

Individual Research

Subject No 80

ORGANIZATION AND EQUIPMENT OF ENGINEER UNITS  
DESIGNATED TO BE ATTACHED TO OR TO COOPERATE  
WITH MECHANIZED CAVALRY

Captain Don G. Shingler, C.E.

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WITH MECHANIZED CAVALRY

Submitted by

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Corps of Engineers

28 February 1936

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ORGANIZATION AND EQUIPMENT OF ENGINEER UNITS  
DESIGNATED TO BE ATTACHED TO  
OR TO COOPERATE WITH  
MECHANIZED CAVALRY

INTRODUCTION

1. ~~PURPOSE~~

The purpose of this <sup>study</sup> ~~paper~~ is to determine the essential elements of organization and equipment of engineer units designated to be attached to or to cooperate with mechanized cavalry.

2. ~~METHOD OF APPROACH~~

"The mission of the engineers in war is to assist the operations of the field forces by means of engineering works". (1) Since the engineer role is one of assistance, it is imperative that the problems of the force as a whole be understood before attempting to consider a particular element of that force. For this reason, Section I has been inserted to summarize the characteristics and tactical employment of mechanized cavalry units with special emphasis on the elements which may affect the engineers. Section II\* develops the type of assistance which can or should be provided, ~~and~~ while subsequent sections deal with the "how" of the problem.

---

(1) ~~EFM, Vol. I, par 1.~~

(\*) \*-This section is considered necessary as a logical approach to the assigned subject of organization and equipment. It follows the directive of the Chief of Staff:

"Too often in the past organization has been attempted from the standpoint of equipment rather than from the standpoint of missions assigned". (Extract from mimeograph: "General Principles to Govern in Extending Mechanization and Motorization Throughout the Army", Chief of Staff, dated May 1, 1931.)

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Introduction ) (Caps + 2 caps

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SECTION I *Copy of Section 2*

MECHANIZED CAVALRY *all up*

3

~~3.~~ COMPOSITION.

~~a.~~ During the development stage, mechanization has assumed a variety of forms in this country as well as abroad. The assigned subject of this paper limits the general subject to mechanized cavalry. In order to have a more or less concrete unit to consider, it will be assumed that mechanized cavalry units will have the general composition indicated by the Tables of Organization and Reference Data used for instructional purposes at the Command and General Staff School during the school year 1935-1936. ~~(1)~~

~~b.~~ The basic elements of the mechanized cavalry regiment consist of:

~~1.~~ (1) Combat-car units utilizing armored vehicles of the fast tank type, combining road speed, ~~great~~ cross-country mobility with shock and fire-power. ~~(2)~~

(2) Armored-car units containing wheeled vehicles possessing great speed and fire-power, particularly suited for distant reconnaissance missions. ~~(2)~~

(3) Machine-gun units of great fire-power, transported in carriers combining cross-country mobility and limited protection for personnel and weapons. ~~(2)~~

~~c.~~ The Cavalry Regiment (mechanized) contains the essential elements shown in the following diagram: ~~(3)~~

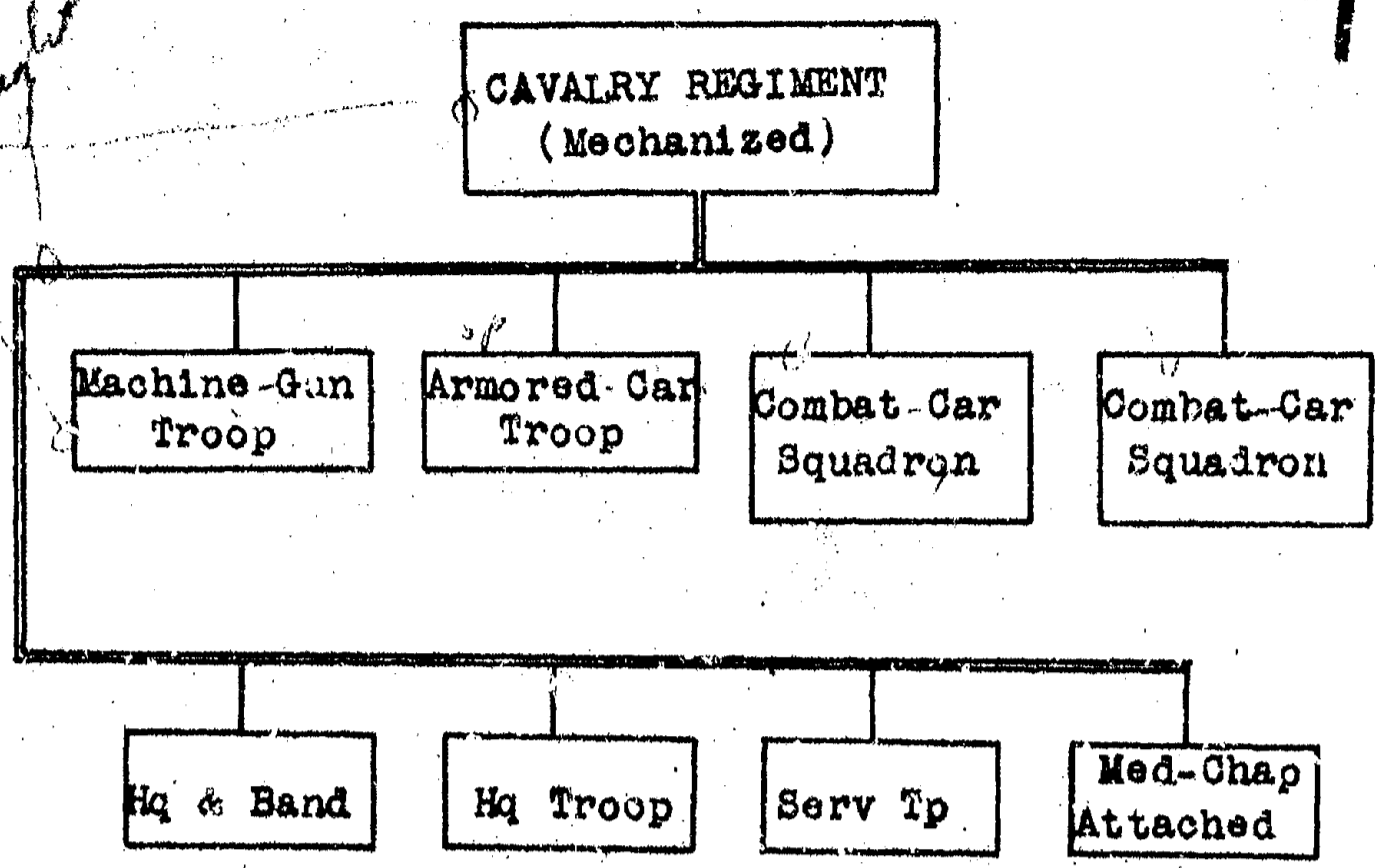
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(1) RD, Table 51, p 48; T/O, pp 84 1/8 to 84 7/8 incl.

(2) TEC, par 73, p 71.

3) Same as (1) above.

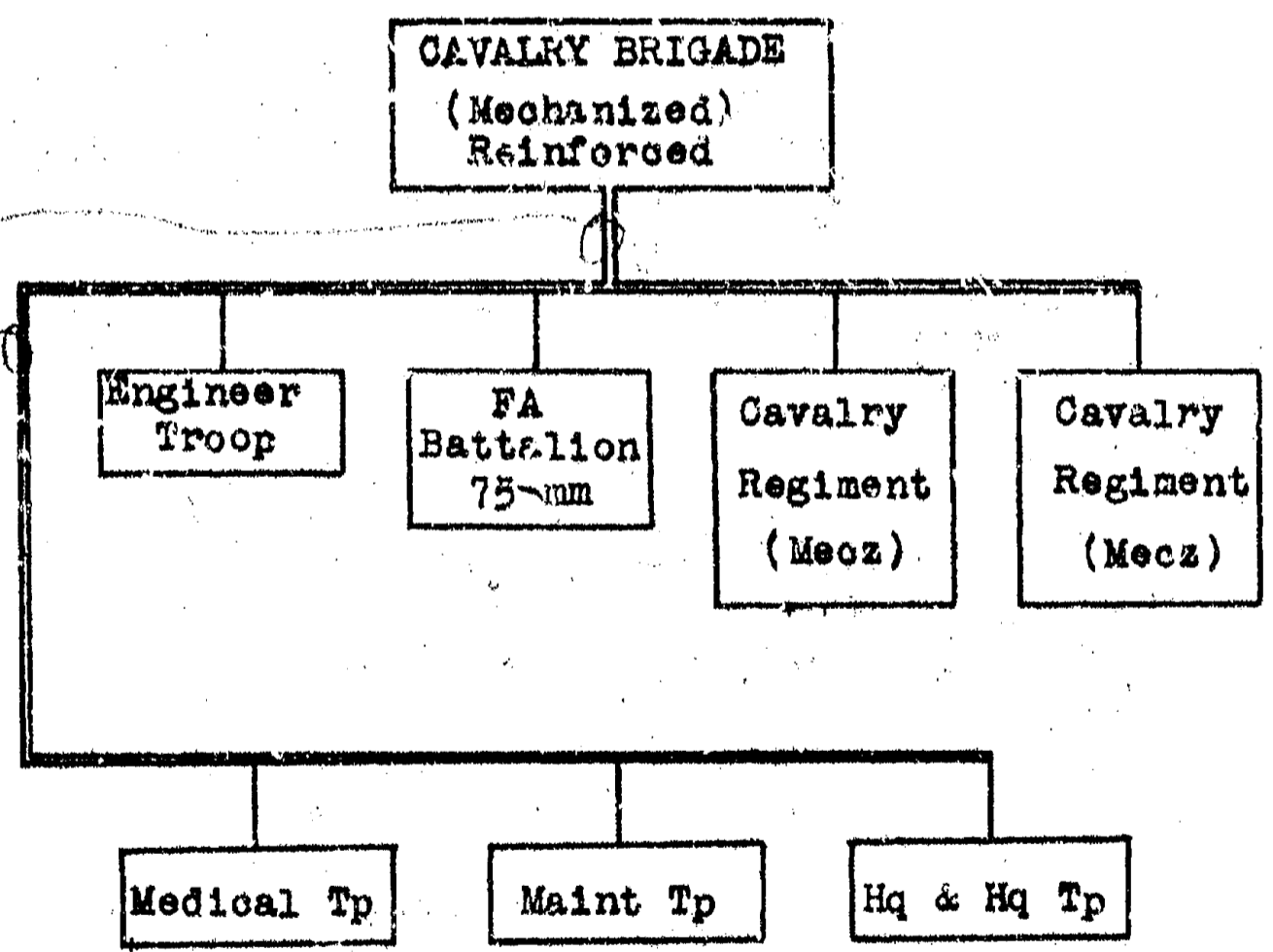
*8/12  
all items light*



*3/10/47*

d. The Cavalry Brigade (mechanized), (Reinforced), contains the components indicated in the following diagram: (4)

*8/12  
all items light*



(4) RD, Table 51, p 48.

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10/17  
4. TACTICAL EMPLOYMENT. --

a. The proposed tactical employment of mechanized cavalry has a decided bearing upon the mission, organization, and equipment of accompanying engineers. Some well-defined premise, therefore, must be established, embracing the generally accepted tactical principles governing the use of this mechanized arm.

The most recent and concise treatise on this subject appears in the Command and General Staff School publication, Tactical Employment of Cavalry (Tentative) (1935), Part B. Cavalry (Mechanized). (5)

In avoidance of excessive detail, a brief summary of the salient points appearing in the above-mentioned text is presented herewith in tabular form. The left column displays principles applicable to mechanized cavalry operations; the right column contains brief remarks to indicate possible engineer considerations which form the basis for subsequent discussion.

b. MARCHES (6)

Mechanized Cavalry

Engineers

- |  |                                       |
|--|---------------------------------------|
| (1) Individual vehicles and platoons may march as fast as 35 miles per hour.               | High degree of mobility required.     |
| (2) Days march - 150 miles for logistical computation.                                     | Limited time for work. Speed; supply. |
| (3) Units larger than regiment usually march in two or more columns, each a tactical unit. | Engineer unit(s) must be divisible.   |
| (4) Typical march formation - See Plate I, following:                                      | Note contemplated use of engineers.   |

(5) Referred to in footnotes as TEC.

(6) TEC, pars 78 to 82 incl.

5

16/4  
A. TACTICAL EMPLOYMENT. --

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Headings for two columns on pp. 4,6,7,8

to be repeated at top of pages where they occur:

Mechanized Cavalry      Engineers

Center of detail 10 pt  
Depos + L. 2 8 pt  
Engineers copy + d.c. 8 pt

and pla- High degree of mo-  
fast as bility required.

es for lo- Limited time for work.  
lon. Varies Speed; supply.

regiment Engineer unit(s) must  
two or more be divisible.

columns, each a tactical unit.

(4) Typical march formation - Note contemplated use  
See Plate I, following: of engineers.

(5) Referred to in footnotes as TEC.

(6) TEC, pars 78 to 82 incl.

84

6

PLATE I

TYPICAL MARCH FORMATION

Reinforced Cavalry Brigade (Mechanized), operating independently. Brigade in two columns.

