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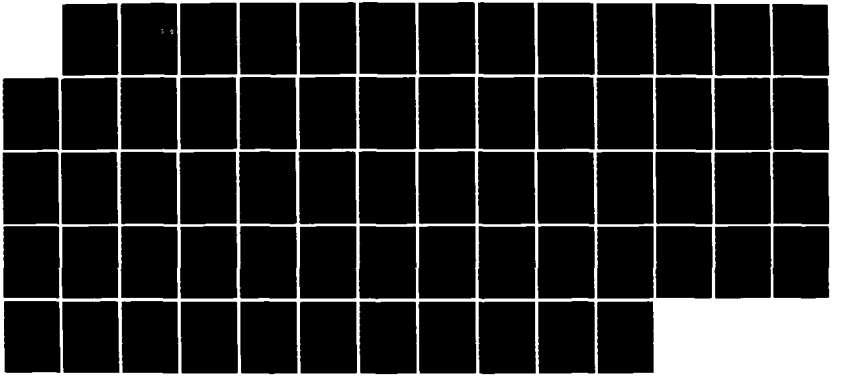

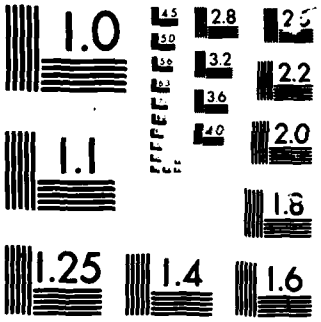

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COMMAND AND CONTROL RELATIONSHIPS AND ORGANIZATION OF ENGINEER SUPPORT TO THE HEAVY DIVISION

by

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Fort Leavenworth, Kansas

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This study is an analysis of the command and control (C2) and organization of divisional and corps engineer units which provide engineer support to the AOE heavy division. The paper assumes that the US Army operations across France and Germany during 1944-45 offer many examples of the style of combat relevant to ALB. Given that assumption, the paper analyzes WW II engineer organizations and C2 doctrine, the actual practices of commanders and engineers during WW II, and recommendations for improving engineer C2 doctrine made by the General Board which met immediately after the war. From this analysis, characteristics of adequate engineer C2 and organization to support the division are derived.

Having established these characteristics, the paper then compares them to current engineer C2 doctrine and organization. This exposes several deficiencies which are then viewed in light of ALB and its attendant changes.

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Finally, recent initiatives which offer possible solutions to the deficiencies of current engineer C2 doctrine are addressed. The paper ends with five conclusions. They are, 1) the Division Engineer needs to command more engineers to support his normal functions, 2) maneuver commanders within the division need to have a "more than habitual" relationship with their supporting engineers, 3) engineers at all levels must retain flexibility and be flexible simultaneously, 4) engineers fight as infantry more often than we realize, and 5) engineer units within the division must be capable of independent operations.

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ABSTRACT

COMMAND AND CONTROL RELATIONSHIPS AND ORGANIZATION OF ENGINEER SUPPORT TO THE HEAVY DIVISION, by Major Scott B. Cottrell, USA, 57 pages.

This study is an analysis of the command and control (C2) and organization of divisional and corps engineer units which provide engineer support to the AOE heavy division. The paper assumes that the U.S. Army operations across France and Germany during 1944 and 1945 offer many examples of the style of combat relevant to ALB. Given that assumption, the paper analyzes WW II engineer organizations and C2 doctrine, the actual practices of commanders and engineers during WW II, and recommendations for improving engineer C2 doctrine made by the General Board which met immediately after the war. From this analysis, characteristics of adequate engineer C2 and organization to support the division are derived.

Having established these characteristics, the paper then compares them to current engineer C2 doctrine and organization. This exposes several deficiencies which are then viewed in light of ALB and its attendant changes. Finally, recent initiatives which offer possible solutions to the deficiencies of current engineer C2 doctrine are addressed. The paper ends with five conclusions. They are, 1) the Division Engineer needs to command more engineers to support his normal functions, 2) maneuver commanders within the division need to have a "more than habitual" relationship with their supporting engineers, 3) engineers at all levels must retain flexibility and be flexible simultaneously, 4) engineers fight as infantry more often than we realize, and 5) engineer units within the divisin must be capable of independent operations.

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SECTION I INTRODUCTION

In 1982, the United States Army completed its doctrinal transition from the Active Defense to AirLand Battle (ALB) with the publication of Field Manual 100-5, Operations. Accompanying the switch to ALB are many doctrinal, equipment and organizational changes within the division. New items of equipment such as the M1 tank and the M2 infantry fighting vehicle, new organizations such as the Combat Aviation Brigade (CAB), new concerns such as Deep Battle and Rear Battle, and a renewed interest in maneuver all have implications for the command and control (C2) of the Heavy Division and its supporting elements.

The Engineer C2 relationships and organization supporting the Heavy Division have not changed appreciably with that transition, albeit many new items of equipment and minor organizational changes have been incorporated into divisional and supporting corps engineer units. The purpose of this paper is to determine if the current C2 relationships and organization of the divisional engineer battalion and those corps engineer units that will support the Heavy Division are adequate. A historical review and analysis of current engineer doctrine place that adequacy in doubt.

The paper will first look at C2 of engineers supporting the division in the European Theater of Operations (ETO), World War II. This theater offers many examples of the style of combat relevant to ALB. Field Manuals (FM) from 1943 with changes through 1944 provide much of the doctrinal information, while after-action reports and unit histories yield actual practices from both the corps' and division's perspective.

Immediately after the war, the General Board, U.S. Forces, Euro-

pean Theater (USFET) met in Europe and recommended changes to U.S. Army and engineer doctrine and structure. A review of these recommendations combined with lessons gained from actual experience will reveal several trends or characteristics indicative of adequate engineer C2 and organization to support the division. Though both infantry and armored divisions are studied, the emphasis will be on armored divisions which more closely resembled the Heavy Divisions of today.

An analysis of current C2 of engineers supporting the Heavy Division and subsequent comparison to the trends derived from World War II (WW II) will highlight areas of concern. A look at the implications of ALB and its attendant organizations, equipment and directions will further emphasize and add to those problems. The paper will then look at current initiatives and contemporary examples of engineer C2 from other countries, which if incorporated into U.S. doctrine could reduce these inadequacies. The repitition of WW II inadequacies in current doctrine, and the exacerbation of those problems due to ALB result in their repeated exposure in this paper.

Finally, the paper will draw conclusions from its comparison of the characteristics of adequate engineer C2 and organizations with current engineer C2 doctrine, implications of ALB, and recent initiatives.

The following limitations and assumptions affect the applicability of this paper:

1) The concepts discussed pertain to a mid-high intensity conflict, which because of the nature of modern warfare may be very short and violent.

2) The Army of Excellence (AOE) TOE is in effect.

3) Engineer support to Light Divisions, including Airborne and Air

Assault, is not addressed.

4) Detailed C2 relationships of river crossings, reorganization as infantry, and amphibious landings are excluded.

5) The adequacy of engineer communications equipment is not addressed.

6) The campaign waged by the U.S. Army across France and Germany during 1944-1945, offers many examples of the style of combat relevant to ALB.

SECTION II WORLD WAR II

A. DOCTRINE

During WW II, the Army consisted of Army Ground Forces, Army Air Forces, and Army Service Forces. The engineer units that served these different elements were classified as either combat or service units, depending on their particular mission.[1] Ground Forces had both engineer units, combat, (e.g. Engineer Combat Battalion at corps) and engineer units, service, (e.g. Engineer Light Equipment Company) working for them. Army Air Forces also had both types of engineer units working for them, such as the Engineer Aviation Battalion and the Engineer Aviation Topographic Company. Army Service Forces had only service units working for them, such as the Port Construction and Repair Group.[2] Engineer Construction Battalions, the equivalent of today's Combat Heavy Battalion, were assigned to Construction Groups working in the COMMZ or zone of the interior as service units.[3]

At corps level, the engineer section was known as the Corps Engineer Command. At the start of the war, the Corps Engineer had a small staff and commanded all engineer units assigned or attached to the corps and its subordinate groups.[4] In 1944 doctrine changed, relegating

the Corps Engineer to a mere staff officer who did not command the Engineer Groups at corps level, but simply transmitted the orders of the Corps Commander to the Group Engineers.[5] The Corps Commanders did not uniformly follow this change.[6] The Corps Engineer did not command the divisional engineer units but could inspect them for technical matters and require technical reports.[7]

Subordinate to the Corps Engineer Command were Engineer Combat Group Headquarters (HQ), usually two or more depending on the number of divisions attached to the corps. These tactical HQs were normally attached to the corps.[8] Commanded by a colonel, each group consisted of two to six attached Engineer Combat Battalions and attached smaller units. Typically it had three combat battalions, a maintenance company, an equipment company and ponton bridging assets.[9]

The Engineer Combat Battalions (Engr Cbt Bn) were to provide the bulk of corps engineer support to the division. They could work in division service areas, reinforce divisional engineers, or relieve them, freeing them to work closer to the front.[10] Doctrinally, the corps Engr Cbt Bns were to support forward divisions without being commanded by them. Specific limits of work were to be given and liaison established with the Division Engineer. However, the doctrine writers did foresee the attachment of corps engineers to the division during pursuits, river crossings and attack of organized positions. In that event, corps engineer units would be attached to the divisional engineer battalion even though the corps engineer battalion commander might have been senior.[11]

Work assignment at any level was based on the following conditions:[12]

1) Area-responsible for all engineer work in a geographic area

2) Task-responsible for doing one or more specific tasks.

3) Combination-responsible for an area with emphasis on a particular task in that area.

4) Attachment-similar to today's concept.

5) Support-a task assignment in which the engineer commander responds to the requests of the supported commander.

The engineer commander retained command of his assigned engineers in all but attachment.

