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Roads of War: Paved Highways and the Rise of IED Attacks in Afghanistan

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Roads of War: Paved Highways and the Rise of IED Attacks in Afghanistan

Abstract

Paved roads have been widely heralded by members of the policymaking world as a useful tool in combating the use of improvised explosive devices (IEDs) in Afghanistan. With the number of IED attacks growing exponentially since 2006, government officials have made the case for greater funding for road construction by explicitly linking paved roads with improved security conditions. This thesis subjects that connection to greater scrutiny and gives voice to the few detractors who contend that paved roads make security conditions worse. Moreover, this thesis examines new data on IED attacks along roads in Afghanistan and concludes that paving has no meaningful effect on the frequency of IED incidents, suggesting that policymakers should reassess the value of road construction projects and the reasoning used to sell those projects.

Keywords

Afghanistan, IED, road, terrorism, Taliban, military, JIEDDO, International Relations, Political Science, Social Sciences, Robert Vitalis, Vitalis, Robert

Disciplines

Political Science

Roads of War

Paved Highways and the Rise of IED Attacks in Afghanistan

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April 8, 2010**

**A thesis submitted for the degree of Bachelor of Arts in
Political Science at the University of Pennsylvania**

To Robert

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*Roads of War:
Paved Highways and the Rise of Suicide and IED Attacks in Afghanistan*

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Roads of War
Paved Highways and the Rise IED Attacks in Afghanistan

List of Acronyms and Abbreviations

AIMS	Afghan Information Management Services
CRS	Congressional Research Service
DID	Difference in Differences
DoD	Department of Defense
EFP	Explosively Formed Projectiles/Penetrator
GAO	Government Accountability Office
GIS	Geographic Information System
GIST	Geographic Information Support Team
HMMWV	High Mobility Multipurpose Wheeled Vehicle (Humvee)
IED	Improvised Explosive Device
ISAF	International Security Assistance Force
JIEDDO	Joint IED Defeat Organization
MRAP	Mine Resistant Ambush Protected Vehicle
NGO	Non-Governmental Organization
PRT	Provincial Reconstruction Team
RPG	Rocked Propelled Grenade
USAID	United States Agency for International Development
USDMA	United States Defense Mapping Agency

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Abstract

Paved roads have been widely heralded by members of the policymaking world as a useful tool in combating the use of improvised explosive devices (IEDs) in Afghanistan. With the number of IED attacks growing exponentially since 2006, government officials have made the case for greater funding for road construction by explicitly linking paved roads with improved security conditions. This thesis subjects that connection to greater scrutiny and gives voice to the few detractors who contend that paved roads make security conditions worse. Moreover, this thesis examines new data on IED attacks along roads in Afghanistan and concludes that paving has no meaningful effect on the frequency of IED incidents, suggesting that policymakers should reassess the value of road construction projects and the reasoning used to sell those projects.

I. Introduction

“Improvised explosive devices, usually made of fertilizer, are the Afghan insurgents' great force equalizer”

-Yaroslav Torfimov

Foreign Correspondent, Wall Street Journal

I remember the precise day the idea behind this thesis first came to me. It was December 28, 2009 — the day I began reading David Kilcullen’s *The Accidental Guerrilla*. The Afghan war was an intriguing topic to me, and I believed the writing of a counterinsurgency expert would shed some light on the topic. It was his book that first introduced me to the argument that paving roads reduces the number of IED attacks in Afghanistan. The material also came in the shadow of a major policy address on Afghanistan earlier that month by President Barack Obama. His speech touched upon a variety of different points, but one quote in particular summarized his decision: “as Commander-in-Chief, I have determined that it is in our vital national interest to send an additional 30,000 U.S. troops to Afghanistan. After 18 months, our troops will begin to come home.”¹ After listening to the President’s new strategy and after several days of reading and note taking on Kilcullen’s book I asked myself, “are paved roads *really* a key solution for something as complex as IED attacks in Afghanistan, and if so, how should this new revelation change US strategy?”

I have spent much of my time since then asking myself that question, and for me the answer has changed twice. The elegance and simplicity behind Kilcullen’s logic that paved roads reduce IED attacks is compelling, and it wasn’t until a year later that I began to doubt the claims of the former Australian army Lieutenant Colonel. Arguments made

¹ Obama, Barack, “The New Way Forward” (speech presented at West Point to address changes in US strategy in Afghanistan, New York, December 1, 2009).
<<http://www.whitehouse.gov/blog/2009/12/01/new-way-forward-presidents-address>>
(April 7, 2011)

by intellectuals like Joshua Foust, field researchers like Brian Glyn Williams and scholars like John O’Loughlin all placed enough doubt in my mind that I began to believe the opposite — that paving roads *increases* IED attacks.² It wasn’t late in the process that my mind changed a second time. After examining new data on IED attacks along roads in Afghanistan, I concluded that paving roads has no meaningful impact on the frequency of IED attacks, positive *or* negative.

Structure

I divide my analysis of IEDs among four sections. I begin by tracing how IED attacks arrived in Afghanistan, starting with how the war has changed since 2001. Second, I define and assess the impact of IEDs and IED countermeasures in Afghanistan, including how policymakers, field researchers and civil war and insurgency theorists describe the impacts of road construction projects on IED attacks. Third, I test these assessments of road projects against military data on IEDs from Afghanistan, using two separate roads from eastern and southern Afghanistan as case studies. In the conclusion, I offer some practical suggestions for policymakers based on the findings in the third section.

Sources of Information

This thesis draws extensively from three sources of information: field research from Afghanistan conducted between the start of 2007 and 2009 by Brian Glyn Williams,

² Joshua Foust is fellow at the American Security Project; Brian Glyn Williams is an Associate Professor of Islamic History at the University of Massachusetts-Dartmouth; and a John O’Loughlin is a Professor of Geography at the University of Colorado-Boulder.

Carter Malkasian and Gerald Meyerle; government documents from the US Agency for International Development (USAID), the Congressional Research Service (CRS) and the Government Accountability Office (GAO); and geographic data on IEDs between 2004 and 2009 — known more commonly in the press as the “Afghan war logs”³ — leaked by the website WikiLeaks on July 25, 2010.

³ Alexandra Topping and Jo Adetunji, “Afghanistan War Logs: Wikileaks Founder Rebuts White House Criticism,” *The Guardian*, July 26, 2006, <<http://www.guardian.co.uk/world/2010/jul/26/war-logs-wikileaks-rebuts-criticism>> (April 7, 2011).

II. The Arrival of IEDs

Background

Aside from the merits of the decision to send additional troops to Afghanistan, the mere fact a surge was deemed necessary to turn the tide of the war is emblematic of how much the nature of the war has changed since 2001. Commonly described the “Forgotten War,” the Afghan war has not been a consistent battle between Taliban insurgents and US and coalition forces.⁴ In the first years following the invasion, the United States was enormously successful in Afghanistan. The initial invasion lasted less than two months, as Taliban resistance collapsed almost immediately. During the first four years following the collapse of the Taliban, US forces faced relatively low levels of insurgent violence, and US operations were primarily geared at eliminating Taliban remnants in the country.⁵ With superior firepower, particularly the use of tactical aircraft armed with state-of-the-art weaponry, the United States held a consistent advantage against Taliban forces using traditional guerilla warfare tactics. By late 2005, military commanders believed that their operations, combined with added political and economic reconstruction, had essentially ended the insurgency.⁶

⁴ Major news outlets have repeatedly used this terminology to describe the war in Afghanistan. For examples see Charles M. Sennott, “Afghanistan: After 5 years, a forgotten war?,” *New York Times*, September 12, 2006, <<http://www.nytimes.com/2006/09/12/world/asia/12iht-afghan.2785628.html>> (April 7, 2011); Carlotta Gall, “Despite Years of U.S. Pressure, Taliban Fight on in Jagged Hills,” *New York Times*, June 4, 2005, <<http://query.nytimes.com/gst/fullpage.html?res=9A03E7D71438F937A35755C0A9639C8B63>> (April 7, 2011).

⁵ U.S. Library of Congress. Congressional Research Service. *Afghanistan: Post-War Governance, Security, and U.S. Policy* by Kenneth Katzman (Washington, DC: November 26, 2008), 23.

⁶ Kenneth Katzman, 23.

They were wrong. As Lieutenant General David Barno, the US and coalition commander in Afghanistan from 2003 to 2005, explained, “since 2006 the Taliban and [Al-Qaeda have] gathered strength, changed tactics, and increased their capabilities and attacks.”⁷ Like the Stinger missiles the US supplied to the mujahideen in Afghanistan in the 1980s, Taliban insurgents needed an equalizer — something to help level the playing field. The Taliban found that equalizer in a tactic that has heavily shaped the nature of the Afghan war since 2006: improvised explosive devices (IEDs).

The Iraq Connection

Based on his field research during the spring of 2007, Brian Glyn Williams argues that Afghanistan experienced an “Iraq effect,” or the transfer of terrorist tactics from Iraq to Afghanistan, beginning in the summer of 2006. The US widely suspected that many of Al-Qaeda’s emissaries from Iraq were crossing between the two theatres as early as 2003, sharing information on tactics and encouraging Taliban and Taliban-affiliated groups to replace their strategy of traditional guerrilla warfare with IED and suicide operations.⁸ In a demonstration of the law unintended consequences, Williams explains that those insurgents initially opposed to changing tactics were convinced to adopt them after

⁷ Valentina Taddeo, “US Response to Terrorism: A Strategic Analysis of the Afghanistan Campaign.” *Journal of Strategic Security* 3, no. 2 (Summer 2010): 29-31, <<http://scholarcommons.usf.edu/jss/vol3/iss2/3/>> (April 7, 2011).

⁸ Brian Glyn Williams, “Mullah Omar’s Missiles. A Field Report on Suicide Bombers in Afghanistan,” *Middle East Policy* 15, no. 4 (Winter 2008): 31, <<http://www.brianglynwilliams.com/publications.html>> (April 7, 2011).

watching DVDs of successful IED and suicide attacks on US forces in Iraq.⁹ These DVDs were widely available in the tribal regions of Pakistan by the summer of 2004. Taliban leaders have also admitted to having regular interaction with members of the Iraqi insurgency. Mullah Dadullah, a former senior Taliban military commander, explains in an interview quoted by Williams that Afghan insurgents learned the bombings they carry out from Iraqi insurgents, adding that the Taliban regularly sends individuals to Iraq to learn “more effective killing techniques.”¹⁰ After a year of testing the impact of IED and suicide attacks the Taliban began to regularly deploy both tactics in 2006. Observers began to notice the change, explaining that the Afghan insurgents appeared to have learned the techniques from Iraqi insurgents.¹¹ As the Afghan National Directorate of Security bluntly put it in 2007, “Had the Americans not invaded Iraq and created a jihadi training ground there, we would never have had these bombers here. This all comes to us as a result of America’s war against (Saddam) Hussein.”¹²

⁹ The rise of suicide bombing in Afghanistan, although not the focus of this thesis, could serve as a useful case study confirming and challenging existing notions of the motivations behind suicide bombing. The strategic application of suicide bombing in Afghanistan lends credence to Robert Pape’s central claim that there is a strategic logic behind suicide terrorism. See Robert Pape, “Dying to Win: The Strategic Logic of Suicide Terrorism,” *Australian Army Journal* 3, no. 3 (Summer 2006) and Assaf Moghadam, “Motives for Martyrdom,” *International Security* 33, no. 3 (Winter 2008-2009) for additional literature on suicide terrorism.

¹⁰ Williams, 34.

¹¹ Peter Bergen, “The Taliban, Regrouped and Rearmed,” *The Washington Post*, September 10, 2006, < <http://www.washingtonpost.com/wp-dyn/content/article/2006/09/08/AR2006090801614.html>> (April 7, 2011).

¹² Williams, 32.

III. Addressing IEDs: Roads and The Search for Solutions

Improvised explosive devices (IEDs) arrived in Afghanistan under similar circumstances as suicide bombings, but while suicide attacks have remained limited to a few hundred incidents per year, the frequency of IED attacks has risen far more dramatically. Since 2005, these devices have continued to produce devastating results against NATO and US forces and civilians, and today, IEDs are one of the key tactical weapons used by the Taliban and other Afghan insurgent groups. The US military defines an IED as:

*A device placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic, or incendiary chemicals and designed to destroy, incapacitate, harass, or distract. It may incorporate military stores, but is normally devised from nonmilitary components.*¹³

In principle any explosive weapon not constructed on a production line may be classified as an IED. This definition would include not only roadside bombs but also car bombs, shape charge IEDs and suicide bombs.¹⁴ However, given the physical differences between a so-called “smart” suicide bomb and other improvised explosive devices, this thesis is limited to exploring the only the latter tactic.

In response to the rise of this tactic in Iraq and Afghanistan, the office of the Army Chief of Staff established the Army IED Task Force in October 2003, tasked with coordinating the efforts of other government agencies, the private sector, academics and other organizations to develop new methods and technologies to counter IEDs. The task

¹³ U.S. Department of Defense, *The Dictionary of Military and Associated Terms* (Joint Publication 1-02), 177.

