Engineer Force Structure for Division Mobility Operations

A Monograph

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2020

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
13-04-2020	Master's Thesis	JUN 2019 – JUN 2020

4. TITLE AND SUBTITLE

Engineer Force Structure for Division Mobility Operations

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

MAJ Jo Edmonds, US Army

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, KS 66027-2301

8. PERFORMING ORG REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Advanced Military Studies Program

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public Release; Distribution is Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

As the primary tactical headquarters for large-scale combat operations, divisions need an organic engineer command and control headquarters to synchronize combined arms mobility operations. The US Army's shift out of counter-insurgency operations and into large-scale combat operations requires divisions to be highly mobile. Two historical case studies focus on the robust engineer task organization to both heavy and light divisions, and the impacts of a brigade engineer headquarters in mobility operations. During World War II and the Persian Gulf War, US Army divisions used echelon above brigade combat team engineers for large-scale gap crossing and breaching operations. These engineer forces were engineer groups, transformed into today's engineer brigades.

15. SUBJECT TERMS

Large Scale Combat Operations; Mobility; Gap Crossing; Breaching; Engineer Force Structure; World War II, Lorraine Campaign; Persian Gulf War; Operation Desert Storm

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. PHONE NUMBER (Include area code)
(U)	(U)	(U)	(U)	46	702-622-7940

Monograph Approval Page

Name of Candidate: MAJ Jo-Ann Edmonds

Monograph Title: Engineer Force Structure for Division Mobility Operations

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Abstract

Engineer Force Structure for Division Mobility Operations, by MAJ Jo-Ann Edmonds, 42 pages.

As the primary tactical headquarters for large-scale combat operations, divisions need an organic engineer command and control headquarters to synchronize combined arms mobility operations. The US Army's shift out of counterinsurgency operations and into large-scale combat operations requires divisions to be highly mobile. Two historical case studies focus on the robust engineer task organization to both heavy and light divisions, and the impacts of a brigade engineer headquarters in mobility operations. During World War II and the Persian Gulf War, US Army divisions used echelon above brigade combat team engineers for large-scale gap crossing and breaching operations. These engineer forces were engineer groups, transformed into today's engineer brigades.

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Introduction

The new Field Manual (FM) 3-0, *Operations* addresses the US military's shift of focus from counterinsurgency operations to preparations for combat against emerging regional threats such as China, Russia, Iran, and North Korea. These peer threats represent an increase in the intensity and lethality of operations. Field Manual (FM) 3-0, *Operations* predicts the US Army's future challenges center on large-scale combat operations. US Army divisions and corps are the primary tactical echelons to execute and win in large-scale ground combat. While the corps serves as a tactical land headquarters, divisions must serve as a fighting formation shaping the deep area through fires, intelligence, and aviation or reinforcing brigades in the close area.[1] Establishment of complex obstacles and defenses are anticipated activities adversaries may use to deny US forces the ability to maneuver.

The key to success for almost all division operations is mobility.[2] Not only is it the best means of survivability, divisions must have the speed and unhindered movement to succeed in combat.[3] The two primary mobility operations this monograph will address are gap crossing and combined arms breaching. These operations will suggest the requirement for division-level engineer capabilities in large-scale combat operations. The central idea of this monograph is that maneuver forces cannot move without mobility, thus divisions require an assigned engineer command and control element.[4] As doctrine rapidly develops for large-scale ground combat,

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[1] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), Foreword - 2-13.

[2] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 8-29.

[3] Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia: University of Missouri Press, 2017), 247.

[4] Florian L. Waitl, *Into the Breach: Historical Case Studies of Mobility Operations in Large-Scale Combat Operations* (Fort Leavenworth: Army University Press, 2018), xii.

divisions do not have enough assigned engineer capability to command and control breaching and gap crossing operations.

Engineer units are currently organic to brigade combat teams, not the division.[5] From 2005 to 2013, the post-9/11 division had four engineer companies residing within the brigade special troops battalions. This force structure was in response to counterinsurgency operations and the need for less combat engineer capability in tactical divisions. More engineers were pooled at the corps level, resulting in larger corps engineer brigades. The divisions went through another major restructuring in 2014 with the reduction to three brigade combat teams.[6] Each brigade combat team gained a brigade engineer battalion with two engineer companies, increasing combat engineer capability in the division. As a result, the corps engineer brigades reduced their number of engineer battalions to increase the capability in the divisions.

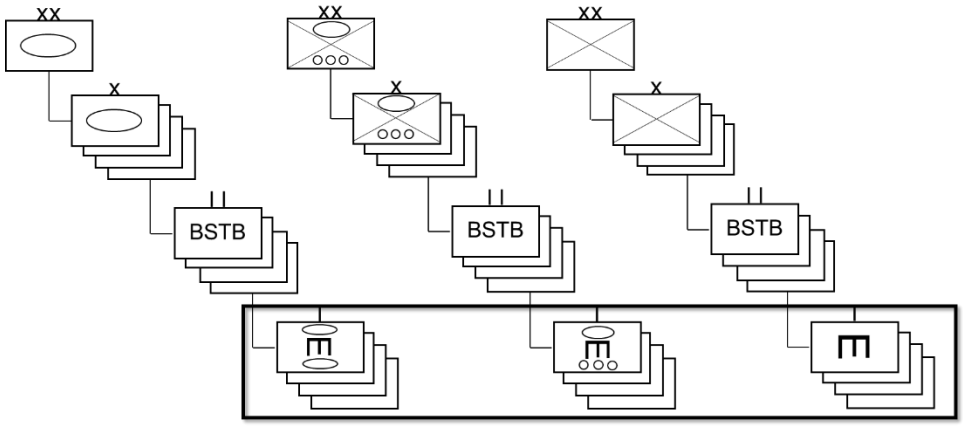

Figure 1. Division Task Organizations (2005-2013). Modified by author. "Legacy Unit Identification Code (UIC) Hierarchy 2005-2017," U.S. Army Directorate of Force Management, accessed 23 December 2019, https://fmsweb.fms.army.mil/protected/fileman/default.asp?Section=PUBLIC_FILES&strPath=[PUBLIC_FILES]/Hierarchies.

[5] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-70.

[6] "Legacy Unit Identification Code (UIC) Hierarchy 2005-2017," U.S. Army Directorate of Force Management, accessed 23 December 2019, https://fmsweb.fms.army.mil/protected/fileman/default.asp?Section=PUBLIC_FILES&strPath=[PUBLIC_FILES]/Hierarchies.

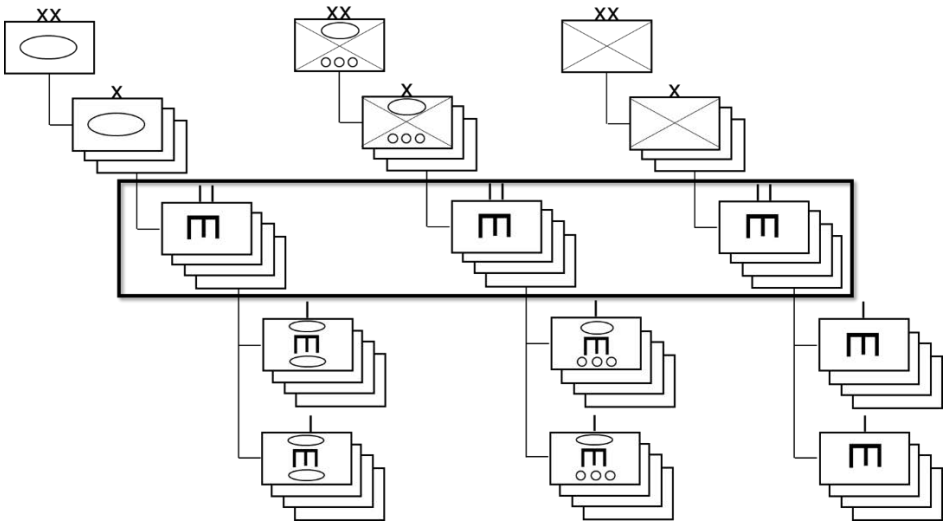

Figure 2. Division Task Organizations (2014-current). Modified by author. "Legacy Unit Identification Code (UIC) Hierarchy 2005-2017," U.S. Army Directorate of Force Management, accessed 23 December 2019, https://fmsweb.fms.army.mil/protected/fileman/default.asp?Section=PUBLIC_FILES&strPath=[PUBLIC_FILES]/Hierarchies.

This monograph outlines the requirements of current doctrine for division units in large-scale combat operations to understand what the engineer force needs to provide for mobility operations. Research will analyze historical cases to identify capability gaps in mobility operations and demonstrate the requirement for sufficient engineer organization at the division level. During the Lorraine Campaign in World War II, the US Third Army's XII Corps conducted division-level river crossings at the Dieulouard and Nancy bridgeheads. Analysis of World War II river crossings illustrate corps and division-level crossing operations on the Western Front. World War II provides the most extensive large-scale ground combat in history using US Army divisions. In Operation Desert Storm, the 1st Infantry Division executed a division-level combined arms breach during the initial phases of offensive operations. To illustrate the most recent mobility operations in large-scale combat operations, observations and first-hand accounts taken from Operation Desert Storm will suggest the requirements for engineers at the division echelons for combined arms breaching operations. The Gulf War case study reinforces the role of engineers in heavy divisions and the demand for mobility in offensive operations. These historical

case studies will show the use of engineers in large-scale combat operations, and the engineer force structure assigned to the division during those time periods. Analysis of current doctrine and use of historical examples of mobility operations in large-scale combat operations will drive understanding of the role of engineers in combined arms operations and provide insight to future force structuring for divisions.

Literature Review

There are numerous works on the Army's transition to large-scale combat operations and the Engineer Regiment's support to division and corps. This monograph focuses primarily on engineer force structure at the division echelon; not specific to heavy, light, or Stryker units. It includes data from the archives at the Ike Skeleton Combined Arms Library at Fort Leavenworth, KS. This literature review will outline the requirements of the division in mobility operations and the role of engineers. This monograph presents case studies from World War II and the Persian Gulf War to demonstrate previous mobility operations in large-scale combat. The sources used to inform this monograph are divided into four categories: 1) current doctrine describing large-scale combat operations and the significance of division mobility operations, 2) new large-scale combat operations manuals highlighting maneuver, mobility, and breaching operations, 3) after action reports and campaign studies on the Third Army in World War II focusing on gap crossing operations, and 4) lessons learned on the 1st Infantry Division in Operation Desert Storm discussing breaching operations. This section explains the importance of these works and how they inform the monograph's analysis and conclusions.