Left Column	Right Column	Remarks
All or part of armored-car Tp. Engineer reconnaissance personnel.	All or part of armored-car Tp. Engineer reconnaissance personnel.	Reconnaissance detachment or detachments.
Distance: 0 to 2 hours or more.		
CC Tr (less one plat) with MG plat attached	CC Tr (less one plat) with MG plat attached	Advance Guard Engineer platoons may be attached or placed at head of main body.
Distance: 5 to 15 minutes. Brigade and regimental commanders' groups usually march in this interval.		
Fwd Ech RHQ MG Tr (less 1 pl) Mortar Plat All or part of FA Bn CC Sqs (less Det) Armd C Tr (less dets)  Engr Tr (less dets)  Hq Tp: R Ech Med Det Maint Plat, Serv Tr	Fwd Ech RHQ MG Tr (less 1 plat) Mortar Plat All or part of FA Bn CC Sqs (less det) Armd C Tr (less dets)  Fwd Ech Brig Hq  Hq Tp: R Ech Med Det Maint Plat, Serv Tp	FA Bn CO's party in one column. When Bn is split, necessary parties go with each Fwd Ech.   Either column
Distance: 0 to 75 miles.		
Med Tr Trains (Serv Trs (less Maint Plats)) Maint Tr	Med Tr Trains (Serv Trs (less Maint Plats)) Maint Tr	Follow either or both columns.

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Mechanized Cavalry

Engineers

(5) Road reconnaissance should precede each march.

Engineer reconnaissance (?)

(6) Security by advance, flank, or rear guards; attach Engineer section or platoons if available. security elements.

Provision for engineer contingents with

c. BIVOUACS (7)

(1) When operating independently bivouacs to be suitable for all-around defense.

Defensive works.

Camouflage.

Reconnaissance.

d. RECONNAISSANCE (8)

(1) By bounds within specified limits or zones.

(2) Night operations restricted.

(3) Air cooperation desirable.

(4) Reconnoitering detachments precede main body; reinforced sq or Tp with Armored-Car Troop attached for patrols.

Engineer reconnaissance if available with each det and perhaps with each patrol. (9)

(5) Armored-Car Troop - zone 25 miles wide using 3 platoons for patrols.

Broad front for engineer reconnaissance.

(6) Radio for communication.

Engineer radio (?)

Vehicles also used.

Messenger service.

e. COUNTER RECONNAISSANCE (10)

(1) Less adapted for this role.

(2) Valuable to counter hostile mechanized forces.

Defensive works.

Obstacles.

(7) TEC, par 83

(9) TEC, par 87 b.

(8) TEC, pars 85 to 87

(10) TEC, par 88.

10/14  
f. ATTACK (11)

8

- (1) Selection of terrain important; use of obstacles for own advantage. Reconnaissance.  
Good maps.  
Obstacles.
- (2) Terrain reconnaissance important for all agencies. Reconnaissance.
- (3) Combined action habitual: dismounted fire-support of weapons; mounted attack by combat-car elements. Overcome obstacles (12)  
Assist in organization of captured terrain. (12)
- (4) Main attack usually an envelopment.

g. DEFENSE (13)

- (1) Active defense most favorable form. Communications, (14)  
Eventual reserve. (14)
- (2) Passive defense emphasizes obstacles and fields of fire. Prepare obstacles, (14)  
Fields of fire. (14)

h. DELAYING ACTION (15)

- (1) Block advance (defensive); offensive action against hostile flanks. Defensive works.  
Communications.  
Reconnaissance.
- (2) Terrain important. Reconnaissance.

i. RAIDS (16)

- (1) Suitable mission where terrain favors action. Route and terrain reconnaissance.
- (2) Object: reconnaissance or destruction. Reconnaissance.  
Demolition.

---

(11) T. M., pars 90 to 97

(14) TEC, par 98 f.

(12) TEC, par 92 g.

(15) TEC, pars 101-102.

(13) TEC, pars 98 to 100.

(16) TEC, par 104.

J. DEFENSE AGAINST MECHANIZATION (17)

- (1) Natural or artificial obstacles prevent or limit operations. Information needed. Coordinate technical and tactical.
- (2) Defended obstacles most effective. Defense by cavalry or engineer personnel?
- (3) Obstacles overcome by: removal, detouring, or bridging (crossing). Value of obstacle depends upon ultimate delay it causes.

K. DEFENSE DISPOSITIONS (18)

- (1) Units of all arms and services equipped and trained to defend themselves. Weapons. Armor. Training.
- (2) Trains require anti-tank guns. Armament of service vehicles.
- (3) At a halt, security forces establish road blocks. Location, construction; Supply of materials.
- (4) Active reconnaissance by air and mechanized agencies a prerequisite. Reconnaissance. Liaison with air service.

(17) TEC, pars 109 to 111 (incl).

(18) TEC, par 111

SECTION II

ENGINEER FUNCTIONS

5. GENERAL CONSIDERATIONS,

a. "Engineer troops are essentially organizations of skilled labor designed to increase the combat capacity of other arms through the execution of works facilitating their movement, increasing their defensive powers, and providing for their shelter and water supply". (1)

b. The Engineer Field Manual (Volume I) summarizes the functions of engineers in the theater of operations thus:

"(1) All work of construction and the repair and maintenance of all structures of every character, except such as are specifically assigned to other services.

"(2) Military mining, demolitions, and protective measures against enemy mines.

"(3) The operation of railways, portable and fixed electric light and power systems, water supply systems, and all other utilities of general service, except such as are specifically assigned to other services.

"(4) The execution of surveying and mapping, including the production and distribution of maps.

"(5) The procurement, storage, and issue of all materials for construction work, for the organization of defensive systems, and for all other operations assigned to the engineer arm, including all plant, tools, and appliances for such work.

" b. The most important function of the engineer arm is the maintenance, improvement, and construction of routes of communication and movement. This is a continuous operation and employs the major portion of the engineer personnel". (2)

c. To the above list may be added two other functions which an engineer contingent must consider: camouflage (3), and combat (4).

(1) FFR, par 96, p 20.

(2) EFM, Vol I, Sect I, par 2; Cf, FSR, par 96, p 20.

(3) EFM, Vol II, Sect II, par 4; T & T Engrs, Ch IV, par 60

(4) T & T ENGRS, Ch VIII, par 9; TEC, par 98 f.

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g. The organization, equipment, and technique of engineer components, designed to perform the functions listed, and generally applicable to non-mechanized operations, is fully described in current official publications. The general subject requires no further elaboration in connection with the present study.

The significance of the functions noted in subparagraphs p and q, above, as specifically applied to mechanized cavalry, will be discussed successively in the paragraphs which follow. In this connection, attention is invited to the engineer considerations noted in the summary presented in paragraph 4.

*Copy + S. copy*  
6. CONSTRUCTION.---

a. Since mobility is the essential characteristic of mechanized cavalry, it is safe to assume that during active operations the construction and repair of permanent or semi-permanent installations will rarely be necessary. In situations where time permits such work, time and circumstances should also permit the assignment of appropriate engineer units from higher echelons for the accomplishment of the tasks. (5) As in the case of the combat regiment and the engineer squadron, construction work appropriate for mechanized engineers will be limited to minor tasks requiring a short time and but few pioneer tools.

*Copy + S. copy*  
7. DEMOLITION AND OBSTACLES. ---

a. "Since all mechanized forces are sensitive to terrain, and because of their limited defensive power, the creation of obstacles to impede the enemy's forces, and the removal of obstacles to assist our own, become

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(5) EUSTIS, par 12 d.

major problems". (6) The importance of this class of engineer work has been repeatedly stressed by military writers since the problems of mechanization came up for close study. (7) The use of obstacles is not limited to purely defensive operations. As shown in the on "Tactical Employment", paragraph 4, obstacles are an important consideration in most phases of mechanized cavalry operations. (8) The general subject of demolitions is closely allied with that of obstacles, and no purpose is apparent in undertaking an academic distinction. However, extensive demolition projects may become necessary or desirable in connection with raids against sensitive points in hostile rear or flank areas. (9)

b. A great variety of installations have been proposed to limit or delay the advance of mechanized vehicles. (10) A complete description of these involve questions of technique beyond the scope of this paper. The Engineer Field Manual, Volume II, Part Two, describes certain standardized forms of obstacles and demolition measures. In general, these fall into three classes: first, those providing craters, ditches, or tank traps to interrupt avenues of approach; second, obstacles created from felled trees, barbed wire, cables, posts, or combinations thereof; and third, anti-tank mines. To the commander of an engineer unit, the above installations indicate the need for the following

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(6) EUSTIS, par 12 a.  
 (7) EUSTIS, par 12 a; MFB, par 6; BONSTEEL, p 20; ROBINSON, p 17; RILEY, p 9; RCMW, Vol IX, No 3437, 1929-1930, p 164; GMA; FULLER, p 258; FSR III, pp 103-4; EFM, Vol I, par 186 g.  
 (8) See paragraph 4.  
 (9) See paragraph 4 1, and TEC par 104.  
 (10) FITZPATRICK, pp 322-323; MFB, par 6; T & T ENGRS Ch IV, Sect IV; MARTEL, pp 175-176.

materials and equipment:

- (1) Relatively large quantities of explosives with necessary demolition equipment,
- (2) Power equipment capable of making rapid excavations; air drills; cranes, etc.
- (3) Anti-tank mines of a design convenient for transporting as well as laying. (11)
- (4) A supply of barbed wire, steel cables, and accessories.
- (5) Chemical mines (if authorized).
- (6) Sufficient demolition personnel.
- (7) Suitable transportation for personnel and materials.

g. Counter measures against hostile installations involve tasks extremely variable in nature and difficult to anticipate. Road craters, road blocks, mines, and demolitions may block routes of communication. Extensive belts of anti-tank mines, gassed areas, and traps may limit or prevent the operation of mechanized vehicles within or across a zone. In such cases the engineers should be able to obtain timely information of the extent and nature of enemy works, then furnish a quick and accurate estimate of the time required to remove or detour such obstructions, in order that the cavalry commander may be able to make a prompt decision as to future action. (12) Technical and tactical aspects may thus be inter-dependent, and increasingly so if the obstructions be covered by hostile fire. (13)

The essential engineer requirements to counter

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(11) FULLER, p 258; FSR III, p 104; EIMANNSBERGER, Ch VII; MARTEL, p 172.

(12) EUSTIS, par 12 g; BONSTEEL, p 20.

(13) EUSTIS, par 12 b.

hostile works can be summarized thus:

- (1) Timely information (reconnaissance).
- (2) Qualified personnel.
- (3) Rapid means of communication between engineers, reconnaissance personnel, and tactical commanders.
- (4) Equipment and personnel capable of prompt and rapid action at the desired points.

*Caps & Discaps*  
8. UTILITIES.---

*g.* Railway operations will doubtless be important in the supply of mechanized cavalry units. However, unless the engineer units assigned to such a force be made disproportionately large, the maintenance and operation of rail facilities will have to fall on the engineers of higher echelons.

*h.* Electric light and water supply systems operated by organic engineer personnel are provided in units down to the division. With the mechanized cavalry units, it seems reasonable to relieve the engineers from the responsibility of illuminating the unit headquarters. The electrical system of modern vehicles provides a source of power which can be made available for essential command and administrative agencies which require illumination in or adjacent to their respective vehicles. Supervision over the operation of existing commercial facilities may still come under the technical control of the unit engineer without materially affecting the organization or equipment of the engineer unit.

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(14) FSR III, p 128; MPB, par 6; STAMPS.

~~g.~~ Water supply for mechanized cavalry is a pertinent engineer function, (14) but promises to be less difficult than for infantry or horse-cavalry units. Mobile missions will afford opportunities to refill vehicle and individual water containers from existing facilities. The quantity of water required will be relatively small due to the absence of animals and the negligible amount required for such vehicles as have water-cooled motors. Mechanized cavalry units possess a variety of fast-moving vehicles capable of transporting small containers of water sufficient for drinking purposes and mess requirements, in case water supply points are scarce.

~~d.~~ Considering the above points, and in order to have a basis for the study of engineer organization and equipment, the following assumptions will be made:

- (1) No special electric lighting equipment will be required.
- (2) A small, portable, gasoline-driven water pump will be carried for the dual purpose of providing a water supply point if required, and for such engineer work as may demand such equipment.
- (3) The engineers can improvise and mark suitable water supply points near bivouacs, making full use of local sources.
- (4) The unit engineer will have personnel qualified to supervise the operation of existing commercial facilities in small towns and villages in case military control is necessary.

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(14) FER III, p 128; MPB, par 6; STAMPS.

16

*Caps + h. caps*

9. RECONNAISSANCE.

*g.* The great importance of reconnaissance in general and engineer reconnaissance in particular is most obvious in the remarks noted in <sup>the</sup> paragraph <sup>on "Tactical Employment"</sup>. In principle, it differs little from the essentials applicable to a less mobile force. The subject is covered in detail in current publications. (16) However, the need for speed increases, both in collecting the information, and in passing it on to the agencies immediately concerned. Moreover, the area to be reconnoitered may be both broad (17) and deep. (18) As was previously stated, engineer reconnaissance may have a decided effect on tactical plans (19) and hence should be carefully correlated with tactical reconnaissance. Air reconnaissance should prove of great value, especially if it works in close cooperation with ground agencies. (20)

*h.* What specific information must engineer reconnaissance secure, which cannot be obtained by the mechanized cavalry agencies specially trained and equipped for reconnaissance missions? In addition to purely tactical information, cavalry personnel can be expected to check the routes followed, noting obvious defects in existing route maps; note the location and general nature of natural or artificial obstacles encountered; determine points favorable for the creation of obstacles; make a reasonable estimate of the suita-

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(16) TR 445-105; T & T ENGRS, Ch II.

(17) TEC, par 87 d.

(18) TEC, par 78 e.

(19) Par 7 e, above.

(20) EUSTIS, par 19 e; EFM, Vol I, par 186 d.

