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Economic Effect of Restricted Crossing U-Turn Intersections in Louisiana

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16. Abstract

The RCUT, aka J-turn intersection, is an innovative alternative intersection design that displaces left-turn and through movements from the minor street. There is sufficient evidence that these designs reduce severe injury crashes and the FHWA hence added them to their list of "Proven Safety Countermeasures." However, there is often resistance from businesses located near planned J-turns because of potential loss of business due to a perceived reduced ease of access of customers to their business. This report analyzes sales data surrounding ten completed J-turn projects in four study locations in Louisiana for a time period of two years before and two years after the completion of the projects. Analysis of aggregated sales data show an overall increase in sales after the completion of the projects. A parish-by-parish analysis of sales data also shows that there is no evidence of a decline in sales, but rather an increase. One parish that has been undergoing considerable growth in the state appeared to have mixed findings: looking at only businesses that existed before and after the J-turns were completed, some showed a slight decline in sales while the overall sales volume of all businesses around the J-turns increased. The decline at some isolated locations was likely due to increased competition from a number of new businesses near the J-turns. Overall, these findings suggest the construction of J-turns is associated with an increase in sales among businesses in their vicinity. Results from the business and patron surveys provide some insight into perceptions of access in these locations. Perceptions of access appear to coincide with primary concerns about congestion, traffic/backups, and perceptions of ongoing construction impacts.

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ABSTRACT

The Restricted Crossing U-Turn (RCUT), also known as a J-turn intersection, is an innovative alternative intersection design that displaces left-turn and through movements from the minor street. There is sufficient evidence that these designs reduce severe injury crashes and the FHWA hence added them to their list of "Proven Safety Countermeasures." However, there is often resistance from businesses located near planned J-turns because of potential loss of business due to a perceived reduced ease of access of customers to their business. This report analyzes sales data surrounding 10 completed J-turn projects in four study locations in Louisiana for a time period of two years before and two years after the completion of the projects. An analysis of aggregated sales data shows an overall increase in sales after the completion of the projects. A parish-by-parish analysis of sales data also shows that there is no evidence of a decline in sales, but rather an increase. One parish that has been undergoing considerable growth in the state appeared to have mixed findings: looking at only businesses that existed before and after the J-turns were completed, some showed a slight decline in sales while the overall sales volume of all businesses around the J-turns increased. The decline at some isolated locations was likely due to increased competition from a number of new businesses near the J-turns. Overall, these findings suggest the construction of J-turns is associated with an increase in sales among businesses in their vicinity. Results from the business and patron surveys provide some insight into perceptions of access in these locations. Perceptions of access appear to coincide with primary concerns about congestion, traffic/backups, and perceptions of ongoing construction impacts.

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IMPLEMENTATION STATEMENT

The report will provide support for an improved public understanding of implications of J-turn construction. The analysis finds that there is, on average, no reduction in business sales after construction of the J-turns. Also, the public is primarily concerned about congestion. These findings should be used in communications and outreach to the public/stakeholders for projects involving the construction of J-turns.

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INTRODUCTION

The goal of "Destination Zero Deaths," as envisioned in the 2017 Louisiana Strategic Highway Safety Plan (SHSP), is to achieve a significant reduction of vehicle-related fatalities and serious injuries on all public roads statewide. The SHSP establishes statewide safety priorities and outlines the strategies and actions needed to address Louisiana's most severe traffic safety problems [*1*]. The SHSP mission is "to reduce the human and economic toll on Louisiana's surface transportation system due to traffic crashes through widespread collaboration and an integrated 4E (i.e., engineering, enforcement, emergency medical services, and education) approach" [*1*]. Under the leadership of the Louisiana Department of Transportation and Development (DOTD), the Louisiana State Police (LSP), and the Louisiana Highway Safety Commission (LHSC), and in partnership with safety stakeholders, the SHSP is a coordinated, comprehensive, multidisciplinary approach to identifying and addressing the most pressing safety priorities (i.e., emphasis areas). Priorities are determined based on analysis of available data and involvement from safety stakeholders [*2*]. One of Louisiana's SHSP goals focuses specifically on Infrastructure and Operations. As stated in the 2017 SHSP, "Louisiana experiences high incidences of roadway departure and intersection-related crashes" as well as crashes involving non-motorized users [*1*]. In 2016, roadway departure accounted for 57.8% of fatalities and 40.3% of all severe injuries, while intersection-related crashes accounted for 19.1% of fatalities and 39.9% of severe injuries [*1*].

DOTD has made progress toward reducing crashes and increasing capacity along strategic highway corridors throughout the state. One method has been the deployment of access management in locations with considerable potential for total and/or targeted crash reduction, particularly fatal and serious injury crash reductions. Access management formally refers to the "systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway" [*3*]. Examples include raised non-traversable medians and reduced-conflict intersections (RCIs) specifically designed to reduce traffic congestion, crashes, and injuries associated with making left turns, such as the Restricted Crossing U-Turn (RCUT) intersection. The RCUT, aka J-turn intersection, superstreet, or synchronized street, is an innovative alternative intersection design that displaces left-turn and through movements from the minor street [*4*]. Sufficient evidence regarding the effectiveness of infrastructure-focused treatments such as RCIs exists, prompting the FHWA to add them to their list of "Proven Safety Countermeasures" [*5*].

Since 2011, DOTD has deployed about a dozen J-turn intersections at strategic locations and along major corridors throughout the state. Ample research shows these treatments greatly improve road safety and increase mobility for a reasonable cost; however, projects such as this can be controversial at the local level, particularly among businesses. While J-turns are associated with a significant decline in crashes and injuries along the corridors in states where they have been implemented, businesses are predominantly concerned that modifying or limiting direct access to their properties will have a negative economic impact on their business. State DOTs that have implemented unconventional intersection designs like the RCUT have faced opposition from business located near project sites. Though research examining the economic impact of access management techniques is limited, findings have generally indicated effects to businesses are positive or neutral. Specifically, DOTD has received negative comments from businesses near locations where J-turns are planned.

This research will provide insight into the economic impact (real and perceived) of J-turns on local businesses and will assess the extent to which (if at all) J-turns have had a negative (quantifiable) impact on business. In the end, this research will help clarify the impact of J-turns on traffic safety and the economic priorities of local businesses, which DOTD and other SHSP stakeholders can use for more effective deployment of access management in Louisiana.

OBJECTIVE

The overall goal of this research is to assess the economic impact J-turns have had on businesses in the corridors where these treatments have already been implemented in Louisiana. A secondary goal is to assess the perception of businesses near these J-turns. The analysis in this study can be used by DOTD for more effective access management in Louisiana.

SCOPE

The scope of the project includes 10 projects/locations where J-turns have been constructed in Louisiana and a limited survey of businesses and customers at these 10 locations. Sales taxes for two years before and after construction of the J-turns were analyzed.

METHODOLOGY

Before reviewing the research documenting safety and economic impacts of specific access management techniques, it is important to provide a basic overview of access management. This overview provides a practical foundation for the research presented in this report and covers the fundamental concepts underlying the definition and development of access management in the United States as well as the traffic engineering concepts underlying highway operations. In many respects, the practice of access management cannot be sufficiently understood without acknowledging the dynamic relationship between transportation and land use in context. Therefore, some background discussion of the transportation-land use relation is provided.

A Basic Overview of Access Management

State DOTs are responsible for managing and maintaining the vast multimodal transportation infrastructure system on which all members of society depend. A significant component of this responsibility comes down to preserving the public investment in roads and streets, maintaining these facilities, and ensuring connectivity within a safe and reliable travel network. The functional integrity of the network ultimately comes down to how efficiently traffic flows through the transportation system, which depends on balancing the need for mobility against the need for access.

In the United States, all DOTs employ access management in some capacity. The primary goal of access management is to satisfy access to land development in a way that maintains the safety and efficiency of the transportation system [*3*]. In practice, "access management" refers to *a coordinated process* and *a set of techniques*. As a coordinated process, particularly in the earliest stages of economic development, access management includes "policy, planning, design, and highway system operations" [*6*]. As a set of techniques, access management incorporates both strategic (i.e., policy/management) and/or tactical (i.e., design/operations) treatments designed to reduce crashes, congestion, and travel delays while simultaneously improving road user safety and traffic flow. These techniques can be deployed at specific sites or retrofit to existing facilities that have become functionally inefficient and/or present safety concerns. An NCHRP research synthesis sponsored by the FHWA determined that, as of 2010, about two-thirds of states have adopted formal access management programs and policies, while the remaining one-third practice access management informally as part of normal operations [*7*].

Background: Transportation & Land Use

The relationship between transportation infrastructure and land use/development is mutually dependent, dynamic, and complex. This section provides a basic outline of the most essential concepts and terms underlying access management. These concepts are directly pertinent to access management approaches, in theory and in practice. While transportation professionals such as engineers and planners are no doubt well aware of the complex relationship between transportation and land use, it would not be reasonable to assume that stakeholders with less specialized knowledge would possess such an understanding. For the uninitiated, this section provides a sufficient foundation for the research presented in this report.

The relationship between transportation and land use is difficult to isolate, much like the classic "chicken-or-egg" paradox. Given the highly complex and interdependent nature of the relationship, impacts are largely dynamic and become evident over time. Transportation systems are spatial networks subject to physical constraints [*8*]. While full discussion of transportation networks is beyond the scope of this research, Appendix A provides a diagram illustrating the structural components of transportation networks, the properties of which resemble networks such as the Internet. Ultimately, the transportation system infrastructure affects the pattern of urban development in what Stover and Koepke termed the "transportation-land use cycle" [*9*]. The main way in which transportation impacts land use is through provision of *access*. Access (i.e., accessibility) refers to the capacity or opportunity to get to some particular location relative to another. Without access to land, development could not occur. Since land is developed with specific uses in mind (e.g., agricultural, commercial, residential, etc.), changes in land use affects activity patterns, influencing travel patterns which can impact the transportation network in critical—often irreversible—ways. Figure 1 illustrates a general diagram of transportation-land use cycle, which is essentially a "retroactive feedback system" of mutual influence [*8*].

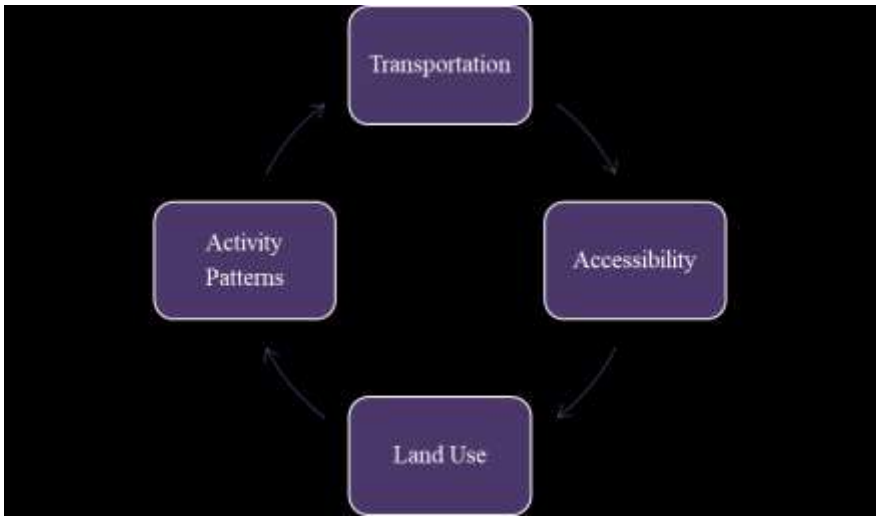

Figure 1
Transportation-land use cycle (conceptual diagram)

State DOTs impact land development primarily through providing infrastructure (i.e., roads, bridges) and secondarily through transportation-related regulations [*10*]. Land-use patterns reflect zoning practices as well (e.g., single-use vs. mixed-use) largely due to the effect that particular uses have on the road network and the potential interactions that arise as a result [*11*]. Because land-use management practices and area planning implementation occurs at the local level, there is considerable variation in how decisions and policies related to comprehensive planning play out. Moreover, the political incentives of local actors or special interests rather than community preferences may drive such comprehensive planning efforts [*12*]. Spatial and temporal interactions occur at multiple scales (e.g., local, regional, etc.) and the potential complexity of emergent patterns are a challenge, if not impossible, to predict. Land uses for particular locations along an arterial can change numerous times, and zoning changes tend to occur without a consistent consideration of long-term consequences [*9*]. One way impacts can be seen is in travel patterns. Thus, the impact of land use on transportation can occur in many ways. Operationally, this has obvious implications for the functional integrity of the road network.

Functional Classification. Roadways serve two primary purposes: access to/egress from particular properties/locations and travel mobility [*13*]. Most travel involves the use of multiple interdependent roadways to reach a specific destination. While roads can and do serve multiple purposes, the functional classification of a roadway determines the primary function a given roadway provides within the road hierarchy and how the road interacts with other roads to allow traffic to flow through the network. The functional integrity of the network ultimately comes down to how efficiently traffic flows through the transportation

system. Generally, freeways are designed to move traffic over long distances at high speeds with fully-controlled access. Arterials offer a high degree of mobility for longer distances; many are partially-limited-access, serving as intermediaries between freeways and collector roads. Collectors are lower-moderate speed roads designed to circulate traffic to arterials and local streets and provide access to properties. Local roads feed into collector roads and tend to have low-traffic volume at lower speeds, providing the highest levels of accessibility to property. Figure 2 illustrates the functional classification of roads relative to the degree to which their primary function is one of mobility or access. Maintaining the functional integrity of the road system ultimately depends on preserving the functional classification of roadways.

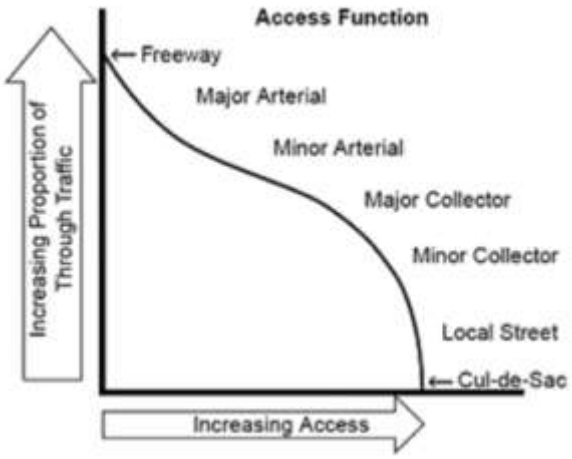

Figure 2
Functional classification of roadways [TRB Access Management Manual]

Capacity and Level of Service. Problems arise when roads originally intended to provide a high degree of mobility no longer function as intended. Many factors can affect a road's "ability" to serve its intended function whether on a temporary or situational basis, such as heavy traffic associated with a major sporting event or backups from a crash, many mobility or access problems emerge over time in response to land-use changes, road use patterns, and travel demands. Roads have fixed properties, such as capacity. The FHWA defines road capacity as "the maximum sustainable flow rate at which vehicles can pass through a given point in an hour under prevailing conditions" [*14*]. Estimating capacity is frequently "based on assumed values for saturation flow," the number and width of lanes, grades, and lane use allocations, in addition to signalization conditions [*14*, *15*]. Thus, a road's capacity is finite. In general, higher-speed roads designed to move traffic over longer

distances tend to have higher capacity and more travel lanes than roads that function primarily to provide access to properties. It is important to note that increasing capacity by adding more lanes may alleviate congestion and improve safety, but effects are only temporary since crash rates generally increase with the addition of more lanes [*16*]. Since capacity is a probabilistic measure, it varies in terms of time and location, traffic conditions, road design, traffic composition and environmental conditions [*17*]. When travel demand exceeds available capacity, such as in peak travel times, congestion ensues and the road's operational performance, i.e., "level of service," declines.

The term "level of service" (LOS) is a qualitative measure of effectiveness, involving performance measures such as speed and travel time, density, and delay. LOS depends on the flow of traffic under varying operational conditions and anything that impairs a road's ability to serve its intended function can decrease LOS. For instance, operational "decision points" along specific segments of the roadway, like merge areas, on and off ramps, and traffic signals, or design constraints such as curves, shoulder presence and/or width can impact performance.

Land Use and Road Operations. A road's functional classification is subject to change over time if routine conditions result in degraded LOS. This can occur whenever, e.g., a regional corridor undergoes significant population growth and/or development and a major arterial starts to experience considerably higher traffic volume, leading to increased travel time, lower speeds, and recurring congestion [*18*]. In this way, congestion is substantially more complex than that of traffic volume merely exceeding road capacity; rather, the capacity problems interact with a host of other "traffic-influencing events" such as crashes, construction, poorly timed signals, and environmental conditions [*15*].

In many instances, LOS issues arise in areas that undergo land-use changes, such as when commercial development takes place in a linear fashion along a busy arterial. Because the arterial's primary function is to move traffic over distance, an increasing number of access points has a negative effect on mobility and can impair the road's LOS. Often, land adjacent to arterials is zoned for commercial purposes [*19*]. The high traffic volume is appealing to businesses and property owners due to increased property values. Given the investment in strategic location, it is natural for businesses to seek as direct-access as possible to their property; however, when access is provided from the arterial, the road's LOS declines. When an existing arterial begins to experience degraded LOS following development and increased commercial activity, improvements become necessary to address congestion and safety problems. Arterial improvements typically increase/improve access to an area and land

values, attract new business to the area, which spurs further development. Eventually, the "new" developed area experiences increased traffic and consequently, traffic conflicts and congestion, which will require further road improvements to mitigate.

According to Stover and Koepke, changes in a major arterial's LOS can result in "unstable land-use patterns as the relative accessibility of other locations changes" [*9*]. The transition happens over time as commercial strip and low-density residential developments situate along the arterial, often in an uncoordinated or seemingly "haphazard" way [*19*]. This type of "unplanned" linear development, commonly referred to as "sprawl," is vehicle-dependent, has varying (and often inadequate) spacing between driveways and side-streets, permits direct access and unrestricted left-turns from the roadway. Ewing finds that the primary factor that distinguishes sprawl from other development patterns is the degree of "poor accessibility among related land uses," which may result from "a failure to concentrate development and/or to mix land uses" [*20*].

Evolution of Access Management

The concept of access management has existed since the late 1800s/early 1900s; however, it has only been within the past several decades that it has gained widespread acceptance and application [*21*]. One of the earliest state statutes concerning access control was enacted in New Jersey in 1902 [*22*]. While the interstate system was built with full access control, the majority of public roads and highways were not. From the early 1910s to 1940s, automobile ownership grew rapidly and with it, so did the demand for improved highways. As automobile use and travel demand continued to increase, commercial and residential land development proliferated, spreading outside of major city-centers. Development along non-freeway principal arterials took place with relatively little oversight as to the frequency and placement of driveways. By the 1950s, a majority of the existing state highway road network (completed in the 1930s) was considered functionally obsolete "due to poor route locations, poor traffic capacity, and a lack of modern highway design features" [*22*].

Another major outcome of the land-use changes was that owning an automobile became ever more important. Traffic volume, congestion, and crashes increased while the functional integrity of roadways continued to decrease [*22*]. Along the same lines, the increase in traffic-related deaths brought about additional safety-related concerns. In the 1950s, research began to examine the impact of driveway frequency on road safety and found a significant relationship between frequent access points and road crashes [*22*]. Access point density (i.e., the number of driveways per mile) has been examined on roads of varying geometry, operating speeds, and traffic volumes for over five decades, with findings consistently

showing that the greater the number of access points, the greater the crash rates [*22-25*]. This knowledge led to the development of national standards for driveway placement, spacing and design beginning in the 1960s.

According to Williams and Levinson, "the *formal* development of access management begins around 1980" [*21*]. At this time, it became clear that "operational techniques alone do not offset the adverse effects of poorly located or poorly planned access to neighboring land, [and] that excessive signals reduce travel speeds…" [*21*]. It also became clear that in order to mitigate these issues in the future, systematic planning of access is critical, particularly in areas undergoing rapid growth [*21*]. The first state to enact a system-wide access management program was Colorado in 1981, followed soon after by states like New Jersey, Florida, and Oregon, among others [*21*]. As of 2010, 33 states have formal access management programs, though the scope and content of these programs vary widely [*7*].

Contemporary access management "extends the concept of access design and location control to all roadways—not just limited-access highways or freeways" [*7*]. This includes traffic signals, driveways, intersections, interchanges, and median openings. The basic principles of access management are as follows [*26, 27*]:

1. Provide a specialized roadway (circulation) system
2. Promote intersection hierarchy
3. Locate signals to favor through movements
4. Preserve the functional area of intersections and interchanges
5. Limit the number of conflict points
6. Separate conflict areas
7. Remove turning vehicles from through traffic lanes
8. Use non-traversable medians on major roadways
9. Provide a supporting street network along arterials and other major travel routes
10. Provide unified site access and circulation systems within and between development sites along major travel routes

Principles 1, 2, 9, and 10 are necessary for coordinating the systemic impact land use has on transportation and traffic operations, but states without formal access management programs can apply any of the techniques to improve road conditions. Because effective access management varies according to roadway function and traffic circulation, land use context, and the sociocultural and/or institutional characteristics of immediate and surrounding areas, there are no "one-size-fits-all" solutions or processes [*26*]. Access management is important

in urban, suburban, and rural environments. The more developed an area becomes, the greater need to manage and plan access.

Impacts of Access Management

Research has examined the impacts of access management techniques on traffic safety, traffic operations and mobility, the economy, and the environment. Impacts of access management techniques are largely interrelated [*28*]. For instance, safety and operations benefits tend to go hand-in-hand: Improving traffic operations and mobility tends to result in better safety and fewer crashes, which has a positive effect on mobility. The role mobility plays in economic development and business activities is so essential, it is undisputed. It makes sense that improved mobility along major corridors would have a positive economic impact. While research has generally found this to be the case, states often face challenges from businesses whenever access management projects are proposed. Given the objectives behind access management principles, and the specific goals stated in the LA SHSP, any discussion of economic impacts [of access management] must be contextualized by safety and operational impacts. Therefore, the first subsection provides an overview of access management impacts on safety and operations, while the second subsection focuses on research examining the economic impacts associated with access management treatments.

Safety and Operational Impacts

Research has shown that access-managed roads are safer, move traffic more effectively and have shorter, more reliable, travel times than roads without [*23*]. This generally has positive implications for business and the environment (e.g., via lower emissions). Moreover, access management prolongs the life of roadways, and by extension, the public investment in highway infrastructure [*24*]. Access management is important in urban, suburban, and rural environments. The more developed an area becomes, the greater need to manage and plan access.

Driveway/Signal Placement & Density. The relationship between crash rates and the frequency, density, and spacing of access points and signals is well-documented: greater frequencies of intersections and driveways generally leads to increased crash rates [*25, 29*]. According to AASHTO, a disproportionate number of crashes occur at driveways rather than at other intersections [*7, 30*]. In general, history has shown that increasing numbers of driveways have "cumulative adverse impacts" on safety and operations [*7*]. Crash rates increase as the density of unsignalized access connections per mile increases, and these

patterns are largely consistent among states [*28, 29*]. For example, one study conducted in South Carolina analyzed the potential safety and operational consequences of individual driveways and their characteristics in order to provide the state with decision-making support with respect to driveway permitting [*31*]. The study found increasing distance between driveways, increasing entry lanes and the presence of raised medians are associated with a decrease in crashes, while wider driveways, corridor volume and higher speeds, as well as high-turnover land use and full access are associated with an increase in crashes [*31*].

Likewise, signal density is associated with higher crash rates [*28, 32, 33*]. Signal density is also related to travel speeds and is one of the most important factors in estimating average speeds on arterial streets [*34*]. The spacing of traffic signals affects the operational performance of urban and suburban highways [*7*]. According to Stover and Williams, the traffic signal spacing has a "direct effect on roadway efficiency" [*26*]. Poorly timed and close, frequent, or non-uniformly placed signals constrain traffic flow, contribute to delays and increase travel times. Gluck, Levinson, and Stover find that increased signal frequency results in reduced progression efficiency with a corresponding increase in delays [*28*]. Short traffic signal spacing is associated with problems like high crash rates, less flexibility in signal timing, greater variability in traffic speeds, as well as environmental consequences i.e., reduced fuel economy and increased emissions [*35*]. It is important to note that the consistency of findings across states holds even as precise relationships vary due to differences in the geometry of roads, intersections, driveways, etc., operating speeds and traffic volumes [*28*, *29*].

Conflict Points at Intersections & Medians. The primary goal of access management is to limit the frequency and impact of conflict points (or driver decision points as they are sometimes called) on through-traffic [*36*]. All access points have at least one or more conflict points, i.e., any point where the paths of two road users cross, diverge, or merge. About half of the basic principles underlying access management explicitly pertain to limiting and reducing the impact of conflict points at driveways, intersections, and median openings. These are:

- Preserve the functional area of intersections and interchanges
- Limit the number of conflict points
- Separate conflict areas
- Remove turning vehicles from through traffic lanes
- Use non-traversable medians on major roadways

Any access point (e.g., driveway) that intersects with the road is a potential point of conflict, however, public road intersections are of particular interest [*23*]. By design, intersections are planned locations of friction where road users may come into conflict with one another [*28, 37*]. Because access management techniques are used to control the location of merging, diverging and crossing traffic, they are especially advantageous at intersections [*38*].

The range of potential safety and operational concerns that may arise at a given intersection is related to the surrounding environment. Table 1 provides a basic overview of the operational and safety concerns at intersections in rural, suburban, and urban environments. In urban and suburban areas, for example, congestion at intersections during peak travel periods has a detrimental impact on overall arterial efficiency. According to Reid, "in the vast majority of cases, the single, most limiting capacity factor in overall arterial performance is signalized intersection operations" [*39*].

Table 1
Operational and safety concerns at intersections, by environment-type

	Rural	Suburban	Urban
Operational Concerns	Maintenance of high speeds for through movements Navigation for unfamiliar drivers Provision for comfortable turning movements	Maintenance of flexibility to accommodate traffic growth Control of access along major routes Capacity of major signalized intersections	Intersection capacity Accommodation of parking, deliveries Maintenance of signal progression schemes and network considerations
Safety Concerns	Mitigating rear-end conflicts caused by turning vehicles Providing adequate geometry and sight distance for safe gap acceptance Avoiding 'surprise' situation (e.g., hidden intersections, unusual channelization)	Angle and rear-end conflicts at congested intersections Localized pedestrian-related problems (e.g., schools, shopping) Driveway access conflicts	Pedestrian conflicts Angle and rear-end conflicts at congested intersections

Source: 2004 NCHRP Report 279, p. 40 [14]

Concerns are different in rural areas. First, median-separated (i.e., divided) multi-lane highways or expressways typically have speeds greater than or equal to 50 mph and partial access control in that they allow at-grade intersections and limited driveway access [*40*]. Research shows that increasing minor road traffic is associated with greater crash frequency

and severity [*40*]. One major safety concern at rural intersections is right-angle crashes due to the inability of the driver entering or crossing from the minor road to gage the speed and distance of oncoming vehicles on the major road [*40*].

Intersections vary in complexity by the number of legs (i.e., lanes), entering vehicle volume, as well as the presence of bicyclists and/or pedestrians [*26*]. Intersection complexity generally increases as the number of approach legs increases; as the number of legs increase, so do the number of conflict points. The geometric design or crossing angle contribute to intersection complexity as well. Figure 3 illustrates a conventional four-leg signalized intersection, which has a total of 32 conflict points. Compared to conventional four-leg intersections, a typical rural four-leg divided highway intersection has 42 conflict points, as shown in Figure 3. The presence of many conflict points becomes a greater concern under increasing traffic volumes as the probability of two users coming into contact increases [*26*].

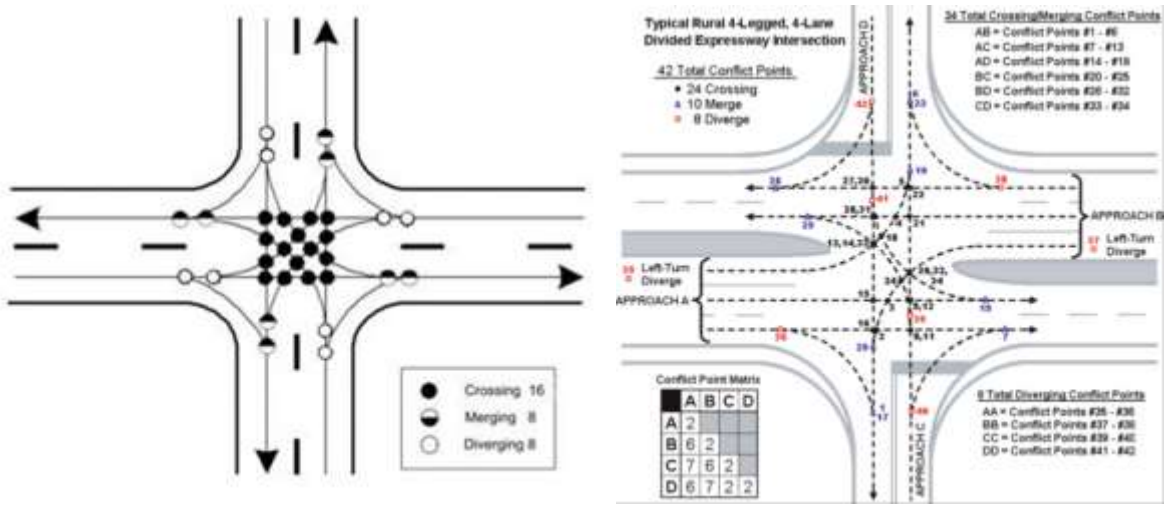

Figure 3
Left: Conflict diagram of conventional four-leg at-grade intersection [*14*]
Right: Conflict diagram of typical rural four-leg divided highway intersection [*19*]

Left-Turn Treatments & Unconventional Intersections. Left-turning vehicles present operational and safety challenges due to conflicts arising from opposing through traffic, same direction through traffic, and crossing traffic with other road users [*41*]. Intersection capacity and operations depend on how left turns are treated [*42*]. Left turn treatments that separate turning vehicles from through movements have been shown to improve intersection performance, maintain travel speed, preserve roadway capacity and

reduce the risk of crashes [*39*]. Separating and limiting conflict points associated with left-turning vehicles can be achieved through various access management techniques, ranging from more conventional options, such as adding protected turn lanes and channelization, installing non-traversable raised medians, to the unconventional, such as re-routing/reconfiguring the intersection by design.

