteria for evaluation

The NRHP Criteria for Evaluation (36 CFR Part 60.4) describe how properties and districts are significant for their association with important events or persons (Criterion A and Criterion B), for their importance in design or construction (Criterion C), or for their information potential (Criterion D). The following is a brief description of each of the four NRHP Criteria for Evaluation (excerpted from National Register Bulletin #15: How to Apply the National Register Criteria for Evaluation):

A. Event—associated with events that have made a significant contribution to the broad patterns of our history; or

B. Person—associated with the lives of persons significant in our past; or

C. Design/Construction—embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represents a significant and distinguishable entity whose components may lack individual distinction; or

D. Information Potential—yielded, or is likely to yield, information important in prehistory or history.

Criterion consideration G

Generally, buildings, structures, landscapes, etc. constructed within the last 50 years are not eligible for the National Register unless they can be classified as exceptionally important under Criterion Consideration G in the National Register Bulletin #15. "The National Register Criteria for Evaluation excludes properties that achieved significance within the past 50 years unless they are of exceptional importance. Fifty years is a general estimate of the time needed to develop historical perspective and to evaluate significance. This consideration guards against the listing of properties of passing contemporary interest and ensures that the National Register is a list of truly historic places."

Although the National Register Criteria do not explicitly define the term exceptional importance, National Register Consideration G and the National Register Bulletin #22: *Guidelines for Evaluating and Nominating Properties that have Achieved Significance within the Past Fifty Years* offers guidance for identifying and evaluating properties that have achieved significance in the past 50 years. Both of these sources stress that, for such properties, sufficient historical perspective must exist to make justifiable determinations of exceptional importance. Proof that sufficient historical perspective exists usually comes in the form of scholarly research and other sources of historical evidence associated with a particular historic context. The significance of Cold War era properties may lie at the national level in association with military themes directly tied to the Cold War, or at the state or local level under other themes.

The Army and Air Force have all issued interim guidelines for managing Cold War resources. The Navy is still working on draft version of guidance. These guidelines are not meant to replace the NHPA and its implementing regulations (Sections 106 and 110). The intent of the guidance is to set up an initial framework for the inventory and evaluation of the Cold War historic properties.

Army cold war guidelines and contexts

The Army developed its "interim Policy for Cold War Era Properties" in 1995. Applying to Army, Army National Guard, and Army Reserve installations, this policy stated that in applying the criteria of exceptional importance, the Army would "focus on the production and combat subsystems of the Army and their associated Real Property and technology that is of unmistakable and extraordinary importance by virtue of a direct and influen-

tial relationship to Cold War tactics, strategy, and events" (Department of the Army Cultural Resources Interim Policy Statements, 1995).

The Interim Policy was set into guidance with *The Thematic Study and Guidelines: Identification and Evaluation of U.S. Army Cold War Era Military-Industrial Historic Properties* in 1997. This guidance is a thematic study on historic properties associated with the military-industrial theme of the Cold War and provides guidelines for the identification and evaluation of Cold War era military-industrial historic properties in the Army. The context focuses in on what the Army did in direct response to the Cold War and directly associated with a major Army mission.

The Cold War context states that only "properties that are directly related to the Cold War military-industrial context" are exceptionally important. They must meet "any or all" of the following conditions:

1. They were specifically constructed or used prior to 1989 to:
   a. Meet the perceived Soviet/communist military threat;
   b. Project a force designed to influence Soviet policy; and
   c. Affect global opinion of the relationship between the superpowers.
2. Through the architectural or engineering design, they clearly reflect one of the Cold War themes:
   a. Basic Scientific Research (Laboratories)
   b. Materiel Development (Research, Development, Engineering Centers, and Proving Grounds)
   c. Wholesale Logistical Operations (Ammunition Production Facilities)
   d. Air Defense, Ballistic Missile Defense, and Army Missiles
   e. Command and Control, Communications, Computer, and Intelligence
   f. Army School System
   g. Operational Forces
   h. Army Medical Activities
   i. Miscellaneous (Nuclear and Aviation).
3. They are directly related to the United States/Soviet relationship through association with a milestone event of the period.
4. They are directly related to the United States/Soviet relationship through association with the life of a person during the Cold War period.