17

bility of routes or areas for the operation of mechanized forces; explore detours and alternate routes; and, as a result of training and practical experience, estimate the capability of bridges and culverts to withstand cavalry loads. In general, then, cavalry personnel can readily determine favorable as contrasted with unfavorable elements. Cavalry personnel, unless specially trained and equipped, cannot be expected to locate and estimate local supplies of construction plant, materials, or explosives; minor repairs required on roads and bridges; the time, labor, and equipment needed to remove obstacles, repair existing roads, bridges, or culverts, or to construct new crossings. In other words, the cavalry units may be expected to rely on engineer personnel to determine the practical feasibility, in time, men, and material, of remedial action, when adverse conditions are encountered.

g. The above considerations are applicable, in general, to distant or route reconnaissance, the close-in reconnaissance of advance, rear, or flank guards, as well as special missions incident to a contemplated tactical maneuver. It is pertinent to note at this point that cavalry vehicles are provided with a full complement of men; each individual has a specific and important task assigned. There is no space within cavalry reconnaissance vehicles for engineer personnel. (21)

d. A better understanding of this vital reconnaissance problem can be obtained by a more detailed

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(21) T/O, Table 414P, p 84 5/8.

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study of an example. Consider the action of the most advanced element of the left column of the brigade march formation shown in Plate I (page 5). Assume that an armored-car troop, with an appropriate engineer detachment, is designated as Reconnaissance Detachment No. 2, and ordered to precede the advance guard, initially, by two hours. Adequate instructions have been issued as to the tactical situation, zone of action, rate of advance or phase lines, mission, and means for lateral coordination. The troop commander may elect to send out three patrols of one platoon each, distributed in width to cover the assigned zone, while he follows his line of patrols with the fourth platoon in reserve.

So long as the patrols encounter no unfavorable conditions, little need exists for engineer assistance. When a questionable situation arises, the information will be made known to the troop commander by radio or messenger. At this time an engineer detail should be available to make a technical report without delay. The results of this report may be of immediate concern to the troop commander, his column commander, the brigade commander, or unit engineer. For the moment, one engineer vehicle dispatched to the reported locality will suffice for the required inspection and report. Other missions can be accomplished in succession. When a broad zone of demolition appears to cover the entire front, a report of its character and extent can be quickly made. The condition of the principle routes can be determined as first priority and technical recommendations submitted without delay. Further, and more detailed reconnaissance, must be made by cavalry and engineer

elements which follow.

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Granted that more than one engineer vehicle would be desirable with each armored-car troop, there is a practical limit to the number of non-organic vehicles which can operate with the cavalry troop without adversely affecting its tactical employment. If one engineer vehicle were provided for each armored-car platoon, there would have to be an engineer vehicle for each 4 cavalry cars. Under the circumstances, it would seem that a single engineer vehicle can accomplish the essential engineer duties required in connection with more or less rapid reconnaissance which would be expected of an armored-car troop under normal conditions.

3 e. Behind the cavalry reconnaissance elements just<sup>mentioned</sup> the advance guard(s) follow(s) with reconnaissance as a partial mission. If an engineer platoon be attached as suggested in Plate I, there will be need of reconnaissance not unlike that performed by the more advanced elements, but probably more restricted in latitude, but more detailed in character. The engineer platoon must be equipped to provide its own reconnaissance vehicles, at least one of which should be capable of defending itself against ambush by hostile elements.

f. The use of armored cars for certain types of engineer reconnaissance seems necessary. If a cavalry regiment requires an armored-car unit for reconnaissance purposes, rather than motorcycles or trucks, there must be distinct need for the more elaborate vehicles. If the proposed use of cavalry reconnaissance elements is such as to require the protection,

fire-power, and mobility of armored cars, then any vehicle intended to accompany and cooperate with the cavalry armored cars must possess similar characteristics or else become a liability. For this reason engineer armored cars have been considered as appropriate for use with cavalry armored-car elements. If and when the cavalry reconnaissance vehicles are radically altered in characteristics the engineer vehicles should be made to conform.

In addition to the special reconnaissance vehicles just considered, there will always be need in an engineer unit for light, unarmored vehicles for use on technical missions close to or behind friendly troops.

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10. MAPS.

*3* a. Adequate maps should be provided a mechanized force. (22) In this discussion the word map will be assumed to include both the standard sheets prepared in advance of operations, and the sketches, overlays, overprints, and graphical reports prepared during a campaign. The two classes will be considered in turn.

*2* b. The compilation and reproduction of multi-colored and detailed military maps requires highly trained technicians and special equipment. Such work is obviously beyond the capabilities of a relatively small engineer unit such as might be assigned duties with the mechanized cavalry. It is the function of <sup>*Staff*</sup> G.H.Q. to make available, at the beginning of an operation, appropriate maps in adequate quantities. Distribution is effected through unit engineers. (23)

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(22) MFB, par 6.

(23) T & T ENGRS, Ch IV, par 44 g.

Commercial road maps are becoming more numerous and complete and possess some military value. (24) <sup>Geological Survey</sup> U.S. ~~G.S.~~ maps were found satisfactory by the mechanized force at Fort Eustis. (25)

c. Assuming that a reasonable supply of maps are made available to a mechanized force, there remains the important task of verifying or revising the data shown, and supplementing them with the latest available information of friendly or hostile installations, as well as showing the suitability of terrain for mechanized operations. (26) An engineer unit should be able to collect, interpret, and disseminate such information promptly to the mechanized command either in the form of overprints, overlays, sketches, airplane photographs, or bulletins. (27)

*Cops + S. Cops*  
11. (ENGINEER SUPPLY, ---)

A mechanized cavalry unit will look to its engineer contingent for the supply of equipment and materials normally furnished through engineer channels. Since the cavalry unit will attempt to carry a reserve to enable it to operate for a prescribed period without replenishment, (28) provision should be made to maintain essential engineer supply on the same basis. Unfortunately, construction materials are heavy and bulky, so that they cannot be carried

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(24) Report of General Holbrook reported in the Army-Navy Journal, Aug 31, 1935, p 1151.  
(25) EUSTIS, par 19 d.  
(26) TROWLAND, p 80; FULLER, p 20; EFM, Vol I, par 186 d.  
(27) EUSTIS, par 19 d.  
(28) RD, Table 51, note.

in large quantities as a normal load. Reconnaissance is necessary in order to locate available local resources, and the needs for future operations. Requisitions on rear establishments must be submitted early to insure delivery at the time and place required. Bridge timber, explosives and mines, wire, cables, and road block materials may prove more necessary to mechanized units than the familiar sand bags and barbed wire to the infantry elements.

b. The organic engineer units of the infantry and cavalry divisions transport a supply of engineer entrenching tools for the use of the combat elements. This arrangement lightens the load of the foot and animal elements, and makes available the entire stock of tools to the particular units requiring them in a given situation. In a mechanized cavalry brigade, a different condition <sup>prevails.</sup> ~~obtains.~~ The use of trenches, emplacements, or defensive works will be exceptional and probably limited to the machine-gun units or rear elements. Then, too, the mobility of the combat unit will not be appreciably affected by the bulk or weight of the few tools required by the personnel of each vehicle. Even if the tools were pooled and transported on engineer vehicles the distribution to the several combat elements might prove time-consuming and difficult. For these reasons, it seems logical that cavalry vehicles should be provided with essential engineer tools as standard equipment, available for assisting the vehicles over minor obstacles, improvising road blocks, or providing protective works for personnel or weapons when on the ground. Engineer transportation will thus be relieved of a considerable load.

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C. G. & S. C. G.

12. MAINTENANCE OF ROUTES OF COMMUNICATION.

a. The maintenance of routes of communication promises to be a most important as well as difficult task. From the engineer standpoint, the difficulty arises from a combination of circumstances: the great weight and number of vehicles involved, the rapid rate of advance, probable enemy counter-measures, the extensive road net, the limited personnel available for maintenance and repair, and the vital importance of time.

b. Excluding for the moment any consideration of bridges, it is apparent that no attempt can be made by a relatively small engineer component to maintain roads in the sense the term is used in civilian practice or even in the areas of less mobile military forces. The aim will be to get the force forward with the least delay by work of a pioneer rather than an engineering nature. (29) It will involve such tasks as repairing culverts, removing road blocks or mines, marking routes, and strengthening bridges. Time will be conserved by early and thorough reconnaissance, followed by the quick dispatch of personnel and equipment to perform essential work. Machine tools and labor-saving devices will facilitate operations. The marking and clearing of landing fields may require the occasional assignment of engineer personnel. (30)

b. The repair or construction of bridges presents a serious problem. What an engineer unit can accom-

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(29) EUSTIS, par 12 e.

(30) MFB, par 6.

plish will prove far short of what the engineer desires and what the cavalry commander may expect. Bridging operations will be limited by time, material, and personnel.

d. As an approach to the subject consider the question of load capacity. The War Department has fixed 15 tons gross as the maximum allowable weight for a fully loaded vehicle designated to accompany an army for movement by highway, and seven and one-half tons gross as the maximum for vehicles to accompany an infantry or cavalry division in the field. (31) Since a mechanized cavalry unit may be expected to be a G.H.Q. unit or Army organization, (32) future development may result in vehicles approaching 15 tons in weight, although existing models of combat vehicles, such as the cavalry modification of the T-2 tank, tend to limit gross weights to seven or eight tons. (33)

e. Ponton equipment of appropriate load capacity for seven and one-half ton vehicles already exists in the form of Light Ponton Companies assigned to field armies, and adapted for motor traction. (34) This equipment is considered suitable for use with large mechanized forces only. (34) One company contains 36 pontoons and the necessary equipment to construct 688 feet of seven and one-half ton bridge. (35) It may be presumed that the necessary amount of this

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(31) G.O. 9.

(32) TEC, par 72 g.

(33) RD, Table 49.

(34) T & T ENGRS, Ch IV, par 16 b; Ch VIII, Table II.

(35) EFM, Vol I, Table XII.

equipment, together with additional personnel for its construction, would be made available to the mechanized cavalry commander when circumstances warranted, and when time and space factors permitted. On the other hand, to include any considerable portion of the equipment as organic equipment of a small mechanized unit, designed for great mobility, seems unjustified.

f. Studies are being conducted by the Engineer Board of folding pontoons of light construction, as well as various forms of rubber equipment. (36) The development of some form of light, mobile equipment capable of carrying mechanized cavalry loads appears highly desirable and would offer the mechanized engineers a valuable tool when bridging or ferrying operations are anticipated. A small unit of such equipment would furnish a fairly rapid means of bridging relatively narrow<sup>w</sup> streams, and could also be used<sup>for</sup> ferrying operations on wider bodies of water. However, until an approved design is available for consideration, it appears inadvisable to specify exactly what, if any, ponton equipment is to form part of the organizational equipment of mechanized engineer units.

g. Fixed bridges must be considered both in the light of what the tactical commander may desire and what the engineer is able to furnish under probable operating conditions. Many views have been expressed concerning the bridging requirements of mechanized units. Certain foreign writers have suggested that engineers furnish bridging tanks (37) perhaps de-

(36) EBR, 1934, pp 14-16.

(37) EIMANNSBERGER, Ch VII; FSR III, pp 103-104.

signed to permit the bridge to be launched from within the tank. (38) There appears to be substantial agreement only in the fact that some form of quick and portable bridging expedient is necessary. (39)

h. Prior to operations in a particular area, a map study or airplane reconnaissance should disclose the existence and general character of major streams or obstacles which may have to be negotiated in carrying out a definite tactical mission. Anticipatory planning will thus enable the engineer to make provision for the forwarding of adequate ponton equipage, portable bridge units, or materials for standard types of bridges, and if necessary, additional engineer work units for construction.

i. Minor obstacles will be encountered which cannot be anticipated from a general reconnaissance. Such obstacles may take the form of skilfully placed road craters, comparatively narrow draining lines with steep banks, or small streams which cannot be forded due to the condition of the bottom. Mechanized operations will not be restricted to improved roads but will, on occasion, involve cross-country movement - at least by combat elements. Minor obstacles may have to be crossed at points not on the road net. This is the type of bridging operations which the mechanized unit must be prepared to meet. In many cases it is probable that the time element will be of vital importance.

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(38) FOWLE, p 222; MARTEL, p 132.  
(39) ROBINSON, p 57; STAMPS; MFB, par 6; MARTEL, p 146. See also (37) and (38).

7. As in the past, the engineer must place his chief reliance on improvised means to overcome minor obstacles. The combat vehicles of the mechanized force have a high degree of cross-country mobility which simplifies the engineer task by permitting the vehicles to negotiate steep slopes (as when a bank is cut down in lieu of bridging), pass over soft ground, and utilize improvised bridges lacking finished approaches. When the construction of a bridge up to about 30 feet in length becomes unavoidable, the time element may preclude the use of improvised means. The Engineer Field Manual suggests that about one and one-third <sup>Basic Work Units</sup> ~~B.W.U.~~ days (of 8 hours each) will be required to construct a timber trestle 30 feet in length, providing the materials are available at the bridge site. (40) One engineer platoon of present strength could not complete this task in an 8-hour working day, while an entire troop would require more than five hours for the construction after assembling all materials.

8. Although no definite design has been adopted for a portable bridge 30 feet in length and suitable for mechanized cavalry use, considerable thought has been given the subject and several designs proposed which indicate the feasibility of the plan. (41) The characteristics of such a portable bridge cannot be predicted with accuracy, but should be: transportable in two vehicles of high cross-country mobility; capable of being erected with the minimum of personnel,

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(40) EFM, Vol 1, Table XI, p 319.

(41) EBR, 1934, pp 13 and 15; MIL ENGR, Vol XXVI, No 149, pp 346 to 351 (incl); MIL ENGR, Vol XXVI, No 150, pp 447 to 458 (incl).

using such tools and equipment as may be available to a mechanized unit; capable of being erected in a minimum of time.(42) A length of approximately 30 feet appears to be a conservative minimum from a tactical viewpoint.(43) One unit of such a bridge should be included in the organizational equipment of a mechanized engineer unit. Although it is an obvious burden, its availability may at times be vital, and the necessity for its use cannot always be foreseen as in the case of extensive ponton operations.

