

The Impact of Logistics on General Robert E. Lee at Gettysburg

A Monograph

by

MAJ Joshua D. Woodruff
US Army



School of Advanced Military Studies
US Army Command and General Staff College
Fort Leavenworth, KS

2019

Approved for public release, distribution is unlimited

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YYYY) 23 05 2019		2. REPORT TYPE MASTER'S THESIS		3. DATES COVERED (From - To) JUNE 18-MAY 19	
4. TITLE AND SUBTITLE The Impact of Logistics on General Robert E. Lee at Gettysburg				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) MAJ Joshua D. Woodruff				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 One of the most important campaigns during the American Civil War was Confederate General Robert E. Lee's invasion of Pennsylvania in the summer of 1863. The campaign took place when the Confederacy was at the zenith of its power. Many historians to refer to this period as the high-water mark of the Confederacy. Despite success in previous battles, General Lee's army was soundly defeated at Gettysburg. Their defeat left the Confederacy with little chance to win the war. This monograph examines how the Confederates structured their operational logistics for the Gettysburg campaign. The study focuses on their use of wagon trains as the only mode of transporting supplies. It also looks at a shortfall in artillery ammunition at a decisive point in the battle. Logistical limitations had a major impact on General Lee's decision making during the campaign. Many of General Lee's most crucial decisions can be explained through a closer look at these logistical considerations.					
15. SUBJECT TERMS Logistics; Civil War; Gettysburg; Robert E. Lee; Sustainment; Protection; Operational Reach; Culmination; Decision Points					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Major Joshua D. Woodruff
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. PHONE NUMBER (include area code)
(U)	(U)	(U)	(U)	40	330 204 3146

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

Monograph Approval Page

Name of Candidate: MAJ Joshua D. Woodruff

Monograph Title: The Impact of Logistics on General Robert E. Lee at Gettysburg

Approved by:

_____, Monograph Director
Justin E. Kidd, PhD

_____, Seminar Leader
Larry V. Geddings, COL

_____, Director, School of Advanced Military Studies
Kirk C. Dorr, COL

Accepted this 23th day of May 2019 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, PhD

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the US Army Command and General Staff College or any other government agency. (References to this study should include the foregoing statement.)

Fair Use determination or copyright permission has been obtained for the use of pictures, maps, graphics, and any other works incorporated into the manuscript. A work of the US government is not subject to copyright, however further publication or sale of copyrighted images is not permissible.

Abstract

The Impact of Logistics on General Robert E. Lee at Gettysburg, by MAJ Joshua D. Woodruff, US Army, 38 pages.

One of the most important campaigns during the American Civil War was Confederate General Robert E. Lee's invasion of Pennsylvania in the summer of 1863. The campaign took place when the Confederacy was at the zenith of its power. Many historians refer to this period as the high-water mark of the Confederacy. Despite success in previous battles, General Lee's army was soundly defeated at Gettysburg. Their defeat left the Confederacy with little chance to win the war.

This monograph examines how the Confederates structured their operational logistics for the Gettysburg campaign. The study focuses on their use of wagon trains as the only mode of transporting supplies. It also looks at a shortfall in artillery ammunition at a decisive point in the battle. Logistical limitations had a major impact on General Lee's decision making during the campaign. Many of General Lee's most crucial decisions can be explained through a closer look at these logistical considerations.

Contents

Acknowledgements	v
Section I: Introduction.....	1
Background	2
Definition of terms	4
Research questions	5
Hypothesis	6
Limitations.....	6
Delimitations	7
Section II: Literature Review	7
The Gettysburg Campaign.....	8
Confederate sustainment bureaucracy	11
Confederate transportation	14
Wagon trains.....	15
Lee’s foraging strategy	18
Section III - Methodology	19
Section IV – Impact of Sustainment Trains.....	20
Preparing for invasion	20
Rolling northward.....	21
Foraging operations	23
Wagons and the race to Gettysburg	24
Wagon parks become hospitals	25
Foraging while fighting	26
Wagons and artillery	27
Ambulances	29
Protecting the wagons	30
Section V – Findings and Analysis	31
Section VI – Conclusion.....	37
Bibliography	39

Acknowledgements

I would like to express my sincere thanks and appreciation to Dr. Justin Kidd and COL Larry Geddings at the School of Advanced Military Studies for their guidance and patience during this project. As this was my first attempt at a long-term research project, their instruction and advice were invaluable. I would also like to thank Dr. Harry Laver of the US Command and General Staff College for helping me to frame a topic suitable for this project. The librarians and employees of the Ike Skelton Combined Arms Research Library were also an immense help in collecting research material. Lastly, I would like to thank my wife Kim for her love and support throughout the year.

Section I: Introduction

One of the most important campaigns during the Civil War was Confederate General Robert E. Lee's invasion of Pennsylvania in the summer of 1863. The campaign took place when the Confederacy was at the zenith of its power. Many historians have referred to this period as the high-water mark of the Confederacy.¹ GEN Lee's Army of Northern Virginia had defeated the Union Army of the Potomac in consecutive battles at Fredericksburg and Chancellorsville. By this point in the war, GEN Lee was a seasoned operational leader who had been in command just over one year. The Confederate army enjoyed high morale compared to their opponents who had replaced their commander twice in under six months.

Despite their recent successes, the conduct of the war was becoming unsustainable for the South. While winning tactical victories, the Confederates faced a difficult strategic position. The North could replace soldiers and equipment much easier than the resource constrained South. The battle of Chancellorsville was a tactical Confederate victory, but it cost them a similar number of casualties as their opponents. One of the most consequential of these casualties was GEN Lee's most trusted subordinate, Lieutenant-General Thomas "Stonewall" Jackson. LTG Jackson's death left a void in Confederate senior leadership. In addition, the Confederates were struggling in the war's western theater where Union General Grant had begun the siege of Vicksburg. Recent battlefield success amid a grim strategic situation created a sense of urgency within Confederate leadership. Understanding they could not win a war of attrition; GEN Lee believed the Gettysburg campaign could force a war-weary North to accept an independent Confederacy.

Despite the momentum leading into the campaign, GEN Lee and his Army of Northern Virginia were soundly defeated at Gettysburg. The Confederates failed to exploit early successes on the first day, and allowed the Union to dig in to defensive positions on higher ground. The

¹ Larry Schweikart, *A Patriot's History of the United States: From Columbus's Great Discovery to the War on Terror* (New York: Penguin Group, 2004), 377.

Confederates conducted flank attacks on the second day with little success. On the third day, GEN Lee ordered a massive frontal assault known as “Pickett’s Charge.” This assault failed and left the Confederate army unable to continue the campaign. GEN Lee’s loss at Gettysburg coincided with the fall of Vicksburg in the west. The combination of these two events left the Confederacy with little chance to resolve the war favorably.

The drama of the three-day battle and its impact on the war has inspired historians to closely examine how the whole campaign unfolded. Many of these studies have focused on tactical narratives of the battle, or the biographies of the great leaders involved. Few studies have explored the impact logistics could have played in the Confederate’s failures. This has left a gap in the record which this study intends to explore. By considering some of these facts, the reasoning behind some of GEN Lee’s decisions, and the subsequent failure at Gettysburg, may be easier to understand.

Background

Before exploring the impact of logistics on decisions made in the Civil War, it is necessary to explain why military logisticians should study this conflict. Many historians view the American Civil War as the first modern war.² This is, in part, because of the major technological advances in logistics and transportation. The capabilities of railroad networks had grown large enough to move massive quantities of troops and equipment across entire theaters. They also allowed commanders to stay connected with their industrial base. While conducting large scale combat operations, commanders had to not only develop strategies to defeat the opposing army, but also keep their large armies fed, clothed, and equipped. GEN Lee’s Gettysburg campaign is especially interesting because his Army of Northern Virginia pushed far into Union territory away from their industrial base, across significantly stretched lines of communication. Lessons

² Williamson Murray, *A Savage War: A Military History of the Civil War* (Princeton, NJ: Princeton University Press, 2016), 5.

learned from GEN Lee's invasion may shed light on how contemporary commanders may be forced to make decisions in a logistically constrained environment. A study of GEN Lee at Gettysburg may show military professionals how logistical considerations could limit their options.

While much has been written on Gettysburg, many studies focus on the tactics of the battle. Tactically focused works such as Terry Jones's *Cemetery Hill: The Struggle for the High Ground*, study the significance of key terrain but do not address the operational context. Other studies, such as Matt Spruill's *Decisions at Gettysburg*, examine the impact of key decisions made during the battle but do not fully explore how logistics may have influenced these decisions. GEN Lee's decisions at Gettysburg had vast consequences on the battle and the war but some of these decisions have been attributed more to his audacious personality than to some of his army's limitations. While personalities play a large part of decision making, more research is necessary to properly explore what options GEN Lee had during key decisions and what factors may have influenced them.

