Infrastructure as Institutional Relics: Insights from the United States Bridge System

Submitted in partial fulfillment of the requirements for

the degree of

Doctor of Philosophy

in

Engineering and Public Policy

Jaison D. Desai

B.S., Political Science, American University
M.P.P., American University
M.B.A., Webster University
M.S., Engineering and Public Policy, Carnegie Mellon University

Carnegie Mellon University
Pittsburgh, PA

August, 2018

ACKNOWLEDGEMENTS

First and foremost, all of my gratitude goes to my wife, Jennifer. You are my soulmate and the one who always picks me up when I am down. Even when you didn't understand a word I was saying, you still told me this research was interesting and that it would all work out in the end. I love you so very much and thank you for all you do to raise our son and care for me while trying to pursue your own dreams. Patton, I hope you enjoy reading this when you get older and need a way to fall asleep. To my mom, Patty, you are the greatest and most inspiring parent any child could ask for. Everything I achieve in life is because of the foundation you provided, the lessons you taught me, and the sacrifices you made to ensure I had every opportunity to succeed.

To my friends and family members, you all mean so much to me, even if I do not always find ways to express it on a regular basis. Dave Garcia, you have always been a combination of the brother I never had and the father I wished I had. Pete Judge, Jessie Bourland, Dr. Ryan Barrett (mildly upset you beat me to that title), you truly are my greatest friends in life. Greg Lucsko, Evan Finkelstein, and Jim Garboden, I am honored to wear the same letters as you and thank you for being my friends and support network here in Pittsburgh. Kate McMahon, Francisco Fonseca, Liza Reed, Christophe Combemale, Amanda Quay, Erezi Ogbo, Mike Ford, Sam Jones, Priyank Lathwal, Dian Yu, Sarah Robb, Travis Carless, Daniel Gingrich, and all the other students and graduates of EPP, thank you for being so welcoming and for your friendship and assistance.

My deepest and heartfelt thanks to all the members of my committee – Daniel Erian Armanios, Ph.D., Assistant Professor, Department of Engineering & Public Policy, Carnegie Mellon University (Committee Chair); Douglas C. Sicker, Ph.D., Department Head, Engineering & Public Policy, Lord Endowed Chair of Engineering, and Professor, College of Engineering, School of Computer Science, and Heinz College, Carnegie Mellon University; Erica R. H.

Fuchs, Ph.D., Professor, Engineering & Public Policy, Carnegie Mellon University; and Burcu Akinci, Ph.D., Paul Christiano Professor, Civil & Environmental Engineering, Carnegie Mellon University.

Daniel Armanios, you are the best advisor that any student could ask for. Thank you for always believing in me, pushing me to work harder (and faster), and guiding me on this amazing intellectual journey. Doug Sicker, thank you for taking a chance on me and allowing me to be a member of this amazing program. Erica Fuchs, your advice, feedback, and guidance was instrumental in my success and I am so grateful for your brilliant insights. Burcu Akinci, I am thankful for your kindness and support and I drew strength knowing that you were so incredibly excited by what this work could offer to the engineering community. I also offer special thanks to the many faculty members who supported me in this effort – Baruch Fischhoff, Granger Morgan, Alex Davis, Mario Bergés, Costa Samaras, Scott Matthews, Paul Fischbeck, Jared Cohon, Katie Whitefoot, Parth Vaishnav, Brian Kovak, Jonathan Caulkins, and many others.

None of this would have been possible without the support and recommendation of many mentors in the United States Army. COL Joe Clark, sir, you are the greatest Cavalryman I have ever met and the most amazing leader I ever worked for. It is only because of you that I am here today. COL Doug Matty, you truly believed in me from the beginning and were convinced that EPP was the right place for me; thank you for this chance to justify your faith in me. BG Jeff Broadwater, thank you sir for endorsing the application that led to this opportunity. MG John Ferrari and all the members of the ORSA team, I thank you for letting me complete this program and learn new skills so I can continue to take care of Soldiers. COL Marie Lou Hall, your mentorship throughout this process cannot be understated. And to all the officers, NCOs, and

Troopers I have had the opportunity to serve alongside my entire career, thank you for all the lessons you provided me.

Last, but certainly not least, I am deeply indebted to all of the amazing staff members from the Department of Engineering & Public Policy and Carnegie Mellon who work tirelessly on behalf of students every day. Most especially, Vicki Finney and Deb Kuntz, who fought to ensure my success in the program, and Sean Petrisko, who became a valued friend. I also owe deep gratitude to Adam Loucks, Deb Scappatura, Patti Steranchak, and Kim Martin.

This research would not have been possible without the financial support provided by the United States Army Advanced Civilian Schooling program, the United States Army Functional Area 49 (Operations Research & Systems Analysis) Proponent, the Omar N. Bradley Officer Research Fellowship in Mathematics (2016 award), and the Department of Engineering and Public Policy at Carnegie Mellon University.

ABSTRACT

This thesis considers challenges with infrastructure management at the nexus of sociology and engineering. Why do we continue to struggle with the management of deteriorating infrastructure systems when capable engineering systems exist for monitoring, identifying, and prioritizing facets of these systems? The prevailing view of infrastructure systems assumes that they are *exogenous* to society and thus largely focus on the social impacts of the technical facets of such systems (infrastructure → society). Utilizing institutional theory, science and technology studies, and social movement theory, this thesis advances the perspective that social factors have an influence on the technical parameters of infrastructure systems; infrastructure is therefore *endogenous* to society (society → infrastructure). The interplay between social and technical factors is explored through three complementary sections using a variety of statistical methods and 21 years of data from the National Bridge Inventory (NBI) of the United States Federal Highway Administration (FHWA) and other sources.

The first paper explores the institutional constraints that inhibit bridge managers from addressing challenges with remediation of outdated bridges. More specifically, it depicts bridges as *institutional relics*, whereby a bridge's physical attributes reflect the accepted standards of the time and later persist even when those standards may change. Bridges are more likely to be institutional relics when built prior to the adoption of national design mandates (*regulative-based* relics) or in locales whose engineering norms conflict with these national standards (*normative-based* relics). Bridge ownership and the spatial constraints present in more urban settings moderate the ability of bridge managers to address those bridges that are identified as relics.

The second paper focuses on the role of attachment to institutional relics and its potential to inspire collective action around *preserving* them. Specifically, it considers movements to enroll bridges into the National Register of Historic Places (NRHP) on closure rates and subsequent sufficiency. Not only do bridges enrolled on the NRHP have a lower risk of closure in post-enrollment years as compared to similar non-enrolled bridges, but these movements also restrict engineering options on enrolled bridges, with improvements focused on non-historic elements (i.e. the bridge's substructure). This informs social movement research by considering movements of preservation instead of change and how movements can directly influence the built environment as an end goal.

In the third paper, bridge sufficiency is considered through the lens of inspection data to identify influential attributes affecting monitoring of potential institutional relics. A framework is developed for providing feedback to bridge managers, designers, and policymakers. Given computation challenges, previous studies understandably and necessarily begin with a limited scope, data, or variable selection. This study leverages novel computational techniques, namely a least absolute shrinkage and selection operator (LASSO) approach, that can more comprehensively consider the entire United States bridge system and its variables to inform attribute selection. It finds that a mixture of inspector-driven variables, design/maintenance variables, and weather are highly influential in calculating overall bridge sufficiency rating. Many of the factors that persistently influence bridge sufficiency are also related to social challenges, namely the presence of institutional relics, explored previously. As such, this paper presents one possible computational approach for scoping the most salient technical and social variables for which bridge designers and managers should focus attention when seeking to monitor bridge deterioration.

These results are then tied to contemporary issues in bridge management and used to propose policy actions within each section of findings to better address bridge management issues. In sum, this thesis helps advance a more sociological understanding toward infrastructure, namely how social parameters can influence engineering systems, as applied in the context of bridge systems.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

Why do we continue to struggle with the management of deteriorating infrastructure, even though we have extremely capable engineering systems for monitoring, identifying, and prioritizing elements of these systems? Infrastructure systems represent the most fundamental blocks upon which a country is built, making their effectiveness in design and maintenance a critical national priority. Yet, the most recent Infrastructure Report Card by the American Society of Civil Engineers graded the cumulative condition of the nation's infrastructure at a D+ level, indicating it is in poor shape, at risk, and exhibits significant deterioration. For example, across the national bridge system there exist over 56,000 structurally deficient bridges and repairing the system would take an additional $123 billion of spending (ASCE, 2017).

While highly competent systems exist to identify appropriate technical solutions and their associated costs, there are perhaps other obstacles that prevent us from addressing deteriorating infrastructure. The prevailing view of infrastructure systems assumes that they are *exogenous* to society and thus largely focus on the social impacts of the technical facets of such systems (infrastructure → society). In other words, already existing infrastructure generates social impacts, such as user costs imposed as a result of deterioration or closure for maintenance. However, perhaps we need to more deeply consider the social and institutional factors that have an influence on the technical parameters of infrastructure systems. In this manner, infrastructure is considered from a perspective of being *endogenous* to society (society → infrastructure).

In this thesis, infrastructure is reconceptualized as *institutional relics*, whereby physical attributes reflect the accepted standards of the time of construction and later persist even when those standards may change. It considers infrastructure through the case of the system of bridges within the United States and takes a sociological perspective through the application and theoretical advancement of three primary literature streams – institutional theory, science and technology studies, and social movement theory. In addition, it advances the literature within the phenomenon of the bridge management system. Through the exploration of gaps within each of these streams, this work seeks to advance the perspective that social factors have an influence on the technical parameters of infrastructure systems and infrastructure is therefore endogenous to society.

INSTITUTIONAL THEORY

Any discussion of infrastructure systems must include the institutional forces that surround such systems. Whether designing an entirely new infrastructure, redesigning an existing system, or simply adding a new element or object to an existing arrangement, the institutions within which designers and builders operate serve as powerful influencers on the end result. In the case of large-scale projects of national importance, the highest and most powerful institutions, namely the federal government and its subsidiary agencies, can play a defining role in project development. Yet a single bridge is also likely influenced by state and local factors and may even be impacted by private interests or additional institutions that are stakeholders in the decisions for siting, building, and design.

At any level, powerful institutions have a critical role to play in shaping the acceptance of standards across an infrastructure system. Although nascent systems may be highly malleable by developers, once established they are subject to attempts at standardization by such powerful institutions for a variety of purposes. These may include safety concerns, social equality issues, accessibility needs, or the desire for interconnectedness. When powerful actors, such as the federal government, accept and disseminate regulatory standards, these standards appear more credible, which makes other institutions involved in such systems more likely to accept such standards (DiMaggio & Powell, 1983).

In his seminal work, Scott (2001) details the three pillars – regulative, normative, and cultural-cognitive – that support and reinforce institutions. In the case of disseminating standards for infrastructure development, governments may utilize regulatory powers to establish rules and define penalties for noncompliance. For example in 1956, the Federal Aid Highway Act formally introduced common design standards for roadways and bridges as part of the Code of Federal Regulations. From a normative perspective, these newly issued standards redefined norms and values, particularly the ability for large vehicles to transit unimpeded across the nation. Whether intentionally or unintentionally, such actions impose constraints on social behavior and empower social action. They also help create a common cultural-cognitive framework of meaning that eventually leads to these objects and their properties becoming taken-for-granted facets of society.

There are also inherent disparities between levels of institutions, such as from the federal to the state level, which may create conflicts that lead to differences in design and implementation. Oliver (1991) discusses how institutional pressures toward conformity may result in varied responses by organizations which, in some cases, may resist such institutionalization. In other words, when local practices conflict with national standards, local institutions may try to defy such standards. This is shown to be the case in prioritization of government action items (Kozhikode and Li, 2012), varying community responses to regulatory pressures (Lee and Lounsbury, 2015), and even decisions on how and when to implement changes at the firm level (Chandler, 2014). Thus, we cannot simply view federal mandates as inherently defining the resulting output of infrastructure systems. Local facets of such systems may differ from federal mandates, especially in locations where there is conflict with the national level regarding infrastructure deployment and design.

Changes in the institutional or policy landscape create the need to adjust the way in which infrastructure is designed and deployed. If these are minor changes, or they apply to easily modifiable parameters, they may be negligible. On the other hand, if the changes are paradigm-altering or apply to deeply ingrained parameters, they will be harder or potentially impossible to effect. In this latter case, policy changes alone may not necessarily result in the intended outcome and may require other environmental factors. This interaction effect between policy changes and other factors, such as technical capacity or cultural environment, has been highlighted in the banking sector (Marquis & Huang, 2009), as well as in national-level efforts to spur entrepreneurship (Armanios & Eesley, 2018).

This literature primarily focuses on the ways in which institutions make decisions, enact new regulations, or maintain existing regulations. In this manner, the concern is with how to approach relevant, present-day action to make changes to future infrastructure parameters, or how varying levels of institutions may resist the efforts promulgated from higher levels. Yet we know that infrastructure is generally designed to have longevity and resilience due to its critical nature. Indeed, such infrastructure may even outlive the institutions and social systems that put in place its original parameters. In short, we understand better how institutions persist and change, but less so how they are remediated (i.e. redress outdated elements). Thus, the gap to be addressed from this perspective when considering infrastructure systems is: *how do we remedy systems that represent remnants of outdated regulations?*

SCIENCE & TECHNOLOGY STUDIES

In the field of papers that can generally be referred to as Science and Technology Studies (STS), the primary investigative concern is with the interplay of technologies and society. More specifically, how technologies influence and serve as drivers of social change or, conversely, how societies can influence the trajectory of technological development. In short, STS depicts an infrastructure system as a duality, or tug-of-war, between the human social factor and the nonhuman technical factors that comprise the system. On the one hand, people create technologies and therefore must influence them. On the other hand, these technologies will then be used by many other people, who may or may not share the same views of the designer.

The classic piece regarding the sociology of bridges from the STS perspective is the discussion of Robert Moses and his low-clearance bridges by Winner (1980). The paper argues that it was the fervent racism of Moses and his desire to prevent buses, primarily used by African Americans, from reaching Jones Beach that led to his design decision. This was later challenged by others, who pointed to financial constraints, local traffic laws, and overall ambivalence of infrastructure to argue that such conclusions were based on conjecture (Joerges, 1999; Woolgar & Cooper, 1999). What is perhaps most relevant to this work is not the use of the Moses example, but rather Winner's insight on temporality:

> "To our accustomed way of thinking, technologies are seen as neutral tools that can be used well or poorly, for good, evil, or something in between. But we usually do not stop to inquire whether a given device might have been designed and built in such a way that it produces a set of consequences logically and temporally *prior* to any of its professed uses" (italics in original, Winner, 1980, p. 125).

Thus, when talking about infrastructure systems, we tend to take-for-granted their design and creation and do not consider what consequences may result from undertaking that design or creation, or that the very design was made to elicit such social consequences.

Infrastructure must be viewed as both social and technical in the relation of people to the built environment that infrastructure represents. In this regard, infrastructure means different things to different people, depending on their particular uses for such infrastructure (Star, 1999). Temporal factors, coupled with the inability to easily modify large-scale deployed infrastructure, create the setting for infrastructure to remain that embodies previous standards of design. Law's (2012) concept of *heterogeneous engineering* follows from Callon (1984) in observing that the stability and form of infrastructure results from the interaction of both the conditions and methods of building. One cannot simply divorce the construction of infrastructure completely from the social context within which it is located. While engineers are experts at the skills of construction, they must often deal with constituencies that have different views of the resulting project and its implications. The preferred alternative may then be more a function of human input rather than a strictly technical engineering approach (Suchman, 2000).

The very longevity of infrastructure design may serve to create problems when the time comes for future modification efforts. Modification of large-scale infrastructure such as bridges is time-consuming, imposes significant user costs in detours and congestion, and may be cost-prohibitive given funding constraints (Liu & Frangopol, 2006a; Xu et al, 2015). In such cases, the parameters and technical properties that are built into the bridge may actually serve as a barrier to change. Such a situation is posited by Leonardi & Barley (2010), who acknowledge the contrast to many social constructivist arguments that constraints presented by infrastructure help mold and influence the direction of change within organizations.

Beyond general social influences on designers, pieces of infrastructure can continue to influence society by their presence and meaning. Once constructed and ingrained into the community, these objects can generate sentimental attachment within people who encounter them (Suchman, 2005; Jerolmack & Tavory, 2014; Barnard, 2016). Attachment to objects often is not due to functional attributes but is rooted in a sense of security, personal memories, and connection to other community members (Wallendorf & Arnould, 1988). In this manner, the infrastructure system takes on not just functional but cultural value and social importance as a piece of the physical landscape (Greider & Garkovich, 1994). Thus, in addition to financial and engineering challenges to modify infrastructure, the local society may actively resist efforts to replace or modify objects perceived as historic and sentimental.

The prevailing focus in this segment is to acknowledge and describe how and why social factors come to be infused into the design and use of technical systems. Infrastructure is tied to social systems and motivations and may be interpreted in many ways based on the individual who is attempting to use the system. While Leonardi (2011) discusses the concept of human and material agency in a changing organizational environment, the literature in this area is sparse. Finally, while social and institutional forces are discussed from the perspective of technology change, less attention is given to how such factors can inhibit change (Leonardi & Barley, 2010). Thus, the gap to be addressed from this perspective when considering infrastructure systems is: *how can social and institutional factors inhibit change within infrastructure systems?*

SOCIAL MOVEMENT THEORY

Although powerful institutions may put forth regulations that define the parameters of infrastructure development and maintenance, these are influenced by the stakeholders and creators of the system, as discussed above. Such endogenous actors include the designers, builders, and funders of infrastructure systems, who can affect the creation of the system and thereby embed their values into it. For long-lasting parameters or those which are economically or physically difficult to modify, such infrastructure may last for significant periods of time.

Moreover, limited funding may result in prioritization of certain segments of the system while neglecting others (Chang & Garvin, 2008). Given these considerations, concerned actors may attempt to use social movements to affect the future trajectory of particular segments of the system (i.e. a particular bridge) or the system itself (i.e. modification of built parameters).

The purpose of social movements is to influence society based on a real or perceived grievance, often breeding formal organization structures that attempt to accomplish this goal (McCarthy & Zald, 1977). Such groups engage in resource mobilization to garner support from a variety of actors, including members of the aggrieved population, adherents to the cause, and supporters who provide their money, time, and connections. Using target goals, messaging strategies, and direct action, the movement tries to sway public opinion and argue for change. In the case of infrastructure systems, such efforts require engagement with the political structure, either for regulatory changes, design modifications, or funding support.

Movements are largely borne of environmental factors and require three broad areas for emergence and development – political opportunities, mobilizing structures, and framing processes (McAdam et al, 1996). First, movements are shaped by the constraints and openings presented by the political system within which they operate. For example, the recruitment and use of political elites is often critical to achieving the aims of the movement, as it provides legitimacy and plausible avenues for redress of issues (Soule & Olzak, 2004). Movements may thus be borne of a perceived or real grievance due to governmental action or inaction, such as when a local transportation department initiates the replacement of historic infrastructure. Alternately, they may be tied to a political opportunity, such as when a state conducts a system-wide assessment of infrastructure for the purpose of determining historicity.

Mobilizing structures are then required to bring people together for the purpose of engaging in collective action (McAdam et al, 1996). The creation of organizations and vehicles for the mobilization of resources allows for a confluence of supporters and the ability to move forward in achieving the desired goals of the movement (McCarthy & Zald, 1977). Through the use of meetings, creation of social media pages, and online petitions, groups may expand their base and maximize opportunities for protest, advocacy at political meetings, or legal avenues. Grassroots organizations, such as an effort to influence one local piece of an infrastructure system, may also tie in with similar regional or national organizations.

Framing processes highlight both the grievance and the hope that collective action may resolve it. The frames that are utilized give a social movement resonance, as tied to its credibility and salience, and serve as a way to influence action toward the ultimate goal (Snow et al, 1986; Benford & Snow, 2000). From an infrastructure perspective, frames may be developed to highlight grievances that contribute to a larger movement, such as segregation and civil rights (McAdam, 1982). Alternately, feelings of attachment toward long-standing infrastructure can be used to focus on historic importance to the community, a sense of nostalgia, and how change may disrupt everyday life (Snow et al, 1998). Overall, the frame provides resonance for people to become involved in the collective action effort.

In general, the use of infrastructure within social movement research seems to focus on the ability to expand the movement's reach and coordination. Perhaps one of the most defining social movements surrounding infrastructure was the effort to achieve passage for the Americans with Disabilities Act beginning in the late 1980s. This effort is highlighted prominently by both Star (1999) and Schindler (2014) as an example of recognizing that infrastructure can inherently treat people differently through a lack of accessibility. However, this movement uses the constructed environment as a means to highlight an aggrieved population and broader movement goals, and not necessarily as an end in and of itself. This extends to other movements, such as infrastructure segregation in the Civil Rights Movement (McAdam, 1982), protests against nuclear plants as part of a broader energy security movement (Kitschelt, 1986), and encouragement of renewable resources as a way to modify energy policy (Sine & Lee, 2009; Carlos et al, 2014).

In this third stream of research, physical systems represent a means through which larger social movements mobilize resources and help frame their overall objective. This does not consider the potential for infrastructure serving as an end goal of the movement, such as when a civic organization seeks to mobilize support for placing an aging bridge on the National Register of Historic Places. In fact, current legal precedent tends to view physical systems as innocuous and often does not recognize such physical systems as potential forms or influencers of social change (Schindler, 2014). Indeed, a major quality associated with infrastructure is that it is taken-for-granted within society (Star & Ruhleder, 1996). From this vantage point, one would seemingly argue that infrastructure cannot inspire mobilization unto itself.

Moreover, social movements are generally discussed as bringing about change, with ample studies describing these efforts (e.g. McAdam, 1982; Strang & Soule, 1998; Carroll & Swaminathan, 2000; Schneiberg & Soule, 2005; King & Soule, 2007; King & Pearce, 2010). However, far fewer studies chronicle how a social movement may bring about preservation. These movements, often termed reactionary movements, seek to resist change or maintain a previous form of social order against societal changes (Turner & Killian, 1957; Snow & Soule, 2010). Considering the ability for objects to generate sentimental attachment due to historic properties or local importance, local mobilization to save such objects may be generated if they are threatened with replacement or removal.

From the perspective of infrastructure, we are therefore interested with two areas of focus for social movements. First, what happens when a movement is concerned with affecting the built environment directly as the primary end goal of the movement? Second, how can attachment to and preservation of socially-important objects generate movements that are aimed at preservation? Such movements, if successful, have the potential to restrict engineering options available for system management, as the historical value of objects would then have to be considered in engineering options (54 U.S.C. § 306108). Thus, the gap to be addressed from this perspective when considering infrastructure systems is: *how can preserving physical systems be an end goal of a movement and what are the impacts on the engineering community?*

PHENOMENON: UNITED STATES BRIDGE SYSTEM

The engineering literature on bridge infrastructure is predominantly focused on technical improvements to processes and measuring systems to account for present impacts and to inform future construction methodologies. Technical improvements include ways to more accurately measure vertical clearances (Liu et al, 2011; Rister et al, 2011; Gong et al, 2012; Riviero et al, 2012) or how to improve inspection processes (Hugenschmidt, 2002; Metni & Hamel, 2007; Oh et al, 2009; Tang & Akinci, 2012). When considering the upkeep and development of the bridge system, the predominant focus is on engineering factors such as structural load, design, and condition ratings (Mohammadi et al, 1995; Chengalur-Smith et al, 1997). When social factors are included, they largely highlight the cost of maintenance to the bridge user of in terms of traffic delays, congestion, and detour lengths (Liu & Frangopol, 2005; 2006a; 2006b). Other efforts attempt to include user costs and technical parameters affecting these costs into state-level bridge management systems (Johnston et al, 1993; Son & Sinha, 1997; Thompson et al, 2003; Sobanjo & Thompson, 2011; Twumasi-Boakye & Sobanjo, 2017) or by including them as small percentages of the sufficiency rating and functional obsolescence calculations (Federal Highway Administration, 2000; Chang & Garvin, 2008).

Numerous studies also attempt to use machine learning and statistical methods to develop predictive models of bridge deterioration. One line of effort is focused on improving the use of physical inspectors by attempting to optimize inspection procedures or combine inspector-driven data with predictive algorithms (Hachem et al, 1991; Kushida et al, 1997; Sun et al, 2004). A second area focuses primarily on predictive quality, using a variety of attributes to try and make inspection results more accurate, improve bridge management systems, and identify factors influential to deterioration (Tokdemir et al, 2000; Morcous et al, 2002; Melhem & Cheng, 2003; Chang, 2016). However, there are three major limitations with many of these studies. First, they generally focus on a particular locality, such as a state or region. Second, they generally use one year of data in their analysis. Third, they limit the number of attributes included in the model, either through assumptions or due to lack of quality data. While this provides an opportunity to improve accuracy in prediction, it takes away from the ability to generalize across the entire system.

RESEARCH DIRECTION

What is clear from previous work is that much of the literature treats infrastructure as being exogenous to society. In this view, the primary concern is on the way in which technical parameters of infrastructure have social implications once the infrastructure is established. This also helps in understanding why much of the focus is on the present or the future and not looking backwards at longevity implications or how efforts at change may actually be inhibited.

The series of papers presented here ask *how social factors influence the technical parameters and management of infrastructure systems*. In this manner, infrastructure is treated as endogenous to society, which merits not just an engineering and economic but also a sociological analysis. While scholarly dialog between engineering and sociology has commenced, it is still a relatively recent and nascent trend (Javernick-Will & Levitt, 2010; Javernick-Will & Scott 2010; Peschiera & Taylor, 2012; Kaminsky & Javernick-Will, 2014; Barley, 2016). These three complementary sections seek to explore this notion of social impacts on infrastructure more closely through all stages of the U.S. bridge system.

The first paper considers the social factors that impact bridge ***design and management*** through an assessment of restrictive vertical clearances and mechanisms that may help us understand the persistence of such bridges. These vertical clearance issues create social and economic costs yet there are still thousands of instances where roadways do not have appropriate clearances to allow for commercial traffic. This paper proposes viewing bridges as *institutional relics*, in that they use design standards backed by reputable institutions, and these bridges remain even if those standards later change. In this manner, and through a system-wide cross-sectional analysis of data from the National Bridge Inventory, this study addresses the identified institutional and science & technology literature gaps.

If we know that a system's design standards are often misaligned with more modern present-day standards, then how does a deteriorating system persist even when there are engineering proposals to address it? The second paper analyzes the efforts of social movements to enroll bridges onto the National Register of Historic Places and considers the impact on bridge ***maintenance***. Bridges form an indelible mark on landscapes and generate sentimental attachment within members of local communities. This paper considers the role of attachment to infrastructure objects and its potential to inspire collective action around *preservation* rather than around *change*. It further considers how such collective action can restrict the engineering options available to maintain the system. Using a uniquely developed panel data set from the National Bridge Inventory, it provides a macro perspective of local preservation efforts and addresses the gaps in the social movement and science & technology literatures.

The third paper utilizes the insights of the first two papers to more fully explore the role of social, design and management factors relating to bridge ***monitoring***. While myriad efforts focus on improving the procedures and quality of monitoring, this paper provides an approach for designers and managers to gain feedback from inspection results to improve such efforts. By taking a system-wide approach across 20 years of National Bridge Inventory data and maximizing the attributes used in the analysis, it identifies the most influential components to the sufficiency rating of bridges. This goes beyond localized and restrictive analyses to provide national, system-wide feedback by using a methodology that may also be implemented at state or local levels to gain insights. In this manner, it addresses gaps in the technical literature to inform system managers and designers.

Each of these papers primarily utilizes data from the National Bridge Inventory (NBI), a nationwide compilation of U.S. bridges maintained by the Federal Highway Administration (FHWA) housed within the United States Department of Transportation (DOT). Collected annually and publicly available since 1992, the NBI mandates the reporting of specific bridges that fit the criteria for receiving federal funding across 135 characteristics. These include attributes related to design, management, inspection, use, and geography. This Inventory falls under the National Bridge Inspection Standards (NBIS), which define the criteria and frequency of public bridge inspections (23 U.S.C. § 101). The first paper presented here focuses on cross-sectional data from the first publicly available year, NBI-1992, with 20 additional years also used to provide robustness to the main results. For the second paper, a unique panel of 21 years (1992-2012) was developed to consider longevity from a perspective of closure and condition ratings. Finally, the third paper uses 20 years of data (1993-2012), both cross-sectionally and in aggregated form, to consider influential attributes to monitoring over the long-term. Additional datasets are also utilized to provide insight from attributes not routinely collected in the NBI.

The overarching goal of this work is to serve not only as an intellectual enterprise, but as a means of informing policy decisions at all levels. Policy-relevant recommendations are integrated into each of the sections as a way to highlight applicability and future efforts based on the results. Additionally, while focused on the bridge system, much of the work presented here is likely applicable to other infrastructure systems and their similar management challenges. Hopefully the entire suite of actors responsible for and affected by infrastructure – designers, managers, inspectors, policymakers, and users – will find value in the work presented here.

Chapter 2

What Can't Be Cured Must Be Endured:

Understanding Bridge Systems as Institutional Relics[1]

Why do outdated bridges persist even when there are capable engineering management systems to remediate such systems and their associated costs? This study explores the institutional constraints that inhibit bridge managers from addressing these challenges. More specifically, it depicts bridges as *institutional relics*, whereby a bridge's physical attributes reflect the accepted standards of the time and later persist even when those standards may change. Through a systematic analysis of the National Bridge Inventory, bridges are more likely to be institutional relics when built prior to the adoption of national design mandates (*regulative-based* relics) or in locales whose engineering norms conflict with these national standards (*normative-based* relics). While state owners seem more sensitive to regulatory pressures, sub-state and private owners seem more sensitive to normative pressures. Finally, more physically constrained urban settings impede the ability of bridge managers to address those bridges that are identified as relics. These results are tied to contemporary issues in bridge management and used to propose policy actions to better address restrictive clearance issues.

---

[1] This work has been accepted for publication in the *Journal of Infrastructure Systems* as:
Desai, J. D. & Armanios, D. E. (2018). What can't be cured must be endured: Understanding bridge systems as institutional relics. *Journal of Infrastructure Systems*, (in press).

INTRODUCTION

Why do outdated bridges persist even when there are capable engineering management systems to remediate such systems and their associated costs? This study argues that we do not have adequate explanations or solutions for such challenges because when considering the impact of bridge systems, we predominantly focus on bridge *users*. What is considered here is how institutional constraints affect bridge *managers* from easily updating bridge systems to minimize these costs. Identifying outdated bridges and their associated user costs help diagnose and treat the symptoms; understanding the institutional constraints preventing managers from systematically addressing these issues can help explain why we still cannot fully arrive at a cure.

A variety of engineering and social science disciplines have identified restrictive vertical clearance as a key example of how outdated bridges can present significant social and economic costs. In the United States, 14% of bridge failures over a 38-year period (1951-1988) were due to collisions with low clearance bridges (Harik et al, 1990; Fu et al, 2004). Vehicles are often re-routed due to low bridge clearances, which imposes additional time and congestion costs (Bai et al, 2014; Miller et al, 2015). Restrictive bridge clearances also present mobility issues in that clearances may be sufficient for cars but not for buses, thereby limiting the mobility of populations that depend on mass transportation (Winner, 1980).

Far from being an isolated problem, these restrictive bridges are persistent and continue to affect significant roadway traffic. Based on the authors' analysis of National Bridge Inventory (NBI) data from 1992, bridges having clearances less than 4.27 meters (14 feet) – enough for a car but not enough for a commercial truck – impacted nearly 80 million trips daily. Analysis of the NBI data from 2012 shows these bridges still impacted over 52 million trips daily. Moreover, as of 2012, these bridges have an average construction year of 1933, demonstrating the persistence of these structures. Given the clear social and economic costs of low bridge clearances, what explains the persistence of these bridges?

This study aims to identify a set of institutional factors that can help explain the persistence of these restrictive clearance bridges with the objective of including these factors amongst other factors already used in bridge design and maintenance. When considering the upkeep and development of a bridge system, the predominant focus is on engineering factors such as structural load, design, and condition ratings (Mohammadi et al, 1995; Chengalur-Smith et al, 1997). When social factors are included, they largely highlight the cost of maintenance to the bridge user in terms of traffic delays, congestion, and detour lengths (Liu & Frangopol, 2005; 2006a; 2006b).

When vertical clearance heights are more specifically considered, the discussion is predominantly focused along three streams of research. The first stream is on the technical improvements in measuring such clearances in existing bridges (Liu et al, 2011; Gong et al, 2012; Riveiro et al, 2012; Rister et al, 2013). The second stream is on the integration of vertical restrictive clearances and other factors (such as detour lengths, insufficient width, and other deficiencies) into state-level bridge management systems as a way of acknowledging social impacts of technical bridge parameters on users (Johnston et al, 1993; Son & Sinha, 1997; Thompson et al, 2000, 2003; Sobanjo & Thompson, 2011; Twumasi-Boakye & Sobanjo, 2017). The third stream is on the incorporation of vertical clearances and other engineering factors into calculations of sufficiency ratings and assessments of functional obsolescence to prioritize which bridges are eligible for federal and state-level funding (Lemer, 1996; Chang & Garvin, 2008; Federal Highway Administration, 2000). These studies greatly advance our understanding of how to identify, prioritize, and remediate vertically restrictive bridges, and their associated social costs to bridge users. However, these studies do not adequately consider those institutional constraints on bridge managers that prevent them from addressing these costs to bridge users.

This paper takes an interdisciplinary approach. In particular, this study integrates insights from civil engineering with sociology, namely from institutional theory and science and technology studies. In so doing, it begins to answer recent calls that highlight the need for more interdisciplinary engagement across the engineering and social sciences to address the technical, economic, and social issues around infrastructure systems (Grabowski et al, 2017).

RECONCEPTUALIZING BRIDGES AS *INSTITUTIONAL RELICS*

To better understand the persistence of low clearance bridges, this study considers bridges as *institutional relics*. They are "institutional" in that bridges are designed according to standards backed by authoritative institutions of the time (DiMaggio & Powell, 1983; Scott, 2001). They are "relics" in that these standards are explicitly built into the physical attributes of the bridge, and these attributes persist even when these standards may later change (Winner, 1980; Latour, 1990; Suchman, 2000). Through this notion of institutional relics, the authors surmise that the persistence of low clearance bridges occurs because after these bridges were built, standards were changed to raise clearance heights. However, because bringing already built bridges up to these new standards can be very costly (Xu et al, 2015), bridge engineers are more constrained in updating existing bridges than in building new bridges that reflect these new standards. As such, existing bridges may continue to reflect the outdated standards in which they were initially constructed.

Overall, this notion of institutional relics better addresses the idea that while physical infrastructure systems remain, the social systems around them may change. From an engineering perspective, such longevity is an asset, but when a bridge becomes an institutional relic, such longevity may actually become a liability. This study seeks to better characterize those changes that can lead a bridge to become an institutional relic to better inform bridge design and maintenance choices that can alleviate such issues. In so doing, we hope to better account for not just social costs on the user but the implementation constraints such social factors place on the bridge manager.

As such, the focus of this paper is on the constraints faced by bridge managers and the larger implications of decisions made at the time of bridge creation on both bridge design and maintenance. Here, we propose and analyze two processes for how a bridge can become an institutional relic. First, federally mandated bridge standards emerge after a bridge is already built, creating a situation where an older bridge may not meet these new standards. Such *regulative-based relics* impact bridge maintenance, as the challenge becomes addressing those bridges that are now out of date due to these regulations. Second, bridges are built in locales whose engineering norms may not align with these new national standards. From the perspective of establishing a consistent national bridge system, such misalignment generates *normative-based relics.* Such relics impact both bridge maintenance and design, as both new and old bridges in these locales will continue to reflect local practices that are unlikely to update to these national standards. These processes directly relate to institutional pressures on engineers in their decision-making, both in terms of regulatory standards and normative codes of conduct passed through the civil engineering profession (DiMaggio & Powell, 1983). We then argue which of these two processes (regulative or normative) is more salient depends on the type of inventory route in which the bridge is placed (interstate vs. non-interstate) and bridge owner (federal, state, sub-state, or private). Finally, physical and financial constraints, which are more acute in urban settings than in rural settings, present additional engineering adaptation challenges on bridge managers seeking to remedy identified relics.

As discussed at the end of this study, conceptualizing bridges as institutional relics does not just help us understand the historical basis for challenges in updating our bridge systems. It also helps us better understand more contemporary infrastructure challenges such as those around scour and load rating. As such, this study's findings may help assist policymakers in internalizing the social costs of restrictive bridges, especially from the perspective of bridge managers. In so doing, we hope this study can help policymakers better target and maximize the value of the limited resources available for repairing and replacing bridges by better acknowledging these constraints.

National Institutional Mechanisms: Federal Acceptance of Bridge Standards

Institutional theory informs us that powerful institutions have a critical role to play in shaping the acceptance of standards across an infrastructure system. When powerful institutions, such as the federal government, accept and disseminate regulatory standards, these standards appear more credible, which makes other institutions involved in such systems more likely to accept such standards (DiMaggio & Powell, 1983; Scott, 2001). What is particularly unique about using an institutional lens here is that such acceptance creates regulatory (coercive) pressure if the bridge owner is under federal jurisdiction, such as those bridges crossing over segments of the interstate highway system. For these instances, managers that do not meet federal standards can incur penalties such as ineligibility for federal funding.

While regulatory changes to bridge standards are relatively straightforward to incorporate in new bridge designs, incorporating such changes in existing bridges is more difficult. Bridges are inherently designed to have longevity, and this designed longevity of existing bridges present technical and financial constraints to updating these bridges to meet new standards. In this particular case, this would require raising the bridge's existing clearance height, which prior studies note can be prohibitively costly (Xu et al, 2015). These costs may result in the persistence of bridges that predate these standards and whose characteristics continue to not meet these standards. Thus, existing bridge maintenance is more constrained in addressing new bridge standard regulations than new bridge design.

This analysis centers on the "Interstate Era" of highway development, defined as the period from 1944, the year when the national highway system was conceived, to 1973, the year when highway funds were made available for other infrastructure systems such as mass transit (Root, 2000; Pfeiffer, 2006). Of particular importance to this study, the Federal-Aid Highway Act of 1956 promulgated a minimum bridge clearance standard of 4.27 meters (14 feet). This standard had existed since at least 1928 in published guidebooks by the American Association of State Highway Officials (AASHO), but these recommendations had not been federally adopted until 1956. In 1960, this clearance was raised to 4.88 meters (16 feet) for defense purposes (Department of Commerce, 1960).

In short, federally mandated bridge standards are argued to motivate engineers to build new bridges in alignment with these standards, as compared to prior periods where there were no such federal guidelines. Thus, *bridges built after 1956 are more likely associated with clearances that exceed 4.27 meters (14 feet), and bridges built after 1960 are more likely associated with clearances that exceed 4.88 meters (16 feet).*

LOCAL INSTITUTIONAL MECHANISMS: RESISTANCE TO BRIDGE STANDARDS

Work within science and technology studies (STS) shows that local social context influences how infrastructure is built (Suchman, 2000; Star & Bowker, 2006; Law, 2012; Pinch & Bijker, 2012). Given the longevity of infrastructure, the local conventions of the time that are embodied in these systems can persist even as these conventions change (Latour, 1990; Star & Ruhleder, 1996).

In thinking about the interplay between institutional theory and STS, there is now a possible tension. On the one hand, institutional theory argues that the adoption of a national standard by powerful institutions (i.e. federal government) should strongly motivate states to implement these standards. Yet on the other hand, STS shows how local norms can be embedded into how infrastructure is built, and these practices can run counter to national standards. For example, there may be local desires to limit large vehicles for political and social reasons (Winner, 1980), or to restrict the flow of non-commercial traffic (Joerges, 1999). More generally, a particular design standard or approach to bridge building may reflect preferences of local prominent designers and their students and apprentices, which can serve as the basis of locally distinctive "engineering subcultures" (Cleary, 2007). In other words, when local norms conflict with national standards, local institutions may try to defy such standards (Oliver, 1991).

If the aim is to create a consistent national bridge system, these normative conflicts generate challenges that are felt in both bridge maintenance and design. New bridges will be designed to continue to reflect local norms that disagree with preferences reflected in national standards. This generates additional new local bridges that will be outdated relative to national standards. Moreover, existing bridges that reflect these local standards are also unlikely to be updated to reflect such national standards. The overall result is local norms impede the ability for bridge managers to remediate existing bridges to address the costs that changes in national bridge standards are seeking to address. Moreover, new bridges in these locales will also reflect these conflicting local norms, which may further exacerbate this problem vis-à-vis national standards.

Varying local practices are observed by comparing bridges in New York State with those in the New England region. The New England region comprises the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island and was selected as a comparison to New York due to its similar bridge and geographic profile. Based on the earliest publicly available NBI data (1992), the median vertical clearance and preferred construction material between these two regions are highly similar. Of the bridges built prior to 1956 with some vertical clearance restriction, New York has 939 records, with a median clearance of 4.4 meters and 81% use steel construction. New England contains 2,252 records, with a median clearance of 4.4 meters and 79% use steel. Using these regions for analysis also ensures an appropriate sample size for comparison.

An illustrative example of possible tensions in local practices as compared to new federal mandates can be observed in the proclivities of urban planners in New York City and Boston. In New York, Robert Moses favored aesthetics over functionality. In so doing, he advocated restrictions that favored cars over mass transit to reduce traffic and thus enhance the pleasure of driving (Caro, 1974; Winner, 1980). These studies also depict Moses as prejudicially motivated in creating local design norms to exclude people of color from certain areas, though this assertion has been debated (Joerges, 1999). When given the opportunity to design the national highway system, federal officials explicitly rejected Moses' vision, as his regional focus and exclusionary tendencies conflicted with national aims to improve the mass flow of goods and people (Rose, 1979).

Comparatively, the New England region does not seem to have local practices that conflict to these nationally accepted standards. For example, in Boston, William Callahan seemed to prefer functionality over aesthetics. A contemporary of Moses, the two were sometimes compared to one another, especially given their local prominence, strong personalities, and ability to influence local government to increase their control. Whether intentional or not, Callahan's projects also adversely impacted minority areas, displacing families and situating interchanges to benefit white neighborhoods (Rubin, 2006). Yet Callahan differed from Moses in that he viewed highway development as a way to enhance rapid mass movement of people and goods (O'Connor, 1995).

These two designers seem to be similar in their strong regional influence and that their initiatives (Moses seemingly more intentionally so than Callahan) had deleterious consequences to specific demographic groups. However, they differ in their perspective on roadway design. Regardless of motivations, the Moses approach is in conflict with the national vision, while the Callahan approach is more aligned with the national vision. Further, this comparison acknowledges that while Moses and Callahan operated primarily in New York City and Boston, respectively, their reach in terms of influence on bridge systems went well beyond that. For example, Moses was active from the mid-1920s through the late 1960s, was a powerful voice throughout the state, and was a *de facto* representative of the region in Washington, DC (Caro, 1974). Callahan was active from the 1930s through his death in 1964, and he served as the first chairman of the Massachusetts Turnpike Authority from 1952 to 1964 (O'Connor, 1995).

Despite similar structural characteristics, there is an expectation that these two regions diverged in their response to the 1956 and 1960 federal bridge standards. Due to more aesthetic-based local norms, New York State is more likely to resist national standards that intend to raise clearances. However, due to more functionality-based local norms, New England is more likely to follow these national standards. In the Robustness Checks section, we conduct additional analyses that restrict the comparison to the city-level (New York City vs. Boston), state-level

(New York vs. Massachusetts), to bridges only in these two regions, as well as to only urban routes further account for both the more specific operational reach and arguably wider professional reach of these two influential designers. Thus, *New York State, in comparison to the New England region, is associated with a lower likelihood of building bridges over vehicular traffic and a lower likelihood of meeting the clearance requirements following both the 1956 and 1960 reforms.*

OTHER INSTITUTIONAL CONSIDERATIONS: BRIDGE OWNER AND INVENTORY ROUTE TYPE

To ascertain whether regulative or normative-driven relics are more influential, we consider other institutional considerations that could moderate these effects. In particular, we consider the type of bridge owner (federal, state, sub-state, or private) and type of inventory route (interstate vs. non-interstate highway) that may lead to differential responses of bridge managers to national standard changes. The federal mandate for bridge clearances applied only to those bridges supporting or crossing the interstate highway system or seeking federal funding support (AASHO, 1956; Federal-Aid Highway Act of 1956). This creates a *regulative* (coercive) motivation to comply with standards for bridges associated with interstates (DiMaggio & Powell, 1983). However, local roadways and bridges were not specifically mandated to follow these new regulations, especially if they did not intersect the interstate highway system.

From institutional theory, an authoritative institution backing professional codes of conduct can influence engineers to act in ways that are perceived as becoming of their occupation (DiMaggio & Powell, 1983). In other words, endorsements of professional standards present normative pressures, even if they may not present regulatory pressures. The historic promulgation of a 4.27-meter (14-foot) standard by the national AASHO organization (1928), backed by an authoritative institution like the government via the 1956 reform, suggests a normative motivation to abide by that standard as a matter of professional engineering duty. Because of perceived professional duty, and insofar as there are not local normative conflicts with national bridge standards changes, bridge managers of non-interstate highway segments may also feel *normative* pressure to comply to these standards.

To consider whether bridge managers feel more regulative or normative pressure to comply to these standards, we further consider interactions between bridge owners (federal, state, sub-state, or private) and type of inventory route (interstate vs. non-interstate). If the bridge is complying to standards on interstate routes, then the bridge manager may be feeling more regulatory pressure to comply to these bridge standards as a matter of avoiding penalties for non-compliance. If the bridge is complying to standards on non-interstate routes, then the bridge designer may be feeling normative pressure to comply to these bridge standards as a matter of professional engineering duty. This is especially given these routes are not part of the aforementioned regulatory mandates. Thus*, if a bridge owner is more sensitive to regulatory pressure, that owner will have a lower proportion of bridges built with restrictive clearances on* <u>*interstate*</u> *inventory routes after 1956. If a bridge owner is more sensitive to normative pressure, that owner will have a lower proportion of bridges built with restrictive clearances on* <u>*non-interstate*</u> *inventory routes after 1956*.

PHYSICAL CONSTRAINTS: URBAN VS. RURAL

Now that we have considered national (regulatory) and local (normative) institutional influences on bridge managers, and other institutional considerations that may moderate each of these influences, we will consider the role of physical constraints. The creation of infrastructure in urban areas is naturally constrained by competing demands for space, routing decisions, and existing obstacles. This limits the ability of bridge managers to remedy those bridges that become relics. Besides physical constraints in the form of more population and building density vis-à-vis rural areas, urban areas were also financially constrained during the Interstate Era. The wording of the Federal-Aid Highway Acts routinely concentrated aid towards rural development at the expense of urban projects, with the 1956 Act explicitly limiting urban areas from accessing federal funds. Following 1973, the end date of the analysis, federal funding restrictions were relaxed to include allowing the use of highway funds for mass transportation projects.

With federal mandates of bridge clearance standards, coupled with both physical and financial constraints, urban planners will have additional reason to avoid creating bridges that may have restrictive vertical clearances. In the event that avoidance is not possible, then urban areas will design such bridges to just meet national clearance standards. The 1956 standard of 4.27-meter (14 foot) clearance was reinforced in urban areas by the 1960 revision that specifically mandated rural areas to increase all bridges to a 4.88-meter (16 foot) clearance, while allowing urban locations to maintain 4.27 meters (14 feet) on all but one route. Thus, these competing restrictions on urban building will have an increased propensity to meet the 4.27-meter (14 foot) clearance, but little motivation to exceed that standard when unnecessary. In rural areas, where physical (and financial) constraints are less concerning, such federal clearance mandates will be less disruptive. In short, physical constraints do not inherently drive the likelihood of a bridge to become a relic. Rather, these constraints limit the available space, and therefore make it more difficult for managers to remedy those bridges that are identified as relics. Thus, *while newly built urban bridges are associated with a greater likelihood of meeting the 4.27-meter (14 foot) standard after the 1956 and 1960 guidelines, urban areas are also associated with a lower likelihood of building such bridges over vehicular traffic.*

In summary, this paper posits the existence of two institutional forces (one regulative and another normative) that impact bridge managers. These forces highlight two possibilities as to how a bridge may become a relic. First, changes to regulations by powerful institutions create a strong motivation for designers to abide by the change. Thus, bridges built *prior* to these standard changes become *regulative-based relics*. This particularly challenges managers around bridge maintenance as they need to overcome physical, technical, and financial constraints to update existing bridges built on outdated standards to reflect these new standards. Second, local engineering norms may conflict with changes made to national standards. Thus, bridges in those locales whose norms conflict with national standard changes become *normative-based relics*. This challenges managers in both bridge maintenance and design, as local norms constrain managers from both designing new bridges and updating existing bridges to reflect national standards. We then consider how the type of inventory route and bridge owner moderates which of these two forms of relics (regulative or normative) are most prominent. Finally, we consider how physical limitations (i.e. urban areas) constrain managers from addressing these relics.

DATA: U.S. NATIONAL BRIDGE INVENTORY

To investigate these potential issues of bridge clearances in a systematic and quantitative framework, this study utilizes the National Bridge Inventory (NBI), a nationwide compilation of U.S. bridges maintained by the Federal Highway Administration (FHWA) housed within the United States Department of Transportation (DOT). Collected annually and publicly available since 1992, the NBI mandates the reporting of specific bridges that fit the criteria for receiving federal funding across 135 characteristics. This Inventory falls under the National Bridge Inspection Standards (NBIS), which define the criteria and frequency of public bridge inspections (23 U.S.C. § 101). This data is also attractive because, prior to 2013, states were also requested to report bridges that did not necessarily meet NBIS criteria but were still associated with important routes within the state infrastructure system (Federal Highway Administration, 2000). In 2013, a policy change restricted these annual reports to only the NBI-qualified bridges, which notably removes the reporting of most bridges with restrictive clearances (known as "under-records"). Therefore, the dataset for this study is limited from 1992 (when this data was first made available) to 2012 (the last date when under-records were accepted). The resulting data consist of 21 observation years, with raw total entries ranging from 666,206 in NBI-1992 to 716,436 in NBI-2012.

The analysis here primarily concerns those bridges built during the Interstate Era that present a vertical clearance restriction to a serviced roadway (unique observations ranging from 45,331 reported in NBI-1992 to a maximum of 53,671 reported in NBI-2000). There are two types of records that have clearance restrictions. An "under-record" is where the inventory route (roadway carrying vehicular traffic) passes underneath the bridge, thus creating a clearance restriction from the top of the roadway to the underside of the bridge passing over it. An "over-record" is where the inventory route is carried by the bridge and passes over an obstruction, such as a body of water or another roadway. In this case, the clearance restriction above the roadway is due to the bridge design, such as a truss, or another object, such as an overpass or interchange. The subset of bridges with vertical clearance restrictions is overwhelmingly due to the presence of "under-record" bridges. For example, in the NBI-1992 data, 93% of Interstate Era bridges with a vertical restriction are coded as "under-records". This will be consequential in the later discussion of the policy implications for this study's findings. Observations are then identified by clearance bands of different heights to more precisely assess the degree to which different vehicles can utilize the route impacted by a bridge of interest (see Table 1).

Table 1. Five categories of restrictive clearances as used in analysis, compared by vehicle type, number of observations, and average daily traffic for 1992 and 2012.

Analysis Category	Vertical Clearance	Vehicle Type	Number of Bridges (1992)	Ave. Daily Traffic (1992)	Number of Bridges (2012)	Ave. Daily Traffic (2012)
Mini	3.0m to 3.65m (>9'10" to <12')	Cars	1,673	12 million	1,087	3 million
Low	3.66m to 4.26m (>12' to <14')	Buses, Light Trucks	6,227	68 million	3,819	49 million
Mid	4.27m to 4.87m (>14' to <16')	Commercial Trucks	30,382	628 million	25,200	588 million
High	4.88m to 5.48m (>16' to <18')	Military Vehicles	25,357	584 million	36,906	1,160 million
Super	5.49m to 29.99m (>18' to <98'6")	No Restrictions	16,137	347 million	28,559	886 million

Note: These bands were established based on exhaustive archival search of existing bridge standards and average height range for each vehicle type. Lower bound of vertical clearance established at 3 meters (9’10”) to account for potential misreporting. Upper bound of 30 meters (98’6”) reflects maximum reportable clearance, per NBI guidelines.

The NBI is known to contain reporting issues due to record incompleteness and miscoding of reported variables. Employing similar error checks to those of prior studies that account for such misreporting (Din & Tang, 2016), all records with a reported vertical clearance of less than 3.0 meters (9 feet, 10 inches) were removed. The authors personally confirmed there are bridges with known clearances as low as 2.64 meters (8 feet, 8 inches) such as those along New York’s Saw Mill River Parkway. However, given the infeasibility of confirming these low clearance levels for all bridges, 3.0 meters serves as a conservative estimate for such clearances.

These data present possible censoring concerns, as the observations are collected from 1992 to 2012, yet the focal years of analysis are from 1944 to 1973 (Interstate Era). T-tests of the mean ages across variables of interest (see Variable section that follows) helped to gauge these issues and are reported in Supplement 1. These t-tests show that during the Interstate Era the ages are largely similar across the variables of interest. This indicates that if there are missing values, they are likely missing at random, which suggests that censoring does not bias the results. Plotting average bridge clearance heights across NBI years to see if there are drastic changes over time also supports these assumptions.

As seen in Fig. 1, there is strong consistency in bridge clearance heights across all NBI years. For any given year built, there is little change in clearance heights across 21 years of available data on each bridge from 1992 (red line) to 2012 (1993-2012 represented by black lines). In fact, these differences usually only range between 1% and 8% from lowest to highest NBI year average for any given year built. In line with prior studies, this suggests changing a bridge's clearance height is a costly undertaking (Xu et al, 2015), and thus is unlikely to change much over a bridge's lifetime. This is a useful descriptive justification that using bridge clearance heights is an illustrative context in which to analyze and understand institutional relics. Given there is little difference across NBI years, we use 1992 data to assess construction in the Interstate Era. That said, we show in the Robustness Checks section that analysis across NBI years reflects similar results to those presented in the Main Results section. Also, as expected, there is a clear upward trend in clearances for bridges built after the 1956 reform. This provides initial descriptive evidence that regulatory reforms were important in increasing clearance heights for bridges built after these reforms and, thus, serve as a useful baseline for this study.

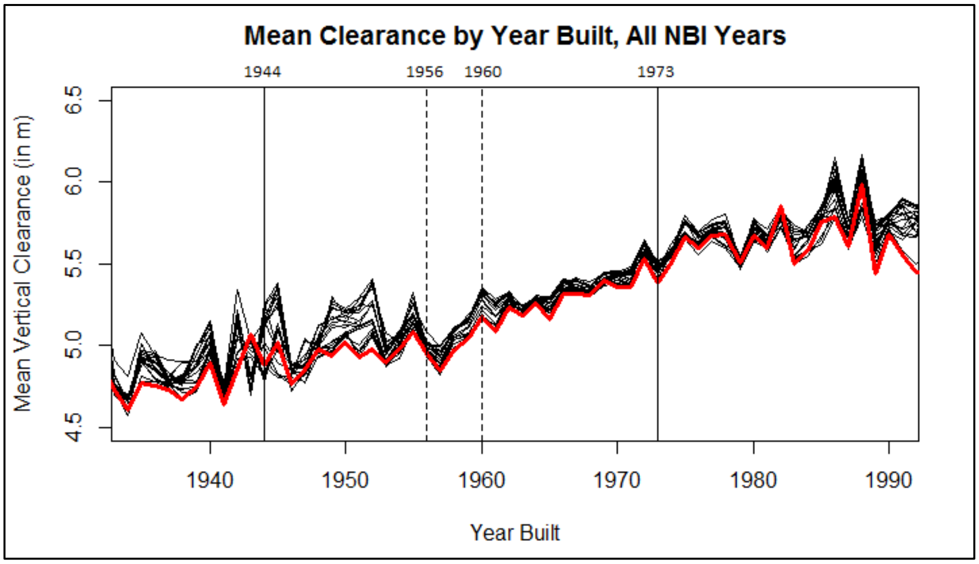


Fig. 1. Mean Inventory Route Minimum Vertical Clearance (IMVC) by Year Built during the Interstate Era (1944-1973, solid vertical lines) surrounding reform years (dashed vertical lines, 1956 & 1960). Each trendline reflects data from an individual reporting year of the NBI from 1992 to 2012 (21 total years). The thick red line represents NBI-1992 data, as used in the primary analysis. As shown in this figure and for any given year built of a bridge, the clearance heights do not fluctuate drastically across 20 NBI years (generally 1-8%). This suggests changing the clearance height of a bridge is a costly undertaking and, thus, does not drastically change over time.

DEPENDENT VARIABLE

There are two dependent variables in the analysis. The first dependent variable is bridge clearance height based on Inventory Route Minimum Vertical Clearance (IMVC), as represented in meters. These are derived from NBI Item 10, which is measured utilizing a 3-meter width across the roadway lane and identifying the lowest point of clearance above that 3-meter width. Clearances of 30 meters (98 feet, 6 inches) and higher are only optionally reported or are without any clearance restriction whatsoever, so the restriction set contains those bridges coded with less than 30 meters of clearance.

To more precisely understand the implication of bridge clearance heights, five bands of clearances are defined within the restriction set of bridges: *Mini*, with IMVC between 3.0 and

3.65 meters (9 feet, 10 inches to under 12 feet); *Low*, with IMVC between 3.66 and 4.26 meters (above 12 feet to under 14 feet); *Mid*, with IMVC between 4.27 and 4.87 meters (above 14 feet to under 16 feet); *High*, with IMVC between 4.88 and 5.48 meters (above 16 feet to under 18 feet); and *Super*, with IMVC greater than 5.48 meters and below the 30 meter maximum (above 18 feet to under 98 feet, 6 inches). Each observation is coded as 1 within its appropriate clearance categorization and 0 for all others. As noted previously in Table 1, these bands each limit different forms of transportation. Thus, using these as cut-points allows for better isolation of which bridges present mobility issues (i.e. constrict bus transportation) or economic issues (i.e. constrict truck traffic). As we show in the Robustness Checks section, when IMVC is run as a continuous measure of clearance the results are consistent to those reported in the Results section.

The second dependent variable is whether or not a bridge is built over a roadway ("under-records"). These bridges inherently present a clearance restriction to highway traffic going underneath the bridge, irrespective of bridge design. This allows for a more precise assessment of the possible propensity to avoid building such bridges. The variable *UnderRecord* takes a value of 1 if the record type is defined as an under-record and 0 if otherwise. Given the aim here is to ascertain the increased association of a bridge with a roadway underneath, this analysis includes not just bridges with vertical restrictions but all bridges built during the Interstate Era (unique observations ranging from 316,434 reported in NBI-1992 to a minimum of 270,665 reported in NBI-2012).

INDEPENDENT VARIABLES

To explore the role of the 1956 and 1960 national reforms on bridge managers (via bridge clearance heights), two dummy variables are utilized: *Reform56* and *Reform60*. These variables are lagged one year to account for the time from bridge design to completion. Such a one year-lag "design year" approximates well the typical time between bridge planning, whereby a decision is reached to build a bridge at a certain height, and actual bridge construction (Berg et al, 2006; Wu et al, 2010). As we show in the Robustness Checks section, when the lag is increased to see whether the analysis is sensitive to this choice of lag time the results are consistent to those reported in the Main Results section. For the analysis of each reform, observations with a design year that falls on the reform year (1956 and 1960) are removed to account for the fact that some bridges are designed during the reform year but prior to when the reform actually took effect (the 1956 standard was adopted on July 12, 1956 and the 1960 standard was implemented on January 27, 1960). Thus, *Reform56* is coded as 0 for bridges with a design year prior to 1956 (which incorporates one-year lag between planning and construction) and 1 for bridges with a design year of 1957 and beyond. *Reform60* is coded as 0 for bridges with a design year prior to 1960 and 1 for bridges with design year of 1961 or later.

To explore the role of local institutions on bridge managers (via bridge clearance heights), the *NY* variable is defined as 1 for bridges reported in the NBI as being located in the state of New York, else 0. Similarly, the *NE* variable is defined as 1 for bridges reported as located in the New England region and 0 otherwise. In the Robustness Checks section, the analysis is further restricted to just New York and the New England region by coding *NY* as 1 if in New York and 0 if and only if in the New England region (removing bridges from all other locations), with results consistent to those reported. Moreover, given the particular differences between the New York City and Boston metropolitan areas, the analysis is further restricted to just New York State and Massachusetts and just New York City and Boston, and the results were consistent to those reported.

To explore the role of physical constraints on bridge managers (via bridge clearance heights), the *Urban* variable defines bridge location. The Functional Class of Inventory Route variable (NBI Item 26) categorizes the type of associated roadway and *Urban* takes value of 1 for bridges with an urban designation and 0 otherwise.

CONTROL VARIABLES

A series of control variables are also employed. The first control is for engineering design factors that may influence the choice of bridge clearance, irrespective of the social factors identified here (Ehlen, 1997; Chen & Duan, 2000). To these ends, fixed effects for material (concrete, concrete continuous, steel, steel continuous, prestressed concrete, prestressed concrete continuous, wood/timber, masonry, aluminum/wrought iron/cast iron, and other) and design (22 different design types including slab, stringer/multi-beam or girder, girder and floorbeam, tee beam, box beam or girders variants, truss variants, arch variants, movable variants, and others) are used. Bridge length is also included as a control variable and log-transformed to handle the variable’s skewness. Bridge sufficiency and condition ratings were also considered as potential controls. However, sufficiency and condition ratings pertain to the bridge and thus more directly apply to the inventory route on the bridge (i.e. the over-record) and not routes underneath the bridge (i.e. the under-record), which are of primary interest here. Thus, including these controls was infeasible. To explore whether this potentially biases the analysis, we conducted t-tests of the over-records for which bridge sufficiency and condition ratings are documented (Supplement 1). Theses t-tests show generally small qualitative differences in mean bridge sufficiency and condition ratings across the explanatory variables of interest and NBI years. This indicates that not including sufficiency and condition ratings is likely not a major source of bias.

The second control is for those factors that determine how often the bridge is used, which may influence choice of clearance, irrespective of the institutional factors identified here (Pan, 2008). A measure of the Average Daily Traffic (ADT) reported for each bridge is thus included. To account for variable skewness, this variable is log-transformed, with predominantly unused bridges (i.e. 0 ADT) accounted for by adding 1 to the reported ADT when conducting this procedure. The results are consistent when using the untransformed ADT variable (available on request).

Third, financial constraints may inhibit managers from building bridges with higher clearances, irrespective of the factors identified here (Joerges, 1999; Chengalur-Smith et al, 1997). To address these more financial concerns, the U.S. Census Bureau Database on Historical Finances of State Governments provides the revenues and expenditures of all U.S. state governments for the period of 1942-2008. This database includes intergovernmental transfers as a source of revenue and incorporates both federal and local transfers for highway projects into category totals. Although bridge spending is not specifically provided, the total highway spending is given for each state. More specifically, the *Total Highways-Tot Exp* variable in the dataset includes both state-level funding *and* intergovernmental transfers at all levels of government, thus representing the overall monetary outlay for all highway projects in a given state and year. Using this figure from the design year of each bridge, we divided by total state expenditures across all expense categories (*Total Expenditure* variable) in the design year to produce a percentage of total revenues allocated to highway development. This approach helps to control for financial effects by serving as a proxy measure of the relative importance each state placed on highways within their budget in a given year and provides data across the entire analyzed time frame.

Finally, state fixed effects are included for all models except those evaluating the *NE* and *NY* variables to account for time-invariant state effects that may influence regression results. The reason state fixed effects were excluded with models that had location variables, such as *NE* and *NY*, is that adding such fixed effects along with these variables can introduce issues of multicollinearity. All other models are also re-run without these state fixed effects, and results were consistent to those in the Results section (available on request).

METHOD: LOGISTIC REGRESSION

Regression models were constructed for assessing bridge clearance heights (as well as the propensity to even construct a bridge that will be restrictive). In particular, the generalized linear model (glm) function, as part of the stats package in R, was used to model the dependent variables as binomial logistic regressions (see Appendix A for more detail). Utilizing the generalized linear model with such a logistic specification allows for the evaluation of binary outcomes. In the first set of regressions, each of the five clearance bands heights in Table 1 (*Low*, *Mini*, *Mid*, *High*, and *Super*) were modelled individually as five separate regressions. In the second set, all bridges were coded as either an under-record or not and again tested as a binary outcome. Robust standard errors (sandwich errors) are used due to some models exhibiting features of over-dispersion (Dispersion Parameter > 1) (Supplement 2).

Overall, the full binomial regression model is as follows:

$$logit(p) = log\left[\frac{p}{1-p}\right] = \beta_0 + \beta_1 Reform + \beta_2 X_2 + \beta_2 (X_2 * Reform) + \delta X_i$$

where *Reform* is the reform of interest (i.e. *Reform56* or *Reform60*), X_2 is the vector of independent variables (*NY, NE, RROver, Urban*), and X_i is the vector of control variables.

Given the models depend on fixed effects, analyzing such models as a single panel can present an incidental parameters problem (Greene, 2003). To account for this, the models are assessed as separate yearly cross-sections, whereby each year of NBI data is modeled separately. As noted in the Robustness Checks section, the results are consistent no matter the NBI year that is modeled.

RESULTS

Table 2 presents the correlations amongst the major dependent, independent, and control variables. These suggest generally low potential for multicollinearity within the models. The largest correlation is a positive relationship between *Urban* and *LogADT*, which is expected as urban areas are more likely to have higher daily traffic than rural areas. Additionally, there is a moderate relationship between *LogLength* and *LogADT*, suggesting an expected positive relationship between the length of the bridge and the average traffic that the bridge carries.

MAIN RESULTS

Table 3 reports the full models across the major explanatory variables posited for this study (Supplement 3 provides the intermediate models for the interested reader). The left side of each panel reports the full binomial logit regression across restriction bands (*Mini, Low, Mid, High, Super*). The rightmost column of each panel reports the binomial logistic results on *UnderRecord*.

Across all regression models, *Reform56* and *Reform60* are both positive and significant for *High* and *Super* and negative and significant for *Mini*, *Low*, and *Mid*. As expected, this suggests the national adoption of standards (higher than 4.27 meters for 1956 and 4.88 meters for 1960) are associated with greater odds of newly built bridges that meet or exceed these clearance requirements. These reforms do seem to have drastic effects. For example, practically speaking, on average and all else equal, the 1956 reform is associated with greater odds of *High* and *Super* bridges of approximately 209% and 37%, respectively (based on intermediate models in

Supplement 3 that isolate the reform variable). At the same time, on average and all else equal, the 1956 Reform is associated with decreased odds of *Mini*, *Low*, and *Mid* bridges by approximately 374%, 276%, and 89%, respectively. Similar effect sizes are found for the 1960 Reform. Fig. 2 also represents this visually in that prior to 1956, *Mid* bridges represent the largest percentage of bridge clearance restrictions. However, after 1956 among newly built bridges, *High* and *Super* bridges increase their percentage share, while *Mid*, *Low*, and *Mini* categories all decline as a percentage of total restriction bridges. Visualizing these results more temporally (Fig. 3), we see similar trends whereby after the 1956 and 1960 reforms, the *High* and *Super* bands notably increase as we expect from these reforms.

The comparison across similar geographical sets shows local institutions may play a role in bridge clearance heights. As expected, the New York and New England regions are associated with quite different responses to the passage of these reforms. New England is associated with clearance heights that meet these 1956 and 1960 reform standards, while New York may display resistance to these reforms in that the state is associated with clearance heights that seem to routinely undercut reform standards. The New England regressions are associated with an increased propensity to meet the 4.27 meters (14 feet) standard of 1956 and adjust upward to meet the higher 1960 standard, closely following post-reform building propensities in the rest of the country. Conversely, the New York regressions are associated with an increased propensity to build below the clearance levels mandated by both the 1956 and 1960 reforms as there is increased log-likelihood in bands that do not meet reform requirements. Bridges built in New York had 373% higher odds of being built in the *Low* band than bridges built elsewhere following the 1956 reform and 71% higher odds of being built in the *Mid* band following the 1960 reform, holding all other regressors fixed. Fig. 4 also visually reaffirms these results. While

New York largely remained unchanged in its bands, Boston displays an upward shift into *High* bands that was largely not seen in New York. The *UnderRecord* models also demonstrate that, in the long run, New England is not associated with any significant avoidance of building under-records, while New York is associated with avoidance in building these bridges following the reforms.

Finally, physical constraints in urban locales do play a role in bridge clearance heights. The 1956 reform is associated with 85% higher odds to build *Mid* bridges in urban areas compared to rural areas and 142% lower odds to build *High* bridges in urban areas compared to rural areas, holding all else equal. The 1960 reform results show that this 4.27-meter (14 foot) standard in the *Mid* band was maintained, which is expected since urban routes were largely exempted from the 4.88-meter (16 foot) requirement. Interestingly, the results also suggest possible perverse incentives in urban areas. While urban areas after the reforms are associated with a reduction in propensity to build *Mini* bridges, they are also associated with a reduced propensity to build *High* bridges. In fact, after the reform, the only significant increase was an associated propensity to build *just* to standard (i.e. *Mid* bridges). This is in line with prior work postulating that the issuance of a standard may lead to perverse incentives to just barely meet requirements (Akerlof, 1970). The negative interaction terms in the *UnderRecord* models also demonstrate an associated propensity for avoidance of building under-records in urban areas after the reforms.

Table 2. Correlation matrix and summary statistics for primary variables in main analysis, NBI 1992, Interstate Era.

	Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Controls																		
1. Percent_HW	0.23	0.06	0.04	0.48	1													
2. LogADT	7.11	2.40	0.00	13.82	-0.14	1												
3. LogLength	3.31	1.01	-1.20	10.69	-0.06	0.45	1											
Instruments																		
4. Reform56	0.71	0.45	0	1	0.04	0.13	0.18	1										
5. Reform60	0.57	0.50	0	1	-0.17	0.12	0.18	0.73	1									
Independent Variables																		
6. NY	0.03	0.18	0	1	-0.29	0.09	0.05	-0.02	-0.01	1								
7. NE	0.03	0.17	0	1	0.03	0.12	0.04	-0.01	-0.02	-0.03	1							
8. Urban	0.29	0.45	0	1	-0.13	0.55	0.32	0.12	0.11	0.09	0.10	1						
Dependent Variables																		
9. Mini	0.00	0.03	0	1	0.00	-0.01	0.00	-0.01	-0.01	0.01	0.00	0.01	1					
10. Low	0.00	0.07	0	1	-0.01	0.01	0.02	-0.03	-0.03	0.04	0.05	0.04	0.00	1				
11. Mid	0.07	0.25	0	1	-0.03	0.18	0.18	0.04	0.02	0.07	0.02	0.21	-0.01	-0.02	1			
12. High	0.05	0.22	0	1	-0.02	0.20	0.21	0.11	0.12	0.01	0.01	0.10	-0.01	-0.02	-0.06	1		
13. Super	0.03	0.17	0	1	-0.03	0.11	0.20	0.07	0.07	0.02	0.01	0.12	0.00	-0.01	-0.04	-0.04	1	
14. UnderRecord	0.14	0.35	0	1	-0.04	0.30	0.32	0.12	0.11	0.07	0.03	0.26	0.05	0.14	0.61	0.52	0.38	1

Table 3. Main results, NBI-1992, Interstate Era (1944-1973)

Panel 1A: Effects of Reform 1956 on bridges built in New York vs. elsewhere

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	0.226[0.794]	1.509[0.000]	2.480[0.000]	-4.676[0.000]	-2.774[0.000]	-4.729[0.000]
	(0.87)	(0.34)	(0.15)	(0.17)	(0.16)	(0.09)
Reform56	-1.297[0.000]	-1.471[0.000]	-0.797[0.000]	1.246[0.000]	0.377[0.000]	0.605[0.000]
	(0.20)	(0.08)	(0.04)	(0.05)	(0.05)	(0.02)
NY	0.414[0.136]	0.692[0.000]	0.218[0.012]	-0.378[0.002]	-0.364[0.004]	0.961[0.000]
	(0.28)	(0.13)	(0.09)	(0.12)	(0.13)	(0.05)
R56xNY	-0.555[0.313]	0.625[0.000]	0.296[0.002]	-0.126[0.341]	0.005[0.969]	-0.678[0.000]
	(0.55)	(0.17)	(0.10)	(0.13)	(0.14)	(0.06)
Urban	0.126[0.472]	0.263[0.000]	0.603[0.000]	-0.888[0.000]	0.175[0.000]	0.426[0.000]
	(0.18)	(0.06)	(0.02)	(0.02)	(0.03)	(0.02)
Percent_HW	0.470[0.672]	2.097[0.000]	0.773[0.000]	-0.141[0.418]	-1.428[0.000]	0.864[0.000]
	(1.11)	(0.47)	(0.17)	(0.18)	(0.23)	(0.10)
LogADT	-0.264[0.000]	-0.226[0.000]	-0.044[0.000]	0.220[0.000]	-0.120[0.000]	0.225[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
LogLength	-0.588[0.000]	-0.556[0.000]	-0.668[0.000]	0.188[0.000]	0.782[0.000]	0.364[0.000]
	(0.15)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.285	0.207	0.078	0.083	0.082	0.238
N	45,331	45,331	45,331	45,331	45,331	316,434

Panel 1B: Effects of Reform 1960 on bridges built in New York vs. elsewhere

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	0.016[0.985]	1.673[0.000]	2.730[0.000]	-4.834[0.000]	-2.884[0.000]	-4.705[0.000]
	(0.86)	(0.32)	(0.16)	(0.18)	(0.16)	(0.09)
Reform60	-1.004[0.000]	-1.354[0.000]	-0.868[0.000]	1.031[0.000]	0.390[0.000]	0.369[0.000]
	(0.18)	(0.07)	(0.03)	(0.03)	(0.03)	(0.01)
NY	0.530[0.030]	0.482[0.000]	0.107[0.121]	-0.311[0.001]	-0.243[0.012]	0.727[0.000]
	(0.24)	(0.11)	(0.07)	(0.09)	(0.10)	(0.04)
R60xNY	-2.262[0.025]	0.170[0.357]	0.428[0.000]	-0.038[0.721]	-0.125[0.282]	-0.377[0.000]
	(1.01)	(0.19)	(0.09)	(0.11)	(0.12)	(0.05)
Urban	0.112[0.526]	-0.007[0.907]	0.581[0.000]	-0.854[0.000]	0.196[0.000]	0.440[0.000]
	(0.18)	(0.06)	(0.02)	(0.02)	(0.03)	(0.02)
Percent_HW	-1.674[0.146]	-0.455[0.324]	-0.633[0.000]	1.532[0.000]	-0.883[0.000]	1.570[0.000]
	(1.15)	(0.46)	(0.18)	(0.18)	(0.24)	(0.10)
LogADT	-0.250[0.000]	-0.191[0.000]	-0.054[0.000]	0.230[0.000]	-0.116[0.000]	0.232[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
LogLength	-0.556[0.000]	-0.566[0.000]	-0.652[0.000]	0.184[0.000]	0.774[0.000]	0.366[0.000]
	(0.16)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.278	0.195	0.09	0.091	0.084	0.238
N	44,478	44,478	44,478	44,478	44,478	314,391

Panel 2A: Effects of Reform 1956 on bridges built in New England vs. elsewhere

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	0.223[0.795]	1.640[0.000]	2.617[0.000]	-4.760[0.000]	-2.835[0.000]	-4.615[0.000]
	(0.86)	(0.33)	(0.15)	(0.17)	(0.16)	(0.09)
Reform56	-1.309[0.000]	-1.169[0.000]	-0.794[0.000]	1.210[0.000]	0.342[0.000]	0.546[0.000]
	(0.19)	(0.07)	(0.03)	(0.04)	(0.05)	(0.02)
NE	-0.106[0.856]	2.100[0.000]	-0.338[0.010]	-0.801[0.000]	-1.252[0.000]	-0.217[0.003]
	(0.58)	(0.16)	(0.13)	(0.22)	(0.28)	(0.07)
R56xNE	-1.713[0.187]	-2.513[0.000]	0.307[0.031]	0.813[0.000]	1.299[0.000]	-0.103[0.195]
	(1.30)	(0.29)	(0.14)	(0.23)	(0.29)	(0.08)
Urban	0.165[0.349]	0.319[0.000]	0.606[0.000]	-0.893[0.000]	0.172[0.000]	0.432[0.000]
	(0.18)	(0.06)	(0.02)	(0.02)	(0.03)	(0.02)
Percent_HW	0.270[0.793]	0.412[0.354]	0.210[0.184]	0.363[0.030]	-1.000[0.000]	0.486[0.000]
	(1.03)	(0.44)	(0.16)	(0.17)	(0.21)	(0.09)
LogADT	-0.266[0.000]	-0.225[0.000]	-0.044[0.000]	0.220[0.000]	-0.119[0.000]	0.229[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
LogLength	-0.582[0.000]	-0.549[0.000]	-0.666[0.000]	0.186[0.000]	0.778[0.000]	0.362[0.000]
	(0.15)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.286	0.215	0.076	0.082	0.082	0.237
N	45,331	45,331	45,331	45,331	45,331	316,434

Panel 2B: Effects of Reform 1960 on bridges built in New England vs. elsewhere

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	0.059[0.943]	2.281[0.000]	2.827[0.000]	-4.959[0.000]	-3.001[0.000]	-4.580[0.000]
	(0.83)	(0.32)	(0.16)	(0.18)	(0.16)	(0.09)
Reform60	-1.149[0.000]	-1.153[0.000]	-0.858[0.000]	1.002[0.000]	0.368[0.000]	0.321[0.000]
	(0.17)	(0.07)	(0.02)	(0.03)	(0.03)	(0.01)
NE	-0.763[0.246]	2.203[0.000]	-0.119[0.116]	-0.889[0.000]	-0.615[0.000]	-0.311[0.000]
	(0.66)	(0.11)	(0.08)	(0.11)	(0.13)	(0.05)
R60xNE	-0.218[0.852]	-2.748[0.000]	0.015[0.882]	0.942[0.000]	0.686[0.000]	0.082[0.159]
	(1.17)	(0.35)	(0.10)	(0.13)	(0.15)	(0.06)
Urban	0.120[0.492]	0.037[0.546]	0.586[0.000]	-0.861[0.000]	0.193[0.000]	0.445[0.000]
	(0.18)	(0.06)	(0.02)	(0.02)	(0.03)	(0.02)
Percent_HW	-1.907[0.070]	-2.705[0.000]	-1.080[0.000]	2.086[0.000]	-0.342[0.126]	1.070[0.000]
	(1.05)	(0.41)	(0.17)	(0.18)	(0.22)	(0.09)
LogADT	-0.243[0.000]	-0.216[0.000]	-0.054[0.000]	0.233[0.000]	-0.114[0.000]	0.236[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.551[0.000]	-0.576[0.000]	-0.649[0.000]	0.181[0.000]	0.770[0.000]	0.366[0.000]
	(0.15)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.276	0.225	0.088	0.092	0.084	0.237
N	44,478	44,478	44,478	44,478	44,478	314,391

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Table 3. Main results, NBI-1992, Interstate Era (1944-1973)

Panel 3A: Effects of Reform 1956 on bridges built in Urban vs. Rural areas

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	0.812[0.527]	1.034[0.089]	1.127[0.000]	-2.412[0.000]	-3.918[0.000]	-5.851[0.000]
	(1.29)	(0.61)	(0.24)	(0.25)	(0.25)	(0.13)
Reform56	-1.058[0.001]	-1.187[0.000]	-1.011[0.000]	1.490[0.000]	0.353[0.000]	0.955[0.000]
	(0.32)	(0.11)	(0.06)	(0.07)	(0.08)	(0.03)
Urban	0.754[0.011]	0.514[0.000]	0.028[0.673]	-0.278[0.001]	0.240[0.010]	1.128[0.000]
	(0.30)	(0.11)	(0.07)	(0.08)	(0.09)	(0.04)
R56xUrban	-0.977[0.009]	-0.228[0.087]	0.589[0.000]	-0.604[0.000]	-0.054[0.577]	-0.798[0.000]
	(0.37)	(0.13)	(0.07)	(0.09)	(0.10)	(0.04)
Percent_HW	-1.015[0.549]	0.317[0.607]	4.360[0.000]	-3.368[0.000]	-2.142[0.000]	0.995[0.000]
	(1.69)	(0.62)	(0.24)	(0.25)	(0.31)	(0.13)
LogADT	-0.262[0.000]	-0.209[0.000]	-0.054[0.000]	0.249[0.000]	-0.128[0.000]	0.221[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.625[0.000]	-0.583[0.000]	-0.741[0.000]	0.156[0.000]	0.851[0.000]	0.397[0.000]
	(0.16)	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.34	0.252	0.136	0.123	0.12	0.263
N	45,331	45,331	45,331	45,331	45,331	316,434

Panel 3B: Effects of Reform 1960 on bridges built in Urban vs. Rural areas

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	0.165[0.903]	1.464[0.017]	1.347[0.000]	-2.445[0.000]	-4.061[0.000]	-5.746[0.000]
	(1.35)	(0.61)	(0.24)	(0.25)	(0.25)	(0.13)
Reform60	-0.944[0.000]	-1.266[0.000]	-0.894[0.000]	1.100[0.000]	0.312[0.000]	0.585[0.000]
	(0.25)	(0.10)	(0.04)	(0.04)	(0.05)	(0.02)
Urban	0.534[0.020]	0.107[0.193]	0.288[0.000]	-0.544[0.000]	0.235[0.000]	0.755[0.000]
	(0.23)	(0.08)	(0.04)	(0.05)	(0.06)	(0.02)
R60xUrban	-0.964[0.006]	-0.083[0.514]	0.369[0.000]	-0.352[0.000]	-0.043[0.508]	-0.461[0.000]
	(0.35)	(0.13)	(0.05)	(0.05)	(0.07)	(0.03)
Percent_HW	-5.519[0.001]	-1.730[0.008]	2.293[0.000]	-1.028[0.000]	-1.448[0.000]	2.059[0.000]
	(1.66)	(0.66)	(0.25)	(0.26)	(0.33)	(0.14)
LogADT	-0.234[0.000]	-0.194[0.000]	-0.057[0.000]	0.251[0.000]	-0.125[0.000]	0.224[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.595[0.000]	-0.623[0.000]	-0.725[0.000]	0.161[0.000]	0.845[0.000]	0.403[0.000]
	(0.15)	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.335	0.263	0.14	0.127	0.122	0.263
N	44,478	44,478	44,478	44,478	44,478	314,391

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

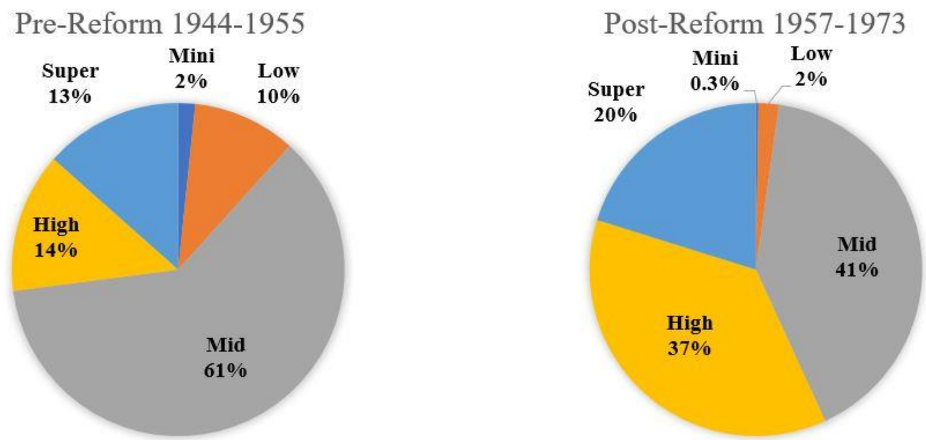


Fig. 2. Proportion of bridges built within each clearance band for restriction bridges built during the Interstate Era. The figure on the left depicts the breakdown for those built prior to the 1956 Reform (1944 – 1955; N = 6,526). The figure on the right depicts the breakdown for those built after the 1956 Reform, which called for a mandatory clearance of new bridges to be at least in the *Mid* band (1957 – 1973; N = 41,176).

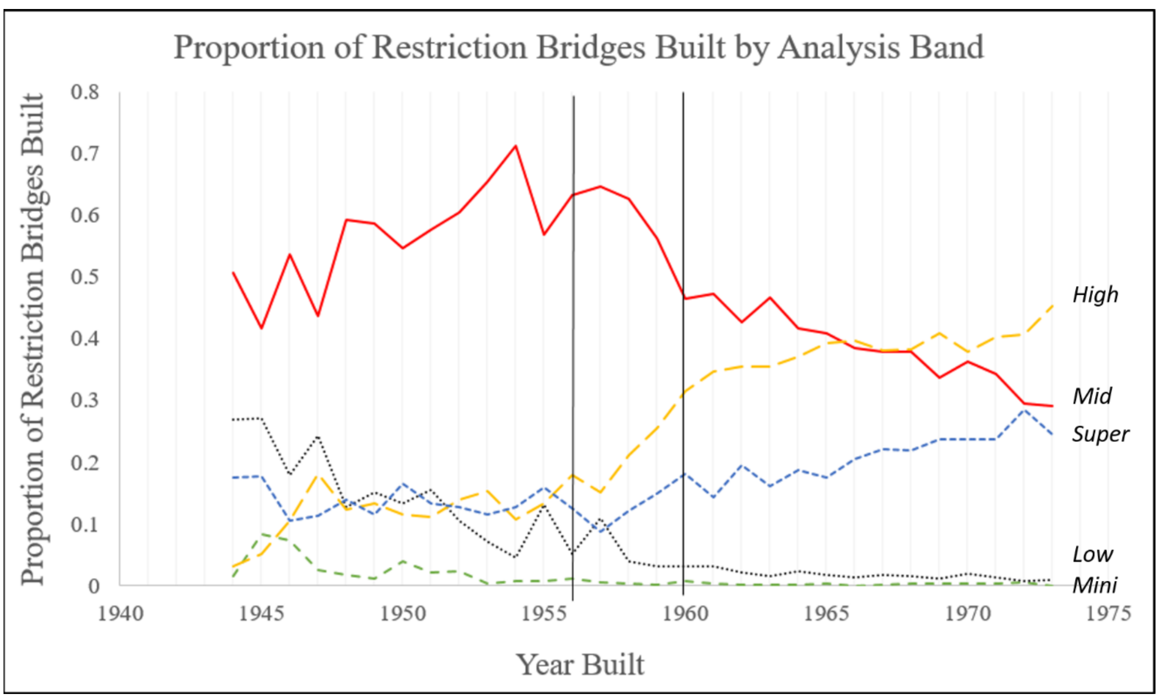
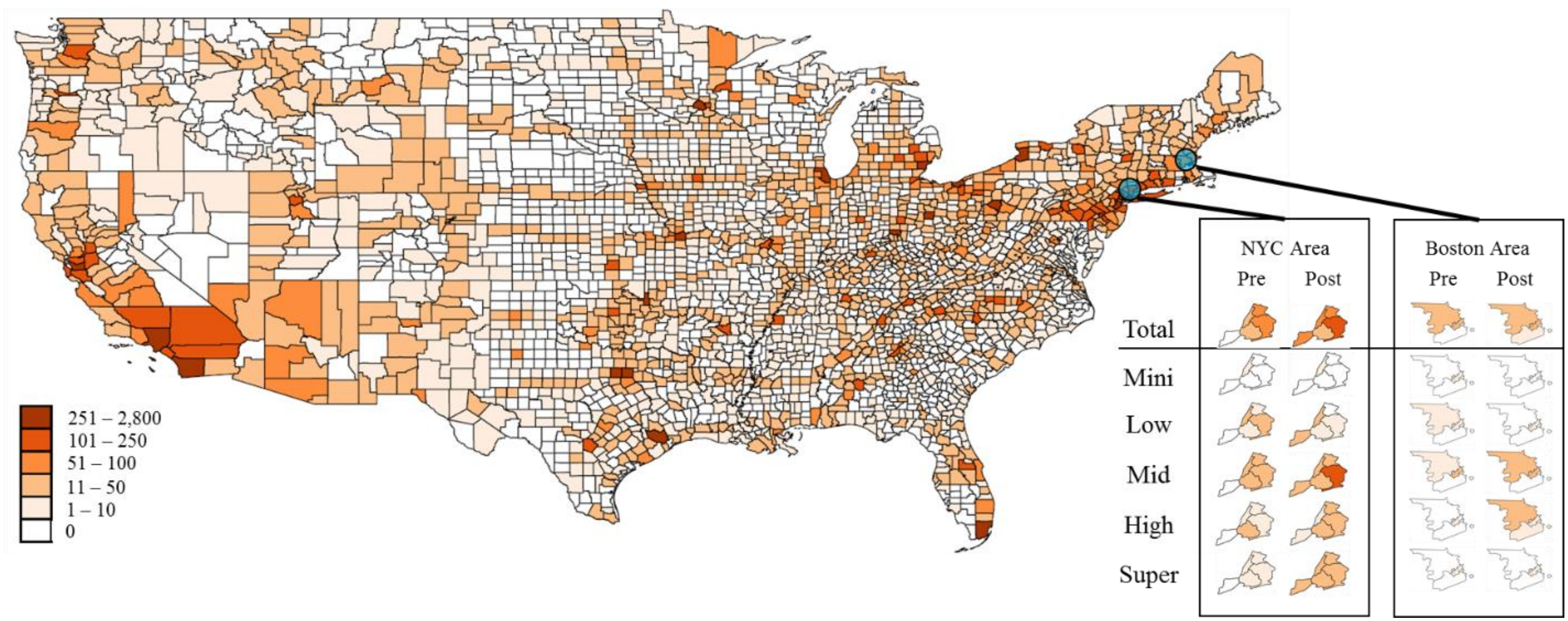


Fig. 3. The proportion of bridges with some restriction that were built in each of the five defined height bands during the "Interstate Era" (1944-1973). As expected following the 1956 and 1960 reforms (vertical lines), an increase in *High* and *Super* bridges and a decrease in *Low* and *Mid* bridges is observed.