Military doctrine and training websites help explain how mobility operations are a key component in large-scale combat operations. The primary doctrine referenced is Field Manual (FM) 3-0, *Operations,* highlighting the importance of large-scale combat operations. Enabling divisions for large-scale ground combat begins by configuring combined arms operations with effective doctrine and resources. Reinforcing Field Manual (FM) 3-0, *Operations*, comparison of

the most current field manuals and Army Technical Publications outline mobility operations, the roles of divisions command and control structure, and engineer force structure. These manuals define breaching and gap crossing as two primary mobility operations. Divisions have annual training requirements for mobility operations to maintain readiness. Current military doctrine was critical in identifying engineer force structure gaps at the division level. Wire diagrams illustrate the possible corps and division task organizations with engineer forces and the command and control capability gaps.

The Third Army's Lorraine Campaign in World War II describes some of the US Army's largest river crossing operations and the challenges faced by the combined arms team. This campaign highlights several divisions' successes and failures to build bridges under fire. Hugh M. Cole's campaign study, *Lorraine Campaign*, gives a detailed summary of the Third Army's advance along the western front into Germany. The importance of this study illustrated the number of obstacles each corps would face during their assault to the Rhine River. Christopher R. Gabel's book, *Lorraine Campaign*: *September – December 1944,* provides a detailed sequence of events highlighting the multiple division-sized river crossings in detail. The Third Army's after action report, *Third Army After Action Report*, Vol. 1 emphasized the requirement for synchronization between fires, infantry, and engineers. This highlighted the engineer task organization required for a division river crossing during high intensity conflict. Alfred M. Beck's book, *The Corps of Engineers: The War Against Germany*, focused specifically on engineer units in World War II and force structure of Engineer Combat Groups, Engineer General Service Regiments, and Engineer Combat Battalions. This was helpful in identifying additional corps-level assets task organized to Third Army divisions. Inferred from these sources were the Third Army's robust engineer task organizations for each division river crossing. These are depicted in diagrams in the case study.

The case study for Operation Desert Storm in the Persian Gulf War relies on primary sources from units and individuals who experienced the events and secondary sources from

persons capturing unit events. Florian L. Waitl's book, *Into the Breach: Historical Case Studies of Mobility Operations in Large-Scale Combat Operations,* provides the background on the Persian Gulf War beginning with the fall of Sadaam Hussein, and goes into the importance of combat engineers integrating with maneuver forces. Stephen Bourque's, *Jayhawk! The VII Corps in the Persian Gulf War,* explains the engineer force structure task organized to the 1st Infantry Division. David F. Gross' article, "The Breach of Saddam's Defensive Line: Recollections of a Desert Storm Armored Task Force Commander," explains the effects on the Iraqi obstacles on operations and the challenges of the breaching equipment used. The primary source used for this case study was Gregory Fontenot's book, *The 1st Infantry Division and the US Army Transformed,* which gave a battalion commander's detailed perspective on the breakdown of the attack and breach, the command and control structure, and force structure for 1st Infantry Division.

Doctrine Requirements for Division Mobility Operations

This section provides a review of current doctrine on mobility operations outlining the requirements for divisions and the roles engineers play in these operations. Mobility operations are one of the principal tactical enabling tasks as part of large-scale combat operations.[7] The two main combined arms mobility operations are breaching and gap crossing. While both have similar fundamentals, there are unique requirements for each requiring engineer capability. The biggest challenge identified is how the division command and controls these operations and the lack of engineer capability within its task organization.

[7] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), ii.

Current Doctrine on Mobility Operations

Current Army Doctrine states that the purpose of mobility operations is to overcome natural and man-made obstacles to enable movement and maneuver.[8] This is especially important in offensive operations as units maneuver quickly across an area of operations. Since mobility is part of the maneuver warfighting function, engineers play a significant role in offensive operations.[9] The primary functions of combat engineers are mobility, counter-mobility, and survivability.[10] Mobility operations are combined arms activities, not solely the responsibility of engineers.[11] Within mobility operations, breaching and gap crossing are operations specific to maneuver.[12] This implies that these tasks are expected to be conducted under fire, and that the combined arms team must train on breaching and gap crossing frequently to be successful.[13]

Breaching operations are part of the mission essential task list for brigade combat teams and divisions with an annual training requirement.[14] This includes incorporating engineers early in the training and execution process to understand unit standard operating procedures. One of the most difficult movement and maneuver tasks is breaching, due to the amount of planning,

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[8] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 2-1.

[9] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-41.

[10] US Department of the Army, Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* (Washington, DC: Government Printing Office, 2014), 1-1.

[11] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), viii.

[12] Ibid., viii.

[13] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-60.

[14] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), viii.

synchronization, and rehearsals required.[15] Suppress, obscure, secure, reduce, assault are the breaching fundamentals used when there is a requirement to reduce an obstacle.[16] The division supports suppression and obscuration through fires. A combination of deep fires from artillery and aviation with artillery delivered smoke in the close area produces the best effects. These are shaping operations which enable brigade combat teams to secure, reduce, and assault in the close area. Suppress, obscure, secure, reduce, and assault applies to both breaching and gap crossing operations.[17] A major planning factor for engineers is the correct makeup of reduction assets and task organized engineers. The doctrinal rule of thumb is a loss of fifty percent of reduction assets during a breach.[18] This is due to the likelihood of enemy contact during the breach as obstacles should be covered by observation, direct, and indirect fire to be effective. This presents a significant challenge for planning task organization during breaching operations and follow on missions. Divisions have limited engineer capability, thus task organizing engineers to main efforts contributes to success for any mobility operation.

Gap crossing is another important mobility operation. Gap crossing also requires divisions to overcome obstacles that impede maneuver.[19] These operations include mitigation of natural obstacles such as rivers. Current doctrine suggests gap crossing in combined arms breaching is a reduction method as it requires the creation of a lane through an obstacle.[20] This means the principles of breaching and gap crossing are similar. Wet-gap crossing operations are

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[15] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 5-17.

[16] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 3-7.

[17] Ibid., 3-7.

[18] Ibid., 3-11.

[19] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 5-18.

[20] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 3-1, 4-1.

one of the most dangerous and important combined arms missions.[21] What makes gap crossing as challenging as breaching operations is creating multiple lanes over difficult terrain. Areas of operations that include multiple rivers and streams make units most vulnerable during bridge emplacement. Expansion of river crossing lanes depend on the width and number bridges available. Thus, multiple crossing points will reduce risk of units against enemy contact in river crossing operations. Units are also at risk for becoming isolated on the far side if they lose a bridge.

The main differences between breaching fundamentals and gap crossing fundamentals is that gap crossing includes more planning considerations, traffic control, and organization.[22] Coordinating with corps echelons is essential because there are no organic bridging assets in the division. The width of the passage lane is generally narrower than a breach lane so traffic control is more stressed in gap crossing. This helps avoid a build-up of units on the near side and accounts for two-way traffic. Engineers need more space for bridging equipment rather than breaching equipment during this operation, therefore organization is a fundamental of gap crossing.

Breaching and gap crossing both require large-scale obscuration.[23] However, fires are the primary division-level means for delivering large-scale obscuration as divisions no longer have chemical companies.[24] Combined arms doctrine predating the latest Field Manual (FM) 3-0, *Operations* reflect these requirements. Specific gap crossing and breaching manuals are now obsolete. Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (dated 2016)

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[21] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 1-2.

[22] Ibid., 4-5.

[23] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 7-18.

[24] "Unit Identification Code (UIC) Hierarchy 2021," U.S. Army Directorate of Force Management, accessed 22 December 2019, https://fmsweb.fms.army.mil/protected/webtaads/Frame_DocTypes.asp.

replaced the previous Field Manual (FM) 90-13, *River Crossing* (dated 2002) and Field Manual (FM) 3-34.2, *Combined Arms Breaching* (dated 2008). Field Manual (FM) 3-0, *Operations* This moved away from engineer-focused manuals to a wider combined arms audience.

Current doctrine on combined arms mobility and division operations suggests a significant capability gap in engineer force structure. Gap crossing and breaching are combined arms operations involving synchronization of intelligence, fires, ground maneuver, and engineers. Divisions need the ability to conduct complex mobility operations in large-scale combat operations, but not all doctrine has caught up to the new Field Manual (FM) 3-0, *Operations*. The corps echelon holds the engineer capability required for gap crossing such as the multirole bridge company. Since gap crossing, and especially river crossing is one of the most complicated operations a combined arms teams could face, these operations need frequent combined arms training. This emphasizes the need for gap crossing training even more. Brigade combat teams may require additional breaching assets from mobility augmentation companies or sapper companies which could lead to more than one engineer battalion in the breach. If the maneuver enhancement brigade receives an area of operations in the support area, it cannot effectively command and control forward engineer units. This sends a demand signal for an additional engineer headquarters in the division for mission command.

Engineer Force Structure at Corps and Division

One of the most important capability gaps highlighted in doctrine is the division command and control capability for breaching and gap crossing operations. Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility*, outlines the division mission command requirements for crossing operations. A designated assistant division commander serves as the crossing area commander, and either an engineer brigade commander or maneuver enhancement

brigade commander serves as the crossing area engineer.[25] When operations require division level control of gap crossing or breaching operations, an engineer headquarters is needed to manage multiple engineer units.[26] The engineer brigade serves as the crossing area engineer headquarters for river crossing operations.[27] When there are multiple engineer battalions executing breaching or gap crossing operations, an engineer brigade or maneuver enhancement brigade is required.[28] However, if the maneuver enhancement brigade is assigned an area of operations in the support area, and the corps does not provide an engineer brigade, the division has a capability gap.[29] This is dangerous for multiple divisions executing large-scale combat operations. Figure 3 shows a division gap crossing operation and incorporation of a crossing area engineer headquarters.

[25] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 4-14.

[26] US Department of the Army, Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* (Washington, DC: Government Printing Office, 2015), 5-13.

[27] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 6-44.

[28] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 4-15.

[29] US Department of the Army, Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* (Washington, DC: Government Printing Office, 2015), 5-8, A-6.

