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FINAL REPORT

ANALYSIS OF DEMOGRAPHIC, SOCIOECONOMIC AND REGIONAL DIFFERENCES IN TDOT CUSTOMER SATISFACTION SURVEY

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DISCLAIMER

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16. Abstract

The Tennessee Department of Transportation (TDOT) has conducted three statewide residential customer surveys (2006, 2013, 2016) to aid in identifying and assessing satisfaction with transportation services. This research focused on demographic analysis of the Tennessee Department of Transportation's previous residential survey data with the goals of:

- Identifying significant differences in customer perceptions of TDOT services, both over time and between demographic groups;
- Developing visualizations of spatial trends over time that identify and communicate important changes and possible connections to TDOT's activities and investments;
- Determining a best-practice approach for survey design and stakeholder engagement that will result in valuable information related to TDOT's key areas of interest for future survey events; and
- Creating a set of guidelines for future survey events that enhance the potential for information obtained to be integrated into TDOT's decision-making process.

To achieve these goals, a comprehensive analysis was conducted of the survey instruments themselves as well as response data. With each of the previous survey events, basic descriptive statistics, cross-tabular analysis of response frequencies for certain demographics, and presentation of spatial differences (by county or Super District) were provided by the contractor conducting the surveys and initial data analysis for TDOT. The current study extends this work to provide more in-depth analysis, examine differences between additional demographic groupings, and analyze trends over time. Additional spatial statistics as well as other advanced analyses are also examined for potential to enhance TDOT's ability to extract information that is useful for strategic planning and decision-making. Finally, a comprehensive literature review and interviews of other Departments of Transportation (DOT) across the country were conducted to fully inform the development of the framework for action and recommendations for TDOT's future survey events.

Key findings from this study included that TDOT did well in keeping survey instruments consistent and in obtaining representative samples for analysis. TDOT also demonstrated significant innovation in commissioning a research study to examine the survey effort. The research determined that little variation was present in response data, which may be indicative of survey fatigue or lack of understanding of question topics. Public transportation related questions resulted in the lowest levels of satisfaction across all stakeholder types. In terms of temporal changes, ratings on interstate surface conditions declined over time across the board, urban residents indicated marked decline over time in satisfaction related to congestion questions, Region 3 had the most frequent statistically significant results for a decline in ratings over time related to congestion, and communication preferences have changed with print communication preference declining and increased preference for email and social media. When examining various stakeholder groups, differences were seen between counties of different economic statuses for congestion-oriented topics. Finally, a proof-of-concept study demonstrated the utility of Twitter data for extracting important factors influencing perceptions of transportation systems as well as indicating public sentiment.

Recommendations resulting from this research include redesigning the survey to increase participation (particularly for diverse groups), adjusting the survey schedule to regular intervals to increase utility of longitudinal data, adapting practices to make a more frequent schedule feasible, and considering the most appropriate spatial distribution for the state for analysis purposes. The study also uncovered several innovative survey platforms that may create opportunities for TDOT for future survey activities, including platforms that allow participants to provide geolocations. Additionally, recommendations were developed to promote more continuous and robust conversations with Tennessee stakeholders, including development of a social media campaign designed to create a two-way conversation and to enhance data mining opportunities to inform future studies. It is expected that the results and recommendations of this study will promote more strategic and equitable investments by TDOT through a well-planned and executed survey design, data collection, and analyses process in the future.

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Executive Summary

The Tennessee Department of Transportation (TDOT) has conducted three statewide residential customer surveys (2006, 2013, 2016) to aid in identifying and assessing satisfaction with transportation services. The 2006 survey event marked the first time that a statistically valid sample was collected for the state related to customer experience. The surveys included questions on a range of topics and requested resident perceptions to inform the improvement of TDOT services, including:

- Maintaining the Transportation System
- Public Transportation and Pedestrian Facilities
- Perceptions of Highway Travel
- TDOT Communication
- TDOT Investments
- Overall Ratings

These surveys were initially analyzed to develop a profile of residential perceptions of TDOT's performance and to identify high priority initiatives as well as areas with opportunity for improvement. While the initial analysis provided insight into the perceptions of Tennessee residents as a whole, analyses by demographics and trends over time were not conducted.

It is important for TDOT to understand if and how perceptions and priorities differ for the diverse stakeholders in the state. This can lead to a more balanced approach to decision-making that ensures appropriate differences are reflected in the approach TDOT takes to investment and project prioritization. Accordingly, this research focused on further analyzing results of TDOT's previous residential survey events with the goals of:

- Identifying significant differences in customer perceptions of TDOT services, both over time and between demographic groups;
- Developing visualizations of spatial trends over time that identify and communicate important changes and possible connections to TDOT's activities and investments;
- Determining a best-practice approach for survey design and stakeholder engagement that will result in valuable information related to TDOT's key areas of interest for future survey events; and
- Creating a set of guidelines for future survey events that enhance the potential for information obtained to be integrated into TDOT's decision-making process.

To achieve these goals, a comprehensive analysis was conducted of the survey instruments themselves as well as response data. With each of the previous survey events, basic descriptive statistics, cross-tabular analysis of response frequencies for certain demographics, and presentation of spatial differences (by county or Super District) were provided by the contractor conducting the surveys and

initial data analysis for TDOT. The current study extends this work to provide more in-depth analysis, examine differences between additional demographic groupings, and analyze trends over time. Additional spatial statistics as well as other advanced analyses are also examined for potential to enhance TDOT's ability to extract information that is useful for strategic planning and decision-making. Finally, a comprehensive literature review and interviews of other Departments of Transportation (DOT) across the country were conducted to fully inform the development of the framework for action and recommendations for TDOT's future survey events.

Key Findings

TDOT Best Practices

1. TDOT did well in keeping questionnaires consistent between events and getting representative samples.
2. TDOT was forward-thinking in commissioning a project to look at best practices and identify areas for improvement. The DOTs interviewed as part of this project were very complimentary of this approach and interested in reviewing the final report to see how it might inform their own practices.

General Survey Results

3. Overall, TDOT residential stakeholder survey results show little variation between items and demographics for any survey year. The lack of variation in responses may be due to survey fatigue or limited familiarity with question topics.
4. The question related to value residents receive from transportation taxes had the highest frequency of 'Don't Know' responses for all survey years, indicating more education and outreach may be needed.
5. Questions related to public transportation showed lower levels of satisfaction in every survey year.
6. Communication preferences have changed considerably over time for Tennessee residents. Print communication has fallen out of favor while residents tend to prefer electronic communication via email and social media.

Survey Results by Demographic

7. The condition of interstate surfaces was rated significantly lower over time by both urban and rural residents.
8. Urban residents showed a marked decline over time in satisfaction related to congestion on interstates and highways.
9. Region 3 had the most frequent statistically significant results for a decline in ratings over time related to congestion.
10. Differences were observed between counties of different economic statuses for questions related to congestion. However, these trends are likely because most urban residents live in non-distressed counties.
11. Urban residents dominated responses. And, even though representative samples were obtained for Super Districts, respondents living near major urban areas made up the majority of responses within the Super District.

Recommendations

Survey Design and Sampling Protocol

1. TDOT should consider a comprehensive redesign of its survey to facilitate participation and increase the utility of the resulting data for informing decision-making. Surveys should be short and simple for participants to complete, rating scales should be carefully considered to avoid bias, and deployment strategies should be designed to obtain maximum participation.
2. If survey results are to be used to inform strategic planning, survey events need to occur on a more regular and frequent schedule (such as biannual). With a shift to more frequent survey events, TDOT will need to consider the best strategy for managing this effort at a reasonable cost.
3. In future survey events, TDOT should consider the spatial discretization that will result in the most valuable input for decision-making. Strategies to better engage rural residents are needed to ensure more balanced perspectives are obtained.
4. TDOT should consider providing a map of TDOT roads to survey participants who may not otherwise know which roads are being evaluated in the survey.

Survey Distribution and Analysis

5. TDOT should consider innovative survey platforms such as Maptionnaire or Publicinput.com for future surveys, as this may be more engaging and provide richer data, particularly related to spatial context. Maptionnaire is an emerging map-based survey tool based that shows promise for transportation agencies. Publicinput.com is another similar option that also provides database management, online meeting platforms, and social media tools designed specifically for government agencies.
6. TDOT is encouraged to develop a comprehensive data inventory of information to be used in conjunction with survey results for richer, more thorough analysis.
7. With careful survey design, specialized regression methodologies can be used to determine the factors influencing customer satisfaction ratings and identify key differences between demographics.
8. A proof-of-concept study demonstrated the utility of Twitter data for extracting important factors influencing perceptions of transportation systems as well as indicating public sentiment. TDOT should consider deploying a social media strategy for data collection to complement survey efforts and compare instances of frustration (such as tweets during peak hour traffic) with long-term satisfaction.

Communicating Results

9. Visualization, such as through GIS Story Maps, should be used to share survey results both within and external to TDOT.
10. To increase survey participation and validity of resulting data, it is very important to establish trust with residential stakeholders. TDOT should develop a feedback loop to ensure stakeholders are aware of survey results and the impact of results on TDOT's decisions.

It is expected that the results and recommendations of this study will promote more strategic and equitable investments by TDOT through a well-planned and executed survey design, data collection, and analyses process in the future.

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Chapter 1. Introduction

This report details the results of a research study related to the Tennessee Department of Transportation's (TDOT) statewide residential customer survey events. Previous surveys were conducted in 2006, 2013, and 2016 by the ETC Institute for TDOT. The surveys included questions on a range of topics and requested resident perceptions to inform improvement of TDOT services, including:

- Maintaining the Transportation System
- Public Transportation and Pedestrian Facilities
- Perceptions of Highway Travel
- TDOT Communication
- TDOT Investments
- Overall Ratings

TDOT intends to refine its strategic framework for not only conducting future survey events, but also ensuring that information obtained can be readily integrated into statewide investment and planning decisions and communicated effectively with various stakeholders. Although multiple stakeholder groups were engaged in all three survey efforts, this work focuses on analyzing results of TDOT's previous residential survey events with the goals of:

- Identifying significant differences in customer perception of TDOT services, both over time and between demographic groups;
- Developing visualizations of spatial trends over time that identify and communicate important changes and possible connections to TDOT's activities and investments;
- Determining a best-practice approach for survey design and stakeholder engagement that will result in valuable information related to TDOT's key areas of interest for future survey events; and
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To achieve these goals, a comprehensive analysis was conducted of the survey instruments themselves as well as response data. With each of the previous survey events, basic descriptive statistics, cross-tabular analysis of response frequencies for certain demographics, and presentation of spatial differences (by county or Super District) were provided by the contractor conducting the surveys and initial data analysis for TDOT. The current study extends this work to provide more in-depth analysis, examine differences between additional demographic groupings, and analyze trends over time. Additional spatial statistics, as well as other advanced analyses, are also examined for potential to enhance TDOT's ability to extract information that is useful for strategic planning and decision-making. Finally, a comprehensive literature

review and interviews of other Departments of Transportation (DOT) across the country were conducted to fully inform the development of the framework for action and recommendations for TDOT's future survey events.

1.1. Organization of Report

This report contains the following:

- Review of best survey practices from current literature
- Description of methodology used in the construction and organization of the data analysis, including:
    - Survey question correspondence for the three surveys
    - Notes on the grouping of data by demographic
    - Sample sizes and representation of each demographic
- Customer Service Analysis Results
    - Analysis of the survey instruments
    - Analysis of data trends by survey topic and demographic
    - Analysis of trends in "Don't Know" responses
- Visualization of spatial trends in the survey data – both between spatial demographics and changes over time
- Results of nationwide interviews with state DOTs
- Recommended framework for future TDOT survey events
- Appendices – TDOT Customer Satisfaction Survey Instruments
    - Appendix A – 2006 Survey Instrument
    - Appendix B – 2013 Survey Instrument
    - Appendix C – 2016 Survey Instrument

The following datasets were provided to TDOT as part of this project:

V. Descriptive Statistics by Demographic Group
VI. Survey Comparison Spreadsheets by Demographic Group
VII. Survey Instruments from Other State DOTs
VIII. Statistical Analyses by Demographic Group Across Survey Years

Chapter 2. Literature Review

In the current climate where consumers expect instantaneous service, customer feedback is also requested at an increasing rate. Private and public sector entities frequently seek feedback in order to improve the level of service that is delivered to their customer base. The way surveys are designed may result in issues related to survey distribution, data accuracy and data reliability. Considerations related to survey design and distribution are especially important to understand so that state agencies can develop protocols and instruments that engage a diverse population of residents and reflect true opinions.

2.1. Response Accuracy and Bias

As shown in a recent study, survey creators frequently design survey instruments based on their own preferences rather than research-based evidence, consequently producing less-than desirable survey results (Chyung, Kennedy and Campbell 2018). Problems associated with low or inaccurate user response can be attributed to questions with unclear wording, questions with insufficient or inappropriate response options, or questions that have little or no relevance to the respondent (Sinickas 2007). In order to ensure survey items are worded in such a way to avoid misunderstandings and to elicit the desired information from respondents, the Pew Research Center recommends *pretesting*, a method that uses a small sample of people from the survey population. A pretest is conducted using the same protocol(s) and setting as the survey and is typically conducted once the questionnaire and procedures have been finalized (Pew Research Center Methods 2020). There are two types of survey pretesting: participating and undeclared (Paul Barribeau 2012). Participating pretesting involves interaction between the survey administrator and the pretest participants in an interview setting so respondents can discuss the survey questions while in an undeclared pretest, the respondents are not aware that they are participating in a test survey (Paul Barribeau 2012).

The Encyclopedia of Survey Research Methods suggests that when conducting pretests or pilot tests, all of the procedures of the actual survey should be used including modes of survey administration, respondent rules, utilizing the same staff that will be conducting the interviews, and interview training (Sage Publications 2008). Additionally, conducting a pretest provides survey administrators a forum to openly discuss questions and uncertainties that are apparent in a survey instrument before it is administered to an actual pool of respondents. It is also important to note that once a group of pretest participants has taken part in a survey, they should be excluded from the larger population sample to mitigate survey bias (Nardi 2018).

Survey respondents are also known to show acquiescence bias and social-desirability bias. These types of bias reflect respondents' tendencies to provide 'polite' or 'socially acceptable' responses rather than their true opinions (Chyung, Kennedy and Campbell 2018). The frequently used Likert-format (typically structured as 5-scale level of agreement options for responses) is particularly prone to eliciting responses that reflect social-desirability bias. Ways to combat this bias include presenting 5-scale levels in ascending order to reduce inflated positive scoring, as it has been demonstrated that descending-order scales result in respondents selecting more positive responses (Chyung, Kennedy and Campbell 2018). In addition to this, the literature has also shown that presenting half of survey items with descending-ordered scales and the other half with ascending-ordered scales helps produce a higher level of reliability (Chyung, Kennedy and Campbell 2018). It has also been shown that a 7-point Likert scale increases reliability of response since it provides the user a greater range of choice (Ankur Joshi 2015). Users that participate in a survey that includes 5-point questions can be faced with an issue of "the motif lying between two descriptive options provided on a 5-point scale" (Ankur Joshi 2015). A 7-point scales provides more fine-tuning and a greater option for survey responders to eliminate the dilemma of choosing between two extremes. There is limited research on the effects of a 3-point Likert scale, although in the case of the Wyoming Department of Transportation (WyDOT), when the format of the survey instrument changed from a 5 point Likert scale to a 3 point Likert scale, completion of the survey was faster for participants and more usable data was obtained by WyDOT (Wyoming Survey and Analysis Center 2016).

SurveyMonkey, a leading survey development company, has conducted extensive research on survey design through its user platform and suggests placing more personal questions near the end of a survey to provide a sense of trust and user buy-in, leading to more honest and detailed responses (SurveyMonkey 2019). The use of close-ended questions should also be considered since these are more quantitative and are easier for respondents to complete (SurveyMonkey 2019) (Nardi 2018). SurveyMonkey Audience suggests frustration in survey design can lead to incomplete or inaccurate responses. Twenty-seven percent (27%) of users say not being able to skip a question is enough to make them quit the survey completely, while 25% of users provide a random answer just to move forward (Susteren 2018). Providing the option for open-ended questions offers a survey administrator an avenue to gain more insight on the thoughts and feelings of the survey taker and to better interpret results (Nardi 2018).

2.2. Survey Fatigue

A growing problem in the digital world today is survey fatigue due to the frequent rate at which consumers receive requests for feedback (SurveyGizmo 2019). Thus, it is important that survey design and

distribution methods are carefully considered to increase the likelihood of responses and to avoid respondent fatigue. Respondent fatigue, better known as survey fatigue, refers to the situation in which respondents give less thoughtful answers to questions in the later parts of a survey, or prematurely terminate participation (O'Reilly-Shah 2017). In order to combat survey fatigue, entities that request customer and user feedback need to ensure they produce surveys using best practices in order to gain relevant and representative data. Strategies may include reducing survey length as well as breaking up long surveys into a series of shorter ones (Sinickas 2007). Over time, survey conductors have realized that there is no such thing as the perfect survey. Many different approaches must be taken to address the various population types that can be represented in a survey.

A study produced by SurveyMonkey Audience has shown that 60% of survey respondents are less inclined to take a survey that is longer than 10 minutes (Susteren 2018). Signs of survey fatigue also include straight-line answering, a situation in which the respondent chooses a singular option from a survey (O'Reilly-Shah 2017). An example of straight-line answering is choosing the same letter on a multiple-choice survey for several questions in a row (O'Reilly-Shah 2017). Survey fatigue can also be detected by blank open-ended questions and default options left unchanged in situations related to online surveys (O'Reilly-Shah 2017). The most extreme case of respondent fatigue is non-completion.

2.3. Issues with Non-Response

Survey non-response can be attributed to many things such as the survey analysis method, survey sponsorship, and the survey population (Council 2013). With the increasing demand to complete surveys as well as the growing bias created by an increase in telemarketing and sales' ploys, survey takers are less likely to participate in surveys; thereby, creating a greater margin of bias that can attribute to non-response (Greenland n.d.). There have been many studies to pinpoint the reason for survey non-response. In a study comparing panel surveys (those conducted on a sample group of individuals and traced over time) versus cross-sectional surveys (those distributed to a population in a single event), it was shown that the drop-out rates from panel surveys after an initial baseline interview tended to be smaller than that of a cross-sectional survey (Council 2013). This is related to the survey buy-in of having a preselected panel to complete different trials of the survey. However, researchers saw a drop-off of participation due to increasing familiarity of the survey interview methods that led to flat results from a panel surveying trial (Council 2013). A comparison was completed to determine factors of non-survey response from a survey conducted in 1978 versus a survey conducted in 2008. Results from the study determined factors that relate to recent survey non-response rates include respondent disinterest, lack of time to take the

survey, privacy concerns, and other factors (Council 2013). Researchers also concluded the overarching theme is the cost-benefit ratio of completing a survey – survey respondents want to know if the rewards outweigh the cost (Council 2013). Another contribution to declining response rates is a lessening of social pressure to respond to surveys due to the increasing nature of the ability to disseminate surveys using the internet (Karlberg 2015). It has also been shown that high response rates do not always reduce the risk of nonresponse bias (Council 2013). Though the risk of non-response exists, a scientific, research-based survey is one of the most unbiased, methodical ways to collect and understand human behavior and opinion (McPhee 2020).