¹⁴ Carlo Kopp, “Technology of Improvised Explosive Devices,” *Defence Today*, 46, <www.ausairpower.net/DT-IED-1007.pdf> (April 7, 2011).

force was made permanent in February 2006 and was renamed the Joint IED Defeat Organization (JIEDDO). However, despite the organization's efforts IED attacks are more frequent and as deadly as ever. JIEDDO itself explained in its FY 2009 Annual Report that the number of IED incidents in Afghanistan nearly doubled from FY 2008 and the number of casualties caused by IEDs increased 39 percent.¹⁵ In short, the United States has not yet developed a strategy or technology that has significantly decreased these numbers.

Uniqueness of Afghanistan IEDs

“We are essentially attempting to find a fertilizer-based bomb, so it has very low or no metallic content, and it is [typically] buried [in the dirt on] an unimproved road.” This explanation by the Director of JIEDDO — Lieutenant General Michael L. Oates — is the most basic and accurate characterization of the types of IEDs the US military faces in Afghanistan. The overwhelming majority of IED attacks are ammonium nitrate-based explosives triggered by a pressure plate.¹⁶ A chemical compound commonly found in high-nitrogen fertilizer, ammonium nitrate was the explosive used in 80 to 90 percent of Afghan IEDs between 2007 and 2009.¹⁷ These devices are different from many in Iraq,

¹⁵ U.S. Department of Defense. Joint IED Defeat Organization. *Annual Report FY 2009*. (Washington, DC: 2009).

¹⁶ Michael L. Oates, “US Government Efforts to Counter IEDs,” Foreign Press Center, Washington, DC: December 3, 2010. <https://www.jieddo.dod.mil/content/docs/20101206_FPC_LTG_Oates_on%2520_EDs.pdf> (April 7, 2011).

¹⁷ Michael Flynn, “State of the Insurgency: Trends, Intentions, and Objectives” (PowerPoint slides, December 22, 2009), 9-11.

where a significant number of military-grade munitions leftover from Saddam Hussein's regime are used as IEDs.¹⁸

However, the reality that the overwhelming majority of attacks are comprised of homemade explosives should not imply that IEDs in Afghanistan are unvaried or unsophisticated. Ammonium nitrate-based fertilizer bombs are the most common, but the Haqqani network, an insurgent group closely allied with the Taliban located principally in eastern Afghanistan, prefers to use potassium chlorate explosives. Roadside bombs are also often supplemented with additional tactics, including small unit ambushes when first responders arrive on the scene and the use of conventional weapons.¹⁹ Afghan insurgents have increasingly used even more powerful IEDs, explosively formed projectiles (EFPs) — made from pipes filled with explosives — that are commonly used in Iraq. These devices strike with enough power to penetrate heavy armor, producing more heavy casualties than traditional IEDs.²⁰

Impact of IED Attacks

Given the death tolls caused by IEDs, finding a technology or method to combat these devices is one of the most important priorities for the US military. By every measure IED attacks cause more deaths than any other tactic utilized by the Afghan insurgency. For NATO's International Security Assistance Force (ISAF), roadside bombs

¹⁸ Oates, Foreign Press Center, December 6, 2010.

¹⁹ U.S. Library of Congress, Congressional Research Service, *Improvised Explosive Devices (IEDs) in Iraq and Afghanistan: Effects and Countermeasures* by Clay Wilson (Washington, DC: August 28, 2007), 3.

²⁰ U.S. Library of Congress, Congressional Research Service, *Improvised Explosive Devices (IEDs) in Iraq: Effects and Countermeasures* by Clay Wilson (Washington, DC: February 10, 2006), 3.

were responsible for the majority of the deaths of coalition forces, totaling an estimated 60 percent in 2009.²¹ The Department of Defense estimates that while suicide bombs were responsible for less than two percent of US troops deaths since the start of the war, IED attacks were responsible for a plurality — 40.8 percent — of US troop deaths, despite the fact that IEDs were not widely used in Afghanistan prior to 2006. IEDs were also responsible for a majority of US troop deaths in two of the last three years.²²

Although Taliban insurgent attacks are primarily targeted toward government or military forces they are often carried out in areas frequented by civilians, often resulting in an even larger number of civilian casualties.²³ Of all the casualties from IED attacks, about two-thirds are Afghan.²⁴ Of the 1,630 civilian deaths reportedly caused by the insurgency in 2009, 47 percent were due to IED attacks.²⁵

These attacks have also inhibited the military's efforts to win over the local population — a necessary step in a successful counterinsurgency operation. Mullah Mohammed Omar, the spiritual leader of the Taliban insurgency, published a new code of conduct for insurgents in 2009 in an attempt to win local support for the Taliban. Among its 13 chapters and 67 articles, the book prohibits certain types of behavior, including taking children for jihad, avoiding the deaths of locals while conducting suicide

²¹ “Roadside Bombs Surge in Afghanistan,” *Associated Press*, June 4, 2009, <http://www.msnbc.msn.com/id/31111482/ns/world_news-south_and_central_asia> (April 7, 2011).

²² Ian S. Livingston et al, *Afghanistan Index: Tracking Variables of Reconstruction & Security in Post-9/11 Afghanistan*, Brookings Institution, February 28, 2011, 11.

²³ United Nations Assistance Mission in Afghanistan (UNAMA), *Afghanistan: Annual Report on Protection of Civilians in Armed Conflict, 2009*, Kabul: January 2010, 5.

²⁴ U.S. Department of Defense, Joint IED Defeat Organization, *JIEDDO Fact Sheet*, August 2010 <https://www.jieddo.dod.mil/content/docs/20100804_JIEDDO_Fact_Sheet.pdf> (April, 2011).

²⁵ UNAMA (January 2010), 15.

bombings and eliminating forced donations from the population.²⁶ Despite these alleged changes, multiple human rights organizations note that IED attacks are still used by the Taliban to spread fear and to intimidate the local population, while other insurgent groups like the Haqqani network in eastern Afghanistan are even less willing to discriminate between their targets, attacking civilians and coalition forces in equal numbers.²⁷ Locals commonly report feeling trapped between the fear of being attacked by insurgents if they do cooperate and being attacked by US forces if they do not.²⁸

Existing Countermeasures

Both Congress and the Department of Defense have recognized the threat posed by IED attacks. The DoD has been aware of the danger of these devices dating back to the start of the Iraqi insurgency in 2003, and Congress has allocated billions of dollars to various countermeasures through JIEDDO.²⁹ The organization's project budget is \$3.465 billion for FY2011, and in total, the Pentagon has invested over \$20 billion developing technologies to address IEDs, ranging from basic tactics to the new, cutting-edge

²⁶ Mullah Mohammed Omar, *Afghanistan Islamic Emirate: Rules and Regulations for Mujahidin* (2009),

<www.pbs.org/wgbh/pages/frontline/obamaswar/etc/mullahomar.pdf>.

²⁷ United Nations Assistance Mission in Afghanistan (UNAMA), *Afghanistan Mid-Year Report 2010, Protection of Civilians in Armed Conflict*, Kabul: August 2010, 21. Oates, Foreign Press Center, 7.

²⁸ Afghanistan Independent Human Rights Commission, *Insurgent Abuses Against Afghan Civilians*, December 2008, 4.

²⁹ U.S. Department of Defense, Office of the Inspector General, *Marine Corps Implementation of the Urgent Universal Needs Process for Mine Resistant Ambush Protected Vehicles*, December 8, 2008, Report No. D-2009-030, i
<<http://pogoarchives.org/m/ns/dod-ig-report-20081208c.pdf>>.

technology.³⁰ However, only a few of initiatives have produced results, leaving the US still struggling to find an effective countermeasure for these homemade devices.

Joint IED Defeat Organization (JIEDDO)

Table 1: Funding to the Joint IED Defeat Organization							
By fiscal year (in billions)							
Fiscal Year	FY06	FY07	FY08	FY09	FY10	FY11	Total
Funding	\$3.7 ³¹	\$4.393 ³²	\$3.551 ³³	\$3.1 ³⁴	\$3.38 ³⁵	\$3.465 ³⁶	\$21.589

Within its annual report, JIEDDO divides its initiatives into three broad categories — “defeat the device,” those that detect and disarm IEDs using new or existing technologies; “attack the network,” those that target the individuals and groups planting IEDs; and “train the force,” those that instruct soldiers on how to conduct counter-IED operations and operate equipment.³⁷

“Defeat the Device”

³⁰ U.S. Department of Defense, Joint IED Defeat Organization, “JIEDDO Fiscal Year 2011 Budget,” press release, February 5, 2010, <<https://www.jieddo.dod.mil/article.aspx?ID=854>> (April 7, 2011). Rowan Scarborough, “Hunter lauds tactic to snuff IEDs,” *Washington Times*, September 16, 2010, <<http://www.washingtontimes.com/news/2010/sep/16/lawmaker-lauds-tactic-to-snuff-ieds-in-war-zones>> (April 7, 2011).

³¹ U.S. Government Accountability Office, *Warfighter Support: Actions Needed to Improve Visibility and Coordination of DoD’s Counter-Improvised Explosive Device Efforts* (2010), < www.gao.gov/new.items/d1095.pdf > (April 7, 2011).

³² U.S. Department of Defense, Joint IED Defeat Organization, *Annual Report FY 2007*, 17 <[https://www.jieddo.dod.mil/content/docs/2007_JIEDDO%2520Annual%2520Report_\(U\).pdf](https://www.jieddo.dod.mil/content/docs/2007_JIEDDO%2520Annual%2520Report_(U).pdf)> (April 7, 2011).

³³ U.S. Department of Defense, Joint IED Defeat Organization, *Annual Report FY 2008*, 7 <https://www.jieddo.dod.mil/content/docs/20090625_FULL_2008_Annual_Report_Unclassified_v4.pdf> (April 7, 2011).

³⁴ Joint IED Defeat Organization, *Annual Report FY 2009*, 13-17 <https://www.jieddo.dod.mil/content/docs/20090909_FULL_2009%2520Annual%2520Report_Unclassified_v1_lr.pdf> (April 7, 2011).

³⁵ Joint IED Defeat Organization, press release, February 5, 2010.

³⁶ Joint IED Defeat Organization, press release, February 5, 2010.

³⁷ JIEDDO, *Annual Report FY 2009*, 11-15.

JIEDDO has been unable to innovate efficient technologies to detect and disarm IEDs. The most sophisticated technologies developed by JIEDDO tend to locate 50 percent of IEDs in Afghanistan and Iraq. However, despite five years and \$9.4 billion worth of investments, bomb-sniffing dogs are still the most efficient method of detecting the devices, capable of locating 80 percent of IEDs when paired with trained handlers.³⁸ As a result Congress has heavily cut funding for IED detection, from \$2.53B in 2007 to \$1.973B in 2008 and \$1.4B in 2009. Meanwhile, the military has continued to invest in IED-sniffing dogs. K2 Solutions Inc., a private contractor to the military, agreed last year to an \$8.7 million contract with the Marine Corps to provide an additional 112 trained and certified dogs.³⁹ Currently there are 300 of these IED-sniffing dogs deployed in Afghanistan, many of them operating under the IED detector dog program launched by the Marine Corps in 2007.⁴⁰

Electronic “jammers,” designed to disrupt the frequencies of cell phone or radio waves that trigger IEDs, have become less effective over time. Most IEDs in Afghanistan initially used this type of trigger, and by employing jammers the military reduced radio-

³⁸ Shaun Waterman, “General: K-9 Teams Find IEDs Better than \$10 Billion Tech Gear,” *Washington Times*, October 20, 2010

<<http://www.washingtontimes.com/news/2010/oct/20/general-k-9-teams-find-ieds-better-10-billion-tech/>> (April 7, 2011). Sandra Erwin, “Technology Falls Short in the War Against IEDs,” *National Defense Magazine*, October 10, 2010, <<http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=221>> (April 7, 2011).

³⁹ Dan Lamothe, “Dogs Becoming Essential in Fight Against IEDs,” *Marine Corps Times*, March 25, 2010, <http://www.marinecorpstimes.com/news/2010/03/marine_dogs_032510w/> (April 7, 2011).

⁴⁰ Ali Sanders, “U.S. Troops Experience Downturn in IED Violence,” JIEDDO Public Affairs press release, February 3, 2011, <https://www.jieddo.dod.mil/content/docs/20110203_Downtrend_IED_story.pdf> (April 7, 2011).

controlled IEDs to less than 10 percent of all explosive devices.⁴¹ The military also developed a way to operate jammers without disrupting its own equipment.⁴² However, insurgents responded by devising simpler IEDs that use pressure plate devices instead, ones that are immune to jammers. While the technology has been a success, the highest detection rates are still achieved using K-9 units.⁴³

“Attack the Network”

The US military has also applied social network analysis to target insurgent groups planting IEDs. Rooted in the belief that a roadside bomb is not the work of a single individual, the process disrupts IED networks by identifying and targeting key individuals responsible for the bombs. The technique has been used both in Iraq and Afghanistan and is most notable for contributing to the capture of Saddam Hussein in December 2003.⁴⁴ The military has long appreciated the need to study relationships, but computer modeling has helped produce conclusions more rapidly than experienced intelligence analysts.⁴⁵ The military has also provided this type of expertise to its soldiers at the battalion and brigade level.⁴⁶

“Train the Force”

⁴¹ Matthew O’Hara (2008), *Detection of IED Emplacement in Urban Environments*, Master’s thesis, Naval Postgraduate School, 19.

⁴² Noah Shachtman, “Ratio-Friendly Jammers?” *Wired*, March 16, 2007 <http://www.wired.com/dangerroom/2007/03/american_radio/> (April 7, 2011).

