RESEARCH

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RAISED MEDIAN ECONOMIC IMPACT STUDY

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16. Abstract

Raised medians offer a departure from more traditional two-way left turn lanes typically built on Utah collector and arterial streets and can offer advantages in terms of safety, capacity, and aesthetics. At the same time, individual business owners often oppose raised medians due to fear of business loss.

The purpose of this study is to evaluate the Utah-specific effects of raised medians on retail sales. Using recent projects, this study evaluates retail sales both before and after the implementation of raised medians. Sales analysis used taxable sales data obtained from the Utah State Tax Commission. Sales data were requested for one full calendar year preceding the initiation of construction and one full calendar year following project completion. Sales analysis was also performed for corresponding control corridors in which a similar roadway project was completed that did not include the installation of a raised median.

For all of the corridors in which raised medians were constructed there was an increase in corridor-area retail sales and sales per square foot. Analysis showed that in every case there was no evidence of a negative impact on corridor sales due to installation of a raised median.

A business impact survey was administrated to qualitatively evaluate the perceived impacts of each road project in front of individual businesses. Business owners on corridors where the project included the installation of a raised median typically perceived the actual results of the project more negatively than corridors where the project did not install a raised median.

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EXECUTIVE SUMMARY

Raised medians offer a departure from more traditional two-way left turn lanes (TWLTL) typically built on Utah collector and arterial streets. In certain applications, raised medians offer proven advantages in terms of safety, capacity, and aesthetics. Raised center medians are promoted by many transportation experts for their ability to reduce conflict points on roadways and appeal to local governments' desire to improve streetscape appearance. At the same time, individual business owners often oppose raised medians due to a fear of business loss.

The purpose of this study is to evaluate the Utah-specific effects of raised medians on retail sales. Using recent projects as examples, this study evaluates retail sales both before and after the construction of raised medians. Existing research has primarily examined the safety, design and operational aspects of raised medians; however, there are a growing number of studies that evaluate the economic impacts. Some aspects of this research study have been inspired by similar studies performed in other states.

Three study and three control corridor pairs (six total corridors) were selected from a larger set of Utah corridors that had undergone a recent road construction project. Study corridors included the installation of a raised median. A corresponding control corridor was paired with each study corridor. The control corridor was a nearby roadway with a construction project completed in a similar time frame but did not include the installation of a raised median.

Analysis was performed using taxable sales data obtained from the Utah State Tax Commission. Sales data were requested for one full calendar year preceding the initiation of construction and one full calendar year following corridor construction project completion.

Data showed that there was an increase in corridor-area retail sales and sales per square foot in each of the study corridors in which a raised median was constructed. Sales per square foot increased between 5 percent and 100 percent depending on the corridor. Analysis showed that in every case there was no evidence of a negative impact on corridor retail sales due to installation of a raised median. It is important to note that this does not mean that each and every business within the corridor did better following installation of the median.

A business impact survey was administrated to qualitatively evaluate the perceived impacts of the study and control corridor projects. Though not statistically significant, the results help supplement the sales analysis and offer a brief look at business owner perspectives. Overall, study corridors typically yielded more negative perceptions about the transportation project and its impacts than their control corridor counterparts. Essentially, business owners on corridors where the project included the installation of a raised median did not expect the road project to improve conditions and typically perceived the actual results of the project more negatively than corridors where the project did not install a raised median.

Survey questions were grouped by categories regarding sales, customer activity, safety and access. Business owners on study corridors were most likely to report negative, pre-project, expected impacts and experienced post-project impacts regarding the ease of deliveries, business access, sales, and number of customers response categories. Meanwhile, the traffic congestion, number of traffic crashes, and overall impact question categories were more likely to elicit neutral or positive responses in terms of both expectations and experiences. Thus, it appears business owners had a more optimistic view of the raised median project's impact on traffic operations than business related factors.

1.0 INTRODUCTION

1.1 Research Objective

In recent years, UDOT has implemented a variety of widening projects involving raised, or otherwise non-traversable, center medians. Raised medians are a departure from more traditional two-way left turn lanes (TWLTL) typically built on Utah collector and arterial streets and, in certain applications, provide proven advantages in terms of safety, capacity, and aesthetics. Raised medians are promoted by many transportation experts for their ability to reduce conflict points on roadways and appeal to local governments' desire to improve streetscape appearance. At the same time, individual business owners often oppose raised medians due to a fear of business loss.

The purpose of this study is to evaluate the effects of raised medians on retail sales and specifically examine whether raised medians negatively affect sales. Using recent projects as examples, this study evaluates retail sales both before and after the construction of raised medians. Limited national studies are available on this topic and offer conclusions that vary based on the types of businesses. Local businesses in Utah often cite different economic or land use patterns in Utah to refute the use of national conclusions. This research builds on the growing body of knowledge nationally and offers Utah-specific research to increase understanding of the effects of raised medians on retail performance.

Sales analysis was completed using taxable sales data obtained from the Utah State Tax Commission. Sales data were requested for one full calendar year preceding the initiation of construction and one full calendar year following corridor construction project completion. Although the focus of the research was to gather and evaluate sales data, additional traffic data were also summarized and a non-statistical business survey administered to review perceptions of the construction projects evaluated.

1.2 Outline of Report

The body of this report includes seven chapters. Chapter 1 provides an overview of the study purpose and background. Chapter 2 presents the literature review including findings from

recent related studies. Chapter 3 outlines the study methodologies utilized to analyze taxable sales data and administer the business impact survey. Chapter 4 documents the process undertaken to select the final six corridor pairs (three study corridors, three control corridors). Chapter 5 details the taxable sales analysis conducted before and after each project construction period. Chapter 6 presents the results of the business impact survey. Finally, Chapter 7 provides the study summary and conclusions.

2.0 LITERATURE REVIEW

2.1 Background

This study is intended to add Utah-specific findings to the existing body of research regarding the impacts of raised medians. Existing research has primarily examined the design and operational aspects of raised medians; however, there are a growing number of studies that involve the economic impacts. Some aspects of this research study have been inspired by similar studies in other states. This section contains summaries of particularly relevant work undertaken is presented in chronological order.

2.2 Transportation Research Board Research Results Digest

Weisbrod and Neuwirth (1998) released a digest of research regarding the business impacts of restricting left-turn traffic. A diversity of road designs and economic settings were studied through the nine case study sites included in the report. Researchers measured business impacts by studying shifts in economic and traffic data following the altered road design. Surveys and interviews of local officials, real estate experts, business owners, and customers also helped measure business impacts. The study concluded with developing a predictive model to estimate the effects of left-turn restriction projects.

The major conclusions on the study include:

1. When left-turns are restricted, gas stations, non-durable goods retailers, and service businesses showed the largest sales declines and highest rates of business change; the opposite occurred for grocery stores and restaurants.
2. Overall business owner impressions of left-turn restriction projects were mixed.
3. Business owners at mid-block locations had a negative impression of left-turn restriction projects.
4. Prime commercial sites in some study areas shifted following the installation of a raised median.

5. Surveyed customers indicated that restricted access to a particular business does not impact the frequency of their patronage.

2.3 Iowa

Maze et al. (1999) investigated the impacts of access management treatments to corridors in Iowa. Safety, traffic, and business data were used to measure impacts caused by raised medians in case study areas. Economic impacts were analyzed through sales tax data, business turnover data, and business owner/manager interviews.

The major conclusions on the study include:

1. Business success was not, for the most part, diminished when access is managed.
2. Access management projects increased safety, decreased crash severity, reduced number of crashes, and reduced property damage.
3. Benefits of access management also included reduced delays.

2.4 Texas

Eisele and Frawley (2000) summarized several years of research study in a 2000 report. The study remains one of the most in-depth analyses of raised-median economic impacts. The research produced a methodology that was used to measure the impacts of raised medians on local businesses. Results were acquired via customer and business owner surveys, employment data, sales data, and property value data.

The major conclusions on the study include:

1. In-person survey methods yielded a higher response rate (62 percent) than a mail-back survey (9 percent).
2. Business owners ranked “accessibility” below customer service, quality, and value when asked what drives their customers to choose their business.
3. Total number of employees along several corridors constructed with raised medians remained unchanged.

4. Property values rose on average by 6.7 percent after the construction of a median.
5. The most significant negative business impacts occurred during construction.
6. After construction, gasoline station and auto repair businesses indicated a small negative effect on gross sales, and slightly fewer customers per day.
7. After construction there was a 17.7 percent increase in customers per day for all businesses present for the entire construction cycle and a reduction in gross sales of 0.03 percent.
8. Perceptions of business owners present before, during, and after median construction were more favorable towards the effects of medians than the perceptions expressed before construction.

2.5 Washington State

Vu et al. (2002) produced a statistical study to understand the perceived business impacts of access management styles. Impressions were gathered from 280 businesses along six major commercial corridors in western Washington via a paper, mail-back survey. Business owners were asked in the survey to provide their perceptions about the impacts of access management on their clientele, business type, current access control treatments, existing traffic conditions, and preferred access management treatment. The second portion of the report used the survey data to develop a statistical framework for analyzing perceived economic impacts of raised medians. Nearly 21 percent of businesses surveyed had accesses with right-in/right-out, the most restrictive access control type; and 13 percent had consolidated driveways.

The major conclusions on the study include:

1. The majority of businesses had some degree of concern about the ability of vehicles to exit and enter their driveway, at 76 percent and 73 percent, respectively.
2. Similarly, for impacts on business revenue, just over half of businesses reported negative effects due to their current access management.
3. Perceived economic impact due to access management is correlated to a businesses' accessibility.

4. Statistically significant factors that impact perceptions include business type, business operational variables, street environment variables, and willingness-to-pay amounts.

2.6 Utah

Saito et al. (2005) compared median design types through eight case studies: four roads with raised medians and four without. Changes in customer travel behaviors were measured by researchers through a survey conducted at select businesses along case study corridors. The study sought to develop a procedure for timing new raised median projects, develop a consensus on economic impacts and examine safety data.

The major conclusions on the study include:

1. Of customers surveyed, 83 percent said they were just as likely to visit a business despite an inconvenience caused by a raised median.
2. Customers ranked accessibility as least important when choosing a business.
3. Most managers did not perceive a change in the volume of business after the installation of a raised median.

2.7 Minnesota

Preston et al. (2007) studied the economic impacts of the mid 1980s upgrade of the US-12 highway to the I-394 freeway. As a result of this change, all direct accesses onto US-12 were closed and routed onto frontage roads. The Minnesota study evaluated the business impacts caused by the upgrade. Indicators, such as land value changes, income trends of nearby residents, retail activity, employment trends, business turnover rate, historic estimated market values, travel time comparisons, access path comparisons, and interviews from a sample of businesses are included in that study.

The major conclusions on the study include:

1. Perceived negative impacts were generally worse than actual impacts.

2. Business climate along the corridor improved with more businesses in existence after the impacts, some increasing sales and others number of employees.
3. Business success along the corridor is connected to adaptability in changing conditions.
4. Overall impacts on business are described from “neutral” to “very positive.”

2.8 North Carolina

Cunningham et al. (2010) performed the only economic access management study conducted since the 2008 economic crisis. A major focus of the study was to provide the results using local case studies because business owners in North Carolina were skeptical of research which used case studies from other states. The study used a perception-based survey of local business owners and managers of 789 businesses along eight corridors with access management treatments. These results were compared against a baseline derived from eight “control” corridors.

The major conclusions on the study include:

1. Business owners reported no significant revenue changes caused by the raised medians.
2. Perceptions about the reduced number of customers were more negative than reality.
3. Single-location businesses were negatively impacted; however, larger economic conditions were the likely cause.
4. High business turnover was possibly attributable to anticipatory moving before construction and new businesses opening after construction.

2.9 Summary

Studies influencing this research utilized quantitative and qualitative data. Most studies also compared impacts experienced on study and control corridors. Studies usually utilized eight to 16 case study corridors. The quantitative data were often safety, property value, business turnover rates, employment, sales, and traffic. Qualitative data were gathered from business owners, managers, and customers through surveys. Surveys usually involved topics such as sales,

number of customers, perceptions, and ease of access. A clear consensus among the studies holds that in-person surveys resulted in the highest response rates. Business owner skepticism of research from other states seems to be another common feature.

In general, studies found that business owner expectations before the installation of a raised median were more pessimistic than experience revealed. Most businesses did not experience a negative impact caused by the raised median. However, different business types experienced negative impacts to varying degrees. Surveys also found that factors determining an individual business' level of impact were location on the block, quality of access management, and business model. Businesses with a single location or relying on pass-by customers were more likely to experience negative impacts. Customer's impressions, when surveyed, indicated that a businesses' ease of access was only a slight influence on their behavior.

3.0 STUDY METHODOLOGY

3.1 Overview

The examination of the business impacts of raised median projects was accomplished primarily through evaluation of taxable sales data and administration of a business owner/manager survey on select corridors in Utah. Guidance, support, and comments were provided throughout the project by the research team.

3.2 Corridor Selection

Three study and control corridor pairs (six total corridors) were selected from a larger set of Utah corridors that recently experienced a road construction project. Study corridors are roadways in which the UDOT construction project included installation of a raised median. Control corridors are corresponding nearby roadways with a UDOT construction project completed in a similar time frame and where the project did not include the installation of a raised median. The corridors selected from this process provided the analysis areas to be used in the remainder of the study. Further detail of the corridor selection process is provided in Chapter 4.