The CSA's experienced Corps commander, LTG James Longstreet was extremely critical of GEN Lee's decisions in his memoirs. He wrote that the invasion itself was a mistake. He believed Confederate leadership should have allowed his corps to reinforce the western theater and attempt to save Vicksburg. LTG Longstreet's criticisms continued during the battle where he believed the Confederates should have disengaged after the first day of fighting.³ This would have allowed the Confederates to find more favorable defensive ground between the Union army and Washington D.C. LTG Longstreet argued this point strongly with GEN Lee during the battle but was overruled. Artillery chief, Colonel E.P. Alexander, agreed with LTG Longstreet and

³ James Longstreet, *From Manassas to Appomattox: Memoirs of the Civil War in America*. (CreateSpace Independent Publishing Platform, 2017), 138.

wrote a similar opinion against GEN Lee's decisions in his own memoirs.⁴ The controversy of this decision is highlighted in Michael Shaara's historical novel, *The Killer Angels*.⁵

Other theories claim GEN Lee's decisions were sound, but the fault lay in the execution. One popular theory is that LTG Longstreet failed to coordinate Pickett's Charge appropriately. Historians Scott Bowden and Bill Ward advance this theory in their book, *Last Chance for Victory: Robert E. Lee and the Gettysburg Campaign*.⁶ They believe that LTG Longstreet was obstinate and failed to act decisively. His delay in execution cost the Confederate army the initiative during the battle. Both points of view focus on the tactical picture without considering other important aspects of the decision.

The purpose of this study is to examine GEN Lee's operational decisions and the logistical considerations which may have underpinned them. A better understanding of the challenges GEN Lee faced in both maneuvering and feeding his Army of Northern Virginia may help historians better understand the campaign. It may also assist military professionals understand the role of operational logistics within campaigns. GEN Lee's 1863 Gettysburg campaign is an example of how sustainment considerations affected operational decisions during the American Civil War.

Definition of terms

During the American Civil War, the Government of the United States is often referred to as the Union, the North, or the Federals. The Confederate States of America are referred to as the Confederates, the South, or as the rebels. Each side was organized into several field armies operating in different theaters. The eastern theater refers to fighting which occurred east of the

⁴ Porter Alexander, *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander* (Chapel Hill, NC: The University of North Carolina Press, 1989), 277.

⁵ Michael Shaara, *The Killer Angels: A Novel of the Civil War* (New York: Random House Publishing Group, 1974), 106.

⁶ Scott Bowden and Bill Ward, *Last Chance for Victory: Robert E. Lee and the Gettysburg Campaign* (El Dorado Hills, CA: Savas Publishing Company, 2001), 473.

Appalachian Mountains. The western theater is defined by field armies fighting west of the mountains. This study focuses on the Confederate Army of Northern Virginia which fought in the eastern theater of the war. GEN Robert E. Lee commanded the army of approximately 75,000 men. Just prior to the Gettysburg campaign, the army was reorganized into three corps. The corps commanders were Lieutenant Generals A.P Hill, James Longstreet, and Richard Ewell. The army also had a separate cavalry division commanded by Major General Jeb Stuart. The Army of Northern Virginia's primary opponent was the Union Army of the Potomac led by newly appointed GEN George Meade. It was a force of over 93,000 men organized into seven corps.

This monograph will look at the logistical considerations through the pertinent elements of operational art, operational reach, and culmination. Operational reach will be used to define the distance and duration which an army can sustain its military capabilities. It represents a tension between endurance, maneuver, and protection. Culmination is the limit to that reach, where an army can no longer maintain its campaign.⁷ These two factors must be considered when assessing the logistical capabilities of the Confederate Army.

Research questions

This study aims to answer the following primary and secondary research questions:

R1: To what extent did logistics affect GEN Robert E. Lee's decisions in the Gettysburg campaign of 1863?

R2: Did Confederate wagon trains affect the Army of Northern Virginia's operational reach?

R3: Did artillery ammunition shortfalls cause GEN Lee's Gettysburg campaign to culminate?

⁷ US Department of the Army. *Army Doctrine Publication (ADP) 4-0, Sustainment* (Washington DC: Government Printing Office, 2012), 11-12.

Hypothesis

H1: The logistical considerations of the Confederate army can help explain GEN Lee's operational decisions.

H2: The Confederate wagon train system did not facilitate necessary operational reach for their army.

H3: Artillery ammunition shortages caused GEN Lee's campaign to culminate.

Limitations

This study is limited by the fact Confederate record keeping was not as comprehensive as the Union's. Some Confederate logistics records were not well preserved, and some assumptions need to be made to complete the record.⁸ In some cases, it was necessary to assume some of the consumption factors based on the Union's planning factors. This study examines the impact of logistics on GEN Lee's major operational decisions. Although, GEN Lee did not publish memoirs, insights can be found in his correspondence, orders, and reports compiled in the Official Record of the War of the Rebellion. In his correspondence with President Jefferson Davis, GEN Lee displayed significant bias in his reports following the battle. His commentary shows he either failed to understand the significance of his defeat, or more likely, tried to paint his decisions in the best possible light. Although memoirs from the major actors in this battle provide great resources, they cannot be taken at face value. As an example, LTG Longstreet's memoirs were written to counter attacks from critics who felt his actions or inactions cost the Confederates the battle.⁹

⁸ Earl Hess, *Civil War Logistics: A Study of Military Transportation* (Baton Rouge, LA: Louisiana State University Press, 1969), 31.

⁹ Longstreet, 3.

Delimitations

This monograph focuses on the period of May 1 to July 24, 1863. While logistical considerations impacted many Civil War operations, this study will focus on Lee's decisions concerning his second invasion of the North. The focus of this monograph is the impacts of logistical considerations to explain GEN Lee's operational decisions. Logistics areas of transportation, foraging, and artillery ammunition are expanded while maintenance, and general supply are not. Operational considerations such as terrain, weather, and force ratios played major roles in the battle but are not fully investigated in this study. This study does not address what many writers have described as GEN Lee's "overconfidence," or belief that his army was "invincible."¹⁰ Although folklore surrounding GEN Lee claims he was, "audacity personified," this study will treat him as a rational operational commander who weighed risk and reward to make decisions.¹¹

Section II: Literature Review

This section will investigate what has been written about the Confederate logistical system. Although most Civil War scholars focus on the battles themselves, a few writers focused exclusively on logistics issues. This section will examine how the new Confederate government organized its sustainment bureaucracies. It will then provide background on how Civil War armies transported supplies. Lastly, it will summarize key events of the campaign to give the reader context for the study. The goal of this review is to establish the context in which GEN Lee made operational level decisions as the commander of the Army of Northern Virginia.

¹⁰ Edwin Coddington, *The Gettysburg Campaign: A Study in Command* (New York: Charles Scribner's Sons, 1984), 4-5

¹¹ Porter Alexander, *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander* (Chapel Hill, London: The University of North Carolina Press, 1989), 233.

The Gettysburg Campaign

In the spring of 1863, GEN Lee and his Army of Northern Virginia, had just defeated the Army of the Potomac in two consecutive battles at Fredericksburg and Chancellorsville. Chancellorsville was a tactical victory for GEN Lee, but Williamson Murray and Wayne Wei-Siang Hsieh point out each side lost roughly the same number of soldiers (8,962 Confederate, 8,623 Union).¹² The South could not win the war fighting this style of attritional warfare. In the western theater, the Confederates were under siege by GEN Grant at Vicksburg, a strategic city on the Mississippi River.¹³ However, in the North, opposition to the war had grown. Matt Spruill wrote there was reason to believe President Lincoln's government was vulnerable to the peace-party candidates.¹⁴ With all these factors to consider, the Confederate leadership was at a strategic crossroads.

In May 1863, GEN Lee consulted with Confederate Secretary of War James Seddon and President Jeff Davis on what to do next. Coddington, Spruill, Murray, and Hsieh agree Confederate leadership had three options.¹⁵ The first had been proposed to Secretary Seddon by LTG Longstreet. He believed with the Union campaign in Virginia halted, GEN Lee should detach a corps in order to relieve Vicksburg. GEN Lee strongly disagreed with this because it would take away a third of his army. The second option was to continue to fight a defensive campaign in Virginia to protect Richmond. However, this option would not accomplish the political objective of forcing the North to recognize an independent Confederacy. The third course of action was to conduct an offensive campaign by invading the North. GEN Lee convinced Seddon and Davis this was the best choice.

¹² Murray and Hsieh, 265, 268.

¹³ Coddington, 4-5.

¹⁴ Matt Spruill, *Decisions at Gettysburg: The Nineteen Critical Decisions That Defined the Campaign* (Knoxville, TN: The University of Tennessee Press, 2011), 5-7.

¹⁵ Coddington, 6-9, Murray and Hsieh, 268-269, Spruill, 5-9.

Coddington and Spruill describe two operational objectives for the Gettysburg campaign. The first was maneuver focused while the second was logistics based. Foremost, GEN Lee sought to disrupt the Union's summer campaign plan. By seizing the initiative, GEN Lee believed he could dislodge the union army from their foothold in Virginia and force them to follow him north where he could dictate when and where to decisively defeat the Union Army.¹⁶ The second objective was to feed his soldiers. Spruill explained the Virginia countryside and Confederate supply system were not sustaining GEN Lee's army. Kent Brown agreed and cited a Confederate engineer who described central Virginia in 1863 as a, "stripped and desolate country."¹⁷ By moving the war into the North, Southern crops and livestock could be replenished. The Northern countryside and towns, being untouched by the war thus far, would provide ample sustainment for GEN Lee's army as it marched.

Neither side planned to fight at Gettysburg. Murray and Hsieh explain how GEN Lee had been maneuvering without any significant reconnaissance and was surprised to run into the enemy while looking for shoes in Gettysburg.¹⁸ GEN Lee's lead element commanded by BG Henry Heth became engaged with BG John Buford's cavalry just north of the town. Heth ignored orders not to bring about a general engagement because he assessed the force that opposed him were only local militia. Once it became clear he was facing Union regulars, the engagement became a race to employ the most troops in the field; both sides attempted to mass their forces. At the end of the first day, the Confederates had success and pushed the Union southward through the town. The Union retreated and ended the day by occupying strong defensive ground called Cemetery Ridge. Cemetery Hill anchored this ridge and represented the strongest point in the Union line at the time.