Air Force cold war guidelines and context

The U.S. Air Force recognizes five property type groups in the Interim Guidance that may convey important aspects of the Cold War. These five properties include:

1. Operational and Support Installations
   a. Air Force bases, including Command Centers
   b. Missile Stations
   c. Launch Complexes
2. Combat Weapons Systems and Combat Support Systems
   a. Missiles
   b. Aircraft (Fixed Wing and Rotary)
   c. Ground Vehicles and Equipment
3. Training Facilities
   a. Warfighting, Combat Support, and Intelligence Schools
   b. Launch Complexes
   c. Combat Training Ranges
   d. Impact Areas; Targets
   e. POW (Prisoner of War) Training Camps
4. Materiel Development Facilities
   a. Research Laboratories
   b. Manufacturing Sites
   c. Test Sites
   d. Proving Grounds
5. Intelligence Facilities
   a. Radar Sites
   b. Listening Posts.

Significance

Military training ranges need to be researched and evaluated as a whole landscape, including all the buildings/structures, firing lines, target mechanisms, etc. and not evaluated as individual elements that sit on the range. Military training ranges were originally designed and intended to be utilized as a whole complex. Each structure/element provides a vital role in the functioning of the range and the overall effectiveness of the training procedures for the soldiers.

The overall importance of particular ranges depends on the mission of whichever installation the research is focusing on. The mission critical ranges are what is important and need to be evaluated as a historic district. For example, a large arms range like a tank range needs to be examined and evaluated from the parking lot all the way out to the target butt, regardless of individual building or range element construction date. Thus just looking at an individual observation tower, latrine, firing targets, etc. should not be done. Look at the entire range. But go one step further and look at all of the ranges and training lands on the installation as one large

group to see if there is even information for a large district. No individual building/structure/element will ever be individually significant.

Once the training range is inventoried and evaluated as a complex, the next step is to determine if a particular range/buildings are significant to the individual installation being researched. For example, all ranges at Fort Jackson, SC could possibly be evaluated as one large district because Fort Jackson is the home of basic training; whereas the tank ranges located at Fort Knox, KY would be important to the mission because Fort Knox was the home of the Armor division. Ultimately, the researcher needs to look at the overall mission of the installation before deciding what is important on the ranges.

For instance, a large arms range, like the field artillery range, may have been constructed in 1944 but may contain buildings and structures from the entire stretch of the Cold War. As individual building elements and training mechanisms wore out they typically were replaced with new materials and technologies. The ranges will always be ranges and used for training, therefore, continue use of the landscape and structures are important. It is important to evaluate the location of replacement elements. Is the newer observation tower in the same location as the original? Are the replacement latrines, bleachers, and storage buildings located in the same spot on the range landscape?

Properties considered under the Large Arms Range Context are training ranges that the War Department, Navy Department, and Department of Defense constructed for their personnel and are associated with one of the following military training periods:

- Pre-Civil War (up to 1861)
- Civil War (1861-1865)
- National Expansion (1865-1916)
- World War I (1917-1920)
- Interwar (1921-1940)
- World War II (1941-1945)
- Early Cold War (1946-1955)
- Late Cold War (1956-1989).

The researcher still has to be able to identify that firing range to what period it is significant for no matter if there are replacement structures or elements located on the range.

Aspects of integrity

In addition to possessing historical significance, training ranges must also retain sufficient physical integrity of the features that convey their significance to be eligible to the NRHP (NRB #15, 44).

Training lands/ranges will either retain integrity (that is, convey their significance) or they will not. Within the concept of integrity, the National Register criteria recognize seven aspects or qualities that, in various combinations, define integrity.

To retain historic integrity a property will always possess several, and usually most, of the aspects. The retention of specific aspects of integrity is paramount for training lands/ranges to convey their significance. Determining which of these aspects are most important to a particular training land/range requires knowing which association is significant.