3.3 Sales Analysis

Analysis was performed using taxable sales data from the Utah State Tax Commission. Sales data were requested for one full calendar year preceding initiation of construction and one full calendar year following construction project completion. Data for the selected corridors were aggregated by corridor area after being located along the street centerline to protect individual business confidentiality. The specific data were then compared against overall sales data at the zip-code level to provide a larger geographic context to the corridor-specific changes in revenues. Gross floor area estimates for businesses along the corridors were used to develop the sales per square-foot figures. Further detail about the sales analysis process can be found in Chapter 5.

3.4 Business Impact Survey

A business impact survey was administrated to qualitatively evaluate the perceived impacts of the study and control corridor road construction projects among individual business owners located along or near the roadway frontage. Though not statistically significant, the results help supplement the sales analysis and offer a brief look at business owner/manager perspectives. The survey compared anticipated versus experienced impacts related to the project's finished form. Survey respondents were asked a series of qualitative questions including such topics as business access, customer numbers, and sales. Responses to the survey were primarily collected by canvassing businesses along the study and control corridors. To be eligible to participate in the survey, the business *and* survey respondent had to be present prior to the construction. A total of 56 surveys were collected through in-person interviews, online, as well as mail-back forms. Survey responses were collected in late October 2012 through early November 2012 to avoid competing for attention with the holiday shopping season. Further detail about the business impact survey methodologies and results are in Chapter 6.

3.5 Research Team

Throughout the research process, an interdisciplinary research team of individuals with professional backgrounds in traffic safety, academic research, planning, economics, and public involvement were consulted for guidance and comment. Members of the committee provided input throughout the study's progress. For example, the research team recommended research to be included in the literature review, suggested potential study and control corridors, provided input on corridor selection decisions, and commented on the design and development of the business impact survey. The research team also provided comment as to the conclusions, meaning, and application of sales analysis and business survey analysis results. Finally, the team provided recommendations for further research. The research team was a valuable asset that greatly contributed to the strength of this research process. (Specific persons on the Research Team are noted in the Acknowledgements section.)

4.0 CORRIDOR SELECTION PROCESS

4.1 Overview

The six final corridors (three study and three control) were identified through a two-level screening process that originated from an initial list of 38 candidate study and control corridors. The following sections describe in detail the selection and screening process.

4.2 Preliminary List

The preliminary list of study and control corridors yielded 38 candidate sites across the state of Utah. Research team suggestions, UDOT historic project lists, and local knowledge of the roadway system contributed to the initial list of corridors. The preliminary list was identified based on the following general criteria. The criteria were applied broadly, rather than strictly, so as to produce a large set of candidate sites, yet eliminate any obvious misfits.

- Corridor project completed within the last ten years
- Corridor project completed more than one year ago (in order to preserve one full year of sales tax data)
- Raised median installed on a significant section of the project (study corridor only)
- Roadway construction project did not include a raised median and no raised median was present prior to project (control corridor only)
- Surrounding land use primarily commercial
- Corridor located on the State Highway system
- Corridor between 0.5 and two miles long
- Geographically diverse - corridors represent all parts of the state

Table 1 summarizes the initial 38 study and control corridors.

Table 1 List of Preliminary Corridors

Area	Study					Control				
	Route	Road	Extents	Year	Project Notes	Route	Road	Extents	Year	Project Notes
Cache County	US-89/ US-91	Main St Logan	100 W to 900 S	2010	Install raised median	US-91	Main St Logan	1000 N to 1600 N	2009	Resurfacing, portion of a longer project area
N. Wasatch Front						SR-26	Riverdale Rd	I-84 to US-89	2009/ 2010	Widen 4 lanes + TWLTL to 6 lanes + TWLTL
						SR-108	Antelope Dr	1000 W to 2000 W	2009	Widen 2 lanes to 4 lanes + TWLTL
						SR-134	2700 N N. Odgen	I-15 to SR-235	2004	Widen 2 lanes to 4 lanes + TWLTL
						SR-39	12th Street	I-15 to US-89	2009/ 2010	Reconstruction of road surface
Salt Lake County	SR-71	12300 S	265 W to 300 E	2003/ 2004	Widen 3 lanes + TWLTL to 6 lanes + raised median	SR-71	12300 S	300 E to 700 E	2003/ 2004	Widen 3 lanes + TWLTL to 4 lanes + TWLTL
	US-89	State St	9000 S to 10000 S	2007/ 2008	Widen 4 lanes + TWLTL to 6 lanes + raised median	SR-68	Redwood Rd	10600 S to 11400 S	2007	Widen 2 lanes to 4 lanes + TWLTL
	SR-71	700 E	9400 S to Carnation	2006	Widen 3/4 lanes + TWLTL to 4 lanes + raised median	SR-71	700 E	10300 S to 11400 S	2010	Widen 2/3 lanes + TWLTL to 4 leans + TWLTL
	n/a	1300 E	Creek Rd to Draper	2009/ 2010	Resurfacing and install raised median	SR-68	Redwood Rd	9000 S to 104000 S	2002/ 2003	Widen 2 lanes to 4 lanes + TWLTL
	SR-226	4500 S	I-15 to State St	2007/ 2008	Widen 4 lanes to 6 lanes. Raised median pre-project	SR-209	9000 S	Redwood Rd to 1300 W	2008	Resurfacing
	SR-209	9000 S/ 9400 S	700 E to 1100 E	2006	Widen 2 lanes to 4 lanes + raised median.	SR-172	5600 W	6200 S to 5000 S	2007	Widen 2 lanes + TWLTL to 4 lanes + TWLTL. Mostly residential

(continued on next page)

Table 1 List of Preliminary Corridors (continued)

Area	Study					Control				
	Route	Road	Extents	Year	Notes	Route	Road	Extents	Year	Notes
Salt Lake County	SR-171	3500 S	Bangerter to 2700 W	2008/ 2009	Widen 4 lanes + TWLTL to 6 lanes + raised median/BRT lanes	SR-48	7800 S	4000 W to 2700 W	2010	Resurfacing, median removed and re-installed several times
						SR-190	Wasatch Blvd	3000 E to Ft Union Blvd	2009	Resurfacing
						SR-152	Van Winkle	900 E to I-215	2008	Resurfacing
						SR-172	5600 W	4450 S to 4700 S	2007	Widen 2 lanes + TWLTL to 4 lanes + TWLTL. Mostly residential
						SR-171	3300 S	State St to 1300 E	2008/ 2009	Resurfacing
						SR-68	Redwood Rd	2320 S to 3500 S	2005-2007	Reconstruct road surface. Significant disruption
Provo/ Orem	SR-52	800 N Orem	400 W to 200 E	2008	Widen 4 lanes + TWLTL to 6 lanes + raised median	SR-52	800 N Orem	1200 W to 400 W	2009/ 2010	Widen 4 lanes + TWLTL to 5 lanes + TWLTL
	SR-265	Univ. Pkwy	400 W to 200 E	Pre 2003	Convert 6 lanes + TWLTL to 6 lanes + raised median	US-189	Univ. Ave	Univ. Pkwy to Canyon	2009	Resurfacing, added 1 northbound lane
Washing-ton Co.	SR-34	St George Blvd	Bluff St to 1000 E	2005	Convert 4 lanes + TWLTL to 4 lanes + raised median	SR-8	Sunset Blvd	Dixie Dr to 1100 W	2009	Resurfacing
	SR-9	State St	300 W to 800 N	2010	Widen 2 lanes + TWLTL to 4 lanes + raised median	SR-9	State St	3700 W to 300 W	2009	Resurfacing, post-project median added 2010 or 2011
						SR-212	Telegraph St	500 W to 300 E	2011/ 2012	Widen to 4 lanes + TWLTL.
						SR-212	Telegraph St	I-15 to 500 W	2011	Widening, part from 2 lanes + TWLTL to 4 lanes + TWLTL
						SR-18	Bluff St	Main St to Snow Canyon	2011	Resurfacing

4.3 Level 1 Screening List

The Level 1 screening process narrowed the preliminary list of 38 corridors down to 12 corridors (six study/control corridor pairs). Corridors were paired according to proximity to each other, similarities in project type, and roadway and land use characteristics. Efforts were made to select pairs of projects distributed across Utah. The following is the list of general guidelines used in selecting study/control corridor pairs:

- Study and control corridors located within a few miles of each other
- Study and control corridor projects completed within similar time frame
- Study and control corridor projects similar in scope and impact
- Study and control corridor projects of similar length
- Fewest other changes to surrounding area (road projects and development)
- Geographically diverse - represent all parts of the state

Table 2 summarizes the Level 1 Screening List. The locations of the project pairs included two pairs in Salt Lake County, two pairs in Washington County, one pair in Cache County, and one pair in the Provo/Orem area. The project construction dates ranged from 2003/2004 to as recent as 2010.

Table 2 Level 1 Screening List (Six Pairs of Study/Control Corridors)

ID	Area	Type	Route	Road	Extents	Year	Notes
A1	Cache County	Study	US-89/ US-91	Main St Logan	100 W to 900 S	2010	Installed raised median
A2	Cache County	Control	US-91	Main St Logan	1000 N to 1600 N	2009	Resurfacing, portion of a longer project area
B1	Salt Lake County	Study	SR-71	12300 S	265 W to 300 E	2003/ 2004	Widen 3 lanes + TWLTL to 6 lanes + raised median
B2	Salt Lake County	Control	SR-71	12300 S	300 E to 700 E	2003/ 2004	Widen 3 lanes + TWLTL to 4 lanes + TWLTL
C1	Salt Lake County	Study	US-89	State St	9000 S to 10000 S	2007/ 2008	Widen 4 lanes + TWLTL to 6 lanes + raised median
C2	Salt Lake County	Control	SR-68	Redwood Rd	10400 S to 11400 S	2007	Widen 2 lanes to 4 lanes + TWLTL
D1	Provo/ Orem	Study	SR-52	800 N Orem	400 W to 200 E	2008	Widen 4 lanes + TWLTL to 6 lanes + raised median
D2	Provo/ Orem	Control	SR-52	800 N Orem	1200 W to 400 W	2009/ 2010	Widen 4 lanes + TWLTL to 5 lanes + TWLTL
E1	Washing-ton Co.	Study	SR-34	St George Blvd	Bluff St to 1000 E	2005	Convert, 4 lanes + TWLTL to 4 lanes + raised median
E2	Washing-ton Co.	Control	SR-8	Sunset Blvd	Dixie Dr to 1100 W	2009	Resurfacing
F1	Washing-ton Co.	Study	SR-9	State St	300 W to 800 N	2010	Widen 2 lanes + TWLTL to 4 lanes + raised median
F2	Washing-ton Co.	Control	SR-9	State St	3700 W to 300 W	2009	Resurfacing. Post-project median added 2010 or 2011

4.4 Final Corridors (Level 2 Screening List)

To assist in the final corridor selection process, additional data were gathered for each of the six corridor pairs advanced from Level 1 screening. First, detailed land use profiles were estimated using UDOT RoadView imagery (UDOT 2012a) as well as Google Earth aerial imagery (Google 2012). Second, median and access data were obtained from this imagery. Finally, historical crash data and traffic volume data (UDOT 2012b) were obtained from the UDOT Traffic and Safety Division. This information is included in the Appendix.

The above information assisted in the Research Team's selection of the final three pairs of corridors. The final selection was based on the following general guidelines:

- Corridors primarily commercial in land use
- Corridor pairs with similar amount and degree of commercial land use
- Minimal changes in the surrounding area before and after the project
- Corridor pairs represent different areas of the state
- At least one pair of corridors adjacent to each other and at least one pair of corridors separated by two or more miles
- More recent projects preferred over past projects to maximize business owner survey responses

Based on the above criteria, the A, C, and F corridor pairs were selected as the final three corridor pairs for analysis. The B, D, and E corridor pairs were eliminated due to having been constructed too far in the past, exhibiting a lack of consistent commercial land use, and/or study and control projects differing in scope and impact to the roadway. Table 3 lists the final three corridor pairs. A brief discussion of each selected corridor follows.

Table 3 Level 3 Screening List (Final Corridor Sets)

ID	Area	Type	Route	Road	Extents	Year	Notes
A1	Cache County	Study	US-89/ US-91	Main St Logan	100 W to 900 S	2010	Installed raised median
A2		Control	US-91	Main St Logan	1000 N to 1600 N	2009	Resurfacing, portion
C1	Salt Lake County	Study	US-89	State St	9000 S to 10000 S	2007/ 2008	Widen 4 lanes + TWLTL to 6 lanes + raised median
C2		Control	SR-68	Redwood Rd	10400 S to 11400 S	2007	Widen 2 lanes to 4 lanes + TWLTL
F1	Wash-ington County	Study	SR-9	State St	300 W to 800 N	2010	Widen 2 lanes + TWLTL to 4 lanes + raised median
F2		Control	SR-9	State St	3700 W to 300 W	2009	Resurfacing. Post-project median added 2010 or 2011

4.4.1 Cache County Study Corridor

Corridor A1 is located between 100 West and Main Street on US-91 in southern Logan City, as illustrated in Figure 1. This corridor serves as a gateway to Logan City for travelers from southwestern Cache Valley and the Wasatch Front. The surrounding land use on this corridor is dominated by commercial properties, including a Walmart Supercenter, a strip mall, fast food establishments, and several hotels. A raised median was installed on the northern half this corridor in 2010, extending from the Main Street intersection past Golf Course Road. South of the median, left-turns can be conducted via a TWLTL.