Ways to increase participation in surveys can be related to incentivization of completing a survey. This method is not limited to monetization. One way of introducing non-monetized participation is the method of reciprocation (Karlberg 2015). The concept is attributed to meeting others as you are met, meaning that there is a human tendency to reciprocate positive behavior (Karlberg 2015). It has also been suggested that incentives should be offered before a user participates in a survey event, regardless of if they have committed to participating or not (Karlberg 2015). Social exchange theory is related to this as well. The concept suggests that when people consider participating in a survey, they evaluate a variety of nonmonetary costs and rewards (e.g., desire to help or social validation) (Sage Publications 2008). An article from Sales and Marketing Journal suggests selling the value of the survey (Nolan, 2016). This is a method of building a strong campaign around your survey. Successful surveys appeal to both business and personal motivators, and the campaigns highlight that value (Nolan, 2016). The Encyclopedia of Survey Research Methods also states that providing incentives is an effective way to increase response rates and reduce the potential of non-response bias (Sage Publications 2008). A pre-paid (monetary) incentive is considered a good-will gesture to ensure trust and understanding between a researcher and subject to offer a stronger guarantee of survey completion (Sage Publications 2008). Additionally, a monetary incentive should be looked at as a token of appreciation rather than an economic exchange to reduce the chances of the respondent not completing the survey due to a diminished lack of obligation (Sage Publications 2008). Overall, offering incentives (cash, gift cards, etc.) increases response rates (Sage Publications 2008). Though monetary incentives have a correlation with higher response rates, there are many instances in which a non-monetary approach is necessary to fulfill obligations of the entity or organization producing and conducting a survey.

2.4. Survey Delivery

There are many ways for surveys to reach a population. Surveys are either interview-based or self-completed (Administration 2015). Face-to-face and telephone surveys are considered to be interview based while mail-back, hand-delivered questionnaires and web-based surveys are considered self-completed (Administration 2015). The ubiquitous use of technology has disrupted traditional delivery method of surveys, namely the phone. The Pew Research Center reported a decline of telephone surveys with rates dropping from 7 percent in 2017 to 6 percent in 2018 (HARTIG 2019). Reasons attributed to this decline from the steady 9 percent of years past are attributed to an influx of robo-telemarketer calls and the predominance of cellphones (HARTIG 2019). Cellphones have shifted into a primary means of communication for many people. Survey administrators have been forced to adapt to this in order to obtain a representative sample. The Pew Research Center employs a random digit sample of both landline and cell phone numbers in all 50 states (Nardi 2018). Surveys are now often distributed over the internet via an emailed link either to a website created by the survey administrator or to a commercial survey service such as SurveyMonkey (Nardi 2018). While this provides ease of distribution, one hinderance to participation in electronically distributed surveys is lack of access to or ownership of a computer (Nardi 2018). Consideration must be placed on how a survey is delivered. There are survey respondents that prefer to participate in a mail survey versus one offered online (McPhee 2020). The low response score produced by the United States Census Bureau showed that delivery of surveys was higher for residents that owned homes vs renters (McPhee 2020).

2.5. Survey Innovation

Innovation is related to survey improvement such as in design, distribution, or rates of engagement. In the advent of data mining and data collection, surveys have adapted. Survey administrators have created new and innovative ways for users to complete surveys. Online or web surveys have been the most prevalent mode over the past decade (Robertson 2017). Mobile phone surveys are also on the rise and have benefits such as a quick turnaround period as well as the ability to work on a multitude of platforms (Robertson 2017). Microsurveys, or very short surveys that take no more than five minutes to complete, are also becoming more widely accepted as an effective method to obtain user feedback. In a 2014 study, a case study was conducted to assess microsurveys as a method of conducting user experience research whereby the study concluded that microsurveys quickly provide large amounts of data with relatively low setup costs (Sosik, Bursztein and Con 2014). Microsurveys allow survey administrators to formulate real-time trends, attain high response rates and obtain better insights on user perception of products and

services where, in particular, corporations have found response rates as high as 60 percent (Zhang 2018). Microsurveys provide the ability to survey more often due to reduced lengths as compared to traditional surveys (Zhang 2018).

2.5.1. Communicating Survey Results

Equally important to survey design and delivery is communicating results with all stakeholders. For survey participants, this means creating a feedback loop so that respondents understand how the information they contributed will be used. As such communicating survey results in a clear and effective manner is imperative.

Clear communication often means developing visualizations of data to help stakeholders understand survey findings and how the findings can guide improved decision-making and investments. State departments of transportation have a duty to support the diverse populations they represent. With innovative ways to visualize the spatial information obtained from perception and demographic questions from a customer service survey, respondents can effectively see that their voices are being heard and that there is an end goal for the data being collected.

2.5.2. GIS for Communication and Visualization

There are different ways to produce a visualization of spatial data. Among the most popular is Geographic Information System (GIS). GIS is an effective means of communicating results through a spatial context that tells a story of the gathered information. Furthermore, advanced geospatial methods are powerful tools that have only recently been harnessed to better understand and portray complex demographic analysis through advanced spatial analyses, spatial econometrics, geographical regression analysis, and spatial pattern analysis (Matthews and Parker 2013). These tools can provide greater insight, pattern recognition, and predictive ability to researchers (Matthews and Parker 2013). State DOTs frequently use GIS as a decision-making tool and are beginning to utilize its capabilities for communication across broader stakeholder groups. In a case study completed by the Texas Department of Transportation (TxDOT), GIS was used to help in the decision-making process by providing a greater understanding of where TxDOT projects overlap and developing a robust visualization tool that practitioners could use in project development (Jojo France-Mensah 2017).

ESRI® suggests ArcGIS StoryMaps as the next-generation, place-based story telling tool (ArcGIS 2020). A study was done to compare two multimedia methods for delivering educational content: PowerPoint versus an ESRI StoryMap (Garth Groshans 2019). Groshans (2019) showed that students acquired greater

familiarity, perception, and confidence with digital story maps. In addition, participants rated the ESRI StoryMap's storytelling effectiveness as "excellent" (Garth Groshans 2019). The functions available within ESRI StoryMaps offer a multitude of ways to convey demographic data that has been collected. ESRI's StoryMaps have been used across many different sectors, whether it is used as a tool to enhance a student research project, to display facts about a non-profit, or as an engine for public relations professionals to advertise events and trends (ESRI 2019). With the multitude of offerings and options that ESRI StoryMaps contains, this is an excellent platform for communicating statewide survey findings. Other GIS systems, such as the open-source QGIS, may have similar story mapping capabilities as well.

TDOT has a duty to residents, elected officials, and other stakeholders to make informed and educated decisions that promote equitable investment within the state. This requires a wholistic method to evaluate not only projects, but other important outcomes related to project delivery, services provided, and long-range planning.

Chapter 3. Methodology

The initial focus of this study was to examine survey data for items of interest to TDOT across specific demographic groups, trends over time, and spatial analyses where appropriate. While some survey items varied each issuance period, most questions remained consistent among the surveys. Three surveys were conducted by TDOT over the past two decades: 2006, 2013 and 2016. The 2006 survey included 39 questions, the 2013 included 44, and the 2016 included 37. Many of the questions had multiple parts, for example: question 1 had 22 parts in 2016, so each survey was quite lengthy. A copy of each survey instrument is provided in the Appendices.

3.1. Survey Question Matching

Twenty-three items were identified by TDOT as being of interest for further investigation of demographic differences and trends. Because many of the questions had multiple parts, this resulted in a total of sixty-nine (69) separate analyses developed for each demographic grouping. Unfortunately, similar survey questions across the surveys were not numbered identically. Table 3.1.1 shows how survey questions from the three years were paired for subsequent analysis. In this report and the attached survey comparison spreadsheets (Dataset II), unless otherwise specified, stated question numbers originate with the 2016 survey instrument and can be linked to their corresponding question numbers in the 2013 and 2006 surveys using Table 3.1.1 as the guide. For example, if "Question 1.14" is mentioned, it refers to question 1.14 in 2016, and using Table 3.1.1, correlates to questions in 2013 and 2006 that are coded as 1M and 1N, respectively.

Table 3.1.1. Survey Question Matching

2006	2013	2016	2006	2013	2016	2006	2013	2016
1A	1A	1.1	3	3	3	25	31	14
1B	1B	1.2	4	4	4	26	32	15
1C	1C	1.3	8B	5A	5.1	28	33	16
1D	1D	1.4	8C	5B	5.2	--	30A	17.1
1F	1E	1.5	--	5C	5.3	24D	30B	17.2
1V	1U	1.6	8D	5D	5.4	24E	30C	17.3
1G	1F	1.7	8H	5E	5.5	24F	30D	17.4
1H	1G	1.8	8I	5F	5.6	--	30E	17.5
--	1H	1.9	1W	5G	5.7	24A	30F	17.6
1I	1I	1.10	9	6	6	--	30G	17.7
1K	1J	1.11	10A	7A	7.1	27	29	23
1L	1K	1.12	10D	7B	7.2	19F	--	24.1
1M	1L	1.13	10E	7C	7.3	19F	15D	24.2

2006	2013	2016	2006	2013	2016	2006	2013	2016
1N	1M	1.14	10F	7D	7.4	19L	15L	24.3
1O	1N	1.15	10G	7E	7.5	19A,B*	15A	24.4
1P	1O	1.16	10H	7F	7.7	--	--	24.5
1Q	1P	1.17	10J	7G	7.8	--	--	24.6
1R	1Q	1.18	--	7H	7.10	19D	15C	24.7
1S	1R	1.19	--	7I	7.11	--	--	24.8
8A	1V	1.20	--	7J	7.13	19M	15I	24.9
8A	1V	1.21	--	7J	7.14	19M	15I	24.10
1X	1W	1.22	13	12	11	19I	15G	--
2	2	2	18	14	12	20	16	25

Some special notes on what is shown in Table 3.1.1:

- Questions indicated in blue were similar across years but split into two questions in some years. For example, question 19M in 2006 asks about "pedestrian and bicycle facilities". In 2016, this question is split in two—one for pedestrian facilities and one for bicycle facilities. Questions like this were still recorded in the comparisons with no alteration but in gray text.
- Questions with a dash (--) were missing from one or more surveys. These are indicated in the comparisons as "No Data".
- Question 19A and 19B from the 2006 survey were condensed into a single question for the 2013 and 2016 surveys. For these questions, the means and number of "Don't Know" responses from 2006 questions 19A and 19B were averaged.
- Questions 19-20 in 2006, questions 15-16 in 2013, and questions 24-25 in 2016 all asked about prioritizing TDOT investments in the future, but for different time periods. 2006 asked about the next 2 years, 2013 about the next 25, and 2016 about the next 10. For this reason, these questions were not compared across survey years.

3.2. Evaluating Differences in Demographic Groups

Survey results were analyzed to identify trends that emerged between demographic groups for survey items of interest to TDOT. The following demographic groups and regions were considered:

- Age
- County economic status
- Gender
- Hispanic ancestry
- Total household income
- Physical disabilities
- Primary language
- Race/ethnicity
- TDOT region
- TDOT super district
- Urban/Rural

Table 3.2.1 on page 13 provides details on the specific categories analyzed within each of these demographic groups.

For each question that was analyzed, basic descriptive statistics were used to create tables of the means and standard deviations (where applicable) for each demographic, as well as the total number of respondents and number of survey participants marking “Don’t Know” or leaving the question blank. These tables are included in Dataset I.

Further analysis was conducted to identify practically and statistically significant differences between demographic groups. The threshold for practical significance used for this study was a difference of 0.5 points on the Likert scale. Anything less than this, while interesting and possibly statistically significant, was determined not to be of value for decision-making or implementing strategic actions to address. Very few comparisons between demographics resulted in practically significant results. However, for demographic groupings that had a spatial context, such as urban versus rural, economic status, Region, and Super District, several practical distinctions existed. Thus, these responses were further analyzed for statistical significance. When comparing differences between groups with only two categories (such as urban vs. rural), Mann-Whitney U was used because of the ordinal nature of the Likert-scale data. Mann-Whitney U is appropriate when comparing two sets of ordinal data that are not normally distributed and is essentially a nonparametric t-test. The test is non-parametric, in that it does not rely on an assumed frequency distribution (such as the normal distribution required for t-tests) underling the data. When more than two groups are compared, the non-parametric Kruskal-Wallis H test and parametric ANOVA have been shown to yield similar results, with the ANOVA performing well for ordinal/Likert data even though the underlying assumptions of normality and skewness are violated (Norman, 2010). Each set of tests (ANOVA and Kruskal-Wallis) were applied to a relevant comparison group to determine what differences, if any, exist between the methods. The tests revealed the same outcomes and very small differences in results. Thus, the ANOVA was chosen to represent categories for two or more group comparisons since it is more widely recognized and provides relative ease in interpretation. Data analysis was completed in IBM SPSS Statistics Version 26 provided in the University of Memphis Applications Suite. ANOVA was used for comparing distressed, non-distressed and at-risk categories, regions, and district trends. Tukey Post Hoc testing was applied to ANOVA testing due to the nature of unequal means.

Additionally, the means and number of “Don’t Know” responses for each question were compared using spreadsheets and descriptive statistics to visualize the data. This was to determine both differences in

demographics and trends over time, to be discussed at the end of this section. The spreadsheets are attached digitally as Dataset III.

Finally, some questions asked respondents to rank the top 3 or 4 priorities from a list of items. For these questions, a weighting system was used to give each item a score for comparison purposes. The items were then ranked by score for each demographic and survey year. A percentage of the total weighted score shared by each item was also calculated and stacked bar charts were built for comparison.

3.2.1. Important Notes on Grouping

All responses with a demographic question left blank were discarded for that demographic grouping (e.g., if a respondent left the race/ethnicity question blank, their response was discarded for the race/ethnicity grouping, but not necessarily for any other demographic grouping). Table 3.2.1 summarizes the groupings for each demographic considered in this study.

Table 3.2.1. Demographic Groupings

Demographic Group	**Notes**
Age	Grouped based upon respondent age and split into five age ranges, using 18 years old as the minimum age. The respondent age field was only present for the 2016 data. - 18-34 - 35-44 - 45-54 - 55-64 - 65+
Economic Status	Grouped as Distressed, At-Risk, and Not Distressed based upon Transparent Tennessee distressed and at-risk county boundaries for 2013 and 2016 (State of Tennessee n.d.). Distressed county data was not readily available for 2006.
Gender	Grouped as Male and Female.
Hispanic/Non-Hispanic	Grouped as Hispanic and Not Hispanic. This was a separate question for the 2006 survey. For 2013 and 2016, if “Hispanic” was indicated at all, the response was counted as Hispanic, even if other races were also indicated.
Income	Grouped as “Under $25,000” and “Over $25,000”. All respondents reporting income over $25,000 were grouped for analysis.
Physical Disability	Grouped as Physical Disability and No Physical Disability.
Primary Language	Grouped as English and Other. Because the 2006 survey had only 54 respondents in the “Other” category, it was not considered for this demographic grouping.

Demographic Group	Notes
Race/Ethnicity	Grouped as African American/Black, Caucasian/White, and Other. Due to small sample sizes, the following were condensed into an "Other" category. - American Indian/Eskimo - Asian/Pacific Islander - Hispanic (for 2013 and 2016 surveys only) - Multiple races indicated
Region	Grouped using the "county" field and TDOT region boundaries. - Region 1 - Region 2 - Region 3 - Region 4
Super District	Grouped using the "county" field and Super District boundaries. - 1 (E, W, and C) - 2 (N, E, and W) - 3 (S, E, and W) - 4 (N, E, and W)
Urban/Rural	Used 2018 boundaries for MPO and RPO planning areas (TDOT Long Range Planning Division 2018). Some counties are split between planning areas. For these counties: - The “city” field in the data was used to sort responses into MPO or RPO for the 2006 survey - Split counties were sorted into MPO or RPO based on land area for the 2013 and 2016 surveys, as no “city” field existed for these survey years.

3.2.2. Sample Sizes

Table 3.2.2 displays the respondent numbers for each demographic and survey year.

Table 3.2.2. Survey Respondent Numbers by Demographic

Number of Survey Participants by Demographic Group			
Age	**2006**	**2013**	**2016**
18-34	--	--	473
35-44	--	--	481
45-54	--	--	511
55-64	--	--	494
65+	--	--	442
Total	--	--	2401

Economic Status	2006	2013	2016
Distressed	--	381	197
At-Risk	--	628	503
Not Distressed	--	1711	1736
Total	--	2720	2436
Super District	**2006**	**2013**	**2016**
1E	127	170	176
1W	100	304	175
1C	221	240	250
2N	112	225	177
2E	293	181	250
2W	80	186	151
3S	251	212	201
3E	170	348	250
3W	147	158	235
4N	93	215	158
4E	199	190	163
4W	176	292	250
Total	1969	2721	2436
Gender	**2006**	**2013**	**2016**
Male	1168	1442	1222
Female	868	1287	1208
Total	2036	2729	2430
Hispanic Ancestry	**2006**	**2013**	**2016**
Hispanic	59	125	129
Not Hispanic	1953	2604	2307
Total	2012	2729	2436
Income	**2006**	**2013**	**2016**
Under $25,000	456	426	324
Over $25,000	1310	1955	1830
Total	1766	2381	2154
Race/Ethnicity	**2006**	**2013**	**2016**
African American/Black	119	368	366
Caucasian/White	1822	2131	1785
Other	42	215	216
Total	1983	2714	2367
TDOT Region	**2006**	**2013**	**2016**
1	506	660	601
2	522	636	578
3	499	708	686
4	509	716	571
Total	2036	2720	2436

Urban vs. Rural	2006	2013	2016
MPO	973	1359	1374
RPO	1059	1360	1062
Total	2032	2719	2436
Physical Disability	**2006**	**2013**	**2016**
Physical Disability	320	384	326
No Physical Disability	1654	2292	2018
Total	1974	2676	2344
Primary Language	**2006**	**2013**	**2016**
English	--	2568	2242
Other	--	146	123
Total	--	2714	2365

3.2.3. Checking for Accurate Representation

The number of survey respondents for each demographic was checked with recorded demographic data to ensure a representative sample size was used during survey distribution. The percentage of survey respondents of each demographic was compared with the percentage of Tennessee's population of each demographic. The differences were minimal, which indicates a representative sample for each analyzed demographic.

3.2.4. Percentage of "Don't Know" Responses

Because the number of respondents varied by survey year, "No. of Don't Knows" was expressed as a percentage of the total respondents for each demographic group. The axes for the "% Don't Know" graphs were standardized across demographic groups but not across questions. This analysis was of interest to determine if there were any significant differences within the demographic groupings in terms of the questions each group was unable to answer. This was deemed important as it could indicate potential issues in information dissemination or communication with a particular demographic group.