Fig. 4. Map of United States counties showing total number restriction bridges built during the Interstate Era (1944-1973). The New York City area (Bronx, Kings, New York, Queens, and Richmond counties) is compared to the Boston area (Middlesex, Norfolk, and Suffolk counties) in the periods that precede (1944-1955) and postdate (1957-1973) the 1956 reform mandating clearances fall at least in the *Mid* band of 4.27 meters or higher.



Robustness Checks

To assess the consistency and robustness of the primary model, the authors conducted several checks, which all produced results that are highly consistent to those presented in the Results section. First, the main model was modified by varying the lag to include 1-year, 2-year, and 3-year lags, expanding the analysis from the Interstate Era (1944-1973) to include all observations supported by the financial data (1942-2008), and narrowing further in on the reforms of interest with equal windows ranging from 3 to 10 years (Supplement 4). Second, primary models were run for all NBI years (1992-2012) separately to ascertain consistency and longevity of effect (Supplement 5). Third, the models were run using vertical clearance as a continuous dependent variable (Supplement 6). Fourth, the regional comparison was reassessed in several ways by restricting the observations to just the New York and New England data, to just New York and Massachusetts, and to just New York City and Boston area counties (Supplement 7). Fifth, state fixed effects were removed from the urban models (Supplement 8).

Finally, we assessed the exogeneity assumptions of the model through placebo regressions that naively assume the reform year is different than the reform years of interest (i.e. not 1956 or 1960) (Supplement 9). While these results did show slight indications of secular effects for some models, the general pattern of results across all placebo models was usually different than models presented in the Main Results section. This suggests the results are largely unique to the reform years of interest and less attributable to wider secular trends in bridge clearance heights.

Supplementary Analysis: Bridge ownership and inventory Route Type

Recall that our argument demonstrates that federal acceptance of AASHO professional standards may be due to both regulatory and/or normative pressures. As such, acknowledging that these reforms were promulgated from the federal level and were primarily aimed at the development of the interstate highway system, it is important to further consider other institutional considerations around ownership and route classification. If acceptance was due to regulatory pressure, then we would expect these effects to occur mainly for federal owners and any owner of an interstate highway bridge. However, if acceptance reflects normative pressure, then we would expect these effects to occur mainly for non-federal bridge owners and for non-interstate highways.

To account for missing owner values in the NBI (approximately 12.5% of all records for NBI-1992, primarily under-records), we developed a process for assigning ownership based on a three-step system. First, if a bridge had a reported agency for maintenance, but no owner, the maintenance agency was assigned as the owner. Second, records were matched based on state, county, and structure number to capture over-records of the same bridge and assign that owner to the relevant under-record entry. Finally, if an under-record still had no reported owner and the service on the bridge was only railroad, then railroad ownership was assigned. The result of this process reduced the number of missing owners to less than 2% of all records for NBI-1992. Owner codes were then grouped based on Federal, State, Sub-State (county, city, and local), and Private (railroad and other private) ownership based on the NBI coding guide. Within the Interstate Era of construction, State ownership was most common (60%), followed by Sub-State (38%), Private (1%), and Federal (< 1%). Among the 1,822 bridges from this period with clearances less than 4.27 meters (14 feet), State ownership was most common (56%), followed by Private (21%), Sub-State (12%), and Federal (1%), with 10% of these bridges having a missing owner.

To test the impact of ownership on the primary results, Supplement 10 includes owner as a fixed effect based on these four groups. Overall, these continue to support the results described above, though there are two differences of note when using this control. First, the *NY* regressions show a loss of significant increase in the *Low* band and a strongly significant increase in only the *Mid* band after the 1956 Reform, though the main results continue to be supported following the 1960 reform. Second, the *NE* regressions indicate an initial avoidance to building under-records following the 1956 reform, though this returns to an insignificant result following the 1960 reform, as indicated in the main results.

The regression results above indicate that ownership may play an important role in the response to such reforms. While the 1956 reform mandated a minimum clearance of 4.27 meters along interstate highways, the NBI-1992 data report at least 176 bridges built after the reform do not abide to this clearance level along interstate routes. To further probe into these issues, a series of tests were conducted to assess differences in the proportion of bridges built under the 4.27-meter (14-foot) standard across owner (Federal, State, Sub-State, Private) and route type (Interstate, Non-Interstate). Assessing bridges built during the Interstate Era, we used a Kruskal-Wallace test because the data violated assumptions of using an ANOVA test, namely requirements for a normal distribution with equal variance across the samples. The Kruskal-Wallace test showed a significant difference between the proportion of bridges under 4.27 meters (14 feet) among the four owner groups (χ-square = 5767, $p < 0.001$). A pairwise Wilcoxon test with a Bonferroni adjustment method, the complement to the Kruskal-Wallace test for comparing across group levels, further showed significant differences in under 4.27-meter bridges across most owner comparisons, as displayed in Table 4.

To further probe into the impacts across route types, Supplement 11 subsets the data into just those routes listed as being an Interstate Highway and those that are not an Interstate Highway. These results indicate that both reforms are associated with increased propensities to build in lower clearance bands along interstate routes and higher clearance bands along non-interstate routes, across all three independent variables following the reforms. This suggests the presence of stronger normative influences of such policies.

Table 5 reports t-tests performed on subsets by owner and route type to more specifically assess changes in building bridges with clearances below 4.27 meters (14 feet) before and after the 1956 reform. The reported findings were robust when using a two-sample Wilcoxon test. These results indicate that while *state* owners are associated with stronger responses to the *regulatory* pressures of the reform on interstates (significant t-test for state owners on interstate highways but not on non-interstate highways), *sub-state* owners and *private* owners are associated with stronger responses to the *normative* pressures reinforced by such reforms in their non-interstate projects (significant t-tests on non-interstate highways but not on interstate highways).

Overall then, state owners appear to respond to these reforms more for regulatory reasons, but sub-state and private owners appear to respond to these reforms more for normative reasons. We surmise this may be the case because state governments have regulatory status within the NBIS system as they are the government level responsible for collecting and reporting of all bridge data to the federal government (23 CFR § 650.307). However, sub-state governments and private owners have less recognized regulatory status within this system. As such, they may be compensating for their lack of regulatory credibility by ensuring their choices comply to normative professional standards within engineering. This regulatory-normative distinction across bridge owners is a fruitful avenue for further investigation.

Table 4. Pairwise Wilcoxon Rank Sum Test with Bonferroni correction comparing proportion of bridges under 4.27 meters (14 feet) clearance across owner levels (NBI-1992, Interstate Era (1944-1973)). Values reported are p-values between pairwise groups.

	Federal	State	Sub-state
State	0.17	-	-
Sub-state	< 0.001	< 0.001	-
Private	< 0.001	< 0.001	< 0.001

Table 5. T-test of propensity to build bridges with under 4.27-meter (14-foot) clearance pre- and post-1956 reform by owner and route type (NBI-1992, Interstate Era (1944-1973), 2-tailed test).

		Interstate Highway		Non-Interstate Highway	
		Pre-1956 Reform	Post-1956 Reform	Pre-1956 Reform	Post-1956 Reform
Federal Owner	N	0	52	394	899
	Proportion under 4.27m	0	0	0.018	0.007
	T-stat	-		1.54	
	p-value	-		0.12	
State Owner	N	4,705	52,085	38,113	101,009
	Proportion under 4.27m	0.018	0.002	0.006	0.006
	T-stat	8.20		0.51	
	p-value	< 0.001		0.61	
Sub-State Owner	N	43	285	38,955	82,766
	Proportion under 4.27m	0.023	0.042	0.003	0.001
	T-stat	-0.72		4.94	
	p-value	0.47		< 0.001	
Private Owner	N	201	591	1,963	1,987
	Proportion under 4.27m	0.015	0.015	0.140	0.050
	T-stat	-0.03		9.67	
	p-value	0.98		< 0.001	

LIMITATIONS

Scott's (2001) institutional analysis involves three pillars: regulative, normative, and cultural-cognitive. While we are able to analyze the normative and regulative pillars, our data are not adequate for addressing the cultural-cognitive pillar. While cultural-cognitive considerations such as racial bias are potentially relevant, and Moses and Callahan potentially share those biases, our data is not systematic enough to reliably analyze the impacts of this pillar. This is especially true given the anecdotal nature of such arguments (Caro, 1974; Winner, 1980), and the existence of equally anecdotal counterarguments (Joerges, 1999). Assessing the potential historical biases of influential bridge managers on bridge systems, as well as infrastructure systems more generally, is a fruitful and important area for additional research. More narrowly-focused studies that consider micro-census demographic data surrounding these bridges may help illuminate this discussion with greater empirical rigor and clarity than is feasible with the data used here.

DISCUSSION

This paper conceptualizes bridges not just as engineering projects (Mohammadi et al, 1995; Chengalur-Smith et al, 1997; Liu & Frangopol, 2005; 2006a; 2006b), but as *institutional relics*, whereby a bridge's physical attributes reflect the accepted standards of the time and later persist even when those standards may change. This insight helps explain why the institutional processes that shaped the formation of a bridge remain so powerful even when those institutional forces change. In depicting bridges as institutional relics, this study goes beyond a focus on bridge *user* costs to consider those institutional factors that constrain bridge *managers* from both designing bridges and modifying existing bridges to reflect updated standards. This study particularly focuses on one aspect of bridges that are widely viewed as generating significant social and economic costs – low bridge clearances – to explain why such restrictive clearances may persist despite these known costs.

Controlling for various engineering and financial factors (i.e. bridge design, length, materials, funding), this study finds that national institutional factors, local institutional factors, and physical factors (urban vs. rural) are all associated with persistently more restrictive bridge clearances. More specifically, bridges built under different regulatory standards, in this particular analysis prior to federal endorsement of design standards in 1956, (regulative-based) and in locations that utilize different design criteria than those preferred nationally (normative-based) are more likely to be institutional relics. We also find that state owners appear more sensitive to regulatory pressures, while sub-state and private owners appear more sensitive to normative pressures. Finally, we find more physically constrained urban settings impede the ability of bridge managers to address those bridges that are identified as relics.

Answering calls for more interdisciplinary studies around infrastructure systems (Grabowski et al, 2017), this study is unique in that it uses sociology to better inform bridge engineering, and also uses bridge engineering to help inform sociological thinking around engineering. In particular, this study answers two key scholarly calls in the sociology of technology. The first is the need to better understand how institutional systems shape the ways in which technologies are constructed (Winner, 1980; Suchman, 2000). In this case, how federal mandates shape the clearance level of newly constructed bridges. The second is the need to better understand how the technical properties of a bridge may not enable change but rather increase resistance to change (Leonardi & Barley, 2010). In this case, a bridge's structural properties seem to make alterations more difficult when bridge design standards later change. Overall, these findings demonstrate the fruitfulness of engaging in a dialog between engineering and sociology, which is the subject of recent scholarly calls (Barley, 2016; Grabowski et al, 2017), and remains an emerging though nascent trend (i.e. Javernick-Will & Levitt, 2010; Javernick-Will & Scott 2010; Peschiera & Taylor, 2012; Kaminsky & Javernick-Will, 2014).

Depicting bridges as institutional relics can also help us understand other technical challenges around bridges beyond restrictive clearance heights. For example, scour is a pressing technical challenge, and those bridges especially prone to scour issues are those built before 1991 when bridge standards were updated to account for scour. The difficulty of bringing these bridges up to these new standards has had catastrophic consequences as most bridge collapses due to scour have occurred on those bridges built prior to 1991 (Flint et al, 2017). This example reinforces focusing professional attention on bridges that *predate* a regulatory mandate (i.e. regulative-based relics) is an important consideration.

Another recent development for consideration under this framework is the revised federal mandate on load posting requirements, as promulgated in the Fixing America's Surface Transportation Act (FAST Act) of 2015. This raises normative-based relic concerns as state and local governments have the authority to make load posting decisions for bridges owned at their level, which may be in conflict with federal standards. Many states prioritize particular industries that are locally important and may not be adequately accommodated by national standards. For example, Wisconsin has an axle-load exemption for dairy products and is one of 24 states that provides general exemptions for agricultural vehicles. As a result, while only 10% of all bridges are posted for load, more than 80% of these load-posted bridges are owned by local governments (Hearn, 2014). This example reinforces focusing professional attention on bridges that reflect local norms that may *conflict* with national standards (i.e. normative-based relics) is an equally important consideration.

These examples suggest the contemporary importance of the findings from the more historical analysis conducted in this study. More specifically, the challenges around remediating bridges built prior to updated national standards (regulative-based) or in locales whose norms conflict with national standards (normative-based) may also help us understand present-day challenges such as issues around scour and load ratings, respectively. Thus, we hope future work takes this institutional relic approach to better appreciate the institutional constraints on managers when seeking to address contemporary bridge and other major infrastructure challenges.

POLICY IMPLICATIONS

In conceiving bridges as institutional relics, what the findings more generally imply is that long-lasting infrastructure requires management of both its technical and social elements. Policies also need to better consider the environment in which a potential bridge or roadway underpass is expected to be sited (i.e. in an urban setting that presents physical constraints or on a non-interstate highway). For example, while a process exists for requesting exemptions for low-clearances affecting the military's Strategic Highway Network (STRAHNET), this does not cover all interstate highways, nor does it account for local and state-level roadway clearance issues (Ptak, 1997; Horne, 2009). Using normative standards for bridge design, as promulgated by the American Association of State Highway and Transportation Officials (AASHTO), and then requiring state Departments of Transportation (DOTs) to report deviations from these standards for all bridges to the FHWA could better identify locales whose needs are both varied and inadequately anticipated by national standards.

Besides the requirement to apply for clearance height exceptions, the authors propose mandating the NBI to expand its reporting policy beyond the current federal NBIS (23 CFR Part 650, Subpart C) and require entries for all bridges, including all inventory routes passing underneath a bridge structure ("under-records"). In so doing, bridge maintenance decisions would not just include structural factors and social factors as they pertain to bridge users. They would also better account for implementation challenges, namely those factors identified here that hinder bridge managers from addressing these restrictive clearances as designed. Given the

NBI stopped including under-records in 2013, such observations would no longer be visible through analysis of current data. As part of these efforts, logical error checks advocated in prior work should be required during the NBI data submission process for these records (Din & Tang, 2016).

Though potentially an unfunded mandate, costs may be mitigated through simple changes to the existing NBI reporting to assist in streamlining this process and integrating data that is already captured through current bridge management systems (Sanford et al, 1999). For example, adding new item numbers to over-record entries that indicate the presence of a route below the bridge, along with critical impacts to that route directly related to the bridge, would greatly benefit future efforts while minimizing the impact on inspectors. Future work that utilizes machine learning for data imputation and prediction could also help reduce these costs and has been useful in past efforts at refining data from physical inspections (e.g. Tokdemir et al, 2000; Melhem & Cheng, 2003; Sun et al, 2004).

The authors also believe depicting restrictive bridges as institutional relics can help states better target their limited bridge funding. According to the most recent Infrastructure Report Card (ASCE, 2017), repairing America's bridge system would take an additional 123 billion dollars and there still remain 56,007 bridges that are structurally deficient. This clearly indicates that states are under deep resource constraints that require additional prioritization of the repairs of some bridges over others and that engineering and economic analyses alone may not be enough to help policymakers make such decisions. As such, depicting bridges as institutional relics can help policymakers not just better internalize social costs emanating from low bridge clearance heights, but also better understand how both regulative *and* normative forces combine to encourage (or discourage) such changes. Such institutional considerations can help further target and prioritize which bridges are most in need of repair.

In particular, this study can help policymakers ascertain where to target funds and rehabilitation efforts based off of a more holistic assessment that includes not just engineering and financial considerations, but also the type of social impacts embodied here through this analysis of bridge clearances. A nationwide impact assessment of low clearance bridges may better identify those which present significant impediments to the flow of people and goods as well as present the most difficult implementation challenges to bridge managers. This will allow for more targeted identification of truly problematic bridges from those where the impact is less significant. By using such evidence-based approaches, funds can be more effectively allocated to address these challenges.

Chapter 3

Social Movements for Preservation:

The National Register of Historic Places and Roadway Bridges

How does a deteriorating system persist, even as its original design standards are often misaligned with those of the present-day? We argue deteriorating systems, such as bridges and other civil infrastructure systems, can persist when they are not just critical for the provision of goods and services but when local communities build social meaning into their components. This paper argues that such attachment to technical objects can inspire collective action around their preservation rather than change. Specifically, we consider movements to enroll bridges into the National Register of Historic Places (NRHP) on closure rates and their subsequent deterioration levels (i.e. sufficiency ratings). Using panel data derived from the National Bridge Inventory (NBI), preprocessed through the use of coarsened exact matching (CEM), and employing Cox proportional hazards and linear regression models, bridges enrolled on the NRHP have a 65% lower risk of closure in post-enrollment years as compared to similar non-enrolled bridges. Moreover, social movements can restrict engineering options on enrolled bridges, with improvement on bridge conditions occurring only on those elements that do not hold social value to the movement. Thus, social movements may directly affect the built environment by encouraging the persistence of deteriorating yet locally meaningful infrastructure assets.

INTRODUCTION

How does deteriorating physical infrastructure persist, even when there are capable engineering management systems to remediate such systems and their associated costs? Given infrastructure management systems extensively consider the technical and economic issues around infrastructure maintenance (Mohammadi, Guralnick, & Yan, 1995; Chengalur-Smith, Ballou, & Pazer, 1997), this study argues perhaps there are organizational factors that lead to such persistence. In particular, we know from the science and technology studies perspective that the motivations and influence of community members can play a role in how infrastructure is designed (Winner, 1980; Suchman, 2000). In this manner, infrastructure objects are not just engineering marvels that are critical for the flow of goods and services; they are often also socially meaningful to the local community. Thus, perhaps there are some social elements that must be considered in the maintenance of infrastructure. In fact, organizational theorists and civil engineers alike argue that an organizational lens may help improve engineering systems such as those pertaining to civil infrastructure and that role has not been adequately considered (Barley, 2016; Grabowski et al, 2017).

In the case of infrastructure, these systems are both designed for longevity and with the standards of the time in which they were built. As these systems persist, societies around these systems evolve and so do the needs and standards for their infrastructure systems. This implies the system is no longer conforming to modern-day social norms, and we would expect such systems would lose legitimacy and be replaced (DiMaggio & Powell, 1983; Scott, 2001). However, this is not the case. For example, even though bridges are built for a 50-year design life, almost 40% of the 614,387 bridges in the U.S. are 50 years or older. Moreover, as of 2012, more than one in ten U.S. bridges (~10.8%) and over 254 million trips daily occur on bridges that are structurally deficient in that they are rated as substandard in any of their component ratings, based on National Bridge Inventory (NBI) data used in this study. This is despite the fact that bridge funding increased by over 56% with the enactment of the American Recovery and Reinvestment Act (ARRA) (American Society of Civil Engineers, 2017). Further, many bridges have designs or conditions that are not suitable for current societal traffic demands or standards. Formerly referred to as "functionally obsolete", more than one-fifth of U.S. bridges (~21.9%) qualified for this designation in 2012 and serviced one-quarter of all bridge trips daily (~24.7%), based on an analysis of NBI data.[2] In short, even when controlling for financing, recent work in civil engineering shows outdated infrastructure persists even when it reflects past design standards that no longer meet the needs of present-day society (Desai & Armanios, 2018). The key theoretical question for organizational theory then that we argue emanates from this phenomenological challenge is *how does a deteriorating system persist, even as its original standards are often misaligned with those of the present-day*?

Our aim is to better expand our theoretical understanding to capture this observed empirical conundrum that deteriorating systems persist even as the standards and societies around them evolve. In particular, this paper seeks to inform social movement theory with work in science and technology studies to argue how a changing modern society *can actually come to push for the preservation rather than change of their deteriorating technical objects*. Prior social movement research focuses more on change (e.g., McAdam, 1982; Hiatt et al., 2009; Sine and Lee 2009), than on preservation (Turner & Killian, 1957; Snow & Soule, 2010). Here, we help to

[2] The designation of "functionally obsolete" was used through FY 2015, when the Moving Ahead for Progress in the 21st Century Act (MAP-21) redefined the method for allocation of bridge funding. The new approach focuses on structural deficiency only. Additionally, a bridge that previously qualified as both structurally deficient and functionally obsolete would be listed only as structurally deficient for reporting purposes. The numbers reported here include all bridges that met the qualifications for obsolescence.

advance recent scholarly calls that highlight the need for more interdisciplinary engagement between engineering and organizational theory, in this case civil engineering and social movement research, to better understand challenges in engineering systems (Barley, 2016; Grabowski et al, 2017).

THE BUILT ENVIRONMENT AND SOCIAL MOVEMENTS

SCIENCE AND TECHNOLOGY STUDIES (STS)

The work in science and technology studies (STS), as well as the related sociomateriality literature, has been the predominant organizational literature to consider the built environment. This literature has long argued that there are inherently social and political components in the construction of physical infrastructure (Winner, 1980; Suchman, 2000). As such, this literature argues the social and technical become intertwined in the construction and evolution of a seemingly technical object (Law & Callon, 1988; Law, 2012; Pinch & Bijker, 2012).

Particularly for this study, we leverage recent STS literature around how a constructed technical object, such as a piece of infrastructure, can engender *attachment* to the local communities who frequent it (Suchman, 2005; Jerolmack & Tavory, 2014; Barnard, 2016). Attachment is defined as “the degree of linkage perceived by an individual between him/her self and a particular object” (Schultz, Kleine, & Kernan, 1989). Attachment then to an object is not just to its functional attributes but also to the sense of security, personal memories, and connection to other community members that were enabled through the object (Wallendorf & Arnould, 1988). For example, as neighborhood development becomes more pedestrian-oriented and mixed use, the more it becomes a conduit for increased social capital and public health (Leyden, 2003). What this suggests is that this sense of attachment leads to not just measurable functional benefits from infrastructure but more intrinsic value placed on an infrastructure system. In short, the infrastructure system takes on not just functional but cultural value and social importance as a piece of the physical landscape (Greider & Garkovich, 1994). Our study argues that as an infrastructure system persists, it may not just have perceived functional benefits to a local society; the local society may come to also appreciate the system's social and cultural value to its community life.

SOCIAL MOVEMENTS

If infrastructure systems create not just functional benefits but such social attachment, then we argue that when there are threats to changing such technical objects of social attachment, such threats can become a source of social movements around these systems. In general, social movement research tends to focus on the built environment as a means to expand the movement's reach and coordination, rather than an end unto itself for a movement. The disability rights movement and passage of the Americans with Disabilities Act is a prominent example of recognizing that infrastructure can inherently treat people differently through a lack of accessibility (Star, 1999; Schindler, 2014). However, this movement used the constructed environment as a means to highlight an aggrieved population and broader goals, not necessarily to modify the built environment as the end goal. This extends to other movements, such as infrastructure segregation as part of the greater Civil Rights Movement (McAdam, 1982), protests against nuclear plants as part of the broader energy security movement (Kitschelt, 1986), and encouragement of renewable resources as part of the greater environmentalist movement (Sine & Lee, 2009; Carlos et al, 2014). Other studies have discussed mobilized opposition to infrastructure development, such as not-in-my-backyard (NIMBY) efforts and "site fights" to prevent energy project development, though these seek to prevent new projects and are again related to a broader energy and environmentalist movement (McAdam & Boudet, 2012; McAdam et al, 2010).

Current research does not yet adequately consider the potential for infrastructure management serving as an end goal of a movement, such as when a civic organization mobilizes support for the sole purpose of protecting an object with significant social meaning. Such considerations are potentially important because legal precedent tends to view physical systems as innocuous and often does not recognize such physical systems as influencers of social change (Schindler, 2014). In fact, one of the salient qualities often associated with infrastructure is that it is taken-for-granted (Star & Ruhleder, 1996). From this vantage point, one would even argue that such objects cannot inspire mobilization. So, what happens when preservation of the object itself is the end goal rather than the means of collective action remains unclear.

What we argue is if an infrastructure system takes on social and cultural value to a local community (i.e. engenders social *attachment*), then *social movements arise not around change but around preservation*. Ample studies chronicle how a social movement arises to bring change (e.g. McAdam, 1982; Strang & Soule, 1998; Carroll & Swaminathan, 2000; Schneiberg & Soule, 2005; King & Soule, 2007; King & Pearce, 2010). However, and as is important in this case, far fewer studies chronicle how a social movement arises to bring preservation. These movements, often termed reactionary movements, seek to resist change or maintain a previous form of social order against societal changes (Turner & Killian, 1957; Snow & Soule, 2010). This resistance to change is often argued to originate through counter-movements that respond to an initial change-focused movement (Meyer & Staggenborg, 1996). Other research considers reactionary movements in the context of national political party actions in response to a perception that the country is changing for the worse (e.g. Parker & Barreto, 2013; Hepner & Güney, 1996).

However, what our study argues is perhaps attachment to existing objects in the built environment, rather than a social or political change per se, could also generate such reactionary movements.

Beyond a sense of physical attachment and nostalgia, long-standing, taken-for-granted infrastructure is also central to the patterns and routines of everyday life. When these routines are threatened, this may result in collective action as a reaction to the concern over change. This "quotidian disruption," or interruptions in everyday mundane things, creates uncertainty in an individual's habits and routines and such threats can propel mobilization (Snow et al, 1998; Snow & Soule, 2010). For example, Snow and colleagues (1998) discuss how perceived or actual intrusions that threaten to disrupt community and cultural routines may serve as a catalyst for NIMBY movements, busing boycotts, and movements against drunk driving. Therefore, in this context, while infrastructure may be aging and in need of change, it is also known, comfortable, and routinized in the minds of those who depend on it and may therefore inspire reactions to save and protect it when threatened.

By leveraging insights from science and technology studies to inform social movement research, we can better consider the interplay between the built environment and collective action. Science and technology studies informs us that social communities can build a sense of attachment to existing infrastructure objects that goes beyond measurable functional value. This influences the mobilization of resources and formation of social movements with the goal of preserving infrastructure out of this sense of attachment. Because these are movements of preservation and not of change, they can be considered reactionary movements and may be created when there is a perceived or actual threat to the object. As such, these reactionary movements may therefore not need a key social or political catalyst. They may simply need an infrastructure object that generates social attachment and whose change would disrupt a group's accustomed way of life.

THEORY DEVELOPMENT

What are the motivating factors that could generate this sense of attachment to otherwise benign pieces of an infrastructure system? When considering human attachment to the nonhuman, the two major lines of discussion center on a connection to places and the importance of animals and objects. Physical and natural landscapes generate "place attachment" based on personal bonds to locations, with aesthetic qualities playing a key role (Brown & Raymond, 2007). Objects of personal importance are often tied to a sense of community and memories. For example, when identifying their favorite object, people refer to symbolism and shared history rather than functional attributes (Wallendorf & Arnould, 1988). Thus, long-standing pieces of physical infrastructure can also serve as cross-generational reminders of community history and generate special significance in the minds of individuals.

Through this sense of attachment to infrastructure objects, and subsequent advocacy to preserve them, we argue infrastructure objects may persist even when functional and technical needs from such systems change over time. As we argue reactionary movements arise around infrastructure that engenders a collective sense of attachment, these movements likely seek to preserve their infrastructure targets rather than change them. In these situations, adherents to the movement are driven by a desire to protect and save the object by using frames that highlight its historic nature and local importance. As such, these social movement advocates are likely to prevent infrastructure managers from closing these infrastructure systems, even when technical and economic realities may necessitate replacement rather than preservation of these systems.

> **Hypothesis 1 (H1):** Social movements will decrease the likelihood of closure for a physical infrastructure target.

If these social movements are truly out a sense of attachment, this is likely to constrain the subsequent engineering that can be performed on these systems (Desai & Armanios, 2018). Therefore, managers will likely face constraints in their ability to maintain these systems without substantially affecting those elements that give the movement its sense of attachment with these objects. In particular, the attachment of the social movement to the object is rooted in the characteristics and features of the object that inspire such sentimentality. When considering attachment to important individual objects, the connection to personal memories and important life events was found to be most salient (Wallendorf & Arnould, 1988). Studies also find aesthetic value to commonly be the most important factor in defining the connection to "special" places (Brown & Raymond, 2007). Thus, we posit that in the case of the built environment, the physical appearance manifest in its design and construction is a critical element affecting the sense of attachment of a local community to such objects.

Following from the first hypothesis, if these deteriorating systems are to remain an active part of the physical infrastructure system, there is now a tension. Managers need to at least conduct repairs (without complete replacement) that enhance the operability and reliability of such infrastructure. However, the movement has introduced a constraint on managers to not substantially modify those elements that reflect the movement's sense of attachment to the object. Thus, we argue the way these two competing forces are reconciled is that engineers will be restricted to only updating those features that do *not* give the movement its sense of attachment to the object.

> **Hypothesis 2 (H2):** Social movements will only improve the conditions of those parts of an infrastructure target that do *not* comprise the movement's attachment to the object.

EMPIRICAL CONTEXT

THE NATIONAL REGISTER OF HISTORIC PLACES

Established via the National Historic Preservation Act of 1966, the National Register of Historic Places (NRHP) is a national program supporting public and private initiatives to identify, evaluate, and protect historic places deemed worthy of preservation. Nomination packets are submitted to the State Historic Preservation Office, which solicits public comments and then conducts a review board to assess eligibility. Certified recommendations are sent to the U.S. National Parks Service for a final review and, if approved, formal entry into the registry. Over 2,400 roadway bridges have been entered into the NRHP since its inception and these bridges still figure prominently on the roadway network. Using NBI data collected for this study and a conservative estimate of historic bridges, these bridges still carried more than 4 million vehicle trips per day in 2012 and were 55 years older than the average roadway bridge.[3] Additionally, 65% of those still being reported were either structurally deficient or functionally obsolete, as compared to 23% of all bridges.

Although nomination packets may be submitted by any interested party, what is unique in the process is the need for detailed historical documentation about the object and justification of why it meets the criteria for listing on the registry. Technical details about material and design, architectural aspects, and even the background of the original builder are necessary to fully explain its origins and history. Such an undertaking requires historical research support from either private or public-sector individuals from a variety of engineering, architecture, and historical backgrounds. Indeed, the National Historic Preservation Act of 1966 mandates that the

[3] This is a conservative estimate as we capture data only within the time period and regions observed for this study. As only those counties with bridges enrolled on the NRHP between 1992-2012 are considered, we code and remove only those pre-1992 enrollments within the same counties. This biases our estimates downward and suggests the analysis is a conservative one.

majority of members on state historic review boards be “professionals qualified in history, prehistoric and historic archeology, architectural history, architecture, folklore, cultural anthropology, curation, conservation, landscape architecture, and related disciplines” (54 U.S.C. §300307).

Additionally, the case of nominating pieces of publicly-owned infrastructure poses a unique challenge in that any nomination requires consent from the owner. Government agencies must primarily concern themselves with the safety and efficiency of infrastructure systems, which favor modern and higher-capacity structures over historical structures. Thus, social movements are often needed to raise awareness of infrastructure systems worthy of preservation, effectively apply appropriate frames to justify their preservation, and recruit political allies to support their efforts (McCarthy & Zald, 1977; McAdam, McCarthy, & Zald, 1996; Benford & Snow, 2000). We discuss this in greater detail in the next section.

The appeal of NRHP enrollment for a social movement lies in the ability to bring public attention to the object and its preservation serves as a tangible and attainable goal. Listing on the registry also provides access to federal resources, such as Historic Preservation Fund (HPF) grants from state offices and permanent legal protections of historic structures owned by preservation groups, nonprofits, or private entities. Perhaps most importantly, NRHP enrollment also mandates review and comment by the federal Advisory Council on Historic Preservation (ACHP) for any project drawing from federal funding sources (National Historic Preservation Act, Section 106). Once enrolled, governments seeking to modify these bridges using federal funds must demonstrate that such work will not diminish the historic integrity of the object before they are allowed to expend those funds (54 U.S.C. §306108).

Aside from formal regulatory barriers present for enrolled bridges, there are also normative professional engineering guidelines with regard to historic preservation. For example, the American Association of State Highway and Transportation Officials (AASHTO) disseminates instructions that document the expectations for state transportation system managers when it comes to making repair and replace decisions on historic bridges (Harshbarger et al, 2007). This decision-making process is an attempt to not only improve the overall management of historic elements of the transportation system, but also to provide a national set of standards. However, by reinforcing the importance of maintaining the individual historic aspects of registered infrastructure this also complicates and restricts the engineering options, as engineers have to show how they will maintain this historicity in any subsequent repairs. Figure 5 summarizes how this process of social movements around registering a bridge on the NRHP can subsequently restrict engineering options that can be made on such bridges.

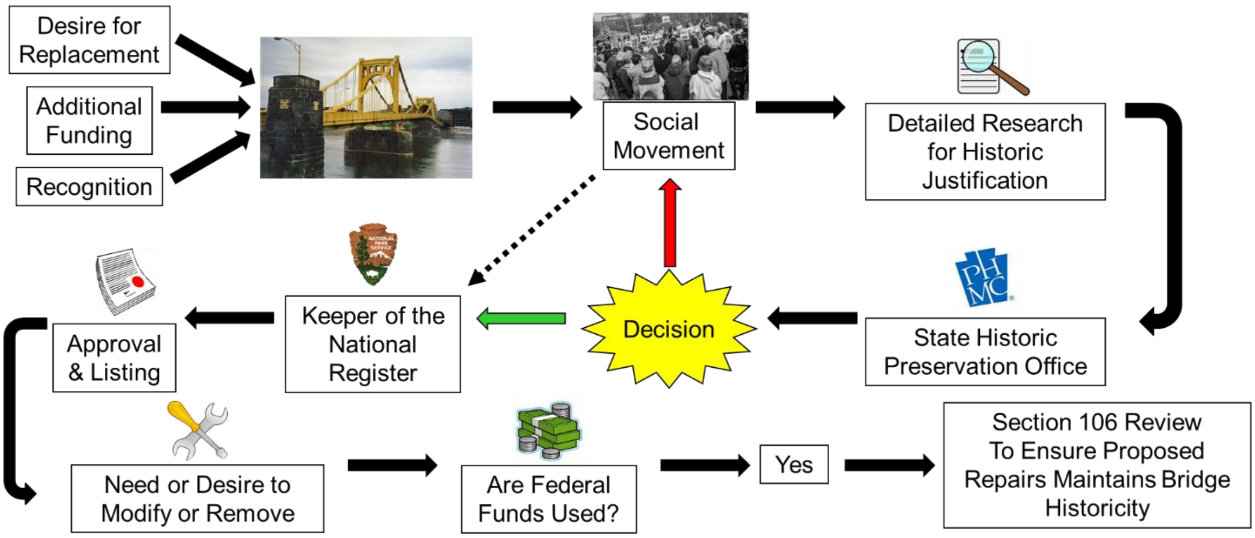


Fig. 5. Summary of the process through which a social movement can register a bridge on the National Register of Historic Places (NRHP), thereby restricting the engineering that can be performed on the bridge.

BRIDGE PRESERVATION AS A SOCIAL MOVEMENT

Bridges are critical pieces of the national transportation system, linking locations and populations together. Yet, they also form an indelible mark on landscapes and in the minds of those who respect their engineering and historical significance. The historical significance of a bridge – due to age, design uniqueness, local importance, or a combination of these factors – may thus generate feelings of attachment that help mobilize individuals and effectively frame efforts to save or protect the structure (McAdam, McCarthy, & Zald, 1996; Benford & Snow, 2000).

Social movements are argued to require three elements: framing, mobilization, and political opportunity (McAdam, McCarthy, & Zald, 1996). Framing the issue as one of preservation around a sense of nostalgia refines and focuses this sense of attachment. Such framing processes that highlight both the grievance and the hope that collective action may resolve it are one requirement for the formation of a social movement (McAdam, McCarthy, & Zald, 1996; Benford & Snow, 2000). In this case, the sense of attachment may be the driver of the movement, exacerbated by a real or perceived threat to the structure. Bridges are easily portrayed as being historically important for connecting people, facilitating economic development, and beautifying the landscape of towns. Personal stories of family and community can help further reinforce the motivation to save a piece of local history when it is perceived as being threatened. For the Green Bridge in Waverly, Iowa, the argument was both functional and social. The small one-lane bridge is a connector to the southeast community and was considered for replacement and expansion to multiple lanes. But advocates for its preservation highlighted its place in defining the community as a "*smaller river crossing in this slower, historic residential section of town*" and that it reinforced the "*certain quality of life*" of the neighborhood that would be threatened with a bigger bridge (Schildroth & Schildroth, 2017). When the Red Bridge of Jasper County, Iowa was threatened with demolition, arguments for saving it appealed to this sense of nostalgia:

> But if you're like me and spent a lot of time running around Skunk bottoms as a kid, then you know that bridges have a purpose far beyond letting vehicles cross a river. The bridges of Jasper County were places of refuge, where friends and families gathered to fish, swim or simply be outdoors when the weather was nice…We can't save them all but we should at least save one (Otto, 2018).

Local advocates for advancing the historical identification of a bridge focus on political opportunities, the second of the three factors necessary for a social movement (McAdam, McCarthy, & Zald, 1996). Such opportunities may manifest in two ways. The first is as a threat to the infrastructure with local social attachment, such as a decision to replace or demolish an aging structure. In this case, advocates must overcome political and engineering decisions that have already been set in motion to justify why the structure should remain. Organizers to save the Green Bridge spent more than a decade providing public input and attending any city council meeting where engineering options for replacing or demolishing the bridge were being considered (Molseed, 2015). The second is a political opening for recognition tied to a broader assessment or inventory process. A common example of this is when state departments of transportation or historic preservation offices decide to undertake a systemwide inventory for purposes of historic evaluation. For example, in 1994 the Michigan Department of Transportation identified a cadre of historians, assessors, and local experts to document its roadway bridges and make recommendations to an advisory board. This resulted in a 76-page submission documenting the detailed history of transportation in the state, which served as the supporting basis for NRHP enrollment of at least 74 bridges between November 1999 and February 2000 (Roise & Fraser, 1999). In instances such as this, local advocates may capitalize on the opportunity to ensure their particular bridge is recognized before serious threats arise to its future on the transportation network.

The final requirement for a social movement is some form of mobilizing structure, which may consist of a formal organization or informal networks (McAdam, McCarthy, & Zald, 1996). An effort to save a local bridge is a function of the community, its attachment to the bridge, and its reaction to perceived or real threats to its continued existence. Groups also engage in resource mobilization to garner support from a variety of actors, including members of the aggrieved population, adherents to the cause, and constituents who provide their money, time, connections, and historical expertise (McCarthy & Zald, 1977). Thus, as with the recent efforts to save the Green Bridge, community members organized to express discontent at local government meetings, formed a social media organization on Facebook, and created an online petition. To save other bridges, local towns and residents have engaged in their own engineering assessments and even filed court cases, going so far as to petition the Department of the Interior to prevent new bypasses and the demolition of history (Roberts, 2018). National advocacy groups include the independent Historic Bridge Foundation and the National Trust for Historic Preservation, which help grassroots organizations by providing access to organizing resources and generating public and political support. Websites such as HistoricBridges.org and BridgeHunter.com provide platforms for volunteers to document the status of bridges through pictures and posting of ongoing rehabilitation or demolition efforts. Finally, the Advisory Council on Historic Preservation (ACHP) serves as the independent government agency that coordinates activities at a federal level.

Social Movement Case: The Vida Shaw Bridge of Iberia Parish, LA

The Vida Shaw Swing Bridge (Louisiana NBI Structure Number 032330019914421), also known as the Teche Bayou Bridge, lies near the village of Loreauville in Iberia Parish, LA, about 27 miles southeast of Lafayette. The opening of the Vida Sugar Mill in 1923 required the placement of a bridge to allow local farmers to bring their cane to the mill site. The current bridge dates to 1938, after floods damaged previous versions, and it served the mill until the facility's closure in 1974 (Save Vida Bridge, 2018). A single-lane, steel-structure truss, the bridge is designed to swing to the side of the river to allow boat traffic to pass and then return to its normal configuration to allow road traffic. Although once fairly common in Louisiana, this is one of a very few number of swing bridges remaining in the state.

In March 2007, Iberia Parish and the Louisiana Department of Transportation and Development (LADOTD) began making plans to replace the Vida Shaw with a newer two-lane bascule bridge (Bandy, 2007a). Reacting to the news, local community members organized the "*Save Vida Bridge*" grassroots campaign to try and halt the replacement project. They also enlisted the help of the Historic Bridge Foundation, a national nonprofit committed to historic preservation efforts (Henderson, 2018). Framing the effort as one of preserving history and community legacy, organizers highlighted the importance of the sugar industry to the development of the region and the central role of the bridge.

> [T]he bridge signifies the resilience of the Iberia Parish farm families and is testimony to the determination of these families on the North side of the Bayou to bring their sugarcane to market. As the only remaining relic of the Vida Sugar mill, this small one lane bridge is reminder to all that further up the Bayous [sic] cut bank once stood a mechanical factory that revolutionized the processing of sugarcane (Save Vida Bridge, 2018).

Advocates pressured the LADOTD and the State Historic Preservation Office (SHPO) to conduct a historic review determination. In June 2007, the Iberia Parish Council voted overwhelmingly to replace the bridge, using three arguments for justification (Bandy, 2007b).

First, the replacement bridge was already built and paid for while repairing the Vida Shaw would cost an estimated $2 million. Second, the new two-lane bridge would allow for better traffic flow and enable larger tractors to cross the bayou at that point. Finally, the LADOTD and SHPO reported that historic evaluation did not meet the criteria for NRHP inclusion, even though a 1999 assessment recommended its inclusion (Advisory Council on Historic Preservation, 2007).

With the state offices denying the historic claim, advocates contacted the Advisory Council on Historic Preservation (ACHP), an independent federal agency that advises the President and Congress on national historic preservation policy. Members of the grassroots effort to save the bridge requested the ACHP ask the Federal Highway Administration (FHWA) for a special assessment of eligibility by the Keeper of the NRHP (Advisory Council on Historic Preservation, 2007). The ACHP agreed to the request, citing a petition signed by over 1,000 local residents to repair and maintain the existing bridge as a major motivating factor. In September 2007, the Keeper of the NRHP determined that the Vida Shaw Bridge was eligible for the NRHP, citing it as "*one of a small number of high steel swing-span bridges that survive in Louisiana*" and highlighting its "*rim-bearing pivot mechanism*" as an important design element. With this finding, the FHWA invoked Section 106 consultation and LADOTD was required to consider alternatives to replacement, regardless of the Parish Council vote. The bridge was entered into the NRHP on July 6, 2010 and currently remains in place as discussion on its future continues.

EMPIRICAL TESTS OF HYPOTHESES

The social movement thus utilizes a nostalgic sense of attachment to ascribe meaning and sentiment to the bridge, arguing for its preservation. Once political opportunities or threats to its continued existence present themselves, this collective sentiment may form the structures necessary to take advantage of the opportunities or threats. Reactionary social movements seek to register the bridge as a means to preserve that object and existing systems. In the face of local mobilization, we posit that government entities will be less likely to approve projects that destroy or remove these bridges. Thus, to more specifically test our Hypothesis 1 within this empirical context, we assert that *NRHP-enrolled bridges (reactionary movement) are associated with lower closure rates than similar non-enrolled bridges*.

However, this now creates a tension in the ability to manage infrastructure. While the social movement seeks to preserve the object, powerful institutional entities (state departments of transportation) want to ensure the highest quality infrastructure at the lowest cost. In light of the proposition that enrollment is associated with lower closure risk, this means that bridges must continue to support traffic but with fewer acceptable avenues for maintenance management. This tradeoff between ensuring vehicular safety and preserving historicity is likely to result in negligible improvement for historic bridges, with a focus on areas that are not viewed as detracting from historicity. From civil engineering, we know that the substructure elements support the bridge and transfer of structural load to the foundation (Zhao & Tonias, 2012). The attachment ascribed by the social movement is tied to historicity and aesthetic, which is generally associated with the visible elements of the superstructure and deck. Thus, there is a dual desire to maintain the operability of the bridge, or improve its sufficiency rating in civil engineering terms, while minimizing impact to its historicity. We argue the result will likely be in improvements to the substructure, but not to the superstructure or deck. To more specifically test our Hypothesis 2 in this empirical context, we therefore posit that *NRHP-enrolled bridges are associated with improvements in sufficiency rating than similarly non-enrolled bridges, but only in substructure (non-historic) and not in superstructure or deck (historic) elements*.

One example of the prioritization of visible elements, namely the superstructure and deck, over supporting elements, namely the substructure, is found in the NRHP nomination of the Red Bridge in Jasper County, IA, built in 1892. The supporting documentation highlights the uniqueness of the superstructure and deck of the bridge, referring to its pin-connected Warren Truss superstructure as being "*technologically significant as an intact example of this exceedingly rare structural type*" (Fraser, 1994). It also mentions the "*gravel-surfaced county road*" to highlight the historicity of the roadway and deck construction. What is unique in this case is that the bridge sustained significant damage in 1947 due to flooding, requiring replacement of one of the original steel piers with a concrete version (a major modification to the substructure of the bridge) and the addition of a pony truss section (a major modification to the superstructure). Even though these changes fundamentally altered the historicity of the bridge, and the state assessment guidelines were to consider only bridges built prior to 1942, the bridge was still recommended for inclusion with only the superstructure modifications highlighted in the justification. As stated in the NRHP documents, "*Although substantially altered by the addition of the pony truss approach span, the bridge is an important and uncommon remnant of early Iowa transportation*" (Fraser, 1994). While the substructure modifications were noted in the historical summary, no justification was included for this change when considering the historical value. This supports the face validity of our assumption that of the three major condition rating areas – deck, superstructure, and substructure – the deck and superstructure are considered to most heavily impact perceptions of historicity.

DATA: U.S. NATIONAL BRIDGE INVENTORY

To provide a systematic and quantitative approach to considering the impact of social movements on bridge preservation, this study utilizes the National Bridge Inventory (NBI), a nationwide compilation of U.S. bridges maintained by the Department of Transportation's Federal Highway Administration (FHWA). Collected annually and publicly available since 1992, the NBI mandates the reporting of specific bridges that fit the criteria for receiving federal funding across 135 characteristics. This Inventory falls under the National Bridge Inspection Standards (NBIS), which define the criteria and frequency of public bridge inspections (23 U.S.C. §101). This data is also attractive because prior to 2013 states were also requested to report bridges that did not necessarily meet NBIS criteria but were still associated with important routes within the state infrastructure system (Federal Highway Administration, 2000). In 2013, a policy change restricted these annual reports to only the NBI-qualified bridges, resulting in a removal of many previously reported entries. From 1992-2012, raw entries to the NBI increased by an average of 2,500 records per year. In 2013, the total reported records decreased by 15% over the 2012 report, followed by average annual increases of approximately 1,800 bridges from 2014-2017. Therefore, the dataset for this study is limited from 1992 (when this data was first made available) to 2012 (the last date prior to reporting policy changes). The resulting data consist of 21 observation years, with raw total entries ranging from 666,206 in NBI-1992 to 716,436 in NBI-2012.

To more adequately assess impacts over time, we developed a bridge-year panel using the annual NBI datasets. During the period of analysis, many states changed their coding schemes for assigning unique structure numbers to bridges, most frequently due to the adoption of computerized bridge management systems. Unfortunately, such changes are not made retroactively in the NBI database. We thus updated the panel using an official database of reported changes to structure numbers provided by the Federal Highway Administration in order to more effectively match all observations to the appropriate bridge. This resulted in over 14.6

million bridge-year observations and 1,047,127 unique bridge-routes in an unbalanced panel format (some bridges were first built after 1992). Appendix B provides additional detail on the panel creation methodology.

We then conducted a hand-coding process to identify all bridges enrolled in the NRHP during the reporting years. Utilizing the official NRHP registry, a search for all entries containing the term "bridge" and not relating to a historic "district" produced 1,161 possible enrollments from 1992-2015. These records are reported by common name, while the NBI is reported using alphanumeric structure numbers. This required individually matching bridges by comparing location and bridge design data points in the NBI to those on the NRHP application, web searches for historical details of the bridge, and approximate geolocation of the bridge overlaid on satellite imagery. The process resulted in 861 matched (76%),[4] of which 835 were enrolled within the period of analysis from 1992-2012. Given we want to assess pre and post enrollment, we further exclude enrollments in 1992 (no pre point) and 2012 (no post point), the first and final years of our dataset, resulting in 751 historic bridges.

DEPENDENT VARIABLES

For hypothesis 1, the primary analysis of this study is an assessment of the impact of social movements on bridge survival, which is performance through a Cox proportional hazard model to be discussed shortly. Since the data have a finite window from 1992-2012, the analysis only considers survival and reported characteristics within this window. Thus, we define a survival function for each bridge based on reporting year and status in that reporting year. Bridge status

---

[4] Of the 300 bridges that could not be matched to NBI records, 133 were identified as having no road access, servicing only railway traffic, or being solely for display or pedestrian use since prior to 1992, 58 contained the string "bridge" in the description but were not actually a bridge, and 86 were not located in the NBI. The two primary reasons for the inability to locate NBI records were the length of the bridge, as only bridges greater than 20 feet must be reported, and ownership, as privately-owned bridges do not have to be reported. This all suggests a strong matching rate with non-matches predominantly not actually being roadway bridges.

(*Status* variable), is 1 in the year in which the bridge is permanently closed and 0 for observations when the bridge is open.[5] The operational status of bridges is reported through the Structure Open, Posted, or Closed to Traffic entry (NBI Item 41), with code "K" indicating the bridge is closed to all traffic. To determine permanent bridge closure, we consider all panel observations where the bridge is not closed and identify the last entry reported for the bridge. If this entry is prior to 2012 (the end of the panel) then the bridge is assessed as closed following that time. Since bridges are not required to be reported to the NBI if they are permanently closed, we assign the final observation year of operation as the year of closure. Observations after the year of permanent closure are removed. Any bridge reported as open in 2012 is considered to be right-censored for the purposes of this analysis.

For the linear regression model testing Hypothesis 2, we consider five separate dependent variables. The *Sufficiency Rating* of a bridge provides a holistic rating on a 0 to 100 scale that represents the bridge's condition and is based on 18 different technical inspection criteria. This rating is what centrally decides a bridge's roadworthiness and its adequacy to hold roadway traffic (Federal Highway Administration, 1997; 2000). The *Deck*, *Substructure*, and *Superstructure Condition Ratings* describe the major bridge components as they currently exist on a 0 to 9 scale, with 0 indicating failed condition and 9 representing excellent condition. These component condition ratings are also inputs into *Sufficiency Rating*, so these condition ratings help us to see what bridge component improvements occur (if they do at all) that improve the overall sufficiency rating. We additionally consider *Total Project Cost* as a dependent variable in

[5] Bridges that are only temporarily closed, such as for repairs, remain in the sample as an open bridge. To determine this, we identified if the bridge was reported as closed in a particular year and then reported as open in subsequent years. This indicated that the closure was likely temporary and the bridge should be considered as surviving for the purpose of this analysis. Bridges listed as closed in 2011 and not listed as open in 2012 were considered permanently closed, which provides a conservative estimate when assessing the likelihood of closure as it is possible some of these bridges reopened at a later date.

the Robustness Checks section and ascertain that these results are not financially-based as costs do not significantly change following enrollment.

INDEPENDENT AND CONTROL VARIABLES

Since this analysis seeks to understand the impact of registration on the National Register of Historical Places (NRHP), we define two variables to distinguish bridges registered during the period of analysis. The *Group* variable takes a value of 1 for all yearly observations in the panel of a bridge that will at some point be registered on the NRHP (the "treatment" group). The *NRHP* variable then takes a value of 1 for those years in which a bridge is registered on the NRHP. All bridges that are never enrolled during the panel years or bridge-years prior to NRHP enrollment have a value of 0. This produces three logical groups for comparison. If *Group* = 0 and *NRHP* = 0, the bridge is never enrolled ("control" group). If *Group* = 1 and *NRHP* = 0, we are assessing those bridges that will eventually gain enrollment but in the period prior to their actual listing. Finally, when *Group* = 1 and *NRHP* = 1 we are assessing the impacts to bridges after they are formally registered on the NRHP. Note that the challenge here is that we cannot observe the counterfactual of a bridge that never enrolled but is observed post-enrollment (*Group* = 0 and *NRHP* = 1). For this reason, and to come up with as tight a control counterfactual group as possible, we engage in coarsened exact matching (CEM) to ensure each NHRP "treatment" is compared to the most similar unregistered "control" bridge. We will discuss this preprocessing step in greater detail in the next section.

Relevant controls must also be utilized when conducting the statistical analysis. A factor variable for the state owning the bridge (*StateName*) controls for regional variation and the critical role of state departments of transportation in determining bridge maintenance and longevity (23 C.F.R. §650.307). Structure Type (*ST*) and decade of year built (*YBDec*) consider both the uniqueness and age of the bridge as contributors to obsolescence and potential hindrances to rehabilitation, as well as likelihood for being registered as historic (36 C.F.R. §60.4). The location (*Urban*) and average daily traffic (*LogADT*) acknowledge that bridges in high-traffic areas are more visible and impact more drivers as they deteriorate, which could hasten calls to replace such bridges. These five controls are used in both the Cox model and in the linear regression. Additionally, a fixed effect for NBI year is included in the linear regression.

METHODS: COX PROPORTIONAL HAZARD ANALYSIS & LINEAR REGRESSION

To assess the impact of social movements (via NRHP enrollment) on bridge closure rates, we utilize a Cox proportional-hazards approach (Cox, 1972). This provides a multivariate statistical approach using both quantitative and categorical variables to investigate their effects on survival times of entities. This model is frequently used in social movement research to handle data censoring issues such as those in our context (e.g. Sine, Haveman, & Tolbert, 2005; Haveman, Rao, & Paruchuri, 2007; Sine & Lee, 2009; Boone & Özcan, 2014).

An important benefit of the Cox approach is that no assumptions are made as to the shape of the baseline hazard. This results in a larger amount of modeling flexibility when assessing a multivariate function. The hazard rate is given by:

$$h(t) = h_0(t)\exp(\beta_1 Group + \beta_2 NRHP + \delta X_i)$$

where $h(t)$ is the expected hazard at time t, $h_0(t)$ is the baseline hazard, *Group* and *NRHP* are the predictors of interest, and X_i is the vector of control variables discussed previously. The exponentiated coefficients, $\exp(\beta_i)$, provide the hazard ratio to measure effect size of the covariates. Hazard ratios greater than 1 are associated with decreased survival (increased risk of closure) and ratios less than 1 are associated with improved survival (decreased risk of closure).

We utilize the *coxph* function in the *survival* package within R to conduct this estimation. Since the Cox approach assumes a constant baseline hazard over time, we also utilize a piecewise exponential hazards approach as a robustness check, as older bridges are more likely to close than younger bridges and thus the baseline hazard may change over time. The results are robust to the Cox model findings presented below (see Robustness Checks section).

To assess the impacts of social movements (via NRHP enrollment) on sufficiency ratings and condition ratings of bridges, we utilize an ordinary least squares linear regression approach. Each of the five dependent variables is modeled separately against the same set of independent and control variables. This model takes the form:

$$DV_{i,t} = \beta_0 + \beta_1 Group_{i,t} + \beta_2 NRHP_i + \delta X_{i,t} + \varepsilon_{i,t}$$

where *DV* is the dependent variable being modeled for a given bridge *i* at time *t*, *Group* and *NRHP* are the predictors of interest, and $X_{i,t}$ is the vector of control variables.

PREPROCESSING THROUGH COARSENED EXACT MATCHING

A critical challenge in assessing historic bridges across the entire bridge system is that such bridges are, by definition, unique in several ways. Moreover, as we discussed before, we cannot identify the perfect counterfactual of a bridge that is not enrolled and can be observed post-enrollment as that is not a logical possibility. Thus, a direct comparison of the treated bridge to all possible control bridges introduces bias into standard statistical approaches in that the samples being compared are not truly from comparable populations. For example, age and unique or rare design features are just two of the possible criteria for enrollment into the NRHP. Naïvely comparing such historic bridges to modern bridges makes it difficult to assess whether results are due to these inherent characteristics or the act of enrollment on the NRHP.

To more adequately match historic and non-historic bridges along similar characteristics, we utilize coarsened exact matching (CEM) (Iacus, King & Porro, 2008; 2009). In this manner, we create strata of observations based upon a vector of controls and manually-defined cut points that identify bridges of nearly identical features. The treatment group is defined as those bridges enrolled on the NRHP during the period of analysis, while the control group contains bridges that are not enrolled during the period of analysis. Those strata containing at least one bridge in the treatment group and at least one bridge in the control group are retained. Within each stratum, the nearest control bridge to each treatment bridge is identified using a Euclidean distance to form a *k-to-k* matched set. We also develop a *k-to-m* version as a robustness check, where all bridges within matched strata are included to produce a larger sample and leads to consistent results (see Robustness Checks section).

Prior to matching, we assign a *MatchYear* to ensure that treatment and control observations are compared in the same reporting year. For treatment bridges, this is the year of enrollment on the NRHP or their year of permanent closure,[6] whichever is earlier. They are matched with control group observations of the same reporting year. Additionally, we note that there is potential for certain local governments to place higher emphasis on historic preservation than others. Thus, the full sample is limited to consider only control bridges from the same set of counties and states present within the treatment group of bridges enrolled during the analysis period.

We utilize a set of six variables to conduct the CEM process. The *MatchYear* is used as an exact match. Applications for enrollment on the NRHP must be submitted through the State

[6] This accounts for the possibility that a bridge may be enrolled after it is permanently closed but is still contained in the dataset in the pre-enrollment period. As there is no required report following a bridge closure, this ensures these cases can still be included in the analysis. This then presents a conservative estimate of survival, as the results would consider such cases as closed following the social movement.

Historic Preservation Office for review and endorsement prior to submission to the National Parks Service. Due to the critical role of states, bridges are matched exactly within the state based on the *StateName* variable but may be matched to a bridge in another county to attain the closest match, given the rarity of such structures. The age of the structure is a common metric used in determining eligibility for the NRHP (36 C.F.R. §60.4). We use the Year Built (NBI Item 27) and round to the nearest decade to create *YBDec* and match within these bands.[7] Many applications highlight bridge design and the limited number of surviving counterparts when making recommendations for enrollment. We use the Structure Type (NBI Item 43), combining both the material (10 codes including concrete, steel, wood, etc.) and the design (23 codes including slab, stringer/girder, deck-truss, through-truss, deck-arch, through-arch, etc.) into the *ST* variable, which must be an exact match. The location of a bridge in either an urban or rural area may affect its perceived historicity due to prominence and usage. The *Urban* variable is derived from the Functional Classification of Inventory Route (NBI Item 26), with urban bridges taking a value of 1 and rural bridges taking a value of 0. Regardless of all other factors, how much a bridge is used on an annual basis may impact the likelihood of NRHP registration. The Average Daily Traffic (NBI Item 29) is log-transformed into the *LogADT* variable and used as a final comparison point. With this final variable, we allow the algorithm to automatically assign cut points based on natural breaks in the data (manual modifications did not substantially improve the matching effectiveness). Appendix C provides additional detail on this process.

Using these six matching criteria produces a data set of treated and control bridges that are extremely similar in comparative aspects in the year of enrollment. Figures 6 and 7 provide

[7] Matching processes have tradeoffs between precision and loss of sample and enforcing an exact match by year greatly restricts the available control bridges. We found utilizing a decade window allowed for the most optimal balance between a better match and greater sample retention. We discuss this process further in Appendix C.

photographic examples of two of the matched pairs obtained by the process. In the first example, the Carpenter's Flats Bridge over the Ausable River in Clinton County, NY (enrolled on NRHP in 1999) was matched with the Susquehanna River Bridge in Delaware County, NY (control group). Both are steel thru-truss bridges, had a logged-value for average daily traffic of 7.8 in the matched year and are located in rural areas. The former was built in 1941 and the latter in 1935. In the second example, the East Indian Creek Bridge in Story County, IA (enrolled on NRHP in 1998) was matched with the Haight Creek Bridge in Des Moines County, IA (control group). Both are concrete deck-arch bridges and are in rural areas. The former had a logged-value for average daily traffic of 4.1 and was built in 1912, while the latter had a logged-value for average daily traffic of 4.4 and was built in 1909.

Fig. 6. Example of matched bridge pair. On the left is the Carpenter's Flats Bridge, Clinton County, NY (enrolled on NRHP in 1999) and on the right is the Susquehanna River Bridge, Delaware County, NY (control group). [Photo credit: GoogleMaps]

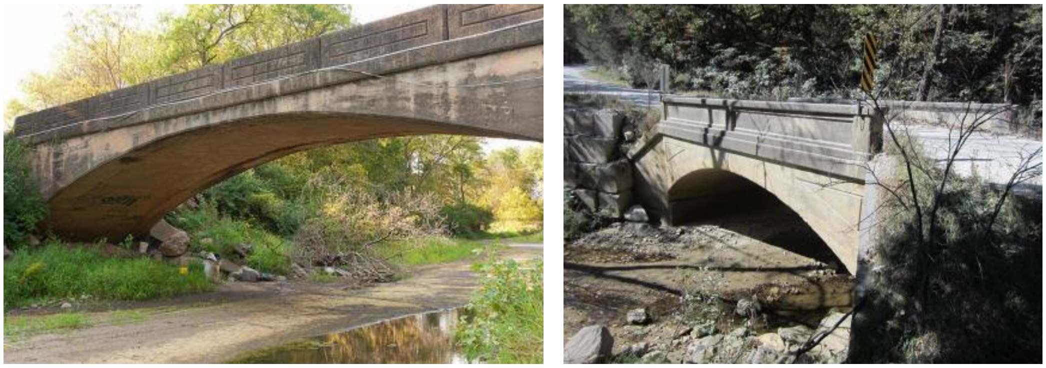


Fig. 7. Example of matched bridge pair. On the left is the East Indian Creek Bridge, Story County, IA (enrolled on NRHP in 1998) and on the right is the Haight Creek Bridge, Des Moines County, IA (control group). [Photo credit: BridgeHunter.com]

For the Cox analysis, the treated group consists of 742 unique bridges after removing those that do not have reported entries for all matching variables. The control group consists of 131,164 unique bridges. The panel observations for both sets of bridges consists of 2,182,059 bridge-year observations after limiting to counties that have NRHP enrollments and removing those observations without fully reported matching variables. Table 6 describes the imbalance statistics as a result of the matching process. The CEM *k-to-k* results in 352 (N=704) matched pairs of bridges (47% of treatment group). The multivariate imbalance measure ($\mathcal{L}_1$) reduces from 0.99 to 0.18 and both t-tests and Kolmogorov-Smirnov tests on each variable in the matched set show highly similar distributions between the treatment and control group. Including all bridge-year observations in the matched set and considering the pre-enrollment comparison values, both t-test results and KS-test results are still insignificant, suggesting acceptable comparative distributions for the main analysis.

For the linear regression analysis, CEM preprocessing further restricts the available matching pool to contain only those observations with valid entries for each of the five dependent variables. This results in only minimal reduction of the available bridges. The largest matched *k*-

to-k sample contains 352 matched bridges (N=704), while the smallest matched sample contains 330 matched bridges (N=660).

Table 6. Imbalance Summary for CEM Preprocessing of Cox Proportional Hazards Model

1A. Full Data

Overall Imbalance (L1)	0.99

Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	13,426	2,166,413	223.18	0	0.69	0
NBIYear	13,426	2,166,413	4.62	0	0.02	0
LogADT	13,426	2,166,413	44.19	0	0.14	0
Urban	13,426	2,166,413	33.99	0	0.12	0

1B. Matched Data, k-to-k

Overall Imbalance (L1)	0.18

Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	352	352	0	1	0	1
NBIYear	352	352	0	1	0	1
LogADT	352	352	-0.06	0.95	0.03	1
Urban	352	352	0	1	0	1

1C. Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.45

Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	2,844	2,796	0.32	0.75	0.01	1
NBIYear	2,844	2,796	0.44	0.66	0.01	1
LogADT	2,844	2,796	-1.41	0.16	0.04	1
Urban	2,844	2,796	-1.05	0.29	0.01	1

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

RESULTS

Table 7 presents the correlations between the main variables of interest within the regression and generally suggests low potential for multicollinearity within the models. The largest correlation is between *LogADT* and *Urban,* which is expected as urban areas are more likely to have higher daily traffic than rural areas. There is also a positive correlation between *YBDec* and *LogADT*, which indicates that bridges built in more recent decades tend to carry larger amounts of daily traffic, which is also expected.

Table 8 reports the main results for the Cox proportional hazards model used in this study. The coefficient for each variable is reported in the β_i column, with the p-value in brackets next to the estimate and the standard error of the coefficient underneath in parentheses, clustered by bridge. The hazard ratio is reported in the $\exp(\beta_i)$ column. Model 1 considers only the effect of *Group* on risk of closure, which is an assessment of all bridges that will be enrolled during the period on the NRHP, regardless of whether they are enrolled yet or not. This first-stage assessment suggests a reduced risk of closure for those bridges eventually attaining NRHP enrollment. However, this simply assesses these bridges as a group, without considering that the act of enrollment itself may be consequential. Indeed, Model 2 indicates that enrollment may be largely associated with this reduced risk of closure for historic bridges.

Model 3 supports the hypothesis that successful enrollment on the NRHP is associated with lower closure rate (higher survival rate) than similar bridges that are not selected for enrollment. Historic bridges are associated with a hazard rate of 0.35, or a 65% lower risk of closure than comparable bridges following enrollment on the NRHP. These results support Hypothesis 1 and suggest that social movements can be effective at shaping the built environment through their actions, namely preventing bridge closure.

Table 7. Correlation Matrix for Cox Proportional Hazard model, k-to-k matched set

	Mean	SD	Min	Max	1	2	3	4	5	6
Dependent Variables										
1. Status	0.02	0.14	0	1	1					
Independent Variables										
2. Group	0.51	0.50	0	1	-0.02	1				
3. NRHP	0.26	0.44	0	1	0.03	0.58	1			
Control Variables										
4. YBDec	1921	16	1870	1960	-0.07	0.00	0.00	1		
5. LogADT	5.34	2.20	0	13.78	-0.04	0.01	-0.01	0.40	1	
6. Urban	0.11	0.31	0	1	-0.03	0.00	-0.01	0.11	0.56	1

Table 8. Cox Proportional Hazard Estimate for Bridge Closure, k-to-k matched set

	Model 1		Model 2		Model 3	
	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$
Group	-0.38 [0.003] (0.13)	0.68			0.40 [0.127] (0.26)	1.49
NRHP			-0.45 [0.001] (0.14)	0.64	-1.06 [0.000] (0.28)	0.35
LogADT					-0.04 [0.484] (0.06)	0.96
Urban					-0.64 [0.141] (0.43)	0.53
State (factor)	No		No		Yes	
Structure Type (factor)	No		No		Yes	
YBDec (factor)	No		No		Yes	
N (Bridge-Years)	12,714		12,714		12,714	
Treatment N (Bridges)	352		352		352	
Control N (Bridges)	352		352		352	

p-values in brackets; two-tailed
Coefficient standard errors by bridge in parentheses

Tables 9 and 10 report the results of the linear regression models on the CEM matched sets for each dependent variable (see Supplements 12 and 13 for CEM summary data and Supplements 14 and 15 for intermediate models). Table 9 reports the results when considering the full set of bridges from the main analysis. Table 10 assesses only those bridges that do not permanently close and are in service at the end of the period of analysis. This allows more targeted assessment of post-enrollment impacts.

Assessing the full set (Table 9), the *NRHP* variable coefficient indicates that overall sufficiency rating minimally, though statistically significantly, improves following enrollment (0.96 points on a 100-point scale). Likely, the reason for such minimal though significant improvements on sufficiency rating is because of the three condition ratings only the substructure shows minimum though statistically significant improvement (0.13 points on a 9-point scale). This suggests substructure improvements are what drive the sufficiency rating boost.

Table 9. Linear Regression on Sufficiency and Condition Factors with CEM Preprocessing, all bridges

DV:	Sufficiency Rating	Deck CR	Substructure CR	Superstructure CR
(Intercept)	2.489[0.314]	4.829[0.000]	2.432[0.000]	5.372[0.000]
	(2.47)	(0.21)	(0.19)	(0.18)
Group	-2.007[0.000]	0.088[0.007]	-0.018[0.567]	-0.102[0.001]
	(0.36)	(0.03)	(0.03)	(0.03)
NRHP	0.964[0.040]	0.025[0.541]	0.131[0.001]	-0.005[0.898]
	(0.47)	(0.04)	(0.04)	(0.04)
LogADT	1.409[0.000]	0.171[0.000]	0.146[0.000]	0.218[0.000]
	(0.12)	(0.01)	(0.01)	(0.01)
Urban	-0.131[0.874]	-0.027[0.644]	0.141[0.006]	-0.058[0.269]
	(0.82)	(0.06)	(0.05)	(0.05)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.52	0.18	0.22	0.30
N (Bridge-Yr)	12,709	11,851	12,250	12,031
Treatment N (Bridges)	352	330	340	335
Control N (Bridges)	352	330	340	335

p-values in brackets; two-tailed
Standard errors by bridge in parentheses; FE = fixed effect

However, it is possible that these results are skewed by considering all enrolled bridges in the matched set, regardless of longevity on the system. We would expect those taken out of service at some point to decline in ratings while those remaining on the system should improve. In considering the subset of only those bridges that remain in service until the end of the period of analysis, the results in Table 10 support Hypothesis 2. After NRHP enrollment, the general sufficiency rating is minimally, though statistically significantly, improved (1.82 points on a 100-point scale), as is the substructure condition rating (0.18 points on a 9-point scale). The superstructure rating shows no significant change.

However, the deck condition rating also displays minimum, though statistically significant, improvement (0.11 points on a 9-point scale) in a departure from our hypothesis that only those elements not associated with the attachment of the social movement to the object (substructure) will improve following enrollment. This suggests that perhaps deck quality is viewed as a more practical concern if the bridge will continue to be utilized. Given that the deck directly carries roadway traffic, it is reasonable that users would be less comfortable with deterioration in this aspect than in superstructure. We also discover in the Robustness Checks section that this deck improvement tends to accrue over the long-term for bridges still in operation and is not an immediate effect from the movement. This suggests deck improvements is more a cumulative secular effect, possibly of minor engineering improvements over time on this component, rather than any short-term, more movement-specific effect.

Overall then, we find support for Hypothesis 2 that bridge rating improvement will be focused on non-historic aspects following enrollment. While registration spurs continued vehicular use as opposed to closure, it also restricts engineering options and produces only marginal improvements to non-historic components (i.e. substructure). This suggests that even as these systems are deteriorating, these social movements (via placement of these bridges on the NRHP) greatly restrict what can be done on these bridges as only minimal improvements on the more load-bearing, non-historic parts of the bridge seem possible.

Through this assessment, we demonstrate the ability of social movements to affect the built infrastructure as an end goal. These movements focus on preservation rather than change by decreasing closure rates of infrastructure objects (H1), as well as create engineering restrictions in the subsequent maintenance of those objects (H2).

Table 10. Linear Regression on Sufficiency and Condition Factors with CEM Preprocessing, only non-closed bridges

DV:	Sufficiency Rating	Deck CR	Substructure CR	Superstructure CR
(Intercept)	13.798[0.000]	5.352[0.000]	2.750[0.000]	5.885[0.000]
	(3.91)	(0.31)	(0.23)	(0.18)
Group	-0.907[0.033]	0.133[0.000]	0.032[0.361]	-0.082[0.012]
	(0.42)	(0.03)	(0.04)	(0.03)
NRHP	1.818[0.001]	0.105[0.017]	0.181[0.000]	-0.007[0.863]
	(0.53)	(0.04)	(0.05)	(0.04)
LogADT	1.509[0.000]	0.125[0.000]	0.097[0.000]	0.173[0.000]
	(0.14)	(0.01)	(0.02)	(0.01)
Urban	0.831[0.312]	-0.069[0.316]	-0.106[0.067]	-0.048[0.388]
	(0.82)	(0.07)	(0.06)	(0.06)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.53	0.19	0.21	0.31
N (Bridge-Yr)	8,885	8,003	8,347	8,164
Treatment N (Bridges)	214	194	202	198
Control N (Bridges)	214	194	202	198

p-values in brackets; two-tailed
Standard errors by bridge in parentheses; FE = fixed effect

ROBUSTNESS CHECKS

While the Cox Proportional Hazard model is widely utilized, the underlying assumption of a constant hazard rate may not be appropriate when discussing bridge closure. As bridges age, the expected hazard will likely increase due to deterioration and reduction in viability. To assess these concerns, we conducted a Piecewise Exponential approach (Friedman, 1982) using observations around 1-, 2-, 3-, and 4-year time intervals and modeled via the *glm* package in R. The results were robust to the findings of the Cox model, regardless of selected time interval (see Supplement 16).

The use of a *k-to-k* matching procedure ensures a closely comparable set of bridges, but also selects a single treatment-control bridge pair when there may be many others also contained in that stratum. We thus conducted a *k-to-m* process to include all members of the matched strata to provide a larger sample. These results were consistent to the main *k-to-k* findings for both the hazards and linear models (see Supplements 17 and 18). Additionally, as different bridges are enrolled in different years, this means that the window to observe changes in the post-enrollment period varies. Thus, we restricted the analysis to include only those observations within pre- and post-enrollment maximum windows of 3, 5, 7, and 9 years (see Supplements 19 and 20). This more conservative approach suggests that the deck rating improvements, which diverged from our hypothesized results, primarily accrue over the long-term for bridges that remain in operation. This long-term accrual is also the case for sufficiency rating improvements and the results reinforce the significance of substructure improvements, both in the near and long-term.

Finally, we include the *Total Project Cost* as a dependent variable in the linear regressions to assess financial arguments for NRHP enrollment (see Supplements 21 and 22). This is an estimation of all costs required for bridge rehabilitation or improvement outside of normal maintenance and must be updated at least every eight years. It is reported in thousands of dollars and is log-transformed for this analysis to handle skewness. We find that bridges that will enroll on the NRHP tend to have project costs that are around 48% more than bridges that will not enroll (from *Group* variable, Supplement 22, Panel A) and there is no significant difference to these costs in the post-enrollment period. When considering only those bridges that do not close, those that will be enrolled have approximately 29% higher project costs than those that will not be enrolled (from *Group* variable, Supplement 22, Panel B), but again there is no significant difference in the post-enrollment period. This reinforces the assertion that government entities and engineers are now faced with managing these bridges due to social pressures, even though maintaining the roadworthiness of existing bridges may be costlier than simply replacing them.

BOUNDARY CONDITIONS

While this study broadly discusses infrastructure systems and the combination of social and technical forces at play, the context selected here for exploration lends itself to some caveats. Our assertions hinge on the role of attachment in the formation of social movements through frames that evoke nostalgia and connectedness. Such attachment is likely much more easily developed in the case of more visible, aesthetically-pleasing and long-lasting pieces of infrastructure that are integrated into the landscape of communities. This is also suggested by the fact that objects such as buildings and bridges dominate the National Register of Historic Places listings. Thus, while infrastructure is generally considered in the framing of this research, it is likely that those systems which are less visible, such as sewage and pipelines, are less likely to generate the attachment needed for such social movements. Additionally, parts of systems that change or get replaced quickly may not last long enough to generate such attachment.

Another area for consideration is the regional variation in infrastructure importance. Previous studies show there is the potential for regional differences in areas whose engineering norms differ from nationally accepted standards (Desai & Armanios, 2018). Thus, aging infrastructure within industries that are important to local communities could also possibly generate the attachment necessary for movements of preservation.

DISCUSSION

Throughout this analysis, we have considered the challenge of how a deteriorating system may persist, even as its design standards are often misaligned with more modern present-day standards. While it is sensical to assume that deteriorating pieces of infrastructure would be replaced by newer, more modern versions, it is clear that many outdated pieces of infrastructure still exist, creating major engineering and social challenges. What is proposed here, through social movement theory as informed by insights from science and technology studies, is that a changing modern society can actually come to *push for the preservation rather than change* of their deteriorating infrastructure system. More specifically, the *attachment* that a local community can derive from a piece of local infrastructure can generate social movements that seek to preserve rather than change these systems, even when they are in disrepair.

Here, we have posited two ways of considering social movements in the context of the built environment. First, social movements are generally considered as bringing about change in some aspect of society (e.g. McAdam, 1982; Strang & Soule, 1998; Carroll & Swaminathan, 2000; Schneiberg & Soule, 2005; King & Soule, 2007; King & Pearce, 2010). However, this study contends that if the historicity of an infrastructure system is primarily of concern, and thus its cultural and social value, then social movements may arise not around change but around preservation. Whereas prior work discusses how reactionary movements or countermovements arise upon threats of political or social change (Meyer & Staggenborg, 1996), we show here how attachment to objects can also lead to the formation of such movements without necessarily requiring such sociopolitical threats. This is especially true when faced with the potential loss of an object that has significance to the community, such as an aging bridge, that evokes a sense of attachment and historic importance.

Second, social movements are rarely discussed as having the preservation of infrastructure as an end goal; rather the focus is on infrastructure as a means to serve some broader movement purpose (e.g. McAdam, 1982; Kitschelt, 1986; Star, 1999; Sine & Lee, 2009; Carlos et al, 2014. The continued existence of these structures is inherent in the movement's purpose and support to continued use in the infrastructure system requires proper maintenance. Our analysis suggests that social movements designed around the preservation of infrastructure do succeed in shaping the built environment directly; social movements can also see infrastructure as an end and not just a means. Bridges that are successfully enrolled on the NRHP have a reduced risk of closure in post-enrollment years as compared to bridges that are highly similar in design and usage but do not have an associated mobilization effort to gain NRHP registration.

Overall then, this study helps relax implicit assumptions within social movement theory, namely that you need a social or politically-oriented threat to drive social movements. Social movements may arise simply from a local community's attachment to the material objects around them. These movements arise not to change but to preserve these objects, even when these objects are in disrepair and no longer reflect current legitimated building standards.

As such, these social processes may provide a key explanation as to how *institutional relics* that are no longer appropriate based on current standards persist, which is highly pertinent to the deterioration in our current infrastructure systems. Prior research defines institutional relics as when infrastructure's "physical attributes reflect the accepted standards of the time and later persist even when those standards may change" (Desai & Armanios, 2018, p. 28). Analysis of ratings for these bridges indicates that while some aspects do minimally improve, such as overall sufficiency and substructure, the enrollment has little impact on more historically-focused components, such as superstructure. This is compounded by the observation that bridges targeted for enrollment have higher project costs than their counterparts, yet there is no significant reduction in costs following enrollment for those bridges remaining in use. This suggests that these movements constrain replacement options, otherwise costs would decline in the post-enrollment period as we know replacement becomes an increasingly cheaper alternative to repair as bridges age (Estes & Frangopol, 1999). As such, we see this study not just having important theoretical implications for social movement theory, but also helping to address key phenomenological challenges, namely novel explanations for the persistent deterioration in the U.S. infrastructure system.

Additionally, this study makes secondary contributions to science and technology studies. In particular, our study shows how social meaning ascribed by local communities, rather than just the physical constraints of these systems, can make a technical object resistant to change. Prior work in science and technology studies (STS) tends to prioritize "change over stasis" (Leonardi & Barley, 2010, p. 39). Moreover, when resistance is considered, the focus is on how the technical properties of the system constrain action and not the social values ascribed to these systems (Hutchby, 2001; Leonardi & Barley, 2010; Leonardi, 2011). In this manner, we add to recent STS literature that has begun to look at how the establishment of a technical object can shape the actions of the social context around it (Leonardi 2011; Leonardi & Barley 2010)

Finally, this study responds to recent scholarly calls for expanded dialog between engineering and sociology (Barley, 2016; Grabowski et al, 2017) and extends a nascent trend in such research in civil engineering (i.e. Javernick-Will & Levitt, 2010; Javernick-Will & Scott 2010; Peschiera & Taylor, 2012; Kaminsky & Javernick-Will, 2014; Desai & Armanios, 2018). In particular, this study considers collective action through the lens of the built environment. In the case explored here, the properties of a bridge that make it socially and historically relevant also make it more difficult for engineers and transportation offices to update and replace such an institutional relic, further embedding it in the transportation system. In this manner, technical challenges are intertwined with social concerns and collective action.

We hope our study opens new opportunities for more organizational theorists to consider these pressing engineering challenges. With the exception of the STS (and its related sociomateriality) literature, such phenomena have received little attention from organizational theory. As Barley (2016) notes, analyzing these phenomena would not just widen the social impact of organizational theory but also help us better inform these theories in the process.

POLICY IMPLICATIONS

The findings reaffirm the need for open and honest dialogue between government organizations and social organizations regarding projects and the true costs of such undertakings (Suchman, 2000; Selvaraj, Roy, & Mahalingam, 2017). Most importantly, a balance must be struck to ensure the preservation of history while also modernizing and updating a crumbling national infrastructure that already contains over 56,000 structurally deficient bridges and requires an additional 123 billion dollars to repair (American Society of Civil Engineers, 2017). This clearly indicates that states are already under deep resource constraints and that tradeoffs must continue to be made in how we approach historic bridge preservation.

One common approach that has been taken is to transition these bridges to end-of-life and repurpose them for display, pedestrian, or recreational use. Effective strategies include establishing trails, providing them as areas for community events, and relocating smaller bridges to parks or public spaces. Once removed from the transportation network, civic organizations and historic preservation offices must then pick up the cost of maintenance, which can be extensive if left in place. Open dialogue with a defined deadline for either private acquisition or government demolition can help to provide an opportunity for preservation off the road network and give social movements and activists a realistic assessment of the financial and safety impacts of long-term continued traffic service. A federal effort via the Department of the Interior and Congressional budget committees to fully funding the Historic Preservation Fund can also have a large impact in this area. Although authorized at $150 million annually, this program has averaged less than $50 million in allocated funding per year (National Parks Service, 2017). As of 2012, the limited number of historic bridges considered only within our dataset required over $990 million in total project costs for structural improvements. Dedicating additional preservation funds to bridge transition efforts may further assist in either full long-term rehabilitation for service or removal to a less maintenance-intense purpose.

Chapter 4

Determination of Influential Factors on Roadway Bridge Sufficiency and Condition Using Inspection Data and LASSO: A Proof-of-Concept

Although experts and rating systems to prioritize structures for remediation exist at the federal level, bridge deterioration models may be limited in geographic and temporal scope and may only include a limited number of factors. This study seeks to help alleviate these limitations and provides a methodology to assist bridge designers and managers in selecting the most influential variables for their bridges by considering 64 different variables from the United States National Bridge Inventory System and across 20 years of data (1993-2012). The basis for this methodology is the least absolute shrinkage and selection operator (LASSO) approach for attribute selection. We find that a mixture of inspector-driven variables and design/maintenance variables, especially inventory rating, age, load posting, bypass, structural evaluation, and vertical clearance, are highly influential in calculating overall bridge sufficiency rating. When including weather variables, precipitation is also influential toward sufficiency rating. Variables including age, inventory rating, deck condition, and bride railings are highly influential toward inspector-rated superstructure and substructure conditions. We feel this proof-of-concept can eventually be tailored to national, state, and local needs so as to help decisionmakers at each of these levels more quickly identify the key factors that persistently influence bridge sufficiency.

INTRODUCTION

Bridge inspections are critical in ensuring the continuing sufficiency and viability of the national transportation infrastructure. Although experts and rating systems exist at the federal level to prioritize structures for remediation, there are still more than 56,000 structurally deficient bridges in the United States, comprising 9.1% of the national bridge system (American Society of Civil Engineers, 2017). This study argues that perhaps when considering deterioration and prioritization, existing methods are prematurely limiting in that they utilize a small number of variables that are collected and reported during formal bridge inspections (Federal Highway Administration, 2000). While many other methods and approaches exist for predicting bridge deterioration, they are subject to the choice of variables and study region within the model, which can be limited by model design or by availability of data (Enright & Frangopol, 1999). Perhaps, then, there are additional variables that are already being collected and reported which are influential in bridge deterioration but are not being considered through current methods. In so doing, we could potentially further hone in our structure prioritization choices to rank and remediate existing structurally deficient bridges.

The National Bridge Inventory (NBI) contains a wide array of information across design, usage, and technical inspection attributes and is reported across the entire United States (Federal Highway Administration, 2016). While bridges are required to be inspected at least every two years, the National Bridge Inspection Standards (NBIS) also mandate that all roadway bridges be reported annually. This provides a temporally-based data set that allows for examination and generalization across the entirety of the bridge system. Especially for assisting in a nationwide bridge prioritization strategy, such generalization is needed given the predominant focus in previous studies is on a particular state, region, or set of variables, such as design type (e.g

Kushida et al., 1997; Mourcous et al., 2002; Melhem & Cheng, 2003; Chang, 2016; Contreras-Nieto et al., 2016; Jonnalagadda et al., 2016). The aim of this study then is to develop a proof-of-concept of how to more systematically and widely assess bridge inspection data so bridge managers can further prioritize the remediation of structurally deficient bridges.

To develop such a proof-of-concept, this study focuses on the direct and indirect factors that drive sufficiency rating. Bridge sufficiency rating is a critical measure of a bridge's capacity to remain in service. This measure is also heavily utilized as an indicator of overall system health and a way to provide thresholds for funding decisions on rehabilitation and replacement (American Society of Civil Engineers, 2017). However, while only 18 variables are used to calculate this metric, there are 135 variables collected by the NBIS (including sub-attributes of combination codes). This suggests that perhaps other variables may be relevant to sufficiency rating that are not being included. Additionally, based on analysis of the data used in this study, over 14% of bridge reports between 1993-2012 contain an asterisk prefix for the sufficiency rating, indicating that some essential data for the calculation was missing or incorrectly coded.

Overall then, if we can perhaps develop an approach that helps connect and identify the most critical factors that influence sufficiency rating, we could perhaps better assist both managers and designers in better prioritizing remediation of structurally deficient bridges. Thus, our aim is to help bridge managers distill the wide and rich array of NBI data into a key set of influential factors on sufficiency rating. In so doing, this study aims to create a replicable methodology that more systematically and comprehensively connects bridge inspection data to those bridge managers who are seeking to further concentrate their limited time and resources on those bridges that have the greatest impact on traffic and are most in need of repairs.