The divisional engineer battalion in the infantry division consisted of a battalion HQ, a HQ and service company, and three line companies of three platoons each. The divisional and corps Engr Cbt Bns were identical (see diagram 1).[13] Within the division, an engineer platoon supported an habitually associated Regimental Combat Team (RCT). That platoon was habitually backed up by its parent company.[14] During combat, engineer line companies were frequently to be placed in support of habitually associated RCTs.[15] There were occasions when engineers were to be attached to maneuver units, such as to the covering force and flank guard during the advance, to lead infantry elements in the attack, or to encircling forces during a pursuit. However, generally engineers in the infantry division were to remain in support of maneuver units or under the direct control of the Divisional Engineer (Div Engr).[16] The divisional engineer battalion commander was the Div Engr. The division received additional engineer support from corps as required.

Initially, the Armored Engineer Battalion (Arm Engr Bn) of the armored division consisted of a battalion HQ, a HQ and service company, four line companies and a bridge company (see diagram 2)[17], but LTG Leslie McNair, the Commander of Army Ground Forces in 1943, trimmed it to

three companies and moved the bridge company to corps.[18]

The armored division's Treadway Bridge Company had originally been included in the Arm Engr Bn because force designers realized that the armored division would be operating long distances from corps with need of rapid response.[19] However, due to LTG McNair's influence, bridge companies were pooled at corps level for efficiency's sake yet designed to be attached to armored divisions for river crossings.[20] Doctrine called for an engineer company from the Arm Engr Bn to be attached to each brigade-sized Combat Command (CC) in the division because of anticipated independent operations.[21] Company training emphasized working as a member of the various armored combat teams that might be put together within the division or CC.[22] The Div Engr was then free to use the rest of the Arm Engr Bn to reinforce the engineers in the CCs as he deemed necessary.[23] As with the infantry division, the armored division received additional engineer support from corps as required.

Such were the doctrinal relationships of the corps and divisional engineer units in the ETO during 1944-1945. Though there was some evolution in those relationships, such as moving the Treadway Bridge Company to corps or making the Corps Engineer a staff officer, they did not necessarily reflect reality. Doctrine consistently lagged behind reality or never even caught up. In fact, engineer doctrine was the most neglected of the combat arms' during WW II.[24]

B. AS PRACTICED

In both the corps and division, actual C2 relationships and practices were often different than doctrine indicated. A look at VII and XIX Corps will reveal how at least two different corps perceived the situation and how they dealt with it.

Both VII and XIX Corps preferred to leave their Corps Engineer in the direct chain of command over the attached Engineer Groups. From the perspective of the Corps Engineer, two general trends or guidelines for supporting attached divisions can be drawn. The first trend surfaced soon after the beaches of Normandy and was that the divisional engineers simply did not have the resources to complete all that was asked of them.[25] This forced the Corps Engineers to continually push support forward. Typical of this was VII Corps supporting each division as it advanced to the Ardennes with a battalion from the groups at corps.[26] Prior to that, VII Corps engineers built and maintained roads to the front line RCTs while divisional engineers worked in front of them.[27] XIX Corps placed the 246th Engr Cbt Bn in support of the 30th Infantry Division to work on Bailey bridges in front of the infantry in June 1944.[28]

The list goes on and on. Suffice it to say, that the Corps Engineer continually pushed engineer support forward for the divisions. In VII Corps, an Engr Cbt Bn was normally put in support of each division in contact. That battalion commander worked for his group commander but established contact with the supported Div Engr and answered his requests for assistance.[29] In XIX Corps, an engineer group normally supported a front line division. Any requests for engineer support from the corps units went through the Div Engr and then to the supporting engineer group.[30] In both cases, the Corps Engineer (Corps Engr) recognized the paucity of engineers organic to the division.

The second trend was that of retaining flexibility or the capacity to influence the situation. Both the VII and XIX Corps Engrs preferred placing corps engineer units in support of divisions rather than attaching them. This allowed them to retain command of the units and to

react to unexpected situations or reinforce as necessary.[31] Previous examples showed that although corps engineer units were well forward supporting the divisions, they were often not attached. They were commanded by their groups or the Corps Engr, and ostensibly coordinated by the Div Engr.

Though doctrine called for the Div Engr to be responsible for all engineer activity in his area, this was frequently not the case. Many times he merely passed requests on to a group engineer. In the case of large river crossings he became a participant in an operation planned jointly by the Group and Div Engrs, with the Group Engr setting up his command post near the division's command post.[32] Engineer work lines separating divisional and corps engineer effort were often forward of the division rear tactical boundary,[33] thus mingling division and corps units without unity of command. It was not unusual for corps engineer units to perform specific missions forward of the work line. VII Corps believed that this type of system worked only because the divisional and corps engineer battalion commanders were capable and cooperative.[34]

A notable exception to the second trend was the realization that some missions required the attachment of corps engineers to divisions. This seemed to be more prevalent in XIX Corps than VII Corps. XIX Corps realized that special missions such as river crossings, heavy minefield breaches, or a wide envelopment by a CC often involved attachment.[35] VII Corps understood that on occasion it could be advantageous to attach their units to the divisions, as they demonstrated by attaching the 1106 Engr Group (-) to the 4th Infantry Division to build bridges across inundated areas on the Normandy beachhead.[36]

So while circumstances forced the Corps Engrs to push a great

amount of engineer support forward, they felt the need to retain flexibility by assigning support missions to the corps Engr Cbt Bns, in lieu of attaching them to the supported unit. Special missions or situations could dictate attachment, but that was not preferred. The divisions and the Div Engr had an entirely different outlook on corps engineer support to the division and engineer support within the division. The 4th, 6th, and 7th Armored Divisions are used as representative examples.

The Div Engr did agree with Corps Engr on at least one thing; that the division simply did not have the assets to accomplish all its assigned engineer tasks. The three engineer line companies were inadequate for mobility missions, not to mention their secondary role as infantry.[37] This was especially true in the armored divisions. In the XIX Corps, Engr Cbt Bns were heavily involved in bridge building operations up front.[38] During Operation Cobra, VII Corps placed both of their Engr Groups in support of front line divisions.[39] River crossings were especially demanding, with the divisional engineers usually building the footbridges and conducting assault crossings while corps engineers built the heavier class bridges.[40] These and the previous examples all pointed to the need for frequent and substantial reinforcement of the divisional engineers.

Not only did the Div Engr need more engineers, he also felt that he habitually needed the same ones attached from corps. Corps commanders soon found that what they gained by shifting non-divisional units between divisions to maximize output, they lost in confusion and unfamiliarity with procedures and people.[41] Contrary to the Corps Engr's perception, in France in 1944 it was common for corps engineer units to be attached to the front divisions for long periods of time, often with habitual associations.[42] Treadway Bridge Companies were attached

for extended periods, as long as 45 days in the 6th Armored Division. Corps Engr Cbt Bns were occasionally attached for periods of 3-15 days in the 6th.[43] The 4th Armored Division's 24th Arm Engr Bn usually had the 995th Engr Treadway Bridge Company attached to it during combat.[44] It was also common for corps engineer units to be sub-attached to CCs and RCTs.[45] When the 6th Armor Division crossed the Our River in February 1945, it had two corps Engr Cbt Bns attached to its CCA and a corps Engr Cbt Bn and a divisional engineer company attached to its CCB.[46] It is quite evident that WW II divisions not only wanted more engineer support from corps, but they also wanted it habitually associated and attached. Once they got them, the divisions did not like to give up their attachments.[47] Though the Corps Engrs spoke of retaining flexibility, they often had to sacrifice much of it in order to adequately support the divisions.

Within the division itself, engineer support to the committed RCTs and CCs was not always doctrinal either. As stated above, the Div Engr needed more engineer support from corps, preferably attached with habitual associations. The Div Engr seems to have employed his organic divisional engineers and often these attached corps engineers in a manner that continued the push of engineers forward. This resulted in engineer elements consistently employed at lower levels and with different relationships than the doctrine writers had originally conceived.

The regiments in the infantry division were generally configured into RCTs with their slice of engineers either attached or placed in support of their associated RCT.[48] Whether a platoon or company of engineers, this was not too far from doctrinal. The armored division was a different matter.

The armored division usually operated in brigade-sized, combined arms units known as Combat Commands, or CCs, which often included an attached engineer company. This was true for both the old heavy type, comprised of two armored regiments, one infantry regiment and artillery, and the light armored division comprised of three tank, three armored infantry, and three field artillery battalions. The heavy armored division normally split into a CCA and CCB with a reserve frequently designated as the CCR. The light divisions always organized into CCA, CCB, and CCR. A CC typically operated in two task forces with an engineer platoon attached to each task force.[49] This was a subtle but important difference from doctrine, which called for an engineer company normally to be attached to the CCs, but not further sub-attached.

In the 4th Armored Division, an engineer platoon attached to a task force would frequently build bridges at night in front of the tanks, and sweep mines with the infantry during daylight.[50] That kind of cooperation over often wide and divergent routes would have been hard to coordinate at a higher level under a support relationship.

The 6th Armored Division usually attached one engineer company to each CC, generally the same one. Although they sometimes weighted a CC with more than a company, or practiced economy of force by reducing a CC's engineer support to a platoon,[51] it was obvious that the guiding principle of engineer support within the division was the attachment of an engineer company to its habitually associated CC. But the 6th went one step further. Their standard procedure called for the formation of two or three combat teams (Bn TF size) per each CC, with an engineer platoon attached to each.[52] The habitual relationship within the 6th was so strong, that when a CC was cross-attached to another corps it usually took its slice with it, including engineers.[53]

The 7th Armored Division fielded six task forces from its CCs, each with its own engineer platoon for enhanced mobility.[54] After the 7th's reconstitution during the Battle of the Bulge, they trained in teams comprised of a tank platoon, an infantry company, and small engineer elements, pushing engineer support even farther down. These teams were designed for the offensive, travelling over road and trail to get to the enemy's rear where they disrupted and surprised them.[55] The concepts of area, task, or support assignment obviously did not facilitate that type of activity.