⁴³ Shaun Waterman, <<http://www.washingtontimes.com/news/2010/oct/20/general-k-9-teams-find-ieds-better-10-billion-tech/>>.

⁴⁴ Tom Gjelten, “U.S. ‘Connects the Dots’ to Catch Roadside Bombers,” *National Public Radio*, December 3, 2010, <<http://www.npr.org/2010/12/03/131755378/u-s-connects-the-dots-to-catch-roadside-bombers>> (April 7, 2011).

⁴⁵ Tom Gjelten <<http://www.npr.org/2010/12/03/131755378/u-s-connects-the-dots-to-catch-roadside-bombers>>.

⁴⁶ “Defeating the IED,” *Military Training Technology*, February 2010, 2 <http://kmimediagroup.com/files/MT2%2015-1_JIEDDO.pdf> (April 7, 2011).

JIEDDO has invested \$400 to \$500 million per year in training soldiers to identify and search for IED explosives, most notably through the Joint Center of Excellence (JCOE).⁴⁷ These skills are then tested through various simulations and training exercises to prepare soldiers for likely real-world scenarios.

Additional Countermeasures

Beyond funding to JIEDDO, High Mobility Multipurpose Wheeled Vehicles (HMMWVs) are also one of the primary methods used to curb the death tolls of IED attacks. While the Department of Defense did not initially acquire funding for the safer Mine-Resistant, Ambush-Protected (MRAP) Vehicles, the DoD pushed for a rise in HMMWV investment in FY2004. A significant investment in force protection equipment was one of the primary drivers behind the rise in war-related investment costs from FY2004 to FY2009. As a result, production of armored HMMWVs rose dramatically — from 15 per month in August 2003 to 450 per month in December 2004.⁴⁸ These vehicles are still, however, vulnerable to EFPs.⁴⁹

In response to rising death tolls the DoD launched another procurement initiative in 2007 to replace up-armored HMMWVs with MRAPs. MRAP funding tripled from \$5.411 billion in FY2007 to \$16.838 billion in FY2008. Used in limited numbers in Iraq and Afghanistan in 2003, the MRAPs were shown to provide “significantly more

⁴⁷ Joint IED Defeat Organization, Annual Report FY 2009, 11-16

⁴⁸ Jim Garamone, “Armored Humvees, Tactics Address IED Threats,” *American Forces Press Service*, December 8, 2004, <<http://www.defense.gov/news/newsarticle.aspx?id=24640>> (April 7, 2011)

⁴⁹ James Bevan, ed., “Conventional Ammunition in Surplus: A Reference Guide,” *Small Arms Survey*, Graduate Institute of International Studies, Geneva: 2008, 174.

protection against Improvised Explosive Devices (IEDs) than up-armored HMMWVs.”⁵⁰ DoD officials have explained that the casualty rate for an MRAP (6 percent) is less than half that of an M-1 Abrams battle tank (15 percent) and less than a third of an up-armored HMMWV (22 percent).⁵¹ These numbers have been reflected in IED incidents in Afghanistan. Between January and July 2007 the average IED attack on a Humvee killed an occupant 80 percent of the time, but that number drops to 15 percent among attacks on MRAP vehicles.⁵²

However, the added security comes with certain tradeoffs. The armor provides better protection from typical roadside bombs, but the armor can still be penetrated with EFPs. As a result, military officials expect insurgents to increase their use of these more deadly devices.⁵³ The weight added onto the Humvee also hinders the payload and performance of the vehicle.⁵⁴ Added weight forces drivers to go slower, meaning that the vehicles are more protected from any individual IED but are *more* vulnerable to

⁵⁰ U.S. Library of Congress, Congressional Research Service, *Mine-Resistant, Ambush-Protected (MRAP) Vehicles: Background and Issues for Congress* by Andrew Feickert, (Washington, DC: January 18, 2011).

⁵¹ Geoff Morrell, “DoD News Briefing with Geoff Morrell,” press transcript, May 15, 2008, <<http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4231>> (April 7, 2011).

⁵² Tom Vanden Brook, “Armored trucks cut IED deaths among allied troops,” *USA Today*, September 7, 2010. Quoted in Andrew Feickert, 2 <http://www.usatoday.com/news/military/2010-09-07-1Aafghan07_ST_N.htm> (April 7, 2011).

⁵³ Tom Vanden Brook, “MRAPs can't stop newest weapon,” *USA Today*, May 31, 2007. Quoted in Andrew Feickert, 4 <http://www.usatoday.com/news/world/iraq/2007-05-31-mrap-insurgents_N.htm> (April 7, 2011).

⁵⁴ U.S. Library of Congress, Congressional Research Service, *Improvised Explosive Devices (IEDs) in Iraq and Afghanistan: Effects and Countermeasures* by Clay Wilson (Washington, DC: August 28, 2007), 6.

command-detonated IEDs and rocket propelled grenades (RPGs).⁵⁵ As a result, US forces are not currently using many older MRAPs in Afghanistan. As the Congressional Research Service questions, “if a large number of MRAPs are, in fact, not being used then a fundamental question is, why were they shipped to Afghanistan in the first place?”⁵⁶

The Afghan government has taken some its own steps to curb IED attacks. Afghan President Hamid Karzai issued a decree in January 2010 banning the importation, use, production, storage or sale of ammonium nitrate.⁵⁷ NATO estimates that less than 5 percent of the nitrate fertilizer is used for a legitimate use, while the chemical is a major component in 80 to 90 percent of IED attacks.⁵⁸

Lack of Progress

While some of these technologies have demonstrated results, none of them have been able to reverse the increasingly grim IED statistics. Between 2007 and 2009, the number of IED attacks in Afghanistan has tripled while deaths caused by IED attacks among US soldiers have quadrupled.⁵⁹ While larger numbers of IEDs may result in a larger number of deaths regardless of how effective US countermeasures may be, the

⁵⁵ Chris Lowe, “Afghan MRAP Wars: IEDs vs. Mobility,” May 24, 2010, <<http://www.dodbuzz.com/2010/05/24/afghan-mrap-wars-ieds-vs-mobility/>> (April 7, 2011).

⁵⁶ Andrew Feickert, 4.

⁵⁷ UNAMA. *Afghanistan Rights Monitor Mid-Year Report, Civilian Casualties of Conflict January-June 2010*. Kabul, Afghanistan. 8 <www.arm.org.af/file.php?id=2> (April 7, 2011).

⁵⁸ Michael Flynn, 9.

⁵⁹ Anthony H. Cordesman, Marissa Allison, and Jason Lemieux, *IED Metrics of Afghanistan, January 2004 – September 2010*, Center for Strategic and International Studies, November 11, 2010, 3-10.

dramatic rise in IED incidents demonstrates that insurgents have not been deterred by US countermeasures. Most importantly, IED countermeasures have failed to positively change two of the most important statistics: the IED detection rate and the rate of “effective incidents” — those that injure or kill coalition forces.⁶⁰ The rate of detection of IEDs in Iraq and Afghanistan has held steady around 50 percent, despite billions of dollars worth of investment to improve it.⁶¹ The percentage of effective incidents is even worse. As a percentage of IED attacks, the number of effective incidents has *increased* over the last three years, from 7.7 percent in 2007 to 10.0 percent in 2008 and 2009 to 10.8 percent through May 2010.⁶² Therefore, as of 2010 JIEDDO’s countermeasures have been unable to effectively address the problem of IEDs.

A Development Solution: Roads

Background

Prior to the US invasion of Afghanistan in 2001, it was the Soviet Union that built much of Afghanistan's road network. The Soviets built roads during the 1960s and 1970s prior to the Soviet-Afghan war, including the ring road system linking Afghanistan’s major cities. Since that time, three decades of war have largely destroyed all road infrastructure in the country. By the late 1990s, the ring road was so destroyed that it

⁶⁰ Nathan Hodge, “Afghans Report More Roadside Bombs, Attacks on the Rise,” *Wired*, April 9, 2010, <<http://www.wired.com/dangerroom/2010/04/afghans-report-more-roadside-bombs-attacks-still-on-the-rise/>> (April 7, 2011).

⁶¹ Sandra Erwin, <<http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=221>>.

⁶² Anthony H. Cordesman, 3-17.

ceased to exist in many areas beyond a dirt track.⁶³ While a few sporadic road improvements were made under the Taliban regime, the US Agency of International Development (USAID) estimated that Afghanistan had only about 50 kilometers of paved roads prior to 2001.⁶⁴

The Case for Roads

In the absence of a panacea or silver bullet, several policymakers throughout the length of Afghan war have supported a less straightforward method to combat IEDs — building roads. Even JIEDDO has stressed the importance of non-technological ways to combat IEDs, highlighting the importance of political reconciliation.⁶⁵ Under a counterinsurgency strategy, reconciliation starts with winning over the populous, which requires that the United States both demonstrate its long-term investment in Afghanistan’s future and present tangible benefits to locals. Roads fulfill those criteria, and several field researchers, theorists and policymakers contend that roads decrease the frequency of IED attacks.

Among its supporters, roads are hailed as an effective solution for simultaneously addressing the logistical and systemic issues behind IED attacks — beginning with the pavement of the road itself. David Kilcullen, a former senior counterinsurgency adviser to General David Petraeus, suggests that the primary effect of road construction on IEDs

⁶³ Larry Goodson, “The Fragmentation of Culture in Afghanistan,” *Alif: Journal of Comparative Poetics*, no. 18 (1998): 273.

⁶⁴ U.S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Foreign Operations, Export Financing, and Related Programs, *USAID Accomplishments in Afghanistan*, 109th Cong., 1st sess., September 11, 2006, <<http://www.usaid.gov/press/speeches/2006/ty060911.html>> (April 7, 2011).

⁶⁵ Sandra Erwin <<http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=221>>.

is derived from the pavement.⁶⁶ Kilcullen argues insurgents are faced with a two options when attempting to place an IED along a paved road. Insurgents could dig through the hard surface, but this requires more time or a larger number of individuals than on an unpaved road, making it more likely the insurgents will be caught. Furthermore, the disturbance of the smooth pavement makes the IED easier for coalition forces to spot. Alternatively, insurgents can place the IED on the surface — either on the pavement or on the sides of the road. Coalition commanders spent considerable time considering this possibility, but ultimately concluded the devices would still be easier to spot than ones buried in the roadway, and therefore, they would still be better off with pavement than without it.⁶⁷ Faced two less-than-ideal options, Kilcullen concludes that IED incidents should decline.

Road projects also provide incentive to locals to report the placement of IEDs. Road projects developed under Provincial Reconstruction Teams (PRTs) — government organizations that combine military and civilian reconstruction experts to work on reconstruction projects in volatile areas — initiate a series of negotiations with local tribal elders to construct portions of the road running through their territory. These elders then distribute jobs securing and constructing the road to their people, giving the populous a sense of ownership over the road. This is particularly the case with PRTs operating under a “10-kilometer rule,” which requires that 80 percent of unskilled labor come from within 10 kilometers of the project.⁶⁸ Kilcullen contends that while IED attacks may rise in the short-term due to a road project, locals that value the project

⁶⁶ Kilcullen, David, *The Accidental Guerrilla: Fighting Small Wars in the Midst of a Big One* (New York: Oxford University Press, 2009) 102.

⁶⁷ Kilcullen, 99.

⁶⁸ Kilcullen, 92.

respond to attacks by immediately repairing the road and providing intelligence on the insurgents they believe are responsible. As Lieutenant Colonel Chris Cavoli, a battalion commander for the PRT in Kunar province, remarked, "...the road helped us get the population to help us with IEDs...[t]here was one period, winter [2007], when we had 17 IEDs...14 turned in by locals or found by our guards, 3 found by our Huskies...zero exploded."⁶⁹

The projects deprive insurgents of local support by connecting the population to the Afghan government. Before beginning construction, Provincial Reconstruction Teams reach out to district governors and local tribal elders to establish political institutions, or shuras. Enticed by the prospect of securing jobs and the power to consult on the project, elders come forward to participate in the shura.⁷⁰ Road projects also generate disputes that government representatives can mediate, connecting themselves to the locals while raising their own status.⁷¹ Once built, the road also leads to traffic safety issues that can be managed by the Afghan government and used as an opportunity to create a habit of cooperation between the government and local tribes. Government officials, both on the provincial and national level, can also more easily and more frequently visit local leaders thanks to the dramatically reduced travel time. For instance, the road between Kabul and

⁶⁹ Kilcullen, 100.

⁷⁰ Carter Malkasian and Gerald Meyerle, "Provincial Reconstruction Teams: How do We know They Work?" *The Letort Papers* (March 2009), 16-18.

⁷¹ Kilcullen, 89-90.

Kandahar cut traveling time to a third.⁷² The drop in travel time also works in favor of Afghan forces.⁷³

Finally, road projects provide economic incentives to locals. PRTs track the price insurgents offer individuals to attack roads or vehicles and ensure that they pay their road workers slightly more, eliminating any financial temptation for workers to plant IEDs or sabotage road construction projects. Beyond individual employment, decreased travel time, when combined with improved security, encourages the population to invest in crops because products are more likely to reach a market safe and unspoiled.⁷⁴ USAID has stressed this particular point, identifying the improvement of roads to market centers as key indicator of the development of a licit economy in Afghanistan.⁷⁵ US government officials have also used improved prosperity in one district to entice tribal elders in others into guaranteeing security. With local support, the military clears new areas, following up with reconstruction projects.⁷⁶

The Bush Administration, while not initially supportive of roads during the first year of the Afghan war, eventually reversed its stance. President Karzai's initial attempts

⁷² Markus Gauster, "Provincial Reconstruction Teams in Afghanistan," *George C. Marshall European Center for Security Studies Occasional Paper Series*, no. 16 (January 2008), 37.