The literature surrounding bridge management suggests myriad attributes that are important to how bridge sufficiency is defined. While many approaches discuss technical factors (i.e. condition ratings) as being the essential qualities (e.g. Hachem et al., 1991; Chengalur-Smith et al., 1997; Estes & Frangopol, 2001), the issue of user costs and influence of socially-generated attributes is also considered (e.g. Lemer, 1996; Liu & Frangopol, 2005; Chang & Garvin, 2008; Sobanjo & Thompson, 2011). Sociological research also considers the interplay between the social and technical, arguing that they are intertwined and that design and management choices fundamentally impact society, just as society can impact management (e.g. Winner, 1980; Law, 2012; Desai & Armanios, 2018a, 2018b). Thus, when considering decision making processes, we include not just technical but also social factors that could influence bridge prioritization.

This paper builds on and extends previous research in critical ways. Prior studies begin with a predefined set of variables, states, or regions (e.g. Mourcous et al., 2002; Melhem & Cheng, 2003; Chang, 2016; Contreras-Nieto et al., 2016). As such, prior research often has to justify up-front the variables included in the research (e.g. Tokdemir et al., 2000; Melhem & Cheng, 2003; Contreras-Neito et al., 2016). Given existing computational capacity, our study seeks to relax these assumptions and instead allows for a more replicable mathematically-driven approach to variable selection. We do this through utilizing a least absolute shrinkage and selection operator (LASSO) statistical approach to identify the most influential variables across a broad range of reported characteristics. As such, the methodology trialed here makes fewer up-front restrictions, which allows this approach to utilize data from the entire bridge system across 20 years of data to better inform the most influential variables that generalize across the entire NBI. In other words, our approach allows the data to drive the most important factors while making less up-front assumptions as to what those factors should be included. As such, we feel this process is a more tailorable and replicable one where federal policymakers can use the entire dataset, as we do here. At the same time, state officials can use this methodology only on their own state's bridges to ensure the most influential factors are tailored to their bridge needs.

This approach also eschews a focus on highly accurate year-over-year prediction and instead provides a feedback loop based on reported inspection data. More specifically, besides isolating the influential factors on sufficiency rating, we also indirectly assess those factors that drive sufficiency rating and are based on an inspector's expert judgement. In so doing, we do not just help bridge designers and managers understand those variables that influence sufficiency rating. We also help bridge designers and managers better appreciate those factors that can guide inspector-driven appraisals, which also contribute to sufficiency ratings. The goal, therefore, is to both draw inferences on a systemwide level and provide an analysis framework by which designers and managers at all levels can gain insight from a variety of socially and technically-relevant inspection data.

MACHINE LEARNING IN BRIDGE MANAGEMENT

Machine learning and deterioration modeling techniques such as LASSO have frequently been utilized to attempt to address a variety of bridge management challenges. Across a variety of different algorithms and approaches, the end goal has generally been to select key variables for inclusion, train a model based on acquired or imputed data, and assess its predictive efficacy. In this manner, the focus is generally on providing feedback on the current and future state of the system by either enhancing or supplanting physical inspectors. The quality and type of data, coupled with the research focus area, then drives which variables can or should be included.

One stream of research effort focuses on deterioration modeling by trying to improve the efficiency and quality of physical inspections. For example, Hachem et al. (1991) proposed a methodology that included 22 attributes in an attempt to predict sufficiency rating. Their model argued that thresholds could be used to optimize the timing of required bridge inspections and more efficiently deploy inspectors to focus on bridges at greatest risk for poor sufficiency. Kushida et al. (1997) used a neural networks approach to improve on concrete bridge rating systems using 10 judgement factors elicited from inspectors. Sun et al. (2004) used the deck, superstructure, and substructure condition ratings from the NBI, combined with projected state financial outlays, to predict future bridge health and the need for additional rehabilitation in Louisiana bridges.

Another stream focuses primarily on predictive quality, using a variety of attributes to try and make inspection results more accurate and improve bridge management systems. For example, Melhem and Cheng (2003) used eight deck survey attributes from Kansas bridge inspectors and both *k*-nearest-neighbor and inductive learning approaches to attempt to predict the remaining service life of bridge decks. Tokdemir et al. (2000) used 28 variables from California bridges in 1999 to develop artificial neural network (ANN) and genetic algorithm approaches for prediction of sufficiency ratings. Selecting six design-focused variables from the 2014 NBI, Jonnalagadda et al. (2016) used ANN and full factorial-based simulation to predict deck and superstructure condition for prestressed concrete bridges in the southeastern United States.

While the preponderance of machine learning work in this area tends to focus on artificial neural networks (e.g. Kushida et al., 1997; Tokdemir et al., 2000; Huang, 2010; Winn & Burgueño, 2013; Jonnalagadda et al., 2016), there have been several alternative approaches utilized as well. For example, Morcous et al. (2002) developed a case-based reasoning approach for modeling deck deterioration and applied it using 17 attributes of bridges in Quebec. Contreras-Nieto et al. (2016) compared decision tree and regression approaches with neural networks in predicting superstructure ratings. Their study used 18 attributes from the 2013 NBI and focused on Oklahoma bridges with specific design and material characteristics. Desai and Armanios (2018b) utilized coarsened exact matching, hazard models and linear regression to assess changes in sufficiency and condition ratings as a result of bridges receiving a historic designation.

With all of these studies, the biggest limiting factor is in the selection of inputs to include in the model. Naturally, these are restricted by data availability, quality of the inputs selected, and computational power. In some cases, strict limitations are placed on the types of bridges included for analysis, such as by predicting only for those with a certain type of material or design characteristic (e.g. Kushida et al., 1997; Jonnalagadda et al., 2016). Additionally, most studies use only a single year of data and are restricted to a single state or localized region, which presents issues with generalizability (e.g. Tokdemir et al., 2000; Contreras-Nieto et al., 2016; Jonnalagadda et al., 2016). The method presented here is thus designed to broaden these approaches by assessing a large number of potential attributes, including all bridges in the national system that have complete data, and using 20 years of national data from the NBI, both cross-sectionally and in combination.

THE LASSO REGRESSION APPROACH

When conducting data analysis, major challenges occur both when selecting the appropriate variables for inclusion into the model and then attempting to interpret the model based off those variables. In situations where the data presents a large number of variables for consideration, and the researcher wishes to identify a set of these attributes for model inclusion, an alternative approach to value-based judgment is to utilize the least absolute shrinkage and selection operator (LASSO) to assist in identification of influential attributes (Tibshirani, 1996).

This process allows for inclusion of all potential variables and a tuning parameter (λ) that can progressively add coefficients to the regression based on relative importance. Mathematically,

$$\hat{\beta} = argmin[\|y - \boldsymbol{X}\beta\|_2^2 + \lambda\|\beta\|_1]$$

where the first term is the L2-norm for least squares error and the second term is the L1-norm for least absolute deviation. The latter serves as a penalization, with the parameter (λ) always greater than or equal to zero.

This approach was successfully utilized by Chang (2016) to identify critical variables in determining deck, superstructure, and substructure condition ratings. The study considered bridges in Wyoming using 2104 NBI data across 27 attributes. The top five attributes were then identified and discussed for each rating based on systematically decreasing the value of λ utilized. The LASSO method has also been used in other engineering challenges, such as forecasting road traffic and residential energy consumption in order to assist in attribute selection (Kamarianakis et al., 2011; Jain et al., 2014).

We utilize the general approach of Chang (2016), but with important modifications. First, we expand the number of NBI attributes considered for the LASSO to 64. Second, we utilize the entire national dataset across 20 years to maximize generalizability. Third, we consider sufficiency rating as the initial outcome variable, as that is the metric most commonly utilized in management decisions and government funding allocations for rehabilitation (Federal Highway Administration, 1997; American Society of Civil Engineers, 2017). We then use those results to guide second-stage analysis of those inspector-driven attributes deemed important to sufficiency rating. Fourth, we identify the top-10 attributes from each of the 20 years and then use a weighted aggregation to identify the most influential across all years. Using the entire dataset, we then use the selected attributes to calculate prediction error across all 20 years to assess generalizability.

Granted, there are other possible modelling techniques that can be used for this purpose such as the Stepwise Forward Selection approach. Given our aim is to help bridge managers identify the most influential attributes from inspection data to help them quickly and better prioritize bridge remediation efforts, the functionality of LASSO was particularly desired as it allows for us to systematically ascertain how we limit attributes across models. In particular, this is done through incrementally change the tuning parameter (λ) that reduces the numbers of variables selected into the model. From that, the optimal model is the one with the least number of parameters that also leads to significant reductions in mean-squared error (MSE). As will be noted below, models including the 10 most influential parameters provided the best tradeoff between number or parameters and model accuracy (i.e. minimized MSE). Figure 8 summarizes the approach used here.

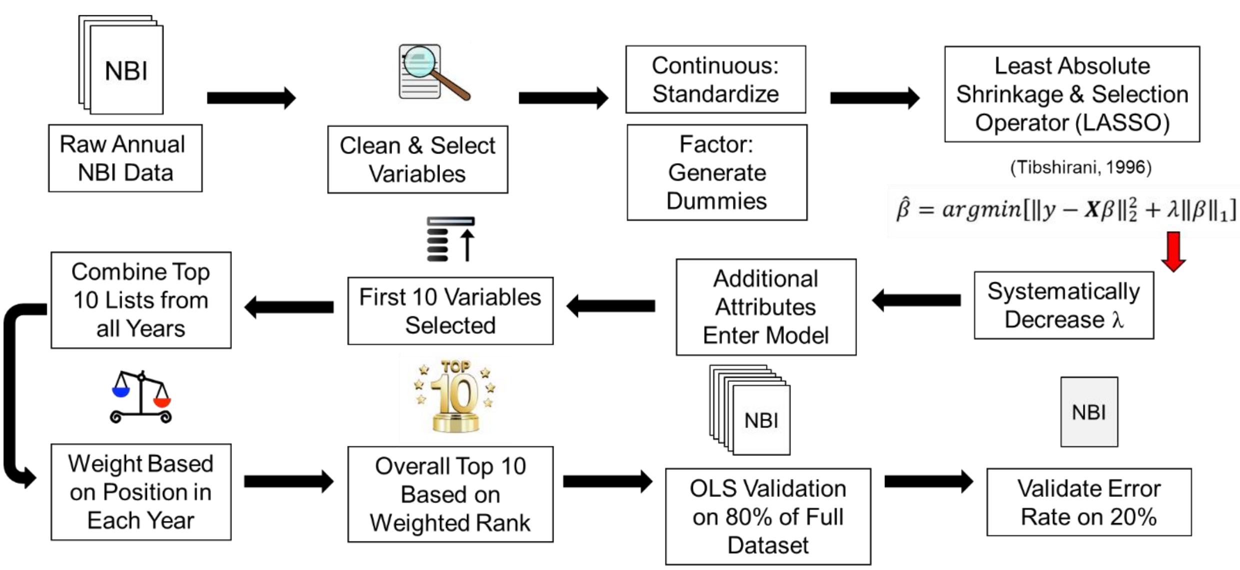


Fig. 8: Summary of LASSO Regression Approach Methodology

DATA

In order to consider the entirety of the bridge system, this study utilizes the National Bridge Inventory (NBI), a nationwide compilation of U.S. bridges maintained by the Department of Transportation's Federal Highway Administration (FHWA). Collected annually and publicly available since 1992, this Inventory falls under the National Bridge Inspection Standards (NBIS), which define the criteria and frequency of public bridge inspections (23 U.S.C. § 101). Prior to 2013, states were also requested to report bridges that did not necessarily meet NBIS criteria but were still associated with important routes within the state infrastructure system (Federal Highway Administration, 2000). In 2013, a policy change restricted these annual reports to only the NBI-qualified bridges, resulting in a removal of many previously reported entries. Additionally, initial analysis demonstrated that the 1992 NBI contains a much higher number of missing variables than all other years and thus a much lower number of complete observations when compared to the total reported bridge population. Therefore, this study considers data from 1993 to 2012 (the last date prior to reporting policy changes). The resulting data consist of 20 observation years, with raw total entries ranging from 670,876 in NBI-1994 to 716,436 in NBI-2012, with over 13.9 million entries across all 20 years.

The NBI is known to have reporting errors due to missing values and miscoding. To account for these challenges, all variables were cleaned using the official NBI coding guide to remove any invalid entries (Federal Highway Administration, 2000). All invalid codes were coerced to reflect missing values, as codes representing "NA" are valid for many of these attributes. Several variables have defined maximum thresholds, such as ones dealing with clearance height (i.e. an entry of 30-meters indicates 30-meters or greater of clearance up to unlimited clearance). In these cases, all reported values exceeding the threshold were coerced to the threshold value. For several variables, we employed an approach of logical error checks to define threshold values, such as with conservative minimum values for reported clearance heights (Din & Tang, 2016; Desai & Armanios, 2018). Finally, the top 0.01% of entries for continuous variables lacking a defined upper threshold value were removed to mitigate outliers.

Two variables were also significantly modified from their original versions for the purposes of this analysis. While age of the structure is often considered to be a highly influential variable, simply relying on the original year of construction, reported in the NBI as the year built (NBI Item 27), does not take into account major reconstruction. We thus consider year built in combination with a year of reconstruction (NBI Item 106), if provided, to create an imputed age based on original building date or reconstruction date (Hachem et al., 1991). Second, the variables indicating ownership and maintenance responsibility include dozens of codes for specific agencies. To provide greater generalization, these are grouped into four levels representing federal, state, sub-state (county or local), or private (including railroad) ownership (Desai & Armanios, 2018a). Additionally, we add a binary variable for urban vs. rural location, which is based on the functional classification of the route.

If the ultimate goal is to compare relative coefficient sizes to determine model impact, then it is important for all variables to be comparable. As the data contain a mix of discrete and continuous variables, we conducted a standardization procedure on the continuous predictors by subtracting the mean and dividing by the standard deviation. Discrete factor variables were expanded into a set of dummy variables via the *model.matrix* function in R prior to analysis. This allows the LASSO to more appropriately return the most influential coefficients, without concern over parameterization choices within the modeling framework, and is in line with recommendations from Gelman (2009).

While there are 135 attributes reported in the NBI, not all of these entries are usable when conducting quantitative analysis. We conducted a systematic assessment of each variable to identify those that are feasible and useful for inclusion. The three reasons for attribute removal were: 1) The attribute is a string variable, such as a description of roadway intersections; 2) The attribute has high levels of missing or non-reported entries across all years of data, such as those which are only required to be reported for certain types of bridges; and 3) The attribute lacks variability within the data set as there are very few observations that are outside of a single reporting category. For example, more than 95% of entries for the directional suffix of the route (NBI Item 5E) were reported as not applicable. This resulted in 64 variables considered, which span across social/geographic influenced, design/management influenced, and inspection influenced categories (see Table 11).

Table 11. Attributes considered in LASSO Models

Attribute	NBI Item #	Type	LASSO Treatment
Sufficiency Rating	SR	Integer	DV
Social/Geographic Attributes:			
State Code	1	Discrete	Factor Dummies
Route Signing Prefix	5B	Discrete	Factor Dummies
Designated Level of Service	5C	Discrete	Factor Dummies
Toll	20	Discrete	Factor Dummies
Maintenance Responsibility	21	Discrete	Factor Dummies
Owner	22	Discrete	Factor Dummies
Functional Class of Inventory Route	26	Discrete	Factor Dummies
Urban	[26]	Binary	Binary
Average Daily Traffic	29	Integer	Standardized
STRAHNET Highway Designation	100	Discrete	Factor Dummies
Highway System of Inventory Route	104	Binary	Binary
Average Daily Truck Traffic	109	Integer	Standardized
Designated National Network	110	Binary	Binary
Design/Management Attributes:			
Inventory Route, Min Vertical Clearance	10	Continuous	Standardized
Bypass, Detour Length	19	Integer	Standardized
Imputed Age	[27, 106]	Integer	Standardized
Lanes On Structure	28A	Integer	Standardized
Lanes Under Structure	28B	Integer	Standardized
Design Load	31	Discrete	Factor Dummies
Approach Roadway Width	32	Continuous	Standardized

Skew	34	Integer	Standardized
Structure Flared	35	Binary	Binary
Bridge Railings	36A	Discrete	Factor Dummies
Transitions	36B	Discrete	Factor Dummies
Approach Guardrail	36C	Discrete	Factor Dummies
Approach Guardrail Ends	36D	Discrete	Factor Dummies
Navigation Control	38	Discrete	Factor Dummies
Structure Open / Posted / Closed	41	Discrete	Factor Dummies
Kind of Material / Design (Main Structure)	43A	Discrete	Factor Dummies
Type of Design / Construction (Main Structure)	43B	Discrete	Factor Dummies
Kind of Material / Design (Approach Spans)	44A	Discrete	Factor Dummies
Type of Design / Construction (Approach Spans)	44B	Discrete	Factor Dummies
Number of Spans in Main Unit	45	Integer	Standardized
Number of Approach Spans	46	Integer	Standardized
Inventory Route, Total Horizontal Clearance	47	Continuous	Standardized
Length of Maximum Span	48	Continuous	Standardized
Structure Length	49	Continuous	Standardized
Left Curb / Sidewalk Width	50A	Continuous	Standardized
Right Curb / Sidewalk Width	50B	Continuous	Standardized
Bridge Roadway Width, Curb-to-Curb	51	Continuous	Standardized
Deck Width, Out-to-Out	52	Continuous	Standardized
Min Vertical Clearance Over Bridge Roadway	53	Continuous	Standardized
Reference Feature (Under - Vertical)	54A	Discrete	Factor Dummies
Minimum Vertical Underclearance	54B	Continuous	Standardized
Reference Feature (Under - Lateral)	55A	Discrete	Factor Dummies
Minimum Lateral Underclearance	55B	Continuous	Standardized
Temporary Structure Designation	103	Binary	Binary
Deck Structure Type	107	Discrete	Factor Dummies
Type of Wearing Surface	108A	Discrete	Factor Dummies
Membrane Type (Wearing Surface)	108B	Discrete	Factor Dummies
Inspection Attributes:			
Deck (Condition Rating)	58	Discrete	Factor Dummies
Superstructure (Condition Rating)	59	Discrete	Factor Dummies
Substructure (Condition Rating)	60	Discrete	Factor Dummies
Channel & Channel Protection (Condition Rating)	61	Discrete	Factor Dummies
Culverts (Condition Rating)	62	Discrete	Factor Dummies
Operating Rating	64	Continuous	Standardized
Inventory Rating	66	Continuous	Standardized
Structural Evaluation (Appraisal Rating)	67	Discrete	Factor Dummies
Deck Geometry (Appraisal Rating)	68	Discrete	Factor Dummies
Underclearance, Vertical & Horizontal (Appraisal Rating)	69	Discrete	Factor Dummies
Bridge Posting (Appraisal Rating)	70	Discrete	Factor Dummies
Waterway Adequacy (Appraisal Rating)	71	Discrete	Factor Dummies
Approach Roadway Alignment (Appraisal Rating)	72	Discrete	Factor Dummies
Scour Critical Bridge	113	Discrete	Factor Dummies

RESULTS

SUFFICIENCY RATING

Sufficiency rating is heavily used as a comprehensive indication of bridge health and is tied to funding decisions on repair or replacement options. Currently, the United States sufficiency rating approach considers 18 variables and contains both rule-based and nonlinear transformations across design, usage, and inspector-determined variables (Federal Highway Administration, 2000). Thus, we utilize the LASSO approach as a way to assist in either confirming that the variables presently used in the calculation are indeed the most influential or to identify other attributes for consideration.

First, the LASSO procedure was performed cross-sectionally across each of the 20 years of data, with 80% of randomized annual records used for training the model and 20% used for predictive validation. The *glmnet* function in the R *glmnet* package was utilized to progressively decrease the tuning parameter (λ) values and thereby identify when each attribute entered the model. To provide a manageable list of attributes, we identified the first 10 variables to enter the model for each of the 20 years. For factors, we included the entire variable with all levels if any one of the dummy attributes corresponding to its levels appeared in the top-10. This is a conservative approach, as it is possible that other code levels are of only minor importance. Supplement 23 reports the findings from each year of data and the lambda value corresponding to each variable's entry into the model. Prediction was also conducted on the test set using the lambda that provided for 10 variables in order to obtain error rates. Additionally, we performed a 10-fold cross-validation using the *cv.glmnet* function to identify the lambda that minimized the mean cross-validation error. While this approach included far too many non-zero attributes to be practically useful, the error rate is useful as a minimum threshold for comparison.

However, we wish to use these cross-sectional results to generalize to the overall system, regardless of year modeled. Thus, Table 12 lists all of the variables identified in the top-10 for each of the 20 years and their total number of top-10 appearances regardless of position. They are ordered based on a weighted total of importance within each year, with a scale of 10 to 1 points from the most influential to the tenth most influential. To determine if the variable selection is both appropriate and effective, regardless of the year being modeled, the 18 identified attributes were progressively added into an OLS linear model in R using the *lm* function. For this approach, all 20 years of data were aggregated and randomized, with 80% selected for training and 20% for prediction.

Table 13 summarizes the error rates from the cross-sectional LASSO approach. On average across the 20 modeled years the absolute error was approximately 11 points for the sufficiency rating, which is reported on a 100-point scale, when identifying the top-10 unique variables. Table 14 summarizes the error rates for the full OLS predictive approach, while Figure 9 graphically depicts the gain in predictive capacity when adding additional variables to the full data set. The predictors were added in rank order according to Table 12 and the mean absolute error was less than 7 points on a 100-point scale when using the top 10 overall predictors. Note that the error rate was also expected to be slightly lower in this case than in the cross-sectional approaches as all levels of factor variables in the OLS were included here, while only those levels that were highly influential were included in the error calculations for LASSO.

The results tend to support the current sufficiency rating calculation approach, but with some modifications. Of the 18 variables identified here, 12 of them are already included in the FHWA calculation, including 6 of the top 7 most influential. It is clear that the most influential variable is inventory rating, which defines the load level that can safely use a bridge for an indefinite period of time (Federal Highway Administration, 2000), as it was the first attribute selected in all years. Four of those variables that are identified but not included in the FHWA equation are closely related to the inventory rating, such as bridge posting, which reports whether load postings are required, operating rating, which reflects the maximum permissible load, the design load, and whether the bridge is open, posted for load, or closed to traffic. Similarly, the inventory route minimum vertical clearance is closely related to the minimum vertical clearance over bridge roadway, which is already included as the sixth-most influential variable.

The inventory route total horizontal clearance is related to the bridge roadway width (NBI Item 51), but while the latter is included in the FHWA calculation only the former is present in the influential attribute list. The major difference between these two metrics is that the roadway width measures the sum of all elements between restrictive features across the entire bridge, while the total horizontal clearance reports the single maximum width available for wide-load traffic (Federal Highway Administration, 2000). In other words, on a two-lane bridge with a divider median, the former would report the sum of both lane widths, while the latter would only report the wider of the two individual lane widths. This finding could indicate a potential area for reevaluation in the FHWA formula.

Age has long been considered as an influential variable in modeling and it is noteworthy that our approach of updating and imputing age since rehabilitation instead of relying on the original year built continues to demonstrate importance. The attributes are also dominated by those categorized as inspector and design/management, with 5 of the top 10 weighted attributes from each of these categories. Average daily traffic is commonly used as a metric of usage and, while still influential, is less so than would be expected.

While the results support the general calculation of sufficiency rating, there are also several factors used in the FHWA calculation that were not identified in the top-18 influential attributes. Culvert rating applies only to those bridges that are reported as culverts, thus it may be that the act of generalizing to the entire roadway system is highlighting factors for the majority of bridges but not specific types. Deck condition rating is also not included, which may indicate that of the three major component ratings – deck, superstructure, and substructure – the deck is less influential. The design-focused variables of lanes on the structure and approach roadway width are also not included, though they may be related to the horizontal clearance variable that is included. The waterway adequacy, vertical and horizontal underclearances are also not identified in the most influential listings, nor are traffic safety features or the Strategic Highway Network (STRAHNET) designation, which indicates if the bridge is on the military defense roadway network.

In general, what the findings suggest is that the current FHWA calculation tends to include variables that are highly influential in predicting bridge sufficiency. However, this model also presents some modifications in that other influential variables are not directly from the original FHWA calculation but related to those variables used in the calculation. Those of highest influence, including inventory rating, load-related items, and evaluation and condition ratings are already large components of the FHWA calculation, while many of those that were not identified contribute much smaller percentages to the overall sufficiency determination. In short, this model agrees with the overall architecture of the FHWA calculation of sufficiency rating, but its results do suggest some potential modifications to some of its parts.

Table 12. Influential attributes for Sufficiency Rating based on cross-sectional LASSO

Weighted Rank	Attribute	NBI Item #	FHWA Included?	Total Appearances	Weighted Importance
1	Inventory Rating	66	Yes	20	200
2	Imputed Age	[27, 106]	Yes	20	180
3	Bridge Posting (Appraisal Rating)	70	No	20	146
4	Bypass, Detour Length	19	Yes	20	136
5	Structural Evaluation (Appraisal Rating)	67	Yes	20	103
6	Min Vertical Clearance Over Bridge Roadway	53	Yes	19	103
7	Kind of Material / Design (Main Structure)	43A	Yes	20	62
8	Operating Rating	64	No	6	48
9	Superstructure (Condition Rating)	59	Yes	12	30
10	Design Load	31	No	12	26
11	Structure Open / Posted / Closed	41	No	6	17
12	Inventory Route, Total Horiz Clearance	47	No	3	15
13	Type of Design / Construction (Main Structure)	43B	Yes	5	11
14	Average Daily Traffic	29	Yes	8	9
15	Deck Geometry (Appraisal Rating)	68	Yes	5	5
16	Inventory Route, Min Vertical Clearance	10	No	2	5
17	Substructure (Condition Rating)	60	Yes	1	2
18	Approach Roadway Alignment (Appraisal Rating)	72	Yes	1	2

Table 13. Test set error rates from LASSO modeling approaches with 20 cross-sectional iterations (1993-2012), Sufficiency Rating

	N	With 10 unique variables		Minimized CV mean error	
		rMSE	MAE	rMSE	MAE
Max	572,588	14.26	11.28	6.36	4.65
Min	470,614	13.60	10.71	5.66	4.24
Mean	536,046	14.02	11.10	5.97	4.45

Table 14. Error rates from full OLS approach adding complete predictors with all levels in order of weighted importance, Sufficiency Rating

	N	rMSE	MAE
1 Predictor	10,720,919	17.20	13.77
5 Predictors		9.31	7.36
10 Predictors		8.68	6.84
15 Predictors		6.92	5.20
18 Predictors		6.65	5.02

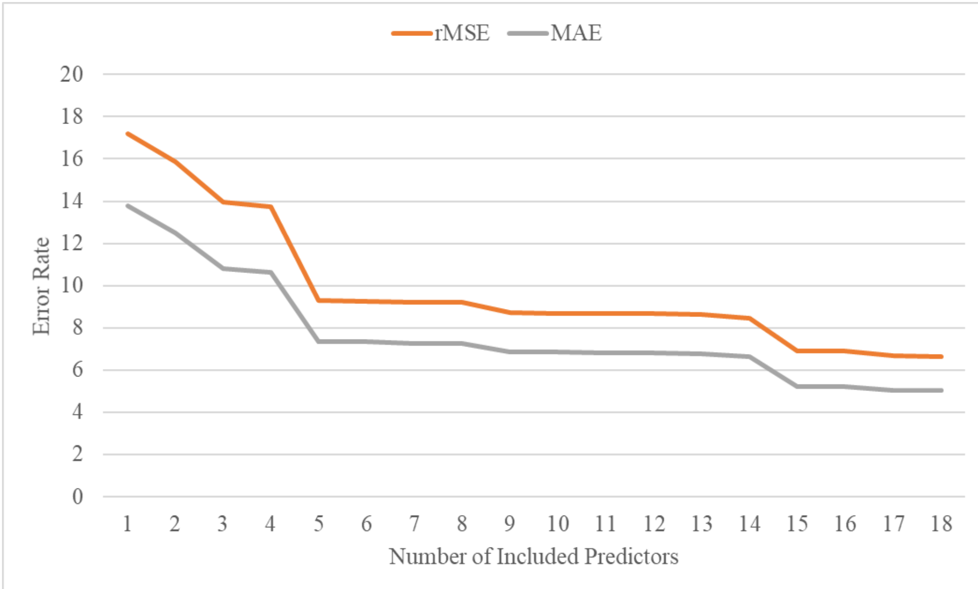


Fig. 9. Error rates as a function of number of predictors utilized in the Sufficiency Rating model

INFLUENTIAL INSPECTOR RATINGS

While the LASSO successfully identified the variables influential for sufficiency rating, many of the major variables are based on the expert judgement of inspectors after conducting physical examinations of the bridge. Some of these, such as inventory rating, bridge posting appraisal, and operating rating, have well-defined standards and methods for technical calculation. However, the structural evaluation appraisal rating is primarily based on inspector judgment. This rating is determined by the lowest of the superstructure or substructure condition ratings, or alternatively by considering a combination of inventory rating and average daily traffic. As the goal of this paper is to provide useful feedback for designers and managers in support of sufficiency, we now consider a second LASSO analysis to identify the influential parameters on these appraisal ratings, namely those that are influential on the judgment-based superstructure and substructure ratings.

Both of these condition ratings utilize an ordinal scale from 0 to 9, with the ability to code "N" if the rating is not applicable for the bridge. For this analysis, only observations given a numerical rating are included. A higher rating reflects a better condition based on the inspector's analysis, where 0 reflects "failed condition" and 9 reflects "excellent condition." The guidelines also provide a short set of grading criteria for each level. For example, a rating of 4 indicates "poor condition" and is defined as "advanced section loss, deterioration, spalling, or scour" (Federal Highway Administration, 2000). Condition ratings are designed to indicate the overall condition of that part of the bridge as it exists at the time of the inspection.

We utilized the same approach as above, beginning with cross-sectional assessments on all 20 years of data and then identifying the top-10 attributes within each year. In this case, we removed the two variables considered here, along with the structural evaluation variable, from consideration in the LASSO. Table 15 through Table 20 summarize the influential attributes from each of the two rating models, along with the error rates from the LASSO and full-predictive model. Supplements 24 and 25 report the findings from each year of data and the lambda value corresponding to each variable's entry into the model. For the assessment of superstructure, 17 variables were identified in the cross-sectional influential lists, with a mean absolute error of approximately 0.7 points for ten predictors in any given year. For the substructure assessment, 19 variables were identified, with a mean absolute error of approximately 0.8 points for ten predictors in any given year. For the OLS prediction, the top-10 variables with full factor-level inclusion produced a mean absolute error between 0.6 and 0.7 on a 9-point scale across the dataset.

There are striking similarities among the two lists of selected variables. Age and inventory rating were the first two identified by the model in all 20 years for both superstructure and substructure. This continues to highlight the importance of age, even when accounting for major reconstructions as we do here. Deck condition rating also plays an influential role in both ratings, suggesting that assessments and reporting of the three major condition ratings – deck, superstructure, and substructure – are correlated with each other as inspectors make their determinations. Even though deck rating is included in the FHWA sufficiency rating formula, it is individually responsible for a much lower percent of the overall rating (~5%) than superstructure or substructure (~55%). However, this finding suggests that the deck and its components may be much more important in the overall bridge rating through influencing other variables. This is supported by the fact that the type of wearing surface used on the deck is also highly influential in both superstructure and substructure ratings. The deck, while treated separately for inspection purposes, is also highly coupled with the bridge's superstructure in engineering and we know that that substructure supports these parts of the bridge and transfers structural load to the foundation (Zhao & Tonias, 2012).

From a design perspective, it is interesting to note that bridge railings are influential to both superstructure and substructure. Specifically, the factor-level attribute appearing in these results was for a rating code of 1, which indicates that bridge railings meet currently acceptable standards. This suggests that potentially taken-for-granted aspects of infrastructure safety systems still play an influential role when assessing the system as a whole. This variable may be identified because safety features are a component of the FHWA sufficiency rating calculation, with the substructure and superstructure ratings serving as a large percentage of the total rating. The purpose of bridge railings is to effectively redirect impacting vehicles and minimize their effect on the structure, thus one reason for the variable's inclusion here may indicate a reduced risk of collision damage that would weaken the structure or create remediation challenges. Additionally, the kind of material used in the structure is influential when considering ratings. In this case, the attribute indicating the use of steel was the first to enter the model and could be indicative of greater degradation challenges than with concrete.

We also see channel protection as influential on inspector-driven assessments. One explanation for this theory is that perhaps this relates to waterway adequacy and thus, the potential for a bridge to experience scour. This is especially crucial in lieu of past work that notes the influence of bridge scour and waterway adequacy on the potential for bridge collapse (Flint et al., 2017). As such, the LASSO results suggest that those bridges interacting with water have additional deteriorating challenges than those passing over another road, railway, or dryland structure.

Overall, this LASSO analysis suggests that a holistic assessment of those factors that *directly* influence sufficiency rating must also include an assessment of those factors that also *indirectly* affect sufficiency rating, namely those that influence inspector-driven appraisals. When considering these inspector-driven appraisals, we identify influential factors that couple substructure and superstructure condition ratings, namely through the deck. We also identify important safety features that influence these appraisals, given the experience and recognition of inspectors that safety features do not just protect those who use the bridge but also the structural health of the bridge. These factors are missed when just assessing sufficiency rating directly both through the first-stage LASSO approach in the aforementioned section, but also in the FHWA calculation.

Table 15. Influential attributes for Superstructure Rating based on cross-sectional LASSO

Weighted Rank	Attribute	NBI Item #	Total Appearances	Weighted Importance
1	Imputed Age	[27, 106]	20	200
2	Inventory Rating	66	20	180
3	Deck (Condition Rating)	58	20	154
4	Min Vertical Clearance Over Bridge Roadway	53	20	116
5	Bridge Railings	36A	19	96
6	Type of Wearing Surface	108A	20	91
7	Kind of Material / Design (Main Structure)	43A	17	81
8	Bridge Posting (Appraisal Rating)	70	20	66
9	Channel & Channel Protection (Condition Rating)	61	17	28
10	Operating Rating	64	6	28
11	Inventory Route, Min Vertical Clearance	10	9	24
12	Minimum Lateral Underclearance	55B	4	22
13	Approach Roadway Alignment (Appraisal Rating)	72	2	5
14	Skew	34	1	4
15	Waterway Adequacy (Appraisal Rating)	71	2	2
16	Number of Approach Spans	46	2	2
17	Minimum Vertical Underclearance	54B	1	1

Table 16. Test set error rates from LASSO modeling approaches with 20 cross-sectional iterations (1993-2012), Superstructure Rating

	N	With 10 unique variables		Minimized CV mean error	
		rMSE	MAE	rMSE	MAE
Max	448,553	1.06	0.81	0.84	0.62
Min	381,335	0.90	0.68	0.74	0.55
Mean	426,319	0.96	0.73	0.79	0.59

Table 17. Error rates from full OLS approach adding complete predictors with all levels in order of weighted importance, Superstructure Rating

	N	rMSE	MAE
1 Predictor	8,526,373	1.10	0.86
5 Predictors		0.86	0.63
10 Predictors		0.83	0.61
15 Predictors		0.82	0.61
17 Predictors		0.82	0.61

Table 18. Influential attributes for Substructure Rating based on cross-sectional LASSO

Weighted Rank	Attribute	NBI Item #	Total Appearances	Weighted Importance
1	Imputed Age	[27, 106]	20	200
2	Inventory Rating	66	20	180
3	Deck (Condition Rating)	58	20	141
4	Bridge Railings	36A	20	119
5	Channel & Channel Protection (Condition Rating)	61	20	93
6	Bridge Posting (Appraisal Rating)	70	19	92
7	Type of Wearing Surface	108A	17	74
8	Kind of Material / Design (Main Structure)	43A	16	39
9	Operating Rating	64	6	38
10	Minimum Lateral Underclearance	55B	5	35
11	Min Vertical Clearance Over Bridge Roadway	53	4	28
12	Scour Critical Bridge	113	8	16
13	Type of Design / Construction (Main Structure)	43B	5	10
14	Skew	34	3	9
15	Minimum Vertical Underclearance	54B	3	9
16	Approach Guardrail	36C	4	6
17	Waterway Adequacy (Appraisal Rating)	71	4	5
18	Length of Maximum Span	48	4	4
19	Number of Spans in Main Unit	45	2	2

Table 19. Test set error rates from LASSO modeling approaches with 20 cross-sectional iterations (1993-2012), Substructure Rating

	N	With 10 unique variables		Minimized CV mean error	
		rMSE	MAE	rMSE	MAE
Max	448,780	1.11	0.87	0.94	0.71
Min	381,716	1.01	0.77	0.81	0.61
Mean	426,734	1.06	0.82	0.87	0.66

Table 20. Error rates from full OLS approach adding complete predictors with all levels in order of weighted importance, Substructure Rating

	N	rMSE	MAE
1 Predictor	8,534,681	1.16	0.90
5 Predictors		0.94	0.71
10 Predictors		0.92	0.69
15 Predictors		0.91	0.68
19 Predictors		0.90	0.68

WEATHER

One final consideration is the impact of weather on bridge system performance. Although not measured by the NBI, studies show that both temperature and precipitation can play a role in bridge degradation (Thepchatri et al., 1977; Roberts-Wollman et al., 2002; Chang, 2016). Obtaining reliable weather data for analysis at system-level has also been identified as a limitation in past work (Melhem & Cheng, 2003). Thus, it is reasonable to consider if these variables may influence the LASSO framework, even if not reported or considered by the NBI.

We utilized the Global Summary of the Year (GSOY) database from the National Centers for Environmental Information (NCEI), which is managed by the National Oceanographic and Atmospheric Administration (NOAA) to extract data from all WBAN-coded stations in the United States. These are formally recognized and assigned stations, with official codes provided by NCEI. The stations were then identified by county and the data aggregated to obtain county-level annual observations. Each bridge observation was then matched to the prior year's weather data, if available for that county and reported for that year.

Due to the size and length of the NBI dataset utilized here and the limitations of the GSOY database, many bridges were located in counties that did not have weather station data and many years were unreported across the stations that were included. As a result, including both average annual temperature and average annual precipitation limited the available data to just over 3 million observations across 20 years, approximately 25.5% of the data used in the prior analyses. Annual observations ranged from a minimum of 86,000 records in 1993 to a maximum of 203,176 in 2011.

We conducted the same procedure to assess the sufficiency rating as the prior iteration, with the addition of the two weather-related attributes – county average annual temperature (standardized) and county average annual precipitation (standardized). The results are reported in Table 21 and demonstrate that annual precipitation is a highly influential attribute when included in the LASSO model, while temperature does not enter the model as an influential attribute. Supplement 26 reports the findings from each year of data and the lambda value corresponding to each variable's entry into the model. Precipitation was the third most influential attribute in 7 years and was in the top-10 attributes in 19 of 20 years. Overall, using our approach, precipitation would be the fourth-highest attribute in weighted ranking.

Table 21. Influential attributes for Sufficiency Rating based on cross-sectional LASSO, including weather attributes

Weighted Rank	Attribute	NBI Item #	FHWA Included?	Total Appearances	Weighted Importance
1	Inventory Rating	66	Yes	20	200
2	Imputed Age	[27, 106]	Yes	20	180
3	Bypass, Detour Length	19	Yes	20	128
4	Precipitation, Annual, County Mean	-	No	19	119
5	Min Vertical Clearance Over Bridge Roadway	53	Yes	20	113
6	Structural Evaluation (Appraisal Rating)	67	Yes	20	96
7	Bridge Posting (Appraisal Rating)	70	No	20	92
8	Operating Rating	64	No	7	50
9	Lanes On Structure	28A	Yes	12	32
10	Average Daily Traffic	29	Yes	14	26
11	Deck Geometry (Appraisal Rating)	68	Yes	12	25
12	Bridge Roadway Width, Curb-to-Curb	51	Yes	9	19
13	Inventory Route, Min Vertical Clearance	10	No	2	8
14	Kind of Material / Design (Main Structure)	43A	Yes	3	5
15	Structure Open / Posted / Closed	41	No	1	4
16	Right Curb / Sidewalk Width	50B	No	1	3

DISCUSSION

The approach presented here takes a broad, system-wide view to ascertain the influence of variables on bridge sufficiency through a least absolute shrinkage and selection operator (LASSO) methodology. By casting a wide net across social/geographic, design/management, and inspector parameters, this study considered the interplay between use, management, and evaluation metrics as they apply to engineering management challenges in considering bridge deterioration. What the findings suggest is that design, management and inspection-based attributes are important, that certain attributes may be more influential than presently considered, and that there is a relationship between these attributes influential in deterioration and other social and institutional challenges in bridge management.

For overall sufficiency, inspector-driven assessments on inventory rating, bridge posting, structural evaluation, operating rating, and superstructure rating were strongly influential. In addition, design and management variables of age, bypass length, minimum vertical clearance, kind of material, and design load were interspersed with the inspector ratings in the top-10 influential variables. Subsequent analysis also demonstrated the strong influence of precipitation on condition rating, which suggests that this attribute should be included in future degradation models, especially when more accurate micro-level data for each bridge is available.

In the second-stage analysis, we considered influential variables on the inspector expert-based superstructure rating and substructure rating. In both cases, the top predictors were age, inventory rating, and deck rating. Other critical design and management variables included bridge railings, the type of deck wearing surface and kind of material for both. Clearance variables were also influential – minimum vertical clearance over the road for superstructure rating and minimum lateral underclearance for substructure. The inspector-driven assessments for bridge posting, channel protection, and operating rating were also common to both ratings.

Those variables directly connected to usage were of surprisingly less influence. While average daily traffic was included in the attribute list for sufficiency rating, its overall ranking was surprisingly low, given the importance often ascribed to this metric. It also was not identified at all in the attributes for superstructure or substructure rating. However, of the influential design and management variables that were identified, there are many that have strong social implications. For example, vertical clearance presents restrictions to certain vehicle classes and contributes to issues with accessibility for those dependent on bus transportation (Winner, 1980; Desai & Armanios, 2018a). Similarly, bypass distance contributes to transportation and commuting challenges and has also been tied to social equity challenges (Schindler, 2014). The issue of scour, an influential attribute to substructure rating, has also been tied to institutional challenges, as bridges more likely to fail were on those built prior to the updating of national standards in 1991 (Flint et al., 2017). Structure age is tied to the ability for historic recognition, which can generate collective action to preserve such structures and limit engineering options (Desai & Armanios, 2018b). These aspects of the bridge thus have technical influences in affecting bridge sufficiency and also have social implications. This highlights how continued discussion between engineers and sociologists can provide opportunities to address issues commonly affecting both areas.

Additionally, the interrelated aspects of many of these variables is important to acknowledge. A bridge is a holistic and integrated system and to consider aspects in isolation obfuscates the correlations among its pieces. One intriguing finding here is the strong influence of deck rating on both superstructure and substructure ratings. We expect these to be somewhat correlated, as a poor condition in one could indicate the entire system is in disrepair and inspectors may also be anchored downward in other ratings if the first observed segment is in poor condition. In this context, what is implied is that studies seeking to predict deterioration in only one component (e.g. superstructure) must not ignore other components (e.g. deck) when selecting attributes for inclusion in their deterioration model.

Finally, it is important to note that the length and breadth of data utilized here generalizes to a national system that is diverse, both geographically and temporally. While most studies select a particular state or region, we intentionally sought to explore this approach on a more general systemwide level. This is additionally important since the FHWA inherently treats the entire system as one entity, as the sufficiency rating calculation is standardized nationally. As a result, local variations will undoubtedly occur and the findings will be sensitive to what data is included and what years are being modeled.

This challenge is evident when considering the final analysis that included weather data. Even though the number of observations was still quite large, there were numerous changes among the list of influential attributes as compared to using the full dataset supported by the NBI. However, it is also critical to recognize that the most influential variables were generally the same across these two approaches, including age, inventory rating, bypass, vertical clearance, and structural evaluation. This provides support in the form of a robustness test and suggests that there is general stability in attribute selection among those that are of the strongest influence.

Overall, what we have proposed here is a proof-of-concept framework that provides designers, managers, and policymakers with the ability to look at areas where they have to prioritize, and the flexibility to subsequently be tailored to not just national but also state and local needs. In particular, we relax the need for up-front assumptions through using a LASSO-driven approach to help identify the most influential factors on the U.S. bridge system. Moreover, we note the importance of running this approach not just directly on sufficiency rating, but also indirectly on those inspector-driven factors that are shown to influence sufficiency rating. In so doing, this approach does not just isolate the most influential factors on sufficiency rating. This also helps designers and managers better appreciate the factors that inform an inspector's expert appraisals of a bridge's condition.

While there are certainly much more computationally detailed approaches, the focus here is to allow decisionmakers to quickly and understand the key factors that persistently influence bridge sufficiency in a parsimonious and computationally tractable way. This methodology provides a window into the interconnectedness of the inspector, designer, and manager, while reinforcing the interplay between the technical and social in infrastructure.

FUTURE WORK

As our aim here was to make a more systemwide assessment of the NBI using this LASSO framework, taking this beyond a proof-of-concept to actual implementation would require us to assess the differences between this systemwide analysis and a system tailored to individual states and key bridge designs. Thus, in follow-up work, seeing the differences between the systemwide analysis here and influential factors across each state and key bridge type can better help us understand the implementation opportunities of this LASSO framework. This would also require including variables that affect a limited set of bridges but may be crucial for bridge officials operating in particular contexts. For example, precipitation from snow cover was not included in this analysis as it only affects a particular set of bridges. However, for tailoring the LASSO approach here to the Northeast for example, this is likely highly consequential. Finally, we also would need to assess the robustness of our approach to other LASSO modelling approaches such as Group LASSO approach that handles sensitivities to data with numerous factor variables such as is the case here.

Chapter 5

Conclusions

SUMMARY OF RESULTS

This work asked why we continue to struggle with the management of deteriorating infrastructure, even though extremely capable engineering systems exist for monitoring, identifying, and prioritizing elements of these systems. Taking a sociological perspective to a system rich with technical challenges allowed for the exploration of bridge management concerns through the lenses of institutional theory, science and technology studies (STS), and social movement theory. In so doing, this work advances the concept that social factors have an influence on the technical parameters of infrastructure systems and infrastructure is therefore endogenous to society. It also begins to answer recent calls for more scholarly work at the intersection of engineering and social sciences to address technical, economic, and social issues around infrastructure systems (Grabowski et al, 2017).

INFRASTRUCTURE AS INSTITUTIONAL RELICS

Chapter 2 began by highlighting how the current focus is on assessing costs to bridge users. Instead, this paper considered how institutional constraints affect bridge managers from easily updating bridge systems to minimize those costs. To do so required reconceptualizing bridges as *institutional relics,* in that they are designed according to standards backed by authoritative institutions of the time, but these attributes persist even when standards may later change. In considering the case of restrictive vertical clearance heights, we found that bridges built under different regulatory standards (e.g. prior to federal endorsement of design standards in 1956) are more likely to be *regulative-based relics*. These impact bridge maintenance efforts, as the challenge becomes addressing those bridges that are out of date due to updated regulations.

Another key finding was considering bridges built in locales whose engineering norms may not align with changes in national standards. From the perspective of establishing a consistent national bridge system, this misalignment generates *normative-based relics.* These relics impact both bridge maintenance and design, as both new and old bridges in these locales will continue to reflect local practices that are unlikely to update to these national standards. This supports previous research that suggests when local norms conflict with national standards, local institutions may try to defy such standards (Oliver, 1991). Thus, beyond regulatory efforts, focusing professional attention on bridges that reflect such conflicting norms is an equally important consideration.

We also found that state owners appear more sensitive to regulatory pressures, while sub-state and private owners appear more sensitive to normative pressures, suggesting that a single regulatory or policy-based approach may not work across the entirety of a system. This also reinforces focusing professional attention on those bridges that predate a regulatory mandate to aid in identifying potential issue areas. Improving and expanding reporting policies for the NBI can assist in such identification. Institutional considerations can also help further target and prioritize which bridges are most in need of repair through the use of more holistic assessments.

Through these findings, this paper addresses gaps identified in both the institutional theory and STS literatures. The creation of the *institutional relics* construct, along with the identification of two forms of institutional relics – regulative and normative – provides insight into remediation challenges for outdated infrastructure. These also begin to highlight factors that inhibit change within infrastructure systems. Namely, they help to explain why the institutional processes that shaped the formation of a bridge remain so powerful even when those institutional forces change.

Following from this paper, one area of fruitful research is in applying the broad, national-based findings here to more localized data. More narrowly-focused studies that consider micro-census demographic data surrounding these bridges may help illuminate these findings. Specifically, such work can assist in more fully exploring the cultural-cognitive considerations that were not fully able to be considered. Assessing the potential historical biases of influential bridge managers on bridge systems, as well as infrastructure systems more generally, is especially important given the presently anecdotal-based nature of these arguments.

SOCIAL MOVEMENTS FOR PRESERVATION

In Chapter 3, the role of collective action with regards to infrastructure objects was explored from a perspective of *preservation*. While social movement research typically focuses on change-oriented causes, this research considered reactionary movements to recognize aging bridges through historic designations. Community members may become attached to objects that represent cultural value and social importance as part of the physical landscape. Real or perceived threats to these objects, along with the disruption of daily routines that would occur from their closure, may thus motivate collective action efforts to preserve them, even as their condition and usefulness within the infrastructure system degrades. When these movements are successful, they restrict management options and result in these bridges remaining on the system at a much higher rate than similar bridges with no associated successful collective action.

The ability of attachment to generate collective action also ties the framing and motivations of the adherents to this sense of attachment. Therefore, what is unique about this research is that instead of the built environment serving as a mechanism to highlight a larger grievance, the physical object is the primary focus of the movement. This also helps define a clear objective within the movement for preservation, with historic enrollment serving as a method to advance that objective. However, historic recognition also places restrictions on the engineers responsible for managing the object as a piece of a larger infrastructure system. The findings indicate that these bridges have a lower risk of closure than similar bridges that are not historically recognized, but their historicity must also be considered in management decisions. As a result, we note that while overall sufficiency improves slightly following registration, non-historic components (substructure) improve in their condition while those most tied to historic attachment (superstructure) do not.

This study addresses gaps in the social movement and STS literatures through the lens of collective action. First, it treats preserving physical systems as an end goal of movements and demonstrates how the built environment can be directly affected by such movements. Second, it considers the impacts to engineers who must maintain the infrastructure system, namely that they are restricted in their options by the success of these movements. This concurrently informs the STS literature gap by demonstrating another way in which social factors may inhibit change within infrastructure system.

While these findings are theorized to apply to infrastructure in general, additional exploration is needed to determine the true breadth of applicability. Research that further explores feelings of attachment toward infrastructure objects may help in developing other contexts within which this framework may be applied. Locally-important infrastructure with long histories, such as coal in West Virginia and Pennsylvania, could also present insights, especially given political efforts focused on the industry. More generally, expanded research into reactionary movements that focus on preservation is needed, especially in contexts where they arise without an initiating change-oriented social or political catalyst. Examples may also be found in areas struggling with economic revitalization efforts, such as proposals to remove crumbling factories that were formerly critical to the community.

ATTRIBUTES INFLUENCING SUFFICIENCY

In Chapter 4 we expanded on bridge deterioration models, which are generally restrictive in scope, to provide a national and long-term perspective using a wide range of bridge attributes. The results primarily identified inspector-related variables and design/management variables as being most influential to sufficiency, especially inventory rating, age, load posting, bypass, structural evaluation, and vertical clearance. We also ascertained that precipitation is highly influential when included in models. Further analysis into subjective-based condition ratings identified age, inventory rating, deck condition, and bride railings as highly influential. The developed framework may allow decisionmakers and managers to quickly identify key factors that persistently affect these ratings.

There is also a clear connection between several of these variables and other discussions presented here. For example, vertical clearance was identified as influential to both sufficiency rating and superstructure rating and scour susceptibility was identified as influential to substructure rating. These are also both discussed prominently in Chapter 2 from an *institutional relics* perspective. The age of the structure was heavily influential in all analyses and is a central attribute in defining the historicity and collective action addressed in Chapter 3. This reinforces that continued discussion between engineers and sociologists can provide opportunities to tackle issues commonly affecting both areas.

While the framework presented in this paper is useful from a practical standpoint, advanced machine learning and statistical techniques can continue to be employed to improve deterioration models. Further effort to map the dependencies and influences among all the NBI variables can assist in selecting critical focus areas and, perhaps, identifying data points that are redundant or inconsequential. Integrating NBI data with the more detailed inspection and repair records at state and county levels can also help illuminate variables that should be nationally collected. Including accurate weather data in modeling and exploring climate effects on bridge deterioration is also an important effort.

SUMMARY OF POLICY RECOMMENDATIONS

In conceiving bridges as institutional relics, what the findings throughout this thesis imply is that long-lasting infrastructure requires management of both its technical and social elements. Depicting bridges as institutional relics can help policymakers not just better internalize social costs in bridge management, but also better understand how both regulative and normative forces may encourage (or restrict) such changes. Such institutional considerations can help further target and prioritize which bridges are most in need of repair.

The targeting of funds can thus be based off of a more holistic assessment that includes not just engineering and financial considerations, but also the type of social impacts discussed here. A nationwide impact assessment of bridges and areas susceptible to being regulative or normative relics may better identify where managers may be faced with remediation challenges. This can be greatly assisted by the improvement and expansion of NBI reporting processes for use in continued data analysis. Specifically, the NBI should expand its reporting policy beyond the current federal NBIS (23 CFR Part 650, Subpart C) and require entries for all bridges, including all inventory routes passing underneath a bridge structure. Identification of bridge attributes that are influential to bridge deterioration and related to institutional and social constraints on managers can also assist in prioritization.

Policies also need to better consider the environment in which a potential bridge or roadway underpass is expected to be sited. There is currently no centralized requirement or process to report or catalog bridges that deviate from national standards, outside of the limited reporting of those impacting the Strategic Highway Network (STRAHNET). Using normative standards for bridge design, as promulgated by the American Association of State Highway and Transportation Officials (AASHTO), and then requiring state Departments of Transportation (DOTs) to report deviations from these standards for all bridges to the FHWA could better identify locales whose needs are both varied and inadequately anticipated by national standards

Finally, policymakers must ensure open and honest dialog with constituents regarding the true costs of projects and strike a balance between system improvement and historic maintenance. Programs focused on end-of-life transitions and repurposing for recreational use or display may be especially productive. Establishing a defined deadline for transition, private acquisition or government demolition can help to provide an opportunity for preservation off the road network and give social movements and activists a realistic assessment of the financial and safety impacts of long-term continued traffic service. At a national level, fully funding the Historic Preservation Fund is one step toward assisting localities with such management challenges.

BIBLIOGRAPHY

Advisory Council on Historic Preservation. (2007). Case digest: Section 106 in action. Retrieved from http://www.achp.gov/docs/CaseDigestFall2007.pdf.

Akerlof, G. A. (1970). The market for 'lemons': Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, *84*(3), 488-500.

American Association of State Highway Officials. (1928). *Standard specifications for highway bridges and incidental structures*. New York.

American Association of State Highway Officials. (1956). *A policy on design standards*. Washington, DC.

American Society of Civil Engineers. (2017). Bridges. In *Infrastructure Report Card*. Retrieved from http://www.infrastructurereportcard.org/cat-item/bridges/.

Armanios, D. E., & Eesley, C. E. 2018. Scaffolds and intermediaries: How changing institutional infrastructure can alleviate knowledge barriers to entrepreneurship. *Organization Science*, reject & resubmit

Bai, R., Wallace, S. W., Li, J., and Chong, A. Y. (2014). Stochastic service network design with rerouting. *Transportation Research Part B: Methodological*, 60, 50-65.

Bandy, S. (2007). Au revoir, Vida Shaw. *The Daily Iberian*. Retrieved from https://www.iberianet.com/news/au-revoir-vida-shaw/article_30f9f40e-bcbf-51bd-b92f-c8b545ae9bd8.html.

Bandy, S. (2007). Vida Shaw loses vote. *The Daily Iberian*. Retrieved from https://www.iberianet.com/news/vida-shaw-loses-vote/article_cf141eca-30a5-50c5-a50d-b9bcb1c423df.html.

Barley, S. R. (2016). 60th anniversary essay: Ruminations on how we became a mystery house and how we might get out. *Administrative Science Quarterly, 61*(1), 1-8.

Barnard, A. V. (2016). Making the city "second nature": Freegan "Dumpster divers" and the materiality of morality. *American Journal of Sociology*, *121*(4), 1017-1050.

Benford, R. D., & Snow, D. A. (2000). Framing processes and social movements: An overview and assessment. *Annual Review of Sociology, 26*, 611-639.

Berg, A. C., Bank, L. C., Oliva, M. G., and Russell, J. S. (2006). Construction and cost analysis of an FRP reinforced concrete bridge deck. *Construction and Building Materials*, 20(8), 515-526.

Boone, C., & Özcan, S. (2014). Why do cooperatives emerge in a world dominated by corporations? The diffusion of cooperatives in the US bio-ethanol industry, 1978–2013. *Academy of Management Journal*, *57*(4), 990-1012.

Brown, G., & Raymond, C. (2007). The relationship between place attachment and landscape values: Toward mapping place attachment. *Applied geography*, *27*(2), 89-111.

Carlos, C., Sine, W. D., Lee, B. H., & Haveman, H. A. (2014). Gone with the wind: Industry development and the evolution of social movement influence. Working Paper.

Carroll, G. R., & Swaminathan, A. (2000). Why the microbrewery movement? Organizational dynamics of resource partitioning in the US brewing industry. *American Journal of Sociology*, *106*(3), 715-762.

Callon, M. (1984). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St-Brieuc Bay. *Sociological Review Monograph*, *32*(S1), 196-233.

Caro, R.A. (1974). *The power broker: Robert Moses and the fall of New York*. New York, Knopf.

Chandler, D. (2014). Organizational susceptibility to institutional complexity: Critical events driving the adoption and implementation of the ethics and compliance officer position. *Organization Science*, *25*(6), 1722-1743.

Chang, J., & Garvin, M. J. (2008). A new model for infrastructure service life with applications to bridge assessment and management. *Public Works Management & Policy*, *12*(3), 515-532.

Chang, M. (2016). *Investigating and Improving Bridge Management System Methodologies Under Uncertainty* (Doctoral dissertation). Retrieved from Utah State University Digital Commons (No. 5039).

Chen, W., and Duan, L. (2000). *Bridge engineering handbook*. Boca Raton, FL, CRC Press.

Chengalur-Smith, I. N., Ballou, D. P., & Pazer, H. L. (1997). Modeling the costs of bridge rehabilitation. *Transportation Research Part A: Policy and Practice, 31*(4), 281-293.

Cleary, R. L., (2007). *Bridges*. Washington, DC, Norton.

Contreras-Nieto, C., Lewis, P., & Shan, Y. (2016). Developing predictive models of superstructure ratings for steel and prestressed concrete bridges. In *Construction Research Congress 2016* (pp. 859-868).

Cox, D. R. (1972). Regression models and life-tables. *Journal of the Royal Statistical Society Series B (Methodological), 34*(2), 87-22.

Department of Commerce. (1960). Vertical clearance on the national system of interstate and defense highways. Retrieved from https://spexternal.modot.mo.gov/sites/de/DSL/D-1960-00_2.pdf.

Desai, J. D., & Armanios, D. E. (2018). What can't be cured must be endured: Understanding bridge systems as institutional relics. *Journal of Infrastructure Systems*, (in press).

Desai, J. D. & Armanios, D. E. (2018). Social movements for infrastructure preservation: Roadway bridges and the National Register of Historic Places. *Administrative Science Quarterly* (under review).

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*(2), 147-160.

Din, Z. U., and Tang, P. (2016). Automatic logical inconsistency detection in the National Bridge Inventory. *Procedia Engineering*, 145, 729-737.

Ehlen, M. (1997). Life-cycle costs of new construction materials. *J. Infrastruct. Syst.*, 10.1061/(ASCE)1076-0324(1997)3:4(129), 129-133.

Enright, M. P., & Frangopol, D. M. (1999). Condition prediction of deteriorating concrete bridges using Bayesian updating. *Journal of Structural Engineering*, *125*(10), 1118-1125.

Estes, A. C., & Frangopol, D. M. (1999). Repair optimization of highway bridges using system reliability approach. *Journal of Structural Engineering*, *125*(7), 766-775.

Estes, A. C., & Frangopol, D. M. (2001). Minimum expected cost-oriented optimal maintenance planning for deteriorating structures: Application to concrete bridge decks. *Reliability Engineering & System Safety*, *73*(3), 281-291.

Federal-Aid Highway Act of 1944, Pub. L. No. 78-521, 58 Stat. 838

Federal Aid Highway Act of 1956, Pub. L. No. 84-627, 70 Stat. 374.

Federal Highway Administration. (1997). Additional guidance on 23 CFR 650D. Retrieved from https://www.fhwa.dot.gov/bridge/0650dsup.cfm.

Federal Highway Administration. (2000). *Recording and coding guide for the structure inventory and appraisal of the nation's bridges* (Report No. FHWA-PD-96-0001). Washington, D.C.: Department of Transportation.

Federal Highway Administration. (2016). *National Bridge Inventory* [Data files]. Retrieved from http://www.fhwa.dot.gov/bridge/nbi/ascii.cfm.

Flint, M. M., Fringer, O., Billington, S. L., Freyberg, D., and Diffenbaugh, N. S. (2017). Historical analysis of hydraulic bridge collapses in the continental United States. *J. Infrastruct. Syst.*, 10.1061/(ASCE)IS.1943-555X.0000354, 04017005.

Fraser, C. B. (1994). Registration Form: Red Bridge. *National Register of Historic Places*. Retrieved from https://npgallery.nps.gov/NRHP/GetAsset/04ebf9fb-0775-463c-bf16-a2e7b2bfdace.

Friedman, M. (1982). Piecewise exponential models for survival data with covariates. *The Annals of Statistics*, 101-113.

Fu, C., Burhouse, J., and Chang, G. L. (2004). Overheight vehicle collisions with highway bridges. *Transportation Research Record: Journal of the Transportation Research Board*, 1865, 80-88.

Gelman, A. (2009). When to standardize regression inputs and when to leave them alone [Blog post]. Retrieved from http://andrewgelman.com/2009/07/11/when_to_standar/.

Gong, J., Zhou, H., Gordon, C., & Jalayer, M. (2012). Mobile terrestrial laser scanning for highway inventory data collection. *Computing in Civil Engineering, 2012*, 545-552.

Grabowski, Z. J., Matsler, A. M., Thiel, C., McPhillips, L., Hum, R., Bradshaw, A., Miller, T. and Redman, C. (2017). Infrastructures as socio-eco-technical systems: Five considerations for interdisciplinary dialogue. *J. Infrastruct. Syst.*, 10.1061/(ASCE)IS.1943-555X.0000383, 02517002.

Greene, W. H. (2003). *Econometric analysis* (5th ed.). Upper Saddle River, NY, Prentice Hall.

Greider, T., & Garkovich, L. (1994). Landscapes: The social construction of nature and the environment. *Rural sociology*, *59*(1), 1-24.

Hachem, Y., Zografos, K., & Soltani, M. (1991). Bridge inspection strategies. *Journal of Performance of Constructed Facilities*, *5*(1), 37-56.

Harik, I. E., Shaaban, A. M., Gesund, H., Valli, G. Y. S., and Wang, S. T. (1990). United States bridge failures, 1951-1988. *J. Perform. Constr. Facil.*, 10.1061/(ASCE)0887-3828(1990)4:4(272), 272-277.

Harshbarger, J. P., McCahon, M. E., Pullaro, J. J., & Shaup, S. A. (2007). *Guidelines for historic bridge rehabilitation and replacement*. American Association of State Highway and Transportation Officials (AASHTO).

Haveman, H. A., Rao, H., & Paruchuri, S. (2007). The winds of change: The progressive movement and the bureaucratization of thrift. *American Sociological Review*, *72*(1), 117-142.

Hearn, G. (2014). *State bridge load posting processes and practices*. Washington, DC, National Academies of Science.

Henderson, K. (2018). Every bridge tells a story. *Historic Bridge Foundation*. Retrieved from http://historicbridgefoundation.com/.

Heper, M., & Güney, A. (1996). The military and democracy in the Third Turkish Republic. *Armed Forces & Society*, *22*(4), 619-642.

Hiatt, S. R., Sine, W. D., & Tolbert, P. S. (2009). From Pabst to Pepsi: The deinstitutionalization of social practices and the creation of entrepreneurial opportunities. *Administrative Science Quarterly*, *54*(4), 635-667.

Horne, D. A. (2009). Action: Coordination of vertical clearance design expectations on the interstate system [Memorandum]. Washington, DC, Federal Highway Administration. Retrieved from https://www.fhwa.dot.gov/design/090415.cfm.

Huang, Y. H. (2010). Artificial neural network model of bridge deterioration. *Journal of Performance of Constructed Facilities, 24*(6), 597-602.

Hugenschmidt, J. (2002). Concrete bridge inspection with a mobile GPR system. *Construction and building materials*, *16*(3), 147-154.

Hutchby, I. (2001). Technologies, texts and affordances. *Sociology*, *35*(2), 441-456.

Iacus, S. M., King, G., & Porro, G. (2008). Matching for causal inference without balance checking. http://dx.doi.org/10.2139/ssrn.1152391

Iacus, S. M., King, G., & Porro, G. (2009). CEM: Software for coarsened exact matching. *Journal of Statistical Software*, *30*(13), 1-27.

Jain, R. K., Damoulas, T., & Kontokosta, C. E. (2014). Towards data-driven energy consumption forecasting of multi-family residential buildings: feature selection via the lasso. *Computing in Civil and Building Engineering (2014)*, 1675-1682.

Javernick-Will, A. & Levitt, R. E. (2010). Mobilizing institutional knowledge for international projects. *Journal of Construction Engineering and Management, 136*(4), 430-441.

Javernick-Will, A. N. & Scott, W. R. (2010). Who needs to know what? Institutional knowledge and global projects. *Journal of Construction Engineering and Management, 136*(5), 546-557.

Jerolmack, C., & Tavory, I. (2014). Molds and totems: Nonhumans and the constitution of the social self. *Sociological Theory*, *32*(1), 64-77.

Joerges, B. (1999). Do politics have artefacts?. *Social Studies of Science, 29*(3), 411-431.

Johnston, D. W., Chen, C., & Abed-Al-Rahim, I. (1993). Developing user costs for bridge management systems. In *7th Conference on Bridge Management-Preprints* (No. Preprint Number 16).

Jonnalagadda, S., Ross, B. E., & Khademi, A. (2016). A modelling approach for evaluating the effects of design variables on bridge condition ratings. *Journal of Structural Integrity and Maintenance, 1*(4), 167-176.

Kamarianakis, Y., Shen, W., & Wynter, L. (2012). Real-time road traffic forecasting using regime-switching space-time models and adaptive LASSO. *Applied Stochastic Models in Business and Industry, 28*(4), 297-315.

Kaminsky, J. A. & Javernick-Will, A. N. (2014). The internal social sustainability of sanitation infrastructure. *Environmental Science & Technology, 48*(17), 10028-10035.

King, B. G., & Pearce, N. A. (2010). The contentiousness of markets: Politics, social movements, and institutional change in markets. *Annual review of sociology*, *36*, 249-267.

King, B. G., & Soule, S. A. (2007). Social movements as extra-institutional entrepreneurs: The effect of protests on stock price returns. *Administrative Science Quarterly*, *52*(3), 413-442.

Kitschelt, H. (1986). Political opportunity structures and political protest: Anti-nuclear movements in four democracies. *British Journal of Political Science*, *16*(1), 57-85.

Kozhikode, R. K., & Li, J. (2012). Political pluralism, public policies, and organizational choices: Banking branch expansion in India, 1948–2003. *Academy of Management Journal*, *55*(2), 339-359.

Kushida, M., Miyamoto, A., & Kinoshita, K. (1997). Development of concrete bridge rating prototype expert system with machine learning. *Journal of Computing in Civil Engineering*, *11*(4), 238-247.

Latour, B. (1990). Drawing things together. In M. Lynch and S. Woolgar (Eds.) *Representation in scientific practice*. Cambridge, MA: MIT Press.

Law, J. (2012). Technology and heterogeneous engineering: The case of Portuguese expansion. In W. E. Bijker, T. P. Hughes, & T. Pinch (Eds.) *The social construction of technological systems: New directions in the sociology and history of technology* (pp. 105-128). Boston: MIT Press.

Law, J., & Callon, M. (1988). Engineering and sociology in a military aircraft project: A network analysis of technological change. *Social problems*, *35*(3), 284-297.

Lee, M. D. P., & Lounsbury, M. (2015). Filtering institutional logics: Community logic variation and differential responses to the institutional complexity of toxic waste. *Organization Science*, *26*(3), 847-866.

Lemer, A. C. (1996). Infrastructure obsolescence and design service life. *J. Infrastruct. Syst.*, 10.1061/(ASCE)1076-0342(1996)2:4(153), 153-161.

Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and imbrication of human and material agencies. *MIS Quarterly*, *35*(1), 147-168.

Leonardi, P. M., & Barley, S. R. (2010). What's under construction here? Social action, materiality, and power in constructivist studies of technology and organizing. *The Academy of Management Annals, 4*(1), 1-51.

Leyden, K. M. (2003). Social capital and the built environment: the importance of walkable neighborhoods. *American journal of public health*, *93*(9), 1546-1551.

Liu, M., & Frangopol, D. M. (2005). Multiobjective maintenance planning optimization for deteriorating bridges considering condition, safety, and life-cycle cost. *Journal of Structural Engineering, 131*(5), 833-842.

Liu, M. & Frangopol, D. M. (2006). Probability-based bridge network performance evaluation. *Journal of Bridge Engineering, 11*(5), 633-641.

Liu, M., & Frangopol, D. M. (2006). Optimizing bridge network maintenance management under uncertainty with conflicting criteria: Life-cycle maintenance, failure, and user costs. *Journal of Structural Engineering, 132*(11), 1835-1845.

Liu, W., Chen, S. E., & Hasuer, E. (2011). Bridge clearance evaluation based on terrestrial LIDAR scan. *Journal of Performance of Constructed Facilities*, *26*(4), 469-477.

Marquis, C., & Huang, Z. (2009). The contingent nature of public policy and the growth of US commercial banking. *Academy of Management Journal*, *52*(6), 1222-1246.

McAdam, D. (1982). *Political process and the development of black insurgency, 1930-1970*. Chicago: University Press.

McAdam, D., Boudet, H. S., Davis, J., Orr, R. J., Scott, W. R., & Levitt, R. E. (2010). “Site fights”: Explaining opposition to pipeline projects in the developing world. *Sociological Forum, 25*(3), 401-427.

McAdam, D., & Boudet, H. (2012). *Putting social movements in their place: Explaining opposition to energy projects in the United States, 2000–2005*. Cambridge University Press.

McAdam D., McCarthy J. D. & Zald, M. N. (1996). Opportunities, mobilizing structures, and framing processes: Toward a synthetic, comparative perspective on social movements. In D. McAdam, J. D. McCarthy, & M. N. Zald (Eds.) *Comparative Perspectives on Social Movements*. New York: Cambridge University Press.

McCarthy, J. D. & Zald, M. N. (1977). Resource mobilization and social movements: A partial theory. *American Journal of Sociology 82*(6), 1212-1241.

Melhem, H. G., and Cheng, Y. (2003). Prediction of remaining service life of bridge decks using machine learning. *J. Comput. Civ. Eng.*, 10.1061/(ASCE)0887-3801(2003)17:1(1), 1-9.

Metni, N., & Hamel, T. (2007). A UAV for bridge inspection: Visual servoing control law with orientation limits. *Automation in construction*, *17*(1), 3-10.

Meyer, D. S., & Staggenborg, S. (1996). Movements, countermovements, and the structure of political opportunity. *American Journal of Sociology*, *101*(6), 1628-1660.

Miller, M. C., Rueda, J. A., and Gransberg, D. D. (2015). Applying social return on investment to risk-based transportation asset management plans in low-volume bridges. *Transportation Research Record: Journal of the Transportation Research Board*, 2473, 75-82.

Mohammadi, J., Guralnick, S. A., & Yan, L. (1995). Incorporating life-cycle costs in highway-bridge planning and design. *Journal of Transportation Engineering, 121*(5), 417-424.

Molseed, J. (2015). Time taking toll on green bridge in Waverly. *Des Moines Register*. Retrieved from https://www.desmoinesregister.com/story/news/2015/12/05/waverly-green-bridge/76755778/

Morcous, G., Rivard, H., & Hanna, A. M. (2002). Modeling bridge deterioration using case-based reasoning. *Journal of Infrastructure Systems*, *8*(3), 86-95.

National Bridge Inspection Standards, 23 CFR Part 650, Subpart C

National Centers for Environmental Information. (2017). *Global Summary of the Year* [Data files]. Retrieved from https://www.ncei.noaa.gov/data/gsoy/.

National Historic Preservation Act of 1966. 16 U.S.C. §470.

National Parks Service. (2017). The historic preservation fund annual report, 2016. Retrieved from https://www.nps.gov/shpo/downloads/2016HPFReportweb.pdf.

National Register of Historic Places, 36 C.F.R. §60.

O'Connor, T. H. (1995). *Building a new Boston: Politics and urban renewal, 1950-1970*. Boston, Northeastern University Press.

Oh, J. K., Jang, G., Oh, S., Lee, J. H., Yi, B. J., Moon, Y. S., Lee, J. S., & Choi, Y. (2009). Bridge inspection robot system with machine vision. *Automation in Construction*, *18*(7), 929-941.

Oliver, C. (1991). Strategic responses to institutional processes. *Academy of Management Review*, *16*(1), 145-179.

Otto, J. (2018). Why save Red Bridge? *Newton Daily News*. Retrieved from http://www.newtondailynews.com/2018/01/05/why-save-red-bridge/aqa9fc0/.

Pan, N. (2008). Fuzzy AHP approach for selecting the suitable bridge construction method. *Automation in Construction*, 17(8), 958-965.

Parker, C. S., & Barreto, M. A. (2013). *Change they can't believe in: The Tea Party and reactionary politics in America*. Princeton University Press.

Peschiera, G., & Taylor, J. E. (2012). The impact of peer network position on electricity consumption in building occupant networks utilizing energy feedback systems. *Energy and Buildings, 49*, 584-590.

Pfeiffer, D. A. (2006). Ike's interstates at 50: Anniversary of the highway system recalls Eisenhower's role as catalyst. *Prologue,* 38(2).

Pinch, T. J., and Bijker, W. E. (2012). The social construction of facts and artifacts: Or how the sociology of science and the sociology of technology might benefit each other. In W. E. Bijker, T. P. Hughes, and T. Pinch (Eds.) *The social construction of technological systems: New directions in the sociology and history of technology*. Boston, MIT Press.

Ptak, T. J. (1997). Action: Vertical clearance, interstate system coordination of design expectations [Memorandum]. Washington, DC, Federal Highway Administration. Retrieved from https://www.fhwa.dot.gov/bridge/081597.cfm.

Rister, B., McIntosh, L., & Whelan, J. (2013). Utilization of mobile Lidar to verify bridge clearance heights on the Western Kentucky Parkway. *University of Kentucky, KTC-13-09/FRT199-13-1F*.

Riveiro, B., Jauregui, D. V., Arias, P., Armesto, J., & Jiang, R. (2012). An innovative method for remote measurement of minimum vertical underclearance in routine bridge inspection. *Automation in Construction, 25,* 34-40.

Roberts, J. (2018). Residents in struggling Arkansas town see possibilities for historic bridge – but first they have to save it. *Arkansas Democrat Gazette*. Retrieved from http://m.arkansasonline.com/news/2018/jan/21/struggling-delta-town-sees-possibilitie/

Roberts-Wollman, C. L., Breen, J. E., & Cawrse, J. (2002). Measurements of thermal gradients and their effects on segmental concrete bridge. *Journal of Bridge Engineering*, *7*(3), 166-174.

Roise, C. K., & Fraser, C. B. (1999). Historic highway bridges of Michigan, 1875-1948. *National Register of Historic Places Digital Asset Management System*. Retrieved from https://npgallery.nps.gov/GetAsset/c5cbb4fe-c5c1-4904-9ea0-bb0fd112695a.

Root, N. F. (2000). The evolution of bridges in the United States. In W. Chen and L. Duan (Eds.) *Bridge Engineering Handbook*. Boca Raton, FL, CRC Press.

Rose, M. H. (1979). *Interstate: Express highway politics, 1941-1956*. Lawrence, KS, Regents Press of Kansas.

Rubin, E. (2006). Interchange: Highways and displacement in the postwar American city. *UC Berkeley: University of California International and Area Studies*. Retrieved from https://escholarship.org/uc/item/6q56k6m0.

Sanford, K. L., Herabat, P., and McNeil, S. (1999). Bridge management and inspection data: Leveraging the data and identifying the gaps. In *Proc., 8th Int. Bridge Management Conf.*, Vol. 1, 1-15.

Save Vida Bridge. (2018). Retrieved from http://www.graphicdetailsmedia.com/Client/Vida%20Bridge%20Site/index.html.

Schildroth, D. J. & Schildroth, M. L. (2017). Thank you for upcoming Green Bridge repairs. *Waverly Newspapers*. Retrieved from https://www.facebook.com/SaveWaverlyGreenBridge/.

Schindler, S. B. (2014). Architectural exclusion: Discrimination and segregation through physical design of the built environment. *Yale Law Journal*, *124*, 1934.

Schneiberg, M., & Soule, S. A. (2005). Institutionalization as a contested, multi-level process: Politics, social movements and rate regulation in American fire insurance. In G. F. Davis, D. McAdam, & M. N. Zald (Eds.), *Social movements and organization theory* (pp. 122–160). New York, NY: Cambridge University Press.

Schultz, S. E., Kleine, R. E., & Kernan, J. B. (1989). 'These are a few of my favorite things': Toward an explication of attachment as a consumer behavior construct. *Advances in Consumer Research*, *16*(1), 359-366.

Scott, W. R. (2001). *Institutions and organizations* (2nd Ed.). Thousand Oaks, CA, SAGE Publications.

Selvaraj, K., Roy, P., & Mahalingam, A. (2017). Stakeholder management in public space design projects – strategies for sustainable change: The Luz Church Road case in Chennai. Working Paper Series. *Proceedings of the EPOC-MW Conference, Engineering Project Organization Society*, Fallen Leaf Lake, CA, USA. June 5-8, 2017.

Sine, W. D., Haveman, H. A., & Tolbert, P. S. (2005). Risky business? Entrepreneurship in the new independent-power sector. *Administrative Science Quarterly*, *50*(2), 200-232.

Sine, W. D., & Lee, B. H. (2009). Tilting at windmills? The environmental movement and the emergence of the US wind energy sector. *Administrative Science Quarterly*, *54*(1), 123-155.

Snow, D., Cress, D., Downey, L., & Jones, A. (1998). Disrupting the "quotidian": Reconceptualizing the relationship between breakdown and the emergence of collective action. *Mobilization: An International Quarterly*, *3*(1), 1-22.

Snow, D., Rochford, E., Worden, S., & Benford, R. (1986). Frame alignment processes, micromobilization, and movement participation. *American Sociological Review*, *51*(4), 464-481.

Snow, D., & Soule, S. A. (2010). *A primer on social movements.* W.W. Norton.

Sobanjo, J. O., and Thompson, P. D. (2011). Enhancement of the FDOT's project level and network level bridge management analysis tools. Florida Department of Transportation (Contract No. BDK83977-01).

Son, Y., and Sinha, K. (1997). Methodology to estimate user costs in Indiana Bridge Management System. *Transportation Research Record: Journal of the Transportation Research Board*, 1597, 43-51.

Soule, S. A., & Olzak, S. (2004). When do movements matter? The politics of contingency and the equal rights amendment. *American Sociological Review*, *69*(4), 473-497.

Star, S. L. (1999). The ethnography of infrastructure. *American Behavioral Scientist*, *43*(3), 377-391.

Star, S. L., and Bowker, G. C. (2006). How to infrastructure. In *Handbook of new media: Social shaping and social consequences of ICTs*. Thousand Oaks, CA, SAGE Publications.

Star, S. L., and Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research,* 7(1), 111-134.

Strang, D., & Soule, S. A. (1998). Diffusion in organizations and social movements: From hybrid corn to poison pills. *Annual review of sociology*, *24*(1), 265-290.

Suchman, L. (2000). Organizing alignment: A case of bridge-building. *Organization*, *7*(2), 311-327.

Suchman, L. (2005). Affiliative objects. *Organization*, *12*(3), 379-399.

Sun, X., Zhang, Z., Wang, R., Wang, X., and Chapman, J. (2004). Analysis of past National Bridge Inventory ratings for predicting bridge system preservation needs. *Transportation Research Record: Journal of the Transportation Research Board,* 1866, 36-43.

Tang, P., & Akinci, B. (2012). Formalization of workflows for extracting bridge surveying goals from laser-scanned data. *Automation in Construction*, *22*, 306-319.

Thepchatri, T., Johnson, C. P., & Matlock, H. (1977). *Prediction of temperature and stresses in highway bridges by a numerical procedure using daily weather reports* (Report No. FHWATX-77-23-1). Texas State Department of Highways and Public Transportation.

Thompson, P., Soares, R., Choung, H., Najafi, F., and Kerr, R. (2000). User cost model for bridge management systems. *Transportation Research Record: Journal of the Transportation Research Board*, 1697, 6-13.

Thompson, P. D., Sobanjo, J. O., and Kerr, R. (2003). Florida DOT project-level bridge management models. *J. Bridge Eng.*, 10.1061/(ASCE)1084-0702(2003)8:6(345), 345-352.

Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society. Series B (Methodological)*, 267-288.

Tokdemir, O. B., Ayvalik, C., and Mohammadi, J. (2000). Prediction of highway bridge performance by artificial neural networks and genetic algorithms. In *Proc., 17th Int. Symp. on Automation and Robotics in Construction (ISARC)*, 1091-1098.

Turner, R. H., & Killian, L. M. (1957). *Collective behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Twumasi-Boakye, R., and Sobanjo, J. O. (2017). Evaluating transportation user costs based on simulated regional network models. *Transportation Research Record: Journal of the Transportation Research Board*, 2612, 121-131.

United States Census Bureau. (2010). *Database on historical finances of state governments* [Data files]. Retrieved from http://www2.census.gov/pub/outgoing/govs/special60/.

Wallendorf, M., & Arnould, E. J. (1988). “My favorite things”: A cross-cultural inquiry into object attachment, possessiveness, and social linkage. *Journal of Consumer Research, 14*(4), 531-547.

Winn, E. K., & Burgueño, R. (2013). Development and validation of deterioration models for concrete bridge decks; Phase 1: Artificial intelligence models and bridge management system. (Report No. CEE-RR-2013/01). Michigan Department of Transportation (Contract No. 2009-0746/Z2).

Winner, L. (1980). Do artifacts have politics? *Daedalus, 109*(1), 121-136.

Woolgar, S., & Cooper, G. (1999). Do artefacts have ambivalence? *Social Studies of Science, 29*(3), 433-449.

Wu, I., Borrmann, A., Beißert, U., König, M., and Rank, E. (2010). Bridge construction schedule generation with pattern-based construction methods and constraint-based simulation. *Advanced Engineering Informatics,* 24(4), 379-388.

Xu, C., Xu, L., and Zhou, J. (2015). Integral lifting of a three-span continuous beam bridge. *J. Perform. Constr. Facil.,* 10.1061/(ASCE)CF.1943-5509.0000598, 04014117.

Zhao, J. J. & Tonias, D. E. (2012). *Bridge Engineering* (3rd ed.). McGraw Hill.

Appendix A

Logistic Regression Methodology (Chapter 2)

To test the hypotheses, the study in Chapter 2 utilizes a binomial logistic regression that is specified as a generalized linear model (GLM) (glm function in R stats package). Utilizing the generalized linear model allows for the evaluation of binary outcomes, represented by two series of regressions. In the first set, each bridge is assigned to one of the five clearance height bands discussed in the Independent Variables section (*Mini, Low, Mid, High,* and *Super*). In this manner, each bridge is assigned a value of 1 for its appropriate height band and zero to all other bands. Each band is then tested individually, producing a binary outcome variable across five separate regressions. In the second set, we assign all bridges as either an under-record or not and again test this binary outcome.

Initially, we fit our dependent variables Y (in our case the clearance height bands and whether the bridge is built over a roadway – has an "under-record") as Bernoulli stochastic variables such that $Y \sim Bernoulli(p)$ and attempt to assign as $Binomial(n_i, p_i)$. The logit, or log-odds, is defined as:

$$logit(p) = log\left[\frac{p}{1-p}\right]$$

However, there is the potential for Binomial data to be overdispersed when there is more variability than expected by the distribution. This can occur when the observations are not identically distributed or are not independent. This can be assessed by calculating:

$$\phi = \frac{residual\ deviance}{df}$$

If the value is greater than 1, it indicates that the data are overdispersed as compared to the binomial and thus scaling or providing robustness to the standard errors is warranted.

In this case, parameter estimates of the binomial, binomial with robust standard errors, and quasibinomial approaches are expected to be the same, but the standard errors will likely be larger (more conservative) in the latter two approaches. Thus, using either of these later two approaches creates a conservative estimate of standard errors, making statistical significance harder to obtain, and accounting for the potential bias in the normal standard errors returned with a simple binomial approach (Hilbe, 2015).

For the analysis, we ran all three variants – binomial, binomial robust, and quasibinomial regressions – and confirmed that some models exhibited features of overdispersion (Supplement 2). Further, the results obtained by using a binomial robust approach were slightly more conservative in their significance than the quasibinomial approach, which is why this model was selected for use across the entire study.

The logit link function assesses the conditional mean of the data and applies the logit transform, thereby relating this unobserved mean to its observed binary outcomes. This is essential in order to deal with the problem of predictions on the scale of -∞ to ∞ in a linear model, when our dependent outcome is discretely assigned as 0 or 1. Thus, the link specifies the relationship between log-odds and regressors as:

$$logit(p(x)) \; = \; log\left[\frac{p(x)}{1-p(x)}\right] = \beta_0 + \beta_i X_i$$

In practice, there are three relevant equations to consider, as depicted below, where δX_i represents control variables:

$$logit(p) \; = \; log\left[\frac{p}{1-p}\right] = \beta_0 + \beta_1 Reform + \delta X_i$$

$$logit(p) = log\left[\frac{p}{1-p}\right] = \beta_0 + \beta_2 X_2 + \delta X_i$$

$$logit(p) = log\left[\frac{p}{1-p}\right] = \beta_0 + \beta_1 Reform + \beta_2 X_2 + \beta_3 (Reform * X_2) + \delta X_i$$

The coefficient (β_1) reflects the log-odds of the DV following the reform when the regressor is 0, the coefficient (β_2) reflects the log-odds of the DV prior to the reform when the regressor is 1, and the coefficient ($\beta_1 + \beta_2 + \beta_3$) reflects the log-odds of the DV after the reform when the regressor is 1. The third model above is the full models reported in the main Results section, while the first and second models are the intermediate models reported in Supplement 3.

Appendix B:

Panel Creation Methodology (Chapter 3)

The National Bridge Inventory is a cross-sectional listing of bridges, collected annually by the Federal Highway Administration of the U.S. Department of Transportation. Thus, creation of a panel data set was necessary in order to more fully explore time-dependent issues within the data, focused at the Bridge-Year level of analysis. As with previous studies (Desai & Armanios, 2018), we restrict the NBI data to a 21-year period of 1992 through 2012 as a policy change in 2013 restricted reporting to only NBI-qualified bridges, while prior years allowed states to submit reports for other bridges impacting significant routes. Summary data associated with each step in the cleaning process described below is included in Table B1.

First, the NBI data were panelized through a simple row-bind across all 21 years of data, resulting in a full set of approximately 14.6 million reported Bridge-Year records, based on State FIPS and Structure Number. Although the Structure Number of a bridge is intended to be a unique and permanent identifier, many changes have occurred over the years due to state naming convention modifications, formatting requirements for state bridge management systems, and other considerations. Using an official change database provided by the FHWA, we sought to account for these name changes over time by assigning a *New Structure Number* variable, thereby reflecting the updated numbers in older records. We then restrict this change database to only those changes reported during our data period of 1992 to 2012 (129,370 total reported changes)

There are three logical scenarios that may occur in the change database to confound efforts to assign unique IDs to bridges across time. First, a bridge may have an initial structure number, which is later changed to a new structure number (*A* → *B*). For some reason, that same original structure number may also be listed as having another change later on to a third structure number (*A* → *C*). These cases are easily identifiable by creating a vector of state and structure number combinations that appear twice within the "old" number column (69 total cases). We wish to ensure that only one of these changes is used consistently to represent the same bridge, thus we assign *C* as the final target structure number and recognize there already exists an entry to update all *A* entries to a *C* value. We then modify the first change entry for each member of the vector of instances so that *B* is listed as the "old" number and *C* is reflected as the "new" number. In this manner, any entry of the bridge using *A* or *B* as the reported structure number will report *C* as the updated structure number upon merging.