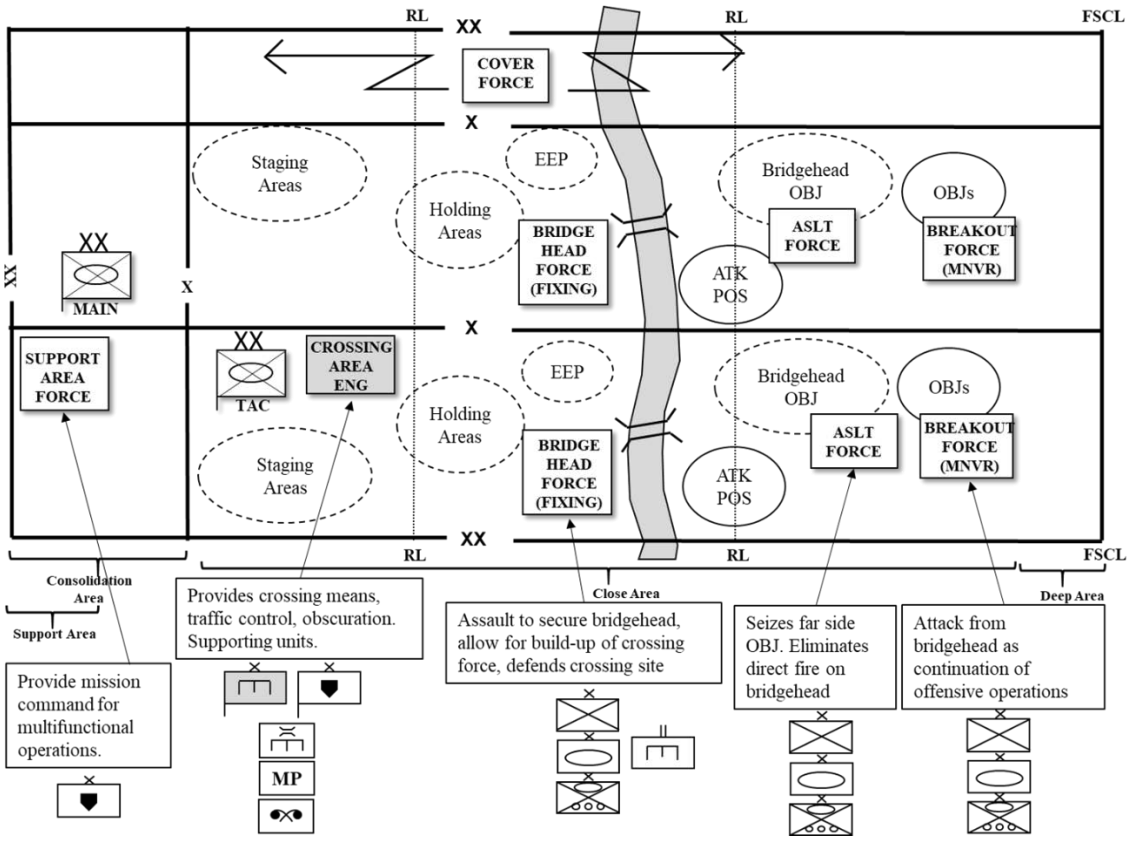

Figure 3. Crossing Area Engineer for Division Gap Crossing. Modified by author. US Department of the Army, Field Manual (FM) 90-13, *River Crossing Operations* (Washington, DC: Government Printing Office, 1998), 3-1, 5-3 – 5-11.

The engineer brigade currently resides under the corps echelon due to force pooling. Field Manual (FM) 3-94, *Theater Army, Corps, and Division* omits discussion of engineer brigades altogether.[30] Instead, three separate Army Techniques Publications discuss engineer brigades. Army Techniques Publications (ATP) 3-91, *Division Operations* and 3-92, *Corps Operations* discuss the capability of the engineer brigade. Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* covers engineer force packaging for corps and divisions. When there are more than two corps engineer battalions

[30] US Department of the Army, Field Manual (FM) 3-94, *Theater Army, Corps, Division Operations* (Washington, DC: Government Printing Office, 2014), 3-9.

provided to a division, normally an engineer headquarters is allocated.[31] Figure 4 shows an engineer brigade either attached or operational control in a corps task organization.

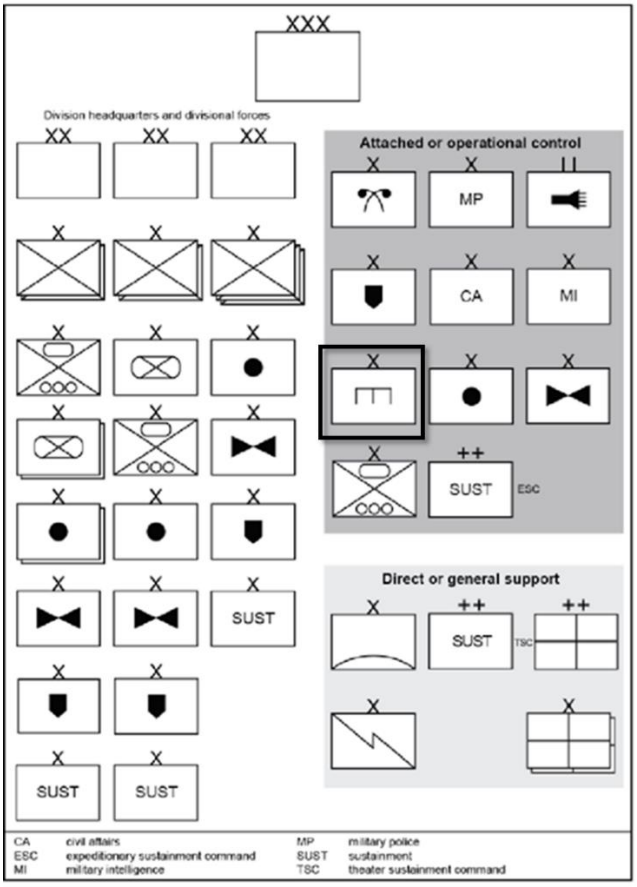

Figure 2-3. Possible tactical corps task organization

Figure 4. Engineer Brigade in Corps Task Organization. Modified by author. US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-12.

For limited contingency and small-scale operations, when divisions receive separate and multifunctional brigades, it usually does not include an engineer brigade.[32] Divisions normally receive a maneuver enhancement brigade for support area operations.[33] Maneuver enhancement

[31] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 1-17.

[32] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-18.

[33] Ibid., 2-18.

brigades primarily operate in the division support area and not the close area.[34] However, there may be instances where the division commander requires introduction of an engineer brigade headquarters to control multiple corps engineer battalions.[35] Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team,* recommends divisions have one of each type of support brigade for large-scale combat operations.[36] This requires a restructuring of current force pooling for engineers at corps to multiple army divisions to meet division mobility requirements. Figure 5 shows additional engineers above brigade combat team in direct support or general support to a division during large-scale combat operations. Depending on the number of additional engineer battalions, and whether the division is executing large-scale breaching or gap crossing operations, this may increase to an engineer brigade.

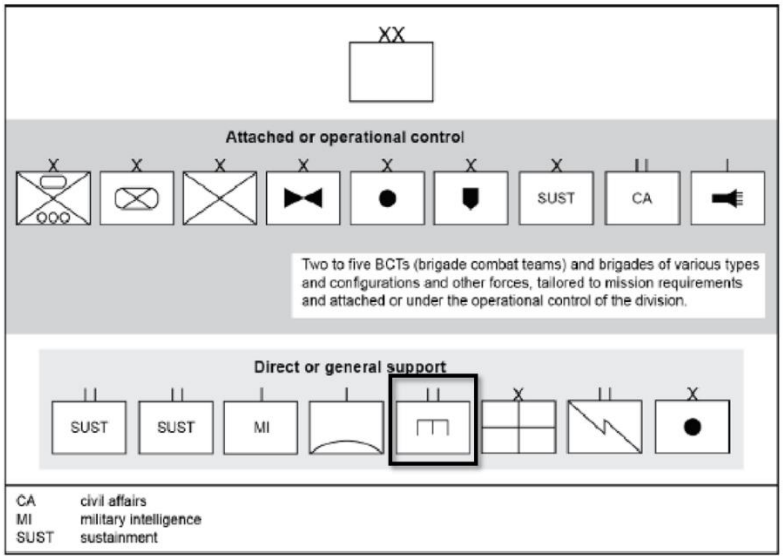

Figure 5. Additional Echelon Above Brigade Combat Team Engineers in Division Task Organization for Large-Scale Combat Operations. Modified by author. US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-14.

[34] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-1.

[35] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 1-25.

[36] US Department of the Army, Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* (Washington, DC: Government Printing Office, 2015), 1-7, 5-7.

The division receives an engineer brigade when the functional engineer brigade requirements exceed the span of control of the maneuver enhancement brigade.[37] This is the case when division-level engineers serve as both a functional and multifunctional capacity. Engineers are functional when supporting gap crossing and breaching operations enabling "the ability to quickly reduce, mark, and guide the supported maneuver unit through an obstacle is the engineer's hallmark."[38] Engineers are multifunctional when they support general engineering and other activities in the support area. Figure 6 shows an example division task organization with an engineer brigade headquarters and other echelon above brigade combat team engineers.

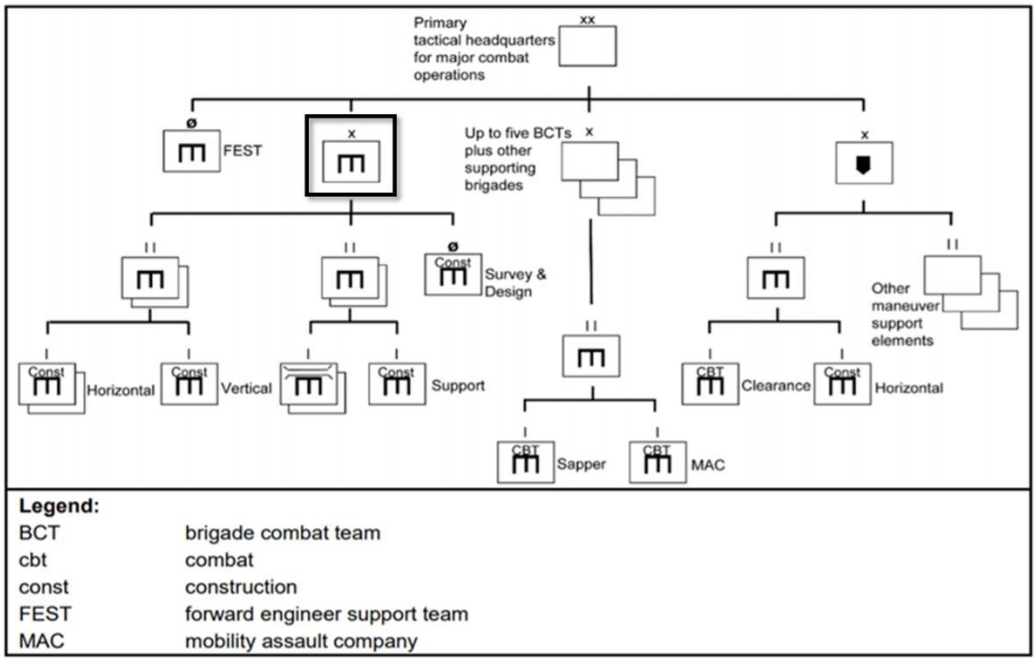

Figure 6. Example Task Organization of a Division with an Engineer Brigade. Modified by author. US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), A-7.