A review of 14 representative operations conducted by the 14 armored divisions assigned to the ETO during WW II reveals that over 95% of the time, the CC's task organizations included an attached engineer company or more. It was more almost 10% of the time. Those same operations show that over 90% of the time the CCs further sub-attached at least an engineer platoon to battalion-sized task forces.[56]

The preceding examples show that the Div Engr followed the doctrinal method of attaching one engineer company to each CC. However, they also show much more. They show that the required support for a CC was consistently a company or more. They show a habitual relationship between that engineer company and the CC that could transcend the boundaries of the parent division. Finally, they show that attached engineer support did not stop at the CC level, but reached lower, such that the Div Engr and CC commander normally sub-attached engineer platoons to task forces and even company-sized teams.

From the division point of view, several discernible trends manifest themselves when considering adequate engineer C2 and organization of the division. First, the Div Engr consistently needed more engineer support from corps to complete all his tasks. Second, he preferred that

support be habitually associated and attached to him. Finally, the Div Engr exceeded the bounds of doctrine which called for an engineer company attached to each CC by pushing his organic and often attached engineers down to task force level and lower. This provided rapid response to engineer requirements.

Two other factors which influenced engineer support to the division need to be addressed. The first of these was the ability to adapt to varied and abnormal missions and task organizations. This was perhaps akin to the Corps Engr's desire to retain flexibility by keeping a "string" on his units, but was also appropriately described as being flexible. The C2 and organization of engineers at both corps and division had to include the ability to be flexible.

It was very common for corps Engr Cbt Bns to work on division and corps tasks simultaneously.[57] During the St.Lo breakout, the VII Corps put a corps battalion on each of four MSRs to repair them while maintaining contact with the front infantry units with their forward reconnaissance elements.[58] XIX Corps conducted very similar operations when they created special engineer task forces to maintain roads and facilitate movement of 2d Armor Division. These task forces trailed the division's lead elements. Another time they formed a task force of the 82d Engr Cbt Bn, the 992d Engr Treadway Bridge Company and 1st Plt, 512th Light Ponton Co to help the 7th Armored Division clear out the enemy west of the Meuse River.[59]

The divisional engineers required similar flexibility. In January, 1945, the 7th Armored Division's engineers reconnoitered 1600 miles of roads and trails, supported the division with logistics and training, swept mines and hauled away mountains of snow.[60] The Div Engr also had to be adaptable to rapidly changing task organizations. In February

1945, elements of Co C, 24th Arm Engr Bn, 4th Arm Div, supported the 5th Infantry Division in a river crossing.[61] Previously cited examples of corps units attached to the divisional engineer battalion, and even CCs and lower, demonstrated the need for unit engineers at all levels in the division to be able to accept extra engineer support. At both the corps and division, the unusual or special engineer task organization and the ability to expand rapidly usually involved some sort of HQ or semblance of a staff on which to build.

The second additional factor that influenced engineer support to the division was fighting as infantry. Though it may not be widely recognized in today's Corps of Engineers, fighting as infantry in WW II was not a sometime thing for only the most forward engineer elements. On the contrary, not only were divisional engineers frequently thrown into the fracas, but corps engineer units often made the transition, too, such as in the Ardennes.

In the divisions, fighting as infantry and performing engineer missions apparently fused on the front lines as task forces and teams including engineers were in constant contact with the enemy. But this was usually on an individual or very small unit basis. Because of the often dispersed nature of the CCs and subordinate maneuver elements, a divisional engineer battalion was not frequently called upon to fight as an infantry battalion. Company commanders and platoon leaders had to be able to operate independently.

Though not always on the front, corps engineer units frequently found themselves masquerading as infantry, sometimes planned well in advance and sometimes quite unexpectedly. When Hitler launched his Ardennes Offensive, some of the earliest defenses it ran into were corps engineers:

> Many of the units along the front were corps and army engineer battalions, scattered throughout the area in company, platoon and even squad sized groups. Engineers, who had been engaged in road maintenance and saw milling, suddenly found themselves manning road blocks and preparing defensive positions... [62]

The exploits of the 291st Engr Cbt Bn are famous in this regard.[63] In a rare instance in which a divisional engineer battalion fought as an infantry battalion, on 17 December 1944 the 106th Infantry Division told LTC Thomas Riggs to form up his divisional 81st Engr Cbt Bn and the 168th Engr Cbt Bn from corps and set up defensive positions east of St. Vith.[64] Roles could and did rapidly change.

Corps engineer units were frequently very deliberately reorganized as infantry to assume particular missions. In VII Corps, all corps Engr Cbt Bns were eventually used as infantry. From 29 September to 22 October 1944, VII Corps replaced an RCT on the front lines near Aachen with its 1106th Engr Cbt Group and attached artillery units.[65] The XIX Corps had similar experiences with reorganizing engineers as infantry. When they created an infantry battalion from an engineer battalion, they normally attached it to a division. If two or more corps battalions were reorganized, corps put them under a group HQ and gave them a sector under Corps Engineer Command.[66] On 11 October 1944, XIX Corps reorganized the 246th Engr Cbt Bn as infantry and attached it to the 30th Infantry Division to help them encircle and take Aachen.[67]

At first glance, reorganization as infantry would seem to have little to do with adequate engineer C2 and organization supporting a division. However, in many instances those corps engineer units that made the transition to infantry were already in the division's area of responsibility, but commanded by non-divisional HQs. To transfer the command of a corps engineer unit to a division while concurrently

reorganizing as infantry, or to send a corps Engr Cbt Bn recently reorganized as infantry into a division's sector, would seem to be confusing at best. It would be better if those corps engineer units normally found in the division area were already part of that division or habitually attached to it, being intimately familiar with the current situation and the procedures and personalities of the division.

C. GENERAL BOARD

Immediately after the war, the U.S. Army convened the General Board, U.S. Forces, European Theater (USFET). Made up of high ranking officers and experts in their fields, this group of men met to determine how we fought WW II, and how to improve upon that. They studied each branch and special function in depth. As far as this paper is concerned, four of the 132 studies are very relevant.These are the Organization, Equipment and Tactical Employment of the Infantry Division, the same for the armored division, Engineer Organization, and Engineer Tactical Policies. As stated in the study on engineer organizations, " The purpose of this study is to determine the most effective organization for future operations"[68]. This, indeed, was the purpose of all the studies.

At corps level, the fixed engineer regiments of North Africa had given way to the tactical Engr Cbt Group HQ, with its attached Engr Cbt Bns and smaller units. These battalions were very independent which increased their flexibiltity and enhanced their effectiveness in WW II's fluid nature.[69] The board recommended that the independent nature of the Engr Cbt Bns be maintained, i.e., capable of short, self-sustained, independent operations. However, they also thought that the term, Regiment, should be used instead of Group, to allow engineers to

identify with a numbered unit of long standing and tradition. The regiment was to be a loose organization whose HQs would have tactical and administrative control of the battalions, without wresting the battalion's independent quality from it.[70]

At the division level, the board recognized what the corps and division engineers and commanders found out soon after Normandy: the divisional engineer battalion was simply inadequate to the task.[71] They realized that each division in the ETO, be it infantry or armor, required at least two engineer battalions working in its sector to complete all its engineer tasks. Normally, this was the divisional battalion and an Engr Cbt Bn from corps.[72] Within the infantry division, the corps battalion was often in support of the division, but not attached. Therefore, personalities determined the amount of control exercised by the Div Engr. In the armored division, quite often the corps battalion was attached, but had different types of vehicles than the Arm Engr Bn[73] and could not keep up with the rapid pace of the action. In many instances, three battalions actually worked in the division's area.[74]

This shortage of engineers at the division was the source of many problems for the Div Engr throughout the war. The board found that the Div Engr's were held responsible for all the work in their area, but did not always command nor even control the engineers performing the work. According to the board, "Responsibility without authority is unsound in principle and should not be allowed to exist at any echelon".[75] The board believed that the Div Engr should have all the engineer assets that he normally needed under his permanent command, with special requirements getting added support.[76]

Other deficiences resulted from the division's lack of sufficient

engineers. As the Div Engrs pushed their organic assets forward to support the CCs and, to a lesser degree, the RCTs , their shortage was exacerbated. This forced the corps to push their engineer support forward. This often required the field army to push their engineer assets forward to support the corps, and occasionally the divisions. Thus, large numbers of engineers from several different echelons were mixed in the division's area, without definite unity of command.[77]

Teamwork suffered as a result of pushing units forward. This is not to say that the support should have been withheld, but that perhaps a better arrangement was needed. Corps usually supported a division with an Engr Cbt Group or Engr Cbt Bn. The corps battalion or group then sent a Liaison Officer to the Div Engr to coordinate the effort. If the parties disagreed, the LNO would call back to his battalion, group, or even Corps Engr Command for a decision.[78] Even if both sides were cooperative, unfamiliarity with procedures and personalities hampered teamwork. Often Corps Engr Command or a corps Engr Cbt Group planned special operations such as a river crossing, even though the Div Engr knew the terrain and his division best.[79]

Attempts to alleviate some of the confusion between corps and divisional engineer units, such as the Engineer Work Line (EWL),were not totally successful. EWL's did not normally coincide with administrative boundaries between units, such as between corps and division, or between division and CCs or RCTs .[80] This required higher echelon engineer units to coordinate with multiple HQs to perform one task in a division area. The need to send corps units forward of the EWL to conduct specific task assignments such as installing a minefield or building a bridge, accentuated this problem.