The second logical scenario involves a bridge that has an initial change to its structure number (*A* → *B*) and that is modified a second time later on (*B* → *C*). To identify these cases, we create a vector of state and structure numbers combinations that appear in the "new" column and also appear in the "old" column (32,370 total cases). Similar to the instance above, we seek to assign *C* as the final target structure number and recognize the latter entry already updates all *B* entries to a *C* value. We thus modify the first change entry for each member of the vector of instances so that *A* remains as the "old" number and *C* is reflected as the "new" number. This results in entries updating both *A* and *B* to a final reported value of *C* upon merging.

The final logical scenario involves a bridge that has a combination of both of the first two scenarios, such as an initial change to its structure number (*A* → *B*), a secondary change (*B* → *C*), and a later listing that updates the original number to the new number (*A* → *C*). However, this case is already accounted for through the processes above as the first action would modify the first listing (*A* → *C*), maintain the second listing (*B* → *C*), and maintain the third listing (*A* →

C). This creates the desired outcome and the duplicate entries may be dropped, which we accomplish through running a *unique* function after each iteration. This results in 129,357 final change entries.

It is also reasonable to conclude that these efforts may produce additional instances of the logical issues presented above, or that some bridges have multiple changes outside of these simplistic two-step scenarios. We thus iterate the first logical check a second time to determine if there are multiple "old" entries for bridges. This column cannot contain duplicates otherwise the merge process will be confounded by having multiple "new" entries for the same bridge. This iteration presented 19 new cases, which were modified using the process detailed above.

To further refine the selection of an appropriate bridge identifier that captures unique structures, we considered several variables that should not change over time and carry over consistently through the NBI entries. The first addition to the State – New Structure Number combination was to include the *Record Type* code, which reflects the specific route being reported (1 for an "over record" on top of the bridge and 2 or a letter for an "under record" passing beneath the bridge). A single bridge may have multiple entries in the NBI depending on the routes associated with it, making this a prudent addition to ensure the same route is reflected in the panel data. This one change drastically reduced the number of unique entries with more than 21 Bridge-Years in the panel, a logical error check as there are only 21 years of data. Second, we further refined the data by including the *Year Built* at the end of the identifier, as this should not change over time and would also account for structures that were demolished or newly built using a former structure number. We also explored using additional variables, such as the *Directional Suffix*, *Direction of Traffic*, *Kilometer Point*, and *Latitude/Longitude*, but found these to be much less reliable. Thus, the final combination of

StateFIPS_NewSN_RecordType_YearBuilt (e.g. 1_00000000000S700_1_1989) is formally defined as the Bridge Identifier and reflected in the panel as the variable *BID*. We also identify and code all instances of multiple reports for a given bridge in a given year to allow for filtering in future analysis.

Table B1. Summary data of selecting an appropriate Bridge ID for panel.

Step	Bridge ID Basis	# Unique IDs	# with >21 entries	# with >22 entries
1	State - SN	953,121	79,802	73,325
2	State - New SN	845,960	80,990	74,413
3	State - New SN - Record Type	968,998	5,663	147
4	State - New SN - Record Type - Year Built	1,052,131	5,273	97

Note: “SN” = “Structure Number”

Appendix C:

Coarsened Exact Matching (CEM) Approach (Chapter 3)

In order to better compare enrolled historic bridges with unique qualities to appropriate control bridges, we utilize a Coarsened Exact Matching (CEM) technique to develop comparable sets of bridges for analysis. The *cem* package in R was utilized to conduct the match. The primary regressions report a *k-to-k* match using a Euclidean distance measure to obtain the nearest matched control bridge within the strata of each treated bridge. Additionally, we develop a *k-to-m* set for robustness checks, whereby all bridges within strata containing members of both the treatment and control group were included, with appropriate weights utilized during regression analysis to account for varying numbers within strata.

Prior to matching, we assign a *MatchYear* to ensure that treatment and control observations are compared in the same reporting year. For treatment bridges, this is the year of enrollment on the NRHP or their year of permanent closure, whichever is earlier. For control group bridges, we include all annual observations of each bridge as eligible for matching. Thus, when creating matched strata, only the control bridge observations with the same NBI year as the *MatchYear* of the enrolled bridge will be considered for matching. For example, a bridge enrolled on the NRHP in 1999 would be compared with the properties of all control bridges as they are reported in 1999.

In addition to the *MatchYear*, which must be an exact match, we utilize five additional variables. First, we match exactly within states using the *StateName* variable, as we note the critical role of states in the application and approval process for NRHP enrollment. This additionally allows for a wider matching ability, as the rarity of these bridges limits the ability to achieve a high number of close matches within the same county. We do, however, limit the control group available for matching to only those counties that also have a bridge in the treatment group. This accounts for the possibility that other counties may not support the NRHP program or that there are higher barriers to enrollment in those counties that have no registrations during our period of analysis.

The age of the structure is a common metric used in determining eligibility for the NRHP (36 C.F.R. § 60.4). In fact, the NRHP mandates that such structures must be at least 50 years old to be considered, except in exceptional circumstances. We use the Year Built (NBI Item 27) and round to the nearest decade to create *YBDec* and match within these bands. Any years ending in five or greater are rounded up, while those ending in four or less are rounded down. Matching processes have tradeoffs between precision and loss of sample and enforcing an exact match by year greatly restricts the available control bridges. We found utilizing a decade window allowed for the most optimal balance between a better match and greater sample retention.

Many applications highlight bridge design and the limited number of surviving counterparts when making recommendations for enrollment. One criterion used in NRHP evaluation is whether the bridge has unique characteristics in design or methods of construction. We use the Structure Type (NBI Item 43) as the *ST* variable, which must be an exact match. This variable consists of three digits, with the first digit representing the material code (10 codes including concrete, steel, wood, etc.) and the second and third digit representing the design code (23 codes including slab, stringer/girder, deck-truss, through-truss, deck-arch, through-arch, etc.).

The location of a bridge in either an urban or rural area may affect its perceived historicity due to prominence and usage. Prior research also highlights how urban areas may present obstacles to remediation of bridges that are outdated (Desai & Armanios, 2018). We use the

Functional Classification of Inventory Route (NBI Item 26) to derive the *Urban* variable, as this item codes routes as being located in either an urban or rural area. Thus, urban bridges take a value of 1 and rural bridges taking a value of 0 and are matched exactly.

Regardless of all other factors, how much a bridge is used on an annual basis may impact the likelihood of NRHP registration. On the one hand, a heavily utilized bridge may be a strong candidate for enrollment because it is known and used by more people. On the other hand, people may view the structural sufficiency and safety of a heavily utilized bridge as being more important than its historicity. We use the Average Daily Traffic (NBI Item 29) variable and note that it is highly right-skewed. Thus, we add a value of one to all observations (as there are some bridges with a value of zero if they are temporarily shut or unused) and conduct a log-transformation to generate the *LogADT* variable. With this final variable, we allow the algorithm to automatically assign cut points based on natural breaks in the data (manual modifications did not substantially improve the matching effectiveness).

This CEM process is conducted prior to each analysis of a particular dependent variable. Although the vector of matching variables remains the same, the total matching rate fluctuates across models because not all observations report every dependent variable. For example, less bridges have reported condition ratings than reported sufficiency ratings. Thus, instead of constructing a single matched set and applying it to all models, we allow for the maximum matching efficiency as a function of the outcome being assessed. Overall, the differences in total observations are small, with a maximum of 352 matched pairs (N = 704) for the sufficiency rating analysis and a minimum of 330 matched pairs (N = 660) for the deck condition rating analysis (see Table 4).

Ensuring an appropriate match is critical, especially in this approach where we match on a given year and then include pre- and post-match year observations for analysis. To confirm the validity of the match, we constructed imbalance tables that report how closely the treatment and control observations compare to each other, using both t-tests to assess means and Kolmogorov-Smirnov tests (KS-tests) to assess distributions. These are reported for the Cox hazards model results in Table 1 and we include these tables here for the linear regressions on all bridges (Tables A2 through A5) and linear regressions on non-closed bridges only (Tables A6 through A9). The top panel of each table reports the imbalance statistics for the full data set available to use in the CEM process. The second panel reports statistics for the single-year matched observations (*MatchYear*) for all those bridges successfully matched through the CEM process. The third panel considers how well the pre-enrollment period is represented by reporting imbalance on all pre-enrollment observations for the treatment group and all corresponding pre-*MatchYear* observations for the control group. In general, the lack of significance on t-tests indicates that the means are not significantly different between the treatment and control bridges in the pre-enrollment period and the KS-tests demonstrates the distributions are effectively matched.

The main results for the linear regressions on sufficiency and condition ratings are reported in Table 4, with additional analysis on only those bridges that remain open during the entire time period reported in Table 5. Additionally, we report the intermediate models here to provide the full progression and isolation of key variables. The intermediate models for the full data regressions are reported in Tables A10 through A13 and the models for the non-closed regressions are reported in Tables A14 through A17.

SUPPLEMENTAL DATA

Supplement 1A - T-Tests of Average Bridge Age Across Independent Variables and NBI Years

NBI:	1992		1993		1994		1995		1996		1997		1998	
Data Years:	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era
Ref. Year:	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built
N:	649,769	330,749	651,858	328,004	657,056	327,953	666,144	329,356	665,376	324,695	668,831	322,069	670,135	320,025
NY = 1	1951.6	1960.2	1952.4	1960.2	1953.0	1960.2	1953.8	1960.3	1954.5	1960.3	1955.1	1960.3	1955.7	1960.3
N	21,473	10,782	21,502	10,733	21,476	10,685	21,606	10,650	21,610	10,599	21,623	10,567	21,661	10,514
SD	22.64	7.39	22.78	7.38	22.88	7.39	23.14	7.38	23.30	7.38	23.45	7.38	23.72	7.38
SE	0.15	0.07	0.16	0.07	0.16	0.07	0.16	0.07	0.16	0.07	0.16	0.07	0.16	0.07
NY = 0	1956.7	1960.7	1957.4	1960.7	1958.1	1960.8	1958.9	1960.8	1959.5	1960.8	1960.2	1960.9	1960.8	1960.9
N	628,296	319,967	630,356	317,271	635,580	317,268	644,538	318,706	643,766	314,096	647,208	311,502	648,474	309,511
SD	21.93	7.47	22.03	7.46	22.08	7.45	22.17	7.43	22.30	7.43	22.42	7.43	22.49	7.41
SE	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
T-stat	32.3	6.8	31.6	7.0	32.5	7.3	31.5	7.2	30.8	7.5	31.7	7.9	30.9	8.3
Difference	5.1	0.5	5.0	0.5	5.1	0.6	5.1	0.5	5.0	0.5	5.1	0.6	5.1	0.6
NE = 1	1950.0	1959.9	1950.7	1959.9	1951.5	1960.0	1952.0	1960.0	1952.4	1960.0	1952.4	1960.0	1952.8	1960.0
N	19,432	10,403	19,741	10,477	19,913	10,601	20,075	10,642	20,290	10,624	21,503	11,020	21,217	10,829
SD	26.63	6.84	25.80	6.84	25.38	6.82	25.34	6.84	25.25	6.84	25.36	6.91	25.32	6.92
SE	0.19	0.07	0.18	0.07	0.18	0.07	0.18	0.07	0.18	0.07	0.17	0.07	0.17	0.07
NE = 0	1956.7	1960.7	1957.4	1960.7	1958.1	1960.8	1958.9	1960.8	1959.5	1960.8	1960.3	1960.9	1960.9	1960.9
N	630,337	320,346	632,117	317,527	637,143	317,352	646,069	318,714	645,286	314,071	647,328	311,049	648,918	309,196
SD	21.78	7.49	21.92	7.47	21.99	7.46	22.08	7.44	22.22	7.45	22.33	7.44	22.41	7.43
SE	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
T-stat	34.7	11.3	36.1	11.3	36.7	11.7	38.4	12.3	39.6	12.7	44.9	13.5	30.9	14.0
Difference	6.7	0.8	6.7	0.8	6.6	0.8	6.9	0.8	7.1	0.8	7.9	0.9	8.1	0.9
Urban = 1	1960.5	1962.0	1961.0	1962.0	1961.7	1962.1	1962.3	1962.1	1962.8	1962.1	1963.4	1962.1	1963.8	1962.2
N	156,933	94,447	160,182	95,023	166,134	97,619	169,127	97,840	171,909	98,142	175,441	98,512	176,531	98,304
SD	19.97	6.73	20.00	6.73	19.93	6.73	20.05	6.72	20.10	6.72	20.20	6.72	20.26	6.71
SE	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02
Urban = 0	1955.2	1960.1	1956.0	1960.1	1956.7	1960.2	1957.5	1960.2	1958.1	1960.3	1958.8	1960.3	1959.5	1960.3
N	491,498	235,605	490,768	232,566	489,961	229,777	496,357	231,173	493,214	226,458	492,572	223,053	492,721	221,176
SD	22.41	7.68	22.55	7.67	22.68	7.66	22.78	7.64	22.95	7.65	23.11	7.65	23.21	7.64
SE	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02
T-stat	-88.6	-70.1	-84.6	-69.3	-85.5	-70.3	-82.3	-70.2	-81.1	-69.9	-79.0	-69.2	-74.9	-68.3
Difference	-5.3	-1.9	-5.0	-1.9	-5.0	-1.9	-4.8	-1.9	-4.7	-1.8	-4.6	-1.8	-4.3	-1.9

Supplement 1A - T-Tests of Average Bridge Age Across Independent Variables and NBI Years

NBI:	1999		2000		2001		2002		2003		2004		2005	
Data Years:	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era
Ref. Year:	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built
N:	674,204	317,858	687,305	322,338	679,653	313,239	681,497	309,804	672,433	301,647	672,799	296,886	690,048	300,551
NY = 1	1956.5	1960.3	1957.2	1960.4	1957.8	1960.4	1958.4	1960.4	1958.7	1960.4	1959.4	1960.4	1959.9	1960.5
N	21,658	10,440	22,004	10,557	21,684	10,250	21,648	10,140	21,652	10,089	21,810	10,049	21,975	10,067
SD	23.94	7.38	24.15	7.37	24.37	7.39	24.56	7.38	24.70	7.39	25.00	7.38	25.17	7.37
SE	0.16	0.07	0.16	0.07	0.17	0.07	0.17	0.07	0.17	0.07	0.17	0.07	0.17	0.07
NY = 0	1961.5	1961.0	1962.4	1961.0	1962.9	1961.0	1963.5	1961.1	1964.1	1961.1	1964.8	1961.1	1965.7	1961.2
N	652,546	307,418	665,301	311,781	657,969	302,989	659,849	299,664	650,781	291,558	650,989	286,837	668,073	290,484
SD	22.61	7.40	39.73	7.37	22.81	7.39	22.98	7.38	23.16	7.39	23.35	7.39	23.44	7.35
SE	0.03	0.01	0.05	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
T-stat	30.4	8.3	30.5	9.2	30.0	8.5	30.7	8.9	31.2	8.6	31.6	8.9	33.3	9.4
Difference	5.0	0.7	5.2	0.6	5.1	0.6	5.1	0.7	5.4	0.7	5.4	0.7	5.8	0.7
NE = 1	1953.3	1960.0	1953.8	1960.1	1954.1	1960.0	1954.4	1960.1	1955.0	1960.1	1955.3	1960.1	1955.8	1960.1
N	21,221	10,796	21,725	11,058	21,367	10,763	21,387	10,695	21,422	10,683	21,405	10,623	21,395	10,532
SD	25.26	6.92	25.37	6.90	25.51	6.91	25.73	6.89	25.83	6.87	25.94	6.87	26.15	6.87
SE	0.17	0.07	0.17	0.07	0.17	0.07	0.18	0.07	0.18	0.07	0.18	0.07	0.18	0.07
NE = 0	1961.6	1961.0	1962.5	1961.1	1963.0	1961.0	1963.7	1961.1	1964.2	1961.1	1964.9	1961.1	1965.8	1961.2
N	652,983	307,062	665,580	311,280	658,286	302,476	660,110	299,109	651,011	290,964	651,394	286,263	668,653	290,019
SD	22.54	7.42	39.68	7.39	22.74	7.40	22.90	7.39	23.08	7.41	23.28	7.40	23.36	7.37
SE	0.03	0.01	0.05	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
T-stat	47.1	14.3	48.4	14.8	50.0	15.2	50.7	14.7	51.4	14.3	53.7	14.5	55.3	15.4
Difference	8.3	1.0	8.7	1.0	8.9	1.0	9.3	1.0	9.2	1.0	9.6	1.0	10.0	1.1
Urban = 1	1964.5	1962.2	1965.2	1962.3	1965.6	1962.2	1966.3	1962.3	1966.6	1962.3	1967.3	1962.3	1967.9	1962.4
N	180,193	98,655	188,627	102,628	184,507	98,464	187,055	97,726	185,408	95,709	188,223	95,356	198,788	99,208
SD	20.38	6.71	32.67	6.68	20.58	6.70	20.80	6.72	21.03	6.73	21.21	6.73	21.33	6.72
SE	0.05	0.02	0.08	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02
Urban = 0	1960.2	1960.4	1961.1	1960.4	1961.6	1960.4	1962.3	1960.5	1962.8	1960.5	1963.6	1960.5	1964.5	1960.6
N	493,176	218,729	497,761	219,236	495,146	214,775	494,442	212,078	487,025	205,938	484,576	201,530	491,260	201,343
SD	23.36	7.63	41.55	7.61	23.59	7.61	23.75	7.60	23.93	7.62	24.15	7.61	24.28	7.58
SE	0.03	0.02	0.06	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02
T-stat	-73.8	-67.5	-43.3	-68.5	-68.2	-67.1	-67.8	-65.7	-63.8	-64.9	-61.8	-64.9	-57.5	-65.0
Difference	-4.3	-1.8	-4.1	-1.9	-4.0	-1.8	-4.0	-1.8	-3.8	-1.8	-3.7	-1.8	-3.4	-1.8

Supplement 1A - T-Tests of Average Bridge Age Across Independent Variables and NBI Years

NBI:	2006		2007		2008		2009		2010		2011		2012	
Data Years:	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era	Full	Int Era
Ref. Year:	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built	Yr Built
N:	685,193	294,491	690,107	292,660	702,680	294,535	698,131	290,111	696,614	285,502	698,158	282,998	701,750	280,174
NY = 1	1960.4	1960.5	1960.8	1960.5	1967.6	1960.5	1962.0	1960.6	1962.4	1960.6	1962.9	1960.6	1963.4	1960.6
N	21,971	10,009	22,259	10,101	22,248	10,003	22,093	9,816	22,092	9,751	22,090	9,670	22,089	9,584
SD	25.35	7.37	25.49	7.36	25.70	7.35	25.98	7.36	26.13	7.37	26.34	7.37	26.56	7.37
SE	0.17	0.07	0.17	0.07	0.17	0.07	0.17	0.07	0.18	0.07	0.18	0.07	0.18	0.08
NY = 0	1966.3	1961.2	1967.0	1961.3	1961.4	1961.3	1968.2	1961.3	1968.8	1961.4	1969.4	1961.4	1970.0	1961.4
N	663,222	284,482	667,848	282,559	680,432	284,532	676,038	280,295	674,522	275,751	676,068	273,328	679,661	270,590
SD	23.62	7.34	23.77	7.33	23.89	7.33	24.00	7.32	24.16	7.32	24.28	7.31	24.44	7.30
SE	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
T-stat	34.2	9.9	35.8	10.1	35.3	10.3	35.0	9.9	35.9	9.8	35.9	10.0	36.7	10.6
Difference	5.9	0.7	6.2	0.8	-6.2	0.8	6.2	0.7	6.4	0.8	6.5	0.8	6.6	0.8
NE = 1	1956.1	1960.2	1956.7	1960.2	1957.1	1960.2	1957.5	1960.2	1958.2	1960.2	1958.8	1960.2	1959.4	1960.3
N	21,478	10,498	21,566	10,453	21,624	10,440	21,655	10,400	21,762	10,358	21,678	10,198	21,903	10,273
SD	26.41	6.87	26.64	6.87	26.82	6.87	27.02	6.87	27.42	6.87	27.69	6.83	27.85	6.83
SE	0.18	0.07	0.18	0.07	0.18	0.07	0.18	0.07	0.19	0.07	0.19	0.07	0.19	0.07
NE = 0	1966.5	1961.3	1967.1	1961.3	1967.7	1961.3	1968.3	1961.4	1968.9	1961.4	1969.5	1961.4	1970.2	1961.5
N	663,715	283,993	668,541	282,207	681,056	284,095	676,476	279,711	674,852	275,144	676,480	272,800	679,847	269,901
SD	23.54	7.36	23.69	7.35	23.80	7.35	23.91	7.34	24.07	7.33	24.19	7.32	24.35	7.32
SE	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
T-stat	56.9	16.1	56.9	16.1	57.7	16.5	58.4	16.7	56.9	16.8	56.3	17.1	56.7	17.1
Difference	10.4	1.1	10.4	1.1	10.6	1.1	10.8	1.2	10.7	1.2	10.7	1.2	10.8	1.2
Urban = 1	1968.4	1962.4	1969.0	1962.4	1969.6	1962.4	1970.2	1962.4	1970.8	1962.4	1971.2	1962.4	1971.8	1962.5
N	202,979	99,646	210,780	101,511	215,723	102,428	218,889	102,438	219,797	100,933	221,113	100,501	224,031	100,079
SD	21.58	6.71	21.88	6.73	22.05	6.74	22.21	6.74	22.50	6.75	22.64	6.76	22.85	6.76
SE	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.02
Urban = 0	1965.2	1960.6	1965.8	1960.7	1966.4	1960.7	1967.0	1960.7	1967.5	1960.7	1968.2	1960.8	1968.9	1960.8
N	482,214	194,845	479,327	191,149	486,604	192,013	479,033	187,596	476,655	184,537	476,977	182,486	477,676	180,087
SD	24.47	7.57	24.61	7.57	24.71	7.57	24.83	7.56	24.95	7.55	25.08	7.53	25.24	7.53
SE	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.02
T-stat	-54.4	-64.1	-53.3	-62.5	-53.0	-62.2	-53.7	-61.2	-53.9	-60.6	-50.2	-59.6	-47.6	-58.7
Difference	-3.2	-1.8	-3.2	-1.7	-3.2	-1.7	-3.2	-1.7	-3.3	-1.7	-3.0	-1.6	-2.9	-1.7

Supplement 1B - T-Tests of Average Sufficiency Rating Across Independent Variables and NBI Years

NBI:	1992		1993		1994		1995		1996		1997		1998	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	584,294	285,635	583,925	282,042	588,136	281,258	595,907	282,341	592,860	276,908	595,393	274,575	595,226	271,985
NY = 1	59.0	62.3	60.0	62.3	60.5	62.3	61.3	62.6	61.9	62.5	62.5	62.6	66.8	67.3
N	17,319	7,997	17,322	7,957	17,305	7,913	17,395	7,884	17,392	7,842	17,391	7,810	17,380	7,735
SD	24.6	20.2	24.5	20.3	24.5	20.2	24.3	19.9	24.2	20.0	23.9	19.7	23.9	20.2
SE	0.19	0.23	0.19	0.23	0.19	0.23	0.18	0.22	0.18	0.23	0.18	0.22	0.18	0.23
NY = 0	72.2	73.5	72.9	73.9	73.4	74.0	74.0	74.3	74.5	74.5	74.8	74.4	75.3	74.7
N	566,975	277,638	566,603	274,085	570,831	273,345	578,512	274,457	575,468	269,066	578,002	266,765	577,846	264,250
SD	24.0	21.3	23.7	21.1	23.4	20.9	23.2	20.7	23.0	20.7	22.8	20.4	22.5	20.3
SE	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
T-stat	-69.4	-48.8	-68.0	-50.2	-68.2	-50.7	-68.0	-51.5	-67.9	-52.2	-66.9	-52.2	-46.2	-31.8
Difference	-13.2	-11.2	-12.8	-11.6	-12.9	-11.7	-12.7	-11.7	-12.6	-12.0	-12.3	-11.8	-8.5	-7.4
NE = 1	72.8	79.2	73.3	79.2	73.3	78.8	73.8	78.8	73.9	78.7	73.3	78.0	74.0	78.3
N	16,957	8,449	17,064	8,461	17,120	8,449	17,263	8,493	17,261	8,474	18,593	8,874	18,574	8,846
SD	22.8	16.7	22.6	16.9	22.2	16.5	21.8	16.5	21.7	16.7	21.9	17.1	22.0	17.5
SE	0.18	0.18	0.17	0.18	0.17	0.18	0.17	0.18	0.17	0.18	0.16	0.18	0.16	0.19
NE = 0	71.7	73.0	72.5	73.4	73.0	73.5	73.6	73.8	74.2	74.0	74.5	74.0	75.1	74.3
N	567,337	277,186	566,861	273,581	571,016	272,809	578,644	273,848	575,599	268,434	576,800	265,701	576,652	263,139
SD	24.1	21.5	23.9	21.3	23.6	21.1	23.3	20.9	23.2	20.9	22.9	20.6	22.6	20.4
SE	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
T-stat	6.2	33.0	4.6	30.7	2.2	28.6	1.0	27.5	-1.4	25.2	-7.4	21.8	-6.7	21.1
Difference	1.1	6.1	0.8	5.8	0.4	5.3	0.2	5.0	-0.2	4.7	-1.2	4.0	-1.1	4.0
Urban = 1	77.3	78.3	77.7	78.5	77.8	78.2	78.3	78.3	78.6	78.4	78.6	78.1	79.2	78.5
N	116,542	67,845	117,953	67,706	122,265	69,180	124,353	69,219	126,002	69,152	128,832	69,737	129,346	69,453
SD	20.3	17.3	20.2	17.2	19.9	17.1	19.6	17.0	19.4	16.9	19.1	16.8	18.7	16.6
SE	0.06	0.07	0.06	0.07	0.06	0.07	0.06	0.06	0.05	0.06	0.05	0.06	0.05	0.06
Urban = 0	70.4	71.6	71.2	72.0	71.7	72.2	72.4	72.5	72.9	72.7	73.3	72.7	73.9	73.0
N	467,312	217,649	465,614	214,234	464,923	211,530	470,885	212,786	466,665	207,690	466,082	204,562	465,398	202,276
SD	24.8	22.3	24.5	22.1	24.3	21.9	24.0	21.7	23.9	21.7	23.7	21.4	23.5	21.2
SE	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.03	0.05	0.03	0.05
T-stat	99.2	82.1	94.4	78.8	91.5	75.2	89.1	73.2	88.0	71.7	83.9	68.0	84.8	69.8
Difference	6.9	6.7	6.5	6.4	6.1	6.1	5.8	5.8	5.7	5.7	5.3	5.4	5.3	5.5

Supplement 1B - T-Tests of Average Sufficiency Rating Across Independent Variables and NBI Years

NBI:	1999		2000		2001		2002		2003		2004		2005	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	597,646	269,644	599,047	266,922	602,953	265,283	604,231	262,496	593,932	254,003	596,042	251,196	608,286	253,271
NY = 1	73.2	74.5	74.5	75.8	76.7	78.1	77.4	78.6	77.6	78.6	77.9	78.7	78.0	78.7
N	17,372	7,674	17,391	7,610	17,429	7,539	17,443	7,474	17,381	7,431	17,397	7,371	17,436	7,325
SD	22.7	18.8	23.0	19.4	20.6	16.7	20.4	16.6	20.0	16.7	19.7	16.6	19.5	16.5
SE	0.17	0.21	0.17	0.22	0.16	0.19	0.15	0.19	0.15	0.19	0.15	0.19	0.15	0.19
NY = 0	75.7	74.8	76.2	75.0	76.5	75.0	77.0	75.3	77.4	75.5	77.8	75.7	78.3	75.7
N	580,274	261,970	581,656	259,312	585,524	257,744	586,788	255,022	576,551	246,572	578,645	243,825	590,850	245,946
SD	22.4	20.3	22.1	20.1	22.2	20.2	21.9	20.1	21.8	20.0	21.6	19.9	21.3	19.7
SE	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
T-stat	-14.3	-1.2	-9.9	3.6	1.3	15.7	2.6	17.1	1.4	15.6	0.4	15.2	-1.7	15.2
Difference	-2.5	-0.3	-1.8	0.8	0.2	3.1	0.4	3.4	0.2	3.1	0.1	3.0	-0.3	3.0
NE = 1	74.8	79.0	74.9	78.8	74.4	78.4	74.7	78.4	74.7	78.2	74.8	78.2	75.1	78.2
N	18,603	8,803	18,596	8,737	18,756	8,762	18,691	8,643	18,751	8,691	18,732	8,637	18,718	8,544
SD	21.6	17.2	21.5	17.2	21.2	16.9	21.1	17.0	21.0	17.1	20.9	17.1	20.7	17.0
SE	0.16	0.18	0.16	0.18	0.15	0.18	0.15	0.18	0.15	0.18	0.15	0.18	0.15	0.18
NE = 0	75.7	74.6	76.2	74.9	76.6	75.0	77.1	75.3	77.5	75.5	77.9	75.7	78.4	75.7
N	579,043	260,841	580,451	258,185	584,197	256,521	585,540	253,853	575,181	245,312	577,310	242,559	589,568	244,727
SD	22.4	20.3	22.2	20.1	22.2	20.2	21.9	20.1	21.7	20.0	21.5	19.9	21.3	19.7
SE	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
T-stat	-5.6	23.3	-8.4	20.9	-13.6	18.2	-15.5	16.6	-18.1	14.3	-20.4	13.0	-21.0	13.0
Difference	-0.9	4.4	-1.3	3.9	-2.1	3.4	-2.4	3.1	-2.8	2.7	-3.2	2.4	-3.2	2.4
Urban = 1	79.8	79.0	80.1	79.1	80.2	78.9	80.5	79.1	80.7	79.3	81.0	79.4	81.1	79.3
N	131,524	69,567	132,760	69,284	134,742	69,268	136,804	68,877	134,862	66,874	137,030	66,873	143,848	69,272
SD	18.3	16.3	18.1	16.3	18.4	16.6	18.2	16.4	18.1	16.4	18.0	16.4	17.7	16.2
SE	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06
Urban = 0	74.5	73.3	75.0	73.6	75.4	73.8	76.0	74.0	76.5	74.3	76.9	74.5	77.4	74.5
N	465,695	199,881	465,738	197,457	468,211	196,015	467,427	193,619	459,070	187,129	459,012	184,323	464,438	183,999
SD	23.3	21.3	23.0	21.0	23.0	21.1	22.8	21.0	22.6	20.8	22.4	20.7	22.2	20.7
SE	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05
T-stat	88.5	72.9	85.0	70.0	78.8	65.4	76.2	64.3	71.4	62.1	69.0	61.0	64.8	60.9
Difference	5.4	5.7	5.1	5.5	4.8	5.2	4.5	5.1	4.3	4.9	4.1	4.9	3.7	4.8

Supplement 1B - T-Tests of Average Sufficiency Rating Across Independent Variables and NBI Years

NBI:	2006		2007		2008		2009		2010		2011		2012	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	609,969	250,371	612,316	247,958	612,959	245,209	608,134	241,346	608,065	237,890	608,376	235,387	609,754	232,326
NY = 1	77.8	78.4	77.8	78.2	78.2	78.5	78.3	78.5	79.2	78.6	79.4	78.5	79.5	78.3
N	17,425	7,266	17,448	7,210	17,450	7,138	17,457	7,068	17,443	7,009	17,459	6,961	17,492	6,915
SD	19.7	16.7	19.6	16.7	19.2	16.4	19.2	16.3	18.3	16.1	18.2	16.1	18.1	16.2
SE	0.15	0.20	0.15	0.20	0.15	0.19	0.15	0.19	0.14	0.19	0.14	0.19	0.14	0.20
NY = 0	78.6	75.8	79.0	76.0	79.3	76.0	79.5	76.1	79.8	76.3	80.2	76.4	80.5	76.6
N	592,544	243,105	594,868	240,748	595,509	238,071	590,677	234,278	590,622	230,881	590,917	228,426	592,262	225,411
SD	21.1	19.6	20.9	19.5	20.6	19.3	20.4	19.2	20.2	19.2	20.0	19.2	19.8	19.0
SE	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
T-stat	-5.5	12.9	-8.2	11.3	-7.5	12.5	-7.9	12.1	-4.4	12.0	-5.3	10.6	-7.0	8.4
Difference	-0.8	2.6	-1.2	2.3	-1.1	2.5	-1.2	2.4	-0.6	2.4	-0.7	2.1	-1.0	1.7
NE = 1	75.4	78.6	75.8	78.9	76.4	78.7	76.5	78.6	76.8	78.5	77.3	78.8	77.6	78.6
N	18,833	8,523	18,926	8,492	18,794	8,452	18,803	8,418	18,899	8,377	18,928	8,302	18,994	8,269
SD	20.7	16.7	21.1	16.9	20.0	16.8	19.9	16.8	19.8	16.9	19.3	16.7	19.2	16.8
SE	0.15	0.18	0.15	0.18	0.15	0.18	0.15	0.18	0.14	0.18	0.14	0.18	0.14	0.18
NE = 0	78.7	75.8	79.1	75.9	79.4	76.0	79.6	76.1	79.9	76.3	80.2	76.4	80.5	76.6
N	591,136	241,848	593,390	239,466	594,165	236,757	589,331	232,928	589,166	229,513	589,448	227,085	590,760	224,057
SD	21.0	19.6	20.9	19.5	20.6	19.3	20.3	19.2	20.1	19.2	20.0	19.2	19.7	19.0
SE	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
T-stat	-21.8	15.0	-20.8	16.0	-20.2	14.4	-20.9	13.0	-21.5	12.0	-20.1	12.6	-21.0	10.8
Difference	-3.3	2.8	-3.2	3.0	-3.0	2.7	-3.1	2.5	-3.1	2.3	-2.9	2.4	-3.0	2.0
Urban = 1	81.2	79.2	81.4	79.3	81.5	79.2	81.8	79.3	82.1	79.4	82.3	79.4	82.4	79.4
N	147,460	69,855	152,623	70,782	154,618	70,727	157,047	70,933	157,813	70,120	159,271	69,629	160,946	69,255
SD	17.6	16.1	17.5	16.0	17.2	16.0	16.9	15.8	16.7	15.7	16.5	15.7	16.4	15.7
SE	0.05	0.06	0.04	0.06	0.04	0.06	0.04	0.06	0.04	0.06	0.04	0.06	0.04	0.06
Urban = 0	77.8	74.6	78.1	74.7	78.5	74.9	78.6	74.9	79.0	75.1	79.4	75.2	79.8	75.5
N	462,509	180,516	459,693	177,176	458,193	174,454	451,025	170,401	448,881	167,766	449,088	165,757	448,805	163,071
SD	22.0	20.5	21.8	20.5	21.5	20.3	21.4	20.2	21.2	20.3	21.0	20.3	20.8	20.1
SE	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05
T-stat	60.4	59.0	58.9	58.8	55.1	55.9	59.4	57.6	58.7	56.4	56.5	54.2	51.1	50.7
Difference	3.4	4.6	3.2	4.6	3.0	4.3	3.2	4.4	3.1	4.4	2.9	4.2	2.6	3.9

Supplement 1C - T-Tests of Average Deck Condition Rating Across Independent Variables and NBI Years

NBI:	1992		1993		1994		1995		1996		1997		1998	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	469,799	230,979	468,120	227,823	469,473	226,589	474,252	227,462	470,790	222,894	470,967	220,114	470,123	217,857
NY = 1	5.13	5.14	5.17	5.15	5.20	5.17	5.25	5.19	5.28	5.20	5.29	5.20	5.71	5.61
N	12,543	6,017	12,395	5,986	12,280	5,947	12,231	5,916	12,120	5,871	12,025	5,846	11,946	5,788
SD	1.4	1.2	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3
SE	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
NY = 0	6.57	6.51	6.59	6.52	6.61	6.51	6.62	6.51	6.61	6.48	6.62	6.46	6.62	6.45
N	457,256	224,962	455,725	221,837	457,193	220,642	462,021	221,546	458,670	217,023	458,942	214,268	458,177	212,069
SD	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.3	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-113.0	-85.3	-107.9	-82.8	-106.2	-81.0	-102.3	-78.8	-99.1	-76.4	-98.8	-76.1	-67.5	-48.7
Difference	-1.44	-1.37	-1.42	-1.37	-1.41	-1.34	-1.37	-1.32	-1.33	-1.28	-1.33	-1.26	-0.91	-0.84
NE = 1	6.22	6.36	6.28	6.43	6.32	6.45	6.36	6.47	6.38	6.50	6.38	6.49	6.40	6.47
N	14,980	7,581	14,967	7,527	14,987	7,506	15,125	7,561	15,105	7,534	15,845	7,641	15,827	7,618
SD	1.4	1.1	1.4	1.1	1.4	1.1	1.3	1.1	1.3	1.1	1.4	1.1	1.3	1.1
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.54	6.48	6.56	6.48	6.58	6.48	6.59	6.47	6.58	6.45	6.59	6.43	6.60	6.43
N	454,819	223,398	453,153	220,296	454,486	219,083	459,127	219,901	455,685	215,360	455,122	212,473	454,296	210,239
SD	1.4	1.3	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-29.1	-9.0	-25.0	-4.2	-23.3	-1.9	-20.9	0.2	-18.1	4.0	-19.0	5.1	-19.1	3.8
Difference	-0.32	-0.12	-0.28	-0.05	-0.26	-0.03	-0.23	0.00	-0.20	0.05	-0.21	0.06	-0.20	0.04
Urban = 1	6.53	6.41	6.56	6.42	6.56	6.41	6.57	6.41	6.58	6.41	6.54	6.34	6.55	6.34
N	95,539	57,124	96,411	56,932	99,726	58,196	100,928	58,130	101,973	57,964	104,039	58,328	104,537	58,126
SD	1.4	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.2	1.1	1.2	1.1
SE	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.53	6.50	6.55	6.50	6.57	6.50	6.58	6.49	6.57	6.47	6.60	6.46	6.61	6.46
N	373,845	173,715	371,404	170,800	368,970	167,940	372,829	169,079	368,662	164,877	366,538	161,568	365,152	159,508
SD	1.4	1.3	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-0.4	-14.5	1.9	-12.7	-2.1	-14.9	-2.2	-14.3	1.9	-10.8	-13.8	-21.4	-15.4	-22.2
Difference	0.00	-0.09	0.01	-0.08	-0.01	-0.09	-0.01	-0.08	0.01	-0.06	-0.06	-0.12	-0.06	-0.12

Supplement 1C - T-Tests of Average Deck Condition Rating Across Independent Variables and NBI Years

NBI:	1999		2000		2001		2002		2003		2004		2005	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	470,957	215,558	481,736	218,476	473,557	211,386	473,062	208,442	465,715	202,173	465,172	199,167	472,428	199,513
NY = 1	6.27	6.15	6.47	6.26	6.52	6.29	6.56	6.31	6.60	6.35	6.64	6.37	6.65	6.36
N	13,332	6,127	14,681	6,366	14,948	6,430	14,939	6,369	14,905	6,312	14,920	6,255	14,941	6,209
SD	1.5	1.3	1.6	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3
SE	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
NY = 0	6.60	6.41	6.57	6.37	6.60	6.38	6.60	6.36	6.60	6.35	6.60	6.34	6.61	6.32
N	457,625	209,431	467,055	212,110	458,609	204,956	458,123	202,073	450,810	195,861	450,252	192,912	457,487	193,304
SD	1.3	1.2	1.4	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-25.1	-15.7	-8.2	-6.2	-6.8	-5.2	-3.6	-3.1	0.4	0.3	3.1	1.9	3.4	2.8
Difference	-0.33	-0.26	-0.10	-0.11	-0.08	-0.09	-0.04	-0.05	0.00	0.00	0.04	0.03	0.04	0.04
NE = 1	6.41	6.46	6.41	6.42	6.42	6.40	6.43	6.40	6.43	6.37	6.44	6.37	6.46	6.37
N	15,784	7,567	15,848	7,557	15,783	7,528	15,703	7,422	15,770	7,470	15,734	7,424	15,706	7,340
SD	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.60	6.40	6.58	6.36	6.61	6.37	6.61	6.36	6.60	6.35	6.61	6.34	6.61	6.32
N	455,173	207,991	465,888	210,919	457,774	203,858	457,359	201,020	449,945	194,703	449,438	191,743	456,722	192,173
SD	1.3	1.2	1.4	1.3	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-17.3	4.8	-16.0	4.2	-17.6	2.5	-16.9	2.8	-16.9	1.7	-16.0	2.5	-14.7	4.1
Difference	-0.19	0.06	-0.17	0.06	-0.19	0.03	-0.18	0.04	-0.17	0.02	-0.17	0.03	-0.15	0.05
Urban = 1	6.55	6.32	6.46	6.23	6.54	6.29	6.55	6.28	6.55	6.28	6.56	6.28	6.55	6.26
N	106,320	58,240	113,574	61,093	108,744	58,056	110,125	57,544	108,740	55,994	110,101	55,892	115,180	57,630
SD	1.2	1.1	1.5	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.1
SE	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.60	6.43	6.61	6.42	6.62	6.41	6.62	6.39	6.61	6.37	6.61	6.36	6.63	6.34
N	364,267	157,150	367,720	157,226	364,813	153,330	362,937	150,898	356,975	146,179	355,071	143,275	357,248	141,883
SD	1.3	1.2	1.4	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-12.1	-19.8	-31.0	-29.8	-17.7	-21.4	-17.5	-19.9	-15.3	-16.4	-14.0	-13.9	-17.8	-13.6
Difference	-0.05	-0.11	-0.15	-0.19	-0.08	-0.12	-0.07	-0.11	-0.06	-0.09	-0.05	-0.08	-0.08	-0.08

Supplement 1C - T-Tests of Average Deck Condition Rating Across Independent Variables and NBI Years

NBI:	2006		2007		2008		2009		2010		2011		2012	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	472,349	196,603	473,122	194,210	473,206	191,757	471,445	188,841	469,761	186,128	469,946	183,586	469,742	180,596
NY = 1	6.64	6.35	6.64	6.33	6.64	6.32	6.62	6.30	6.61	6.28	6.61	6.27	6.58	6.23
N	14,882	6,145	14,901	6,090	14,924	6,033	14,902	5,961	14,886	5,908	14,826	5,853	14,773	5,806
SD	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.4	1.3
SE	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
NY = 0	6.61	6.30	6.60	6.28	6.60	6.26	6.58	6.24	6.58	6.23	6.58	6.22	6.58	6.21
N	457,467	190,458	458,221	188,120	458,282	185,724	456,543	182,880	454,875	180,220	455,120	177,733	454,969	174,790
SD	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.2	1.1	1.2	1.1	1.2	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	2.5	3.0	2.6	3.1	3.4	3.4	3.1	3.8	2.8	3.3	2.3	2.5	0.6	1.0
Difference	0.03	0.05	0.04	0.05	0.04	0.06	0.04	0.06	0.03	0.05	0.03	0.05	0.00	0.02
NE = 1	6.47	6.36	6.49	6.36	6.48	6.33	6.47	6.31	6.49	6.31	6.50	6.31	6.51	6.31
N	15,840	7,324	15,908	7,301	15,917	7,272	15,901	7,237	15,940	7,196	15,897	7,123	15,949	7,095
SD	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.2	1.1	1.3	1.1
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.61	6.30	6.61	6.28	6.60	6.26	6.59	6.23	6.58	6.23	6.58	6.22	6.58	6.21
N	456,509	189,279	457,214	186,909	457,289	184,485	455,544	181,604	453,821	178,932	454,049	176,463	453,793	173,501
SD	1.3	1.2	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.2	1.1	1.2	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-13.6	5.5	-12.0	6.4	-12.4	5.5	-11.4	5.9	-9.2	6.8	-8.1	7.3	-6.6	7.7
Difference	-0.14	0.06	-0.12	0.08	-0.12	0.07	-0.12	0.08	-0.09	0.08	-0.08	0.09	-0.07	0.10
Urban = 1	6.55	6.25	6.55	6.23	6.55	6.22	6.54	6.21	6.54	6.22	6.54	6.22	6.53	6.22
N	117,732	57,936	121,699	58,621	123,344	58,545	124,829	58,442	125,420	57,893	126,382	57,392	127,349	56,949
SD	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.63	6.32	6.62	6.30	6.62	6.28	6.60	6.25	6.60	6.24	6.60	6.22	6.59	6.21
N	354,617	138,667	351,423	135,589	349,627	133,184	346,559	130,389	344,298	128,234	343,545	126,192	342,391	123,647
SD	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-18.3	-12.3	-18.1	-11.3	-17.5	-9.5	-15.8	-6.5	-13.7	-3.2	-13.2	-0.2	-15.5	2.6
Difference	-0.08	-0.07	-0.07	-0.07	-0.07	-0.06	-0.06	-0.04	-0.06	-0.02	-0.06	0.00	-0.06	0.01

Supplement 1D - T-Tests of Average Superstructure Condition Rating Across Independent Variables and NBI Years

NBI:	1992		1993		1994		1995		1996		1997		1998	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	475,844	232,466	473,706	228,926	475,467	227,752	479,968	228,329	476,705	223,928	476,541	221,036	475,145	218,613
NY = 1	5.21	5.33	5.27	5.33	5.30	5.32	5.34	5.32	5.37	5.30	5.40	5.28	5.81	5.72
N	15,732	7,020	15,701	6,995	15,662	6,942	15,713	6,913	15,695	6,880	15,677	6,844	15,656	6,783
SD	1.6	1.3	1.6	1.3	1.6	1.3	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.3
SE	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
NY = 0	6.63	6.68	6.64	6.67	6.65	6.66	6.66	6.64	6.66	6.62	6.66	6.59	6.67	6.58
N	460,112	225,446	458,005	221,931	459,805	220,810	464,255	221,416	461,010	217,048	460,864	214,192	459,489	211,830
SD	1.5	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-111.4	-89.4	-106.9	-88.7	-104.0	-87.8	-101.4	-87.5	-99.9	-88.6	-98.1	-88.2	-67.2	-56.1
Difference	-1.42	-1.35	-1.37	-1.34	-1.35	-1.34	-1.32	-1.32	-1.29	-1.32	-1.26	-1.31	-0.86	-0.86
NE = 1	6.39	6.71	6.43	6.74	6.45	6.74	6.46	6.71	6.46	6.69	6.45	6.65	6.45	6.63
N	15,601	7,683	15,620	7,642	15,642	7,615	15,772	7,647	15,749	7,616	16,493	7,721	16,463	7,690
SD	1.4	1.0	1.4	1.0	1.4	1.0	1.4	1.0	1.4	1.0	1.4	1.0	1.3	1.0
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.59	6.64	6.60	6.63	6.62	6.62	6.62	6.60	6.62	6.57	6.62	6.55	6.65	6.55
N	460,243	224,783	458,086	221,284	459,825	220,137	464,196	220,682	460,956	216,312	460,048	213,315	458,682	210,923
SD	1.5	1.3	1.5	1.2	1.5	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-17.3	5.9	-15.0	9.2	-15.0	10.2	-14.5	9.6	-14.5	9.9	-16.4	9.0	-18.7	6.7
Difference	-0.20	0.07	-0.17	0.11	-0.17	0.12	-0.16	0.11	-0.16	0.12	-0.17	0.10	-0.20	0.08
Urban = 1	6.71	6.70	6.72	6.69	6.72	6.67	6.72	6.64	6.72	6.62	6.69	6.56	6.72	6.57
N	98,255	58,046	98,982	57,708	102,256	58,887	103,395	58,773	104,398	58,591	106,239	58,787	106,641	58,560
SD	1.4	1.1	1.4	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.55	6.62	6.56	6.61	6.58	6.60	6.59	6.59	6.58	6.56	6.60	6.55	6.62	6.55
N	377,115	174,272	374,399	171,126	372,423	168,412	376,178	169,387	372,141	165,282	369,894	162,024	368,051	159,824
SD	1.5	1.3	1.5	1.3	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	32.3	13.6	32.9	13.9	29.3	11.5	27.3	10.0	28.8	10.4	21.2	2.5	20.9	4.4
Difference	0.16	0.08	0.16	0.08	0.14	0.07	0.13	0.05	0.14	0.06	0.09	0.01	0.10	0.02

Supplement 1D - T-Tests of Average Superstructure Condition Rating Across Independent Variables and NBI Years

NBI:	1999		2000		2001		2002		2003		2004		2005	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	470,957	215,558	481,736	218,476	473,557	211,386	473,062	208,442	465,715	202,173	465,172	199,167	472,428	199,513
NY = 1	6.40	6.37	6.55	6.51	6.74	6.65	6.79	6.67	6.83	6.69	6.85	6.69	6.86	6.68
N	15,614	6,716	15,611	6,656	15,596	6,587	15,595	6,530	15,624	6,505	15,654	6,453	15,694	6,414
SD	1.6	1.2	1.7	1.4	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2
SE	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NY = 0	6.66	6.55	6.64	6.51	6.67	6.52	6.68	6.50	6.67	6.48	6.68	6.47	6.68	6.45
N	459,602	209,357	469,579	212,192	460,836	204,992	460,336	202,083	453,205	195,972	452,931	193,130	460,228	193,531
SD	1.4	1.1	1.4	1.2	1.4	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-20.8	-11.9	-6.7	-0.2	5.8	8.8	9.5	11.4	12.8	14.0	14.7	14.8	15.1	16.0
Difference	-0.26	-0.18	-0.09	0.00	0.07	0.13	0.11	0.17	0.16	0.21	0.17	0.22	0.18	0.23
NE = 1	6.45	6.61	6.45	6.58	6.45	6.57	6.46	6.55	6.45	6.51	6.46	6.50	6.47	6.49
N	16,428	7,641	16,512	7,625	16,422	7,590	16,343	7,486	16,411	7,542	16,389	7,494	16,342	7,409
SD	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.66	6.55	6.65	6.51	6.68	6.52	6.69	6.51	6.69	6.49	6.69	6.48	6.70	6.45
N	458,788	208,432	468,678	211,223	460,010	203,989	459,588	201,127	452,418	194,935	452,196	192,089	459,580	192,536
SD	1.4	1.2	1.5	1.2	1.4	1.1	1.4	1.1	1.4	1.1	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-19.6	6.0	-18.8	6.3	-21.6	4.0	-21.6	3.7	-22.3	2.1	-22.0	2.4	-21.8	3.3
Difference	-0.21	0.06	-0.20	0.07	-0.23	0.05	-0.23	0.04	-0.24	0.02	-0.23	0.02	-0.23	0.04
Urban = 1	6.75	6.59	6.66	6.50	6.76	6.56	6.77	6.56	6.77	6.55	6.78	6.54	6.77	6.52
N	108,015	58,546	115,168	61,339	110,008	58,154	111,379	57,606	110,108	56,111	111,600	56,055	116,743	57,811
SD	1.2	1.0	1.5	1.3	1.2	1.1	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0
SE	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.63	6.53	6.63	6.52	6.65	6.51	6.65	6.49	6.65	6.47	6.65	6.45	6.66	6.43
N	366,807	157,348	369,557	157,341	366,424	153,425	364,552	151,007	358,721	146,366	356,985	143,528	359,179	142,134
SD	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	27.6	10.0	5.9	-2.8	24.9	9.4	27.9	13.4	29.1	16.2	29.9	17.7	24.6	17.7
Difference	0.12	0.06	0.03	-0.02	0.11	0.05	0.12	0.07	0.12	0.08	0.13	0.09	0.11	0.09

Supplement 1D - T-Tests of Average Superstructure Condition Rating Across Independent Variables and NBI Years

NBI:	2006		2007		2008		2009		2010		2011		2012	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	472,349	196,603	473,122	194,210	473,206	191,757	471,445	188,841	469,761	186,128	469,946	183,586	469,742	180,596
NY = 1	6.85	6.66	6.85	6.62	6.83	6.58	6.82	6.55	6.80	6.52	6.79	6.47	6.76	6.43
N	15,679	6,358	15,704	6,301	15,688	6,233	15,673	6,160	15,660	6,108	15,631	6,055	15,579	6,003
SD	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2
SE	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
NY = 0	6.69	6.43	6.69	6.41	6.68	6.39	6.67	6.36	6.67	6.34	6.66	6.33	6.66	6.31
N	460,328	190,738	461,101	188,417	461,124	185,989	460,424	183,557	458,635	180,880	459,096	178,472	459,063	175,571
SD	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	14.0	15.1	13.3	13.7	12.9	12.3	12.2	12.0	11.4	11.4	10.4	9.5	8.9	7.8
Difference	0.16	0.23	0.16	0.21	0.15	0.19	0.15	0.19	0.13	0.18	0.13	0.14	0.10	0.12
NE = 1	6.48	6.47	6.48	6.46	6.47	6.44	6.46	6.41	6.48	6.39	6.48	6.38	6.48	6.34
N	16,454	7,395	16,543	7,373	16,556	7,348	16,541	7,316	16,595	7,281	16,556	7,213	16,608	7,190
SD	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3	1.1
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.70	6.44	6.70	6.42	6.70	6.39	6.69	6.37	6.68	6.35	6.68	6.33	6.67	6.31
N	459,553	189,701	460,262	187,345	460,256	184,874	459,556	182,401	457,700	179,707	458,171	177,314	458,034	174,384
SD	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-22.1	3.2	-21.5	4.0	-22.0	3.7	-21.4	3.9	-19.5	3.8	-19.1	3.7	-18.4	2.6
Difference	-0.22	0.03	-0.22	0.04	-0.23	0.05	-0.23	0.04	-0.20	0.04	-0.20	0.05	-0.19	0.03
Urban = 1	6.77	6.50	6.77	6.49	6.76	6.46	6.75	6.44	6.75	6.43	6.74	6.41	6.73	6.40
N	119,390	58,151	123,447	58,857	125,055	58,767	126,841	58,760	127,388	58,195	128,478	57,741	129,493	57,327
SD	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.67	6.41	6.67	6.39	6.66	6.36	6.65	6.33	6.64	6.31	6.64	6.29	6.64	6.28
N	356,617	138,945	353,358	135,861	351,511	133,426	349,196	130,946	346,862	128,791	346,230	126,784	345,147	124,247
SD	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.3	1.1	1.3	1.1
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	22.5	17.4	23.1	18.9	22.7	19.2	24.2	20.7	25.3	22.3	24.6	22.1	22.5	22.4
Difference	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.12	0.10	0.12	0.09	0.12

Supplement 1E - T-Tests of Average Substructure Condition Rating Across Independent Variables and NBI Years

NBI:	1992		1993		1994		1995		1996		1997		1998	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	476,467	232,761	474,228	229,192	475,816	227,923	480,545	228,705	477,049	224,106	477,500	221,388	476,522	219,065
NY = 1	4.65	4.63	4.70	4.63	4.71	4.62	4.74	4.62	4.76	4.61	4.76	4.59	5.22	5.04
N	15,710	7,016	15,687	6,989	15,653	6,938	15,702	6,912	15,685	6,877	15,670	6,844	15,640	6,781
SD	1.3	1.0	1.3	1.0	1.3	1.0	1.3	0.9	1.3	0.9	1.3	0.9	1.4	1.1
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NY = 0	6.49	6.48	6.49	6.46	6.51	6.44	6.51	6.43	6.51	6.41	6.49	6.36	6.50	6.35
N	460,757	225,745	458,541	222,203	460,163	220,985	464,843	221,793	461,364	217,229	461,830	214,544	460,882	212,284
SD	1.5	1.3	1.5	1.3	1.5	1.3	1.4	1.3	1.4	1.3	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-180.3	-155.4	-174.8	-154.6	-175.5	-154.1	-172.0	-156.3	-168.8	-155.1	-168.5	-155.4	-115.4	-95.9
Difference	-1.84	-1.85	-1.79	-1.83	-1.80	-1.82	-1.77	-1.81	-1.75	-1.80	-1.73	-1.77	-1.28	-1.31
NE = 1	6.37	6.60	6.40	6.59	6.40	6.57	6.41	6.57	6.41	6.55	6.39	6.53	6.38	6.51
N	15,617	7,692	15,632	7,649	15,649	7,621	15,780	7,657	15,756	7,625	16,506	7,734	16,473	7,699
SD	1.2	0.9	1.2	1.0	1.2	1.0	1.2	0.9	1.2	0.9	1.2	1.0	1.2	1.0
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.43	6.41	6.43	6.39	6.45	6.38	6.46	6.37	6.45	6.35	6.44	6.30	6.46	6.30
N	460,850	225,069	458,596	221,543	460,167	220,302	464,765	221,048	461,293	216,481	460,994	213,654	460,049	211,366
SD	1.5	1.4	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.5	1.3	1.4	1.3
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-6.1	16.7	-3.9	17.9	-5.0	17.0	-4.5	17.6	-4.9	18.4	-5.0	20.6	-8.2	18.1
Difference	-0.06	0.19	-0.03	0.20	-0.05	0.19	-0.05	0.20	-0.04	0.20	-0.05	0.23	-0.08	0.21
Urban = 1	6.64	6.60	6.64	6.57	6.63	6.55	6.63	6.54	6.63	6.52	6.57	6.44	6.60	6.45
N	98,356	58,067	99,046	57,728	102,305	58,906	103,445	58,797	104,477	58,628	106,415	58,867	106,850	58,648
SD	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.1	1.3	1.1	1.2	1.1	1.2	1.0
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.37	6.36	6.38	6.34	6.39	6.33	6.40	6.32	6.40	6.29	6.39	6.26	6.42	6.26
N	377,640	174,548	374,862	171,372	372,728	168,563	376,595	169,654	372,411	165,423	370,677	162,296	369,219	160,188
SD	1.6	1.4	1.5	1.4	1.5	1.4	1.5	1.4	1.5	1.3	1.5	1.3	1.5	1.3
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	53.9	40.1	52.8	39.3	49.7	37.7	48.4	37.7	50.7	39.9	40.0	32.8	40.4	35.2
Difference	0.27	0.24	0.26	0.23	0.24	0.22	0.23	0.22	0.23	0.23	0.18	0.18	0.18	0.19

Supplement 1E - T-Tests of Average Substructure Condition Rating Across Independent Variables and NBI Years

NBI:	1999		2000		2001		2002		2003		2004		2005	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	476,432	216,556	485,956	219,173	476,904	211,813	476,598	208,920	469,491	202,712	469,130	199,762	476,278	200,062
NY = 1	6.00	5.84	6.24	6.07	6.46	6.27	6.50	6.28	6.49	6.26	6.50	6.25	6.52	6.24
N	15,599	6,713	15,606	6,655	15,592	6,587	15,591	6,530	15,623	6,505	15,653	6,453	15,693	6,414
SD	1.4	1.2	1.6	1.3	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1
SE	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NY = 0	6.50	6.33	6.48	6.30	6.51	6.30	6.51	6.29	6.51	6.28	6.52	6.27	6.53	6.25
N	460,833	209,843	470,350	212,518	461,312	205,226	461,007	202,390	453,868	196,207	453,477	193,309	460,585	193,648
SD	1.4	1.2	1.5	1.3	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-43.1	-33.1	-18.2	-13.9	-3.9	-2.7	-0.7	-1.1	-1.9	-1.4	-1.3	-1.5	-0.9	-0.7
Difference	-0.50	-0.49	-0.24	-0.23	-0.05	-0.03	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01
NE = 1	6.38	6.48	6.37	6.44	6.37	6.42	6.36	6.39	6.34	6.35	6.35	6.34	6.36	6.32
N	16,446	7,657	16,530	7,644	16,454	7,619	16,371	7,509	16,427	7,556	16,399	7,506	16,353	7,423
SD	1.2	1.0	1.2	0.9	1.2	0.9	1.2	0.9	1.2	1.0	1.2	1.0	1.2	1.0
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.49	6.31	6.47	6.28	6.51	6.30	6.52	6.29	6.51	6.27	6.52	6.27	6.54	6.25
N	459,986	208,899	469,426	211,529	460,450	204,194	460,227	201,411	453,064	195,156	452,731	192,256	459,925	192,639
SD	1.4	1.2	1.5	1.3	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-11.4	14.6	-11.2	14.4	-15.4	11.4	-17.2	9.0	-18.6	6.6	-18.9	6.5	-19.5	6.3
Difference	-0.11	0.17	-0.10	0.16	-0.14	0.12	-0.16	0.10	-0.17	0.08	-0.17	0.07	-0.18	0.07
Urban = 1	6.63	6.47	6.55	6.40	6.65	6.46	6.66	6.46	6.66	6.45	6.66	6.45	6.66	6.43
N	108,261	58,659	115,319	61,419	110,085	58,210	111,515	57,698	110,214	56,178	111,690	56,110	116,797	57,838
SD	1.2	1.0	1.4	1.2	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.44	6.26	6.44	6.25	6.46	6.24	6.46	6.23	6.46	6.21	6.47	6.20	6.49	6.18
N	367,776	157,717	370,172	157,585	366,819	153,603	365,083	151,222	359,277	146,534	357,440	143,652	359,481	142,224
SD	1.5	1.3	1.5	1.3	1.5	1.3	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	46.1	39.5	23.3	25.1	44.7	40.5	47.9	45.0	47.4	46.7	46.0	47.3	40.8	48.2
Difference	0.19	0.21	0.11	0.15	0.19	0.22	0.20	0.23	0.20	0.24	0.19	0.25	0.17	0.25

Supplement 1E - T-Tests of Average Substructure Condition Rating Across Independent Variables and NBI Years

NBI:	2006		2007		2008		2009		2010		2011		2012	
Data Years:	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra	Full	IntEra
N:	476,194	197,166	476,966	194,776	476,994	192,295	476,286	189,813	475,716	187,097	474,991	184,707	474,713	181,609
NY = 1	6.52	6.22	6.53	6.21	6.52	6.18	6.51	6.15	6.51	6.14	6.51	6.11	6.49	6.06
N	15,677	6,357	15,702	6,300	15,690	6,233	15,677	6,160	15,665	6,109	15,633	6,055	15,582	6,004
SD	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1	1.4	1.1
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NY = 0	6.54	6.24	6.55	6.23	6.55	6.21	6.54	6.19	6.54	6.17	6.53	6.16	6.53	6.15
N	460,517	190,809	461,264	188,476	461,304	186,062	460,609	183,653	460,051	180,988	459,358	178,652	459,131	175,605
SD	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-2.2	-1.7	-1.9	-1.4	-2.2	-2.6	-2.4	-2.7	-2.2	-2.3	-1.6	-3.5	-3.7	-6.0
Difference	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04	-0.03	-0.03	-0.02	-0.05	-0.04	-0.09
NE = 1	6.37	6.32	6.37	6.31	6.36	6.27	6.36	6.26	6.38	6.25	6.39	6.25	6.40	6.24
N	16,463	7,405	16,552	7,383	16,568	7,360	16,551	7,325	16,603	7,288	16,558	7,215	16,608	7,190
SD	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0
SE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NE = 0	6.55	6.24	6.56	6.23	6.55	6.21	6.54	6.18	6.54	6.17	6.53	6.15	6.53	6.14
N	459,731	189,761	460,414	187,393	460,426	184,935	459,735	182,488	459,113	179,809	458,433	177,492	458,105	174,419
SD	1.4	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2	1.3	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	-19.0	7.1	-19.6	6.9	-20.6	5.6	-19.6	6.6	-17.0	7.5	-15.2	8.9	-14.3	8.5
Difference	-0.18	0.08	-0.19	0.08	-0.19	0.06	-0.18	0.08	-0.16	0.08	-0.14	0.10	-0.13	0.10
Urban = 1	6.66	6.42	6.66	6.40	6.66	6.39	6.65	6.37	6.65	6.36	6.64	6.35	6.63	6.34
N	119,418	58,166	123,458	58,860	125,070	58,773	126,894	58,794	127,463	58,251	128,523	57,780	129,491	57,332
SD	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	0.9	1.1	0.9	1.1	0.9
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban = 0	6.50	6.17	6.51	6.15	6.51	6.13	6.50	6.10	6.49	6.08	6.49	6.07	6.49	6.06
N	356,776	139,000	353,508	135,916	351,677	133,493	349,332	131,008	346,971	128,844	346,449	126,925	345,220	124,277
SD	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2	1.4	1.2
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-stat	39.2	49.2	38.2	48.7	38.5	50.2	39.8	52.2	41.0	54.0	41.3	54.2	39.0	54.5
Difference	0.16	0.25	0.15	0.25	0.15	0.26	0.15	0.27	0.16	0.28	0.15	0.28	0.14	0.28

Supplement 2 - Dispersion Parameters for Main Analysis (NBI 1992, Interstate Era)

Panel 1A: DV "Mini", Reform 1956

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	36708	48869	48108	40963
Residual DF	45242	45292	45292	45243
Dispersion Parameter	0.81	1.08	1.06	0.91

Panel 1B: DV "Mini", Reform 1960

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	38625	43779	44634	41433
Residual DF	44389	44439	44439	44390
Dispersion Parameter	0.87	0.99	1.00	0.93

Panel 2A: DV "Low", Reform 1956

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	39687	42983	44974	42503
Residual DF	45242	45292	45292	45243
Dispersion Parameter	0.88	0.95	0.99	0.94

Panel 2B: DV "Low", Reform 1960

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	40707	45058	46566	45320
Residual DF	44389	44439	44439	44390
Dispersion Parameter	0.92	1.01	1.05	1.02

Panel 3A: DV "Mid", Reform 1956

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	47204	46218	46244	47021
Residual DF	45242	45292	45292	45243
Dispersion Parameter	1.04	1.02	1.02	1.04

Panel 3B: DV "Mid", Reform 1960

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	45968	45188	45225	45845
Residual DF	44389	44439	44439	44390
Dispersion Parameter	1.04	1.02	1.02	1.03

Panel 4A: DV "High", Reform 1956

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	48343	47005	47117	48009
Residual DF	45242	45292	45292	45243
Dispersion Parameter	1.07	1.04	1.04	1.06

Panel 4B: DV "High", Reform 1960

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	47300	46251	46349	47039
Residual DF	44389	44439	44439	44390
Dispersion Parameter	1.07	1.04	1.04	1.06

Panel 5A: DV "Super", Reform 1956

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	46300	46571	46576	46312
Residual DF	45242	45292	45292	45243
Dispersion Parameter	1.02	1.03	1.03	1.02

Panel 5B: DV "Super", Reform 1960

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	45637	45905	45771	45610
Residual DF	44389	44439	44439	44390
Dispersion Parameter	1.03	1.03	1.03	1.03

Panel 6A: DV "UnderRecord", Reform 1956

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	379153	419052	417970	379733
Residual DF	316345	316395	316395	316346
Dispersion Parameter	1.20	1.32	1.32	1.20

Panel 6B: DV "UnderRecord", Reform 1960

	Model 4a	Model 4b	Model 4c	Model 4d
Pearson Statistic	379458	408702	410016	363631
Residual DF	314302	314352	314352	314303
Dispersion Parameter	1.21	1.30	1.30	1.16

Supplement 3 - NBI 1992, Full Model Set

Panel 1A: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12')

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	0.857[0.509]	0.813[0.524]	0.240[0.782]	0.226[0.794]	0.291[0.734]	0.223[0.795]	0.813[0.524]	0.812[0.527]
	(1.30)	(1.28)	(0.86)	(0.87)	(0.86)	(0.86)	(1.28)	(1.29)
Reform56		-1.556[0.000]	-1.354[0.000]	-1.297[0.000]	-1.350[0.000]	-1.309[0.000]	-1.556[0.000]	-1.058[0.001]
		(0.22)	(0.19)	(0.20)	(0.19)	(0.19)	(0.22)	(0.32)
NY			0.246[0.317]	0.414[0.136]				
			(0.25)	(0.28)				
R56xNY				-0.555[0.313]				
				(0.55)				
NE					-0.704[0.177]	-0.106[0.856]		
					(0.52)	(0.58)		
R56xNE						-1.713[0.187]		
						(1.30)		
Urban	0.193[0.313]	0.227[0.244]	0.122[0.489]	0.126[0.472]	0.146[0.403]	0.165[0.349]	0.227[0.244]	0.754[0.011]
	(0.19)	(0.20)	(0.18)	(0.18)	(0.18)	(0.18)	(0.20)	(0.30)
R56xUrban								-0.977[0.009]
								(0.37)
Percent_HW	-2.819[0.120]	-0.775[0.656]	0.553[0.619]	0.470[0.672]	0.157[0.878]	0.270[0.793]	-0.775[0.656]	-1.015[0.549]
	(1.81)	(1.74)	(1.11)	(1.11)	(1.02)	(1.03)	(1.74)	(1.69)
LogADT	-0.226[0.000]	-0.253[0.000]	-0.264[0.000]	-0.264[0.000]	-0.263[0.000]	-0.266[0.000]	-0.253[0.000]	-0.262[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LogLength	-0.717[0.000]	-0.617[0.000]	-0.587[0.000]	-0.588[0.000]	-0.582[0.000]	-0.582[0.000]	-0.617[0.000]	-0.625[0.000]
	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.16)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.309	0.337	0.284	0.285	0.285	0.286	0.337	0.340
N	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331

Panel 1B: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12')

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-0.296[0.830]	0.106[0.938]	0.030[0.972]	0.016[0.985]	0.063[0.940]	0.059[0.943]	0.106[0.938]	0.165[0.903]
	(1.37)	(1.36)	(0.85)	(0.86)	(0.83)	(0.83)	(1.36)	(1.35)
Reform60		-1.363[0.000]	-1.143[0.000]	-1.004[0.000]	-1.153[0.000]	-1.149[0.000]	-1.363[0.000]	-0.944[0.000]
		(0.18)	(0.17)	(0.18)	(0.17)	(0.17)	(0.18)	(0.25)
NY			0.202[0.392]	0.530[0.030]				
			(0.24)	(0.24)				
R60xNY				-2.262[0.025]				
				(1.01)				
NE					-0.817[0.141]	-0.763[0.246]		
					(0.55)	(0.66)		
R60xNE						-0.218[0.852]		
						(1.17)		
Urban	0.160[0.399]	0.203[0.292]	0.099[0.575]	0.112[0.526]	0.120[0.494]	0.120[0.492]	0.203[0.292]	0.534[0.020]
	(0.19)	(0.19)	(0.18)	(0.18)	(0.18)	(0.18)	(0.19)	(0.23)
R60xUrban								-0.964[0.006]
								(0.35)
Percent_HW	-2.397[0.186]	-5.580[0.001]	-1.607[0.166]	-1.674[0.146]	-1.909[0.070]	-1.907[0.070]	-5.580[0.001]	-5.519[0.001]
	(1.81)	(1.70)	(1.16)	(1.15)	(1.05)	(1.05)	(1.70)	(1.66)
LogADT	-0.212[0.000]	-0.228[0.000]	-0.245[0.000]	-0.250[0.000]	-0.243[0.000]	-0.243[0.000]	-0.228[0.000]	-0.234[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LogLength	-0.678[0.000]	-0.594[0.000]	-0.555[0.000]	-0.556[0.000]	-0.552[0.000]	-0.551[0.000]	-0.594[0.000]	-0.595[0.000]
	(0.16)	(0.15)	(0.15)	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.308	0.332	0.275	0.278	0.276	0.276	0.332	0.335
N	44,478	44,478	44,478	44,478	44,478	44,478	44,478	44,478

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 3 - NBI 1992, Full Model Set

Panel 2A: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	0.766[0.206] (0.61)	1.071[0.079] (0.61)	1.465[0.000] (0.34)	1.509[0.000] (0.34)	1.965[0.000] (0.33)	1.640[0.000] (0.33)	1.071[0.079] (0.61)	1.034[0.089] (0.61)
Reform56		-1.325[0.000] (0.08)	-1.358[0.000] (0.07)	-1.471[0.000] (0.08)	-1.385[0.000] (0.07)	-1.169[0.000] (0.07)	-1.325[0.000] (0.08)	-1.187[0.000] (0.11)
NY			0.967[0.000] (0.10)	0.692[0.000] (0.13)				
R56xNY				0.625[0.000] (0.17)				
NE					1.052[0.000] (0.11)	2.100[0.000] (0.16)		
R56xNE						-2.513[0.000] (0.29)		
Urban	0.336[0.000] (0.07)	0.372[0.000] (0.07)	0.272[0.000] (0.06)	0.263[0.000] (0.06)	0.278[0.000] (0.06)	0.319[0.000] (0.06)	0.372[0.000] (0.07)	0.514[0.000] (0.11)
R56xUrban								-0.228[0.087] (0.13)
Percent_HW	-0.217[0.745] (0.67)	0.353[0.568] (0.62)	1.971[0.000] (0.46)	2.097[0.000] (0.47)	-0.043[0.920] (0.43)	0.412[0.354] (0.44)	0.353[0.568] (0.62)	0.317[0.607] (0.62)
LogADT	-0.188[0.000] (0.01)	-0.208[0.000] (0.01)	-0.226[0.000] (0.01)	-0.226[0.000] (0.01)	-0.219[0.000] (0.01)	-0.225[0.000] (0.01)	-0.208[0.000] (0.01)	-0.209[0.000] (0.01)
LogLength	-0.649[0.000] (0.06)	-0.581[0.000] (0.06)	-0.557[0.000] (0.05)	-0.556[0.000] (0.05)	-0.559[0.000] (0.05)	-0.549[0.000] (0.05)	-0.581[0.000] (0.06)	-0.583[0.000] (0.06)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.224	0.252	0.206	0.207	0.205	0.215	0.252	0.252
N	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331

Panel 2B: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	0.552[0.364] (0.61)	1.464[0.017] (0.61)	1.670[0.000] (0.32)	1.673[0.000] (0.32)	2.286[0.000] (0.31)	2.281[0.000] (0.32)	1.464[0.017] (0.61)	1.464[0.017] (0.61)
Reform60		-1.309[0.000] (0.07)	-1.333[0.000] (0.07)	-1.354[0.000] (0.07)	-1.384[0.000] (0.07)	-1.153[0.000] (0.07)	-1.309[0.000] (0.07)	-1.266[0.000] (0.10)
NY			0.528[0.000] (0.10)	0.482[0.000] (0.11)				
R60xNY				0.170[0.357] (0.19)				
NE					1.667[0.000] (0.09)	2.203[0.000] (0.11)		
R60xNE						-2.748[0.000] (0.35)		
Urban	0.052[0.424] (0.07)	0.078[0.232] (0.07)	-0.005[0.932] (0.06)	-0.007[0.907] (0.06)	-0.002[0.977] (0.06)	0.037[0.546] (0.06)	0.078[0.232] (0.07)	0.107[0.193] (0.08)
R60xUrban								-0.083[0.514] (0.13)
Percent_HW	2.007[0.002] (0.64)	-1.722[0.009] (0.66)	-0.463[0.315] (0.46)	-0.455[0.324] (0.46)	-2.450[0.000] (0.41)	-2.705[0.000] (0.41)	-1.722[0.009] (0.66)	-1.730[0.008] (0.66)
LogADT	-0.176[0.000] (0.01)	-0.194[0.000] (0.01)	-0.191[0.000] (0.01)	-0.191[0.000] (0.01)	-0.201[0.000] (0.01)	-0.216[0.000] (0.01)	-0.194[0.000] (0.01)	-0.194[0.000] (0.01)
LogLength	-0.704[0.000] (0.06)	-0.622[0.000] (0.06)	-0.566[0.000] (0.05)	-0.566[0.000] (0.05)	-0.584[0.000] (0.05)	-0.576[0.000] (0.05)	-0.622[0.000] (0.06)	-0.623[0.000] (0.06)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.233	0.263	0.195	0.195	0.216	0.225	0.263	0.263
N	44,478	44,478	44,478	44,478	44,478	44,478	44,478	44,478

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 3 - NBI 1992, Full Model Set

Panel 3A: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	0.489[0.039]	0.854[0.000]	2.455[0.000]	2.480[0.000]	2.591[0.000]	2.617[0.000]	0.854[0.000]	1.127[0.000]
	(0.24)	(0.24)	(0.15)	(0.15)	(0.15)	(0.15)	(0.24)	(0.24)
Reform56		-0.638[0.000]	-0.760[0.000]	-0.797[0.000]	-0.776[0.000]	-0.794[0.000]	-0.638[0.000]	-1.011[0.000]
		(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.06)
NY			0.434[0.000]	0.218[0.012]				
			(0.05)	(0.09)				
R56xNY				0.296[0.002]				
				(0.10)				
NE					-0.088[0.095]	-0.338[0.010]		
					(0.05)	(0.13)		
R56xNE						0.307[0.031]		
						(0.14)		
Urban	0.538[0.000]	0.544[0.000]	0.605[0.000]	0.603[0.000]	0.607[0.000]	0.606[0.000]	0.544[0.000]	0.028[0.673]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.07)
R56xUrban								0.589[0.000]
								(0.07)
Percent_HW	4.327[0.000]	4.346[0.000]	0.757[0.000]	0.773[0.000]	0.239[0.131]	0.210[0.184]	4.346[0.000]	4.360[0.000]
	(0.24)	(0.24)	(0.17)	(0.17)	(0.16)	(0.16)	(0.24)	(0.24)
LogADT	-0.051[0.000]	-0.055[0.000]	-0.044[0.000]	-0.044[0.000]	-0.044[0.000]	-0.044[0.000]	-0.055[0.000]	-0.054[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.775[0.000]	-0.744[0.000]	-0.669[0.000]	-0.668[0.000]	-0.666[0.000]	-0.666[0.000]	-0.744[0.000]	-0.741[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.129	0.135	0.078	0.078	0.076	0.076	0.135	0.136
N	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331

Panel 3B: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	0.461[0.051]	1.232[0.000]	2.710[0.000]	2.730[0.000]	2.827[0.000]	2.827[0.000]	1.232[0.000]	1.347[0.000]
	(0.24)	(0.24)	(0.16)	(0.16)	(0.16)	(0.16)	(0.24)	(0.24)
Reform60		-0.674[0.000]	-0.835[0.000]	-0.868[0.000]	-0.857[0.000]	-0.858[0.000]	-0.674[0.000]	-0.894[0.000]
		(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)
NY			0.349[0.000]	0.107[0.121]				
			(0.05)	(0.07)				
R60xNY				0.428[0.000]				
				(0.09)				
NE					-0.111[0.030]	-0.119[0.116]		
					(0.05)	(0.08)		
R60xNE						0.015[0.882]		
						(0.10)		
Urban	0.531[0.000]	0.537[0.000]	0.584[0.000]	0.581[0.000]	0.586[0.000]	0.586[0.000]	0.537[0.000]	0.288[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)
R60xUrban								0.369[0.000]
								(0.05)
Percent_HW	4.545[0.000]	2.277[0.000]	-0.634[0.000]	-0.633[0.000]	-1.081[0.000]	-1.080[0.000]	2.277[0.000]	2.293[0.000]
	(0.24)	(0.25)	(0.18)	(0.18)	(0.17)	(0.17)	(0.25)	(0.25)
LogADT	-0.048[0.000]	-0.057[0.000]	-0.054[0.000]	-0.054[0.000]	-0.054[0.000]	-0.054[0.000]	-0.057[0.000]	-0.057[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.766[0.000]	-0.725[0.000]	-0.652[0.000]	-0.652[0.000]	-0.649[0.000]	-0.649[0.000]	-0.725[0.000]	-0.725[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.128	0.139	0.089	0.090	0.088	0.088	0.139	0.140
N	44,478	44,478	44,478	44,478	44,478	44,478	44,478	44,478

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 3 - NBI 1992, Full Model Set

Panel 4A: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-1.404[0.000] (0.24)	-2.107[0.000] (0.25)	-4.664[0.000] (0.17)	-4.676[0.000] (0.17)	-4.813[0.000] (0.17)	-4.760[0.000] (0.17)	-2.107[0.000] (0.25)	-2.412[0.000] (0.25)
Reform56		1.129[0.000] (0.04)	1.232[0.000] (0.04)	1.246[0.000] (0.05)	1.248[0.000] (0.04)	1.210[0.000] (0.04)	1.129[0.000] (0.04)	1.490[0.000] (0.07)
NY			-0.482[0.000] (0.06)	-0.378[0.002] (0.12)				
R56xNY				-0.126[0.341] (0.13)				
NE					-0.064[0.260] (0.06)	-0.801[0.000] (0.22)		
R56xNE						0.813[0.000] (0.23)		
Urban	-0.828[0.000] (0.03)	-0.837[0.000] (0.03)	-0.888[0.000] (0.02)	-0.888[0.000] (0.02)	-0.891[0.000] (0.02)	-0.893[0.000] (0.02)	-0.837[0.000] (0.03)	-0.278[0.001] (0.08)
R56xUrban								-0.604[0.000] (0.09)
Percent_HW	-3.252[0.000] (0.24)	-3.380[0.000] (0.25)	-0.138[0.429] (0.17)	-0.141[0.418] (0.18)	0.406[0.015] (0.17)	0.363[0.030] (0.17)	-3.380[0.000] (0.25)	-3.368[0.000] (0.25)
LogADT	0.242[0.000] (0.01)	0.250[0.000] (0.01)	0.220[0.000] (0.01)	0.220[0.000] (0.01)	0.220[0.000] (0.01)	0.220[0.000] (0.01)	0.250[0.000] (0.01)	0.249[0.000] (0.01)
LogLength	0.206[0.000] (0.02)	0.157[0.000] (0.02)	0.188[0.000] (0.02)	0.188[0.000] (0.02)	0.186[0.000] (0.02)	0.186[0.000] (0.02)	0.157[0.000] (0.02)	0.156[0.000] (0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.108	0.122	0.083	0.083	0.082	0.082	0.122	0.123
N	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331

Panel 4B: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-1.212[0.000] (0.25)	-2.300[0.000] (0.25)	-4.832[0.000] (0.18)	-4.834[0.000] (0.18)	-4.974[0.000] (0.18)	-4.959[0.000] (0.18)	-2.300[0.000] (0.25)	-2.445[0.000] (0.25)
Reform60		0.904[0.000] (0.03)	1.029[0.000] (0.03)	1.031[0.000] (0.03)	1.045[0.000] (0.03)	1.002[0.000] (0.03)	0.904[0.000] (0.03)	1.100[0.000] (0.04)
NY			-0.337[0.000] (0.06)	-0.311[0.001] (0.09)				
R60xNY				-0.038[0.721] (0.11)				
NE					-0.240[0.000] (0.06)	-0.889[0.000] (0.11)		
R60xNE						0.942[0.000] (0.13)		
Urban	-0.799[0.000] (0.03)	-0.809[0.000] (0.03)	-0.855[0.000] (0.02)	-0.854[0.000] (0.02)	-0.858[0.000] (0.02)	-0.861[0.000] (0.02)	-0.809[0.000] (0.03)	-0.544[0.000] (0.05)
R60xUrban								-0.352[0.000] (0.05)
Percent_HW	-3.871[0.000] (0.24)	-1.032[0.000] (0.27)	1.531[0.000] (0.18)	1.532[0.000] (0.18)	2.020[0.000] (0.18)	2.086[0.000] (0.18)	-1.032[0.000] (0.27)	-1.028[0.000] (0.26)
LogADT	0.235[0.000] (0.01)	0.251[0.000] (0.01)	0.230[0.000] (0.01)	0.230[0.000] (0.01)	0.232[0.000] (0.01)	0.233[0.000] (0.01)	0.251[0.000] (0.01)	0.251[0.000] (0.01)
LogLength	0.212[0.000] (0.02)	0.158[0.000] (0.02)	0.184[0.000] (0.02)	0.184[0.000] (0.02)	0.181[0.000] (0.02)	0.181[0.000] (0.02)	0.158[0.000] (0.02)	0.161[0.000] (0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.108	0.126	0.091	0.091	0.091	0.092	0.126	0.127
N	44,478	44,478	44,478	44,478	44,478	44,478	44,478	44,478

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 3 - NBI 1992, Full Model Set

Panel 5A: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable])

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-3.644[0.000]	-3.887[0.000]	-2.775[0.000]	-2.774[0.000]	-2.903[0.000]	-2.835[0.000]	-3.887[0.000]	-3.918[0.000]
	(0.24)	(0.24)	(0.16)	(0.16)	(0.16)	(0.16)	(0.24)	(0.25)
Reform56		0.317[0.000]	0.378[0.000]	0.377[0.000]	0.393[0.000]	0.342[0.000]	0.317[0.000]	0.353[0.000]
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.08)
NY			-0.360[0.000]	-0.364[0.004]				
			(0.06)	(0.13)				
R56xNY				0.005[0.969]				
				(0.14)				
NE					-0.083[0.213]	-1.252[0.000]		
					(0.07)	(0.28)		
R56xNE						1.299[0.000]		
						(0.29)		
Urban	0.189[0.000]	0.191[0.000]	0.175[0.000]	0.175[0.000]	0.173[0.000]	0.172[0.000]	0.191[0.000]	0.240[0.010]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.09)
R56xUrban								-0.054[0.577]
								(0.10)
Percent_HW	-2.195[0.000]	-2.139[0.000]	-1.428[0.000]	-1.428[0.000]	-0.937[0.000]	-1.000[0.000]	-2.139[0.000]	-2.142[0.000]
	(0.30)	(0.31)	(0.23)	(0.23)	(0.21)	(0.21)	(0.31)	(0.31)
LogADT	-0.128[0.000]	-0.128[0.000]	-0.120[0.000]	-0.120[0.000]	-0.119[0.000]	-0.119[0.000]	-0.128[0.000]	-0.128[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.860[0.000]	0.851[0.000]	0.782[0.000]	0.782[0.000]	0.778[0.000]	0.778[0.000]	0.851[0.000]	0.851[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.119	0.120	0.082	0.082	0.081	0.082	0.120	0.120
N	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331

Panel 5B: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable])

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-3.702[0.000]	-4.044[0.000]	-2.876[0.000]	-2.884[0.000]	-3.007[0.000]	-3.001[0.000]	-4.044[0.000]	-4.061[0.000]
	(0.24)	(0.25)	(0.16)	(0.16)	(0.16)	(0.16)	(0.25)	(0.25)
Reform60		0.285[0.000]	0.380[0.000]	0.390[0.000]	0.399[0.000]	0.368[0.000]	0.285[0.000]	0.312[0.000]
		(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
NY			-0.322[0.000]	-0.243[0.012]				
			(0.06)	(0.10)				
R60xNY				-0.125[0.282]				
				(0.12)				
NE					-0.139[0.036]	-0.615[0.000]		
					(0.07)	(0.13)		
R60xNE						0.686[0.000]		
						(0.15)		
Urban	0.198[0.000]	0.203[0.000]	0.195[0.000]	0.196[0.000]	0.194[0.000]	0.193[0.000]	0.203[0.000]	0.235[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)
R60xUrban								-0.043[0.508]
								(0.07)
Percent_HW	-2.325[0.000]	-1.442[0.000]	-0.883[0.000]	-0.883[0.000]	-0.385[0.083]	-0.342[0.126]	-1.442[0.000]	-1.448[0.000]
	(0.31)	(0.33)	(0.24)	(0.24)	(0.22)	(0.22)	(0.33)	(0.33)
LogADT	-0.126[0.000]	-0.125[0.000]	-0.116[0.000]	-0.116[0.000]	-0.115[0.000]	-0.114[0.000]	-0.125[0.000]	-0.125[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.856[0.000]	0.845[0.000]	0.773[0.000]	0.774[0.000]	0.770[0.000]	0.770[0.000]	0.845[0.000]	0.845[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.120	0.122	0.084	0.084	0.083	0.084	0.122	0.122
N	44,478	44,478	44,478	44,478	44,478	44,478	44,478	44,478

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 3 - NBI 1992, Full Model Set

Panel 6A: DV "Under-Record"