Although some training lands/ranges may not meet integrity standards for individual eligibility to the National Register, they may meet a standard as a contributing resource to a larger training district. Training lands/ranges are considered to be significant if they possess a majority of the following Seven Aspects of Integrity (NRB #15, 44-45):

1. **Location.** Location is the place where the historic property was constructed or the place where the historic event occurred.
2. **Design.** Design is the combination of elements that create the form, plan, space, structure, and style of a property. It results from conscious decisions made during the original conception and planning of a property (or its significant alteration) and applies to activities as diverse as community planning, engineering, architecture, and landscape architecture. Design includes such elements as organization of space, proportion, scale, technology, ornamentation, and materials.
3. **Setting.** Setting is the physical environment of a historic property. Setting refers to the character of the place in which the property played its historical role. It involves how, not just where, the property is situated and its relationship to surrounding features and open space.
4. **Materials.** Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
5. **Workmanship.** Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.

6. **Feeling.** Feeling is a property's expression of the aesthetic or historic sense of a particular time period.
7. **Association.** Association is the direct link between an important historic event or person and a historic property.

Character defining features

The character defining features of a range depend on the associated NRHP Criteria and the associated property type. A large arms range typically was designed and constructed with the following:

- a set of cleared and leveled firing points laid out on a firing line and associated features (foxholes, trenches, sandbags, embankments, etc)
- stationary or moving targets (cables, pulleys, tracks, pop-up targets, miniature airplanes, etc)
- embankments or walls (built up behind targets to catch ammunition, in front of targets for concealment and protection, at firing lines for firing support, between ranges to protect from adjacent fire)
- buildings (control or observation tower, bleachers, latrines, target storage houses, ammunition storage buildings)
- typical features include multiple range layouts, firing lines, targets, embankments/trenches, and buildings.

Context example photographs

Two members of the research team conducted a site visit to Fort Bragg, NC. Fort Bragg was chosen for the site visit because it had one of the largest groupings of different training lands in the Department of Defense; the complexity of its training lands; and the level of historical background that Fort Bragg had on its training lands. There are few examples gathered from other installations. In addition to the photographs taken at Fort Bragg, the researchers searched the previous ERDC/CERL pertaining to training lands and used some of these for examples in the evaluation chapter.

When the researcher is tasked to research and inventory items on a military training range, the researcher is going to find things that are on the real property list, items that are not listed on the real property list, abandoned structures, and foundations. It is the task of the researcher to inventory and document all elements of the range, the role of the elements and the condition of the elements.

Below, is a photographic representation of a variety of examples of large arms range elements. The examples should be used as a guide to help identify key character defining features which will ultimately help determine the integrity of each range.

Overall range layout (tank range)



Figure 294. Tank range layout, Fort Bragg, 17 May 2006.



Figure 295. Tank range layout, Fort Bragg, 17 May 2006.



Figure 296. Tank range layout, Fort Bragg, 17 May 2006.

Targets and embankments

Salvaged vehicle/tank targets



Figure 297. Salvaged vehicle/tank targets, Fort Bragg, 17 May 2006.



Figure 298. salvaged vehicle/tank targets, Fort Bragg, 17 May 2006.

Pop-up targets



Figure 299. Pop-up target built into an embankment, Fort Bragg, 17 May 2006.



Figure 300. Pop-up target built into an embankment, Fort Bragg, 17 May 2006.

Moving target tracks



Figure 301. Pop-up target mounted on a dolly moving along a target track protected by an embankment, Fort Bragg, 17 May 2006.



Figure 302. Target storage and repair building at the end of the target track protected by an embankment, Fort Bragg, 17 May 2006.



Figure 303. Target storage and repair building at the end of the target track built into an embankment, Fort Bragg, 17 May 2006.

Buildings

Observation towers

WWII



Figure 304. remains of WWII observation tower Bldg R122, Fort Gordon, GA, January 2004.



WWII Observation tower Bldg 9805, Fort Bliss, TX, November 2005.



Figure 305. WWII observation tower Bldg 9805, Fort Bliss, TX, November 2005.



Figure 306. remains of WWII observation tower Bldg R122, Fort Gordon, GA, January 2004.



Figure 307. WWII observation tower Bldg 9789, Fort Knox, KY, November 2005.



Figure 308. Remains of WWII observation tower Bldg 9606, Fort Knox, KY, November 2005.