3.3. Evaluating Trends Over Time

Survey responses were also analyzed across the survey years. To perform this analysis, spreadsheets were used to construct bar graphs visualizing means and "Don't Know" responses over time using basic descriptive statistics. Additionally, for all demographic groups, differences over time were calculated by subtracting the mean values for each matched question from 2016 to 2006 and from 2016 to 2013. Negative values denote downward trends in user perception and positive data denote upward trends in user perception over time. Initial screening was used to identify differences greater than 0.5 for further statistical testing, as this threshold was used for practical significance. For items above this threshold,

additional statistical tests for significance were conducted. Due to the nature of the Likert-Scale data, the Mann-Whitney U test was used to compare survey trends over time.

Chapter 4. Statewide Customer Survey Analysis Results

4.1. Analysis of the Survey Instrument

A frequency analysis of the mean responses was completed for all three surveyed years. The histograms in Figure 4.1.1 displays the frequency of the mean responses for all questions using a 5-point Likert scale across the three surveyed years, where a rating of 5 indicated most satisfied and 1 indicated least satisfied with a particular topic. Figure 4.1.1 shows that the majority of the mean responses fall between 3.5 and 4.5 for all three years indicating that respondents are somewhat satisfied with TDOT services for most issues presented in the survey. The "Don't Know" responses were analyzed to determine the presence of trends across the survey. Figure 4.1.2 through Figure 4.1.4 display the "Don't Know" responses for the three surveys.

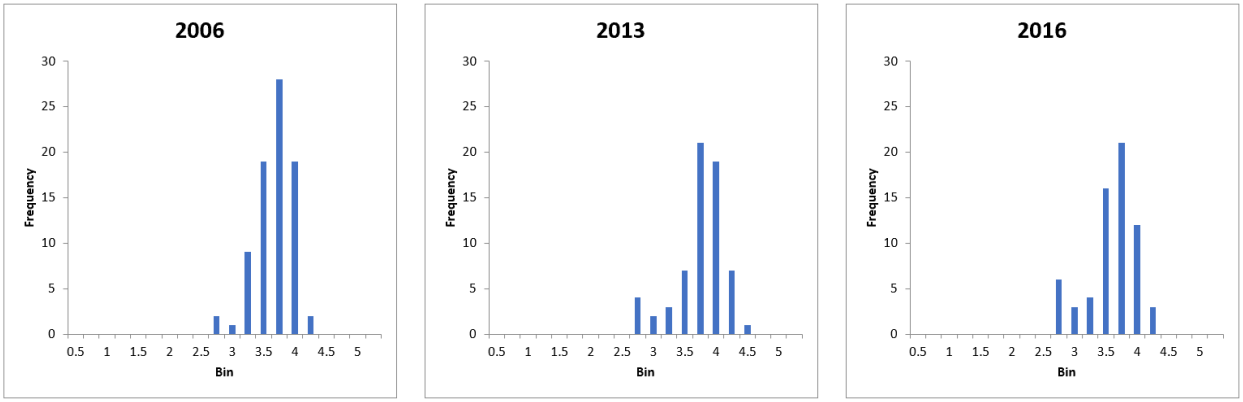

Figure 4.1.1. Mean Response Frequency for All Three Years

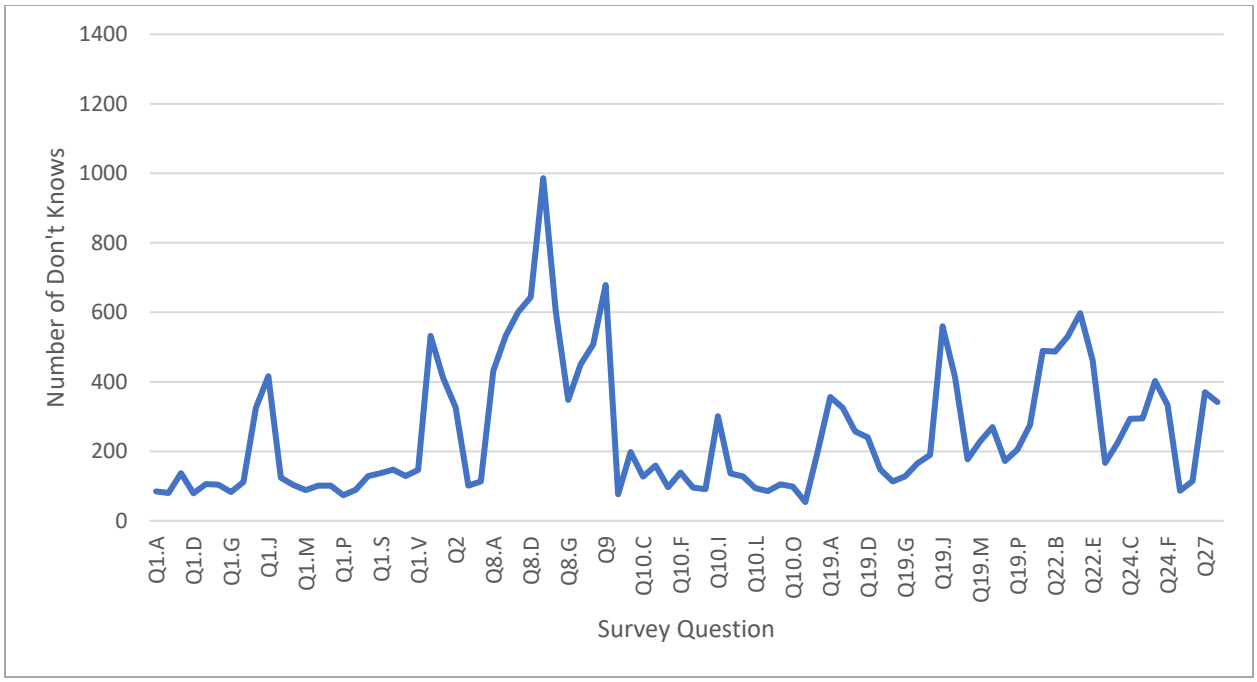

Figure 4.1.2. Don't Know Responses for the 2006 Survey

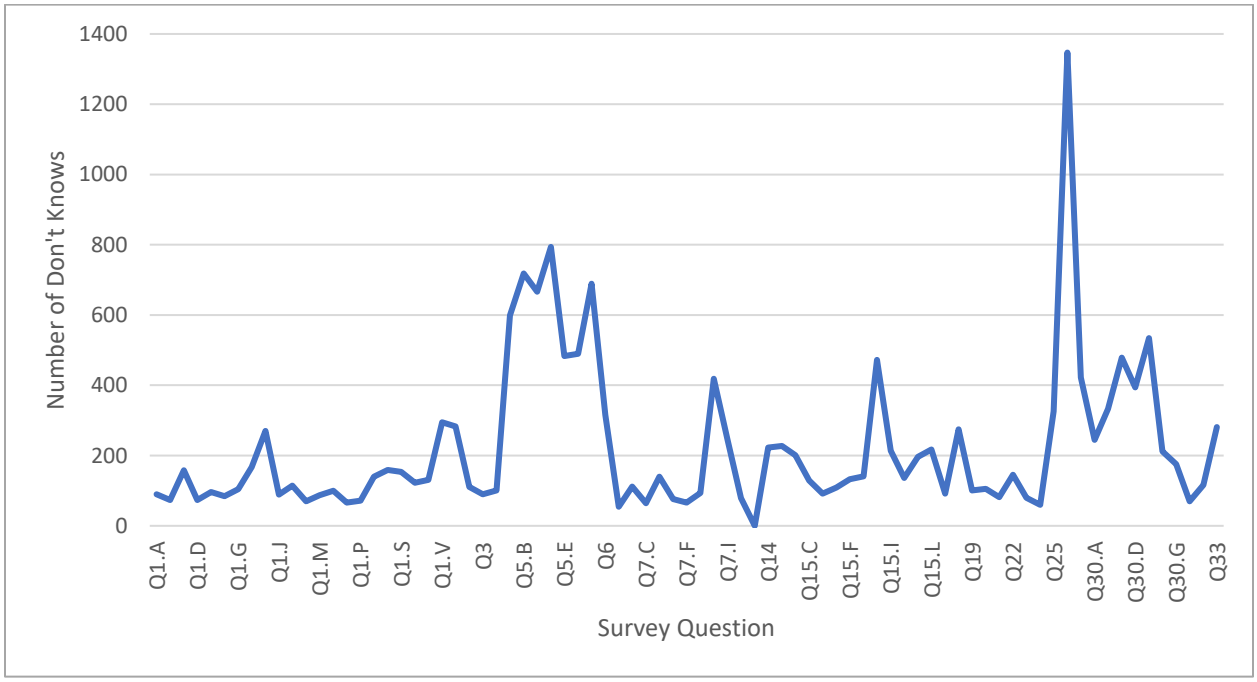

Figure 4.1.3. Don't Know Responses for the 2013 Survey

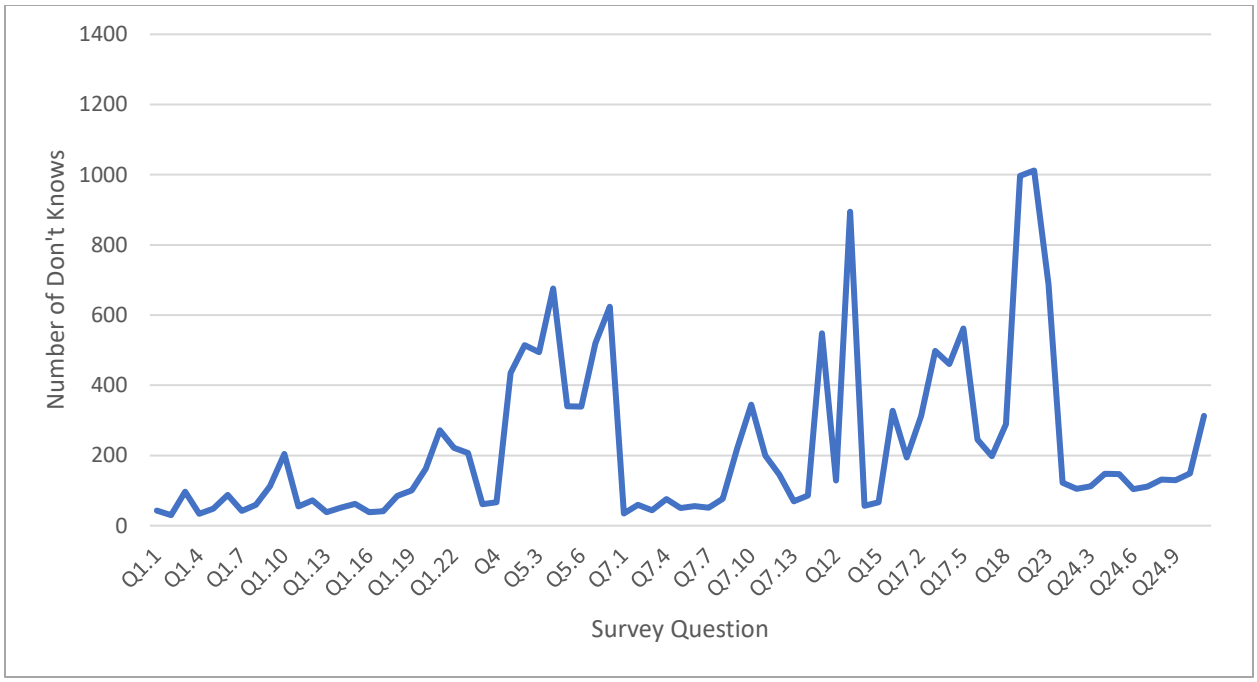

Figure 4.1.4. Don't Know Responses for the 2016 Survey

Figures 4.1.2 through 4.1.4 indicate that there is a slight increase in the number of underlying "Don't Know" responses as the survey progresses, excluding the few spikes in the data. This increase is potentially a result of the survey respondents marking "Don't Know" as a means of finishing the survey quickly due to survey fatigue. The figures also indicate that questions pertaining to public transportation services and pedestrian facilities have an increased number of "Don't Know" responses. Additionally, questions pertaining to the environmental concerns of TDOT and the value of transportation taxes also have an increased number of "Don't Know" responses across all three surveys. These results indicate a lack of customer familiarity in these particular areas and a need for additional outreach and communication campaigns.

For additional clarity of responses about the average (i.e., 3 on the Likert Scale thus representing neutral), visual analysis was developed on the survey responses for all three surveys using a Likert Scale of 1 (Very Dissatisfied) to 5 (Very Satisfied), as shown in Figure 4.1.5 through Figure 4.1.7. The positive x-axis indicates the percentage of respondents who felt 4 (Satisfied) or 5 (Very Satisfied). The negative x-axis indicates the percentage of respondents who felt 1 (Very Dissatisfied) or 2 (Dissatisfied) as it pertains to the indicated survey question. The percentage of 3 (neutral) responses are split equally between the positive x-axis and negative x-axis. As a result, questions with a more positive reaction will be skewed more to the right of zero, while questions with more negative reactions will be skewed left. For 2006,

Figure 4.1.5 displays that the majority of questions had a more positive response. Question 19 (parts F and O) had the greatest number of 5 (Very Satisfied) responses, indicating an overall satisfaction with Transportation Investments. Question 8 had the most negative response, indicating a slight dissatisfaction with public transportation and pedestrian facilities. Question 8 (parts B, C, H, and I) all had approximately 40% of respondents indicate a 1 (Very Dissatisfied) or 2 (Dissatisfied) response.

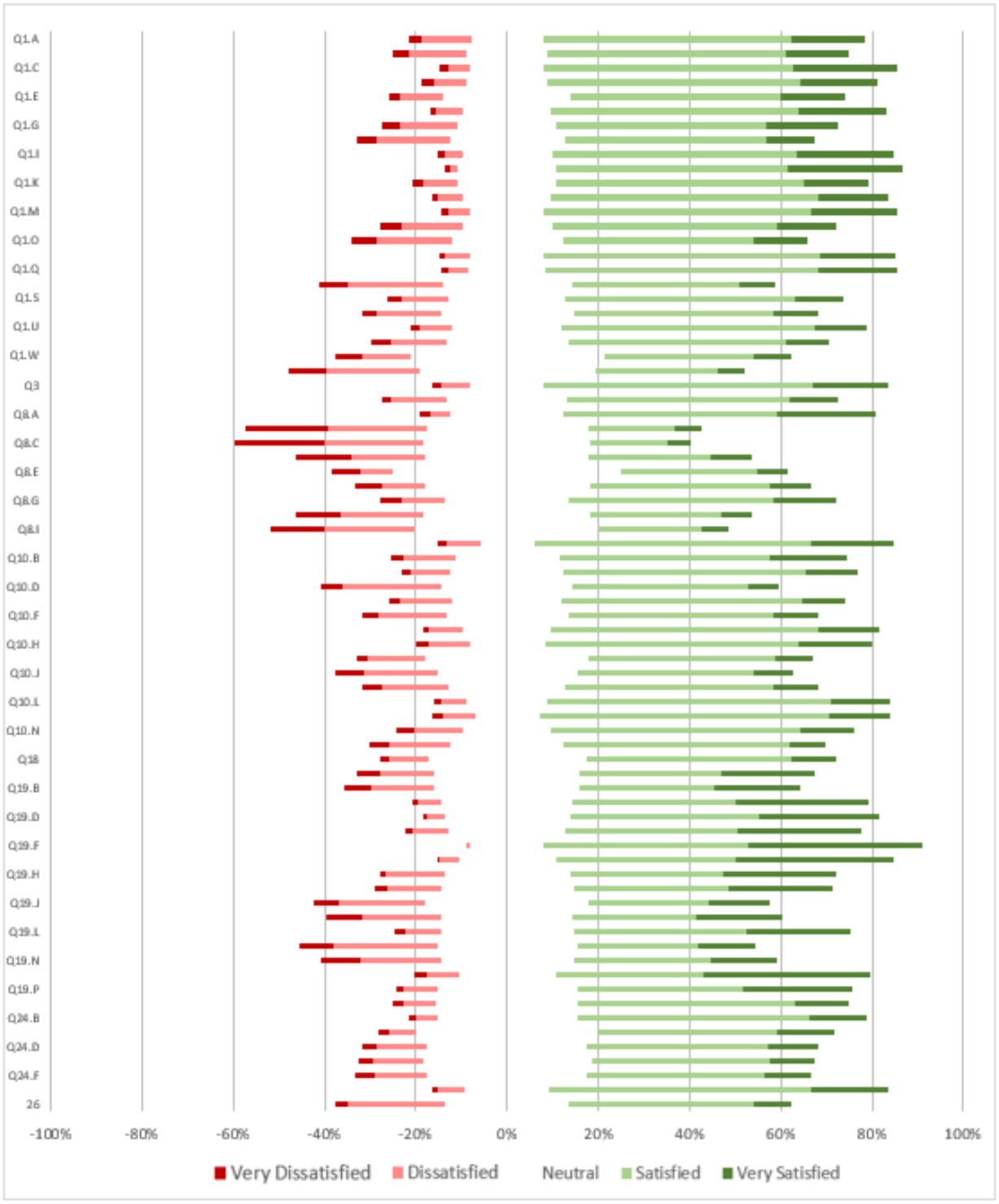

Figure 4.1.5. Data Analysis of 2006 Survey Questions using the Likert Scale

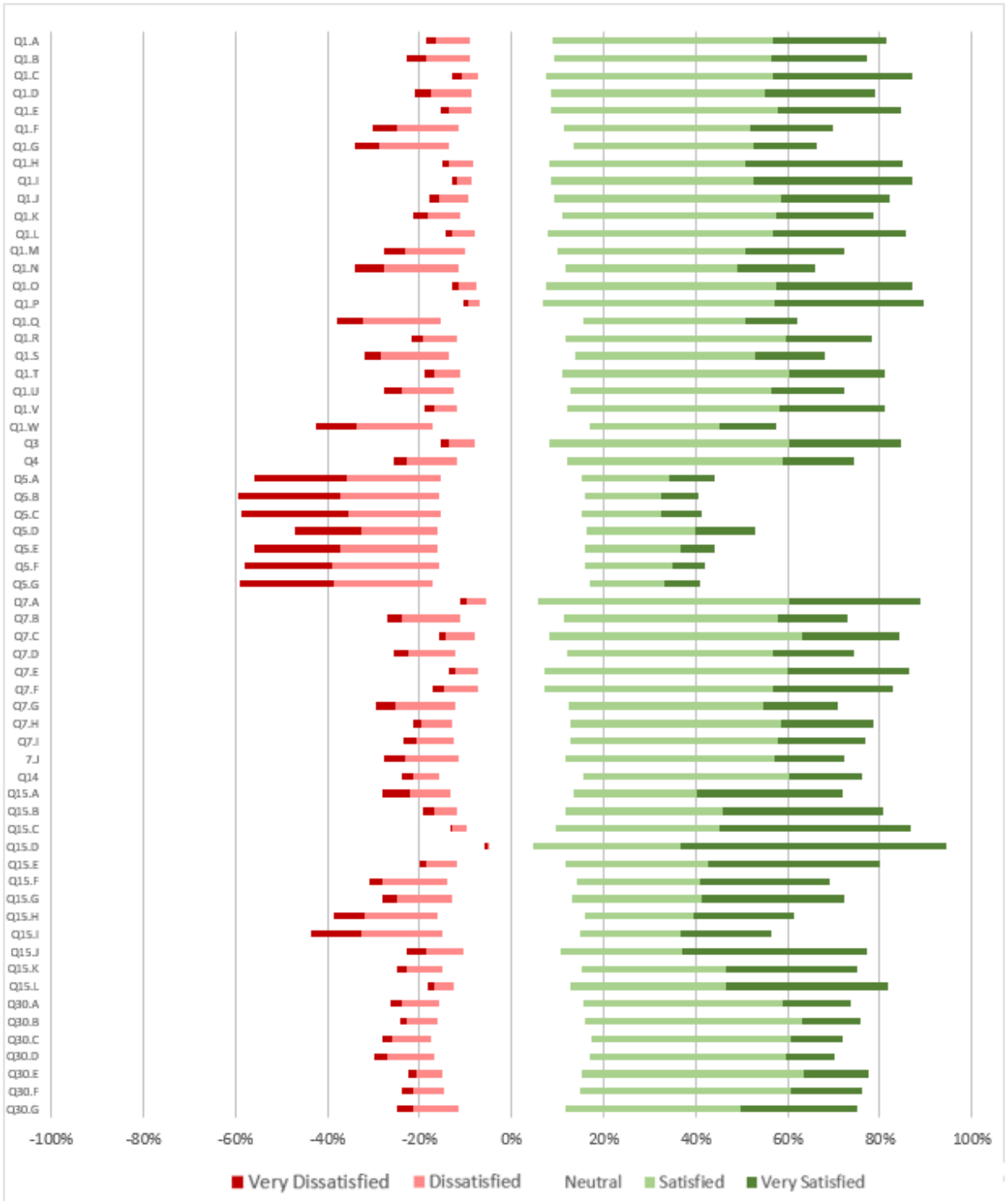

Figure 4.1.6. Data Analysis of 2013 Survey Questions using the Likert Scale

For 2013, Figure 4.1.6 indicates that the majority of questions had a more positive response. Question 15 (parts D and J) have the greatest number of 5 (Very Satisfied) responses. The exception is Question 5 regarding public transportation and pedestrian facilities which has a more negative response.