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-5.301[0.000]	-5.560[0.000]	-4.684[0.000]	-4.729[0.000]	-4.608[0.000]	-4.615[0.000]	-5.560[0.000]	-5.851[0.000]
	(0.13)	(0.13)	(0.09)	(0.09)	(0.09)	(0.09)	(0.13)	(0.13)
Reform56		0.546[0.000]	0.540[0.000]	0.605[0.000]	0.541[0.000]	0.546[0.000]	0.546[0.000]	0.955[0.000]
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
NY			0.472[0.000]	0.961[0.000]				
			(0.03)	(0.05)				
R56xNY				-0.678[0.000]				
				(0.06)				
NE					-0.303[0.000]	-0.217[0.003]		
					(0.03)	(0.07)		
R56xNE						-0.103[0.195]		
						(0.08)		
Urban	0.454[0.000]	0.435[0.000]	0.426[0.000]	0.426[0.000]	0.432[0.000]	0.432[0.000]	0.435[0.000]	1.128[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)
R56xUrban								-0.798[0.000]
								(0.04)
Percent_HW	1.331[0.000]	1.135[0.000]	0.900[0.000]	0.864[0.000]	0.479[0.000]	0.486[0.000]	1.135[0.000]	0.995[0.000]
	(0.13)	(0.13)	(0.10)	(0.10)	(0.09)	(0.09)	(0.13)	(0.13)
LogADT	0.224[0.000]	0.223[0.000]	0.225[0.000]	0.225[0.000]	0.229[0.000]	0.229[0.000]	0.223[0.000]	0.221[0.000]
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
LogLength	0.429[0.000]	0.400[0.000]	0.363[0.000]	0.364[0.000]	0.362[0.000]	0.362[0.000]	0.400[0.000]	0.397[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.257	0.261	0.238	0.238	0.237	0.237	0.261	0.263
N	316,434	316,434	316,434	316,434	316,434	316,434	316,434	316,434

Panel 6B: DV "Under-Record"

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	-5.313[0.000]	-5.659[0.000]	-4.688[0.000]	-4.705[0.000]	-4.581[0.000]	-4.580[0.000]	-5.659[0.000]	-5.746[0.000]
	(0.13)	(0.13)	(0.09)	(0.09)	(0.09)	(0.09)	(0.13)	(0.13)
Reform60		0.352[0.000]	0.344[0.000]	0.369[0.000]	0.325[0.000]	0.321[0.000]	0.352[0.000]	0.585[0.000]
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
NY			0.519[0.000]	0.727[0.000]				
			(0.03)	(0.04)				
R60xNY				-0.377[0.000]				
				(0.05)				
NE					-0.264[0.000]	-0.311[0.000]		
					(0.03)	(0.05)		
R60xNE						0.082[0.159]		
						(0.06)		
Urban	0.451[0.000]	0.441[0.000]	0.439[0.000]	0.440[0.000]	0.445[0.000]	0.445[0.000]	0.441[0.000]	0.755[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
R60xUrban								-0.461[0.000]
								(0.03)
Percent_HW	1.196[0.000]	2.212[0.000]	1.573[0.000]	1.570[0.000]	1.063[0.000]	1.070[0.000]	2.212[0.000]	2.059[0.000]
	(0.13)	(0.14)	(0.10)	(0.10)	(0.09)	(0.09)	(0.14)	(0.14)
LogADT	0.226[0.000]	0.226[0.000]	0.232[0.000]	0.232[0.000]	0.236[0.000]	0.236[0.000]	0.226[0.000]	0.224[0.000]
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.426[0.000]	0.404[0.000]	0.365[0.000]	0.366[0.000]	0.366[0.000]	0.366[0.000]	0.404[0.000]	0.403[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
McFadden R-sq.	0.259	0.261	0.238	0.238	0.237	0.237	0.261	0.263
N	314,391	314,391	314,391	314,391	314,391	314,391	314,391	314,391

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 4A - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 1: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	1.509[0.000]	1.377[0.000]	1.446[0.000]	1.339[0.000]	1.319[0.000]	1.247[0.000]	1.518[0.003]	1.250[0.011]	1.105[0.014]	1.464[0.001]	1.468[0.000]	1.477[0.000]	1.601[0.000]	1.832[0.000]
	(0.34)	(0.35)	(0.34)	(0.31)	(0.32)	(0.31)	(0.52)	(0.49)	(0.45)	(0.43)	(0.38)	(0.37)	(0.36)	(0.36)
Reform56	-1.471[0.000]	-1.654[0.000]	-1.487[0.000]	-1.518[0.000]	-1.692[0.000]	-1.559[0.000]	-0.749[0.000]	-0.749[0.000]	-0.861[0.000]	-1.008[0.000]	-1.093[0.000]	-1.138[0.000]	-1.208[0.000]	-1.291[0.000]
	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.13)	(0.11)	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)	(0.08)
NY	0.692[0.000]	0.436[0.000]	0.416[0.001]	0.749[0.000]	0.513[0.000]	0.491[0.000]	0.937[0.000]	0.755[0.000]	0.798[0.000]	0.714[0.000]	0.626[0.000]	0.645[0.000]	0.715[0.000]	0.586[0.000]
	(0.13)	(0.13)	(0.12)	(0.13)	(0.12)	(0.12)	(0.19)	(0.18)	(0.17)	(0.16)	(0.15)	(0.14)	(0.14)	(0.13)
R56xNY	0.625[0.000]	0.789[0.000]	0.584[0.000]	0.534[0.001]	0.696[0.000]	0.564[0.000]	0.308[0.290]	0.758[0.001]	0.920[0.000]	0.813[0.000]	0.734[0.000]	0.653[0.000]	0.614[0.001]	0.697[0.000]
	(0.17)	(0.17)	(0.17)	(0.17)	(0.16)	(0.16)	(0.29)	(0.24)	(0.21)	(0.21)	(0.20)	(0.19)	(0.18)	(0.18)
Urban	0.263[0.000]	0.060[0.342]	0.007[0.916]	0.176[0.002]	0.007[0.905]	-0.047[0.414]	0.129[0.219]	0.235[0.012]	0.300[0.001]	0.322[0.000]	0.352[0.000]	0.321[0.000]	0.315[0.000]	0.229[0.001]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.09)	(0.09)	(0.09)	(0.08)	(0.07)	(0.07)	(0.07)
Percent_HW	2.097[0.000]	1.617[0.000]	0.226[0.650]	2.396[0.000]	1.863[0.000]	0.886[0.031]	1.160[0.198]	1.012[0.174]	1.265[0.068]	1.212[0.068]	1.180[0.051]	1.019[0.083]	1.247[0.026]	0.721[0.194]
	(0.47)	(0.45)	(0.50)	(0.38)	(0.38)	(0.41)	(0.90)	(0.75)	(0.69)	(0.66)	(0.61)	(0.59)	(0.56)	(0.56)
LogADT	-0.226[0.000]	-0.196[0.000]	-0.195[0.000]	-0.221[0.000]	-0.197[0.000]	-0.194[0.000]	-0.205[0.000]	-0.193[0.000]	-0.205[0.000]	-0.222[0.000]	-0.226[0.000]	-0.224[0.000]	-0.227[0.000]	-0.226[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.556[0.000]	-0.545[0.000]	-0.555[0.000]	-0.564[0.000]	-0.559[0.000]	-0.553[0.000]	-0.480[0.000]	-0.463[0.000]	-0.442[0.000]	-0.472[0.000]	-0.442[0.000]	-0.460[0.000]	-0.489[0.000]	-0.523[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.207	0.202	0.199	0.205	0.204	0.199	0.142	0.136	0.147	0.164	0.170	0.179	0.184	0.189
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	2.480[0.000]	2.542[0.000]	2.588[0.000]	1.583[0.000]	1.694[0.000]	1.852[0.000]	2.342[0.000]	2.424[0.000]	2.376[0.000]	2.644[0.000]	2.526[0.000]	2.750[0.000]	2.864[0.000]	2.913[0.000]
	(0.15)	(0.16)	(0.15)	(0.13)	(0.14)	(0.14)	(0.30)	(0.28)	(0.25)	(0.23)	(0.21)	(0.20)	(0.19)	(0.18)
Reform56	-0.797[0.000]	-0.925[0.000]	-1.018[0.000]	-0.929[0.000]	-1.050[0.000]	-1.147[0.000]	-0.303[0.000]	-0.392[0.000]	-0.458[0.000]	-0.502[0.000]	-0.507[0.000]	-0.545[0.000]	-0.580[0.000]	-0.596[0.000]
	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
NY	0.218[0.012]	0.190[0.021]	0.154[0.047]	0.419[0.000]	0.431[0.000]	0.386[0.000]	-0.079[0.522]	-0.014[0.897]	0.038[0.703]	0.057[0.561]	0.012[0.895]	-0.014[0.874]	-0.014[0.871]	0.030[0.734]
	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	(0.12)	(0.11)	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)
R56xNY	0.296[0.002]	0.348[0.000]	0.451[0.000]	0.530[0.000]	0.519[0.000]	0.583[0.000]	-0.207[0.214]	-0.294[0.037]	-0.333[0.010]	-0.047[0.692]	0.014[0.904]	0.101[0.354]	0.156[0.142]	0.174[0.095]
	(0.10)	(0.09)	(0.09)	(0.10)	(0.09)	(0.09)	(0.17)	(0.14)	(0.13)	(0.12)	(0.11)	(0.11)	(0.11)	(0.10)
Urban	0.603[0.000]	0.622[0.000]	0.636[0.000]	0.525[0.000]	0.537[0.000]	0.551[0.000]	0.127[0.005]	0.233[0.000]	0.285[0.000]	0.372[0.000]	0.430[0.000]	0.484[0.000]	0.507[0.000]	0.551[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	0.773[0.000]	0.302[0.075]	0.468[0.006]	3.750[0.000]	3.325[0.000]	3.147[0.000]	-2.171[0.000]	-1.795[0.000]	-1.585[0.000]	-1.543[0.000]	-1.726[0.000]	-1.722[0.000]	-1.850[0.000]	-1.586[0.000]
	(0.17)	(0.17)	(0.17)	(0.13)	(0.13)	(0.13)	(0.38)	(0.32)	(0.29)	(0.27)	(0.25)	(0.24)	(0.23)	(0.22)
LogADT	-0.044[0.000]	-0.058[0.000]	-0.060[0.000]	-0.033[0.000]	-0.042[0.000]	-0.044[0.000]	0.069[0.000]	0.049[0.000]	0.026[0.005]	0.001[0.881]	-0.004[0.616]	-0.016[0.028]	-0.025[0.000]	-0.031[0.000]
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.668[0.000]	-0.654[0.000]	-0.655[0.000]	-0.658[0.000]	-0.644[0.000]	-0.648[0.000]	-0.608[0.000]	-0.599[0.000]	-0.586[0.000]	-0.598[0.000]	-0.602[0.000]	-0.628[0.000]	-0.632[0.000]	-0.640[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.078	0.085	0.094	0.098	0.102	0.109	0.067	0.062	0.058	0.059	0.061	0.066	0.069	0.071
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4A - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 3: DV "UnderRecord", Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-4.729[0.000]	-4.723[0.000]	-4.623[0.000]	-5.158[0.000]	-5.154[0.000]	-5.064[0.000]	-4.609[0.000]	-4.720[0.000]	-4.658[0.000]	-4.660[0.000]	-4.833[0.000]	-4.910[0.000]	-4.895[0.000]	-4.791[0.000]
	(0.09)	(0.09)	(0.09)	(0.07)	(0.07)	(0.07)	(0.20)	(0.18)	(0.16)	(0.15)	(0.14)	(0.13)	(0.12)	(0.11)
Reform56	0.605[0.000]	0.539[0.000]	0.391[0.000]	0.592[0.000]	0.535[0.000]	0.390[0.000]	0.309[0.000]	0.338[0.000]	0.370[0.000]	0.433[0.000]	0.477[0.000]	0.502[0.000]	0.542[0.000]	0.559[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
NY	0.961[0.000]	0.909[0.000]	0.785[0.000]	1.006[0.000]	0.951[0.000]	0.829[0.000]	0.806[0.000]	0.882[0.000]	0.892[0.000]	0.919[0.000]	0.907[0.000]	0.921[0.000]	0.948[0.000]	0.956[0.000]
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
R56xNY	-0.678[0.000]	-0.633[0.000]	-0.501[0.000]	-0.739[0.000]	-0.694[0.000]	-0.563[0.000]	-0.530[0.000]	-0.585[0.000]	-0.622[0.000]	-0.628[0.000]	-0.649[0.000]	-0.630[0.000]	-0.655[0.000]	-0.663[0.000]
	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.10)	(0.09)	(0.08)	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)
Urban	0.426[0.000]	0.437[0.000]	0.451[0.000]	0.547[0.000]	0.555[0.000]	0.565[0.000]	0.383[0.000]	0.429[0.000]	0.428[0.000]	0.413[0.000]	0.410[0.000]	0.404[0.000]	0.421[0.000]	0.434[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	0.864[0.000]	0.934[0.000]	1.062[0.000]	1.598[0.000]	1.658[0.000]	1.749[0.000]	0.272[0.210]	0.461[0.015]	0.464[0.007]	0.669[0.000]	0.722[0.000]	0.714[0.000]	0.818[0.000]	0.901[0.000]
	(0.10)	(0.10)	(0.10)	(0.07)	(0.07)	(0.07)	(0.22)	(0.19)	(0.17)	(0.16)	(0.15)	(0.14)	(0.13)	(0.12)
LogADT	0.225[0.000]	0.227[0.000]	0.229[0.000]	0.228[0.000]	0.229[0.000]	0.231[0.000]	0.298[0.000]	0.290[0.000]	0.284[0.000]	0.275[0.000]	0.273[0.000]	0.269[0.000]	0.261[0.000]	0.250[0.000]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.364[0.000]	0.369[0.000]	0.366[0.000]	0.382[0.000]	0.387[0.000]	0.386[0.000]	0.316[0.000]	0.327[0.000]	0.327[0.000]	0.314[0.000]	0.346[0.000]	0.363[0.000]	0.356[0.000]	0.352[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.238	0.240	0.238	0.254	0.256	0.255	0.264	0.261	0.256	0.25	0.255	0.255	0.252	0.248
N	316,434	321,424	329,084	466,330	461,647	461,433	77,809	96,557	116,319	135,668	165,824	189,979	208,730	225,923

Panel 4: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	0.016[0.985]	0.170[0.842]	0.500[0.546]	-0.219[0.766]	-0.312[0.674]	-0.011[0.988]	-35.019[0.000]	-33.804[0.000]	-32.934[]	-32.283[0.000]	-2.789[0.060]	-2.821[0.051]	-1.489[0.204]	-0.896[0.404]
	(0.86)	(0.85)	(0.83)	(0.74)	(0.74)	(0.72)	(8.75)	(1.39)		(2.31)	(1.49)	(1.45)	(1.17)	(1.07)
Reform60	-1.004[0.000]	-0.829[0.000]	-0.711[0.000]	-1.000[0.000]	-0.834[0.000]	-0.741[0.000]	-0.608[0.095]	-0.535[0.075]	-0.796[0.007]	-0.903[0.002]	-0.923[0.000]	-0.719[0.003]	-0.862[0.000]	-0.907[0.000]
	(0.18)	(0.17)	(0.17)	(0.16)	(0.15)	(0.15)	(0.37)	(0.30)	(0.29)	(0.29)	(0.26)	(0.24)	(0.23)	(0.22)
NY	0.530[0.030]	0.608[0.015]	0.552[0.030]	0.563[0.015]	0.641[0.005]	0.609[0.008]	0.842[0.197]	1.154[0.020]	1.372[0.000]	1.234[0.000]	1.065[0.001]	0.837[0.009]	0.684[0.029]	0.546[0.087]
	(0.24)	(0.25)	(0.25)	(0.23)	(0.23)	(0.23)	(0.65)	(0.50)	(0.39)	(0.35)	(0.32)	(0.32)	(0.31)	(0.32)
R60xNY	-2.262[0.025]	-2.258[0.026]	-2.130[0.034]	-1.913[0.010]	-1.879[0.011]	-1.788[0.016]	-17.319[0.000]	-18.044[0.000]	-17.907[0.000]	-17.753[0.000]	-16.564[0.000]	-16.476[0.000]	-16.236[0.000]	-1.909[0.063]
	(1.01)	(1.01)	(1.01)	(0.74)	(0.74)	(0.74)	(0.79)	(0.57)	(0.49)	(0.44)	(0.38)	(0.35)	(0.33)	(1.03)
Urban	0.112[0.526]	0.031[0.859]	0.034[0.843]	-0.242[0.099]	-0.238[0.103]	-0.211[0.150]	-0.153[0.709]	-0.183[0.591]	0.009[0.977]	0.119[0.680]	-0.172[0.518]	-0.232[0.352]	-0.165[0.467]	-0.025[0.911]
	(0.18)	(0.17)	(0.17)	(0.15)	(0.15)	(0.15)	(0.41)	(0.34)	(0.31)	(0.29)	(0.27)	(0.25)	(0.23)	(0.22)
Percent_HW	-1.674[0.146]	-1.132[0.319]	-1.949[0.107]	-3.032[0.002]	-2.056[0.037]	-2.610[0.010]	2.051[0.298]	0.118[0.959]	1.151[0.577]	0.928[0.642]	-0.377[0.842]	-0.702[0.681]	-1.536[0.346]	-1.914[0.235]
	(1.15)	(1.14)	(1.21)	(0.98)	(0.99)	(1.01)	(1.97)	(2.28)	(2.06)	(2.00)	(1.89)	(1.71)	(1.63)	(1.61)
LogADT	-0.250[0.000]	-0.255[0.000]	-0.268[0.000]	-0.270[0.000]	-0.263[0.000]	-0.264[0.000]	-0.227[0.000]	-0.255[0.000]	-0.294[0.000]	-0.284[0.000]	-0.265[0.000]	-0.235[0.000]	-0.217[0.000]	-0.233[0.000]
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
LogLength	-0.556[0.000]	-0.632[0.000]	-0.685[0.000]	-0.460[0.000]	-0.512[0.000]	-0.575[0.000]	0.028[0.935]	-0.035[0.902]	-0.059[0.827]	-0.127[0.611]	-0.238[0.322]	-0.287[0.219]	-0.348[0.071]	-0.381[0.048]
	(0.16)	(0.16)	(0.15)	(0.12)	(0.12)	(0.12)	(0.34)	(0.29)	(0.27)	(0.25)	(0.24)	(0.23)	(0.19)	(0.19)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.278	0.270	0.275	0.251	0.250	0.252	0.244	0.247	0.280	0.272	0.259	0.248	0.251	0.254
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4A - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 5: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	2.730[0.000]	2.730[0.000]	2.642[0.000]	1.796[0.000]	1.854[0.000]	1.890[0.000]	3.182[0.000]	3.321[0.000]	3.540[0.000]	3.634[0.000]	3.556[0.000]	3.526[0.000]	3.295[0.000]	3.270[0.000]
	(0.16)	(0.16)	(0.15)	(0.13)	(0.13)	(0.13)	(0.27)	(0.24)	(0.23)	(0.21)	(0.20)	(0.19)	(0.18)	(0.17)
Reform60	-0.868[0.000]	-0.852[0.000]	-0.845[0.000]	-0.934[0.000]	-0.936[0.000]	-0.950[0.000]	-0.562[0.000]	-0.630[0.000]	-0.710[0.000]	-0.742[0.000]	-0.808[0.000]	-0.840[0.000]	-0.850[0.000]	-0.860[0.000]
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
NY	0.107[0.121]	0.057[0.382]	0.017[0.786]	0.368[0.000]	0.320[0.000]	0.265[0.000]	-0.364[0.004]	-0.253[0.025]	-0.186[0.066]	-0.165[0.073]	-0.082[0.327]	-0.009[0.907]	0.046[0.543]	0.055[0.462]
	(0.07)	(0.07)	(0.06)	(0.07)	(0.06)	(0.06)	(0.13)	(0.11)	(0.10)	(0.09)	(0.08)	(0.08)	(0.08)	(0.07)
R60xNY	0.428[0.000]	0.554[0.000]	0.491[0.000]	0.621[0.000]	0.712[0.000]	0.660[0.000]	0.610[0.000]	0.509[0.000]	0.507[0.000]	0.495[0.000]	0.474[0.000]	0.436[0.000]	0.404[0.000]	0.407[0.000]
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.16)	(0.14)	(0.13)	(0.12)	(0.11)	(0.10)	(0.10)	(0.09)
Urban	0.581[0.000]	0.588[0.000]	0.570[0.000]	0.504[0.000]	0.507[0.000]	0.489[0.000]	0.595[0.000]	0.646[0.000]	0.615[0.000]	0.637[0.000]	0.589[0.000]	0.587[0.000]	0.588[0.000]	0.587[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Percent_HW	-0.633[0.000]	-0.789[0.000]	-0.974[0.000]	2.416[0.000]	2.212[0.000]	1.764[0.000]	-2.847[0.000]	-2.795[0.000]	-2.943[0.000]	-2.912[0.000]	-2.653[0.000]	-2.227[0.000]	-1.917[0.000]	-1.690[0.000]
	(0.18)	(0.18)	(0.18)	(0.14)	(0.14)	(0.14)	(0.34)	(0.30)	(0.28)	(0.26)	(0.24)	(0.22)	(0.21)	(0.20)
LogADT	-0.054[0.000]	-0.054[0.000]	-0.056[0.000]	-0.040[0.000]	-0.040[0.000]	-0.041[0.000]	-0.064[0.000]	-0.072[0.000]	-0.072[0.000]	-0.072[0.000]	-0.067[0.000]	-0.065[0.000]	-0.065[0.000]	-0.067[0.000]
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.652[0.000]	-0.662[0.000]	-0.655[0.000]	-0.647[0.000]	-0.651[0.000]	-0.648[0.000]	-0.691[0.000]	-0.697[0.000]	-0.712[0.000]	-0.706[0.000]	-0.684[0.000]	-0.691[0.000]	-0.679[0.000]	-0.679[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.090	0.092	0.092	0.109	0.110	0.109	0.078	0.083	0.087	0.089	0.088	0.090	0.090	0.090
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

Panel 6: DV "UnderRecord", Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-4.705[0.000]	-4.678[0.000]	-4.621[0.000]	-5.052[0.000]	-5.038[0.000]	-5.010[0.000]	-4.024[0.000]	-4.148[0.000]	-4.242[0.000]	-4.297[0.000]	-4.157[0.000]	-4.238[0.000]	-4.372[0.000]	-4.392[0.000]
	(0.09)	(0.09)	(0.09)	(0.07)	(0.07)	(0.07)	(0.17)	(0.15)	(0.14)	(0.13)	(0.12)	(0.11)	(0.11)	(0.10)
Reform60	0.369[0.000]	0.312[0.000]	0.248[0.000]	0.370[0.000]	0.315[0.000]	0.252[0.000]	0.109[0.000]	0.114[0.000]	0.152[0.000]	0.200[0.000]	0.209[0.000]	0.232[0.000]	0.250[0.000]	0.274[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
NY	0.727[0.000]	0.698[0.000]	0.644[0.000]	0.749[0.000]	0.718[0.000]	0.667[0.000]	0.328[0.000]	0.337[0.000]	0.436[0.000]	0.555[0.000]	0.564[0.000]	0.635[0.000]	0.666[0.000]	0.678[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.08)	(0.07)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)
R60xNY	-0.377[0.000]	-0.343[0.000]	-0.305[0.000]	-0.458[0.000]	-0.421[0.000]	-0.376[0.000]	-0.097[0.321]	-0.060[0.491]	-0.141[0.070]	-0.236[0.001]	-0.279[0.000]	-0.366[0.000]	-0.373[0.000]	-0.358[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.10)	(0.09)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
Urban	0.440[0.000]	0.450[0.000]	0.460[0.000]	0.559[0.000]	0.565[0.000]	0.574[0.000]	0.287[0.000]	0.298[0.000]	0.321[0.000]	0.354[0.000]	0.385[0.000]	0.398[0.000]	0.403[0.000]	0.413[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	1.570[0.000]	1.577[0.000]	1.502[0.000]	2.046[0.000]	2.083[0.000]	2.039[0.000]	0.392[0.029]	0.287[0.076]	0.635[0.000]	1.003[0.000]	0.839[0.000]	0.987[0.000]	1.191[0.000]	1.290[0.000]
	(0.10)	(0.10)	(0.10)	(0.08)	(0.08)	(0.08)	(0.18)	(0.16)	(0.15)	(0.14)	(0.13)	(0.12)	(0.12)	(0.11)
LogADT	0.232[0.000]	0.232[0.000]	0.232[0.000]	0.231[0.000]	0.232[0.000]	0.233[0.000]	0.237[0.000]	0.240[0.000]	0.240[0.000]	0.236[0.000]	0.221[0.000]	0.219[0.000]	0.225[0.000]	0.225[0.000]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.366[0.000]	0.368[0.000]	0.374[0.000]	0.383[0.000]	0.386[0.000]	0.393[0.000]	0.367[0.000]	0.389[0.000]	0.374[0.000]	0.370[0.000]	0.367[0.000]	0.366[0.000]	0.367[0.000]	0.361[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.238	0.238	0.238	0.254	0.254	0.255	0.218	0.225	0.224	0.227	0.224	0.224	0.229	0.229
N	314,391	321,616	327,764	464,287	461,839	460,113	89,030	118,096	141,281	166,264	189,269	208,151	231,730	247,469

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4B - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 1: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	1.640[0.000]	1.439[0.000]	1.596[0.000]	1.364[0.000]	1.281[0.000]	1.301[0.000]	1.886[0.000]	1.537[0.002]	1.440[0.001]	1.674[0.000]	1.613[0.000]	1.615[0.000]	1.766[0.000]	1.887[0.000]
	(0.33)	(0.35)	(0.34)	(0.31)	(0.32)	(0.31)	(0.54)	(0.50)	(0.45)	(0.43)	(0.38)	(0.37)	(0.36)	(0.35)
Reform56	-1.169[0.000]	-1.164[0.000]	-1.081[0.000]	-1.302[0.000]	-1.295[0.000]	-1.225[0.000]	-0.413[0.001]	-0.351[0.001]	-0.435[0.000]	-0.645[0.000]	-0.780[0.000]	-0.836[0.000]	-0.911[0.000]	-0.932[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.12)	(0.11)	(0.10)	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)
NE	2.100[0.000]	2.564[0.000]	2.325[0.000]	2.084[0.000]	2.518[0.000]	2.271[0.000]	2.605[0.000]	2.545[0.000]	2.422[0.000]	2.094[0.000]	1.905[0.000]	1.815[0.000]	1.794[0.000]	2.121[0.000]
	(0.16)	(0.12)	(0.11)	(0.16)	(0.12)	(0.11)	(0.22)	(0.21)	(0.21)	(0.21)	(0.18)	(0.18)	(0.18)	(0.16)
R56xNE	-2.513[0.000]	-3.053[0.000]	-2.765[0.000]	-2.306[0.000]	-2.759[0.000]	-2.456[0.000]	-2.533[0.000]	-2.514[0.000]	-2.559[0.000]	-2.179[0.000]	-2.198[0.000]	-2.269[0.000]	-2.306[0.000]	-2.623[0.000]
	(0.29)	(0.29)	(0.29)	(0.26)	(0.25)	(0.25)	(0.49)	(0.42)	(0.41)	(0.39)	(0.36)	(0.34)	(0.34)	(0.32)
Urban	0.319[0.000]	0.191[0.002]	0.102[0.096]	0.221[0.000]	0.113[0.047]	0.027[0.629]	0.152[0.158]	0.262[0.006]	0.346[0.000]	0.373[0.000]	0.411[0.000]	0.375[0.000]	0.370[0.000]	0.294[0.000]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.10)	(0.09)	(0.09)	(0.08)	(0.07)	(0.07)	(0.07)
Percent_HW	0.412[0.354]	0.322[0.478]	-0.954[0.051]	1.233[0.001]	0.956[0.011]	0.008[0.983]	-2.159[0.023]	-2.173[0.005]	-2.326[0.001]	-1.680[0.011]	-0.755[0.195]	-0.901[0.108]	-0.749[0.165]	-0.934[0.075]
	(0.44)	(0.45)	(0.49)	(0.36)	(0.38)	(0.40)	(0.95)	(0.77)	(0.72)	(0.66)	(0.58)	(0.56)	(0.54)	(0.53)
LogADT	-0.225[0.000]	-0.218[0.000]	-0.218[0.000]	-0.216[0.000]	-0.211[0.000]	-0.209[0.000]	-0.196[0.000]	-0.184[0.000]	-0.198[0.000]	-0.211[0.000]	-0.221[0.000]	-0.220[0.000]	-0.223[0.000]	-0.227[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
LogLength	-0.549[0.000]	-0.553[0.000]	-0.558[0.000]	-0.559[0.000]	-0.565[0.000]	-0.557[0.000]	-0.471[0.000]	-0.448[0.000]	-0.417[0.000]	-0.448[0.000]	-0.438[0.000]	-0.452[0.000]	-0.481[0.000]	-0.514[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.215	0.234	0.229	0.210	0.229	0.223	0.171	0.156	0.157	0.170	0.177	0.184	0.188	0.201
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	2.617[0.000]	2.691[0.000]	2.718[0.000]	1.715[0.000]	1.853[0.000]	1.990[0.000]	2.556[0.000]	2.489[0.000]	2.385[0.000]	2.690[0.000]	2.567[0.000]	2.783[0.000]	2.902[0.000]	2.988[0.000]
	(0.15)	(0.16)	(0.15)	(0.13)	(0.14)	(0.13)	(0.30)	(0.27)	(0.25)	(0.23)	(0.21)	(0.20)	(0.19)	(0.18)
Reform56	-0.794[0.000]	-0.936[0.000]	-1.004[0.000]	-0.926[0.000]	-1.068[0.000]	-1.143[0.000]	-0.401[0.000]	-0.475[0.000]	-0.528[0.000]	-0.535[0.000]	-0.523[0.000]	-0.548[0.000]	-0.574[0.000]	-0.602[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
NE	-0.338[0.010]	-0.554[0.000]	-0.428[0.000]	-0.266[0.045]	-0.540[0.000]	-0.418[0.000]	-0.740[0.000]	-0.738[0.000]	-0.618[0.000]	-0.457[0.002]	-0.200[0.154]	-0.224[0.106]	-0.180[0.188]	-0.400[0.002]
	(0.13)	(0.10)	(0.09)	(0.13)	(0.10)	(0.09)	(0.17)	(0.17)	(0.16)	(0.15)	(0.14)	(0.14)	(0.14)	(0.13)
R56xNE	0.307[0.031]	0.468[0.000]	0.300[0.004]	0.162[0.256]	0.428[0.000]	0.290[0.005]	1.443[0.000]	0.989[0.000]	0.673[0.000]	0.509[0.004]	0.321[0.048]	0.285[0.069]	0.245[0.110]	0.467[0.001]
	(0.14)	(0.11)	(0.11)	(0.14)	(0.11)	(0.10)	(0.22)	(0.20)	(0.19)	(0.18)	(0.16)	(0.16)	(0.15)	(0.15)
Urban	0.606[0.000]	0.624[0.000]	0.640[0.000]	0.529[0.000]	0.540[0.000]	0.555[0.000]	0.120[0.009]	0.230[0.000]	0.283[0.000]	0.372[0.000]	0.429[0.000]	0.483[0.000]	0.508[0.000]	0.551[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	0.210[0.184]	-0.253[0.116]	-0.105[0.517]	3.087[0.000]	2.646[0.000]	2.475[0.000]	-2.506[0.000]	-1.672[0.000]	-1.347[0.000]	-1.613[0.000]	-1.841[0.000]	-1.850[0.000]	-2.030[0.000]	-1.863[0.000]
	(0.16)	(0.16)	(0.16)	(0.13)	(0.13)	(0.13)	(0.38)	(0.31)	(0.28)	(0.26)	(0.24)	(0.22)	(0.21)	(0.20)
LogADT	-0.044[0.000]	-0.057[0.000]	-0.060[0.000]	-0.030[0.000]	-0.040[0.000]	-0.042[0.000]	0.064[0.000]	0.046[0.000]	0.025[0.006]	0.001[0.931]	-0.004[0.571]	-0.016[0.026]	-0.026[0.000]	-0.032[0.000]
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.666[0.000]	-0.654[0.000]	-0.653[0.000]	-0.656[0.000]	-0.643[0.000]	-0.646[0.000]	-0.613[0.000]	-0.601[0.000]	-0.587[0.000]	-0.598[0.000]	-0.601[0.000]	-0.628[0.000]	-0.631[0.000]	-0.639[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.076	0.084	0.092	0.093	0.097	0.104	0.070	0.063	0.059	0.059	0.061	0.066	0.069	0.071
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4B - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 3: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-4.760[0.000]	-4.818[0.000]	-4.846[0.000]	-3.457[0.000]	-3.523[0.000]	-3.551[0.000]	-5.347[0.000]	-5.125[0.000]	-5.180[0.000]	-5.412[0.000]	-5.369[0.000]	-5.538[0.000]	-5.704[0.000]	-5.581[0.000]
	(0.17)	(0.17)	(0.16)	(0.13)	(0.13)	(0.13)	(0.42)	(0.39)	(0.35)	(0.33)	(0.28)	(0.26)	(0.25)	(0.24)
Reform56	1.210[0.000]	1.231[0.000]	1.173[0.000]	1.294[0.000]	1.317[0.000]	1.260[0.000]	0.641[0.000]	0.717[0.000]	0.800[0.000]	0.863[0.000]	0.940[0.000]	0.975[0.000]	1.009[0.000]	1.024[0.000]
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.07)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
NE	-0.801[0.000]	-0.955[0.000]	-0.801[0.000]	-0.781[0.000]	-0.884[0.000]	-0.734[0.000]	-0.309[0.254]	-0.298[0.254]	-0.413[0.113]	-0.408[0.096]	-0.639[0.007]	-0.682[0.004]	-0.713[0.002]	-0.849[0.000]
	(0.22)	(0.17)	(0.14)	(0.21)	(0.17)	(0.14)	(0.27)	(0.26)	(0.26)	(0.25)	(0.24)	(0.24)	(0.24)	(0.23)
R56xNE	0.813[0.000]	1.016[0.000]	0.909[0.000]	0.852[0.000]	0.987[0.000]	0.852[0.000]	-0.605[0.056]	0.105[0.719]	0.439[0.120]	0.394[0.138]	0.614[0.016]	0.700[0.005]	0.722[0.004]	0.867[0.000]
	(0.23)	(0.18)	(0.15)	(0.22)	(0.18)	(0.15)	(0.32)	(0.29)	(0.28)	(0.27)	(0.26)	(0.25)	(0.25)	(0.24)
Urban	-0.893[0.000]	-0.882[0.000]	-0.896[0.000]	-0.732[0.000]	-0.723[0.000]	-0.733[0.000]	-0.524[0.000]	-0.627[0.000]	-0.703[0.000]	-0.795[0.000]	-0.861[0.000]	-0.890[0.000]	-0.890[0.000]	-0.915[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.06)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Percent_HW	0.363[0.030]	1.034[0.000]	1.147[0.000]	-1.512[0.000]	-1.059[0.000]	-0.813[0.000]	3.327[0.000]	1.966[0.000]	1.610[0.000]	1.723[0.000]	1.784[0.000]	1.866[0.000]	2.137[0.000]	2.116[0.000]
	(0.17)	(0.17)	(0.17)	(0.12)	(0.13)	(0.13)	(0.43)	(0.35)	(0.31)	(0.29)	(0.26)	(0.25)	(0.23)	(0.22)
LogADT	0.220[0.000]	0.231[0.000]	0.236[0.000]	0.166[0.000]	0.172[0.000]	0.176[0.000]	0.156[0.000]	0.167[0.000]	0.197[0.000]	0.221[0.000]	0.236[0.000]	0.238[0.000]	0.243[0.000]	0.249[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.186[0.000]	0.163[0.000]	0.161[0.000]	0.108[0.000]	0.095[0.000]	0.095[0.000]	0.252[0.000]	0.247[0.000]	0.246[0.000]	0.234[0.000]	0.225[0.000]	0.243[0.000]	0.230[0.000]	0.213[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.082	0.087	0.092	0.069	0.073	0.077	0.070	0.069	0.072	0.078	0.085	0.090	0.092	0.092
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

Panel 4: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable]), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-2.835[0.000]	-2.723[0.000]	-2.672[0.000]	-2.321[0.000]	-2.368[0.000]	-2.447[0.000]	-3.600[0.000]	-3.657[0.000]	-3.358[0.000]	-3.570[0.000]	-3.461[0.000]	-3.448[0.000]	-3.380[0.000]	-3.455[0.000]
	(0.16)	(0.15)	(0.15)	(0.13)	(0.13)	(0.13)	(0.36)	(0.33)	(0.29)	(0.27)	(0.24)	(0.22)	(0.21)	(0.20)
Reform56	0.342[0.000]	0.454[0.000]	0.509[0.000]	0.455[0.000]	0.557[0.000]	0.602[0.000]	0.132[0.072]	0.119[0.072]	0.160[0.009]	0.159[0.006]	0.130[0.014]	0.160[0.002]	0.190[0.000]	0.219[0.000]
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.07)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
NE	-1.252[0.000]	-1.293[0.000]	-0.699[0.000]	-1.292[0.000]	-1.301[0.000]	-0.719[0.000]	-1.881[0.001]	-1.940[0.000]	-1.635[0.000]	-1.443[0.000]	-1.520[0.000]	-1.163[0.000]	-1.206[0.000]	-1.308[0.000]
	(0.28)	(0.23)	(0.16)	(0.27)	(0.23)	(0.16)	(0.54)	(0.54)	(0.43)	(0.37)	(0.34)	(0.29)	(0.29)	(0.31)
R56xNE	1.299[0.000]	1.351[0.000]	0.737[0.000]	1.328[0.000]	1.314[0.000]	0.725[0.000]	1.751[0.002]	1.718[0.002]	1.468[0.001]	1.326[0.001]	1.334[0.000]	1.043[0.001]	1.099[0.000]	1.175[0.000]
	(0.29)	(0.24)	(0.18)	(0.28)	(0.24)	(0.17)	(0.57)	(0.56)	(0.45)	(0.40)	(0.36)	(0.31)	(0.31)	(0.32)
Urban	0.172[0.000]	0.168[0.000]	0.178[0.000]	0.195[0.000]	0.192[0.000]	0.196[0.000]	0.348[0.000]	0.282[0.000]	0.267[0.000]	0.258[0.000]	0.240[0.000]	0.222[0.000]	0.203[0.000]	0.188[0.000]
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
Percent_HW	-1.000[0.000]	-1.201[0.000]	-1.234[0.000]	-2.392[0.000]	-2.325[0.000]	-2.130[0.000]	0.382[0.491]	0.947[0.037]	0.908[0.027]	1.104[0.003]	1.143[0.001]	1.027[0.001]	0.834[0.005]	0.564[0.047]
	(0.21)	(0.22)	(0.21)	(0.15)	(0.16)	(0.16)	(0.55)	(0.46)	(0.41)	(0.37)	(0.35)	(0.32)	(0.30)	(0.28)
LogADT	-0.119[0.000]	-0.119[0.000]	-0.118[0.000]	-0.091[0.000]	-0.089[0.000]	-0.089[0.000]	-0.167[0.000]	-0.169[0.000]	-0.164[0.000]	-0.154[0.000]	-0.153[0.000]	-0.146[0.000]	-0.142[0.000]	-0.141[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.778[0.000]	0.755[0.000]	0.742[0.000]	0.669[0.000]	0.664[0.000]	0.664[0.000]	0.862[0.000]	0.863[0.000]	0.814[0.000]	0.826[0.000]	0.823[0.000]	0.829[0.000]	0.830[0.000]	0.847[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.082	0.086	0.086	0.085	0.087	0.088	0.105	0.101	0.090	0.090	0.092	0.090	0.091	0.092
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4B - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 5: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	2.281[0.000]	2.108[0.000]	2.218[0.000]	1.988[0.000]	1.898[0.000]	1.905[0.000]	1.416[0.019]	2.493[0.000]	2.520[0.000]	2.519[0.000]	2.192[0.000]	2.061[0.000]	1.875[0.000]	1.786[0.000]
	(0.32)	(0.32)	(0.32)	(0.29)	(0.30)	(0.30)	(0.60)	(0.52)	(0.47)	(0.44)	(0.41)	(0.39)	(0.37)	(0.36)
Reform60	-1.153[0.000]	-1.126[0.000]	-1.066[0.000]	-1.294[0.000]	-1.259[0.000]	-1.234[0.000]	-0.475[0.000]	-0.605[0.000]	-0.683[0.000]	-0.804[0.000]	-0.827[0.000]	-0.874[0.000]	-0.872[0.000]	-0.947[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.12)	(0.10)	(0.10)	(0.09)	(0.08)	(0.08)	(0.08)	(0.07)
NE	2.203[0.000]	2.092[0.000]	2.033[0.000]	2.151[0.000]	2.052[0.000]	1.988[0.000]	0.201[0.642]	2.841[0.000]	2.548[0.000]	2.839[0.000]	2.744[0.000]	2.635[0.000]	2.536[0.000]	2.359[0.000]
	(0.11)	(0.11)	(0.10)	(0.11)	(0.10)	(0.10)	(0.43)	(0.17)	(0.16)	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)
R60xNE	-2.748[0.000]	-2.531[0.000]	-2.567[0.000]	-2.376[0.000]	-2.198[0.000]	-2.143[0.000]	-0.970[0.234]	-3.500[0.000]	-3.382[0.000]	-3.568[0.000]	-3.064[0.000]	-3.095[0.000]	-3.144[0.000]	-2.995[0.000]
	(0.35)	(0.34)	(0.36)	(0.27)	(0.27)	(0.27)	(0.82)	(0.54)	(0.52)	(0.47)	(0.39)	(0.39)	(0.39)	(0.38)
Urban	0.037[0.546]	0.040[0.518]	0.055[0.365]	-0.015[0.786]	-0.021[0.713]	-0.018[0.740]	0.252[0.029]	-0.282[0.004]	-0.210[0.022]	-0.217[0.008]	-0.158[0.041]	-0.097[0.192]	-0.031[0.666]	-0.000[0.999]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.12)	(0.10)	(0.09)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)
Percent_HW	-2.705[0.000]	-2.615[0.000]	-3.777[0.000]	-1.857[0.000]	-1.804[0.000]	-2.661[0.000]	-3.299[0.002]	-6.467[0.000]	-5.099[0.000]	-5.613[0.000]	-4.719[0.000]	-3.943[0.000]	-3.572[0.000]	-3.016[0.000]
	(0.41)	(0.46)	(0.46)	(0.36)	(0.40)	(0.41)	(1.08)	(0.84)	(0.76)	(0.69)	(0.62)	(0.57)	(0.54)	(0.50)
LogADT	-0.216[0.000]	-0.205[0.000]	-0.211[0.000]	-0.209[0.000]	-0.201[0.000]	-0.204[0.000]	-0.284[0.000]	-0.247[0.000]	-0.227[0.000]	-0.240[0.000]	-0.235[0.000]	-0.231[0.000]	-0.223[0.000]	-0.217[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
LogLength	-0.576[0.000]	-0.574[0.000]	-0.565[0.000]	-0.584[0.000]	-0.587[0.000]	-0.568[0.000]	-0.307[0.001]	-0.404[0.000]	-0.471[0.000]	-0.444[0.000]	-0.439[0.000]	-0.461[0.000]	-0.443[0.000]	-0.460[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.09)	(0.09)	(0.08)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.225	0.219	0.209	0.220	0.216	0.206	0.195	0.221	0.215	0.234	0.225	0.219	0.214	0.210
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

Panel 6: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-4.959[0.000]	-4.893[0.000]	-4.845[0.000]	-3.479[0.000]	-3.457[0.000]	-3.466[0.000]	-5.219[0.000]	-5.471[0.000]	-5.775[0.000]	-5.797[0.000]	-5.697[0.000]	-5.568[0.000]	-5.444[0.000]	-5.432[0.000]
	(0.18)	(0.17)	(0.16)	(0.13)	(0.13)	(0.13)	(0.34)	(0.30)	(0.29)	(0.27)	(0.24)	(0.23)	(0.22)	(0.21)
Reform60	1.002[0.000]	0.920[0.000]	0.864[0.000]	1.038[0.000]	0.964[0.000]	0.920[0.000]	0.544[0.000]	0.643[0.000]	0.722[0.000]	0.780[0.000]	0.866[0.000]	0.899[0.000]	0.917[0.000]	0.943[0.000]
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
NE	-0.889[0.000]	-0.523[0.000]	-0.340[0.000]	-0.727[0.000]	-0.434[0.000]	-0.280[0.001]	-0.893[0.000]	-1.135[0.000]	-1.069[0.000]	-1.109[0.000]	-1.017[0.000]	-0.949[0.000]	-0.936[0.000]	-0.905[0.000]
	(0.11)	(0.09)	(0.08)	(0.11)	(0.09)	(0.08)	(0.17)	(0.14)	(0.13)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)
R60xNE	0.942[0.000]	0.506[0.000]	0.334[0.002]	0.799[0.000]	0.457[0.000]	0.276[0.008]	1.096[0.000]	1.324[0.000]	1.214[0.000]	1.245[0.000]	1.155[0.000]	1.083[0.000]	1.066[0.000]	1.008[0.000]
	(0.13)	(0.12)	(0.11)	(0.13)	(0.11)	(0.10)	(0.20)	(0.17)	(0.16)	(0.15)	(0.15)	(0.14)	(0.14)	(0.14)
Urban	-0.861[0.000]	-0.848[0.000]	-0.831[0.000]	-0.702[0.000]	-0.695[0.000]	-0.679[0.000]	-0.974[0.000]	-0.947[0.000]	-0.910[0.000]	-0.926[0.000]	-0.906[0.000]	-0.894[0.000]	-0.897[0.000]	-0.890[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	2.086[0.000]	2.385[0.000]	2.493[0.000]	-0.124[0.351]	0.097[0.464]	0.350[0.008]	3.124[0.000]	3.362[0.000]	3.602[0.000]	3.776[0.000]	3.780[0.000]	3.324[0.000]	3.103[0.000]	2.915[0.000]
	(0.18)	(0.17)	(0.17)	(0.13)	(0.13)	(0.13)	(0.35)	(0.31)	(0.28)	(0.26)	(0.24)	(0.22)	(0.21)	(0.20)
LogADT	0.233[0.000]	0.229[0.000]	0.230[0.000]	0.172[0.000]	0.170[0.000]	0.171[0.000]	0.278[0.000]	0.267[0.000]	0.269[0.000]	0.278[0.000]	0.277[0.000]	0.267[0.000]	0.261[0.000]	0.260[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.181[0.000]	0.180[0.000]	0.178[0.000]	0.104[0.000]	0.107[0.000]	0.107[0.000]	0.194[0.000]	0.230[0.000]	0.224[0.000]	0.191[0.000]	0.195[0.000]	0.197[0.000]	0.182[0.000]	0.178[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.092	0.087	0.085	0.076	0.073	0.072	0.085	0.090	0.092	0.094	0.097	0.095	0.094	0.093
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4B - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 7: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable]), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-3.001[0.000]	-2.877[0.000]	-2.734[0.000]	-2.426[0.000]	-2.451[0.000]	-2.464[0.000]	-3.627[0.000]	-3.671[0.000]	-3.674[0.000]	-3.730[0.000]	-3.452[0.000]	-3.412[0.000]	-3.283[0.000]	-3.222[0.000]
	(0.16)	(0.15)	(0.15)	(0.13)	(0.13)	(0.12)	(0.29)	(0.25)	(0.24)	(0.22)	(0.21)	(0.20)	(0.19)	(0.18)
Reform60	0.368[0.000]	0.379[0.000]	0.385[0.000]	0.443[0.000]	0.461[0.000]	0.467[0.000]	0.184[0.000]	0.227[0.000]	0.274[0.000]	0.303[0.000]	0.318[0.000]	0.346[0.000]	0.359[0.000]	0.361[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)
NE	-0.615[0.000]	-0.574[0.000]	-0.508[0.000]	-0.573[0.000]	-0.560[0.000]	-0.509[0.000]	-0.276[0.091]	-0.549[0.000]	-0.578[0.000]	-0.703[0.000]	-0.629[0.000]	-0.627[0.000]	-0.604[0.000]	-0.602[0.000]
	(0.13)	(0.12)	(0.11)	(0.13)	(0.12)	(0.11)	(0.16)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)
R60xNE	0.686[0.000]	0.686[0.000]	0.557[0.000]	0.605[0.000]	0.596[0.000]	0.509[0.000]	0.152[0.493]	0.516[0.006]	0.542[0.002]	0.597[0.001]	0.556[0.001]	0.546[0.001]	0.510[0.001]	0.531[0.001]
	(0.15)	(0.14)	(0.14)	(0.15)	(0.14)	(0.13)	(0.22)	(0.19)	(0.18)	(0.17)	(0.17)	(0.16)	(0.16)	(0.16)
Urban	0.193[0.000]	0.180[0.000]	0.194[0.000]	0.211[0.000]	0.203[0.000]	0.212[0.000]	0.261[0.000]	0.246[0.000]	0.224[0.000]	0.202[0.000]	0.227[0.000]	0.212[0.000]	0.214[0.000]	0.201[0.000]
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Percent_HW	-0.342[0.126]	-0.737[0.001]	-0.539[0.010]	-1.778[0.000]	-1.858[0.000]	-1.473[0.000]	1.846[0.000]	1.843[0.000]	1.522[0.000]	1.219[0.000]	0.652[0.034]	0.485[0.088]	0.348[0.196]	0.173[0.502]
	(0.22)	(0.22)	(0.21)	(0.16)	(0.16)	(0.16)	(0.45)	(0.40)	(0.36)	(0.34)	(0.31)	(0.29)	(0.27)	(0.26)
LogADT	-0.114[0.000]	-0.117[0.000]	-0.116[0.000]	-0.087[0.000]	-0.088[0.000]	-0.087[0.000]	-0.120[0.000]	-0.117[0.000]	-0.120[0.000]	-0.123[0.000]	-0.128[0.000]	-0.127[0.000]	-0.123[0.000]	-0.121[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.770[0.000]	0.767[0.000]	0.738[0.000]	0.662[0.000]	0.671[0.000]	0.661[0.000]	0.817[0.000]	0.830[0.000]	0.847[0.000]	0.870[0.000]	0.808[0.000]	0.803[0.000]	0.798[0.000]	0.795[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.084	0.089	0.085	0.087	0.090	0.087	0.085	0.084	0.087	0.092	0.084	0.085	0.086	0.085
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4C - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 1: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	0.812[0.527]	0.848[0.522]	1.548[0.236]	1.210[0.269]	1.265[0.248]	1.610[0.143]	-39.056[0.000]	-19.430[]	0.155[0.963]	1.051[0.637]	1.613[0.373]	1.564[0.358]	1.834[0.247]	1.482[0.330]
	(1.29)	(1.32)	(1.31)	(1.10)	(1.09)	(1.10)	(3.99)		(3.32)	(2.22)	(1.81)	(1.70)	(1.58)	(1.52)
Reform56	-1.058[0.001]	-0.914[0.003]	-0.587[0.048]	-0.832[0.002]	-0.751[0.004]	-0.576[0.018]	-0.968[0.120]	-0.739[0.144]	-0.897[0.087]	-0.913[0.062]	-1.383[0.000]	-1.258[0.000]	-1.379[0.000]	-1.399[0.000]
	(0.32)	(0.31)	(0.30)	(0.26)	(0.26)	(0.24)	(0.62)	(0.51)	(0.53)	(0.49)	(0.38)	(0.36)	(0.35)	(0.35)
Urban	0.754[0.011]	0.742[0.012]	0.796[0.005]	0.768[0.004]	0.711[0.007]	0.753[0.003]	0.036[0.955]	0.079[0.879]	0.383[0.444]	0.266[0.562]	0.395[0.252]	0.477[0.146]	0.434[0.178]	0.517[0.100]
	(0.30)	(0.30)	(0.29)	(0.27)	(0.26)	(0.25)	(0.64)	(0.52)	(0.50)	(0.46)	(0.35)	(0.33)	(0.32)	(0.31)
R56xUrban	-0.977[0.009]	-1.131[0.003]	-1.251[0.001]	-1.387[0.000]	-1.362[0.000]	-1.445[0.000]	-0.231[0.774]	-0.134[0.840]	-0.481[0.434]	-0.631[0.276]	-0.419[0.374]	-0.596[0.185]	-0.565[0.206]	-0.633[0.144]
	(0.37)	(0.38)	(0.37)	(0.33)	(0.33)	(0.32)	(0.80)	(0.67)	(0.62)	(0.58)	(0.47)	(0.45)	(0.45)	(0.43)
Percent_HW	-1.015[0.549]	-0.412[0.813]	-4.092[0.017]	-3.047[0.009]	-2.331[0.053]	-4.240[0.000]	2.907[0.618]	3.714[0.352]	1.315[0.666]	0.648[0.813]	1.442[0.552]	1.544[0.520]	2.435[0.275]	2.370[0.256]
	(1.69)	(1.75)	(1.72)	(1.17)	(1.20)	(1.21)	(5.82)	(3.99)	(3.04)	(2.74)	(2.43)	(2.40)	(2.23)	(2.09)
LogADT	-0.262[0.000]	-0.266[0.000]	-0.274[0.000]	-0.283[0.000]	-0.276[0.000]	-0.272[0.000]	-0.315[0.000]	-0.322[0.000]	-0.248[0.000]	-0.254[0.000]	-0.299[0.000]	-0.322[0.000]	-0.320[0.000]	-0.300[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
LogLength	-0.625[0.000]	-0.655[0.000]	-0.660[0.000]	-0.516[0.000]	-0.546[0.000]	-0.570[0.000]	-0.138[0.644]	-0.387[0.181]	-0.514[0.041]	-0.330[0.139]	-0.471[0.012]	-0.395[0.023]	-0.428[0.016]	-0.450[0.011]
	(0.16)	(0.17)	(0.16)	(0.12)	(0.13)	(0.12)	(0.30)	(0.29)	(0.25)	(0.22)	(0.19)	(0.17)	(0.18)	(0.18)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.340	0.330	0.326	0.297	0.298	0.297	0.367	0.341	0.320	0.311	0.337	0.320	0.325	0.330
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	1.127[0.000]	1.301[0.000]	1.487[0.000]	1.114[0.000]	1.205[0.000]	1.408[0.000]	1.914[0.000]	1.865[0.000]	1.404[0.001]	1.826[0.000]	1.683[0.000]	1.538[0.000]	1.373[0.000]	1.342[0.000]
	(0.24)	(0.24)	(0.24)	(0.21)	(0.21)	(0.21)	(0.53)	(0.48)	(0.43)	(0.40)	(0.36)	(0.33)	(0.31)	(0.29)
Reform56	-1.011[0.000]	-1.091[0.000]	-1.245[0.000]	-0.978[0.000]	-1.062[0.000]	-1.232[0.000]	-0.427[0.000]	-0.654[0.000]	-0.771[0.000]	-0.861[0.000]	-0.875[0.000]	-0.892[0.000]	-0.918[0.000]	-0.911[0.000]
	(0.06)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.09)	(0.08)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
Urban	0.028[0.673]	0.173[0.005]	0.191[0.000]	0.008[0.908]	0.159[0.010]	0.166[0.002]	-0.111[0.213]	-0.116[0.149]	-0.122[0.109]	-0.141[0.057]	-0.102[0.135]	-0.053[0.431]	-0.044[0.507]	0.006[0.933]
	(0.07)	(0.06)	(0.05)	(0.07)	(0.06)	(0.05)	(0.09)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
R56xUrban	0.589[0.000]	0.470[0.000]	0.477[0.000]	0.533[0.000]	0.399[0.000]	0.416[0.000]	0.212[0.042]	0.378[0.000]	0.458[0.000]	0.580[0.000]	0.601[0.000]	0.597[0.000]	0.617[0.000]	0.595[0.000]
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.10)	(0.09)	(0.09)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)
Percent_HW	4.360[0.000]	3.627[0.000]	4.007[0.000]	6.616[0.000]	6.099[0.000]	5.981[0.000]	-2.269[0.002]	-0.909[0.097]	0.486[0.309]	1.176[0.008]	1.187[0.003]	1.434[0.000]	1.556[0.000]	2.081[0.000]
	(0.24)	(0.25)	(0.25)	(0.16)	(0.17)	(0.17)	(0.74)	(0.55)	(0.48)	(0.44)	(0.40)	(0.39)	(0.37)	(0.35)
LogADT	-0.054[0.000]	-0.064[0.000]	-0.066[0.000]	-0.057[0.000]	-0.064[0.000]	-0.064[0.000]	0.077[0.000]	0.056[0.000]	0.034[0.001]	0.006[0.475]	-0.003[0.673]	-0.014[0.069]	-0.022[0.003]	-0.032[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.741[0.000]	-0.721[0.000]	-0.731[0.000]	-0.728[0.000]	-0.708[0.000]	-0.716[0.000]	-0.648[0.000]	-0.630[0.000]	-0.617[0.000]	-0.640[0.000]	-0.637[0.000]	-0.670[0.000]	-0.690[0.000]	-0.699[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.136	0.141	0.149	0.170	0.170	0.176	0.116	0.107	0.102	0.102	0.104	0.109	0.116	0.119
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4C - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 3: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-2.412[0.000]	-2.618[0.000]	-2.669[0.000]	-1.953[0.000]	-2.044[0.000]	-2.036[0.000]	-5.007[0.000]	-4.679[0.000]	-4.134[0.000]	-4.284[0.000]	-4.072[0.000]	-3.806[0.000]	-3.902[0.000]	-3.414[0.000]
	(0.25)	(0.24)	(0.24)	(0.19)	(0.19)	(0.19)	(0.66)	(0.57)	(0.53)	(0.48)	(0.43)	(0.39)	(0.36)	(0.33)
Reform56	1.490[0.000]	1.600[0.000]	1.502[0.000]	1.443[0.000]	1.560[0.000]	1.461[0.000]	0.763[0.000]	0.930[0.000]	1.063[0.000]	1.194[0.000]	1.323[0.000]	1.359[0.000]	1.383[0.000]	1.372[0.000]
	(0.07)	(0.06)	(0.05)	(0.07)	(0.06)	(0.05)	(0.11)	(0.10)	(0.09)	(0.09)	(0.08)	(0.08)	(0.07)	(0.07)
Urban	-0.278[0.001]	-0.252[0.001]	-0.393[0.000]	-0.233[0.005]	-0.205[0.007]	-0.340[0.000]	-0.152[0.198]	-0.208[0.048]	-0.246[0.013]	-0.236[0.014]	-0.243[0.007]	-0.271[0.002]	-0.274[0.002]	-0.316[0.000]
	(0.08)	(0.08)	(0.06)	(0.08)	(0.08)	(0.06)	(0.12)	(0.11)	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)
R56xUrban	-0.604[0.000]	-0.627[0.000]	-0.498[0.000]	-0.503[0.000]	-0.527[0.000]	-0.405[0.000]	-0.350[0.008]	-0.428[0.000]	-0.481[0.000]	-0.583[0.000]	-0.646[0.000]	-0.641[0.000]	-0.644[0.000]	-0.617[0.000]
	(0.09)	(0.08)	(0.07)	(0.09)	(0.08)	(0.07)	(0.13)	(0.12)	(0.11)	(0.10)	(0.10)	(0.09)	(0.09)	(0.09)
Percent_HW	-3.368[0.000]	-2.405[0.000]	-2.193[0.000]	-3.791[0.000]	-3.258[0.000]	-2.935[0.000]	2.436[0.010]	0.644[0.355]	-0.686[0.250]	-1.377[0.012]	-1.383[0.004]	-1.404[0.002]	-1.190[0.005]	-1.413[0.000]
	(0.25)	(0.26)	(0.26)	(0.15)	(0.16)	(0.16)	(0.95)	(0.70)	(0.60)	(0.55)	(0.49)	(0.46)	(0.42)	(0.40)
LogADT	0.249[0.000]	0.253[0.000]	0.258[0.000]	0.203[0.000]	0.204[0.000]	0.206[0.000]	0.175[0.000]	0.188[0.000]	0.216[0.000]	0.241[0.000]	0.260[0.000]	0.258[0.000]	0.258[0.000]	0.267[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.156[0.000]	0.132[0.000]	0.139[0.000]	0.046[0.001]	0.032[0.026]	0.038[0.009]	0.220[0.000]	0.223[0.000]	0.227[0.000]	0.225[0.000]	0.217[0.000]	0.234[0.000]	0.226[0.000]	0.204[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.123	0.126	0.130	0.110	0.113	0.116	0.124	0.122	0.119	0.120	0.125	0.126	0.128	0.129
N	45,331	45,649	46,990	60,089	58,926	59,005	9,892	12,640	15,262	18,438	21,993	25,130	27,970	30,708

Panel 4: DV "UnderRecord", Reform 1956

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-5.851[0.000]	-5.864[0.000]	-5.726[0.000]	-6.178[0.000]	-6.163[0.000]	-6.010[0.000]	-5.416[0.000]	-5.370[0.000]	-5.167[0.000]	-5.289[0.000]	-5.462[0.000]	-5.656[0.000]	-5.718[0.000]	-5.623[0.000]
	(0.13)	(0.13)	(0.13)	(0.11)	(0.11)	(0.11)	(0.32)	(0.28)	(0.26)	(0.24)	(0.21)	(0.20)	(0.18)	(0.17)
Reform56	0.955[0.000]	0.864[0.000]	0.648[0.000]	0.892[0.000]	0.810[0.000]	0.594[0.000]	0.508[0.000]	0.534[0.000]	0.586[0.000]	0.692[0.000]	0.779[0.000]	0.831[0.000]	0.886[0.000]	0.915[0.000]
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Urban	1.128[0.000]	1.068[0.000]	0.915[0.000]	1.136[0.000]	1.093[0.000]	0.947[0.000]	0.689[0.000]	0.749[0.000]	0.793[0.000]	0.875[0.000]	0.928[0.000]	0.969[0.000]	1.018[0.000]	1.063[0.000]
	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
R56xUrban	-0.798[0.000]	-0.740[0.000]	-0.576[0.000]	-0.653[0.000]	-0.612[0.000]	-0.458[0.000]	-0.428[0.000]	-0.430[0.000]	-0.480[0.000]	-0.588[0.000]	-0.653[0.000]	-0.698[0.000]	-0.732[0.000]	-0.758[0.000]
	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Percent_HW	0.995[0.000]	1.051[0.000]	1.398[0.000]	2.143[0.000]	2.159[0.000]	2.323[0.000]	1.614[0.000]	1.380[0.000]	0.976[0.001]	0.930[0.000]	0.733[0.002]	0.698[0.002]	0.878[0.000]	0.959[0.000]
	(0.13)	(0.13)	(0.13)	(0.08)	(0.08)	(0.09)	(0.43)	(0.34)	(0.29)	(0.27)	(0.24)	(0.23)	(0.21)	(0.20)
LogADT	0.221[0.000]	0.221[0.000]	0.221[0.000]	0.216[0.000]	0.216[0.000]	0.217[0.000]	0.310[0.000]	0.301[0.000]	0.293[0.000]	0.282[0.000]	0.276[0.000]	0.269[0.000]	0.261[0.000]	0.248[0.000]
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.397[0.000]	0.408[0.000]	0.404[0.000]	0.417[0.000]	0.426[0.000]	0.424[0.000]	0.351[0.000]	0.366[0.000]	0.365[0.000]	0.354[0.000]	0.382[0.000]	0.402[0.000]	0.396[0.000]	0.391[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.263	0.265	0.262	0.277	0.278	0.278	0.290	0.286	0.281	0.276	0.282	0.280	0.278	0.274
N	316,434	321,424	329,084	466,330	461,647	461,433	77,809	96,557	116,319	135,668	165,824	189,979	208,730	225,923

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4C - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 5: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	0.165[0.903]	1.088[0.409]	1.793[0.165]	1.026[0.368]	1.384[0.216]	1.797[0.104]	-56.576[]	-53.235[0.001]	-50.763[0.000]	-49.643[0.000]	-17.645[0.000]	-17.565[]	-0.303[0.879]	-0.688[0.698]
	(1.35)	(1.32)	(1.29)	(1.14)	(1.12)	(1.10)		(15.87)	(11.49)	(6.88)	(2.52)		(1.98)	(1.77)
Reform60	-0.944[0.000]	-0.692[0.003]	-0.498[0.038]	-0.831[0.000]	-0.609[0.002]	-0.484[0.016]	-0.766[0.237]	-0.778[0.072]	-1.169[0.007]	-1.316[0.001]	-1.132[0.002]	-0.904[0.006]	-1.041[0.001]	-1.088[0.000]
	(0.25)	(0.24)	(0.24)	(0.21)	(0.20)	(0.20)	(0.65)	(0.43)	(0.43)	(0.41)	(0.37)	(0.33)	(0.31)	(0.30)
Urban	0.534[0.020]	0.528[0.021]	0.565[0.016]	0.507[0.016]	0.467[0.025]	0.526[0.012]	0.297[0.567]	0.158[0.695]	0.248[0.455]	0.299[0.338]	0.026[0.935]	-0.015[0.962]	0.143[0.624]	0.190[0.503]
	(0.23)	(0.23)	(0.24)	(0.21)	(0.21)	(0.21)	(0.52)	(0.40)	(0.33)	(0.31)	(0.32)	(0.31)	(0.29)	(0.28)
R60xUrban	-0.964[0.006]	-1.012[0.004]	-1.051[0.004]	-1.320[0.000]	-1.233[0.000]	-1.284[0.000]	-0.107[0.906]	-0.267[0.679]	-0.289[0.633]	-0.240[0.672]	-0.456[0.374]	-0.518[0.266]	-0.579[0.178]	-0.447[0.270]
	(0.35)	(0.35)	(0.36)	(0.30)	(0.29)	(0.30)	(0.91)	(0.65)	(0.61)	(0.57)	(0.51)	(0.47)	(0.43)	(0.41)
Percent_HW	-5.519[0.001]	-3.901[0.033]	-6.550[0.000]	-6.190[0.000]	-4.620[0.000]	-6.007[0.000]	18.005[0.194]	15.311[0.045]	5.678[0.310]	3.032[0.543]	3.027[0.460]	1.136[0.719]	-4.057[0.182]	-4.623[0.087]
	(1.66)	(1.83)	(1.76)	(1.22)	(1.28)	(1.26)	(13.86)	(7.63)	(5.59)	(4.98)	(4.09)	(3.16)	(3.04)	(2.70)
LogADT	-0.234[0.000]	-0.251[0.000]	-0.263[0.000]	-0.263[0.000]	-0.261[0.000]	-0.262[0.000]	-0.245[0.003]	-0.291[0.000]	-0.321[0.000]	-0.305[0.000]	-0.278[0.000]	-0.236[0.000]	-0.202[0.000]	-0.217[0.000]
	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.08)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
LogLength	-0.595[0.000]	-0.656[0.000]	-0.703[0.000]	-0.500[0.000]	-0.552[0.000]	-0.611[0.000]	-0.098[0.775]	-0.148[0.619]	-0.154[0.582]	-0.173[0.507]	-0.304[0.246]	-0.389[0.120]	-0.474[0.020]	-0.490[0.014]
	(0.15)	(0.16)	(0.15)	(0.12)	(0.13)	(0.12)	(0.34)	(0.30)	(0.28)	(0.26)	(0.26)	(0.25)	(0.20)	(0.20)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.335	0.322	0.326	0.293	0.290	0.294	0.378	0.366	0.367	0.353	0.330	0.315	0.315	0.318
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

Panel 6: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	1.347[0.000]	1.431[0.000]	1.425[0.000]	1.143[0.000]	1.168[0.000]	1.171[0.000]	1.110[0.029]	1.134[0.008]	1.302[0.001]	1.868[0.000]	1.759[0.000]	1.861[0.000]	1.616[0.000]	1.629[0.000]
	(0.24)	(0.24)	(0.23)	(0.21)	(0.21)	(0.21)	(0.51)	(0.43)	(0.38)	(0.34)	(0.31)	(0.30)	(0.29)	(0.28)
Reform60	-0.894[0.000]	-0.843[0.000]	-0.814[0.000]	-0.784[0.000]	-0.755[0.000]	-0.758[0.000]	-0.744[0.000]	-0.753[0.000]	-0.834[0.000]	-0.846[0.000]	-0.892[0.000]	-0.923[0.000]	-0.926[0.000]	-0.928[0.000]
	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
Urban	0.288[0.000]	0.363[0.000]	0.410[0.000]	0.278[0.000]	0.352[0.000]	0.394[0.000]	0.267[0.000]	0.383[0.000]	0.347[0.000]	0.360[0.000]	0.327[0.000]	0.309[0.000]	0.304[0.000]	0.295[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
R60xUrban	0.369[0.000]	0.281[0.000]	0.194[0.000]	0.269[0.000]	0.181[0.000]	0.107[0.012]	0.512[0.000]	0.392[0.000]	0.424[0.000]	0.413[0.000]	0.391[0.000]	0.407[0.000]	0.399[0.000]	0.401[0.000]
	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.07)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
Percent_HW	2.293[0.000]	1.951[0.000]	1.632[0.000]	5.350[0.000]	5.057[0.000]	4.464[0.000]	1.157[0.084]	0.770[0.198]	-0.010[0.984]	-0.143[0.769]	-0.368[0.387]	-0.160[0.662]	0.315[0.349]	0.696[0.027]
	(0.25)	(0.25)	(0.25)	(0.18)	(0.18)	(0.18)	(0.67)	(0.60)	(0.53)	(0.49)	(0.43)	(0.37)	(0.34)	(0.32)
LogADT	-0.057[0.000]	-0.055[0.000]	-0.053[0.000]	-0.058[0.000]	-0.056[0.000]	-0.053[0.000]	-0.058[0.000]	-0.064[0.000]	-0.062[0.000]	-0.067[0.000]	-0.056[0.000]	-0.057[0.000]	-0.060[0.000]	-0.064[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.725[0.000]	-0.731[0.000]	-0.736[0.000]	-0.717[0.000]	-0.718[0.000]	-0.724[0.000]	-0.783[0.000]	-0.770[0.000]	-0.793[0.000]	-0.782[0.000]	-0.747[0.000]	-0.755[0.000]	-0.747[0.000]	-0.753[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.140	0.143	0.143	0.173	0.173	0.171	0.126	0.127	0.137	0.136	0.134	0.137	0.138	0.138
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 4C - Robustness of Varying Permutations on NBI 1992 Main Model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 7: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-2.445[0.000]	-2.632[0.000]	-2.557[0.000]	-1.733[0.000]	-1.731[0.000]	-1.664[0.000]	-2.961[0.000]	-2.629[0.000]	-3.140[0.000]	-3.012[0.000]	-3.043[0.000]	-3.026[0.000]	-3.033[0.000]	-3.001[0.000]
	(0.25)	(0.24)	(0.23)	(0.19)	(0.19)	(0.19)	(0.51)	(0.46)	(0.42)	(0.38)	(0.34)	(0.33)	(0.31)	(0.30)
Reform60	1.100[0.000]	0.988[0.000]	0.888[0.000]	0.999[0.000]	0.895[0.000]	0.819[0.000]	0.774[0.000]	0.871[0.000]	0.925[0.000]	0.962[0.000]	1.029[0.000]	1.039[0.000]	1.057[0.000]	1.063[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)
Urban	-0.544[0.000]	-0.607[0.000]	-0.667[0.000]	-0.507[0.000]	-0.565[0.000]	-0.615[0.000]	-0.658[0.000]	-0.626[0.000]	-0.598[0.000]	-0.606[0.000]	-0.577[0.000]	-0.570[0.000]	-0.564[0.000]	-0.566[0.000]
	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
R60xUrban	-0.352[0.000]	-0.265[0.000]	-0.173[0.000]	-0.212[0.000]	-0.136[0.003]	-0.064[0.141]	-0.450[0.000]	-0.429[0.000]	-0.425[0.000]	-0.416[0.000]	-0.416[0.000]	-0.409[0.000]	-0.402[0.000]	-0.385[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.08)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Percent_HW	-1.028[0.000]	-0.140[0.591]	0.274[0.286]	-2.442[0.000]	-2.072[0.000]	-1.647[0.000]	-1.812[0.015]	-1.807[0.007]	-0.943[0.107]	-0.575[0.282]	-0.197[0.675]	-0.367[0.365]	-0.349[0.334]	-0.525[0.117]
	(0.26)	(0.26)	(0.26)	(0.17)	(0.17)	(0.17)	(0.75)	(0.67)	(0.59)	(0.54)	(0.47)	(0.41)	(0.36)	(0.34)
LogADT	0.251[0.000]	0.244[0.000]	0.243[0.000]	0.202[0.000]	0.198[0.000]	0.196[0.000]	0.304[0.000]	0.286[0.000]	0.280[0.000]	0.289[0.000]	0.287[0.000]	0.283[0.000]	0.278[0.000]	0.279[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.161[0.000]	0.156[0.000]	0.157[0.000]	0.048[0.001]	0.050[0.001]	0.051[0.000]	0.191[0.000]	0.225[0.000]	0.225[0.000]	0.184[0.000]	0.181[0.000]	0.180[0.000]	0.172[0.000]	0.166[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.127	0.123	0.121	0.113	0.111	0.109	0.123	0.126	0.127	0.130	0.132	0.131	0.130	0.129
N	44,478	45,749	46,285	59,236	59,026	58,300	14,690	18,745	22,506	25,880	29,702	32,649	35,473	37,762

Panel 8: DV "UnderRecord", Reform 1960

Data Permutation:	**Interstate Era Lag-1**	**Interstate Era Lag-2**	**Interstate Era Lag-3**	**Full Lag-1**	**Full Lag-2**	**Full Lag-3**	**3-Year Window**	**4-Year Window**	**5-Year Window**	**6-Year Window**	**7-Year Window**	**8-Year Window**	**9-Year Window**	**10-Year Window**
(Intercept)	-5.746[0.000]	-5.685[0.000]	-5.638[0.000]	-5.948[0.000]	-5.897[0.000]	-5.853[0.000]	-4.442[0.000]	-4.808[0.000]	-4.991[0.000]	-5.209[0.000]	-5.054[0.000]	-5.163[0.000]	-5.198[0.000]	-5.236[0.000]
	(0.13)	(0.13)	(0.13)	(0.11)	(0.11)	(0.11)	(0.27)	(0.23)	(0.21)	(0.19)	(0.18)	(0.17)	(0.16)	(0.15)
Reform60	0.585[0.000]	0.514[0.000]	0.418[0.000]	0.515[0.000]	0.445[0.000]	0.352[0.000]	0.149[0.000]	0.193[0.000]	0.236[0.000]	0.317[0.000]	0.336[0.000]	0.367[0.000]	0.384[0.000]	0.420[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Urban	0.755[0.000]	0.725[0.000]	0.673[0.000]	0.772[0.000]	0.748[0.000]	0.697[0.000]	0.386[0.000]	0.431[0.000]	0.456[0.000]	0.521[0.000]	0.570[0.000]	0.607[0.000]	0.618[0.000]	0.647[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
R60xUrban	-0.461[0.000]	-0.427[0.000]	-0.351[0.000]	-0.282[0.000]	-0.255[0.000]	-0.183[0.000]	-0.127[0.003]	-0.189[0.000]	-0.203[0.000]	-0.251[0.000]	-0.277[0.000]	-0.313[0.000]	-0.320[0.000]	-0.347[0.000]
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	2.059[0.000]	2.064[0.000]	2.202[0.000]	2.724[0.000]	2.739[0.000]	2.789[0.000]	-0.537[0.177]	-0.446[0.196]	0.453[0.123]	1.474[0.000]	1.120[0.000]	1.158[0.000]	1.254[0.000]	1.420[0.000]
	(0.14)	(0.13)	(0.13)	(0.09)	(0.09)	(0.09)	(0.40)	(0.35)	(0.29)	(0.26)	(0.24)	(0.21)	(0.19)	(0.17)
LogADT	0.224[0.000]	0.224[0.000]	0.223[0.000]	0.217[0.000]	0.219[0.000]	0.219[0.000]	0.244[0.000]	0.244[0.000]	0.247[0.000]	0.240[0.000]	0.222[0.000]	0.219[0.000]	0.225[0.000]	0.223[0.000]
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.403[0.000]	0.408[0.000]	0.412[0.000]	0.421[0.000]	0.425[0.000]	0.431[0.000]	0.394[0.000]	0.422[0.000]	0.407[0.000]	0.402[0.000]	0.403[0.000]	0.403[0.000]	0.403[0.000]	0.396[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.263	0.262	0.262	0.276	0.276	0.277	0.245	0.251	0.248	0.251	0.248	0.247	0.252	0.252
N	314,391	321,616	327,764	464,287	461,839	460,113	89,030	118,096	141,281	166,264	189,269	208,151	231,730	247,469

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 5A - Robustness across NBI years of main model
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 1: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive), Reform 1956

NBI Year:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
(Intercept)	1.509[0.000]	1.676[0.000]	1.554[0.000]	1.643[0.000]	1.875[0.000]	1.431[0.000]	1.281[0.000]	1.231[0.001]	1.368[0.000]	1.165[0.002]	0.864[0.019]	0.967[0.008]	0.840[0.020]	1.509[0.000]	1.704[0.000]	1.810[0.000]	2.114[0.000]	1.990[0.000]	1.908[0.000]	2.066[0.000]	2.986[0.000]
	(0.34)	(0.31)	(0.32)	(0.32)	(0.28)	(0.35)	(0.36)	(0.36)	(0.36)	(0.37)	(0.37)	(0.36)	(0.36)	(0.38)	(0.39)	(0.39)	(0.40)	(0.40)	(0.41)	(0.40)	(0.50)
Reform56	-1.471[0.000]	-1.454[0.000]	-1.235[0.000]	-1.194[0.000]	-1.113[0.000]	-1.152[0.000]	-1.131[0.000]	-1.113[0.000]	-1.241[0.000]	-1.187[0.000]	-1.037[0.000]	-1.049[0.000]	-0.985[0.000]	-1.028[0.000]	-1.080[0.000]	-0.960[0.000]	-1.023[0.000]	-0.923[0.000]	-0.867[0.000]	-0.949[0.000]	-1.064[0.000]
	(0.08)	(0.08)	(0.08)	(0.08)	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
NY	0.692[0.000]	0.787[0.000]	0.800[0.000]	0.870[0.000]	0.674[0.000]	1.010[0.000]	0.819[0.000]	0.904[0.000]	0.840[0.000]	0.878[0.000]	1.069[0.000]	0.953[0.000]	0.936[0.000]	0.946[0.000]	0.921[0.000]	1.187[0.000]	1.146[0.000]	1.264[0.000]	1.260[0.000]	1.255[0.000]	1.140[0.000]
	(0.13)	(0.13)	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
R56xNY	0.625[0.000]	0.428[0.014]	0.224[0.200]	0.151[0.383]	0.074[0.659]	0.144[0.411]	-0.002[0.990]	0.061[0.740]	0.094[0.611]	0.126[0.496]	-0.019[0.918]	0.015[0.936]	-0.014[0.938]	0.002[0.990]	0.011[0.953]	-0.211[0.271]	-0.250[0.201]	-0.318[0.110]	-0.355[0.077]	-0.285[0.162]	-0.097[0.634]
	(0.17)	(0.17)	(0.18)	(0.17)	(0.17)	(0.18)	(0.18)	(0.18)	(0.18)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
Urban	0.263[0.000]	0.230[0.000]	0.323[0.000]	0.311[0.000]	0.147[0.004]	0.187[0.003]	0.210[0.001]	0.249[0.000]	0.339[0.000]	0.160[0.012]	0.252[0.000]	0.164[0.010]	0.116[0.073]	0.119[0.065]	0.137[0.035]	0.177[0.010]	0.205[0.003]	0.231[0.001]	0.236[0.001]	0.169[0.017]	0.178[0.013]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Percent_HW	2.097[0.000]	2.068[0.000]	1.276[0.008]	1.344[0.004]	1.155[0.002]	2.183[0.000]	2.048[0.000]	2.443[0.000]	1.744[0.000]	2.629[0.000]	3.270[0.000]	2.984[0.000]	2.386[0.000]	2.458[0.000]	2.540[0.000]	2.586[0.000]	2.989[0.000]	2.704[0.000]	2.231[0.000]	2.736[0.000]	3.142[0.000]
	(0.47)	(0.46)	(0.48)	(0.47)	(0.37)	(0.47)	(0.47)	(0.47)	(0.48)	(0.48)	(0.49)	(0.48)	(0.50)	(0.50)	(0.49)	(0.53)	(0.52)	(0.54)	(0.55)	(0.54)	(0.55)
LogADT	-0.226[0.000]	-0.225[0.000]	-0.220[0.000]	-0.229[0.000]	-0.209[0.000]	-0.191[0.000]	-0.178[0.000]	-0.185[0.000]	-0.228[0.000]	-0.188[0.000]	-0.192[0.000]	-0.178[0.000]	-0.168[0.000]	-0.180[0.000]	-0.193[0.000]	-0.210[0.000]	-0.245[0.000]	-0.263[0.000]	-0.266[0.000]	-0.281[0.000]	-0.283[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.556[0.000]	-0.582[0.000]	-0.576[0.000]	-0.581[0.000]	-0.653[0.000]	-0.556[0.000]	-0.569[0.000]	-0.559[0.000]	-0.502[0.000]	-0.556[0.000]	-0.537[0.000]	-0.529[0.000]	-0.554[0.000]	-0.589[0.000]	-0.587[0.000]	-0.571[0.000]	-0.590[0.000]	-0.542[0.000]	-0.532[0.000]	-0.509[0.000]	-0.494[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.207	0.208	0.211	0.214	0.173	0.204	0.204	0.203	0.208	0.208	0.195	0.196	0.185	0.186	0.188	0.208	0.206	0.212	0.212	0.219	0.220
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

NBI Year:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
(Intercept)	2.480[0.000]	1.997[0.000]	2.095[0.000]	2.083[0.000]	1.597[0.000]	1.458[0.000]	1.529[0.000]	1.600[0.000]	1.726[0.000]	1.503[0.000]	1.552[0.000]	1.639[0.000]	0.543[0.004]	1.454[0.000]	1.426[0.000]	1.326[0.000]	1.706[0.000]	1.984[0.000]	1.822[0.000]	2.496[0.000]	2.707[0.000]
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.21)	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)	(0.19)	(0.27)	(0.27)	(0.27)	(0.27)	(0.26)	(0.26)	(0.28)	(0.41)
Reform56	-0.797[0.000]	-0.761[0.000]	-0.793[0.000]	-0.791[0.000]	-0.672[0.000]	-0.775[0.000]	-0.737[0.000]	-0.735[0.000]	-0.733[0.000]	-0.774[0.000]	-0.751[0.000]	-0.721[0.000]	-0.740[0.000]	-0.769[0.000]	-0.775[0.000]	-0.782[0.000]	-0.770[0.000]	-0.782[0.000]	-0.740[0.000]	-0.743[0.000]	-0.745[0.000]
	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
NY	0.218[0.012]	0.247[0.004]	0.244[0.004]	0.226[0.009]	0.342[0.000]	0.296[0.001]	0.341[0.000]	0.354[0.000]	0.261[0.002]	0.367[0.000]	0.384[0.000]	0.302[0.001]	0.372[0.000]	0.404[0.000]	0.450[0.000]	0.394[0.000]	0.379[0.000]	0.340[0.000]	0.406[0.000]	0.374[0.000]	0.438[0.000]
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
R56xNY	0.296[0.002]	0.339[0.000]	0.343[0.000]	0.351[0.000]	0.266[0.006]	0.347[0.000]	0.245[0.012]	0.237[0.015]	0.169[0.077]	0.255[0.010]	0.221[0.026]	0.266[0.007]	0.277[0.006]	0.296[0.003]	0.287[0.004]	0.361[0.000]	0.360[0.000]	0.401[0.000]	0.344[0.001]	0.374[0.000]	0.361[0.000]
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Urban	0.603[0.000]	0.590[0.000]	0.559[0.000]	0.568[0.000]	0.537[0.000]	0.580[0.000]	0.587[0.000]	0.590[0.000]	0.626[0.000]	0.559[0.000]	0.609[0.000]	0.629[0.000]	0.661[0.000]	0.653[0.000]	0.664[0.000]	0.680[0.000]	0.680[0.000]	0.720[0.000]	0.703[0.000]	0.731[0.000]	0.719[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	0.773[0.000]	0.848[0.000]	1.046[0.000]	1.042[0.000]	1.375[0.000]	1.381[0.000]	1.383[0.000]	1.310[0.000]	0.667[0.000]	1.106[0.000]	0.949[0.000]	0.849[0.000]	1.089[0.000]	1.236[0.000]	1.271[0.000]	1.373[0.000]	1.238[0.000]	1.357[0.000]	1.094[0.000]	1.093[0.000]	1.192[0.000]
	(0.17)	(0.16)	(0.17)	(0.16)	(0.16)	(0.17)	(0.16)	(0.17)	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.18)
LogADT	-0.044[0.000]	-0.041[0.000]	-0.050[0.000]	-0.050[0.000]	-0.026[0.000]	-0.042[0.000]	-0.041[0.000]	-0.045[0.000]	-0.056[0.000]	-0.048[0.000]	-0.047[0.000]	-0.046[0.000]	-0.050[0.000]	-0.048[0.000]	-0.061[0.000]	-0.075[0.000]	-0.084[0.000]	-0.103[0.000]	-0.088[0.000]	-0.098[0.000]	-0.100[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.668[0.000]	-0.634[0.000]	-0.648[0.000]	-0.661[0.000]	-0.632[0.000]	-0.691[0.000]	-0.717[0.000]	-0.724[0.000]	-0.717[0.000]	-0.722[0.000]	-0.719[0.000]	-0.703[0.000]	-0.694[0.000]	-0.719[0.000]	-0.707[0.000]	-0.680[0.000]	-0.699[0.000]	-0.687[0.000]	-0.667[0.000]	-0.679[0.000]	-0.708[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.078	0.074	0.077	0.078	0.068	0.083	0.084	0.085	0.080	0.084	0.084	0.082	0.083	0.085	0.085	0.086	0.087	0.088	0.086	0.088	0.090
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 3: DV "UnderRecord", Reform 1956

NBI Year:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
(Intercept)	-4.729[0.000]	-4.033[0.000]	-4.057[0.000]	-4.091[0.000]	-4.051[0.000]	-1.651[0.000]	-1.328[0.000]	-1.418[0.000]	-1.800[0.000]	-1.310[0.000]	-1.287[0.000]	-1.306[0.000]	-0.540[0.001]	-3.050[0.000]	-3.083[0.000]	-3.164[0.000]	-3.117[0.000]	-3.065[0.000]	-3.173[0.000]	-3.746[0.000]	-3.216[0.000]
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.20)	(0.20)	(0.20)	(0.22)	(0.22)	(0.22)	(0.23)	(0.30)
Reform56	0.605[0.000]	0.566[0.000]	0.590[0.000]	0.600[0.000]	0.597[0.000]	0.612[0.000]	0.613[0.000]	0.612[0.000]	0.638[0.000]	0.606[0.000]	0.589[0.000]	0.595[0.000]	0.590[0.000]	0.569[0.000]	0.575[0.000]	0.587[0.000]	0.578[0.000]	0.571[0.000]	0.562[0.000]	0.542[0.000]	0.532[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
NY	0.961[0.000]	0.898[0.000]	0.873[0.000]	0.903[0.000]	0.858[0.000]	0.880[0.000]	0.899[0.000]	0.888[0.000]	0.833[0.000]	0.860[0.000]	0.863[0.000]	0.833[0.000]	0.835[0.000]	0.843[0.000]	0.857[0.000]	0.779[0.000]	0.772[0.000]	0.702[0.000]	0.730[0.000]	0.722[0.000]	0.724[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
R56xNY	-0.678[0.000]	-0.657[0.000]	-0.677[0.000]	-0.682[0.000]	-0.669[0.000]	-0.720[0.000]	-0.742[0.000]	-0.732[0.000]	-0.677[0.000]	-0.740[0.000]	-0.750[0.000]	-0.748[0.000]	-0.764[0.000]	-0.745[0.000]	-0.732[0.000]	-0.684[0.000]	-0.670[0.000]	-0.633[0.000]	-0.633[0.000]	-0.611[0.000]	-0.615[0.000]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Urban	0.426[0.000]	0.451[0.000]	0.469[0.000]	0.484[0.000]	0.499[0.000]	0.627[0.000]	0.636[0.000]	0.641[0.000]	0.462[0.000]	0.668[0.000]	0.687[0.000]	0.716[0.000]	0.734[0.000]	0.727[0.000]	0.652[0.000]	0.623[0.000]	0.596[0.000]	0.571[0.000]	0.544[0.000]	0.561[0.000]	0.544[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	0.864[0.000]	0.835[0.000]	0.422[0.000]	0.672[0.000]	0.536[0.000]	0.266[0.004]	0.169[0.070]	0.138[0.140]	0.613[0.000]	-0.023[0.803]	-0.055[0.557]	-0.151[0.106]	-0.483[0.000]	-0.281[0.003]	0.078[0.407]	-0.133[0.161]	0.012[0.896]	-0.018[0.852]	0.267[0.005]	0.323[0.001]	0.371[0.000]
	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)	(0.09)	(0.10)	(0.09)	(0.09)	(0.10)	(0.09)	(0.09)
LogADT	0.225[0.000]	0.213[0.000]	0.211[0.000]	0.208[0.000]	0.204[0.000]	0.131[0.000]	0.117[0.000]	0.119[0.000]	0.202[0.000]	0.101[0.000]	0.087[0.000]	0.070[0.000]	0.075[0.000]	0.090[0.000]	0.119[0.000]	0.136[0.000]	0.150[0.000]	0.160[0.000]	0.173[0.000]	0.168[0.000]	0.168[0.000]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LogLength	0.364[0.000]	0.368[0.000]	0.386[0.000]	0.380[0.000]	0.382[0.000]	0.463[0.000]	0.472[0.000]	0.466[0.000]	0.409[0.000]	0.491[0.000]	0.516[0.000]	0.521[0.000]	0.514[0.000]	0.520[0.000]	0.496[0.000]	0.502[0.000]	0.483[0.000]	0.476[0.000]	0.476[0.000]	0.485[0.000]	0.504[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.238	0.240	0.246	0.247	0.245	0.241	0.239	0.238	0.252	0.237	0.237	0.234	0.237	0.238	0.240	0.245	0.242	0.241	0.243	0.243	0.243
N	316,434	315,475	314,121	315,829	311,213	309,876	308,110	306,026	308,959	302,179	298,958	291,195	286,609	290,216	284,367	282,616	283,897	279,853	275,626	273,370	270,665