One other deficiency created by the division's lack of engineers

was the failure of the division to integrate the supporting corps battalions into division security plans.[81] In fact, they could not do otherwise given the corps' reluctance to attach battalions to the division, especially the infantry divisions. This failure was intrinsically critical when the time came to reorganize as infantry.

One of the more interesting observations of the board was that the engineer company supporting an RCT was often underworked and took away from the Div Engr's flexibility. Most on the board felt that engineers should not be organic to the RCT because they would be too close to the front and take too many casualties.[82] This contradicted the board's own observation that divisions frequently formed infantry-armor-engineer teams to advance during hedgerow fighting.[83] It is also contrary to the armored division's predilection and apparent acceptance by the board to attach an engineer company from the divisional engineer battalion to the CCs, and the CC's tendency to further sub-attach those elements to task forces and even company-sized teams.[84]

Although each individual on the board had his own observations and lessons learned from WW II and recommendations were not always unanimous, they were able to reach a consensus on several issues concerning adequate engineer C2 relationships and organizations that support the the division.

As stated above, the board recommended engineer regiments to supplant groups at corps level. These consisted of three attached, independent battalions, separate companies, and bridging.[85]

The board set down some basic principles by which a unit engineer, including the Div Engr, should guide his actions. First, the board recognized that the unit engineer must command all engineer troops under direct control of his HQs. Second, they realized that the unit engi-

neer will normally have both command and staff responsibilities. Finally, they saw the need for the unit engineer to be responsible for all engineer operations in his area. For assigned and attached units this was no problem. But for other engineer units working in his area, the board felt the unit engineer should be able to plan for their use, coordinate their work and check it, and coordinate the administration of those units with his own.[86]

Probably the most dramatic recommendation the board made was to increase the size of the organic divisional engineers from a battalion to a regiment. For both the infantry and armored divisions, they recommended an engineer regiment with two dependent battalions (as opposed to the indpendent ones for corps regiments) and a regimental HQ and service company. Based on their observations as shown above, it would take at least that much engineer support to meet the normal and heavy equipment requirements of the division.[87] Not only had actual combat demonstrated this need, but the Army Engineers of 1st, 3rd, 7th, and 15th Armies all supported this move.[88]

The proposed regiment was to have consisted of two each, 615-man battalions, with a total of 1443 personnel in the regiment (see diagram #3).[89] Each battalion was to have a HQ detachment and three line companies, three platoons per company and three squads per platoon. A small amount of bridging was to be located in the regimental HQ.[90] The concept allowed for special engineer units to be attached to lower engineer commanders, facilitating a better defined command structure.[91] This concept also allowed the Div Engr to put a battalion HQs with a CC or RCT, permitting rapid expansion of engineer support to that maneuver element.

The Engineer Tactical Policies study maintained that terrain more

than size of unit should determine the number of engineers attached to or supporting a maneuver unit. They recommended against a standard complement of engineers in the combat team or task force.[92] Noticeable by its absence from this admonition is the Combat Command. Though no one recommended assigning an engineer company to each CC, the board apparently accepted the doctrinal practice of attaching one to it. However, they obviously disdained the further sub-attachments commonly made to task forces and lower in the armored division.

As mentioned earlier, unanimity did not always exist within the board. In November 1945, a distinguished group of officers met and listened to the board's recommendation for an engineer regiment to be the armored division's engineer element. This body believed that a single engineer battalion consisting of a HQ and service company, four line companies, and a bridge company would more efficiently eliminate the shortage of engineers in the armored division.[93] The board then accepted this suggestion in its recommendations. At this point, two items need to be addressed. First, after reviewing historical data it is obvious that the armored divisions did, in fact, normally need two or more engineer battalions to accomplish all the engineer tasks assigned to them. In a fast paced war such as WW II could be, perhaps the maneuver unit commanders lost sight of all the furious engineer activity to their rear and flanks, yet within the division's boundary. Second, the divisions of today carry with them much more baggage than the streamlined armor divisions of WW II. Cumbersome though it may be, this burgeoning staff and logistical baggage is necessary and requires engineer support.

In summary, the General Board made four primary recommendations. First, they felt that the Engr Cbt Group at corps level should be re-

placed with the regiment, consisting of attached independent battalions and smaller units. Second, they recommended that the division get a two battalion regiment as its organic engineer element (questionably amended to one battalion for the armored division). Third, they recommended that the Div Engr be made responsible for all engineer operations in his area by giving him the authority to command or control those units working for him. Finally, they implicitly expressed concern for retainning flexibility at both corps and division by their desire for independent battalions in the corps regiments, and their hesitancy to assign engineers to RCTs and task forces.

D. CHARACTERISTICS OF ADEQUATE ENGINEER C2 AND ORGANIZATION FROM WW II

The United States entered WW II with engineer C2 doctrinal relationships and organizations. These were soon found to be wanting when put into actual practice in France and Germany during the period from June 1944 to May 1945. Unit engineers and commanders corrected some of these problems under fire by using their engineers as they best saw fit, within the constraints imposed upon them. They were unable to correct some problems, living with the system as best they could. After the war, the General Board formally recognized many of these problems and offered recommendations to incorporate both the methods used by the divisions during the war and suggested improvements for those problems the units could not entirely eliminate. When analyzed, these practices and subsequent recommendations yield several lessons. These lessons can then be lumped into six broad trends or characteristics which are indicative of adequate engineer C2 relationships and organization to support the division.

The first characteristic was that of "more". Corps and Div Engrs

saw very early on that the divisional engineer battalion simply could not adequately support the division. This was not a sometime thing, but a constant, requiring corps to continually push groups and battalions forward to meet the need. The board recognized this when they recommended an engineer regiment be organic to the division.

The second characteristic was what one might call, "more than habitual" association between corps and divisional engineer units. Not only did the divisions need more support, but to be effective that support had to have an appreciation for the procedures and personalities of the division it supported. This was only obtained through the attachment of corps units to the same divisions. Anything less than attachment created confusing and conflicting command structures in which the Div Engr often took the back seat. The division's reluctance to give up attached engineer units is indicative of this. The board's divisional engineer regiment and admonition that the Div Engr command all the assets that he normally needed also supported this concept.

The third characteristic was that of the Div Engr attaching his organic and often attached engineers to the subordinate maneuver units in the division. Both the rapid pace of the war and the great distances between maneuver units such as the CC dictated that engineer support be pushed down to respond to the requirements of the CC commander right then, not later. Doctrine provided for an engineer company to be attached to each CC, actual combat demanded it, and the board approved it, although they did not favor a standard engineer element with RCTs or task forces. However, combat also showed the need for a somewhat standard engineer element at the task force level, normally a platoon or more. The CCs and task forces needed "more than habitual" relationships at their level, too, to insure effective support.

A fourth characteristic was flexibility. Commanders and their unit engineers had to retain it to influence the situation as necessary. This was especially true of the Corps and Div Engrs who could not afford to waste their scarce assets. In reality, both retained less than they wished due to the overriding requirements for support in the front line divisions and CCs which had consuming needs for engineers. But flexibility also means being flexible, capable of adapting to new task organizations and missions and able to expand rapidly. WW II gave repeated examples of this at all levels.

The fifth characteristic or trend was the capability for engineer units, both divisional and corps, to quickly reorganize as infantry. This transition was sometimes planned well in advance, often unexpected and uncoordinated. Though this paper does not deal with detailed C2 relationships within an engineer unit during or after reorganization as infantry, the fact that engineer elements from many different echelons reorganized while in the division's area obviously had impact on overall C2 of engineers within the division.

The last characteristic was implied. Throughout WW II, CCs and their attached engineers frequently worked at great distances from other CCs in their division, and from the division itself. When cross-attached to another division or corps, they habitually took their engineers with them. Task forces within the CCs often worked as separate entities. Without being specifically articulated, it was apparent that supporting engineer company commanders and platoon leaders had to be able to operate independently with minimal guidance.

SECTION III CURRENT

A. CURRENT ENGINEER C2 DOCTRINE AND ORGANIZATION

Current engineer doctrine assigns Engineer Brigades to Theater Armies. These brigades may then be attached to an Engineer Command, or to the various corps HQs. Each Engineer Brigade has two to four Engineer Groups attached to it, with each group having several engineer battalions and various separate companies and teams attached to it. The Engineer Brigade Commander is the Corps Engineer, and as such, is both a commander and a staff officer.[94]

The group HQs is a tactical HQs, consisting of an HHC. It performs all its functions through its attached battalions, companies and teams.[95] Though each group may be configured slightly differently, they will consist of several Engr Cbt Bns, either wheeled or mech (though most are wheeled), an Engr Cbt Bn (Heavy), which is primarily a construction unit, and an Engr Bn (Composite), which usually houses the separate bridge, truck and equipment companies and smaller teams.[96]

The Engr Bn, Heavy Division, provides organic engineer support to Armored and Mech divisions. It consists of an HHC, four line companies and a bridge company (see diagram #4).[97] Within each HHC are an Assistant Division Engineer section (ADE) and three Brigade Engineer Sections. These sections work in the division and maneuver brigade HQs, respectively, planning engineer operations.

Engineer C2 relationships between engineers or between engineers and other arms (primarily maneuver units) are designated as either support or command. The normal relationships are Direct Support (DS), General Support (GS), attached, and Operational Control (OPCON). See diagram 5 for a more detailed explanation of each.[98] Suffice it to say that DS is similar to WW II's concept of "in support" and attached is virtually the same today as it was in WW II.