The term "unconventional intersection" refers to any intersection design that does not allow direct movement in all directions. Throughout the literature, there are a number of terms used describe the unconventional intersections with apparent interchangeability, i.e. reduced conflict intersections (RCI), innovative intersections, alternative intersections and non-traditional intersections. There are three main principles behind unconventional intersection design, operations, and management:

1. Design and operational emphasis on through movements (preserve functional classification of arterials, minimize stopped delay for through movements)
2. Reduction in the number of signal phases (reduce cycle length)
3. Reduction of conflict points at intersections and separation of remaining [*39, 43*].

Considering these principles in the context of access management, unconventional intersections are ultimately "conflict-point management" treatments. Conflict-point management treatments are those that, by design, strategically reduce, relocate or otherwise control the number and/or the potential severity of conflicts at intersections [*40*]. The effectiveness of such treatments comes down to the elimination of the high-risk conflict points, which varies according to intersection complexity and traffic volume [*40*]. For example, on rural high-speed roads, the highest-risk conflict points are those on the far-side intersection associated with left turns and crossing maneuvers from the minor street. Case studies on several different unconventional intersection designs have shown that they are capable of improving both operational efficiency and safety [*40*].

The unconventional intersection design most suited for a particular location depends on a multitude of factors, including whether or not the design will be implemented at a single location or at multiple intersections successively along a corridor [*39*]. Compared to conventional intersections, unconventional designs are capable of mitigating the growing congestion problems experienced on high-volume roads because they operate more efficiently and with less signal phases, which can be especially beneficial when implemented systemically [*39*]. They can also be very effective at isolated locations, particularly as a safety countermeasure.

While there are at least a dozen unconventional designs and a number of variations associated with each, states are increasingly considering designs that do away with direct left turns (i.e., unconventional median U-turn crossover, RCUT, roundabouts) as a means of access management. The unconventional intersection design of interest in this study is the Restricted Crossing U-turn (RCUT), otherwise referred to as a J-turn, superstreet, or synchronized street intersection [*44*]. The RCUT is a variation of the median U-turn (MUT) intersection design, also called "Michigan left" due to its frequent use along roads and highways in the state of Michigan [*45*]. In the state of Utah, this design is called a "ThrU-Turn," while in other states, the terms U-turn Crossover, Express Left, or Boulevard Turnaround are used.

There are differences between the MUT and RCUT worth noting; however, before describing how the designs differ, it is important to first clarify how alternative intersection designs such as these compare with conventional designs to reduce the number of conflict points. Table 2 displays the number of conflict points these designs have compared to conventional intersections. Both the MUT and the RCUT eliminate 50% or more of the total conflict points associated with conventional intersections and well over 75% of the crossing conflict points, which are considered far more severe than those left remaining. Obviously, more lanes will increase the number of conflict points, but the number will still be fewer than a conventional intersection with the same number of legs.

Table 2
Intersection design and number of conflict points

Type of Intersection	No. of Legs	Crossing	Diverging	Merging	Total
Conventional	4	16	8	8	32
Conventional Divided Hwy	4	24	8	10	42
Conventional T	3	3	3	3	9
Offset T (two T intersections)	3	22	2	2	26
Median U-Turn (MUT)	3 or 4	4	6	6	16
RCUT/J-Turn/Superstreet	3 or 4	2	6	6	14

Median U-Turn. The MUT and RCUT are closely related but differ in important ways [*45*]. First, the MUT intersection eliminates direct left turns from major and/or minor approaches, often both, and requires drivers to travel through the main intersection and then make a U-turn downstream at a median opening followed by a right turn. In most cases, the

main MUT intersection is signalized, while a crossover may or may not be signalized [*45*]. Due to its design, signalized MUT intersections have only two signal phases and operate more efficiently than conventional intersections. As previously mentioned, the MUT is heavily used in Michigan and has been since the 1960s [*46*].

A FHWA research synthesis of 25 studies published between 1974 and 2005 reviewed findings concerning the safety and operational performance of MUT intersections [*47*]. In general, reduction of signal phases leads to about 20-50% increased capacity for the intersection, while the reduction in conflict points has been shown to reduce the number of crashes from about 20-50% as well, with a dramatic reduction in the most severe conflict points [*47*]. Reid et al. examined a combination of comparative simulation and field studies with publication dates ranging from 1997-2002 and 1974-2010, respectively, and concluded that MUT intersections have the following operational advantages over conventional intersections:

- Added 14-18% capacity
- Increase total throughout from 15-40%
- Lower number of stopped vehicles in network, 20-40% lower
- Critical lane volumes reduced by 17%
- MUT corridors reduce travel times by about 17% and increase average speed by 25% (compared to conventional corridors with TWLTLs) [*48*].

Restricted Crossing U-Turn. An RCUT intersection redirects left turns and through movements from minor/side street approaches, requiring all left-turning vehicles approaching the major road to turn right onto the major road and make a U-turn at a directional median opening 400-1000 ft. downstream [*45*]. Drivers who need to continue through on the side street follow the same path, only they would turn right from the major road to the side road. A basic illustration of the RCUT design appears in Figure 4. The primary difference between the two designs is that the RCUT reroutes through movements whereas the MUT does not. This difference suggests that in places with high through demand, the MUT may be a better option [*46*].

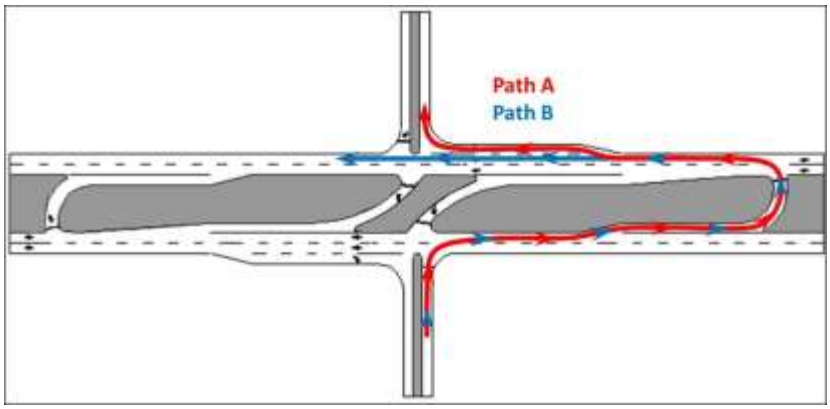

Figure 4
RCUT intersection diagram, from FHWA

The purpose of RCUT intersections is to serve through traffic on the major road. By design, they have the capability to provide a relatively high LOS to major road through traffic over a wide range of demands. The RCUT intersection is known by alternative terms such as a "superstreet," J-turn, or "synchronized street" intersection. The terms are used with apparent interchangeably throughout the literature; however, the term "J-turn" was first applied to unsignalized RCUT intersections on high-speed rural highways [*45*].

The RCUT was first presented in the late 1980s by Richard Kramer, a traffic engineer in Huntsville, AL, but the design was also independently developed in Maryland and North Carolina in the late 1980s-early 1990s [*44, 49*]. Kramer, who was primarily concerned with congestion on suburban arterials carrying high volumes of through traffic, called the design a "superstreet" advancing the idea that signal-controlled intersections along arterials should have a "high percentage of green time… to promote high quality-progression" [*45*]. In Maryland, the RCUT primarily developed out of the need to maintain adequate traffic flow at some minor road intersections on high-speed four-lane rural roads [*44*]. Specifically, operational issues were beginning to emerge under growing traffic volumes and conflicts, increasing the potential for signalization. The state was concerned that signals ultimately would decrease arterial mobility, attract more development, and increase minor street traffic. Maryland was the first state to install an unsignalized RCUT intersection, which they called a "J-turn." In North Carolina, a series of RCUT intersections, were installed on a "narrow, high-speed, four-lane highway through the mountains" to address conflicts associated with left-turning vehicles from the minor street without signals [*44*]. North Carolina adopted Kramer's term "superstreets" for these intersections.

RCUT intersections may be signalized, stop-controlled, or merge/yield-controlled. As with any geometric treatment, the suitability of a particular treatment at a given location depends on a constellation of factors (i.e., access/land use, operational, safety, etc.) as well as an assessment of the relative impact the treatment would have on the overall road network. According to Hummer et al., "stop-controlled RCUT intersections are typically used as a safety countermeasure, RCUT intersections with merges are often used as an interim measure instead of implementing an interchange, and RCUT intersections with signals are an arterial corridor treatment" [*44*]. When signalization is warranted, the RCUT requires only two phases (as opposed to four phases at conventional intersections) [*45*]. This improves signal progression and offers important operational benefits. The RCUT can be implemented as a "safety measure" or as a "collision countermeasure" [*45*].

As of 2014, RCUT intersections have been installed in Texas, Tennessee, Alabama, Louisiana, Ohio, Maryland, Missouri, Michigan, and Minnesota [*44*]. Because of the relative newness of RCUT implementation; however, there have only been a handful of comprehensive impact studies, conducted in North Carolina, Maryland, and Missouri, which are reviewed here. The focus is predominantly on unsignalized RCUTs and safety impacts, but some studies also include signalized RCUTs and examine operational impacts. Several studies published after 2016 provide further insight into the safety and operational impacts. One particularly relevant 2018 study examined the safety impacts of RCUTs (in addition to three other countermeasures) on Louisiana highways [*50*]. These studies are reviewed here as well. While more research is undoubtedly needed, findings consistently support the claim that RCUTs perform better than conventional intersections (with respect to travel time/delay, signal progression, pedestrian crossing and transit service) [*51*].

North Carolina. One of the first major studies to examine safety and operational impacts was conducted in North Carolina [*52, 53*]. Hummer et al examined the safety impacts of 13 unsignalized superstreets on four-lane divided highways in North Carolina using traffic flow adjustment, comparison-group, and Empirical Bayes (EB) analyses [*53*]. Findings indicate significant reductions in total, angle and right turn, and left turn crashes overall and at 10-12 of the 13 individual sites [*52, 53*]. Overall, the researchers recommend unsignalized superstreets for rural and suburban arterials, particularly where high-volume, divided arterials with four or more lanes intersect with two-lane minor roads [*52, 53*].
The study also compared the travel times of three signalized superstreets, two of which are at isolated locations and the other, a five-intersection corridor, which they compared to comparable conventional intersections [*53*]. In all three cases, the superstreets out-performed conventional intersections in reducing overall travel times during peak periods. As a corridor

treatment, superstreets allow for "perfect progression in both directions at any speed and signal spacing" [*53*]. Additionally, the researchers recommend building superstreets along developing corridors as a "preventative measure" to reduce congestion and increase capacity before it truly becomes a problem. Arterial traffic will eventually outgrow the capacity of a conventional design before it will the superstreet, which is ultimately a cost-saving measure in the end [*53*].

Maryland. Inman and Haas evaluated the safety and operations of an RCUT (i.e., J-turn) intersection on a rural four-lane divided highway from a human factors perspective [*54*]. The researchers compared several observations at the RCUT intersection to a nearby conventional intersection located on the same corridor [*54*]. Observations included: conflict between vehicles, merging behavior, lag acceptance, weaving, and travel time differences between the RCUT and the conventional intersection [*54*]. They also examined the impact of converting conventional intersections along two rural high-speed divided highways to RCUTs in Maryland by conducting a before-and-after analysis of crash data using three approaches. In total, they considered nine RCUT intersections, installed between 1998 and 2003. Findings indicated that while travel times at the RCUT took about a minute longer than the conventional intersection, there were clear safety impacts that make the RCUT safer than conventional designs. The before-and-after crash analysis showed between 28 and 44% crash reduction following the conversion to RCUT and suggested a decrease in crash severity. In their conclusions, the researchers recommend the RCUT design for minor road intersections of sufficient volume where they meet four-lane divided highways, noting that with increased volume on the major road, the increased travel time at the RCUT is likely to decrease [*54*].

Subsequent case study research conducted by the Applied Technology and Traffic Analysis Program, a partnership between Maryland State Highway Administration and the University of Maryland, provides additional support for earlier findings. In a presentation for the 2014 TRB Alternative Intersections & Interchanges Symposium, Rahwanji, and Kim present the state of the practice, case studies, and analysis tools on unconventional designs in Maryland [*55*]. Specifically, results of a before-and-after (i.e., 3 years before, 1.25 years after) comparison of crash data at the signalized RCUT intersection in Maryland. In general, the superstreet saw the most impactful crash reductions in angle crashes, which went from 12 (2008-2010) to 1 (2012-2013).

Missouri. Edara, Sun, and Breslow evaluated the effectiveness of J-turns in Missouri by conducting field studies, a public survey, crash analysis, and conflict analysis [*56*]. The researchers report that in the sample of five intersections the J-turn design resulted in

approximately 35% reduction in crash frequency for all crashes and about a 54% reduction in crash frequency for all injury and fatal crashes. Among injury crashes, serious injury crashes decreased by 86% while minor injury crashes decreased by 50%. There were zero fatal crashes following J-turn implementation. Of all of the potential safety benefits associated with the J-turn design, decreasing the frequency of angle crashes is perhaps one of the most important safety impacts. In this study, the researchers reported that annual right angle crashes decreased by 80% for all five sites. They also report that the J-turns "completely eliminated" left-turn right-angle crashes. Another safety finding involved a comparison between a J-turn site and a TWSC site on US 63 on "time to collision," a measure of conflict defined as "the time after which a vehicle will collide with another vehicle if both vehicles were to maintain their current speed and path" [*56*]. With this measure, smaller values indicate greater crash likelihood if no evasive actions are made, while higher values suggest lower crash likelihood. Time to collision was significantly higher at the J-turn site than at the TWSC site, which was an average of 41.28 second and 10.40 seconds respectively. See also [*57, 58*].

Other States. The studies on unsignalized RCUTs indicate generally positive impacts, particularly in regards to safety but also in operations. In general, when states install signalized RCUT intersections they typically do so as a corridor treatment to improve traffic operations [*44*]. Hummer and Rao collected and analyzed crash data at 11 intersections in four states (i.e., Alabama, North Carolina, Ohio, and Texas) to examine before-and-after conversion from conventional to RCUT design [*51*]. All of the intersections were in suburban areas along four-lane or six-lane arterials. All four states reported the predominant reason they chose the RCUT design was for operational reasons rather than safety. The researchers were able to determine high-quality comparison sites. In general, they find that support for the assumption that signalized RCUT intersections reduce crashes. At 8 of the 11 sites, they observed reduction in overall and injury crashes. Among the three sites that did not show a reduction in crashes, the researchers observed each had three-lane approaches from at least one of the minor streets. This finding suggests RCUTs may be safer when the minor streets are narrower and/or have lower traffic volumes [*51*].

In their 2018 study particularly relevant to this research, Sun and Rahman investigated the safety impact of several crash countermeasures recently installed in Louisiana, one being the RCUT [*50*]. In total, all of the countermeasures examined achieved a reduction in crashes and all were deemed cost-effective, but this review focuses only on the RCUT findings. For 10 RCUTs in Louisiana (one rural, nine urban) Sun and Rahman performed a before-and-after crash characteristics analysis, developed the crash modification factor (CMF) of RCUT

intersections (using two methods), and estimated the overall safety benefit-cost ratio of RCUT installations [*50*]. The researchers classified crashes occurring within 150 ft. of the intersection as "intersection only" crashes, while crashes taking place between the two U-turns were classified as "RCUT crashes." Despite some variation in crash changes, the before-and-after crash characteristics analysis showed significant reductions in RCUT crashes (by 13%, 11%, and 100% for total, injury and fatal crashes, respectively) and Intersection only crashes (by 31.1%, 41.8%, and 100%, respectively).

The researchers estimated the CMFs using the Improved Prediction method (for both RCUT and intersection only) and the Empirical Bayes (EB) method (for intersections only). For the Improved Prediction method, the expected crash reduction is 85 (14%) for RCUTs, which translates to a CMF of 0.86 (95% confidence) with the intersection only CMF estimated to be 0.69. The EB method estimates the CMF of intersection only crashes is 0.80, indicating a 20% reduction in the total number of crashes at RCUT intersections. The safety benefit-cost analysis provides insight into how the decreased number of crashes translates into economic savings. Using an average construction cost estimate of $300,000 (provided by a DOTD district representative), the researchers estimate the overall safety benefit cost ratio is 2.72. Even if the average RCUT construction cost estimate was $500,000, the researchers estimate the ratio would be 1.63 [*50*].

Summary. The impact of access management on safety and operations is well documented. While there are many techniques to reducing, separating, relocating, and minimizing the impact of conflict points, unconventional intersection designs such as the RCUT provide simultaneous benefits to roadway operations and safety. Any potential limitations associated with the unconventional designs (such as potential driver confusion or increased travel time for minor street access) are out-weighed by the safety and operational benefits, which significantly impact all road users.

Barriers to Implementation

State DOTs often face serious challenges and opposition to access management projects, which require the coordination of state/local resources and policy as well as the cooperation and support from property owners and developers to be successful. Consistent throughout the literature, access management strategies and treatments go a long way in improving roadway operations and safety. Despite the documented benefits, there continue to be a number of barriers to implementation. *NCHRP Report 548: A Guidebook for Including Access Management in Transportation Planning* lists some of the more common barriers states face to addressing access management concerns in the planning process [*6*]. These include

insufficient funding, a lack of standardized procedures and/or an inability to apply standards consistently, as well as a lack of understanding among local elected officials and small property owners [*6*]. Other barriers include attitudes and perceptions of access management techniques among local elected officials, property owners and the public overall. For instance, Rose notes the persistent "erroneous public belief that U-turns are dangerous" and the longstanding "preconceived notion of the negative impact of access management techniques" [*6*]. This is especially the case among businesses, as there is a tendency to perceive any proposed access changes negatively due to the overriding perception that the changes to access will be harmful to their bottom lines.

In a 2012 publication, Shumaker, Hummer, and Huntsinger examined the barriers to implementing unconventional intersection designs (UIDs) by conducting a national survey of 1,073 randomly selected members of the Institute for Transportation Engineers (ITE) [*59*]. The response rate was 23% (N=245). When asked to provide their level of familiarity with and their opinion on UIDs, respondents who reported being very familiar with UIDs were most likely to report the opinion that they offer much potential for improvement over the conventional designs [*59*]. Respondents were asked to rank barriers in the order of importance, which were divided into three separate categories: Public acceptance barriers (n=6), Professional barriers (n=8), and Political barriers (n=8). Of the public acceptance barriers, respondents ranked "potential for driver confusion" at the top, followed by "fear of the unknown." Respondents ranked public opinion the highest among political barriers, followed by "Lack of proof of design function," which also ranked first among professional barriers. When asked which factors are most important to increasing the use of UIDs, all of the respondents indicated some degree of importance in "proof of benefits" and "education."

Controversy. The barriers to implementation tend to be similar regardless of the access management technique proposed. One of the most controversial issues in access management, for example, is the construction of raised/nontraversable medians (i.e., left-turn restrictions) in areas with extensive development and heavy traffic volume. In general, research finds that crash rates on multi-lane undivided highway decline when any median treatment is implemented [*28, 30, 60-62*]. Compared to two-way left turn lanes (TWLTs), which are the least access-restrictive median treatment, nontraversable medians physically separate opposing traffic and directly reduce the number of left-turn conflict points, in addition to a host of other safety benefits, such as providing a pedestrian refuge and reducing driver workload [*63*].

Research published since the 1980s has tended to arrive at the same conclusion: that four- and six-lane divided highways with nontraversable medians have lower crash rates than similar capacity roads with TWLTLs [*28*]. On average, the crash rate is approximately 30% lower [*18*]. Despite the clear implications for safety, which are well-documented, these projects are generally perceived negatively by citizens and businesses likely to be affected.

Dixon, Hibbard, and Mroczka examined the public perception of median treatments for three median improvement projects on developed urban roads in Cobb County, GA, located in the greater Atlanta area [*64*]. Dixon et al, reviewed public hearing comments and found comments tended to reflect five basic areas of concern, specifically: (1) Total project opposition, (2) design based on abutting land use, (3) access constraints, (4) safety, and (5) cost. One thing that was apparent to the researchers was that in many cases, the features of the treatment that were perceived as strengths to one group of citizens was perceived as a weakness to others. Some citizens took the public hearing as an opportunity to communicate their dissatisfaction with local government. In general, citizens appeared primarily concern with the potential impacts the median improvement would have on them personally, rather than the impact on road operations. Dixon et al. suggest agencies preparing for public hearings set up the meeting in such a way as to more directly communicate the potential impacts on individual citizens [*64*].

Ott, Feilder et al., recommend a proactive approach to communicating the safety and operational benefits of proposed projects to members of the public as well as to businesses [*65*]. They emphasize the importance of pinpointing what is "of value" to various stakeholders in the public (i.e., residents, businesses, commuters) in their education and awareness outreach efforts [*65*]. A study on public involvement in median projects in Florida found that some of the FDOT district offices handled public concerns more proactively than others, which led to better success. For example, involving the public in earlier phases of the project development process (such as the design phase) can head off public opposition to median decisions [*66*]. Williams notes "agencies that rely on public hearings for median projects report they tend to be adversarial and have not been effective in resolving public concerns for several reasons," such as the point in the process when they are typically held, the fact that the hearing must focus on a broad range of issues as opposed to access issues, and a lack of time spent explaining the project necessity. [*66*]. To improve success, Williams recommends holding open house-style public meetings as well as one-on-one meetings with civic groups and officials as needed to "diffuse conflict and promote a more personal atmosphere" [*66*].

Business Opposition. According to the FHWA, "access management has no impact on the demand for goods and services;" therefore, it is improbable that access changes will be a primary cause of a business' success or failure [*67*]. Still, research has tended to show businesses often perceive access changes negatively. As one part of a large study evaluating operational and economic impacts of access management along corridors in South Carolina, researchers conducted an online survey of state DOTs as well as phone interviews (18 participants) to gain more in-depth insight into state DOTs access management practices. Thirty-two DOTs responded to the online survey and 18 of them participated in phone interviews. In both samples, approximately 80% of state DOTs reported that opposition from business owners is a primary challenge [*68*].

Business & Economic Impacts

There are a number of difficulties associated with measuring and assessing economic impacts of access management treatments [*28*]. Some of this difficulty is attributed to obstacles obtaining reliable business income and property value data [*24, 69*]. According to Gluck et al., economic impacts not only depend on the extent to which access to adjacent property increases or decreases following the change, but also on the type of business activity affected and the "background economic conditions." [*28*]. These effects are also contingent on changes in business conditions, traffic volume, population shifts as well as shifts in purchasing power, and developing sites of business competition [*28*]. Moreover, other confounding factors that influence business activity and traffic patterns, etc. could mediate and/or moderate the relationship. For example, several studies conducted in the late 2000s coincided with the global economic recession, making it difficult to determine exact impacts from access management on business sales [*70*].

Several studies conducted in the 1990s and 2000s examined the economic impact of median treatments/left turn restrictions. Research since the 2010s has expanded to include other types of access management treatments; however, only a few studies primarily focus on economic impacts and none of them specifically considers J-turns or RCUT intersections. Existing studies look at the impacts of specific techniques (such as raised medians) on business perceptions while also examining sales data, property values, employment and other metrics before-and-after construction. The most common methods of analysis include perception-based surveys at retrofit project sites, before-and-after survey studies, and empirical analysis of quantitative data when available, with the former two being far more prevalent than the latter [*69, 71*]. The majority of economic impact studies tend to be "desired in a short time frame" and post-construction, thus "no true before-and-after studies [have been] completed to

date" [*69*]. Almost all use survey methods to measure business perception following the treatment.

From a transportation/access perspective, businesses are primarily considered one of two types: "Destination" or "Drive-by." Destination businesses are those that customers typically plan to patronize before their trip begins. Examples of these include professional services, major retailers, specialty retailers, most professional offices, sit-down restaurants, etc. Drive-by businesses are those that customers tend to stop at on impulse or for convenience, as they are "passing by." These include convenience stores, gas stations and fast-food restaurants. Economic impact studies conducted in Texas, Minnesota, Washington, Utah, and others generally conclude that most businesses (regardless of type) tend to perform the same or better once access projects have been implemented [*19, 67, 70, 72-74*]. These studies are reviewed below.

Business Perceptions. Eisle and Frawley conducted a four-year research effort to develop and test a methodology for determining the economic impact of raised medians [*72, 75*]. In the first year of the project, the methodology was developed and tested at one case study location in College Station, TX before and during construction of a raised median. The second year, 10 additional case study locations were identified and data collected in the cities of McKinney, Longview, Wichita Falls, Odessa, Houston, and Port Arthur, TX. These cities reflect a range of development mixes and a variety of population sizes, ranging from approximately 35,000 in McKinney to about 1.8 million in Houston. Data were collected using survey research methods among business owners and managers along corridors where raised medians were installed. The survey questions were focused on gathering insights into perceptions of business performance over time (i.e., better/worse/same). Some of the key findings include:

- Perceptions of median impact prior to installation were slightly more pessimistic than what actually occurred. Businesses interviewed before construction had more negative perceptions.
- When asked to rank the relative importance that their customers placed on "accessibility to business," "distance to travel," "hours of operation," "customer service," "product quality," and "product price," businesses ranked "accessibility" as fourth or lower, while "customer service," "product quality," and "product price" were ranked within the top three.

- Based on self-reported number of customers per day and gross sales, most business types experienced increases once the installation was complete. The exceptions were auto-repair shops and gas stations.
- Among business owners present before, during, and after construction, property values increased by 6.7% while business owners anticipating access changes perceived property values would decrease.
- The most impactful phase of the process was the construction phase in which businesses reported a reduction in the number of customers per day and gross sales. Most businesses (with the exception of auto-repair shops and gas stations) reported increases following median installation [*72, 75*].

Another Texas study considered effects of access management projects on operations, safety, and economic performance of businesses in the greater Houston, TX, area [*70*]. The economic assessment entailed an analysis of taxable sales data before, during, and after completion of access management improvements for various classes of business along three corridor study areas. All three corridors consisted of principal arterials with retail and residential urban development. Businesses were classified according to North American Industry Classification System (NAICS) as pass-by, destination, or combination (i.e., 50% pass-by/50% destination). Economic tax data were received in aggregate form for each corridor section and business category, which they analyzed by zip code. Taxable sales receipts were adjusted to 2012 U.S. dollars with consumer price index data for normalization purposes and local control zones were created from the zip codes for comparison purposes.

For the most part, results of the analysis indicate mostly positive findings across the three corridors. Two corridors in particular saw taxable sales increases for all three business types after access management improvements had been completed. The results for the third corridor were mixed, with some sections of the corridor showing significant decreases, and others showing large increases. In general, the trends model the taxable sales growth trends observed in the zip code control zones. This suggests that business sales along the corridors after access management improvements were completed increased at a rate greater than businesses in the adjacent control zone [*70*]. The researchers note that during the study period, two major hurricanes (i.e., Rita in 2005, Ike in 2008) along with the global economic recession may have been confounding factors; however, there is no way to determine their impact [*70*].

In Utah, Riffkin, et al. examined the economic impact (i.e., retail sales) before and after the completion of raised median projects along three study and three comparison corridors [*76*]. The study corridors included the construction of a raised median, while the comparison corridors consisted of nearby roads on which other construction projects (i.e., not raised medians) were completed within the same period. Taxable sales data were analyzed one full year before and after the projects were completed. Findings showed that along all of the raised median corridors, corridor-area retail sales and sales per square feet increased, with no evidence of any negative sales impacts. They did not analyze impacts on individual business, so it is possible that not all businesses experienced positive impacts. Riffkin et al. also conducted a business perception survey and found, in general, those businesses who were located along a corridor where raised medians were added, had more negative perceptions of the raised median impact before and after the project completion than businesses along the comparison corridor that did not add raised medians. Overall, business owners had neutral-positive perceptions of the raised medians' impact on traffic safety and operations while also reporting neutral-negative perceptions of the raised medians' impact on sales. Despite the relatively negative perception, sales data analysis indicated that there was a 32% increase in sales along the raised median corridors. This finding suggests perceptions of individual businesses may not reflect reality [*76*].