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 5A - Robustness across NBI years of main model
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 4: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	0.016[0.985]	-0.204[0.803]	1.053[0.181]	0.595[0.457]	-0.255[0.780]	-0.803[0.466]	0.247[0.811]	0.524[0.612]	0.981[0.285]	0.831[0.421]	0.327[0.747]	0.497[0.633]	-0.276[0.797]	0.399[0.769]	-0.422[0.781]	-0.133[0.930]	-0.873[0.668]	-0.597[0.730]	-0.302[0.876]	0.003[0.999]	-15.387[0.000]
	(0.86)	(0.82)	(0.79)	(0.80)	(0.91)	(1.10)	(1.04)	(1.03)	(0.92)	(1.03)	(1.02)	(1.04)	(1.08)	(1.36)	(1.52)	(1.52)	(2.03)	(1.73)	(1.93)	(1.83)	(1.37)
Reform60	-1.004[0.000]	-0.979[0.000]	-0.909[0.000]	-0.951[0.000]	-0.892[0.000]	-0.885[0.000]	-0.927[0.000]	-0.919[0.000]	-1.246[0.000]	-0.992[0.000]	-0.886[0.000]	-1.028[0.000]	-1.085[0.000]	-1.174[0.000]	-1.110[0.000]	-1.142[0.000]	-1.171[0.000]	-1.161[0.000]	-1.293[0.000]	-1.217[0.000]	-1.189[0.000]
	(0.18)	(0.18)	(0.18)	(0.17)	(0.17)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.17)	(0.18)	(0.18)	(0.19)	(0.18)	(0.18)	(0.18)	(0.17)	(0.18)	(0.18)	(0.19)
NY	0.530[0.030]	0.718[0.003]	0.702[0.004]	0.789[0.001]	1.031[0.000]	1.045[0.000]	-0.301[0.475]	-0.951[0.105]	-1.135[0.053]	-0.897[0.127]	-0.629[0.224]	-0.590[0.252]	-0.213[0.616]	-0.436[0.355]	-0.469[0.318]	-0.752[0.152]	-1.123[0.041]	-0.806[0.131]	-0.832[0.128]	-0.838[0.128]	-1.561[0.039]
	(0.24)	(0.25)	(0.25)	(0.24)	(0.23)	(0.23)	(0.42)	(0.59)	(0.59)	(0.59)	(0.52)	(0.51)	(0.42)	(0.47)	(0.47)	(0.53)	(0.55)	(0.53)	(0.55)	(0.55)	(0.76)
R60xNY	-2.262[0.025]	-2.185[0.035]	-2.222[0.033]	-0.875[0.126]	-0.955[0.093]	-0.798[0.167]	-0.253[0.764]	0.375[0.691]	0.216[0.842]	0.423[0.654]	0.064[0.943]	0.163[0.855]	-0.156[0.853]	0.036[0.967]	-0.050[0.953]	0.225[0.802]	0.350[0.704]	0.140[0.877]	0.390[0.670]	-0.429[0.710]	0.358[0.775]
	(1.01)	(1.04)	(1.04)	(0.57)	(0.57)	(0.58)	(0.84)	(0.94)	(1.08)	(0.94)	(0.89)	(0.89)	(0.84)	(0.87)	(0.86)	(0.90)	(0.92)	(0.91)	(0.92)	(1.15)	(1.25)
Urban	0.112[0.526]	-0.016[0.923]	-0.096[0.574]	0.073[0.660]	0.014[0.930]	-0.060[0.722]	-0.102[0.592]	-0.034[0.862]	-0.064[0.729]	-0.159[0.402]	0.113[0.525]	-0.077[0.687]	-0.185[0.307]	-0.131[0.475]	0.059[0.742]	0.117[0.526]	0.188[0.314]	0.385[0.038]	0.406[0.039]	0.357[0.069]	0.402[0.041]
	(0.18)	(0.17)	(0.17)	(0.17)	(0.16)	(0.17)	(0.19)	(0.19)	(0.19)	(0.19)	(0.18)	(0.19)	(0.18)	(0.18)	(0.18)	(0.19)	(0.19)	(0.19)	(0.20)	(0.20)	(0.20)
Percent_HW	-1.674[0.146]	-1.679[0.156]	-1.999[0.094]	-1.609[0.188]	0.395[0.734]	1.620[0.137]	-0.135[0.910]	-0.157[0.897]	-0.905[0.428]	-0.249[0.843]	0.671[0.562]	0.178[0.889]	0.782[0.525]	0.854[0.485]	0.767[0.555]	0.760[0.584]	-0.490[0.727]	0.820[0.525]	0.360[0.800]	0.791[0.561]	1.563[0.238]
	(1.15)	(1.18)	(1.20)	(1.22)	(1.16)	(1.09)	(1.20)	(1.22)	(1.14)	(1.25)	(1.16)	(1.27)	(1.23)	(1.22)	(1.30)	(1.39)	(1.40)	(1.29)	(1.42)	(1.36)	(1.33)
LogADT	-0.250[0.000]	-0.254[0.000]	-0.250[0.000]	-0.262[0.000]	-0.263[0.000]	-0.223[0.000]	-0.234[0.000]	-0.253[0.000]	-0.319[0.000]	-0.251[0.000]	-0.258[0.000]	-0.250[0.000]	-0.252[0.000]	-0.272[0.000]	-0.285[0.000]	-0.316[0.000]	-0.382[0.000]	-0.387[0.000]	-0.390[0.000]	-0.406[0.000]	-0.404[0.000]
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LogLength	-0.556[0.000]	-0.510[0.000]	-0.764[0.000]	-0.655[0.000]	-0.698[0.000]	-0.584[0.000]	-0.654[0.000]	-0.668[0.000]	-0.588[0.000]	-0.736[0.000]	-0.721[0.000]	-0.680[0.000]	-0.577[0.001]	-0.657[0.000]	-0.444[0.004]	-0.451[0.003]	-0.215[0.189]	-0.370[0.028]	-0.432[0.021]	-0.388[0.021]	-0.404[0.022]
	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)	(0.16)	(0.17)	(0.17)	(0.16)	(0.18)	(0.16)	(0.17)	(0.17)	(0.17)	(0.16)	(0.15)	(0.16)	(0.17)	(0.19)	(0.17)	(0.18)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.278	0.280	0.297	0.276	0.273	0.255	0.244	0.256	0.293	0.271	0.238	0.246	0.237	0.256	0.227	0.251	0.246	0.236	0.242	0.251	0.247
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

Panel 5: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	2.730[0.000]	2.202[0.000]	2.276[0.000]	2.243[0.000]	1.748[0.000]	1.549[0.000]	1.602[0.000]	1.686[0.000]	1.810[0.000]	1.602[0.000]	1.607[0.000]	1.749[0.000]	0.616[0.001]	1.550[0.000]	1.590[0.000]	1.509[0.000]	1.899[0.000]	2.161[0.000]	2.014[0.000]	2.708[0.000]	2.962[0.000]
	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)	(0.22)	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)	(0.19)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.29)	(0.41)
Reform60	-0.868[0.000]	-0.839[0.000]	-0.839[0.000]	-0.833[0.000]	-0.746[0.000]	-0.838[0.000]	-0.806[0.000]	-0.797[0.000]	-0.795[0.000]	-0.843[0.000]	-0.808[0.000]	-0.781[0.000]	-0.762[0.000]	-0.757[0.000]	-0.757[0.000]	-0.762[0.000]	-0.738[0.000]	-0.731[0.000]	-0.725[0.000]	-0.721[0.000]	-0.706[0.000]
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
NY	0.107[0.121]	0.152[0.026]	0.161[0.018]	0.151[0.028]	0.251[0.000]	0.185[0.008]	0.198[0.004]	0.225[0.001]	0.112[0.094]	0.237[0.001]	0.269[0.000]	0.204[0.004]	0.307[0.000]	0.359[0.000]	0.400[0.000]	0.386[0.000]	0.381[0.000]	0.354[0.000]	0.399[0.000]	0.370[0.000]	0.424[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
R60xNY	0.428[0.000]	0.452[0.000]	0.442[0.000]	0.447[0.000]	0.386[0.000]	0.470[0.000]	0.387[0.000]	0.366[0.000]	0.314[0.000]	0.385[0.000]	0.326[0.000]	0.361[0.000]	0.320[0.000]	0.316[0.000]	0.310[0.000]	0.340[0.000]	0.327[0.000]	0.346[0.000]	0.315[0.000]	0.339[0.000]	0.343[0.000]
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Urban	0.581[0.000]	0.563[0.000]	0.529[0.000]	0.537[0.000]	0.505[0.000]	0.533[0.000]	0.541[0.000]	0.548[0.000]	0.582[0.000]	0.516[0.000]	0.564[0.000]	0.580[0.000]	0.609[0.000]	0.602[0.000]	0.608[0.000]	0.620[0.000]	0.622[0.000]	0.659[0.000]	0.648[0.000]	0.673[0.000]	0.666[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	-0.633[0.000]	-0.549[0.002]	-0.375[0.031]	-0.335[0.052]	0.137[0.429]	0.068[0.695]	0.125[0.470]	0.102[0.559]	-0.554[0.001]	-0.183[0.290]	-0.294[0.091]	-0.313[0.077]	-0.076[0.673]	0.069[0.702]	0.116[0.518]	0.193[0.283]	0.094[0.603]	0.274[0.128]	-0.001[0.993]	-0.039[0.828]	0.080[0.665]
	(0.18)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.16)	(0.17)	(0.17)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
LogADT	-0.054[0.000]	-0.050[0.000]	-0.058[0.000]	-0.058[0.000]	-0.032[0.000]	-0.044[0.000]	-0.041[0.000]	-0.048[0.000]	-0.060[0.000]	-0.051[0.000]	-0.048[0.000]	-0.049[0.000]	-0.052[0.000]	-0.050[0.000]	-0.064[0.000]	-0.079[0.000]	-0.089[0.000]	-0.105[0.000]	-0.091[0.000]	-0.102[0.000]	-0.104[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.652[0.000]	-0.619[0.000]	-0.633[0.000]	-0.648[0.000]	-0.615[0.000]	-0.688[0.000]	-0.714[0.000]	-0.720[0.000]	-0.708[0.000]	-0.718[0.000]	-0.716[0.000]	-0.710[0.000]	-0.701[0.000]	-0.728[0.000]	-0.717[0.000]	-0.686[0.000]	-0.700[0.000]	-0.687[0.000]	-0.665[0.000]	-0.677[0.000]	-0.709[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.090	0.085	0.087	0.088	0.077	0.094	0.095	0.096	0.090	0.095	0.095	0.092	0.092	0.093	0.093	0.094	0.093	0.094	0.092	0.094	0.095
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

Panel 6: DV "UnderRecord", Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	-4.705[0.000]	-4.019[0.000]	-4.027[0.000]	-4.073[0.000]	-4.028[0.000]	-1.666[0.000]	-1.353[0.000]	-1.438[0.000]	-1.829[0.000]	-1.315[0.000]	-1.299[0.000]	-1.277[0.000]	-0.484[0.004]	-2.993[0.000]	-3.057[0.000]	-3.167[0.000]	-3.155[0.000]	-3.110[0.000]	-3.250[0.000]	-3.843[0.000]	-3.282[0.000]
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.15)	(0.16)	(0.16)	(0.17)	(0.16)	(0.17)	(0.17)	(0.17)	(0.19)	(0.20)	(0.20)	(0.21)	(0.22)	(0.22)	(0.22)	(0.29)
Reform60	0.369[0.000]	0.351[0.000]	0.348[0.000]	0.370[0.000]	0.362[0.000]	0.372[0.000]	0.368[0.000]	0.368[0.000]	0.397[0.000]	0.359[0.000]	0.341[0.000]	0.349[0.000]	0.321[0.000]	0.315[0.000]	0.353[0.000]	0.350[0.000]	0.356[0.000]	0.347[0.000]	0.350[0.000]	0.339[0.000]	0.323[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
NY	0.727[0.000]	0.675[0.000]	0.635[0.000]	0.670[0.000]	0.629[0.000]	0.640[0.000]	0.654[0.000]	0.643[0.000]	0.598[0.000]	0.611[0.000]	0.611[0.000]	0.589[0.000]	0.573[0.000]	0.581[0.000]	0.615[0.000]	0.545[0.000]	0.552[0.000]	0.486[0.000]	0.511[0.000]	0.514[0.000]	0.506[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
R60xNY	-0.377[0.000]	-0.375[0.000]	-0.381[0.000]	-0.393[0.000]	-0.384[0.000]	-0.431[0.000]	-0.458[0.000]	-0.445[0.000]	-0.394[0.000]	-0.454[0.000]	-0.469[0.000]	-0.474[0.000]	-0.472[0.000]	-0.444[0.000]	-0.451[0.000]	-0.418[0.000]	-0.424[0.000]	-0.380[0.000]	-0.377[0.000]	-0.370[0.000]	-0.361[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
Urban	0.440[0.000]	0.462[0.000]	0.478[0.000]	0.494[0.000]	0.510[0.000]	0.641[0.000]	0.654[0.000]	0.659[0.000]	0.477[0.000]	0.688[0.000]	0.705[0.000]	0.736[0.000]	0.753[0.000]	0.747[0.000]	0.667[0.000]	0.640[0.000]	0.611[0.000]	0.581[0.000]	0.553[0.000]	0.570[0.000]	0.547[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	1.570[0.000]	1.499[0.000]	1.093[0.000]	1.366[0.000]	1.229[0.000]	0.952[0.000]	0.838[0.000]	0.784[0.000]	1.311[0.000]	0.599[0.000]	0.528[0.000]	0.430[0.000]	0.045[0.649]	0.231[0.017]	0.649[0.000]	0.445[0.000]	0.578[0.000]	0.540[0.000]	0.825[0.000]	0.876[0.000]	0.889[0.000]
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
LogADT	0.232[0.000]	0.220[0.000]	0.218[0.000]	0.214[0.000]	0.210[0.000]	0.136[0.000]	0.121[0.000]	0.122[0.000]	0.206[0.000]	0.104[0.000]	0.089[0.000]	0.072[0.000]	0.077[0.000]	0.091[0.000]	0.122[0.000]	0.139[0.000]	0.153[0.000]	0.164[0.000]	0.178[0.000]	0.172[0.000]	0.173[0.000]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LogLength	0.366[0.000]	0.370[0.000]	0.389[0.000]	0.383[0.000]	0.387[0.000]	0.468[0.000]	0.478[0.000]	0.473[0.000]	0.414[0.000]	0.497[0.000]	0.522[0.000]	0.527[0.000]	0.520[0.000]	0.527[0.000]	0.500[0.000]	0.506[0.000]	0.486[0.000]	0.479[0.000]	0.478[0.000]	0.487[0.000]	0.507[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.238	0.240	0.246	0.247	0.245	0.240	0.238	0.238	0.252	0.237	0.236	0.233	0.236	0.237	0.239	0.244	0.242	0.241	0.243	0.243	0.243
N	314,391	313,378	312,057	313,682	309,160	307,788	306,036	303,936	306,663	300,076	296,734	289,032	284,471	287,928	282,083	280,327	281,676	277,599	273,382	271,193	268,547

p-value in brackets, 2-tailed   Additional results for all DVs across this IV model are available upon request
Robust Std Errors in parentheses

Supplement 5B - Robustness across NBI years of main model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 1: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	1.640[0.000]	1.810[0.000]	1.838[0.000]	1.938[0.000]	2.018[0.000]	1.698[0.000]	1.483[0.000]	1.445[0.000]	1.600[0.000]	1.371[0.000]	1.114[0.002]	1.198[0.001]	1.022[0.005]	1.788[0.000]	2.000[0.000]	2.223[0.000]	2.483[0.000]	2.356[0.000]	2.283[0.000]	2.488[0.000]	3.478[0.000]
	(0.33)	(0.31)	(0.32)	(0.31)	(0.28)	(0.35)	(0.36)	(0.35)	(0.35)	(0.37)	(0.37)	(0.36)	(0.36)	(0.39)	(0.39)	(0.40)	(0.40)	(0.40)	(0.41)	(0.40)	(0.50)
Reform56	-1.169[0.000]	-1.205[0.000]	-1.153[0.000]	-1.121[0.000]	-1.061[0.000]	-1.071[0.000]	-1.093[0.000]	-1.067[0.000]	-1.190[0.000]	-1.128[0.000]	-1.022[0.000]	-1.027[0.000]	-0.971[0.000]	-1.013[0.000]	-1.070[0.000]	-0.993[0.000]	-1.062[0.000]	-0.971[0.000]	-0.928[0.000]	-1.012[0.000]	-1.096[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
NE	2.100[0.000]	2.048[0.000]	0.845[0.000]	0.860[0.000]	0.599[0.001]	0.643[0.002]	0.599[0.005]	0.495[0.028]	0.623[0.003]	0.617[0.006]	0.271[0.292]	0.201[0.449]	0.237[0.382]	0.262[0.330]	0.228[0.392]	0.110[0.714]	0.077[0.801]	0.212[0.485]	0.125[0.704]	-0.138[0.705]	-0.004[0.991]
	(0.16)	(0.16)	(0.20)	(0.19)	(0.18)	(0.21)	(0.21)	(0.23)	(0.21)	(0.23)	(0.26)	(0.27)	(0.27)	(0.27)	(0.27)	(0.30)	(0.30)	(0.30)	(0.33)	(0.37)	(0.35)
R56xNE	-2.513[0.000]	-2.429[0.000]	-0.927[0.001]	-0.956[0.001]	-1.237[0.000]	-1.373[0.000]	-1.041[0.002]	-1.017[0.003]	-0.811[0.009]	-1.014[0.002]	-0.649[0.066]	-0.672[0.063]	-0.569[0.115]	-0.571[0.115]	-0.423[0.231]	-0.271[0.479]	-0.327[0.400]	-0.355[0.357]	-0.297[0.466]	0.067[0.879]	-0.015[0.971]
	(0.29)	(0.29)	(0.29)	(0.28)	(0.28)	(0.35)	(0.34)	(0.35)	(0.31)	(0.34)	(0.35)	(0.36)	(0.36)	(0.36)	(0.35)	(0.38)	(0.39)	(0.39)	(0.41)	(0.44)	(0.41)
Urban	0.319[0.000]	0.288[0.000]	0.345[0.000]	0.337[0.000]	0.170[0.001]	0.220[0.000]	0.233[0.000]	0.277[0.000]	0.364[0.000]	0.186[0.003]	0.281[0.000]	0.190[0.003]	0.144[0.026]	0.142[0.028]	0.156[0.016]	0.233[0.001]	0.271[0.000]	0.290[0.000]	0.289[0.000]	0.225[0.001]	0.211[0.003]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Percent_HW	0.412[0.354]	0.479[0.283]	-0.385[0.396]	-0.366[0.415]	0.165[0.640]	0.266[0.564]	0.708[0.115]	0.896[0.051]	0.224[0.624]	1.120[0.016]	1.548[0.001]	1.402[0.003]	0.801[0.098]	0.771[0.109]	0.898[0.058]	0.594[0.249]	1.188[0.019]	0.765[0.139]	0.282[0.596]	0.748[0.154]	1.145[0.031]
	(0.44)	(0.45)	(0.45)	(0.45)	(0.35)	(0.46)	(0.45)	(0.46)	(0.46)	(0.47)	(0.48)	(0.47)	(0.48)	(0.48)	(0.47)	(0.52)	(0.51)	(0.52)	(0.53)	(0.53)	(0.53)
LogADT	-0.225[0.000]	-0.226[0.000]	-0.217[0.000]	-0.225[0.000]	-0.206[0.000]	-0.181[0.000]	-0.170[0.000]	-0.175[0.000]	-0.220[0.000]	-0.177[0.000]	-0.179[0.000]	-0.165[0.000]	-0.157[0.000]	-0.168[0.000]	-0.182[0.000]	-0.199[0.000]	-0.241[0.000]	-0.255[0.000]	-0.258[0.000]	-0.275[0.000]	-0.278[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.549[0.000]	-0.573[0.000]	-0.570[0.000]	-0.575[0.000]	-0.648[0.000]	-0.555[0.000]	-0.571[0.000]	-0.560[0.000]	-0.500[0.000]	-0.557[0.000]	-0.535[0.000]	-0.531[0.000]	-0.555[0.000]	-0.591[0.000]	-0.588[0.000]	-0.575[0.000]	-0.589[0.000]	-0.542[0.000]	-0.532[0.000]	-0.510[0.000]	-0.486[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.215	0.216	0.206	0.209	0.171	0.197	0.201	0.198	0.203	0.203	0.188	0.190	0.179	0.180	0.183	0.199	0.199	0.204	0.203	0.210	0.212
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	2.617[0.000]	2.113[0.000]	2.194[0.000]	2.184[0.000]	1.712[0.000]	1.546[0.000]	1.622[0.000]	1.695[0.000]	1.778[0.000]	1.602[0.000]	1.643[0.000]	1.718[0.000]	0.592[0.002]	1.586[0.000]	1.578[0.000]	1.479[0.000]	1.855[0.000]	2.127[0.000]	1.987[0.000]	2.713[0.000]	2.955[0.000]
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.22)	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)	(0.19)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.28)	(0.40)
Reform56	-0.794[0.000]	-0.746[0.000]	-0.738[0.000]	-0.737[0.000]	-0.623[0.000]	-0.715[0.000]	-0.687[0.000]	-0.684[0.000]	-0.684[0.000]	-0.734[0.000]	-0.712[0.000]	-0.671[0.000]	-0.695[0.000]	-0.725[0.000]	-0.734[0.000]	-0.729[0.000]	-0.719[0.000]	-0.727[0.000]	-0.689[0.000]	-0.688[0.000]	-0.699[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
NE	-0.338[0.010]	-0.224[0.082]	0.592[0.000]	0.592[0.000]	0.709[0.000]	0.662[0.000]	0.780[0.000]	0.776[0.000]	0.665[0.000]	0.502[0.000]	0.590[0.000]	0.623[0.000]	0.583[0.000]	0.624[0.000]	0.700[0.000]	0.712[0.000]	0.625[0.000]	0.609[0.000]	0.739[0.000]	0.773[0.000]	0.701[0.000]
	(0.13)	(0.13)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.15)	(0.15)	(0.15)	(0.15)	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
R56xNE	0.307[0.031]	0.153[0.275]	-0.561[0.000]	-0.525[0.000]	-0.678[0.000]	-0.665[0.000]	-0.747[0.000]	-0.770[0.000]	-0.781[0.000]	-0.523[0.000]	-0.644[0.000]	-0.699[0.000]	-0.635[0.000]	-0.618[0.000]	-0.640[0.000]	-0.638[0.000]	-0.582[0.000]	-0.558[0.001]	-0.629[0.000]	-0.666[0.000]	-0.569[0.000]
	(0.14)	(0.14)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.16)	(0.16)	(0.16)	(0.16)	(0.17)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Urban	0.606[0.000]	0.593[0.000]	0.562[0.000]	0.571[0.000]	0.539[0.000]	0.581[0.000]	0.588[0.000]	0.591[0.000]	0.629[0.000]	0.560[0.000]	0.610[0.000]	0.631[0.000]	0.663[0.000]	0.652[0.000]	0.664[0.000]	0.688[0.000]	0.689[0.000]	0.727[0.000]	0.707[0.000]	0.735[0.000]	0.714[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	0.210[0.184]	0.232[0.136]	0.411[0.009]	0.417[0.007]	0.695[0.000]	0.694[0.000]	0.736[0.000]	0.660[0.000]	0.249[0.094]	0.439[0.005]	0.307[0.051]	0.249[0.118]	0.373[0.021]	0.417[0.010]	0.400[0.013]	0.469[0.004]	0.371[0.022]	0.517[0.001]	0.181[0.274]	0.182[0.270]	0.192[0.251]
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.15)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)
LogADT	-0.044[0.000]	-0.041[0.000]	-0.051[0.000]	-0.052[0.000]	-0.027[0.000]	-0.041[0.000]	-0.040[0.000]	-0.045[0.000]	-0.056[0.000]	-0.046[0.000]	-0.046[0.000]	-0.045[0.000]	-0.048[0.000]	-0.047[0.000]	-0.061[0.000]	-0.074[0.000]	-0.085[0.000]	-0.103[0.000]	-0.087[0.000]	-0.099[0.000]	-0.101[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.666[0.000]	-0.631[0.000]	-0.646[0.000]	-0.659[0.000]	-0.630[0.000]	-0.690[0.000]	-0.717[0.000]	-0.724[0.000]	-0.718[0.000]	-0.721[0.000]	-0.717[0.000]	-0.703[0.000]	-0.694[0.000]	-0.718[0.000]	-0.706[0.000]	-0.680[0.000]	-0.699[0.000]	-0.688[0.000]	-0.668[0.000]	-0.679[0.000]	-0.706[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.076	0.072	0.075	0.076	0.066	0.081	0.083	0.084	0.080	0.082	0.082	0.080	0.080	0.082	0.083	0.083	0.084	0.085	0.083	0.085	0.087
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 3: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	-4.760[0.000]	-4.221[0.000]	-4.110[0.000]	-4.131[0.000]	-3.779[0.000]	-2.528[0.000]	-2.522[0.000]	-2.554[0.000]	-2.933[0.000]	-2.448[0.000]	-2.729[0.000]	-2.686[0.000]	-2.247[0.000]	-2.875[0.000]	-2.948[0.000]	-2.788[0.000]	-3.357[0.000]	-3.611[0.000]	-3.625[0.000]	-3.564[0.000]	-3.652[0.000]
	(0.17)	(0.15)	(0.15)	(0.15)	(0.15)	(0.21)	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)	(0.17)	(0.24)	(0.25)	(0.25)	(0.25)	(0.26)	(0.26)	(0.28)	(0.36)
Reform56	1.210[0.000]	1.151[0.000]	1.123[0.000]	1.138[0.000]	1.101[0.000]	1.046[0.000]	1.023[0.000]	0.987[0.000]	1.037[0.000]	1.091[0.000]	1.022[0.000]	1.022[0.000]	1.002[0.000]	1.020[0.000]	1.057[0.000]	0.996[0.000]	1.004[0.000]	0.993[0.000]	1.000[0.000]	0.979[0.000]	1.014[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
NE	-0.801[0.000]	-0.929[0.000]	-0.723[0.000]	-0.726[0.000]	-0.795[0.000]	-0.602[0.001]	-0.771[0.000]	-0.692[0.000]	-0.553[0.001]	-0.446[0.012]	-0.319[0.067]	-0.273[0.121]	-0.329[0.069]	-0.467[0.013]	-0.577[0.002]	-0.462[0.012]	-0.319[0.075]	-0.337[0.062]	-0.324[0.071]	-0.380[0.039]	-0.374[0.040]
	(0.22)	(0.22)	(0.20)	(0.20)	(0.21)	(0.18)	(0.20)	(0.19)	(0.17)	(0.18)	(0.17)	(0.18)	(0.18)	(0.19)	(0.19)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
R56xNE	0.813[0.000]	1.019[0.000]	0.715[0.001]	0.658[0.002]	0.779[0.000]	0.608[0.002]	0.705[0.001]	0.590[0.003]	0.508[0.005]	0.368[0.049]	0.303[0.098]	0.303[0.101]	0.309[0.104]	0.369[0.060]	0.416[0.035]	0.311[0.107]	0.212[0.258]	0.209[0.270]	0.182[0.335]	0.177[0.360]	0.098[0.608]
	(0.23)	(0.23)	(0.21)	(0.21)	(0.21)	(0.19)	(0.21)	(0.20)	(0.18)	(0.19)	(0.18)	(0.19)	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Urban	-0.893[0.000]	-0.874[0.000]	-0.864[0.000]	-0.891[0.000]	-0.831[0.000]	-0.815[0.000]	-0.829[0.000]	-0.816[0.000]	-0.897[0.000]	-0.750[0.000]	-0.794[0.000]	-0.815[0.000]	-0.824[0.000]	-0.844[0.000]	-0.885[0.000]	-0.899[0.000]	-0.929[0.000]	-0.955[0.000]	-0.970[0.000]	-0.984[0.000]	-0.992[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	0.363[0.030]	0.099[0.551]	0.225[0.173]	0.274[0.094]	-0.158[0.340]	-0.357[0.028]	-0.163[0.313]	-0.132[0.414]	0.284[0.060]	0.118[0.454]	0.088[0.579]	-0.005[0.977]	0.247[0.133]	0.243[0.137]	0.338[0.038]	0.374[0.022]	0.433[0.009]	0.458[0.006]	0.606[0.000]	0.810[0.000]	0.926[0.000]
	(0.17)	(0.17)	(0.17)	(0.16)	(0.17)	(0.16)	(0.16)	(0.16)	(0.15)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
LogADT	0.220[0.000]	0.216[0.000]	0.221[0.000]	0.226[0.000]	0.202[0.000]	0.179[0.000]	0.175[0.000]	0.178[0.000]	0.224[0.000]	0.162[0.000]	0.173[0.000]	0.168[0.000]	0.161[0.000]	0.169[0.000]	0.201[0.000]	0.218[0.000]	0.256[0.000]	0.275[0.000]	0.282[0.000]	0.285[0.000]	0.285[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.186[0.000]	0.167[0.000]	0.150[0.000]	0.143[0.000]	0.139[0.000]	0.126[0.000]	0.125[0.000]	0.119[0.000]	0.101[0.000]	0.101[0.000]	0.128[0.000]	0.111[0.000]	0.104[0.000]	0.092[0.000]	0.063[0.000]	0.019[0.171]	0.013[0.349]	0.009[0.542]	0.009[0.546]	0.008[0.577]	0.004[0.809]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.082	0.081	0.079	0.080	0.072	0.075	0.077	0.075	0.078	0.073	0.078	0.076	0.076	0.074	0.078	0.078	0.081	0.086	0.088	0.089	0.090
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 5B - Robustness across NBI years of main model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 4: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable]), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	-2.835[0.000]	-3.051[0.000]	-3.166[0.000]	-3.175[0.000]	-3.262[0.000]	-4.046[0.000]	-4.068[0.000]	-3.985[0.000]	-3.633[0.000]	-3.886[0.000]	-3.564[0.000]	-3.791[0.000]	-2.815[0.000]	-3.128[0.000]	-3.167[0.000]	-3.249[0.000]	-3.215[0.000]	-3.273[0.000]	-2.941[0.000]	-3.708[0.000]	-4.094[0.000]
	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)	(0.25)	(0.25)	(0.26)	(0.25)	(0.25)	(0.24)	(0.24)	(0.19)	(0.33)	(0.35)	(0.36)	(0.38)	(0.38)	(0.37)	(0.40)	(0.48)
Reform56	0.342[0.000]	0.322[0.000]	0.326[0.000]	0.289[0.000]	0.284[0.000]	0.286[0.000]	0.264[0.000]	0.273[0.000]	0.178[0.000]	0.246[0.000]	0.257[0.000]	0.213[0.000]	0.234[0.000]	0.268[0.000]	0.253[0.000]	0.245[0.000]	0.241[0.000]	0.242[0.000]	0.146[0.000]	0.195[0.000]	0.183[0.000]
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
NE	-1.252[0.000]	-1.211[0.000]	-1.097[0.000]	-1.149[0.000]	-1.056[0.000]	-1.047[0.000]	-1.037[0.000]	-1.045[0.000]	-1.096[0.000]	-0.880[0.000]	-0.924[0.000]	-0.982[0.000]	-0.934[0.000]	-0.849[0.001]	-0.809[0.001]	-0.933[0.000]	-0.870[0.000]	-0.880[0.000]	-1.011[0.000]	-0.937[0.000]	-0.889[0.000]
	(0.28)	(0.27)	(0.24)	(0.24)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.25)	(0.25)	(0.25)	(0.25)	(0.24)	(0.24)	(0.24)	(0.25)	(0.24)
R56xNE	1.299[0.000]	1.195[0.000]	1.040[0.000]	1.129[0.000]	1.105[0.000]	1.108[0.000]	1.114[0.000]	1.214[0.000]	1.338[0.000]	1.043[0.000]	1.051[0.000]	1.086[0.000]	1.059[0.000]	0.985[0.000]	0.944[0.000]	1.032[0.000]	0.965[0.000]	0.982[0.000]	1.053[0.000]	1.061[0.000]	1.068[0.000]
	(0.29)	(0.28)	(0.25)	(0.25)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.26)	(0.25)	(0.25)	(0.26)	(0.25)	(0.25)	(0.25)	(0.26)	(0.25)
Urban	0.172[0.000]	0.165[0.000]	0.203[0.000]	0.216[0.000]	0.192[0.000]	0.173[0.000]	0.181[0.000]	0.160[0.000]	0.241[0.000]	0.165[0.000]	0.124[0.000]	0.134[0.000]	0.128[0.000]	0.175[0.000]	0.197[0.000]	0.197[0.000]	0.215[0.000]	0.195[0.000]	0.254[0.000]	0.261[0.000]	0.293[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	-1.000[0.000]	-0.617[0.003]	-0.925[0.000]	-0.938[0.000]	-1.013[0.000]	-0.585[0.004]	-0.988[0.000]	-0.924[0.000]	-0.937[0.000]	-1.010[0.000]	-0.762[0.000]	-0.499[0.012]	-0.932[0.000]	-0.923[0.000]	-1.031[0.000]	-1.094[0.000]	-1.158[0.000]	-1.316[0.000]	-0.907[0.000]	-1.297[0.000]	-1.483[0.000]
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
LogADT	-0.119[0.000]	-0.122[0.000]	-0.117[0.000]	-0.115[0.000]	-0.115[0.000]	-0.097[0.000]	-0.096[0.000]	-0.094[0.000]	-0.136[0.000]	-0.077[0.000]	-0.084[0.000]	-0.080[0.000]	-0.073[0.000]	-0.079[0.000]	-0.088[0.000]	-0.086[0.000]	-0.108[0.000]	-0.106[0.000]	-0.132[0.000]	-0.118[0.000]	-0.117[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.778[0.000]	0.766[0.000]	0.789[0.000]	0.803[0.000]	0.828[0.000]	0.791[0.000]	0.817[0.000]	0.816[0.000]	0.854[0.000]	0.808[0.000]	0.757[0.000]	0.768[0.000]	0.754[0.000]	0.764[0.000]	0.771[0.000]	0.755[0.000]	0.788[0.000]	0.779[0.000]	0.735[0.000]	0.749[0.000]	0.762[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.082	0.083	0.088	0.089	0.091	0.087	0.088	0.089	0.089	0.088	0.086	0.086	0.084	0.087	0.087	0.086	0.090	0.088	0.084	0.083	0.083
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 5: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive), Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	2.281[0.000]	2.332[0.000]	2.077[0.000]	2.178[0.000]	2.138[0.000]	2.198[0.000]	1.926[0.000]	1.903[0.000]	2.059[0.000]	1.851[0.000]	1.414[0.000]	1.517[0.000]	1.400[0.000]	2.201[0.000]	2.410[0.000]	2.611[0.000]	2.900[0.000]	2.802[0.000]	2.764[0.000]	2.962[0.000]	3.914[0.000]
	(0.32)	(0.29)	(0.30)	(0.29)	(0.26)	(0.35)	(0.36)	(0.36)	(0.36)	(0.37)	(0.37)	(0.37)	(0.37)	(0.39)	(0.39)	(0.40)	(0.42)	(0.41)	(0.42)	(0.42)	(0.52)
Reform60	-1.153[0.000]	-1.193[0.000]	-1.139[0.000]	-1.159[0.000]	-0.986[0.000]	-1.081[0.000]	-1.075[0.000]	-1.079[0.000]	-1.150[0.000]	-1.035[0.000]	-0.908[0.000]	-0.967[0.000]	-1.000[0.000]	-1.029[0.000]	-1.064[0.000]	-0.977[0.000]	-1.041[0.000]	-0.999[0.000]	-0.991[0.000]	-1.023[0.000]	-1.083[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.05)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
NE	2.203[0.000]	2.113[0.000]	1.770[0.000]	1.774[0.000]	1.460[0.000]	0.068[0.707]	0.060[0.750]	-0.002[0.992]	0.166[0.363]	0.114[0.552]	-0.138[0.514]	-0.240[0.260]	-0.177[0.408]	-0.127[0.544]	-0.152[0.463]	-0.201[0.381]	-0.292[0.205]	-0.183[0.427]	-0.270[0.272]	-0.354[0.189]	-0.334[0.193]
	(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	(0.18)	(0.19)	(0.20)	(0.18)	(0.19)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.23)	(0.23)	(0.23)	(0.25)	(0.27)	(0.26)
R60xNE	-2.748[0.000]	-2.416[0.000]	-1.766[0.000]	-1.768[0.000]	-2.173[0.000]	-0.279[0.408]	-0.024[0.941]	-0.041[0.904]	0.106[0.719]	-0.008[0.980]	0.183[0.570]	0.207[0.526]	0.307[0.342]	0.287[0.371]	0.430[0.167]	0.467[0.164]	0.500[0.139]	0.483[0.148]	0.538[0.120]	0.667[0.069]	0.749[0.031]
	(0.35)	(0.31)	(0.27)	(0.27)	(0.28)	(0.34)	(0.33)	(0.34)	(0.29)	(0.31)	(0.32)	(0.33)	(0.32)	(0.32)	(0.31)	(0.34)	(0.34)	(0.33)	(0.35)	(0.37)	(0.35)
Urban	0.037[0.546]	0.029[0.628]	0.051[0.408]	0.046[0.440]	-0.026[0.610]	0.109[0.090]	0.126[0.051]	0.184[0.004]	0.286[0.000]	0.108[0.090]	0.213[0.001]	0.102[0.112]	0.056[0.386]	0.049[0.447]	0.060[0.356]	0.137[0.047]	0.162[0.019]	0.208[0.003]	0.202[0.004]	0.152[0.031]	0.142[0.050]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Percent_HW	-2.705[0.000]	-2.589[0.000]	-2.495[0.000]	-2.412[0.000]	-1.591[0.000]	-1.950[0.000]	-1.418[0.003]	-1.128[0.020]	-1.961[0.000]	-0.963[0.049]	-0.208[0.678]	-0.268[0.582]	-0.902[0.075]	-0.983[0.051]	-0.884[0.075]	-1.079[0.048]	-0.655[0.225]	-0.989[0.071]	-1.407[0.012]	-0.889[0.107]	-0.436[0.440]
	(0.41)	(0.41)	(0.41)	(0.41)	(0.33)	(0.48)	(0.47)	(0.48)	(0.48)	(0.49)	(0.50)	(0.49)	(0.51)	(0.50)	(0.50)	(0.55)	(0.54)	(0.55)	(0.56)	(0.55)	(0.57)
LogADT	-0.216[0.000]	-0.213[0.000]	-0.203[0.000]	-0.209[0.000]	-0.196[0.000]	-0.183[0.000]	-0.170[0.000]	-0.177[0.000]	-0.225[0.000]	-0.179[0.000]	-0.177[0.000]	-0.164[0.000]	-0.159[0.000]	-0.169[0.000]	-0.184[0.000]	-0.201[0.000]	-0.242[0.000]	-0.257[0.000]	-0.261[0.000]	-0.280[0.000]	-0.285[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.576[0.000]	-0.584[0.000]	-0.563[0.000]	-0.567[0.000]	-0.640[0.000]	-0.570[0.000]	-0.588[0.000]	-0.575[0.000]	-0.516[0.000]	-0.585[0.000]	-0.556[0.000]	-0.552[0.000]	-0.578[0.000]	-0.621[0.000]	-0.616[0.000]	-0.598[0.000]	-0.611[0.000]	-0.568[0.000]	-0.562[0.000]	-0.540[0.000]	-0.525[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.225	0.223	0.215	0.221	0.176	0.199	0.202	0.201	0.203	0.201	0.184	0.189	0.183	0.184	0.186	0.202	0.203	0.208	0.210	0.217	0.220
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

Panel 6: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	-4.959[0.000]	-4.400[0.000]	-4.262[0.000]	-4.254[0.000]	-3.897[0.000]	-2.518[0.000]	-2.519[0.000]	-2.558[0.000]	-2.941[0.000]	-2.408[0.000]	-2.699[0.000]	-2.670[0.000]	-2.241[0.000]	-2.926[0.000]	-3.071[0.000]	-2.953[0.000]	-3.501[0.000]	-3.704[0.000]	-3.721[0.000]	-3.728[0.000]	-3.763[0.000]
	(0.18)	(0.16)	(0.16)	(0.16)	(0.15)	(0.20)	(0.21)	(0.21)	(0.20)	(0.20)	(0.21)	(0.21)	(0.17)	(0.24)	(0.24)	(0.24)	(0.25)	(0.25)	(0.25)	(0.28)	(0.37)
Reform60	1.002[0.000]	0.983[0.000]	0.951[0.000]	0.962[0.000]	0.931[0.000]	0.878[0.000]	0.848[0.000]	0.818[0.000]	0.843[0.000]	0.857[0.000]	0.827[0.000]	0.802[0.000]	0.807[0.000]	0.807[0.000]	0.807[0.000]	0.775[0.000]	0.785[0.000]	0.775[0.000]	0.771[0.000]	0.754[0.000]	0.756[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
NE	-0.889[0.000]	-0.875[0.000]	-0.963[0.000]	-1.018[0.000]	-0.981[0.000]	-0.806[0.000]	-1.036[0.000]	-0.947[0.000]	-0.645[0.000]	-0.833[0.000]	-0.683[0.000]	-0.649[0.000]	-0.689[0.000]	-0.778[0.000]	-0.836[0.000]	-0.796[0.000]	-0.714[0.000]	-0.700[0.000]	-0.744[0.000]	-0.915[0.000]	-0.919[0.000]
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)	(0.09)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)
R60xNE	0.942[0.000]	1.025[0.000]	1.023[0.000]	1.025[0.000]	1.032[0.000]	0.892[0.000]	1.063[0.000]	0.920[0.000]	0.658[0.000]	0.849[0.000]	0.752[0.000]	0.767[0.000]	0.739[0.000]	0.740[0.000]	0.744[0.000]	0.704[0.000]	0.660[0.000]	0.625[0.000]	0.668[0.000]	0.804[0.000]	0.727[0.000]
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)	(0.11)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.12)
Urban	-0.861[0.000]	-0.838[0.000]	-0.828[0.000]	-0.852[0.000]	-0.793[0.000]	-0.777[0.000]	-0.793[0.000]	-0.783[0.000]	-0.862[0.000]	-0.718[0.000]	-0.754[0.000]	-0.769[0.000]	-0.773[0.000]	-0.796[0.000]	-0.833[0.000]	-0.845[0.000]	-0.872[0.000]	-0.904[0.000]	-0.923[0.000]	-0.936[0.000]	-0.951[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	2.086[0.000]	1.830[0.000]	1.904[0.000]	1.907[0.000]	1.427[0.000]	1.131[0.000]	1.283[0.000]	1.218[0.000]	1.707[0.000]	1.556[0.000]	1.459[0.000]	1.326[0.000]	1.621[0.000]	1.633[0.000]	1.720[0.000]	1.721[0.000]	1.814[0.000]	1.750[0.000]	1.957[0.000]	2.179[0.000]	2.309[0.000]
	(0.18)	(0.17)	(0.17)	(0.17)	(0.18)	(0.17)	(0.17)	(0.17)	(0.16)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.18)	(0.18)	(0.18)
LogADT	0.233[0.000]	0.227[0.000]	0.233[0.000]	0.237[0.000]	0.212[0.000]	0.185[0.000]	0.181[0.000]	0.184[0.000]	0.233[0.000]	0.167[0.000]	0.176[0.000]	0.171[0.000]	0.165[0.000]	0.172[0.000]	0.206[0.000]	0.224[0.000]	0.263[0.000]	0.282[0.000]	0.287[0.000]	0.291[0.000]	0.292[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.181[0.000]	0.159[0.000]	0.139[0.000]	0.134[0.000]	0.129[0.000]	0.121[0.000]	0.123[0.000]	0.116[0.000]	0.097[0.000]	0.100[0.000]	0.127[0.000]	0.115[0.000]	0.107[0.000]	0.097[0.000]	0.066[0.000]	0.019[0.195]	0.011[0.456]	0.006[0.669]	0.005[0.721]	0.007[0.632]	0.005[0.708]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.092	0.091	0.088	0.089	0.081	0.083	0.085	0.083	0.084	0.080	0.084	0.081	0.081	0.078	0.081	0.081	0.084	0.089	0.091	0.092	0.092
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 5B - Robustness across NBI years of main model
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 7: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable]), Reform 1960

NBI Year:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
(Intercept)	-3.001[0.000]	-3.213[0.000]	-3.309[0.000]	-3.343[0.000]	-3.423[0.000]	-4.224[0.000]	-4.206[0.000]	-4.129[0.000]	-3.775[0.000]	-4.039[0.000]	-3.652[0.000]	-3.968[0.000]	-2.947[0.000]	-3.174[0.000]	-3.198[0.000]	-3.263[0.000]	-3.298[0.000]	-3.433[0.000]	-3.127[0.000]	-3.825[0.000]	-4.227[0.000]
	(0.16)	(0.15)	(0.15)	(0.15)	(0.15)	(0.25)	(0.26)	(0.26)	(0.25)	(0.25)	(0.24)	(0.24)	(0.20)	(0.33)	(0.34)	(0.36)	(0.37)	(0.39)	(0.38)	(0.41)	(0.49)
Reform60	0.368[0.000]	0.354[0.000]	0.350[0.000]	0.338[0.000]	0.343[0.000]	0.324[0.000]	0.305[0.000]	0.315[0.000]	0.254[0.000]	0.307[0.000]	0.277[0.000]	0.287[0.000]	0.253[0.000]	0.242[0.000]	0.254[0.000]	0.249[0.000]	0.228[0.000]	0.219[0.000]	0.187[0.000]	0.207[0.000]	0.195[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
NE	-0.615[0.000]	-0.552[0.000]	-0.578[0.000]	-0.573[0.000]	-0.490[0.000]	-0.512[0.000]	-0.530[0.000]	-0.529[0.000]	-0.440[0.000]	-0.403[0.000]	-0.496[0.000]	-0.500[0.000]	-0.480[0.000]	-0.489[0.000]	-0.473[0.000]	-0.539[0.000]	-0.526[0.000]	-0.567[0.000]	-0.658[0.000]	-0.495[0.000]	-0.426[0.000]
	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
R60xNE	0.686[0.000]	0.557[0.000]	0.530[0.000]	0.545[0.000]	0.526[0.000]	0.566[0.000]	0.605[0.000]	0.719[0.000]	0.702[0.000]	0.558[0.000]	0.639[0.000]	0.606[0.000]	0.613[0.000]	0.653[0.000]	0.632[0.000]	0.668[0.000]	0.652[0.000]	0.711[0.000]	0.735[0.000]	0.624[0.000]	0.622[0.000]
	(0.15)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Urban	0.193[0.000]	0.187[0.000]	0.226[0.000]	0.236[0.000]	0.213[0.000]	0.191[0.000]	0.198[0.000]	0.175[0.000]	0.253[0.000]	0.178[0.000]	0.133[0.000]	0.141[0.000]	0.131[0.000]	0.180[0.000]	0.203[0.000]	0.208[0.000]	0.222[0.000]	0.210[0.000]	0.266[0.000]	0.273[0.000]	0.307[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	-0.342[0.126]	0.016[0.942]	-0.321[0.143]	-0.358[0.099]	-0.445[0.046]	0.014[0.946]	-0.422[0.046]	-0.339[0.108]	-0.463[0.025]	-0.500[0.016]	-0.271[0.184]	-0.028[0.892]	-0.481[0.024]	-0.512[0.015]	-0.620[0.003]	-0.674[0.001]	-0.777[0.000]	-0.943[0.000]	-0.610[0.003]	-0.976[0.000]	-1.173[0.000]
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.20)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.20)	(0.21)	(0.21)
LogADT	-0.114[0.000]	-0.119[0.000]	-0.114[0.000]	-0.112[0.000]	-0.112[0.000]	-0.095[0.000]	-0.094[0.000]	-0.091[0.000]	-0.131[0.000]	-0.074[0.000]	-0.082[0.000]	-0.077[0.000]	-0.070[0.000]	-0.076[0.000]	-0.085[0.000]	-0.083[0.000]	-0.104[0.000]	-0.103[0.000]	-0.128[0.000]	-0.115[0.000]	-0.114[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.770[0.000]	0.762[0.000]	0.785[0.000]	0.799[0.000]	0.823[0.000]	0.789[0.000]	0.813[0.000]	0.813[0.000]	0.845[0.000]	0.807[0.000]	0.757[0.000]	0.776[0.000]	0.765[0.000]	0.774[0.000]	0.783[0.000]	0.763[0.000]	0.793[0.000]	0.784[0.000]	0.740[0.000]	0.751[0.000]	0.764[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.084	0.085	0.090	0.092	0.094	0.089	0.090	0.091	0.090	0.090	0.088	0.088	0.086	0.089	0.090	0.089	0.092	0.091	0.086	0.085	0.085
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

p-value in brackets, 2-tailed

Additional results for all DVs across this IV model are available upon request

Robust Std Errors in parentheses

Supplement 5C - Robustness across NBI years of main model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 1: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	0.812[0.527]	0.691[0.561]	2.553[0.020]	2.371[0.025]	1.260[0.267]	-1.533[0.448]	2.696[0.039]	3.151[0.015]	3.700[0.001]	1.930[0.123]	1.545[0.185]	0.120[0.940]	0.744[0.586]	1.145[0.428]	0.815[0.577]	0.961[0.515]	-0.294[0.880]	-0.511[0.786]	-0.070[0.971]	-0.105[0.952]	-17.155[0.000]
	(1.29)	(1.19)	(1.10)	(1.06)	(1.13)	(2.02)	(1.31)	(1.29)	(1.11)	(1.25)	(1.16)	(1.60)	(1.37)	(1.44)	(1.46)	(1.48)	(1.95)	(1.88)	(1.89)	(1.76)	(0.79)
Reform56	-1.058[0.001]	-1.235[0.000]	-1.078[0.000]	-1.061[0.000]	-0.979[0.000]	-1.125[0.000]	-1.226[0.000]	-1.442[0.000]	-1.619[0.000]	-1.336[0.000]	-1.424[0.000]	-1.634[0.000]	-1.510[0.000]	-1.509[0.000]	-1.830[0.000]	-2.015[0.000]	-1.683[0.000]	-1.898[0.000]	-2.298[0.000]	-1.931[0.000]	-1.979[0.000]
	(0.32)	(0.29)	(0.29)	(0.27)	(0.27)	(0.29)	(0.33)	(0.33)	(0.29)	(0.31)	(0.29)	(0.31)	(0.30)	(0.30)	(0.30)	(0.32)	(0.31)	(0.31)	(0.35)	(0.34)	(0.35)
Urban	0.754[0.011]	0.560[0.045]	0.586[0.042]	0.617[0.021]	0.558[0.036]	0.428[0.124]	0.408[0.186]	0.302[0.323]	0.059[0.835]	0.116[0.698]	0.341[0.227]	-0.042[0.887]	0.109[0.709]	0.195[0.511]	0.032[0.915]	0.047[0.885]	0.106[0.745]	0.338[0.273]	0.242[0.434]	0.358[0.256]	0.327[0.305]
	(0.30)	(0.28)	(0.29)	(0.27)	(0.27)	(0.28)	(0.31)	(0.31)	(0.28)	(0.30)	(0.28)	(0.30)	(0.29)	(0.30)	(0.30)	(0.33)	(0.33)	(0.31)	(0.31)	(0.32)	(0.32)
R56xUrban	-0.977[0.009]	-0.727[0.045]	-0.790[0.032]	-0.660[0.049]	-0.687[0.039]	-0.475[0.170]	-0.372[0.324]	-0.080[0.830]	0.131[0.706]	-0.141[0.701]	0.120[0.721]	0.215[0.563]	-0.207[0.572]	-0.233[0.526]	0.356[0.320]	0.516[0.178]	0.360[0.344]	0.429[0.242]	0.743[0.059]	0.323[0.404]	0.467[0.242]
	(0.37)	(0.36)	(0.37)	(0.34)	(0.33)	(0.35)	(0.38)	(0.37)	(0.35)	(0.37)	(0.34)	(0.37)	(0.37)	(0.37)	(0.36)	(0.38)	(0.38)	(0.37)	(0.39)	(0.39)	(0.40)
Percent_HW	-1.015[0.549]	-1.309[0.441]	-1.554[0.363]	-1.039[0.538]	1.146[0.473]	1.901[0.254]	-0.570[0.751]	-1.373[0.469]	-1.780[0.344]	-1.333[0.502]	-0.905[0.628]	-3.090[0.128]	-2.221[0.266]	-2.132[0.291]	-2.564[0.198]	-2.847[0.177]	-3.446[0.102]	-2.180[0.281]	-2.791[0.207]	-3.075[0.160]	-1.677[0.444]
	(1.69)	(1.70)	(1.71)	(1.69)	(1.60)	(1.67)	(1.80)	(1.90)	(1.88)	(1.99)	(1.87)	(2.03)	(2.00)	(2.02)	(1.99)	(2.11)	(2.11)	(2.02)	(2.21)	(2.19)	(2.19)
LogADT	-0.262[0.000]	-0.266[0.000]	-0.272[0.000]	-0.288[0.000]	-0.294[0.000]	-0.266[0.000]	-0.281[0.000]	-0.318[0.000]	-0.334[0.000]	-0.293[0.000]	-0.328[0.000]	-0.330[0.000]	-0.349[0.000]	-0.354[0.000]	-0.371[0.000]	-0.394[0.000]	-0.431[0.000]	-0.423[0.000]	-0.429[0.000]	-0.441[0.000]	-0.446[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LogLength	-0.625[0.000]	-0.652[0.000]	-0.869[0.000]	-0.811[0.000]	-0.871[0.000]	-0.741[0.000]	-0.779[0.000]	-0.817[0.000]	-0.778[0.000]	-0.735[0.000]	-0.712[0.000]	-0.639[0.000]	-0.461[0.006]	-0.582[0.001]	-0.412[0.010]	-0.449[0.004]	-0.279[0.083]	-0.370[0.022]	-0.398[0.020]	-0.357[0.030]	-0.403[0.021]
	(0.16)	(0.15)	(0.15)	(0.17)	(0.18)	(0.18)	(0.19)	(0.18)	(0.18)	(0.19)	(0.17)	(0.18)	(0.17)	(0.18)	(0.16)	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	(0.18)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.340	0.341	0.351	0.327	0.329	0.326	0.318	0.337	0.362	0.326	0.296	0.316	0.317	0.339	0.320	0.351	0.333	0.327	0.344	0.346	0.338
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	1.127[0.000]	0.554[0.017]	0.627[0.006]	0.579[0.010]	0.009[0.969]	0.114[0.717]	-0.589[0.075]	-0.481[0.139]	-0.503[0.116]	-1.014[0.003]	-1.065[0.001]	-1.201[0.023]	-2.199[0.000]	-0.414[0.181]	-0.395[0.205]	-0.347[0.272]	0.014[0.964]	0.197[0.528]	0.093[0.766]	0.506[0.129]	0.547[0.245]
	(0.24)	(0.23)	(0.23)	(0.23)	(0.22)	(0.32)	(0.33)	(0.33)	(0.32)	(0.34)	(0.33)	(0.53)	(0.58)	(0.31)	(0.31)	(0.32)	(0.31)	(0.31)	(0.31)	(0.33)	(0.47)
Reform56	-1.011[0.000]	-0.900[0.000]	-0.967[0.000]	-0.989[0.000]	-0.808[0.000]	-1.020[0.000]	-0.946[0.000]	-0.952[0.000]	-0.971[0.000]	-0.968[0.000]	-0.954[0.000]	-0.926[0.000]	-1.036[0.000]	-1.073[0.000]	-0.998[0.000]	-1.025[0.000]	-0.954[0.000]	-0.966[0.000]	-0.934[0.000]	-0.902[0.000]	-0.923[0.000]
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Urban	0.028[0.673]	0.072[0.259]	-0.006[0.927]	-0.050[0.439]	0.019[0.765]	-0.060[0.358]	-0.001[0.983]	-0.014[0.825]	-0.003[0.962]	-0.030[0.649]	-0.022[0.734]	-0.028[0.660]	-0.058[0.378]	-0.090[0.174]	-0.001[0.983]	0.010[0.877]	0.079[0.245]	0.125[0.067]	0.112[0.099]	0.171[0.014]	0.146[0.037]
	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
R56xUrban	0.589[0.000]	0.528[0.000]	0.594[0.000]	0.646[0.000]	0.533[0.000]	0.667[0.000]	0.602[0.000]	0.621[0.000]	0.636[0.000]	0.615[0.000]	0.633[0.000]	0.646[0.000]	0.716[0.000]	0.750[0.000]	0.672[0.000]	0.639[0.000]	0.579[0.000]	0.578[0.000]	0.550[0.000]	0.526[0.000]	0.538[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Percent_HW	4.360[0.000]	4.459[0.000]	4.338[0.000]	4.474[0.000]	4.694[0.000]	4.489[0.000]	4.454[0.000]	4.410[0.000]	4.380[0.000]	4.784[0.000]	4.682[0.000]	4.505[0.000]	4.565[0.000]	4.398[0.000]	4.272[0.000]	4.492[0.000]	4.107[0.000]	4.449[0.000]	4.452[0.000]	4.198[0.000]	4.169[0.000]
	(0.24)	(0.23)	(0.24)	(0.23)	(0.23)	(0.23)	(0.23)	(0.24)	(0.22)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.25)	(0.24)	(0.25)
LogADT	-0.054[0.000]	-0.048[0.000]	-0.054[0.000]	-0.057[0.000]	-0.030[0.000]	-0.050[0.000]	-0.046[0.000]	-0.050[0.000]	-0.068[0.000]	-0.051[0.000]	-0.048[0.000]	-0.048[0.000]	-0.048[0.000]	-0.048[0.000]	-0.064[0.000]	-0.083[0.000]	-0.096[0.000]	-0.118[0.000]	-0.106[0.000]	-0.118[0.000]	-0.120[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.741[0.000]	-0.695[0.000]	-0.698[0.000]	-0.718[0.000]	-0.687[0.000]	-0.737[0.000]	-0.770[0.000]	-0.782[0.000]	-0.782[0.000]	-0.765[0.000]	-0.756[0.000]	-0.738[0.000]	-0.715[0.000]	-0.717[0.000]	-0.721[0.000]	-0.709[0.000]	-0.722[0.000]	-0.711[0.000]	-0.704[0.000]	-0.708[0.000]	-0.712[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.136	0.129	0.136	0.138	0.128	0.127	0.129	0.134	0.135	0.148	0.149	0.135	0.137	0.141	0.139	0.133	0.137	0.136	0.136	0.135	0.136
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

Panel 3: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	-2.412[0.000]	-1.974[0.000]	-1.857[0.000]	-1.907[0.000]	-1.604[0.000]	-1.237[0.000]	-1.263[0.000]	-1.415[0.000]	-1.752[0.000]	-1.464[0.000]	-1.806[0.000]	-13.477[0.000]	-13.367[0.000]	-2.473[0.000]	-2.566[0.000]	-2.476[0.000]	-3.010[0.000]	-3.304[0.000]	-3.324[0.000]	-3.175[0.000]	-3.351[0.000]
	(0.25)	(0.24)	(0.24)	(0.23)	(0.23)	(0.28)	(0.30)	(0.31)	(0.29)	(0.31)	(0.31)	(0.35)	(0.32)	(0.30)	(0.30)	(0.31)	(0.31)	(0.31)	(0.31)	(0.32)	(0.43)
Reform56	1.490[0.000]	1.367[0.000]	1.327[0.000]	1.364[0.000]	1.308[0.000]	1.322[0.000]	1.271[0.000]	1.208[0.000]	1.281[0.000]	1.372[0.000]	1.283[0.000]	1.246[0.000]	1.275[0.000]	1.368[0.000]	1.420[0.000]	1.394[0.000]	1.362[0.000]	1.388[0.000]	1.347[0.000]	1.342[0.000]	1.354[0.000]
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Urban	-0.278[0.001]	-0.331[0.000]	-0.352[0.000]	-0.304[0.000]	-0.283[0.000]	-0.192[0.013]	-0.236[0.003]	-0.260[0.001]	-0.292[0.000]	-0.075[0.348]	-0.124[0.110]	-0.161[0.038]	-0.137[0.076]	-0.054[0.488]	-0.065[0.415]	-0.077[0.325]	-0.162[0.043]	-0.138[0.083]	-0.219[0.006]	-0.229[0.004]	-0.234[0.004]
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
R56xUrban	-0.604[0.000]	-0.540[0.000]	-0.515[0.000]	-0.585[0.000]	-0.545[0.000]	-0.620[0.000]	-0.584[0.000]	-0.554[0.000]	-0.595[0.000]	-0.687[0.000]	-0.666[0.000]	-0.645[0.000]	-0.684[0.000]	-0.775[0.000]	-0.818[0.000]	-0.789[0.000]	-0.742[0.000]	-0.793[0.000]	-0.722[0.000]	-0.732[0.000]	-0.721[0.000]
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Percent_HW	-3.368[0.000]	-3.561[0.000]	-3.272[0.000]	-3.342[0.000]	-3.623[0.000]	-3.361[0.000]	-3.128[0.000]	-3.054[0.000]	-3.353[0.000]	-3.312[0.000]	-3.343[0.000]	-3.261[0.000]	-2.972[0.000]	-3.093[0.000]	-2.893[0.000]	-3.004[0.000]	-3.001[0.000]	-3.125[0.000]	-2.959[0.000]	-2.698[0.000]	-2.717[0.000]
	(0.25)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.22)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)
LogADT	0.249[0.000]	0.239[0.000]	0.244[0.000]	0.253[0.000]	0.229[0.000]	0.190[0.000]	0.185[0.000]	0.187[0.000]	0.248[0.000]	0.174[0.000]	0.180[0.000]	0.175[0.000]	0.166[0.000]	0.177[0.000]	0.218[0.000]	0.237[0.000]	0.280[0.000]	0.301[0.000]	0.310[0.000]	0.310[0.000]	0.313[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.156[0.000]	0.135[0.000]	0.111[0.000]	0.102[0.000]	0.096[0.000]	0.096[0.000]	0.104[0.000]	0.093[0.000]	0.060[0.000]	0.083[0.000]	0.107[0.000]	0.103[0.000]	0.094[0.000]	0.071[0.000]	0.043[0.005]	0.016[0.295]	0.002[0.918]	-0.002[0.921]	0.002[0.893]	0.004[0.776]	-0.005[0.735]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.123	0.122	0.118	0.119	0.123	0.107	0.108	0.107	0.114	0.115	0.120	0.113	0.109	0.111	0.114	0.109	0.112	0.117	0.118	0.118	0.118
N	45,331	46,717	47,445	47,966	48,155	47,833	47,908	47,806	53,671	49,401	49,365	47,575	46,651	47,667	48,317	48,497	48,064	48,314	47,346	47,390	46,797

p-value in brackets, 2-tailed

Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 5C - Robustness across NBI years of main model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 4: DV "UnderRecord", Reform 1956

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	-5.851[0.000]	-3.888[0.000]	-4.011[0.000]	-4.002[0.000]	-3.873[0.000]	-1.079[0.000]	-0.588[0.019]	-0.859[0.000]	-0.973[0.000]	-0.685[0.007]	-0.719[0.004]	-12.526[0.000]	-11.709[0.000]	-3.947[0.000]	-3.799[0.000]	-3.951[0.000]	-3.894[0.000]	-3.872[0.000]	-3.942[0.000]	-4.617[0.000]	-3.955[0.000]
	(0.13)	(0.17)	(0.16)	(0.16)	(0.16)	(0.23)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.26)	(0.25)	(0.20)	(0.22)	(0.22)	(0.23)	(0.24)	(0.24)	(0.24)	(0.35)
Reform56	0.955[0.000]	0.888[0.000]	0.925[0.000]	0.939[0.000]	0.942[0.000]	0.973[0.000]	0.987[0.000]	0.985[0.000]	0.996[0.000]	0.978[0.000]	0.966[0.000]	0.948[0.000]	0.961[0.000]	0.959[0.000]	0.946[0.000]	1.018[0.000]	1.018[0.000]	1.020[0.000]	1.003[0.000]	1.022[0.000]	0.981[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Urban	1.128[0.000]	1.096[0.000]	1.102[0.000]	1.134[0.000]	1.152[0.000]	1.322[0.000]	1.340[0.000]	1.328[0.000]	1.150[0.000]	1.332[0.000]	1.347[0.000]	1.379[0.000]	1.404[0.000]	1.378[0.000]	1.312[0.000]	1.320[0.000]	1.305[0.000]	1.279[0.000]	1.250[0.000]	1.300[0.000]	1.253[0.000]
	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
R56xUrban	-0.798[0.000]	-0.734[0.000]	-0.732[0.000]	-0.747[0.000]	-0.750[0.000]	-0.791[0.000]	-0.806[0.000]	-0.793[0.000]	-0.769[0.000]	-0.781[0.000]	-0.779[0.000]	-0.789[0.000]	-0.811[0.000]	-0.792[0.000]	-0.760[0.000]	-0.807[0.000]	-0.815[0.000]	-0.813[0.000]	-0.802[0.000]	-0.845[0.000]	-0.804[0.000]
	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Percent_HW	0.995[0.000]	1.039[0.000]	1.071[0.000]	1.093[0.000]	1.055[0.000]	1.175[0.000]	1.174[0.000]	1.172[0.000]	0.958[0.000]	1.210[0.000]	1.294[0.000]	1.330[0.000]	1.319[0.000]	1.279[0.000]	1.182[0.000]	1.068[0.000]	0.956[0.000]	0.926[0.000]	0.873[0.000]	0.911[0.000]	0.904[0.000]
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
LogADT	0.221[0.000]	0.203[0.000]	0.200[0.000]	0.199[0.000]	0.193[0.000]	0.117[0.000]	0.106[0.000]	0.109[0.000]	0.194[0.000]	0.092[0.000]	0.078[0.000]	0.060[0.000]	0.067[0.000]	0.081[0.000]	0.107[0.000]	0.126[0.000]	0.139[0.000]	0.151[0.000]	0.168[0.000]	0.163[0.000]	0.163[0.000]
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LogLength	0.397[0.000]	0.402[0.000]	0.414[0.000]	0.410[0.000]	0.411[0.000]	0.488[0.000]	0.495[0.000]	0.486[0.000]	0.431[0.000]	0.513[0.000]	0.534[0.000]	0.545[0.000]	0.535[0.000]	0.538[0.000]	0.516[0.000]	0.523[0.000]	0.509[0.000]	0.502[0.000]	0.504[0.000]	0.513[0.000]	0.537[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.263	0.264	0.267	0.265	0.264	0.260	0.258	0.258	0.270	0.257	0.258	0.254	0.258	0.255	0.255	0.262	0.258	0.257	0.258	0.258	0.259
N	316,434	315,475	314,121	315,829	311,213	309,876	308,110	306,026	308,959	302,179	298,958	291,195	286,609	290,216	284,367	282,616	283,897	279,853	275,626	273,370	270,665

Panel 5: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	0.165[0.903]	-0.041[0.974]	2.196[0.054]	2.415[0.028]	1.075[0.356]	-0.982[0.674]	3.103[0.009]	3.522[0.004]	4.077[0.000]	2.218[0.074]	1.738[0.137]	0.821[0.603]	1.515[0.264]	1.479[0.311]	1.115[0.458]	1.301[0.391]	-0.504[0.846]	-0.688[0.795]	-0.192[0.946]	-0.187[0.939]	-18.054[]
	(1.35)	(1.25)	(1.14)	(1.10)	(1.16)	(2.33)	(1.19)	(1.21)	(1.09)	(1.24)	(1.17)	(1.58)	(1.36)	(1.46)	(1.50)	(1.52)	(2.59)	(2.65)	(2.82)	(2.44)	
Reform60	-0.944[0.000]	-0.967[0.000]	-0.901[0.000]	-0.976[0.000]	-1.054[0.000]	-1.064[0.000]	-1.178[0.000]	-1.295[0.000]	-1.513[0.000]	-1.362[0.000]	-1.388[0.000]	-1.436[0.000]	-1.309[0.000]	-1.405[0.000]	-1.721[0.000]	-1.926[0.000]	-1.630[0.000]	-1.796[0.000]	-1.971[0.000]	-1.738[0.000]	-1.839[0.000]
	(0.25)	(0.24)	(0.23)	(0.22)	(0.22)	(0.23)	(0.25)	(0.25)	(0.24)	(0.25)	(0.25)	(0.26)	(0.25)	(0.25)	(0.25)	(0.27)	(0.26)	(0.26)	(0.31)	(0.29)	(0.32)
Urban	0.534[0.020]	0.468[0.033]	0.373[0.096]	0.431[0.042]	0.282[0.169]	0.182[0.413]	0.174[0.476]	0.115[0.644]	-0.010[0.965]	-0.108[0.672]	0.207[0.395]	0.048[0.851]	0.072[0.771]	0.098[0.693]	-0.013[0.958]	0.013[0.961]	0.128[0.627]	0.337[0.192]	0.276[0.298]	0.296[0.262]	0.322[0.221]
	(0.23)	(0.22)	(0.22)	(0.21)	(0.21)	(0.22)	(0.24)	(0.25)	(0.23)	(0.26)	(0.24)	(0.25)	(0.25)	(0.25)	(0.25)	(0.27)	(0.26)	(0.26)	(0.27)	(0.26)	(0.26)
R60xUrban	-0.964[0.006]	-1.009[0.004]	-0.852[0.013]	-0.559[0.075]	-0.315[0.308]	-0.235[0.463]	-0.130[0.707]	0.163[0.635]	0.220[0.511]	0.277[0.423]	0.424[0.185]	0.061[0.869]	-0.264[0.470]	-0.219[0.552]	0.458[0.186]	0.676[0.061]	0.276[0.446]	0.422[0.229]	0.583[0.142]	0.302[0.434]	0.423[0.292]
	(0.35)	(0.35)	(0.34)	(0.31)	(0.31)	(0.32)	(0.35)	(0.34)	(0.34)	(0.35)	(0.32)	(0.37)	(0.37)	(0.37)	(0.35)	(0.36)	(0.36)	(0.35)	(0.40)	(0.39)	(0.40)
Percent_HW	-5.519[0.001]	-5.936[0.000]	-5.429[0.001]	-4.517[0.008]	-2.259[0.174]	-1.527[0.370]	-4.353[0.014]	-4.859[0.008]	-5.853[0.001]	-5.152[0.006]	-4.600[0.012]	-6.584[0.001]	-5.820[0.002]	-5.800[0.003]	-5.863[0.004]	-6.376[0.003]	-6.754[0.001]	-5.844[0.003]	-6.480[0.003]	-6.807[0.001]	-5.993[0.007]
	(1.66)	(1.65)	(1.70)	(1.71)	(1.66)	(1.70)	(1.78)	(1.84)	(1.81)	(1.88)	(1.82)	(1.93)	(1.92)	(1.95)	(2.03)	(2.13)	(2.03)	(1.98)	(2.18)	(2.14)	(2.21)
LogADT	-0.234[0.000]	-0.245[0.000]	-0.253[0.000]	-0.280[0.000]	-0.281[0.000]	-0.255[0.000]	-0.281[0.000]	-0.326[0.000]	-0.346[0.000]	-0.299[0.000]	-0.337[0.000]	-0.344[0.000]	-0.362[0.000]	-0.363[0.000]	-0.378[0.000]	-0.406[0.000]	-0.443[0.000]	-0.436[0.000]	-0.437[0.000]	-0.447[0.000]	-0.452[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LogLength	-0.595[0.000]	-0.606[0.000]	-0.849[0.000]	-0.790[0.000]	-0.818[0.000]	-0.707[0.000]	-0.760[0.000]	-0.798[0.000]	-0.735[0.000]	-0.738[0.000]	-0.708[0.000]	-0.639[0.000]	-0.486[0.004]	-0.594[0.001]	-0.426[0.007]	-0.455[0.003]	-0.247[0.123]	-0.354[0.027]	-0.424[0.013]	-0.371[0.023]	-0.420[0.016]
	(0.15)	(0.15)	(0.15)	(0.17)	(0.17)	(0.18)	(0.18)	(0.18)	(0.17)	(0.18)	(0.16)	(0.18)	(0.17)	(0.18)	(0.16)	(0.15)	(0.16)	(0.16)	(0.17)	(0.16)	(0.17)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.335	0.337	0.345	0.325	0.319	0.317	0.309	0.328	0.360	0.323	0.295	0.314	0.314	0.338	0.318	0.348	0.335	0.326	0.342	0.346	0.339
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

Panel 6: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1960

NBI Year:	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(Intercept)	1.347[0.000]	0.767[0.001]	0.809[0.000]	0.682[0.002]	0.106[0.628]	0.155[0.635]	-0.647[0.057]	-0.544[0.103]	-0.614[0.064]	-1.070[0.002]	-1.163[0.001]	-1.236[0.019]	-2.311[0.000]	-0.585[0.063]	-0.474[0.136]	-0.369[0.249]	-0.013[0.968]	0.149[0.636]	0.082[0.796]	0.490[0.147]	0.643[0.181]
	(0.24)	(0.23)	(0.23)	(0.22)	(0.22)	(0.33)	(0.34)	(0.33)	(0.33)	(0.35)	(0.34)	(0.53)	(0.59)	(0.32)	(0.32)	(0.32)	(0.31)	(0.31)	(0.32)	(0.34)	(0.48)
Reform60	-0.894[0.000]	-0.819[0.000]	-0.855[0.000]	-0.853[0.000]	-0.721[0.000]	-0.895[0.000]	-0.854[0.000]	-0.849[0.000]	-0.852[0.000]	-0.894[0.000]	-0.856[0.000]	-0.819[0.000]	-0.847[0.000]	-0.817[0.000]	-0.783[0.000]	-0.808[0.000]	-0.751[0.000]	-0.745[0.000]	-0.717[0.000]	-0.698[0.000]	-0.671[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Urban	0.288[0.000]	0.299[0.000]	0.249[0.000]	0.233[0.000]	0.253[0.000]	0.198[0.000]	0.219[0.000]	0.221[0.000]	0.235[0.000]	0.173[0.000]	0.202[0.000]	0.219[0.000]	0.212[0.000]	0.240[0.000]	0.284[0.000]	0.271[0.000]	0.318[0.000]	0.354[0.000]	0.348[0.000]	0.398[0.000]	0.403[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
R60xUrban	0.369[0.000]	0.327[0.000]	0.372[0.000]	0.394[0.000]	0.319[0.000]	0.425[0.000]	0.393[0.000]	0.402[0.000]	0.415[0.000]	0.437[0.000]	0.420[0.000]	0.402[0.000]	0.452[0.000]	0.412[0.000]	0.373[0.000]	0.358[0.000]	0.316[0.000]	0.323[0.000]	0.284[0.000]	0.265[0.000]	0.241[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Percent_HW	2.293[0.000]	2.556[0.000]	2.343[0.000]	2.549[0.000]	3.040[0.000]	2.934[0.000]	2.980[0.000]	2.974[0.000]	2.947[0.000]	3.291[0.000]	3.298[0.000]	3.287[0.000]	3.364[0.000]	3.260[0.000]	3.191[0.000]	3.276[0.000]	3.008[0.000]	3.413[0.000]	3.306[0.000]	3.080[0.000]	3.074[0.000]
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.24)	(0.25)	(0.25)	(0.25)	(0.26)	(0.25)	(0.25)	(0.26)	(0.25)	(0.26)	(0.26)	(0.26)	(0.26)
LogADT	-0.057[0.000]	-0.050[0.000]	-0.056[0.000]	-0.057[0.000]	-0.030[0.000]	-0.049[0.000]	-0.045[0.000]	-0.050[0.000]	-0.068[0.000]	-0.050[0.000]	-0.048[0.000]	-0.049[0.000]	-0.048[0.000]	-0.048[0.000]	-0.064[0.000]	-0.085[0.000]	-0.099[0.000]	-0.118[0.000]	-0.107[0.000]	-0.120[0.000]	-0.122[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.725[0.000]	-0.680[0.000]	-0.684[0.000]	-0.704[0.000]	-0.671[0.000]	-0.740[0.000]	-0.770[0.000]	-0.784[0.000]	-0.782[0.000]	-0.767[0.000]	-0.760[0.000]	-0.747[0.000]	-0.727[0.000]	-0.733[0.000]	-0.735[0.000]	-0.720[0.000]	-0.729[0.000]	-0.716[0.000]	-0.709[0.000]	-0.712[0.000]	-0.720[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.140	0.133	0.139	0.141	0.130	0.136	0.138	0.142	0.143	0.156	0.156	0.143	0.143	0.147	0.145	0.140	0.143	0.142	0.142	0.141	0.141
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 5C - Robustness across NBI years of main model
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 7: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1960

NBI Year:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
(Intercept)	-2.445[0.000]	-1.999[0.000]	-1.899[0.000]	-1.866[0.000]	-1.538[0.000]	-1.088[0.000]	-1.046[0.000]	-1.217[0.000]	-1.539[0.000]	-1.231[0.000]	-1.588[0.000]	-13.509[0.000]	-13.446[0.000]	-2.284[0.000]	-2.468[0.000]	-2.443[0.000]	-2.929[0.000]	-3.129[0.000]	-3.187[0.000]	-3.052[0.000]	-3.266[0.000]
	(0.25)	(0.24)	(0.24)	(0.23)	(0.23)	(0.27)	(0.28)	(0.29)	(0.27)	(0.29)	(0.29)	(0.34)	(0.31)	(0.29)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.32)	(0.43)
Reform60	1.100[0.000]	1.033[0.000]	1.026[0.000]	1.051[0.000]	0.996[0.000]	0.990[0.000]	0.952[0.000]	0.906[0.000]	0.923[0.000]	0.972[0.000]	0.925[0.000]	0.848[0.000]	0.881[0.000]	0.902[0.000]	0.912[0.000]	0.907[0.000]	0.885[0.000]	0.882[0.000]	0.843[0.000]	0.842[0.000]	0.823[0.000]
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Urban	-0.544[0.000]	-0.583[0.000]	-0.555[0.000]	-0.532[0.000]	-0.500[0.000]	-0.465[0.000]	-0.497[0.000]	-0.514[0.000]	-0.569[0.000]	-0.391[0.000]	-0.432[0.000]	-0.507[0.000]	-0.473[0.000]	-0.455[0.000]	-0.495[0.000]	-0.477[0.000]	-0.547[0.000]	-0.560[0.000]	-0.622[0.000]	-0.633[0.000]	-0.649[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
R60xUrban	-0.352[0.000]	-0.283[0.000]	-0.320[0.000]	-0.369[0.000]	-0.333[0.000]	-0.355[0.000]	-0.324[0.000]	-0.303[0.000]	-0.323[0.000]	-0.382[0.000]	-0.352[0.000]	-0.268[0.000]	-0.322[0.000]	-0.353[0.000]	-0.363[0.000]	-0.363[0.000]	-0.326[0.000]	-0.344[0.000]	-0.284[0.000]	-0.297[0.000]	-0.275[0.000]
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Percent_HW	-1.028[0.000]	-1.334[0.000]	-1.115[0.000]	-1.268[0.000]	-1.720[0.000]	-1.432[0.000]	-1.294[0.000]	-1.326[0.000]	-1.565[0.000]	-1.504[0.000]	-1.643[0.000]	-1.661[0.000]	-1.384[0.000]	-1.548[0.000]	-1.365[0.000]	-1.470[0.000]	-1.441[0.000]	-1.672[0.000]	-1.429[0.000]	-1.233[0.000]	-1.287[0.000]
	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.25)	(0.25)	(0.25)	(0.24)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
LogADT	0.251[0.000]	0.240[0.000]	0.246[0.000]	0.255[0.000]	0.231[0.000]	0.190[0.000]	0.185[0.000]	0.188[0.000]	0.250[0.000]	0.175[0.000]	0.180[0.000]	0.176[0.000]	0.167[0.000]	0.177[0.000]	0.219[0.000]	0.240[0.000]	0.283[0.000]	0.303[0.000]	0.312[0.000]	0.312[0.000]	0.317[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.161[0.000]	0.135[0.000]	0.109[0.000]	0.102[0.000]	0.096[0.000]	0.099[0.000]	0.109[0.000]	0.096[0.000]	0.067[0.000]	0.089[0.000]	0.114[0.000]	0.111[0.000]	0.102[0.000]	0.083[0.000]	0.053[0.001]	0.025[0.109]	0.009[0.568]	0.005[0.742]	0.008[0.608]	0.012[0.454]	0.006[0.712]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.127	0.127	0.123	0.123	0.128	0.111	0.112	0.111	0.117	0.118	0.123	0.115	0.111	0.112	0.114	0.109	0.112	0.116	0.118	0.118	0.118
N	44,478	45,842	46,594	47,090	47,299	46,961	47,051	46,938	52,611	48,546	48,400	46,723	45,814	46,769	47,421	47,614	47,200	47,444	46,438	46,493	45,890

Panel 8: DV "UnderRecord", Reform 1960

NBI Year:	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
(Intercept)	-5.746[0.000]	-3.822[0.000]	-3.933[0.000]	-3.923[0.000]	-3.776[0.000]	-1.048[0.000]	-0.580[0.021]	-0.810[0.001]	-0.927[0.000]	-0.656[0.008]	-0.709[0.004]	-12.683[0.000]	-11.838[0.000]	-3.798[0.000]	-3.683[0.000]	-3.850[0.000]	-3.808[0.000]	-3.772[0.000]	-3.861[0.000]	-4.524[0.000]	-3.935[0.000]
	(0.13)	(0.16)	(0.16)	(0.16)	(0.16)	(0.24)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.26)	(0.25)	(0.20)	(0.21)	(0.21)	(0.22)	(0.23)	(0.23)	(0.23)	(0.32)
Reform60	0.585[0.000]	0.558[0.000]	0.586[0.000]	0.592[0.000]	0.593[0.000]	0.620[0.000]	0.630[0.000]	0.631[0.000]	0.633[0.000]	0.626[0.000]	0.612[0.000]	0.619[0.000]	0.614[0.000]	0.609[0.000]	0.610[0.000]	0.640[0.000]	0.647[0.000]	0.639[0.000]	0.622[0.000]	0.623[0.000]	0.585[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Urban	0.755[0.000]	0.758[0.000]	0.768[0.000]	0.790[0.000]	0.809[0.000]	0.958[0.000]	0.978[0.000]	0.974[0.000]	0.807[0.000]	0.983[0.000]	0.989[0.000]	1.040[0.000]	1.040[0.000]	1.020[0.000]	0.966[0.000]	0.952[0.000]	0.934[0.000]	0.900[0.000]	0.869[0.000]	0.890[0.000]	0.843[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
R60xUrban	-0.461[0.000]	-0.435[0.000]	-0.439[0.000]	-0.442[0.000]	-0.448[0.000]	-0.465[0.000]	-0.482[0.000]	-0.477[0.000]	-0.464[0.000]	-0.464[0.000]	-0.453[0.000]	-0.487[0.000]	-0.481[0.000]	-0.461[0.000]	-0.445[0.000]	-0.471[0.000]	-0.477[0.000]	-0.468[0.000]	-0.451[0.000]	-0.466[0.000]	-0.424[0.000]
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	2.059[0.000]	2.042[0.000]	2.158[0.000]	2.171[0.000]	2.135[0.000]	2.276[0.000]	2.282[0.000]	2.287[0.000]	2.115[0.000]	2.318[0.000]	2.396[0.000]	2.352[0.000]	2.334[0.000]	2.242[0.000]	2.135[0.000]	2.062[0.000]	1.955[0.000]	1.916[0.000]	1.826[0.000]	1.865[0.000]	1.845[0.000]
	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)	(0.14)
LogADT	0.224[0.000]	0.206[0.000]	0.203[0.000]	0.201[0.000]	0.196[0.000]	0.119[0.000]	0.107[0.000]	0.109[0.000]	0.195[0.000]	0.092[0.000]	0.077[0.000]	0.059[0.000]	0.067[0.000]	0.079[0.000]	0.107[0.000]	0.126[0.000]	0.139[0.000]	0.152[0.000]	0.169[0.000]	0.164[0.000]	0.166[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LogLength	0.403[0.000]	0.408[0.000]	0.420[0.000]	0.417[0.000]	0.419[0.000]	0.496[0.000]	0.503[0.000]	0.495[0.000]	0.441[0.000]	0.520[0.000]	0.543[0.000]	0.551[0.000]	0.541[0.000]	0.545[0.000]	0.522[0.000]	0.529[0.000]	0.515[0.000]	0.507[0.000]	0.509[0.000]	0.519[0.000]	0.543[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.263	0.263	0.266	0.265	0.263	0.259	0.258	0.257	0.269	0.256	0.257	0.253	0.257	0.254	0.254	0.262	0.257	0.256	0.257	0.258	0.258
N	314,391	313,378	312,057	313,682	309,160	307,788	306,036	303,936	306,663	300,076	296,734	289,032	284,471	287,928	282,083	280,327	281,676	277,599	273,382	271,193	268,547

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 6 - NBI 1992, Continuous DV

Panel 1A: DV "IMVC" (Inventory Route Minimum Vertical Clearance, in meters)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	4.510[0.000]	4.403[0.000]	5.405[0.000]	5.423[0.000]	5.363[0.000]	5.400[0.000]	4.403[0.000]	4.372[0.000]
	(0.24)	(0.24)	(0.22)	(0.22)	(0.22)	(0.22)	(0.24)	(0.24)
Reform56		0.177[0.000]	0.199[0.000]	0.174[0.000]	0.204[0.000]	0.178[0.000]	0.177[0.000]	0.217[0.000]
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)
NY			-0.117[0.001]	-0.255[0.000]				
			(0.03)	(0.04)				
R56xNY				0.194[0.001]				
				(0.06)				
NE					-0.034[0.364]	-0.400[0.000]		
					(0.04)	(0.09)		
R56xNE						0.452[0.000]		
						(0.10)		
Urban	0.024[0.077]	0.024[0.078]	0.024[0.080]	0.022[0.098]	0.023[0.090]	0.021[0.113]	0.024[0.078]	0.079[0.063]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)
R56xUrban								-0.063[0.154]
								(0.04)
Percent_HW	-0.534[0.000]	-0.517[0.000]	-0.387[0.000]	-0.376[0.000]	-0.228[0.025]	-0.269[0.008]	-0.517[0.000]	-0.519[0.000]
	(0.15)	(0.15)	(0.10)	(0.10)	(0.10)	(0.10)	(0.15)	(0.15)
LogADT	-0.067[0.000]	-0.066[0.000]	-0.064[0.000]	-0.064[0.000]	-0.064[0.000]	-0.064[0.000]	-0.066[0.000]	-0.066[0.000]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LogLength	0.533[0.000]	0.524[0.000]	0.488[0.000]	0.488[0.000]	0.487[0.000]	0.487[0.000]	0.524[0.000]	0.524[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
Adj. R-squared	0.122	0.124	0.105	0.105	0.104	0.105	0.124	0.124
N	45,331	45,331	45,331	45,331	45,331	45,331	45,331	45,331