Current doctrine also provides for additional coordination measures just as in WW II. Supplementing support and command relationships are the concepts of area assignment and task assignment, with essentially the same meaning as in WW II. Engineer Work Lines (EWL) are still used to separate the efforts of different engineer units working in close proximity.[99]

Many of the corps engineer units will be in DS of other corps units such as a Field Artillery Brigade or an Armored Cavalry Regiment, or GS to the corps. Other engineer units will support the divisions in a DS, OPCON, or attached status.[100] At any one time, engineer support to a single Heavy Division will consist of five engineer battalions or the equivalent.[101] A typical scenario as envisioned by the Division 86 Study placed a corps mech engineer battalion and the divisional battalion operating in the MBA and CFA, while two corps wheeled engineer battalions, a heavy battalion, an equipment company and two bridge companies supported as required.[102] The normal C2 relationship for corps engineer units supporting a division is DS. If the Corps or Group Engr is unable to control them, or if they must be split up and task organized to properly support the division's mission, then they may be attached or OPCON'd to the division. Doctrine prescribes attachment for exploitation or pursuit and OPCON for covering force operations.[103]

Doctrine specifically states that,"The Div Engr coordinates all engineer combat support to the division".[104] Doctrine also states that the Corps Engr commands and controls non-divisional engineers working DS or GS in the division's area.[105] This dichotomy could create a dilemma for the Div Engr.

Generically, offensive operations involve more decentralized planning and execution, with perhaps more use of OPCON and attached rela-

tionships between the engineer unit and the supported unit. Defensive operations usually involve more use of DS and GS relationships between the engineers and the supported unit, although selected missions such as covering force operations may require OPCON or attachment.

After receiving engineer assets from corps, the Div Engr task organizes both the corps and divisional engineers to best support the maneuver brigades. It must be noted that a relationship of DS or GS precludes further task organization by the recipient. Therefore, the Div Engr cannot split up the corps engineer units that he receives from corps in that status. Nor can the maneuver brigade commander or supporting engineer commander further task organize his engineers if they are in a DS or GS status.

Normal support to a maneuver brigade is an engineer company from the divisional engineer battalion. This company should habitually be the same one to facilitate the development and maintenance of good working relations. Unit integrity should also be maintained whenever possible.[106] The Div Engr will create Engineer Task Forces if he assigns more than two companies to the task organization of a maneuver unit, and if that maneuver force HQ has no engineer on its staff. Engineer Task Forces are temporary combinations of engineer units under one commander, put together to support a specific operation or to perform a specific task.[107] Technically, the Div Engr will not assign an Engr Task Force to a maneuver brigade, because under the J-series TOE, a Brigade Engr Section goes to each brigade to act as their staff engineer. However, the major in that section could in fact form the basis of an ad hoc staff for an Engr Task Force.

Doctrinally, maneuver commanders at battalion level and higher will normally have an engineer to advise them.[108] Since maneuver batta-

lions do not have assigned engineer staff officers, this implies at least an engineer platoon DS, OPCON, or attached to the battalion, yielding an engineer platoon leader to act as an advisor. In order for the parent engineer company to send one of its platoons DS, OPCON, or attached to a maneuver battalion, that company must first be either OPCON or attached to the maneuver brigade. Paradoxically, doctrine specifies DS as the preferred mission for engineer companies.

Conceptually, the AOE organization of the divisional engineer battalion pushes engineer support forward, stripping away construction capability[109] and becoming more sapper oriented. Flexibility is emphasized under current doctrine. Engineer commanders must be able to rapidly shift forces to needed locations and task organize as best fits the situation.[110] Finally, because of the expected nature of the next war, decentralized execution must be stressed.[111]

In brief, such are the current doctrinal engineer C2 relationships and organizations that provide engineer support to the Heavy Division. Within the division itself, the divisional engineer battalion pushes engineer support forward to support the maneuver brigades. That support is nominally a company. Quite often, engineer platoons are further pushed forward to support battalion task forces. In either case, more support may be allocated, requiring the creation of Engr Task Forces if the support and command relationships will allow it. The Corps Engr will support the Div Engr with the equivalent of four more battalions in the division area. These battalions will be DS, GS, OPCON, or attached, depending on several factors. The Div Engr is responsible for coordinating all combat engineer effort in the division area, but the Corps and Group Engrs will command and control their engineers that are in the division area unless they are OPCON or attached to the di-

vision. Within the division, habitual association between the divisional engineer elements (companies and platoons) and maneuver units (brigades and battalions) is emphasized. Doctrine also stresses flexibility and decentralized execution.

A comparison between current doctrine and the six characteristics of adequate engineer C2 and organizations as established by WW II, is now in order.

B. COMPARISON OF CURRENT C2 TO WW II

Current engineer doctrine does recognize the need for more engineers to support the division. The divisional engineer battalion in the Heavy Division is just as inadequate to the task as was the divisional battalion in WW II, and even more so. Where each division needed about three engineer battalions during WW II, the Heavy Division of today will need five (one divisional, four from corps). Not only does FM 5-100, Engineer Combat Operations, dated May 1984, recognize this requirement, but studies conducted by others also corroborate the divisional engineer battalion's inability to satisfy the division's needs, whether in the offense or the defense.[112] Unfortunately, the current level of engineers in Europe cannot support the requirement, nor does REFORGER's emphasis on combat units alleviate the situation.[113] Be that as it may, the need still exists and Corps Engrs must be prepared to satisfy it.

Current doctrine does not fully support a "more than habitual" relationship between corps engineer units and supported divisions. FM 5-100 talks in generalities about habitual association, but not specifically from the corps to the division. Doctrine calls for the attachment or OPCON of corps units to divisions in certain situations, other-

wise they support in a DS or GS role. This leads to the problem experienced in WW II of who controls the corps engineers in the division's area if they are not attached or OPCON. Doctrine gives seemingly conflicting guidance when it states that the Div Engr coordinates all the engineer support in the division's area, but in the same breath says that the Corps and Group Engrs command and control those corps engineer units in the divisional area which are not attached or OPCON. Even if the Corps Engr attaches the units to the division, if that relationship is not habitual, efficiency will suffer. This was amply demonstrated by WW II. Finally, the start of hostilities is not the preferred time for beginning a habitual relationship. The General Board realized these points when it recommended an engineer regiment as the division's organic engineer element. Our doctrine does not assign to the Div Engr the assets that he normally needs.

Within the division, doctrine is currently leaning towards pushing organic engineer assets down to subordinate maneuver units. Doctrine stresses the preferred habitual relationship between engineer companies and platoons, and maneuver brigades and battalions. However, in many cases that relationship may only be DS. Given the expected fluid, dispersed and rapid nature of the next war, maneuver units in the division will need immediate support from their engineers, not a delay while the unit engineer obtains permission for this or that. One recent study has aptly shown that not even two engineer companies can adequately support a maneuver brigade in the defense.[114] One might ask, why hold them back? Brigades will need engineers no matter what their mission.[115] In WW II, doctrine and combat experience called for an engineer company to be attached to each CC. Current doctrine is not yet there.

Our current doctrine does stress flexibility, both in terms of retaining it and having it. The Corps and Div Engrs retain flexibility by assigning DS and GS roles to their subordinate units, thus withholding command from the subordinate maneuver units who will need their immediate response. The creation of Engr Task Forces and ad hoc staffs to support specific missions is an excellent example of having flexibility. As WW II showed, this ability is a prerequisite for an effective engineer unit. However, at the division level, the 5-man ADE section does not have the capability to plan for the five battalions expected in the area. Although a supporting group staff could be of assistance, conflicting C2 relationships and unfamiliarity could hamper that effort. At the brigade level, the new Brigade Engr Section appears to be a great boon to planning and could act as a focal point around which an Engr Task Force or attached corps battalion could build.

FM 5-100 devotes an entire chapter, eleven pages long, to reorganizing as infantry. Every engineer officer worth his salt knows that his secondary mission is to fight as infantry. Unfortunately, most do not realize how prevalent those opportunities will be in the next war, nor does doctrine alleviate the problem of reorganizing corps engineer units which are in the division's area. The FM does not address the integration of corps units into a division's security arrangements. In fact, the only reference to employing corps battalions is as follows:

> Non-division engineer battalions working in the rear areas are usually in direct control of their companies. These battalions can be quickly reorganized and employed as infantry battalions in rear area combat operations. 116

This statement has two problems. First, corps battalions may be working in forward areas and not under corps control if attached or OPCON.

Second, a C2 structure which cannot adequately coordinate all the activities of five battalions in the division's area might have problems quickly reorganizing some or all of those units as infantry.

The last comparison to make is that of independent operations. WW II implied its requirement by the way CCs and task forces fought. Current doctrine emphasizes the need to be able to operate independently, and the current inclination towards pushing organic divisional engineers down to the maneuver commanders corresponds with that emphasis. However, the lack of a "more than habitual" relationship between the maneuver commander and the engineer unit belies that emphasis.

From the above comparisons, a brief synopsis of doctrinal deficiencies reveals that; 1) the Div Engr does not command nor have definitive control of all those engineer battalions which constitute his normal support, 2) maneuver brigades do not have at least an engineer company with a "more than habitual" relationship, 3) the Div Engr does not have the flexibility nor inherent capability to coordinate five engineer battalions, whether as engineers or infantry, and 4) the C2 structure does not fully support independent operations.

C. IMPLICATIONS OF ALB ON ENGINEER C2

Given that there are some inadequacies in current engineer C2 and organization, the implications of ALB unfortunately only compound those problems for the engineer.

When the Army adopted ALB, many equipment, organizational and doctrinal changes accompanied that move. One of the biggest was the consolidation of all aviation assets and the divisional cavalry squadron into the Combat Aviation Brigade (CAB). This unit is also the fourth maneuver brigade, possibly having one or more maneuver battalions at-

tached to it. Since the divisional engineer battalion has only four line companies, if each brigade is supported by a company very little is left for the Div Engr to use to support other elements such as the Div HQs, DIVARTY and the DISCOM. Additionally, the increased emphasis on divisional attack aviation units flying cross-the-FEBA missions creates new demands for Forward Aviation Combat Engineering (FACE). Given that the Div Engr is already incapable of supporting three maneuver brigades, the CAB apparently argues for more organic engineer assets.