Post WWII

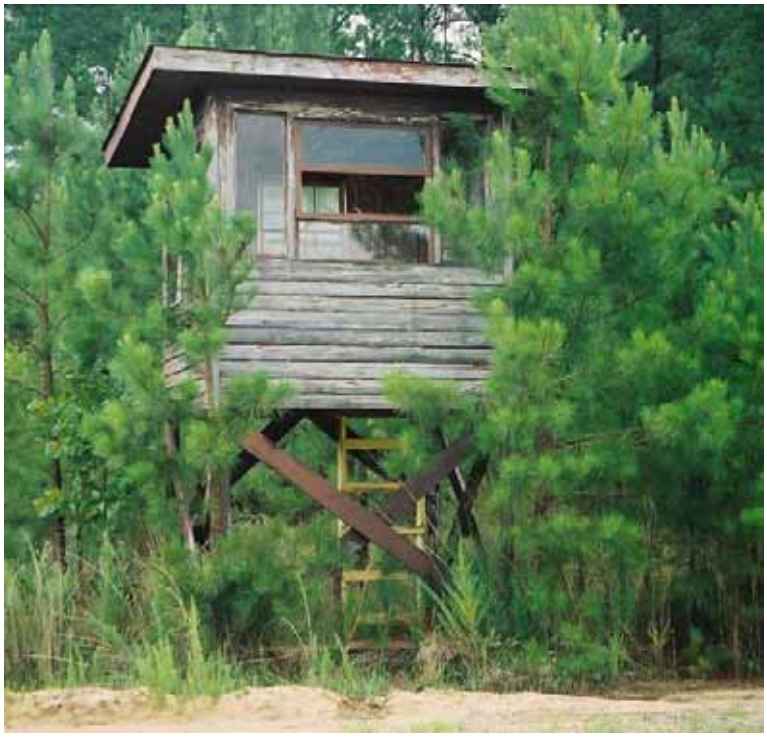


Figure 309. Remains of 1950s observation tower, Fort Jackson (SCARNG), June 2004.



Figure 310. Remains of 1950s observation tower, Fort Jackson (SCARNG), June 2004.

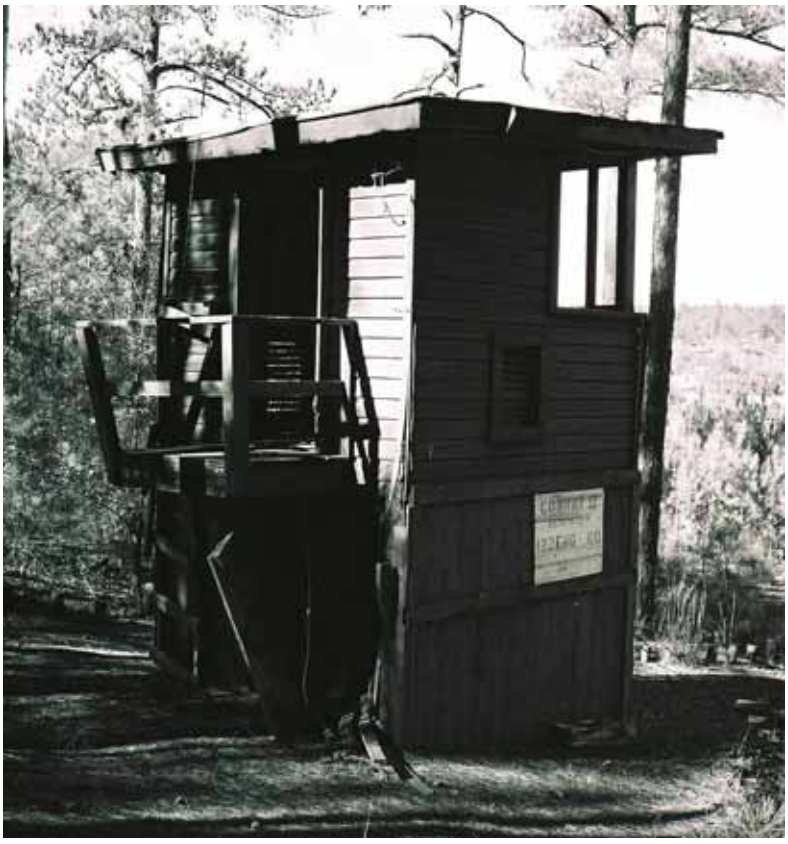


Figure 311. Remains of 1950s observation tower on Combat II Range, Fort Jackson, June 2004.