*Caps + S. caps*  
13. CAMOUFLAGE

a. The engineers normally assume certain responsibilities in connection with camouflage which may be summarized as follows:(44)

- (1) Advice and assistance on camouflage matters, including training
- (2) Erection of minor camouflage of common interest to all elements
- (3) Supply of special camouflage materials and tools.

b. Camouflage principles appear to be especially applicable to the operations of a mechanized unit:

- (1) as an element of protection from hostile observation and attack in connection with bivouacs, marches, and installations; and (2) to secure surprise. These closely-related topics will be considered briefly.

c. Since hostile attack in force must, in general, be based upon specific information as to the loca-

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(42) FOWLE, p 222.  
 (43) FOWLE, p 222; RILEY, p 5; MFB, par 7.  
 (44) EFM, Vol I, par 158 a.

tion of the objective, it seems obvious that any measures which tend to prevent or vitiate hostile reconnaissance become valuable protective measures. Effective camouflage of bivouacs appears very important. (45) Mechanized elements in motion are difficult to conceal unless the movement is made at night or under cover of fog or smoke. However, it appears possible to conceal the character of the vehicles by the use of light covers or nets, (46) designed to alter the characteristic outlines of combat vehicles. Such measures should prove especially effective against hostile observation aviation. As a protective measure, it seems desirable to utilize all means available to conceal the location of supply vehicles and establishments, as well as obstacles (47), and especially prepared crossings.

d. Effective surprise involves, among other things, movements which are unexpected in force, character, or direction. The elements noted in <sup>the above</sup> paragraph ~~above~~, contribute to this end.

e. The engineer mission, in connection with camouflage, is closely allied with that of the other arms and services contained in a mechanized organization. Training Regulations 195-40 (paragraph 11) tabulate and weigh camouflage requirements as follows:

- (1) Proper choice of positions. . . . 40%
- (2) Camouflage discipline . . . . . 25%
- (3) Proper erection of materials . . . . 20%
- (4) Camouflage materials used . . . . 15%

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(45) ROBINSON, p 17; BONSTEEL, p 20.  
 (46) MIL ENGR, Vol XXVII, No 151, p 70; MARTEL, p 165.  
 (47) RUSI, Sept 1929, pp 480-481.

The engineers have advisory responsibility in connection with the first three items, and supply functions in connection with the last-named. (48) Camouflage material, in turn, may be considered under two headings: that forming part of the normal equipment furnished to and used by units of other arms, and special supplies required for a particular situation. Apart from periodic replacement, mechanized engineers will have little concern with the former. For the latter, a limited amount may be carried with the organization, depending upon the proximity of rear supply establishments.

7. Based on the foregoing considerations, the following conclusions are drawn as applicable to engineer camouflage functions with mechanized cavalry:

(1) Each vehicle and unit in the cavalry force should carry, as standard equipment, such camouflage materials and tools as it may require.

(2) The supply of camouflage tools and equipment will be effected through engineer channels as in the case of other engineer supplies.

(3) Each element of the cavalry command will be responsible for the planning and execution of routine camouflage work.

(4) Engineer personnel attached to or cooperating with mechanized cavalry will provide technical supervision of camouflage activities, and assist in the erection of minor camouflage of common interest to all elements. (49)

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(48) EFM, Vol I, par 158 a.

(49) EFM, Vol I, par 158 a; MFB, par 6.

14. COMBAT.

a. Combat missions may be required of mechanized engineers in connection with and incidental to their normal technical duties, as combat elements covering obstacles or crossings, or as potential reserves. (50) The magnitude of the tasks already apparent, indicates the virtue of the accepted principle that engineers can contribute most to the success of an operation by concentrating on technical duties rather than having their capabilities impaired by employment on combat missions for which they are not primarily organized or equipped.

b. In connection with engineer technical missions, combat may be involved in a variety of forms. Engineer elements with reconnaissance detachments may be expected to meet hostile vehicles or detachments. An advance by force may be required to secure essential information concerning routes or areas. This fact would seem to indicate the desirability of making the engineer reconnaissance elements conform, in general, to the characteristics possessed by the cavalry elements with which they are associated. The same considerations <sup>prevail</sup> ~~obtain~~ in connection with engineer elements with security detachments. During the period of actual construction, there exists the necessity for the engineer contingent to defend itself against possible interruption by hostile mechanized or less mobile detachments. Similar defensive action may be required of engineer units and trains on the march as well as in bivouac.

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(50) TEC, par 98 f.

g. The effectiveness of anti-mechanized obstacles is increased if covered by fire.<sup>(51)</sup> What troops are to provide this defense? The answer, of course, rests with the cavalry commander; his policy cannot be anticipated with certainty. In the usual case it may be presumed that the engineers will continue to erect other obstacles, leaving the defense of those in place to appropriate elements of the cavalry command. However, it appears probable that circumstances will arise which will necessitate the assignment of engineer personnel to such work. The same conclusion may be drawn as regards the defense of bridges or prepared avenues of approach.

g. The use of engineers on strictly tactical missions of combat is normally exceptional, but is justified when the situation becomes so acute that the usefulness of the engineers for such a purpose outweighs their value for engineering tasks. The organization, equipment, and training of the mechanized engineers should be such as to fit them for such combat missions, with due consideration given the fact that it is a secondary mission.

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(51) TEC, par 110 d; MARTEL, p 176.

SECTION III

MECHANIZED ENGINEERS

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15. *Copies & drawings* ASSIGNMENT.

g. In Sections I and II the discussion has been purposely generalized both as to the relative size of the mechanized cavalry and engineer units, and as to their organizational status. More specific conclusions as to the organization and equipment of engineers can be reached only after determining: first, the size of the mechanized cavalry unit, and second, the organizational relationship which may be employed.

h. Prior to the formation of mechanized organizations, the division was the smallest unit to which engineers were assigned as organic components. The division then represented the smallest unit composed of all the essential arms and services, designed to be tactically and administratively self-sustaining and capable of conducting important operations by its own means. (1) Although approved War Department tables of organization pertaining to higher echelons of mechanized cavalry are not available, tentative tables (2) indicate that the mechanized cavalry brigade possesses the essential characteristics heretofore found only in divisions or larger units. The mechanized cavalry regiment, like the infantry and cavalry brigade, appears to lack the means characteristic of the next higher echelon. In keeping with these considerations, it seems logical to conclude

(1) MCLU, Vol I, par 74.  
(2) RD, Table 51, p 48; TEC, par 75.

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that if required at all, engineers will be found in the mechanized cavalry brigade. Similar reasoning leads to the conclusion that engineer assistance required by the mechanized cavalry regiment assumes a different character, just as now exists in the case of the infantry or cavalry brigade.

g. The fact that engineer personnel should appear in the mechanized brigade has been assumed in the tentative tables of organization already referred to. The soundness of this conclusion is indicated by the numerous and important engineering tasks connected with the several types of operations outlined in/para-<sup>the</sup> on "Tactical Employment" graph. Similar conclusions have been expressed by military writers both in this country and abroad, in connection with mechanized units embodying many of the characteristics of the mechanized brigade.(3)

d. The same conditions which prompt the inclusion of engineer personnel with the mechanized cavalry brigade, indicate the desirability of having such personnel an organic part, rather than reinforcing or attached. Other considerations lead to the same conclusion. The duties of an engineer unit with the mechanized brigade are continuous during periods of operation; they cover all phases of operations as well as the preparations preceding an operation. The situation is in marked contrast to the special circumstances which prompt the attachment of ponton trains or general service regiments to an infantry division. Material benefits accrue to the brigade as a whole by reason of joint training and close association between

(3) FOWLE, p 219; EUSTIS; ROBINSON, p 2; T & T ENGRS, Ch VIII, Table II; MARTEL, p 248.

the members of the same combat team.(4)

e. The engineer requirements of the mechanized cavalry regiment must not be overlooked. This unit is assumed to contain all the elements found in the brigade excepting only the field artillery component, the <sup>l.c</sup> Maintenance Troop, <sup>l.g</sup> and perhaps the engineers.(5) It possesses nearly one-half the combat strength of the brigade. It has been referred to as a self-contained administrative and tactical unit capable of independent operation in the execution of cavalry missions.(6) Probable engineer missions may thus be similar in nature to those applicable to a brigade, but perhaps less extensive. The question of engineer assignment will depend on the organizational status of the regiment. If the regiment forms an element of a fully organized brigade, proper engineer assistance can and should be provided from the means available to the brigade. This is a normal brigade problem.

A different condition is presented if a mechanized cavalry regiment is constituted that is entirely divorced from a brigade, or if independent regiments be created and brigade organizations not be completed. Under these conditions, engineer assistance appears essential if the mobility and combat effectiveness of the unit is to be realized. Organic engineers are not contemplated in the tentative organization (5), and the idea appears sound. The attachment of a re-

(4) BONSTEEL, p 20; FOWLE, p 219.

(5) RD, Table 51, p 48; TEC, par 75.

(6) TEC, par 76.

inforcing engineer detachment affords a reasonable alternative which will receive further consideration in Section V.

f. Conclusions.- Assuming that mechanized cavalry units are to be organized in substantial accord with the tentative tables of organization, conclusions as to the assignment of engineer personnel may be summarized thus:

(1) An engineer component of appropriate size and characteristics should form an organic part of the mechanized cavalry brigade.

(2) Engineer personnel should not form an organic part of a mechanized cavalry regiment when brigaded.

(3) An engineer group should be attached to an independent regiment in order to preserve its mobility and combat effectiveness.

16. DESIGNATION.

Due to its specialized missions and mechanized characteristics, an engineer unit designed as an element of a mechanized brigade will be difficult to compare with existing engineer organizations. However, its designation should conform, in general, to current practice. An engineer squadron is the organic unit in the cavalry division. ~~(7)~~ An engineer troop is considered an appropriate reinforcement for a cavalry brigade (reinforced). (8) To continue the parallel, it seems appropriate to consider a troop as a suitable designation for the engineer component of a mechanized

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(7) RD, Table 50.

(8) RD, Table 55, par 5.

brigade. This designation has, in fact, been adopted in tentative tables of organization. In this connection it should be noted that the designation of such a unit may not justly describe its capabilities as compared with other engineer units bearing similar titles. The internal organization, as well as the equipment of a mechanized engineer troop is considered in subsequent paragraphs.

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17. (A TENTATIVE ORGANIZATION. --)

a. The organization of the mechanized engineer troop should be based on its probable missions. (9) The discussion of these missions in Section II indicated the importance of mobility and speed of execution. These requisites in turn suggest that the engineer unit possess the maximum amount of mechanical equipment to conserve time, and yet avoid carrying unnecessary impedimenta that may adversely affect mobility. The latter consideration is complicated by the fact that the mechanized brigade may operate at a considerable distance from other forces and, therefore, must be organically equipped for a variety of eventualities. In short, the engineer troop must carry equipment and supplies for essential needs, and yet be so organized that the troop as a whole will not adversely affect the mobility of the brigade, nor engineer detachments unduly hamper subordinate cavalry units with which they may be operating.

b. An obvious solution to the problem appears to be the creation of highly mobile operating platoons equipped with a minimum of heavy equipment, but cap-

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(9) See footnote (2), page 1.

able of performing a wide variety of pioneer tasks; and the formation of a troop headquarters with limited personnel but carrying special equipment and supplies for use by the operating platoons as required. This troop headquarters is in effect an equipment pool, to reinforce the operating platoons.

g. The question of the number of platoons and their subdivisions must of course be answered in the light of their probable missions. Both the combat engineer company and the motorized engineer troop contain two operating platoons of two sections each, in addition to a company or troop headquarters. (10) It will prove convenient to assume a similar organization for the mechanized troop, then test the efficacy of this organization in connection with the cavalry operations summarized in the on "Tactical Employment" paragraph. Any defects which appear in this assumed organization can then be rectified. Although the question of equipment is unavoidably involved in the discussion, the effect of organization is the central topic.

*Cavalry & Engineer*  
17. (MARCHES. ---)

A. Distant or route reconnaissance may be under brigade or column commanders. If under the former, accompanying engineer personnel can be drawn from troop headquarters; if under the latter, operating platoons, reinforced as required, can provide the personnel and vehicles. When the brigade marches in one column, engineer personnel can be distributed as required under any reasonable organizational plan. While moving in multi-columns, control will probably

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(10) T & T ENGRS, Ch VIII, Table II.

be decentralized to regimental or combat team commanders. As long as there are but two principal commanders, an engineer platoon is available for cooperation with each, further subdivision within the platoon being possible. Where three or more principal subdivisions of the brigade are created, engineer assignment becomes less satisfactory. One workable solution would be the division of one or both platoons into sections, each reinforced with such additional equipment as appears necessary. The work capacity of a section is relatively small.

h. The allocation of engineer means to advance, flank, or rear guards depends upon such a variety of considerations that any generalization is difficult. It involves the same basic factors as were just discussed. However, a reasonable concentration of engineer effort is desirable, and the detachment of an excessive proportion of engineer personnel on isolated missions is undesirable under any organization.

*Orgs + 2 corps*  
 (19) BIVOUACS.

At a halt, elements of the brigade may be less dispersed so that control is less difficult. Whether security measures are centralized under brigade control or decentralized to regimental or combat team commanders, appropriate subdivision of the engineer means can be effected under the proposed two-platoon organization. The construction of obstacles, camouflage, and road work will be simplified by the fact that all elements of the engineer troop will be rela-

tively close together thereby facilitating the supply of materials and special equipment.

*Caps & S. cap*  
20) RECONNAISSANCE AND COUNTER-RECONNAISSANCE.