Several studies have been conducted in North Carolina. Cunningham et al. studied the perceptions and attitudes toward access management held by business owners and managers [*69, 71*]. In order to conduct a before–after study, the researchers identified seven treatment sites where medians were installed and seven comparison sites (as a surrogate for the "before period"). The purpose of using the comparison sites was to control for "the same general macroeconomic conditions, similar traffic patterns, and roadway geometry." [*69, 71*]. The researchers worded the questions differently so that the business comparison group was asked how they think potential access modifications *would* impact them, which served as a proxy before-group. Results indicated that there were no significant differences in revenue changes according to the self-reported responses. There were no significant differences in business turnover. There were differences in perceptions of safety between the comparison group and the after-treatment group in that the after group tended to express positive or neutral attitudes. Additionally, perceived impact on the number of customers-per-day was worse in the comparison group than it was for after-treatment group, suggesting the impact of the median was far less negative than first perceived [*69, 71*].

Vu, Shankar, and Ulfarsson examined business perceptions of access management impacts on accessibility and patronage in Western Washington State (King County) along six major commercial corridors [*74, 77*]. The purpose of the study was to develop explanatory models that provide insight into factors contributing to business perceptions of access management. Data were collected using survey research methods, which asked businesses about current access control, existing traffic conditions, perceptions of patronage impact and preferences for different access management treatments. The researchers assumed (and confirmed) a correlation between perceptions of access management impacts on perceptions of accessibility and perceptions of patronage impact as well as simultaneity in the relationship between perceptions of each (i.e., they influence one another). To examine the relationship, the researchers constructed a "discrete choice model of business perceptions" using a simultaneous logit model approach. Controlling for business use, operation, and street environment variables, the following hypotheses were tested:

- Available access (via driveway controls) could have "significant marginal effects on patronage perceptions;" and,
- "Access management should not directly affect businesses perceptions of accessibility, i.e., the measure of ease of entry or exit at driveways" since the effect of current accessibility should be captured by "street environment" variables [*77*].

One general finding from analysis of the survey data is that businesses tended to have similar perceptions of traffic concerns at their location as well as the corridor. The street environment variables include level of congestion on corridor as well as the presence of right-in-right-out (RIRO) driveways and traffic signals. Results show that perceptions of current accessibility had a significant impact on perceptions of patronage. Specifically, businesses with shared driveways or traffic signal access control had a more positive perception of the impact, while businesses with more restrictive access (e.g., RIRO) had a more negative perception of the impact on patronage. The perceptions of impacts on patronage are closely related to perceptions of access impacts on revenue, with businesses reporting substantially similar perceptions of access impacts on revenue. This suggests that it is reasonable to view perceptions of patronage impacts as a proxy for perceptions of revenue impacts. Additionally, perceptions of traffic concerns, namely high traffic volume/ congestion and high speeds at business driveways, are very similar to the perceptions of traffic concerns along the corridor. Consistent with the second hypothesis, none of the access management variables had a significant impact on perceptions of accessibility; controlling for business operation variables, high traffic volume/congestion was significantly related to perceptions of accessibility, in that the more congestion, the greater the accessibility concerns and less congestion with lower accessibility concerns [*74, 77*].

A study of long-term impacts of access management on business and land development was conducted in Minnesota, following the systematic comprehensive conversion of US Hwy 12 to Interstate 394 in the Twin Cities metro area between 1985 and 1993 [*73*]. Secondary data analysis to assess economic, transportation, land use and demographic trends from 1980 to the early 2000s provided insight across the corridor as a whole, while interviews with 14 business owners and managers representing a cross-section of business-types located in the corridor provided insight into how individual businesses managed during the transition [*73*]. At the corridor level, the impact of the conversion was very positive: traffic volumes increased to nearly double the traffic volume carried on Hwy 12; peak hour speeds increased between 2-25 miles per hour (despite greater volume) and travel time for typical trips generally decreased (despite greater indirect access to retailers). Traffic safety-wise, the rate of fatal and injury crashes (normalized by traffic volume) declined significantly. Land use trend analysis showed land use growing more intensive overtime, with commercial and industrial land use increasing and vacant land decreasing. Post-conversion, gross retail sales (which include taxable services) increased considerably; employment increased and the business turnover-rate in the area was less than typical annual rates for Minnesota (and the country overall) and commercial land values increased greatly. The interviews with business owners yielded findings consistent with other studies: while the experience of individual businesses varied, most businesses were doing well and for the most part, the impact of the conversion was positive. The researchers note that prior to the conversion, some business owners raised concerns about the expected impact to their business. The actual impact turned out to be much less (and generally in the opposite direction) than anticipated and no business suffered as a direct result. Most of the businesses interviewed reported positive experiences [*73*].

Methods

This section describes the data sources, collection, processes, and methodologies used in analysis for this project.

Economic Impact Analysis

The primary data used in the analysis came from the Louisiana Department of Revenue, who provided sales tax data for individual business locations surrounding the J-turns. J-turn location data was provided by DOTD. In some cases, businesses may have experienced turnover, such as a change in ownership or even business type, or become established for the first time during the study period. These transitions were included in the revenue data by a marker to provide a more comprehensive dataset while making clearer potential causes for

changes in business activity over time. These sales tax series are transformed into total sales using the tax rates in each time period, and these total sales figures are the primary subject of our analysis. The statewide sales tax rate increased from 4% to 5% on May 1, 2016. To provide a more consistent measure of economic activity over time, the sales tax collections in each period were divided by the relevant sales tax rate to produce a more consistent measures of taxable sales in each period. In some of the analyses, parish level data were used to provide comparisons to local level economic trends. Total wages, employees, and establishments were acquired from the Quarterly Census of Employment and Wages for each parish where a J-turn was installed. Parish-wide sales tax revenue was acquired from each parish's tax collection agency.

Survey Methods

To gather insight into the perceived impact of access changes on business activity in areas where J-turns were previously installed, both local businesses and their patrons were surveyed. Questionnaires were created and programmed using Qualtrics data collection software: one specifically tailored to business managers and employees and the other was developed for a general population. The primary objective is to survey businesses within a half-mile of existing J-turns constructed between 2011-2013. Given the amount of time since the J-turns were constructed, it is possible that participants may lack a clear recall before or after construction. It was also acknowledged that current employees or managers may not have been present before or after construction and may not recall a time before it was there. The same can also be said for patrons. To avoid introducing memory/recall bias by priming the respondent to think about the J-turn specifically, the questionnaires focus on identifying any access-related issues businesses in the area and their patrons were *currently* experiencing. Copies of both questionnaires are in Appendix B but they are described generally below. For specific question wording or other details, please refer to Appendix B. Both questionnaires were approved for exemption from institutional oversight by LSU IRB.

Businesses. The business survey was open to the highest-level employee available at the time of request who had to be at least 18 years of age as well as have worked at the location or in the immediate area for at least one month. The questionnaire includes a set of questions about the business and its daily operations such as number of employees, number of customers/clients per day on average, etc.; a set of items assessing perceptions of their customers and their perceptions of traffic congestion at their busiest times of day. Several items ask about access-related and safety concerns and asked for elaboration if any concern was mentioned. Finally, for analysis purposes, basic demographic information (e.g., gender, age, etc.) was requested.

Patrons. All participants in the patron intercept survey had to be at least 18 years of age and had to have resided in Louisiana for at least the past month. Patrons were asked if they had planned to stop as well as how frequently they tend to visit that business or others in the area, among other items regarding their preferences and concerns. Like the business survey, there are several items about access-related and safety concerns, as well as basic demographic items.

Recruitment and Data Collection. Recruitment for participation in this study took place on-site, with interviewers spending one day at each of the four general locations to collect data for both surveys. With the exception of a handful of businesses who participated at a later date by telephone interview, all data were collected electronically on iPads, facilitated in-person by the research team who were trained in survey interviewing specifically for this study. Interviewers were accompanied by field supervisors with prior experience to monitor effort, manage the distribution of interviewers across businesses and to answer any questions throughout the day. All participants in this study were assured that their responses would remain anonymous and their answers could not be traced back to them statistically or otherwise.

Survey Sites. Though at least 10 J-turns in the state were constructed between 2011-2013, not all locations were suitable for on-site survey data collection (due to less traffic volume, less commercial development, etc.). One J-turn is located in a rural area and on US 90 for instance, where five of the 10 J-turns were constructed as a corridor treatment, not all of these intersections had enough businesses to generate sufficient patron traffic. Table 3 describes the primary survey site locations. Figure 5 provides a general idea of where these locations are in relation to each other and within the state.

Table 3
Survey sites

Location of J-turn	City	Parish	DOTD District	Year	Setting
US 61 & LA 42	Baton Rouge	East Baton Rouge	61	2013	Urban 4-lane divided
US 90 Corridor (mult. intersections)	Broussard	Lafayette	3	2012	Urban 6-lane divided
LA 21 & Zinnia Dr.	Covington	St. Tammany	62	2012	Urban 4-lane divided
LA 45 & 10th Street	Marrero	Jefferson	2	2013	Urban 4-lane divided

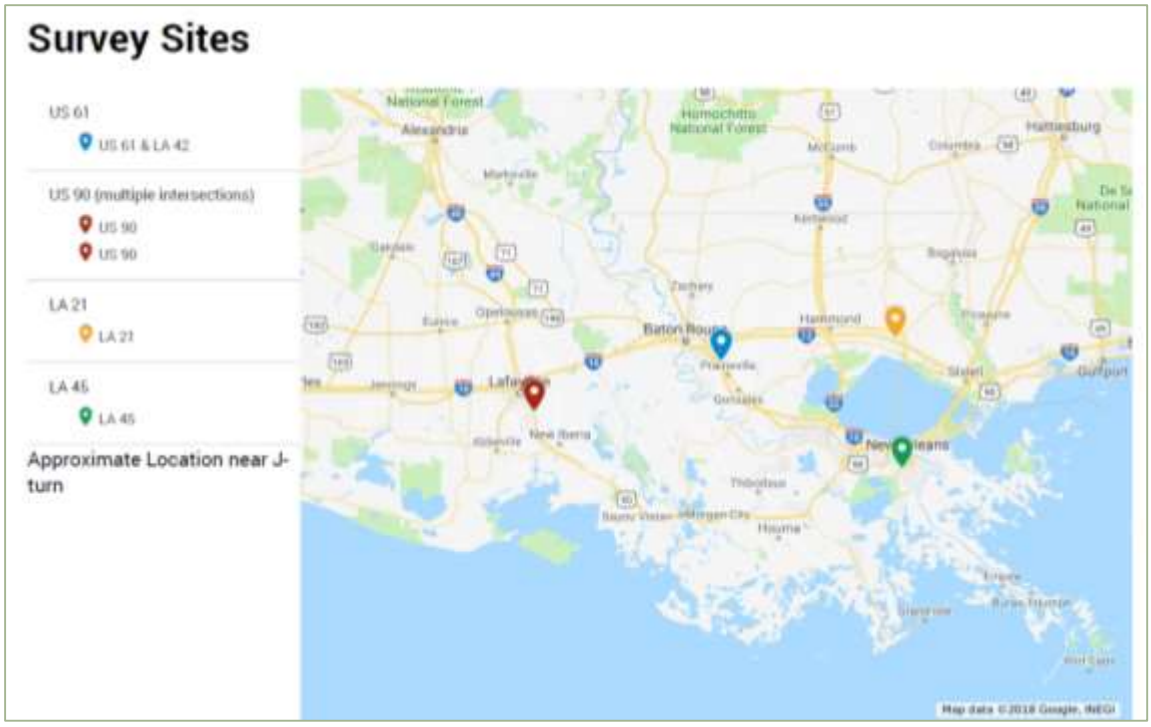

Figure 5
Survey sites, approximate location of existing J-turns

DISCUSSION OF RESULTS

Economic Impact Analysis

Analysis of the economic effects of J-turns follows a top-down approach, which starts by looking at the data broadly and becomes progressively more granular in subject matter. In particular, this analysis focuses on whether J-turns may impact the level of sales at nearby businesses. The first, broadest level of analysis is the aggregate, which includes sales of all businesses within a half-mile of any J-turns matched to the Louisiana Department of Revenue tax database in all years and parishes combined. Second, the data are split by the years that the J-turns were installed, so that different year effects can be observed. The third section splits the data by parish in order to compare business sales to local trends. The final section looks at two specific businesses types, gas stations and restaurants, which were considered most susceptible to impacts from changes in access in the area due to the higher focus on convenience among customers.

Within each of these four sections, two categories of businesses will be analyzed. Businesses within a half mile of the new J-turns were reviewed and categorized as either "affected" or "unaffected" based on whether or not there was a change in travel distance after J-turn installation. An affected business is one that a customer would have to go further out of their way to patronize after installation of the J-turn. Each section compares how affected and unaffected businesses changed after installation of the J-turn. The unaffected businesses act as a local control group to determine the J-turn effect. These comparisons will be done for all matched businesses in the area and also for a more limited set of businesses active 12 months before and 12 months after the installation to ensure a more direct comparison of site-level sales over time. In these data, frequent turnover in storefronts and the establishment of new businesses after infrastructure improvements could lead to trends in sales data that should be attributed to changes in business type or number of businesses. Isolating the analysis to just these existing, constant businesses may clarify the impact of the J-turns, but also in some cases limits the data to too few businesses to draw robust conclusions.

In some cases, it might be preferred to separate the data into affected and unaffected existing businesses to examine the differences between these two groups at every level of detail. However, in some locations, or for certain subgroups, there are not enough businesses in the data to produce reliable results. Moreover, results based on small samples sizes cannot be published due to confidentiality limitations of the data. In addition, an analyst's assessment of whether a business is affected or not by a J-turn requires making certain simplifying assumptions about typical routes taken by drivers in the area and such a determination may

not account for unexpected routes and thereby misclassify some businesses as unaffected when they are in fact affected in some cases, or vice versa. By analyzing all businesses as a group as well as businesses active throughout the study period, the effects of j-turns can be examined at varying levels of detail.

Aggregate

The first seven graphs begin at the macro level by aggregating sales across all matched Louisiana businesses near J-turn installations in all parishes and years. A necessary step in viewing all sales on a single graph is to reference the time frame by which they are examined to be relative to the period in which the J-turn is installed. The J-turns were not all installed in the same year so timing of the data must be adjusted to combine into one graph. After adjustment, zero is the first month of the year of installation. Included in all of the graphs are vertical red lines depicting the period of construction, horizontal lines showing the average before and after the installation period, and monthly sales of businesses surrounding J-turns. The time frame stretches two years before the installation to two years after.

To help control for external factors that may influence sales, monthly sales surrounding each J-turn were divided by monthly sales in the parish. During the study period, a number of economic trends can be expected to influence sales. For example, flooding in August 2016 directly impacted businesses in the Baton Rouge and Lafayette areas with sharp negative consequences followed by a boost driven by rebuilding activity in subsequent months. In addition, a slowdown in oil and gas activity that began in late 2014 cost the Lafayette region thousands of jobs leading to worsening economic conditions in 2015 and 2016. By dividing sales at businesses surrounding J-turns by parish-wide sales figures, broad economic trends can be taken out of the analysis to better assess the impact of J-turns on business activity. However, J-turns are often located in areas that have seen nearby construction of new commercial developments and sales at surrounding businesses may be influenced by more localized factors than parish-level economic trends. These considerations will be discussed when relevant.

Figure 6 depicts the percentage of parish sales that the J-turns are responsible for over time. The percentage is calculated by summing all the sales around the J-turns and dividing them by the sum of all the parish sales within a year. The average before the J-turn is 0.22% and the average after is 0.28%. A hypothesis test of mean equality yields a p-value of less than .05, and rejects the null at this level of significance that the two means are equal. Thus, the aggregate share of parish sales can be said to increase on average after the J-turn's

installations. (Note that Vernon Parish did not disclose their sales taxes so Vernon Parish businesses have not been included in this graph.)

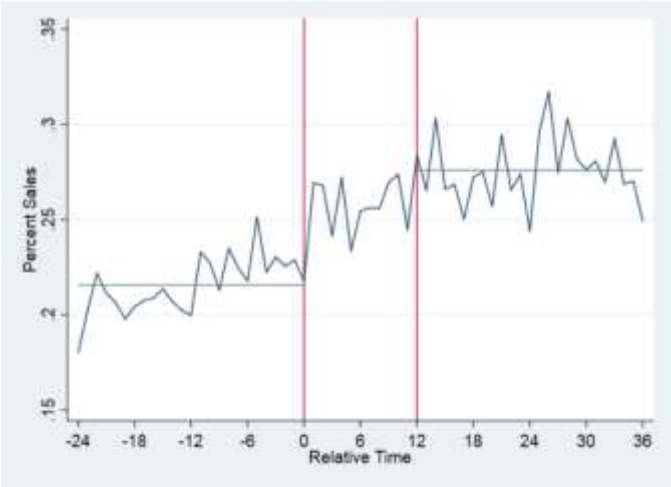

Figure 6
Sales of businesses surrounding J-turns as a percentage of all parish sales

Figure 7 displays nominal sales across all J-turns in millions of dollars. The average before J-turn is $9.6 million and the average after is $13.1 million. A hypothesis test that the two means are equal yields a p-value of less than .05, rejecting the null hypothesis at this significance level, indicating the higher sales after the J-turn are statistically significant.

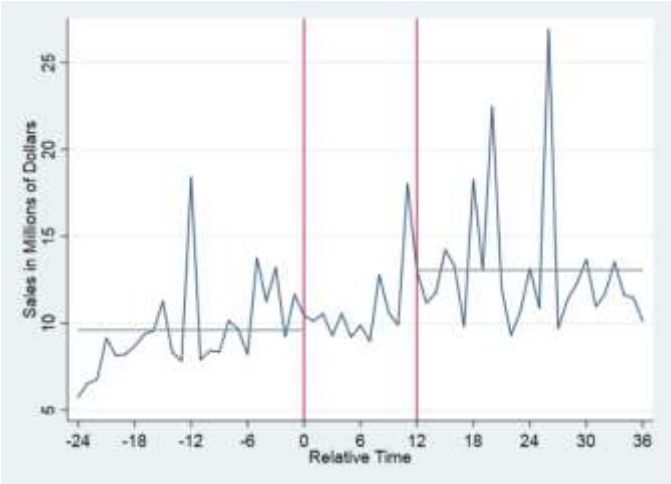

Figure 7
Sales of all businesses surrounding J-turns

Figure 8 shows the same aggregate sales before and after installation but with one key difference: the eight most volatile firms, with standard deviations of over $150,000, have been removed. These were largely oil and gas related firms that might have large sales of equipment or other goods and services in one quarter, and nothing in the next. They have also been removed from all further analysis. The average before installation is 4.4 and after is 6.3. The null hypothesis of the equality of these two means being equal is less than .05, indicating that the mean sales after is significantly more than the mean before.

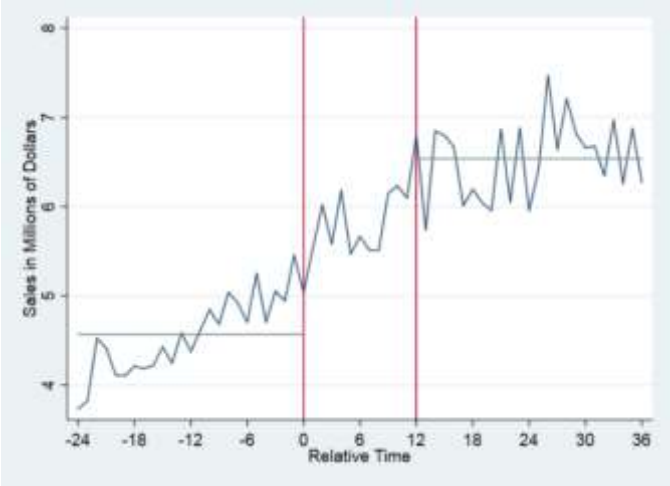

Figure 8
Sales of all businesses surrounding J-turns with volatile industry firms removed

The next two graphs divide businesses by whether their access is affected or unaffected by the J-turn, as determined by travel distance and typical travel in the area (i.e., a mapped route from one point to another not accounting for potential missed turns or temporary disruptions caused by accidents, construction, or other obstructions). Figure 9 portrays the series and averages of the unaffected businesses and Figure 10 portrays those of the affected. The mean of unaffected business sales before the J-turn installation is 3.0, and the mean after is 3.9. The null hypothesis that these two means are equal is rejected at the .05 significance level, indicating that the mean sales after is greater than the mean before.

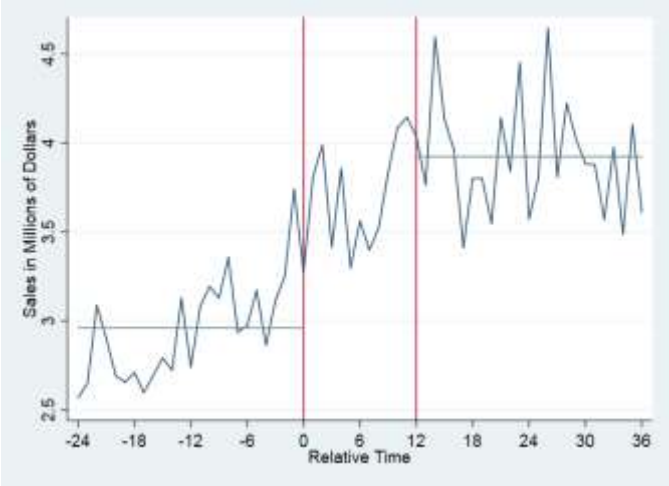

Figure 9
Sales of businesses unaffected by J-turns

Figure 10 depicts the sales of those businesses that were affected by the installation of J-turns. The mean before the installation period is 1.6 and the mean after is 2.6. The equality of the means can be rejected at the .05 level of significance. In both unaffected and affected cases, the mean sales after the J-turns have increased and do not seem to be negatively affected by the J-turn.

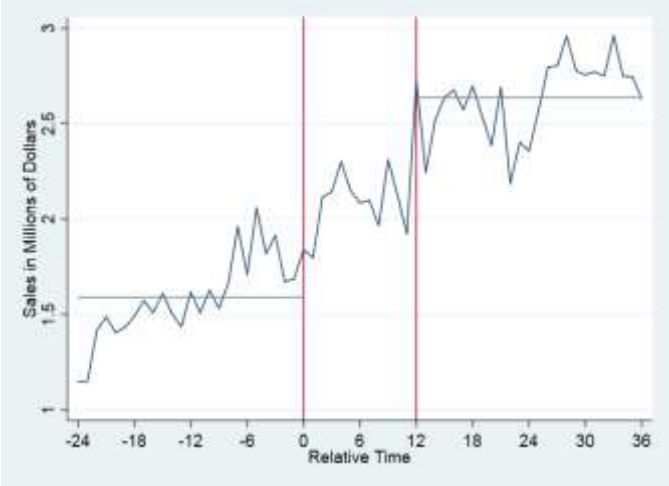

Figure 10
Sales of businesses affected by J-turns

Figures 11 and 12 show the same categories of affected and unaffected businesses, but are restricted to those businesses that were active from a year before the J-turn installation to a

year after. This comparison is useful to examine because it eliminates many conflicting explanations of sales trends due to business turnover and focuses on individual business effects. Figure 11 depicts the sales of unaffected businesses that were active throughout the period of analysis. The mean before the installation period began was 2.9 and the mean after was 3.2. The null hypothesis of equality of means is rejected at the .05 significance level. Thus, sales were higher after the J-turn installation in businesses unaffected by J-turns active throughout the period.

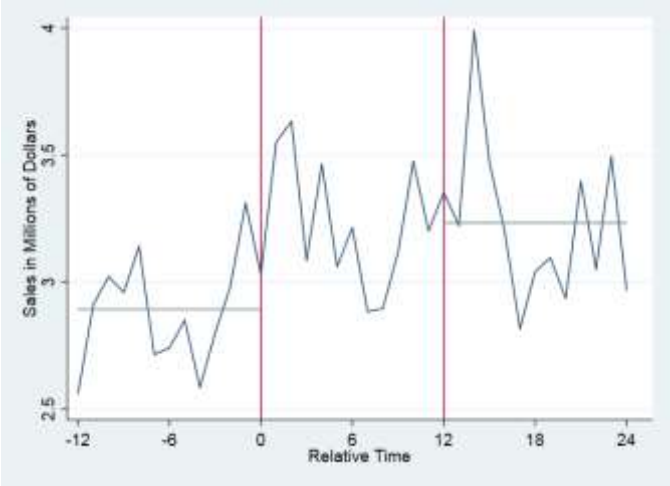

Figure 11
Sales of businesses unaffected by J-turns active throughout period

Figure 12 is the counterpart of Figure 11 and illustrates only those businesses whose access is affected by the installation of a J-turn that were also active throughout the period of analysis. Average sales before the installation was 1.0 and the mean after is 1.2. The null hypothesis of mean equality is again rejected at the .05 level of significance. Sales among this set of businesses were also higher after the J-turn among affected businesses.

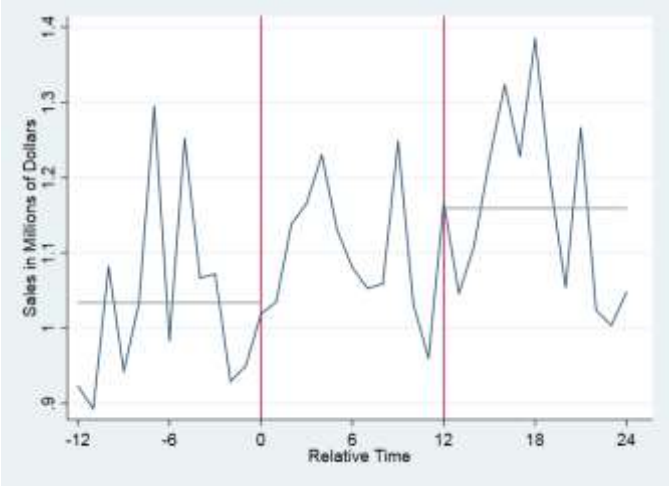

Figure 12
Sales of businesses affected by J-turns active throughout period

Summary. There is no evidence at the aggregate level that J-turns have a negative effect on business sales in the areas where they are installed. On the contrary, they appear to be correlated with growth wherever they are installed. This correlation should not necessarily be taken to mean that J-turns improve business sales; even in the last comparison of businesses active throughout the entire period, there are other factors that may affect business sales, such as the business climate in the parish and the neighborhoods in which they are installed, and potentially growing population and development necessitating J-turn traffic controls in the first place. The fact both affected and unaffected [by travel distance due to the J-turn] businesses experienced increased sales seems to indicate factors besides the J-turn alone may explain the increased sales. These caveats aside, the evidence shows that in aggregate, J-turns do not appear to harm business sales in a significant way.

Summary statistics are shown in Table 4, which displays the means (M), the standard errors (SE) of the means before and after installation, the difference between the means, and indicators representing the level of significance at which the two means are different from one another. To indicate the degree of statistical significance, one, two, or three asterisks indicates rejection of the hypothesis that means are equal at the .10, .05, or .01 level, respectively. A dash in the significance column indicates that the null hypothesis that the means were equal could not be rejected. In every case in this section, the mean after the installation was above the mean before the installation began. Also, every case rejected the null hypothesis that the two means were equal, indicating that within each group analyzed in this section, the mean after J-turn installation is greater than the mean before.

Table 4
Aggregate summary statistics

List of Figures	Mean Before (Std. Err)	Mean After (Std. Err)	Difference Between Means
Figure 6: Sales of businesses surrounding J-turns as a percentage of all parish sales	0.2156 (-0.0149)	0.2759 (-0.0178)	0.0603***
Figure 7: Sales of all businesses surrounding J-turns	9.603 (-2.6499)	13.0523 (-4.0065)	3.4493***
Figure 8: Sales of all businesses surrounding J-turns with volatile industry firms removed	4.408 (-0.4205)	6.3123 (-0.4253)	1.9043***
Figure 9: Sales of businesses unaffected by J-turns	2.9609 (-0.2877)	3.9226 (-0.3238)	0.9617***
Figure 10: Sales of businesses affected by J-turns	1.5909 (-0.22)	2.6357 (-0.1994)	1.0448***
Figure 11: Sales of businesses unaffected by J-turns active throughout period	2.893 (-0.2151)	3.2333 (-0.3109)	0.3403***
Figure 12: Sales of businesses affected by J-turns active throughout period	1.0339 (-0.1231)	1.1595 (-0.1228)	0.1256**

Note ** p=.05; *** p=.01

Installation Years

This section divides the J-turns into the years that they were built. The J-turns in this study were installed between 2011 and 2013. As with the aggregate sales, businesses are first pooled and then categorized as affected and unaffected businesses first with all businesses in the area and then with only those businesses active 12 months before and 12 months after the installation period. These divisions are only included when the number of businesses are sufficiently large to protect confidentiality of sales figures, so 2011 is left out of the detailed analysis. While detailed results cannot be published, the general pattern for businesses surrounding the 2011 J-turn is consistent with other findings that sales increased after installation and the mean was significantly higher in the period following the J-turn than in the period before the J-turn.

The sales of businesses surrounding J-turns built in 2012 are shown in Figure 13. The mean before the installation period for these businesses is 2.9 and the mean after is 4.5. The two means are significantly different at the .05 significance level.