⁷³ David Ignatius, "Building Bridges in the Back of Beyond," *Washington Post*, May 1, 2008, <http://www.washingtonpost.com/wp-dyn/content/article/2008/04/30/AR2008043003253.html?hpid=opinionsbox1&utm_source=wordtwit&utm_medium=social&utm_campaign=wordtwit> (April 7, 2011).

⁷⁴ Kilcullen, 91-102.

⁷⁵ USAID. *Performance Management Plan (PMP), Afghanistan Alternative Livelihoods Program Northern Region — Badakhshan and Takhar (ALP/N)*, No. 305-M-00-05-00517-00, June 30, 2006, A7.

⁷⁶ David Ignatius, May 1, 2008.

to reconstruct the ring road around Afghanistan were turned down.⁷⁷ Even USAID, the organization used today to manage most US-sponsored road construction in Afghanistan, initially declined to support the project, stating the organization “did not do road building.”⁷⁸ During meetings in January and February 2002, Robert Finn, the first official American ambassador to Afghanistan in nearly 20 years, proposed investing in the Afghan ring road as a way to win the loyalty of locals.⁷⁹ Finn has maintained this position, writing in 2007, “the more roads and infrastructure, the less the influence of the Taliban.”⁸⁰ The Administration reversed course as President Bush pledged support for Afghan reconstruction, including road building, in a speech in April 2002.⁸¹ That pledge translated into \$297 million in reconstruction funds, and by November 2002, the US agreed to build its first highway, connecting Kabul to Herat via Kandahar.⁸²

High-level policymakers — both in the military and the State Department — have bought into the connection between roads and security and have played a key role in acquiring funding for road building. Former Afghan Ambassador Ronald E. Neumann explains that while the US allocated some initial funding to road projects during the first few years of the war, that funding had flat-lined by 2006. The draft 2006 budget, unlike

⁷⁷ Ahmed Rashid, *Descent into Chaos: The US and the Disaster in Pakistan, Afghanistan, and Central Asia*, (New York: Penguin Books, 2008), 186.

⁷⁸ Rashid, 186.

⁷⁹ David Rohde, “Afghan Symbol for Change Becomes a Symbol of Failure,” *New York Times*, September 5, 2008, <<http://query.nytimes.com/gst/fullpage.html?res=9C0DE5DD1631F936A3575AC0A9609C8B63&pagewanted=print>> (April 7, 2011).

⁸⁰ Wolfgang Danspeckgruber and Robert P. Finn, ed., *Building State and Security in Afghanistan*, (Princeton: Lynne Rienner Publishers, Inc., 2007), 153, 266-267.

⁸¹ George W. Bush, “President Outlines War Effort” (speech to the George C. Marshall ROTC Award Seminar, Virginia, April 17, 2002), <<http://georgewbush-whitehouse.archives.gov/news/releases/2002/04/20020417-1.html>> (April 7, 2011).

⁸² Rashid, 186.

the FY 2004 budget, would have significantly underfunded development by committing funds only to existing road projects.⁸³ Hoping to significantly expand funding for road construction, Neumann developed a \$600.9 million supplement with \$223 million for roads.⁸⁴ Facing significant resistance and the absence of a sense of urgency from Congress, Neumann explains that he won support for the project gradually through reports, conversations and individual meetings, as well as continuously stressing the connection between road building and security to key individual throughout the US government, starting with Secretary of State Condoleezza Rice. Neumann and Lieutenant General Karl Eikenberry, then the Commander of the Combined Forces Command in Afghanistan, couched their funding requests in security rather than developmental terms as war deteriorated in 2006. “Where we opened roads security increased, the economy expanded, and it become harder for the insurgents to conceal bombs. We endlessly quoted Eikenberry’s statement, ‘Where the roads end, the insurgency begins.’”⁸⁵ Military officials in Afghanistan have reiterated this claim, stating simply, “if you have a paved road here, you have fewer improvised explosive devices (IEDs).”⁸⁶

The support of policymakers for additional roads has translated into billions of dollars for construction projects. Along with managing the majority of overall US assistance to Afghanistan, USAID has handled the majority of funding for these

⁸³ Ronald E. Neumann, *The Other War: Winning and Losing in Afghanistan* (Washington: Potomac Books, 2009), 39.

⁸⁴ Neumann, 42.

⁸⁵ Neumann, 94.

⁸⁶ “Roads Key to Afghan Security,” *Daily Times Pakistan*, May 5, 2008, <http://www.dailytimes.com.pk/default.asp?page=2008\05\05\story_5-5-2008_pg7_50&utm_source=wordtwit&utm_medium=social&utm_campaign=wordtwit> (April 7, 2011).

projects.⁸⁷ Road construction has become a significant segment of the agency's budget for Afghanistan, constituting 20 percent of USAID's \$5.9 billion in assistance as of 2008. By September of that year, USAID had constructed or rehabilitated over 1,650 miles of roads.⁸⁸ Meanwhile, under the Commander's Emergency Response Program (CERP), the Department of Defense has also allocated \$300 million for civilian road projects, with an additional \$260 million in roads for military purposes.⁸⁹

By fiscal year (in millions)									
Program Category	2002	2003	2004	2005	2006	2007 request	2008 request	Total	Percent of Total
Roads	\$51	\$142	\$354	\$276	\$255	\$446	\$338	\$1,862	27

By fiscal year (in millions)									
Year	2002	2003	2004	2005	2006	2007	2008	2009	Total
Funding	\$124	\$295	\$855	\$1,240	\$706	\$1,191	\$1,491	\$1,871	\$7,776

Few experts have been critical of Kilcullen's association of road building with decreases in IED attacks, but those that have argued that the association is *positive*, not negative. In short, road building *increases* IED attacks. As Joshua Foust, a fellow at the American Security Project, argues, discussion over road building largely omits how

⁸⁷ U.S. Government Accountability Office, *Afghanistan Reconstruction: Progress Made in Construction Roads, but Assessment for Determining Impact and a Sustainable Maintenance Program Are Needed* (2008), 9 <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

⁸⁸ U.S. Library of Congress, Congressional Research Service, *Afghanistan: U.S. Foreign Assistance* by Curt Tarnoff, (Washington DC: July 8, 2009), 4.

⁸⁹ U.S. Government Accountability Office (2008), 1, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

⁹⁰ U.S. Government Accountability Office, *Securing, Stabilizing, and Reconstructing Afghanistan: Key Issues for Congressional Oversight* (2007), 29 <www.gao.gov/new.items/d07801sp.pdf> (April 7, 2011).

⁹¹ U.S. Government Accountability Office, *Afghanistan: Key Issues for Congressional Oversight* (2007), 4, <www.gao.gov/new.items/d09473sp.pdf> (April 7, 2011).

insurgents can adapt to paved roads. Coalition forces and civilians are not the only groups that can take advantage of the new projects. Whether paved or unpaved, roads are still at a fixed location and can be used by anyone, and without constant patrols by US and coalition forces Taliban militants and other insurgent groups can lay down IEDs on the roads and quickly escape.⁹² During the Soviet-Afghan war, insurgents were able to use their mastery of the roads to prevent the consistent transport of supplies into Afghanistan, preventing the Soviets from supporting a larger force.⁹³ As a result of reduced travel time, increased traffic along paved highways may also provide additional incentive to insurgents to target those roads. The level of violence along major paved highways adds weight to this claim. While roads are generally a target for insurgent attacks — with 85.9 percent of all insurgent violence occurring near a road — John O’Loughlin finds that insurgent incidents within a five-kilometer buffer of the ring road are higher than coalition incidents, concluding that the ring road has become a disproportionately large target for IED attacks because it remains a major transport artery for government and allied forces.”⁹⁴ The Kabul-Kandahar section of the ring road, a signature construction project built well before IEDs were common in Afghanistan, has been nicknamed the “highway to hell” and is commonly the sight of kidnappings and insurgent attacks.

⁹² Joshua Foust, “Thinking Critically About Road Construction,” *Registan*, May 6, 2008, <http://www.registan.net/index.php/2008/05/06/thinking-critically-about-road-construction/?utm_source=wordtwit&utm_medium=social&utm_campaign=wordtwit> (April 7, 2011).

⁹³ Lester W. Grau and Mohammad Yahya Nawroz, “The Soviet War in Afghanistan: History and Harbinger of Future War?” *Military Review*, (September/October 1995).

⁹⁴ John O’Loughlin et al, “Peering Into the Fog of War: The Geography of the WikiLeaks Afghanistan War Logs, 2004-2009,” *Eurasian Geography and Economics* 51, no. 4 (2010), 487.

Insurgents hold control of many sections of the road, even by day in certain areas.⁹⁵ Multiple news outlets have reported a Taliban resurgence along this road by 2007, claiming that insurgents control the road and many of the villages along it.⁹⁶ Even smaller road projects off of Highway 1, such as the Tangi Valley road, are dubbed “IED alley.”⁹⁷ Back in May 2007, Brian Glyn Williams applied this same title to another paved road — the Kabul-Gardez highway — that was completed over a half year earlier in September 2006.⁹⁸ Despite paving thousands of kilometers of roads over the course of the war, military officials admitted in 2009 that it is more dangerous to travel by road in Afghanistan today than back under the Taliban.⁹⁹

The risk associated with traveling on paved roads has limited the pace of development in Afghanistan. Taliban attacks make traveling on paved roads a less appealing option, limiting the effect the road project can contribute to improving the economy and underscoring the weakness of the Afghan central government.¹⁰⁰ The danger along the roads has similarly limited the impact of NGOs. Many NGOs have

⁹⁵ Alastair Leithead, “Taleban Rule the Road in Ghazni,” *BBC News*, August 6, 2007 <http://news.bbc.co.uk/2/hi/south_asia/6933029.stm> (April 7, 2011).

⁹⁶ Salih Muhammad Salih and Abubakar Siddique, “Death Stalks the Highway to Hell,” *Radio Free Europe*, October 24, 2008, <http://atimes.com/atimes/South_Asia/JJ24Df03.html> (April 7, 2011).

⁹⁷ Fred W. Baker III, “Clearing the Tangi: Task Force in Afghanistan Takes Troubled Valley,” *American Forces Press Service*, <<http://www.army.mil/-news/2009/03/10/17994-clearing-the-tangi-task-force-in-afghanistan-takes-troubled-valley/>> (April 7, 2011).

⁹⁸ Williams, 26.

⁹⁹ Aislinn Laing and Ben Farmer, “Travelling by Road in Afghanistan is ‘now more dangerous than under Taliban,’” *Telegraph (UK)*, December 4, 2009 <<http://www.telegraph.co.uk/news/uknews/defence/6718217/Travelling-by-road-in-Afghanistan-now-more-dangerous-than-under-Taliban.html>> (April 7, 2011).

¹⁰⁰ C.J. Chivers, “Danger Rules Lawless Highway 1 in Afghanistan,” *New York Times*, <<http://www.nytimes.com/2007/12/03/world/asia/03iht-afghan.1.8567407.html>> (April 7, 2011).

limited their movement, delayed or cut back projects and avoided the roads entirely. As Afghan Development Association Director Esmatullah Haidary explained, most foreigners avoid the roads by traveling by plane, and in southern Afghanistan, aid workers are largely limited to city centers for security purposes.¹⁰¹ By forcing aid workers to cut back on development projects, the violence ensures that the needs of the local population are less effectively met.

If road construction projects are a particular target for insurgents, one should expect the US government and its partners to consistently fail to meet targets for road construction. This is precisely what has happened, and contractors have explained that poor security conditions are primarily to blame.¹⁰² USAID failed to meet its targets for kilometers of road paved annually from 2006 to 2008. The Japanese government finally completed a 114-kilometer section of the Kandahar-Heart road in southern Afghanistan in July 2009, despite initially estimating that the section would be completed three years earlier.¹⁰³ Security along the road from the Kajaki Dam to the ring road became so severe between 2007 and 2008 that the project was terminated despite of the fact USAID had already spent \$5 million.¹⁰⁴

¹⁰¹ Bronwen Roberts, “Afghan Insecurity Putting Pressure on NGOs,” *Agence France-Presse*, May 1, 2007, <<http://www.reliefweb.int/rw/rwb.nsf/db900SID/SODA-72S55Z?OpenDocument&RSS20=02-P>> (April 7, 2011).

¹⁰² U.S. Government Accountability Office (2008), 22, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

¹⁰³ Ministry of Foreign Affairs of Japan, “Completion of the Kandahar-Heart Highway,” press release, July 7, 2009, <http://www.mofa.go.jp/announce/announce/2009/7/1193560_1138.html> (April 7, 2011).