[37] US Department of the Army, Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* (Washington, DC: Government Printing Office, 2015), 1-6, 1-7, A-6.

[38] Ibid., 5-12.

The brigade engineer battalion assigned to brigade combat teams provides only twenty five percent of its required engineer capability.[39] Battalions under engineer brigades or maneuver enhancement brigades reinforce divisions to complete the mission. Corps sapper companies, mobility augmentation companies, and multi-role bridge companies, are weighted to the main effort division.[40] The offensive scenario in Army Techniques Publication (ATP) 3-9, *Division Operations* shows the corps assigning a division an engineer brigade when it anticipates multiple river crossings.[41] Division engineers need to be readily available to close with the enemy. This proves difficult when multiple divisions are required to conduct gap crossing or breaching operations.

Planning and coordination for separate engineer capability is the responsibility of the corps and division engineers. Divisions planners must coordinate with corps engineers to receive additional engineer capability for mobility operations. Engineers are task organized directly under maneuver commanders to provide mobility assets forward in the close fight.[42] Given the proximity to enemy direct and indirect fire, gap crossing and breaching are close area operations built around brigade combat teams.[43] Brigade combat teams may require more than one engineer battalion for gap crossing and breaching operations to control multirole bridge companies and mobility augmentation companies.[44] Since the primary combined arms force is the brigade

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[39] US Department of the Army, Army Techniques Publication (ATP) 3-92, *Corps Operations* (Washington, DC: Government Printing Office, 2016), 6-38.

[40] US Department of the Army, Army Techniques Publication (ATP) 3-34.23, *Engineer Operations - Echelons Above Brigade Combat Team* (Washington, DC: Government Printing Office, 2015), 1-3.

[41] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 6-28.

[42] Ibid., 6-20.

[43] Ibid., 6-24.

[44] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 1-4.

combat team, not having sufficient gap crossing and breaching assets at the division presents a capability gap.[45]

For divisions to be successful in large-scale combat operations, they must be able to maneuver through their battlespace. This emphasizes the importance for divisions to train on combined arms mobility operations. Current doctrine highlights the unique challenges of breaching and gap crossing, as well as the requirement for divisions to command and control those operations. When divisions need more engineer battalions and the ability to command and control multiple engineer units, they must pull capability from corps. This dependency produces a significant training gap in their ability to conduct mobility operations. To fill this gap, divisions should strongly consider an engineer command and control headquarters like that of a division artillery brigade.

The Lorraine Campaign (September – December 1944)

The US Third Army under LTG George S. Patton entered World War II between D-15 to D-60 of Operation Overlord.[46] Operation Overlord's purpose was to enter Europe through France and establish a lodgment to execute further operations.[47] The Lorraine campaign started in the second phase of the operation and extended east into Germany.[48] As part of General Dwight D. Eisenhower's strategy, the Third Army's orders were to attack the Saar industrial region in Germany by advancing through Lorraine.[49] Lorraine was a long disputed region between France and Germany, due to its shared French and German culture and its importance as a border

[45] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-14.

[46] Headquarters Third United States Army, *Third Army After Action Report*, Vol. 1 (APO 403, 1945), 9.

[47] Ibid.

[48] Ibid.

[49] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 1.

region.[50] Within Lorraine lies the Moselle, Seille, Meurthe, and Saar Rivers.[51] In conducting the campaign, Third Army would have to cross these rivers as well as the Maginot and Siegfried Lines.[52] Patton's ultimate objective was to cross the Rhine River in Germany at Mannheim and Mainz by seizing the towns of Metz and Nancy along the way.[53] Figure 7 shows the geography of the Lorraine Campaign including the crossing site towns, the rivers, and the German defensive obstacles.

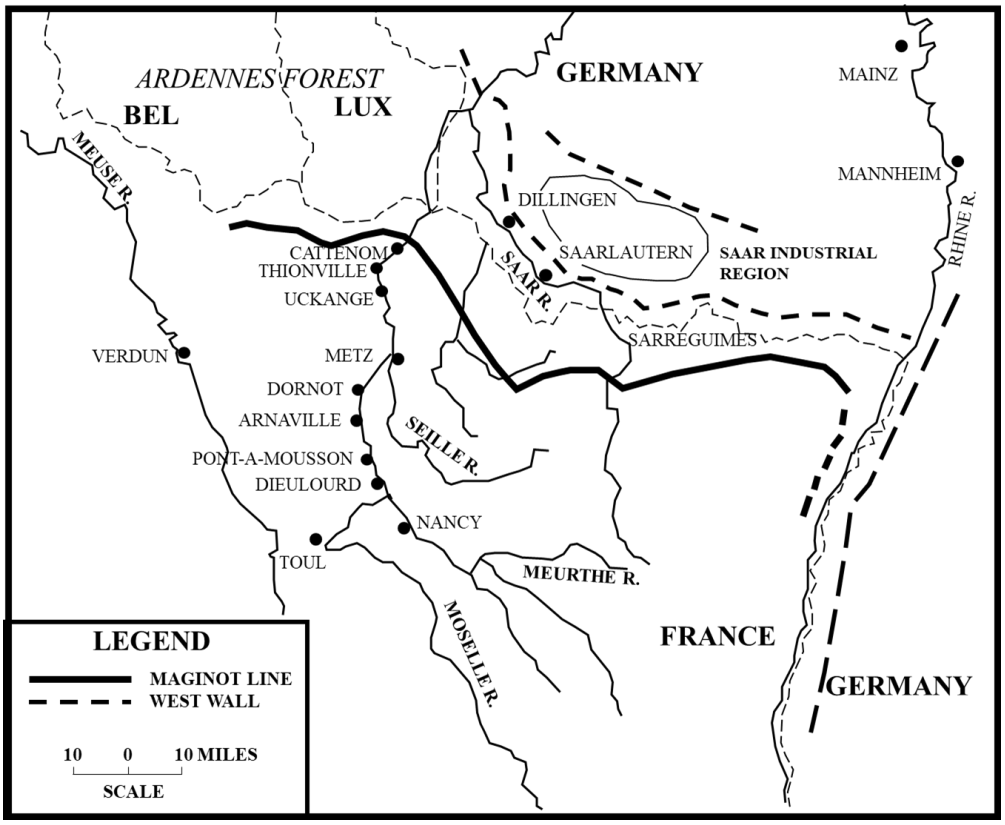

Figure 7. Lorraine Campaign Map. Modified by author. Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth, KS: US Army Command and General Staff College, 1985), 4, 29.

[50] Michael S. Nieberg, *The Treaty of Versailles* (New York: Oxford University Press, 2017), 57-58.

[51] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 1.

[52] Ibid.

[53] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 1.

The Third Army's main effort forces were the XX and XII Corps.[54] Army Corps in World War II typically were task organized with two Engineer Combat Regiments while Infantry and Armored Divisions maintained their one organic Engineer Combat Battalion.[55] The XX Corps and XII Corps task organized Engineer Combat Regiments directly to the divisions due to the number of river crossings in the campaign.[56] One critical requirement of the Engineer Combat Battalion was bridging. The Engineer Combat Regiments brought additional bridging to divisions with a treadway bridge company, increasing the river crossing capability with pontoon bridges.[57]

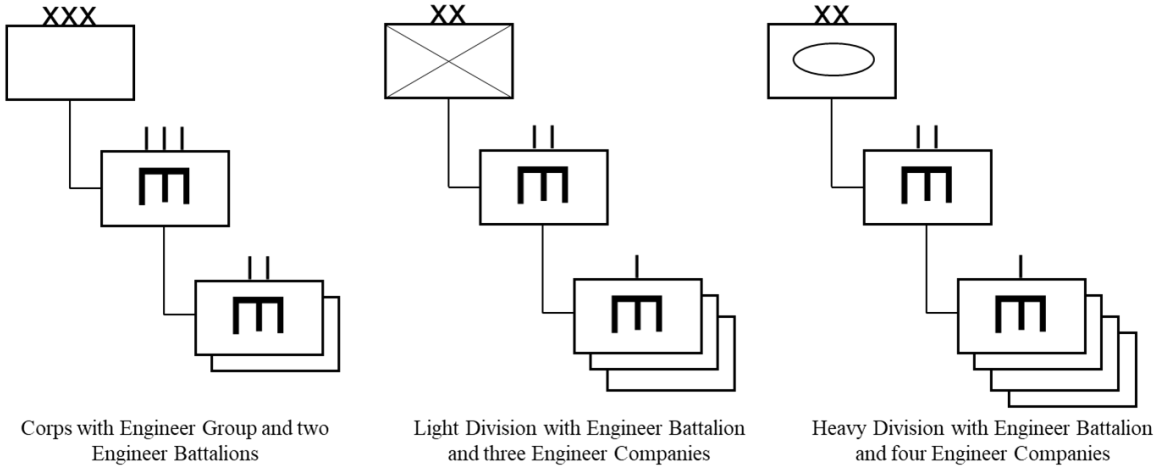

Figure 8. Typical Engineer Task Organization for Corps and Divisions. Modified by author. Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 4, 5.

80th Infantry Division Crosses the Moselle River

The first obstacle the Third Army faced on their eastern advance into Lorraine was the Moselle River. In the center of the advance, the 80th Infantry Division attempted crossings

[54] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 14.

[55] Kent R. Greenfield, *The Organization of Ground Combat Troop* (Washington, DC: US Government Printing Office, 2004), 274, 321, 354, 366, 478.

[56] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 71, 76, 144.