Figure 13
Sales of businesses surrounding J-turns built in 2012

Businesses nearby J-turns built in 2012 were further subdivided into those expected to be unaffected and affected by changes in access due to the installation of the J-turn. Unaffected business sales of J-turns built in 2012 are shown in Figure 14. The mean after installation (2.4) is greater than the mean before (1.7) at the .05 level of significance.

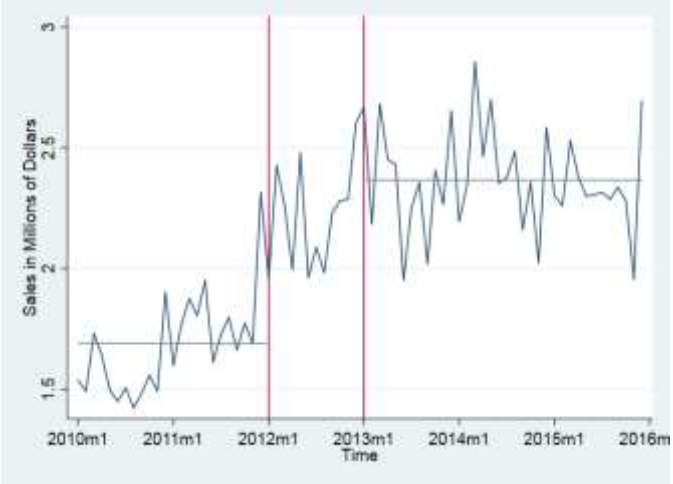

Figure 14
Sales of businesses unaffected by J-turns built in 2012

Affected business sales of J-turns built in 2012 are shown in Figure 15. The mean before the installation period is 1.2 and the mean after is 2.2. The mean after installation is concluded to be significantly greater than the mean before at the .05 level of significance.

Figure 15
Sales of businesses affected by J-turns built in 2012

Figure 16 divides the 2012 year of installation into affected and unaffected businesses and displays these categories on the same graph. The affected and unaffected business sales exhibit very similar trends around the time that the J-turn is built, which would indicate that there is no or little effect on business sales from the J-turns installed in 2012.

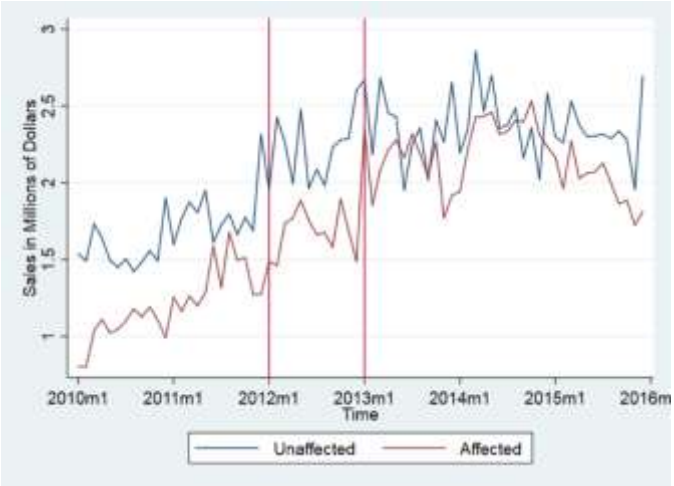

Figure 16
Sales of unaffected and affected businesses built in 2012

Figure 17 further limits the analysis to include only those businesses that were active throughout the period of analysis (i.e. excludes any new businesses or businesses that closed during this period). These businesses had average sales of 2.7 before the installation period

began and average sales of 3.0 after. The difference in means is significant at the .05 level of significance.

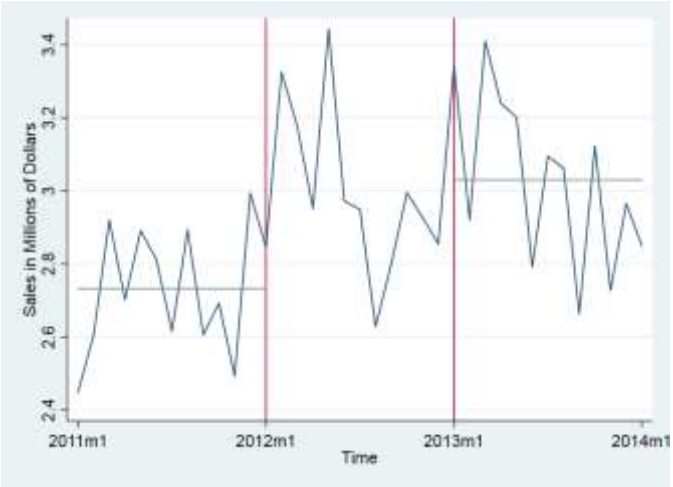

Figure 17
Sales of businesses surrounding J-turns built in 2012 and active throughout period

Next, Figure 18 further limits the analysis to include only those businesses that were active throughout the period of analysis and that were unaffected by the J-turns (i.e. excludes any new businesses or businesses that closed during this period). These businesses had average sales of 1.7 before the installation period began and average sales of 1.9 after. The difference in means is significant at the .05 level of significance.

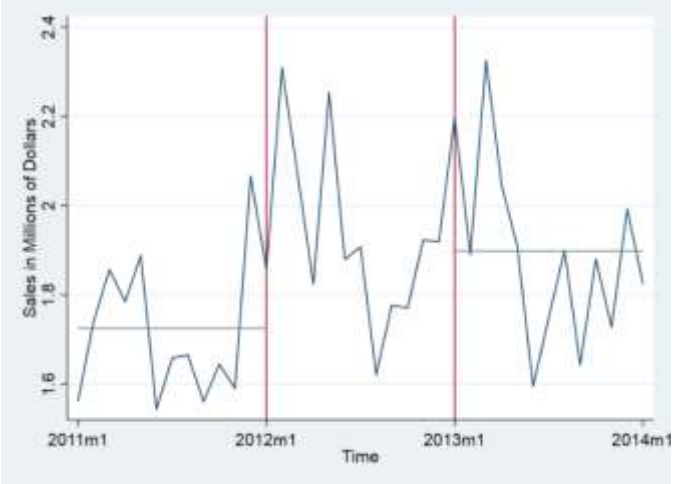

Figure 18
Sales of businesses unaffected by J-turns built in 2012 and active throughout period

Figure 19 depicts only those sales of affected businesses surrounding J-turns built in 2012 that were also active for a year before and a year after the completion of the installation. The mean before and the mean after are 1.0 and 1.1, respectively. The null hypothesis that the two means are equal is rejected at the .05 level. Next, Figure 20 shows both the affected and unaffected businesses surrounding J-turns built in 2012 that began at least a year before installation and existed to at least a year after on the same graph to allow for easier comparison. After omitting disturbances from new businesses opening or closing, the trends for both affected and unaffected are stable and similar. No negative effect is detectable on the businesses that were flagged as affected by changes in traffic due to the 2012 J-turns.

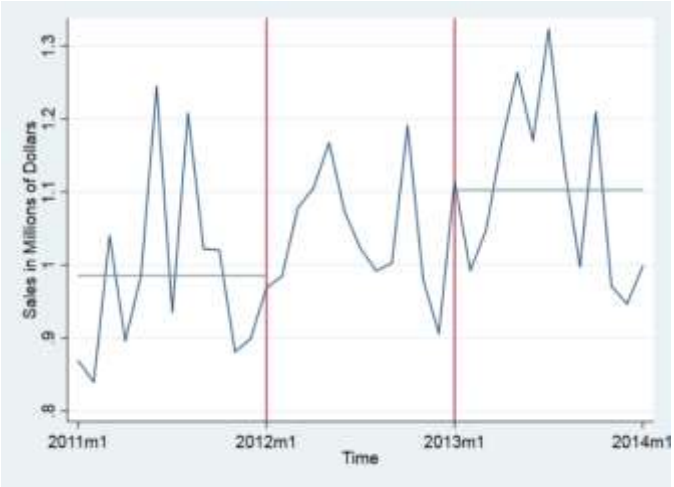

Figure 19
Sales of businesses affected by J-turns built in 2012 and active throughout period

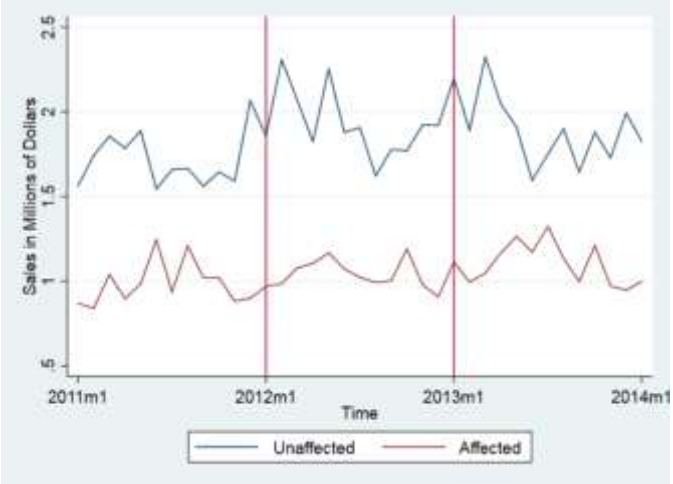

Figure 20
Sales of unaffected and affected businesses built in 2012 and active throughout period

The last year of J-turn installation included in the study is 2013 and the sales surrounding these J-turns are shown in Figure 21. The mean before and the mean after are 1.6 and 1.8, respectively. The two means are significantly different at the .05 significance level.

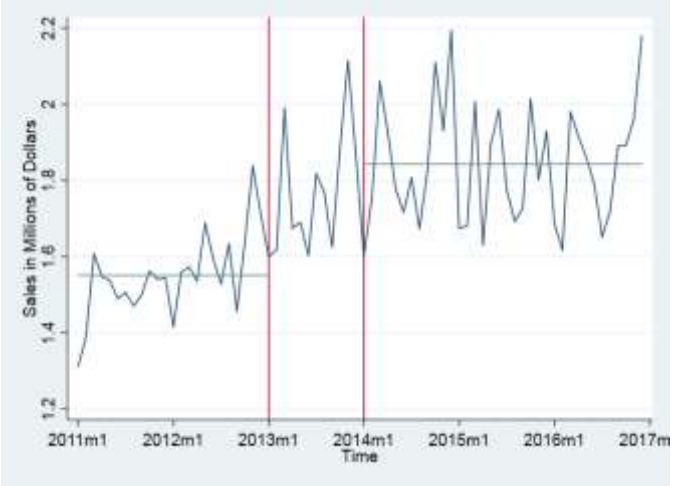

Figure 21
Sales of businesses surrounding J-turns built in 2013

Figure 22 further limits the dataset to businesses surrounding J-turns built in 2013 that also were active for one year before and for one year after. The mean before the installation period began was 1.1 while the mean after was 1.2. The null hypothesis of the equality of these two means is rejected at the .05 significance level.

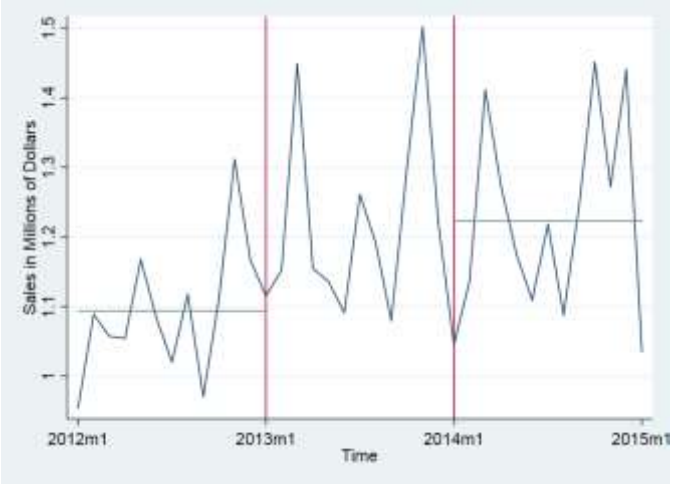

Figure 22
Sales of businesses surrounding J-turns built in 2013 and active throughout period

Summary. The analyses summarized above produces no evidence that J-turns have a negative significant effect on business sales in any year. Sales were either stable or increasing over the study period in 2011, 2012, and 2013 installations. Table 5 displays the summary statistics for this section. No years displayed mean sales after J-turn installation as being significantly below mean sales before. On the contrary, in every case in this section the mean after was indicated to be greater and significantly different at the .05 or higher level of significance.

Table 5
Installation year summary statistics

List of Figures	Mean Before (Std. Err)	Mean After (Std. Err)	Difference Between Means
Figure 13: Sales of businesses surrounding J-turns built in 2012	2.9227 (0.3565)	4.5471 (0.3456)	1.6244***
Figure 14: Sales of businesses unaffected by J-turns built in 2012	1.6893 (0.2073)	2.3658 (0.2130)	0.6765***
Figure 15: Sales of businesses affected by J-turns Built in 2012	1.2123 (0.2194)	2.1509 (0.2155)	0.9386***
Figure 17: Sales of businesses surrounding J-turns built in 2012 and active throughout period	2.7325 (0.1730)	3.0300 (0.2343)	0.2976***
Figure 18: Sales of businesses unaffected by J-turns built in 2012 and active throughout period	1.7247 (0.1581)	1.8984 (0.2073)	0.1737**
Figure 19: Sales of businesses affected by J-turns built in 2012 and active throughout period	0.9852 (0.1246)	1.1028 (0.1207)	0.1176**
Figure 21: Sales of businesses surrounding J-turns Built in 2013	1.5513 (0.1074)	1.8426 (0.1593)	0.2913***
Figure 22: Sales of businesses surrounding J-turns built in 2013 and active throughout period	1.093793 (0.0926)	1.223308 (0.1439)	0.1295**

Note ** p=.05; *** p=.01

Parishes

This section separates J-turn sales by parish. Throughout this section, sales are represented as a percentage of total sales in the parish to capture local trends in the data. Using the percent of total sales in the parish helps to isolate changes in sales attributable to J-turns as opposed to larger economic trends like increasing development in certain parishes. It shows how the sales in the businesses near J-turns fare relative to the entire parish. The following parishes will be shown: Lafayette, East Baton Rouge, Jefferson, and St. Tammany.

For each parish, first, an analysis of all businesses surrounding J-turns will be shown; second the affected and unaffected businesses displayed separately when a sufficient number of businesses are present; third, all businesses active throughout the period; finally, only those businesses active throughout the entire period of study are studied when a sufficient number of businesses exist. While each successive level of analysis provides more detailed and relevant analysis, the number of existing businesses in some cases is quite small, which limits the generalizability of some inferences. For an overview of all summary statistics presented in each of the figures of this section, please refer to Appendix C.

Lafayette Parish. The sales from Lafayette Parish J-turns are exhibited in Figure 23. One notable difference between this graph and previous graphs is that sales have actually declined after the J-turn installation. The means before and after are 0.52 and 0.51, respectively. The p-value of the test that the means are equal is 0.37 and cannot be rejected under any reasonable significance level. Thus, the null hypothesis that the means are equal cannot be rejected, indicating no significant difference between percentages of sales before and after the J-turn installation. Thus, no conclusion can be made as to whether the businesses were negatively affected.

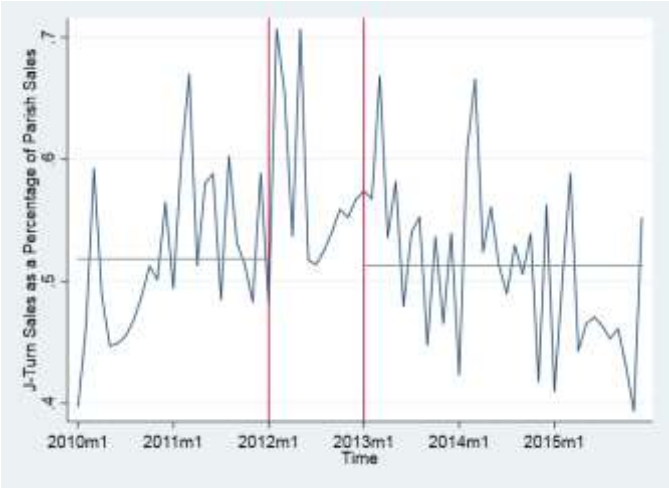

Figure 23
Lafayette Parish: Sales of businesses surrounding J-turns as percentage of parish sales

Next, Figure 24 includes sales of unaffected businesses from Lafayette Parish J-turns. The mean before the installation is 0.28 and the mean after is 0.28. Just as in the last graph, the null hypothesis that the means are equal cannot be rejected in this scenario. In other words, there does not appear to be a significant effect of the J-turn on sales.

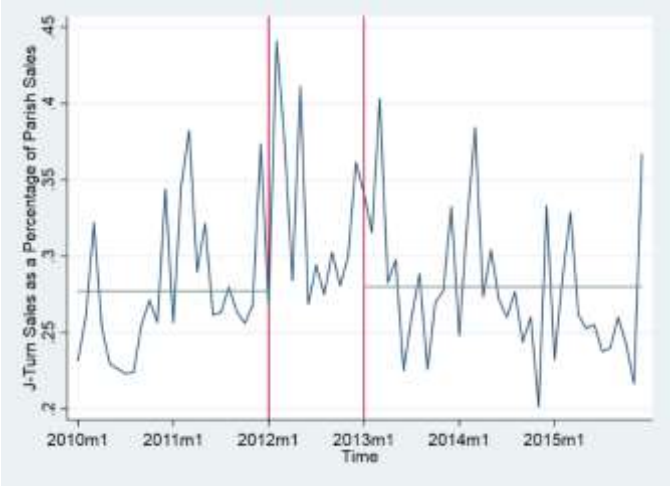

Figure 24
Lafayette Parish: Sales of businesses unaffected by J-turns as percentage of parish sales

In the same way that Figure 24 showed unaffected sales, Figure 25 exhibits the sales of affected businesses around Lafayette Parish J-turns as a percentage of parish sales. The mean before the installation is 0.24 and the mean after is 0.23. The null hypothesis cannot be rejected at the .05 level of significance.

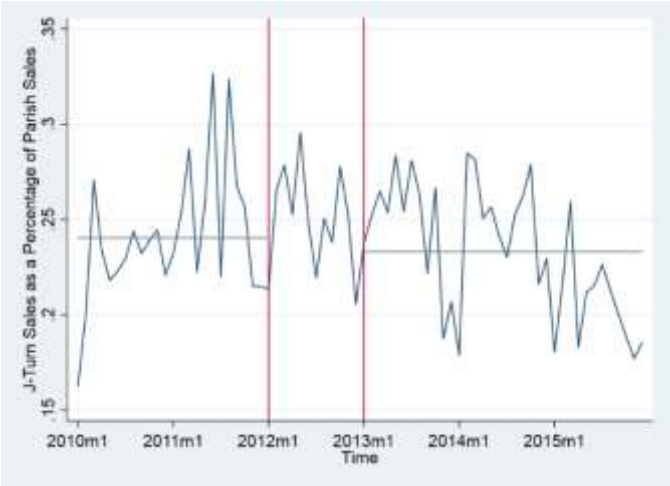

Figure 25
Lafayette Parish: Sales of businesses affected by J-turns as a percentage of parish sales

Figure 26 shows sales as a percentage of parish sales at Lafayette J-turns from a subset of businesses that were open for a full year before and a full year after the installation was

complete. The mean before is 0.47 and the mean after is 0.45; however, the difference between means is not statistically significant.

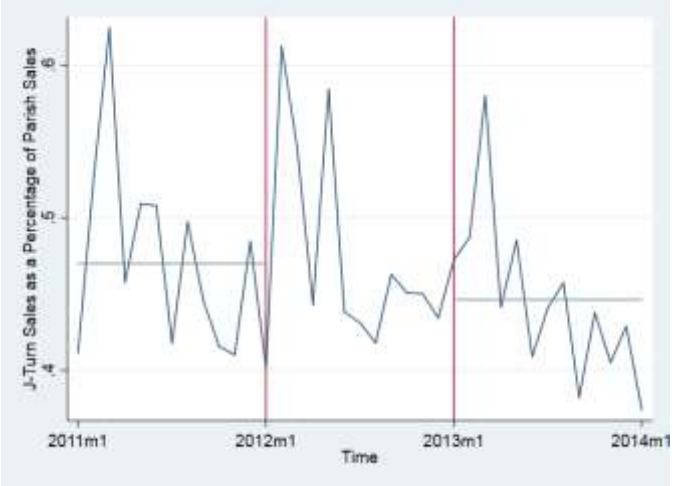

Figure 26
Lafayette Parish: Sales of businesses surrounding J-turns active throughout period as a percentage of parish sales

Next, Figure 27 shows only those businesses active throughout the period that were expected to be unaffected by changes in access caused by the J-turn. The mean before is 0.28 and the mean after is 0.26; however, the difference between means is not statistically significant. No statistically significant conclusions can be drawn about sales impacts.

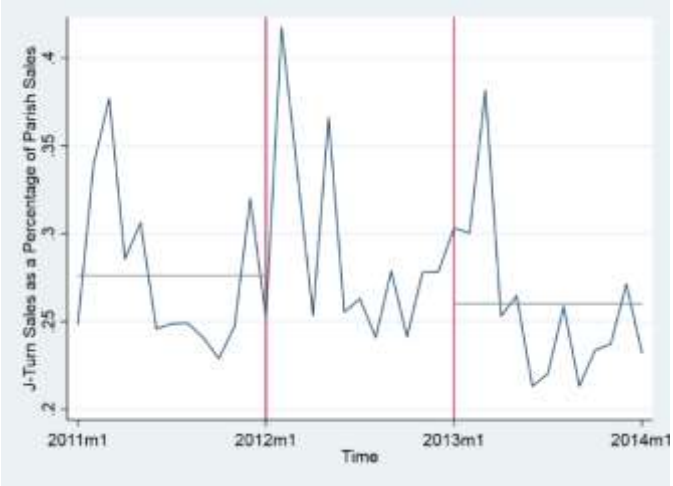

Figure 27
Sales of businesses unaffected by J-turns active throughout period in Lafayette Parish as a percentage of parish sales

Figure 28 shows only those businesses active throughout the period that were expected to be affected by changes in access due to the J-turn. The mean before is 0.19 and the mean after is 0.19, but the difference is not statistically significant.

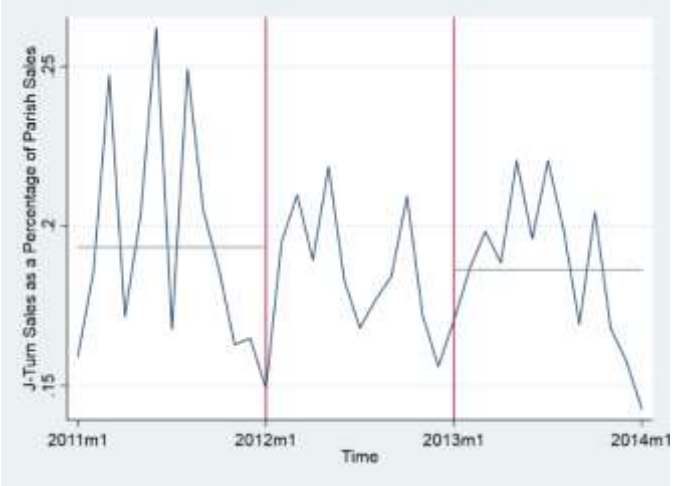

Figure 28
Sales of businesses affected by J-turns active throughout period in Lafayette Parish as a percentage of parish sales

Summary. Although in all but one of these graphs from Lafayette Parish, the mean sales as a percentage of parish sales appears to be decreasing, the small sample size and small change leads to a finding that the differences are not significant.

East Baton Rouge Parish. The following graphs show the analysis of J-turn installations in East Baton Rouge Parish. Figure 29 shows the aggregated East Baton Rouge J-turn sales as a percentage of East Baton Rouge Parish sales. The mean before the installation began was 0.16 and after was 0.17, but the difference is not significant. Due to small sample sizes, separate results for affected and unaffected businesses cannot be displayed, but the pattern is similar with no significant differences before and after J-turn installation.

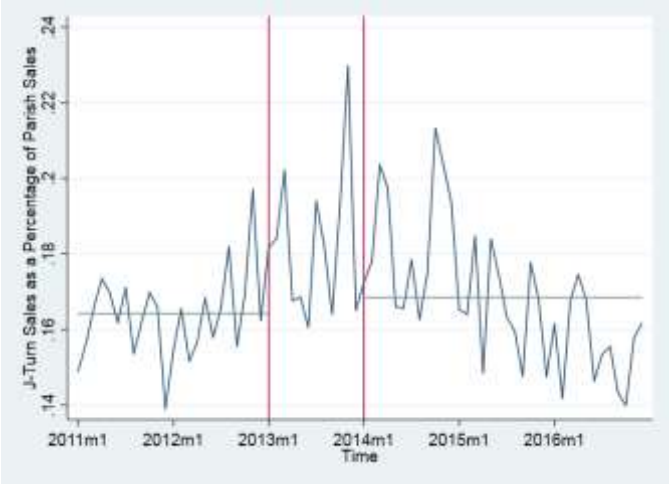

Figure 29
East Baton Rouge Parish sales of businesses surrounding J-turns as a percentage of parish sales

Figure 30 shows sales at those businesses near the J-turn and active a year before and a year after the installation as a percentage of East Baton Rouge Parish sales. The mean before is 0.11 and the mean after is 0.12 and the difference is statistically significant suggesting that among existing businesses, sales actually went up in the period after the J-turn was installed.

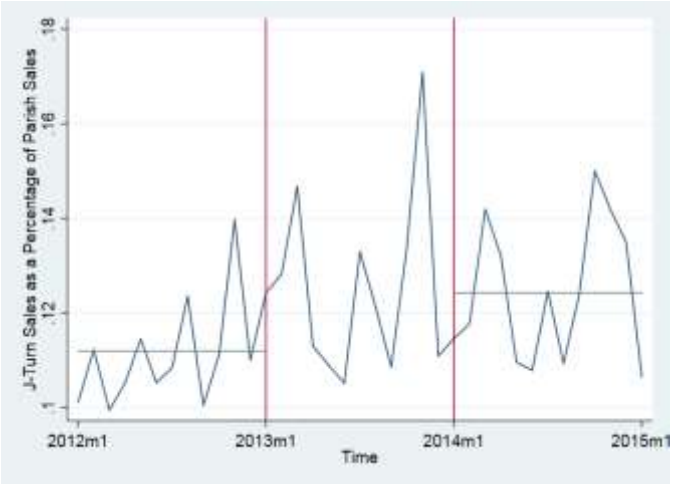

Figure 30
East Baton Rouge Parish sales of businesses surrounding J-turns active throughout period as a percentage of parish sales

Due to small sample sizes, separate results for affected and unaffected businesses cannot be displayed, but the pattern for affected and unaffected businesses continuously operating is

similar to the overall pattern for continuously operating businesses with statistically significant increases in sales relative to the parish after the J-turn was installed.

Summary. In East Baton Rouge Parish, there is no evidence that J-turns harm businesses, and there is in fact a statistically significant increase in sales after installation. As discussed in the aggregate section, this correlation does not mean that J-turns cause an increase in business sales. There are a number of other factors that may affect business sales. Even with parish sales to benchmark against and control for some local conditions, neighborhood-level economic conditions like new developments may contribute to the difference.

Jefferson Parish. This subsection looks at business sales in Jefferson Parish. Figure 31 shows the sales of businesses surrounding J-turns in Jefferson Parish as a percentage of sales of the entire parish. The mean before is 0.07 and the mean after is 0.09 and the difference is significant at the .05 level. Due to small sample sizes, separate results for affected and unaffected businesses cannot be displayed, but the pattern is similar for both groups with sales as a percentage of parish sales increasing significantly after the J-turn was installed.

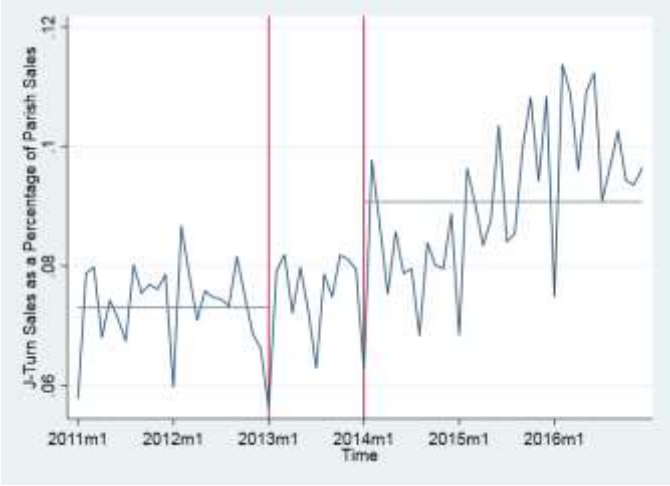

Figure 31
Sales of businesses surrounding J-turns in Jefferson Parish (percentage of parish sales)

Next, Figure 32 shows sales as a percentage of parish sales at Jefferson J-turns from businesses that were there a year before and a year after the installation was complete. The mean before is 0.05 and the mean after is 0.05, but the difference is not significant. Due to

small sample sizes, separate results for affected and unaffected businesses cannot be displayed, but the pattern is similar unaffected businesses with no significant difference. On the other hand, businesses that would be expected to be affected exhibited a significant increase in sales relative to the parish after the J-turn was installed.