Brigade reconnaissance missions were discussed at some length in <sup>the</sup> paragraph ~~15 (pages 16 to 19)~~ on "Assignment". Counter-reconnaissance operations may be expected to require a somewhat similar organization, although the mission will be one of preventing hostile ground reconnaissance. In this case the engineer reconnaissance vehicles with a detachment may have to be augmented by one or more vehicles of engineer personnel and supplies for the erection of road blocks, defensive works, and obstacles. (11) Since the engineer detachment will be relatively small, it can be drawn from the operating platoons without seriously impairing the capabilities of these units.

*Caps & S. cap*  
21) ATTACK

a. Much of the engineer work incident to an attack must precede the delivery of the main blow. This is particularly true of reconnaissance, efforts to limit hostile maneuver, reduction of obstacles hindering the advance, and the construction of obstacles required for the security of the attacker's flanks and rear. The allocation of engineers on such tasks appears relatively easy and offers few possibilities for testing the effectiveness of engineer organization.

b. During the attack it appears that the mechanized brigade may be tactically or geographically separated

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(11) Note engineer missions in par 4 e, page 6.

into four groups: (1) the maneuvering force, or main effort; (2) the brigade reserve; (3) the pivot of maneuver (relatively fixed); and (4) the trains or rear elements not participating directly in the engagement. Granting that the engineer requirements of each depend largely on specific circumstances, some generalization is possible. From a tactical viewpoint, the importance of each group follows the order named. The engineer effort should adhere to a similar priority.

f. The maneuvering force may require two major engineering tasks: first, facilitating the advance of the force, and second, assisting in the organization of captured terrain.<sup>(12)</sup> Due to its importance and the necessity for rapid execution, assume that a platoon is assigned to this mission. Such a unit should provide adequate engineer assistance.

g. In second priority, the brigade reserve promises two engineer missions: the construction of obstacles and other security measures, and the preparation as well as marking of routes for future movements. The first of these missions may be closely allied with the engineer help furnished the pivot of maneuver, since these two groups may be in the same general locality. The preparation and marking of routes for the reserve presents a variable requirement which in general may be assumed to require only moderate speed of execution, and relatively small means. An engineer platoon less one section, should be able to perform these duties.

h. Engineer tasks affecting the pivot of maneuver will include the preparation of suitable fields of fire,

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(12) TEC, par 92 g.

and security measures on the flanks and rear. One operating section, perhaps reinforced with equipment, should be able to accomplish these tasks in the time available, especially if the remainder of the platoon, earmarked for use with the reserve, is sufficiently nearby so that the engineer work can be coordinated.

f. The trains or service vehicles possess a high degree of mobility but may require some pioneer work for their close defense. Personnel from these service elements must be impressed into service, utilizing the tools and equipment available to them for works designed to increase their own security. The cavalry vehicles are armed with machine guns for this purpose. Engineer vehicles must be similarly armed to provide for their own close defense.

g. The foregoing assignment is not to be construed as recommending attachment of the indicated engineer units to the several tactical elements, but rather approximates an engineer plan such as might be devised by the engineer troop commander. Under the assumptions stated, the proposed organization appears to lend itself to the performance of the tasks probable in an attack.

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(22) DEFENSE AND DELAYING ACTION. --

As noted in paragraphs ~~4 g~~ and ~~4 h~~, the cavalry brigade may be expected to utilize its mobility and shock-power even in defensive situations. <sup>What is</sup> The same general tactical or geographical division of the cavalry command may obtain in defensive operations was indicated in the discussion of the attack. A

As noted in the subparagraphs "Defense" and "Delaying Action", under the paragraph on "Tactical Employment",

similar apportionment of engineer personnel is not unlikely. However, there may be increased need for demolitions and obstacles. (14)

*Supra. p. 104. c. 104.*  
23. (RAIDS, --)

Although extensive reconnaissance and major destruction are the probable characteristics of a raid, (15) the assignment of engineers and the suitability of the proposed organization is difficult to estimate without complete information as to the tactical plan. Provided adequate equipment be given the engineer troop, the two-platoon organization appears sufficiently flexible to meet probable requirements.

*Supra. p. 104. c. 104.*  
24. (CONCLUSION. --)

Based on the brigade organization assumed in the on "Composition", paragraph 3, and its probable employment as outlined (the on "Tactical Employment", in/paragraph 4, the following conclusions as to the organization of an engineer troop are pertinent:

(1) A troop composed of two operating platoons of two sections each can function effectively in all normal operations of the mechanized brigade, provided:

(a) Each platoon is organized and equipped to perform routine pioneer work when separated from the troop.

(b) A troop headquarters is established to provide an equipment and supply pool to reinforce subordinate elements for specific tasks.

(c) At least two reconnaissance vehicles (armored,

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(14) TEC, par 98 f.

(15) TEC, par 104.

cars) be incorporated in the troop headquarters, with one additional vehicle organic in each platoon, and other vehicles suitable for general reconnaissance purposes be available in troop headquarters as well as platoons, and

(d) Ample demolition equipment be available, and a large proportion of the engineer personnel adequately trained in demolition work.

(2) A troop composed of three platoons of two sections each will provide added engineer strength and somewhat greater flexibility, but is open to the following objections:

(a) It will materially increase the size of the troop and hence the ratio of engineer strength to total strength.

(b) By increasing the vehicle strength of the brigade without contributing proportionate firepower, a larger engineer unit tends to reduce the mobility of the brigade as a whole.

(c) It is not essential for the accomplishment of probable engineer missions.

(3) A troop of two platoons, organized under the principles indicated in sub-paragraph (1) above, can be considered an appropriate organization for the mechanized brigade until field tests indicate the necessity for modification.

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SECTION IV *Caps & Equip*

MECHANIZED ENGINEERS *all caps*

-- EQUIPMENT

*Caps & Equip*  
25. (TRANSPORTATION. --)

4. The characteristics of engineer transportation will have a marked influence upon the effectiveness of the engineer unit. Reasonable cross-country and high road mobility are vital requirements. (1) The capacity for self-defense is a consideration; (2) and finally, the suitability of the transportation for the contemplated loads must be checked. Commercial automotive design is showing such rapid improvement that it is difficult to specify the exact type of vehicles which gives evidence of providing the most desirable form of transportation. As a result of continuing study and tests, military vehicles are being improved and modified at frequent intervals. Under the circumstances, it seems desirable in this discussion to designate vehicles by types rather than by specific characteristics. The vehicles mentioned are intended to represent the most approved forms which are in current use in the Army in general and the mechanized cavalry in particular. In avoidance of introducing an excessive number of special vehicles, it will be assumed that whenever

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(1) FOWLE, p 215; EIMANNSBERGER, Ch VII, pp 174-175.

(2) TEC, par 84 g.

possible, standard chassis will be used, and the minimum amount of special construction will be required in the body of the vehicle.

b. The need for armored cars has already been pointed out. Under the proposed organization, two of these vehicles will form the reconnaissance section of troop headquarters, and one car provided for each platoon as well as the troop commander - a total of five armored cars.

c. Personnel carriers for the engineer unit can be similar to those employed by the mechanized cavalry units. As now planned, these carriers are track or half-track fighting vehicles combining cross-country mobility with reasonable carrying capacity and a certain amount of protection for personnel and equipment. (3) Each carrier transports one squad with its equipment. (4)

d. Two men have been assigned to each cargo truck and special vehicle. This loading will permit certain specialists to ride with their equipment and also obviate the necessity for providing carriers for personnel other than operating sections of the platoons.

e. The practicability of trailers in an engineer unit is a controversial subject. The apparent economy in prime-movers must be weighed against decreased mobility. Although trailers are used in the present motorized troop and have been recommended on occasion

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(3) TEC, par 73.

(4) T/O, Table 430-P (Tentative)

for inclusion in a mechanized troop, (5) this type of vehicle has been condemned as hard to handle (6) and detrimental to mobility. Tentative tables for the motorized troop (C of E, T/O, 468 W, 19 Jan 34) contemplate the elimination of all trailers. Since a high degree of mobility is a prime consideration, it is believed that the use of trailers with mechanized engineers is not justified, and that an appropriate type of self-propelled vehicle should be substituted.

f. Motorcycles have been the subject of considerable criticism by several Engineer officers who have had occasion to employ them in cavalry maneuvers. However, their use for reconnaissance and messenger service is frequently recommended, and is in fact contemplated under existing tables of organization applicable to mechanized cavalry units. (7) Their use in mechanized maneuvers, for messenger service to supplement radio communication, has been found useful. (8) Motorcycles have the disadvantage of being of little use except as conveyances for messengers or for such limited reconnaissance as one or two men can effect. On the other hand, light trucks can be used either for messenger service, transportation of larger and more effective reconnaissance groups, dispatch of demolition parties, personnel carriers, or light cargo vehicles. To an engineer unit, this wide

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(5) STAMPS; EUSTIS, Appendix A.

(6) STAMPS.

(7) T/O, Table 423 P (Mech) (Tentative).

(8) EUSTIS, par 9 f.

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range of usefulness presents distinct advantages not applicable, in full, to other branches. For this reason, motorcycles have not been provided in the engineer troop but light trucks have been added for messenger service as well as general utility.

~~G.~~ One passenger car has been assigned to the troop headquarters. This is in accord with the contemplated equipment of mechanized cavalry units and has some merit. The car may be used for command purposes, messenger service, or reconnaissance. On the other hand, a car is not a necessity and could be replaced by a light truck or even a motorcycle without detriment to the engineer unit. As long as mechanized cavalry troops are so equipped, the engineers will no doubt be able to effect closer liaison by conforming.

~~H.~~ Cargo vehicles within the troop have been confined to three types, all of which are either commercial products or types already in use in the army. Light trucks with pick-up bodies are commercial vehicles well adapted for messenger service and general utility. One such vehicle can be equipped to serve as a light repair truck. Commercial types of one and one-half to two ton dump trucks, similar to those used by the motorized engineer troop, are suitable for use as ration and baggage trucks, kitchen, and gas and oil carriers. By dumping their prescribed loads, these trucks become available for a variety of engineer use. Finally, the half-track type, or its successor, is used for engineer vehicles which may be required to leave the road or move with operating units. Such vehicles are the tool trucks,

bridge carriers, demolition track, crane-excavator, and air compressors.

26. MACHINERY.

a. The provision of adequate engineer machinery promises to be essential if the engineer component is to function with speed and effectiveness. Certain types of machinery have already demonstrated their utility in connection with the work of the motorized troops of horse-cavalry units. The need for certain other items has been predicted, but the exact form requires special study and field tests. The technical considerations of this latter class are beyond the scope of the present study; it must suffice to indicate the character of the work which the machine is to perform.

b. A light tractor has been proposed as part of the equipment of the engineer squadron (motorized), (9) as well as the mechanized troop. (10) The machine is particularly valuable for making extensive road repairs and moving disabled vehicles. For road repair work the tractor must be used with road graders, scrapers, or drags. The bulk and weight of such equipment is considerable. Since mechanized engineers are not expected to undertake extensive road repair, a tractor is not considered an appropriate item of equipment. The numerous half or full-track prime movers within the mechanized brigade should

(9) C of E Table of Organization 466 W (Tentative) January 19, 1934.

(10) BUSTIS, Appendix A; STAMPS; EFM, Vol I, par 136 g.

suffice for moving disabled vehicles to nearby repair points.

g. Air compressors are useful for a variety of purposes such as drilling, bank excavation, tamping, and sawing. The need for such a tool was suggested ~~the~~ <sup>(on "Demolition and Obstacles",</sup> ~~1 1/2~~ paragraph b. Air compressors have been included in the equipment proposed for British mechanized engineers, (11), and tentatively proposed as standard equipment in our own motorized squadron. (12) It will be assumed that an air compressor, with all requisite attachments, can be carried portee on a truck of the half-track type, capable of operating effectively off the road. Because of its great versatility, and the importance of road blocks and demolitions for which it is particularly adapted, this machine should be included in the basic equipment of each platoon.

d. A small, motor-driven water pump will be found useful for the establishment of water points, as well as for certain types of construction work. (13) Such a unit can be carried in troop headquarters.

e. The need for a versatile machine in the nature of a truck crane, derrick, or excavating machine has been suggested by a number of officers. British engineers, concerned with mechanized forces, have suggested a 2 1/2-ton derrick on a tool truck designed particularly for launching portable bridges. (14) As a result of experiences with the mechanized force in

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(11) FITZPATRICK, p 321; MORLEY, p 143.

(12) C of E, Table of Organization 466 W (Tentative) January 19, 1934.

(13) See paragraph 8 d.

(14) MARTEL, p 143; FITZPATRICK, p 321.

the United States, vehicle cranes with a capacity of four tons were recommended for use with mechanized engineers in the proportion of one per platoon. (15) Reviewing the possible tasks indicated by the discussion in previous paragraphs of this paper, the following types of work stand out as being appropriate for the machines now being considered:

(1) Launching portable bridges,

(2) Weight lifting, especially in connection with the repair of existing bridges, or the construction of new ones,

(3) Loading heavy materials,

(4) Pile driving,

(5) Removing obstacles,

(6) Excavating bridge or ford approaches,

(7) Excavating trenches or obstacles,

(8) Excavations incident to road repair.

1. Specific recommendations are difficult to make without considering actual designs and the performance of such designs on appropriate field tests. However, the following conclusions are based on a study of the theoretical needs, with due regard to the practicalities of design:

(1) Each tool truck in the engineer troop should possess a weight-lifting device of moderate capacity to enable it to assist in placing portable bridges, handle heavy materials, and remove obstacles. This device may either take the form of a light hand crane such as is common on commercial wrecking cars, or an A-frame such as is used by the British on their

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(15) EUSTIS, par 7; STAMPS.

tool lorries.