[57] Kent R. Greenfield, *The Organization of Ground Combat Troops* (Washington, DC: US Government Printing Office, 2004), 309, 352.

between 04 – 12 September 1944 in the towns of Pont-A-Mousson and Dieulourd.[58] At Pont-A-Mousson, engineers of the 305th Combat Engineer Battalion attempted to ferry platoons of the 317th Infantry Regiment across in vain against heavy enemy direct and indirect fire.[59] Friendly artillery support was only prioritized to one battalion's crossing and unable to support the three planned crossings.[60] Despite having enough engineer support, the crossing at Pont-A-Mousson failed due to a lack of planning, reconnaissance, and artillery support, key functions of the division.[61] Eventually the 80th Infantry Division achieved success at Dieulourd where the pontoon bridges were located.[62] The crossing operation opened with aerial bombings from IX Bomber Command coupled with a massive artillery barrage by nine field artillery battalions.[63] This umbrella of indirect and aerial fire allowed reconnaissance patrols to observe enemy activity on the far side of the river and identify better crossing sites.[64] Although under enemy fire, the 1117th Engineer Combat Group and the 305th Engineer Combat Battalion successfully emplaced heavy pontoon bridges and footbridges across a fifty meter gap, due to sound reconnaissance in finding ideal crossing sites.[65] Companies from the 167th and 248th Engineer Combat Battalions were designated to defend the bridges against any German counterattack.[66]

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[58] Kent R. Greenfield, *The Organization of Ground Combat Troops* (Washington, DC: US Government Printing Office, 2004), 60-65, 74-84.

[59] Ibid., 64-65.

[60] Ibid., 62.

[61] Kent R. Greenfield, *The Organization of Ground Combat Troops* (Washington, DC: US Government Printing Office, 2004), 65.

[62] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 16.

[63] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 76-79.

[64] Ibid., 77.

[65] Ibid., 76-79.

[66] Ibid., 81.

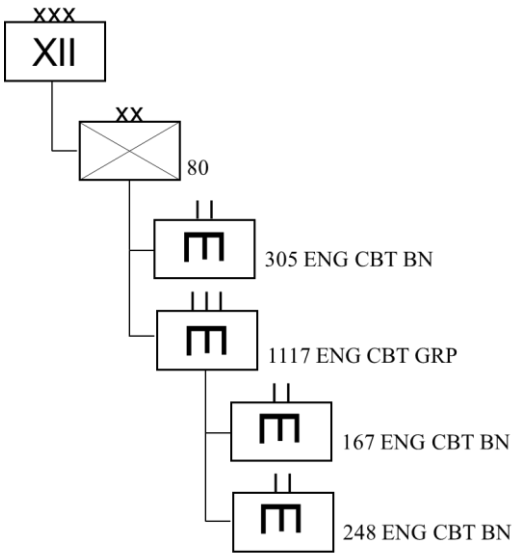

Figure 9. 80th Infantry Division Engineer Task Organization. Created by author.

5th Infantry Division Crosses the Moselle River

The 5th Infantry Division's crossings followed a similar path of initial failure and success in the north of Third Army's advance. The bridgehead attempt at the town of Dornot on 07 September 1944 failed due to the lack of friendly artillery suppression against German infantry and artillery on the far side of the river.[67] The 5th Infantry Division quickly regrouped and incorporated both air and artillery support for the Arnaville crossing site. The XIX Tactical Air Command launched a heavy bombardment with P-47s, limiting the Germans from affecting the crossing of the first battalions.[68] The crossing was also supported by artillery fire from thirteen artillery battalions and a heavy smoke screen.[69] Despite the additional air and artillery fires, engineers from the 1103rd Engineer Combat Regiment battled to emplace bridges under direct

[67] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth, KS: US Army Command and General Staff College, 1985), 20.

[68] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 142-143.

[69] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 20.

and sometimes heavy fire.[70] The river was too shallow for heavy pontoon bridges, requiring the use of treadway bridges and footbridges.[71] The 5th Infantry Division received two bridging companies, supplementing their organic engineer battalion to ultimately cross the Moselle between 10-12 September 1944.[72]

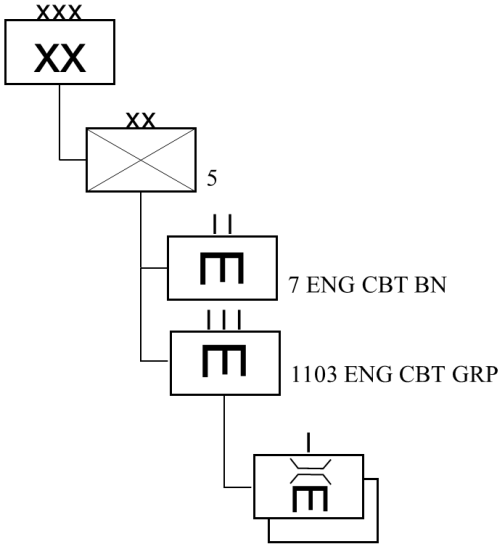

Figure 10. 5th Infantry Division Engineer Task Organization. Created by author.

35th Infantry Division Crosses the Moselle River

To the south of Third Army's advance, the 35th Infantry Division crossed two regiments with the support of the 1135th Engineer Combat Group.[73] The first attempt was to cross a mined bridge at the town of Flavigny, but once lead forces reached the far side, the Germans damaged the bridge and created heavy losses for the 134th Infantry Regiment.[74] The second attempt was at

[70] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 144-151.

[71] Ibid., 148.

[72] Ibid., 150-151.

[73] Ibid., 71.

[74] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 71.

Crevechamps and Neureville-sur-Moselle.[75] The 137th Infantry Regiment used XII Corps artillery for thirty minutes of artillery fire and crossed two battalions.[76] Engineers with armor support from the 8th Tank Battalion, completed the final crossing by emplacing a fifty meter bridge at Bayon.[77] The Germans launched a heavy counter-attack, yet, despite heavy casualties and equipment loss the 35th Infantry Division crossed the Moselle successfully.[78]

At the end of September, the Third Army's advance east was halted due to delays in resupply.[79] The Lorraine was 500 miles from their major supply area at Normandy and the Red Ball Express, but the massive attempt to extend operational reach to Allied forces across Europe, slowly degraded.[80] The Third Army received orders to resume operations on 10 November 1944, only to be impacted by two major floods.[81] The river crossing operations in the second half of the campaign were characterized by heavy flooding and mud. The Germans used the flooding as an opportunity to destroy or rig bridges with demolitions to slow the Third Army's advances.[82]

90th Infantry Division Infantry Division Crosses the Moselle

The northern most sector of Third Army's area of operations was the towns of Cattenom and Koenigsmacker. The majority of the engineer efforts to cross the Third Army over the Moselle were in the 90th Infantry Division's assault.[83] The division was supported by five

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[75] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 70-71.

[76] Ibid., 71-72.

[77] Ibid., 72.

[78] Ibid., 74-75.

[79] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 21-22.

[80] Ibid., 4.

[81] Ibid., 24, 28.

[82] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 24.

[83] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 424.

engineer battalions: their organic 315th Combat Engineer Battalion, the 135th, 160th, 179th, and 206th Engineer Combat Battalions under the 1139th Engineer Combat Group.[84] This was one of the largest task organizations of engineers to any one division during the Lorraine campaign. The engineers trained with two infantry regiments in preparation for a crossing at Cattenom and Koenigsmacker.[85] After the crossing of the first two battalions by treadway bridge, the remaining were crossed by rubber boats.[86] The boats were either damaged or lost in the assault due to heavy German direct and indirect fire.[87] The 90th Infantry Division managed to cross eight battalions by the end of November 1944.[88]

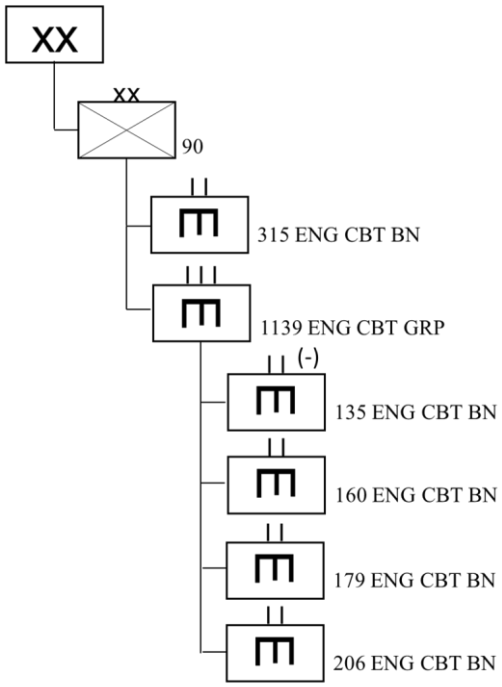

Figure 11. 90th Infantry Division Engineer Task Organization. Created by author.

[84] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 424, 427.

[85] Ibid.

[86] George S. Patton Jr, *War As I Knew It* (Cambridge: The Riverside Press, 1947), 172.

[87] Ibid., 424-425.

[88] Ibid., 425.

95th Infantry Division and 10th Armored Divisions Cross the Moselle

South of the 90th Infantry Division were the towns of Thionville and Uckange. There were some existing bridges in the town of Thionville, but the 95th Infantry Division engineers needed to emplace additional bridges due to heavy flooding damaging or destroying a majority of them.[89] The 1306th Engineer General Service Regiment, serving in the capacity of an engineer combat group, augmented the 90th Infantry Division engineers by constructing a Bailey bridge.[90] The engineer regimental commander discovered the initial site assessment to emplace the bridge was incorrect, most notably that gap was over sixty meters, exceeding the length of their Bailey bridge.[91] This resulted in the engineers having to spend more time to expand the near shore to accommodate the bridge, and taking heavy losses from German mortar fire.[92] They eventually received obscuration by a smoke generating company, but had to replace engineer companies due to the sustained casualties.[93] A heavy pontoon (float) bridge was also established at the small town of Uckange and by 14 November 1944, the engineers crossed the 95th Infantry Division and the 10th Armored Division.[94] The 135th Engineer Combat Battalion from the 1139th Engineer Combat Group were assigned to assist the crossing and expand the bridgehead.[95]

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[89] William C. Hall, "Bridging at Thionville," *The Military Engineer* 40, no. 270 (1948): 169, 170, accessed 30 October 2019, https://www.jstor.org/stable/44556060.

[90] Ibid., 427-428.

[91] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 427-428.

[92] Ibid., 427-428.

[93] Ibid., 428.

[94] Ibid., 427, 429.

[95] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 377, 403.

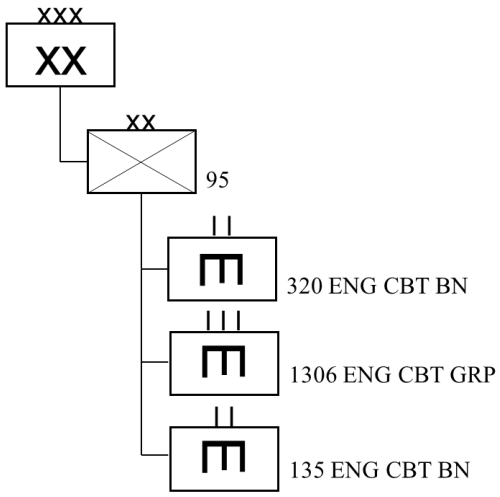

Figure 12. 95th Infantry Division Engineer Task Organization. Created by author.