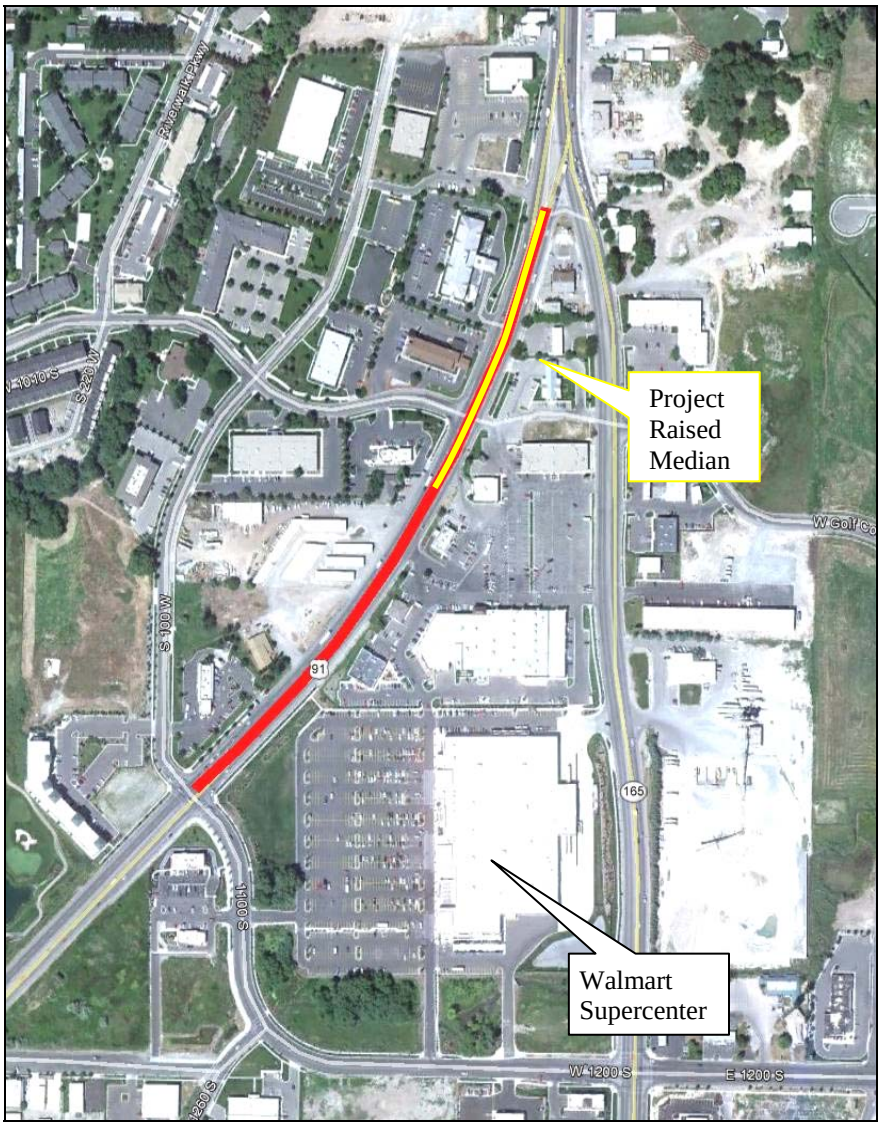

Figure 1 Corridor A1

4.4.2 Cache County Control Corridor

Corridor A2 is also located on US-91, approximately 2.25 miles to the north of Corridor A1 in northern Logan City, as illustrated in Figure 2. Spanning from 1000 North to 1600 North, Corridor A2 is a 0.75 mile section of heavily developed commercial land uses, including a Walmart Supercenter, a small mall, several big box stores, and numerous strip malls and stand-alone establishments like fast food restaurants and banks. In 2009, a resurfacing project was conducted on US-91 starting at 1000 North and proceeding 4.5 miles to the north. Business-owner interviews indicated the resurfacing project was minimally disruptive with work occurring

primarily at night. Access from Corridor A2 can be made traffic signals spaced every 1/4 mile or via a TWLTL spanning the corridor.

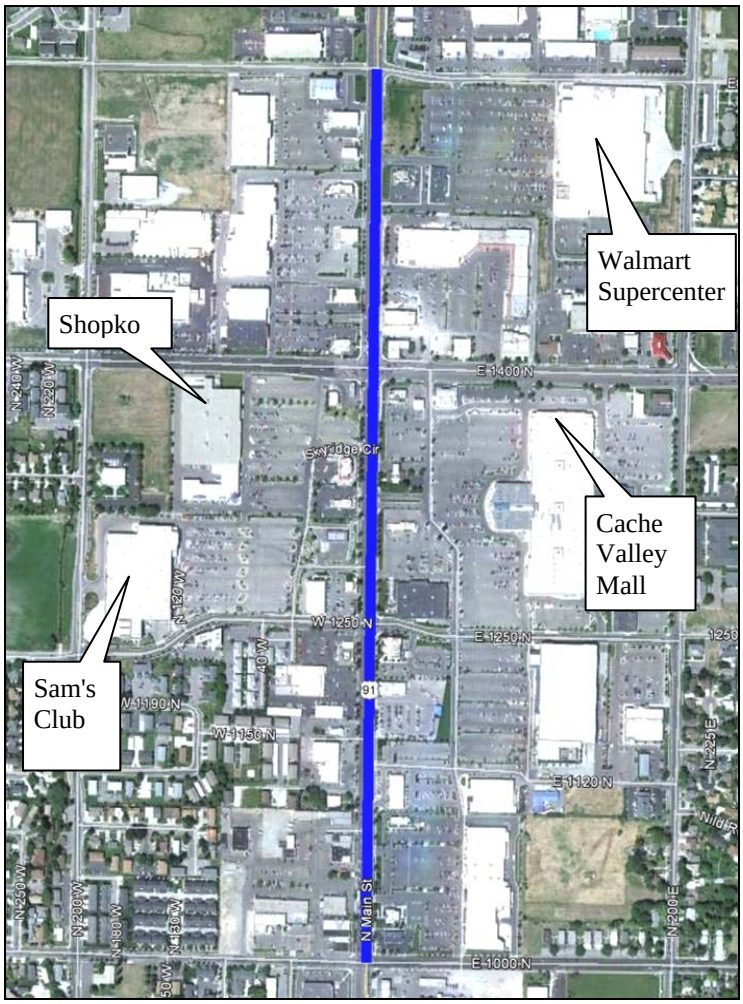

Figure 2 Corridor A2

4.4.3 Salt Lake County Study Corridor

Corridor C1 is located on US-89 (State Street) between 10000 South and 9000 South in the southern part of the Salt Lake Valley, as illustrated in Figure 3. The 1.25 mile corridor features a mix of commercial, industrial, and public land uses, including a major shopping center, a soccer stadium, a high school, a medical manufacturing plant, and a convention center. The corridor runs parallel to a light rail corridor to the east and I-15 to the west. The raised median was installed as part of a widening project in 2007/2008. Some left-turns can be made

via the few median breaks on the corridor, but traffic signals serve the majority of the left-turn demand.

Figure 3 Corridor C1

4.4.4 Salt Lake County Control Corridor

Corridor C2 is also located in south Salt Lake Valley and is situated on SR-68 (Redwood Road) between 11400 South and 10400 South, as illustrated in Figure 4. Like Corridor C1, Corridor C2 is a 1.25 mile segment of roadway servicing a mix of commercial and public land uses. The commercial land uses are generally clustered at the northern end of the corridor while the southern end features several parks and the Salt Lake County Fairgrounds. A widening project was conducted on Corridor C2 in 2007. Portions of the roadway were widened from two

or three lanes to four lanes with a TWLTL. A short raised median at the 10400 South intersection was preserved as part of the project.

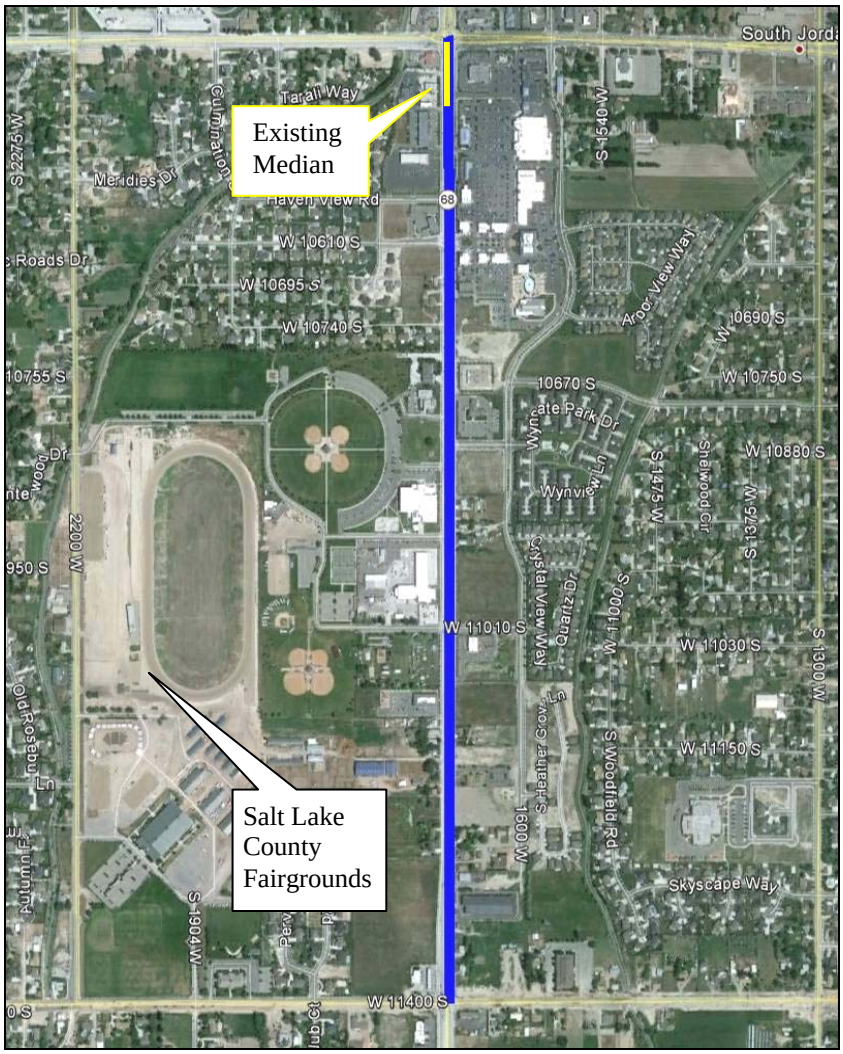

Figure 4 Corridor C2

4.4.5 Washington County Study Corridor

Corridor F1 is located on SR-9 (State Street) in Hurricane City, which is situated in southwestern Utah, as illustrated in Figure 5. The study corridor is adjacent to its paired control corridor and runs approximately 0.4 miles from 300 West to 100 East. Land use along the corridor is mainly small commercial establishments accompanied by some public uses including a historical site and an elementary school. The corridor project was completed in 2010 and included widening the roadway from two lanes and a TWLTL to four lanes and installation of a

raised median. The project continued one mile past the limits of the study area. Within the study area the raised median was constructed with median breaks at each city block.

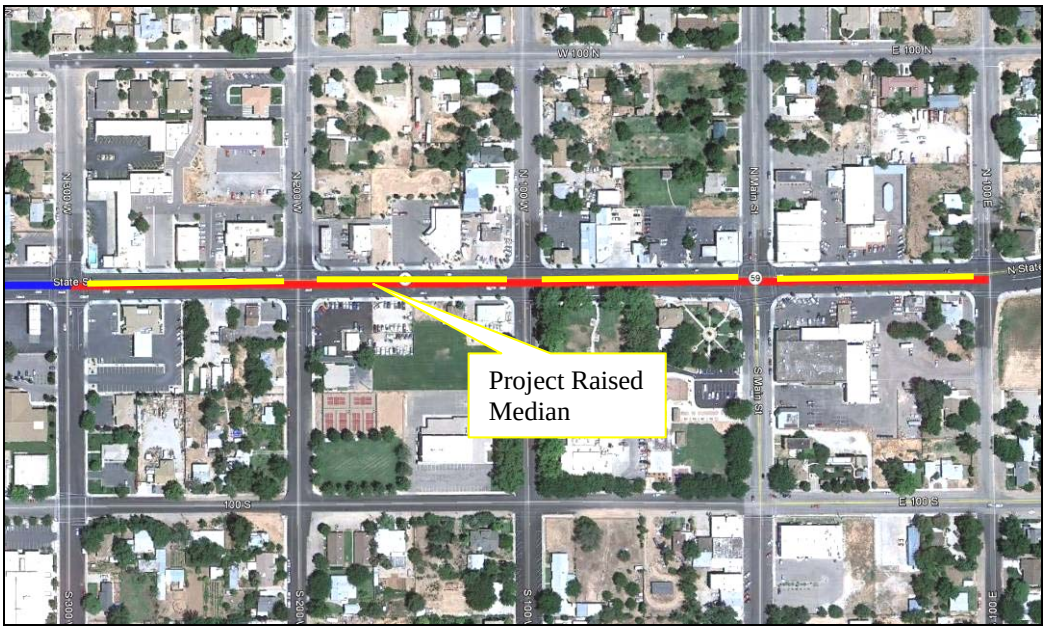

Figure 5 Corridor F1

4.4.6 Washington County Control Corridor

Corridor F2 is adjacent (just to the west) to Corridor F1. The corridor extends approximately 0.9 miles from 1150 West to 300 West, as illustrated in Figure 6. Like Corridor F1, land use is primarily comprised of small commercial establishments. In addition to the commercial properties, there is some vacant land as well as a high school along this corridor. The corridor project was completed in 2009 and included resurfacing the roadway within the study area and extending several miles to the west. Sometime after the project (likely 2010 or 2011) short raised medians were installed at the 1150 West intersection and the 300 West intersection. These medians only affect a small portion of the corridor so they are not expected to influence sales data results.