¹⁶ Coddington, 8-9, Spruill, 6-7.

¹⁷ Brown, 14.

¹⁸ Murray, 272-273.

In *Cemetery Hill: The Struggle for the High Ground*, history professor Terry Jones noted that GEN Lee recognized Cemetery Hill as key terrain, and ordered LTG Richard Ewell to secure it “if practicable.”¹⁹ Without knowing the full enemy strength, and still waiting for one of his divisions to arrive, LTG Ewell hesitated. The hesitation allowed the Union to reinforce their position. After losing this opportunity, LTG Ewell thought he had found another way. By capturing the adjacent Culp’s Hill, he could use artillery to force the Union to withdraw from their position. However, LTG Ewell’s Corps were not able to coordinate an attack before darkness fell that evening. Inadequate knowledge of enemy strength prevented LTG Ewell from launching an assault on Culp’s Hill during the first day of the battle.²⁰ Reconnaissance problems plagued the Confederates throughout the campaign.

The next day GEN Lee ordered attacks on both flanks. The Union defensive line was formed into the shape of a fishhook with the northern side curving around Cemetery Hill terminating at Culp’s Hill. The line followed Cemetery Ridge south and ended at Little Round Top. When GEN Lee drew up his plans that morning, he did not believe the Union occupied Little Round Top. LTG Longstreet explained his orders were to attack up the Emmitsburg Road, which would have rolled the Union left flank up and through Cemetery Hill.²¹ LTG Ewell was to synchronize his attack with LTG Longstreet’s so the Union could not reinforce both sides at once. Longstreet argued his Corps should swing all the way around the Union army and threaten their wagon trains from the south. GEN Lee overruled this suggestion.²² The assault began late as LTG Longstreet waited for BG Law’s division to get to Gettysburg. His division had marched twenty-three miles starting at 0300, and still had five miles to go to get into position.²³ This delay

¹⁹ Terry Jones, *Cemetery Hill: The Struggle for the High Ground, July 1-3, 1863* (Cambridge, MA: Da Capo Press, 2003), 47.

²⁰ *Ibid.*, 49-50

²¹ Longstreet, 142.

²² *Ibid.*

²³ *Ibid.*, 141.

allowed the Union to move soldiers and artillery onto Little Round Top. By the time LTG Longstreet began his attack, the presence of Union Soldiers on Little Round Top undermined his axis of advance. Troy Herman described this problem in his book *Lee's Real Plan at Gettysburg*.²⁴

Pickett's charge was the decisive event on the third day of the battle. LTG Longstreet coordinated the attack, which was comprised of BG Pickett's, BG Pettigrew's, and BG Trimble's Divisions, and preceded by a massive artillery barrage from COL E.P. Alexander's batteries. There is some disagreement amongst historians about the third day's objectives. The accepted narrative put forth by Coddington, and also cited by Spruill, claims GEN Lee originally intended to continue the second day's attacks against the flanks toward Cemetery Hill.²⁵ After LTG Longstreet protested, GEN Lee changed the objective to the, "grove of trees" in the center of the Union line. GEN Lee believed GEN Meade had reinforced his flanks and therefore had to be weak in the center. Herman disagreed and cited numerous Confederate and Union leaders who verify Cemetery Hill remained the final objective of Pickett's Charge. Regardless of the charge's final objective, it was never reached. The third day's assault failed, and GEN Lee and his army were forced to retreat to Virginia.

Confederate sustainment bureaucracy

To understand how the Confederacy supplied their armies, it is necessary to understand their logistics bureaucracy. Organization for the Confederate sustainment functions began on February 26, 1861 even before the authorization of an army on March 6.²⁶ Richard Goff detailed how the Confederacy organized their sustainment bureaus in his 1969 work, *Confederate Supply*. The legislature passed a bill in February of 1861, establishing an Adjutant and Inspector

²⁴ Troy Herman, *Lee's Real Plan at Gettysburg* (Mechanicsburg, PA: Stackpole Books, 2003), 50.

²⁵ Coddington, 458, Spruill, 84.

²⁶ Richard Goff, *Confederate Supply* (Durham, NC: Duke University Press, 1969), 6-7.

General's Department, as well as the Quartermaster, Subsistence, and Medical Departments. A Bureau of Ordnance was created in similar fashion that April.²⁷ The leaders of the Quartermaster, Subsistence and Ordnance Departments, Abraham Myers, Lieutenant-Colonel Lucius Northrop, and Major Josiah Gorgas had considerable influence on logistics organizations and operations for the Confederate armies. These three men were charged with the responsibility of harnessing the Southern economy to support the armies.

Quartermaster Abraham Myers was the only one with significant logistics experience. He had been the Quartermaster General in General Taylor's army during the Mexican War.²⁸ He was responsible for supplying the army, and for transporting all its equipment. However, his tenure was plagued with mismanagement and inefficiency.²⁹ Wilson faulted Myers for the Quartermaster Department's inability to properly equip and clothe the Confederate soldiers. Myers consistently failed to anticipate the operational requirements of the army.³⁰ As a result, GEN Lee was often at a logistical disadvantage compared to his Union counterparts. After several similar instances, President Davis fired Myers in August of 1863, one month after GEN Lee's failed Gettysburg campaign.³¹

LTC Northrop, responsible for the subsistence department, struggled to keep Confederate armies fed. Vandiver noted LTC Northrop had a frustrating tendency to deny support by creating unnecessary administrative hurdles and red tape.³² Goff agreed and noted that in the spring prior to Gettysburg, GEN Lee complained about the failure of the Subsistence Department to supply

²⁷ Goff, 8-10.

²⁸ Ibid.

²⁹ Hess, 31.

³⁰ Harold Wilson, *Confederate Industry: Manufacturers and Quartermasters in the Civil War* (Jackson, MS: University Press of Mississippi, 2002), 4.

³¹ Hess, 31.

³² Frank Vandiver, *Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance* (Austin, TX: University of Texas Press, 1952), 165.

the required amount of meat for his army. The army lived, “hand-to-mouth” until the summer.³³ GEN Lee and LTC Northrop’s feud would last the entirety of the war leading to Northrop’s dismissal following the Petersburg Campaign in early 1865.³⁴

Of the three big sustainment departments, MAJ Gorgas’s Bureau of Ordnance was the most successful. MAJ Gorgas developed a department that remained self-sufficient, and was successful at producing its own supplies without impressing the Southern population. MAJ Gorgas was responsible for building an industry capable of supplying all the powder and artillery for the Confederacy, all while facing significant labor shortages.³⁵ Biographer Frank Vandiver agrees with Goff’s assessment of the Ordnance Bureau. The thesis of his work was that although the Confederate armies often lacked basic food and clothing, they were rarely without necessary ammunition. MAJ Gorgas promptly addressed issues of malfunctioning fuses and poor quality control at Augusta Power Works and Tredegar Iron Works.³⁶ When shortages in ammunition did occur, it was often because the army was operating too far from its supply bases, and had to rely on wagons for transport. His success led to his promotion to Brigadier General before the end of the war.

Notably absent in the Confederate sustainment departments was the presence of a department of transportation. President Davis did not feel it was necessary to appoint a transportation manager, and instead left the duties to an already overwhelmed Quartermaster Department.³⁷ Myers’ Quartermaster Department had a hard-enough time consolidating supplies from the Southern economy. Synchronizing their transportation resources was beyond his capabilities. Hess asserts the lack of a transportation department was fundamental to the South’s

³³ Goff, 79-80.

³⁴ Goff, 231.

³⁵ *Ibid.*, 246.

³⁶ Vandiver, 146.

³⁷ Hess, 32.

failure to sustain its armies.³⁸ In many cases, Confederate armies in the field lacked supplies located in depots throughout the South. Subsistence Chief LTC Northrop often complained that food he collected for the feeding of armies was either late or spoiled before it was received by soldiers in the field.³⁹ The lack of a department of transportation had a negative impact on the ability of the Confederate government to provide the supplies GEN Lee would need to conduct the Gettysburg campaign.

Confederate transportation

Although both sides used steam ships on the rivers and coasts, the eastern theater relied on the use of railroad transportation. The Civil War was the first American war to use railroads for the transportation of armies and supplies. The average speed of a train was five times faster than wagons. This enabled troops and supplies to arrive in better condition than if they traveled over roads.⁴⁰ An average train consisted of seventeen cars with each car capable of carrying ten tons of equipment. One train could carry the equivalent of 120 wagons making them more efficient. They did not burn fuel when not in use, whereas, wagons pulled by draft animals still had to eat when idle. However, as a new technology, there were plenty of problems.

In the South, the railroads were established by private companies, and lacked governmental standardization. This led to eleven different gauges of rails throughout the country. Fixed to the terrain, they were also vulnerable to sabotage from enemy raids. The South was also at a significant disadvantage in terms of numbers of railways. Their iron industry produced 26,252 tons of railroad iron during the war, compared to 222,577 tons for the Union. Problematically, twenty-five percent of Confederate railroad grade iron was diverted to produce

³⁸ Ibid., 108.