(2) One versatile machine of greater capacity, normally moving with troop headquarters, should be capable of use as a power crane, pile driver, clam-shell or drag-line shovel. It should be on a self-propelled mount capable of reasonably high road speeds, and still possess the ability to move off the road. Such a machine has a variety of possible designations. In this paper it will be referred to as a crane-excavator.

g. Trench diggers have been proposed for use with British mechanized engineers, (16) and mentioned in our own Engineer Field Manual. (17) In a rapidly moving situation it would seem that only infrequently would time permit the construction of extensive trenches, either as tank obstacles or as defensive works for personnel and weapons. The machine described in the preceding subparagraph can be employed on relatively small tasks of this nature. The addition of other and perhaps heavier machines specifically designed for trench digging would appear to lessen the mobility of the unit, without providing additional engineer means essential to its more probable missions. For this reason, no trench digger is contemplated in the mechanized unit.

h. Bridging machines of one type or other have been mentioned by several foreign writers. (18) Most of them were designed for use in connection with tanks

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(16) MARTEL, p 132; EIMANNSBERGER, Ch VII.

(17) EFM, Vol I, par 186 g.

(18) MARTEL, p 132; EIMANNSBERGER, Ch VII.

employed under the relatively stabilized situations obtaining on the western front during the World War. The essential feature of such machines seems to be their ability to launch a portable bridge while under fire, all operations being effected without exposing the personnel. The practicality of the scheme has been demonstrated, but the vehicle is of necessity a cumbersome affair with limited mobility. Until a design more suitable for operation with mechanized cavalry is provided, it seems desirable to omit such equipment from our mechanized units. Of course, bridging equipment will be required but it will be carried on ordinary vehicles suitable for cross-country movement, and therefore, not properly classed as bridging machines.

4. Gasoline shovels and road graders have recently been listed as standard equipment for the motorized engineer squadron. (20) The excavating machine proposed in <sup>preceding paragraphs,</sup> ~~subparagraph 1,~~ above, provides a reasonable, though less effective substitute for the gasoline shovel. However, the increased importance of speed tends to reduce the number of opportunities which the engineers will have to make major road repairs or complete extensive excavation projects. For this reason, neither a gasoline shovel nor a road grader are considered essential machines for mechanized engineers.

5. Other machines such as power saws, concrete mixers, and scrapers will find insufficient use to warrant their inclusion in the list of essential machinery.

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(20) C of E, T/O 466 W (Tentative) January 19, 1934.

*Caps & 2 Caps*

27. ENGINEER TOOLS.--

a. Engineer units are provided with essential tools by the assignment to designated organizations, of specific allotments of complete tool sets, each suited for a particular class of work. (21) This procedure simplifies procurement and supply. In the field it facilitates work by permitting the delivery, in a compact unit, of all tools which a detachment may be expected to require for a given operation. For the same reasons, it appears advisable to continue this policy in the assignment of tools to the mechanized engineers. Since the mechanized troop closely parallels the motorized troop in organization, and will have many similar missions, there is no reason why full use should not be made of standard tool sets, even though a few individual items within a set appear to demand modification or substitution. In the discussion which follows, standard sets of equipment will be adopted where the need for a given type of equipment is indicated. Such sets will be subject to periodic improvement by the Corps of Engineers, and when assigned to a particular troop will always be somewhat modified by troop personnel.

b. Carpenter.--The combat company and the motorized troop are furnished carpenter sets of Engineer issue at the rate of one per platoon. (21) The company is provided with a supplementary set of Quartermaster origin, containing additional and

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(21) TBA; CESC.

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more specialized implements. This distribution is desirable for the mechanized troop as well. The platoon sets can be carried on the platoon tool trucks while troop headquarters moves the supplementary set on a headquarters truck, available for issue to the platoons upon request.

c. Pioneer.--Pioneer tools are grouped into platoon sets, issued at the rate of one per platoon to combat companies and motorized troops. (22) This equipment is of particular value to a mechanized troop. The assignment of one set per operating platoon should prove adequate.

d. Demolition Equipment.--The extended use of demolition measures which is anticipated in mechanized cavalry operations, necessitates the provision of more demolition equipment than is found in the organizational allotments of the combat company or motorized troop. Where the latter units are assigned one demolition set per platoon, the mechanized unit should have two. In addition, the troop headquarters should have two sets in its organic equipment to supplement that of the platoons. Although this provides six demolition sets for the mechanized troop as compared with two for the motorized unit, the need for the reinforcement is apparent from the missions anticipated in <sup>the</sup> paragraph on "Maps", 10, and the contemplated usage sketched in paragraphs on "Marches", "Bivouacs", etc. 18 to 23. When the tactical situation demands extensive demolitions, all available engineer personnel must be equipped to assist. The engineer

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(22) TEA

troop has been provided with adequate personnel and a suitable number of appropriate vehicles; the lack of demolition equipment must not limit its capability. Fortunately, the standard demolition set is conveniently small (5.9 cubic feet), and weighs but 134 pounds exclusive of the 100 pounds of explosive normally carried. (23)\* The disposition of these sets on troop vehicles is indicated in Plates II and III. One set has been assigned to the air-compressor truck, because of the probability that this machine will be used whenever extensive demolition is undertaken. It is possible, of course, to shift the demolition set to the platoon tool truck or to one of the personnel carriers as required. Two demolition sets are loaded on the troop headquarters demolition truck, and thus made available for use with that vehicle or reassignment to platoons.

e. Supplementary Equipment.—Troop headquarters of an independent troop must assume the essential duties normally performed by the Headquarters and Service Troop of the Engineer Squadron. Not the least of these functions is the provision of additional tools and supplies for operating units. Due to the unusual position of the mechanized troop, no standard tool set can be found in existing tables which provides the essential elements for troop supplementary equipment. One must be devised. In principle, it should contain additional tools likely to be needed by the operating platoons to supplement their own, and in addition contain a reasonable quantity

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(23) CESS.

quantity of expendable supplies ear-marked for platoon use. It will be similar in character to Unit Number 40 in the Engineer Supply Catalog, but smaller. The exact specifications for this equipment cannot be given at this time, since engineers have had insufficient experience with large mechanized cavalry units to justify conclusions. However, it seems apparent that a supply of heavy steel blocks (double, triple, and snatch), together with several hundred feet of heavy cable will prove necessary. In addition, there should be included a supply of expendable items such as drift bolts, spikes, nails, wire, etc.

f. Drafting and Duplicating Equipment can well be limited to the standard company set which weighs but 76 pounds. This will provide essential equipment for rough engineer or topographical drafting and the reproduction of a limited number of prints. Although the duplicating equipment is of doubtful value in its present form, considerable experimenting is being done on substitute methods. It is desirable that means be furnished for printing road sketches quickly.

g. Miscellaneous.--Certain other items of equipment will prove necessary. The following sets have been included in the proposed organization for reasons which are obvious: photographic, pipefitting, sign-painting, sketching, and tinmith. The illuminating set (gasoline lanterns) are omitted as being non-essential.

h. Summary.--The following table indicates the assignment of equipment sets to the several elements of the mechanized troop:

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Unit	Troop No.	Each Plat	Troop Total
Carpenter equipment, platoon, engineer, set	--	1	2
Carpenter and wheelwright, Quartermaster, set	1	--	1
Demolition equipment, platoon, engineer, set	2	2	6
Drafting and Duplicating, equipment, set	1	--	1
Library, reference, company, set	1	--	1
Pioneer equipment, platoon, engineer, set	--	1	2
Pipefitting equipment, set	1	--	1
Signpainting equipment, set	1	--	1
Sketching equipment, set	1	1	3
Supplementary equipment, mechanized troop, set	1	--	1
Tinsmith equipment, set	1	--	1

28. *Caps & Supplies*  
ENGINEER SUPPLIES.

*g.* Explosives.-- The demolition truck in troop headquarters was provided to carry a reasonable supply of military explosives. Sufficient capacity exists to transport 1000 pounds of explosive in addition to the anti-tank mines and demolition sets. Since large quantities of explosives will be required to carry out extensive projects, it is imperative that full use be made of local supplies. Engineer reconnaissance agencies must be alert to the necessity of locating these local resources. The normal loads of explosive carried by the troop will be:

Troop Headquarters . . . . .	1000 pounds
6 Demolition sets @ 100 . . . . .	600 pounds
<hr/>	<hr/>
Total . . . . .	1600 pounds

Of this amount 200 pounds normally go with each platoon while 1200 pounds remain in troop headquarters.

b. Anti-tank mines.--The liberal use of anti-tank mines has been predicted by numerous writers.(24) Provision has been made to carry approximately one hundred ten-pound anti-tank mines or an equivalent weight of other sizes in the demolition truck. For special operations requiring a greater supply, surplus cargo capacity exists within the troop on the light pick-up trucks (3) as well as the troop tool truck. It will be preferable, however, to have unusually large shipments sent forward in transportation furnished by higher echelons.

c. Camouflage.--Until the technique of camouflage applicable to mechanized units is more fully developed, the type and quantity of materials required for this work cannot be established. If each vehicle carries a net or cover for its own use, the engineer troop need provide but one or two extra ones to serve as replacements or for minor camouflage benefitting the brigade as a whole. These nets can be carried on the troop tool truck. Until the need for it is established no provision should be made for special paints, wire netting, poles, or burlap.

d. Bridge Material.--Previous discussion indicated the desirability of including one unit of portable bridge (approximately 30 feet) in the organizational equipment.(25) This unit is transported on two

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(24) COLLINS, pp 93-96; FOWLE, p 217; EIMANNSBERGER, Ch VII; FULLER, p 258; FSR III, p 103; MARTEL, p 172; T & T ENGRS, Ch VIII, Table II.

(25) See par 12 k, pp 26-27

half-track carriers attached to troop headquarters.

In addition to the portable bridge unit, the troop vehicles may transport a small quantity of timber or light metal members suitable for strengthening existing bridges and culverts, or spanning ditches. The exact nature of such material can be determined only after a study of the character of bridges common to a theater of operations, hostile methods of demolition, and the availability of local supplies. The troop commander must anticipate his requirements and maintain a supply of such materials as cannot be procured locally.

e. Prepared Obstacles.--A certain amount of prepared obstacles or the construction materials therefor, will form an essential part of the load of engineer vehicles. The character and amount to be carried may well be left to the discretion of the unit engineer who can better weigh his probable requirements against the carrying capacity of his vehicles. The design of obstacles affords a broad field for utilizing ingenious expedients. A great variety of road blocks have been proposed among which are: cables, (26) planks studded with barbed spikes, (27) and coils of steel wire, (28). Sufficient material must be available to the engineer unit to erect such obstacles as may be required for each particular operation.

f. Miscellaneous.--Items of individual equipment now issued to the personnel of motorized engineer units,

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(26) MARTEL, p 175.

(27) MARTEL, p 176.

(28) GHA

should apply also to mechanized personnel. Engineer equipment furnished to the individuals or organizations of the cavalry brigade should be replaced from depots as required. The engineer troop should not undertake to maintain a reserve of these supplies for reissue to cavalry units.

*Supplies & other*  
 (29) OTHER SUPPLIES.--

a. Rations.--Tentative plans contemplate that each mechanized unit provide itself with <sup>two</sup> rations in addition to the individual reserve ration. (29) The engineer troop will carry one ration on the kitchen and one ration on the ration and baggage truck. The weight of one ration will be approximately 600 pounds. The reserve ration will be carried by the individuals in their packs or on their vehicles.

b. Water.--No special water-carrying vehicle has been included in the mechanized troop. As has been pointed out before, the water requirements will be small and to all practical purposes limited to the supply of kitchens, since individuals may be expected to have access to local supplies. It is assumed that kitchen trucks will be provided with containers designed to provide adequate water for messing purposes.

c. Gasoline and Oil.--It is proposed to provide units of the mechanized brigade with fuel sufficient for two days' march of 150 miles each. Armored cars can carry sufficient for 250 miles. (29) Reserve gasoline and oil in the necessary quantities will be carried in convenient drums on the gasoline and oil truck of troop headquarters.

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(29) RD, Table 51, p 46.

d. Ammunition. -- In order to conform to the logistical plan of the mechanized brigade, the engineers must carry 2 1/2 days of fire of ammunition, of which 1 1/2 days of fire will be on the vehicles with the weapons. (30) This leaves one day of fire to be transported by troop headquarters.

30. WEAPONS.

a. It is essential that all vehicles be equipped to provide for their own defense. For this reason, and in conformity with the practice in other units of mechanized cavalry, one light machine gun, caliber .30, has been placed on each vehicle except the light passenger car. (31) Armored cars have been given the same armament as the corresponding cavalry vehicles, that is: 1 sub-machine gun caliber .45, 2 light machine guns caliber .30, and 1 heavy machine gun caliber .50. (31)

b. The corporals, privates first class, and privates in the operating sections are armed with semi-automatic rifles caliber .30, identical to those provided for the personnel of the cavalry rifle platoon of the machine-gun troop. All other individuals within the troop are armed with a pistol.

c. The armament specified above differs materially from that now authorized for the motorized troop. However, it appears desirable to utilize the same weapons employed by the cavalry elements in order to simplify the maintenance and supply problem. If changes are made

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(30) RD, Table 51, p 48.

(31) T/O, Tables: 414P (Mecz)(Tentative), 430 P (mecz), 425 P (Mecz)(Tentative).

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In the character of the weapons assigned cavalry units, similar changes should be effected in the engineer troop so that a minimum variety of Ordnance materiel will be required within the cavalry brigade.

*also in S. Report*  
31. RADIO.

✓ Radio communication will be quite as necessary for the engineer troop as for the other elements of the mechanized brigade. Communication may be required in the reconnaissance, command, administrative, or air-ground nets. Only by prompt communication between the engineer elements, and between the engineers and other units can essential cooperation be secured in a rapidly moving situation. For this reason, it seems desirable to include one radio set in each operating platoon and one in troop headquarters. Because of their missions and probable method of employment it is desirable to have one radio set in each of the two engineer reconnaissance cars of troop headquarters. A somewhat similar recommendation was submitted as a result of engineer experience with the Mechanized Force at Fort Eustis, Virginia. (32)

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(32) EUSTIS, par 9 f.