New equipment such as the M1 Abrams tank, the M2 Bradley fighting vehicle, the Multiple Rocket Launcher System (MRLS), and the engineer's own M9 Armored Combat Earthmover (ACE), all emphasize the speed and violence with which the next war will be fought. Units which sport the 45 mph cross-country capability of the M1 and M2 vehicles will need similar speeds from their supporting engineers. The ACE is an attempt to provide that. More significantly, that same speed requires the maneuver commander to have a relationship with the supporting engineer which is responsive. He needs engineers who can operate independently, separated from their parent unit.

The Family of Scatterable Mines (FASCAM) presents a new set of problems for the Div Engr. During WW II, engineers controlled all mining efforts.[117] Now, however, several branches are involved. The engineers still emplace minefields the old way, by hand, and with mechanical minelayers such as the M-57 and the new Ground Emplaced Mine Scattering System (GEMSS). Aviators and Air Force pilots can put in minefields from the air with the M-56 and GATOR mine dispenser, respectively. Finally, the artillery can "shoot" a minefield in, in quick order. Each branch's school is developing their own doctrine, too.

Add to this the problem of insuring proper minefield recording and reporting,[118] and it seems apparent that confusion may reign.

Ultimately, the engineer must be responsible for controlling mine warfare, no matter what the delivery vehicle.[119] To that end, perhaps the current ADE section and the divisional engineer battalion S-3 shop are not quite able to handle the task. The Brigade Engr Section can certainly assist in this matter, but an engineer brigade or regimental HQs and two or three more battalion HQs would help even more.

The advent of ALB brought with it new and renewed concerns. Aviation and artillery units will conduct most of the division's Deep Battle. However, it is entirely possible for brigades and even battalion task forces to conduct relatively deep encircling movements. Their engineer support must be able to move with them and respond instantly and independently. REFORGER exercises have shown that corps engineer battalions will usually work well forward in the main battle area, side by side with divisional engineers. Unfortunately, since they are normally equipped with wheeled, not tracked, vehicles, they have great difficulty staying with the maneuver units.[120]

ALB means renewed emphasis on the offensive and maneuver. The engineer company that is DS to a brigade and must check with its battalion prior to supporting an exploitation or a counterattack beyond the FEBA, will probably not be able to provide the instant response that the brigade commander needs.

Rear Battle was a given during periods of WW II. Having recently rediscovered the possibly damaging affects of Rear Battle, the Army has given the responsibility for coordinating Area Damage Control (ADC) in the division rear area to the Div Engr. As if he and the ADE section were not already busy enough trying to coordinate the activities of

rive engineer battalions in their area, some of which the Corps and Group Engrs still control, they are now the point of contact for ADC.[121]

Finally, the very nature of war itself will be violent, rapid, and dispersed. The Div Engr will need to have enough engineers on hand to satisfy his normal requirements and should not be required to request that which he and the Corps Engr already know he will need. ALB does not reduce the need for five engineer battalions in each division area, but rather demands it. ALB also requires rapid response. Maneuver commanders and their engineers will have to practice what the Germans call Beweglichkeit, that is, "Mobility of armored troops on the battlefield and flexibility of the leaders at all levels in command and control".[122] It involves a C2 system that is able to switch and cross-attach units, and even systems, and can change rapidly from different types of combat, such as moving successively from a delay, to defense, to the attack.[123]

Briefly, the adoption of ALB and its attendant organizational, equipment, and doctrinal changes points to needed engineer C2 and organizational changes that follow the same patterns as the lessons gleaned from WW II. The implications of ALB reinforce the inadequacies of current engineer C2. The Div Engr needs more engineers, under his control, and must push assets forward to the maneuver units on a "more than habitual" basis if not attached or organic. Flexibility and the ability to conduct independent operations will mark the successful engineer.

D. CURRENT INITIATIVES AND EXAMPLES

Several ideas and initiatives from different groups and individuals have surfaced recently. These and contemporary engineer C2 methods

used in other countries could alleviate some of our problems if adopted, or at least they appear to have some merit to them.

The Engineer School at Ft. Belvoir is currently pushing an initiative to increase the organic divisional engineer element to a three battalion engineer brigade, commanded by an O-6. This would do several things. First, it would put more of the engineer support normally required by the Div Engr under his command. Second, it would provide three more staffs to facilitate the creation of Engr Task Forces to support maneuver units. Third, the addition of an engineer brigade HQ and staff would aid future expansion and enhance the ability of the Div Engr to control a wide-scale reorganization as infantry.[124] Finally, it would eliminate the problem of the Div Engr focusing his attention on his organic engineer battalion while three or four corps battalions were in his area. An O-6 with a brigade staff could better orchestrate the efforts of all the battalions normally assigned, attached, or even DS to the division.[125] (see diagram 6).

BG Kirk, formerly of the 5th Infantry Division (Mech), has suggested putting an engineer battalion HQs DS to each brigade to control all the engineer assets working for the brigade.[126] Kirk also stresses habitual association as the single most important factor in providing adequate engineer support to the brigade.[127] A battalion HQ at each brigade would require three or more engineer battalions assigned, attached or OPCON to each division due to the restrictions placed on DS and GS missions. Some have taken the final step and recommended putting an engineer company organic to each maneuver brigade.[128]

Though these suggestions may seem radical, other countries have long since adopted similar arrangements. Soviet divisions, for example, have a small organic engineer battalion at division level and an engi-

neer company organic to each tank or motorized rifle regiment.[129] In the West German Army, an engineer element is organic to the Armored Brigade. When the brigade organizes into battalion task forces the task organization normally includes engineers.[130] The French Armored Division of 7000 personnel includes an organic, 840-man engineer regiment. Contrast that with the 890-man engineer battalion in a U.S., 16000-man heavy division.[131] This is comparable to a U.S. engineer battalion organic to a U.S. separate brigade.

There is also a growing awareness that engineers really have to be able to operate independently; Auftragstaktik for engineers, if you will. Due to the anticipated dispersion of the next war, engineer units will be spread far and wide, requiring solid leadership at the small unit level.[132] The engineer company commander and platoon leader will have to anticipate the needs of the maneuver commander, creating obstacles and breaching minefields as though they knew the mind of the commander.[133] ALB demands no less.

SECTION IV CONCLUSIONS

This paper initially established six characteristics of adequate engineer C2 and organization to support the Heavy Division by analyzing engineer operations in the ETO during WW II. Doctrine, actual practice and the General Board recommendations were the bases of those characteristics. A review of current engineer C2 and organization, and comparison to the six characteristics revealed several apparent deficiencies. The added implications of ALB were shown to exacerbate and add to those inadequacies. Finally, when these problems are studied in light of some recent initiatives and contemporary examples of foreign engineer C2, several conclusions become evident.

The first conclusion is that the Div Engr needs more engineers, and he needs to command them. To this end, Ft. Belvoir s recommended divisional engineer brigade commanded by an O-6 seems to have merit (This brigade is really more the size of a group or large battalion). For those who worry about adding troops to the force structure, this would not. Each battalion in the brigade would be smaller than the current divisional battalion, with the additional slots coming from corps. Under this concept, the number of engineers, both corps and divisional, working in the division's area would actually be less than
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under current doctrine. The Corps Engr may feel he is losing some of his flexibility, however, to win a war one must first not lose it. The overriding requirements will be with divisions who will need their engineers on day one of the next war. An alternative to the divisional engineer brigade might be corps engineer battalions that are doctrinally attached to the same divisions for long periods of time.

The second conclusion is that the maneuver commanders in the division must have a "more than habitual" relationship with their engineers. The Brigade Engr Section was a big step in that direction and allows for more detailed and prior planning for supporting engineers. However, due to the dispersed and rapid nature of war when the commander wants his engineers to follow him and provide instant response, a DS company or an attached one whom he's never seen before, will not be able to satisfactorily meet his needs. An engineer company that is habitually attached to the same brigade or organic to it, can much better respond. Many times that one company will not be adequate to the task. In that case, it and the Brigade Engr Section can form the basis of an Engr Task Force, giving it the needed habitual association. Training might become a problem for an organic engineer company in the bri-

gade, but there is nothing to prevent it from training with the divisional engineer units, if that need should arise.

The third conclusion is that engineers at all levels must still retain flexibility and be flexible, simultaneously. For the Corps Engr, the loss of some of his assets to the division would reduce his capability. But if WW II is any example, he would have lost much of that flexibility anyway when he pushed his engineers forward to support the divisions. Even with that loss, he would still have some of his assets to influence the situation, especially after reinforcements arrive.

With the current, single battalion assigned to the division, the Div Engr is reluctant to attach companies to brigades except for select missions. If the Div Engr had three battalions, one of them could attach its companies to the brigades or each battalion could attach one or more companies to each brigade. The Div Engr would still have the capability to reinforce as necessary. Of course, if each maneuver brigade had its own organic engineer company a divisional engineer brigade might have one less battalion.