³⁹ Goff, 107-108, Hess, 32, 106.

⁴⁰ Christopher Gabel. *Railroad Generalship: Foundations of Civil War Strategy* (Fort Leavenworth, KS: Combat Studies Institute, 1997), 3.

iron-clad ships rather than lay new tracks.⁴¹ Black notes in his study of southern railroads that, no new tracks were laid in Southern states.⁴² The problems faced on all major southern lines included deteriorating tracks, poor maintenance readiness for the locomotives, and a lack of railcars.⁴³ Confederate rail lines were also shorter in length and plagued by high accident rates. Another problem for the South was the practice of prioritizing higher paying private cargo over military equipment.⁴⁴ Jefferson Davis did not authorize the impressment of civilian railroads until much later in the war. These issues prevented the Confederacy from leveraging railroads to the same extent as the Union.

Union railways were a different story. The United States Military Railroad (USMRR) was an agency established by Congress in 1862. This legislation allowed the US Government to seize any railway or telegraph necessary for military use.⁴⁵ However, this authorization was only used for seizing Southern railways during the war. Transportation coordinator Lewis Parsons perfected the military, private company relationship by aligning the profit motives of business with the operational needs of the military. While the Confederate rail industry stagnated, in the North it boomed. By the end of the war, the USMRR controlled over 2,600 miles of track used to move troops and supplies quickly between theaters.⁴⁶

Wagon trains

During the war, both sides relied heavily on the use of wagons to carry supplies and serve as ambulances. Wagon trains have been the main method of supplying armies dating back to the

⁴¹ Murray, 131, 517.

⁴² Robert Black, *Railroads of the Confederacy* (Chapel Hill, NC: The University of North Carolina Press, 1998), 124.

⁴³ *Ibid.*, 124-126.

⁴⁴ Earl Hess, *Civil War Logistics: A Study of Military Transportation* (Baton Rouge, LA: Louisiana State University Press, 1969), 32.

⁴⁵ Gabel, 13.

⁴⁶ Hess, 95.

Roman Empire.⁴⁷ Roman armies relied on wagons to transport supplies sixty miles from their source of supply. This range could be stretched for short periods up to two hundred miles. These historical planning factors were used throughout the Civil War. Transportation historian Richard Killblane commented that Civil War era supply wagon had an effective operating range of one hundred and fifty miles.⁴⁸ This estimate seemed too optimistic for some commanders, with Hess noting Union General William T. Sherman was uncomfortable with his wagons hauling over fifty miles from their depots.⁴⁹

Although supply wagons could carry an impressive amount of cargo, they also came with considerable overhead. The typical Civil War wagon could carry as much as 2,674 pounds, but the effective weight limit varied depending on the conditions of the roads.⁵⁰ It was common for commanders to limit wagon capacities to under 2,000 pounds in order to properly manage their teams, and reduce the risk of becoming stuck.

The wagons were pulled by teams of six mules or four horses, and traveled only slightly faster than a marching rate, about three miles per hour. Feeding and caring for the animals increased the sustainment requirements on the armies tremendously. Teague also notes that each mule needed nine pounds of grain, twelve pounds of fodder, and ten gallons of water per day. Requirements for horses were even higher at fourteen pounds of grain, fourteen pounds of fodder, and ten gallons of water a day per horse. Waste product from the animals also created significant sanitation and odor issues in camp. Each animal produced ten to fifteen pounds of manure and

⁴⁷ Ibid., 140.

⁴⁸ Richard Killblane, "Use of Military Rail by the US Army" (US Army Transportation Corps), accessed October 29, 2018, <http://www.transportation.army.mil/historian/documents/use%20of%20military%20rail%20by%20us%20army.pdf>, 2.

⁴⁹ Hess, 150.

⁵⁰ Ibid., 136.

two gallons of urine a day.⁵¹ The animals also needed to be shod regularly which consumed valuable iron. Following the battle of Gettysburg, GEN Lee wrote to Jefferson Davis that his animals needed horseshoes. He claimed the wagon teams suffered, and half of his cavalry was dismounted due to the inability to care for the animals.⁵² Failure to take care of the animals properly quickly resulted in attrition. Once sick or injured, only sixty percent of the animals returned to service once sent to camps in the rear for rehabilitation.⁵³

Wagon trains also presented operational problems for commanders. They took up a large amount of space on the roads, and often congested lines of communication. These frustrations caused Civil War officers to refer to their baggage trains as *impedimenta* – a bulky encumbrance.⁵⁴ Lined up on a road, each wagon occupied sixty feet of linear space. On the move, that distance increased to eighty feet to account for the distance between moving wagons.⁵⁵ In the case of corps level movements, the trains themselves could stretch over fifteen miles. Longer trains also increased the protection requirement. Commanders assigned cavalry units to protect their supply trains, which limited their ability to conduct reconnaissance. Hess described the requirement for commanders to keep the trains, “close enough to effectively supply the moving infantry, artillery, and cavalry units but not so near the scene of action as to be taken by a quick enemy strike.”⁵⁶ Thus, the positioning and movement of the wagons became a balancing action between responsiveness and survivability.

⁵¹ Charles Teague, *Gettysburg By the Numbers: The Essential Pocket Compendium of Crucial and Curious Data About the Battle* (Gettysburg, PA: Adams County Historical Society, 2006), 21.

⁵² OR 27 (2), 304.

⁵³ Hess, 167.

⁵⁴ Hess., 139.

⁵⁵ Rodney Lackey, “Notes of Civil War Logistics: Facts and Stories” (US Army Transportation Corps) accessed October 29, 2018, <http://www.transportation.army.mil/history/StaffRides.html>., 20, 88.

⁵⁶ Hess, 140.

Lee's foraging strategy

GEN Lee's invasion route north would take him almost two-hundred miles away from his nearest railhead in Staunton, VA. To augment his supplies, GEN Lee planned to live off the land and local economy. This would also allow him to maximize valuable wagon space for other essentials such as ammunition. In his memoirs, LTG James Longstreet recalled the Confederate Second Corps was first in the order of march. They were tasked with collecting supplies for themselves and the other two other Confederate corps. Once across the Potomac River they took different routes to Williamsport and Shepherdstown and continued marching towards Harrisburg, Pennsylvania.

Harrisburg was an area known to have enough produce to support the army. By spreading the army out, the Confederates eased congestion on the roads. This also allowed the army to cover more of the countryside to gather supplies.⁵⁷ It also gave the animals more area to graze. Former Gettysburg guide, Matt Spruill, wrote Gettysburg was a fertile area, "which had barely been touched by the war."⁵⁸ Although living off the land was an effective way to keep the army fed, it also had an important drawback. As the army moved through an area, it quickly consumed all available resources. To sustain itself, the army would have to continue moving. This limited the army's ability to fight as LTG Longstreet had suggested, using terrain and well-developed defensive positions.⁵⁹

While in enemy territory GEN Lee's army also planned to buy local goods, and use captured supplies. The unit quartermasters would present demands of food and supplies to the local civic leaders of the Northern towns. If the demands were not met, Confederate units were authorized to open all the stores of the town and impress what they found.⁶⁰ The army paid those

⁵⁷ Hess, 130-131.

⁵⁸ Spruill, 6.

⁵⁹ Longstreet, 128.

⁶⁰ Brown, 26-27.

impressed goods in Confederate currency, which by 1863 had lost much of its value. GEN Lee issued General Orders No. 72, and No. 73, which specified payment to civilians and forbade destruction of private property.⁶¹ GEN Lee also expected to capture Union equipment along the way, and included this in his sustainment plan. The lead unit commander, LTG Richard Ewell of Second Corps, issued guidance to his division commanders on captured equipment. All captured equipment was required to be turned over to their appropriate departments to be consolidated and reissued by the quartermasters.⁶²

Section III - Methodology

The research method for this study follows a qualitative approach. Much of the research for this study is from the archives of the Combined Arms Research Library (CARL) on Fort Leavenworth. First-hand accounts from those who served in the campaign were useful, especially the memoirs written by LTG James Longstreet, LTG Richard Ewell, and COL Porter Alexander. The Official Record of the War of the Rebellion (OR) allows researchers to find the original reports and correspondence of key leaders in the battle. Since GEN Lee died before publishing his memoir, the best insight into his thinking is through his official correspondence with President Jefferson Davis and his subordinate commanders published in the OR. Hard copies of the OR exist at the CARL while websites such as HathiTrust.org allow researchers to conduct more focused searches of the text. This study relies on the data of these original reports to reanalyze the subject from a logistical lens. Lastly, past visits to the battlefield itself provided familiarity of the environment and key events.

It was also important to broadly research the topic of Civil War logistics to understand the challenges Civil War armies faced in keeping themselves supplied. The catalogue of works

⁶¹ United States War Department. *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*. ser. 2, vol. XXVII (Washington, DC: Government Printing Office, 1896), 895. Henceforth abbreviated as OR 27 (2).

⁶² OR 27 (2), 895.

which specifically focused on logistics was significantly shorter than the list on the battle of Gettysburg. However, three works stood out which helped form an understanding on the logistical processes of the era. Earl Hess' *Civil War Logistics*, Richard Goff's *Confederate Supply*, and Kent Brown's *Retreat from Gettysburg* focus on the logistical challenges of Civil War armies. Brown's book specifically deals with logistics at Gettysburg although its focus is on challenges faced during the retreat after the battle. Again, the OR provided a great primary source as a great deal of logistical information exists in the original reports and correspondence.