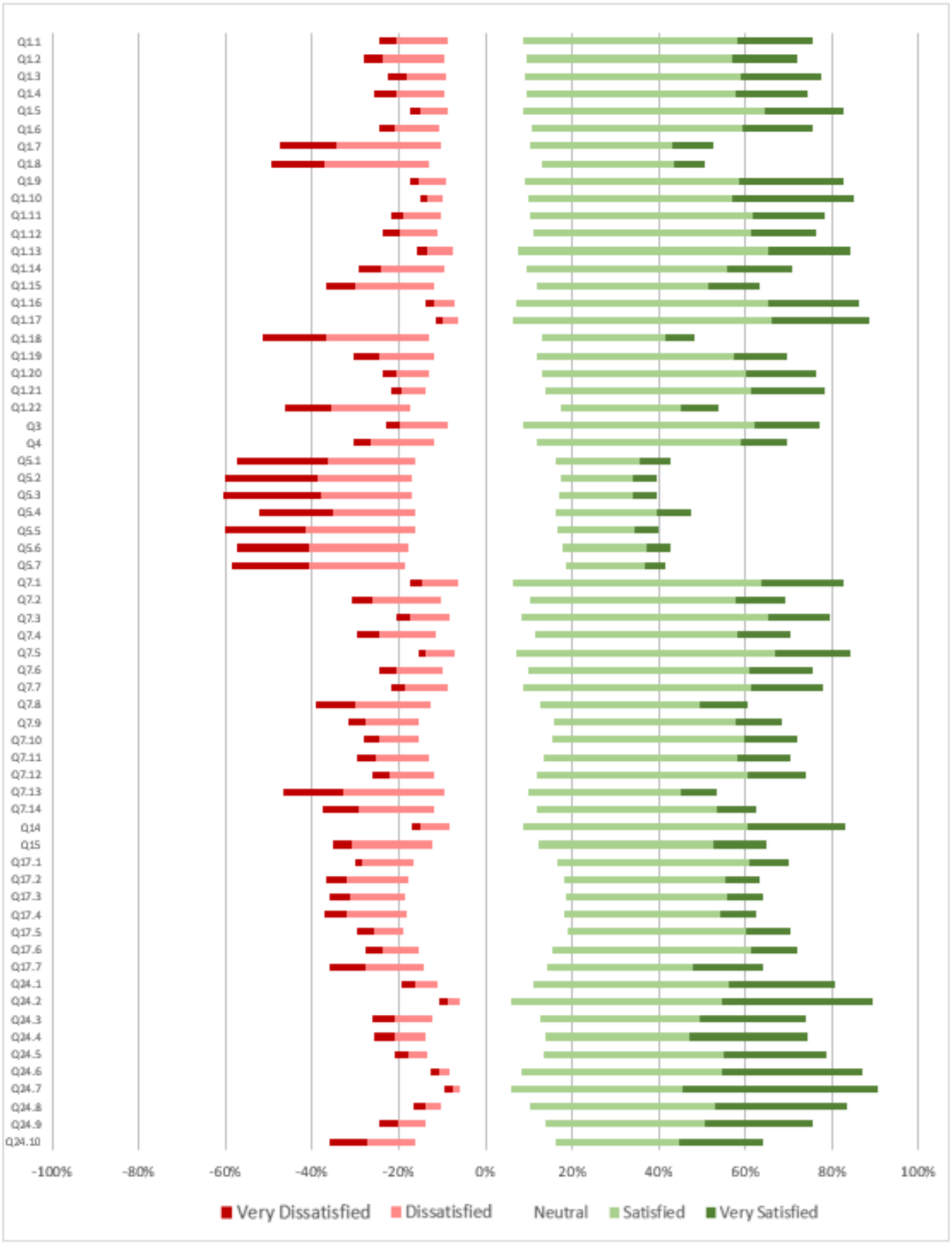

Figure 4.1.7. Data Analysis of 2016 Survey Questions using the Likert Scale

For 2016, Figure 4.1.7 indicates that the majority of questions also had a more positive response. Questions 1 (parts 16 and 17) and 24 (parts 2, 6, 7, and 8) had the most positive response, indicating agreeable perceptions to TDOT investments and the implementation of warning signs. Question 5 had the most negative response overall indicating dissatisfaction with public transportation and pedestrian facilities. Across all three surveyed years, there is a more positive reaction overall. Items related to TDOT investments consistently have the most positive responses and the public transportation and pedestrian facilities consistently have the most negative responses.

4.2. Overall Trends in Survey Responses

In general, the percent of "Don't Know" responses decreased across survey years from 2006 to 2016. This may point to success on TDOT's part in communicating with the public. The means for all questions rated on a scale of 1 to 5 tend to hover in the 3.5-4.0 range, between "neutral" and "satisfied". This lack of variation could be a result of survey fatigue, as discussed previously.

The question regarding the primary language spoken in the household was analyzed to determine the most frequent primary household language other than English. This analysis was conducted for only the 2006 and 2016 surveys given the 2013 data did not include this free response answer. Figure 4.2.1 displays the results of the analysis for the 2006 survey respondents.

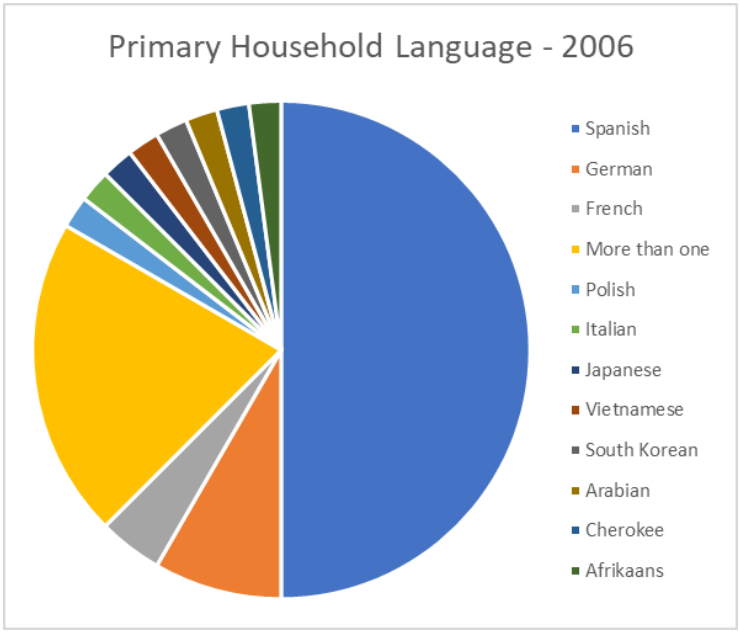

Figure 4.2.1. Non-English Primary Household Language of 2006 Survey Respondents

Figure 4.2.2 displays the results of the analysis for the 2016 survey respondents.

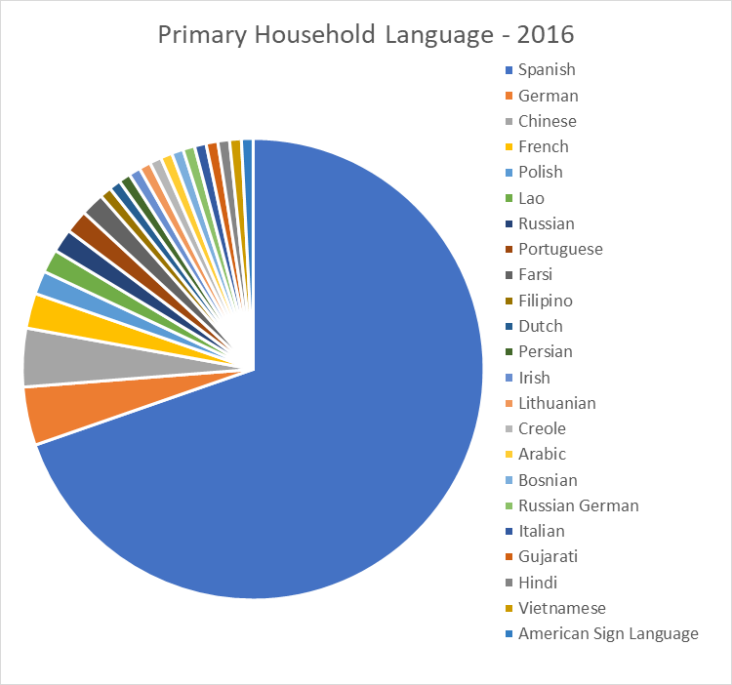

Figure 4.2.2. Non-English Primary Household Language of 2016 Survey Respondents

Figure 4.2.1 and Figure 4.2.2 indicate that the primary household language other than English is Spanish for both the 2006 and 2016 survey. The next most common languages are German, Chinese, and French. It is interesting to note the rather dramatic increase in number of languages reported – from twelve in 2006 to twenty-five in 2016.

In the following sections of the report, we highlight interesting trends, significant differences between demographics and across time, and visualize spatial differences. If no analyses are reported for a demographic group, this means the data was essentially consistent across categories with no differences observed. The remaining analyses are divided into sections based upon the topic of the questions in the survey: maintaining the transportation system, public transportation and pedestrian facilities, perception of highway travel, TDOT communication, overall ratings, and TDOT investments. For each topic area, results for each demographic group are presented. In each section, general findings for the topic overall are presented followed by results for each demographic group. Full analyses for each demographic grouping with trends over time is provided in Dataset II.

4.3. Maintaining the Transportation System

Survey participants were asked to respond to twenty-five (25) questions regarding the maintenance and management of Tennessee's transportation system. Question 1 asked them to rate TDOT's efforts to maintain the transportation system regarding various focus areas. Question 2 asked them to rank the focus areas they thought should receive the most attention from TDOT over the next two years. Questions 3 and 4 asked participants to rate TDOT's overall satisfaction with maintaining interstates and other state highways, respectively. Table 4.3.1 displays the topics of each of the questions and their corresponding question numbers (see Table 3.1.1) from each survey year.

Table 4.3.1. Survey Questions Concerning the Maintenance of Tennessee's Transportation System

Maintenance of Tennessee's Transportation System			
2006	**2013**	**2016**	**Topic**
1A	1A	1.1	Removing debris
1B	1B	1.2	Picking up litter
1C	1C	1.3	Removing snow and ice
1D	1D	1.4	Mowing and trimming greenery
1F	1E	1.5	Maintaining guardrails and barriers
1V	1U	1.6	Ensuring proper drainage of highways
1G	1F	1.7	Condition of interstate surfaces
1H	1G	1.8	Condition of other highway surfaces
--	1H	1.9	Providing rest areas
1I	1I	1.10	Cleaning rest areas
1K	1J	1.11	Maintaining shoulders
1L	1K	1.12	Maintaining bridges
1M	1L	1.13	Striping visibility during the day
1N	1M	1.14	Striping visibility at night
1O	1N	1.15	Striping visibility in wet weather
1P	1O	1.16	Info/warning sign visibility
1Q	1P	1.17	Info/warning sign coherency
1R	1Q	1.18	Minimizing urban congestion
1S	1R	1.19	Minimizing rural congestion
8A	1V	1.20	HELP truck incident management
8A	1V	1.21	HELP truck motorist assistance
1X	1W	1.22	Alternative modes of transportation
2	2	2	Most emphasis from TDOT (From Question 1)
3	3	3	Maintenance of Interstates
4	4	4	Maintenance of state highways

Note: Question 1 is scaled 1-5 ("Very Dissatisfied" to "Very Satisfied"). Question 2 requires respondent to rank (1st to 3rd). Questions 3 and 4 are scaled 1-5 ("Very Dissatisfied" to "Very Satisfied").

To analyze Question 2, focus areas were categorized for visualization purposes and are displayed in Table 4.3.2.

Table 4.3.2. Question 2 Categorization

Category	Focus Areas
Surfaces	Interstate surfaces Other highway surfaces
Congestion	Minimizing urban congestion Minimizing rural congestion
Roadside Maintenance	Removing debris Mowing and trimming Picking up litter Maintaining landscaping
Infrastructure Maintenance	Maintaining shoulders Maintaining bridges Maintaining guardrails and barriers
Weather	Removing snow and ice Ensuring proper drainage
Striping visibility	Striping visibility in wet weather Striping visibility at night Striping visibility during the day
Multimodal	Modal options Providing park and ride facilities
HELP Trucks	HELP trucks HELP truck incident management HELP truck motorist assistance
Rest areas	Providing rest areas Cleaning rest areas Rest area access for persons w/disabilities
Signage	Info/warning sign visibility Info/warning sign coherency
Lighting	Lighting at rural interchanges Lighting at urban interchanges

4.3.1. General Findings

For question 2, maintaining highway surfaces was consistently the most important topic for survey participants, and increasingly so. Additionally, striping visibility was less important in 2016 than it was in the earlier survey years, as depicted in Figure 4.3.1.

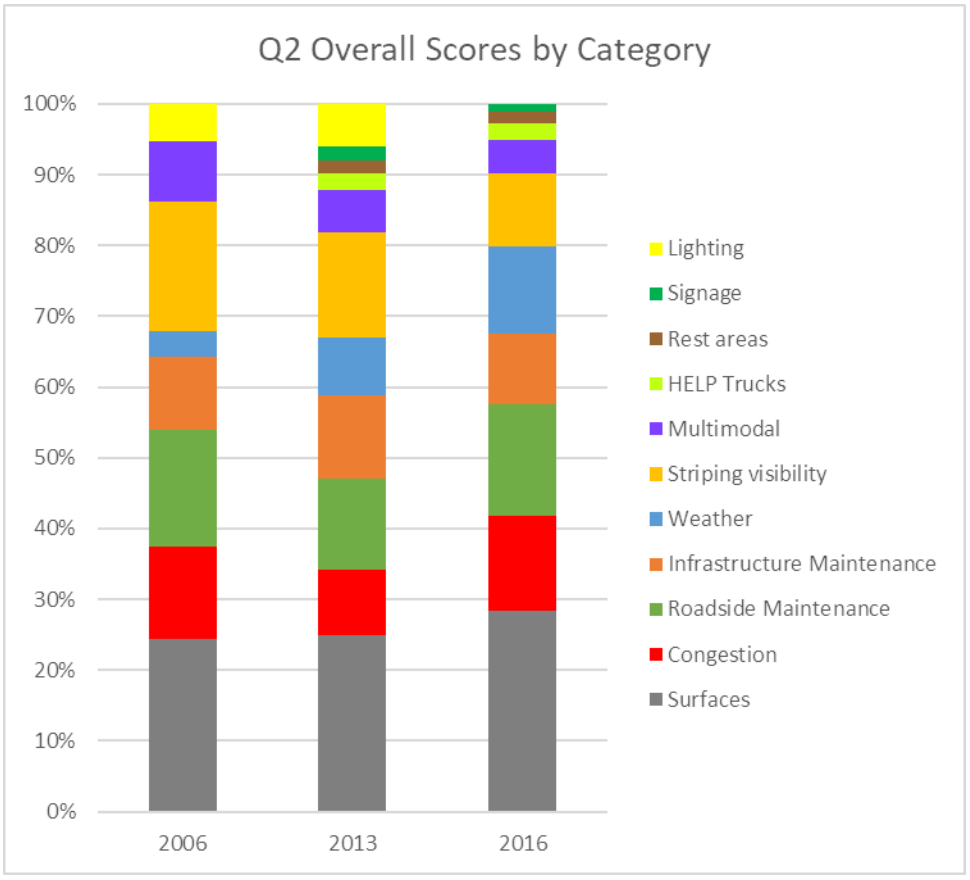

Figure 4.3.1. Weighted Score Comparison for Question 2, Grouped by Category

Not surprisingly, HELP trucks have gotten more awareness over the years. As shown in Figure 4.3.2, the percent of respondents replying “Don’t Know” when asked about HELP trucks has decreased over the years, especially for incident clearance.

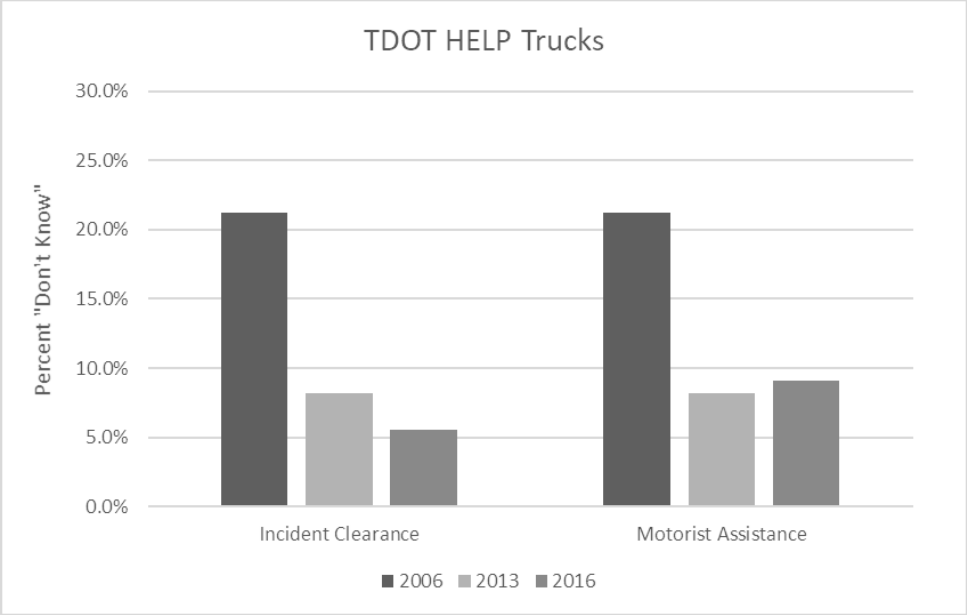

Figure 4.3.2. “Don’t Know” Responses for Questions 1.20 and 1.21

For questions 3 and 4, means across all demographic groups and survey years were around 3.5-4.0, which is between “neutral” and “satisfied”. As shown in Table 4.3.3, the means for question 4 were around 0.2 less than those for question 3, suggesting that residents perceive that TDOT does a slightly better job maintaining Interstates than maintaining other state highways. However, the difference between the ratings is small and not likely to be of practical significance.

