The United States Army Infantry School
Fort Benning, Georgia
6 February 1967

SUBJECT: Destruction of Underground Tunnels and Positions

1. PROBLEM. To determine the most effective means of destroying underground tunnels and positions used by guerrillas.

2. ASSUMPTIONS.

   a. Combat units will continue to encounter underground tunnels and positions during the conduct of counterguerrilla operations.

   b. During the conduct of counterguerrilla operations, objective areas will normally be abandened by our units after the guerrilla force has been found and destroyed.

   c. Upon discovery of underground positions, it is necessary to deny later use of them by the guerrilla force.

   d. Nuclear explosives will not be used for destruction of underground tunnels and positions.

3. FACTS BEARING ON THE PROBLEM.

   a. Tunnels encountered are usually complex, difficult to trace, and well constructed. (2:1-5; 4:7-9 and 21:22; 7:1-13, 8)

   b. Artillery and aerial bombardment have little effect on many systems. (2.3 and 7.1)

   c. Valuable items of intelligence such as prisoners, documents, weapons, and supplies are often found in underground installations. (3:3, 5b; 4:22; 7:3).

4. DISCUSSION.

   a. Guerrilla underground positions and tunnels vary greatly in size, usage, and complexity. Installations less than 70 feet in length may be referred to as short tunnels. Those of greater length may be called long tunnels. Usage of tunnels may be classified into five broad categories: underground bunkers with interlocking tunnel systems, underground storage areas, underground living quarters, multilevel tunnel systems, and home protection shelters. Complexity varies from a mere comouflaged hole in the ground to a mulileveled system of rooms, storage areas and tunnels. (Annex A)

   b. The guerrilla force may be denied further use of underground systems by one or more of the following methods.

      (1) Total or partial destruction may be obtained by manual or mechanical means. This method employs manual labor (picks and shovels), bulldozers, tank dozers, etc. (Annex B)

(2) Destruction by solid explosives may be utilized in many operations. This method employs block charges, bangalore torpedoes, satchel charges and shaped charges. (Annex C)

(3) The use of explosive gas has been attempted with a limited degree of success. Research continues in this field and may provide some important advances in tunnel destruction. (Annex D)

(4) Denial of further use by means of contamination with riot control gases has been utilized with varying degrees of success by several units. Though this method does not, in fact, destroy tunnels; it does deserve consideration as a denial method. (Annex E)

(5) Various other methods of destruction and/or denial that have not been employed should be considered. Though these methods have not been tested, they may meet the criteria of effectiveness, logistical feasibility and simplicity. (Annex F)

5. CONCLUSIONS.

a. When time, the enemy situation, and availability of earth-moving equipment permits, the most effective means of tunnel destruction is by mechanical/manual methods.

b. Of the various solid explosives available, the bangalore torpedo is most effective in tunnel destruction, while the various forms of block charges are preferred for room or bunker type installations.

c. As currently available, the explosive gas, acetylene, has not proven sufficiently effective to warrant its full scale use.

d. Riot control agents do not destroy tunnels but should be considered seriously when time and logistical factors are overriding.

e. The method of using riot control agents for contamination and solid explosives for sealing entrances is the most practical now used.

f. From the Infantryman's point of view, a faster, lighter weight, more effective, and less complex system is needed.

g. An infantry unit conducting counter guerrilla operations does not have the capability of carrying sufficient material to effectively destroy complex underground tunnels and positions.

6. RECOMMENDATIONS.

a. Bulldozers, tankdozers, and other earthmoving equipment organic to combat engineer units continue to be used to destroy underground systems when time, availability of equipment, and the enemy situation permits.

b. Prepackaged tunnel destruction kits consisting of bangalore torpedoes, block explosives, shaped charges, riot control agents, and Mity Mite Blowers be on call for immediate helicopter lift in support of all operations.

c. Sufficient personnel in each rifle company be trained to employ tunnel destruction kits with only a minimum of Engineer advisory personnel to assist them.

d. Research and testing of explosive gas methods of tunnel destruction be continued.

e. Action be initiated to begin research and testing of a system using flexible hose filled with plastic, liquid or powder explosives.