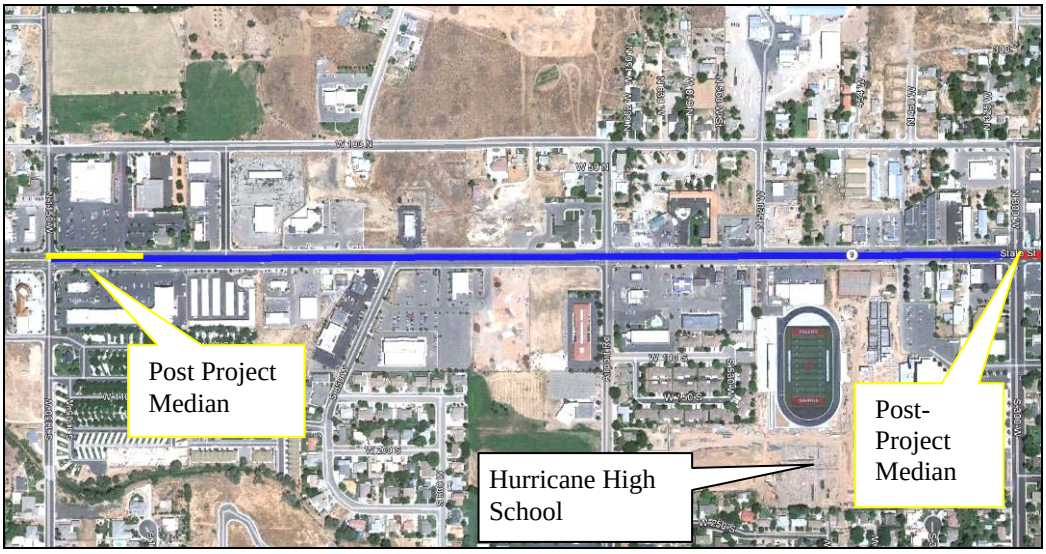

Figure 6 Corridor F2

5.0 SALES ANALYSIS

5.1 Overview

Analysis of retail sales was completed along the selected corridors in Cache County, Salt Lake County and Washington County. The purpose of the analysis was to determine if construction of raised medians in the study corridors had a negative effect on retail sales along the corridor. Retail sales from prior to and following construction were compared. Due to concerns about the recent economic recession, the analysis also compared the before and after retail sales with comparable retail sales data from control corridors within the same county that had been improved but did not include a raised median.

In addition, to measure the extent to which any identified changes in retail sales were the result of economy-wide influences, the study and control retail sales data were compared to zip code and county-wide data for the study time periods.

5.2 Sales Analysis Methodology

The analysis compared the aggregate sales and sales by major industrial classification (three digit North American Industry Classification System (NAICS) code) for each study and control site for the calendar year prior to and following construction. The sales figures were also compared to sales within the zip codes and counties that each corridor intersects or lies within (in some cases the study and control corridors are in different zip codes but within the same county). The zip code data were provided by the Utah State Tax Commission and represent the "unrounded" data for comparison purposes. Rounded data are publicly available on the Tax Commission website. The methodology results in a comparison made in two dimensions, first between the study and control, then against the geographic scale of each corridor's zip code(s) and county.

The total retail square footage for each of the corridors for the time period analyzed was estimated using aerial photographs and site visits. Retail sales per square foot were calculated to

ensure that the comparison was based on sales activity rather than simply an increase or reduction in the retail square footage in the study area.

Due to non-disclosure rules related to sales tax data collected by the Tax Commission, records were aggregated by the state to predefined address ranges. The address ranges were acquired from street centerline (GIS data) of streets within the corridor area. The address ranges relate to the local neighborhood area associated with each corridor considered for study and control sites. As such, street segments for which access could be potentially affected by improvements along the corridor were considered.

To gather the appropriate sales tax data, a list of unique street addresses was compiled by the Tax Commission for zip codes intersecting the study areas for the periods of time under consideration for each site. The list of unique addresses was geocoded (i.e., located along street centerlines) by GSBS and coded as to whether they fell along one of the corridor's neighboring street segments or outside of the study areas. Using these aggregation codes and respective time periods the Tax Commission summarized sales by major NAICS categories and provided the results to the consultant. This allowed an examination of sales across sites, zip codes, counties and time.

The aggregated nature of the Tax Commission data, as well as the pre-defined segmentation of the streets' shapefiles, presented a challenge in acquiring sales tax data limited to the vicinity of the corridor. For the most part, sales tax data were acquired for those addresses most directly impacted by the corridor operation. However, because the Cache County study corridor was relatively short, the scope of sales tax data included addresses beyond the immediate vicinity of the corridor. Thus, results for the Cache County study corridor should be taken in the context of a larger business-area footprint. Figures 7 through 11 diagram each of the study and control corridors as well as the "impacted street" segments for which sales tax data were obtained.