The focus of this study is on the impact of logistics on GEN Lee, as an operational commander and decision maker in the Gettysburg campaign. Specifically, this work attempts to answer the following research questions: R1: To what extent did logistics affect GEN Robert E. Lee's decisions in the Gettysburg campaign of 1863? R2: Did Confederate wagon trains affect the Army of Northern Virginia's operational reach? R3: Did artillery ammunition shortfalls cause GEN Lee's Gettysburg campaign to culminate?

Section IV – Impact of Sustainment Trains

Preparing for invasion

To conduct an invasion of Union territory the Confederates needed to ensure the Army of Northern Virginia could sustain itself during the campaign. LTC James Corley was GEN Lee's Quartermaster General and oversaw this plan. LTC Corley planned to use Staunton, VA, as a logistical support area. It was the last railroad depot from the Confederate line of departure and could be used to house the quartermaster stores that would support the campaign.⁶³ The rail line from Staunton connected to Richmond, and could be used to support movement of captured supplies and wounded soldiers to the rear.

To move supplies forward of Staunton, LTC Corley reorganized the system of wagon trains that would haul everything essential to the conduct of the campaign. As previously noted,

⁶³ Coddington, 23, 74, Brown, 20.

massive quantities of supply wagons would decrease the army's maneuverability and increase protection requirements. In anticipation of these constraints, GEN Lee ordered the army to decrease its wagon allowance from thirty-five per one thousand soldiers, to twenty-eight per one thousand men.⁶⁴ This represented a decrease of over one million pounds of transportation capacity.⁶⁵ Some of the reductions would be negated as the army would be carrying less food as it planned to eat off the land, and the anticipation of capturing enemy wagons along the way. In other areas such as heavy artillery ammunition, the army would have to make do with less than it was accustomed. To mitigate the lack of transportation capacity, GEN Lee put in a requisition for more artillery ammunition to be pushed forward from Staunton once it arrived at the station.⁶⁶ The wagon trains were organized by corps. Each of GEN Lee's three corps had its own wagon train which traveled behind the marching army. LTG Ewell's corps was assigned an additional reserve train that represented all the captured supplies from the invasion.⁶⁷ GEN Lee viewed this reserve train as a strategic asset to be protected at all costs.⁶⁸ Ensuring captured supplies returned to Richmond following the campaign would enable the South's ability to sustain the Army of Northern Virginia during future campaigning seasons.

Rolling northward

GEN Lee planned his invasion route based on the protection and foraging requirements of his wagon trains. The Confederate army used three separate routes to position its forces west of the Blue Ridge Mountains. Once in the Shenandoah Valley, the Blue Ridge Mountains would shield the Confederate trains from enemy attack. The natural protection allowed the army to

⁶⁴ Hess, 148.

⁶⁵ Difference of 7 wagons per 1,000 Soldiers multiplied by an army of approximately 75,000 Soldiers equals total decrease of 525 wagons. This difference can be multiplied by the capacity of wagon at an average of 2,000 pounds to equal a total decrease in capacity of 1,050,000 pounds.

⁶⁶ Brown, 38.

⁶⁷ Ibid., 20.

⁶⁸ Ibid., 23.

spread out over the routes and enabled liberal foraging. LTG Ewell's 2nd Corps was first in the order of march, and his trains crossed the mountains at Chester Gap on June 10.⁶⁹ LTG Longstreet's 1st Corps followed and crossed further north at Snickers Gap. 3rd Corps, commanded by LTG A.P. Hill, brought up the rear after covering the army's displacement from the Fredericksburg area. Once west of the mountains, the army's wagon trains dominated every inch of road space. Breakdowns or issues with stubborn animals caused half-mile gaps in the lines.

Each corps trains occupied between twelve to fifteen miles of road. Had they been traveling along the same route, the total column would have occupied over sixty miles of road or a third of the total distance between Staunton, VA and Gettysburg, PA.⁷⁰ Along the way, the columns had to cross the Potomac River at Williamsport and Shepherdstown by laying pontoon bridges.⁷¹ Confederate columns crossed the Potomac by June 15 and continued north through Chambersburg on June 28. At Chambersburg, Lee further divided his forces, directing LTG Ewell to continue north and east into Carlisle, PA towards Harrisburg. He ordered LTG Longstreet to move due east through Cashtown toward Gettysburg. These movements were done to keep the corps within mutually supporting distances while also enabling their foraging operations. GEN Lee was employing the corps movement and foraging strategy perfected by Napoleon and his Grand Armée.⁷²

GEN Lee knew he could not rely on the physical terrain alone to protect his wagon trains. On June 20, he directed BG John Imboden to use his cavalry to guard the passes along the Blue Ridge Mountains to ensure the protection of his movements.⁷³ However, his biggest fear was that

⁶⁹ Longstreet, 131.

⁷⁰ Coddington, 22.

⁷¹ Brown, 18.

⁷² Michael Bonura, *Under the Shadow of Napoleon: French Influence on the American Way of Warfare from the War of 1812 to the Outbreak of WWII* (New York: New York University Press, 2012), 26.

⁷³ OR 27 (2), 905-906.

the Union Army would follow him on the western side of the Blue Ridge Mountains and interrupt his communications with the support area in Staunton. If this occurred, he would not be able to send captured supplies, prisoners, and his wounded back to Richmond. GEN Lee allowed his principle cavalry commander, BG Stuart to take an easterly route north through Hopewell Gap to meet up with LTG Ewell north of Gettysburg. While this plan took MG Stuart's cavalry away from the main force, his cavalry division attempted to lure the Union army away from GEN Lee's trains to prevent BG Stuart from doing damage close to Washington DC⁷⁴

Foraging operations

GEN Lee's plan during the invasion was to subsist on a mix of captured supplies and goods purchased or impressed off the local economies. The time of their invasion matched the harvest season in southern Pennsylvania.⁷⁵ LTG Ewell's 2nd Corps, as the lead element, did most of the foraging and sent supplies rearward to the other two corps along the route of advance. LTG Ewell had initial success capturing supplies at Winchester. After a short battle, the Confederates captured three hundred loaded wagons, three hundred horses, and large quantities of food and ammunition. Success continued in Martinsburg where they captured over 6,000 bushels of grain.⁷⁶ Only a week into the campaign, GEN Lee's reserve wagon train had already started to grow. The growth of wagon trains increased his consumption rates of fodder, grain, water, and horse and mule shoes. To meet these requirements, the army had to keep moving to new areas as they quickly depleted local resources.

As the army continued its march northward, foraging opportunities dictated its route and tempo. As the army's lead elements approached Chambersburg on June 22, GEN Lee wrote to LTG Ewell, "It will depend upon the quantity of supplies obtained in southern Pennsylvania

⁷⁴ Brown, 19, Coddington, 107-111, Rice, 52.

⁷⁵ Coddington, 162.

⁷⁶ OR 27 (2), 442.

whether the rest of the army can follow.”⁷⁷ LTG Ewell’s Corps met the challenge head on. He presented an official supply requisition to town officials in Chambersburg which they were unable to meet. When the town failed to meet the requisition demands, the Confederate army impressed all local resources. From Chambersburg, they gathered significant amounts of livestock, food, saddles, harnesses, and wagons. MG Early’s Division did likewise at the town of York, PA. His forces took \$28,600 in US currency, 1,000 hats, 1,200 shoes, and large quantities of livestock and wagon equipment.⁷⁸ LTG Ewell passed much of this equipment back to the other two corps in the order of march. LTG Longstreet recorded receiving 3,000 head of cattle and 5,000 barrels of flour to feed his soldiers.⁷⁹ The Confederate army was preparing to conduct foraging operations in Gettysburg when MG Heth’s Confederate division ran into BG Buford’s Union cavalry on July 1.⁸⁰

Wagons and the race to Gettysburg

Despite GEN Lee’s standing order not get drawn into a general engagement, MG Heth’s skirmish quickly morphed into large scale conflict. Once decisively engaged, both Union and Confederate commanders rushed to mass their forces. BG Buford’s cavalry delayed the Confederate advance while Union MG Reynolds marched his 1st Corps north in relief.⁸¹ The Confederates had been spread out during their foraging operations and rushed to converge their three corps on the engagement area. As the battle began, LTG Ewell’s 2nd Corps approached from two separate routes from the north. The rest of the army and the reserve trains were bottlenecked on the Chambersburg-Gettysburg turnpike. As LTG Longstreet attempted to move his forces toward Gettysburg, he recalled having to halt while the reserve train cut in front of his corps to

⁷⁷ Brown, 24.

⁷⁸ Brown, 26-27.

⁷⁹ Longstreet, 133.

⁸⁰ Murray, 273, Coddington, 263.

⁸¹ Coddington, 267.

reunite with LTG Ewell's 2nd Corps.⁸² His furthest rearward division, commanded by MG Law, was twenty-eight miles from Gettysburg when the fighting began. MG Johnson's division of 2nd Corps, had been with the reserve trains and dislocated from the rest of LTG Ewell's corps. As his division moved north, he complained about being delayed by LTG Longstreet's wagon trains.⁸³ The congestion of the roads hindered everyone's movement. By this time, each of the three corps owned their own ten to fifteen-mile wagon train. In addition, the army's reserve train was over fourteen miles long and caused significant delays for GEN Lee's army arriving at Gettysburg.⁸⁴

Once the fighting began, some of the wagons stayed further behind, while others were brought closer to supply timely supplies to the army in contact. The reserve train occupied an area between Chambersburg and Cashtown putting it around ten miles from the front lines and outside the range of enemy long-range artillery. By July 3, the reserve train had grown to between fifteen and twenty miles long.⁸⁵ The wagon trains following each corps were sub-divided by division. These combat trains were parked in fields two to three miles behind their respective divisions.⁸⁶ From there, food would be cooked to support the soldiers on the front lines. Additionally, artillerymen replenished their caissons from an area outside of the enemy's long-range artillery.