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ANNEXES: A - Types of Underground Tunnels and Positions
B - Mechanical and Manual Destruction of Underground Systems
C - Solid Explosive Destruction of Underground Systems
D - Explosive Gas Destruction of Underground Systems
E - Tunnel Denial by Use of Riot Control Agents
F - Untried Methods of Destroying Underground Systems
G - Bibliography

CONCURRENCES: (Omitted)
NONCONCURRENCES: (Omitted)
CONSIDERATION OF NONCONCURRENCES: (Omitted)
ANNEXES ADDED: (Omitted)
ACTION BY APPROVING AUTHORITY:

DATE:

Approved (disapproved), including (excluding) exceptions.

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Signature)

ANNEX A -- Types of Underground Tunnels and Positions

The following types of underground systems have been found by personnel in Viet Nam. Each of the types discussed below are accompanied by a sketch in appendices indicated.

1. Underground bunkers with interlocking tunnel systems (2:3; 3:2; 4:21; and 8) This system employs a series of bunkers capable of supporting one another by interlocking fires. The bunkers are not underground in the true sense, but extend far enough above ground level to provide firing ports and good fields of fire. They are normally reinforced by native materials, such as logs or bamboo, but have been found reinforced with steel or concrete. Tunnels not only connect the bunkers but often provide escape routes. The size of the bunker is usually one to two meters square and one to one and one half meters high. (Sketch on Appendix 1)

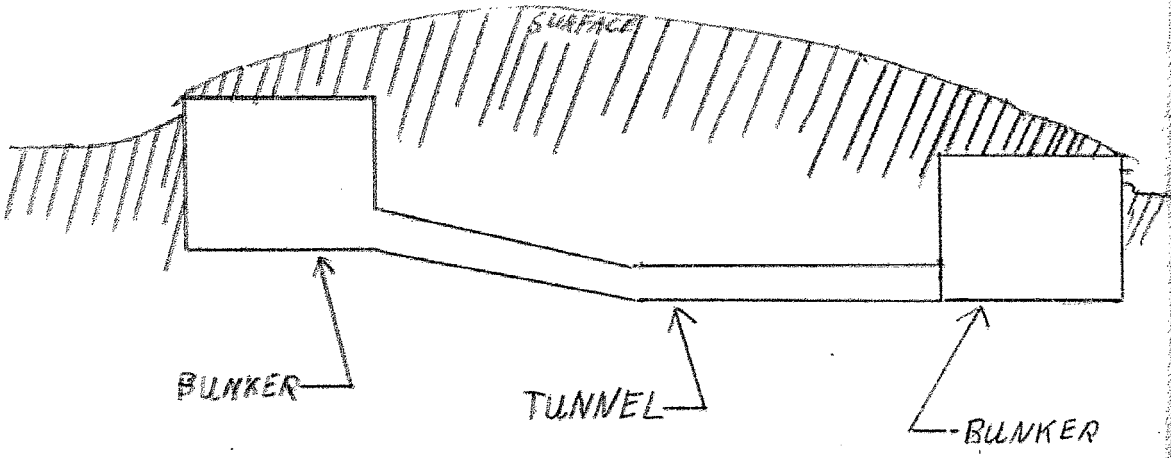
2. Underground Storage Areas. (2:4; 4:21; and 8) This system is a fully underground room having two or more exits. It may be connected to other similar rooms, bunkers, living quarters, or escape routes. It is far enough below the surface to be practically immune to aerial bombardment and artillery. Direct hits may cave it in or damage it. Distance below the surface may be from one and one half to three meters. (Sketch on Appendix 2)

3. Underground Living Quarters. (2:5 and 8) This system is basically the same as the storage rooms except it is usually larger and often is connected to above the surface houses. (Appendix 3)

4. Multilevel Tunnel Systems. (2:5; 4:22; 8) These systems vary in each area encountered. They may include sleeping quarters, bunkers, command posts, hospitals, tunnels and hidden rooms. They vary in size and are well camouflaged. These systems have been known to cover distances of more than a mile. Due to turns, camouflaged trap doors, and hidden exits, it is often difficult to follow the trace of the system. (Appendix 4)