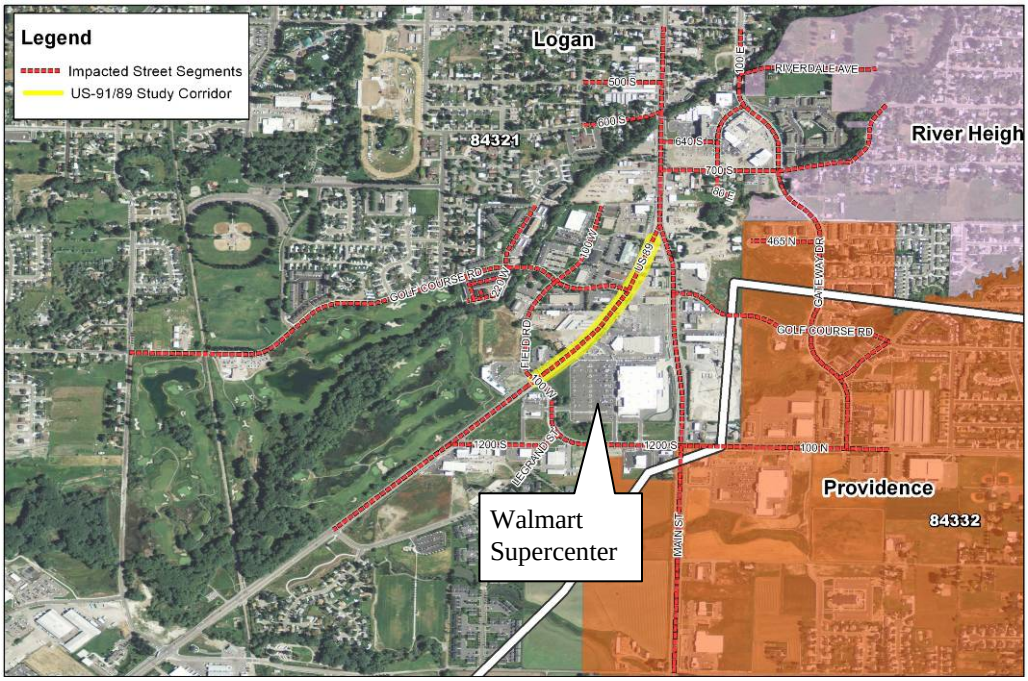

Figure 7 Cache County Study Corridor Sales Tax Capture Area

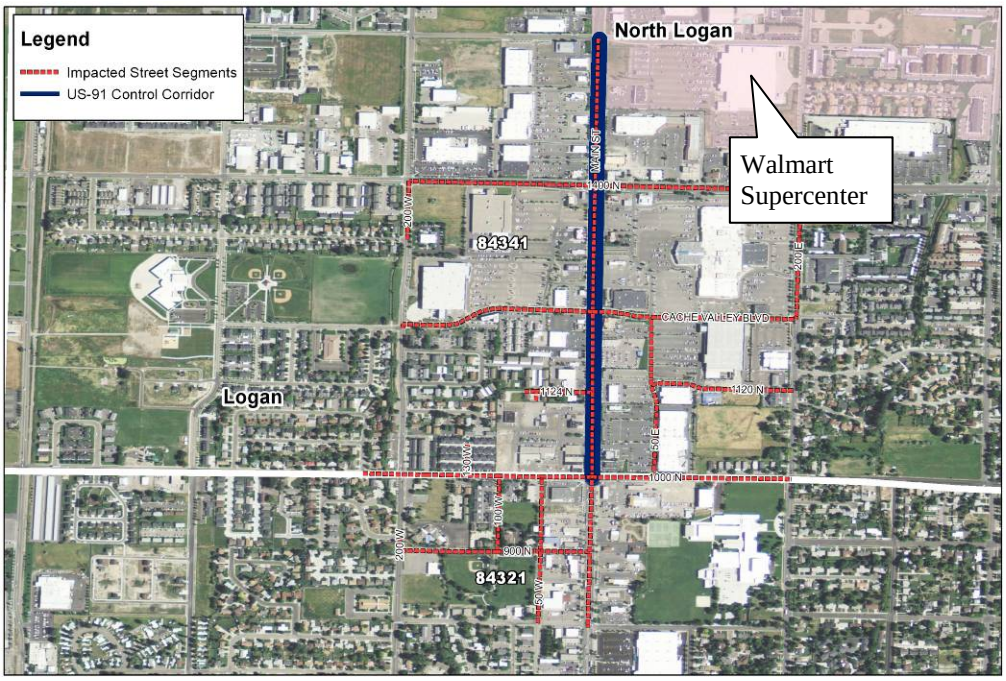

Figure 8 Cache County Control Corridor Sales Tax Capture Area

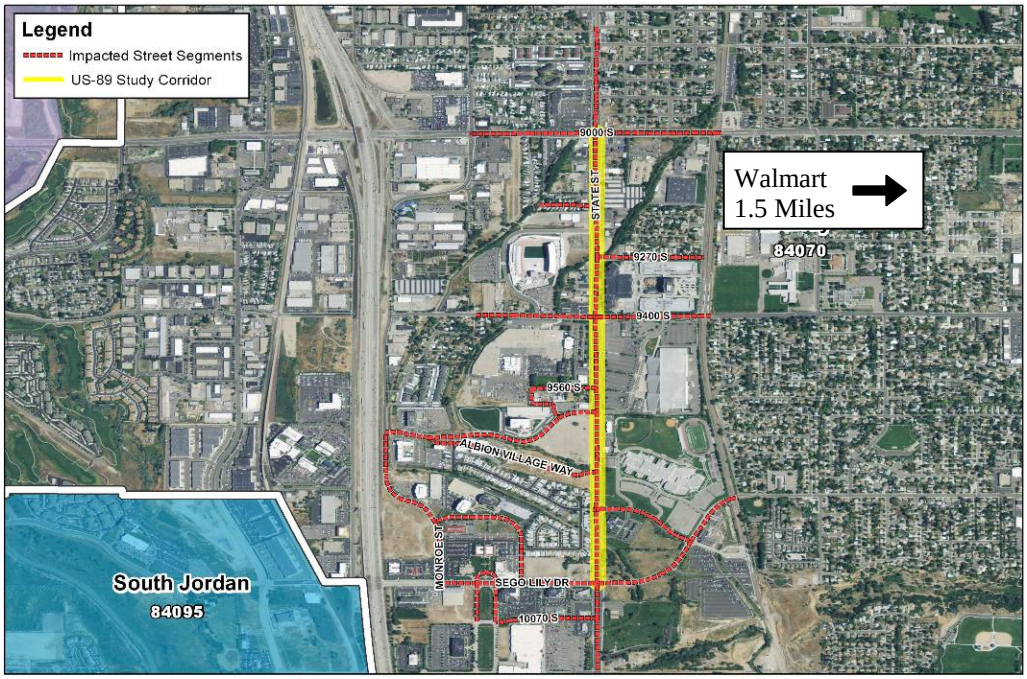

Figure 9 Salt Lake County Study Corridor Sales Tax Capture Area

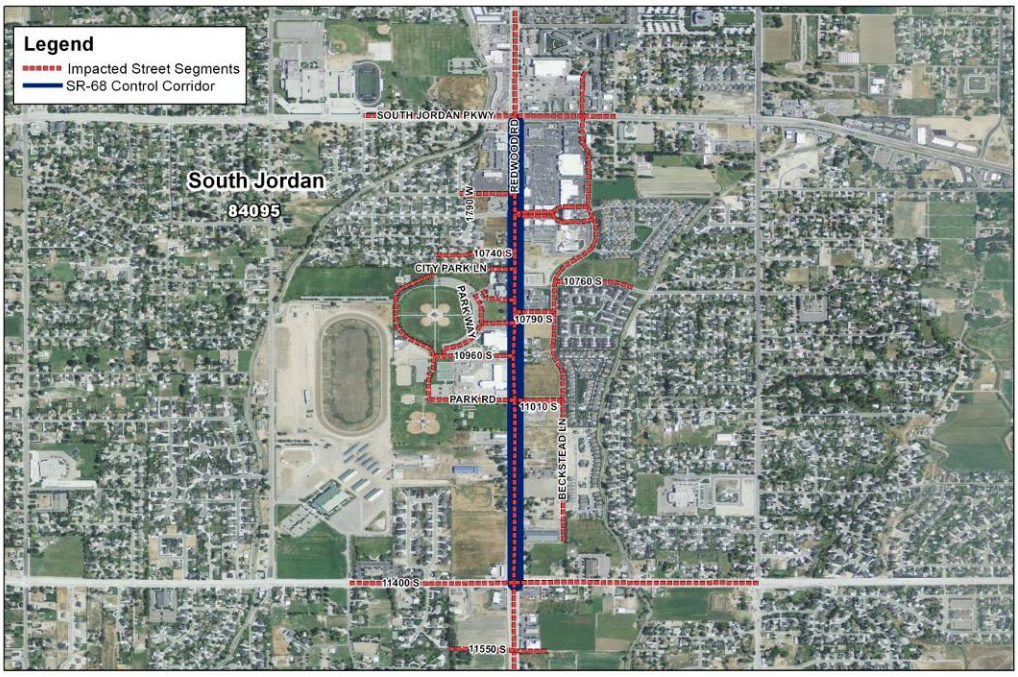

Figure 10 Salt Lake County Control Corridor Sales Tax Capture Area

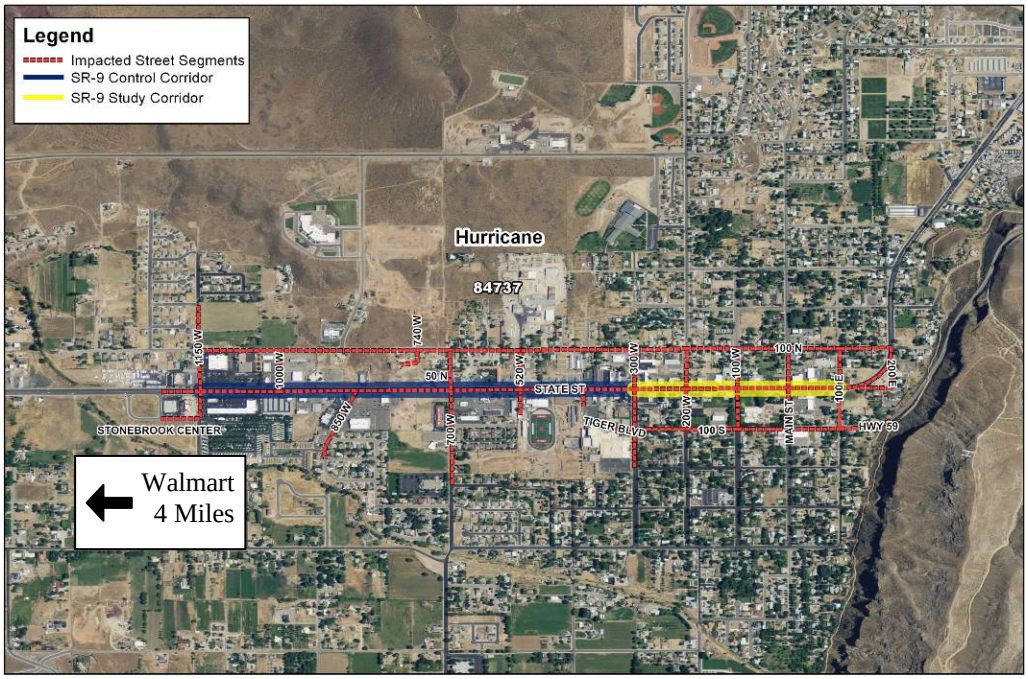

Figure 11 Washington County Study/Control Corridors Sales Tax Capture Areas

5.3 Findings

The results of aggregated sales are presented in the following section. Each section presents sales figures in the aggregate and compares these figures before and after construction of street improvements and to the zip code and county sales figures of these two time periods. Detailed industry level figures for sales were also available to the consultant but are not disclosed due to strict requirements for confidentiality. The industry level figures were carefully examined and guide the discussion.

As the study moved forward it was clear that the Research Team had selected three study corridors that had more than just the installation of a raised median in common. A Walmart Supercenter opened during the study period within the market area of each of the study corridors. Because a Supercenter's market area is larger than the market areas of most of the businesses typically located along the corridors studied, it was not surprising to find that total corridor sales rose as a result of the new store. The influence of this development is addressed in further paragraphs below.

5.3.1 Cache County

5.3.1.1 A1: Cache County Study Corridor

As summarized in Table 4, the Cache County study corridor saw revenues grow by 100.5 percent the year following construction when compared to the year prior to construction. The surrounding zip codes grew 7.4 percent and the county as a whole lost 5.1 percent in sales in the same time period. The study corridor in Cache County shows a considerable increase in sales overall. The increase is coincident with the opening of a new Walmart Supercenter near the old Macey's site near the intersection of U.S. Route 89/91 and 100 West/100 South. Looking at detailed sales tax figures, total sales less Retail-Food and Beverage Stores (affected by the opening of Walmart) still increases over the period by 17 percent suggesting that nearby businesses benefitted in the aggregate from the development of the Supercenter. Additionally, as noted previously, the sales data collected for this corridor encompasses much of the area surrounding the study corridor. Thus, sales tax data patterns should be taken in the context that they also include businesses in the surrounding vicinity.

There is no way to disentangle whether the installation of raised medians may have influenced sales, but they did not appear to have a negative impact great enough to offset positive gains made over the period or made over a larger area.

Table 4 Cache County Study Corridor - Total Taxable Sales

	Corridor	84321/ 84332/ 84341	Cache County	Corridor as % of Zip Code	Corridor as % of County
2009	$35,757,453	$682,326,700	$1,409,836,291	5.2%	2.5%
2011	$71,707,043	$733,004,133	$1,338,547,784	9.8%	5.4%
Percent Change	100.5%	7.4%	-5.1%	86.7%	111.2%

Source: Utah State Tax Commission

5.3.1.2 A2: Cache County Control Corridor

Table 5 shows that control area sales decreased by almost 12 percent between 2008 and 2010 while the surrounding zip codes lost 9 percent in sales and the county lost 13 percent in sales over the same period. Lower sales in the control area in and around North Logan is probably due to competition from the new Walmart Supercenter to the south and the economic downturn as can be seen in lower sales in the county overall.

Table 5 Cache County Control Corridor - Total Taxable Sales

	Corridor	84321/ 84332/ 84341	Cache County	Corridor as % of Zip Code	Corridor as % of County
2008	$322,028,251	$924,647,511	$1,520,982,619	34.8%	21.2%
2010	$283,879,698	$841,646,582	$1,324,009,946	33.7%	21.4%
Percent Change	-11.8%	-9.0%	-13.0%	-3.2%	1.3%

Source: Utah State Tax Commission

5.3.1.3 Study/Control Comparison

Table 6 is a comparison of the before and after sales per square foot in the Cache County study and control corridors. Sales per square foot rose from $53 to $106 between 2009 and 2011 in the study corridor, while they dropped slightly in the control area between 2008 and 2010 from $101 to $87. It should be noted that the square footage values for the study area only include businesses along the corridor frontage, while the sales tax data includes addresses beyond the immediate vicinity of the study corridor. Thus, it is expected that both the before and after sales per square foot values for the study corridor would be lowered if the square footage of all businesses were included. However, it is anticipated that this would not alter the overall pattern that sales per square foot increase since both the before and after values would be affected equally.

Table 6 Cache County Corridors Total Taxable Sales/Square Foot

	Study	Control	Difference
Before Construction	$53	$101	-$49
After Construction	$106	$87	$19
Percent Change	100.5%	-14.2%	

Source: Utah State Tax Commission; InterPlan

It is difficult to disentangle the coincident events of the installation of a raised median with the opening of a new Walmart Supercenter in the Cache County study corridor. However, based on a comparison of sales per square foot and sales by major retail category it is safe to conclude *that there is no evidence that installation of the raised median had a negative impact on retail sales in the area*.

5.3.2 Salt Lake County

5.3.2.1 C1: Salt Lake County Study Corridor

As summarized in Table 7, aggregate sales for 2006 and 2009 in the Salt Lake County study corridor show a 21 percent increase in the year after installation of a raised median. As with the Cache County Study area, in March 2007 Walmart opened a new Supercenter approximately 1.5 miles to the east of the US-89 study corridor in the adjoining 84094 zip code. Sales by detailed category were lower in building material, garden equipment, clothing, electronics and appliances sectors following the opening of the nearby Supercenter. However, lower sales in these sectors were offset by gains in the food and beverage, sporting goods, and wholesale durable goods sectors (some of which may be related to the opening of the REAL Salt Lake soccer stadium). In light of these changes, it appears the retail market in the neighborhood of the US-89 study corridor responded to new competition by adjusting the retail mix offered and preserving a functional retail market. *There is no evidence of a negative impact due to construction of a raised median*. The study corridor performs considerably better than the zip code and county levels.

Table 7 Salt Lake County Study Corridor - Total Taxable Sales

	Corridor	84070	Salt Lake County	Corridor as % of Zip Code	Corridor as % of County
2006	$124,971,856	$1,462,244,805	$20,328,814,095	8.5%	0.6%
2009	$151,607,057	$1,406,888,761	$18,284,173,856	10.8%	0.8%
Percent Change	21.3%	-3.8%	-10.1%	26.1%	34.9%

Source: Utah State Tax Commission

5.3.2.2 C2: Salt Lake County Control Corridor

As summarized in Table 8, the control corridor along Redwood Road shows an increase of 22 percent between 2006 and 2008. The Redwood Road control site posted steady gains in all significant contributing sectors with the exception of the wholesale non-durable goods sector and the building material, garden and supplies sector. However, the control corridor does not share the same remarkable growth as its surrounding zip code (22 percent versus 40 percent growth for zip code 84095).

Table 8 Salt Lake County Control Corridor - Total Taxable Sales

	Corridor	84095	Salt Lake County	Corridor as % of Zip Code	Corridor as % of County
2006	$49,300,769	$382,707,591	$20,328,814,095	12.9%	0.2%
2008	$60,245,395	$534,268,595	$20,477,875,258	11.3%	0.3%
Percent Change	22.2%	39.6%	0.7%	-12.5%	21.3%

Source: Utah State Tax Commission

5.3.2.3 Study/Control Comparison

As summarized in Table 9, the change in per square foot sales for both the Salt Lake County study and control corridor was comparable. The gains in sales for both the study and control corridors out-perform county sales revenue by a considerable margin. *Once again the analysis indicates that there is no evidence that the installation of a raised median had a negative impact on retail sales.*

Table 9 Salt Lake County Corridors Total Taxable Sales/Square Foot

	Study	Control	Difference
Before Construction	$221	$156	$65
After Construction	$265	$186	$80
Percent Change	19.9%	18.9%	

Source: Utah State Tax Commission; InterPlan

5.3.3 Washington County

5.3.3.1 F1: Washington County Study Corridor

Again, a Walmart Supercenter seems to have played a pivotal role in the performance of downtown businesses. The new Walmart along the Washington County study corridor opened for business in the spring of 2009 at 180 North 3400 West in Hurricaine, Utah. As summarized in Table 10, study corridor sales grew 6 percent between 2009 and 2011, while the 84737 zip code grew the same amount and the county lost 5 percent in sales.

Table 10 Washington County Study Corridor - Total Taxable Sales

	Corridor	84737	Washington County	Corridor as % of Zip Code	Corridor as % of County
2009	$5,708,465	$125,391,345	$2,240,397,413	4.6%	0.3%
2011	$6,056,277	$132,918,645	$2,130,979,356	4.6%	0.3%
Percent Change	6.1%	6.0%	-4.9%	0.1%	11.5%

Source: Utah State Tax Commission

5.3.3.2 F2: Washington County Control Corridor

As summarized in Table 11, the control corridor, which includes the majority of downtown businesses, dropped 22 percent between 2008 and 2011, whereas the 84737 zip code saw 4 percent growth. Sales in the county dropped 17 percent during this period. Most sectors in the control corridor saw significant declines in sales with the exception of accommodations, food services and drinking places, healthcare and social assistance, information, professional, scientific and technical services, and other services. Sectors with the greatest decline in taxable sales were retail food and beverage stores and retail-building materials, garden equipment and supply dealers.