¹⁰⁴ U.S. Government Accountability Office (2008), 21-22, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

Even if road projects improve security in the short-term, critics contend the Afghan government lacks the long-term resources to cover the costs of maintaining paved roads. No sustainable road maintenance program exists, and without funding, maintenance has been neglected.¹⁰⁵ The Afghan Ministry of Public Works estimated in 2007 that road maintenance would cost \$30 million, yet the Ministry of Finance only allocated \$8 million to the program, forcing the ministry workers to undertake only occasional maintenance. These costs are expected to rise as additional projects are completed. An estimate by Asian Development Bank pegs the annual cost of road maintenance between 2011 and 2015 to be \$85 million to \$90 million annually, excluding the costs of rural roads.¹⁰⁶ Maintenance will be particularly necessary given the lesser quality of the material used to build the roads. The average cost of a paved road in Afghanistan is about \$500,000 per kilometer, far below the \$3 million to \$6 million typically needed to build a road in the US, Europe or China. Matthew Nasuti, an expert on reconstruction, contends that number *should* be higher given the need to ship equipment, machinery and asphalt to Afghanistan, and cheap labor can only account for part of the difference.¹⁰⁷ Nasuti concludes that USAID has prioritized the quantity of roads over quality, noting that the agency does not provide comprehensive data on the quality of the road materials. NGOs studying roads in Afghanistan have discovered similar quality issues. Integrity Watch Afghanistan, an NGO focused on improving

¹⁰⁵ U.S. Government Accountability Office (2009), 26, <www.gao.gov/new.items/d09473sp.pdf> (April 7, 2011). U.S. Government Accountability Office (2008), 32, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

¹⁰⁶ U.S. Government Accountability Office (2008), 36, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

¹⁰⁷ Matthew Nasuti, "The Ring Road: A Gift Afghanistan Cannot Afford," *Kabul Press*, September 29, 2009, <<http://kabulpress.org/my/spip.php?article4093>> (April 7, 2011).

transparency and accountability, notes that on most district roads, “companies have used Double Basement Surface Treatment (DBST), whose life expectancy is not more than 3 years.”¹⁰⁸ According to the DoD, this type of road needs to be continuously treated — even in lightly trafficked areas — to maintain an acceptable level of service.¹⁰⁹ USAID and international donors have agreed to temporarily fund road maintenance to protect new projects, but unless this funding continues Afghanistan will eventually be left with a crumbling road system, ensuring that neither the economic nor security benefits of roads are long lasting.

The Scholarly Divide

Scholars have been equally divided on a deeper issue behind road construction — does remoteness (generally due to a lack of roads) help or inhibit a government from defeating an insurgency?

Certain civil war scholars have supported the broader claim made by Kilcullen, drawing a connection between roads and the power of a central state. Stated simply: paved roads sap the power of a potential insurgency by allowing a government to project its power out into more remote areas. As Paul Collier and Anke Hoeffler contend, remote areas of terrain are most susceptible to an insurgency.¹¹⁰ Combined with low population

¹⁰⁸ Integrity Watch Afghanistan, *Afghan Roads Reconstruction: Deconstruction of Lucrative Assistance*, Kabul, Afghanistan: 2007, 8-9.

¹⁰⁹ Department of Defense, *Asphalt Maintenance and Repair, Unified Facilities Criteria (UFC)*, March 15, 2001. Quoted in Matthew Nasuti <<http://kabulpress.org/my/spip.php?article4093>>.

¹¹⁰ Paul Collier and Anke Hoeffler. “Greed and Grievance in Civil Wars,” *Oxford Economic Papers* 56 (2004): 663-693. Quoted in Halvard Buhaug and Jan Ketil Rød, “Local Determinants of African Civil Wars, 1970-2001,” *Political Geography* 25, no. 3 (March 2006): 8.

density, the sheer distance of these areas from the center of state power makes them hard to reach by government forces and therefore ideal for organizing a rebellion. Thus as James Fearon and David Laitin conclude, “the most important determinants of the prospects of an insurgency are most likely *the police and military capabilities of the government, and the reach of government institutions into rural areas.*”¹¹¹ By building roads, and subsequently reducing the time needed to travel between two points, a central government can more easily penetrate remote areas and quell resistance. States throughout history have taken advantage of this fact to discipline terrain and expand their authority, particularly the Roman Empire. According to Logan Thompson, the Roman system of roads was developed because routes could not withstand the passage of large quantities of troops, particularly during inclement weather. Unpaved roads disintegrated into mud, seriously impeding the movement of troops, but by paving roads, armies could progress up to twenty-five miles a day toward areas of unrest. Noting that knowledge of this fact itself acted as a deterrent to the development of hostilities, Thompson concludes that roads were the primary reason for the military effectiveness of the Roman Empire.¹¹² Scholars investigating counterinsurgencies in the Philippines¹¹³, the Congo¹¹⁴, Malaya and Burma¹¹⁵ have all attributed increased mobility and economic development to the construction of infrastructure.

However, other civil war scholars contend that isolation acts as an inhibitor of

¹¹¹ James Fearon and David Laitin, “Ethnicity, Insurgency, and Civil War,” *American Political Science Review* (August 2002): 14.

¹¹² Logan Thompson, “Roman Roads,” *History Today* 47, (February 1997), 21-22.

¹¹³ Timothy K. Deady, “Lessons from a Successful Counterinsurgency: The Philippines, 1899-1902,” *Parameters* (Spring 2005): 61.

¹¹⁴ Ted R. Gurr, *Why Men Rebel*, (Princeton, NJ: Princeton University Press, 1970).

¹¹⁵ Corson-Knowles, David, “Highway Robbery: How Road Construction Expanded the Burmese Military's Resource Access,” *Journal of Politics and Society* (2003): 15.

insurgent violence. More recent work by scholars suggests that areas with higher proportions of roads are *more* likely to face violent resistance. Halvard Buhaug and Jan Ketil Rød tested underlying determinants behind civil wars in Africa and found that, controlling for population, the density of roads is *positively* associated with the risk of civil war — contradicting their initial hypothesis. Separatist conflicts, Buhaug concludes, “occur in relatively more, not less developed regions.”¹¹⁶ Buhaug also concludes that mountainous and forested landscape — areas that weaker national governments cannot easily reach — also inhibits rebellion. In Afghanistan, locals have supported this strategy of isolation in the mountainous northeast province in Nuristan, opposing the construction of roads to keep foreigners out of the area.¹¹⁷

These conclusions also match additional studies on Al-Qaeda’s efforts in Somalia. Clint Watts and Joe Felter suggest that one of the primary reasons the Al-Qaeda franchise struggled to take root in Somalia between 1992 and 1994 was that the expected low operational costs never materialized. Quoting from several uncovered letters between Al-Qaeda members, Watts demonstrates that Al-Qaeda leaders discovered that transportation costs were “substantial and paralyzing for the Somali franchise.”¹¹⁸ Due in large part to poor infrastructure, shipping and transportation costs consumed their resources. “The very reasons that [Al-Qaeda] sought Somalia- an isolated safe haven for preparing and conducting terrorist operations- also made it nearly impossible to sustain operations.”¹¹⁹

¹¹⁶ Buhaug and Rød, 5-15.

¹¹⁷ Jackie Northam, “U.S. Troops Withdraw from Isolated Afghan Areas,” *National Public Radio*, September 25, 2009, <<http://www.npr.org/templates/story/story.php?storyId=113182575>> (April 7, 2011).

¹¹⁸ Clint Watts and Joe Felter, *Al-Qaida’s (Mis)Adventures in the Horn of Africa*, Harmony Project: Combating Terrorism Center at West Point (May 2007), 20.

¹¹⁹ Watts and Felter, 20.

In short, isolation and a lack of infrastructure can prevent a non-local insurgency from taking root.

The Existing Evidence

Field researchers interpreting data from provincial reconstruction teams in eastern Afghanistan support Kilcullen's contention that roads reduce IED attacks and improve security. Noting that skeptics have criticized the lack of rigorous assessment of PRT projects, Carter Malkasian and Gerald Meyerle preface their support for PRTs by admitting, "There is no evidence that PRTs on their own have quelled violence."¹²⁰ However, after conducting research for two months in 2007 and two months in 2008 while working with four PRTs, Malkasian concludes that in at least three of the four provinces studied — Khost, Kunar and Ghazni — road projects had a positive impact on security. Of each PRTs spending among these three provinces, "30 to 60 percent went to roads and bridges."¹²¹ In Khost, roads received the largest portion of a \$22 million funding "blitz," and within that province, Malkasian uses a Spearman's Rank correlation to conclude that there is a statistically significant relationship between improvements in safety in individual districts and the level of PRT spending. In Kunar, Malkasian takes note of the drop in IED incidents along paved roads. IED incidents along the Jalalabad-Asadabad highway fell as the road was paved, dropping "from a high of 17 in 2006 to 7 in 2007 following the road's completion."¹²² Like in Khost, Malkasian also explains that the road projects improved governance by increasing local political participation in

¹²⁰ Malkasian and Meyerle, 11.

¹²¹ Malkasian and Meyerle, 31.

¹²² Malkasian and Meyerle, 16.

shuras. Malkasian argues that the same IED effect occurred along an additional PRT-funded road constructed in the Pech River Valley, dropping from a high of 21 in the first 6 months of 2006 (or 6 months before the start of the project) to 2 during the first 6 months of 2008 (around March 2008 when the project was completed).¹²³ In Ghazni, roads were paved in four of the five most dangerous districts. These five districts received the highest concentration of PRT funding, and as in Khost, Malkasian concludes that there is a statistically significant relationship between district security ratings and PRT spending.¹²⁴

However, these statistics supporting the claims made by road advocates have not been rigorously analyzed. Malkasian concludes that PRTs “clearly...helped reduce violence and governance...[T]he strategy of out posting and road building brought security, revitalized local political institutions, and enabled the Afghan government to deliver goods and services to the people for the first time.”¹²⁵ However, Malkasian’s analysis of individual roads in Kunar and Ghazni suffers from selection bias. To determine the association between road construction and the quantity of IED attacks, a study would need to contrast the quantity of attacks along paved roads *against the quantity attacks along unpaved roads* over the same time span. Malkasian’s work does not provide data for the latter, and without a comparable control group, his conclusions cannot be generalized to the rest of Afghanistan. Malkasian also demonstrates a statistically significant relationship between security ratings by district and PRT spending in Khost and Ghazni provinces, but only notes that the correlation is supported by “weak

¹²³ Malkasian and Meyerle, 18-19.

¹²⁴ Malkasian and Meyerle, 23-24.

¹²⁵ Malkasian and Meyerle, 21.

statistical evidence” — or correlation at the .05 level — in the endnotes. Because PRT funding went to a variety of projects beyond roads, including the construction of schools, dams and wells, the effect road construction itself cannot be isolated. Furthermore, Malkasian also adds that the results for Kunar and Nuristan were not significant.¹²⁶

Beyond Malkasian’s work, the influence of road projects on security has not been comprehensively analyzed. US agencies have not conducted sound evaluations to determine which projects have been most effective in achieving their goals, and in many cases, US agencies are not reporting complete information on civilian road projects to USAID.¹²⁷ The few studies that have been conducted, such as the baseline studies for the Kabul-Kandahar and Kandahar-Heart roads, were completed after much of the work on the project was done, skewing any data the evaluations might find.¹²⁸ Like Kilcullen’s work, evidence supporting a connection between roads and improved security conditions is largely anecdotal, while updates on road construction by USAID are incomplete and are limited only to certain years.¹²⁹

¹²⁶ Malkasian and Meyerle, 47.

¹²⁷ U.S. Government Accountability Office (2008), 27, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

¹²⁸ U.S. Government Accountability Office (2008), 27, <www.gao.gov/new.items/d08689.pdf> (April 7, 2011).

¹²⁹ USAID, “Weekly Reports Archive” <<http://www.usaid.gov/locations/asia/countries/afghanistan/weeklyreports/>> (April 7, 2011).

IV. Roads: Weapon or Target?

The contradicting viewpoints among policymakers and theorists on the effect of roads beg the question: do roads impact the frequency of IED attacks in Afghanistan, and if so, is that impact positive or negative? The case studies examined in this thesis attempt to shed some light on that question.

The Case Study

Two pairs of roads are examined in this case study: the Kabul-Gardez and Gardez-Ghazni highways and the Lashkar Gah-Ring Road and Gereshk-Lashkar Gah highways (see appendix, figures 9 and 10).

The decision to evaluate both pairs of highways was driven by several factors. First, both paved highways were started and completed during the earliest portion of the Afghan war logs between mid-2004 and late 2006. The Kabul-Gardez highway was completed between July 2004 and September 2006,¹³⁰ while the Lashkar Gah-Ring Road highway completed between August 2005 and June 2006.¹³¹ The early completion dates create an opportunity to evaluate the effects of the road projects both during construction and three years after their completion. Given the low level of IED attacks in Afghanistan in 2004, both roads also begin with roughly the same number of IED attacks per kilometer. Second, both roads have comparable unpaved roads that can be used as a

¹³⁰ USAID, "Road Update, Issue 65," February 2007, 2, <<http://www.america.gov/st/washfile-english/2004/August/20040804163308ESnamfuaK0.1996533.html>> (April 7, 2011).