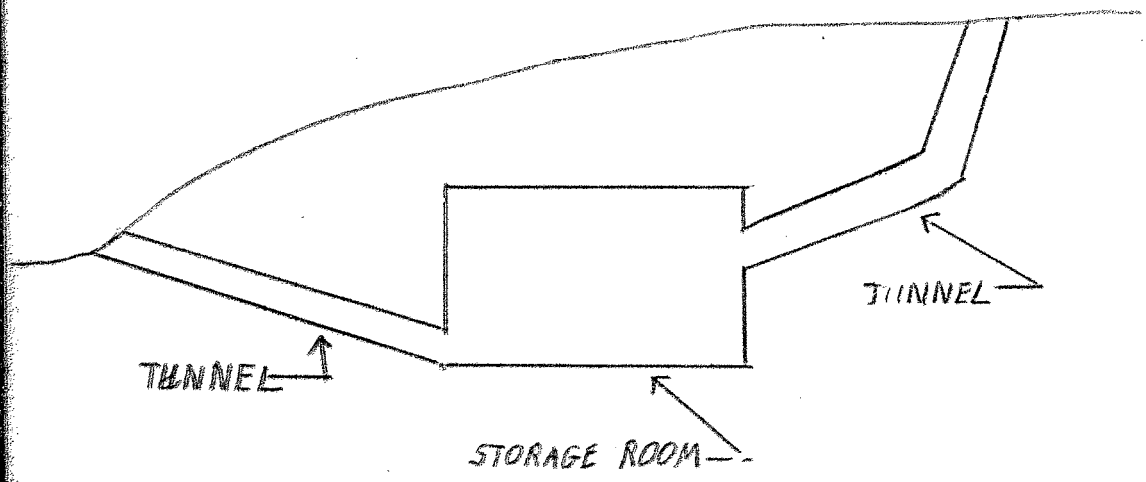
5. Home (Family) Protection Shelters. (4:21-22, 8) This is the simplest type of shelter, normally consisting of merely a hole and a short dead end tunnel or room. This type shelter is used for protection by the occupants to protect themselves from the fires of both the guerrilla and friendly forces. If upon investigation a shelter is determined to be of this type, it is normally left in tact, as most consider it a basic right for a family to have protection. (Appendix 5)