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SECTION V

PERSONNEL

32. OPERATING PLATOON.

As in the case of the present motorized troop and combat company, the platoon of the mechanized troop is designed as the fundamental work unit. It is provided with independent means for reconnaissance, messenger service, command functions, and general pioneer work. It is equipped with essential machine and hand tools, and sufficient personnel to perform effective work. The four squads of the operating sections provide one basic work unit - the customary yardstick for estimating labor requirements. However, because of the machine tools available to the platoon, and the number and character of the vehicles at its disposal, the work capacity of the platoon is materially greater than that of the motorized platoon as now constituted. The flexibility of the platoon is increased by division into two operating sections, each commanded by a sergeant. The section, in turn, contains two trucks, each of which carries one squad under the command of a corporal. In all essential particulars, the proposed platoon organization conforms to that of the older engineer units. A graphical representation of the operating platoon is presented in Plate III. It has a total strength of one officer and 43 enlisted men.

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35. TROOP HEADQUARTERS.

a. The composition of troop headquarters differs radically from that of any existing engineer organization. The difference is necessitated by two practical considerations: first, the engineer functions of the mechanized troop are somewhat unusual particularly as regards reconnaissance; and second, being a separate detachment, troop headquarters must assume all essential functions normally performed by the headquarters and service troop of the engineer squadron.

b. The first of these considerations necessitates the addition of a variety of specialists. The reconnaissance staff sergeant has immediate supervision over the two reconnaissance armored cars, being assisted by one sergeant as car commander of the second vehicle. The great importance of engineer reconnaissance suggests at once the desirability of placing an officer in charge of this activity. On the other hand, well trained non-commissioned officers should be able to perform the field work. In the majority of cases, decisions as to what engineer work must be undertaken, as well as when and where, must be made by the troop commander after studying all reconnaissance reports in the light of the tactical requirements of the brigade as a whole. For this reason, no commissioned officer has been designated as reconnaissance officer. The staff sergeant can serve the troop commander as an agent in securing the most effective coordination between the reconnaissance elements within the troop. One sergeant has been designated as demolition foreman to assist

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the troop commander in demolition plans as well as the supply of the necessary materials. The camouflage foreman (sergeant) has similar responsibility in the camouflage field. When properly trained, this non-commissioned officer becomes a valuable assistant not only for the engineers but other elements as well.

e. The fact that the mechanized troop has no headquarters and service troop to husband it, has necessitated the inclusion, in troop headquarters, of a variety of specialists. Their designation is patterned on that of the motorized headquarters and service troop, but their rank and ratings have been lowered to keep them in line with the platoon specialists. The number and duties of these specialists can be readily determined from Plates II and IV. Although the number of non-commissioned officers and specialists assigned to troop headquarters is materially larger than that obtaining in the motorized troop, the increase appears not only desirable but necessary.

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34. TRAINING. - - -

e. In view of the comparatively small number of men available in the engineer troop and the multiplicity of the duties required of them, it is apparent that small need exists for basic privates--if by that term is meant strong-backed individuals with few, if any, engineering qualifications. On the other hand, there is a pressing need for exceptionally skilled engineer soldiers with broad training. It is parti-

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(1) T/O, Table 467 W, p 94.

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cularly important that a large number of soldiers be qualified as drivers, capable of operating any of the vehicles in the troop and effecting routing maintenance and adjustments. For this reason, no drivers have been included in the list of specialists, it being assumed that on each vehicle at least one individual will be qualified as a driver in addition to his indicated specialty, and will be detailed by name to function as a driver in addition to his other duties. It is important, also, that all engineer soldiers be proficient in the handling of explosives, and be adequately trained in the operation of their individual arms, as well as the automatic weapons found in their unit. These qualifications, together with a general ability to handle engineer tools, must be considered basic qualifications.

b. It is apparent that even with adequate equipment and appropriate organization, the mechanized troop cannot function effectively unless the personnel is thoroughly trained, individually and collectively. With mechanized cavalry, more than with any other force, engineer tasks will take the form of intelligent <sup>improvisa-</sup> improvisations. Due to the lack of data bearing on engineer functions with large mechanized units of the type contemplated in this discussion, it is impossible to compile a comprehensive manual for the training of newly organized units. Training must be based upon field experience rather than theoretical study. Peace time organizations should include a sufficient number of mechanized troops to supply the engineer requirements of such mechanized cavalry units as are expected to participate in the initial phases of a war.

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g. In keeping with this thought, the writer is of the opinion that when an independent mechanized cavalry regiment is created, a mechanized engineer troop (less one platoon) should be organized. The engineer unit should be garrisoned in a locality convenient to the cavalry regiment, and required to participate frequently in actual field maneuvers with the regiment. Later, if the mechanized regiment is expanded into a brigade, the engineer troop can be brought up to full strength rapidly, with reasonable assurance that the engineer contingent will be prepared to carry on its work in a satisfactory manner.

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SECTION VI

CONCLUSIONS

35. GENERAL.

↓ As a natural consequence of the lack of any data based on engineer experience gained from actual tests involving an appropriately equipped engineer unit operating with a complete mechanized cavalry brigade, such conclusions as can be drawn relating to the proper organization and equipment of an engineer unit must be considered as statements of opinion rather than of fact. The opinions expressed in the conclusions which follow represent an attempt to combine the many and often conflicting ideas of military men in this country and abroad, into concrete form. The result is a reasonable basis for actual test, to be modified as future experience may suggest.

36. ORGANIZATION.

↓ An engineer troop (mechanized), organized as shown in Plate IV, is a reasonable unit to be attached to or to cooperate with mechanized cavalry. This unit contains a troop headquarters and two platoons of two sections each, with the following total strength:

- Officers . . . . 4
- Enlisted men . . 116
- Vehicles . . . . 30



DIAGRAMMATIC TABLE  
OPERATING PLATOON - ENGINEER TROOP (MECZ)









PLATOON HEADQUARTERS		SECTION			SECTION			
	ARMORED CAR Reconnaissance							
<b>VEHICLE</b>		UTILITY	HALF - TRACK	HALF - TRACK	HALF - TRACK	HALF - TRACK	HALF - TRACK	HALF - TRACK
<b>PURPOSE</b>		Utility	Tool Truck	Air-Compressor	Para Carrier	Para Carrier	Para Carrier	Para Carrier
<b>PERSONNEL</b>		Sgt - Plat Set Sgt - Carpenter Pvt - Carpenter	Corp - Tool Pvt - Carpenter	*Pvt-Operator Pvt-Deac	Sgt-Foreman Corp. Squad Pvt-Carpenter Pvt-Demolition Pvt-Mechanic *Pvt-M-Gunner Pvt-Basic Pvt-Rigger Pvt-Basic	Sgt-Foreman Corp - Squad Pvt-Carpenter Pvt-Demolition Pvt-Mechanic Pvt-M-Gunner *Pvt-Mechanic Pvt-Rigger Pvt-Basic	Corp - Squad Pvt-Carpenter Pvt-Demolition Pvt-Mechanic Pvt-M-Gunner *Pvt-Mechanic Pvt-Basic Pvt-Basic	Corp - Squad Pvt-Carpenter Pvt-Demolition Pvt-Mechanic Pvt-M-Gunner *Pvt-Mechanic Pvt-Basic Pvt-Basic
<b>DRIVER</b>								
<b>WEAPONS</b>		1 Lt MG Cal.30 2 Pistols	1 Lt MG Cal.30 2 Pistols	1 Lt MG Cal.30 2 Pistols	1 Lt MG Cal.30 1 Pistol 8 Rifles	1 Lt MG Cal.30 1 Pistol 8 Rifles	1 Lt MG Cal.30 1 Pistol 8 Rifles	1 Lt MG Cal.30 8 Rifles
<b>EQUIPMENT</b>		No prescribed load	Plat Tool sets 1 Demo Set	Attachments 1 Demo Set	Individual Equipment	Individual Equipment	Individual Equipment	Individual Equipment

TABLE --- W  
(Proposed)  
TROOP MECHANIZED, CORPS OF ENGINEERS

Designation: .....Troop(Mechanized), Corps of Engineers  
.....Tr (Mech), C of E.

1	2	3	4	5	6	7	8	9	10																								
										UNIT	Specialists' Ratings (Class)	Platoon				REMARKS																	
		Platoon Headquarters	Operating Section	Tool Section	Total Platoon	Troop Headquarters	Two Platoons	Total Troop																									
2	Captain					1		1	a Includes: 29 privates, first class 57 privates.																								
3	First lieutenant							2																									
4	Second lieutenant							1																									
5	TOTAL COMMISSIONED				1	2	2	4																									
6	First sergeants					1		1	b Includes: 1 Command car 2 Reconnaissance car																								
7	Staff sergeants, including	1			1	2	2	4																									
8	Foreman, construction					(1)		(1)																									
9	Platoon sergeant	(1)			(1)		(2)	(2)																									
10	Reconnaissance sergeant					(1)		(1)																									
11	Sergeants, including	1	2		3	7	6	13	c Self-propelled																								
12	Foreman, bridge					(1)		(1)																									
13	Foreman, camouflage					(1)		(1)																									
14	Foreman, construction		(2)		(2)		(4)	(4)	d Includes: 1 Truck, kitchen 1 Truck, R & B 1 Truck, Gas & Oil																								
15	Foreman, demolition					(1)		(1)																									
16	Mess					(1)		(1)																									
17	Reconnaissance	(1)			(1)	(1)	(2)	(3)																									
18	Supply					(1)		(1)																									
19	Truckmaster					(1)		(1)																									
20	Corporals, including		4	1	5	2	10	12	e Includes: 1 Truck, tool 1 Truck, air-compressor.																								
21	Clerk, headquarters					(1)		(1)																									
22	Squad		(4)		(5)		(8)	(8)																									
23	Tool			(1)		(1)	(2)	(3)																									
24	Privates, first class, and privates, including	3	28 <sup>f</sup>	3	34	18	68	86 <sup>g</sup>	f Includes: 1 Truck, Tool 1 Truck, demolition 2 Trucks, portable bridge.																								
25	Bugler	(1)	(4)		(1)	(1)	(2)	(3)																									
26	Carpenters, basic *				(4)		(8)	(8)																									
27	Carpenters, bridge *	4th		(1)	(1)	(1)	(2)	(3)																									
28	Carpen' or general *	3d				(1)		(1)																									
29	Cook	4th				(1)		(1)																									
30	Cook *	5th				(2)		(2)																									
31	Draftsman, general *	4th				(1)		(1)																									
32	Electrician, general *	5th				(1)		(1)																									
33	Gunners, machine		(4)		(4)		(8)	(8)	g Each vehicle carries: 1 Sub-MG, cal .45 2 Lt MGs, cal .30 1 Hvy MG, cal .50.																								
34	Man, demolition	5th				(1)		(1)																									
35	Man, demolition	6th		(1)	(1)	(1)	(2)	(3)																									
36	Man, demolition		(8)		(8)		(16)	(16)																									
37	Mechanic, auto *	4th				(1)		(1)																									
38	Mechanic, general *	5th	(1)		(1)	(2)	(2)	(4)	h Each vehicle carries: 1 Lt MG, cal .30																								
39	Mechanic, general		(4)		(4)		(8)	(8)																									
40	Operator, air-compressor*	5th		(1)	(1)		(2)	(2)																									
41	Operator, crane *	3d				(1)		(1)																									
42	Operator, mimeograph *					(1)		(1)																									
43	Photographer, general *	5th			(1)	(1)	(2)	(4)																									
44	Reconnaissance	6th	(1)		(1)	(2)	(2)	(4)																									
45	Rigger *	6th		(1)	(1)		(2)	(2)																									
46	Basic		(7)		(7)		(14)	(14)	i Armed with semi-automatic rifle, cal .30.																								
47	TOTAL ENLISTED		5	34	4	43	50	86																									
48	AGGREGATE		6	34	4	44	32	88	120																								
49	0 Cars, armored		1			1	2	3 <sup>h</sup>	SUMMARY OF SPECIALISTS RATING: <table border="1"> <thead> <tr> <th>Class</th> <th>Plat</th> <th>Tp Hq</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>3d</td> <td></td> <td>2</td> <td>2</td> </tr> <tr> <td>4th</td> <td>2</td> <td>4</td> <td>6</td> </tr> <tr> <td>5th</td> <td>4</td> <td>7</td> <td>11</td> </tr> <tr> <td>6th</td> <td>6</td> <td>3</td> <td>9</td> </tr> <tr> <td>Total</td> <td>12</td> <td>16</td> <td>28</td> </tr> </tbody> </table>	Class	Plat	Tp Hq	Total	3d		2	2	4th	2	4	6	5th	4	7	11	6th	6	3	9	Total	12	16	28
Class	Plat	Tp Hq	Total																														
3d		2	2																														
4th	2	4	6																														
5th	4	7	11																														
6th	6	3	9																														
Total	12	16	28																														
50	0 Car, 5-passenger, sedan					1	0	1																									
51	0 Cars, half-track, personnel		4		4			8 <sup>h</sup>																									
52	0 Crane-excavator, half-track					1 <sup>d</sup>		1 <sup>h</sup>																									
53	0 Trucks, dump, 4x2 (2dt), 1 1/2 T					3 <sup>d</sup>		3 <sup>h</sup>																									
54	0 Trucks, pick-up body, 1/2 Ton		1		1	1	2	3 <sup>h</sup>																									
55	0 Trucks, half-track, cargo			2 <sup>g</sup>	2	4	4	8 <sup>h</sup>																									
56	0 Truck, repair, 4x2 (2dt)					1		1 <sup>h</sup>																									
57	0 Guns, machine, light, cal .30		3	4	2	9	18	34																									
58	0 Guns, machine, heavy, cal .50		1		1	3	2	5																									
59	0 Guns, sub-machine, cal .45		1		1	3	2	5																									
60	0 Pistols		6	2	4	12	32	56																									
61	0 Rifles, semi-auto, cal .30			32		32	64	64																									