¹³¹ USAID, "Road Update, Issue 65," 2. USAID, "Road Update, Issue 48," August 7, 2005, <http://www.usaid.gov/locations/asia/documents/countries/afghanistan/roadweekly_082705.pdf> (April 7, 2011).

control. In the first case study, both roads begin at the same provincial capital — Gardez — and lead to other provincial capitals, ensuring some level of comparability between the two cases. The same applies for the second pair of roads, where both begin in the provincial capital of Lashkar Gah and end along the ring road within Helmand province. Third, the research proves that neither of the control roads was paved during the time span of the war logs. The Gardez-Ghazni road opened for construction in September 2010, nearly a year after the final entry in the war logs.¹³² Similarly, coalition forces did not start to pave the Gereshk-Lashkar Gah road, also known as “Route Trident,” until mid-December 2009.¹³³ The initial 7.6 kilometers of paved road were completed in March 2010,¹³⁴ and the extension, which will link up with existing roads to provide a continuous road between Lashkar Gah and Garesk, began in July 2010.¹³⁵

Data and Methodology

I use a subset of a new dataset of insurgent and coalition incidents across Afghanistan for this case study, one assembled by the military and leaked by the website

¹³² USAID, “Celebrating Road Construction in Ghazni,” press release, September 30, 2010, <http://afghanistan.usaid.gov/en/USAID/Article/1372/Celebrating_Road_Construction_in_Ghazni> (April 7, 2011).

¹³³ “Road to Hearts and Minds,” *New Civil Engineer*, July 8, 2010, <<http://www.britannica.com/bsp/additionalcontent/18/52419679/ROAD-TO-HEARTS-amp-MINDS/fulltext>> (April 7, 2011).

¹³⁴ United Kingdom Ministry of Defence, “Engineers Complete Route Through Panther’s Claw Territory,” *Military Operations*, March 19, 2010, <<http://www.mod.uk/DefenceInternet/DefenceNews/MilitaryOperations/EngineersCompleteSecureRouteThroughPanthersClawTerritory.htm>> (April 7, 2011).

¹³⁵ Declan Lynch, “Royal Engineers in Afghanistan: Programmed for Peace,” *New Civil Engineer*, September 16, 2010, <<http://www.nce.co.uk/news/international/royal-engineers-in-afghanistan-programmed-for-peace/8605910.article>> (April 7, 2011).

WikiLeaks on July 25, 2010.¹³⁶ Known commonly in the media as the Afghan war logs, the data contains tens of thousands of unique reports on the dates, geographic coordinates and casualties of insurgent and coalition incidents from the start of 2004 to the end of 2009. The subset comes from the Guardian (UK), one of the three newspapers given access to the documents prior to their release. The datajournalism project conducted by investigative reporters at the Guardian includes only the 7,528 successful IED explosions listed in the WikiLeaks documents. As Simon Rogers, a news editor for the Guardian, explains, the dataset “does not include person- or vehicle-borne suicide bombs... and only include[s] IED explosions [and] IED ambushes - where an explosion is combined with an ambush by insurgents.”¹³⁷

The documents certainly do not represent a complete picture of the Afghan war, but the documents are likely to correspond with other existing datasets in the case of IEDs. Given limited information about the insurgency, no reporting mechanism can account for all developments in Afghanistan in an entirely unbiased way. But as O’Loughlin notes, media sources takes note of violent events when they occur, and as such, other coders record and include these incidents in other datasets.¹³⁸

¹³⁶ The entire WikiLeaks dataset can be viewed at <http://213.251.145.96>, while the smaller dataset is available for download at <http://image.guardian.co.uk/sys-files/Guardian/documents/2010/07/28/ExplodedIED.xls>.

¹³⁷ Simon Rogers, “Wikileaks’ Afghanistan War Logs: How Our Datajournalism Operation Worked,” *Guardian (UK)*, July 27, 2010, <<http://www.guardian.co.uk/news/datablog/2010/jul/27/wikileaks-afghanistan-data-datajournalism>> (April 7, 2011).

¹³⁸ O’Loughlin, 480.

ArcGIS 9 was used to narrow down the IED incidents.¹³⁹ Both datasets were converted into shapefiles and compared to two shapefiles of the Afghan road network, both of which were necessary to acquire the proper data for all four roads.¹⁴⁰ The file from the Geographic Information Support Team (GIST) included a key section of the Gardez-Ghazni highway between Ghazni, Dowlat Khan and the Zurmat district in Paktia province.¹⁴¹ The entire GIST road running from Gardez to Ghazni was also combined with a section of road running from Gardez to the Zurmat district from the USDMA file. The GIST file was also the only file that contained a road running through Gholam Dastagir Kalay, a city between Gereshk and Lashkar Gah in Helmand province that only Route Trident runs through. The remaining roads were taken from the USDMA shapefile. A one-kilometer buffer was placed over all four roads (see appendix, figure 11), and those IEDs falling within the boundaries were extracted from the dataset.

I define the treatment as the point at which the road project was completed, even though portions of the road were constructed prior to its completion, because vehicles cannot take full advantage of a paved road in the middle of its construction. Generally portions of a road undergoing work are closed off to traffic, and it's only once the project is completed that the freshly paved road becomes available for public use.

¹³⁹ The Geographic Coordinate System used in the case studies is WGS_1984.prj, while the Projected Coordinate System is Times_(world).prj.

¹⁴⁰ The first road shapefile, digitized by the United States Defense Mapping Agency (USDMA), is available at the Afghanistan Information Management Service's (AIMS) website at

http://www.aims.org.af/services/mapping/shape_files/afghanistan/line/roads.zip. The second shapefile was developed by Geographic Information Support Team (GIST), an US government inter-agency initiative, and is available at http://geocommons.com/maps/61845/edit?add_id=15285.

¹⁴¹ An image of the road can be accessed at <https://www.irp-af.com/?pname=open&id=176&type=html&phpMyAdmin=3jLKUjxroDwu4VuxRBmi1fE5PW4>.

Thus, IED attacks that fell within the buffer were placed into two groups — those that occurred prior to the completion of the road and those that occurred after.¹⁴² I then calculated the average number of attacks in a year along all four roads for both pre- and post-treatment. To control for the varying lengths of the roads, I divided the average number of attacks in a year along all four roads by the respective length of each road (see appendix, tables 4 and 6). The lengths of the four roads are listed below:

- Kabul-Gardez (Treatment 1, T₁) — 125 kilometers¹⁴³
- Gardez-Ghazni (Control 2, C₁) — 92 kilometers¹⁴⁴
- Lashkar Gah-Ring Road (Treatment 2, T₂) — 49 kilometers¹⁴⁵
- Gereskh-Lashkar Gah (Control 2, C₂) — 37 kilometers¹⁴⁶

Example: Kabul-Gardez Highway Post-Treatment, or T_{1B}

$$\frac{59 \text{ IED attacks}}{3.33 \text{ years}} = 17.7 \text{ attacks/year}$$

$$\frac{17.7 \text{ attacks per year}}{125 \text{ km}} = \frac{0.1416 \text{ attacks per year}}{\text{km}}$$

To find the difference in differences (DID) between both pairs of roads, the pre-treatment numbers were subtracted from the post-treatment numbers, minus the difference of the respective control road.

¹⁴² Grouping the data into two groups also helped to eliminate year-to-year variations in IED attacks. IED incidents along the roads were initially grouped by year (see tables 10-11, figures 4-5) and divided by total kilometers. Year-to-year variation complicated any attempt to extract a correlation between paved roads and IED attacks.

¹⁴³ USAID, “Road Update, Issue 65,” February 2007, 2.

¹⁴⁴ Afghanistan Infrastructure and Rehabilitation Program, USAID, “A Road Runs Through It,” <<https://www.irp-af.com/?pname=open&id=176&type=html&phpMyAdmin=3jLKUjxroDwu4VuxRBmilFE5PW4>> (April 7, 2011).

¹⁴⁵ USAID, “Road Update, Issue 65,” February 2007, 2.

¹⁴⁶ This measurement is based on an estimation using ArcGIS.

$$DID_1 = (T_{1B} - T_{1A}) - (C_{1B} - C_{1A})$$

$$DID_2 = (T_{2B} - T_{2A}) - (C_{2B} - C_{2A})$$

Limitations

As with all observational case studies, the conclusions I can draw from this research are limited and rely on a number of assumptions. I assume that the roads examined in this study, both paved and unpaved, are representative of roads generally in the southeast half of Afghanistan where IED attacks are most common. I examined two sets of roads in different regions of the country in an attempt to address part of this issue, but ultimately I cannot say with *complete* certainty that the roads examined accurately reflect all other roads in the region. The study is designed to account for the varying degrees in violence by province by studying roads branching out from a central location to similarly important areas (provincial capitals) as well as the likelihood that larger roads will suffer from a larger quantity of attacks. However, the case study design also cannot rule out the possibility that an omitted third variable has skewed the results. Thus, given the lack of total certainty that the relationship between paved roads and IED attacks is entirely independent, any relationship found between the two variables should be viewed with some degree of skepticism.

Evaluating the Results

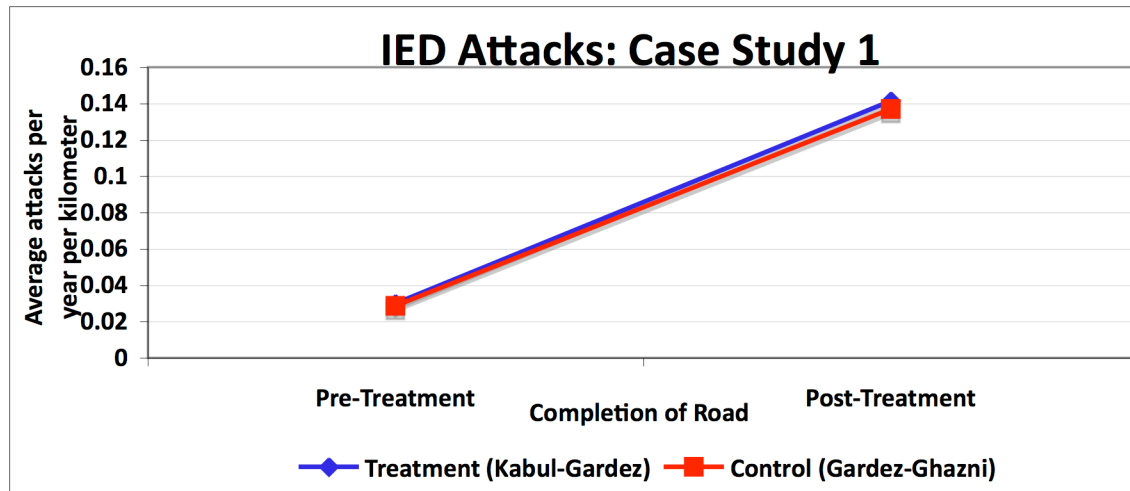


Figure 1. Case Study 1: Difference in attacks per kilometer before and after treatment.

Table 4.

Case Study 1.	Post-Treatment	Pre-Treatment	Differences
Treatment (Kabul-Gardez)	0.1416	0.03	0.1116
Control (Gardez-Ghazni)	0.136956522	0.028532609	0.108423913
Difference	0.004643478	0.001467391	
Difference in Differences (DID₁):	0.003176087	Percent Change:	216.44%

As the graph demonstrates, the DID between the two roads is very small — just over .003. While road paving accounts for a 216.44 percent *increase* in IED attacks per year per kilometer when compared to the pre-treatment difference, the effect in terms of IEDs per year is small. Presuming that longer roads are no more likely to be target of IED attacks than shorter roads per kilometer, the road treatment increased IED attacks by .397 per year (see table 5).

Table 5.

Case Study 1.	Post-Treatment	Pre-Treatment	Differences	Post-T IEDs/year
Treatment (Kabul-Gardez)	0.1416	0.03	0.1116	17.7
Untreated (Kabul-Gardez)	0.138423913	0.03	0.108423913	17.30298913
Control (Gardez-Ghazni)	0.136956522	0.028532609	0.108423913	
Effect:				0.397010875

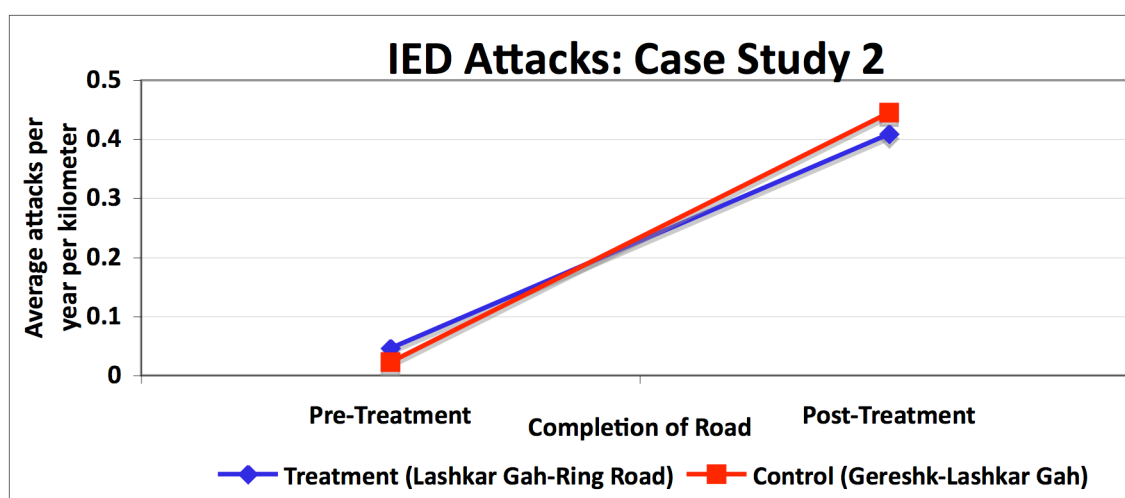


Figure 2. Case Study 2: Difference in attacks per kilometer before and after treatment

Table 6.