APPENDIX 1 TO ANNEX A



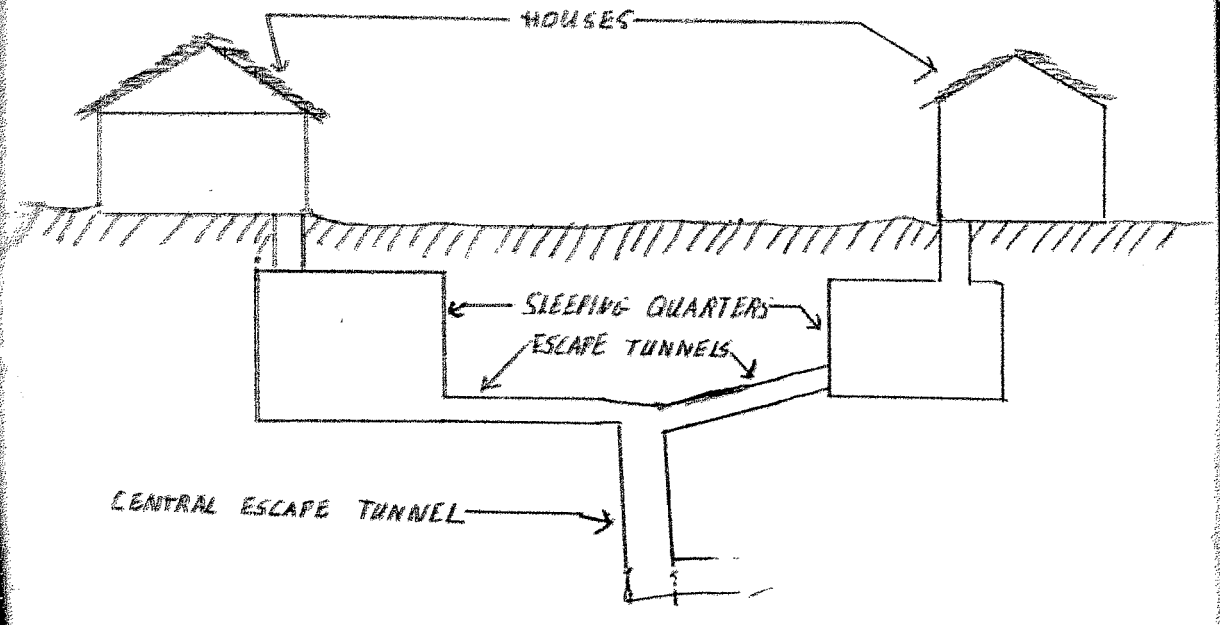
TYPICAL UNDERGROUND BUNKERS WITH INTERLOCKING TUNNEL SYSTEM

APPENDIX 2 TO ANNEX A



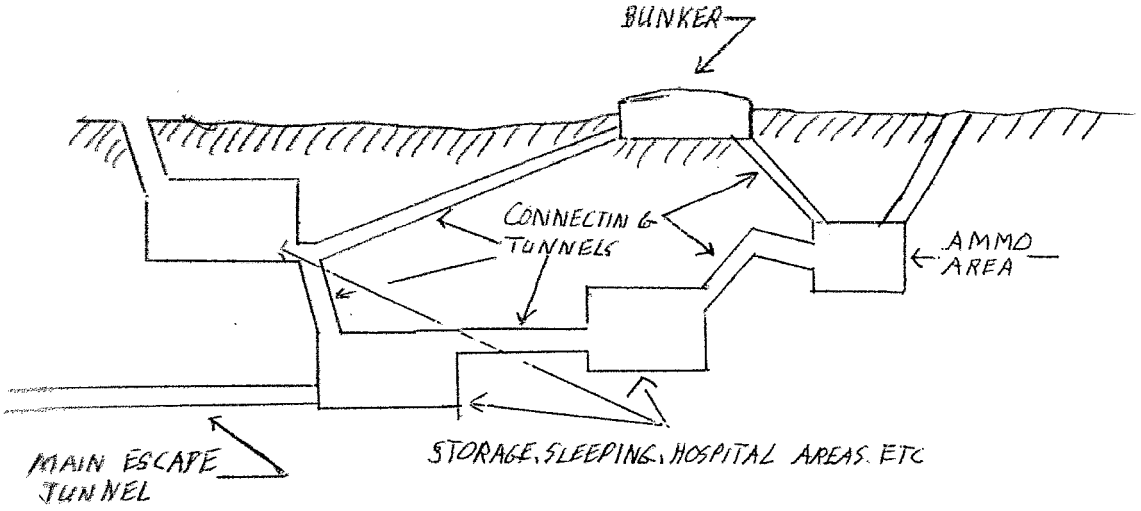
UNDERGROUND STORAGE AREA

APPENDIX 3 TO ANNEX A



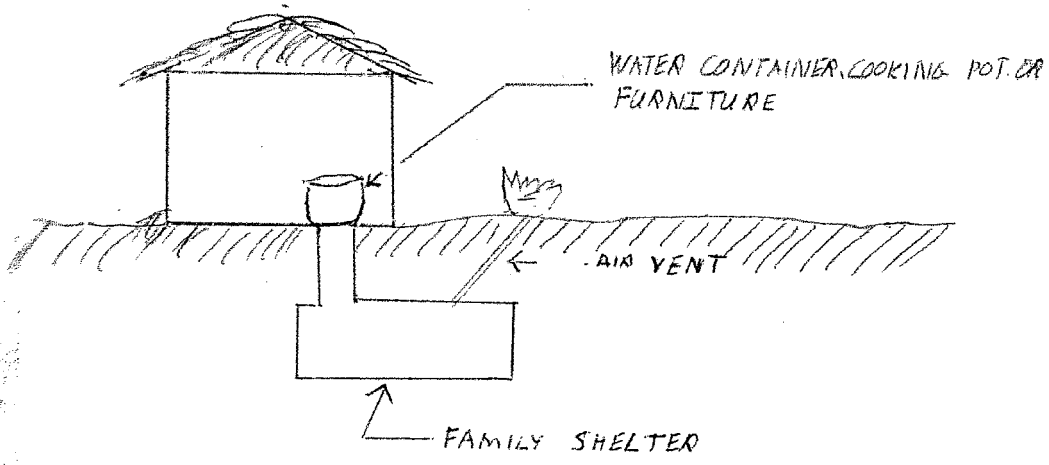
UNDERGROUND SLEEPING QUARTERS

APPENDIX B TO ANNEX A



MULTILEVEL TUNNEL SYSTEM

APPENDIX 6 TO ANNEX A



HOME (FAMILY) PROTECTION SYSTEM

ANNEX B -- Mechanical and Manual Destruction of Underground Systems

This method of tunnel destruction involves the use of manual labor and/or earthmoving equipment. The disadvantages of a strictly manual labor method are readily apparent. The availability of manpower and the man hours required for destruction of a large system place strict limitations on this method. Small individually submerged systems can be effectively destroyed by the "pick and shovel" method. The units of the Infantry Division Engineer Battalion can provide equipment capable of destroying tunnels. This equipment includes tractor and tank dozers and the scoop loader tractors. Security for the engineer unit is required if the equipment is employed. There must be sufficient time to bring the equipment in, to allow for destruction, and to remove the equipment. An adequate protected road system must be open for the introduction of the equipment into the area. If the above conditions are met, total destruction of the underground system is practical and possible. There is the added advantage of allowing sufficient time for a complete search of the system and gathering of good items of intelligence.

ANNEX C -- Solid Explosive Destruction of Underground Systems

1. The methods discussed in this annex include standard "block" explosives (C4 and TNT), satchel charges, shaped charges, and bangalore torpedoes.

a. Block Explosives. (2:6, 7:6)

(1) Advantages.

(a) Little training required for employment.

(b) Ease of Placement.

(c) Air transportable.

(d) Easily Procured (Already in the Army Supply System).

(2) Disadvantages.

(a) Explosive power not distributed throughout system.

(b) Requires personnel to enter and traverse the system.

(3) Most effective method. Tamp large (10 to 12 pound) blocks against ceiling near opening and smaller (2 pound)blocks at 2 to 3 meter intervals throughout the tunnel.

b. Shaped and cratering charges. (2:6 and 7:8)

(1) Advantages (same as 1 a(1)above).

(2) Disadvantages (same as 1 a (2) above).

(3) These charges appear to be most effective in the destruction of rooms and bunkers. If the overburden is not over one meter, a shaped charge may be placed on the outside of the system and aimed downward. In deep systems, good destruction may be obtained by aiming the charge upward from within the room.