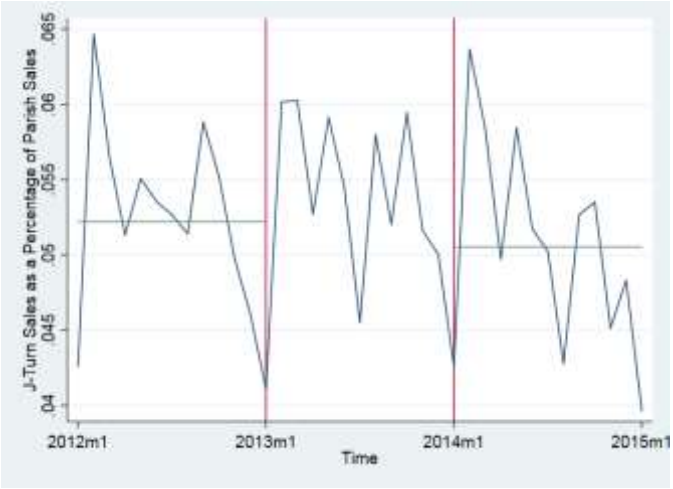

Figure 32
Sales of businesses surrounding J-turns active throughout period in Jefferson Parish as a percentage of parish sales

Summary. While some comparisons discussed above showed no statistically significant change, the general pattern was an increased level of sales after the J-turn was installed. In total, businesses in areas where J-turns were installed were shown to outpace the rest of the parish.

St. Tammany Parish. This final parish subsection shows the analysis of J-turn installations in Covington, LA, located in St. Tammany Parish. There has been considerable population growth in Covington, and the area of study is conveniently situated next to the interstate, which has attracted many new businesses. One of the J-turns in Covington was put in as part of a larger road widening. In response to the improvement of the flow of traffic and the increasing population of Covington, many new businesses opened around the time of the installation of this J-turn. The other J-turn installed in Covington was constructed principally for the development of a new general merchandise retailer. Large retailers often draw other companies to capitalize on the new traffic attracted by the anchor tenant. In both cases the J-turns, like other infrastructure improvements, are associated with increasing traffic (i.e., the transportation-land use cycle). New businesses are built as companies take advantage of the increased throughput of a road, often increasing the aggregate sales of businesses in the area.

Figure 33 shows the sales of businesses surrounding J-turns in St. Tammany Parish as a percentage of sales of the entire parish. The mean before is 0.23 and the mean after is 0.48. The change is significantly different at the .05 level. Due to small sample sizes, separate results for affected and unaffected businesses cannot be displayed, but the pattern is similar for both groups with sales as a percentage of parish sales increasing significantly after the J-turn was installed.

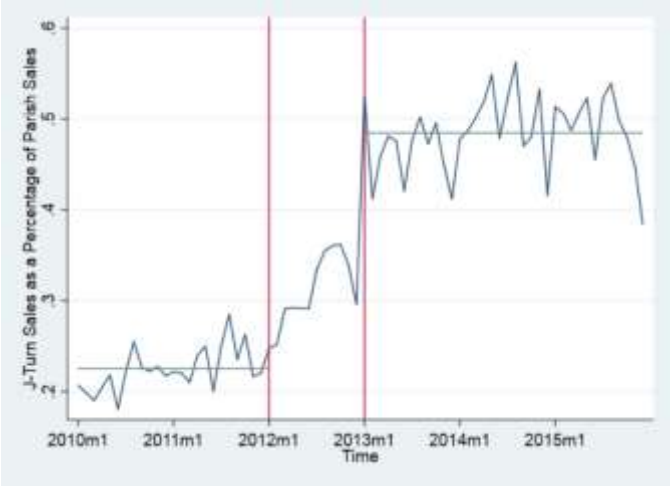

Figure 33
Sales of businesses surrounding J-turns in St. Tammany Parish as a percentage of parish sales

Figure 34 shows sales as a percentage of parish sales at St. Tammany J-turns from businesses that were continuously operating a year before and a year after the installation was complete. The mean before is 0.22 and the mean after is 0.21, but the difference is not significant. Due to small sample sizes, separate results for affected and unaffected businesses cannot be displayed, but the pattern is similar unaffected businesses with no significant difference. On the other hand, businesses that would be expected to be affected based on typical traffic flow exhibited a significant decrease in sales relative to the parish after the J-turn was installed.

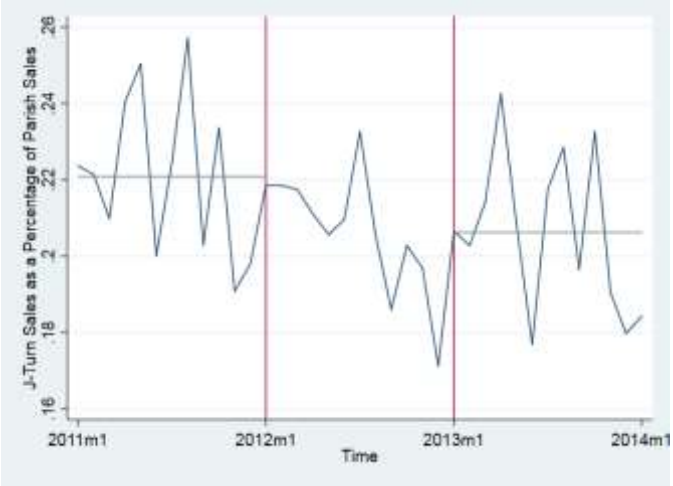

Figure 34
Sales of businesses surrounding J-turns active throughout period in St. Tammany Parish as a percentage of parish sales

Summary. In this section on St. Tammany, J-turns are shown to significantly increase total sales as a percentage of total parish sales in the area, but there are some indications of a decrease in sales among existing businesses that are affected by changes in access. These two observations seem to lie counter to one another, but the likely explanation is that new development is causing increased sales in the area and significantly outpacing the rest of the parish. The area has attracted many new businesses, which would increase competition. The decline in sales among affected businesses active before and after the J-turn was driven largely by one business that saw a relatively large number of competitors enter the area around the same time, it seems more likely that economic factors rather than the J-turn were the underlying cause. However, additional research may be needed to draw conclusive results.

Gas Stations and Restaurants

This final section of graphs isolates the sales of two types of businesses that might be most susceptible to access-related concerns: gas stations and restaurants. These business types often have many nearby substitutes so ease of access may play an important role in patronage; that is, any inconvenience caused by a J-turn or some other obstacle may cause someone to pass one up in favor of another nearby alternative. This section will first explore overall sales before and after J-turn installation in gas stations and restaurants then compare sales in affected and unaffected businesses. Figure 35 contains the sales in millions of dollars of all gas stations and restaurants across all J-turns. The mean before the installation is 1.7 and the mean after is 2.8, a significant difference.

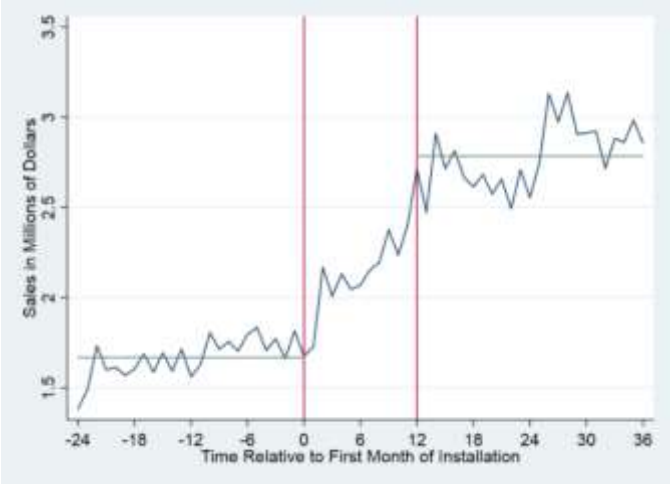

Figure 35
Sales of gas stations and restaurants surrounding J-turns

Figure 36 limits the sample to only those businesses that would be expected to be unaffected based on typical traffic flow and routes. The mean before the installation was 1.1 and the mean after was 1.5, a significant difference.

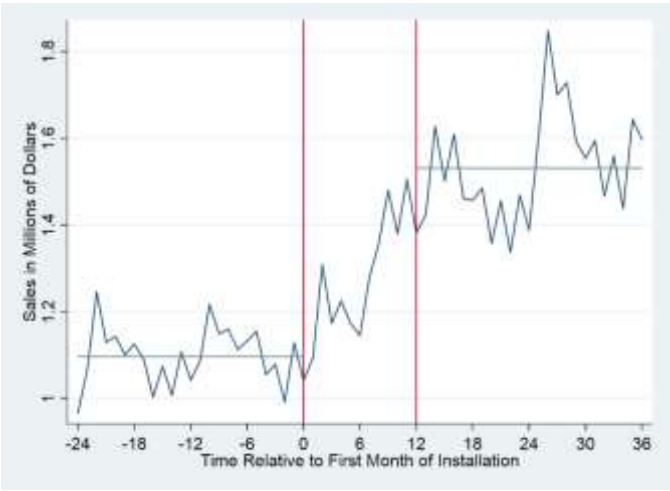

Figure 36
Sales of gas stations and restaurants unaffected by J-turns

Figure 37 includes those businesses that would be expected to be affected by the J-turns. The mean before the installation was 0.6 and the mean after was 1.3, a significant difference.

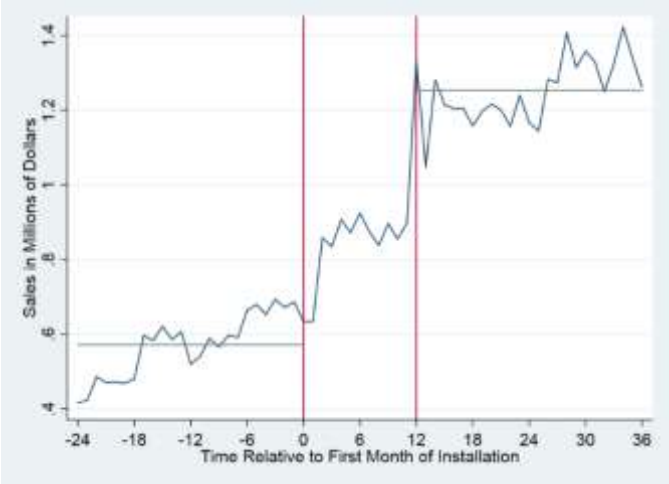

Figure 37
Sales of gas stations and restaurants affected by J-turns

Figure 38 contains only those businesses that were active from a year before the installation period to a year after the installation. The mean before the installation period begins is 1.2 and the mean after it concludes is also 1.2, not a significant difference.

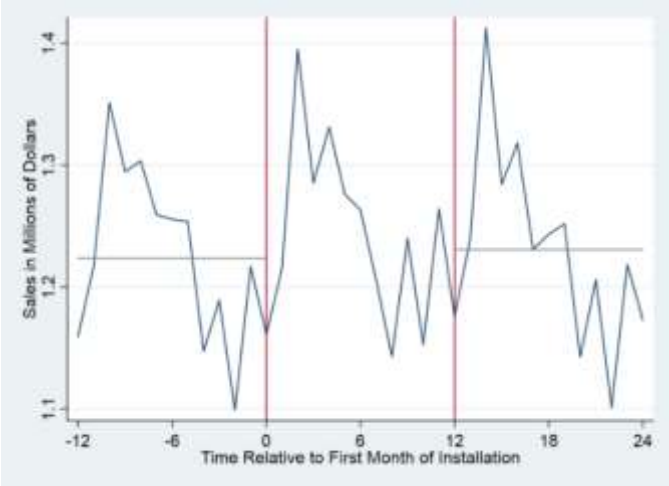

Figure 38
Sales of gas stations and restaurants active throughout period surrounding J-turns

Similarly, Figure 39 contains only businesses that were unaffected. The mean before the installation period begins is 1.0 and the mean after is 1.1, but the difference is not significant.

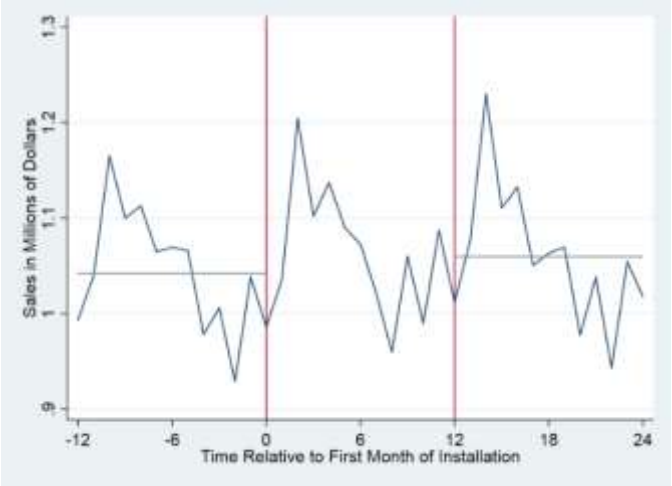

Figure 39
Sales of gas stations and restaurants unaffected by J-turns and active throughout period

Figure 40 contains only businesses that were affected and active throughout the period. The mean before the installation period begins is 0.18 and the mean after it concludes is 0.17. The difference of about $10,000 is significant at the .05 level. However, as discussed in the context of St. Tammany, given the broader trend of increasing sales among gas stations and restaurants, it is likely that the decrease within this group is driven heavily by increased competition from new businesses in the area. In particular, new dining establishments in Covington now compete with what was once one of very few places to dine in a developing area. During the installation period, several new businesses opened.

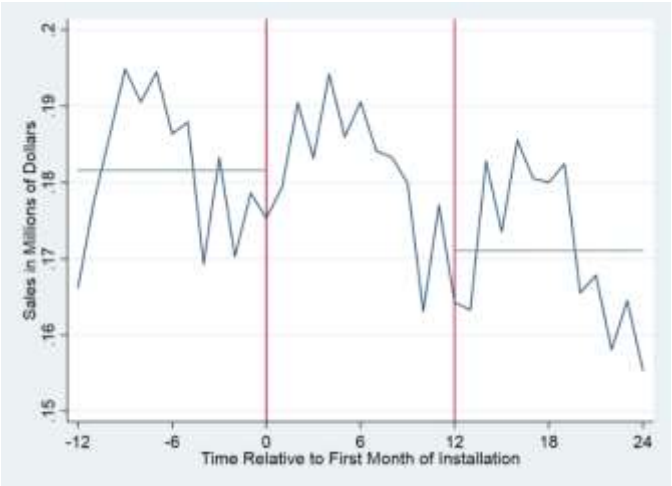

Figure 40
Sales of gas stations and restaurants affected by J-turns and active throughout period

Summary. Most of the graphs in this section show statistically significant increases in sales among gas stations and restaurants, indicating that any access limitations caused by J-turns do not negatively harm these types of businesses. The exception is among existing businesses, which saw a decrease in sales among affected businesses after the J-turn. However, because the series for all gas stations and restaurants, including new and competing dining options, shows a dramatic increase in sales after the J-turn, this is likely due to competition with new establishments rather than any negative affect caused by one element of infrastructure changes in the area. The results of this final section are summarized in Table 6. There were six graphs in this section and of these, three means after were significantly greater than the means before, one mean after was significantly less than the means before, and two were insignificant.

Table 6
Gas stations & restaurants summary statistics

List of Figures	Mean Before (Std. Err)	Mean After (Std. Err)	Difference Between Means
Figure 35: Sales of gas stations and restaurants surrounding J-turns	1.6684 (0.1071)	2.7843 (0.1798)	1.1159***
Figure 36: Sales of gas stations and restaurants unaffected by J-turns	1.0963 (0.0671)	1.5310 (0.1245)	0.4347***
Figure 37: Sales of gas stations and restaurants affected by J-turns	0.5721 (0.0844)	1.2534 (0.0886)	0.6812***
Figure 38: Sales of gas stations and restaurants active throughout period surrounding J-turns	1.2237 (0.0716)	1.2306 (0.0795)	0.0070
Figure 39: Sales of gas stations and restaurants unaffected by J-turns and active throughout period	1.0421 (0.0640)	1.0596 (0.0720)	0.0175
Figure 40: Sales of gas stations and restaurants affected by J-turns and active throughout period	0.1816 (0.0095)	0.1710 (0.0102)	(0.0105)**

Note ** p=.05; *** p=.01

Survey Data Analysis

The following sections report the results of the survey data analysis. Given the centrality of location to this study, it is important to understand the perceptions of businesses and their patrons on access in the vicinity of the J-turns. After first providing an overview of achieved sample statistics for both surveys (all locations), the survey findings are presented by location, beginning with business results followed by patron results. Because these are convenience samples, it is not possible to make inferences to the general population or to the broader local population in these locations. These findings provide qualitative insight into

individuals' preferences and opinions about access to businesses in a particular location where traffic conditions as well as land use patterns are highly contextualized.

Sample Overview

Table 7 provides an overview of the number of completed surveys for the business sample and the patron sample, across the four locations. Efforts were made to achieve business and patron participation for each distinct business visited, but participation in the survey was strictly voluntary so this was not always possible. The first row shows the number of business completes per location. All businesses participating have an N=1, meaning that only one interview was completed per business per location. The second row shows the number of patron completes for each location, which ranged from 0-52 completes per location. The next row, "Distinct Business N" refers to the number of *distinct* businesses represented in both survey samples. In total, 70 distinct businesses are represented in the data. This includes businesses that declined participation in the survey with at least one patron participating (n=28) and businesses that participated with zero corresponding patron responses (n=20).

Table 7
Total sample overview (patron and business respondents) by parish location

	East Baton Rouge	Lafayette	St. Tammany	Jefferson	Total
Business N	8	28	4	3	43
Patron N	54	124	84	52	314
Distinct Business N	13	34	17	6	70
Patrons only (no business n)	5	7	13	3	28
Business only (no patron n)	4	14	1	1	20

The number of patron completes per business varied a great deal. Some businesses, specifically very large retail stores (e.g., grocery stores) had a very high number of patron responses at single locations, while many smaller businesses have less than a few. To illustrate variance, measures of central tendency by parish location appear in Table 8.

Table 8
Patron sample N by parish location: Measures of central tendency/dispersion

	East Baton Rouge	Lafayette	St. Tammany	Jefferson
N	54	124	84	52
Mean	4.15	3.65	4.94	8.67
Median	1	1	1	5.5
Mode	1	0	1	1
SD	5.98	8.95	12.29	9.69
R	0-17	0-44	0-52	0-23

Business Types/Characteristics. The next several tables provide an overview of the types of businesses represented in both survey samples. To ensure anonymity of participants is protected, no individual businesses will be named specifically in this report. Instead, businesses are described by their characteristics and analyzed in context of location.

Table 9 provides a general overview of the types of businesses participating in the study for the business sample only (N=43). While there are a variety of business types represented, the two most common are retail sales (N=13) and fast food restaurants (N=12). Many of the properties (N=30) are well-established regional or national chains (e.g., Subway, Walmart, etc.) while the remaining business are specifically local in prominence, having just one location (N=7) or multiple locations (N=6) in the state. Please note that the number of businesses participating in the survey varies considerably across locations, ranging from three businesses in Jefferson Parish to 28 businesses in Lafayette Parish. The total sample size achieved for each of the four locations appears in the last row of Table 9.

Table 9
Participating business types (N) by parish location

	East Baton Rouge	Lafayette	St. Tammany	Jefferson	Total (Row)
Retail Sales	4	6	1	2	13
Retail Service	0	6	0	0	6
Restaurant/fast food	2	7	3	0	12
Restaurant/sit down	0	4	0	1	5
Professional Office	0	1	0	0	1
Convenience Store/gas station	1	3	0	0	4
Other	1	1	0	0	2
Total (Column)	8	28	4	3	43

Table 10 provides an overview of the types of businesses the patrons participating in the study visited. The overall patron sample was much larger than the business sample (N=314).

Like with the business sample, the two most common business types are retail sales (N=180) which constitute about 57% of the patron sample, followed by fast food restaurants (N=63), accounting for about 20% of the patron sample. The vast majority of patron respondents were visiting chain businesses with a regional or national presence (N=296). Across all locations, 18 patrons were visiting local businesses with either one (N=10) or multiple (N=8) locations. The total sample size achieved for each location appears in the last row of Table 10.

Table 10
Patron sample representation of business types by parish location

	E. Baton Rouge	Lafayette	St. Tammany	Jefferson	Total (Row)
Retail Sales	12	89	55	24	180
Retail Service	0	3	1	0	4
Restaurant/fast food	19	26	18	0	63
Restaurant/sit down	1	1	10	1	13
Professional Office	0	0	0	0	0
Convenience Store/Gas station	22	4	0	27	53
Other	0	1	0	0	1
Total (Column)	54	124	84	52	314

As presented earlier in Table 7, the patron sample includes patrons of businesses participating in the business survey as well as patrons of businesses who declined participation. The patron sample includes respondents from an additional 28 businesses not included in the business sample. The location with the greatest discrepancy between businesses participating and the number of patrons from non-participating businesses is Covington/St. Tammany Parish (Business N=4, Patrons/non-participating businesses N=71).

Patron Respondent Characteristics. The samples appear relatively balanced across locations in terms of some demographic characteristics (i.e., gender and age). Samples differed by location in terms of racial composition and residential environment characteristics. Table 11 provides an overview of patron sample demographics (i.e., residential environment, gender, race and age) by location. Note that business sample respondent characteristics are reported by location along with business location details. The next four sections report the remaining findings by location, first presenting analysis of the business sample results followed the patron sample.

Table 11
Patron demographics by parish location

Residential Environment	E. Baton Rouge N=54		Lafayette N=124		St. Tammany N=84*		Jefferson N=52	
Rural	8	14.81%	42	33.87%	18	21.43%	3	5.77%
Somewhat Rural	7	12.96%	32	25.81%	21	25.00%	4	7.69%
Suburban	35	64.81%	38	30.65%	37	44.05%	24	46.15%
Urban	4	7.41%	12	9.68%	8	9.52%	21	40.38%
Gender								
Male	25	46.30%	60	48.39%	33	39.29%	32	61.54%
Female	29	53.70%	64	51.61%	50	59.52%	20	38.46%
Race								
Black	9	16.67%	35	28.23%	4	4.76%	20	38.46%
White	40	74.07%	84	67.74%	73	86.90%	28	53.85%
Hispanic	3	5.56%	2	1.61%	2	2.38%	2	3.85%
Mixed/Other	2	3.70%	3	2.42%	4	4.76%	2	3.85%
Age (years)								
M (SD)	43.45 (17.21)		46.41 (16.52)		49.14 (16.95)		48.35(16.98)	
Min-Max (n)	18-78 (53)		18-90 (122)		18-87 (83)		18-75 (52)	

**note:* respondents were not forced to answer these questions; frequency count totals vary slightly from location sample N for one of more variables due to individual item non-response. The percentages are calculated using the full sample size for each location and therefore may not add perfectly to 100%.

East Baton Rouge Parish

The location of the J-turn in East Baton Rouge Parish is at US 61 and LA-42. Eight businesses participated in the survey and of these, one business is classified as local (single location) while the remaining seven businesses are classified as regional or national chains.

Baton Rouge Business Sample Details & Respondent Characteristics.

Respondents provided additional details about their business location, such as how long their respective business has been in operation at that location, an estimate for the number of employees and an estimate for the number of patrons per day, as well as additional information about their employment at this location such as title, length of employment, etc. The results to these items for the Baton Rouge business sample appear in Table 12. All cells display count data.

Table 12
Business location and employment details: Baton Rouge business sample (n=8)

Business Location Details		Respondent Employment Details	
Time in Location	N	**Job Title**	N
5 years or less	3	Owner/Proprietor	1
more than 5, less than 10	0	Manager (non-owner)	5
more than 10	5	Assistant Manager/Supervisor	1
unknown	0	Employee	1
Number of Employees (estimate)		**Years Employed at Location**	
less than 10	3	Mean	1.91
11-25	2	Min	0.17
26-40	1	Max	5
41-60	0	**Work Commute (days per week)**	
61-74	1	6-7 days	3
more than 75	1	4-5 days	5
unknown	0	3 or less	0
Patrons Per Day (estimate)		**Basic Demographics**	
less than 50	0	Mean Age Years (SD)	30.76 (12.21)
50-99	2	Age Years Min-Max (N)	18-52 (8)
100-200	1	% White (n)	63% (5)
more than 200	5	% Female (n)	63% (5)

Business Respondent Access-Related Items. Business respondents answered a series of closed and open-ended questions designed to gain insight into their perceptions of patron access. When asked to estimate what percentage of patrons plan to stop at their business location (as opposed to the percentage of patrons who might stop out of convenience as they are passing by), respondent estimates (n=8) varied from 25% to 90% (M=62.5%, SD=19.6%). All eight businesses reported that most patrons access their parking lot from the major street, while two businesses indicated an additional access option (one reported from minor street, the other from neighboring business lot). To obtain a sense of how business respondents view the degree of congestion on the roadway during their busiest hours, respondents were asked to indicate the blocks of time in which their business is typically the busiest (i.e., Before 9am, Between 9a-11a, Between 11a-1pm, Between 1pm-4pm, Between 4pm-7pm, After 7pm, Other). Next, for each block of time selected, respondents were asked to describe the degree of congestion in the area immediately surrounding their business on a four-point scale.

Table 13 shows the frequencies for the busiest times as well as the respondent-reported degree of congestion represented in colors (i.e., green=not congested, yellow=slightly

congested, bright red=congested, deep red=very congested). The numbers displayed in cells are frequencies for businesses near the J-turn located in Baton Rouge. Since respondents were encouraged to select all applicable busiest times, some businesses indicated degree of congestion for multiple times, which is also clarified in the table (under "No. of times selected"). As shown, five respondents reported just one busiest time while three respondents reported two times.

Table 13
Degree of congestion surrounding business during busiest times: Baton Rouge

	N	S	C	V	No. of Times Selected	N
Before 9am			1		One busiest time	5
B/t 9am-11am		1			Two busiest times	3
B/t 11am-1pm			2			
B/t 1pm-4pm		1	1	1		
B/t 4pm-7pm			3	1		
After 7pm						

All respondents were asked to rank six general factors that people typically consider when deciding whether or not to patron a particular business. Specifically, they were asked to consider where they (personally) would rank each factor when selecting a business of the same type on a scale of 1-6, with 1 being most important and 6 being least important:

- Distance to travel
- Hours of operation
- Customer service
- Quality of products/services
- Pricing of products/services
- Accessibility to location/Ease of access

This ranking item has been used in several other access management business perception studies and provides insight into the relative position of importance access tends to rank. Figure 41 illustrates the mean rank position for each of the items, ordered in importance from most (lowest mean rank) to least important (highest mean rank). Additional descriptive statistics such as detailed rank information, range, standard deviation, and count data are provided in Appendix D.

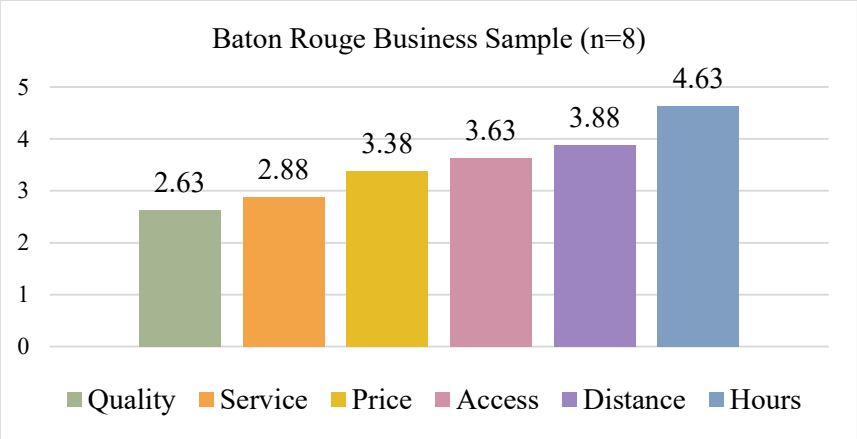

Figure 41
Baton Rouge businesses (n=8) ranked considerations (mean)

Business Respondent Access-Related and Traffic Safety Concerns. The end of the business survey asks a series of four yes/no questions regarding access-related and other traffic safety concerns. All "yes" responses were followed up with an open-ended question for additional details. The first question asks business respondents if any of their customers reported any difficulty accessing their business (at any time)? Among Baton Rouge businesses participating in the survey, about 50% reported "yes," with three mentioning problems with traffic in general (e.g., backups at major road intersection) and one mentioned left turn restrictions on Highland Rd. (i.e., LA 42). The next question asks, "Thinking about the area immediately surrounding your business, do you currently have any access-related concerns?" All eight participants indicated "no" to this item. When asked about any traffic safety concerns in the area immediately surrounding his/her business, three respondents reported "yes" and 5 reported "no." Two of the "yes" responses involved concern with the amount of crashes taking place at the Airline Hwy/Highland Rd. intersection. The other "yes" mentioned that removing the median on Highland Rd. created a higher crash risk turning out of the parking lot (adding that cars speed to make it through the green light) at this location. When asked if respondents had any further comments or concerns about access management in the vicinity of their business they would like to add, all eight respondents reported "no."

Baton Rouge Patron Sample: Business Visit and Prior Patronage. Upon meeting the age and residency criteria, the first question patron respondents were asked was, "Thinking about your visit today, were you specifically planning to come to this business, or did you stop because it is convenient on the way to somewhere else?" Among patrons visiting Baton Rouge businesses (n=54), 57.41% (n=31) reported that they had planned to stop while the remaining 42.59% (n=23) reported that they stopped as they were passing by.