Wagon parks become hospitals

During the battle, the wagon parks also became the location of the division hospitals. The hospitals required water, surgical equipment, and large numbers of tents. The wagon trains provided all the medical supplies necessary to run a field hospital. Standard operating procedure during the period was to dedicate at least one wagon per regiment to carry hospital equipment and

⁸² Longstreet, 136.

⁸³ Brown, 39.

⁸⁴ Longstreet, 139, Brown, 34.

⁸⁵ Brown, 38, 49.

⁸⁶ *Ibid.*, 47.

supplies such as splints, bandages, stretchers, medicine, and tents.⁸⁷ To keep the area running efficiently, the hospitals were put under the command of the division quartermaster. Assistant quartermaster and subsistence officers served a dual role as hospital attendants during the battle.⁸⁸ During, and after the battle of Gettysburg, forty Confederate division hospitals treated nearly 20,000 sick and wounded soldiers.⁸⁹ Although there were some efficiencies gained by having the hospitals at the wagon parks, the location caused a few problems as well. The wagon parks were also the location of the commissary and subsistence stores. Waste from commissary livestock led to unsanitary conditions. Mortality rates for amputations were over twenty-eight percent.⁹⁰ Without rail transportation to the rear areas, the numbers of wounded and sick soldiers accumulated and presented a mobility problem for GEN Lee's army.

Foraging while fighting

From July 1 thru July 3, as the battle progressed, the effort to keep the wagons full through foraging continued. The supplies GEN Lee's army took from Northern towns were needed to sustain the army for subsequent campaigning seasons. While the Confederate army was in Union territory, areas around Richmond, Virginia could recover. Every war-related good that could be procured was added to the reserve trains. Although Confederate quartermasters did not keep an accurate account of everything they acquired, Gettysburg citizens claimed eight-hundred horses, a dozen mules, one thousand cattle, two-hundred hogs, and four-hundred sheep were seized. Confederate foragers also took over one-hundred wagons, fifty carriages, and many

⁸⁷ N. S. Dodge, *Hints on Army Transportation* (Albany, NY: Charles Van Benthuysen Printer, 1863), 7.

⁸⁸ Brown, 50.

⁸⁹ Brown, 51

⁹⁰ Stanley Burns, *Surgery in the Civil War* (PBS.org), accessed 26 November 2018, <http://www.pbs.org/mercy-street/uncover-history/behind-lens/surgery-civil-war/>.

harnesses. By the end of the battle, GEN Lee's reserve wagon train had grown an additional six miles in length⁹¹

GEN Lee's concept of support depended on living off the land to feed the army while in Union territory. This would ensure the soldiers in the field had the strength and energy necessary to sustain combat operation. On the first day of the battle, LTG Longstreet's quartermasters obtained 3,024 pounds of corn, and 2,000 pounds of hay. After the first day, supplies became scarcer. The longer the army stayed in one spot, the harder it became to find supplies. GEN Lee wrote about this problem in his reports to Richmond. In his detailed report about the campaign GEN Lee wrote about the Gettysburg area, "the country was unfavorable for collecting supplies in the presence of the enemy, who could restrain our foraging parties by holding the mountain passes with local and other troops."⁹² The concurrent foraging operation was crucial to GEN Lee's ability to keep his army in the field.

On July 3, the third day of the battle, the Union army became aware of the Confederate reserve wagon train occupying ground between Cashtown and Chambersburg. Small detachments of Union cavalry had circled eight miles behind the Confederate Army, and threatened GEN Lee's trains around Fairfield, Virginia.⁹³ The threat of enemy forces halted the foraging activities in GEN Lee's rear area. This would limit the fresh food and fodder making its way to the front lines to sustain the fight. It would only be a matter of time before GEN Lee would lose the ability to keep his army in the field.

Wagons and artillery

On the last day of the battle, as the inflow of logistical support dwindled, GEN Lee ordered LTG Longstreet to attack the middle of the Union line in what became known as

⁹¹ Brown, 48-49.

⁹² OR 27 (2), 318.

⁹³ Brown, 39.

Pickett's Charge. It was their last decisive effort to drive Union forces from the field. Pickett's charge began with an artillery barrage commanded by LTG Longstreet's chief of artillery, COL Alexander. The intent of the barrage was to, "drive off the enemy or demoralize him greatly."⁹⁴ To do this, COL Alexander allocated over one hundred and fifty guns to the barrage.⁹⁵ COL Alexander was skeptical of his ability to accomplish his task with the amount of artillery ammunition on hand. Each gun carried one hundred and twenty-five rounds in its limber and caisson. The Confederates began the battle with somewhere between one-hundred and two-hundred rounds per gun in their wagons. However, they had already refilled their caissons from the wagons the previous day. COL Alexander knew most of what was left in the wagons was canister and ineffective at long range.⁹⁶ GEN Lee was aware of his artillery ammunition shortage and had put in an order to LTC Gorgas to send more solid shot. The ammunition was gathered in Richmond but would have to be transported to Staunton, VA by train, and then brought by wagon over one hundred and fifty miles to GEN Lee's quartermasters. The required ammunition never made it to GEN Lee's army.⁹⁷

With his limited ammunition and almost empty wagons, COL Alexander calculated the length of time he could conduct the pre-attack barrage, and still have enough left to support the attack. His estimate was twenty to thirty minutes of firing before the attack stepped off, and an hour of support during the attack. COL Alexander began his pre-attack artillery barrage around 1300 on July 3.⁹⁸ At 1335, after thirty-five minutes of firing, COL Alexander sent LTG Longstreet a note saying, "Come quick, or I can't support you."⁹⁹ LTG Longstreet hesitated, not

⁹⁴ Alexander, 245.

⁹⁵ Coddington, 493.

⁹⁶ Alexander, 246.

⁹⁷ OR 27 (2), 358, 504.

⁹⁸ Coddington, 493.

⁹⁹ Alexander, 253.

wanting to give an order he thought would fail. In all the smoke, no one could be sure the barrage was having any effect. The artillerymen had to measure their effectiveness by the amount of return fire they were receiving. By 1345 the Confederate rate of fire had lessened.¹⁰⁰ LTG Longstreet ordered COL Alexander to replenish his ammunition from the wagons. COL Alexander replied, “General, I can’t do that, we nearly emptied the trains last night.”¹⁰¹

COL Alexander’s artillery provided as much support as it could, but the barrage was largely unsuccessful. Without accurate spotters, most of the artillery overshot.¹⁰² In addition, many of the long-range shells failed to explode and landed harmlessly behind Union lines.¹⁰³ Union counter artillery did decline during the barrage but mostly due to their understanding of the need to conserve their own ammunition for the attack they knew was imminent. Union losses during the barrage were around two hundred soldiers killed and a few cannons destroyed.¹⁰⁴

Pickett’s charge failed to push the Union from their position. The Confederate survivors, many who were wounded, limped back to Confederate lines. GEN Lee now faced a situation where he lacked artillery ammunition to continue to fight. Additionally, his decreased foraging supplies and his number of wounded soldiers became a serious liability. His campaign had culminated; he decided to withdraw from Gettysburg and return his army to Virginia.

Ambulances

Due to the shortage of ambulances and large amount of litter patients, empty ammunition wagons were quickly converted into ambulances.¹⁰⁵ The battle had produced 20,451 casualties, with many too grievously wounded to be moved. The Confederates left 6,802 soldiers on and

¹⁰⁰ OR 27 (2), 320.

¹⁰¹ Alexander, 261.

¹⁰² Coddington, 494.

¹⁰³ Murray, 287.

¹⁰⁴ Schweikart, 377.

¹⁰⁵ Brown, 70, 95, 118.

near the battlefield along with a few surgeons, knowing they would become prisoners of war.¹⁰⁶ The rest of the wounded were loaded onto wagons. The ambulances were organized into their own wagon trains by the brigade quartermasters. The subsistence trains traveled first followed by the ambulances, the ordinance trains, and then the infantry soldiers on foot. The brigade surgeons traveled with the ambulance trains in order to provide continued care during the transport.¹⁰⁷ The ambulances used by the Confederate army varied in size and capacity. Depending on the wagon, an ambulance could carry anywhere from eight to eighteen wounded or sick soldiers.¹⁰⁸ Converted ordinance wagons would have been on the lower end of this range. Due to the lack of sophisticated suspension systems, wounded soldiers had to deal with uncomfortable conditions for the duration of the ride back.

Protecting the wagons

After failing to defeat the Union army, the priority for GEN Lee became the protection of his retreating army and its wagon trains. They would be the first element of the Confederate army to leave Gettysburg. The supplies captured while in Northern territory were necessary to sustain the Confederate army during the coming fall and winter. It was important to give the reserve wagons a head start so it did not constrain the rest of the force's movement. GEN Lee appointed his quartermaster, MAJ Harmon, to command the reserve train, while BG Imboden and his cavalry provided the protection for the trains. Elements of Imboden's cavalry were intermixed into the trains at an interval of every mile.¹⁰⁹ The reserve train, at this point, was over twenty miles long and took longer than fifteen hours to clear the immediate area. The reserve train left on July 3 and carried with it: 5,000 head of cattle, 5,000 sheep, and thousands of hogs. After the

¹⁰⁶ Coddington, 537.