c. Bangalore Torpedoes. (2:7 and 7:7)

(1) Advantages.

(a) Even distribution of explosive power.

(b) Relatively little training required.

(c) Adaptable to most twists and turns in tunnels.

(2) Disadvantages.

(a) Heavy Weight.

(b) Each section must be hand carried into the tunnel.

(3) This system has been most effectively employed by placing the bangalore torpedoes throughout the system. The explosion and its resulting even distribution of power normally achieves complete destruction of tunnels.

2. The use of any of the solid type explosives requires personnel to enter the underground system in order to properly place the charges. In most cases this is desirable because of the need to obtain intelligence data that may be located. However, it is hazardous and time consuming. The Mity Mite Portable blower can speed up the process of tracing the tunnel and locating vents and entrances. (5:1-5) This system can force smoke through the system. As vents and entrances are detected, they may be marked and sealed. When impractical, due to time or logistical considerations, destruction may be limited to the apertures only. Annex E includes further discussions of this system in conjunction with the use of riot control agents.

ANNEX D -- Explosive Gas Destruction of Underground Systems. (1: 1-27, 2:7 and Appendix 1; 5; 7:7-8)

1. Tests have been conducted in Viet Nam with an experimental gas generating and dispensing unit. The set contained calcium carbide to which was added locally obtained water. The combination forms the highly volatile and explosive gas, acetylene. The general idea is for the newly generated gas to be forced out of the container, through hoses, and into the tunnel system. Then the gas is detonated from without the tunnel, Experimentation has shown that one unit employing twenty-five pounds of calcium carbide can destroy a 50 foot tunnel with an overburden of less than two meters. It has not reduced the logistical requirements significantly. The tunnels do have to be sealed first. The use of the Mity Mite Portable blower with colored smoke is the ideal method of locating all the apertures in order that the tunnel may be sealed. The largest single advantage of the system is that personnel are not required to enter the tunnel system to place charges. This system is currently being tested, researched, and hopefully improved. Though not fully proven yet, it shows some promise as a desirable method of tunnel destruction.