Figure 312. observation tower, Fort Bragg, 17 May 2006.

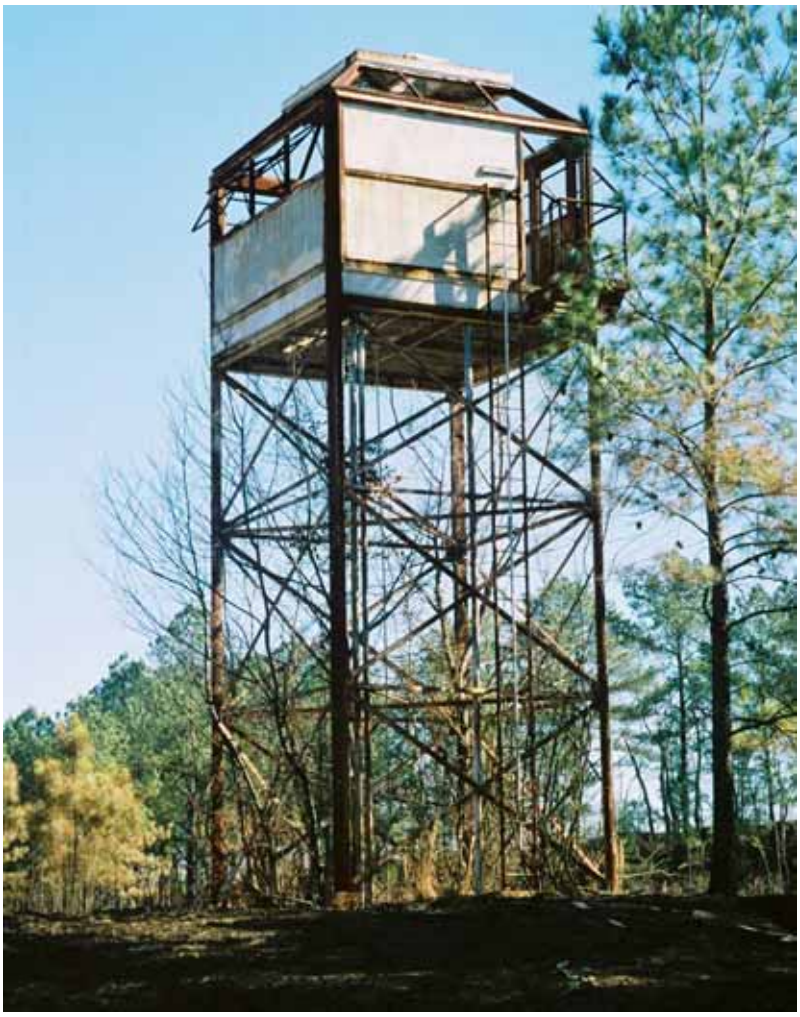


Figure 313. 1966 observation tower near Old Range #19, Fort Gordon, GA, January 2004.



Figure 314. Remains of 1966 observation tower (near Bldg421), Fort Gordon, GA, July 2004.



Figure 315. 1987 range building 486, Fort Gordon, GA, January 2004.



Figure 316. 1995 Range 10 observation tower and grandstand, Fort Jackson, SC, July 2003.



Figure 317. Control tower and range buildings, Fort Bragg, 17 May 2006.



Figure 318. observation tower, Fort Bragg, 17 May 2006.



Figure 319. observation tower, Fort Bragg, 17 May 2006.



Figure 320. observation tower, Fort Bragg, 17 May 2006.

Storage buildings

WWII



Figure 321. WWII range target storage building 9898, Fort Bliss, TX, November 2005.



Figure 322. WWII range target storage building 9898, Fort Bliss, TX, November 2005.



Figure 323. Remains of WWII known distance range target butt, latrine, and target storage, Fort Jackson (SCARNG), June 2004.



Figure 324. Remains of WWII range target shed Bldg R161, Fort Gordon, GA, January 2004.



Figure 325. Remains of WWII range target shed Bldg R161, Fort Gordon, GA, January 2004.

Post WWII



Figure 326. 1966 Bldg 421 range target shed, Fort Gordon, GA, January 2004.



Figure 327. 1966 Bldg 421 range target shed, Fort Gordon, GA, January 2004.