¹⁰⁷ Brown, 97.

¹⁰⁸ "Civil War Ambulance Wagons," *Civil War Home*, last modified October 19th, 2006, accessed December 17, 2019, <http://civilwarhome.com/ambulancewagons.htm>.

¹⁰⁹ *Ibid.*, 119.

reserve train, the order of march was LTG Hill's Corps, LTG Longstreet's Corps, and then LTG Ewell's Corps.¹¹⁰ The three infantry corps remained in their positions until July 4. They left Gettysburg as soon as it was dark.

The retreating Confederate army faced additional challenges as they attempted to get their cumbersome wagon trains back to Virginia. Beginning on July 4 and continuing through July 7, torrential downpours complicated the challenges of coordinating the movement of thousands of wagons.¹¹¹ Underdeveloped roads did not drain well, and the wagon's narrow wheels sank into the mud. The weather slowed the retreat's tempo and raised the Potomac River level at the fords, making them impassable.¹¹² The Confederate army was finally able to cross the Potomac River at Williamsport on July 14th.¹¹³

Section V – Findings and Analysis

The primary research question of this study was:

R1: To what extent did logistics affect GEN Robert E. Lee's decisions in the Gettysburg campaign of 1863?

It began with the hypothesis:

H1: The logistical considerations of the Confederate army can help explain GEN Lee's operational decisions.

The findings of this study validate H1. GEN Lee's decisions were impacted by logistical considerations. Although many other considerations were likely a factor, this study confirms logistics played an influential role in the major decisions of the campaign. In the planning phase, GEN Lee prioritized the anticipated supplies and war material gained in the campaign as a secondary objective only to the decisive defeat of the Union forces. This affected how he directed

¹¹⁰ Brown, 72-73.

¹¹¹ Coddington, 540.

¹¹² Brown, 323-324.

¹¹³ Ibid., 336.

the composition of this logistics element and how he visualized the movement of his army through enemy territory. He made task organization decisions based on the considerations of this logistics element. Once engaged at Gettysburg, GEN Lee decided to stay and fight the three-day battle because he understood the limits his logistics had put on his army's maneuverability. However, the position of his army and the congestion of his wagon trains limited his ability to mass his force and sustain the initiative. After his forces were tactically defeated at Gettysburg, GEN Lee decided to withdraw because his campaign had culminated, and his logistics system had become a liability.

When GEN Lee designed the invasion of Pennsylvania, he did so partially for logistical reasons. He realized waging a defensive war in Virginia was not sustainable in the long-term. The Virginia countryside had become completely barren of fodder for the animals, and the impact of two years of campaigning had decimated the crops. To sustain his army for the long term, he had to look elsewhere. Pennsylvania had been largely unaffected by the war and fit these requirements. By taking the war to the North, he could pay for impressed goods with Confederate money, and increase the political pressure on the Union to negotiate a peace. In addition, the Confederate army's presence in Union territory would force the Union general to attack, presumably on ground of GEN Lee's choosing. This would fit with the style of defensive tactics LTG Longstreet favored. He communicated this campaign vision to Secretary of War Seddon and President Jefferson Davis. When viewed within the context of the Confederate sustainment challenges, the decision to invade aligns with the South's strategic context.

GEN Lee made the decision to accept risk in moving so far away from his railhead base of supply. He understood the strain moving away from the rails would put on his supply system and restructured his system of wagon trains accordingly. His quartermasters needed to find a balance between taking large amounts of wagon trains and shrinking the army's logistical footprint. Having a large wagon allocation would decrease the risk of running out of supplies but would create a maneuver and protection problem. Cutting the wagon allocation too much would

result in his army's inability to supply itself for the campaign. GEN Lee chose a more balanced approach. He cut his allocation from thirty-five wagons per one thousand soldiers, to twenty-eight. One of the biggest reasons he was able to do this was because his foraging strategy estimated he could eliminate the need for eight and one-half wagons per one-thousand soldiers.¹¹⁴

To meet the challenge of reduced transportation capacity, GEN Lee's quartermasters had to make some decisions regarding the amount of artillery ammunition they would carry forward. The long-range artillery necessary to support offensive action was different from the canister and grapeshot used in defensive battles. GEN Lee needed to be prepared for both possibilities, and therefore, did not leave Staunton with sufficient quantities of either type. To mitigate a potential shortfall, GEN Lee put in an order for the delivery of additional artillery ammunition with the Ordinance department. The order never arrived. When the Confederates assumed the role of the offensive force at Gettysburg, they ran out of long-range artillery during the three-day battle. COL Alexander recorded the Confederate artillery situation after Gettysburg as having plenty of short-range canister but not enough long-range to even support a battalion.¹¹⁵ The artillery situation at Gettysburg was a direct result of the "right-sizing" of GEN Lee's wagon trains prior to Gettysburg.

GEN Lee's wagon trains required a substantial amount of cavalry to protect them as they traveled northward. The protection of the wagon trains is what drove GEN Lee to choose the route west of the Blue Ridge Mountains to launch the invasion. More importantly, GEN Lee chose to utilize his cavalry assets to protect the wagons rather than perform reconnaissance. This task-organization decision had significant impacts on the battle itself. MG Stuart was allowed to take his cavalry division east to lure the Union army away from GEN Lee's main force. GEN Lee's other cavalry element, BG Imboden's independent cavalry, was ordered to protect the

¹¹⁴ Lackey, 28.

¹¹⁵ Alexander, 246.

wagon trains during the army's movement. As a result, GEN Lee had no forces allocated to the reconnaissance mission. GEN Lee lamented the lack of reconnaissance to President Davis in his after-action report writing, "The movements of the army preceding the battle of Gettysburg had been much embarrassed by the absence of the cavalry."¹¹⁶ Here, he was referring to the absence of MG Stuart, but in reality he had other assets at his disposal. His task-organization of BG Imboden clearly showed how GEN Lee prioritized the protection of his reserve trains over reconnaissance.

This decision negatively impacted his visualization of the battlefield as the battle developed. GEN Lee was forced to make decisions on where to engage the enemy without knowledge of the enemy's size or disposition. His order to LTG Ewell to take Culp's Hill, "If practicable" reflected his lack of understanding of Union strength, leaving the action to the discretion of a subordinate. Similarly, on the second day, GEN Lee ordered LTG Longstreet to conduct a flank attack up the Emmitsburg Road against the Union left without knowledge of Union forces occupying Little Round Top.¹¹⁷ In each instance, proper reconnaissance could have produced a more informed decision. US Army doctrine warns commanders not to keep reconnaissance assets in reserve.¹¹⁸ In this case, GEN Lee's task organization decision violated this tactical principle, and proved costly during the battle.

The most crucial decision GEN Lee made during the Gettysburg campaign was made exclusively on logistical considerations. The "crisis of the campaign," as COL Alexander put it, was the decision to stay after the first day of fighting at Gettysburg. After the first day of fighting, GEN Lee's forces had tactical inertia. They had pushed the lead elements of the Union army south, through Gettysburg, and onto hastily occupied defensive positions along Cemetery Ridge.

¹¹⁶ OR 27 (2), 321.

¹¹⁷ Harmon, 49.

¹¹⁸ US Department of the Army, *Field Manual 3-90-2, Reconnaissance, Security, and Tactical Enabling Tasks Volume 2* (Washington DC: Government Printing Office, 2013), 12.

After the first day's success, LTG Longstreet and COL Alexander argued GEN Lee should have disengaged and maneuvered to the southeast in between the Union Army and Washington. In this course of action, the Confederate army could choose suitable defensive terrain and continue their streak of tactical victories.

GEN Lee rejected this course of action as unfeasible given his logistical considerations. He understood the army could not execute the maneuver due to his wagon trains. After the first day, they were spread out from Gettysburg all the way to Williamsport, MD, a distance of over fifty miles. The roads were congested with wagons and soldiers moving North. The logistics footprint had become too big and cumbersome to facilitate an operational turning movement. GEN Lee articulated this in his after-action report,

“It had not been intended to deliver a general battle so far from our base unless attacked, but coming unexpectedly upon the whole Federal Army, to withdraw through the mountains with our extensive trains would have been difficult and dangerous.”¹¹⁹

The second reason disengaging was not feasible was due to the foraging strategy which was central to GEN Lee's concept of support. In order to mitigate the lack of subsistence and fodder carried in the wagons, GEN Lee's army depended on living off the land. For this to work, the army had to keep moving, as its size quickly depleted the supplies available on the local economy. Foraging also required the security to send out quartermasters to the surrounding towns. GEN Lee understood the difficulty he would face supplying his army if he settled in for a protracted defensive campaign. He expressed this to President Davis by writing, “we were unable to await an attack, as the country was unfavorable for collecting supplies in the presence of the enemy.”¹²⁰ The decision to stay engaged at Gettysburg is often attributed to rash audacity or overconfidence. However, LTG Longstreet and COL Alexander's criticism of GEN Lee in their memoirs may be unfair considering the logistical considerations GEN Lee had to consider.

¹¹⁹ OR 27 (2), 318.