PLATE V

SUMMARY OF EQUIPMENT

ENGINEER TROOP (MECHANIZED)

Unit	Troop Qty	Each Plat	Troop Total
<b>ORGANIZATIONAL EQUIPMENT:</b>			
Carpenter equipment, platoon, engineer, set . . . . .	-	1	2
Carpenter and wheelwright equipment, Quartermaster . . .	1	-	1
Demolition equipment, platoon, engineer, set . . . . .	2	2	6
Drafting and duplicating equipment, set . . . . .	1	-	1
Library, reference, company, set .	1	-	1
Photographic equipment, company, set . . . . .	1	-	1
Pioneer equipment, platoon, engineer, set . . . . .	-	1	2
Pipefitting equipment, set . . . .	1	-	1
Portable bridge, 30' unit . . . . .	1	-	1
Sign-painting equipment, set . . .	1	-	1
Sketching equipment, set . . . . .	1	1	3
Supplementary equipment, mechanized, troop . . . . .	1	-	1
Tinsmith equipment, set . . . . .	1	-	1
<b>MACHINERY:</b>			
Air-compressor, with attachments .	-	1	2
Crane-excavator, half-track . . . .	1	-	1
Trucks, demolition, half-track . . .	1	-	1
Trucks, tool, half-track, with hoist	1	1	3
Water pump, gasoline . . . . .	1	-	1
<b>VEHICLES:</b>			
Armored-cars . . . . .	3	1	5
Car, 5-passenger, sedan . . . . .	1	-	1
Cars, half-track, personnel . . . .	-	4	8
Crane-excavator, half-track . . . . .	1	-	1
Trucks, dump, 4x2 (2ct), 1 1/2-Ton .	3	-	3
Trucks, pick-up body, 1/2-Ton . . .	1	1	3
Trucks, half-track, cargo . . . . .	4	2	8
Truck, repair, 4x2 (2ct), 1 1/2 Ton .	1	-	1
Total	14	8	30
<b>WEAPONS:</b>			
Guns, machine, light, cal. .30 . . .	16	9	34
Guns, machine, heavy, cal. .50 . . .	3	1	5
Guns, sub-machine, cal. .45 . . . .	3	1	5
Pistols . . . . .	32	12	66
Rifles, semi-automatic, cal. .30 . .	-	32	64

## 37. EQUIPMENT.--

The essential equipment for the mechanized troop is listed in Plate V.

## 38. ASSIGNMENT.--

a. An engineer troop (mechanized) should form an organic part of the cavalry brigade (mechanized).

b. No engineer detachment should be included, organically, in the cavalry regiment (mechanized). Engineer assistance to a cavalry regiment temporarily separated from its brigade can be effected from the engineer means available to the brigade, in accordance with probable requirements.

c. A mechanized troop (less one platoon) is an appropriate engineer unit to operate with an independent cavalry regiment not brigaded.

Plate II, III + IV  
 offered insert

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BIBLIOGRAPHY

- Bonsteel, Captain F.T.: Employment of a Mechanized Cavalry Brigade. (Cavalry Journal, September-October 1933.)
- Booth, Major General E.E.: Report of Maneuvers, 1st Cavalry Division, 1931. (Typed manuscript in library of the Command and General Staff School.)
- Cavalry Maneuvers, Fort Riley, May, 1934. (Publication of the Cavalry School, Fort Riley, Kansas.)
- Christmas, Captain John K.: The Supply and Evacuation of Mechanized Forces. (Individual Research study, Command and General Staff School, 1934.)
- Collins, Lieutenant M.O.: Anti-tank Mines. (Royal Engineers Journal (Great Britain), March 1928.)
- Connor, Major General Wm. D.: The Mission and Composition of a Mechanized Force. (Command and General Staff School, 1930.)
- Consolidated Report of Operations. (Headquarters Mechanized Force, Fort Eustis, Virginia, 1 July 1931.)
- Corps of Engineers Supply Catalog, Part I, 1930. (War Department publication.)
- v. Eimannsberger, General Ludwig Ritter (Austria): Mechanized Warfare. (J.F. Lehmanns Verlag, Munchen, 1934. Translated from the German by Army War College, Washington, 1935.)
- Engineer Board: Annual Report, the Engineer Board. (Published by the Engineer Board at Fort Humphreys, Virginia.)
- Engineer Field Manual. (United States Government Printing Office, Washington, 1932.)
- Engineer Unit in a Mechanized Force. (Report of Company C, 1st Engineers, to the Commanding Officer Experimental Mechanized Force, Fort Leonard Wood, Maryland, dated 11 October 1928.)
- Field Service Regulations, United States Army, 1923. (United States Government Printing Office, Washington, 1924.)
- Fitzpatrick, Brevet Lieut. Colonel N.T.: Mechanization and Divisional Engineers. (Royal Engineers Journal (Great Britain), March-December 1931.)
- Fowle, Major F.E.: The R.E. Problem of the Tank Brigade. (Royal Engineers Journal (Great Britain), June 1936.)
- Fuller, Major General J.F.C.: Lecture on F.S.R. III: Operations Between Mechanized Forces. (Published by Sifton Praed & Co., London, 1932.)
- Fuller, Colonel J.F.C.: One Hundred Problems of Mechanization. (Army Quarterly (Great Britain), Volume 19, October 1929-January 1930.)
- General Orders No. 9. (War Department, 11 September 1933.)
- Journal of the Royal United Service Institution (Great Britain).

73

BIBLIOGRAPHY (cont)

- King, Brigadier General Edw. L.: Mechanization in the Army. }  
Command and General Staff School mimeograph, }
- Manual for Commanders of Larger Units. Volume I: Operations. } Government  
Printing Office, Washington, 1930, }
- Mechanized Force Board: Board of Engineer Equipment. } Report of  
Mechanized Force Board, 1 October 1928. Section IV, }
- Military Engineer. } (Bi-monthly periodical published by the Society of  
American Military Engineers, Washington, }
- Reference Data, 1935. With changes to include 8 February 1936. } Publica-  
tion of the Command and General Staff School, Fort Leavenworth,  
Kansas, }
- Rowan-Robinson, Colonel H.: Some Aspects of Mechanization. } (Published  
by Wm. Clowes & Sons, London, 1928, }
- Table of Basic Allowances, Engineers. } (War Department, 14 May 1930, }
- Tables of Organization, 1932. With changes to include 8 February 1936. }  
(Publication of the Command and General Staff School, Fort  
Leavenworth, Kansas, }
- Tactical Employment of Cavalry (Tentative). } (Published by the Command  
and General Staff School, Fort Leavenworth, Kansas. Volume IV  
(1932), and Volume VIII (1935), }
- Tactics and Technique of Engineers (Tentative). } (Published by the Command  
and General Staff School, Fort Leavenworth, Kansas, 1935, }
- Training Regulations. } (War Department, Washington, }
- Trowland, Captain G.B.: Engineers in Cavalry Maneuvers. } (Cavalry  
School Mailing List, Fort Riley, Kansas. Volume VI, Number 2,  
March 15, 1932, }

end Section 1  
RML No. 63

## BIBLIOGRAPHY

SYMBOL	SOURCE
BONSTEEL	"EMPLOYMENT OF A MECHANIZED CAVALRY BRIGADE", - by Captain F.T. Bonsteel. Cavalry Journal (U.S.): September-October, 1933. Page 20.
BOOTH	"REPORT OF MANEUVERS, 1ST CAVALRY DIVISION, 1931", - by Major General E.E. Booth. Typed manuscript in library of C & G S School. Chapter VI, paragraph 3 d.
CESC	"CORPS OF ENGINEERS SUPPLY CATALOG, PART I, 1930". War Department publication.
CHRISTMAS	"THE SUPPLY AND EVACUATION OF MECHANIZED FORCES", - Individual Research No 11, March 23, 1934 (C & GSS); by Captain (now Major) John K. Christmas, O.D.
COLLINS	"ANTI-TANK MINES", - Royal Engineers Journal (Great Britain), March, 1928. pages 93 to 96, inclusive.
CONNOR	"THE MISSION AND COMPOSITION OF A MECHANIZED FORCE", - by Major General Wm D. Connor, March 13, 1930. (C & GSS mimeograph).
EBR	"ANNUAL REPORT, THE ENGINEER BOARD". Published by the Engineer Board at Fort Humphreys, Virginia. Year of publication as indicated in specific reference.
EFM	"ENGINEER FIELD MANUAL". United States Government Printing Office, 1932.
EIMANNS- BERGER	"MECHANIZED WARFARE", - by Ludwig Ritter von Eimannsberger, General of Artillery (Retired) (Austria). Published by J.F. Lehmanns Verlag, Munchen, 1934. Translated from the German by Army War College, Washington, 1935.
EUSTIS	"CONSOLIDATED REPORT OF OPERATIONS", - Headquarters Mechanized Force, Fort Eustis, Virginia; July 1, 1931.
FITZPAT- RICK	"MECHANIZATION AND DIVISIONAL ENGINEERS", - by Brevet Lieutenant Colonel N.T. Fitzpatrick. Royal Engineers Journal (Great Britain), Volume 45, March-December 1931.

FOWLE "THE R.E. PROBLEM OF THE TANK BRIGADE", - by Major F.E. Fowle. Royal Engineers Journal (Great Britain), Volume XLII, June 1935, pages 215 to 226.

FSR "FIELD SERVICE REGULATIONS, UNITED STATES ARMY, 1923". Government Printing Office, Washington, 1924.

FSR III "LECTURE ON F.S.R. III; OPERATIONS BETWEEN MECHANIZED FORCES", - by Major General J.F.C. Fuller (Great Britain). Published by Sifton Praed & Company, London, 1932.

FULLER "ONE HUNDRED PROBLEMS OF MECHANIZATION", - by Colonel (now General) J.F.C. Fuller. Army Quarterly (Great Britain), Volume 19, October 1929- January 1930.

GMA "G-2 REPORT NUMBER 12,519", dated November 22, 1932. Germany (MA). Lieutenant Colonel W.S. Wuest, Military Attachee in Berlin, Germany.

G.O. 9 "GENERAL ORDERS NO 9". War Department, September 11, 1933.

KING "MECHANIZATION IN THE ARMY", - by Brigadier General Edw L. King, Assistant Chief of Staff (G-3). 1931. G & GSS mimeograph.

MCLU "MANUAL FOR COMMANDERS OF LARGER UNITS", Volume 1 (Operations). Government Printing Office, Washington, 1930.

MFB BOARD OF ENGINEER EQUIPMENT; Report of Mechanized Force Board, October 1, 1928; Section IV.

MIL ENGR "THE MILITARY ENGINEER", - Bi-monthly periodical published by the Society of American Military Engineers, Washington. Issues as noted in specific references.

RD REFERENCE DATA, 1935. With changes to include February 8, 1936. Publication of the Command and General Staff School, Fort Leavenworth, Kansas, and used for instructional purposes at that school.

RILEY "CAVALRY MANEUVERS, FORT RILEY, MAY, 1934". Publication of the Cavalry School, Fort Riley, Kansas.

ROBINSON "SOME ASPECTS OF MECHANIZATION", - by Colonel H. Rowan-Robinson (Great Britain). Wm Clowes & Sons, London, 1928.

RUSI JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION (Great Britain). Issues as noted in specific references.

STAMPS "THE ENGINEER UNIT IN A MECHANIZED FORCE". Report of Company C, 1st Engineers, to the Commanding Officer Experimental Mechanized Force, Fort Leonard Wood, Maryland; dated October 11, 1928.

TBA TABLE OF BASIC ALLOWANCES, ENGINEERS. War Department, May 14, 1930.

TEC "THE TACTICAL EMPLOYMENT OF CAVALRY (TENTATIVE)". Published by the Command and General Staff School, Fort Leavenworth, Kansas, and used as a text at that institution. Volume IV (1932); Volume VIII (1935).

T/O TABLES OF ORGANIZATION, 1932. With changes to include February 8, 1936. Publication of the Command and General Staff School, Fort Leavenworth, Kansas, and used for instructional purposes at that school.

TR TRAINING REGULATIONS. War Department, Washington. Sections as noted in specific references.

TROWLAND "ENGINEERS IN CAVALRY MANEUVERS" - by Captain G.B. Trowland, C.E. Cavalry School Mailing List, Fort Riley, Kansas; Volume VI, Number 2, March 15, 1932, pages 79 to 80.

T & T ENGRS "TACTICS AND TECHNIQUE OF ENGINEERS (TENTATIVE)". Published by the Command and General Staff School, Fort Leavenworth, Kansas, 1935, and used as a text at that school.

The views of the following officers have been obtained in connection with one or more phases of the assigned subject, and due consideration has been given their statements. Although no attempt has been made to summarize their contributions, the author is indebted to them for many valuable suggestions, particularly as to certain practical considerations not obtainable in written sources:

Lieutenant Colonel Richard U. Nicholas, Corps of  
Engineers.

Lieutenant Colonel Peter C. Bullard, Corps of  
Engineers.

Major Robert W. Grow, Cavalry.

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Major Wayland B. Augur, Cavalry.

Major Lewis A. Pick, Corps of Engineers.

Captain Clarence L. Adcock, Corps of Engineers.

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Captain Richard Lee, Corps of Engineers.

Captain Robert G. Lovett, Corps of Engineers.

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