Figure 328. Range storage building, Fort Bragg, 17 May 2006.



Figure 329. Range storage building, Fort Bragg, 17 May 2006.



Figure 330. Range storage building, Fort Bragg, 17 May 2006.



Figure 331. Range storage building, Fort Bragg, 17 May 2006.



Figure 332. Range storage building, Fort Bragg, 17 May 2006.



Figure 333. Range storage building, Fort Bragg, 17 May 2006.



Figure 334. Range storage building, Fort Bragg, 17 May 2006.

Ammunition storage buildings



Figure 335. 1987 Bldg 485 range storage, Fort Gordon, GA, January 2004.



Figure 336. Range ammunition storage building, Fort Bragg, 17 May 2006.



Figure 337. Range ammunition storage building, Fort Bragg, 17 May 2006.

Latrines

WWII



Figure 338. remains of WWII latrine Bldg R152, Fort Gordon, GA, January 2004.



Figure 339. Remains of WWII latrine Bldg 9347, Fort Knox, KY, November 2005.



Figure 340. WWII latrine Bldg 9606, Fort Knox, KY, November 2005.



Figure 341. Remains of WWII latrine Bldg 9606, Fort Jackson, November 2003.



Figure 342. Remains of WWII known distance range target butt, latrine, and target storage, Fort Jackson (SCARNG), June 2004.

Post WWII



Figure 343. Range latrine, Fort Bragg, 17 May 2006.



Figure 344. Range latrine, Fort Bragg, 17 May 2006.



Figure 345. Range latrine, Fort Bragg, 17 May 2006.

Bleachers



Figure 346. Range bleachers, Fort Bragg, 17 May 2006.



Figure 347. 1995 Range 10 observation tower and grandstand, Fort Jackson, July 2003.



Figure 348. Range bleachers, Fort Bragg, 17 May 2006.

Mess halls



Figure 349. 1966 Bldg 427 range mess hall, Fort Gordon, GA, January 2004.



Figure 350. 1966 Bldg 427 range mess hall interior, Fort Gordon, GA, January 2004.



Figure 351. Range mess facilities 0-7906, Fort Bragg, 17 May 2006.

Weapons cleaning point



Figure 352. 1995 Range 10 weapons cleaning point, Fort Jackson, July 2003.



Figure 353. weapons cleaning point, Fort Bragg, 17 May 2006.

Firing towers



Figure 354. Range firing tower, Fort Bragg, 17 May 2006.



Figure 355. Range firing tower, Fort Bragg, 17 May 2006.

4 Conclusions

This work developed a historic context for the development of military training lands used by the DOD and its forerunners. This overall project covered five types of military training:

1. Small arms ranges
2. Large arms ranges
3. Training villages and sites
4. Bivouac areas
5. Large-scale operation areas.

This document provides an historic context of large arms ranges on military training lands for the U.S. Army, U.S. Navy, U.S. Army Air Corps/U.S. Air Force, and the U.S. Marines, with a focus on the landscape outside the developed core of military installations. This work concludes that military training lands are significant enough in our nation's history to be surveyed for eligibility to the NRHP. However, training lands must be viewed as a whole; individual buildings on a training range are rarely eligible for the NRHP; buildings in their larger context (and the integrity of that larger context) are important.

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14. ABSTRACT

This work provides an historic context for military training lands, written to satisfy a part of Section 110 of the National Historic Preservation Act (NHPA) of 1966 as amended. Cultural resources personnel at the installation level and their contractors will use this historic context to determine whether military training resources are eligible for the National Register of Historic Places (NRHP), and whether an adverse effect will take place. This overall project covered five types of military training: small arms ranges, large arms ranges, training villages and sites, bivouac areas, and large-scale operation areas. This document provides an historic context of large arms ranges on military training lands for the U.S. Army, U.S. Navy, U.S. Army Air Corps/U.S. Air Force, and the U.S. Marines, with a focus on the landscape outside the developed core of military installations. This work determined that that military training lands are significant enough in our nation's history to be surveyed for eligibility to the NRHP. However, training lands must be viewed as a whole; individual buildings on a training range are rarely eligible for the NRHP; buildings in their larger context (and the integrity of that larger context) are important.

15. SUBJECT TERMS
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