35th Infantry Division Crosses the Saar River

Following the crossings of the Moselle, the Third Army seized the towns of Metz and Nancy and continued the movement east.[96] The next obstacles were the Maginot Line, Saar River, and Siegfried Line.[97] The 10th Armored Division was bogged down by German attacks on the Orscholz Switch Line by a series of fortifications perpendicular to the Seigfried Line beyond the Maginot.[98] In the town of Sarreguimes, the 35th Infantry Division began a surprise river crossing with assault boats on 08 December 1944.[99] Engineers were able to emplace a footbridge after neutralizing a German counter-attack.[100] However the Germans were successful with their artillery fire, halting several battalions during the first assault and keeping the majority of the 35th

[96] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 15-16, 28.

[97] Ibid., 29-30.

[98] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 430.

[99] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 536.

[100] Ibid.

Infantry Division on the near shore.[101] The division attempted to bring in the 81st Chemical Company to create obscuration, but it drew heavy enemy fire.[102] They were not successful until 1135th Engineer Combat Group and the division's organic 60th Engineer Combat Battalion worked during darkness to emplace vehicular bridges.[103]

The Blies River lies on the west side of the Saar. After the initial crossing, the engineers emplaced a Bailey bridge at the town of Habkirchen.[104] This bridgehead was established after several days of hard fighting, and the 35th Infantry Division pushed the German back to the Westwall fortifications.[105]

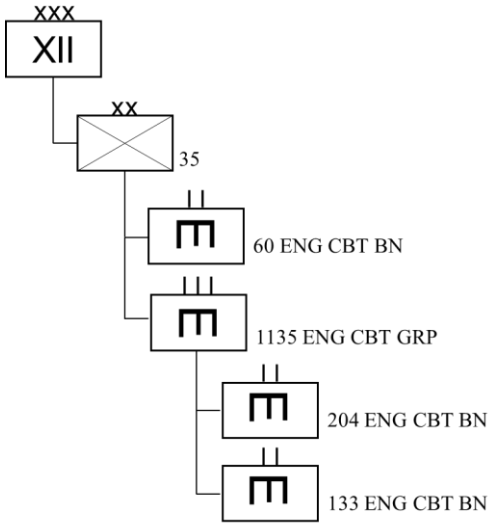

Figure 13. 35th Infantry Division Engineer Task Organization. Created by author.

95th Infantry Division Crosses the Saar River

The farthest the Third Army would advance into Germany was the 95th Infantry Division's assault across the Saar. On 01 December 1944, following a large-scale air

[101] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 540.

[102] Ibid.

[103] Ibid.

[104] Ibid., 542, 544.

[105] Ibid., 544-546.

bombardment with B-26 bombers, the division attacked with three infantry regiments abreast near the town of Saarlautern.[106] The 4th Tank Destroyer Group and corps artillery also supported the assault.[107] The 320th Engineer Combat Battalion conducted a surprise boat crossing under the cover of artillery and poor weather.[108] Once across, the engineers cleared the existing bridge which was already rigged with explosives by the Germans.[109] The Germans attacked to retake or destroy the bridge, but the Americans maintained the bridge and their positions.[110] The 95th Division crossed an infantry and tank battalion, facilitating the Third Army's next move into Germany.[111] On 16 December 1944, General Patton was informed that a major German offensive in the Ardennes was imminent, and the Third Army was to withdraw from the Saar region.[112]

After three months, the Lorraine campaign ended on 20 December 1944.[113] During the campaign, the XX and XII Corps of the Third Army controlled four engineer combat groups and one general engineer service regiment.[114] This added eight additional Engineer Combat Battalions enabling the emplacement of 120 Bailey bridges, 111 treadway bridges, two heavy pontoon bridges, and eleven pontoon and treadway bridges.[115] Each gap crossing division was successful

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[106] Hugh M. Cole, *The Lorraine Campaign* (Washington, DC: US Government Printing Office, 1984), 512-513.

[107] Ibid., 513.

[108] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 431.

[109] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 431.

[110] Ibid., 518.

[111] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 518.

[112] Christopher R. Gabel, *The Lorraine Campaign: An Overview, September – December 1944* (Fort Leavenworth: US Army Command and General Staff College, 1985), 31-32.

[113] Ibid.

[114] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 381-390, 427-429, 525-548.

[115] Headquarters Third United States Army, *Third Army After Action Report*, Vol. 1 (APO 403, 1945), 147.

because they were task organized an engineer combat group or general service regiment, adding at least two additional engineer battalions and increased bridging capability. Gap crossing operations at the division level require an integrated combined arms team. The Third Army in WWII would not have been successful without directly task organizing corps engineer assets directly to divisions.

1st Infantry Division in the Gulf War (February 1991)

Saddam Hussein attacked Kuwait on 02 August 1990 in an attempt to annex the small country and acquire its oil resources. The small 20,000-man Kuwaiti Armed Forces was overwhelmed and were either killed, captured, or escaped to Saudi Arabia. The United States rapidly mobilized a large-scale ground force in response. An international coalition of thirty-two countries participated in Operation Desert Shield and Operation Desert Storm. These operations pushed the Iraqi military out of Kuwait and denied their advancement into Saudi Arabi. Within thirty-six hours, the US military deployed the first echelon of forces into Saudi Arabia with the remainder deploying in the subsequent months. This was a massive logistical effort by air, sea, and rail to move forces into theater to amount an adequate response. Combat engineers were in high demand and short throughout the theater. To prepare for the upcoming breaches of the Iraqi defenses, combat engineers needed to be with their maneuver commanders.[116]

The US Army underwent division restructuring in 1986 and 1992, rewriting Field Manual (FM) 100-5, *Operations*. The new AirLand Battle concept emerged as part of this restructuring in attempts to combat peer or near peer threats in Europe, the Middle East, or North Korea. The new heavy division was a product of these developments with the required engineer force restructuring following. Divisions had their own organic engineer battalion for breaching operations and building defenses. Assigned division chemical companies also provided

[116] Florian L. Waitl, *Into the Breach: Historical Case Studies of Mobility Operations in Large-Scale Combat Operations* (Fort Leavenworth: Army University Press, 2018), 191-192, 194-197.

obscuration for breaching. However, the division still lacked adequate minefield clearing capability. The Army designed engineer brigades to fill this gap but never formally assigned them to divisions.[117]

The 176th Engineer Group, consisting of four engineer battalions filled the void in breaching capability for the 1st Infantry Division. Three of these battalions were direct support to the division to assist in general engineer efforts, specifically to build a replica of the Iraqi defensive obstacles. They also expanded the passage lanes after 1st and 2nd Brigade's breach.[118] The division engineer, LTC Stephen Hawkins, supervised its construction and implementation of additional engineer forces. In the Gulf War, it was common for corps to augment division engineers with additional battalions, sometimes forming a provisional engineer brigade, known as 'E Force.' This allowed one commander to command and control all mobility and counter-mobility assets in the division.[119]

In Operation Desert Storm, the First Infantry Division executed the largest breaching operation since World War II. The division had two engineer battalions to support the breach, its assigned 1st Engineer Battalion and the 9th Engineer Battalion. Each was task organized under 1st and 2nd Brigades for the assault. The 1st Infantry Division's breach was the main effort in VII Corps' assault on the Iraqi Republican Guard's defenses. Intelligence suggested the Iraqi defense was a complex obstacle system defended by infantry supported by tanks. Casualty estimates in the breach were twenty-five percent, so rehearsals were vital. Days prior to the operation, 1st and 2nd Brigades trained on new breaching equipment to include mine rakes for the combat engineer vehicle, mine plows for the M1 tank, and the mine-clearing line charge mounted to the new armored vehicle-launched mine-clearing line charge. The mine-clearing line charge could clear a

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[117] Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia: University of Missouri Press, 2017), 46-51.

[118] Stephen Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Center of Military History, 2002), 200, 209, 350.

[119] Ibid., 110, 212.

hundred-meter by eight-meter lane, unprecedented in breaching until this point. This provided the width needed for all mechanized vehicles in the heavy division. The division treated breaching operations as a river crossing, which the division trained on annually. The sheer number of vehicles needing to roll through the lanes and the control measures made these operations comparable.[120]

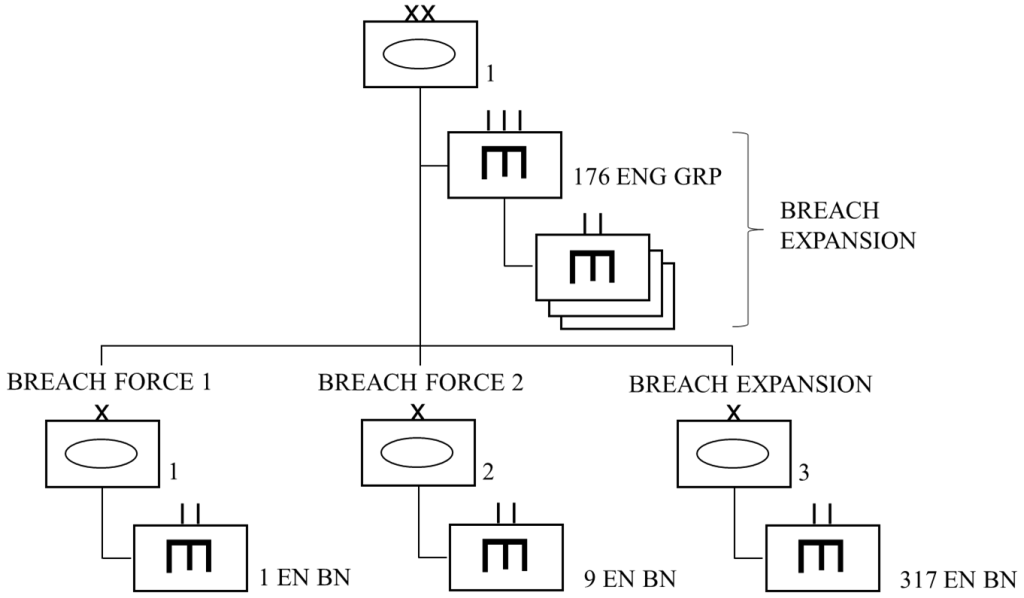

Figure 14. 1st Infantry Division Task Organization with Engineers. Created by author. Stephen Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Center of Military History, 2002), 110, 155, 200, 209, 350.