Table 11 Washington County Control Corridor - Total Taxable Sales

	Corridor	84737	Washington County	Corridor as % of Zip Code	Corridor as % of County
2008	$64,185,609	$127,990,834	$2,582,025,982	50.1%	2.5%
2011	$49,838,724	$132,918,645	$2,130,979,356	37.5%	2.3%
Percent Change	-22.4%	3.9%	-17.5%	-25.2%	-5.9%

Source: Utah State Tax Commission

5.3.3.3 Study/Control Comparison

Table 12 shows that sales per square foot grew from $46 to $48 (5 percent) in the study corridor but declined from $189 to $141 (25 percent) in the control corridor.

Table 12 Washington County Corridors Total Taxable Sales/Square Foot

	Study	Control	Difference
Before Construction	$46	$189	-$142
After Construction	$48	$141	-$92
Percent Change	4.5%	-25.5%	

Source: Utah State Tax Commission; InterPlan

In the Washington County study, it appears that the study corridor neighborhood performed considerably better than the control after project completion. Neither the study or

control neighborhood performed better than the 84737 zip code for either period, which appears to have benefitted from the introduction of a Walmart serving the Retail-General Merchandise Store sector. This same sector saw gains in sales over the period for both the study and control, though. The county as a whole experienced a decline in sales over either period.

5.4 Conclusion

In all three of the studied corridors in which raised medians were constructed there was an increase in corridor area retail sales and sales per square foot. In all cases the study corridors performed as well or better than the control corridors, study corridor zip codes and county-wide areas. Although the construction of a Walmart Supercenter within or near each of the corridors during the studied period complicated the study, *taxable sales data from before and after installation of a median in each study corridor were neutral or positive*. This doesn't mean that each and every business within the corridor did better following installation of the median. Based on anecdotal observations, in some cases the retail mix changed in response to the economy, new area competition and other contributing factors.

As mentioned previously, as the study moved forward it was clear that the development of a Walmart Supercenter on, or relatively near, the corridor occurred for each of the three study corridors. Because a Supercenter's market area is larger than the market areas of most of the businesses typically located along the corridors studied, it was not surprising to find that total corridor sales rose as a result of the new store. The influence of this development is addressed in further paragraphs below.

Two additional levels of analysis were completed to gauge the extent of the impact of the new store on the study results. The first was to look at the taxable sales data on a per square foot basis. The second was to look at the retail sector taxable sales data. The level of detail needed for the sector taxable sales data precludes publication of the actual data; however, the analysts compared the before and after construction taxable sales data for each sector. A close examination of the percent change in taxable sales for all sectors except retail food and beverage sales in Cache County provides a barometer for the localized impacts of the new Walmart Supercenter. The retail food and beverages sales sector is the category in which the majority of

Walmart Supercenter sales were coded for the Cache County Study area. In the other two study areas Walmart was not part of the corridor sales dataset, as the superstore was located nearby but not in the study areas. Zip code aggregations in both of these cases proved to be too general and included too many competing businesses to strain out the effects of individual businesses. Although the removal of the retail food/beverage category from the data affects the percentage change in the Cache corridor, the overall change in retail sales remains positive at 17 percent. This is not to say that the opening of Walmart was not hard on existing retailers and it is clear that in the case of Cache County, and to some extent Salt Lake County, the opening coincided with a considerable shift in the retail mix of these two corridors. Future research would be useful in isolating the impacts of the opening and closing of big box retailers on local retailer markets, as it appears that, second to overall consumer demand, it is these competitive forces that most greatly influence retailer success.

Follow up studies should also broaden the number of corridors and areas studied to verify the findings of this preliminary analysis. Preliminary findings indicate that taxable sales after installation of raised medians were approximately the same or higher even when area wide vicinity sales, measured at the zip code level, and county-wide sales, experienced a decline. The extent to which a raised median can positively affect individual retail performance or increase corridor sales are two potential areas of further study.

BUSINESS IMPACT SURVEY

5.5 Background

To supplement the quantitative sales data, canvassing-style surveys of businesses along the study and control corridors were performed. The surveys were conducted in late October - November 2012. The objective of the survey was to better understand how individuals anticipated the finished project would impact their business and what impacts were actually experienced after construction. The nature of these questions required that both the survey respondent and the business were present prior to and after the road project. The intent of the business survey was not to provide a scientific analysis, but to offer a brief business owner/manager perspective to supplement the sales analysis.

5.6 Methodology

The survey methodology was based on the methods used by similar studies mentioned in the literature review. These studies found that survey response rates were improved through an in-person interview-style approach as opposed to exclusively a mail-back or online survey. To maximize the number of survey responses in this study, individuals were primarily offered an in person survey. If individuals were interested but unable to participate in the survey at that moment, they were offered a paper survey with a return envelope or an access card with directions to an online version of the survey. Since the survey was conducted on study corridors as well as control corridors, the survey form was designed to be generic enough to apply to any type of road project. The two-page survey contained 15 attitudinal questions regarding the anticipated finished-project impacts and what impacts actually occurred on the following elements:

- Traffic congestion on the corridor
- Ease of deliveries by their suppliers
- Number of traffic crashes on the corridor
- Business access
- Sales
- Number of customers

Topics were approached according to the above sequence to help avoid emotional bias in the survey responses. Impressions of each impact were collected using a 1-5 scale: 1 being a strongly negative impact, 3 a neutral impact, and 5 indicating a strongly positive impact (See Table 14). Each question also had an "unsure/no opinion" option. During the interview, respondents were presented with a sheet explaining this scale. Respondents were also reminded that this was not a survey about the impacts that occurred during construction. In addition, since most of the responses were provided in person, respondents could not review actual business data as the survey was geared towards understanding perceptions. A sample survey used in this study is included in the Appendix of this report.

Table 13 Survey Response Scale

Strongly Negative	Somewhat Negative	Neutral	Somewhat Positive	Strongly Positive	Unsure/ No Opinion
1	2	3	4	5	6

5.7 Survey Response Rates

As mentioned previously, the intent of the survey was not to obtain statistically viable results, but to offer a brief look at business owner perspectives in the context of quantitative sales tax data. Overall, a total of 346 businesses were approached. Control corridors had more businesses approached than study corridors This is due to the control corridors being longer and/or featuring more intense retail development, such as the small mall in the Cache County control corridor. However, responses were obtained more frequently on study corridors.

Of the total 346 businesses approached, 56 businesses provided a response. Business eligibility was the most common factor to disqualify businesses from providing a response.

Many businesses either did not exist prior to the project or else did not have an owner/manager who was present throughout the project available to provide a response. Secondly, for those businesses that existed before and after the corridor project, many individuals approached for survey participation disclosed having no memory or opinion about the impacts caused by the particular UDOT project in their area. This was particularly evident on control corridors, where the project was often limited to pavement rehabilitation and frequently only occurred at night.

By far, in-person surveys yielded the most responses (89 percent). Mail-back surveys and online surveys each accounted for 5.3 percent of the responses. Mail-back surveys were somewhat more successful than online surveys in that 22 percent of mail-back surveys were returned while only 7 percent of online-survey-access-cards were used to respond. Tables 15 and 16 summarize corridor-specific response rates, the number of surveys returned and their means.

Again, the survey was not created to be statistically significant. However, when aggregating all responses together, at a 90 percent confidence interval, the margin of error is ±11 percent. Note, this margin of error is only valid for survey results in aggregate and should not be applied to corridor-specific results.

Table 14 Business Impact Survey Response Rate by Corridor

Study Area	Study Corridors			Control Corridors		
	Surveys Completed	Businesses Approached	Response Rate	Surveys Completed	Businesses Approached	Response Rate
Cache County	7	23	30%	14	122	12%
Salt Lake County	8	32	25%	4	72	6%
Washington County	12	31	39%	11	66	17%
Total	27	86	31%	29	260	11%

Table 15 Number of Responses by Corridor and Method

Study Area	Survey Type								Total
	Study Corridors				Control Corridors				
	In-person	Mail-back	Online	Total	In-person	Mail-back	Online	Total	
Cache County	5	2	0	7	12	1	1	14	21
Salt Lake County	8	0	0	8	4	0	0	4	12
Washing-ton County	10	0	2	12	11	0	0	11	23
Total	23	2	2	27	27	1	1	29	56

Note: Some non-sales tax generating establishments were included in the survey (e.g. banks, credit unions)

5.8 Survey Results

The differences in expectation versus experience were gauged by averaging the qualitative responses—communicated on a one to five scale—of the survey. Figures 12 through 17 summarize the results for each set of questions on each corridor. Expected impact scores are indicated by a square on the chart. Experienced impact scores are indicated by an "X". An average experienced impact score that is lower than the expected impact score indicates that businesses on the corridor were disappointed, expecting the project's impact would be more positive than experienced. In contrast, an experienced impact score that is higher than the expected impact score indicates perceived impacts were better than anticipated. The overall impact score evaluates experienced impacts only.

5.8.1 Cache County Corridors

The Cache County corridors produced the most muted responses in that many category scores fell into the neutral range. The only categories with average responses in the positive range include traffic congestion, number of traffic crashes, and overall impact. In essence, business owners were most pleased with the expected and/or experienced impacts related to traffic operations. Other items to note include:

- Experienced impacts on sales, number of customers and business access along the control

and study corridors were slightly more positive than expected.

- Expected and experienced impact scores on the study corridor are slightly more negative than the control corridor.
- Almost 60 percent of surveys on the study corridor were from businesses not directly obstructed by the raised median due to their location on the corridor. It is unclear how these responses reflected overall results.
- The overall impression of the project is neutral on the study corridor and somewhat positive on the control corridor.

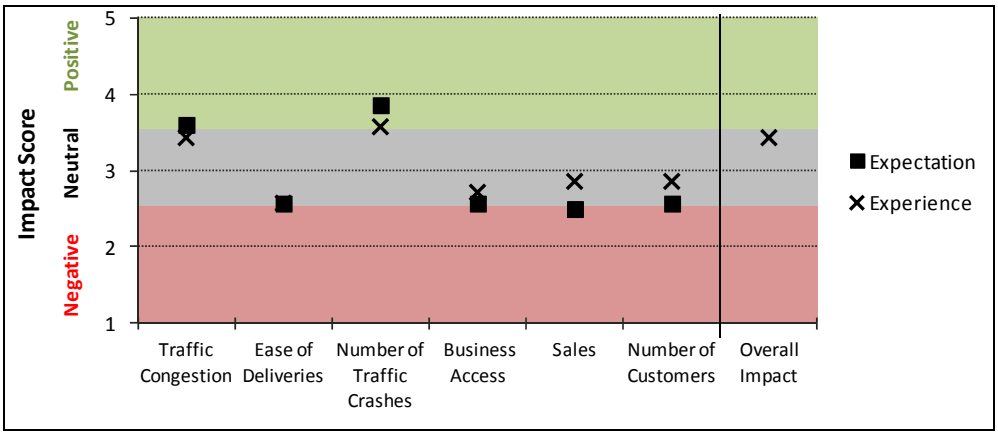

Figure 12 Cache County Study Corridor Survey Summary

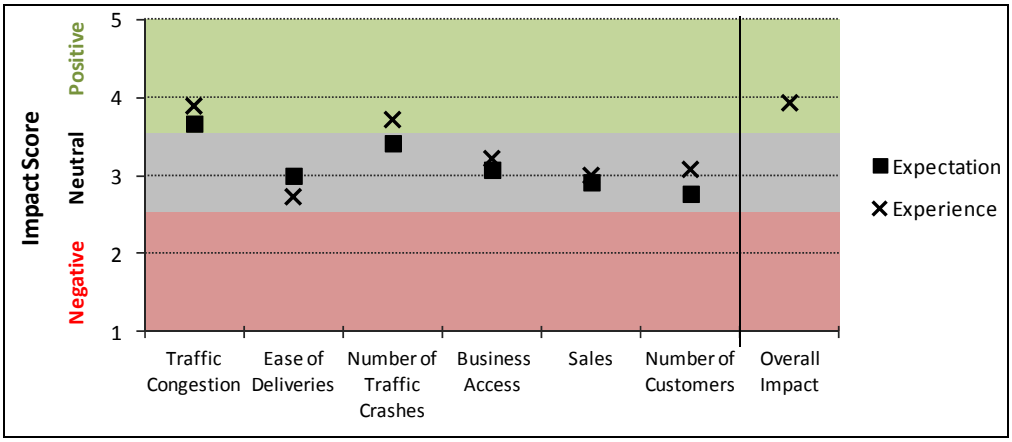

Figure 13 Cache County Control Corridor Survey Summary

5.8.2 Salt Lake County Corridors

The Salt Lake County corridors yielded the biggest discrepancies in scoring. Whereas the control corridor featured the most positive scores and largest positive gains between expected and experienced impacts of all corridors, the study corridor had some of the most negative scores and showed the biggest drops between expected and experienced impact scores. The control corridor impact scores were based on only four survey responses. Other items to note include:

- The number of crashes and traffic congestion experienced impact score on the control corridor was the most positive of the entire survey.
- Study corridor expectations were consistently disappointed, the opposite was true on the control corridor.
- The experienced impact on Business access for the study corridor was the most negative of the entire survey.
- The study corridor featured experienced impact scores in the negative range for the ease of deliveries, business access, sales, and number of customers categories.
- The control corridor featured experienced impact scores in the positive range for the traffic congestion, ease of deliveries, and number of traffic crashes categories.
- Overall impressions on the control were positive while the study corridor was neutral despite the low impact scores on other questions.