It is worth noting that 22 patrons in the Baton Rouge sample visited convenience store/gas station business types (refer to Table 10 for details). Next, patrons were asked how long they have personally been a patron to the business they just visited; how often they visit the business and how often they visit other area businesses. Response frequencies to these items for the Baton Rouge Patron sample appear in Table 14.

Table 14
Baton Rouge patron sample: reported business patronage and frequency

Reported Length of Patronage		
First time was today	3	5.56%
1-12 mos.	8	14.81%
1-3 years	14	25.93%
3-6 years	7	12.96%
Over 6 years	22	40.74%
Total n	54	100%
Reported Frequency of Patronage (excl. first-time patrons)		
Less than once per month	7	13.73%
Once a month	7	13.73%
Several times a month	15	29.41%
Once a week	10	19.61%
Several times a week or more	12	23.53%
Total n	51	100%
Frequency of Visiting Other Area Businesses		
Regularly	41	75.93%
Sometimes/ Not Regularly	10	18.52%
Rarely	2	3.70%
No	1	1.85%
Total n	54	100%

Patron Respondent Access-Related Items and Traffic Safety Concerns. The remaining patron survey items include the same six-factor ranking item asked of the business respondents, as well as a series of simple yes/no questions with open-ended question follow-up whenever the respondent answered "yes." One item includes an additional "maybe" response option, with the follow-up question also being asked of those responding "maybe." These questions varied somewhat from the questions included in the business survey and are stated as follows:

- Have you ever experienced any difficulties accessing this business? (yes/no)
    - What were the circumstances or could you describe the nature of the difficulties?

- Relative to other similar locations, have you ever experienced any issues navigating streets or accessing property in the surrounding area? (yes/no)
    - What sorts of issues or specific problems have you encountered navigating streets or accessing other properties in the area?
- Are you aware of any recent road improvements that may have improved traffic conditions in this area? (yes/maybe/no)
    - What if anything can you recall about the improvements?
- Do you have any comments or other traffic-related concerns in this area that you would like to share?
    - (add comment)

Figure 42 illustrates the mean rank position for each of the items, ordered in importance from most (lowest mean rank) to least important (highest mean rank) among patron respondents in Baton Rouge (N=54). Similar to Baton Rouge business respondents, Access ranked fourth while Hours ranked sixth. Additional descriptive statistics such as detailed rank information, range, standard deviation, and count data are provided in Appendix D.

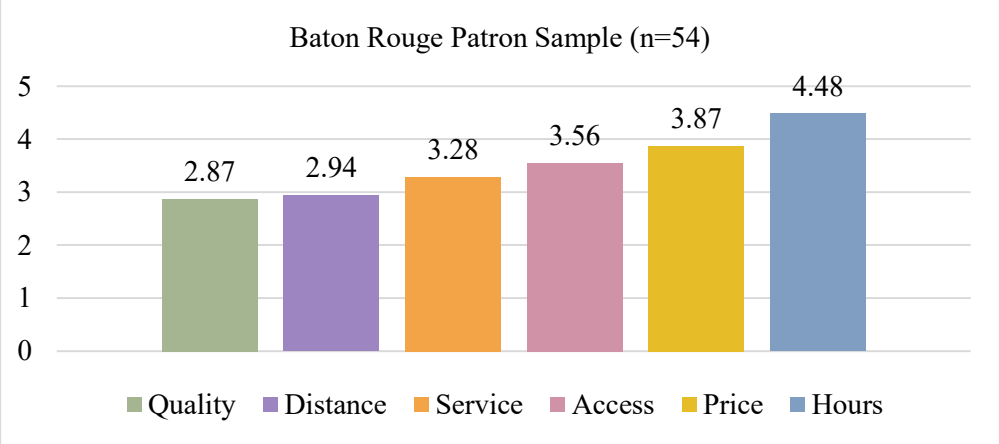

Figure 42
Baton Rouge patrons (n=54) ranked considerations (mean)

When asked if they have ever experienced difficulties accessing the business they just visited, 27.78% (n=15) of Baton Rouge patron respondents reported "yes" while 72.22% reported "no." When asked to tell the circumstances or describe the nature of the difficulties, all 15 provided open-ended responses. Six individuals mentioned more than one aspect. Almost all (n=9) mentioned "traffic" and traffic-related problems, while an additional three

mentioned congestion. One patron mentioned traffic as well as left turn restrictions, stating difficulty leaving the business because of traffic, and they cannot turn left onto Airline Hwy.

The next question asked patrons if they have ever experienced issues navigating streets or accessing other businesses in the surrounding area. Two patrons did not supply a response to this item. Of those who did (n=52), about 40% (n=21) reported "yes." All patrons who said yes provided further details. Four patrons mentioned more than one problem. Again, congestion and traffic (n=11) were mentioned most frequently. Two mentioned construction and six described problems with navigating the area either because of the traffic or difficulty crossing the street. Two respondents specifically mentioned the J-turn/left-turn restrictions due to access management treatment, while one described having to go out of their way to access businesses on either side of the street:

- "That terrible no-left-turn intersection where you have to take a right, go a block then make a U-turn"
- "You cannot go across the median after visiting Chic fil a"
- "Further down by Ruffinos and Healing Place you have to make a loop going in either direction to reach businesses on either side of the street"

The next question asked respondents if they are aware of any recent road improvements that may have improved traffic conditions in the area, to which 18 replied "yes." Reviewing all 18 open-ended responses, almost all (n=17) of the mentions include access-related and operational improvements (e.g., road and intersection widening, improved access, adding extension roads, turn lanes, roundabouts, etc.), while one patron recalled a recently installed stoplight. When asked if they have any comments or traffic related concerns in the area that they would like to share, 21 reported yes. Eleven respondents commented on the traffic/congestion, two reported a lack of synchronization among traffic lights, three mentioned road/pavement quality (e.g., potholes). Four comments involved access-related issues such as a blocked off cut-through, issues with backups due to turning vehicles, and two expressed a need for adding or widening turn lanes. One person gave positive comment: "It's been great. Light put in is great." Finally, one commented, "Baton Rouge all bad," which cannot be easily interpreted for obvious reasons.

Lafayette Parish

The stretch of US 90 of interest in this study is located in Broussard, a small city in Lafayette Parish, where a series of J-turns were constructed in 2012. The approximate location of the J-turns in Broussard is shown in Figure 43. Since that time, US 90 (specifically the 1.6 mile section from Albertson Parkway to Ambassador Caffery Parkway) has been undergoing

multiple major construction/improvement projects. Projects include widening US 90 to six lanes and a new overpass, adding frontage roads, as well as the construction of a brand new interchange on US 90 at Albertson Parkway. The site is part of the future I-49 corridor and improvements are necessary to upgrade US 90 to interstate standards [*78-80*]. As of September 2018, the interchange project is behind schedule and is not expected to be completed until early 2019 [*80*]. For context, Albertson Parkway intersects with US 90, which is about 1 mile from the J-turn at Hwy 90 and Girouard Rd.

Figure 43
Approximate location of J-turns in Broussard/Lafayette

US 90/Broussard Business Sample Details & Respondent Characteristics. The business survey sample includes a total of 28 businesses: 19 are national or regional chains, five are local businesses with one location and four are local businesses with multiple locations. Respondents provided additional details about their business location, such as how long their respective business has been in operation at that location, an estimate for the number of employees and an estimate for the number of patrons per day, as well as additional information about their employment at this location such as title, length of employment, etc. The results to these items for the US 90 business sample appear in Table 15. All cells display count data.

Table 15
Business location and employment details: US 90 business sample (n=28)

Business Location Details		Respondent Employment Details	
Time in Location	N	**Job Title**	N
5 years or less	5	Owner/Proprietor	7
more than 5, less than 10	8	Manager (non-owner)	12
more than 10	12	Assistant Manager/Supervisor	5
unknown	3	Employee	4
Number of Employees (estimate)		**Years Employed at Location**	
less than 10	13	Mean	5.73
11-25	8	Min	0.25
26-40	3	Max	25
41-60	0	**Work Commute (days per week)**	
61-74	0	6-7 days	7
more than 75	3	4-5 days	20
unknown	1	3 or less	1
Patrons Per Day (estimate)		**Basic Demographics**	
less than 50	10	Mean Age Years (SD)	37.15 (15.56)
50-99	2	Age Years Min-Max (N)	19-65 (27)
100-200	4	% White (n)	74% (20)
more than 200	10	% Female (n)	63% (17)
unknown	2		

US 90 Business Respondent Access-Related Items. Business respondents answered a series of closed and open-ended questions designed to gain insight into their perceptions of patron access. When asked to estimate what percentage of patrons plan to stop at their business location (as opposed to the percentage of patrons who might stop out of convenience as they are passing by), respondent estimates (n=28) varied from 10% to 100% (M=58.4%, SD=24.1%). When asked to tell how most patrons accessed the parking lot, most (n=21) indicated only one option, while six indicated two (note: one business declined response to this item). The majority of businesses reported access from the major street (n=11) or the minor street/frontage road (n=17). While one business reported no dedicated lot, two businesses reported access from neighboring business lot. One of these also indicated access from a shared driveway.

Of the 28 businesses participating in the survey, 27 provided information about their busiest times and the degree of congestion at those times on a typical day. Table 16 shows the frequencies for the busiest times as well as the reported degree of congestion, indicated by color. Since respondents were encouraged to select all applicable busiest times, some

businesses indicated degree of congestion for multiple times, which is also clarified in the table (under column labeled "No. [of times] Selected").

Table 16
Degree of congestion surrounding business at busiest times: US 90/Broussard

	N	S	C	V	Total (row)	No. Selected	N=27
Before 9am		1	2	2	5	one	13
B/t 9am-11am	2		1		3	two	12
B/t 11am-1pm	3	3	5	4	15	three	0
B/t 1pm-4pm	2		4	1	7	four	1
B/t 4pm-7pm	2	3	3	5	13	five	0
After 7pm	1	2	1		4	six	1

Next, respondents were asked to rank six general factors that people typically consider when deciding whether or not to patron a particular business. Figure 44 illustrates the mean rank for each of the items, ordered in importance from most (lowest mean rank) to least important (highest mean rank) among participants providing responses to these items (n=27). In general, service and quality ranked most important, while access and hours ranked least. Additional descriptive statistics such as detailed rank information, range, standard deviation, and count data are provided in Appendix E.

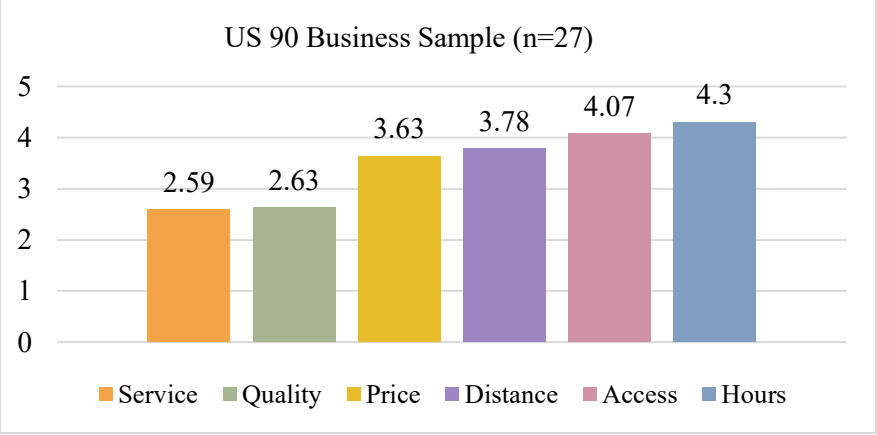

Figure 44
US 90/Broussard businesses (n=27) ranked considerations (mean)

US 90 Business Respondent Access-Related and Traffic Safety Concerns. The end of the business survey asks a series of four yes/no questions regarding access-related and

other traffic safety concerns. Respondents were asked if any of their customers had reported difficulty accessing their business (at any time). Just over 55% (n=15) said yes. When asked to describe in general the kinds of difficulties they have reported, a majority mentioned construction-related difficulties (n=10), followed by navigation-related problems (n=4) and high congestion (n=1). Comments concerning navigation and construction appear in Table 17. Comments are shown verbatim with only minor editing to clarify the nature of the comments as well as to point out the similarities among responses, a number of which express more than one concern.

Table 17
Navigation and construction-related comments on patron access difficulties, US 90

Navigation	Difficulty crossing major highway
	Almost every customer has reported problems with lots of confusion navigating streets and getting around all the road work
	Customers worried that they might get hit from behind turning right into the parking lot.
	Can't turn left from 90. Can't turn left to exit.
Construction	Construction on service road
	Construction in area
	Construction and J-turn having to loop around north of business
	Construction (x2)
	Construction and redirection of traffic.
	Construction has caused road closures and delays.
	Construction has obstructed people getting in and out.
	Construction has made getting around confusing.
	Construction has caused several accidents and traffic backups.

The next question asks, “Thinking about the area immediately surrounding your business, do you currently have any access-related concerns?” Thirteen respondents reported “yes” to this question and 15 reported “no.” Respondents explained their current access-related concerns, which are shown verbatim (with minor editing) in Table 18. The next question asks if the respondent has any traffic-safety concerns in the area immediately surrounding their business, to which 14 answered “yes.” When asked to describe these concerns, a number mention specific intersections, some mentioned aggressive driving (related to the construction,) while others described visibility issues or other operational concerns. These comments appear in Table 19 with only minor editing. Similar to prior items, one of the most frequently mentioned issues is construction.

Table 18
Business comments on current access concerns, US 90

Add a U-turn to access business easier
Not being able to turn left at the light on the main road. There are a lot of accidents still even after the J-turn. There needs to be a few more seconds added to the yellow lights as they are too short. More lighting in the area.
Can't go straight under overpass
Intersection and construction make it difficult to drive around
It can be hard to turn onto side street because of traffic
Construction
Traffic and construction.
No left turn allowed causes access and routing issues.
The left turn from the interstate and issues with the intersection.
Getting in and out is difficult due to construction.
Construction has made it to where it takes much longer than before to get around the surrounding area.
Ongoing construction has made it difficult for customers to have a quick trip.
Extremely difficult to access other businesses in the area. Said that access was killing some businesses in the area and some have had to move

Table 19
Business comments on traffic safety concerns near business US 90

Should be a crosswalk and walking lights
A lot of people go straight at the light illegally when they are supposed to turn right which causes accidents
People have a lot of accidents at the corner of south Morgan and east second street
Light next to hwy overpass
Traffic got worse during construction but now better
Main St. and celebrity intersection can get dangerous
Lane merging in construction.
Construction and restricted turns.
Stoplight can't be seen by large trucks.
Construction has led to congestion which has caused people to drive more aggressively.
Traffic lanes near the bridge get clogged and dangerous.
Construction has caused some drivers to drive dangerously which has caused an uptick in traffic accidents.
Construction and lane closings have made accidents more frequent.
Poorly timed lights make people do crazy things and road under overpass not marked well so people cut others off trying to switch lanes

The last question asked the respondent if they have any further comments/concerns about access management in the vicinity of their business. Four respondents provided comments:

- Past year has cost a lot in profits.
- Construction taking too long and as a result revenue is down.
- Seems that construction outside the business has been ongoing/delayed, and has resulted in a significant drop in business activity due to customers not being able to access the business easily.
- Issues crossing road because cars can cross street from one side but not the other.

About half of the 28 businesses participating in the survey along US 90 expressed a great deal of concern about construction and the perceived impact it has on their customers, traffic, driving behavior, and a variety of operational issues, among others. Though left turn restrictions, J-turns, and factors related to them are mentioned a few times, by and large, respondents generally focused on construction and its impact on traffic safety and operations.

US 90/Broussard Patron Sample: Business Visit and Prior Patronage. With the exception of only five local businesses, the majority (n=119) of businesses visited by patron respondents are regional or national chains. Patrons were asked "Thinking about your visit today, were you specifically planning to come to this business, or did you stop because it is convenient on the way to somewhere else?" Among patrons visiting Broussard businesses (n=124), about 71% (n=88) reported that they had planned to stop while the remaining 29% (n=36) reported that they stopped as they were passing by. The vast majority of patrons (n=89) were visiting retail sales business types (refer to Table 10 for business type details). Next, patrons were asked how long they have personally been a patron to the business they just visited; how often they visit the business and how often they visit other area businesses Response frequencies to these items appear in Table 20.

Table 20
US 90/Broussard patron sample: reported business patronage and frequency

Reported Length of Patronage		
First time was today	3	2.44%
1-12 mos.	17	13.82%
1-3 years	33	26.83%
3-6 years	23	18.70%
Over 6 years	47	38.21%
Total n*	123	100%
Reported Frequency of Patronage (excl. first-time patrons)		
Less than once per month	21	17.36%
Once a month	17	14.05%
Several times a month	27	22.31%
Once a week	20	16.53%
Several times a week or more	36	29.75%
Total n	121	100%
Frequency of Visiting Other Area Businesses		
Regularly	81	65.32%
Sometimes/Not Regularly	26	20.97%
Rarely	11	8.87%
No	6	4.84%
Total n	124	100%

*note: 1 participant did not respond to this item

Patron Respondent Access-Related Items and Traffic Safety Concerns. The remaining patron survey items include the same six-factor ranking item asked of the business respondents, as well as a series of simple yes/no questions with open-ended question follow-up whenever the respondent answered "yes" (or "maybe" on the applicable item). Focusing first on the six-factor ranking item, Figure 45 illustrates the mean rank for each of the items, ordered in importance from most (lowest mean rank) to least important (highest mean rank) among participating patrons of businesses located along US 90 in Broussard/Lafayette Parish (N=123; one participant did not supply responses to any of these items).

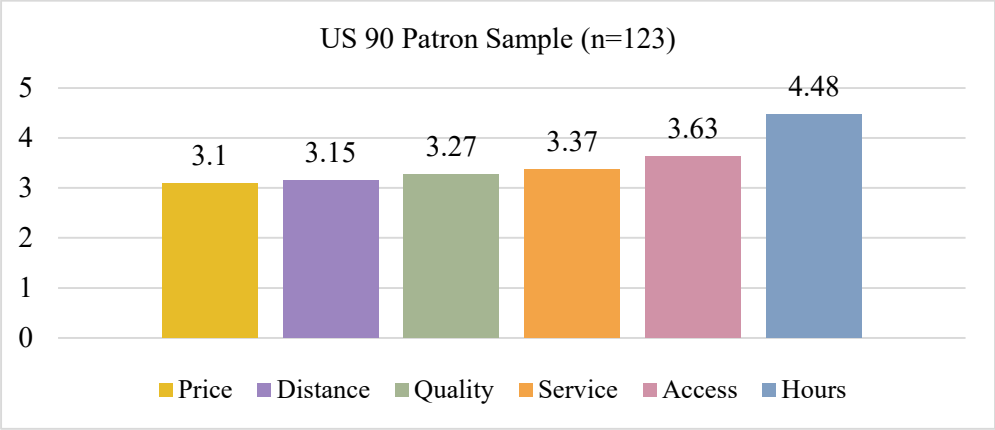

Figure 45
US 90/Broussard patrons (n=123) ranked considerations (mean)

As shown, Access fell fifth on the ranking list of considerations, just above Hours. Distance ranked second, followed by Quality and Service. The mean ranking for the top five considerations ranged from 3.1 (for Price) to 3.63 (for Access) while the mean rank for Hours is 4.48. So while Hours ranks the least important consideration to respondents in this sample, the means for the other five considerations are relatively close in size, which suggests higher degrees of variability relative to rank order. Additional descriptive statistics are displayed Appendix E.

When asked if they have ever experienced difficulties accessing the business they just visited, 29.84% (n=37) of US 90 respondents reported "yes" while 70.16% reported "no." When asked to tell the circumstances or describe the nature of the difficulties, all 37 provided open-ended responses. Eleven mentioned more than one aspect. A majority (n=26) of responses mentioned "construction," which translates to roughly 70% of "yes" responses. Table 21 displays the other comments (that did not only describe construction), which have been minimally edited for punctuation and spelling. As displayed, a number of them mention

difficulty accessing the business due to not being permitted to go straight and/or left turn restrictions. Two comments pertain to construction as well as other issues. One comment, which also mentioned construction, specifically takes issue with the J-turns. These two comments are noted with an asterisk.

Table 21
Patron comments other reported prior difficulties accessing other businesses US 90

Comments
US 90 bridge is terrible
Construction in the area - J-TURNS ARE A PROBLEM AND HORRIBLE*
Construction caused congestion which made it difficult to get in and out*
Difficult to take the u turn
No dedicated turning lane to turn into the driveway.
Traffic congestion.
Some hard to cross street
Underpass lights
Can't go straight at light have to go down and make difficult turn
US 190 bridge intersection can't go straight
Traffic light is a nightmare doesn't stay green long enough and can't go straight
Police had the entrance blocked off
Turning at the light.

*comment included in n=26 (reporting construction), response recorded in all caps

The next question asks respondents if they have experienced issues accessing property in the surrounding area. Nearly half of the US 90 sample (n=55, 44.72%) reported yes, while 55.28% reported no (n=68). Construction was mentioned in 67.3% of respondents' comments, while access-related issues (e.g., can't go straight, hard to turn left) and J-turns (n=3) were mentioned in about 29% of responses. The comments specifically mentioning J-turns include: "Traffic backing up at the J-turn," "J-turns make it hard to cross street," and simply "J-turns." When asked if they were aware of any recent road improvements that may have improved traffic conditions in the area, about 52% reported "no," about 7% reported "maybe" and about 41% reported "yes." Respondents answering yes or maybe were asked what if anything they can recall about the improvements. Table 22 provides a summary of their comments, which have been categorized and sorted. Seven responses were not able to be categorized because they did not clearly express specific improvements or they were more or less complaints. These appear verbatim at the bottom of the table.

Table 22
US 90 patron sample open-ended responses regarding improvements (categorized)

	Yes	Maybe	**Total**
Construction	**20**	**2**	**22**
Construction (general)	5		
On US 90	5		
Bridge/underpass/overpass	10	2	
Specific Improvements	**28**	**3**	**31**
Road Improvements/Repairs (e.g., pavement, filled potholes)	6	2	
Installed new light	4		
Reopening/Completed work	3		
Increase capacity/new extension	5		
Specific treatments (roundabout, J-turn)	3		
Congestion/Traffic reduction	1	1	
Improvement- other	6		
Complaint/tentative improvement (verbatim)	**3**	**4**	**7**
J-turn helped at first, but now causes traffic	1		
Turn on Highway 90 is a pain.	1		
They are in progress	1		
Construction has been hectic but there may be improvements		1	
Makes less traffic when construction finishes		1	
No improvement yet for us 190 highway cutting through town		1	
Supposed to get better but not better yet		1	
Total	**51**	**9**	**60**

Thirty-eight respondents had additional comments they wanted to express. While just under 37% could be categorized as construction-weary, there are a number of complaints about other drivers (e.g., running red lights, aggressive actions, etc.) and operational factors (e.g., light time too short/long, need traffic loop, rerouted traffic issues, etc.) as well as miscellaneous comments that could not be categorized (n=8). The summary of comments by category appears in Table 23.

Table 23
Patron sample US 90 additional comment categorical summary

Construction-Weary	14	36.84%
Driver Actions/Complaints	4	10.53%
Operational Factors/Complaints	8	21.05%
Safety Concern	1	2.63%
J-turn-related Comments	3	7.89%
Other	8	21.05%

With the exception of one of them, the comments specifically pertaining to J-turns are not particularly insightful. One indicates impact to travel time, i.e., "Albertsons J-turn is not good because it [is] increasing time spent driving," but the other two are difficult to meaningfully interpret: "J-turns won't allow for some travel" and "J-turn by movie theater." All 38 comments are listed verbatim (minimal editing) in Appendix F.

St. Tammany Parish

The area of interest in St. Tammany Parish is the city of Covington, specifically near I-12 and along the Hwy 21 corridor. This area of the state, in particular, has undergone extensive population and economic growth as part of a long-term trend dating back to the 1980s. Prior to 2012 when the J-turns were installed, a 2011 *Times-Picayune* article with the headline "Louisiana 21 traffic nightmare is progress in (constant) motion" provides insight into the emergent traffic problems and the specific growth/development trajectory in this location, which continues to this day [*81*]. More recent news articles published in 2017 provide additional context for the area's growth trends. According to a 2017 report by the St. Tammany Economic Development Foundation, in 2016, 2,401 new businesses were incorporated in St. Tammany, a 19.8% increase from 2015 [*82*]. The U.S. Census Bureau estimates the population has grown approximately 7.5% from 2010 to 2016, which translates to an addition of about 10 new residents each day [*83*].

Covington Business Sample Details & Respondent Characteristics. The sample of businesses from Covington is very small; only four businesses participated in the survey. Three businesses are fast food restaurants and one is retail sales. Two of the four are local businesses with multiple locations and the other two are regional/national chains.

Respondents provided additional details about their business location, such as how long their respective business has been in operation at that location, an estimate for the number of employees and an estimate for the number of patrons per day, as well as additional information about their employment at this location such as title, length of employment, etc. Respondents provided details about the business location and their employment, which are shown in Table 24.

Table 24
Business location and employment details: Covington business sample (n=4)

Business Location Details		Respondent Employment Details	
Time in Location	N	**Job Title**	N
5 years or less	0	Owner/Proprietor	0
more than 5, less than 10	2	Manager (non-owner)	2
more than 10	2	Assistant Manager/Supervisor	2
unknown	0	Employee	0
Number of Employees (estimate)		**Years Employed at Location**	
less than 10	2	Mean	2.25
11-25	1	Min	0.58
26-40	0	Max	4
41-60	1	**Work Commute (days per week)**	
61-74	0	6-7 days	1
more than 75	0	4-5 days	3
unknown	0	3 or less	0
Patrons Per Day (estimate)		**Basic Demographics**	
less than 50	0	Mean Age Years (SD)	40 (36.06)
50-99	1	Age Years Min-Max (N)	20-94 (4)
100-200	2	% White (n)	75% (3)
more than 200	1	% Female (n)	75% (3)

Covington Business Respondent Access-Related Items. Business respondents answered a series of closed and open-ended questions designed to gain insight into their perceptions of patron access. When asked to estimate what percentage of patrons plan to stop at their business location (as opposed to the percentage of patrons who might stop out of convenience as they are passing by), respondent estimates (n=4) ranged from 30% to 95% (M=68.75%, SD=28.7%). When asked to tell how most patrons accessed the parking lot, two indicated only one option and two indicated two. One respondent reported having "no dedicated lot" and one respondent reported access from the major street. Of the respondents providing more than one option, one reported having no dedicated lot and access from a neighboring business lot and the other reported access from the major street and the minor street or frontage road.

All four business respondents reported their busiest times as well as the reported degree of congestion at those time. One selected two busiest times and the other three each selected one. One respondent reported their busiest time as "before 9am" and described the degree of congestion as "congested." Another reported the area as "congested" during their busiest time, "between 4pm and 7pm." The other two respondents indicated their busiest times were in mid-day (i.e., both indicated "between 1pm and 4pm" and one also indicated "between

11am and 1pm") and both described the surrounding area as "somewhat congested" during these times. Next, respondents were asked to rank six general factors that people typically consider when deciding whether or not to patron a particular business. Figure 46 illustrates the mean rank for each, ordered in importance from most (lowest mean rank) to least important (highest mean rank) among business respondents (n=4). In general, quality ranked most important, followed by service, while access and hours ranked least (respectively). Additional descriptive statistics are provided in Appendix G.

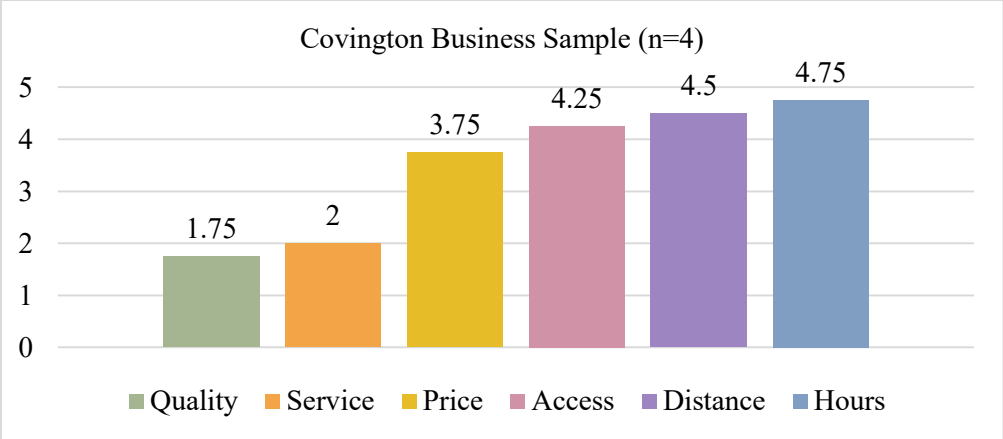

Figure 46
Covington businesses (n=4) ranked considerations (mean)

Covington Business Respondent Access-Related and Traffic Safety Concerns. When asked if customers have reported difficulty accessing their business (at any time), two indicated "yes," but the comments seemed to pertain to factors concerning particular customers or circumstances. Specifically, one comment mentions customers "having to walk too far" and the other indicated that customers have been calling to get directions to the location. None of the respondents reported business-access concerns or traffic safety concerns. One respondent left a final comment, i.e., "Improved streets by adding turning lanes and U-turns with turning lanes" which, while difficult to interpret constructively, doesn't suggest complaint.