Table 4.3.3. Overall Mean Ratings for Questions 3 and 4

Survey Year	Q3 (Interstates)	Q4 (Other State Highways)
2006	3.821	3.527
2013	3.880	3.580
2016	3.651	3.444

4.3.2. Age

No notable differences were identified for any of the maintenance items when examined according to age of respondents.

4.3.3. County Economic Status

Means for all maintenance-related questions tended to decrease from 2013 to 2016 for all demographics. This difference was always the most pronounced for distressed counties, as shown in Figure 4.3.3.

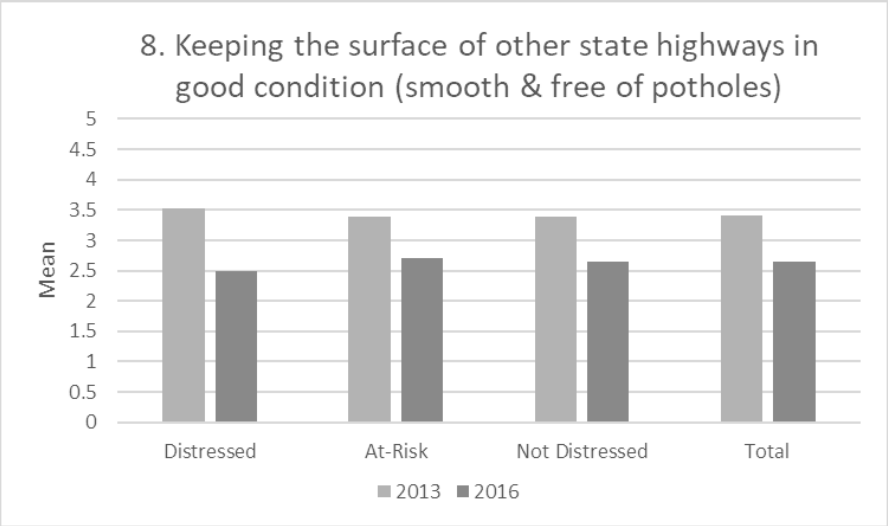

Figure 4.3.3. Mean Rating for Question 1.8 by Economic Status

When asked to rank priorities in Question 2, maintaining bridges arose as a higher priority in distressed and at-risk counties than in non-distressed counties in 2013. In 2016, maintaining bridges was an approximately equal priority for all economic statuses. Detailed in Table 4.3.4, this change may suggest a success on TDOT's part in maintaining bridges in distressed and at-risk counties in the years between 2013 and 2016. Table 4.3.4 shows how maintaining bridges ranked in the weighted score analysis for question 2 and the percentage of the total weighted score it received.

Table 4.3.4. Rank and Share of Total Score for "Maintaining Bridges" in Question 2 by Economic Status

Year	Distressed		At Risk		Not Distressed	
	Rank	% of Weighted Score	Rank	% of Weighted Score	Rank	% of Weighted Score
2013	5	6.2%	3	6.6%	7	5.9%
2016	9	5.2%	8	5.7%	8	4.7%

Interestingly, Question 1.12 shows a *decrease* in means between 2013 and 2016 for all economic statuses, with nearly a one-point drop in rating by persons from distressed counties, as shown in Table 4.3.5. This suggests that residents perceive that bridges have dropped in TDOT's priority for maintenance.

Table 4.3.5. Mean Responses for Question 1.12 by Economic Status

Q1. Maintaining and Managing the Transportation System		
12. Keeping bridges in good condition		
Mean		
Economic Status	**2013**	**2016**
Distressed	3.860	2.996
At-Risk	3.682	3.294
Not Distressed	3.763	3.268
Total	***3.758***	***3.250***

4.3.4. Gender

For Question 2, men have grown less concerned with congestion (red) and more concerned with roadside maintenance (green), while women have grown significantly more concerned about road surfaces (gray) and slightly more concerned with congestion (red). It is unclear what may be causing these gender-based shifts in perception. The results are shown in Figure 4.3.4.

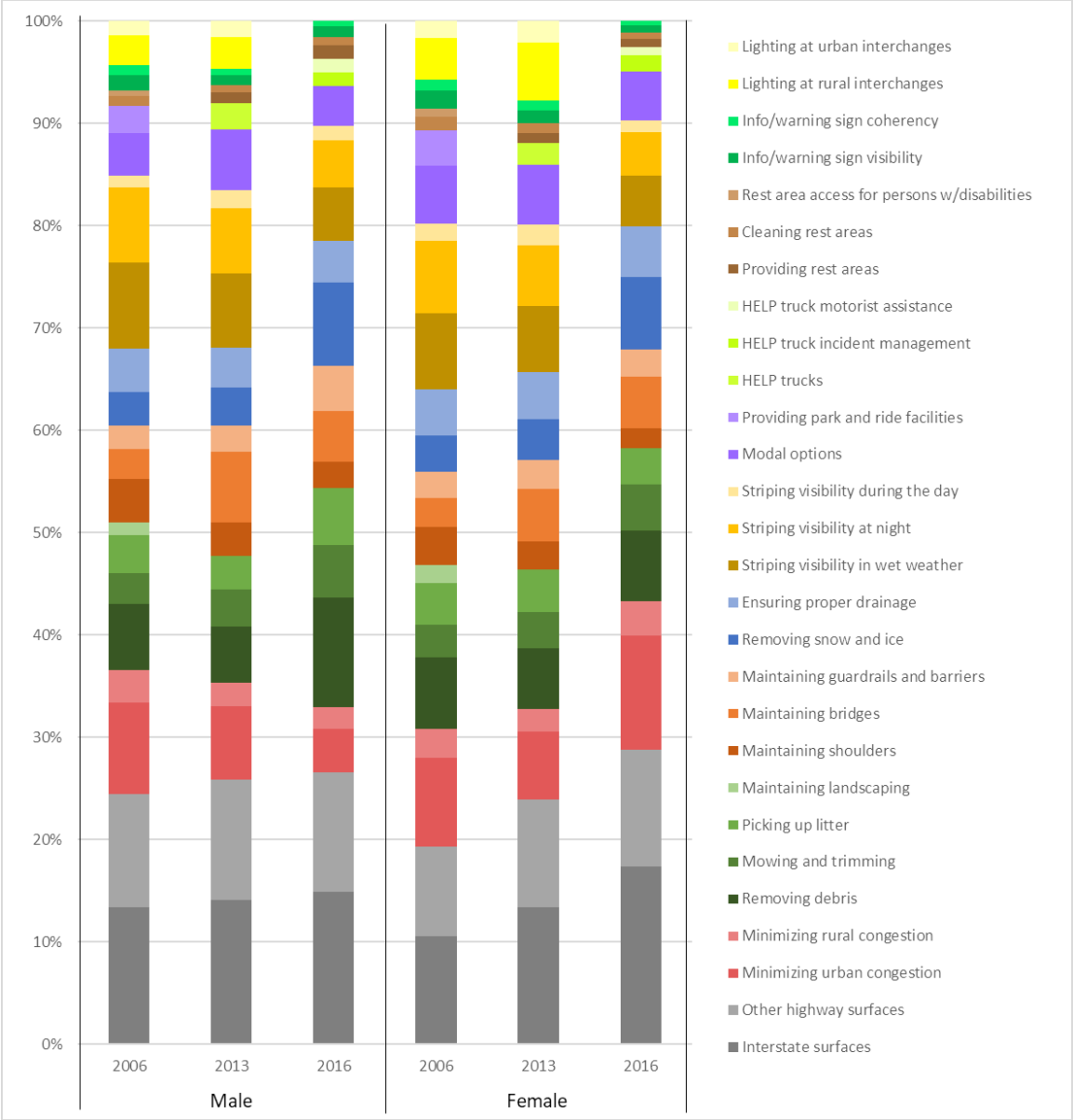

Figure 4.3.4. Percentage of Total Weighted Score for Question 2 by Gender

4.3.5. Hispanic vs. Non-Hispanic

No significant differences were found between Hispanic and Non-Hispanic residents for any maintenance items on the surveys.

4.3.6. Income

As shown in Figure 4.3.5, the percentage of "Don't Know" responses were consistently higher for lower-income respondents for all maintenance-related items.

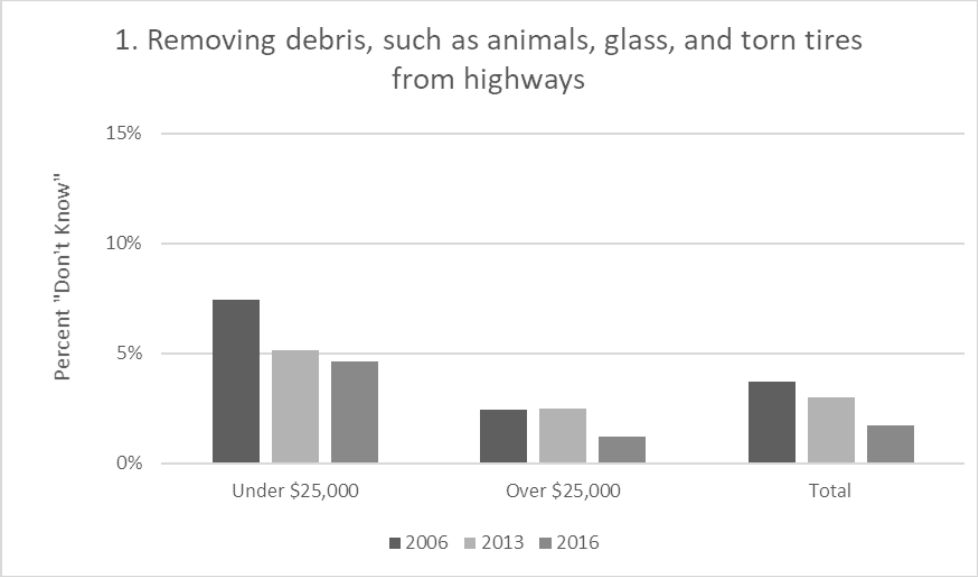

Figure 4.3.5. “Don’t Know” Responses for Question 1.1 by Income

In Question 2, people with lower income consistently prioritized roadside maintenance (green segments) while those with higher income consistently prioritized congestion (red segments), as shown in Figure 4.3.6. Interestingly, there was no significant difference in the means for these topics in Question 1. The congestion difference could be a factor of employment or urban/rural location. The roadside maintenance finding may indicate lower income residents experience greater roadside maintenance issues than higher income residents.

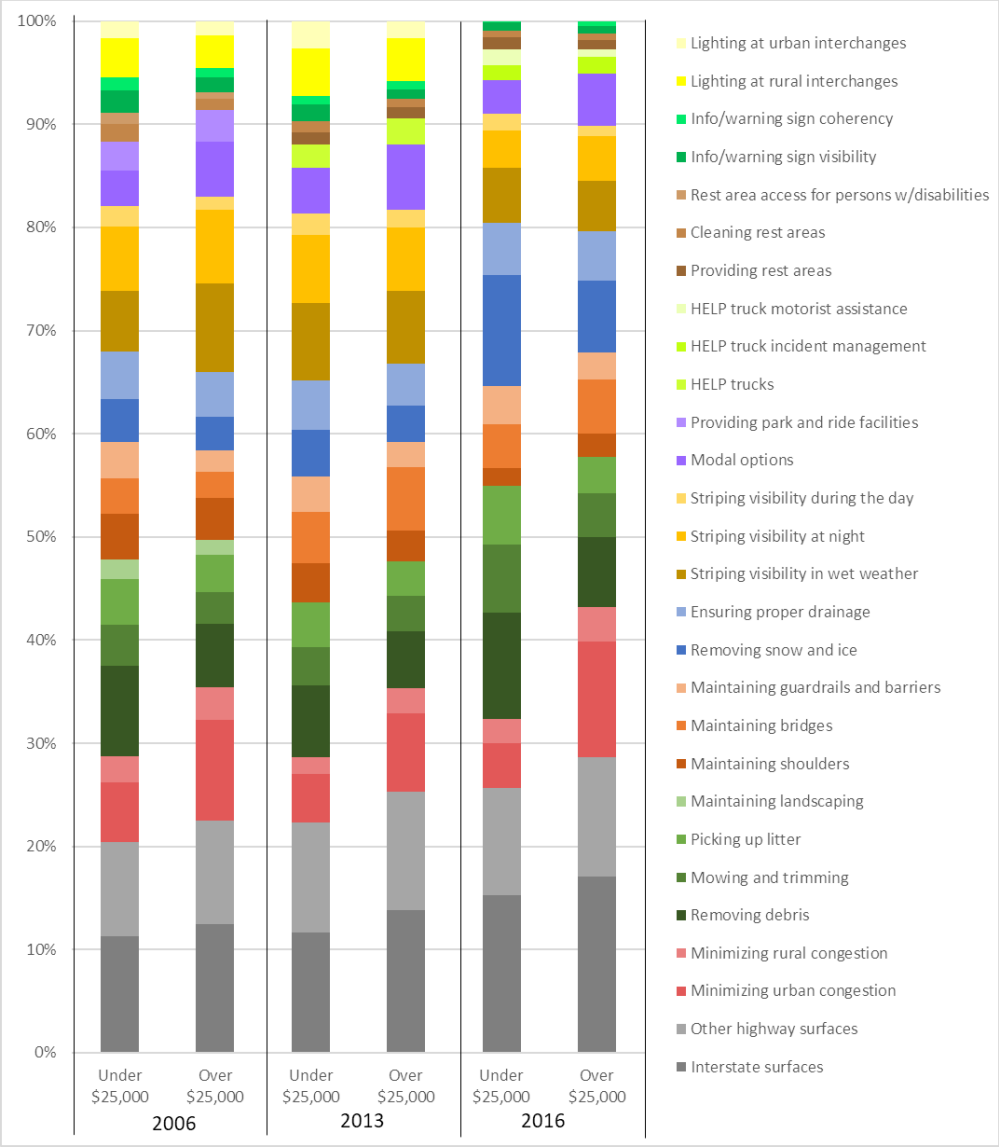

Figure 4.3.6. Percentage of Total Weighted Score for Question 2 by Income

4.3.7. Physical Disability

The percentage of "Don't Know" responses tended to be higher for people with disabilities than for people without disabilities. This could be due simply to a small sample size or because people with disabilities tend to drive less. In Question 2, people without disabilities tended to prioritize congestion more than people with disabilities, perhaps also due to driving less.

Table 4.3.6 displays the top five priorities for Question 2 for respondents with and without disabilities.

Table 4.3.6. Top 5 Priorities for Question 2 by Disability

	Rank	2006	2013	2016
Disability	**1**	Interstate surfaces	Other highway surfaces	Interstate surfaces
	2	Other highway surfaces	Interstate surfaces	Other highway surfaces
	3	Removing debris	Maintaining bridges	Removing debris
	4	Striping visibility at night	Striping visibility in wet weather	Removing snow and ice
	5	Striping visibility in wet weather	Minimizing urban congestion	Picking up litter
No Disability	**1**	Interstate surfaces	Interstate surfaces	Interstate surfaces
	2	Other highway surfaces	Other highway surfaces	Other highway surfaces
	3	Minimizing urban congestion	Minimizing urban congestion	Minimizing urban congestion
	4	Striping visibility in wet weather	Striping visibility in wet weather	Removing snow and ice
	5	Striping visibility at night	Striping visibility at night	Removing debris

4.3.8. Primary Language

No significant differences were found between people who primarily speak English and people who primarily speak other languages for any maintenance items on the survey.

4.3.9. Race and Ethnicity

No significant differences were found between race/ethnicity groupings for any maintenance items on the survey.

4.3.10. Super District

Survey responses were grouped by TDOT super districts, which are subdivisions of the larger TDOT regions with similar geographies. Super districts can be used to better understand differences in survey results and make appropriate decisions. Figure 4.3.7 shows a map of the super districts.

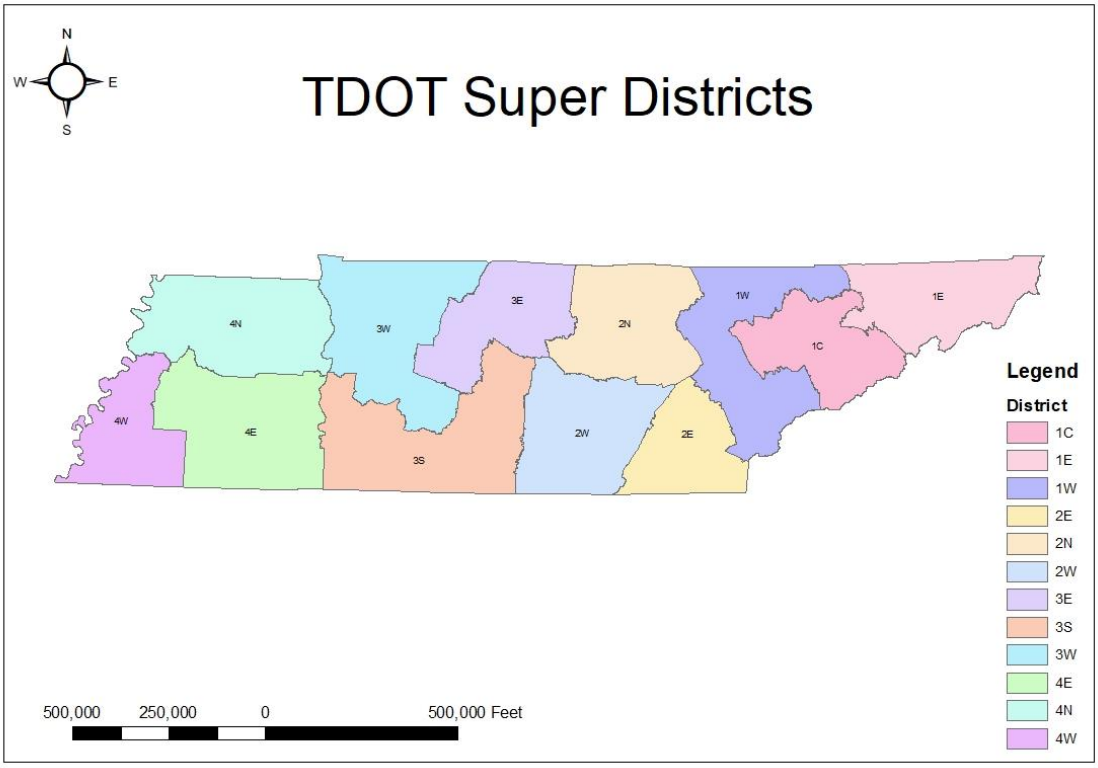

Figure 4.3.7. TDOT Super District Map

District 3E stands out for its emphasis on minimizing congestion in Question 2. This item was the top-ranking factor in all survey years. In fact, District 3E was the only super district in which "interstate surfaces" was not the top priority. Because this district includes the greater Nashville area (excluding Rutherford County), this trend suggests residents are experiencing increasing congestion due to the rapid growth in the area and related highway construction. Table 4.3.7 displays the top five priorities of District 3E for Question 2.