Panel 1B: DV "IMVC" (Inventory Route Minimum Vertical Clearance, in meters)

	Model 1	Model 2	Model 3a	Model 4a	Model 3b	Model 4b	Model 3c	Model 4c
(Intercept)	4.519[0.000]	4.326[0.000]	5.354[0.000]	5.361[0.000]	5.314[0.000]	5.316[0.000]	4.326[0.000]	4.305[0.000]
	(0.24)	(0.24)	(0.21)	(0.21)	(0.21)	(0.21)	(0.24)	(0.24)
Reform60		0.171[0.000]	0.201[0.000]	0.191[0.000]	0.205[0.000]	0.194[0.000]	0.171[0.000]	0.205[0.000]
		(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
NY			-0.085[0.017]	-0.152[0.000]				
			(0.04)	(0.04)				
R60xNY				0.122[0.046]				
				(0.06)				
NE					-0.075[0.037]	-0.196[0.000]		
					(0.04)	(0.05)		
R60xNE						0.219[0.002]		
						(0.07)		
Urban	0.026[0.059]	0.027[0.047]	0.031[0.021]	0.030[0.026]	0.031[0.024]	0.030[0.028]	0.027[0.047]	0.067[0.004]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
R60xUrban								-0.058[0.038]
								(0.03)
Percent_HW	-0.598[0.000]	-0.036[0.824]	-0.043[0.700]	-0.042[0.705]	0.104[0.326]	0.120[0.256]	-0.036[0.824]	-0.039[0.807]
	(0.15)	(0.16)	(0.11)	(0.11)	(0.11)	(0.11)	(0.16)	(0.16)
LogADT	-0.067[0.000]	-0.065[0.000]	-0.062[0.000]	-0.062[0.000]	-0.062[0.000]	-0.061[0.000]	-0.065[0.000]	-0.065[0.000]
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LogLength	0.532[0.000]	0.521[0.000]	0.484[0.000]	0.484[0.000]	0.483[0.000]	0.483[0.000]	0.521[0.000]	0.521[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	No	No	No	No	Yes	Yes
Adj. R-squared	0.124	0.126	0.107	0.107	0.107	0.107	0.126	0.126
N	44,478	44,478	44,478	44,478	44,478	44,478	44,478	44,478

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 7 - NBI 1992, Restricted to just NY and NE observations

Panel 1A: Effects of Reform 1956 on bridges built in New York vs. New England

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-14.465[0.000]	0.160[0.926]	0.142[0.874]	-0.943[0.230]	-19.222[0.000]	-3.909[0.000]
	(2.34)	(1.72)	(0.90)	(0.79)	(0.58)	(0.67)
Reform56	-2.432[0.029]	-3.506[0.000]	-0.573[0.000]	2.021[0.000]	1.690[0.000]	0.432[0.000]
	(1.12)	(0.28)	(0.14)	(0.23)	(0.29)	(0.08)
NY	-0.906[0.240]	-1.105[0.000]	0.522[0.000]	0.282[0.243]	0.967[0.002]	1.110[0.000]
	(0.77)	(0.19)	(0.15)	(0.24)	(0.31)	(0.08)
R56xNY	0.721[0.579]	2.859[0.000]	0.046[0.773]	-1.087[0.000]	-1.201[0.000]	-0.463[0.000]
	(1.30)	(0.32)	(0.16)	(0.25)	(0.31)	(0.09)
Urban	18.253[0.000]	0.112[0.439]	0.143[0.035]	-0.393[0.000]	0.090[0.345]	0.438[0.000]
	(0.78)	(0.14)	(0.07)	(0.08)	(0.10)	(0.05)
Percent_HW	-0.645[0.873]	4.262[0.000]	1.169[0.011]	-2.176[0.000]	-0.619[0.341]	1.745[0.000]
	(4.05)	(0.97)	(0.46)	(0.51)	(0.65)	(0.27)
LogADT	0.043[0.797]	0.086[0.045]	0.000[0.978]	0.041[0.035]	-0.052[0.004]	0.131[0.000]
	(0.17)	(0.04)	(0.02)	(0.02)	(0.02)	(0.01)
LogLength	-0.924[0.064]	-0.628[0.000]	-0.405[0.000]	0.106[0.022]	0.689[0.000]	0.488[0.000]
	(0.50)	(0.11)	(0.04)	(0.05)	(0.05)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.465	0.259	0.051	0.076	0.086	0.150
N	4,870	4,870	4,870	4,870	4,870	20,064

Panel 1B: Effects of Reform 1960 on bridges built in New York vs. New England

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-14.336[0.000]	1.339[0.486]	0.422[0.623]	-1.679[0.023]	-20.427[0.000]	-4.140[0.000]
	(3.13)	(1.92)	(0.86)	(0.74)	(0.25)	(0.64)
Reform60	-1.565[0.132]	-3.638[0.000]	-0.776[0.000]	1.767[0.000]	1.271[0.000]	0.469[0.000]
	(1.04)	(0.34)	(0.10)	(0.13)	(0.15)	(0.06)
NY	-0.923[0.249]	-1.697[0.000]	0.329[0.005]	0.495[0.001]	0.778[0.000]	1.070[0.000]
	(0.80)	(0.17)	(0.12)	(0.16)	(0.18)	(0.07)
R60xNY	-1.904[0.279]	2.745[0.000]	0.284[0.022]	-0.940[0.000]	-0.819[0.000]	-0.454[0.000]
	(1.76)	(0.38)	(0.12)	(0.16)	(0.18)	(0.08)
Urban	18.258[0.000]	-0.649[0.000]	0.218[0.001]	-0.234[0.004]	0.237[0.016]	0.432[0.000]
	(0.88)	(0.13)	(0.07)	(0.08)	(0.10)	(0.05)
Percent_HW	-4.218[0.280]	-2.939[0.000]	-0.248[0.617]	1.873[0.002]	2.135[0.006]	2.742[0.000]
	(3.90)	(0.65)	(0.50)	(0.62)	(0.78)	(0.29)
LogADT	0.182[0.380]	0.178[0.000]	-0.026[0.086]	0.041[0.037]	-0.046[0.015]	0.131[0.000]
	(0.21)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
LogLength	-1.176[0.056]	-0.707[0.000]	-0.376[0.000]	0.140[0.003]	0.684[0.000]	0.490[0.000]
	(0.62)	(0.10)	(0.04)	(0.05)	(0.05)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.526	0.258	0.059	0.083	0.096	0.149
N	4,956	4,956	4,956	4,956	4,956	20,297

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 7 - NBI 1992, Restricted to just NY and NE observations

Panel 2A: Effects of Reform 1956 on bridges built in New York vs. Massachusetts

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-15.848[0.000]	-0.413[0.770]	1.143[0.204]	-1.415[0.099]	-19.765[0.000]	-5.115[0.000]
	(3.99)	(1.42)	(0.90)	(0.86)	(0.89)	(0.69)
Reform56	-1.100[0.560]	-2.029[0.000]	-0.804[0.004]	2.050[0.000]	-0.630[0.253]	0.877[0.000]
	(1.89)	(0.53)	(0.28)	(0.39)	(0.55)	(0.16)
NY	-0.224[0.916]	-0.414[0.242]	-0.471[0.071]	0.355[0.345]	1.005[0.027]	1.816[0.000]
	(2.11)	(0.35)	(0.26)	(0.38)	(0.46)	(0.16)
R56xNY	-0.505[0.804]	1.256[0.018]	0.310[0.285]	-1.162[0.004]	1.136[0.043]	-0.919[0.000]
	(2.04)	(0.53)	(0.29)	(0.40)	(0.56)	(0.17)
Urban	16.782[0.000]	1.101[0.000]	-0.002[0.985]	-0.378[0.000]	0.041[0.747]	0.504[0.000]
	(0.78)	(0.27)	(0.09)	(0.11)	(0.13)	(0.06)
Percent_HW	-0.866[0.859]	3.148[0.069]	2.239[0.016]	-3.756[0.001]	-1.969[0.166]	1.228[0.025]
	(4.88)	(1.73)	(0.93)	(1.17)	(1.42)	(0.55)
LogADT	0.193[0.541]	0.094[0.090]	-0.017[0.451]	0.026[0.358]	-0.027[0.321]	0.193[0.000]
	(0.32)	(0.06)	(0.02)	(0.03)	(0.03)	(0.02)
LogLength	-0.735[0.222]	-0.645[0.000]	-0.355[0.000]	0.188[0.001]	0.602[0.000]	0.429[0.000]
	(0.60)	(0.13)	(0.05)	(0.06)	(0.06)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.446	0.220	0.051	0.077	0.095	0.161
N	3,464	3,464	3,464	3,464	3,464	13,184

Panel 2B: Effects of Reform 1960 on bridges built in New York vs. Massachusetts

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-17.524[0.002]	1.472[0.346]	0.727[0.420]	-2.378[0.007]	-20.331[0.000]	-4.889[0.000]
	(5.79)	(1.56)	(0.90)	(0.88)	(0.84)	(0.64)
Reform60	-0.379[0.830]	-4.429[0.000]	-0.165[0.366]	2.734[0.000]	-0.101[0.851]	0.463[0.000]
	(1.76)	(1.04)	(0.18)	(0.32)	(0.54)	(0.11)
NY	-0.073[0.974]	-1.631[0.000]	0.087[0.558]	1.288[0.000]	1.668[0.000]	1.266[0.000]
	(2.24)	(0.19)	(0.15)	(0.31)	(0.39)	(0.09)
R60xNY	-2.537[0.273]	3.797[0.000]	-0.348[0.069]	-2.077[0.000]	0.429[0.423]	-0.434[0.000]
	(2.32)	(1.05)	(0.19)	(0.32)	(0.54)	(0.11)
Urban	16.543[0.000]	-0.345[0.021]	0.235[0.005]	-0.293[0.007]	0.116[0.371]	0.495[0.000]
	(1.43)	(0.15)	(0.08)	(0.11)	(0.13)	(0.06)
Percent_HW	-4.435[0.402]	5.888[0.000]	-0.848[0.373]	-2.078[0.108]	-2.402[0.111]	3.130[0.000]
	(5.30)	(1.51)	(0.95)	(1.30)	(1.51)	(0.59)
LogADT	0.499[0.339]	0.194[0.001]	-0.049[0.029]	0.022[0.453]	-0.027[0.351]	0.173[0.000]
	(0.52)	(0.06)	(0.02)	(0.03)	(0.03)	(0.02)
LogLength	-0.894[0.292]	-0.846[0.000]	-0.306[0.000]	0.218[0.000]	0.605[0.000]	0.444[0.000]
	(0.85)	(0.13)	(0.05)	(0.06)	(0.06)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.525	0.278	0.046	0.093	0.112	0.153
N	3,555	3,555	3,555	3,555	3,555	13,414

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 7 - NBI 1992, Restricted to just NY and NE observations

Panel 3A: Effects of Reform 1956 on Urban bridges built in New York vs. Massachusetts

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	1.693[0.670]	0.713[0.627]	1.351[0.145]	-1.673[0.070]	-20.409[0.000]	-2.621[0.005]
	(3.98)	(1.46)	(0.93)	(0.92)	(1.02)	(0.93)
Reform56	-18.301[0.000]	-2.738[0.000]	-0.683[0.040]	2.007[0.000]	-0.149[0.824]	1.491[0.000]
	(1.30)	(0.64)	(0.33)	(0.45)	(0.67)	(0.20)
NY	-0.993[0.486]	-0.593[0.141]	-0.653[0.042]	0.376[0.391]	1.596[0.008]	2.369[0.000]
	(1.43)	(0.40)	(0.32)	(0.44)	(0.61)	(0.20)
R56xNY	16.723[0.000]	1.974[0.003]	0.560[0.106]	-1.400[0.003]	0.447[0.513]	-1.479[0.000]
	(1.47)	(0.66)	(0.35)	(0.47)	(0.68)	(0.21)
Percent_HW	-0.427[0.932]	2.548[0.163]	2.214[0.037]	-5.377[0.000]	0.092[0.953]	1.599[0.015]
	(4.99)	(1.83)	(1.06)	(1.37)	(1.57)	(0.66)
LogADT	0.169[0.571]	0.117[0.048]	-0.034[0.163]	0.027[0.406]	-0.020[0.516]	0.028[0.105]
	(0.30)	(0.06)	(0.02)	(0.03)	(0.03)	(0.02)
LogLength	-0.721[0.187]	-0.627[0.000]	-0.354[0.000]	0.215[0.000]	0.569[0.000]	0.223[0.000]
	(0.55)	(0.14)	(0.05)	(0.06)	(0.06)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.425	0.215	0.050	0.074	0.100	0.091
N	2,649	2,649	2,649	2,649	2,649	7,311

Panel 2B: Effects of Reform 1960 on Urban bridges built in New York vs. Massachusetts

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-0.255[0.970]	1.588[0.280]	1.555[0.085]	-2.663[0.006]	-20.748[0.000]	-2.333[0.002]
	(6.70)	(1.47)	(0.90)	(0.96)	(0.87)	(0.77)
Reform60	-17.626[0.000]	-16.966[0.000]	-0.877[0.000]	2.690[0.000]	0.254[0.667]	0.716[0.000]
	(1.76)	(0.25)	(0.25)	(0.40)	(0.59)	(0.12)
NY	-0.754[0.672]	-1.047[0.000]	-0.871[0.000]	1.328[0.001]	2.035[0.000]	1.537[0.000]
	(1.78)	(0.28)	(0.22)	(0.40)	(0.47)	(0.11)
R60xNY	14.759[0.000]	16.098[0.000]	0.850[0.001]	-2.257[0.000]	-0.153[0.795]	-0.650[0.000]
	(2.42)	(0.29)	(0.26)	(0.41)	(0.59)	(0.13)
Percent_HW	-4.478[0.388]	0.149[0.936]	2.075[0.084]	-3.447[0.023]	-0.451[0.786]	4.133[0.000]
	(5.19)	(1.86)	(1.20)	(1.52)	(1.66)	(0.71)
LogADT	0.474[0.350]	0.083[0.134]	-0.027[0.268]	0.028[0.405]	-0.023[0.460]	0.014[0.432]
	(0.51)	(0.06)	(0.03)	(0.03)	(0.03)	(0.02)
LogLength	-0.888[0.285]	-0.646[0.000]	-0.382[0.000]	0.240[0.000]	0.589[0.000]	0.227[0.000]
	(0.83)	(0.13)	(0.05)	(0.06)	(0.06)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.503	0.223	0.065	0.088	0.111	0.083
N	2,656	2,656	2,656	2,656	2,656	7,391

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 7 - NBI 1992, Restricted to just NY and NE observations

Panel 4A: Effects of Reform 1956 on bridges built in New York City vs. Boston

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	-13.958[0.000]	-14.336[0.000]	1.618[0.041]	-3.288[0.001]	-17.776[0.000]	-3.208[0.000]
	(1.99)	(1.00)	(0.79)	(1.02)	(1.12)	(0.62)
Reform56	-15.999[0.000]	-2.476[0.021]	-1.272[0.002]	3.202[0.000]	-0.718[0.564]	0.663[0.015]
	(1.50)	(1.07)	(0.41)	(0.81)	(1.25)	(0.27)
NY	-1.012[0.513]	0.465[0.291]	-1.570[0.000]	1.935[0.014]	1.626[0.034]	2.391[0.000]
	(1.55)	(0.44)	(0.39)	(0.79)	(0.77)	(0.27)
R56xNY	14.590[0.000]	1.379[0.208]	1.332[0.003]	-2.971[0.000]	1.388[0.273]	-0.736[0.014]
	(2.14)	(1.10)	(0.45)	(0.84)	(1.27)	(0.30)
Urban	15.880[0.000]	13.883[0.000]	0.641[0.255]	-1.430[0.018]	13.191[0.000]	-0.308[0.443]
	(1.81)	(0.58)	(0.56)	(0.60)	(0.65)	(0.40)
Percent_HW	-14.293[0.016]	-0.324[0.902]	1.543[0.395]	-0.299[0.902]	-2.933[0.287]	-0.988[0.432]
	(5.95)	(2.64)	(1.82)	(2.44)	(2.75)	(1.26)
LogADT	-0.307[0.056]	-0.059[0.340]	-0.013[0.744]	0.059[0.251]	0.025[0.618]	0.064[0.030]
	(0.16)	(0.06)	(0.04)	(0.05)	(0.05)	(0.03)
LogLength	-0.226[0.683]	-0.152[0.171]	-0.200[0.002]	0.120[0.138]	0.277[0.000]	0.108[0.027]
	(0.55)	(0.11)	(0.07)	(0.08)	(0.08)	(0.05)
Material FE	No	No	No	No	No	No
Design FE	No	No	No	No	No	No
McFadden R-sq.	0.140	0.069	0.030	0.058	0.086	0.119
N	835	835	835	835	835	2,086

Panel 4B: Effects of Reform 1960 on bridges built in New York City vs. Boston

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	-16.758[0.000]	2.072[0.072]	0.478[0.577]	-3.695[0.001]	-18.606[0.000]	-3.483[0.000]
	(2.88)	(1.15)	(0.86)	(1.07)	(1.21)	(0.62)
Reform60	-17.773[0.000]	-16.122[0.000]	-0.901[0.019]	3.467[0.000]	-0.120[0.924]	0.942[0.000]
	(1.39)	(0.38)	(0.39)	(0.80)	(1.26)	(0.24)
NY	-1.218[0.548]	-0.048[0.899]	-1.440[0.000]	2.473[0.002]	2.243[0.003]	2.444[0.000]
	(2.03)	(0.38)	(0.32)	(0.80)	(0.76)	(0.21)
R60xNY	0.337[0.859]	15.101[0.000]	1.019[0.015]	-3.493[0.000]	0.622[0.623]	-1.059[0.000]
	(1.91)	(0.46)	(0.42)	(0.84)	(1.27)	(0.25)
Urban	17.949[0.000]	-1.393[0.072]	1.584[0.010]	-1.503[0.011]	13.050[0.000]	-0.170[0.664]
	(1.86)	(0.77)	(0.61)	(0.59)	(0.63)	(0.39)
Percent_HW	-28.137[0.007]	-1.597[0.564]	1.383[0.457]	-0.866[0.730]	0.315[0.905]	0.344[0.810]
	(10.39)	(2.77)	(1.86)	(2.51)	(2.65)	(1.43)
LogADT	-0.079[0.800]	-0.095[0.130]	0.007[0.871]	0.055[0.339]	0.015[0.767]	0.058[0.060]
	(0.31)	(0.06)	(0.04)	(0.06)	(0.05)	(0.03)
LogLength	-0.248[0.758]	-0.257[0.013]	-0.219[0.002]	0.164[0.059]	0.341[0.000]	0.101[0.044]
	(0.81)	(0.10)	(0.07)	(0.09)	(0.08)	(0.05)
Material FE	No	No	No	No	No	No
Design FE	No	No	No	No	No	No
McFadden R-sq.	0.220	0.081	0.038	0.065	0.096	0.127
N	804	804	804	804	804	2,082

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 8 - NBI 1992, Removing State Fixed Effects

Panel 1: Effects of Reform 1956 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	0.052[0.953]	1.764[0.000]	2.883[0.000]	-5.104[0.000]	-2.919[0.000]	-4.931[0.000]
	(0.88)	(0.33)	(0.16)	(0.18)	(0.17)	(0.09)
Reform56	-0.927[0.000]	-1.258[0.000]	-1.098[0.000]	1.564[0.000]	0.420[0.000]	0.998[0.000]
	(0.27)	(0.11)	(0.05)	(0.07)	(0.08)	(0.03)
Urban	0.623[0.015]	0.422[0.000]	0.154[0.012]	-0.395[0.000]	0.210[0.015]	1.203[0.000]
	(0.26)	(0.11)	(0.06)	(0.08)	(0.09)	(0.03)
R56xUrban	-0.926[0.007]	-0.200[0.125]	0.517[0.000]	-0.536[0.000]	-0.042[0.645]	-0.892[0.000]
	(0.35)	(0.13)	(0.07)	(0.08)	(0.09)	(0.03)
Percent_HW	0.118[0.906]	0.155[0.723]	0.209[0.180]	0.381[0.020]	-0.966[0.000]	0.360[0.000]
	(1.00)	(0.44)	(0.16)	(0.17)	(0.21)	(0.09)
LogADT	-0.270[0.000]	-0.220[0.000]	-0.044[0.000]	0.220[0.000]	-0.119[0.000]	0.222[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
LogLength	-0.584[0.000]	-0.546[0.000]	-0.663[0.000]	0.185[0.000]	0.777[0.000]	0.363[0.000]
	(0.15)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.287	0.199	0.077	0.083	0.081	0.239
N	45,331	45,331	45,331	45,331	45,331	316,434

Panel 2: Effects of Reform 1960 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-0.018[0.983]	1.871[0.000]	2.967[0.000]	-5.088[0.000]	-3.020[0.000]	-4.681[0.000]
	(0.84)	(0.31)	(0.16)	(0.18)	(0.16)	(0.09)
Reform60	-0.831[0.000]	-1.321[0.000]	-1.059[0.000]	1.213[0.000]	0.436[0.000]	0.595[0.000]
	(0.22)	(0.09)	(0.04)	(0.04)	(0.05)	(0.02)
Urban	0.369[0.077]	0.042[0.601]	0.354[0.000]	-0.628[0.000]	0.237[0.000]	0.802[0.000]
	(0.21)	(0.08)	(0.04)	(0.05)	(0.06)	(0.02)
R60xUrban	-0.793[0.022]	-0.092[0.448]	0.343[0.000]	-0.304[0.000]	-0.059[0.341]	-0.527[0.000]
	(0.35)	(0.12)	(0.05)	(0.05)	(0.06)	(0.03)
Percent_HW	-1.990[0.049]	-1.521[0.000]	-1.091[0.000]	1.905[0.000]	-0.441[0.045]	0.880[0.000]
	(1.01)	(0.42)	(0.16)	(0.17)	(0.22)	(0.09)
LogADT	-0.246[0.000]	-0.189[0.000]	-0.055[0.000]	0.232[0.000]	-0.115[0.000]	0.229[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
LogLength	-0.549[0.000]	-0.560[0.000]	-0.649[0.000]	0.182[0.000]	0.769[0.000]	0.369[0.000]
	(0.15)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.277	0.193	0.089	0.091	0.083	0.239
N	44,478	44,478	44,478	44,478	44,478	314,391

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 9A - Placebo Regressions, NBI-1992
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 1: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12')

Data Permutation:	Main Model		Robustness, 5-Year Window		Placebo Regressions, 5-Year Window before and after							
"Reform" Year:	1956	1960	1956	1960	1949	1950	1951	1952	1964	1965	1966	1967
(Intercept)	0.226[0.794]	0.016[0.985]	-0.792[0.544]	-32.934[]	-0.075[0.954]	0.631[0.603]	-0.237[0.842]	0.804[0.439]	-17.389[0.000]	-15.367[0.000]	-16.466[]	-26.801[0.000]
	(0.87)	(0.86)	(1.31)		(1.31)	(1.21)	(1.19)	(1.04)	(3.81)	(3.10)		(4.56)
Reform	-1.297[0.000]	-1.004[0.000]	-0.974[0.003]	-0.796[0.007]	-0.609[0.103]	-1.066[0.000]	-1.434[0.000]	-1.515[0.000]	-0.542[0.055]	-0.171[0.578]	0.478[0.163]	0.586[0.133]
	(0.20)	(0.18)	(0.33)	(0.29)	(0.37)	(0.30)	(0.34)	(0.33)	(0.28)	(0.31)	(0.34)	(0.39)
NY	0.414[0.136]	0.530[0.030]	0.584[0.129]	1.372[0.000]	1.415[0.007]	1.266[0.015]	0.793[0.194]	-0.527[0.537]	-0.287[0.713]	-1.089[0.314]	-16.322[0.000]	-16.496[0.000]
	(0.28)	(0.24)	(0.39)	(0.39)	(0.52)	(0.52)	(0.61)	(0.85)	(0.78)	(1.08)	(0.44)	(0.47)
Reform*NY	-0.555[0.313]	-2.262[0.025]	0.589[0.387]	-17.907[0.000]	-2.272[0.015]	-0.387[0.530]	0.765[0.261]	2.279[0.009]	-16.331[0.000]	-0.115[0.936]	15.302[0.000]	15.439[0.000]
	(0.55)	(1.01)	(0.68)	(0.49)	(0.93)	(0.62)	(0.68)	(0.87)	(0.78)	(1.43)	(0.96)	(1.00)
Urban	0.126[0.472]	0.112[0.526]	-0.060[0.832]	0.009[0.977]	0.267[0.466]	0.392[0.144]	0.425[0.127]	0.429[0.114]	-0.496[0.150]	-0.152[0.660]	0.050[0.895]	0.284[0.491]
	(0.18)	(0.18)	(0.29)	(0.31)	(0.37)	(0.27)	(0.28)	(0.27)	(0.35)	(0.35)	(0.38)	(0.41)
Percent_HW	0.470[0.672]	-1.674[0.146]	2.392[0.140]	1.151[0.577]	1.046[0.659]	4.855[0.003]	6.103[0.000]	3.054[0.096]	-2.326[0.335]	-6.194[0.007]	-4.419[0.086]	-2.870[0.294]
	(1.11)	(1.15)	(1.62)	(2.06)	(2.37)	(1.64)	(1.67)	(1.83)	(2.41)	(2.31)	(2.57)	(2.73)
LogADT	-0.264[0.000]	-0.250[0.000]	-0.254[0.000]	-0.294[0.000]	-0.285[0.000]	-0.321[0.000]	-0.364[0.000]	-0.304[0.000]	-0.197[0.000]	-0.278[0.000]	-0.293[0.000]	-0.303[0.000]
	(0.03)	(0.03)	(0.05)	(0.04)	(0.06)	(0.05)	(0.05)	(0.04)	(0.06)	(0.05)	(0.04)	(0.04)
LogLength	-0.588[0.000]	-0.556[0.000]	-0.427[0.066]	-0.059[0.827]	-0.178[0.349]	-0.482[0.015]	-0.366[0.080]	-0.451[0.021]	-0.685[0.036]	-0.898[0.005]	-0.796[0.014]	-0.665[0.073]
	(0.15)	(0.16)	(0.23)	(0.27)	(0.19)	(0.20)	(0.21)	(0.20)	(0.33)	(0.32)	(0.32)	(0.37)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.285	0.278	0.246	0.280	0.255	0.257	0.273	0.278	0.273	0.285	0.325	0.291
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

Panel 2: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive)

Data Permutation:	Main Model	Main Model	Robustness, 5-Year Window		Placebo Regressions, 5-Year Window before and after							
"Reform" Year:	1956	1960	1956	1960	1949	1950	1951	1952	1964	1965	1966	1967
(Intercept)	1.509[0.000]	1.673[0.000]	1.105[0.014]	1.566[0.001]	-0.744[0.465]	0.700[0.277]	0.410[0.539]	0.826[0.086]	-0.453[0.455]	-1.561[0.016]	-0.804[0.237]	-0.618[0.420]
	(0.34)	(0.32)	(0.45)	(0.46)	(1.02)	(0.64)	(0.67)	(0.48)	(0.61)	(0.65)	(0.68)	(0.77)
Reform	-1.471[0.000]	-1.354[0.000]	-0.861[0.000]	-0.949[0.000]	-0.917[0.000]	-0.872[0.000]	-0.636[0.000]	-0.379[0.001]	-0.319[0.005]	-0.162[0.182]	-0.226[0.098]	-0.286[0.053]
	(0.08)	(0.07)	(0.10)	(0.09)	(0.15)	(0.12)	(0.11)	(0.11)	(0.11)	(0.12)	(0.14)	(0.15)
NY	0.692[0.000]	0.482[0.000]	0.798[0.000]	0.364[0.051]	1.035[0.000]	0.850[0.001]	0.686[0.001]	0.793[0.000]	1.566[0.000]	1.588[0.000]	1.219[0.000]	0.626[0.040]
	(0.13)	(0.11)	(0.17)	(0.19)	(0.29)	(0.25)	(0.22)	(0.20)	(0.22)	(0.22)	(0.26)	(0.31)
Reform*NY	0.625[0.000]	0.170[0.357]	0.920[0.000]	0.199[0.441]	-0.208[0.513]	0.142[0.596]	-0.199[0.419]	-0.277[0.240]	-0.634[0.056]	-0.718[0.040]	-0.346[0.389]	-0.039[0.935]
	(0.17)	(0.19)	(0.21)	(0.26)	(0.32)	(0.27)	(0.25)	(0.24)	(0.33)	(0.35)	(0.40)	(0.48)
Urban	0.263[0.000]	-0.007[0.907]	0.300[0.001]	-0.240[0.010]	0.081[0.496]	0.220[0.041]	-0.301[0.002]	-0.250[0.006]	0.422[0.000]	0.369[0.000]	0.345[0.004]	0.195[0.109]
	(0.06)	(0.06)	(0.09)	(0.09)	(0.12)	(0.11)	(0.10)	(0.09)	(0.10)	(0.11)	(0.12)	(0.12)
Percent_HW	2.097[0.000]	-0.455[0.324]	1.265[0.068]	-1.213[0.105]	4.211[0.000]	2.852[0.000]	2.563[0.000]	1.314[0.031]	2.146[0.044]	3.081[0.005]	2.687[0.011]	2.755[0.015]
	(0.47)	(0.46)	(0.69)	(0.75)	(0.82)	(0.75)	(0.65)	(0.61)	(1.07)	(1.09)	(1.06)	(1.13)
LogADT	-0.226[0.000]	-0.191[0.000]	-0.205[0.000]	-0.183[0.000]	-0.134[0.000]	-0.139[0.000]	-0.042[0.092]	-0.078[0.000]	-0.292[0.000]	-0.289[0.000]	-0.287[0.000]	-0.289[0.000]
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LogLength	-0.556[0.000]	-0.566[0.000]	-0.442[0.000]	-0.474[0.000]	-0.528[0.000]	-0.597[0.000]	-0.605[0.000]	-0.521[0.000]	-0.369[0.000]	-0.319[0.001]	-0.392[0.000]	-0.482[0.000]
	(0.05)	(0.05)	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(0.09)	(0.10)	(0.11)	(0.12)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.207	0.195	0.147	0.173	0.100	0.116	0.089	0.102	0.233	0.227	0.225	0.251
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 9A - Placebo Regressions, NBI-1992
IV: *NY* (effects of *Reform* on bridges built in New York vs. elsewhere)

Panel 3: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive)

Data Permutation:	Main Model	Main Model	Robustness, 5-Year Window		Placebo Regressions, 5-Year Window before and after							
"Reform" Year:	1956	1960	1956	1960	1949	1950	1951	1952	1964	1965	1966	1967
(Intercept)	2.480[0.000]	2.730[0.000]	2.376[0.000]	3.540[0.000]	0.194[0.650]	0.095[0.814]	0.566[0.109]	1.238[0.000]	3.160[0.000]	3.489[0.000]	3.607[0.000]	4.129[0.000]
	(0.15)	(0.16)	(0.25)	(0.23)	(0.43)	(0.40)	(0.35)	(0.30)	(0.24)	(0.23)	(0.23)	(0.23)
Reform	-0.797[0.000]	-0.868[0.000]	-0.458[0.000]	-0.710[0.000]	0.424[0.000]	0.366[0.000]	0.355[0.000]	0.245[0.000]	-0.436[0.000]	-0.415[0.000]	-0.438[0.000]	-0.499[0.000]
	(0.04)	(0.03)	(0.05)	(0.03)	(0.10)	(0.08)	(0.07)	(0.07)	(0.03)	(0.03)	(0.03)	(0.04)
NY	0.218[0.012]	0.107[0.121]	0.038[0.703]	-0.186[0.066]	-0.324[0.201]	-0.438[0.027]	-0.400[0.022]	-0.205[0.192]	0.098[0.270]	0.193[0.032]	0.335[0.000]	0.477[0.000]
	(0.09)	(0.07)	(0.10)	(0.10)	(0.25)	(0.20)	(0.18)	(0.16)	(0.09)	(0.09)	(0.09)	(0.10)
Reform*NY	0.296[0.002]	0.428[0.000]	-0.333[0.010]	0.507[0.000]	0.251[0.345]	0.424[0.047]	0.471[0.014]	0.193[0.273]	0.315[0.010]	0.195[0.109]	0.033[0.791]	-0.337[0.011]
	(0.10)	(0.09)	(0.13)	(0.13)	(0.27)	(0.21)	(0.19)	(0.18)	(0.12)	(0.12)	(0.12)	(0.13)
Urban	0.603[0.000]	0.581[0.000]	0.285[0.000]	0.615[0.000]	-0.298[0.000]	-0.275[0.000]	-0.083[0.168]	-0.038[0.470]	0.805[0.000]	0.838[0.000]	0.804[0.000]	0.846[0.000]
	(0.02)	(0.02)	(0.04)	(0.03)	(0.08)	(0.07)	(0.06)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	0.773[0.000]	-0.633[0.000]	-1.585[0.000]	-2.943[0.000]	-1.782[0.003]	-1.859[0.000]	-1.747[0.000]	-1.587[0.000]	-2.557[0.000]	-2.542[0.000]	-2.811[0.000]	-3.186[0.000]
	(0.17)	(0.18)	(0.29)	(0.28)	(0.60)	(0.50)	(0.47)	(0.42)	(0.28)	(0.30)	(0.31)	(0.32)
LogADT	-0.044[0.000]	-0.054[0.000]	0.026[0.005]	-0.072[0.000]	0.225[0.000]	0.247[0.000]	0.184[0.000]	0.146[0.000]	-0.128[0.000]	-0.134[0.000]	-0.144[0.000]	-0.140[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.668[0.000]	-0.652[0.000]	-0.586[0.000]	-0.712[0.000]	-0.409[0.000]	-0.444[0.000]	-0.429[0.000]	-0.473[0.000]	-0.687[0.000]	-0.736[0.000]	-0.752[0.000]	-0.818[0.000]
	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.078	0.090	0.058	0.087	0.076	0.084	0.065	0.057	0.086	0.091	0.096	0.107
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

Panel 4: DV "UnderRecord"

Data Permutation:	Main Model	Main Model	Robustness, 5-Year Window		Placebo Regressions, 5-Year Window before and after							
"Reform" Year:	1956	1960	1956	1960	1949	1950	1951	1952	1964	1965	1966	1967
(Intercept)	-4.729[0.000]	-4.705[0.000]	-4.658[0.000]	-4.242[0.000]	-5.223[0.000]	-5.711[0.000]	-5.620[0.000]	-5.166[0.000]	-4.043[0.000]	-4.000[0.000]	-3.966[0.000]	-3.896[0.000]
	(0.09)	(0.09)	(0.16)	(0.14)	(0.26)	(0.24)	(0.23)	(0.20)	(0.14)	(0.13)	(0.13)	(0.13)
Reform	0.605[0.000]	0.369[0.000]	0.370[0.000]	0.152[0.000]	0.446[0.000]	0.363[0.000]	0.438[0.000]	0.563[0.000]	0.039[0.024]	0.023[0.193]	0.016[0.383]	-0.006[0.745]
	(0.02)	(0.01)	(0.03)	(0.02)	(0.05)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
NY	0.961[0.000]	0.727[0.000]	0.892[0.000]	0.436[0.000]	0.734[0.000]	0.717[0.000]	0.679[0.000]	0.735[0.000]	0.330[0.000]	0.362[0.000]	0.321[0.000]	0.309[0.000]
	(0.05)	(0.04)	(0.06)	(0.06)	(0.15)	(0.12)	(0.11)	(0.10)	(0.06)	(0.06)	(0.06)	(0.06)
Reform*NY	-0.678[0.000]	-0.377[0.000]	-0.622[0.000]	-0.141[0.070]	0.096[0.528]	0.082[0.515]	0.002[0.986]	-0.263[0.014]	-0.108[0.161]	-0.074[0.329]	-0.021[0.781]	0.030[0.702]
	(0.06)	(0.05)	(0.08)	(0.08)	(0.15)	(0.13)	(0.12)	(0.11)	(0.08)	(0.08)	(0.08)	(0.08)
Urban	0.426[0.000]	0.440[0.000]	0.428[0.000]	0.321[0.000]	0.988[0.000]	0.806[0.000]	0.791[0.000]	0.648[0.000]	0.385[0.000]	0.372[0.000]	0.355[0.000]	0.359[0.000]
	(0.02)	(0.02)	(0.03)	(0.02)	(0.06)	(0.05)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
Percent_HW	0.864[0.000]	1.570[0.000]	0.464[0.007]	0.635[0.000]	0.675[0.064]	1.273[0.000]	0.840[0.003]	0.216[0.365]	0.861[0.000]	1.133[0.000]	1.128[0.000]	1.211[0.000]
	(0.10)	(0.10)	(0.17)	(0.15)	(0.37)	(0.31)	(0.29)	(0.24)	(0.15)	(0.16)	(0.16)	(0.17)
LogADT	0.225[0.000]	0.232[0.000]	0.284[0.000]	0.240[0.000]	0.359[0.000]	0.383[0.000]	0.365[0.000]	0.339[0.000]	0.191[0.000]	0.183[0.000]	0.184[0.000]	0.182[0.000]
	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.364[0.000]	0.366[0.000]	0.327[0.000]	0.374[0.000]	0.129[0.000]	0.199[0.000]	0.234[0.000]	0.249[0.000]	0.404[0.000]	0.402[0.000]	0.389[0.000]	0.375[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.238	0.238	0.256	0.224	0.323	0.321	0.319	0.297	0.209	0.201	0.201	0.198
N	316,434	314,391	116,319	141,281	58,943	76,313	82,532	91,775	144,631	139,841	139,056	134,829

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 9B - Placebo Regressions, NBI-1992
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 1: DV "Low" (Inventory Route Minimum Vertical Clearance of 12'-14', exclusive)

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	1.640[0.000]	2.281[0.000]	1.440[0.001]	2.520[0.000]	-0.546[0.587]	1.097[0.084]	1.404[0.049]	2.464[0.000]	0.246[0.681]	-0.779[0.216]	-0.209[0.756]	-0.349[0.642]
	(0.33)	(0.32)	(0.45)	(0.47)	(1.00)	(0.64)	(0.72)	(0.50)	(0.60)	(0.63)	(0.67)	(0.75)
Reform	-1.169[0.000]	-1.153[0.000]	-0.435[0.000]	-0.683[0.000]	-0.616[0.000]	-0.597[0.000]	-0.739[0.000]	-0.501[0.000]	-0.492[0.000]	-0.388[0.001]	-0.383[0.003]	-0.350[0.013]
	(0.07)	(0.07)	(0.10)	(0.10)	(0.14)	(0.12)	(0.12)	(0.12)	(0.11)	(0.11)	(0.13)	(0.14)
NE	2.100[0.000]	2.203[0.000]	2.422[0.000]	2.548[0.000]	1.922[0.000]	1.803[0.000]	1.477[0.000]	0.271[0.363]	-0.214[0.581]	-0.692[0.088]	-1.022[0.049]	-0.835[0.078]
	(0.16)	(0.11)	(0.21)	(0.16)	(0.29)	(0.22)	(0.21)	(0.30)	(0.39)	(0.41)	(0.52)	(0.47)
Reform*NE	-2.513[0.000]	-2.748[0.000]	-2.559[0.000]	-3.382[0.000]	0.093[0.786]	0.413[0.163]	1.366[0.000]	2.493[0.000]	-0.420[0.530]	0.125[0.855]	0.515[0.525]	0.068[0.938]
	(0.29)	(0.35)	(0.41)	(0.52)	(0.34)	(0.30)	(0.25)	(0.33)	(0.67)	(0.68)	(0.81)	(0.88)
Urban	0.319[0.000]	0.037[0.546]	0.346[0.000]	-0.210[0.022]	0.138[0.244]	0.293[0.007]	-0.095[0.326]	-0.154[0.089]	0.475[0.000]	0.425[0.000]	0.394[0.001]	0.223[0.068]
	(0.06)	(0.06)	(0.09)	(0.09)	(0.12)	(0.11)	(0.10)	(0.09)	(0.10)	(0.10)	(0.12)	(0.12)
Percent_HW	0.412[0.354]	-2.705[0.000]	-2.326[0.001]	-5.099[0.000]	1.073[0.168]	0.548[0.458]	-0.027[0.971]	-4.099[0.000]	-1.002[0.314]	-0.368[0.722]	0.283[0.788]	1.689[0.117]
	(0.44)	(0.41)	(0.72)	(0.76)	(0.78)	(0.74)	(0.75)	(0.65)	(1.00)	(1.03)	(1.06)	(1.08)
LogADT	-0.225[0.000]	-0.216[0.000]	-0.198[0.000]	-0.227[0.000]	-0.140[0.000]	-0.156[0.000]	-0.115[0.000]	-0.142[0.000]	-0.291[0.000]	-0.292[0.000]	-0.290[0.000]	-0.294[0.000]
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
LogLength	-0.549[0.000]	-0.576[0.000]	-0.417[0.000]	-0.471[0.000]	-0.484[0.000]	-0.596[0.000]	-0.642[0.000]	-0.540[0.000]	-0.341[0.000]	-0.281[0.004]	-0.374[0.001]	-0.470[0.000]
	(0.05)	(0.05)	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(0.09)	(0.10)	(0.11)	(0.12)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.215	0.225	0.157	0.215	0.141	0.155	0.189	0.177	0.222	0.217	0.221	0.251
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive)

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	2.617[0.000]	2.827[0.000]	2.385[0.000]	3.586[0.000]	0.247[0.563]	0.034[0.933]	0.367[0.294]	0.931[0.002]	3.248[0.000]	3.604[0.000]	3.774[0.000]	4.310[0.000]
	(0.15)	(0.16)	(0.25)	(0.22)	(0.43)	(0.40)	(0.35)	(0.30)	(0.24)	(0.23)	(0.23)	(0.23)
Reform	-0.794[0.000]	-0.858[0.000]	-0.528[0.000]	-0.669[0.000]	0.320[0.001]	0.365[0.000]	0.439[0.000]	0.299[0.000]	-0.433[0.000]	-0.433[0.000]	-0.464[0.000]	-0.544[0.000]
	(0.03)	(0.02)	(0.04)	(0.03)	(0.09)	(0.07)	(0.07)	(0.06)	(0.03)	(0.03)	(0.03)	(0.04)
NE	-0.338[0.010]	-0.119[0.116]	-0.618[0.000]	0.210[0.028]	-1.393[0.000]	-0.618[0.007]	-0.274[0.194]	0.586[0.016]	-0.070[0.480]	-0.268[0.004]	-0.103[0.269]	0.044[0.630]
	(0.13)	(0.08)	(0.16)	(0.10)	(0.30)	(0.23)	(0.21)	(0.24)	(0.10)	(0.09)	(0.09)	(0.09)
Reform*NE	0.307[0.031]	0.015[0.882]	0.673[0.000]	-0.308[0.015]	0.753[0.027]	0.003[0.991]	-0.706[0.003]	-1.270[0.000]	0.035[0.818]	0.246[0.121]	-0.085[0.630]	-0.202[0.242]
	(0.14)	(0.10)	(0.19)	(0.13)	(0.34)	(0.28)	(0.24)	(0.27)	(0.15)	(0.16)	(0.18)	(0.17)
Urban	0.606[0.000]	0.586[0.000]	0.283[0.000]	0.618[0.000]	-0.321[0.000]	-0.285[0.000]	-0.122[0.043]	-0.043[0.404]	0.807[0.000]	0.842[0.000]	0.807[0.000]	0.847[0.000]
	(0.02)	(0.02)	(0.04)	(0.03)	(0.08)	(0.07)	(0.06)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	0.210[0.184]	-1.080[0.000]	-1.347[0.000]	-3.238[0.000]	-1.312[0.009]	-1.618[0.000]	-1.316[0.002]	-0.535[0.180]	-2.921[0.000]	-2.968[0.000]	-3.414[0.000]	-3.814[0.000]
	(0.16)	(0.17)	(0.28)	(0.26)	(0.51)	(0.44)	(0.42)	(0.40)	(0.26)	(0.27)	(0.28)	(0.30)
LogADT	-0.044[0.000]	-0.054[0.000]	0.025[0.006]	-0.074[0.000]	0.232[0.000]	0.251[0.000]	0.199[0.000]	0.156[0.000]	-0.129[0.000]	-0.135[0.000]	-0.146[0.000]	-0.142[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.666[0.000]	-0.649[0.000]	-0.587[0.000]	-0.709[0.000]	-0.430[0.000]	-0.448[0.000]	-0.435[0.000]	-0.480[0.000]	-0.685[0.000]	-0.734[0.000]	-0.750[0.000]	-0.814[0.000]
	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.076	0.088	0.059	0.087	0.084	0.087	0.073	0.062	0.085	0.091	0.095	0.106
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 9B - Placebo Regressions, NBI-1992
IV: *NE* (effects of *Reform* on bridges built in New England vs. elsewhere)

Panel 3: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive)

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	-4.760[0.000]	-4.959[0.000]	-5.180[0.000]	-5.775[0.000]	-3.765[0.000]	-4.114[0.000]	-4.432[0.000]	-5.271[0.000]	-5.037[0.000]	-4.910[0.000]	-4.967[0.000]	-4.886[0.000]
	(0.17)	(0.18)	(0.35)	(0.29)	(0.65)	(0.59)	(0.58)	(0.55)	(0.27)	(0.25)	(0.25)	(0.24)
Reform	1.210[0.000]	1.002[0.000]	0.800[0.000]	0.722[0.000]	0.160[0.230]	0.145[0.147]	0.133[0.155]	0.206[0.017]	0.355[0.000]	0.317[0.000]	0.344[0.000]	0.402[0.000]
	(0.04)	(0.03)	(0.05)	(0.03)	(0.13)	(0.10)	(0.09)	(0.09)	(0.03)	(0.03)	(0.03)	(0.03)
NE	-0.801[0.000]	-0.889[0.000]	-0.413[0.113]	-1.069[0.000]	-0.604[0.257]	-1.370[0.009]	-1.325[0.005]	-1.363[0.010]	0.239[0.021]	0.313[0.001]	0.117[0.217]	0.018[0.847]
	(0.22)	(0.11)	(0.26)	(0.13)	(0.53)	(0.52)	(0.47)	(0.53)	(0.10)	(0.10)	(0.10)	(0.09)
Reform*NE	0.813[0.000]	0.942[0.000]	0.439[0.120]	1.214[0.000]	0.313[0.602]	1.078[0.065]	0.731[0.147]	0.656[0.232]	-0.184[0.234]	-0.283[0.073]	-0.147[0.389]	-0.145[0.389]
	(0.23)	(0.13)	(0.28)	(0.16)	(0.60)	(0.58)	(0.51)	(0.55)	(0.16)	(0.16)	(0.17)	(0.17)
Urban	-0.893[0.000]	-0.861[0.000]	-0.703[0.000]	-0.910[0.000]	-0.063[0.587]	-0.199[0.031]	-0.142[0.088]	-0.252[0.000]	-1.063[0.000]	-1.076[0.000]	-1.038[0.000]	-1.005[0.000]
	(0.02)	(0.02)	(0.04)	(0.03)	(0.12)	(0.09)	(0.08)	(0.07)	(0.03)	(0.03)	(0.03)	(0.03)
Percent_HW	0.363[0.030]	2.086[0.000]	1.610[0.000]	3.602[0.000]	0.330[0.633]	1.189[0.031]	1.156[0.030]	2.438[0.000]	3.184[0.000]	3.132[0.000]	3.280[0.000]	3.504[0.000]
	(0.17)	(0.18)	(0.31)	(0.28)	(0.69)	(0.55)	(0.53)	(0.51)	(0.26)	(0.27)	(0.28)	(0.28)
LogADT	0.220[0.000]	0.233[0.000]	0.197[0.000]	0.269[0.000]	0.038[0.195]	0.049[0.039]	0.047[0.033]	0.085[0.000]	0.316[0.000]	0.312[0.000]	0.308[0.000]	0.287[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.186[0.000]	0.181[0.000]	0.246[0.000]	0.224[0.000]	0.250[0.000]	0.280[0.000]	0.305[0.000]	0.330[0.000]	0.104[0.000]	0.126[0.000]	0.124[0.000]	0.103[0.000]
	(0.02)	(0.02)	(0.03)	(0.03)	(0.06)	(0.05)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.082	0.092	0.072	0.092	0.037	0.035	0.031	0.039	0.086	0.086	0.083	0.077
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

Panel 4: DV "Super" (Inventory Route Minimum Vertical Clearance of 18'-98.5' [maximum reportable])

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	-2.835[0.000]	-3.001[0.000]	-3.358[0.000]	-3.674[0.000]	-2.899[0.000]	-2.901[0.000]	-2.942[0.000]	-3.409[0.000]	-2.703[0.000]	-2.874[0.000]	-2.743[0.000]	-3.099[0.000]
	(0.16)	(0.16)	(0.29)	(0.24)	(0.51)	(0.48)	(0.43)	(0.38)	(0.23)	(0.22)	(0.21)	(0.22)
Reform	0.342[0.000]	0.368[0.000]	0.160[0.009]	0.274[0.000]	-0.133[0.330]	-0.232[0.028]	-0.296[0.003]	-0.352[0.000]	0.251[0.000]	0.270[0.000]	0.234[0.000]	0.233[0.000]
	(0.05)	(0.03)	(0.06)	(0.04)	(0.14)	(0.11)	(0.10)	(0.10)	(0.04)	(0.04)	(0.04)	(0.04)
NE	-1.252[0.000]	-0.615[0.000]	-1.635[0.000]	-0.578[0.000]	-0.044[0.924]	-0.678[0.117]	-0.998[0.033]	-0.688[0.092]	-0.214[0.104]	-0.012[0.918]	0.024[0.827]	-0.057[0.607]
	(0.28)	(0.13)	(0.43)	(0.14)	(0.47)	(0.43)	(0.47)	(0.41)	(0.13)	(0.12)	(0.11)	(0.11)
Reform*NE	1.299[0.000]	0.686[0.000]	1.468[0.001]	0.542[0.002]	-1.637[0.015]	-1.073[0.082]	-0.630[0.273]	-0.004[0.994]	0.088[0.627]	-0.098[0.583]	0.131[0.470]	0.329[0.062]
	(0.29)	(0.15)	(0.45)	(0.18)	(0.68)	(0.62)	(0.58)	(0.44)	(0.18)	(0.18)	(0.18)	(0.18)
Urban	0.172[0.000]	0.193[0.000]	0.267[0.000]	0.224[0.000]	0.457[0.000]	0.430[0.000]	0.375[0.000]	0.380[0.000]	0.163[0.000]	0.159[0.000]	0.190[0.000]	0.143[0.000]
	(0.03)	(0.03)	(0.05)	(0.04)	(0.12)	(0.10)	(0.09)	(0.08)	(0.04)	(0.04)	(0.04)	(0.04)
Percent_HW	-1.000[0.000]	-0.342[0.126]	0.908[0.027]	1.522[0.000]	1.436[0.058]	1.207[0.063]	0.894[0.169]	1.275[0.048]	0.113[0.732]	0.263[0.440]	0.372[0.271]	0.202[0.557]
	(0.21)	(0.22)	(0.41)	(0.36)	(0.76)	(0.65)	(0.65)	(0.65)	(0.33)	(0.34)	(0.34)	(0.34)
LogADT	-0.119[0.000]	-0.114[0.000]	-0.164[0.000]	-0.120[0.000]	-0.262[0.000]	-0.279[0.000]	-0.243[0.000]	-0.206[0.000]	-0.109[0.000]	-0.104[0.000]	-0.094[0.000]	-0.089[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.778[0.000]	0.770[0.000]	0.814[0.000]	0.847[0.000]	0.769[0.000]	0.831[0.000]	0.795[0.000]	0.803[0.000]	0.764[0.000]	0.771[0.000]	0.738[0.000]	0.827[0.000]
	(0.02)	(0.02)	(0.04)	(0.03)	(0.06)	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No	No	No	No	No	No	No
McFadden R-sq.	0.082	0.084	0.090	0.087	0.134	0.146	0.129	0.111	0.081	0.076	0.075	0.086
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 9C - Placebo Regressions, NBI-1992
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 1: DV "Mini" (Inventory Route Minimum Vertical Clearance < 12'), Reform 1956

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	0.812[0.527]	0.165[0.903]	0.155[0.963]	-50.763[0.000]	1.445[0.487]	0.207[0.925]	-0.624[0.817]	2.318[0.269]	-14.208[]	-14.782[]	-33.827[]	-50.882[]
	(1.29)	(1.35)	(3.32)	(11.49)	(2.08)	(2.20)	(2.70)	(2.10)				
Reform	-1.058[0.001]	-0.944[0.000]	-0.897[0.087]	-1.169[0.007]	-0.203[0.717]	-0.625[0.167]	-0.869[0.092]	-0.912[0.064]	-0.503[0.274]	0.030[0.952]	1.121[0.048]	1.991[0.007]
	(0.32)	(0.25)	(0.53)	(0.43)	(0.56)	(0.45)	-0.516	-0.492	-0.46	-0.487	-0.568	-0.737
Urban	0.754[0.011]	0.534[0.020]	0.383[0.444]	0.248[0.455]	0.834[0.151]	0.683[0.108]	0.599[0.187]	0.451[0.296]	-0.109[0.824]	0.431[0.409]	0.827[0.205]	0.875[0.213]
	(0.30)	(0.23)	(0.50)	(0.33)	(0.58)	(0.43)	(0.45)	(0.43)	(0.49)	(0.52)	(0.65)	(0.70)
Reform*Urban	-0.977[0.009]	-0.964[0.006]	-0.481[0.434]	-0.289[0.633]	-1.314[0.049]	-0.609[0.272]	-0.649[0.275]	-0.006[0.992]	-0.369[0.597]	-0.506[0.402]	-0.878[0.188]	-0.846[0.244]
	(0.37)	(0.35)	(0.62)	(0.61)	(0.67)	(0.55)	-0.595	-0.581	-0.697	-0.604	-0.668	-0.726
Percent_HW	-1.015[0.549]	-5.519[0.001]	1.315[0.666]	5.678[0.310]	1.190[0.738]	5.564[0.072]	9.895[0.001]	1.985[0.521]	-2.456[0.653]	-5.904[0.386]	-2.216[0.761]	7.867[0.361]
	(1.69)	(1.66)	(3.04)	(5.59)	(3.55)	(3.09)	(2.91)	(3.09)	(5.47)	(6.81)	(7.28)	(8.61)
LogADT	-0.262[0.000]	-0.234[0.000]	-0.248[0.000]	-0.321[0.000]	-0.297[0.000]	-0.282[0.000]	-0.365[0.000]	-0.309[0.000]	-0.217[0.001]	-0.301[0.000]	-0.334[0.000]	-0.363[0.000]
	(0.03)	(0.03)	(0.06)	(0.06)	(0.07)	(0.06)	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)	(0.08)
LogLength	-0.625[0.000]	-0.595[0.000]	-0.514[0.041]	-0.154[0.582]	-0.095[0.638]	-0.468[0.027]	-0.354[0.111]	-0.489[0.014]	-0.660[0.059]	-0.852[0.014]	-0.762[0.068]	-0.707[0.098]
	(0.16)	(0.15)	(0.25)	(0.28)	(0.20)	(0.21)	(0.22)	(0.20)	(0.35)	(0.35)	(0.42)	(0.43)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.340	0.335	0.320	0.367	0.358	0.342	0.359	0.346	0.384	0.382	0.427	0.415
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

Panel 2: DV "Mid" (Inventory Route Minimum Vertical Clearance of 14'-16', exclusive), Reform 1956

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	1.127[0.000]	1.347[0.000]	1.404[0.001]	1.302[0.001]	1.407[0.064]	1.258[0.038]	2.300[0.000]	2.585[0.000]	0.902[0.017]	1.312[0.001]	1.372[0.000]	1.916[0.000]
	(0.24)	(0.24)	(0.43)	(0.38)	(0.76)	(0.61)	(0.62)	(0.55)	(0.38)	(0.39)	(0.38)	(0.38)
Reform	-1.011[0.000]	-0.894[0.000]	-0.771[0.000]	-0.834[0.000]	0.341[0.025]	0.249[0.041]	0.142[0.225]	-0.050[0.647]	-0.221[0.000]	-0.185[0.000]	-0.214[0.000]	-0.228[0.000]
	(0.06)	(0.04)	(0.07)	(0.05)	(0.15)	(0.12)	-0.117	-0.11	-0.049	-0.052	-0.056	-0.061
Urban	0.028[0.673]	0.288[0.000]	-0.122[0.109]	0.347[0.000]	-0.345[0.048]	-0.370[0.005]	-0.332[0.006]	-0.424[0.000]	0.864[0.000]	0.952[0.000]	0.947[0.000]	0.968[0.000]
	(0.07)	(0.04)	(0.08)	(0.05)	(0.17)	(0.13)	(0.12)	(0.12)	(0.04)	(0.04)	(0.04)	(0.04)
Reform*Urban	0.589[0.000]	0.369[0.000]	0.458[0.000]	0.424[0.000]	0.015[0.936]	0.074[0.606]	0.291[0.029]	0.428[0.001]	-0.152[0.009]	-0.247[0.000]	-0.332[0.000]	-0.360[0.000]
	(0.07)	(0.05)	(0.09)	(0.06)	(0.18)	(0.14)	-0.133	-0.125	-0.058	-0.059	-0.06	-0.062
Percent_HW	4.360[0.000]	2.293[0.000]	0.486[0.309]	-0.010[0.984]	-0.012[0.989]	-0.729[0.318]	-1.504[0.025]	-1.782[0.008]	-0.471[0.385]	-0.879[0.139]	-1.598[0.012]	-0.728[0.276]
	(0.24)	(0.25)	(0.48)	(0.53)	(0.87)	(0.73)	(0.67)	(0.68)	(0.54)	(0.59)	(0.63)	(0.67)
LogADT	-0.054[0.000]	-0.057[0.000]	0.034[0.001]	-0.062[0.000]	0.208[0.000]	0.236[0.000]	0.185[0.000]	0.153[0.000]	-0.122[0.000]	-0.134[0.000]	-0.138[0.000]	-0.138[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.741[0.000]	-0.725[0.000]	-0.617[0.000]	-0.793[0.000]	-0.443[0.000]	-0.457[0.000]	-0.436[0.000]	-0.479[0.000]	-0.792[0.000]	-0.833[0.000]	-0.878[0.000]	-0.937[0.000]
	(0.02)	(0.02)	(0.04)	(0.03)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.136	0.140	0.102	0.137	0.113	0.126	0.108	0.102	0.146	0.155	0.167	0.180
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 9C - Placebo Regressions, NBI-1992
IV: *Urban* (effects of *Reform* on bridges built in Urban vs. Rural areas)

Panel 3: DV "High" (Inventory Route Minimum Vertical Clearance of 16'-18', exclusive), Reform 1956

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	-2.412[0.000]	-2.445[0.000]	-4.134[0.000]	-3.140[0.000]	-3.100[0.002]	-3.451[0.000]	-3.712[0.000]	-5.330[0.000]	-2.233[0.000]	-1.569[0.000]	-1.382[0.000]	-0.972[0.007]
	(0.25)	(0.25)	(0.53)	(0.42)	(1.00)	(0.85)	(0.81)	(0.87)	(0.37)	(0.38)	(0.38)	(0.36)
Reform	1.490[0.000]	1.100[0.000]	1.063[0.000]	0.925[0.000]	0.067[0.760]	0.294[0.084]	0.267[0.109]	0.393[0.008]	0.162[0.000]	0.067[0.170]	0.111[0.035]	0.144[0.013]
	(0.07)	(0.04)	(0.09)	(0.05)	(0.22)	(0.17)	-0.166	-0.148	-0.046	-0.049	-0.053	-0.058
Urban	-0.278[0.001]	-0.544[0.000]	-0.246[0.013]	-0.598[0.000]	-0.163[0.525]	-0.112[0.555]	-0.122[0.497]	-0.004[0.983]	-1.083[0.000]	-1.141[0.000]	-1.095[0.000]	-1.052[0.000]
	(0.08)	(0.05)	(0.10)	(0.06)	(0.26)	(0.19)	(0.18)	(0.17)	(0.05)	(0.04)	(0.04)	(0.04)
Reform*Urban	-0.604[0.000]	-0.352[0.000]	-0.481[0.000]	-0.425[0.000]	0.222[0.409]	0.028[0.892]	0.037[0.846]	-0.191[0.273]	0.117[0.042]	0.196[0.001]	0.189[0.001]	0.198[0.001]
	(0.09)	(0.05)	(0.11)	(0.07)	(0.27)	(0.20)	-0.192	-0.174	-0.057	-0.057	-0.057	-0.058
Percent_HW	-3.368[0.000]	-1.028[0.000]	-0.686[0.250]	-0.943[0.107]	-1.567[0.229]	-1.624[0.122]	-1.637[0.100]	0.930[0.307]	0.082[0.876]	-0.089[0.878]	0.206[0.739]	0.234[0.721]
	(0.25)	(0.26)	(0.60)	(0.59)	(1.30)	(1.05)	(1.00)	(0.91)	(0.52)	(0.58)	(0.62)	(0.66)
LogADT	0.249[0.000]	0.251[0.000]	0.216[0.000]	0.280[0.000]	0.038[0.220]	0.054[0.039]	0.058[0.023]	0.098[0.000]	0.331[0.000]	0.330[0.000]	0.320[0.000]	0.296[0.000]
	(0.01)	(0.01)	(0.02)	(0.01)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.156[0.000]	0.161[0.000]	0.227[0.000]	0.225[0.000]	0.242[0.000]	0.245[0.000]	0.270[0.000]	0.317[0.000]	0.090[0.000]	0.100[0.000]	0.094[0.000]	0.055[0.025]
	(0.02)	(0.02)	(0.03)	(0.03)	(0.06)	(0.05)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.123	0.127	0.119	0.127	0.085	0.088	0.093	0.104	0.123	0.125	0.123	0.119
N	45,331	44,478	15,262	22,506	4,239	5,705	6,725	8,580	24,847	24,679	24,670	23,999

Panel 4: DV "UnderRecord", Reform 1956

Data Permutation:	**Main Model**	**Main Model**	**Robustness, 5-Year Window**		**Placebo Regressions, 5-Year Window before and after**							
"Reform" Year:	**1956**	**1960**	**1956**	**1960**	**1949**	**1950**	**1951**	**1952**	**1964**	**1965**	**1966**	**1967**
(Intercept)	-5.851[0.000]	-5.746[0.000]	-5.167[0.000]	-4.991[0.000]	-6.198[0.000]	-6.253[0.000]	-6.817[0.000]	-6.185[0.000]	-4.588[0.000]	-4.675[0.000]	-4.882[0.000]	-4.691[0.000]
	(0.13)	(0.13)	(0.26)	(0.21)	(0.52)	(0.43)	(0.42)	(0.36)	(0.20)	(0.20)	(0.19)	(0.20)
Reform	0.955[0.000]	0.585[0.000]	0.586[0.000]	0.236[0.000]	0.766[0.000]	0.691[0.000]	0.785[0.000]	0.897[0.000]	0.021[0.419]	-0.034[0.211]	-0.054[0.063]	-0.097[0.002]
	(0.03)	(0.02)	(0.03)	(0.02)	(0.08)	(0.06)	-0.057	-0.051	-0.025	-0.027	-0.029	-0.032
Urban	1.128[0.000]	0.755[0.000]	0.793[0.000]	0.456[0.000]	1.440[0.000]	1.134[0.000]	1.183[0.000]	1.167[0.000]	0.427[0.000]	0.390[0.000]	0.342[0.000]	0.336[0.000]
	(0.04)	(0.02)	(0.04)	(0.03)	(0.10)	(0.08)	(0.07)	(0.07)	(0.03)	(0.03)	(0.03)	(0.03)
Reform*Urban	-0.798[0.000]	-0.461[0.000]	-0.480[0.000]	-0.203[0.000]	-0.574[0.000]	-0.462[0.000]	-0.557[0.000]	-0.702[0.000]	-0.052[0.106]	0.002[0.960]	0.036[0.264]	0.060[0.070]
	(0.04)	(0.03)	(0.05)	(0.04)	(0.10)	(0.08)	-0.074	-0.067	-0.032	-0.032	-0.033	-0.033
Percent_HW	0.995[0.000]	2.059[0.000]	0.976[0.001]	0.453[0.123]	0.217[0.694]	-0.226[0.611]	0.351[0.389]	1.232[0.001]	0.002[0.995]	0.405[0.219]	0.637[0.068]	0.632[0.085]
	(0.13)	(0.14)	(0.29)	(0.29)	(0.55)	(0.45)	(0.41)	(0.36)	(0.30)	(0.33)	(0.35)	(0.37)
LogADT	0.221[0.000]	0.224[0.000]	0.293[0.000]	0.247[0.000]	0.306[0.000]	0.345[0.000]	0.341[0.000]	0.328[0.000]	0.192[0.000]	0.181[0.000]	0.180[0.000]	0.178[0.000]
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	0.397[0.000]	0.403[0.000]	0.365[0.000]	0.407[0.000]	0.234[0.000]	0.271[0.000]	0.300[0.000]	0.293[0.000]	0.433[0.000]	0.429[0.000]	0.415[0.000]	0.400[0.000]
	(0.01)	(0.01)	(0.02)	(0.01)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.263	0.263	0.281	0.248	0.364	0.357	0.350	0.325	0.233	0.226	0.226	0.223
N	316,434	314,391	116,319	141,281	58,943	76,313	82,532	91,775	144,631	139,841	139,056	134,829

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Additional results for all DVs across this IV model are available upon request

Supplement 10A - NBI 1992, Adding Owner as a Control

Panel 1: Effects of Reform 1956 on bridges built in New York vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-3.203[0.080]	1.223[0.041]	2.416[0.000]	-5.272[0.000]	-2.169[0.000]	-4.064[0.000]
	(1.83)	(0.60)	(0.32)	(0.34)	(0.31)	(0.15)
Reform56	-0.823[0.000]	-1.370[0.000]	-0.715[0.000]	1.186[0.000]	0.341[0.000]	0.682[0.000]
	(0.22)	(0.08)	(0.04)	(0.05)	(0.05)	(0.02)
NY	0.788[0.024]	0.792[0.000]	-0.081[0.475]	-0.179[0.250]	-0.251[0.154]	1.147[0.000]
	(0.35)	(0.16)	(0.11)	(0.16)	(0.18)	(0.07)
R56xNY	-0.842[0.202]	0.398[0.056]	0.440[0.000]	-0.217[0.184]	0.025[0.894]	-0.717[0.000]
	(0.66)	(0.21)	(0.12)	(0.16)	(0.19)	-0.08
Urban	-0.074[0.724]	0.204[0.003]	0.672[0.000]	-0.912[0.000]	0.117[0.000]	0.496[0.000]
	(0.21)	(0.07)	(0.02)	(0.03)	(0.03)	(0.02)
Percent_HW	1.258[0.315]	2.265[0.000]	0.322[0.064]	0.010[0.957]	-1.016[0.000]	1.029[0.000]
	(1.25)	(0.51)	(0.17)	(0.18)	(0.25)	(0.10)
LogADT	-0.249[0.000]	-0.230[0.000]	-0.034[0.000]	0.223[0.000]	-0.137[0.000]	0.097[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.443[0.008]	-0.480[0.000]	-0.730[0.000]	0.203[0.000]	0.829[0.000]	0.277[0.000]
	(0.17)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
Owner FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.330	0.228	0.078	0.088	0.086	0.303
N	41,158	41,158	41,158	41,158	41,158	310,803

Panel 2: Effects of Reform 1960 on bridges built in New York vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-3.356[0.063]	1.523[0.012]	2.597[0.000]	-5.441[0.000]	-2.211[0.000]	-3.945[0.000]
	(1.80)	(0.61)	(0.33)	(0.36)	(0.32)	(0.15)
Reform60	-0.662[0.001]	-1.303[0.000]	-0.813[0.000]	1.010[0.000]	0.340[0.000]	0.348[0.000]
	(0.19)	(0.07)	(0.03)	(0.03)	(0.04)	(0.02)
NY	0.975[0.001]	0.577[0.000]	-0.161[0.057]	-0.041[0.704]	-0.146[0.234]	0.826[0.000]
	(0.28)	(0.13)	(0.08)	(0.11)	(0.12)	(0.05)
R60xNY	-2.247[0.029]	-0.156[0.487]	0.552[0.000]	-0.248[0.041]	-0.070[0.619]	-0.306[0.000]
	(1.03)	(0.23)	(0.10)	(0.12)	(0.14)	-0.065
Urban	-0.084[0.683]	-0.052[0.446]	0.650[0.000]	-0.875[0.000]	0.133[0.000]	0.519[0.000]
	(0.21)	(0.07)	(0.02)	(0.03)	(0.03)	(0.02)
Percent_HW	-0.406[0.745]	-0.508[0.306]	-1.058[0.000]	1.707[0.000]	-0.488[0.058]	1.721[0.000]
	(1.25)	(0.50)	(0.19)	(0.19)	(0.26)	(0.10)
LogADT	-0.248[0.000]	-0.200[0.000]	-0.042[0.000]	0.232[0.000]	-0.133[0.000]	0.100[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.391[0.017]	-0.530[0.000]	-0.717[0.000]	0.203[0.000]	0.821[0.000]	0.282[0.000]
	(0.16)	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
Owner FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.328	0.218	0.088	0.096	0.087	0.303
N	40,300	40,300	40,300	40,300	40,300	308,672

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 10B - NBI 1992, Adding Owner as a Control

Panel 1: Effects of Reform 1956 on bridges built in New England vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-3.385[0.071]	1.035[0.096]	2.485[0.000]	-5.303[0.000]	-2.126[0.000]	-4.017[0.000]
	(1.87)	(0.62)	(0.32)	(0.34)	(0.31)	(0.15)
Reform56	-0.875[0.000]	-1.030[0.000]	-0.700[0.000]	1.128[0.000]	0.281[0.000]	0.673[0.000]
	(0.21)	(0.08)	(0.04)	(0.05)	(0.05)	(0.02)
NE	0.369[0.539]	2.424[0.000]	-0.471[0.000]	-0.775[0.000]	-1.057[0.000]	0.041[0.587]
	-0.601	-0.177	-0.132	-0.22	-0.27	-0.076
R56xNE	-1.673[0.165]	-2.739[0.000]	0.279[0.055]	0.746[0.001]	1.359[0.000]	-0.409[0.000]
	-1.205	-0.315	-0.145	-0.23	-0.28	-0.083
Urban	-0.037[0.861]	0.251[0.000]	0.678[0.000]	-0.917[0.000]	0.111[0.000]	0.506[0.000]
	(0.21)	(0.07)	(0.02)	(0.03)	(0.03)	(0.02)
Percent_HW	0.933[0.437]	0.767[0.116]	0.060[0.721]	0.399[0.024]	-0.889[0.000]	0.660[0.000]
	(1.20)	(0.49)	(0.17)	(0.18)	(0.23)	(0.10)
LogADT	-0.244[0.000]	-0.231[0.000]	-0.034[0.000]	0.223[0.000]	-0.136[0.000]	0.102[0.000]
	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.438[0.008]	-0.463[0.000]	-0.732[0.000]	0.203[0.000]	0.826[0.000]	0.275[0.000]
	(0.17)	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
Owner FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.330	0.243	0.077	0.087	0.087	0.302
N	41,158	41,158	41,158	41,158	41,158	310,803

Panel 2: Effects of Reform 1960 on bridges built in New England vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-3.396[0.059]	1.843[0.003]	2.633[0.000]	-5.525[0.000]	-2.256[0.000]	-3.854[0.000]
	(1.80)	(0.63)	(0.33)	(0.36)	(0.32)	(0.15)
Reform60	-0.827[0.000]	-1.099[0.000]	-0.794[0.000]	0.970[0.000]	0.311[0.000]	0.321[0.000]
	(0.18)	(0.07)	(0.03)	(0.03)	(0.04)	(0.02)
NE	-0.106[0.863]	2.467[0.000]	-0.321[0.000]	-0.778[0.000]	-0.362[0.005]	-0.331[0.000]
	-0.612	-0.125	-0.083	-0.118	-0.13	-0.049
R60xNE	-0.581[0.610]	-2.825[0.000]	0.070[0.522]	0.751[0.000]	0.668[0.000]	0.038[0.544]
	-1.138	-0.369	-0.109	-0.138	-0.153	-0.063
Urban	-0.066[0.744]	-0.015[0.824]	0.656[0.000]	-0.881[0.000]	0.128[0.000]	0.530[0.000]
	(0.20)	(0.07)	(0.02)	(0.03)	(0.03)	(0.02)
Percent_HW	-1.174[0.311]	-2.576[0.000]	-1.183[0.000]	2.120[0.000]	-0.236[0.329]	1.229[0.000]
	(1.16)	(0.44)	(0.18)	(0.19)	(0.24)	(0.10)
LogADT	-0.237[0.000]	-0.228[0.000]	-0.042[0.000]	0.234[0.000]	-0.131[0.000]	0.105[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.385[0.018]	-0.507[0.000]	-0.718[0.000]	0.200[0.000]	0.819[0.000]	0.281[0.000]
	(0.16)	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
Owner FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.323	0.253	0.088	0.096	0.088	0.301
N	40,300	40,300	40,300	40,300	40,300	308,672

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 10C - NBI 1992, Adding Owner as a Control

Panel 1: Effects of Reform 1956 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-2.738[0.152]	0.174[0.832]	1.276[0.001]	-2.939[0.000]	-3.444[0.000]	-5.311[0.000]
	(1.91)	(0.82)	(0.39)	(0.41)	(0.38)	(0.19)
Reform56	-0.480[0.153]	-1.042[0.000]	-0.902[0.000]	1.443[0.000]	0.284[0.001]	1.110[0.000]
	(0.34)	(0.12)	(0.06)	(0.07)	(0.09)	(0.03)
Urban	0.780[0.017]	0.491[0.000]	0.164[0.020]	-0.307[0.001]	0.103[0.305]	1.357[0.000]
	(0.33)	(0.12)	(0.07)	(0.09)	(0.10)	(0.04)
R56xUrban	-1.279[0.002]	-0.290[0.041]	0.511[0.000]	-0.607[0.000]	0.020[0.847]	-0.981[0.000]
	-0.414	-0.142	-0.074	-0.092	-0.103	-0.042
Percent_HW	0.405[0.822]	0.529[0.418]	4.154[0.000]	-3.380[0.000]	-1.948[0.000]	1.030[0.000]
	(1.80)	(0.65)	(0.25)	(0.26)	(0.32)	(0.14)
LogADT	-0.255[0.000]	-0.217[0.000]	-0.047[0.000]	0.256[0.000]	-0.140[0.000]	0.108[0.000]
	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.510[0.002]	-0.503[0.000]	-0.812[0.000]	0.163[0.000]	0.899[0.000]	0.338[0.000]
	(0.17)	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Owner FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.387	0.279	0.128	0.128	0.120	0.337
N	41,158	41,158	41,158	41,158	41,158	310,803

Panel 2: Effects of Reform 1960 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-3.428[0.075]	0.372[0.654]	1.490[0.000]	-2.978[0.000]	-3.497[0.000]	-5.018[0.000]
	(1.93)	(0.83)	(0.39)	(0.41)	(0.37)	(0.19)
Reform60	-0.541[0.042]	-1.165[0.000]	-0.848[0.000]	1.071[0.000]	0.282[0.000]	0.608[0.000]
	(0.27)	(0.10)	(0.04)	(0.04)	(0.06)	(0.02)
Urban	0.523[0.038]	0.102[0.253]	0.352[0.000]	-0.572[0.000]	0.164[0.008]	0.873[0.000]
	(0.25)	(0.09)	(0.04)	(0.05)	(0.06)	(0.03)
R60xUrban	-1.320[0.001]	-0.138[0.313]	0.377[0.000]	-0.361[0.000]	-0.046[0.504]	-0.540[0.000]
	-0.41	-0.137	-0.05	-0.055	-0.069	-0.029
Percent_HW	-2.635[0.119]	-1.382[0.044]	2.176[0.000]	-1.021[0.000]	-1.316[0.000]	2.050[0.000]
	(1.69)	(0.69)	(0.26)	(0.28)	(0.35)	(0.15)
LogADT	-0.242[0.000]	-0.210[0.000]	-0.049[0.000]	0.257[0.000]	-0.136[0.000]	0.110[0.000]
	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.453[0.006]	-0.563[0.000]	-0.797[0.000]	0.172[0.000]	0.892[0.000]	0.348[0.000]
	(0.16)	(0.07)	(0.02)	(0.02)	(0.02)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Owner FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.385	0.293	0.132	0.133	0.120	0.337
N	40,300	40,300	40,300	40,300	40,300	308,672

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 11A - NBI 1992, Interstate Highway Routes Only

Panel 1: Effects of Reform 1956 on bridges built in New York vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-41.841[0.508]	-1.193[0.378]	1.132[0.005]	-1.412[0.000]	-3.736[0.000]	-6.577[0.000]
	(63.14)	(1.35)	(0.40)	(0.33)	(0.37)	(0.23)
Reform56	16.708[0.000]	-3.298[0.000]	-1.901[0.000]	1.862[0.000]	0.981[0.000]	-0.009[0.810]
	(0.64)	(0.23)	(0.07)	(0.08)	(0.11)	(0.04)
NY	-1.706[0.005]	0.367[0.237]	0.512[0.001]	-0.669[0.001]	0.080[0.688]	0.863[0.000]
	(0.61)	(0.31)	(0.15)	(0.20)	(0.20)	(0.09)
R56xNY	-16.513[0.000]	2.865[0.000]	0.270[0.114]	-0.053[0.802]	-0.290[0.192]	-0.710[0.000]
	(0.78)	(0.40)	(0.17)	(0.21)	(0.22)	(0.11)
Urban	-1.630[0.316]	0.102[0.532]	0.865[0.000]	-0.915[0.000]	0.372[0.000]	-0.592[0.000]
	(1.62)	(0.16)	(0.04)	(0.04)	(0.05)	(0.03)
Percent_HW	-6.985[0.204]	3.817[0.007]	2.064[0.000]	-0.652[0.017]	-1.892[0.000]	0.768[0.000]
	(5.50)	(1.42)	(0.31)	(0.27)	(0.38)	(0.16)
LogADT	-0.046[0.780]	-0.160[0.001]	0.068[0.000]	-0.047[0.000]	0.013[0.406]	0.373[0.000]
	(0.16)	(0.05)	(0.02)	(0.01)	(0.02)	(0.02)
LogLength	0.520[0.161]	-0.151[0.313]	-0.476[0.000]	-0.041[0.170]	0.610[0.000]	0.365[0.000]
	(0.37)	(0.15)	(0.04)	(0.03)	(0.04)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.171	0.258	0.137	0.105	0.081	0.147
N	17,104	17,104	17,104	17,104	17,104	58,441

Panel 2: Effects of Reform 1960 on bridges built in New York vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-25.483[0.443]	0.521[0.699]	2.504[0.000]	-1.960[0.000]	-3.947[0.000]	-6.160[0.000]
	(33.18)	(1.35)	(0.42)	(0.34)	(0.37)	(0.23)
Reform60	0.032[0.977]	-3.389[0.000]	-1.963[0.000]	1.484[0.000]	0.829[0.000]	-0.154[0.000]
	(1.11)	(0.26)	(0.05)	(0.04)	(0.06)	(0.03)
NY	-18.182[0.000]	-0.595[0.028]	0.259[0.028]	-0.513[0.000]	-0.032[0.835]	0.589[0.000]
	(0.85)	(0.27)	(0.12)	(0.14)	(0.15)	(0.07)
R60xNY	-0.088[0.883]	2.958[0.000]	0.161[0.295]	0.132[0.427]	-0.007[0.969]	-0.642[0.000]
	(0.60)	(0.45)	(0.15)	(0.17)	(0.19)	(0.10)
Urban	-1.654[0.305]	-0.738[0.000]	0.901[0.000]	-0.884[0.000]	0.410[0.000]	-0.557[0.000]
	(1.61)	(0.16)	(0.04)	(0.04)	(0.05)	(0.03)
Percent_HW	-7.258[0.271]	-1.337[0.125]	-2.413[0.000]	2.167[0.000]	-0.638[0.111]	0.408[0.014]
	(6.59)	(0.87)	(0.35)	(0.30)	(0.40)	(0.17)
LogADT	-0.066[0.659]	-0.015[0.827]	0.001[0.933]	-0.015[0.250]	0.026[0.112]	0.351[0.000]
	(0.15)	(0.07)	(0.02)	(0.01)	(0.02)	(0.02)
LogLength	0.610[0.041]	-0.552[0.000]	-0.432[0.000]	-0.042[0.169]	0.593[0.000]	0.363[0.000]
	(0.30)	(0.16)	(0.04)	(0.03)	(0.04)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.165	0.250	0.196	0.129	0.090	0.146
N	16,837	16,837	16,837	16,837	16,837	57,124

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 11B - NBI 1992, Interstate Highway Routes Only

Panel 1: Effects of Reform 1956 on bridges built in New England vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-43.001[0.212]	-2.946[0.030]	1.599[0.000]	-1.574[0.000]	-3.677[0.000]	-6.372[0.000]
	(34.48)	(1.36)	(0.41)	(0.33)	(0.36)	(0.23)
Reform56	17.258[0.000]	-1.469[0.000]	-2.091[0.000]	1.847[0.000]	0.868[0.000]	-0.123[0.001]
	(0.57)	(0.27)	(0.07)	(0.08)	(0.09)	(0.04)
NE	1.195[0.000]	4.819[0.000]	-1.428[0.000]	-2.461[0.000]	-2.432[0.017]	-0.070[0.607]
	(0.31)	(0.34)	(0.20)	(0.60)	(1.02)	(0.14)
R56xNE	-18.354[0.000]	-4.131[0.000]	1.742[0.000]	2.180[0.000]	2.415[0.018]	-0.171[0.237]
	(0.82)	(0.62)	(0.22)	(0.61)	(1.02)	(0.15)
Urban	-1.604[0.329]	0.520[0.013]	0.855[0.000]	-0.909[0.000]	0.368[0.000]	-0.587[0.000]
	(1.64)	(0.21)	(0.04)	(0.04)	(0.05)	(0.03)
Percent_HW	-4.399[0.463]	-0.559[0.686]	1.032[0.000]	0.166[0.533]	-1.687[0.000]	0.547[0.000]
	(6.00)	(1.38)	(0.30)	(0.27)	(0.36)	(0.15)
LogADT	-0.027[0.875]	-0.072[0.261]	0.065[0.000]	-0.050[0.000]	0.013[0.417]	0.373[0.000]
	(0.17)	(0.06)	(0.02)	(0.01)	(0.02)	(0.02)
LogLength	0.464[0.242]	0.039[0.815]	-0.476[0.000]	-0.045[0.129]	0.608[0.000]	0.357[0.000]
	(0.40)	(0.17)	(0.04)	(0.03)	(0.04)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.166	0.396	0.137	0.104	0.081	0.146
N	17,104	17,104	17,104	17,104	17,104	58,441

Panel 2: Effects of Reform 1960 on bridges built in New England vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-26.862[]	0.574[0.687]	2.588[0.000]	-2.164[0.000]	-3.984[0.000]	-6.028[0.000]
		(1.42)	(0.42)	(0.35)	(0.37)	(0.23)
Reform60	0.321[0.778]	-1.813[0.000]	-2.054[0.000]	1.455[0.000]	0.783[0.000]	-0.238[0.000]
	(1.14)	(0.26)	(0.05)	(0.04)	(0.06)	(0.02)
NE	-16.853[0.000]	4.321[0.000]	-0.513[0.000]	-1.506[0.000]	-0.686[0.001]	-0.403[0.000]
	(0.94)	(0.22)	(0.10)	(0.16)	(0.20)	(0.07)
R60xNE	-0.329[0.655]	-3.001[0.000]	0.878[0.000]	1.215[0.000]	0.725[0.002]	0.304[0.000]
	(0.74)	(0.59)	(0.14)	(0.19)	(0.23)	(0.09)
Urban	-1.616[0.329]	-0.683[0.000]	0.896[0.000]	-0.884[0.000]	0.410[0.000]	-0.559[0.000]
	(1.66)	(0.17)	(0.04)	(0.04)	(0.05)	(0.03)
Percent_HW	-3.229[0.602]	-8.038[0.000]	-2.681[0.000]	3.154[0.000]	-0.430[0.254]	0.261[0.101]
	(6.19)	(1.06)	(0.32)	(0.30)	(0.38)	(0.16)
LogADT	-0.022[0.899]	-0.014[0.855]	0.005[0.750]	-0.014[0.283]	0.027[0.094]	0.352[0.000]
	(0.17)	(0.07)	(0.02)	(0.01)	(0.02)	(0.02)
LogLength	0.547[0.078]	-0.292[0.095]	-0.431[0.000]	-0.050[0.100]	0.594[0.000]	0.354[0.000]
	(0.31)	(0.18)	(0.04)	(0.03)	(0.04)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.156	0.459	0.198	0.133	0.091	0.146
N	16,837	16,837	16,837	16,837	16,837	57,124

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 11C - NBI 1992, Interstate Highway Routes Only

Panel 1: Effects of Reform 1956 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-59.644[]	-17.600[0.000]	-1.177[0.121]	0.433[0.378]	-5.412[0.000]	-6.594[0.000]
		(0.18)	(0.76)	(0.49)	(0.56)	(0.35)
Reform56	16.721[0.000]	-3.033[0.000]	-2.686[0.000]	2.384[0.000]	1.209[0.000]	-0.057[0.288]
	(0.96)	(0.37)	(0.11)	(0.12)	(0.20)	(0.05)
Urban	-1.179[0.190]	-0.144[0.528]	-0.418[0.000]	0.207[0.140]	0.973[0.000]	-0.559[0.000]
	(0.90)	(0.23)	(0.12)	(0.14)	(0.22)	(0.07)
R56xUrban	-0.997[0.604]	1.590[0.000]	1.423[0.000]	-1.165[0.000]	-0.570[0.011]	-0.121[0.093]
	(1.92)	(0.45)	(0.13)	(0.14)	(0.22)	(0.07)
Percent_HW	10.274[0.525]	5.512[0.003]	6.200[0.000]	-2.288[0.000]	-4.268[0.000]	1.222[0.000]
	(16.18)	(1.82)	(0.47)	(0.41)	(0.53)	(0.24)
LogADT	-0.206[0.305]	0.016[0.874]	0.016[0.335]	-0.027[0.048]	0.037[0.036]	0.430[0.000]
	(0.20)	(0.10)	(0.02)	(0.01)	(0.02)	(0.02)
LogLength	0.144[0.751]	0.050[0.733]	-0.557[0.000]	-0.117[0.001]	0.721[0.000]	0.398[0.000]
	(0.45)	(0.15)	(0.05)	(0.03)	(0.04)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.469	0.518	0.221	0.139	0.148	0.188
N	17,104	17,104	17,104	17,104	17,104	58,441