Case Study 2.	Post-Treatment	Pre-Treatment	Differences
Treatment (Lashkar Gah-Ring Road)	0.409302326	0.045977011	0.363325314
Control (Gereshk-Lashkar Gah)	0.445003143	0.022367195	0.422635948
Difference	-0.035700817	0.023609816	
Difference in Differences (DID₂):	-0.059310634	Percent Change:	-251.21%

The DID is small in the second case study as well (-.059), although there is greater variance in the pre- and post-treatment numbers. While the road paving accounts for a 251.21 percent *decrease* in IEDs per year per kilometer when compared to the pre-

treatment difference, the effect in terms of IEDs, given the same assumptions as the first case study, is a decrease in IED attacks of 2.906 per year (see figure 3 and table 7).

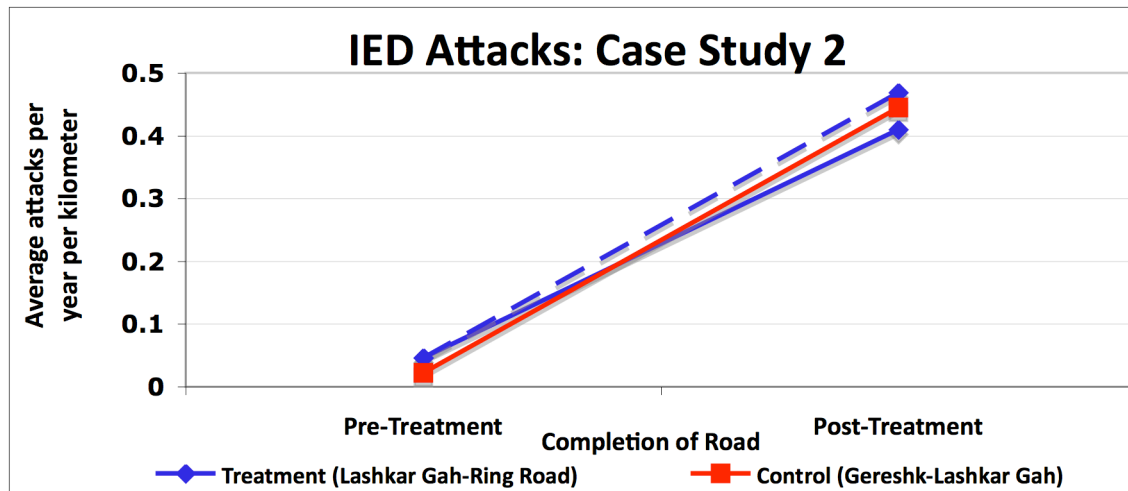


Figure 3. A representation of the trajectory of the road if otherwise left untreated.

Table 7.

Case Study 2.	Post-Treatment	Pre-Treatment	Differences	Post-T IEDs/year
<u>Treatment</u> (Lashkar Gah-Ring Road)	0.409302326	0.045977011	0.363325314	20.05581397
<u>Untreated</u> (Lashkar Gah-Ring Road)	0.468612959	0.045977011	0.422635948	22.96203499
<u>Control</u> (Gereshk-Lashkar Gah)	0.445003143	0.022367195	0.422635948	
			Effect	-2.906221017

V. Conclusion

Despite the number of arguments presented by policymakers, field researchers and theorists about why paved roads should have an effect on IED attacks, either positively or negatively, the results of the two case studies suggest that there is little to no meaningful relationship between the two variables. Both DIDs were relatively small, and when converted into IED attacks per year neither case demonstrated a change of more than 3 IEDs per year. Presuming that the Department of Defense could find qualified contractors capable of handling the same contract as K-9 Solutions Inc. signed with the Marine Corps in 2010, the \$49 million used to construct the Lashkar Gah-Ring Road highway in the second case study could have paid for well over 600 additional trained and certified bomb-sniffing dogs. As the most effective detection device currently available, nearing an 80 percent success rate (compared to 50 percent among other techniques), it is possible that hundreds of additional dogs could have met or surpassed this difference. When measured by the frequency of incidents, roads do not appear to be an effective tactic for addressing the problem of IEDs in Afghanistan.

This is not to suggest that there is no basis upon which to justify spending on road construction. It is possible that IEDs improve trade within Afghanistan and subsequently improve the economy, and testing alternative justifications for road construction is beyond the scope of this thesis. However, policymakers themselves have admitted that roads have been primarily sold to members of Congress and the bureaucracy in terms of security, not development.

Ultimately the results of this thesis suggest that the relationship between road building and the frequency of IED attacks merits greater study. Given the vast sum of

money spent combating IEDs — with hundreds of millions spent on road building and billions spent on research and development — the United States government should invest resources in more precisely and accurately measuring the effect of road building on IED attacks. Learning whether roads are a cost effective method of combating IEDs will help those in the policymaking world determine whether investments in road construction are worth the cost or whether those resources are better spent on more proven methods of IED detection and prevention.

Appendix

Table 8.

<u>Treatment</u> (Lashkar Gah-Ring Road)	IED Attacks	IEDs per year/km
Pre-Treatment	5	0.045977011
Post-Treatment	66	0.409302326
<u>Control</u> (Gereshk-Lashkar Gah)	IED Attacks	IEDs per year/km
Pre-Treatment	2	0.022367195
Post-Treatment	59	0.445003143

Table 9.

<u>Treatment</u> (Kabul-Gardez)	IED Attacks	IEDs per year/km
Pre-Treatment	10	0.03
Post-Treatment	59	0.1416
<u>Control</u> (Gardez-Ghazni)	IED Attacks	IEDs per year/km
Pre-Treatment	7	0.028532609
Post-Treatment	42	0.136956522

Table 10.

Kabul-Gardez		Length: 125 km	Gardez-Ghazni	Length: 92 km	
Year	IED Attacks	IED Attacks/Km	Year	IED Attacks	IED Attacks/Km
2004	2	0.016	2004	3	0.032608696
2005	5	0.04	2005	1	0.010869565
2006	11	0.088	2006	4	0.043478261
2007	17	0.136	2007	17	0.184782609
2008	7	0.056	2008	11	0.119565217
2009	27	0.216	2009	13	0.141304348
Total	69		Total	49	

Table 11.

Lashkar Gah-Ring Road		Length: 49 km	Gereshk-Lashkar Gah	Length: 37 km	
Year	IED Attacks	IED Attacks/Km	Year	IED Attacks	IED Attacks/Km
2004	1	0.020408163	2004	1	0.027027027
2005	3	0.06122449	2005	1	0.027027027
2006	7	0.142857143	2006	2	0.054054054
2007	3	0.06122449	2007	4	0.108108108
2008	24	0.489795918	2008	54	0.108108108
2009	33	0.673469388	2009	49	1.324324324
Total	71		Total	61	

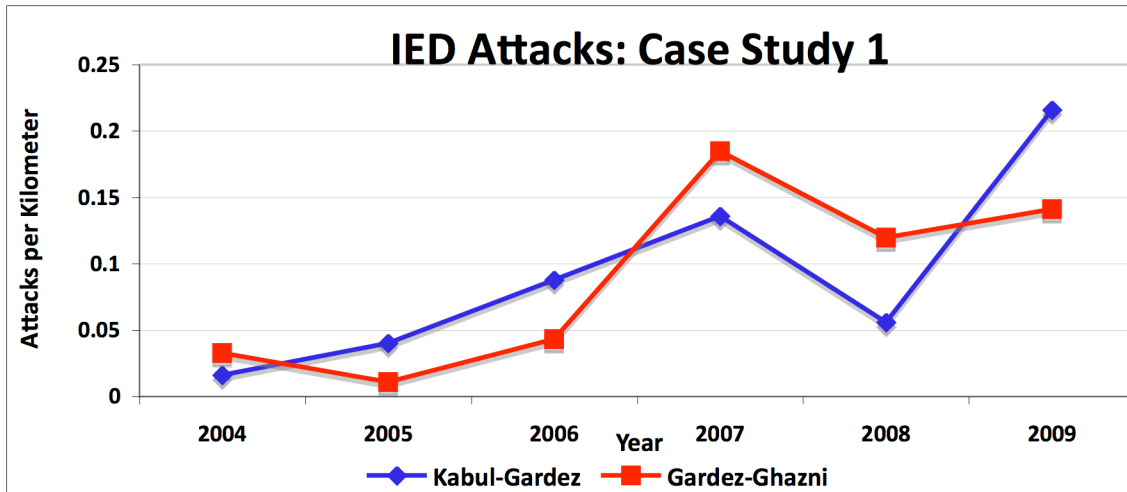


Figure 4. Case Study 1: IED Incidents per year across both treatment and control roads.

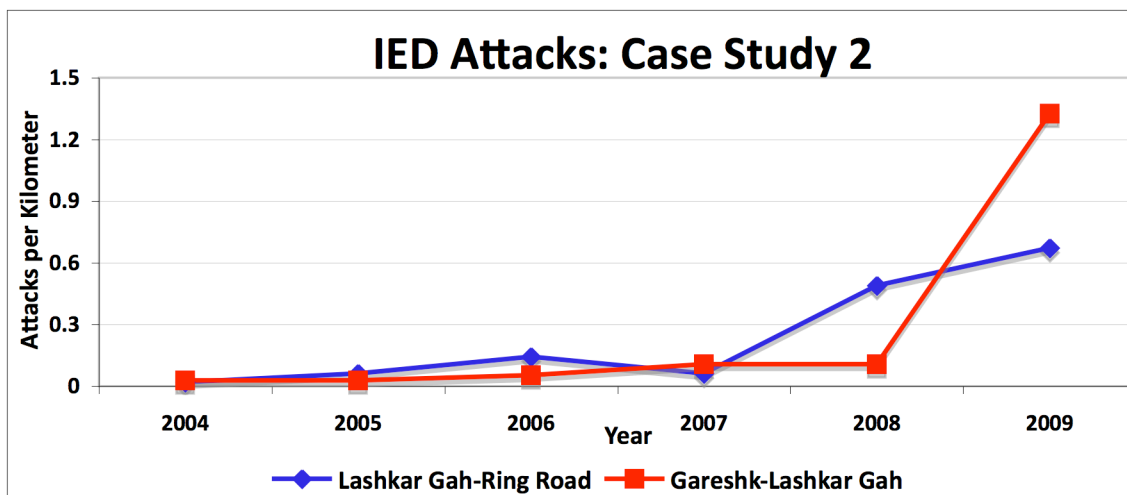


Figure 5. Case Study 2: IED incidents per year across both treatment and control roads.

Figure 6. A countrywide look at the location of IED in Afghanistan relative to roads.

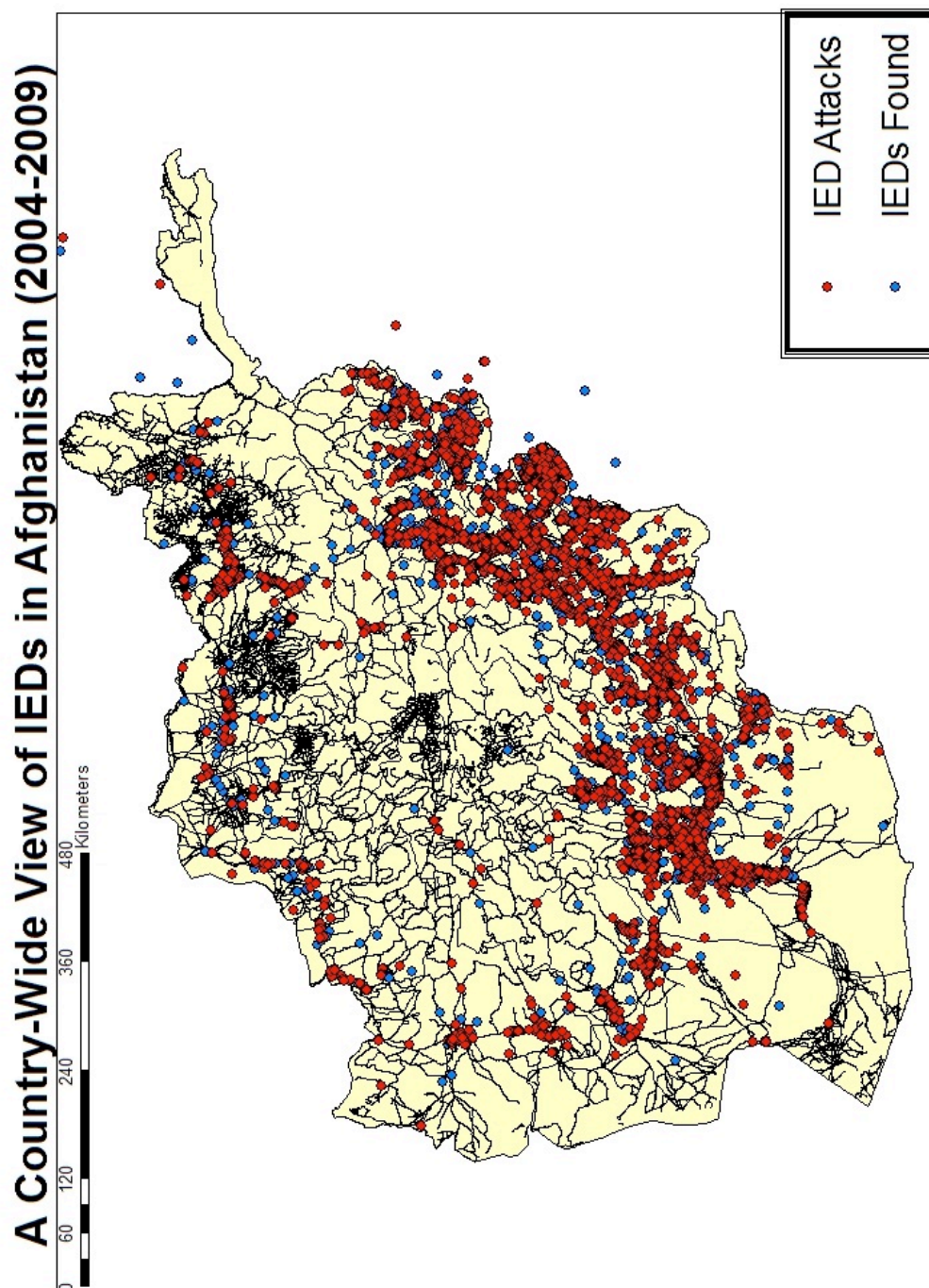


Figure 7. Test Case 1: A visual representation of IED attacks from 2004-2009 along the treatment (Kabul-Gardez) highway in black and the control highway (Gardez-Ghazni) in blue. The Kabul-Gardez road project was started in June 2004 and was completed in September 2006.