¹²⁰ Ibid.

The Confederate army had a challenging time coordinating their attacks the way GEN Lee envisioned. When he advised LTG Ewell to take Culp's Hill on the evening of the first day, he may have been unaware LTG Ewell was still lacking one of his divisions. MG Johnson's division was further behind in the order of march. GEN Lee's foraging strategy affected how the units approached Gettysburg. To cover more foraging ground, the units were spread out more than normal. When the order came to mass on the battlefield, MG Johnson's division was stuck behind LTG Longstreet's wagon trains. His late arrival contributed to LTG Ewell's hesitation to take the hill without all his forces available. Congested roadways also contributed to LTG Longstreet's failure to conduct his day two attack on the Union left flank in conjunction with LTG Ewell's action on the right. LTG Longstreet listed MG Laws struggle to get through the congested supply routes as a reason for his delay.¹²¹ Although GEN Lee understood the fundamental need to mass his troops at decisive points on the battlefield, his own logistics impeded his army's ability to exploit initial success.

These findings answer **R2: Did Confederate wagon trains affect the Army of Northern Virginia's operational reach?** Operational reach was extended in terms of distance but not duration. The Confederate army's wagon train system did not enable them to fight a prolonged conflict in one area for more than a few days. It also significantly constrained GEN Lee's options. Thus, H2 is confirmed.

The last major decision of GEN Lee's Gettysburg campaign was the decision to withdraw his army back to Virginia. Following the failure of Pickett's Charge on the third day, GEN Lee had to decide whether he could continue the campaign. Coddington described GEN Lee's Army of Northern Virginia as far from defeated.¹²² With over 50,000 soldiers still fit for duty, GEN Lee still possessed a formidable fighting force. The Union Army of the Potomac had won a significant

¹²¹ Longstreet, 141.

¹²² Coddington, 537.

victory but had sustained significant casualties as well. However, GEN Lee concluded his campaign had culminated. He records this in his letter to President Davis, “the severe loss sustained by the army and the reduction of its ammunition, rendered another attempt to dislodge the enemy inadvisable, and it was therefore, determined to withdraw.”¹²³ GEN Lee’s reasons reflect the reality that his supply wagons, once full of artillery ammunition, were now full of wounded soldiers. Considering these constraints, he decided to end the campaign and focus on getting his reserve train back to Virginia.

GEN Lee’s letter to President Davis answers Research Question 3: **Did artillery ammunition shortfalls cause GEN Lee’s Gettysburg campaign to culminate?** The answer is yes, but only partially. Following the battle of Gettysburg, the Confederates did not have enough long-range shot to continue an offensive campaign. They did, however, have enough canister and grape shot to hold defensive positions against a Union attack. While artillery ammunition shortfalls were a major contributing factor, it is likely the high number of casualties and reduced foraging opportunities had a higher impact on the campaign’s culmination.

Section VI – Conclusion

This study set out to determine if the sustainment warfighting function had any impact on GEN Lee’s operational decisions during the Gettysburg campaign. The findings may be surprising to some who have only considered Gettysburg a series of tactical mistakes by an overconfident general who believed his troops were invincible. A closer look suggests GEN Lee was constrained by the shortfalls of his logistics. The Confederate concept of support did not facilitate operational reach. Once the Confederate army moved away from its railroads, it lost the ability to replenish its long-range artillery ammunition. Its massive wagon trains limited GEN Lee’s ability to maneuver and the priority he placed on protecting them cost him much needed

¹²³ OR 27 (2), 322.

reconnaissance. The foraging strategy ensured the Confederates could not conduct defensive tactics while in Union territory and led to the ill-advised attacks of the second and third days.

After the defeat of GEN Lee's army in conjunction with the fall of Vicksburg, the South would no longer possess the ability to bring the war to Union territory. The supplies gathered by Lee's army and transported back to Richmond were insufficient to have a lasting effect on their war effort. The Union's industrial advantage slowly took its toll. Although the war would last two more years, Gettysburg represented the Confederacy's last chance to negotiate a favorable peace.

The lessons of this campaign are clear to military professionals and operational planners. The sustainment warfighting function needs to enable the commander and provide options rather than force the commander into a single, unfavorable, course of action. To do this, sustainers must plan for redundancy in modes of transportation. All available ports, rail lines, and aerial resupply must be researched and employed to supplement the ground resupply effort. The Confederate system broke down when it was forced to operate away from the rails. The Confederate army struggled to maneuver while being burdened by its massive wagon train system. Sustainment planners must consider the size of their logistics footprint and work to mitigate the risk they force the commander to assume. Logistics assets become an enticing target for the enemy, and commanders know they must allocate protection assets towards rear areas. Planners should understand the cost of these allocations and find ways such as increased mobility, camouflage, and tactical proficiency to lessen protection requirements. As the army rebuilds its competencies in large scale combat operations, the sustainment warfighting function will need to adapt and find ways to meet the challenges posed by large armies on the move. As sustainment doctrine is rewritten to meet the requirements of FM 3-0, military professionals would be well served to reflect on the lessons from GEN Lee's 1863 Gettysburg campaign.

Bibliography

- Alexander, Edward Porter. *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander*. Edited by Gary W. Gallagher. Chapel Hill, NC: The University of North Carolina Press, 1989.
- Beringer, Richard. *The Elements of Confederate Defeat: Nationalism, War Aims, and Religion*. Athens, GA: The University of Georgia Press, 1988.
- Black, Robert, *Railroads of the Confederacy*. Chapel Hill, NC: The University of North Carolina Press, 1998.
- Bowden, Scott and Ward, Bill, *Last Chance for Victory: Robert E. Lee and the Gettysburg Campaign*. El Dorado Hills, CA: Savas Publishing Company, 2001.
- Brown, Kent. *Retreat from Gettysburg: Lee, Logistics, and the Pennsylvania Campaign*. Chapel Hill, NC: The University of North Carolina Press, 2011.
- Burns, Stanley. *Surgery in the Civil War*. *PBS.org*. Accessed November 26, 2018.
<http://www.pbs.org/mercy-street/uncover-history/behind-lens/surgery-civil-war/>
- Coddington, Edwin. *The Gettysburg Campaign: A Study in Command*. New York: Charles Scribner's Sons, 1984.
- Civil War Home. "Civil War Ambulance Wagons." Home of the American Civil War. Last modified October 19, 2006. Accessed December 17, 2018.
<http://civilwarhome.com/ambulancewagons.htm>.
- Dodge, N. S. *Hints on Army Transportation*. Albany, NY: Charles Van Benthuysen Printer, 1863.
- Gabel, Christopher. *Railroad Generalship: Foundations of Civil War Strategy*. Fort Leavenworth, KS: Combat Studies Institute, 1997.
- Gallagher, Gary. *Why the Confederacy Lost*. Edited by Gabor S. Boritt. Oxford: Oxford University Press, 1992.
- Goff, Richard. *Confederate Supply*. Durham, NC: Duke University Press, 1969.
- Harman, Troy. *Lee's Real Plan at Gettysburg*. Mechanicsburg, PA: Stackpole Books, 2003.
- Hess, Earl. *Civil War Logistics: A Study of Military Transportation*. Baton Rouge, LA: Louisiana State University Press, 2017.
- Jones, Terry. *Cemetery Hill: The Struggle for the High Ground, July 1-3, 1863*. Cambridge, MA: Da Capo Press, 2003.
- Killblane, Richard. "Use of Military Rail by US Army." US Army Transportation Corps, 2010. Accessed October 29, 2018.
<http://www.transportation.army.mil/historian/documents/use%20of%20military%20rail%20by%20us%20army.pdf>.

- Lackey, Rodney. "Notes of Civil War Logistics: Facts and Stories." US Army Transportation Corps. Accessed October 29, 2018.
<http://www.transportation.army.mil/history/StaffRides.html>.
- Longstreet, James. *From Manassas to Appomattox: Memoirs of the Civil War in America*. CreateSpace Independent Publishing Platform, 2017.
- Murray, Williamson. *A Savage War: A Military History of the Civil War*. Princeton, NJ: Princeton University Press, 2016.
- Rice, Johnathan. *Moving Mountains: A Study in Civil War Logistics*. Bloomington, IN: Xlibris Corporation, 2011.
- Schweikart, Larry. *A Patriot's History of the United States: From Columbus's Great Discovery to the War on Terror*. New York, NY: Penguin Group, 2004.
- Shaara, Michael. *The Killer Angels: A Civil War Novel*. New York, NY: Random House Publishing Group, 1974.
- Spruill, Matt. *Decisions at Gettysburg: The Nineteen Critical Decisions that Defined the Campaign*. Knoxville, TN: The University of Tennessee Press, 2011.
- Teague, Charles. *Gettysburg by the Numbers: The Essential Pocket Compendium of Crucial and Curious Data about the Battle*. Gettysburg, PA: Adams Historical Society, 2006.
- United States War Department. *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*. Ser. 2. vol. 27. Washington, DC: Government Printing Office, 1896.
- US Department of the Army, *Field Manual 3-90-2 Reconnaissance, Security, and Tactical Enabling Tasks Volume 2*. Washington, DC: Government Printing Office, 2013.
- _____. *Army Doctrine Publication 4-0, Sustainment*. Washington, DC: Government Printing Office, 2012.
- Wilson, Harold. *Confederate Industry: Manufacturers and Quartermasters in the Civil War*. Jackson, MS: University Press of Mississippi, 2002.