Table 4.3.7. Top 5 Priorities for Question 2 of District 3E

Rank	2006	2013	2016
1	Minimizing urban congestion	Minimizing urban congestion	Minimizing urban congestion
2	Interstate surfaces	Interstate surfaces	Interstate surfaces
3	Striping visibility in wet weather	Other highway surfaces	Modal options
4	Other highway surfaces	Modal options	Other highway surfaces
5	Striping visibility at night	Striping visibility in wet weather	Minimizing rural congestion

4.3.11. TDOT Region

For Question 2, priorities between regions have diverged since 2006, as Region 3 has prioritized minimizing congestion and other regions have prioritized maintaining road surfaces. This could be due to the population of Middle Tennessee increasing faster than that of other regions. Meanwhile, Regions 1 and 4 especially have seen an increase in the priority of maintaining road surfaces. This could potentially be due to construction projects improving perceptions of TDOT's congestion mitigation efforts (so congestion was less of a priority) or media influence on the perception of the presence and severity of potholes (so road surfaces were more of a priority). Figure 4.3.8 displays the percentage of the total weighted score for Question 2 by region.

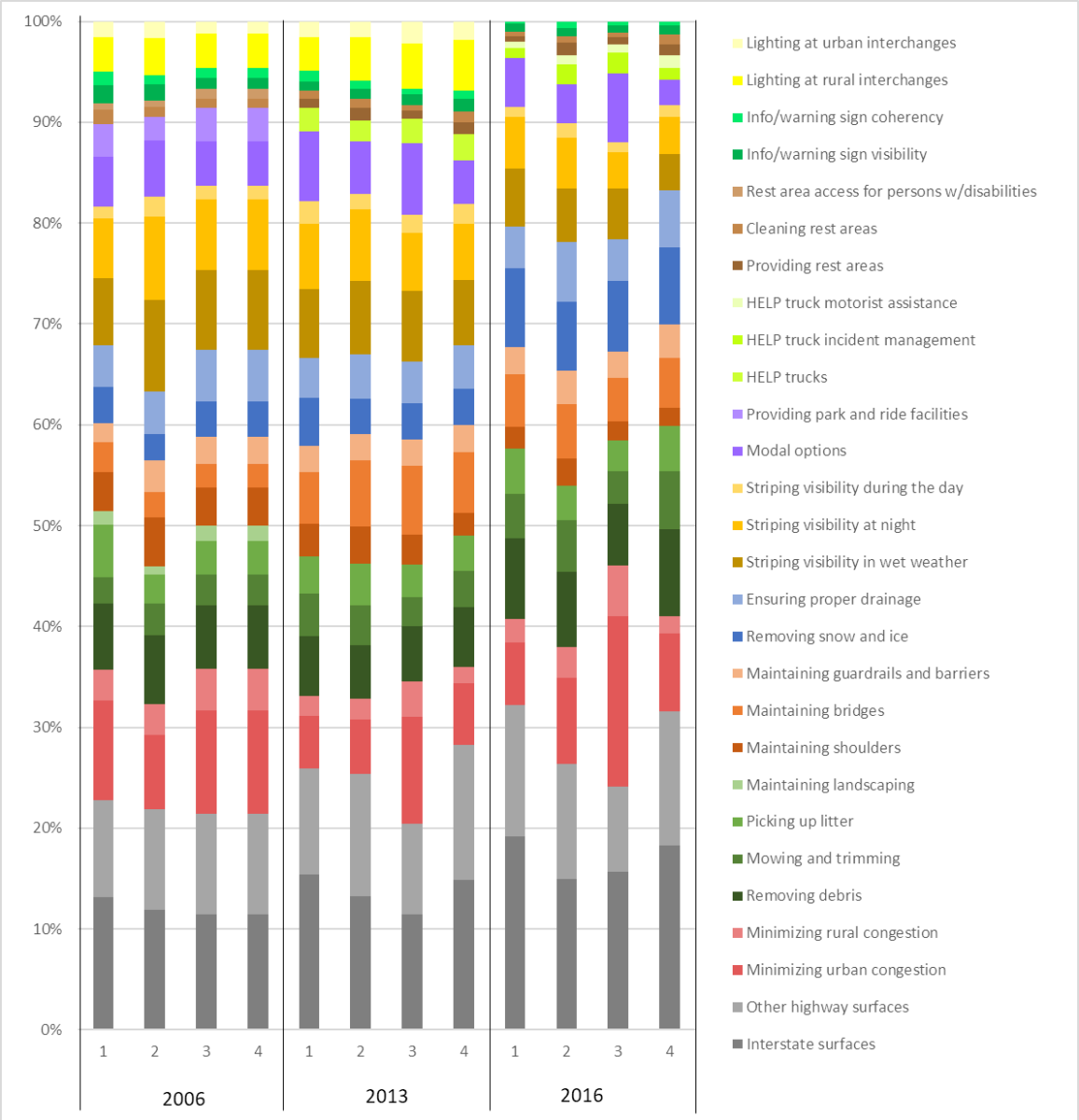

Figure 4.3.8. Percentage of Total Weighted Score for Question 2 by Region

4.3.12. Urban vs. Rural

As would be expected, perceived congestion received a lower rating for rural respondents whereas the opposite was true for urban respondents, as shown in Table 4.3.8.

Table 4.3.8. Top 5 Priorities for Question 2 by Urban vs. Rural

	Rank	2006	2013	2016
MPO	1	Interstate surfaces	Interstate surfaces	Interstate surfaces
	2	Minimizing urban congestion	Other highway surfaces	Minimizing urban congestion
	3	Other highway surfaces	Minimizing urban congestion	Other highway surfaces
	4	Striping visibility in wet weather	Striping visibility in wet weather	Removing debris
	5	Striping visibility at night	Modal options	Removing snow and ice
RPO	1	Interstate surfaces	Interstate surfaces	Interstate surfaces
	2	Other highway surfaces	Other highway surfaces	Other highway surfaces
	3	Striping visibility in wet weather	Maintaining bridges	Removing debris
	4	Striping visibility at night	Striping visibility in wet weather	Removing snow and ice
	5	Removing debris	Striping visibility at night	Minimizing urban congestion

4.4. Public Transportation and Pedestrian Facilities

Survey respondents were asked to respond to eight (8) questions regarding the efficiency and availability of public transportation and pedestrian facilities. Table 4.4.1 displays the topic areas for these 8 questions and the corresponding question/sub-question number in each survey.

Table 4.4.1. Survey Questions Concerning Public Transportation and Pedestrian Facilities

Public Transportation and Pedestrian Facilities			
2006	2013	2016	Topic
8.B	5.A	5.1	Availability of public transportation
8.C	5.B	5.2	Frequency of public transportation
---	5.C	5.3	Proximity to public transportation
8.D	5.D	5.4	Public transportation for elderly and disabled
8.H	5.E	5.5	Pedestrian facilities and sidewalks
8.I	5.F	5.6	Bicycle facilities
1.W	5.G	5.7	Park and ride facilities
9	6	6	Which three options for services do you think should receive the most emphasis from TDOT (from Question 5)

Note: Question 5 is scaled 1-5 ("Very Dissatisfied" to "Very Satisfied"). Question 6 requires respondent to rank (1st to 3rd).

4.4.1. General Findings

For all parts of Question 5, the percentage of "Don't Know" responses was consistently larger for the 2006 survey. This indicates that respondents in 2013 and 2016 were more familiar with or aware of public transportation and pedestrian facilities than in 2006. Figure 4.4.1 illustrates an example of the large difference in the percentage of "Don't Know" responses using the physical disability demographic.

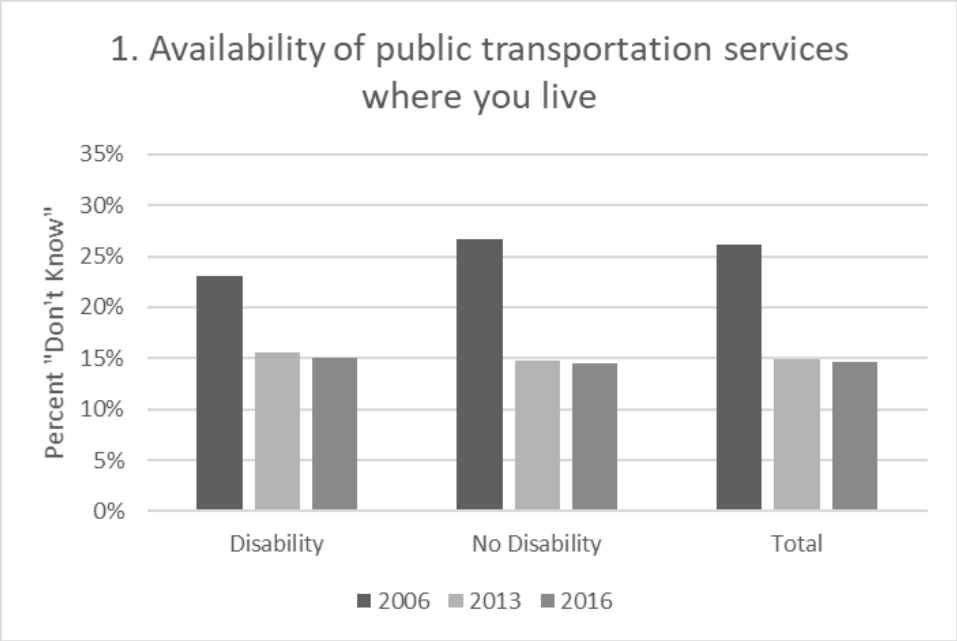

Figure 4.4.1. "Don't Know" Responses for Question 5.1 - Physical Disability

Question 6 asked respondents to rank the top three priorities from a list. The overall results are shown below (Table 4.4.2). Availability of public transportation and public transportation for elderly and disabled were consistently the top two rankings every survey year.

Table 4.4.2. Top 5 Public Transportation Focus Areas – Q6 – All Demographics

Rank	2006	2013	2016
1	Availability of public transportation	Availability of public transportation	Availability of public transportation
2	Public transportation for elderly and disabled	Public transportation for elderly and disabled	Public transportation for elderly and disabled
3	HELP trucks	Pedestrian facilities and sidewalks	Pedestrian facilities and sidewalks
4	Overall passenger air services	Park and ride facilities	Park and ride facilities
5	Frequency of public transportation	Bicycle facilities	Proximity to public transportation

Of note, the topic of HELP trucks was included on this question for the 2006 survey where it was included within Q2 for 2013 and 2016. The most significant difference over time was an increase in concern for pedestrian and bicycle facilities between 2006 and 2013, which may have been due to survey structure (i.e., 2006 had 9 options; 2013 and 2016 had 7 options) or more so likely due to increased emphasis across the state in expansion of bicycle and pedestrian facilities.

4.4.2. Age

For Question 5, the 18-34 age group consistently had a more positive response to items regarding public transportation and pedestrian facilities except for Question 5.7 (Park and Ride Facilities). Additionally, the 18-34 age group consistently had the greatest percentage of "Don't Know" responses in 2016, indicating that this age group is either unfamiliar with or are not regular users of public transportation and pedestrian facilities.

For Question 6, respondents in the 18-34 age group placed a lower emphasis on providing public transportation for the elderly and people with disabilities. Figure 4.4.2 displays the percent of total weighted score for Question 6 by the age of the respondent for the 2016 survey.

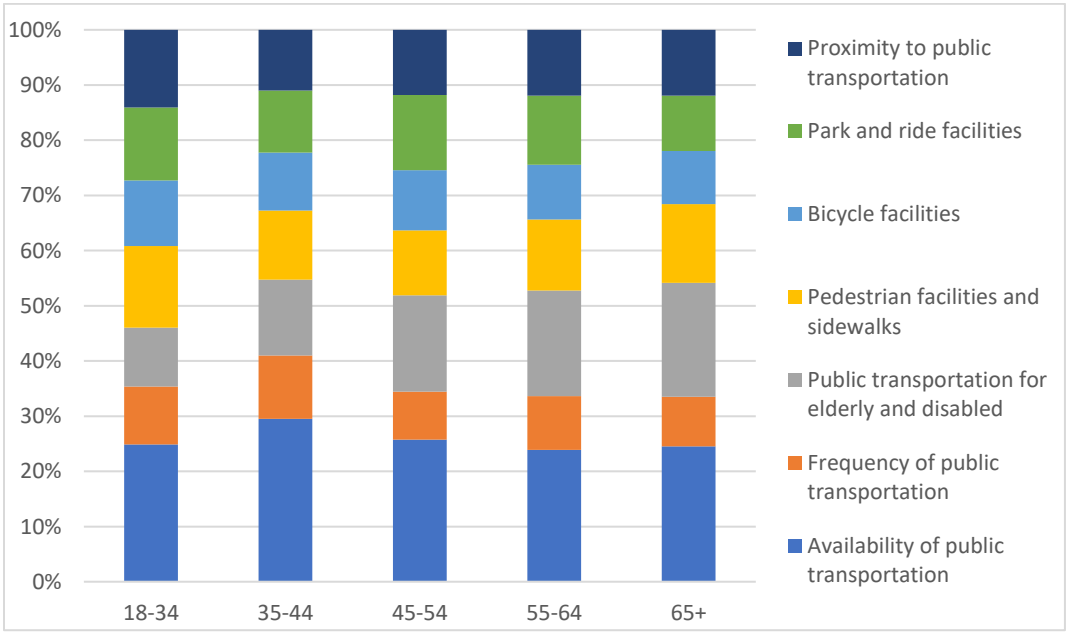

Figure 4.4.2. Percent of Total Weighted Score for Question 6 by Age

4.4.3. County Economic Status

No significant differences were found between respondents from counties of different economic status for any of the public transportation or pedestrian-related items.

4.4.4. Gender

For Question 6, males placed a slightly higher emphasis on HELP trucks than women.

4.4.5. Hispanic vs. Non-Hispanic

For Question 6, Hispanic respondents tended to place somewhat less emphasis on public transportation for elderly and disabled residents and frequency of public transportation between 2006 and 2016, while a similar trend was not noted for non-Hispanic respondents, as shown in Figure 4.4.3.

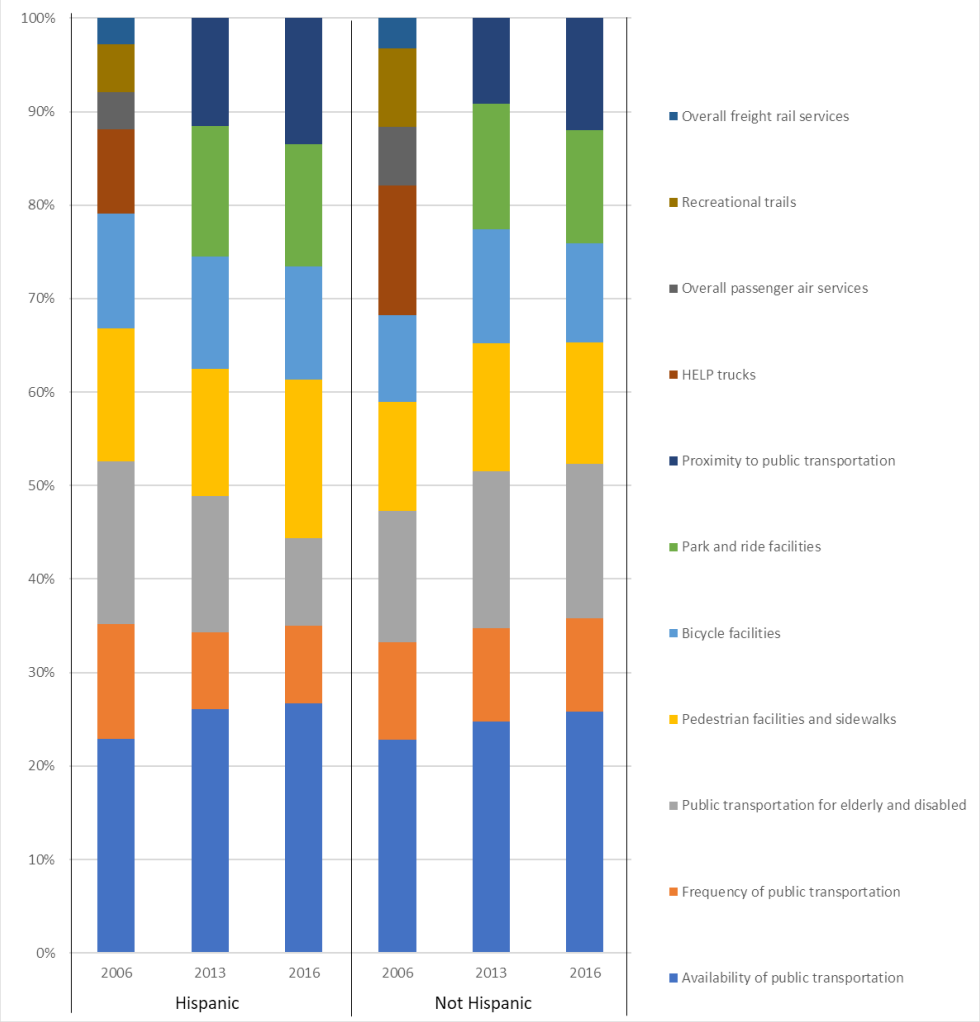

Figure 4.4.3. Percent of Total Weighted Score for Question 6 – Hispanic vs. Non-Hispanic

4.4.6. Income

For all surveyed years, respondents with an income less than $25,000 had a greater mean response to all parts of Question 5. This trend indicates that individuals with an income greater than $25,000 have a less positive perception of public transportation and pedestrian facilities.

4.4.7. Physical Disability

No significant differences were found for any of the public transportation or pedestrian-related items between respondents with and without physical disabilities.

4.4.8. Primary Language

No significant differences were found between people who primarily speak English and people who primarily speak other languages for any public transportation and pedestrian facilities items on the survey.

4.4.9. Race and Ethnicity

Caucasian/White respondents had the greatest percentage of "Don't Know" responses for all parts of Question 5 except Question 5.6 (bicycle lanes), indicating an overall lack of awareness or possible reliance on such facilities. Figure 4.4.4 displays an example of the variation in the percentage of "Don't Know" responses.