Covington Patron Sample: Business Visit and Prior Patronage. While the number of Covington businesses participating in the survey was extremely small, the patron sample size is the second largest in this study by location (n=84). As reported previously in Table 7, the patron sample includes patrons representing 13 additional businesses that did not participate in the business survey. A majority of patrons (n=74) were visiting regional or

national chains, while the remaining patrons visited local businesses with either one location (n=4) or multiple locations (n=6). In terms of business types, 65.5% of respondents (n=55) were visiting retail sales businesses; about 21.4% of patrons were visiting fast food restaurants and slightly under 12% were visiting sit-down restaurants. One patron was visiting a retail service.

Patrons were asked "Thinking about your visit today, were you specifically planning to come to this business, or did you stop because it is convenient on the way to somewhere else?" Among patrons visiting Covington businesses (n=84), about 76% (n=64) reported that they had planned to stop while the remaining 24% (n=20) reported that they stopped as they were passing by. Next, patrons were asked how long they have personally been a patron to the business they just visited; how often they visit the business and how often they visit other area businesses Response frequencies to these items appear in Table 25.

Table 25
Covington patron sample: reported business patronage and frequency

Reported Length of Patronage		
First time was today	6	7.14%
1-12 mos.	14	16.67%
1-3 years	19	22.62%
3-6 years	15	17.86%
Over 6 years	30	35.71%
Total n	84	100%
Reported Frequency of Patronage (excl. first-time patrons)		
Less than once per month	10	12.82%
Once a month	10	12.82%
Several times a month	12	15.38%
Once a week	22	28.21%
Several times a week or more	24	30.77%
Total n	78	100%
Frequency of Visiting Other Area Businesses		
Regularly	60	71.43%
Sometimes/Not Regularly	17	20.24%
Rarely	5	5.95%
No	2	2.38%
Total n	84	100%

Patron Respondent Access-Related Items and Traffic Safety Concerns. The remaining patron survey items include the same six-factor ranking item asked of the business respondents, as well the same yes/no questions asked at the other sample locations. Focusing first on the six-factor ranking item, Figure 47 illustrates the mean rank position for each of

the items, ordered in importance from most (lowest mean rank) to least important (highest mean rank) among patrons of businesses located in Covington/St. Tammany Parish responding to these items (n=83). As illustrated by mean rank, Quality and Distance (respectively) tended to rank as most important. The mean rankings for Access, Price, and Service ranged from 3.55 for access to 3.69 (for Service) while the mean rank for Hours is 4.49. Additional descriptive statistics are provided in Appendix G.

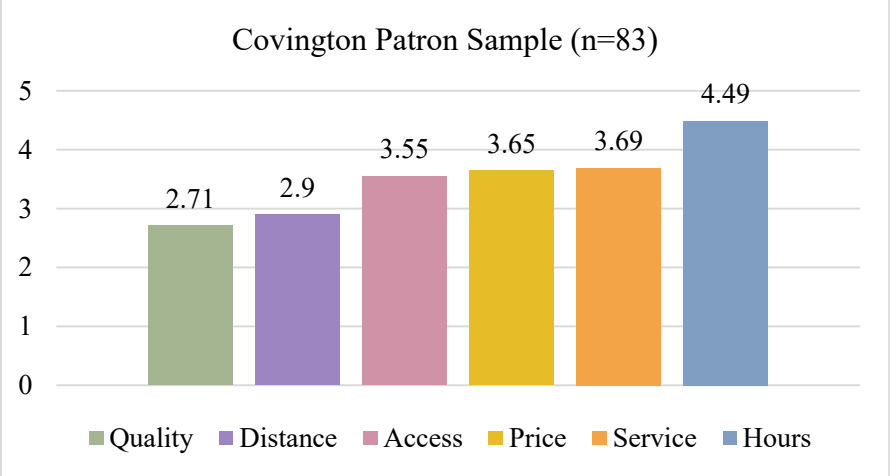

Figure 47
Covington patrons (n=83) ranked considerations (mean)

When asked if they have ever experienced difficulties accessing the business they just visited, 20% (n=17) reported "yes" but one person declined to add comment. Of the 16 comments left, six mentioned traffic and/or backups, three mentioned problems with parking/ parking lots, three mentioned delays at lights, and three indicated they had problems before the construction took place. Finally, one comment did not fall into either of the categories. It states, "the U-turn situation is not ideal" however it is not clear what they mean by that. When asked if they have ever experienced difficulty accessing other property in the area, 38 indicated "yes," 37 of which left comments. Most frequently mentioned (n=23) was difficulty due to traffic/backups, while the remaining comments refer to an array of other concerns, such as parking, construction, etc. Three comments mentioned left turn restrictions and four comments could not be categorized. Table 26 displays an overview of comments categorized by the nature of difficulties expressed.

Table 26
Patron-reported prior difficulties (categorized) accessing other businesses Covington

Comments	N
Traffic/backups	23
Parking	2
Left Turn restrictions	3
Delays (at lights)	1
Construction	4
Other	4
Nothing's ever zoned right	
Walmart down the street is hard to get to	
Difficult regardless of what business	
School traffic needs red light	

When respondents were asked if they were aware of any recent road improvements that may have improved traffic conditions in the area, 51 reported "yes," three reported "maybe," and 30 reported "no." The most frequently mentioned improvement was widening the road/lanes (and adding lanes) along Hwy 21 and the surrounding area (n=40) followed by mentioning of specific treatments such as roundabouts (n=5). Six comments referred to misc. improvements while three declined further comment (two were among the three reporting "maybe," the other "maybe" commented simply "lights"). Finally, when asked if they would like to leave any additional comments, 50% (n=42) reported "yes." All 42 left comments and of these, 27 (64%) specifically mention issues on I-12. Some of these comments specifically referred to exit numbers and/or other roads e.g., Hwy 190, Hwy 21. Though not all explicitly indicate what the issues entail (e.g., "I-12 has to be fixed," "I-12 is bad"), many describe capacity issues like a need to widen I-12 to alleviate traffic and congestion, while some mention safety as their primary concern. In general, patron comments include a range of general and specific complaints. Table 27 provides an overview of the comments, which appear verbatim with minimal editing in Appendix H.

Table 27
Summary of additional patron concerns/comments (categorized) Covington

	N	%
Interstate/I-12	27	64.29%
Hwy 190	3	7.14%
Congestion/Backups	6	14.29%
Other	6	14.29%

Jefferson Parish

The J-turn in Jefferson Parish is located at the intersection of LA 45 and 10th Street in Marrero, a census-designated place (CDP) situated on the Westbank of the Greater New Orleans region.

Marrero Business Sample Details & Respondent Characteristics. Of all four business survey locations, Marrero had the smallest sample size of businesses participating in the study. Two businesses are retail sales and the other is a sit-down restaurant. One is a local business (one location) and the other two are regional or national chains. All three respondents provided details about the business location as well as details about their employment, as shown in Table 28.

Table 28
Business location and employment details: Marrero business sample (n=3)

Business Location Details		Respondent Employment Details	
Time in Location	N	**Job Title**	N
5 years or less	0	Owner/Proprietor	0
more than 5, less than 10	0	Manager (non-owner)	3
more than 10	3	Assistant Manager/Supervisor	0
Number of Employees (estimate)		**Years Employed at Location**	
less than 10	1	Mean	8
11-25	0	Min	4
26-40	0	Max	10
41-60	1	**Work Commute (days per week)**	
61-74	0	6-7 days	0
more than 75	1	4-5 days	3
Patrons Per Day (estimate)		**Basic Demographics**	
less than 50	0	Mean Age Years (SD)	44.67 (21.94)
50-99	0	Age Years Min-Max (N)	20-62 (3)
100-200	1	% White (n)	0% (0)
more than 200	2	% Female (n)	33% (1)

Marrero Business Respondent Access-Related Items. Business respondents answered a series of closed and open-ended questions designed to gain insight into their perceptions of patron access. When asked to estimate what percentage of patrons plan to stop at their business location (as opposed to the percentage of patrons who might stop out of convenience as they are passing by), respondent estimates (n=3) ranged only a slight bit, from 70% to 80% (M=76.67%, SD=5.77%). When asked how most patrons accessed the parking lot, only two of the respondents supplied information. Both reported access from the

major street and one also reported access from the minor street/frontage road as well. All three participating businesses indicated just one block of time as being the busiest. While busy times varied by business, all indicated traffic in the surrounding area is typically not congested during their busiest times.

All three respondents ranked the six general factors that people typically consider when deciding whether or not to patron a particular business. Figure 48 shows the mean rank position for each of the items, ordered in importance from most (lowest mean rank) to least important (highest mean rank). One business ranked Access at most important while the remaining respondents ranked Access fourth or fifth. Similar to the business samples in the other three locations, Quality and Service were ranked higher than the other factors (though the particular placement of order varies) and hours ranked least important. Detailed descriptive statistics are provided in Appendix J.

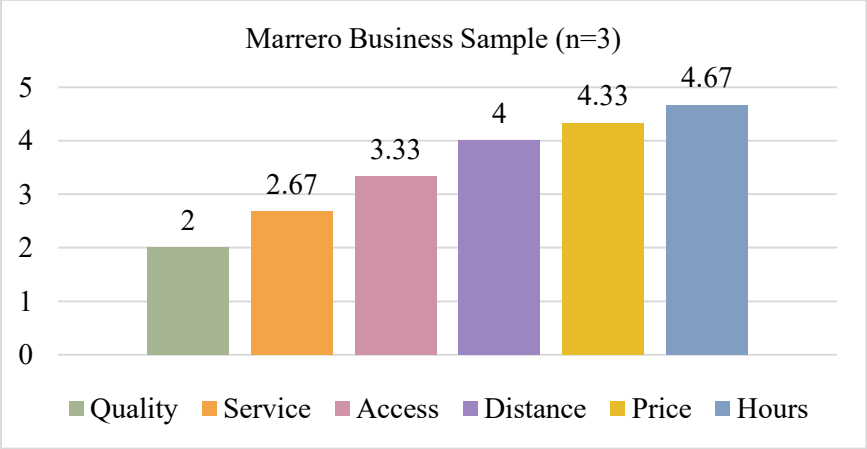

Figure 48
Marrero businesses (n=3) ranked considerations (mean)

Marrero Business Respondent Access-Related and Traffic Safety Concerns. None of the respondents answered "yes" to any of the yes/no concern question items, and so none of the respondents provided any comments to report.

Marrero Patron Sample: Business Visit and Prior Patronage. Compared to the Marrero business survey sample, the patron sample is much larger in size (n=52). As reported previously in Table 7, the patron sample includes patrons representing an additional three businesses that did not participate in the business survey. With the exception of one patron visiting a local business (one location), nearly all of the patrons (n=51) were visiting regional

or national chains. Over half of the sample visited convenience store/gas station businesses (n=27) one patron visited a sit-down restaurant and the remaining patrons were visiting retail sales businesses (n=24). About 48% (n=25) reported that they had planned to stop while the remaining 52% (n=27) reported that they stopped as they were passing by. It is worth noting that, of the 27 patrons who reported they did not plan to stop, 20 of them (about 74%) had visited convenience store/gas station businesses. Next, patrons were asked how long they have personally been a patron to the business they just visited; how often they visit the business and how often they visit other area businesses Response frequencies to these items appear in Table 29.

Table 29
Marrero patron sample reported business patronage and frequency

Reported Length of Patronage		
First time was today	5	9.62%
1-12 mos.	9	17.31%
1-3 years	6	11.54%
3-6 years	6	11.54%
Over 6 years	26	50%
Total n	52	100%
Reported Frequency of Patronage (excl. first-time patrons)		
Less than once per month	5	10.64%
Once a month	4	8.51%
Several times a month	16	34.04%
Once a week	10	21.28%
Several times a week or more	12	25.53%
Total n	47	100%
Frequency of Visiting Other Area Businesses		
Regularly	22	42.31%
Sometimes/Not Regularly	15	28.85%
Rarely	8	15.38%
No	7	13.46%
Total n	52	100%

Patron Respondent Access-Related Items and Traffic Safety Concerns. The remaining patron survey items include the same six-factor ranking item asked of the business respondents, as well the same yes/no questions asked at the other sample locations. Focusing first on the six-factor ranking item, Figure 49 illustrates the mean rank position for each of the items, ordered in importance from most (lowest mean rank) to least important (highest

mean rank) among patrons of businesses located in Marrero/Jefferson Parish (n=52). Detailed descriptive statistics are provided in Appendix J.

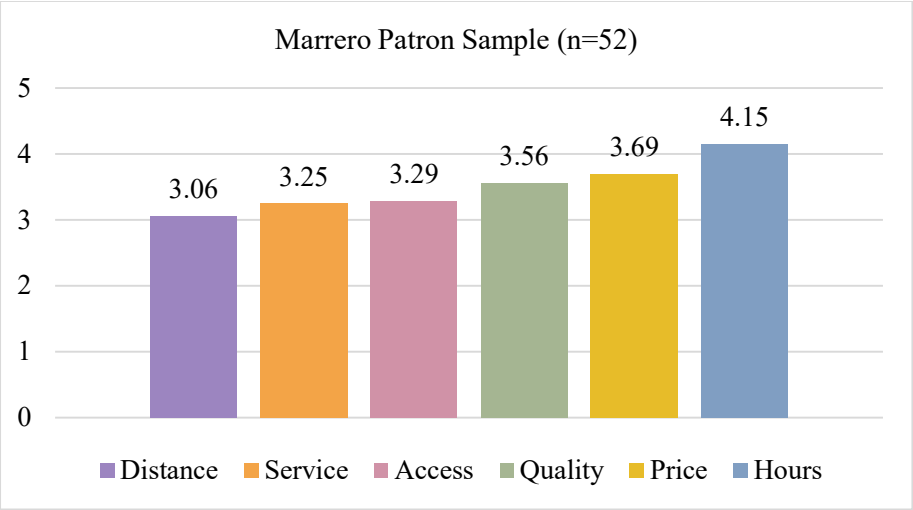

Figure 49
Marrero patrons (n=52) ranked considerations (mean)

When asked if they have ever experienced difficulty accessing the business they just visited, only six (11.54%) reported "yes" and of these, only five provided comments. One respondent reported access-related issues ("lanes blocked"), one mentioned crashes a couple of times a year, and one mentioned traffic around school time. The other two comments are business-specific. One reports the hours of the business while the other refers to crowding (i.e., people staying parked at the gas pumps after filling their gas tanks).

When asked if they have experienced issues accessing property in the surrounding area, eight respondents reported "yes," about 15% of the sample. Seven provided comment in the follow up question. Two respondents reported traffic issues while one indicated "traffic of an accident." Three comments concern navigation or access issues. Two are very general (i.e., Not enough U-turns or turning or access points; Hard to cross) while one is very specific: "Patriot and the corner of Barataria. Heading west on Patriot towards Barataria there should be a third lane for right hand turns only." One comment appears to refer to accessing one of the gas stations at this location, stating: "Truck comes to fill gas and takes too long."

The next question asks respondents if they are aware of any road improvements that may have improved traffic in the area. While eight reported "yes" and two reported "maybe," only six appeared to recall the nature of the improvements, which varied a bit across respondents. These comments appear in Table 30.

Table 30
Marrero patron awareness of recent improvement open-ended response comments

Yes	Opening of the expressway
	Traffic moving better
	Lapalco is now 3 lanes from Westwood to Segette bridge
	The off ramp completed not too long ago. No longer backs up westbound as badly
	Addition of ramp on expressway
Maybe	New light at main intersection

About 19% had additional comments/concerns that they wanted to provide. Similar to the previously reported item, comments varied and with the small size, they are not readily summarized. These comments (verbatim, minimal editing) appear in Table 31. As displayed, several mention concerns with crashes, several mention issues with potholes while others left comment about other drivers/driver actions.

Table 31
Additional patron comments: Marrero

Exit ramps causes traffic and accidents
Greater New Orleans bridge backed up during morning and afternoon
Potholes on service road.
90 business needs to be longer
People should learn how to drive
Red light at corner of Beltaire needs a turning light, accidents frequent
Speeding issue uncontrolled.
Traffic sucks
Potholes need to be filled. Drainage is bad when it rains heavily
Dangerous to cross road to Walgreens.

CONCLUSIONS

The purpose of this study was to assess the economic impact J-turns have had on businesses in the corridors where they have previously been installed in Louisiana. A secondary objective was to provide insight into current existing access-related concerns among businesses and their patrons near the J-turns using survey methods. This section summarizes the findings and conclusions, which have a number of implications for access management in Louisiana.

Economic Impact Findings

First, to assess the extent to which J-turns have had an economic impact on business sales, an economic impact analysis was conducted at multiple levels (i.e., aggregate comparison of affected/not affected business sales within a half mile radius, year effects according to when the J-turn was installed, parish effects at the local trend level and lastly, among businesses of certain types). The economic impact analysis showed that in the aggregate, mean sales are higher after the J-turns were installed and yielded no evidence at the macro level that J-turns had a negative effect on business sales. Rather than harming sales, it appears that the J-turns are positively correlated with growth in areas where they have been installed.

Because sales increased among businesses classified as "affected" and "unaffected" (in terms of travel distance impact from the J-turn), it is unlikely that the sales increase in the half-mile radius is due to the J-turn alone. Rather, the increase in business sales overall suggests other factors are involved (such as the business climate in the parish/neighborhoods, the impact of additional development and/or population growth, etc.). Mean sales increased over the study period (2011-2013) for both unaffected and affected businesses. There is no evidence that the J-turns had a negative impact on business sales in any year. Mean sales remained stable or they increased and in all cases, mean sales one year after installation were higher than the year before installation at statistically significant levels.

At the parish level, sales impacts are analyzed in greater detail, but in some cases, the number of existing businesses is very small, which makes it difficult to draw significant conclusions. Still, by performing analysis on (1) all businesses in close proximity to the J-turn, (2) affected and unaffected businesses separately, (3) all businesses active throughout the period, and (4) only those businesses active throughout the entire study period, it is possible to triangulate findings at the parish level. Focusing first on Lafayette Parish, mean sales as a percentage of parish sales appeared to decline; however, the analysis indicates no substantial differences between affected and unaffected businesses and in all cases, the

decrease was not statistically significant. The small sample size and small variance suggests the changes in mean sales before and after the installation can be attributed to randomness or other factors besides the J-turn alone.

In East Baton Rouge Parish, the sales among existing businesses near the J-turn (that were active a year before and a year after installation) as a percentage of parish sales appeared to slightly increase after installation at statistically significant levels for both affected and unaffected businesses. There are numerous other factors that can affect business sales that would be able to account for the difference. That sales increased for both classifications suggests other factors may be involved. In Jefferson Parish, mean sales increased after installation at statistically significant levels over the before-period. While not all comparisons showed statistically significant increases, the sales increased nonetheless and the general conclusion is that businesses in areas where J-turns were installed experienced sales increases relative to the rest of the parish.

Findings for St. Tammany Parish stand out a bit from the other locations. First, Covington, LA, which is located directly next to the interstate, is a high-traffic area that has seen considerable population growth in recent years. It has also been experiencing new development (including a new Walmart) and many new businesses have opened. The analysis indicates a significant increase in total sales as a percentage of total parish sales in the area and a decrease in sales among existing businesses. The most likely explanation for this is the new area development has increased sales at a rate higher than the rest of the parish. Because the decline in sales is observed in both affected and unaffected active businesses before and after the installation, these changes are likely not due to the J-turn itself but rather new business competition.

Taken together, there is no evidence that J-turns have a negative impact on business sales in the areas where they have been constructed. In the aggregate, J-turns appear to have a positive impact on sales and are even correlated with growth. Declines in sales were not restricted to businesses directly affected by the J-turn but were observed in businesses classified as unaffected as well. Analysis at the parish level suggests factors other than the J-turn may explain sales declines, or the changes may be attributed to randomness. These findings are consistent with prior research examining the economic impact associated with access management treatments.

Perception Survey Findings

The findings from the business survey and the patron survey augment the findings of the economic impact analysis by providing insight into location-specific issues that tended to dominate comments in both samples. While these findings cannot be extrapolated to other locations, it is interesting that the specific difficulties/topics mentioned in the open-ended items tended to be similar among business and patron respondents. For instance, construction and construction-related factors are commonly mentioned among respondents in Broussard/ Lafayette, which also had the highest number of businesses participating relative to the other locations. Likewise, traffic-related problems tended to be dominant in the comments from both respondent samples in Baton Rouge.

Among the business sample (all locations) retail sales and fast food restaurants were the most common types and generally, the majority of participating businesses are regional or national chains. Overall, businesses tended to report that most patrons access their parking lot via the major street and/or minor street or frontage road. Only three business selected "no dedicated lot." Businesses varied in terms of employees, reported average patron counts per day, respondent experience/length of time with the business but no major differences appear to exist between locations. Among the total sample, approximately 23% report the business has been at that location for over five (but less than 10) years, while about 50% report being at their location for over 10 years.

One limitation of the study is the number of businesses participating in the survey differs by location, with two locations having only a handful of respondents (i.e., Covington and Marrero). These businesses tended not to report access or traffic safety concerns and of those who provided comment, none described any issues concerning access management or the J-turn. The patron samples for these two locations, which are much larger than the corresponding business samples, do nonetheless provide some insight into business access issues with respect to location, particularly in Covington where comments concerning access-difficulties were dominated by mentions of traffic/back-ups, especially in relation to I-12. In Marrero, a smaller proportion of respondents reported "yes" to the questions about difficult access/ traffic safety concerns but the comments didn't particularly coalesce around a specific issue, as they tend to do in the other three locations. Findings for the two locations with larger business sample sizes are discussed further.

In Baton Rouge, Access ranked fourth in importance out of the six considerations among patrons and among businesses. Patrons who reported past difficulties accessing the business they just visited (27.78%) primarily reported the difficulty was due to traffic or congestion.

Only one respondent mentioned left turn restrictions. In subsequent items, left-turn restrictions are mentioned in a minority of responses and in general, across all of the open-ended items, traffic and/or congestion were reported at a greater frequency than access-related issues. Findings are relatively consistent with the business sample for this location, where all respondents reported at least some degree of congestion at their busiest time(s) of day, with congested being the most frequently reported. Additionally, half of the business sample indicated patrons have reported difficulty accessing their business at some prior point in time, with three-quarters indicating that "traffic" was the issue. One mentioned left-turn restrictions. No businesses reported having any access concerns and no businesses had any further comments or concerns about access management in the vicinity of their business.

Along US 90 in Broussard/Lafayette, where a significant portion of the highway has been under construction for the past several years, the concerns are quite different. First, access ranked fifth in importance out of the six considerations among patrons and among businesses. It is also worth noting that among patrons, price and distance were ranked most and second-most important, while business respondents ranked service and quality most and second-most important. Interestingly, the degree of congestion reported by business respondents at their busiest times is higher than in any of the other locations. Of the 27/28 business respondents participating along US 90, 14 indicated more than one busiest time. In general, businesses tended to report at least some degree of congestion during these times. Congestion seemed to be heaviest during the time blocks "between 11am-1pm" and "between 4pm-7pm." In looking at the times/level of congestion reported at these times, approximately 60% (n=9 out of n=15) reported the area is typically congested or very congested around mid-day, while 61.5% of respondents who selected the evening commute hours (i.e., 4pm-7pm) as one of their busiest times also reported congested or very congested. The hours between 1pm and 4pm, which seven businesses indicated was one of their busiest times, about 71% reported the area is typically congested or very congested at that time.

Additional findings from the business sample include when asked if any customers have reported difficulty accessing the business, 10/15 respondents reporting yes indicated the difficultly had to do with construction. When respondents were asked if they have any current access concerns, those reporting yes (n=13) tended to report more than one concern. For instance, while some comments include references to left-turn restrictions, routing of access, or issues with lights/intersections, a number attribute the access issues to the construction or to general traffic. Respondents reporting traffic safety concerns also frequently mention construction and/or driver actions.

Similar to business counterparts, patrons also ranked Access fifth in importance out of the six considerations, though there was a lot of variation with respect to rank order among individual respondents, so there is less difference between rankings. The patron sample also "corroborates" the construction-related problems mentioned by business respondents. Of the 37 comments reporting past difficulties accessing the business they just left, 70% mentioned "construction" and the remaining 30% of comments pertained to various access-related issues such as turning movements, re-routed through traffic or left turn restrictions. The next item, which asks about access to property in the surrounding area, has a similar response pattern, with about 67% reporting construction-related difficulties and about 29% reporting access-related issues. Of the 38 respondents with additional comments/concerns, about one-third (n=14) were construction-related comments and three comments pertained to J-turns specifically, though only one of them elaborated on the issue (i.e., increase to driving time). The remaining comments concerned a variety of other issues such as misc. operational issues, complaints about drivers, etc.

Additional insight may be gleaned from considering the mean rank ordering of the six considerations. While it is not possible to extrapolate these results to the general population, or even the local populations from which the sample was drawn, there do appear to be some general observations worth pointing out. Among the business respondents, across locations, the top ranked considerations are quality (of products/services) and customer service, followed by price, which is consistent with prior research [*72, 75*]. Distance tended to rank just above or just below access and hours was consistently ranked least important. The business sample sizes in Covington and Marrero are very small and having a larger sample size could lead to different results in some way, but it impossible to suggest how.

One of the most interesting observations, particularly in comparing business rankings to the patron rankings, is the placement of distance in terms of its importance to consumers. The business sample tended to rank distance close to the bottom, overall and in individual locations. The patron sample tended to rank distance as the second-most important consideration, or as in Marrero, the most important. Considering the patron comments on traffic and congestion, particularly in Baton Rouge, Covington, and along US 90 where construction work is ongoing, and assuming that a longer travel distance might likely result in a longer total trip time at the least, it is reasonable to expect that distance to travel would be a relatively important consideration. In general, access tended to rank higher in Covington and Marrero than in Baton Rouge and along US 90, where it was ranked fourth and fifth respectively in both survey samples. Consistent with the business sample, across all of the locations, hours was consistently ranked the least important among patrons.

Most of the patrons in the sample reported they have a history visiting the business they just left, with a majority of them reporting they visit once a month or more. While many also had complaints and concerns about traffic, congestion, construction inconveniences, maneuvering areas with heavy congestion, and issues with left turn restrictions, there is little evidence to suggest that these factors have such a deterrent effect that they would stop visiting the business altogether. While these factors are unpleasant, they are largely unavoidable if one intends to go about their routine. Considering that many of the businesses represented in the sample are regional and national chains with multiple locations, it is unlikely that patrons would decide to go out of their way over a longer distance to patron e.g., a different Walmart.

Qualitatively, the survey results provide insight into perceptions of access and mobility in these locations and how the transportation-land use cycle plays out over time. While the purpose of conducting the survey of businesses and their patrons was to gather insight into the perceived impact of access changes (i.e., J-turns) on business activity in areas where they have been previously installed, the access-related difficulties reported in the open-ended comments ultimately describe the impact of traffic, congestion, and/or traffic-impacting factors such as rush hour times, road work, driving behavior, etc. The same issues were reported in comments describing traffic-safety concerns and again when respondents were asked if they wanted to express any additional comments/concerns. There is no doubt that congestion has negative impacts on traffic flow through the road network and results in many negative externalities. Findings from prior research suggest that perceptions of congestion influence perceptions of access [*77*].

RECOMMENDATIONS

The state highway system, an integral component of Louisiana's multimodal transportation system, plays an indispensable role in the state's economy and in the lives of millions of people. While the scope of this study is limited to assessing the extent to which previously installed J-turns have had quantifiable economic impacts on business and perceptions of access, the recommendations provided have a number of implications for highway safety priorities, traffic operations, and for the practice of access management in Louisiana.

Proactive Approach to Addressing Business/Stakeholder Concerns

To the extent that it is possible, proactively addressing the concerns of businesses and other stakeholders in preliminary stages of development/project planning is necessary to foster a more cooperative environment and encourage productive dialog between all parties. The simple justification for regulating access connections from the road system is that it is in the best interest of the state and the general welfare of the public. Businesses may not inherently possess a frame of reference for considering access in these terms. The average person is unlikely to possess an in-depth understanding of traffic engineering concepts, such as roadway functional classification or corner clearance, but they are likely well-aware of the problems of congestion, travel delay, and bottlenecks. Traffic problems such as these are associated with a host of adverse and undesirable impacts. Relating access management to congestion and mobility concerns that impact all road users can provide a meaningful frame of reference.

The results of the analysis of sales tax data should be used in communications and outreach to the public/stakeholders for projects involving the construction of J-turns. There is indication that in locations where J-turns are constructed, there have also been new business developments, which may increase sales overall, but also lead to more competition, which generally benefits the citizens of the state. Though research in this area is still somewhat limited, the findings across studies are fairly consistent.