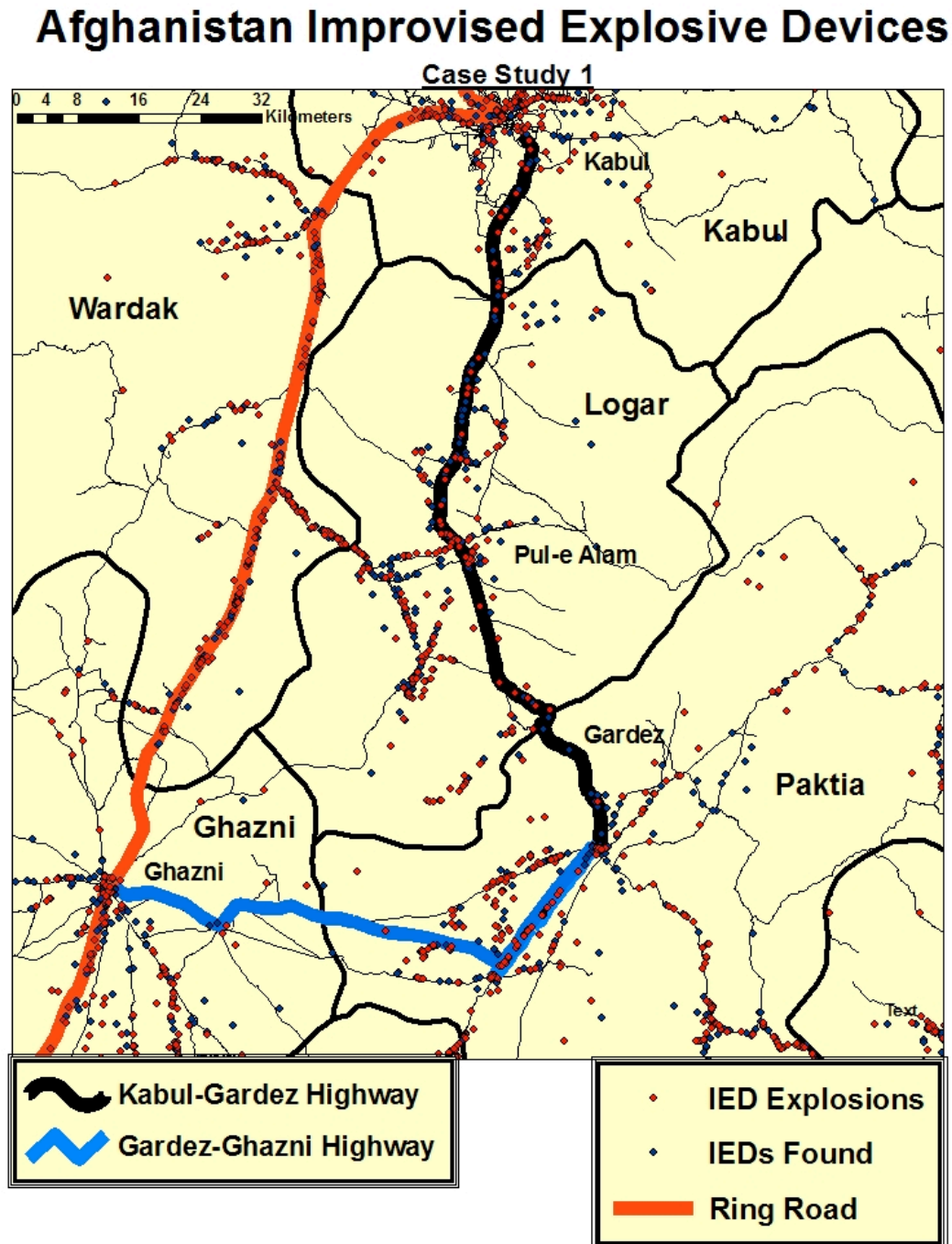


Figure 8. Test Case 2: A visual representation of IED attacks from 2004-2009 along the treatment (Lashkar Gah-Ring Road) highway in black and the control highway (Gereshk-Lashkar Gah) in blue. The Lashkar Gah-Ring Road highway was started in August 2005 and was completed in June 2006.

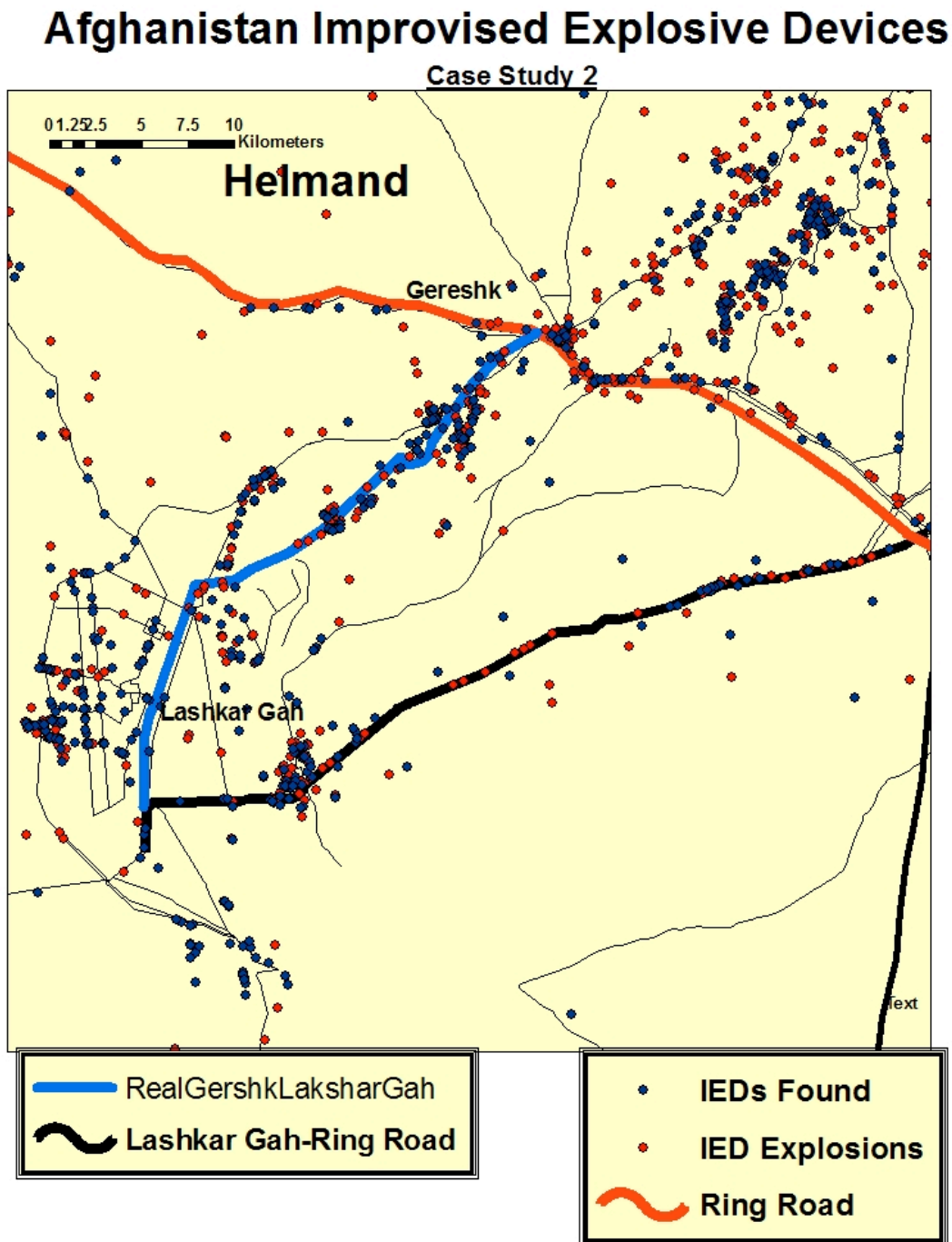
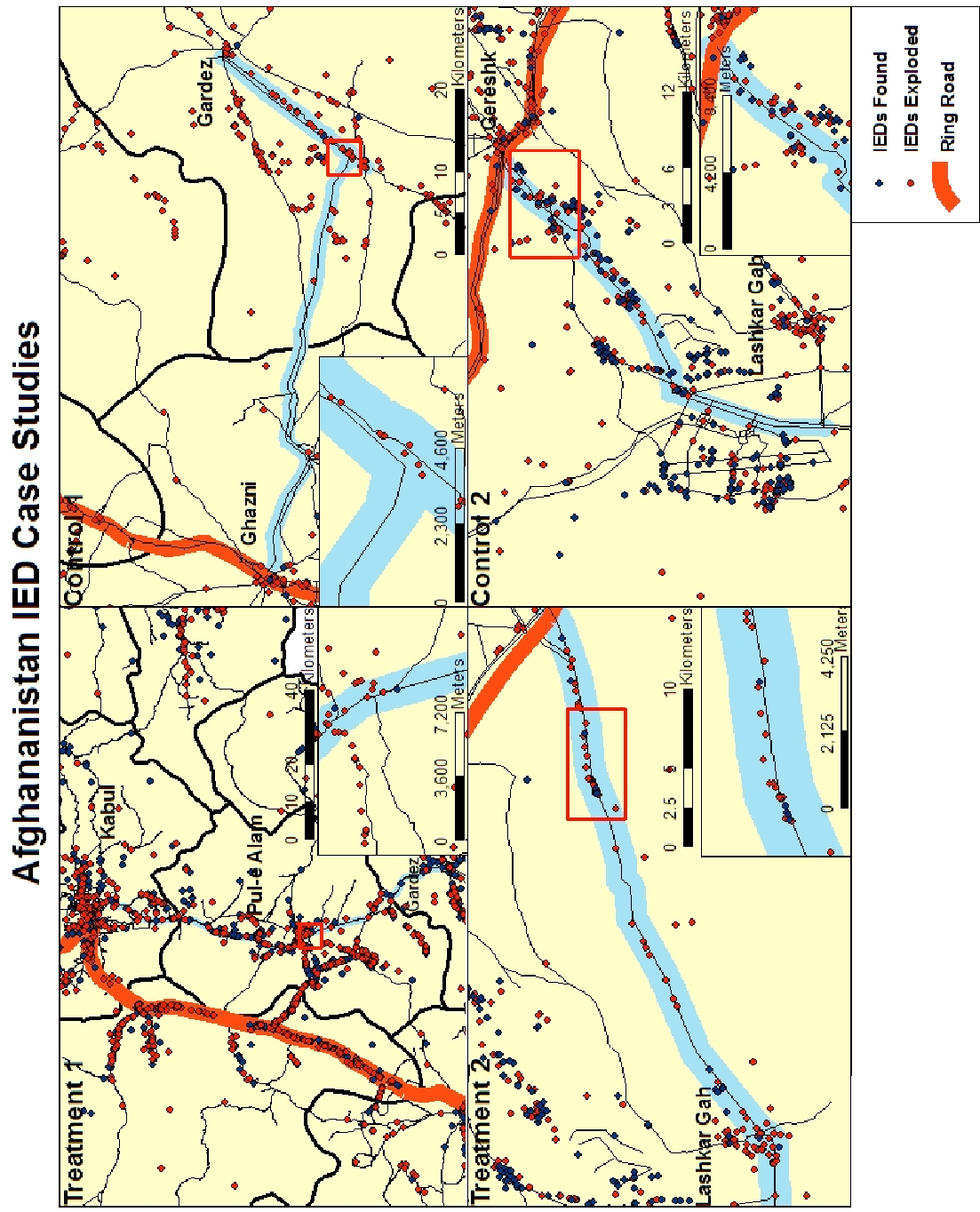


Figure 9. A 1-kilometer buffer was placed over each of the four roads. IEDs located within the buffer were included in the dataset.



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