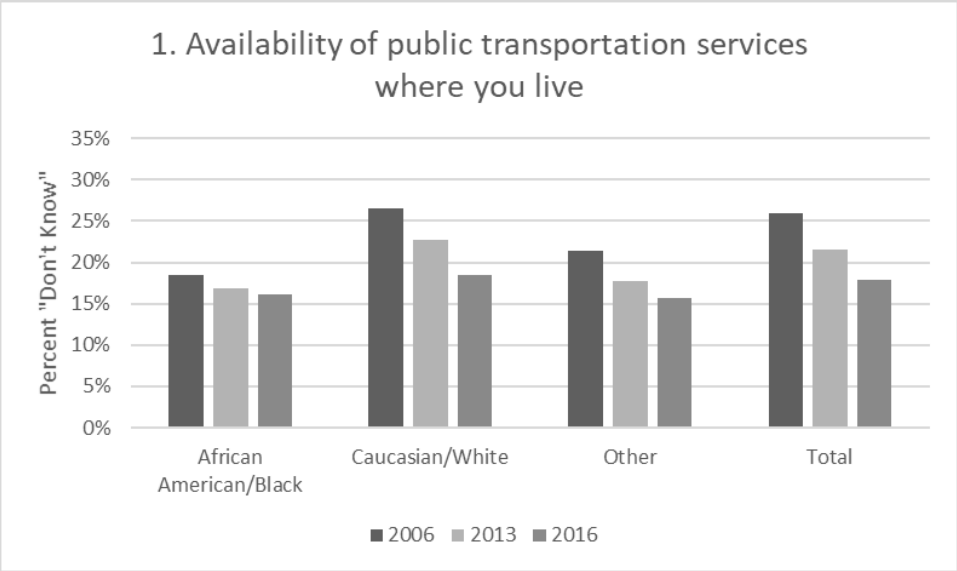

Figure 4.4.4. "Don't Know" Responses for Question 5.1 - Race/Ethnicity

For Question 6, the “other” race/ethnicity category placed a much lower emphasis on availability of public transportation in 2006. However, this demographic had the smallest sample size of all demographics in all survey years with only 27 people responding to Question 6.

4.4.10. Super District

For Question 6, Districts 3S, 3E, 4E, and 4W all exhibited an increase in the emphasis on availability of public transportation. For a discussion on the use of Super Districts, refer to page 36.

4.4.11. TDOT Region

For Question 5, the percentage of "Don't Know" responses decreased from 2006 to 2016 for Regions 2, 3, and 4; thus, indicating greater familiarity with public transportation and pedestrian facilities. Figure 4.4.5 illustrates responses to Questions 5.1 and 5.2 by TDOT region.

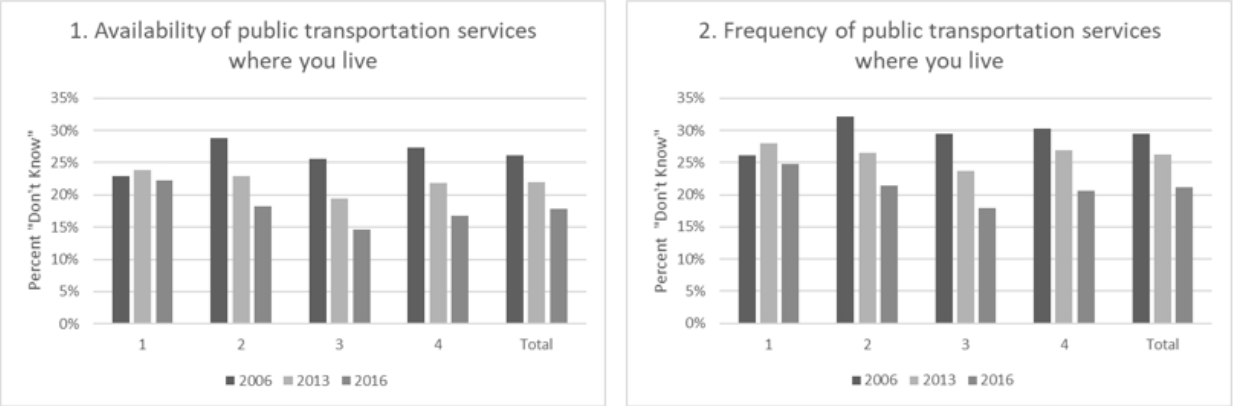

Figure 4.4.5. "Don't Know" Responses for Questions 5.1-5.2 by TDOT Region

4.4.12. Urban vs. Rural

For Question 5, respondents in rural areas had a more positive response in 2016 to Questions 5.4 (public transportation for elderly and disabled) and 5.5 (pedestrian facilities and sidewalks) than individuals in urban areas. Additionally, in the 2016 survey, respondents in an urban area were more likely to mark "Don't Know" on all parts of Question 5 except Question 5.4.

4.5. Perception of Highway Travel

Survey respondents were asked to respond to thirteen (13) questions regarding the perception and management of state highways. Table 4.5.1 displays these questions and their corresponding question/sub-question numbers for each survey year.

Table 4.5.1. Survey Questions Concerning Perceptions and Management of State Highways

Perception of Highway Travel			
2006	**2013**	**2016**	**Topic**
10A	7A	7.1	Overall feeling of safety
10D	7B	7.2	Safety through work zones at night
10E	7C	7.3	Safety through work zones during the day
10F	7D	7.4	Detours
10G	7E	7.5	Warning signs in work zones

10H	7F	7.7	Location of warning signs
10J	7G	7.8	Minimizing construction delays
---	7H	7.10	Incident response
---	7I	7.11	Incident clearance
---	7J	7.13	Traffic congestion on interstates
---	7J	7.14	Traffic congestion on state highways
25	31	14	Travel between cities
26	32	15	Travel within urban areas

Note: Question 7 is scaled 1-5 ("Strongly Disagree" to "Strongly Agree"). Questions 14 and 15 are scaled 1-5 ("Very Difficult" to "Very Easy").

4.5.1. General Findings

Variation in responses between survey years for many of the demographic categories was not notable. There are only a few exceptions which are noted in each section below and, in the case of “Don’t Know” responses, here. For Question 14 and 15, the percentage of "Don't Know" responses decreases from 2006 to 2016. "Don't Know" responses are also observed to decrease from 2006 to 2016 for all parts of Question 7.

4.5.2. Age

No significant differences were found between any of the age groups for any of the responses pertaining to perceptions of highway travel.

4.5.3. County Economic Status

No significant differences were found between distressed, non-distressed, or at-risk counties for any of the items related to perceptions of highway travel.

4.5.4. Gender

No significant differences were found between male and female respondents' perceptions of highway travel.

4.5.5. Hispanic vs. Non-Hispanic

No significant differences were found between Hispanic and Non-Hispanic respondents’ perceptions of highway travel.

4.5.6. Income

For Questions 14 and 15, the respondents with an income less than $25,000 selected the "Don't Know" response with greater frequency than those with higher incomes in 2006 (Figure 4.5.1).

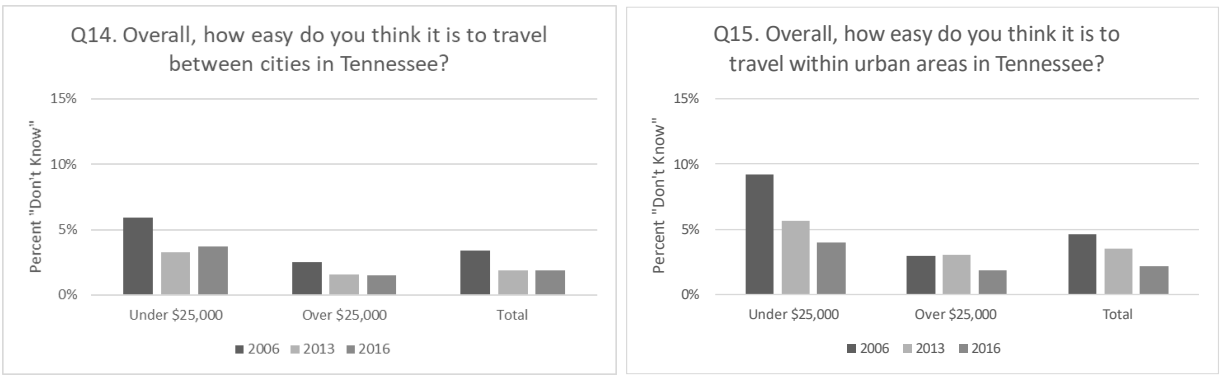

Figure 4.5.1. "Don't Know" Responses for Questions 14 and 15 by Income

Respondents with an income greater than $25,000 had a more negative response to Questions 17.8 and 17.11 related to delays caused by construction and incident clearance than did respondents with incomes less than $25,000.

4.5.7. Physical Disability

For Questions 14 and 15, the respondents with a physical disability are somewhat more likely to choose the "Don't Know" response across all three surveyed years, indicating lesser awareness of ease of travel between cities and within urban areas, as shown in Figure 4.5.2.

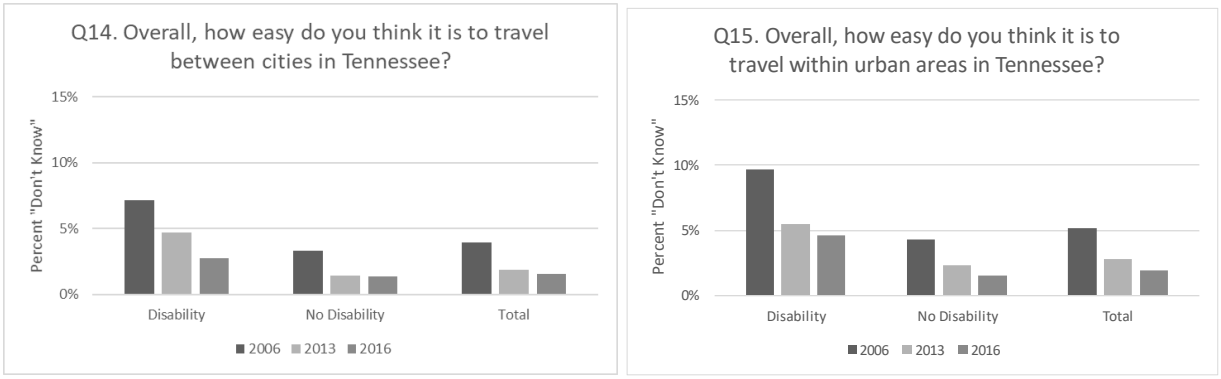

Figure 4.5.2. "Don't Know" Responses for Questions 14 and 15 by Physical Disability

4.5.8. Primary Language

No significant differences were found for perception of highway travel between people who primarily speak English and people who primarily speak other languages.

4.5.9. Race and Ethnicity

No significant differences were found for any of the highway travel questions between any of the race/ethnicity groupings.

4.5.10. Super District

For a discussion on the use of Super Districts, refer to page 36.

For Question 14, Super Districts 3S, 3E and 3W have the lowest mean responses in 2016, while 1E has the highest. However, the difference in rating is less than 0.5 points on the Likert scale across all mean responses. The distribution overall remained fairly flat across time and between regions, as shown in Figure 4.5.3.

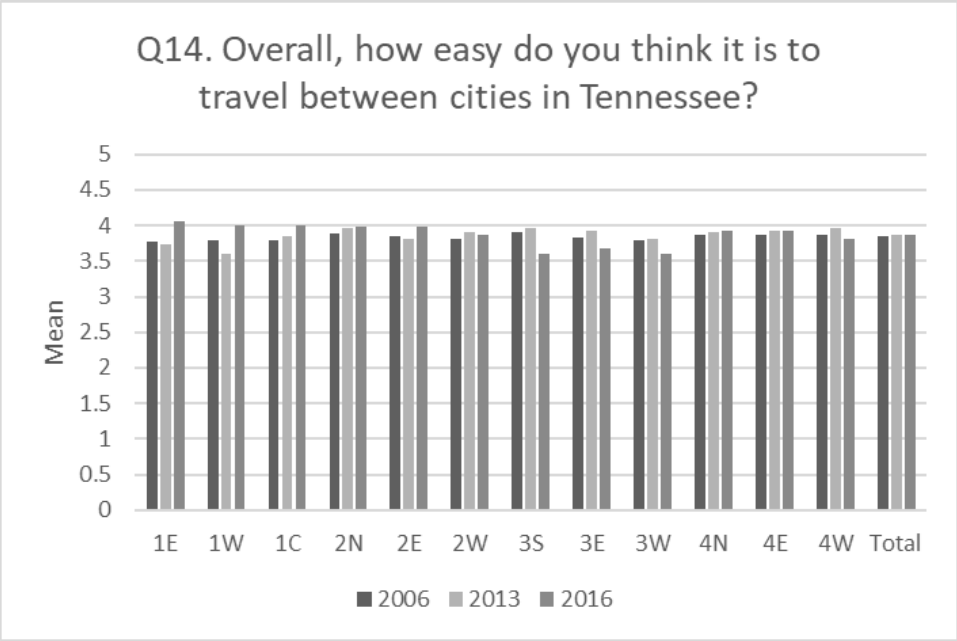

Figure 4.5.3. Mean Responses for Question 14 by Super District

For Question 15, Super Districts 3S and 3E (which contain the entire Nashville MPO, save Robertson and Maury counties) have the lowest mean responses in 2016, representing a noticeable drop in rating from previous years. This decline suggests that there is a relative dissatisfaction with urban travel, as the mean response dropped below 3 (neutral rating). This negative response could be due to the increased congestion and construction within these areas brought on by Nashville's population boom.

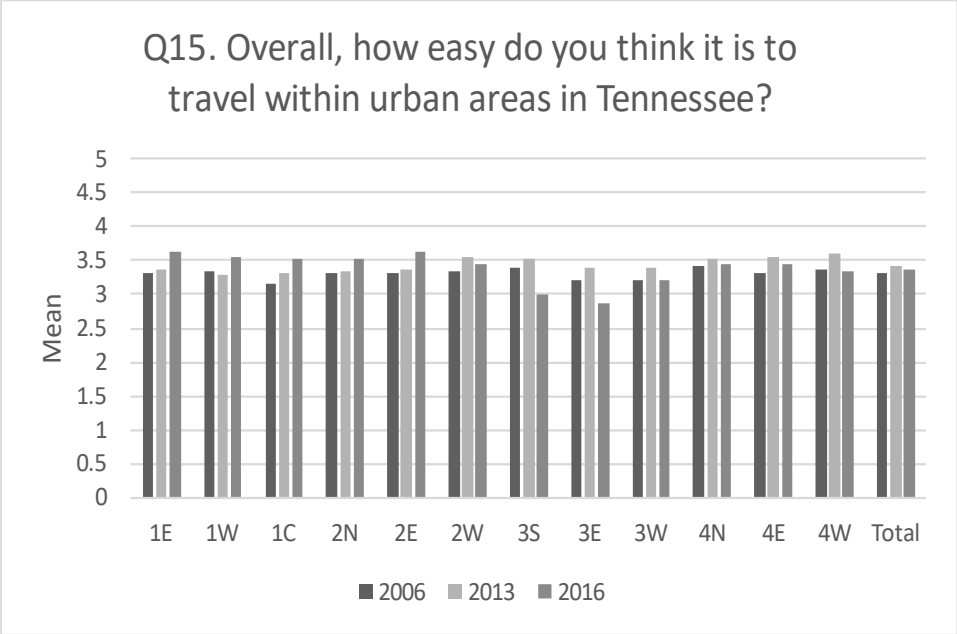

Figure 4.5.4. Mean Responses for Question 15 by Super District

For Question 7.8 (construction delays), Super Districts 3S, 3E and 4W have declines of more than 0.5 points on the rating scale in 2016, as shown in Figure 4.5.5. These Super Districts are the regions surrounding Nashville and Memphis, which were experiencing large construction projects at the time of the survey. Figure 4.5.6 shows the total number of active, long, disruptive construction projects by district for the three survey years. “Active” means the project was let in or before the survey year and completed in or after the survey year. “Long” means the project lasted longer than 90 days. “Disruptive” means the project fell into one of the following categories: Bridge Rehabilitation; Bridge Repair; Bridge Replacement; Construction-New; Intersection Improvements; Intersection Improvements and Signals; Modify Interchange; New Interchange; Noise Barrier Walls; Paving; Realign and Widen; Realignment; Resurface, Safety & Bridge Repair; Resurface & Safety; Resurfacing; Stage Construction-New; Widen; and Widen and Resurfacing. As shown in Figure 4.5.6, District 3E had significantly more long, disruptive projects than other districts, followed by 3W. These districts also had lower mean responses, as shown in Figure 4.5.5, suggesting that these sorts of projects contribute to overall perception of TDOT’s job of minimizing congestion during delays.

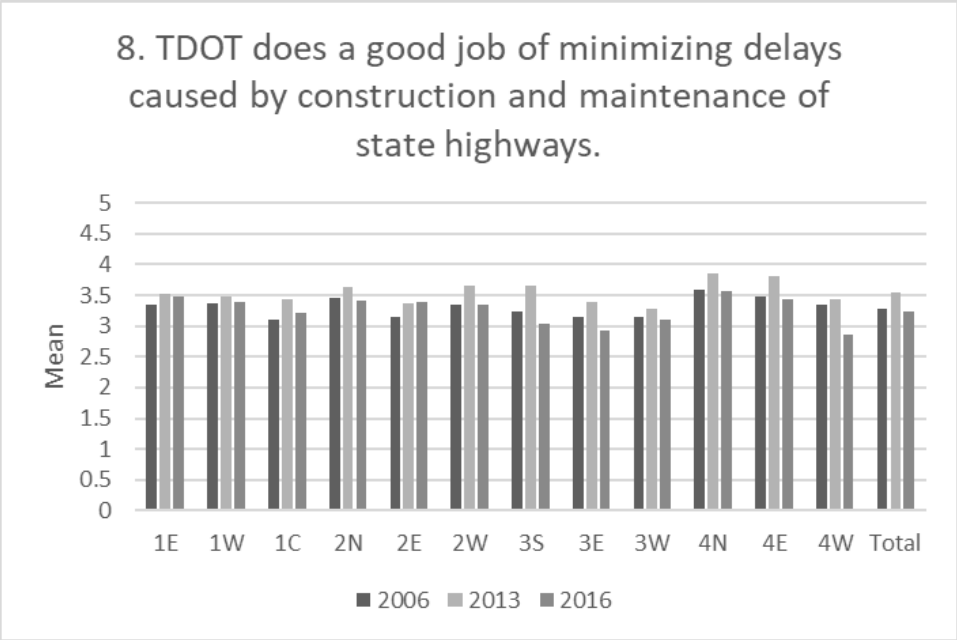

Figure 4.5.5. Mean Response for Question 7.8 by Super District

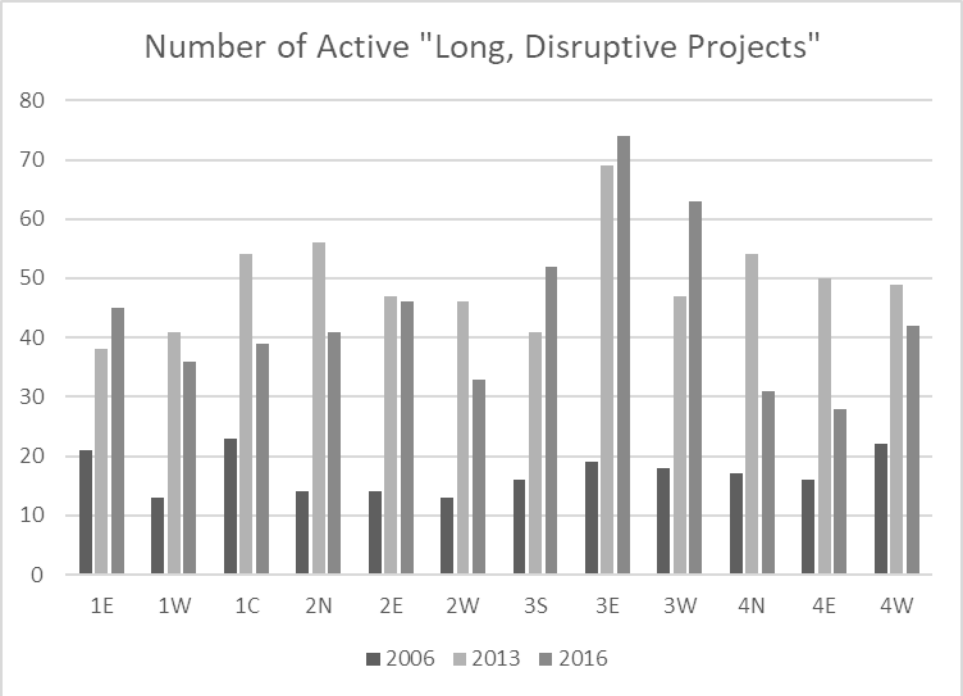

Figure 4.5.6. Total Number of "Long, Disruptive Projects" by District

For Questions 7.13 and 7.14 (traffic congestion), Super Districts 3S, 3E, and 3W have significantly lower mean responses to questions pertaining to traffic congestion on interstate and state highways in 2016. All three drop below a neutral rating, with means ranging from 2.2-2.6 for interstate congestion, and

between 2.6-3.0 for other state highways, as shown in Figure 4.5.7. This negative response could be due to the construction projects within this region of Tennessee.