Panel 2: Effects of Reform 1960 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-149.113[]	-17.463[]	0.046[0.955]	0.051[0.921]	-5.520[0.000]	-6.248[0.000]
			(0.81)	(0.52)	(0.55)	(0.35)
Reform60	32.326[0.000]	-3.281[0.000]	-2.807[0.000]	1.886[0.000]	0.737[0.000]	-0.141[0.000]
	(2.58)	(0.47)	(0.08)	(0.06)	(0.10)	(0.04)
Urban	19.185[0.000]	-1.111[0.000]	0.125[0.058]	-0.254[0.000]	0.585[0.000]	-0.660[0.000]
	(1.07)	(0.19)	(0.07)	(0.07)	(0.11)	(0.04)
R60xUrban	-74.102[0.000]	2.104[0.000]	1.470[0.000]	-0.851[0.000]	-0.152[0.191]	0.042[0.369]
	(11.61)	(0.55)	(0.09)	(0.08)	(0.12)	(0.05)
Percent_HW	174.500[0.089]	6.679[0.000]	-1.500[0.002]	2.010[0.000]	-2.609[0.000]	0.819[0.001]
	(102.64)	(1.88)	(0.48)	(0.44)	(0.57)	(0.26)
LogADT	0.476[0.242]	0.157[0.209]	-0.024[0.142]	-0.010[0.498]	0.039[0.029]	0.406[0.000]
	(0.41)	(0.13)	(0.02)	(0.01)	(0.02)	(0.02)
LogLength	1.597[0.214]	-0.383[0.019]	-0.510[0.000]	-0.095[0.006]	0.721[0.000]	0.387[0.000]
	(1.29)	(0.16)	(0.05)	(0.04)	(0.04)	(0.02)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.699	0.558	0.268	0.165	0.154	0.186
N	16,837	16,837	16,837	16,837	16,837	57,124

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 11D - NBI 1992, Non-Interstate Highway Routes Only

Panel 1: Effects of Reform 1956 on bridges built in New York vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-0.211[0.811]	1.290[0.000]	1.065[0.000]	-3.247[0.000]	-2.833[0.000]	-3.948[0.000]
	(0.88)	(0.36)	(0.17)	(0.20)	(0.19)	(0.10)
Reform56	-1.261[0.000]	-1.167[0.000]	-0.296[0.000]	0.842[0.000]	0.193[0.000]	0.739[0.000]
	(0.20)	(0.08)	(0.04)	(0.05)	(0.06)	(0.02)
NY	0.584[0.042]	0.787[0.000]	-0.042[0.707]	-0.320[0.045]	-0.292[0.094]	0.734[0.000]
	(0.29)	(0.15)	(0.11)	(0.16)	(0.17)	(0.06)
R56xNY	-0.705[0.208]	0.204[0.299]	0.492[0.000]	-0.151[0.381]	-0.124[0.512]	-0.411[0.000]
	(0.56)	(0.20)	(0.12)	(0.17)	(0.19)	(0.07)
Urban	0.142[0.438]	0.259[0.000]	0.185[0.000]	-0.371[0.000]	-0.019[0.612]	1.006[0.000]
	(0.18)	(0.07)	(0.03)	(0.03)	(0.04)	(0.02)
Percent_HW	0.658[0.545]	2.053[0.000]	1.688[0.000]	-1.822[0.000]	-1.121[0.000]	0.862[0.000]
	(1.09)	(0.50)	(0.22)	(0.26)	(0.30)	(0.12)
LogADT	-0.249[0.000]	-0.202[0.000]	0.075[0.000]	0.101[0.000]	-0.139[0.000]	0.149[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.513[0.001]	-0.564[0.000]	-0.618[0.000]	0.161[0.000]	0.858[0.000]	0.378[0.000]
	(0.16)	(0.05)	(0.02)	(0.02)	(0.03)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.265	0.190	0.057	0.036	0.102	0.254
N	28,227	28,227	28,227	28,227	28,227	257,993

Panel 2: Effects of Reform 1960 on bridges built in New York vs. elsewhere

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-0.483[0.575]	1.512[0.000]	1.190[0.000]	-3.326[0.000]	-2.862[0.000]	-4.019[0.000]
	(0.86)	(0.35)	(0.17)	(0.21)	(0.19)	(0.10)
Reform60	-1.017[0.000]	-1.026[0.000]	-0.389[0.000]	0.729[0.000]	0.198[0.000]	0.577[0.000]
	(0.18)	(0.08)	(0.03)	(0.04)	(0.04)	(0.02)
NY	0.630[0.010]	0.721[0.000]	-0.082[0.343]	-0.276[0.023]	-0.166[0.194]	0.639[0.000]
	(0.25)	(0.13)	(0.09)	(0.12)	(0.13)	(0.05)
R60xNY	-2.355[0.020]	-0.292[0.168]	0.684[0.000]	-0.138[0.327]	-0.335[0.029]	-0.171[0.007]
	(1.01)	(0.21)	(0.11)	(0.14)	(0.15)	(0.06)
Urban	0.110[0.548]	0.200[0.004]	0.177[0.000]	-0.358[0.000]	-0.009[0.802]	1.018[0.000]
	(0.18)	(0.07)	(0.03)	(0.03)	(0.04)	(0.02)
Percent_HW	-1.369[0.222]	-0.304[0.571]	1.197[0.000]	-0.694[0.010]	-0.849[0.006]	1.883[0.000]
	(1.12)	(0.54)	(0.23)	(0.27)	(0.31)	(0.13)
LogADT	-0.226[0.000]	-0.204[0.000]	0.074[0.000]	0.105[0.000]	-0.136[0.000]	0.154[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.478[0.002]	-0.559[0.000]	-0.612[0.000]	0.160[0.000]	0.845[0.000]	0.378[0.000]
	(0.16)	(0.06)	(0.02)	(0.02)	(0.03)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.261	0.191	0.061	0.040	0.100	0.254
N	27,641	27,641	27,641	27,641	27,641	257,267

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 11E - NBI 1992, Non-Interstate Highway Routes Only

Panel 1: Effects of Reform 1956 on bridges built in New England vs. elsewhere

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	-0.147[0.867]	1.518[0.000]	1.090[0.000]	-3.330[0.000]	-2.877[0.000]	-3.850[0.000]
	(0.88)	(0.35)	(0.17)	(0.20)	(0.18)	(0.10)
Reform56	-1.309[0.000]	-1.079[0.000]	-0.222[0.000]	0.805[0.000]	0.139[0.010]	0.711[0.000]
	(0.19)	(0.08)	(0.04)	(0.05)	(0.05)	(0.02)
NE	-0.077[0.896]	0.572[0.011]	0.233[0.186]	-0.199[0.390]	-1.007[0.002]	-0.387[0.000]
	(0.59)	(0.23)	(0.18)	(0.23)	(0.33)	(0.09)
R56xNE	-0.988[0.396]	-1.028[0.005]	-0.459[0.017]	0.405[0.104]	1.176[0.001]	0.007[0.944]
	(1.16)	(0.36)	(0.19)	(0.25)	(0.35)	(0.10)
Urban	0.153[0.405]	0.296[0.000]	0.190[0.000]	-0.377[0.000]	-0.023[0.532]	1.016[0.000]
	(0.18)	(0.07)	(0.03)	(0.03)	(0.04)	(0.02)
Percent_HW	0.285[0.780]	0.545[0.243]	1.301[0.000]	-1.321[0.000]	-0.682[0.014]	0.467[0.000]
	(1.02)	(0.47)	(0.20)	(0.24)	(0.28)	(0.12)
LogADT	-0.242[0.000]	-0.196[0.000]	0.075[0.000]	0.101[0.000]	-0.138[0.000]	0.153[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.508[0.001]	-0.555[0.000]	-0.616[0.000]	0.159[0.000]	0.854[0.000]	0.378[0.000]
	(0.15)	(0.05)	(0.02)	(0.02)	(0.03)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.264	0.185	0.056	0.035	0.101	0.253
N	28,227	28,227	28,227	28,227	28,227	257,993

Panel 2: Effects of Reform 1960 on bridges built in New England vs. elsewhere

DV:	"Mini"	"Low"	"Mid"	"High"	"Super"	"Under Record"
(Intercept)	-0.403[0.632]	1.760[0.000]	1.264[0.000]	-3.433[0.000]	-2.972[0.000]	-3.889[0.000]
	(0.84)	(0.34)	(0.17)	(0.20)	(0.18)	(0.10)
Reform60	-1.170[0.000]	-1.054[0.000]	-0.333[0.000]	0.717[0.000]	0.168[0.000]	0.544[0.000]
	(0.17)	(0.07)	(0.03)	(0.04)	(0.04)	(0.02)
NE	-0.254[0.659]	0.420[0.027]	0.116[0.333]	-0.117[0.453]	-0.391[0.025]	-0.483[0.000]
	(0.57)	(0.19)	(0.12)	(0.16)	(0.18)	(0.06)
R60xNE	-0.337[0.762]	-1.091[0.016]	-0.390[0.009]	0.325[0.074]	0.580[0.005]	0.174[0.038]
	(1.11)	(0.45)	(0.15)	(0.18)	(0.21)	(0.08)
Urban	0.109[0.548]	0.221[0.001]	0.183[0.000]	-0.362[0.000]	-0.014[0.713]	1.029[0.000]
	(0.18)	(0.07)	(0.03)	(0.03)	(0.04)	(0.02)
Percent_HW	-1.722[0.092]	-1.517[0.002]	0.723[0.001]	-0.217[0.387]	-0.278[0.332]	1.323[0.000]
	(1.02)	(0.49)	(0.21)	(0.25)	(0.29)	(0.12)
LogADT	-0.215[0.000]	-0.201[0.000]	0.073[0.000]	0.105[0.000]	-0.134[0.000]	0.157[0.000]
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.477[0.002]	-0.553[0.000]	-0.609[0.000]	0.158[0.000]	0.841[0.000]	0.380[0.000]
	(0.15)	(0.06)	(0.02)	(0.02)	(0.03)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	No	No	No	No
McFadden R-sq.	0.256	0.189	0.059	0.040	0.100	0.253
N	27,641	27,641	27,641	27,641	27,641	257,267

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 11F - NBI 1992, Non-Interstate Highway Routes Only

Panel 1: Effects of Reform 1956 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	0.640[0.618]	0.987[0.110]	-0.012[0.963]	-0.977[0.001]	-3.783[0.000]	-5.579[0.000]
	(1.28)	(0.62)	(0.26)	(0.31)	(0.31)	(0.15)
Reform56	-1.035[0.001]	-0.824[0.000]	-0.265[0.000]	0.894[0.000]	0.125[0.188]	1.184[0.000]
	(0.32)	(0.12)	(0.07)	(0.09)	(0.10)	(0.03)
Urban	0.705[0.021]	0.682[0.000]	-0.071[0.389]	-0.051[0.643]	-0.056[0.612]	1.720[0.000]
	(0.31)	(0.13)	(0.08)	(0.11)	(0.11)	(0.04)
R56xUrban	-0.876[0.020]	-0.564[0.000]	0.214[0.013]	-0.231[0.041]	0.024[0.832]	-0.832[0.000]
	(0.38)	(0.15)	(0.09)	(0.11)	(0.11)	(0.04)
Percent_HW	-0.759[0.651]	0.550[0.390]	4.856[0.000]	-5.669[0.000]	-1.316[0.001]	0.730[0.000]
	(1.68)	(0.64)	(0.30)	(0.37)	(0.38)	(0.16)
LogADT	-0.239[0.000]	-0.176[0.000]	0.077[0.000]	0.122[0.000]	-0.156[0.000]	0.138[0.000]
	(0.04)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.565[0.000]	-0.603[0.000]	-0.665[0.000]	0.128[0.000]	0.905[0.000]	0.404[0.000]
	(0.15)	(0.06)	(0.02)	(0.02)	(0.03)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.321	0.221	0.117	0.094	0.133	0.291
N	28,227	28,227	28,227	28,227	28,227	257,993

Panel 2: Effects of Reform 1960 on bridges built in Urban vs. Rural areas

DV:	**"Mini"**	**"Low"**	**"Mid"**	**"High"**	**"Super"**	**"Under Record"**
(Intercept)	-0.172[0.897]	1.500[0.016]	0.049[0.850]	-0.951[0.002]	-3.853[0.000]	-5.529[0.000]
	(1.33)	(0.62)	(0.26)	(0.30)	(0.31)	(0.15)
Reform60	-1.004[0.000]	-0.911[0.000]	-0.184[0.000]	0.590[0.000]	0.123[0.068]	0.902[0.000]
	(0.26)	(0.11)	(0.05)	(0.06)	(0.07)	(0.03)
Urban	0.471[0.049]	0.462[0.000]	0.066[0.236]	-0.189[0.009]	-0.042[0.571]	1.453[0.000]
	(0.24)	(0.10)	(0.06)	(0.07)	(0.07)	(0.03)
R60xUrban	-0.793[0.026]	-0.477[0.001]	0.072[0.247]	-0.089[0.250]	0.017[0.834]	-0.643[0.000]
	(0.36)	(0.14)	(0.06)	(0.08)	(0.08)	(0.03)
Percent_HW	-4.961[0.002]	-3.145[0.000]	4.538[0.000]	-4.269[0.000]	-0.928[0.022]	2.223[0.000]
	(1.63)	(0.73)	(0.32)	(0.39)	(0.41)	(0.17)
LogADT	-0.205[0.000]	-0.175[0.000]	0.076[0.000]	0.119[0.000]	-0.152[0.000]	0.137[0.000]
	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
LogLength	-0.532[0.000]	-0.589[0.000]	-0.664[0.000]	0.133[0.000]	0.892[0.000]	0.409[0.000]
	(0.15)	(0.06)	(0.02)	(0.02)	(0.03)	(0.01)
Material FE	Yes	Yes	Yes	Yes	Yes	Yes
Design FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
McFadden R-sq.	0.318	0.226	0.117	0.093	0.131	0.290
N	27,641	27,641	27,641	27,641	27,641	257,267

p-value in brackets, 2-tailed
Robust Std Errors in parentheses

Supplement 12A. Imbalance Summary for CEM Preprocessing of Full Sufficiency Rating Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	13401	2165191	222.82	0.00	0.69	0.00
NBIYear	13401	2165191	4.62	0.00	0.02	0.00
LogADT	13401	2165191	44.05	0.00	0.14	0.00
Urban	13401	2165191	33.95	0.00	0.12	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.18					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	352	352	0.00	1.00	0.00	1.00
NBIYear	352	352	0.00	1.00	0.00	1.00
LogADT	352	352	-0.06	0.95	0.03	1.00
Urban	352	352	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.45					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	2844	2792	0.36	0.72	0.01	1.00
NBIYear	2844	2792	0.41	0.68	0.01	1.00
LogADT	2844	2792	-1.38	0.17	0.04	1.00
Urban	2844	2792	-1.03	0.30	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 12B. Imbalance Summary for CEM Preprocessing of Full Deck Condition Rating Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	12478	1752296	212.82	0.00	0.68	0.00
NBIYear	12478	1752296	4.21	0.00	0.02	0.00
LogADT	12478	1752296	42.90	0.00	0.16	0.00
Urban	12478	1752296	36.11	0.00	0.13	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.18					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	330	330	0.00	1.00	0.00	1.00
NBIYear	330	330	0.00	1.00	0.00	1.00
LogADT	330	330	-0.06	0.95	0.03	1.00
Urban	330	330	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.44					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	2572	2548	-0.22	0.83	0.01	1.00
NBIYear	2572	2548	0.50	0.62	0.01	1.00
LogADT	2572	2548	-1.11	0.27	0.04	1.00
Urban	2572	2548	-0.29	0.77	0.00	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 12C. Imbalance Summary for CEM Preprocessing of Full Substructure Condition Rating Model

Full Data

Overall Imbalance (L1)	0.99

Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	12950	1775922	214.50	0.00	0.68	0.00
NBIYear	12950	1775922	3.67	0.00	0.01	0.01
LogADT	12950	1775922	41.93	0.00	0.15	0.00
Urban	12950	1775922	33.83	0.00	0.12	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.16

Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	340	340	0.00	1.00	0.00	1.00
NBIYear	340	340	0.00	1.00	0.00	1.00
LogADT	340	340	-0.05	0.96	0.03	1.00
Urban	340	340	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.44

Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	2684	2651	-0.18	0.86	0.01	1.00
NBIYear	2684	2651	0.57	0.57	0.01	1.00
LogADT	2684	2651	-1.06	0.29	0.04	1.00
Urban	2684	2651	-0.32	0.75	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 12D. Imbalance Summary for CEM Preprocessing of Full Superstructure Condition Rating Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	12883	1771222	214.16	0.00	0.68	0.00
NBIYear	12883	1771222	3.44	0.00	0.01	0.03
LogADT	12883	1771222	41.92	0.00	0.15	0.00
Urban	12883	1771222	34.10	0.00	0.12	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.16					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	335	335	0.00	1.00	0.00	1.00
NBIYear	335	335	0.00	1.00	0.00	1.00
LogADT	335	335	-0.05	0.96	0.03	1.00
Urban	335	335	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.44					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	2634	2601	-0.19	0.85	0.01	1.00
NBIYear	2634	2601	0.65	0.52	0.01	1.00
LogADT	2634	2601	-1.01	0.31	0.04	1.00
Urban	2634	2601	-0.62	0.53	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 13A. Imbalance Summary for CEM Preprocessing of Non-Closed Sufficiency Rating Model

Full Data

Overall Imbalance (L1)	1.00					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	10,696	1,865,530	201.39	0.00	0.71	0.00
NBIYear	10,696	1,865,530	2.61	0.01	0.01	0.12
LogADT	10,696	1,865,530	36.85	0.00	0.15	0.00
Urban	10,696	1,865,530	28.07	0.00	0.11	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.16					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	214	214	0.00	1.00	0.00	1.00
NBIYear	214	214	0.00	1.00	0.00	1.00
LogADT	214	214	-0.13	0.89	0.04	1.00
Urban	214	214	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.47					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	1,917	1,908	0.08	0.94	0.01	1.00
NBIYear	1,917	1,908	0.63	0.53	0.01	1.00
LogADT	1,917	1,908	-1.51	0.13	0.05	1.00
Urban	1,917	1,908	-1.25	0.21	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 13B. Imbalance Summary for CEM Preprocessing of Non-Closed Deck Condition Rating Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	9,881	1,496,410	193.36	0.00	0.70	0.00
NBIYear	9,881	1,496,410	2.73	0.01	0.01	0.09
LogADT	9,881	1,496,410	36.17	0.00	0.16	0.00
Urban	9,881	1,496,410	30.62	0.00	0.12	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.17					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	194	194	0.00	1.00	0.00	1.00
NBIYear	194	194	0.00	1.00	0.00	1.00
LogADT	194	194	-0.11	0.91	0.04	1.00
Urban	194	194	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.47					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	1,688	1,687	-0.09	0.93	0.00	1.00
NBIYear	1,688	1,687	0.65	0.51	0.01	1.00
LogADT	1,688	1,687	-1.14	0.26	0.05	1.00
Urban	1,688	1,687	-0.62	0.54	0.00	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 13C. Imbalance Summary for CEM Preprocessing of Non-Closed Substructure Condition Rating Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	10,296	1,517,353	194.09	0.00	0.70	0.00
NBIYear	10,296	1,517,353	2.30	0.02	0.01	0.18
LogADT	10,296	1,517,353	34.95	0.00	0.16	0.00
Urban	10,296	1,517,353	28.30	0.00	0.11	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.17					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	202	202	0.00	1.00	0.00	1.00
NBIYear	202	202	0.00	1.00	0.00	1.00
LogADT	202	202	-0.11	0.91	0.04	1.00
Urban	202	202	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.46					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	1,791	1,771	0.01	0.99	0.01	1.00
NBIYear	1,791	1,771	0.79	0.43	0.01	1.00
LogADT	1,791	1,771	-1.37	0.17	0.06	0.99
Urban	1,791	1,771	-0.83	0.41	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 13D. Imbalance Summary for CEM Preprocessing of Non-Closed Superstructure Condition Rating Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	10,246	1,513,361	193.71	0.00	0.70	0.00
NBIYear	10,246	1,513,361	2.07	0.04	0.01	0.25
LogADT	10,246	1,513,361	34.82	0.00	0.16	0.00
Urban	10,246	1,513,361	28.45	0.00	0.12	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.17					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	198	198	0.00	1.00	0.00	1.00
NBIYear	198	198	0.00	1.00	0.00	1.00
LogADT	198	198	-0.11	0.91	0.04	1.00
Urban	198	198	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.46					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	1,754	1,731	-0.03	0.98	0.01	1.00
NBIYear	1,754	1,731	0.89	0.38	0.01	1.00
LogADT	1,754	1,731	-1.44	0.15	0.05	1.00
Urban	1,754	1,731	-1.27	0.20	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 14. Intermediate Models for Linear Regression on All Bridges

Panel A: Sufficiency Rating, *k-to-k* matching

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	46.777[0.000]	1.769[0.468]	46.131[0.000]	0.259[0.918]	46.777[0.000]	2.489[0.314]
	(0.30)	(2.44)	(0.24)	(2.51)	(0.30)	(2.47)
Group	-1.745[0.000]	-1.527[0.000]			-1.898[0.000]	-2.007[0.000]
	(0.41)	(0.28)			(0.49)	(0.36)
NRHP			-0.951[0.038]	-0.694[0.059]	0.301[0.589]	0.964[0.040]
			(0.46)	(0.37)	(0.56)	(0.47)
LogADT		1.410[0.000]		1.400[0.000]		1.409[0.000]
		(0.12)		(0.12)		(0.12)
Urban		-0.168[0.838]		-0.191[0.817]		-0.131[0.874]
		(0.82)		(0.82)		(0.82)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.52	0.00	0.52	0.00	0.52
N (Bridge-Yr)	12,709	12,709	12,709	12,709	12,709	12,709
Treatment N (Bridges)	352	352	352	352	352	352
Control N (Bridges)	352	352	352	352	352	352

Panel B: Deck Condition Rating, *k-to-k* matching

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	5.526[0.000]	4.808[0.000]	5.581[0.000]	4.939[0.000]	5.526[0.000]	4.829[0.000]
	(0.02)	(0.21)	(0.02)	(0.21)	(0.02)	(0.21)
Group	0.094[0.000]	0.101[0.000]			0.167[0.000]	0.088[0.007]
	(0.03)	(0.02)			(0.03)	(0.03)
NRHP			-0.029[0.316]	0.098[0.001]	-0.141[0.000]	0.025[0.541]
			(0.03)	(0.03)	(0.04)	(0.04)
LogADT		0.171[0.000]		0.172[0.000]		0.171[0.000]
		(0.01)		(0.01)		(0.01)
Urban		-0.028[0.634]		-0.026[0.656]		-0.027[0.644]
		(0.06)		(0.06)		(0.06)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.18	0.00	0.18	0.00	0.18
N (Bridge-Yr)	11,851	11,851	11,851	11,851	11,851	11,851
Treatment N (Bridges)	330	330	330	330	330	330
Control N (Bridges)	330	330	330	330	330	330

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 14. Intermediate Models for Linear Regression on All Bridges

Panel C: Substructure Condition Rating, *k-to-k* matching

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	5.327[0.000]	2.324[0.000]	5.362[0.000]	2.410[0.000]	5.327[0.000]	2.432[0.000]
	(0.02)	(0.19)	(0.02)	(0.19)	(0.02)	(0.19)
Group	0.043[0.094]	0.048[0.037]			0.104[0.001]	-0.018[0.567]
	(0.03)	(0.02)			(0.03)	(0.03)
NRHP			-0.049[0.093]	0.116[0.000]	-0.118[0.001]	0.131[0.001]
			(0.03)	(0.03)	(0.04)	(0.04)
LogADT		0.147[0.000]		0.146[0.000]		0.146[0.000]
		(0.01)		(0.01)		(0.01)
Urban		0.137[0.007]		0.140[0.006]		0.141[0.006]
		(0.05)		(0.05)		(0.05)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.21	0.00	0.22	0.00	0.22
N (Bridge-Yr)	12,250	12,250	12,250	12,250	12,250	12,250
Treatment N (Bridges)	340	340	340	340	340	340
Control N (Bridges)	340	340	340	340	340	340

Panel D: Superstructure Condition Rating, *k-to-k* matching

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	5.252[0.000]	5.376[0.000]	5.238[0.000]	5.246[0.000]	5.252[0.000]	5.372[0.000]
	(0.02)	(0.17)	(0.02)	(0.17)	(0.02)	(0.18)
Group	-0.100[0.000]	-0.104[0.000]			-0.042[0.219]	-0.102[0.001]
	(0.03)	(0.02)			(0.03)	(0.03)
NRHP			-0.141[0.000]	-0.090[0.002]	-0.113[0.003]	-0.005[0.898]
			(0.03)	(0.03)	(0.04)	(0.04)
LogADT		0.218[0.000]		0.218[0.000]		0.218[0.000]
		(0.01)		(0.01)		(0.01)
Urban		-0.058[0.269]		-0.059[0.263]		-0.058[0.269]
		(0.05)		(0.05)		(0.05)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.30	0.00	0.30	0.00	0.30
N (Bridge-Yr)	12,031	12,031	12,031	12,031	12,031	12,031
Treatment N (Bridges)	335	335	335	335	335	335
Control N (Bridges)	335	335	335	335	335	335

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 15. Intermediate Models for Linear Regression on Non-Closed Bridges

Panel A: Sufficiency Rating, *k-to-k* matching

DV:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	50.640[0.000]	12.118[0.002]	50.881[0.000]	12.664[0.001]	50.640[0.000]	13.798[0.000]
	(0.34)	(3.90)	(0.27)	(3.91)	(0.34)	(3.91)
Group	-0.086[0.855]	0.039[0.906]			0.742[0.198]	-0.907[0.033]
	(0.47)	(0.33)			(0.58)	(0.42)
NRHP			-1.091[0.042]	1.058[0.009]	-1.593[0.015]	1.818[0.001]
			(0.54)	(0.41)	(0.66)	(0.53)
LogADT		1.510[0.000]		1.503[0.000]		1.509[0.000]
		(0.14)		(0.14)		(0.14)
Urban		0.759[0.357]		0.816[0.321]		0.831[0.312]
		(0.82)		(0.82)		(0.82)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.53	0.00	0.53	0.00	0.53
N (Bridge-Yr)	8,885	8,885	8,885	8,885	8,885	8,885
Treatment N (Bridges)	214	214	214	214	214	214
Control N (Bridges)	214	214	214	214	214	214

Panel B: Deck Condition Rating, *k-to-k* matching

DV:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	5.685[0.000]	5.242[0.000]	5.772[0.000]	5.535[0.000]	5.685[0.000]	5.352[0.000]
	(0.02)	(0.31)	(0.02)	(0.30)	(0.02)	(0.31)
Group	0.175[0.000]	0.189[0.000]			0.271[0.000]	0.133[0.000]
	(0.03)	(0.03)			(0.04)	(0.03)
NRHP			0.002[0.945]	0.216[0.000]	-0.182[0.000]	0.105[0.017]
			(0.03)	(0.03)	(0.04)	(0.04)
LogADT		0.125[0.000]		0.126[0.000]		0.125[0.000]
		(0.01)		(0.01)		(0.01)
Urban		-0.073[0.287]		-0.069[0.316]		-0.069[0.316]
		(0.07)		(0.07)		(0.07)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.01	0.19	0.00	0.19	0.01	0.19
N (Bridge-Yr)	8,003	8,003	8,003	8,003	8,003	8,003
Treatment N (Bridges)	194	194	194	194	194	194
Control N (Bridges)	194	194	194	194	194	194

p-values in brackets; two-tailed

Standard errors by bridge in parentheses

Supplement 15. Intermediate Models for Linear Regression on Non-Closed Bridges

Panel C: Substructure Condition Rating, *k-to-k* matching

DV:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	5.511[0.000]	2.577[0.000]	5.576[0.000]	2.792[0.000]	5.511[0.000]	2.750[0.000]
	(0.02)	(0.23)	(0.02)	(0.22)	(0.02)	(0.23)
Group	0.130[0.000]	0.127[0.000]			0.203[0.000]	0.032[0.361]
	(0.03)	(0.03)			(0.04)	(0.04)
NRHP			-0.004[0.915]	0.208[0.000]	-0.141[0.001]	0.181[0.000]
			(0.03)	(0.03)	(0.04)	(0.05)
LogADT		0.096[0.000]		0.097[0.000]		0.097[0.000]
		(0.02)		(0.02)		(0.02)
Urban		-0.113[0.052]		-0.106[0.067]		-0.106[0.067]
		(0.06)		(0.06)		(0.06)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.21	0.00	0.21	0.00	0.21
N (Bridge-Yr)	8,347	8,347	8,347	8,347	8,347	8,347
Treatment N (Bridges)	202	202	202	202	202	202
Control N (Bridges)	202	202	202	202	202	202

Panel D: Superstructure Condition Rating, *k-to-k* matching

DV:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	5.510[0.000]	5.892[0.000]	5.531[0.000]	5.777[0.000]	5.510[0.000]	5.885[0.000]
	(0.02)	(0.18)	(0.02)	(0.18)	(0.02)	(0.18)
Group	-0.092[0.002]	-0.086[0.000]			0.064[0.076]	-0.082[0.012]
	(0.03)	(0.03)			(0.04)	(0.03)
NRHP			-0.255[0.000]	-0.076[0.017]	-0.299[0.000]	-0.007[0.863]
			(0.03)	(0.03)	(0.04)	(0.04)
LogADT		0.173[0.000]		0.172[0.000]		0.173[0.000]
		(0.01)		(0.01)		(0.01)
Urban		-0.048[0.390]		-0.049[0.380]		-0.048[0.388]
		(0.06)		(0.06)		(0.06)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.31	0.01	0.31	0.01	0.31
N (Bridge-Yr)	8,164	8,164	8,164	8,164	8,164	8,164
Treatment N (Bridges)	198	198	198	198	198	198
Control N (Bridges)	198	198	198	198	198	198

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 16. Piecewise Exponential Hazard Estimate for Bridge Closure

Panel A: 4-Year Window, *k-to-k* matched set

	Model 1		Model 2		Model 3	
	B_i	$exp(B_i)$	B_i	$exp(B_i)$	B_i	$exp(B_i)$
Group	-0.38 [0.003] (0.13)	0.68			0.37 [0.151] (0.26)	1.45
NRHP			-0.44 [0.001] (0.14)	0.64	-1.03 [0.000] (0.27)	0.36
LogADT					-0.04 [0.485] (0.06)	0.96
Urban					-0.63 [0.144] (0.43)	0.53
State (factor)	No		No		Yes	
Structure Type (factor)	No		No		Yes	
YBDec (factor)	No		No		Yes	
N (Bridge-Years)	12,714		12,714		12,714	
Treatment N (Bridges)	352		352		352	
Control N (Bridges)	352		352		352	

Panel B: 3-Year Window, *k-to-k* matched set

	Model 1		Model 2		Model 3	
	B_i	$exp(B_i)$	B_i	$exp(B_i)$	B_i	$exp(B_i)$
Group	-0.38 [0.003] (0.13)	0.68			0.38 [0.142] (0.26)	1.46
NRHP			-0.45 [0.001] (0.14)	0.64	-1.04 [0.000] (0.27)	0.35
LogADT					-0.04 [0.491] (0.06)	0.96
Urban					-0.63 [0.144] (0.43)	0.53
State (factor)	No		No		Yes	
Structure Type (factor)	No		No		Yes	
YBDec (factor)	No		No		Yes	
N (Bridge-Years)	12,714		12,714		12,714	
Treatment N (Bridges)	352		352		352	
Control N (Bridges)	352		352		352	

p-values in brackets; two-tailed
Coefficient standard errors in parentheses

Supplement 16. Piecewise Exponential Hazard Estimate for Bridge Closure

Panel C: 2-Year Window, *k-to-k* matched set

	Model 1		Model 2		Model 3	
	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$
Group	-0.38 [0.003] (0.13)	0.68			0.40 [0.122] (0.26)	1.49
NRHP			-0.45 [0.001] (0.14)	0.64	-1.06 [0.000] (0.27)	0.35
LogADT					-0.04 [0.488] (0.06)	0.96
Urban					-0.63 [0.142] (0.43)	0.53
State (factor)	No		No		Yes	
Structure Type (factor)	No		No		Yes	
YBDec (factor)	No		No		Yes	
N (Bridge-Years)	12,714		12,714		12,714	
Treatment N (Bridges)	352		352		352	
Control N (Bridges)	352		352		352	

Panel D: 1-Year Window, *k-to-k* matched set

	Model 1		Model 2		Model 3	
	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$
Group	-0.38 [0.003] (0.13)	0.68			0.40 [0.124] (0.26)	1.49
NRHP			-0.45 [0.001] (0.14)	0.64	-1.06 [0.000] (0.27)	0.35
LogADT					-0.04 [0.485] (0.06)	0.96
Urban					-0.63 [0.143] (0.43)	0.53
State (factor)	No		No		Yes	
Structure Type (factor)	No		No		Yes	
YBDec (factor)	No		No		Yes	
N (Bridge-Years)	12,714		12,714		12,714	
Treatment N (Bridges)	352		352		352	
Control N (Bridges)	352		352		352	

p-values in brackets; two-tailed

Coefficient standard errors in parentheses

Supplement 17. Cox Proportional Hazard Estimate for Bridge Closure, *k-to-m* matched set

	Model 1		Model 2		Model 3	
	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$	B_i	$\exp(B_i)$
Group	-0.50 [0.000] (0.10)	0.61			0.18 [0.428] (0.23)	1.19
NRHP			-0.56 [0.000] (0.11)	0.57	-1.17 [0.000] (0.25)	0.31
LogADT					-0.02 [0.481] (0.03)	0.98
Urban					-0.85 [0.000] (0.20)	0.43
State (factor)	No		No		Yes	
Structure Type (factor)	No		No		Yes	
YBDec (factor)	No		No		Yes	
N (Bridge-Years)	50,803		50,803		50,803	
Treatment N (Bridges)	358		358		358	
Control N (Bridges)	2,531		2,531		2,531	

p-values in brackets; two-tailed
Coefficient standard errors in parentheses

Supplement 18. Linear Regression on Sufficiency and Condition with CEM Preprocessing, *k-to-m*

Panel A: All bridges, *k-to-m* matching

DV:	Sufficiency Rating	Deck CR	Substructure CR	Superstructure CR
(Intercept)	45.930[0.004]	3.684[0.000]	2.280[0.000]	5.024[0.000]
	(16.09)	(0.27)	(0.23)	(0.19)
Group	-1.533[0.000]	0.051[0.094]	-0.092[0.002]	-0.069[0.012]
	(0.33)	(0.03)	(0.03)	(0.03)
NRHP	1.719[0.000]	-0.007[0.868]	0.118[0.002]	0.012[0.735]
	(0.46)	(0.04)	(0.04)	(0.04)
LogADT	1.540[0.000]	0.219[0.000]	0.158[0.000]	0.224[0.000]
	(0.12)	(0.01)	(0.01)	(0.01)
Urban	5.091[0.000]	0.055[0.347]	0.091[0.081]	0.032[0.540]
	(0.81)	(0.06)	(0.05)	(0.05)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.50	0.20	0.21	0.31
N (Bridge-Yr)	50,786	49,750	50,423	49,183
Treatment N (Bridges)	358	337	348	343
Control N (Bridges)	2,530	2,485	2,505	2,450

Panel B: Only non-closed bridges, *k-to-m* matching

DV:	Sufficiency Rating	Deck CR	Substructure CR	Superstructure CR
(Intercept)	19.256[0.000]	4.742[0.000]	2.771[0.000]	5.947[0.000]
	(3.18)	(0.27)	(0.18)	(0.18)
Group	-2.721[0.000]	0.047[0.133]	-0.057[0.084]	-0.115[0.000]
	(0.40)	(0.03)	(0.03)	(0.03)
NRHP	1.948[0.000]	0.022[0.600]	0.207[0.000]	-0.014[0.729]
	(0.53)	(0.04)	(0.04)	(0.04)
LogADT	1.028[0.000]	0.132[0.000]	0.113[0.000]	0.174[0.000]
	(0.15)	(0.02)	(0.01)	(0.02)
Urban	1.201[0.121]	-0.014[0.808]	-0.026[0.640]	0.035[0.492]
	(0.78)	(0.06)	(0.06)	(0.05)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.51	0.17	0.21	0.27
N (Bridge-Yr)	32,102	30,143	30,706	29,799
Treatment N (Bridges)	220	199	208	204
Control N (Bridges)	1,327	1,259	1,275	1,238

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 19. Linear Regression Robustness on Pre- and Post-Enrollment Windows, All Bridges, *k-to-k*

Panel A: Sufficiency Rating, with Window Restrictions, All Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	-4.218[0.297]	-1.773[0.591]	0.845[0.777]	2.035[0.469]
	(4.04)	(3.30)	(2.98)	(2.81)
Group	-1.794[0.001]	-1.945[0.000]	-1.852[0.000]	-1.795[0.000]
	(0.52)	(0.44)	(0.40)	(0.39)
NRHP	0.134[0.846]	0.296[0.615]	0.307[0.572]	0.336[0.513]
	(0.69)	(0.59)	(0.54)	(0.52)
LogADT	1.929[0.000]	1.857[0.000]	1.715[0.000]	1.636[0.000]
	(0.19)	(0.15)	(0.14)	(0.13)
Urban	-0.132[0.927]	-1.164[0.308]	-1.540[0.123]	-1.263[0.167]
	(1.43)	(1.14)	(1.00)	(0.91)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.54	0.53	0.53	0.53
N (Bridge-Yr)	4,554	6,793	8,663	9,995
Treatment N (Bridges)	352	352	352	352
Control N (Bridges)	352	352	352	352

Panel B: Deck Condition Rating, with Window Restrictions, All Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	4.545[0.000]	4.474[0.000]	4.592[0.000]	4.607[0.000]
	(0.33)	(0.28)	(0.26)	(0.24)
Group	0.036[0.448]	0.051[0.211]	0.057[0.125]	0.064[0.071]
	(0.05)	(0.04)	(0.04)	(0.04)
NRHP	-0.015[0.809]	-0.009[0.863]	0.004[0.942]	0.020[0.656]
	(0.06)	(0.05)	(0.05)	(0.05)
LogADT	0.226[0.000]	0.213[0.000]	0.201[0.000]	0.188[0.000]
	(0.02)	(0.02)	(0.02)	(0.01)
Urban	-0.412[0.000]	-0.357[0.000]	-0.278[0.000]	-0.189[0.004]
	(0.10)	(0.08)	(0.07)	(0.07)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.20	0.19	0.18	0.18
N (Bridge-Yr)	4,263	6,335	8,072	9,315
Treatment N (Bridges)	330	330	330	330
Control N (Bridges)	330	330	330	330

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 19. Linear Regression Robustness on Pre- and Post-Enrollment Windows, All Bridges, *k-to-k*

Panel C: Substructure Condition Rating, with Window Restrictions, All Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	2.279[0.000]	2.278[0.000]	2.458[0.000]	2.425[0.000]
	(0.31)	(0.27)	(0.24)	(0.23)
Group	0.006[0.897]	-0.003[0.930]	0.001[0.986]	-0.012[0.733]
	(0.05)	(0.04)	(0.04)	(0.03)
NRHP	0.115[0.055]	0.105[0.040]	0.104[0.027]	0.112[0.011]
	(0.06)	(0.05)	(0.05)	(0.04)
LogADT	0.189[0.000]	0.187[0.000]	0.170[0.000]	0.162[0.000]
	(0.02)	(0.02)	(0.01)	(0.01)
Urban	0.006[0.950]	0.014[0.843]	0.045[0.471]	0.065[0.258]
	(0.09)	(0.07)	(0.06)	(0.06)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.22	0.22	0.22	0.22
N (Bridge-Yr)	4,401	6,544	8,342	9,629
Treatment N (Bridges)	340	340	340	340
Control N (Bridges)	340	340	340	340

Panel D: Superstructure Condition Rating, with Window Restrictions, All Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	5.641[0.000]	5.441[0.000]	5.488[0.000]	5.396[0.000]
	(0.28)	(0.24)	(0.22)	(0.21)
Group	-0.145[0.001]	-0.150[0.000]	-0.137[0.000]	-0.128[0.000]
	(0.04)	(0.04)	(0.03)	(0.03)
NRHP	0.067[0.246]	0.050[0.312]	0.034[0.445]	0.017[0.693]
	(0.06)	(0.05)	(0.05)	(0.04)
LogADT	0.269[0.000]	0.262[0.000]	0.247[0.000]	0.235[0.000]
	(0.02)	(0.02)	(0.01)	(0.01)
Urban	-0.295[0.002]	-0.278[0.000]	-0.205[0.001]	-0.158[0.007]
	(0.09)	(0.07)	(0.06)	(0.06)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.32	0.31	0.31	0.31
N (Bridge-Yr)	4,312	6,416	8,176	9,440
Treatment N (Bridges)	335	335	335	335
Control N (Bridges)	335	335	335	335

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 20. Linear Regression Robustness on Pre- and Post-Enrollment Windows, Non-Closed Bridges, *k-to-k*

Panel A: Sufficiency Rating, with Window Restrictions, Non-Closed Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	18.868[0.006]	16.717[0.010]	17.890[0.003]	16.834[0.003]
	(6.88)	(6.44)	(5.99)	(5.58)
Group	-0.277[0.669]	-0.502[0.355]	-0.543[0.269]	-0.623[0.179]
	(0.65)	(0.54)	(0.49)	(0.46)
NRHP	0.562[0.473]	0.978[0.146]	1.366[0.029]	1.557[0.008]
	(0.78)	(0.67)	(0.62)	(0.59)
LogADT	1.966[0.000]	1.895[0.000]	1.727[0.000]	1.654[0.000]
	(0.22)	(0.19)	(0.17)	(0.16)
Urban	-2.490[0.072]	-2.409[0.029]	-1.845[0.057]	-1.174[0.195]
	(1.39)	(1.10)	(0.97)	(0.91)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.54	0.55	0.54	0.54
N (Bridge-Yr)	2,867	4,319	5,632	6,645
Treatment N (Bridges)	214	214	214	214
Control N (Bridges)	214	214	214	214

Panel B: Deck Condition Rating, with Window Restrictions, Non-Closed Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	5.070[0.000]	5.050[0.000]	5.056[0.000]	5.139[0.000]
	(0.53)	(0.47)	(0.42)	(0.39)
Group	0.102[0.051]	0.118[0.008]	0.111[0.006]	0.105[0.005]
	(0.05)	(0.04)	(0.04)	(0.04)
NRHP	0.078[0.256]	0.094[0.102]	0.110[0.034]	0.129[0.008]
	(0.07)	(0.06)	(0.05)	(0.05)
LogADT	0.151[0.000]	0.142[0.000]	0.138[0.000]	0.130[0.000]
	(0.03)	(0.02)	(0.02)	(0.02)
Urban	-0.494[0.000]	-0.394[0.000]	-0.278[0.001]	-0.202[0.010]
	(0.12)	(0.10)	(0.08)	(0.08)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.17	0.17	0.17	0.18
N (Bridge-Yr)	2,596	3,898	5,071	5,983
Treatment N (Bridges)	194	194	194	194
Control N (Bridges)	194	194	194	194

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 20. Linear Regression Robustness on Pre- and Post-Enrollment Windows, Non-Closed Bridges, *k-to-k*

Panel C: Substructure Condition Rating, with Window Restrictions, Non-Closed Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	2.774[0.000]	2.560[0.000]	2.639[0.000]	2.553[0.000]
	(0.38)	(0.35)	(0.31)	(0.29)
Group	0.094[0.074]	0.081[0.073]	0.068[0.094]	0.049[0.196]
	(0.05)	(0.05)	(0.04)	(0.04)
NRHP	0.171[0.010]	0.176[0.002]	0.183[0.001]	0.188[0.000]
	(0.07)	(0.06)	(0.05)	(0.05)
LogADT	0.129[0.000]	0.120[0.000]	0.107[0.000]	0.101[0.000]
	(0.03)	(0.02)	(0.02)	(0.02)
Urban	-0.299[0.002]	-0.267[0.001]	-0.227[0.001]	-0.194[0.003]
	(0.10)	(0.08)	(0.07)	(0.06)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.23	0.22	0.21	0.21
N (Bridge-Yr)	2,705	4,068	5,295	6,243
Treatment N (Bridges)	202	202	202	202
Control N (Bridges)	202	202	202	202

Panel D: Superstructure Condition Rating, with Window Restrictions, Non-Closed Bridges

Max Analysis Window:	3 years	5 years	7 years	9 years
(Intercept)	6.389[0.000]	6.187[0.000]	6.099[0.000]	6.021[0.000]
	(0.28)	(0.25)	(0.21)	(0.20)
Group	-0.091[0.061]	-0.097[0.021]	-0.090[0.018]	-0.083[0.021]
	(0.05)	(0.04)	(0.04)	(0.04)
NRHP	0.014[0.825]	0.032[0.572]	0.034[0.505]	0.023[0.626]
	(0.07)	(0.06)	(0.05)	(0.05)
LogADT	0.211[0.000]	0.205[0.000]	0.200[0.000]	0.194[0.000]
	(0.02)	(0.02)	(0.02)	(0.02)
Urban	-0.202[0.038]	-0.196[0.012]	-0.143[0.036]	-0.123[0.050]
	(0.10)	(0.08)	(0.07)	(0.06)
NBI Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Structure Type FE	Yes	Yes	Yes	Yes
YBDec FE	Yes	Yes	Yes	Yes
Adj R-squared	0.32	0.30	0.31	0.31
N (Bridge-Yr)	2,636	3,966	5,161	6,089
Treatment N (Bridges)	198	198	198	198
Control N (Bridges)	198	198	198	198

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 21A. Imbalance Summary for CEM Preprocessing of Full log(Total Project Cost) Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	12705	1868824	211.94	0.00	0.67	0.00
NBIYear	12705	1868824	4.78	0.00	0.03	0.00
LogADT	12705	1868824	39.99	0.00	0.13	0.00
Urban	12705	1868824	30.87	0.00	0.11	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.15					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	325	325	0.00	1.00	0.00	1.00
NBIYear	325	325	0.00	1.00	0.00	1.00
LogADT	325	325	-0.10	0.92	0.03	1.00
Urban	325	325	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.45					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	2485	2460	0.24	0.81	0.01	1.00
NBIYear	2485	2460	0.36	0.72	0.01	1.00
LogADT	2485	2460	-1.33	0.18	0.04	1.00
Urban	2485	2460	-0.53	0.60	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 21B. Imbalance Summary for CEM Preprocessing of Non-Closed log(Total Project Cost) Model

Full Data

Overall Imbalance (L1)	0.99					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	10,093	1,597,358	191.45	0.00	0.69	0.00
NBIYear	10,093	1,597,358	3.29	0.00	0.03	0.00
LogADT	10,093	1,597,358	32.78	0.00	0.14	0.00
Urban	10,093	1,597,358	25.09	0.00	0.10	0.00

Matched Data, k-to-k

Overall Imbalance (L1)	0.17					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	192	192	0.00	1.00	0.00	1.00
NBIYear	192	192	0.00	1.00	0.00	1.00
LogADT	192	192	-0.13	0.90	0.05	1.00
Urban	192	192	0.00	1.00	0.00	1.00

Matched Data (Pre-Enrollment Observations), k-to-k

Overall Imbalance (L1)	0.47					
Numerical Variables	Treated N (Bridge-Yr)	Control N (Bridge-Yr)	T-Test Statistic	T-Test p-value	KS-Test Statistic	KS-Test p-value
YBDec	1,637	1,625	0.44	0.66	0.01	1.00
NBIYear	1,637	1,625	0.58	0.56	0.01	1.00
LogADT	1,637	1,625	-1.72	0.09	0.06	0.99
Urban	1,637	1,625	-0.83	0.41	0.01	1.00

Note: State Name and Structure Type are treated as factor variables for matching and are evaluated using a chi-squared distribution when calculating the overall imbalance as treating these numerically would be inappropriate.

Supplement 22. Linear Regression on log(Total Project Cost), *k-to-k* matching

Panel A: All Bridges

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	4.052[0.000]	2.774[0.000]	4.280[0.000]	3.003[0.000]	4.052[0.000]	2.729[0.000]
	(0.04)	(0.26)	(0.03)	(0.25)	(0.04)	(0.26)
Group	0.446[0.000]	0.433[0.000]			0.675[0.000]	0.480[0.000]
	(0.05)	(0.04)			(0.06)	(0.05)
NRHP			0.002[0.975]	0.302[0.000]	-0.445[0.000]	-0.094[0.157]
			(0.06)	(0.05)	(0.07)	(0.07)
LogADT		0.081[0.000]		0.085[0.000]		0.081[0.000]
		(0.02)		(0.02)		(0.02)
Urban		-0.035[0.755]		-0.032[0.780]		-0.039[0.725]
		(0.11)		(0.11)		(0.11)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.01	0.32	0.00	0.31	0.01	0.32
N (Bridge-Yr)	11,291	11,291	11,291	11,291	11,291	11,291
Treatment N (Bridges)	325	325	325	325	325	325
Control N (Bridges)	325	325	325	325	325	325

Panel B: Only Non-Closed Bridges

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	3.801[0.000]	2.620[0.000]	3.948[0.000]	2.788[0.000]	3.801[0.000]	2.607[0.000]
	(0.04)	(0.38)	(0.04)	(0.38)	(0.04)	(0.39)
Group	0.293[0.000]	0.272[0.000]			0.452[0.000]	0.285[0.000]
	(0.06)	(0.05)			(0.08)	(0.07)
NRHP			0.000[0.996]	0.213[0.001]	-0.305[0.001]	-0.024[0.780]
			(0.07)	(0.07)	(0.09)	(0.08)
LogADT		0.066[0.006]		0.069[0.004]		0.066[0.006]
		(0.02)		(0.02)		(0.02)
Urban		0.078[0.560]		0.081[0.551]		0.077[0.566]
		(0.14)		(0.14)		(0.14)
NBI Year FE	No	Yes	No	Yes	No	Yes
State FE	No	Yes	No	Yes	No	Yes
Structure Type FE	No	Yes	No	Yes	No	Yes
YBDec FE	No	Yes	No	Yes	No	Yes
Adj R-squared	0.00	0.35	0.00	0.35	0.00	0.35
N (Bridge-Yr)	7,610	7,610	7,610	7,610	7,610	7,610
Treatment N (Bridges)	192	192	192	192	192	192
Control N (Bridges)	192	192	192	192	192	192

p-values in brackets; two-tailed
Standard errors by bridge in parentheses

Supplement 23. Lambda values and variable entry for Sufficiency Rating

NBI-1993

λ	Variable
14.46	Inventory Rating
9.841	Imputed Age
3.319	Bridge Posting (Appraisal Rating)
2.188	Bypass, Detour Length
1.871	Structural Evaluation (Appraisal Rating)
1.834	Min Vertical Clearance Over Bridge Roadway
1.525	Superstructure (Condition Rating)
1.381	Kind of Material / Design (Main Structure)
1.273	Substructure (Condition Rating)
1.211	Deck Geometry (Appraisal Rating)

NBI-1994

λ	Variable
14.37	Inventory Rating
9.835	Imputed Age
3.173	Bridge Posting (Appraisal Rating)
2.203	Bypass, Detour Length
1.846	Min Vertical Clearance Over Bridge Roadway
1.776	Structural Evaluation (Appraisal Rating)
1.447	Superstructure (Condition Rating)
1.352	Kind of Material / Design (Main Structure)
1.275	Approach Roadway Alignment (Appraisal Rating)
1.244	Deck Geometry (Appraisal Rating)

NBI-1995

λ	Variable
14.12	Inventory Rating
9.75	Imputed Age
3.071	Bridge Posting (Appraisal Rating)
2.279	Bypass, Detour Length
1.748	Min Vertical Clearance Over Bridge Roadway
1.744	Structural Evaluation (Appraisal Rating)
1.508	Structure Open / Posted / Closed
1.472	Superstructure (Condition Rating)
1.343	Kind of Material / Design (Main Structure)
1.25	Deck Geometry (Appraisal Rating)

NBI-1996

λ	Variable
14	Inventory Rating
9.737	Imputed Age
3.022	Bridge Posting (Appraisal Rating)
2.218	Bypass, Detour Length
1.736	Structural Evaluation (Appraisal Rating)
1.688	Min Vertical Clearance Over Bridge Roadway
1.479	Kind of Material / Design (Main Structure)
1.465	Superstructure (Condition Rating)
1.353	Structure Open / Posted / Closed
1.232	Deck Geometry (Appraisal Rating)

Supplement 23. Lambda values and variable entry for Sufficiency Rating

NBI-1997

λ	Variable
13.83	Inventory Rating
9.765	Imputed Age
2.91	Bridge Posting (Appraisal Rating)
2.257	Bypass, Detour Length
1.76	Structural Evaluation (Appraisal Rating)
1.638	Min Vertical Clearance Over Bridge Roadway
1.579	Kind of Material / Design (Main Structure)
1.434	Type of Design / Construction (Main Structure)
1.306	Inventory Route, Min Vertical Clearance
1.233	Superstructure (Condition Rating)

NBI-1998

λ	Variable
13.62	Inventory Rating
9.814	Imputed Age
2.888	Bridge Posting (Appraisal Rating)
2.328	Bypass, Detour Length
1.721	Structural Evaluation (Appraisal Rating)
1.61	Min Vertical Clearance Over Bridge Roadway
1.521	Kind of Material / Design (Main Structure)
1.41	Type of Design / Construction (Main Structure)
1.41	Superstructure (Condition Rating)
1.256	Average Daily Traffic

NBI-1999

λ	Variable
13.18	Inventory Rating
9.888	Imputed Age
2.835	Bridge Posting (Appraisal Rating)
2.52	Bypass, Detour Length
1.711	Inventory Route, Total Horiz Clearance
1.693	Min Vertical Clearance Over Bridge Roadway
1.671	Structural Evaluation (Appraisal Rating)
1.39	Kind of Material / Design (Main Structure)
1.322	Superstructure (Condition Rating)
1.272	Average Daily Traffic

NBI-2000

λ	Variable
12.82	Inventory Rating
9.903	Imputed Age
2.824	Bridge Posting (Appraisal Rating)
2.571	Bypass, Detour Length
1.67	Min Vertical Clearance Over Bridge Roadway
1.652	Inventory Route, Total Horiz Clearance
1.628	Structural Evaluation (Appraisal Rating)
1.402	Kind of Material / Design (Main Structure)
1.315	Superstructure (Condition Rating)
1.286	Average Daily Traffic

Supplement 23. Lambda values and variable entry for Sufficiency Rating

NBI-2001

λ	Variable
12.66	Inventory Rating
9.6	Imputed Age
2.804	Bridge Posting (Appraisal Rating)
2.543	Bypass, Detour Length
1.546	Structural Evaluation (Appraisal Rating)
1.463	Min Vertical Clearance Over Bridge Roadway
1.434	Inventory Route, Total Horiz Clearance
1.39	Kind of Material / Design (Main Structure)
1.39	Type of Design / Construction (Main Structure)
1.263	Design Load

NBI-2002

λ	Variable
12.58	Inventory Rating
9.613	Imputed Age
2.671	Bridge Posting (Appraisal Rating)
2.509	Bypass, Detour Length
1.61	Structural Evaluation (Appraisal Rating)
1.444	Kind of Material / Design (Main Structure)
1.386	Min Vertical Clearance Over Bridge Roadway
1.361	Inventory Route, Min Vertical Clearance
1.3	Design Load
1.274	Type of Design / Construction (Main Structure)

NBI-2003

λ	Variable
12.34	Inventory Rating
9.744	Imputed Age
2.61	Bridge Posting (Appraisal Rating)
2.502	Bypass, Detour Length
1.578	Structural Evaluation (Appraisal Rating)
1.544	Min Vertical Clearance Over Bridge Roadway
1.437	Kind of Material / Design (Main Structure)
1.272	Superstructure (Condition Rating)
1.258	Design Load
1.249	Deck Geometry (Appraisal Rating)

NBI-2004

λ	Variable
11.98	Inventory Rating
9.907	Imputed Age
2.591	Bridge Posting (Appraisal Rating)
2.376	Bypass, Detour Length
1.547	Structural Evaluation (Appraisal Rating)
1.538	Min Vertical Clearance Over Bridge Roadway
1.437	Kind of Material / Design (Main Structure)
1.303	Superstructure (Condition Rating)
1.296	Design Load
1.256	Average Daily Traffic

Supplement 23. Lambda values and variable entry for Sufficiency Rating

NBI-2005

λ	Variable
11.8	Inventory Rating
9.999	Imputed Age
2.576	Bridge Posting (Appraisal Rating)
2.273	Bypass, Detour Length
1.587	Structural Evaluation (Appraisal Rating)
1.535	Min Vertical Clearance Over Bridge Roadway
1.385	Kind of Material / Design (Main Structure)
1.315	Design Load
1.305	Superstructure (Condition Rating)
1.233	Average Daily Traffic

NBI-2006

λ	Variable
11.59	Inventory Rating
9.965	Imputed Age
2.493	Bridge Posting (Appraisal Rating)
2.385	Bypass, Detour Length
1.567	Structural Evaluation (Appraisal Rating)
1.502	Min Vertical Clearance Over Bridge Roadway
1.367	Kind of Material / Design (Main Structure)
1.316	Design Load
1.296	Type of Design / Construction (Main Structure)
1.296	Superstructure (Condition Rating)

NBI-2007

λ	Variable
11.6	Inventory Rating
9.774	Imputed Age
2.454	Operating Rating
2.37	Bridge Posting (Appraisal Rating)
2.361	Bypass, Detour Length
1.506	Min Vertical Clearance Over Bridge Roadway
1.498	Structural Evaluation (Appraisal Rating)
1.384	Kind of Material / Design (Main Structure)
1.346	Design Load
1.26	Average Daily Traffic

NBI-2008

λ	Variable
11.63	Inventory Rating
9.855	Imputed Age
2.591	Operating Rating
2.29	Bypass, Detour Length
2.282	Bridge Posting (Appraisal Rating)
2.108	Min Vertical Clearance Over Bridge Roadway
1.644	Structural Evaluation (Appraisal Rating)
1.51	Design Load
1.38	Kind of Material / Design (Main Structure)
1.328	Average Daily Traffic

Supplement 23. Lambda values and variable entry for Sufficiency Rating

NBI-2009

λ	Variable
11.19	Inventory Rating
9.623	Imputed Age
3.257	Operating Rating
2.606	Min Vertical Clearance Over Bridge Roadway
2.39	Bypass, Detour Length
2.224	Bridge Posting (Appraisal Rating)
1.638	Structural Evaluation (Appraisal Rating)
1.478	Design Load
1.403	Kind of Material / Design (Main Structure)
1.343	Structure Open / Posted / Closed

NBI-2010

λ	Variable
11.07	Inventory Rating
9.55	Imputed Age
3.732	Operating Rating
2.698	Min Vertical Clearance Over Bridge Roadway
2.429	Bypass, Detour Length
2.12	Bridge Posting (Appraisal Rating)
1.659	Structural Evaluation (Appraisal Rating)
1.469	Structure Open / Posted / Closed
1.464	Design Load
1.408	Kind of Material / Design (Main Structure)

NBI-2011

λ	Variable
10.94	Inventory Rating
9.456	Imputed Age
4.204	Operating Rating
2.528	Min Vertical Clearance Over Bridge Roadway
2.419	Bypass, Detour Length
2.107	Bridge Posting (Appraisal Rating)
1.679	Structural Evaluation (Appraisal Rating)
1.465	Structure Open / Posted / Closed
1.412	Design Load
1.389	Kind of Material / Design (Main Structure)

NBI-2012

λ	Variable
10.76	Inventory Rating
9.367	Imputed Age
4.491	Operating Rating
2.344	Bypass, Detour Length
2.064	Bridge Posting (Appraisal Rating)
1.658	Structural Evaluation (Appraisal Rating)
1.639	Structure Open / Posted / Closed
1.444	Kind of Material / Design (Main Structure)
1.356	Average Daily Traffic
1.281	Design Load

Supplement 24. Lambda values and variable entry for Superstructure Rating

NBI-1993

λ	Variable
0.7059	Imputed Age
0.346	Inventory Rating
0.1681	Deck (Condition Rating)
0.1011	Min Vertical Clearance Over Bridge Roadway
0.09922	Bridge Posting (Appraisal Rating)
0.09616	Type of Wearing Surface
0.06615	Skew
0.06435	Channel & Channel Protection (Condition Rating)
0.05412	Approach Roadway Alignment (Appraisal Rating)
0.05235	Inventory Route, Min Vertical Clearance

NBI-1994

λ	Variable
0.7024	Imputed Age
0.3412	Inventory Rating
0.1678	Deck (Condition Rating)
0.1028	Min Vertical Clearance Over Bridge Roadway
0.09657	Type of Wearing Surface
0.08181	Bridge Posting (Appraisal Rating)
0.06463	Channel & Channel Protection (Condition Rating)
0.05818	Approach Roadway Alignment (Appraisal Rating)
0.05485	Bridge Railings
0.05277	Waterway Adequacy (Appraisal Rating)

NBI-1995

λ	Variable
0.697	Imputed Age
0.3442	Inventory Rating
0.1641	Deck (Condition Rating)
0.09512	Min Vertical Clearance Over Bridge Roadway
0.09512	Type of Wearing Surface
0.07667	Bridge Posting (Appraisal Rating)
0.07527	Inventory Route, Min Vertical Clearance
0.06181	Channel & Channel Protection (Condition Rating)
0.05473	Bridge Railings
0.05227	Waterway Adequacy (Appraisal Rating)

NBI-1996

λ	Variable
0.7014	Imputed Age
0.3521	Inventory Rating
0.1562	Deck (Condition Rating)
0.09362	Type of Wearing Surface
0.0899	Min Vertical Clearance Over Bridge Roadway
0.0881	Inventory Route, Min Vertical Clearance
0.07801	Bridge Posting (Appraisal Rating)
0.06524	Kind of Material / Design (Main Structure)
0.06061	Channel & Channel Protection (Condition Rating)
0.05745	Bridge Railings

Supplement 24. Lambda values and variable entry for Superstructure Rating

NBI-1997

λ	Variable
0.7029	Imputed Age
0.3236	Inventory Rating
0.1364	Deck (Condition Rating)
0.09365	Kind of Material / Design (Main Structure)
0.09043	Min Vertical Clearance Over Bridge Roadway
0.08748	Type of Wearing Surface
0.07633	Inventory Route, Min Vertical Clearance
0.07633	Bridge Posting (Appraisal Rating)
0.06771	Bridge Railings
0.05952	Channel & Channel Protection (Condition Rating)

NBI-1998

λ	Variable
0.7008	Imputed Age
0.3144	Inventory Rating
0.1294	Deck (Condition Rating)
0.0915	Kind of Material / Design (Main Structure)
0.08345	Type of Wearing Surface
0.08132	Min Vertical Clearance Over Bridge Roadway
0.07444	Bridge Railings
0.07018	Bridge Posting (Appraisal Rating)
0.05503	Channel & Channel Protection (Condition Rating)
0.05382	Inventory Route, Min Vertical Clearance

NBI-1999

λ	Variable
0.7045	Imputed Age
0.2878	Inventory Rating
0.1293	Deck (Condition Rating)
0.08998	Min Vertical Clearance Over Bridge Roadway
0.08358	Type of Wearing Surface
0.07623	Bridge Posting (Appraisal Rating)
0.07511	Bridge Railings
0.0747	Inventory Route, Min Vertical Clearance
0.06518	Kind of Material / Design (Main Structure)
0.04542	Channel & Channel Protection (Condition Rating)

NBI-2000

λ	Variable
0.7128	Imputed Age
0.2917	Inventory Rating
0.1264	Deck (Condition Rating)
0.08582	Min Vertical Clearance Over Bridge Roadway
0.08032	Type of Wearing Surface
0.076	Bridge Posting (Appraisal Rating)
0.07572	Bridge Railings
0.06956	Inventory Route, Min Vertical Clearance
0.06558	Kind of Material / Design (Main Structure)
0.04413	Channel & Channel Protection (Condition Rating)

Supplement 24. Lambda values and variable entry for Superstructure Rating

NBI-2001

λ	Variable
0.7064	Imputed Age
0.3129	Inventory Rating
0.1216	Deck (Condition Rating)
0.0835	Bridge Railings
0.08273	Bridge Posting (Appraisal Rating)
0.08092	Kind of Material / Design (Main Structure)
0.07246	Type of Wearing Surface
0.06831	Min Vertical Clearance Over Bridge Roadway
0.05862	Inventory Route, Min Vertical Clearance
0.04414	Channel & Channel Protection (Condition Rating)

NBI-2002

λ	Variable
0.7081	Imputed Age
0.3051	Inventory Rating
0.1173	Deck (Condition Rating)
0.08589	Bridge Railings
0.08038	Kind of Material / Design (Main Structure)
0.07131	Type of Wearing Surface
0.07052	Minimum Lateral Underclearance
0.06911	Min Vertical Clearance Over Bridge Roadway
0.0686	Bridge Posting (Appraisal Rating)
0.04754	Inventory Route, Min Vertical Clearance

NBI-2003

λ	Variable
0.712	Imputed Age
0.3034	Inventory Rating
0.1145	Deck (Condition Rating)
0.08715	Bridge Railings
0.08292	Minimum Lateral Underclearance
0.08096	Kind of Material / Design (Main Structure)
0.07521	Min Vertical Clearance Over Bridge Roadway
0.06834	Type of Wearing Surface
0.06502	Bridge Posting (Appraisal Rating)
0.03853	Channel & Channel Protection (Condition Rating)

NBI-2004

λ	Variable
0.7219	Imputed Age
0.2921	Inventory Rating
0.1115	Deck (Condition Rating)
0.0927	Bridge Railings
0.08532	Minimum Lateral Underclearance
0.08029	Kind of Material / Design (Main Structure)
0.07162	Min Vertical Clearance Over Bridge Roadway
0.06929	Type of Wearing Surface
0.06158	Bridge Posting (Appraisal Rating)
0.03842	Channel & Channel Protection (Condition Rating)

Supplement 24. Lambda values and variable entry for Superstructure Rating

NBI-2005

λ	Variable
0.7449	Imputed Age
0.2874	Inventory Rating
0.1144	Deck (Condition Rating)
0.09408	Bridge Railings
0.07956	Minimum Lateral Underclearance
0.07556	Min Vertical Clearance Over Bridge Roadway
0.07473	Kind of Material / Design (Main Structure)
0.06981	Type of Wearing Surface
0.05991	Bridge Posting (Appraisal Rating)
0.04332	Minimum Vertical Underclearance

NBI-2006

λ	Variable
0.7389	Imputed Age
0.2814	Inventory Rating
0.1137	Deck (Condition Rating)
0.09419	Bridge Railings
0.07345	Kind of Material / Design (Main Structure)
0.07171	Min Vertical Clearance Over Bridge Roadway
0.07118	Type of Wearing Surface
0.05942	Bridge Posting (Appraisal Rating)
0.04852	Operating Rating
0.03721	Number of Approach Spans

NBI-2007

λ	Variable
0.7398	Imputed Age
0.2896	Inventory Rating
0.1123	Deck (Condition Rating)
0.09465	Bridge Railings
0.07286	Kind of Material / Design (Main Structure)
0.0726	Type of Wearing Surface
0.0701	Min Vertical Clearance Over Bridge Roadway
0.04358	Bridge Posting (Appraisal Rating)
0.03754	Channel & Channel Protection (Condition Rating)
0.03747	Number of Approach Spans

NBI-2008

λ	Variable
0.7424	Imputed Age
0.288	Inventory Rating
0.1257	Min Vertical Clearance Over Bridge Roadway
0.1127	Deck (Condition Rating)
0.0936	Bridge Railings
0.07205	Kind of Material / Design (Main Structure)
0.07205	Type of Wearing Surface
0.04077	Bridge Posting (Appraisal Rating)
0.03651	Operating Rating
0.03591	Channel & Channel Protection (Condition Rating)

Supplement 24. Lambda values and variable entry for Superstructure Rating

NBI-2009

λ	Variable
0.7318	Imputed Age
0.2813	Inventory Rating
0.1858	Min Vertical Clearance Over Bridge Roadway
0.1101	Deck (Condition Rating)
0.09142	Bridge Railings
0.07076	Kind of Material / Design (Main Structure)
0.07063	Type of Wearing Surface
0.06394	Operating Rating
0.03917	Bridge Posting (Appraisal Rating)
0.03481	Channel & Channel Protection (Condition Rating)

NBI-2010

λ	Variable
0.7311	Imputed Age
0.2794	Inventory Rating
0.1919	Min Vertical Clearance Over Bridge Roadway
0.1092	Deck (Condition Rating)
0.1022	Operating Rating
0.09082	Bridge Railings
0.06953	Kind of Material / Design (Main Structure)
0.06123	Type of Wearing Surface
0.0412	Bridge Posting (Appraisal Rating)
0.03471	Channel & Channel Protection (Condition Rating)

NBI-2011

λ	Variable
0.722	Imputed Age
0.2863	Inventory Rating
0.1888	Min Vertical Clearance Over Bridge Roadway
0.1486	Operating Rating
0.1092	Deck (Condition Rating)
0.08854	Bridge Railings
0.06804	Kind of Material / Design (Main Structure)
0.05566	Type of Wearing Surface
0.03745	Bridge Posting (Appraisal Rating)
0.03663	Channel & Channel Protection (Condition Rating)

NBI-2012

λ	Variable
0.7108	Imputed Age
0.2892	Inventory Rating
0.1431	Operating Rating
0.1077	Deck (Condition Rating)
0.08895	Bridge Railings
0.07065	Kind of Material / Design (Main Structure)
0.05769	Min Vertical Clearance Over Bridge Roadway
0.05223	Type of Wearing Surface
0.03646	Channel & Channel Protection (Condition Rating)
0.03593	Bridge Posting (Appraisal Rating)

Supplement 25. Lambda values and variable entry for Substructure Rating

NBI-1993

λ	Variable
0.6537	Imputed Age
0.4012	Inventory Rating
0.1467	Deck (Condition Rating)
0.1078	Type of Wearing Surface
0.1051	Bridge Posting (Appraisal Rating)
0.09963	Channel & Channel Protection (Condition Rating)
0.08921	Bridge Railings
0.07125	Skew
0.05058	Type of Design / Construction (Main Structure)
0.04332	Waterway Adequacy (Appraisal Rating)

NBI-1994

λ	Variable
0.6579	Imputed Age
0.3993	Inventory Rating
0.1463	Deck (Condition Rating)
0.1096	Type of Wearing Surface
0.1008	Channel & Channel Protection (Condition Rating)
0.09524	Bridge Posting (Appraisal Rating)
0.0875	Bridge Railings
0.06223	Skew
0.05007	Type of Design / Construction (Main Structure)
0.04979	Waterway Adequacy (Appraisal Rating)

NBI-1995

λ	Variable
0.6547	Imputed Age
0.4003	Inventory Rating
0.1408	Deck (Condition Rating)
0.1066	Type of Wearing Surface
0.09905	Channel & Channel Protection (Condition Rating)
0.09287	Bridge Posting (Appraisal Rating)
0.091	Bridge Railings
0.05403	Skew
0.0474	Kind of Material / Design (Main Structure)
0.04705	Waterway Adequacy (Appraisal Rating)

NBI-1996

λ	Variable
0.6584	Imputed Age
0.3952	Inventory Rating
0.1328	Deck (Condition Rating)
0.1037	Type of Wearing Surface
0.09391	Channel & Channel Protection (Condition Rating)
0.09253	Bridge Posting (Appraisal Rating)
0.08902	Bridge Railings
0.05816	Type of Design / Construction (Main Structure)
0.05795	Kind of Material / Design (Main Structure)
0.04502	Number of Spans in Main Unit

Supplement 25. Lambda values and variable entry for Substructure Rating

NBI-1997

λ	Variable
0.6559	Imputed Age
0.3781	Inventory Rating
0.1187	Deck (Condition Rating)
0.09583	Type of Wearing Surface
0.09425	Bridge Posting (Appraisal Rating)
0.09151	Channel & Channel Protection (Condition Rating)
0.07668	Bridge Railings
0.06378	Kind of Material / Design (Main Structure)
0.04723	Waterway Adequacy (Appraisal Rating)
0.04628	Type of Design / Construction (Main Structure)

NBI-1998

λ	Variable
0.659	Imputed Age
0.3792	Inventory Rating
0.1116	Deck (Condition Rating)
0.0901	Bridge Posting (Appraisal Rating)
0.08944	Type of Wearing Surface
0.087	Channel & Channel Protection (Condition Rating)
0.08067	Bridge Railings
0.05974	Kind of Material / Design (Main Structure)
0.04843	Type of Design / Construction (Main Structure)
0.04754	Scour Critical Bridge

NBI-1999

λ	Variable
0.666	Imputed Age
0.3508	Inventory Rating
0.1111	Deck (Condition Rating)
0.09105	Bridge Posting (Appraisal Rating)
0.08972	Bridge Railings
0.08616	Type of Wearing Surface
0.0835	Channel & Channel Protection (Condition Rating)
0.06523	Scour Critical Bridge
0.05496	Kind of Material / Design (Main Structure)
0.04563	Number of Spans in Main Unit

NBI-2000

λ	Variable
0.6762	Imputed Age
0.3575	Inventory Rating
0.1087	Deck (Condition Rating)
0.09228	Bridge Posting (Appraisal Rating)
0.09143	Bridge Railings
0.08293	Channel & Channel Protection (Condition Rating)
0.07775	Type of Wearing Surface
0.06935	Scour Critical Bridge
0.04763	Kind of Material / Design (Main Structure)
0.04424	Length of Maximum Span

Supplement 25. Lambda values and variable entry for Substructure Rating

NBI-2001

λ	Variable
0.664	Imputed Age
0.3744	Inventory Rating
0.1087	Deck (Condition Rating)
0.09755	Bridge Railings
0.09559	Bridge Posting (Appraisal Rating)
0.07748	Channel & Channel Protection (Condition Rating)
0.07001	Type of Wearing Surface
0.06042	Scour Critical Bridge
0.05166	Kind of Material / Design (Main Structure)
0.04772	Length of Maximum Span

NBI-2002

λ	Variable
0.6642	Imputed Age
0.3745	Inventory Rating
0.1066	Deck (Condition Rating)
0.1033	Minimum Lateral Underclearance
0.09757	Bridge Railings
0.08373	Bridge Posting (Appraisal Rating)
0.07865	Channel & Channel Protection (Condition Rating)
0.06446	Type of Wearing Surface
0.0601	Scour Critical Bridge
0.05697	Kind of Material / Design (Main Structure)

NBI-2003

λ	Variable
0.672	Imputed Age
0.374	Inventory Rating
0.1133	Minimum Lateral Underclearance
0.1037	Deck (Condition Rating)
0.0962	Bridge Railings
0.08046	Bridge Posting (Appraisal Rating)
0.0719	Channel & Channel Protection (Condition Rating)
0.06841	Minimum Vertical Underclearance
0.0608	Type of Wearing Surface
0.05904	Kind of Material / Design (Main Structure)

NBI-2004

λ	Variable
0.6803	Imputed Age
0.3524	Inventory Rating
0.1279	Minimum Lateral Underclearance
0.1022	Bridge Railings
0.1005	Deck (Condition Rating)
0.07694	Bridge Posting (Appraisal Rating)
0.07069	Channel & Channel Protection (Condition Rating)
0.06506	Minimum Vertical Underclearance
0.06179	Kind of Material / Design (Main Structure)
0.06111	Type of Wearing Surface

Supplement 25. Lambda values and variable entry for Substructure Rating

NBI-2005

λ	Variable
0.7117	Imputed Age
0.3469	Inventory Rating
0.1262	Minimum Lateral Underclearance
0.1075	Bridge Railings
0.1015	Deck (Condition Rating)
0.07463	Bridge Posting (Appraisal Rating)
0.07062	Channel & Channel Protection (Condition Rating)
0.06707	Minimum Vertical Underclearance
0.06464	Type of Wearing Surface
0.05983	Approach Guardrail

NBI-2006

λ	Variable
0.7143	Imputed Age
0.345	Inventory Rating
0.1061	Bridge Railings
0.1002	Deck (Condition Rating)
0.0849	Operating Rating
0.07462	Bridge Posting (Appraisal Rating)
0.07087	Minimum Lateral Underclearance
0.06694	Channel & Channel Protection (Condition Rating)
0.06523	Type of Wearing Surface
0.05766	Approach Guardrail

NBI-2007

λ	Variable
0.7156	Imputed Age
0.3475	Inventory Rating
0.1069	Bridge Railings
0.09838	Deck (Condition Rating)
0.06806	Channel & Channel Protection (Condition Rating)
0.06392	Bridge Posting (Appraisal Rating)
0.06334	Type of Wearing Surface
0.05971	Approach Guardrail
0.05808	Kind of Material / Design (Main Structure)
0.05745	Scour Critical Bridge

NBI-2008

λ	Variable
0.7195	Imputed Age
0.3443	Inventory Rating
0.1057	Bridge Railings
0.09837	Deck (Condition Rating)
0.06893	Min Vertical Clearance Over Bridge Roadway
0.06768	Channel & Channel Protection (Condition Rating)
0.06368	Type of Wearing Surface
0.06241	Kind of Material / Design (Main Structure)
0.06218	Operating Rating
0.06172	Scour Critical Bridge

Supplement 25. Lambda values and variable entry for Substructure Rating

NBI-2009

λ	Variable
0.7095	Imputed Age
0.3327	Inventory Rating
0.1253	Min Vertical Clearance Over Bridge Roadway
0.1037	Bridge Railings
0.0988	Operating Rating
0.09611	Deck (Condition Rating)
0.06747	Channel & Channel Protection (Condition Rating)
0.06444	Kind of Material / Design (Main Structure)
0.06188	Type of Wearing Surface
0.05942	Bridge Posting (Appraisal Rating)

NBI-2010

λ	Variable
0.7108	Imputed Age
0.3395	Inventory Rating
0.1765	Operating Rating
0.1329	Min Vertical Clearance Over Bridge Roadway
0.1025	Bridge Railings
0.09736	Deck (Condition Rating)
0.06624	Channel & Channel Protection (Condition Rating)
0.06408	Kind of Material / Design (Main Structure)
0.05898	Bridge Posting (Appraisal Rating)
0.05581	Length of Maximum Span

NBI-2011

λ	Variable
0.7053	Imputed Age
0.3483	Inventory Rating
0.2409	Operating Rating
0.1316	Min Vertical Clearance Over Bridge Roadway
0.09967	Bridge Railings
0.09536	Deck (Condition Rating)
0.06732	Channel & Channel Protection (Condition Rating)
0.06524	Kind of Material / Design (Main Structure)
0.05746	Bridge Posting (Appraisal Rating)
0.05589	Length of Maximum Span

NBI-2012

λ	Variable
0.6928	Imputed Age
0.3421	Inventory Rating
0.238	Operating Rating
0.09973	Bridge Railings
0.09612	Deck (Condition Rating)
0.06924	Kind of Material / Design (Main Structure)
0.06811	Channel & Channel Protection (Condition Rating)
0.0545	Bridge Posting (Appraisal Rating)
0.0536	Scour Critical Bridge
0.04835	Approach Guardrail

Supplement 26. Lambda values and variable entry for Superstructure Rating, including Weather

NBI-1993

λ	Variable
10.83	Inventory Rating
8.7	Imputed Age
2.369	Precipitation, Annual, County Mean
2.365	Min Vertical Clearance Over Bridge Roadway
2.157	Bridge Posting (Appraisal Rating)
1.903	Bypass, Detour Length
1.603	Structural Evaluation (Appraisal Rating)
1.565	Right Curb / Sidewalk Width
1.47	Deck Geometry (Appraisal Rating)
1.449	Bridge Roadway Width, Curb-to-Curb

NBI-1994

λ	Variable
10.25	Inventory Rating
8.558	Imputed Age
2.177	Min Vertical Clearance Over Bridge Roadway
2.011	Bridge Posting (Appraisal Rating)
1.993	Precipitation, Annual, County Mean
1.755	Bypass, Detour Length
1.664	Structural Evaluation (Appraisal Rating)
1.571	Average Daily Traffic
1.514	Bridge Roadway Width, Curb-to-Curb
1.509	Deck Geometry (Appraisal Rating)

NBI-1995

λ	Variable
10.05	Inventory Rating
8.403	Imputed Age
3.218	Precipitation, Annual, County Mean
2.138	Min Vertical Clearance Over Bridge Roadway
1.858	Bridge Posting (Appraisal Rating)
1.72	Bypass, Detour Length
1.707	Structure Open / Posted / Closed
1.692	Structural Evaluation (Appraisal Rating)
1.529	Deck Geometry (Appraisal Rating)
1.495	Average Daily Traffic

NBI-1996

λ	Variable
9.699	Inventory Rating
7.949	Imputed Age
2.395	Precipitation, Annual, County Mean
2.201	Min Vertical Clearance Over Bridge Roadway
1.814	Bypass, Detour Length
1.768	Bridge Roadway Width, Curb-to-Curb
1.764	Bridge Posting (Appraisal Rating)
1.745	Structural Evaluation (Appraisal Rating)
1.707	Inventory Route, Min Vertical Clearance
1.63	Average Daily Traffic

Supplement 26. Lambda values and variable entry for Superstructure Rating, including Weather

NBI-1997

λ	Variable
9.918	Inventory Rating
8.295	Imputed Age
2.335	Precipitation, Annual, County Mean
2.271	Min Vertical Clearance Over Bridge Roadway
2.053	Inventory Route, Min Vertical Clearance
1.882	Bridge Posting (Appraisal Rating)
1.851	Structural Evaluation (Appraisal Rating)
1.771	Average Daily Traffic
1.758	Bypass, Detour Length
1.528	Kind of Material / Design (Main Structure)

NBI-1998

λ	Variable
10.23	Inventory Rating
8.415	Imputed Age
2.292	Precipitation, Annual, County Mean
2.113	Bypass, Detour Length
1.949	Bridge Posting (Appraisal Rating)
1.823	Min Vertical Clearance Over Bridge Roadway
1.774	Structural Evaluation (Appraisal Rating)
1.443	Kind of Material / Design (Main Structure)
1.411	Average Daily Traffic
1.383	Deck Geometry (Appraisal Rating)

NBI-1999

λ	Variable
9.886	Inventory Rating
8.177	Imputed Age
2.26	Bypass, Detour Length
1.965	Bridge Posting (Appraisal Rating)
1.893	Min Vertical Clearance Over Bridge Roadway
1.812	Structural Evaluation (Appraisal Rating)
1.628	Precipitation, Annual, County Mean
1.455	Deck Geometry (Appraisal Rating)
1.402	Average Daily Traffic
1.284	Bridge Roadway Width, Curb-to-Curb

NBI-2000

λ	Variable
9.828	Inventory Rating
8.639	Imputed Age
2.263	Bypass, Detour Length
1.989	Bridge Posting (Appraisal Rating)
1.893	Structural Evaluation (Appraisal Rating)
1.801	Min Vertical Clearance Over Bridge Roadway
1.616	Precipitation, Annual, County Mean
1.465	Deck Geometry (Appraisal Rating)
1.454	Average Daily Traffic
1.389	Kind of Material / Design (Main Structure)

Supplement 26. Lambda values and variable entry for Superstructure Rating, including Weather

NBI-2001

λ	Variable
9.433	Inventory Rating
8.338	Imputed Age
2.086	Bypass, Detour Length
1.92	Bridge Posting (Appraisal Rating)
1.84	Precipitation, Annual, County Mean
1.82	Structural Evaluation (Appraisal Rating)
1.639	Min Vertical Clearance Over Bridge Roadway
1.494	Deck Geometry (Appraisal Rating)
1.414	Average Daily Traffic
1.343	Lanes On Structure

NBI-2002

λ	Variable
9.343	Inventory Rating
7.989	Imputed Age
2.425	Precipitation, Annual, County Mean
2.043	Bypass, Detour Length
1.86	Bridge Posting (Appraisal Rating)
1.816	Structural Evaluation (Appraisal Rating)
1.475	Lanes On Structure
1.475	Min Vertical Clearance Over Bridge Roadway
1.437	Deck Geometry (Appraisal Rating)
1.437	Average Daily Traffic

NBI-2003

λ	Variable
9.048	Inventory Rating
8.161	Imputed Age
2.095	Bypass, Detour Length
1.845	Structural Evaluation (Appraisal Rating)
1.743	Bridge Posting (Appraisal Rating)
1.711	Precipitation, Annual, County Mean
1.625	Min Vertical Clearance Over Bridge Roadway
1.457	Deck Geometry (Appraisal Rating)
1.455	Lanes On Structure
1.434	Bridge Roadway Width, Curb-to-Curb

NBI-2004

λ	Variable
9.017	Inventory Rating
8.103	Imputed Age
1.994	Bypass, Detour Length
1.894	Operating Rating
1.876	Precipitation, Annual, County Mean
1.866	Structural Evaluation (Appraisal Rating)
1.75	Bridge Posting (Appraisal Rating)
1.674	Min Vertical Clearance Over Bridge Roadway
1.499	Lanes On Structure
1.397	Deck Geometry (Appraisal Rating)

Supplement 26. Lambda values and variable entry for Superstructure Rating, including Weather

NBI-2005

λ	Variable
9.012	Inventory Rating
8.528	Imputed Age
2.034	Precipitation, Annual, County Mean
1.907	Bypass, Detour Length
1.804	Structural Evaluation (Appraisal Rating)
1.778	Bridge Posting (Appraisal Rating)
1.679	Min Vertical Clearance Over Bridge Roadway
1.506	Lanes On Structure
1.465	Bridge Roadway Width, Curb-to-Curb
1.438	Deck Geometry (Appraisal Rating)

NBI-2006

λ	Variable
8.548	Inventory Rating
8.408	Imputed Age
2.02	Bypass, Detour Length
1.789	Structural Evaluation (Appraisal Rating)
1.677	Bridge Posting (Appraisal Rating)
1.538	Min Vertical Clearance Over Bridge Roadway
1.532	Lanes On Structure
1.491	Deck Geometry (Appraisal Rating)
1.471	Bridge Roadway Width, Curb-to-Curb
1.434	Average Daily Traffic

NBI-2007

λ	Variable
9.155	Inventory Rating
8.334	Imputed Age
2.372	Precipitation, Annual, County Mean
2.055	Bypass, Detour Length
1.786	Min Vertical Clearance Over Bridge Roadway
1.78	Operating Rating
1.763	Structural Evaluation (Appraisal Rating)
1.641	Bridge Posting (Appraisal Rating)
1.475	Lanes On Structure
1.453	Average Daily Traffic

NBI-2008

λ	Variable
9.436	Inventory Rating
8.386	Imputed Age
2.57	Operating Rating
2.331	Min Vertical Clearance Over Bridge Roadway
2.06	Precipitation, Annual, County Mean
1.931	Bypass, Detour Length
1.765	Structural Evaluation (Appraisal Rating)
1.528	Bridge Posting (Appraisal Rating)
1.495	Lanes On Structure
1.473	Bridge Roadway Width, Curb-to-Curb

Supplement 26. Lambda values and variable entry for Superstructure Rating, including Weather

NBI-2009

λ	Variable
8.862	Inventory Rating
8.202	Imputed Age
2.999	Min Vertical Clearance Over Bridge Roadway
2.977	Operating Rating
2.011	Bypass, Detour Length
1.771	Structural Evaluation (Appraisal Rating)
1.745	Bridge Roadway Width, Curb-to-Curb
1.47	Precipitation, Annual, County Mean
1.457	Lanes On Structure
1.451	Bridge Posting (Appraisal Rating)

NBI-2010

λ	Variable
8.536	Inventory Rating
8.122	Imputed Age
3.168	Min Vertical Clearance Over Bridge Roadway
3.065	Operating Rating
2.884	Precipitation, Annual, County Mean
2.055	Bypass, Detour Length
1.718	Structural Evaluation (Appraisal Rating)
1.55	Lanes On Structure
1.421	Average Daily Traffic
1.403	Bridge Posting (Appraisal Rating)

NBI-2011

λ	Variable
8.365	Inventory Rating
7.857	Imputed Age
3.461	Operating Rating
2.836	Min Vertical Clearance Over Bridge Roadway
1.977	Bypass, Detour Length
1.846	Structural Evaluation (Appraisal Rating)
1.731	Precipitation, Annual, County Mean
1.556	Lanes On Structure
1.427	Average Daily Traffic
1.408	Bridge Posting (Appraisal Rating)

NBI-2012

λ	Variable
8.325	Inventory Rating
7.979	Imputed Age
3.777	Operating Rating
1.989	Bypass, Detour Length
1.834	Structural Evaluation (Appraisal Rating)
1.824	Precipitation, Annual, County Mean
1.565	Lanes On Structure
1.454	Average Daily Traffic
1.407	Min Vertical Clearance Over Bridge Roadway
1.381	Bridge Posting (Appraisal Rating)