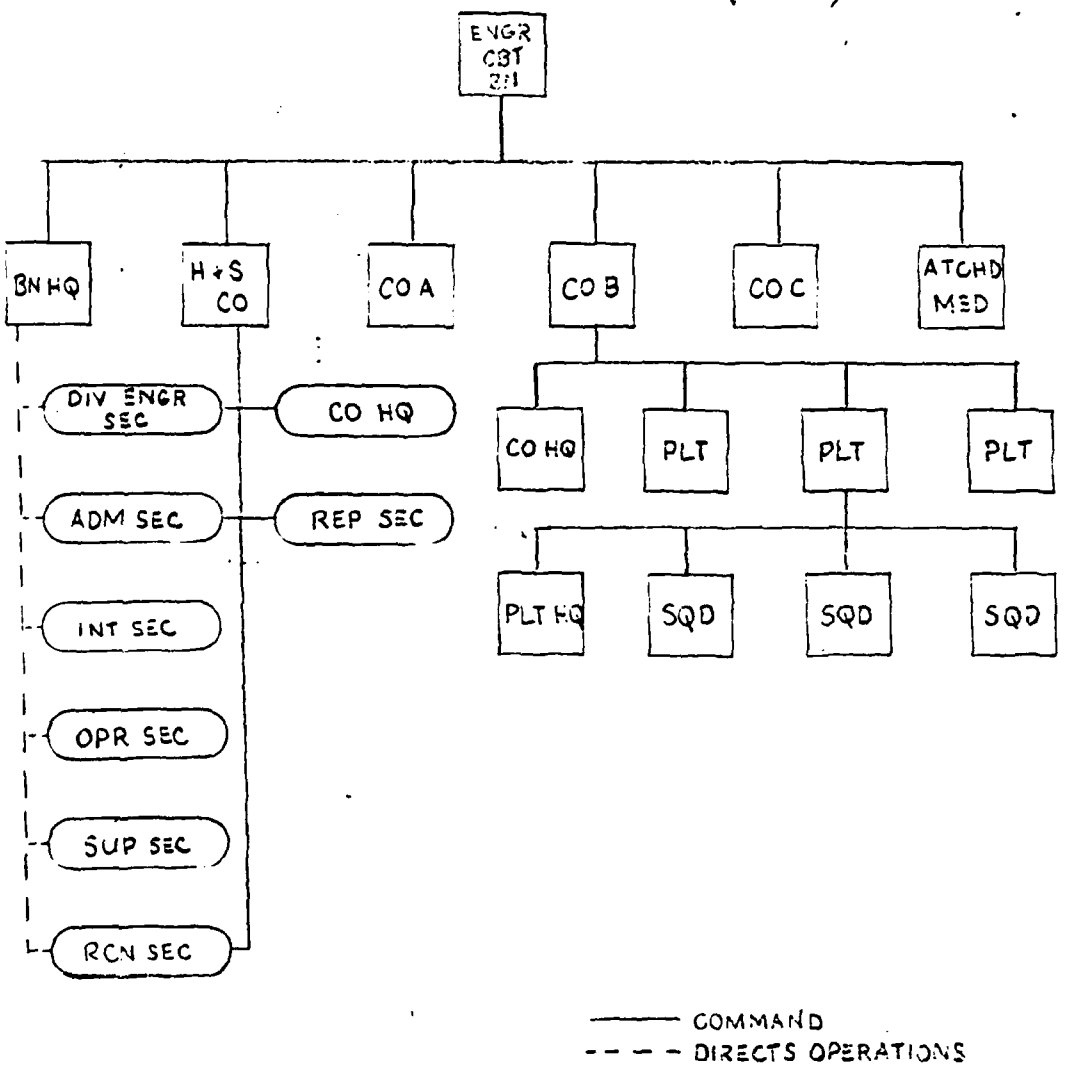
Engineers at all levels in the division must be flexible. A brigade HQs would certainly assist the ADE in planning. It could also much more easily control any additional assets they might receive from corps. The addition of three battalion HQs in the division would facilitate the creation of Engr Task Forces.

The fourth conclusion is that engineers fight as infantry, often, at all levels, in the front and in the rear. Assigning most of the corps engineer units that will be working in the division s area to the Div Engr would ease the C2 of planned and unplanned transitions to infantry. An engineer brigade HQs could more easily handle this activity than a single battalion HQs.

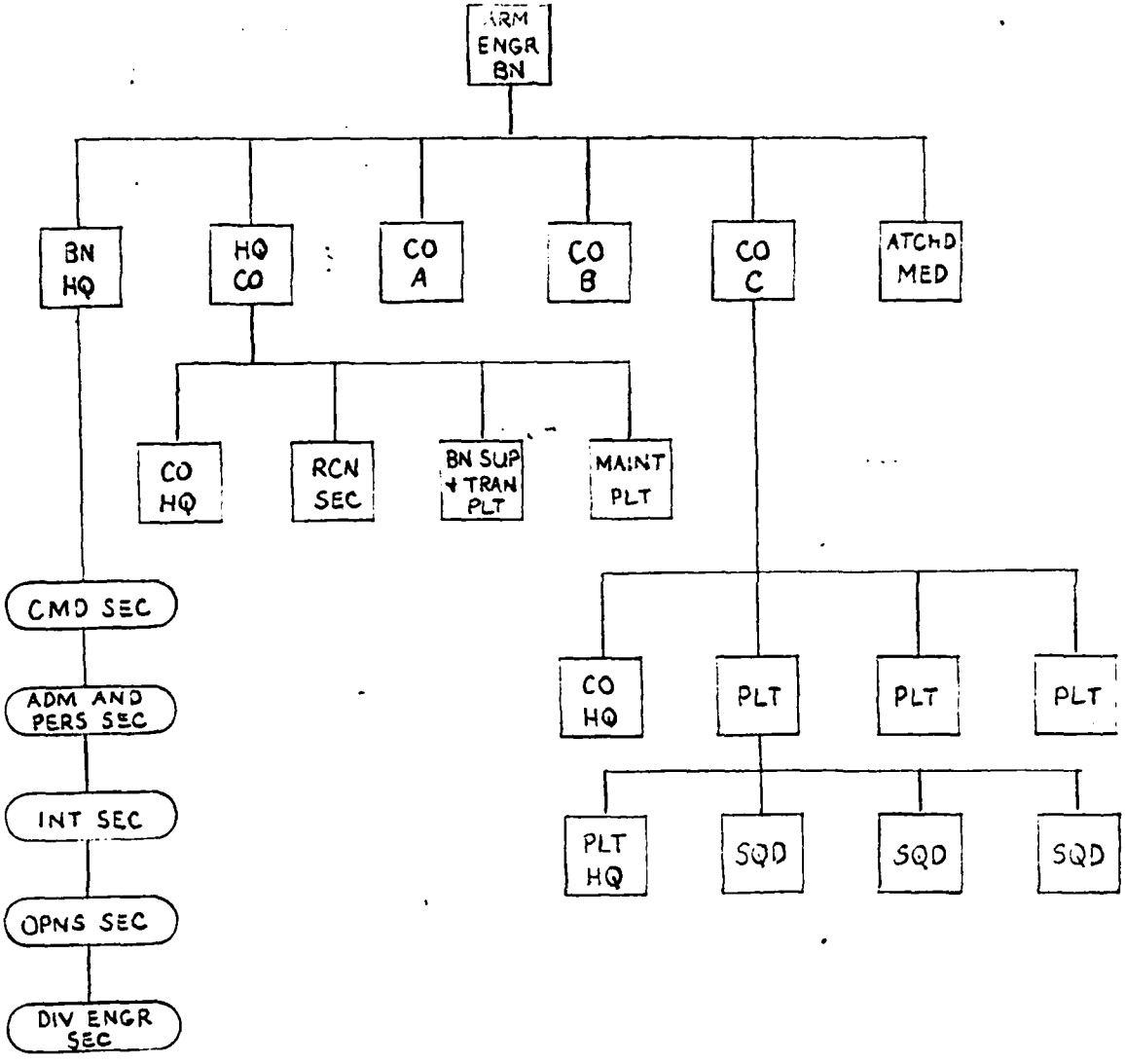
The fifth and final conclusion is that engineer units will have to be capable of independent operations. The nature of the battlefield will allow nothing else. Engineer companies that are habitually attached to the same brigade or are organic to it, will be much more able to operate independently with that brigade than a DS company, or one which is infrequently OPCON d or attached to it. Engineer battalions that are integral to a division or habitually attached to the same division, will be more able to function with minimal guidance and interference in that division's area than a newcomer.