The division's mission was a deliberate attack against Iraqi defenses by conducting a penetration through complex obstacles. MG Tom Rhame, the division commander, wanted to attack along a narrow front with two assaulting brigades, with the third brigade expanding the breach. Battalions from the 176th Engineer Group also executed an expansion of passage lanes and traffic control for support units flowing through the breach.[121] Upon completion of the breach, 1st and 2nd Brigades would pass the 1st Armored Division of the United Kingdom. The

[120] Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia: University of Missouri Press, 2017), 34, 107, 122, 163, 167, 171-172, 180.

[121] Stephen Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Center of Military History, 2002), 200, 209, 350.

breach required an initial depth of five kilometers to prevent direct fires onto the passage lanes, and expand to fifteen kilometers to prevent indirect fires on follow on forces. The attack commenced on 24 February 1991 with an opening barrage of indirect artillery by thirteen field artillery battalions from across VII Corps. Additionally, air defense batteries and smoke platoons supported each of the maneuver brigades. The breaching operation faced little Iraqi resistance. First Brigade encountered a minefield, which they cleared with a mine-clearing line charge. Iraqis attacked with small arms fire from bunkers and were either destroyed quickly or surrendered. Surprisingly, friction proved to be more of a threat than the Iraqi Republican Guard.[122]

Military theorist Carl von Clausewitz explains friction as a force that can interfere with any well-developed and rehearsed plan.[123] The difficulties 1st and 2nd Brigade's faced in the breach are evidence of Clausewitz's friction; as represented by the speed of operations. Speed is a crucial factor for any mobility operation, and mines prove to be a major obstacle in slowing down the 1st Infantry Division. The main challenge of the breaching concept was quickly identifying minefields. Thermal sights were unreliable to see minefields in time for a mine plow to stop and call a mine clearing line charge forward to breach. Maneuvering mine plows and firing mine clearing line charges was a slow process, and the brigades lacked the intelligence of actual locations of the minefields. In addition, thousands of enemy prisoners of war littered the battlefield. The brigades pushed them to the rear, slowing operations moving forward. Despite these hinderances, there were not as many obstacles as expected. The two assaulting brigades cleared small trenches, some berms, and a few minefields overall.[124]

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[122] Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia: University of Missouri Press, 2017), 101, 162-163, 238, 250, 261-267.

[123] Carl von Clausewitz, *On War,* ed. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 17.

[124] David F. Gross, "The Breach of Saddam's Defensive Line: Recollections of a Desert Storm Armored Task Force Commander," *Defense Technical Information Center,* 15 April 1993, accessed 23 December 2019, https://apps.dtic.mil/dtic/tr/fulltext/u2/a265080.pdf.

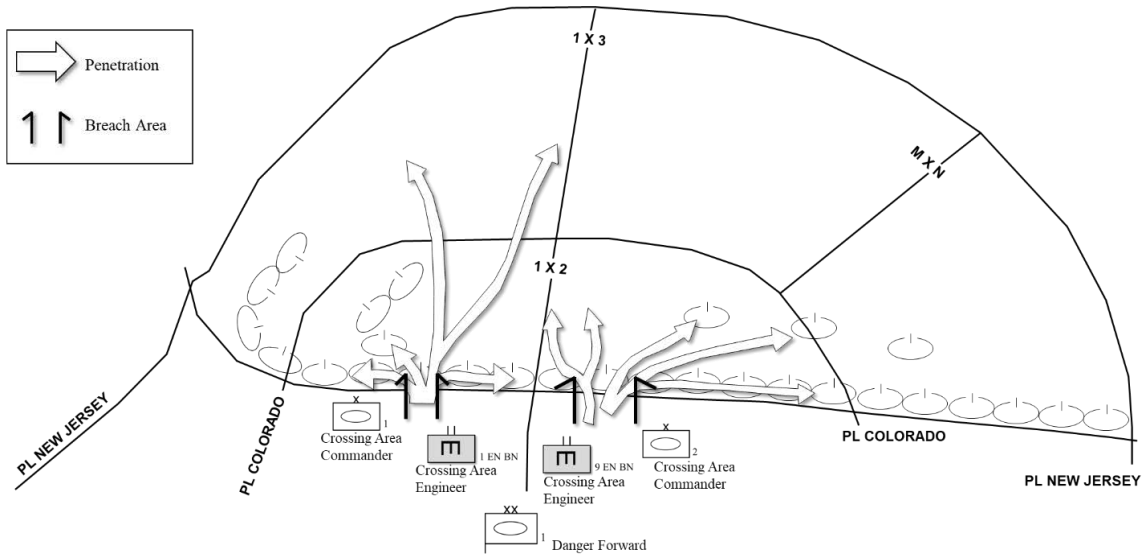

Figure 15. 1st Infantry Division Breach Lanes. Modified by author. Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia, MO: University of Missouri Press, 2017), 262.

The 1st Infantry Division successfully completed breaching operations on 25 and 26 February 1991. To facilitate the expansion of the breach, the division's forward command post, Danger Forward, served as the crossing force headquarters commanded by BG William Carter III, the assistant division commander for maneuver. The two assault brigade commanders, COL Maggart and COL Moreno served as crossing area commanders in their brigade's respective zones. The crossing force engineers were their engineer battalion commanders, LTC Hawkins and LTC Jemiola. This structure similarly follows Field Manual (FM) 90-13, *River Crossing Operations,* where the division directly command and controls the traffic flow from the near to the far side. Ultimately, the division cleared sixteen lanes in support of the VII Corps advance. With the support of two engineer battalions, the 1st Infantry Division's breach enabled VII Corps' defeat of the Iraqi Republican Guard.[125]

[125] Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia: University of Missouri Press, 2017), 250, 266, 284, 298.

Analysis on Doctrine Review and Case Studies

This monograph covered the current doctrine for mobility operations, division operations, and corps operations. It outlined engineer force structure during World War II, the Persian Gulf War, and the current force pooling. Engineer force structure within the US Army division has continued to grow due to past large-scale combat operations and the demand for more engineers within the brigade combat team. With the new Field Manual (FM) 3-0, *Operations* shift out of counterinsurgency operations and back into large-scale combat operations, the demand for engineers in division remains high. The evolution of the US Army division as the key tactical maneuver force for large-scale combat operations requires the division to possess the necessary capability and command and control structure for operations in the close fight. Breaching and gap crossing are two of these operations.

Current Doctrine Requirements of Divisions

As one of the principle tactical enabling tasks in large-scale combat operations, mobility operations must be a training focus for divisions. Combined arms breaching and gap crossing are complex maneuvers requiring detailed planning and synchronization of capabilities. Both are extremely dangerous activities and require extensive rehearsals. Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility,* outlines the requirements for each type of operation, but does not go in depth on the similarities between them.

Figure 16 below, illustrates the correlation between the breach tenets and the gap crossing fundamentals. The breaching tenet, intelligence, is a component of surprise, extensive preparation, and flexible planning in the gap crossing fundamentals. Intelligence on the crossing site or enemy obstacles informs the deception plan and rehearsals. Massing of combat forces on the far side of the breach or gap achieves speed. Part of synchronization is achieving command and control of both the breach or gap crossing as well as traffic management for follow on forces. The most notable comparison between the breaching tenets and gap crossing fundamentals is the

gap crossing organization linkage with the breach fundamentals and breach organization. The division headquarters serving as the crossing area commander provides synchronization as well as command and control for suppression and obscuration. The crossing area engineer provides synchronization of breach or gap crossing assets and expansion of breach lanes or bridge lanes. Doctrine suggests the crossing area engineer for large-scale combat operations as an engineer brigade headquarters. The crossing area engineer at the breach site or river crossing may be the brigade engineer battalion within the brigade combat team. Additional brigade combat teams or maneuver battalions serve as the assault forces and breakout forces for far side objectives. Finally, reverse breach planning can apply to gap crossing, and is the responsibility of the crossing area engineers.[126]

[126] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), Chapter 3-4.

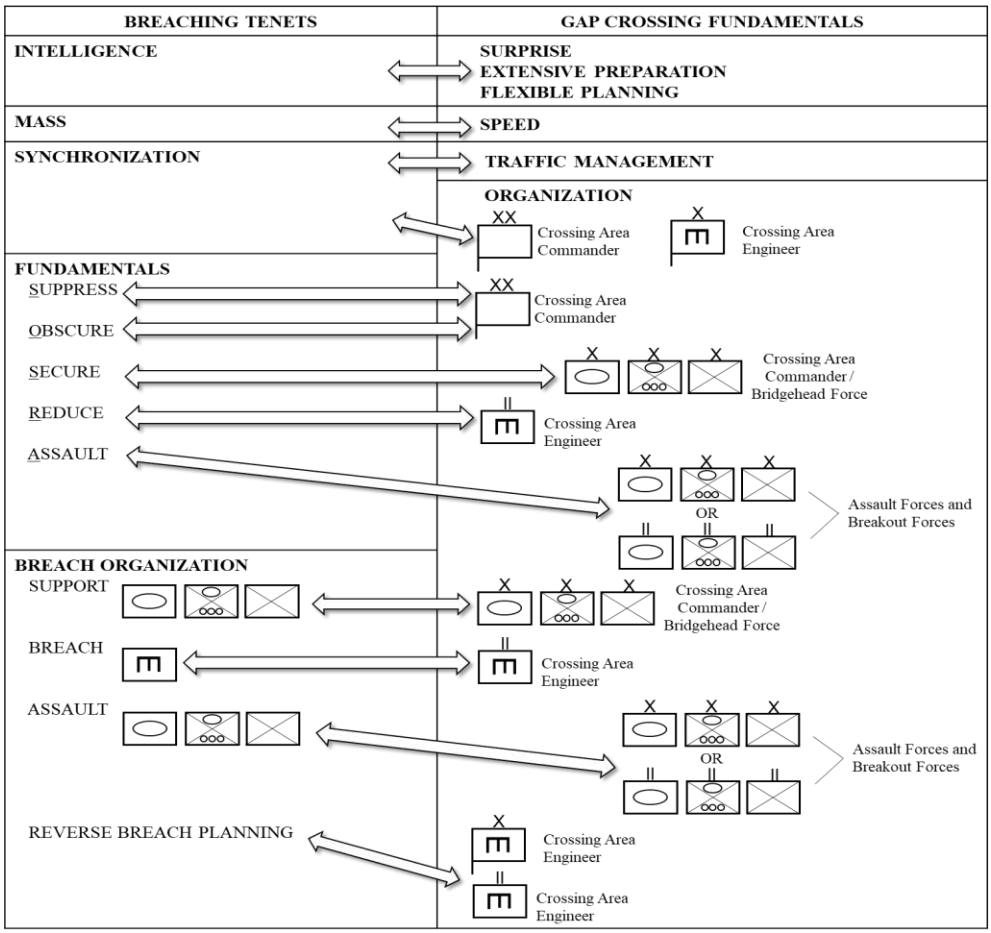

Figure 16. Correlations between Breach Tenets and Gap Crossing Fundamentals. Created by author. US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), Chapter 3-4.

Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility,* also mentions higher than brigade echelons executing breaching operations.[127] However, it does not go into detail defining the higher echelons and how they integrate into the fight. Doctrine needs to address the division and corps roles in breaching and gap crossing operations to increase tactical and operational effectiveness. Furthermore, Army Techniques Publication (ATP) 3-90.4 does outline the division command and control responsibilities for gap crossing, it fails to go in depth on the division headquarters' responsibility for breaching operations. The engineer command and

[127] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 3-23.

control is also mentioned for gap crossing but not mentioned for the engineer brigade or maneuver enhancement brigade for breaching.

Examples of Division-scale Mobility Operations

The Third Army's Lorraine Campaign in World War II illustrated some of the largest river crossing operations in history. The engineer force structure was the linchpin to success in these crossings. Between the XX Corps and VII Corps, the Third Army controlled four engineer combat groups and one general engineer service regiment.[128] Today's corps engineer brigades are the replacement for those engineer groups and regiments. This means that a corps assigned to Third Army possessed three times the engineer brigade support in today's corps. Those engineer combat groups and general engineer service regiments were also task organized directly to five separate divisions conducting river crossing simultaneously or sequentially during the campaign. This demonstrates how more than one division may require a corps engineer brigade in large-scale combat operations. The corps engineer units brought the divisions the heavy bridging capability needed for multiple river crossings across the Western Front.

Despite the increase of engineer forces in the divisions, many crossing attempts failed due to heavy enemy direct and indirect fire, or the division's inability to synchronize artillery and joint fires.[129] This proves the difficulty not only integrating the combined arms team, but it reinforces the division's need to train on gap crossing operations frequently. Divisions today have organic fires within the brigade combat teams and an additional command and control headquarters, the division artillery brigade.[130] The division also has organic engineer capability

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[128] Alfred M. Beck, *The Corps of Engineers: The War Against Germany* (Washington, DC: Government Printing Office, 2002), 381-390, 427-429, 525-548.

[129] Kent R. Greenfield, *The Organization of Ground Combat Troops* (Washington, DC: US Government Printing Office, 2004), 16.

[130] "Division Artillery Unit Identification Code (UIC) Hierarchy 2021," U.S. Army Directorate of Force Management, accessed 23 December 2019, https://fmsweb.fms.army.mil/protected/struct/listing_struct_leg.asp.

within the brigade combat team, but it does not have an additional engineer command and control headquarters for gap crossing.

The 1st Infantry Division's breach of the Iraqi defenses during Operation Desert Storm proved to be one of the most important mobility operations for the modern US Army. One of the main factors of success in this operation was the division's rehearsals of the breach and their ability to command and control multiple breach lanes. Combined arms breach rehearsals enabled the swift execution of the attack. The 1st Infantry Division received the 176th Engineer Group and the 9th Engineer Battalion possessing a total of four additional engineer battalions.[131] This gave the 1st and 2nd Brigades an engineer battalion each, matching today's force structure, but it also gave the division headquarters three more battalions, allowing the division the ability to construct training obstacles for their rehearsals. Since there are no longer engineer groups or regiments, engineer brigades are the corps entity for additional construction.

The 1st Infantry Division followed river crossing doctrine in their command and control of the breach passage lanes. Since they had two brigades breaching across their advance, the division had the two brigade commanders as the crossing area commanders with their engineer battalion commanders serving as their crossing area engineers.[132] The division headquarters still maintained overall command and control of the operation, and used the 176th Engineer Group to expand the breach lanes and assist with traffic control for follow on forces.[133] This is similar to gap crossing where the crossing area engineer headquarters ensure the passage through the breach lanes supports the overall scheme of maneuver.[134] Breaching rehearsals on training obstacles, two

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[131] Stephen Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Center of Military History, 2002), 110, 212.

[132] Gregory Fontenot, *The 1st Infantry Division and the US Army Transformed* (Colombia: University of Missouri Press, 2017), 250, 266, 284, 298.

[133] Stephen Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Center of Military History, 2002), 200, 209, 350.

[134] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 4-14.

brigade breaches, and the expansion of passage lanes for follow on forces would not have successful without the addition of corps engineers task organized to the 1st Infantry Division.

Implications for Large-Scale Combat Operations

If divisions are the key warfighting element required to command and control operations in the close fight, they must receive the organic capability to command and control a large-scale breaching and gap-crossing operations. Lack of a command and control headquarters limits the division's ability to execute these combined arms operations in high intensity conflict. In large-scale combat operations, multiple divisions could conduct breaching or gap-crossing simultaneously. Engineer brigades provide theater-level support, but if the theater requires multiple divisions to breach or cross a river, the corps will need more than one headquarters to task organize to divisions. For example, the scenario in Army Techniques Publication (ATP) 3-91, *Division Operations*, assigns an engineer brigade to a division because of the number of river crossings in the division's area of operations.[135]

Divisions already have limited organic bridging capability, reducing the division's ability to train on gap crossing annually. However, brigade combat teams within a division train on combined arms breach of an obstacle annually. Gap crossing training at the division-level is equally as important since both operations are similar. The crossing area headquarters for gap crossing and the headquarters controlling the passage of a breach are the missing links in annual division mobility training.[136] The crossing area engineer in a gap crossing operation serves as the division's crossing area headquarters.[137] This compares to the headquarters commanding and controlling the passage in a breach operation.[138] Both of these headquarters must come from

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[135] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 6-28.

[136] US Department of the Army, Army Techniques Publication (ATP) 3-90.4, *Combined Arms Mobility* (Washington, DC: Government Printing Office, 2016), 3-23.

[137] Ibid., 4-14.

[138] Ibid., 3-23.

corps. Engineer force pools at echelons above brigade combat team severely restricts a multiple division fight or a division required to conduct either a large-scale breach or gap crossing. Echelon above brigade combat team engineer forces provide flexibility and versatility at the theater-level, but not at the division-level.

Areas for Further Study

This monograph focused on mobility operations at the division echelon. This does not include all mobility tasks and other tasks which may involve engineers from echelons above the brigade combat team. Other mobility operations include: 1) construction and maintenance of combat trails, roads, landing zones, and airfields, 2) route clearance operations, 3) minefield detection and clearance operations, and 4) explosive ordnance disposal. Other division operations requiring echelon above brigade combat team engineer units include construction of obstacles, survivability, and protection tasks.

Engineer battalions in engineer brigades provide divisions with the capability necessary for construction and maintenance of combat trails, roads, landing zones, and airfields. In large-scale combat operations, divisions may deploy to theaters with unimproved roads to maneuver ground forces and a lack of landing zones and airfields for air assets. Construction and maintenance of these areas further provide the division with the freedom to move and maneuver in their area of operations. The future conflict theater is unknown, but the likelihood of adversaries emplacing improvised explosive devices to stop US vehicles remains high. Route clearance and explosive ordnance disposal are two other mobility tasks that may require additional engineer assets from corps engineer brigades. Currently, divisions have limited route clearance capability and no explosive ordnance capability. Combat engineers have limited capacity to reduce unexploded ordnance and may require explosive ordnance disposal units to enhance their capability. Due to the increase in anti-access aerial-denial threats in the security environment, US adversaries will likely emplace complex obstacle defenses that may include

minefields. In addition to breaching operations, the need for minefield detection and clearing capability increases to expand maneuver space within an area of operations and assist movement for the host nation.

Counter-mobility is the second primary task for combat engineers and it is vital for the defense. Brigade combat teams have limited counter-mobility assets for obstacle emplacement. Counter-mobility and survivability occurs in both the close and rear areas. The division headquarters, combat aviation brigade, and sustainment brigade require survivability measures in the rear area. Divisions require additional counter-mobility and survivability capability from the engineer brigades or maneuver enhancement brigades to focus on the rear area to leave maximum engineer assets forward with brigade engineer battalions in the close fight.

Conclusion

Divisions require a brigade level engineer command and control headquarters to synchronize combined arms mobility operations. The US Army's shift to large-scale combat operations place a strong demand on divisions' ability to move and maneuver in high intensity conflict.

> Economy of force is not gained by having a lot of units in a reserve pool where they train individually, knowing little or nothing of the units they are going to fight with…Economy of force and unity of command go together. You get little of either if you get a lot of attached units at the last moment. Team play comes only with practice.[139]
>
> Lt Gen Jacob L. Devers.

Large-scale mobility operations, particularly gap crossings, present an operational limitation due to the need to mass forces at an obstacle to continue movement. Organic task organization that trains and synchronize mobility tactics, techniques, and procedures best mitigate this vulnerability. However, this organic relationship does not currently exist at the division level.

[139] Kent R. Greenfield, *The Organization of Ground Combat Troops* (Washington, DC: US Government Printing Office, 2004), 293.

Since the division is the primary tactical headquarters in large-scale combat operations, habitual relationships with engineers and the division headquarters are essential.[140] The division engineer brigade headquarters could mirror the tailorable division artillery framework, where additional engineer battalions from corps augment the division engineer brigade headquarters. The Lorraine Campaign crossings and the 1st Infantry Division breach are two examples of large numbers of additional engineer attachments to a division. A division engineer brigade headquarters provides the flexibility and versatility to command and control additional engineer attachments to facilitate division level maneuver.

The implementation of the brigade engineer battalions into brigade combat teams gives the brigade combat team commanders the ability to integrate engineer efforts into the scheme of maneuver. This allows for habitual relationships between engineer and maneuver battalion commanders. It also allows engineers to directly train with maneuver forces on all areas of mobility operations. "Keys to effective mobility operations are contingency planning, well-rehearsed breaching operations, and trained engineers familiar with unit standard operating procedures who are integrated into the attack formation."[141] Division headquarters should mirror the organic engineer relationships in the brigade combat team with the addition of a brigade engineer headquarters.

[140] US Department of the Army, Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), 2-35.

[141] US Department of the Army, Army Techniques Publication (ATP) 3-91, *Division Operations* (Washington, DC: Government Printing Office, 2014), 6-11.

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