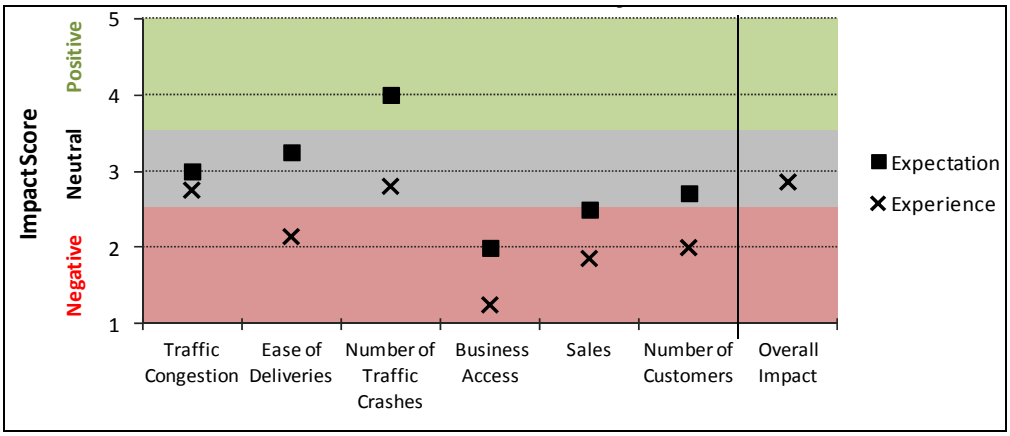

Figure 14 Salt Lake County Study Corridor Survey Summary

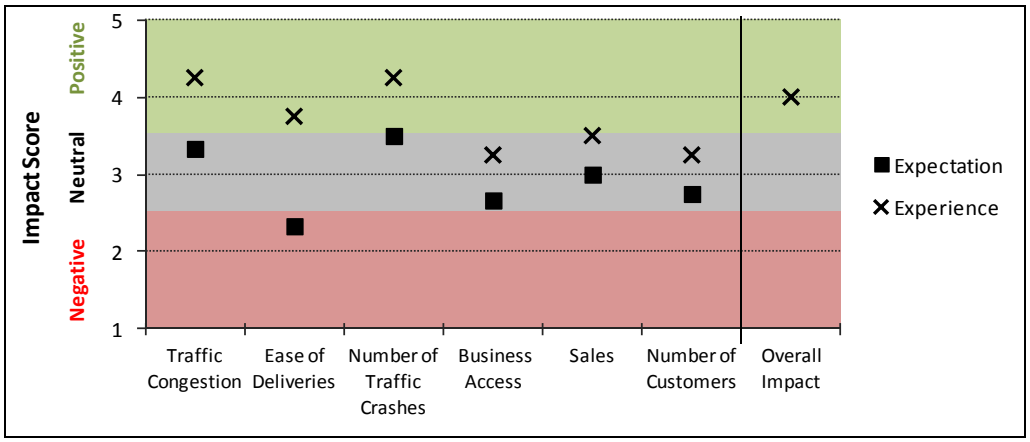

Figure 15 Salt Lake County Control Corridor Survey Summary

5.8.3 Washington County Corridors

As with the Salt Lake County corridors, the Washington County control corridor generally scored more favorably than the study corridor, although the differences are not as extreme. Other items to note include:

- Expected impact scores on both corridors remained fairly similar to experienced impact scores.
- Impacts on the control corridor were generally more positive than on the study corridor.
- The study corridor featured experienced impact scores in the negative range for the ease of deliveries, business access, sales, and number of customers categories.
- The control corridor businesses reported experiencing a positive impact on number of traffic crashes and traffic congestion.
- Overall impressions of the projects were neutral on the study corridor and positive on the control corridor.

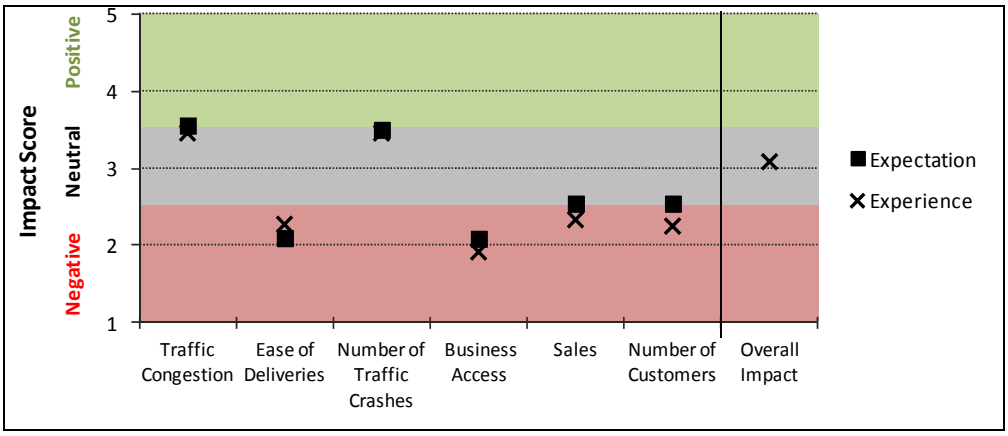

Figure 16 Washington County Study Corridor Survey Summary

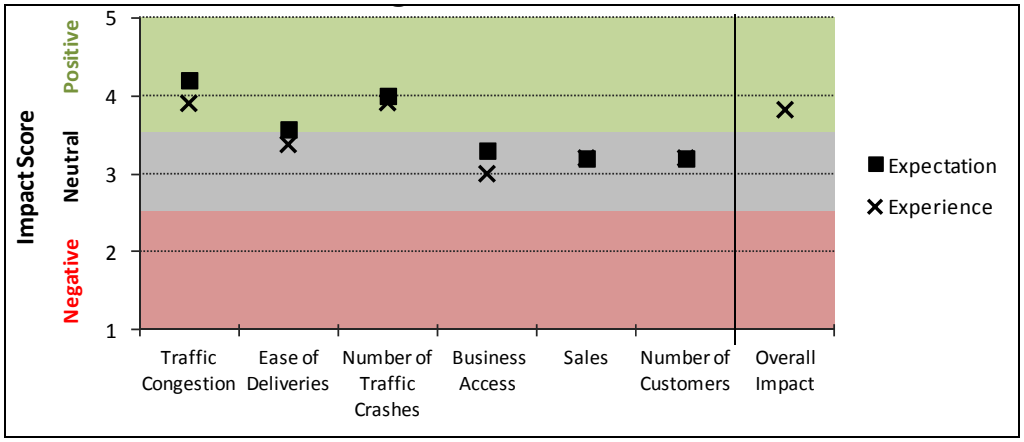

Figure 17 Washington County Control Corridor Survey Summary

5.9 Comparison of Results to Quantitative Data

The aggregate responses for study corridors and control corridors were compared to quantitative data to offer an assessment of how well business-owner attitudes reflect measurable data. Table 17 compares the average impact scores for the number of traffic crashes, business access, sales and number of customers categories against the change in Average Annual Daily Traffic (AADT), number of crashes, and sales tax data for the study areas before and after project construction. Table 17 shows that on study corridors, scores for all four response categories dropped, meaning experienced impacts were, on average, worse than expected impacts for these categories. However, quantitative data often reflects the opposite trend. For example, despite a pessimistic view of the project impact on sales, the average sales tax on study

corridors (weighted by corridor length) increased by 32 percent. Likewise, although the experienced impact on number of traffic crashes was lower than the expected impact, UDOT data reveals a 51 percent decrease in crashes. Conversely, on control corridors, a slight increase in impact scores for the sales category was accompanied by the opposite trend - a slight decrease in actual sales tax data.

Table 16 Survey Impact Score Versus Data Comparison

	Study Corridors Average Scores				Control Corridors Average Scores			
Survey Topic	**Num of Custo-mers**	**Business Access**	**Num of Traffic Crashes**	**Sales**	**Num of Custo-mers**	**Business Access**	**Num of Traffic Crashes**	**Sales**
Expected	2.6	2.2	3.8	2.5	2.9	3.1	3.6	3.0
Experienced	2.4	1.9	3.4	2.4	3.2	3.1	3.9	3.2
Change	-0.2	-0.3	-0.4	-0.1	0.3	--	0.3	0.2
Comparison Data	AADT		Num of Traffic Crashes	Sales Tax Data	AADT		Num of Traffic Crashes	Sales Tax Data
Change in Comparison Data	-3.0%		-51%	32%	2.2%		-30%	-0.4%

Source for crash data: UDOT Traffic and Safety Division

5.10 Conclusions

Though not a statistically valid exercise, the business-owner survey begins to frame the perception among business owners regarding raised median projects. Overall, control corridors (projects without a raised median) typically had more positive scores than their study corridor counterparts (projects with a raised median). Other general conclusions include:

- Both the worst scoring corridor and the best scoring corridor occurred in Salt Lake County.
- On average, overall impressions of study corridors effects were neutral.
- Median design elements can impact perceptions and attitudes. Business owners in the Salt Lake County study corridor expressed frustration at the lack of median breaks while Washington County study corridor business owners noted both positive and negative

opinions of the median landscaping.

- Two of the control corridors featured projects with relatively low impacts. Both the Cache County and Washington County control projects consisted primarily of resurfacing work. In Cache County, most of this work was apparently conducted at night. In connection, responses for these corridors yielded the most neutral scores.

The comparison of survey results to quantitative data showed that perception often did not reflect reality. On study corridors, business owners reported neutral to negative perceptions of sales impacts, however, sales tax data shows an overall increase of 32 percent on the corridor. The discrepancy between business owner/manager attitudes regarding sales and sales tax data may be related to a number of issues. For example, business survey results only represent businesses that were present before and after the project. It is possible that the specific businesses surveyed did, in fact, experience a decrease in sales, but this could have been outweighed by an overall increase in sales from new or redeveloped businesses along the corridor that were not surveyed.

The discrepancy in business owner attitudes regarding number of crashes and actual crash data may also be related to multiple issues. First, it is possible that the presence of a raised median resulted in crashes clustering at access openings rather than being spread out along the corridor. Such clustering could create the perception that crashes are occurring more frequently overall. Second, raised median projects are often touted for their benefits to traffic safety. It is possible a raised median project itself increases interest in traffic safety causing business owners/managers to take more notice of when crashes occur, whereas before the project, crashes were only an afterthought. In other words, the perceived increase in crashes could simply reflect a greater awareness of crash occurrences. Finally, it is possible that the safety benefits of raised medians are overstated by project officials and thus, business owner/manager expectations of safety improvements are not met by reality.

6.0 SUMMARY AND CONCLUSIONS

The purpose of this study was to evaluate the Utah-specific effects of raised medians on retail sales. Using recent projects as examples, this study evaluated retail sales both before and after the construction of raised medians. Existing research has primarily examined the safety, design and operational aspects of raised medians; however, there are a growing number of studies that evaluate the economic impacts.

6.1 Sales Data

For all three of the corridors in which raised medians were constructed, there was an increase in corridor-area retail sales and sales per square foot. Also, in each case, the study corridors performed as well or better than the control corridors, study corridor zip codes and county-wide areas. *Analysis showed that in every case there was no evidence that the installation of a raised median had a negative impact on retail sales*. It is important to note that this does not mean that each and every business within the corridor did better following installation of the median. In some cases the retail mix changed in response to the economy, new area competition and other contributing factors.

Coincidently, a Walmart Supercenter was opened during the study period within the market area of each study corridor. While it is impossible to completely disentangle the influence of a new Walmart Supercenter on study-area sales tax patterns, two methods were used to investigate conditions in the context of the effects of the new Walmart stores. First, sales per square foot showed positive gains for each study corridor. The gains in sales per square foot ranged from 5 percent to over 100 percent. Second, taxable sales data were examined by sector, where possible. In the Cache County Study area, the retail food and beverage sales sector was the sector for which the majority of Walmart Supercenter sales were coded. Even with this sector removed, the percent change in taxable sales remained positive at 17 percent. In the other two study areas Walmart was not part of the corridor sales dataset and both these cases proved to be too general to strain out the effects of individual businesses.

The sales analysis by sector does not conclude that the opening of Walmart was not hard on existing retailers. It is clear that in Cache County, and to some extent Salt Lake County, the

opening coincided with a considerable shift in the retail mix of these two study corridors. Future research would be useful in isolating the impacts of the opening and closing of big box retailers on local retailer markets, as it appears that, second to overall consumer demand it is these competitive forces that most greatly influence retailer success.

6.2 Sales Data and Business Owner Perspective

The business owner survey was not intended to provide statistically valid results, however, the results do begin to frame the perceptions among business owners regarding raised median projects. Overall, study corridors typically had more negative scores than their control corridor counterparts. Essentially, business owners on corridors where the project included the installation of a raised median had more negative perceptions of the impacts before and after the road project than corridors where the project did not install a raised median.

Business owners on study corridors were most likely to report negative experienced impacts regarding the ease of deliveries, business access, sales, and number of customers response categories. Meanwhile, the traffic congestion, number of traffic crashes, and overall impact question categories were more likely to elicit neutral or positive responses. Thus, it appears business owners had a more optimistic view of the raised median project's impact on traffic operations than business related factors.