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AASHTO	American Association of State Highway and Transportation Officials
CMF	Crash Modification Factors
DOT	Department of Transportation
DOTD	Louisiana Department of Transportation and Development
EB	Empirical Bayes
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
ITE	Institute of Transportation Engineers
IRB	Institutional Review Board
LSP	Louisiana State Police
LHSC	Louisiana Highway Safety Commission
LTRC	Louisiana Transportation Research Center
LOS	Level of Service
LSU	Louisiana State University
MUT	Median U-Turn
NAICS	North American Industry Classification System
NCHRP	National Cooperative Highway Research Program
RCI	Reduced Conflict Intersections
RCUT	Restricted Crossing U-Turn
RIRO	Right-In Right-Out
SHSP	Strategic Highway Safety Plan
TRB	Transportation Research Board
TWLTs	Two Way Left Turn Lanes
TWSC	Two Way Stop Control
UIDs	Unconventional Intersection Designs

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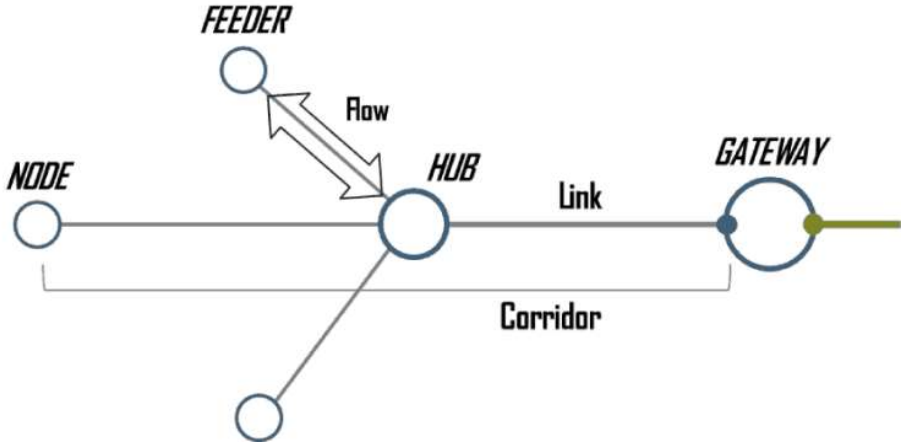
APPENDIX A

Structural Components of Transport Networks



The main structural components of transport networks are:

- **Node**. Any location that has access to a transportation network.
- **Link**. Physical transport infrastructures that enable to connect two nodes.
- **Flow**. The amount of traffic that circulates on a link between two nodes and the amount of traffic going through a node.
- **Gateway**. A node that is connecting two different systems of circulation that are usually separate networks (modes) and which acts as compulsory passage for various flows. An intermodal function is performed so that passengers or freight are transferred from one network to the other.
- **Hub**. A node that is handling a substantial amount of traffic and connects elements of the same transport network, or different scales of the network (e.g. regional and international).
- **Feeder**. A node that is linked to a hub. It organizes the direction of flows along a corridor and can be considered as a consolidation and distribution point.
    - **Corridor**. A sequence of nodes and links supporting modal flows of passengers or freight. They are generally concentrated along a communication axis, have a linear orientation and connect to a gateway.

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APPENDIX B

2018 J-Turn Business Survey Final

Q36 **Interviewer Instructions**
Record location and business information prior to recruiting business participant

Int_ID Interviewer ID Number

_____

BName What is the business name?

_____

BLoc Where is this business located? Choose the option that best approximates location.

- Baton Rouge (East Baton Rouge Parish: US 61 & LA 42) (1)
- Broussard (Lafayette Parish: US 90, mult. intersections) (2)
- Covington (St. Tammany Parish: LA 21 & Zinnia Dr) (3)
- Lafayette (Lafayette Parish: US 90 & Perimeter Rd) (4)
- Leesville (Vernon Parish: Kurthwood Rd & Alexandria Hwy) (5)
- Marrero (Jefferson Parish: LA 45 & 10th St/ Barataria Blvd) (6)
- Maurice (Vermillion Parish: US 167 & LA 699) (7)

Display This Question:

If Where is this business located? Choose the option that best approximates location. = Broussard (Lafayette Parish: US 90, mult. intersections)

BBLoc There are several locations in Broussard. Where along US 90?

- Broussard: US 90 & Morgan Ave. (1)
- Broussard: US 90 & Kol Dr. (2)
- Broussard: US 90 & Park Centre Dr. (3)
- Broussard: US 90 & Girouard Dr. (4)

Btype What is the primary type of business?

- Retail sales (1)
- Retail service (2)
- Fast food restaurant (3)
- Sit down restaurant (4)
- Professional office (5)
- Convenience store/ gas station (6)
- Auto-mechanical service (7)
- Other (please specify) (8)

  _____

BClass How would you classify this business?

- Local (one location) (1)
- Local (multiple locations) (2)
- Regional or national chain (3)
- Unsure (5)

End of Block: Interviewer Block

Start of Block: Screening Block

IConsent
Ask to speak to the **highest-level employee** (ideally the owner or manager) who has worked in the area for a least one month.

Interviewer Script:
We are conducting a short survey on behalf of the Highway Safety Research Group at LSU to gain insight into what if any access-related issues businesses in the area are currently experiencing.

The survey should only take about 5 minutes of your time and your business' participation is greatly appreciated.

Any information you provide will be kept confidential and your participation in this study will be anonymous.

Your responses will not be traced back to you statistically or otherwise. Findings from the study may be published, however, no personally-identifying information will be collected.

Results from this study will be used to help inform policy and decision-makers at DOTD and other agencies at the state and local levels.

Do I have your permission to continue with some preliminary questions?

- Yes (1)
- No (2)

Skip To: End of Survey If Ask to speak to the highest-level employee (ideally the owner or manager) who has worked in the a... = No

Page Break

BPre18 Are you at least 18 years of age or older?

- Yes (1)
- No (2)

Skip To: End of Survey If Are you at least 18 years of age or older? = No

BPreWork Have you worked at this location for at least one (1) month?

- Yes (1)
- No (2)

Display This Question:

If Have you worked at this location for at least one (1) month? = No

BPreWork2 Prior to accepting your current position, was your former place of work located in the same general area?

- Yes (1)
- No (2)

Skip To: End of Survey If Prior to accepting your current position, was your former place of work located in the same gener... = No

End of Block: Screening Block

Start of Block: Respondent Employment

BTitle What is your current job title? If more than one apply, please select the highest title

applicable to your position.

- Owner/ Proprietor (4)
- Manager (non-owner) (1)
- Assistant Manager/ Supervisor (2)
- Employee (3)
- Other (please specify title) (5)
  _____

Bwork How long have you worked at this location?

- Number of years (1) _____
- Number of months (2) _____

BCommute On average, about how many days do you commute to work?

- 3 or less (1)
- 4-5 (2)
- 6-7 (3)

End of Block: Respondent Employment

Start of Block: Business Operation

BOper How long has this business been operating at this location?

- 0-5 years (1)
- More than 5 years, less than 10 (2)
- More than 10 years (3)
- Not sure [Do not read; record only if Respondent reports he or she does not know] (4)

BEmp About how many employees currently work at this location?

- Less than 10 (1)
- 11-25 (2)
- 26-40 (3)
- 41-60 (4)
- 61-74 (5)
- More than 75 (6)
- Not sure/ Other [Do not read; record only if Respondent reports he or she does not

know] (7)

B_Perday On average, about how many customers/clients per day does this business serve?

- Less than 50 (1)
- 50-99 (2)
- 100-200 (3)
- More than 200 (4)
- Not sure [Do not read; record only if Respondent reports he or she does not know] (5)

End of Block: Business Operation

Start of Block: Customer Type

B_Plan Thinking about customers or clients that you think plan to visit your business and those customers or clients who stop on impulse, or just while passing by, what percent do you think plan to visit your business?

_____ Percent Planned stop/ Destination (2)

B_Pass Thinking about customers or clients that you think plan to visit your business and those customers or clients who stop on impulse, or just while passing by, what percent do you think stop on impulse?

_____ Percent Passing-by/ Impulse (1)

End of Block: Customer Type

Start of Block: Considerations etc

B_Rank I'm going to read you six general factors that people typically consider when deciding whether or not to patron a particular business. As I read them to you, consider where you would rank each factor when you are selecting a business of the same type as your visit today, with "1" being most important and "6" being least important.

Click and drag the considerations to rank

_____ Distance to travel (1)
_____ Hours of operation (2)
_____ Customer service (3)
_____ Quality of products/ services (4)
_____ Pricing of products/ services (5)
_____ Accessibility to location/ Ease of access (6)

Page Break

B_Busy What time(s) of the day tends to be the **busiest** for your business in terms of customers/clients coming in?

1. Before 9 am (1)
2. Between 9 am and 11 am (2)
3. Between 11 am and 1 pm (3)
4. Between 1 pm and 4 pm (4)
5. Between 4 pm and 7 pm (5)
6. After 7 pm (6)
7. N/A (explain) (7) _____

Skip To: B_Park If What time(s) of the day tends to be the busiest for your business in terms of customers/clients c... = N/A (explain)

Carry Forward Selected Choices from "What time(s) of the day tends to be the busiest for your business in terms of customers/clients coming in? "

B_BusyCon On a typical day, how would you describe the traffic in the area immediately surrounding your business during your busiest time(s)?

	Not congested (1)	Slightly congested (2)	Congested (3)	Very congested (4)	Not Sure (5)
Before 9 am (x1)	•	•	•	•	•
Between 9 am and 11 am (x2)	•	•	•	•	•
Between 11 am and 1 pm (x3)	•	•	•	•	•
Between 1 pm and 4 pm (x4)	•	•	•	•	•
Between 4 pm and 7 pm (x5)	•	•	•	•	•
After 7 pm (x6)	•	•	•	•	•
N/A (explain) (x7)	•	•	•	•	•

B_Park How do most customers/clients access your parking lot?

Interviewer Instructions: Check up to 2

8. Business does not have a dedicated parking lot (1)
9. Enter parking lot from the major street (2)
10. Enter parking lot from the minor street or frontage road (3)
11. Enter parking lot through neighboring business' parking lot (4)
12. Shared driveway to enter parking lot (5)
13. Other (please explain) (6)

_____

End of Block: Considerations etc

Start of Block: Concerns

B_Acc Have any of your customers reported any difficulty accessing your business (at any time)?

- Yes (1)
- No/ Not that I am aware of (2)

Display This Question:

If Have any of your customers reported any difficulty accessing your business (at any time)? = Yes

B_Acc_T In general, what kinds of difficulties have they reported?

_____

Page Break

B_Con Thinking about the area immediately surrounding your business, do you currently have any access-related concerns?

- Yes (1)
- No (2)

Display This Question:

If Thinking about the area immediately surrounding your business, do you currently have any access-r... = Yes

B_Con_T Please explain your current access-related concerns.

_____

Page Break

B_TraSaf Do you have any traffic safety concerns in the area immediately surrounding your business?

- Yes (1)
- No (2)

Display This Question:

If Do you have any traffic safety concerns in the area immediately surrounding your business? = Yes

B_TraSaf_T Can you please describe the traffic safety concerns you have in the area surrounding your business?

_____

Page Break

B_Comm Do you have any further comments or concerns about access management in the vicinity of your business that you would like to add?

- Yes (1)
- No (2)

Skip To: End of Block If Do you have any further comments or concerns about access management in the vicinity of your busi... = No

B_Comm_T Further access management concerns/comments:

_____

End of Block: Concerns

Start of Block: Demographics

Inst1 We really appreciate your participation in this study and have just a few more questions. Your responses to these basic demographic items will be used for statistical analysis purposes and cannot be traced back to you or to your business.

Interviewer Note: If the respondent is hesitant to provide responses, you may hand them the tablet to self-report the information.

B_R_Zip
What is your residential zip code?

_____

B_R_Age What is your current age (years)?

- Years (1) _____
- Prefer not to say (2)

Display This Question:

If What is your current age (years)? = Prefer not to say

B_R_Agecat Which of the following age categories would best approximate your current age?

- 18-30 (1)
- 31-50 (2)
- Over 50 (3)

B_R_gen What is your gender?

- Male (1)
- Female (2)
- Other/ Prefer not to say (3)

B_R_race What is your race/ethnicity?

- Black (1)
- White (2)
- Hispanic (3)
- Asian (4)
- Mixed/ Other (5)

Inst2 There are no more questions. Thank you for your participation in this study. The survey is complete.

2018 J-turn Patron Intercept Survey Final

Start of Block: Default Question Block

InterID Interviewer ID Number:

_____

BName What is the business name?

_____

BType What is the primary type of business?

- ○ Retail sales (1)
- ○ Retail service (2)
- ○ Fast food restaurant (3)
- ○ Sit down restaurant (4)
- ○ Professional office (5)
- ○ Convenience store/ gas station (6)
- ○ Auto-mechanical service (7)
- ○ Other (please specify) (8)

_____

BLoc Where is this business located? Choose the option that best approximates location.

- ○ Baton Rouge (East Baton Rouge Parish: US 61 & LA 42) (1)
- ○ Broussard (Lafayette Parish: US 90, mult. intersections) (2)
- ○ Covington (St. Tammany Parish: LA 21 & Zinnia Dr) (3)
- ○ Lafayette (Lafayette Parish: US 90 & Perimeter Rd) (4)
- ○ Leesville (Vernon Parish: Kurthwood Rd & Alexandria Hwy) (5)
- ○ Marrero (Jefferson Parish: LA 45 & 10th St/ Barataria Blvd) (6)
- ○ Maurice (Vermillion Parish: US 167 & LA 699) (7)

Display This Question:

If Where is this business located? Choose the option that best approximates location. = Broussard (Lafayette Parish: US 90, mult. intersections)

BBLoc There are several locations in Broussard. Where along US 90?

- ○ Broussard: US 90 & Morgan Ave. (1)
- ○ Broussard: US 90 & Kol Dr. (2)
- ○ Broussard: US 90 & Park Centre Dr. (3)
- ○ Broussard: US 90 & Girouard Dr. (4)

IConsent
Interviewer Script:
We are conducting a short survey on behalf of the Highway Safety Research Group at LSU to learn more about peoples' experience patroning businesses in this area.

The survey should only take about 5 minutes of your time.
Any information you provide will be kept confidential and your participation in this study will be anonymous.

Your responses cannot be traced back to you statistically or otherwise. Findings from the study may be published, however, no personally-identifying information will be collected.

Results from this study will be used to help inform policy and decision-makers at DOTD and other agencies at the state and local levels.

Do I have your permission to continue with some preliminary questions?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Interviewer Script: We are conducting a short survey on behalf of the Highway Safety Research Gr... = No

PreLA Have you resided in Louisiana for at least one full month?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Have you resided in Louisiana for at least one full month? = No

Pre18 Are you at least 18 years of age or older?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Are you at least 18 years of age or older? = No

End of Block: Default Question Block

Start of Block: Visit Today

Today Thinking about your visit today, were you *specifically* planning to come to this business, or did you stop because it is convenient on the way to somewhere else?

- ○ Yes/ Planned to stop (1)
- ○ No/ Convenient (2)

Bpatron How long have you been a patron to this business?

- ○ First time was today (1)
- ○ 1-12 months (2)
- ○ 1-3 years (3)
- ○ 3-6 years (4)
- ○ Over 6 years (5)

Display This Question:

If How long have you been a patron to this business? != First time was today

BFreq How frequently would you say you visit this business?

- ○ Less than once a month (1)
- ○ Once a month (2)
- ○ Several times a month (3)
- ○ Once a week (4)
- ○ Several times a week or more (5)
- ○ Other (do not read; record only if Respondent offers a different frequency) (6) _____

BArea Do you also visit other businesses in the area?

- ○ Regularly (1)
- ○ Sometimes/ On occasion but not regularly (2)
- ○ Rarely (3)
- ○ No (4)

End of Block: Visit Today

Start of Block: Considerations

Rank I'm going to read you **six** general factors that people typically consider when deciding

whether or not to patron a particular business. As I read them to you, consider where you would rank each factor when you are selecting a business of the same type as your visit today, with **"1"** being **most important** and **"6"** being **least important.**

Click and drag the considerations to rank
_____ Distance to travel (1)
_____ Hours of operation (2)
_____ Customer service (3)
_____ Product quality (4)
_____ Product price (5)
_____ Accessibility to business (6)

End of Block: Considerations

Start of Block: Access

BDiff Have you ever experienced any difficulties accessing this business?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Have you ever experienced any difficulties accessing this business? = Yes

Bdiff_T What were the circumstances or could you describe the nature of the difficulties?

_____

BComp Relative to other similar locations, have you ever experienced any issues navigating streets or accessing other property in the surrounding area

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Relative to other similar locations, have you ever experienced any issues navigating streets or a... = Yes

BComp_T What sorts of issues or specific problems have you encountered navigating streets or accessing other properties in the area?

_____

Page Break

RdImp Are you aware of any fairly recent road improvements that may have improved traffic conditions in this area?

- ○ Yes (1)
- ○ Maybe (2)
- ○ No (3)

Display This Question:

If Are you aware of any fairly recent road improvements that may have improved traffic conditions in... != No

RdImp_T What if anything can you recall about the improvements?

_____

Page Break

AddCom_T Do you have any comments or other traffic-related concerns in this area that you would like to share?

- ○ Yes (specify) (1) _____
- ○ No (2)

End of Block: Access

Start of Block: Demographics

Inst2 There are only a few more questions. Your anonymous answers to these items will be used for statistical analysis purposes only and cannot be traced back to you.

R_zip What is your residential zip code?

_____

R_env How would you describe your residential environment?

- ○ Rural (1)
- ○ Somewhat rural (e.g., small town) (2)
- ○ Suburban (4)
- ○ Urban (5)

R_gen What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Other/ Prefer not to say (3)

R_race What is your race/ethnicity?

- ○ Black (1)
- ○ White (2)
- ○ Hispanic (3)
- ○ Asian (4)
- ○ Mixed/ Other (5)

R_age What is your current age (years)?

- ○ Years (1) _____
- ○ Prefer not to say (2)

Display This Question:

If What is your current age (years)? = Prefer not to say

R_agecat Which of the following age categories would best approximate your current age?

- ○ 18-30 (1)
- ○ 31-50 (2)
- ○ Over 50 (3)

Inst3 Thank you for your participation in this study. The survey is complete.

APPENDIX C

Table 32
Overview of parish summary statistics

List of Figures	Mean Before (Std. Err)	Mean After (Std. Err)	Difference Between Means
Figure 23: Sales of businesses surrounding J-turns in Lafayette Parish as a percentage of Parish sales	0.5182 (0.0641)	0.5127 (0.0675)	(0.0055)
Figure 24: Sales of businesses unaffected by J-turns in Lafayette Parish as a percentage of Parish sales	0.2771 (0.0455)	0.2800 (0.0473)	0.0028
Figure 25: Sales of businesses affected by J-turns in Lafayette Parish as a percentage of Parish sales	0.2404 (0.0358)	0.2332 (0.0340)	(0.0072)
Figure 26: Sales of businesses surrounding J-turns active throughout period in Lafayette Parish as a percentage of Parish sales	0.4700 (0.0639)	0.4462 (0.0537)	(0.0237)
Figure 27: Sales of businesses unaffected by J-turns active throughout period in Lafayette Parish as a percentage of Parish sales	0.2761 (0.0458)	0.2601 (0.0470)	(0.0160)
Figure 28: Sales of businesses affected by J-turns Active throughout period in Lafayette Parish as a percentage of Parish sales	0.1934 (0.0377)	0.1862 (0.0236)	(0.0071)
Figure 29: Sales of businesses surrounding J-turns in East Baton Rouge Parish as a percentage of Parish sales	0.1642 (0.0119)	0.1685 (0.0182)	0.0043
Figure 30: Sales of businesses surrounding J-turns active throughout period in East Baton Rouge Parish as a percentage of Parish sales	0.1120 (0.0115)	0.1242 (0.0148)	0.0123**
Figure 31: Sales of businesses surrounding J-turns in Jefferson Parish as a percentage of Parish sales	0.0731 (0.0074)	0.0908 (0.0129)	0.0177***
Figure 32: Sales of businesses surrounding J-turns active throughout period in Jefferson Parish as a percentage of Parish sales	0.0522 (0.0064)	0.0505 (0.0070)	(0.0017)
Figure 33: Sales of businesses surrounding J-turns in St. Tammany Parish as a percentage of Parish sales	0.2252 (0.0239)	0.4846 (0.0412)	0.2594***
Figure 34: Sales of businesses surrounding J-turns active throughout period in St. Tammany Parish as a percentage of Parish sales	0.2209 (0.0206)	0.2062 (0.0206)	(0.0147)*

Note ** p=.05; *** p=.01

APPENDIX D

Table 33
Baton Rouge business sample: Rank by importance
Factors patrons consider in selecting business of same type

Business Sample	Access	Distance	Hours	Service	Quality	Price
Most Important	0	0	1	3	2	2
2	1	1	1	1	3	1
3	4	2	0	0	1	1
4	0	3	1	2	1	1
5	3	1	0	2	0	2
Least Important	0	1	5	0	1	1
Count	8	8	8	8	8	8
mean	3.63	3.88	4.63	2.88	2.63	3.38
sd	1.19	1.25	2.07	1.81	1.69	1.92
min	2	2	1	1	1	1
max	5	6	6	5	6	6
Range	3	4	5	4	5	5

Table 34
Baton Rouge patron ranked considerations when selecting business of same type

Patron Sample	Access	Distance	Hours	Service	Quality	Price
Most Important	11	13	2	8	16	4
2	5	9	7	16	11	6
3	8	16	5	7	7	11
4	12	6	6	9	8	13
5	9	4	17	4	8	12
Least Important	9	6	17	10	4	8
Count	54	54	54	54	54	54
Mean	3.56	2.94	4.48	3.28	2.87	3.87
Sd	1.74	1.61	1.53	1.73	1.68	1.47
Min	1	1	1	1	1	1
Max	6	6	6	6	6	6

APPENDIX E

Table 35
US 90 business sample: Rank by importance
Factors patrons consider in selecting business of same type

Business Sample	Access	Distance	Hours	Service	Quality	Price
Most Important	4	1	0	12	8	2
2	4	4	3	4	9	3
3	2	6	7	2	2	8
4	1	8	5	3	4	6
5	8	5	3	4	1	6
Least Important	8	3	9	2	3	2
Count	27	27	27	27	27	27
mean	4.07	3.78	4.3	2.59	2.63	3.63
sd	1.9	1.34	1.46	1.8	1.67	1.36
min	1	1	2	1	1	1
max	6	6	6	6	6	6
Range	5	5	4	5	5	5

Table 36
US 90 patron ranked considerations when selecting business of same type

Patron Sample	Access	Distance	Hours	Service	Quality	Price
Most Important	20	31	4	16	25	27
2	14	28	11	27	18	25
3	25	9	20	26	22	21
4	16	20	19	19	27	22
5	29	16	25	19	19	15
Least Important	19	19	44	16	12	13
Count	123	123	123	123	123	123
mean	3.63	3.15	4.48	3.37	3.27	3.1
sd	1.69	1.82	1.5	1.6	1.62	1.65
min	1	1	1	1	1	1
max	6	6	6	6	6	6

APPENDIX F

Table 37
US 90 respondent additional comments verbatim (minimally edited)

Construction-Weary (n=14)	The construction takes too much time
	Projects take longer than public is informed.
	Construction has been going on for a while and seems like it will never end
	Too much construction
	Work more often on projects that cause a lot of disruption
	Construction has been going on a long time and is making traffic worse.
	Wish they would finish the construction
	This construction makes it worse
	Get overpass done
	Construction
	Construction is slow
	Overpass needs to be finished
	Traffic from construction
	Construction is a good thing but it's taking too [long]
Driver Actions/ Complaints (n=4)	People cutting you off in traffic
	People running red [lights]
	You can only take a right turn at an intersection at Nazarene and Highway 90 at Albertsons and people go straight illegally
	People don't know how to follow the traffic signs
Operational Factors/ Complaints (n=8)	Rerouted traffic to this street- very busy now
	Turn light time too short
	Roads into St Martinville are in poor condition
	Need a loop; slow workers.
	Light at Sonic is too long
	Lots of potholes on the road that cause me to bob and weave.
	Bad roads
	Water on road when it rains hard
Safety Concern (n=1)	Celebrity Theater & Walk-Ons [intersection] is dangerous
J-Turn-related Comments (n=3)	J-turns won't allow for some travel
	J-turn by movie theater
	Albertsons J-turn is not good because it increasing time spent driving
Other (n=8)	Waiting on the built bridge
	Issue with the left turn at the light.
	You cannot travel north or south at the intersections
	Increase travel on highway 90
	Nothing has improved with getting across Hwy 90
	Continue with I-49 to New Iberia
	Hwy 90 ongoing for long time hopefully better soon; tried turn and nobody knew how to do it, maybe new thing better
	US 190 bridge

APPENDIX G

Table 38
Covington business sample: Rank by importance
Factors patrons consider in selecting business of same type

Business Sample	Access	Distance	Hours	Service	Quality	Price
Most Important	0	1	0	2	1	0
2	0	0	0	1	3	0
3	0	0	1	0	0	3
4	3	0	0	1	0	0
5	1	1	2	0	0	0
Least Important	0	2	1	0	0	1
Count	4	4	4	4	4	4
mean	4.25	4.5	4.75	2	1.75	3.75
sd	0.5	2.38	1.26	1.41	0.5	1.5
min	4	1	3	1	1	3
max	5	6	6	4	2	6
Range	1	5	3	3	1	3

Table 39
Covington patron ranked considerations when selecting business of same type

	Access	Distance	Hours	Service	Quality	Price
Most Important	11	23	3	10	26	10
2	12	19	7	16	16	13
3	14	13	13	11	18	14
4	23	8	11	13	9	19
5	12	11	21	19	7	13
Least Important	11	9	28	14	7	14
Count	83	83	83	83	83	83
mean	3.55	2.9	4.49	3.69	2.71	3.65
sd	1.56	1.72	1.48	1.68	1.61	1.62
min	1	1	1	1	1	1
max	6	6	6	6	6	6

APPENDIX H

Table 40
Covington respondent additional comments verbatim (minimally edited)

Interstate/ I-12	Please fix I-12. A roundabout at 1077 and 190	I-12 between 21 and 59 is tough to get on.
	Get busy getting traffic jam on I-12 and Hwy 21 fixed	I-12 getting over crowded
	I-12 is awful between 190 and here. Overpass at Hwy 21 is very dangerous	I-12 needs to be wider because it bottlenecks
	Interstate 12 is backed up with traffic in both directions	I-12 should be 3 lanes from Hwy 21 to Hwy 190
	Capacity of the interstate is bad. Coming up over the bridge is dangerous because there is usually backup and nobody can see over the bridge	I-12 very unsafe; lots of accidents, needs warning or flashing lights where there is hill near exit 57 & 59 when traffic is stopped
	I-12 they just had multiple fatalities between exit 59 and pinnacle	Widen I-12
	Interstate!	The I-12 has terrible traffic
	I-12 traffic is horrible	Widen the I-12
	Widen the I-12, and hours for Madisonville bridge	Traffic on I-12 is terrible. And bridge to Madisonville
	Traffic on I-12 and Hwy 190 is terrible	I-12 is bad
	I-12 bottlenecks really badly	Interstate needs to be widened
	Interstate 12 at exit 63. There is a large backup all the way to Tangipahoa	I-12 has a dangerous exit
	I-12 has no service roads on the sides so locals have to use the interstate	21 towards the interstate has a lot of wrecks on the on ramp
	I-12 has to be fixed	
Hwy 190	Widen the bridges on Highway 190 coming into Covington	
	More lanes on 190	
	190 is bad with traffic	
Congestion/ Backups	The roads are congested	
	Gets congested in this area	
	Traffic density is way up	
	The bridge backs up with boats coming through	
	By CVS there is bottlenecking from 3-5	
	Tchufuncta bridge backs up around 3&4 o'clock	
Other	Figure out a different system for merging on and off highways. You merge on and off in the same lane	
	Synchronize the lights around the area	
	They are going to widen Tyler St more and worried about the construction	
	Store access has been bad for the traffic in the area	
	Traffic improvement	
	Don't like that you can't make left turns	

APPENDIX I

Table 41
Marrero business sample: Rank by importance
Factors patrons consider in selecting business of same type

Business Sample	Access	Distance	Hours	Service	Quality	Price
Most Important	1	0	0	0	2	0
2	0	1	0	1	0	1
3	0	0	1	2	0	0
4	1	1	0	0	1	0
5	1	0	1	0	0	1
Least Important	0	1	1	0	0	1
Count	3	3	3	3	3	3
mean	3.33	4	4.67	2.67	2	4.33
sd	2.08	2	1.52	0.58	1.73	2.08
min	1	2	3	2	1	2
max	5	6	6	3	4	6
Range	4	4	3	1	3	4

Table 42
Marrero patron ranked considerations when selecting business of same type

	Access	Distance	Hours	Service	Quality	Price
Most Important	8	16	2	13	6	7
2	11	6	8	6	13	8
3	6	7	10	10	8	11
4	16	11	6	9	5	5
5	7	6	12	6	11	10
Least Important	4	6	14	8	9	11
Count	52	52	52	52	52	52
mean	3.29	3.06	4.15	3.25	3.56	3.69
sd	1.53	1.76	1.58	1.77	1.72	1.74
min	1	1	1	1	1	1
max	6	6	6	6	6	6

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