LIST OF DIAGRAMS

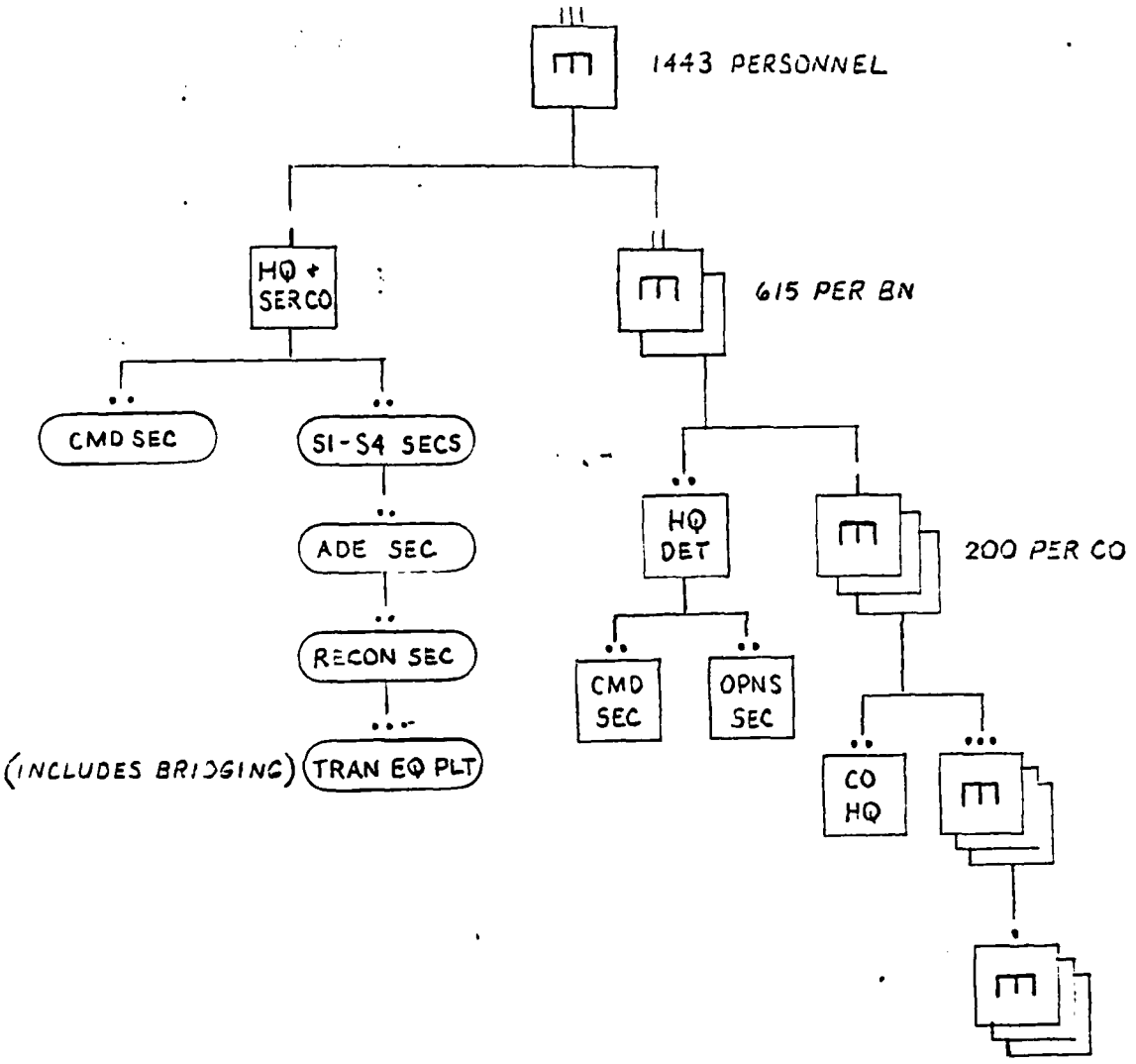
#1 ENGINEER COMBAT BATTALION, CORPS OR INF DIV (WW II)



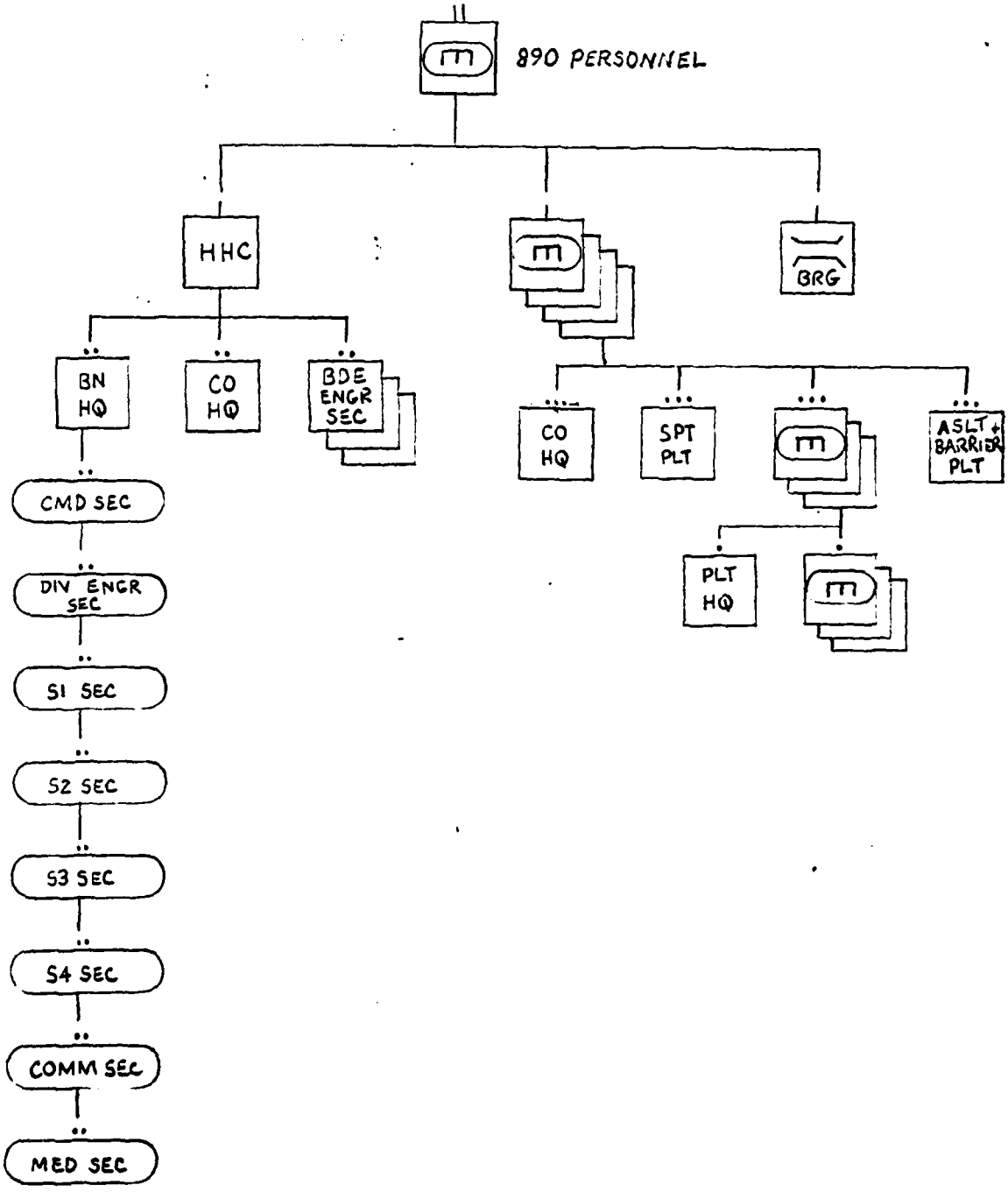
#2 ARMORED ENGINEER BATTLION, ARM DIV (WW II)



#3 PROPOSED DIVISIONAL ENGINEER REGIMENT, 1945



#4 CURRENT ENGINEER BATTALION, HVY DIV



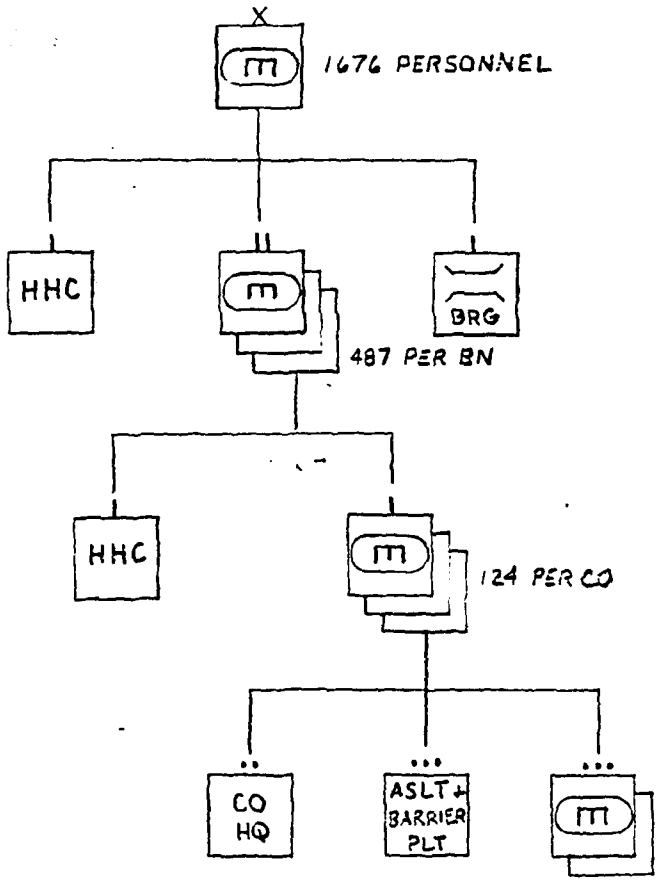
5 COMMAND AND SUPPORT RELATIONSHIPS

An engineer element with a relationship of:	Supported Relationships: Direct Support (DS)	Supported Relationships: General Support (GS)	Command Relationships: OPCON	Command Relationships: Attached/ Assigned
Is commanded by:	Parent unit (Note 2)	Parent unit (Note 2)	Supported unit	Supported unit Cdr
Maintains liaison and communication with:	Supported and parent units	Supported and parent units	Supported unit and parent units	Supported unit
May be task organized by:	Parent unit	Parent unit	Supported unit	Supported unit Cdr
Can be:	Dedicated support to a particular unit. May be given task or area assignments	Used only to support the parent force as a whole. May be given an area/ task assignments	Placed OPCON to other engr/ maneuver units, or made DS to bdes or task forces	Further attached, OPCON, or DS to bdes or task forces, or retained GS
Respond to support requests from:	Supported unit	Parent unit	Supported unit	Supported unit
Work priority established by:	Supported unit	Supported unit	Supported unit	Supported unit
Spare work effort available to	Parent unit	Parent unit	Supported unit	Supported unit
Request for additional support forwarded through:	Parent unit	Parent unit	Supported unit	Supported unit
Receives logistical support from:	Parent unit	Parent unit	Parent unit (Note 1)	Supported unit (Note 1)

NOTES:

1. When attached, the engineer element is provided administrative/logistic support When placed OPCON, the supporting unit provides support in the common classes of supply to the maximum extent possible.
2. It is possible that units will receive additional engineer support without a command relationship, —the support relationship of DS to the division.
3. Regardless of type of relationship, activities of engineer units working in an area are under the staff supervision of the engineer.
4. The supported unit, regardless of command/ support relationship, is to furnish engineer materials to support engineer operations.

#6 PROPOSED DIVISIONAL ENGINEER BRIGADE, 1985



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