ANNEX E -- Tunnel Denial by the Use of Riot Control Agents (3:1; 4:14; 6:1; 7:5-6)

1. This is not a method of tunnel destruction but is a method of tunnel denial. The use of non-toxic gas and CS in underground system denial has been a primary method used by several units.

   a. The Australian Forces in Viet Nam prepare cans of micro-pulverized bulk CS agent with electric blasting caps and ½ pound TNT charges. (6:1) These charges are placed throughout the tunnel at 30 to 40 meter intervals and wired in parrallel to a forty pound charge placed in the tunnel entrance. Upon detonation, the cans of CS agent are ruptured and dispersed in the tunnel and the entrance is sealed.

   b. The 173d Airborne Brigade (6:1) and the 1st Brigade, 101st Airborne Division (7:5) employ a different method. These units wrap 3 pound bags of micro-pulverized CS agent with detonating cord. They are detonated throughout the tunnel area and contaminate the tunnel walls.

2. Though long term denial is expected in either of the above methods, no scientific tests have been conducted. When logistical considerations are paramount, the method of denial by contamination and destruction of openings by explosives is felt to be effective.

ANNEX F -- Untried Methods of Destroying Underground Systems

1. Continued effort is being made to ~~discoer~~ discover methods of tunnel destruction that meet the following criteria:

   a. Effective.

   b. Simple to operate.

   c. Easy to train personnel to employ.

   d. Light weight.

   e. Compact.

   f. Safe to use.

2. Methods considered include:

   a. Introduction of Non toxic Gas by Means of the Mity Mite Portable Blower. (5:1-3) This method is considered feasible for forcing unmasked personnel from underground systems, but has doubtful value as a long term denial method.

   b. Introduction of Additional Oxygen into Explosive Gas-filled Tunnels. (1:18) It is felt that an increase in oxygen in the deeper systems would assist in destroying excessive overburden.

   c. Substitution of Methylacetylene propadiene and propalene gas in lieu of acetylene. (1:18) This gas is readily available in industrial supply, is equally as effective as acetylene, and has a 5 to 1 weight advantage over acetylene when in the liquid form. Introducing this gas into the Army supply system would be costly and time consuming.

2. A method considered by the writer of this report, but to the best of his knowledge, never considered by Engineers or research teams is described below. This method is strictly an Infantryman's idea and is not referenced in any manner. Tests by qualified demolitions men may prove it feasible. This idea embodies the principal of continuous explosion throughout the system, as with the bangalore tropedo, and possibly lighter weight and easier handling. It may prove practical to have a tunnel destruction kit consisting of a flexible hose (plastic or fabric) filled with either liquid or powder explosive. The hose would be placed throughout the tunnel system and detonated from the outside by electric blasting cap. It could be prefilled in 25 foot lengths with a coupling system similar to a garden hose or a fire hose. Placed on reels at a helicopter sight it would be available for immediate support of requesting units. Negotiation of sharp turns would be no problem. T joints should be available to lead off to side tunnels. If not practical to pre-fill the hose, it may be feasible to fill the hose on site. Bags of Riot Control Agent,

CONTINUATION of ANNEX F

CS, could be attached in areas where complete destruction is not anticipated. Flexibility, ease of handling, reduced weight and simplicity of installation could result from such a system.

ANNEX G -- Bibliography

1. Demolition Set, Tunnel Destruct, XM 69 (Washington D. C.: Department of the Army, October 1966).

2. Destruction of Tunnels and Bunkers (Vietnam, undated report by 65th Engineer Battalion, 25th Infantry Division).

3. Investigation and Reporting of Tunnel Systems (Viet Nam, Headquarters, 2d Battalion, 27th Infantry, February 1966).

4. Marine Corps Bulletin 3480, Professional Experience Gained from Operational Experience in the Republic of Viet Nam (Washington, D. C.: Headquarters, United States Marine Corps, October 1966).

5. Operational Employment of the Mighty ~~Might~~ MITE Portable Blower, Lessons Learned Number 52 (Viet Nam; Headquarters United States Military Assistance Command, Viet Nam; November 1965).

6. Tunnel Contamination, Chemical Agent (Viet Nam, Letter from Brigadier General J. K. Boles to U. S. Army Chemical Laboratory, February 1966).

7. Broyles, Robert M. II, The Underground War (Fort Benning, Georgia, Engineer Committee, The U. S. Army Infantry School, December 1966).

8. VC Tunnels and Fortifications (Viet Nam, Headquarters, Field Forces Viet Nam, November 1966).