The comparison of sales data to business owner survey results showed that perception (of individual businesses) often did not reflect reality (of the corridor as a whole). This was particularly true in regards to sales. On study corridors, business owners reported neutral to negative perceptions of sales impacts, however, sales tax data shows an overall increase of 32 percent on the corridor. The discrepancies could reflect the differences between businesses that were eligible to complete the survey (establishments present both before and after the project) and the businesses (new or redeveloped) that have arisen since the project.

Likewise, the expected impacts of the raised median project on safety were not met according to survey respondents. All study corridors yielded an experienced impact score that was lower than the expected impact for the number of traffic crashes response category, despite crash data showing a 51 percent reduction in crashes. This pattern may represent a more

heightened awareness of crash occurrences after the median installation. It may also reflect that the safety benefits of a raised median project not being realized in the eyes of business owners to the degree advertised by project officials.

6.3 Utah Implications/Further Study

6.3.1 Potential Benefits of Increased Business Involvement

As mentioned earlier, it appears that while a corridor may see overall economic improvement, the benefits may not be shared by all businesses. The safety benefits of raised medians are well documented and often key in raised median project promotion. The gap, discussed earlier, between the perceived negative impacts on roadway safety and the actual reductions in crash rates indicates how often these benefits are cited. During the business impact survey, many respondents reflected that they did not feel engaged, and often felt left out, in the process of installing the median. As UDOT continues to install raised medians on roadways throughout Utah, more businesses will be impacted.

An opportunity exists to further involve the business community as well as the municipalities. A member of the Research Team—with a background in municipal economic development—observed that municipalities could be enlisted as allies to work with the local business community to help minimize the negative impacts caused by the installation of a raised median. Resistance could be further minimized through giving local businesses along the corridor ownership of the solution. Also the perceived versus reality gap in terms of crash reductions indicates that an opportunity might exist for greater post-construction follow-up with businesses. Further research could determine if novel project development techniques, such as involving the municipality and further incorporating local business owners in project development, could minimize negative business impacts.

6.3.2 Increased Number of Corridors and Different Measurement Techniques

The primary intention of this study was to add to the body of knowledge regarding the economic impacts of raised medians. Additionally this study was designed to perform an economic impact analysis for Utah-specific case study corridors. Other studies in the literature

review have more prolonged efforts that utilized other metrics for measuring business impacts; metrics such as property valuations, business turnover rates, and employment data. Further study of the business impacts of raised medians in Utah could involve an expanded set of metrics. An increased set of metrics could help develop a more detailed analysis of the economic impacts of raised medians on adjacent businesses and confirm if the trends observed in this study are consistent elsewhere.

Data limitations were another issue in conducting this study. The findings of the business impact survey were limited by the presence of eligible businesses and individual respondents. A differently designed survey could yield statistically significant results. Also businesses that were interviewed had managed to survive the installation of the raised median. Establishments that went out of business before this research, but after the median was installed, could not be included. Hence, incorporating data such as business turnover rates into future research could help answer this question.

6.3.3 Impacts of "The Great Recession"

The North Carolina study (Cunningham et al. 2010) and this study are the only two studies on the subject of the economic impacts of raised medians that include the effects of the 2008 economic crisis. While the local and nationwide economy still continues to recover, negative impacts experienced by businesses could be less a symptom of a raised median and more reflective of larger economic circumstance. Further study in the future could potentially yield different results as the economic outlook improves.

6.3.4 Long Term Impacts

This study compared the year before and the year after the raised median was installed on study corridors. While the short-term impacts are better understood throughout the literature, little research has been conducted on the long-term economic impacts of a raised median on specific corridors.

6.3.5 Data Limitations

The data used in this study is limited in scope as it can be difficult to fully eliminate all external influences. Further research could compare these results in Utah to nationwide findings to confirm the validity of the conclusions.

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APPENDIX A: CORRIDOR DETAILS

Corridor Project And Median Data

ID	Study or Control	Area	City	Route	Road	Project Length	Median to Proj. Length	# Median Breaks		# Accesses		Right-in Right-out Accesses	
								Before	After	Before	After	Before	After
A1	Study	Cache County	Logan	US-91	Main Street Logan	0.16	1:1	n/a	0	14	24	0	11
A2	Control	Cache County	Logan	US-91	Main Street Logan	0.8	n/a	n/a	n/a	26	36	0	0
B1	Study	Salt Lake County	Draper	SR-71	12300 South	0.9	1:1	n/a	3	12	18	1	14
B2	Control	Salt Lake County	Draper	SR-71	12300 South	0.55	n/a	n/a	n/a	12	14	0	0
C1	Study	Salt Lake County	Sandy	US-89	State Street	1.25	1:1	n/a	3	31	36	14	34
C2	Control	Salt Lake County	South Jordan	SR-68	Redwood Road	1.25	n/a	n/a	n/a	13	16	2	3
D1	Study	Provo/ Orem	Orem	SR-52	800 North (Orem)	0.75	1:1	n/a	2	24	20	8	20
D2	Control	Provo/ Orem	Orem	SR-52	800 North (Orem)	1.0	n/a	n/a	n/a	6	6	1	1
E1	Study	Washington County	St George	SR-34	St. George Blvd.	1.75	1:1	n/a	9	113	103	0	102
E2	Control	Washington County	Santa Clara	SR-8	Sunset Blvd	0.9	n/a	n/a	n/a	30	33	0	0
F1	Study	Washington County	Hurricane	SR-9	State Street	0.5	1:1	n/a	2	20	21	0	21
F2	Control	Washington County	Hurricane	SR-9	State Street	1.0	n/a	n/a	n/a	43	41	0	0

Corridor Land Use Estimates

ID	Study or Control	City	Route		Total	Pass-by Comm.	Destination Comm.	Small Comm. Center	Medium Comm. Center	Large Comm. Center	Public	Industrial	Vacant	Office/ Financial	Res.
A1	Study	Logan	US-91	Before	100%	25%	40%	10%	0%	0%	0%	10%	0%	15%	0%
				After	100%	25%	40%	10%	0%	0%	0%	10%	0%	15%	0%
A2	Control	Logan	US-91	Before	95%	15%	30%	20%	15%	10%	0%	0%	10%	0%	0%
				After	95%	15%	35%	20%	15%	10%	0%	0%	5%	0%	0%
B1	Study	Draper	SR-71	Before	50%	20%	15%	10%	0%	0%	0%	0%	50%	0%	5%
				After	70%	15%	20%	20%	0%	15%	0%	0%	30%	0%	0%
B2	Control	Draper	SR-71	Before	70%	20%	15%	10%	0%	0%	10%	0%	30%	5%	10%
				After	80%	25%	20%	10%	0%	0%	5%	0%	20%	10%	10%
C1	Study	Sandy	US-89	Before	85%	5%	20%	0%	0%	0%	25%	15%	15%	5%	15%
				After	90%	5%	20%	5%	0%	0%	30%	15%	10%	5%	10%
C2	Control	South Jordan	SR-68	Before	65%	5%	5%	10%	0%	0%	25%	0%	35%	5%	15%
				After	70%	5%	5%	10%	0%	0%	30%	0%	30%	5%	15%
D1	Study	Orem	SR-52	Before	100%	15%	40%	15%	0%	0%	0%	0%	0%	0%	30%
				After	100%	15%	40%	15%	0%	0%	0%	0%	0%	0%	30%
D2	Control	Orem	SR-52	Before	75%	5%	0%	5%	0%	0%	15%	0%	25%	15%	35%
				After	80%	5%	5%	5%	0%	0%	15%	0%	20%	15%	35%
E1	Study	St George	SR-34	Before	100%	30%	55%	10%	0%	0%	0%	0%	0%	5%	0%
				After	100%	30%	50%	10%	0%	0%	5%	0%	0%	5%	0%
E2	Control	Santa Clara	SR-8	Before	75%	20%	30%	15%	0%	0%	0%	10%	25%	0%	0%
				After	80%	20%	30%	15%	0%	0%	0%	10%	20%	5%	0%
F1	Study	Hurricane	SR-9	Before	95%	15%	35%	10%	0%	0%	15%	0%	5%	10%	10%
				After	100%	15%	45%	10%	0%	0%	15%	0%	0%	5%	10%
F2	Control	Hurricane	SR-9	Before	80%	20%	35%	10%	0%	0%	5%	5%	20%	5%	0%
				After	85%	25%	35%	10%	0%	0%	5%	5%	15%	5%	0%

"Comm." Is Commercial

Corridor Traffic and Safety Data

ID	Study or Control	Route	Road	AADT (Year)		Total Crashes		Crash Rate		# Severe Crashes		# Angle Crashes		# Head-on Crashes		# Rear-end Crashes	
				Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
A1	Study	US-91	Main Street Logan	18,645 (09)	18,125 (11)	18	11	6.96	4.38	2		13		1		3	
A2	Control	US-91	Main Street Logan	30,730 (08)	30,975 (10)	128	133	14.26	14.70	1	1	27	26	1	2	84	81
B1	Study	SR-71	12300 South	29,510 (02)	28,560 (05)												
B2	Control	SR-71	12300 South	27,647 (02)	26,760 (05)												
C1	Study	US-89	State Street	23,115 (06)	22,155 (09)	117	57	11.09	5.64	3	2	25	12	18	0	25	62
C2	Control	SR-68	Redwood Road	18,235 (06)	17,785 (08)	53	31	6.37	3.85	3	2	10	8	3	1	28	15
D1	Study	SR-52	800 North (Orem)	33,325 (06)	33,485 (09)	25	29	2.74	3.16	2	0	5	13	6	1	10	12
D2	Control	SR-52	800 North (Orem)	28,985 (08)	26,195 (10)	34	40	3.21	4.18	1	0	10	16	2	0	21	20
E1	Study	SR-34	St. George Blvd	33,960 (04)	35,470 (07)		121		5.34		2		28		2		71
E2	Control	SR-8	Sunset Blvd	27,905 (08)	25,165 (10)	26	32	2.84	3.87	0	1	11	15	1	3	11	10
F1	Study	SR-9	State Street	22,185 (09)	22,140 (11)	26	11	6.42	2.72	0		3		0		22	
F2	Control	SR-9	State Street	20,055 (08)	22,055 (10)	23	13	3.14	1.61	1	1	8	4	1	1	8	3

Note: Blank cells indicate that data was unavailable.

Crash data from UDOT Traffic and Safety Division

APPENDIX B: BUSINESS IMPACT SURVEY

Business Impact Survey Form Side 1

Impact of UDOT Road Project Survey

Introduction: This survey is being conducted for the Utah Department of Transportation (UDOT) as part of a research study. The purpose of this study is to evaluate raised medians' impact, after construction, on adjacent businesses. You will be asked a series of questions regarding your business on ROUTE in PROJECT YEAR. Estimated survey length: 5 minutes.

Internal Use Only

1) Code: ____-_____

Section A: Background

2) What is the job title for your current position? (Optional)

_____

3) Was this business present at this location before PROJECT YEAR?

☐ Yes
☐ No

4) Did you work here before PROJECT YEAR?

☐ Yes
☐ No

If you answered "Yes" to 3) or 4) continue to Section B.

If you answered "No" to 3) ***OR*** 4) ***DO NOT CONTINUE FILLING OUT THIS SURVEY.*** Thank you for your time.

Internal Use Only ☐ SSCC ☐ MSCC ☐ LSCC ☐ PFC ☐ DFC ☐ OFF

Date: 11/

Section B: Expectations vs Experience

This section will ask you to think back to before the construction occurred on ROUTE and about your experiences after construction was completed. Please mark your responses to each question using the scale below.

THIS SURVEY IS DESIGNED TO STUDY THE AREA BEFORE AND AFTER CONSTRUCTION, NOT DURING CONSTRUCTION.

Strongly Negative	Somewhat Negative	Neutral	Somewhat Positive	Strongly Positive	Unsure/ No Opinion
1	2	3	4	5	6

5) Before construction, how did you expect the finished project would impact traffic congestion on ROUTE?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

6) After construction, how did the finished project impact traffic congestion on ROUTE?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

7) Before construction, how did you expect the finished project would impact ease of deliveries from your suppliers?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

8) After construction, how did the finished project impact the ease of deliveries by your suppliers?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

9) Before construction, how did you expect the finished project would impact the number of traffic crashes on ROUTE?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

10) After construction, how did the finished project impact the number of traffic crashes on ROUTE?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

Business Impact Survey Form Side 2

Section B: Expectations vs Experience (Continued)

Strongly Negative	Somewhat Negative	Neutral	Somewhat Positive	Strongly Positive	Unsure/ No Opinion
1	2	3	4	5	6

11) Before construction, how did you expect the finished project would impact access to your business?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

12) After construction, how did the finished project impact access to your business?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

13) Before construction, how did you expect the finished project would impact sales at your business?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

14) After construction, how did the finished project impact sales at your business?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

15) Before construction, how did you expect the finished project would impact the number of customers at your business?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

16) After construction, how did the finished project impact the number of customers at your business?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

17) Overall, now that the project is finished, and considering the impacts that occurred during construction, how do you view the project on ROUTE as a whole?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6

Section C: Comments (OPTIONAL)

Thank you for your participation in this survey, please use the space below to share any thoughts or comments.

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