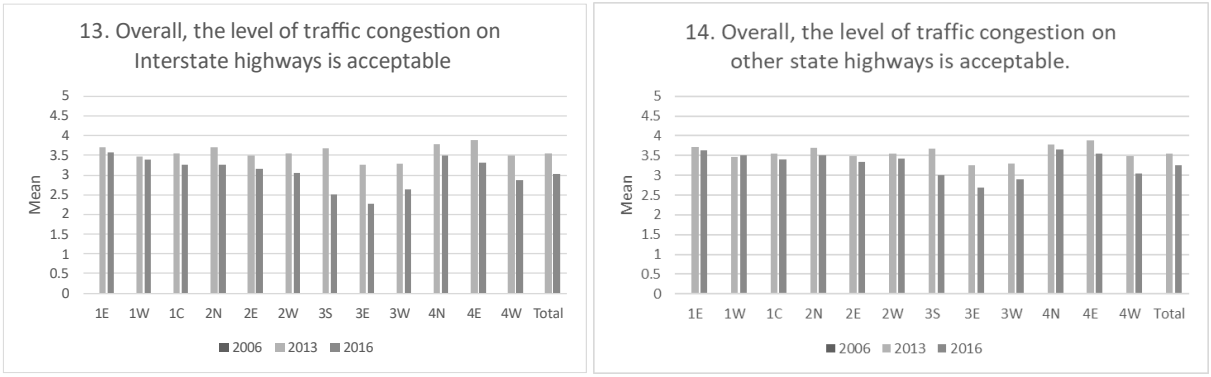

Figure 4.5.7. Mean Responses for Questions 7.13 and 7.14 by Super District

4.5.11. TDOT Region

For Questions 14 and 15, Region 3 as a whole has a lower mean response in 2016 (see Figure 4.5.8), suggesting a lack of ease when traveling between cities and within urban areas. This is likely the result of ongoing large construction projects within Nashville and the surrounding areas, as discussed in the previous section.

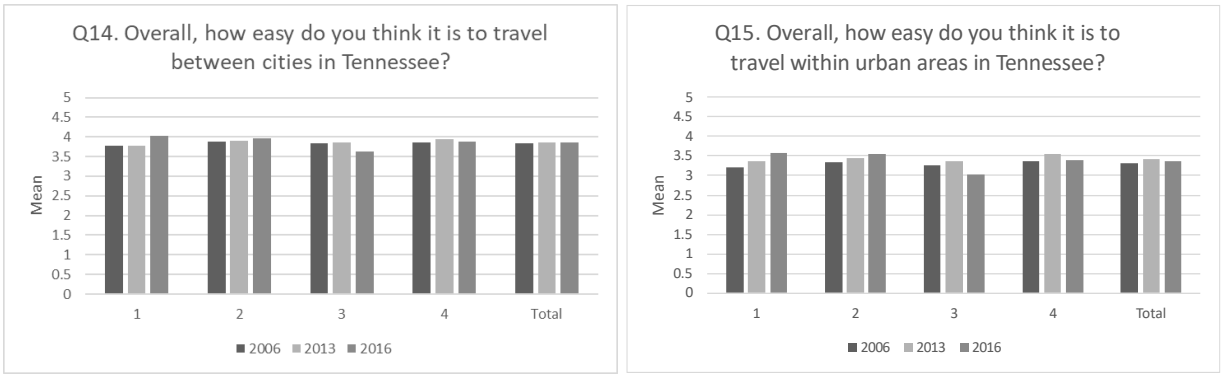

Figure 4.5.8. Mean Responses for Questions 14 and 15 by TDOT Regions

Respondents in Region 3 consistently have both the lowest mean response and lowest percentage of "Don't Know" responses for 2016. This indicates that those respondents are both the most informed and the least satisfied with highway travel.

4.5.12. Urban vs. Rural

Respondents from urban areas have more negative perceptions regarding Questions 7.8, 7.13, and 7.14 regarding construction delays and traffic congestion. This trend follows findings from analysis of the Super Districts and regions and is likely due to the increased construction and maintenance projects in urban areas. Additionally, there is a greater population of both residents and tourists within the urban areas that leads to a greater density of traffic.

4.6. TDOT Communication

The survey respondents were asked to respond to three (3) questions regarding TDOT's communication of information to its customers. Table 4.6.1 displays the topics of these questions and their corresponding question numbers from each survey year.

Table 4.6.1. Survey Questions Concerning the Efficiency of TDOT's Communication of Information

TDOT Communication			
2006	**2013**	**2016**	**Topic**
13	12	11	Ways to provide customers with information
18	14	12	Informing residents about transportation issues
---	---	13	Social media use

Note: Question 11 requires respondent to check all that apply (1-20). Question 12 is scaled 1-5 ("Very Dissatisfied" to "Very Satisfied"). Question 13 requires respondent to fill in the blank.

4.6.1. General Findings

For Question 12, the means across all demographics and survey years were around 3.5 (between “neutral” and “satisfied”) with little to no variation. For Question 11, the total number of responses for each type of communication was counted and recorded as a percentage of total respondents for each demographic. Overall, electronic message boards were found to be the most effective means of communication with approximately 60-85% of all respondents choosing this method across the survey years. Radio consistently came in second place followed by local television networks. Signs on roadways with phone numbers for info have fallen out of favor with only 32% of respondents indicating that these signs were effective means of communication in 2016, compared to 45% in 2006. Email has become more popular over the years as well.

Table 4.6.2 shows some of the most popular communication methods and the percent of survey participants who selected them each year.

Table 4.6.2. Top Responses to Question 11

Communication Method	Percent of Participants		
	2006	2013	2016
Electronic message boards	61.4%	82.5%	77.5%
Radio	45.9%	50.9%	43.1%
Local TV	41.7%	40.9%	33.7%
Signs on roadways with phone numbers for info	45.4%	42.3%	32.0%
Email	8.0%	14.7%	24.9%
Internet/TDOT web page	16.2%	21.3%	21.0%
Newspapers	42.1%	30.2%	20.9%
Direct mailings/newsletters	22.9%	16.3%	14.4%

A few trends are noteworthy, namely, that social media and e-mail have become more preferable means of communication, while newspapers and direct mailings have fallen out of favor. Electronic Message Boards on highways have also become more popular, with nearly 100% of survey participants in 2016 who answered this question indicating that these boards are effective means of communication. Figure 4.6.1 highlights these trends.

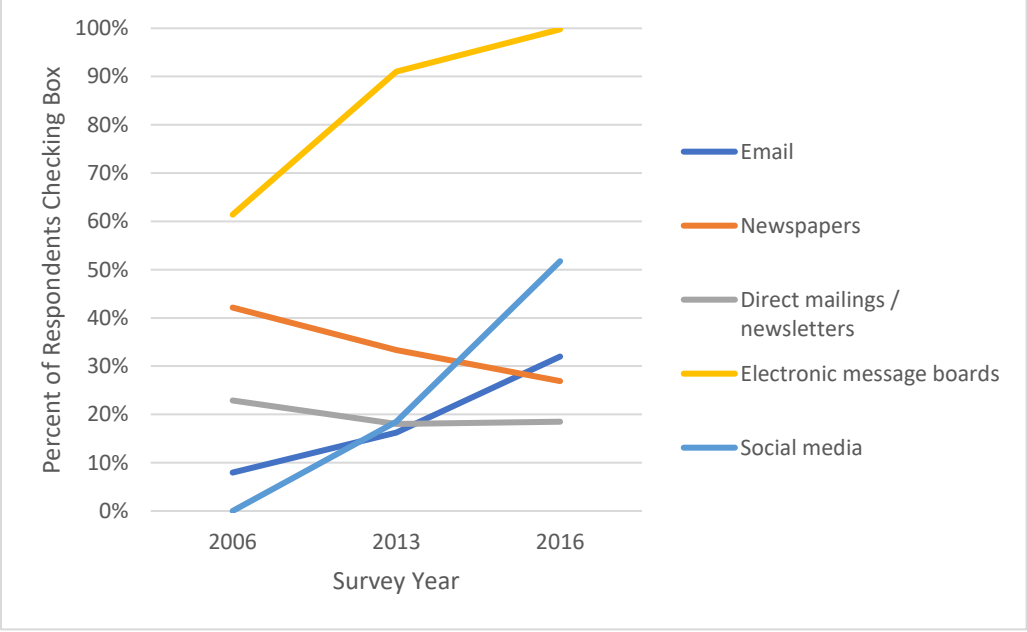

Figure 4.6.1. Significant Communication Preference Trends

4.6.2. Age

Negligible variation exists between age groups for most communication methods. The exceptions to this are email, internet, text messages, and social media, which are more popular with younger demographics,

and newspapers, which are more popular with the older demographic. Figure 4.6.2 shows these differences for 2016, the only survey year with age data.

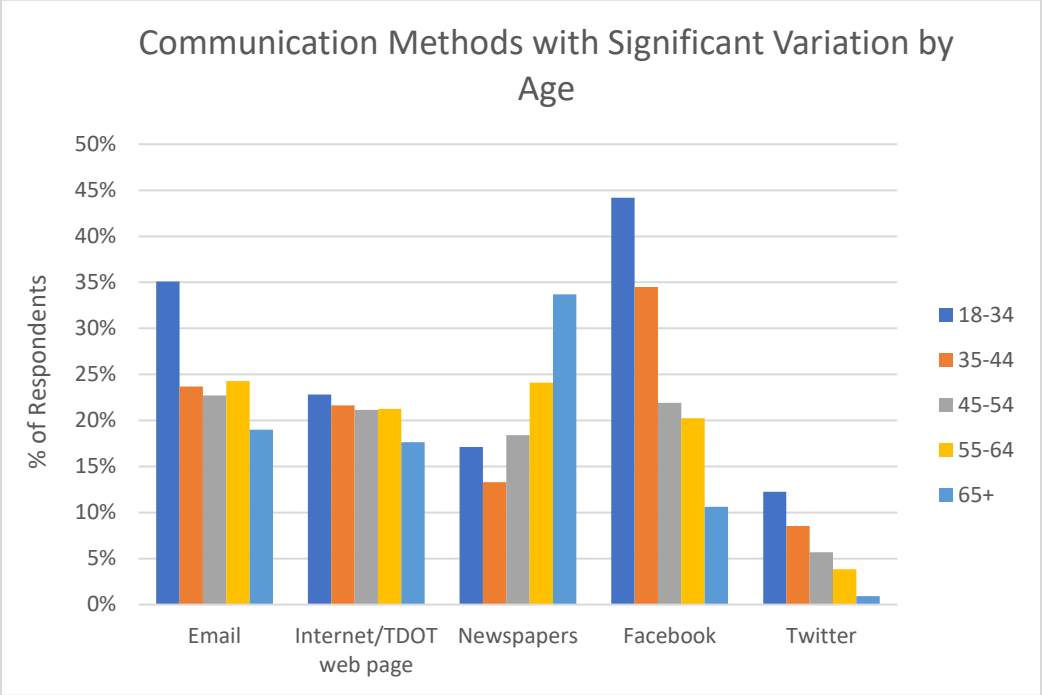

Figure 4.6.2. Selected Responses for Question 11 by Age

4.6.3. County Economic Status

No significant differences were found for communication preferences between the various economic status groupings.

4.6.4. Gender

No significant differences were found between genders for communication preferences.

4.6.5. Hispanic vs. Non-Hispanic

No significant differences were found between Hispanic and Non-Hispanic respondents for communication preferences.

4.6.6. Income

No significant differences were found in communication preferences between the various income groups.

4.6.7. Physical Disability

No significant differences were found in communication preferences between respondents with or without a physical disability.

4.6.8. Primary Language

No significant differences in communication preferences were found between people who primarily speak English and people who primarily speak other languages.

4.6.9. Race and Ethnicity

No significant differences were found in communication preferences between the various race and ethnicity groupings of respondents.

4.6.10. Super District

No significant differences were found across Super Districts in communication preferences. For a discussion on the use of Super Districts, refer to page 36.

4.6.11. TDOT Region

No significant differences were found across Regions in communication preferences.

4.6.12. Urban vs. Rural

No significant differences were found between urban and rural respondents' preferences for communication.

4.7. Overall Ratings

The survey respondents were asked to respond to eight (8) questions concerning the overall ratings of TDOT. Table 4.7.1 displays the topics for these questions/sub-questions for each survey year.

Table 4.7.1. Survey Questions Concerning Overall Ratings

Overall Ratings			
2006	**2013**	**2016**	**Topic**
28	33	16	Current quality of TDOT compared to two years ago
---	30A	17.1	Familiarity with TDOT services
24D	30B	17.2	Prioritization of highway improvements
24E	30C	17.3	Support from TDOT for local transportation projects
24F	30D	17.4	Response of TDOT to concerns of local communities
---	30E	17.5	Environmental concerns
24A	30F	17.6	Trust TDOT to make sound decisions
---	30G	17.7	Comparison to transportation systems of other states

Note: Question 16 is scaled 1-3 ("Better" to "Worse"). Question 17 is scaled 1-5 ("Strongly Disagree" to "Strongly Agree").

4.7.1. General Findings

From 2013 to 2016, the mean response for Question 17 (parts 1-7) decreased, suggesting a negative trend with respondent satisfaction to TDOT's overall ratings. Figure 4.7.1 displays Questions 17.1 and 17.2 for economic status groupings as examples of this negative trend.

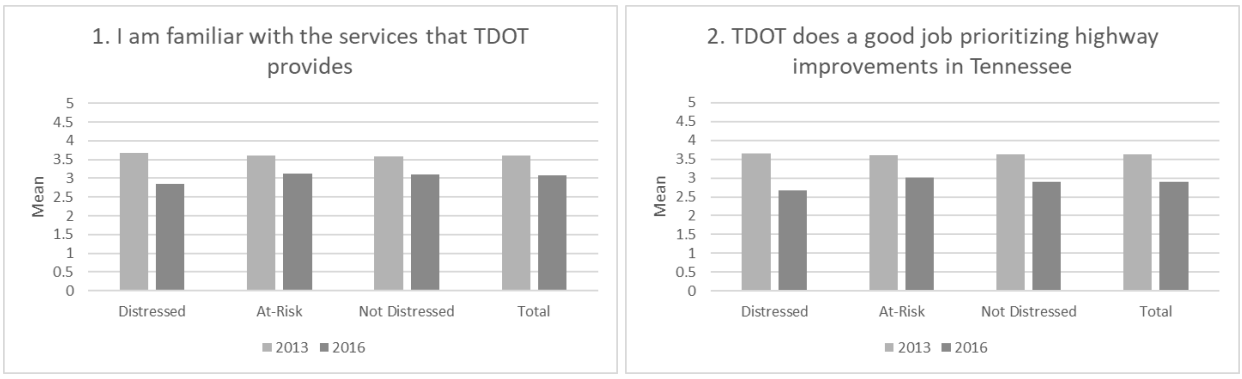

Figure 4.7.1. Mean Responses for Questions 17.1 and 17.2 by County Economic Status

4.7.2. Age

For Question 16, the percentage of "Don't Know" responses slightly increased as the age of the respondent decreased, as shown in Figure 4.7.2.

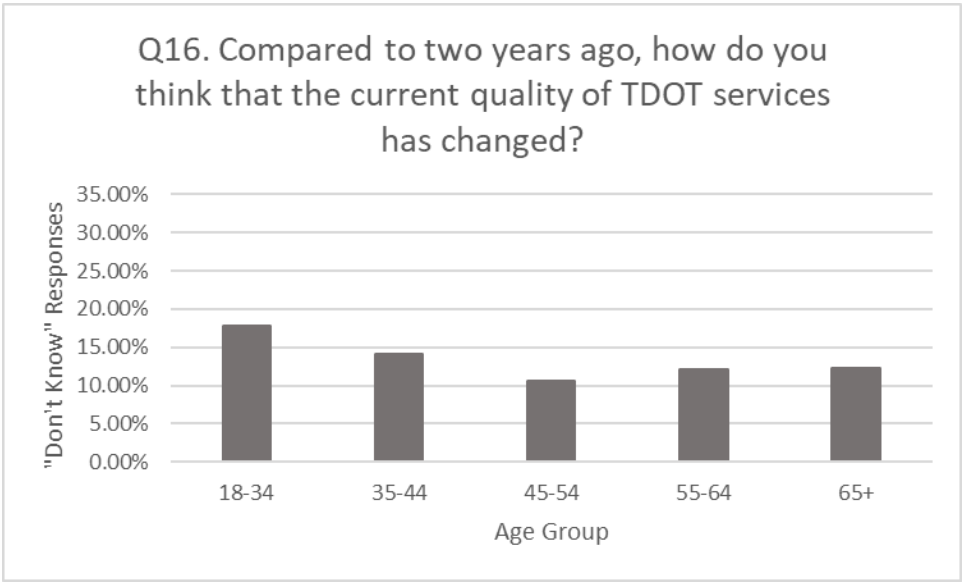

Figure 4.7.2. "Don't Know" Responses for Question 16 by Age

For Question 17, the 55-64 age group had the greatest percentage of "Don't Know" responses, indicating a lack of awareness with TDOT's overall ratings topics. Interestingly, for Question 17.7, as the age of the respondent increased, the mean response increased from slightly over 3.0 for respondents in the 18-34

age category to approximately 3.7 for respondents over 65, as shown in Figure 4.7.3. This discrepancy in ratings may be worth further investigation to determine how to address discrepancy between younger and older adults.

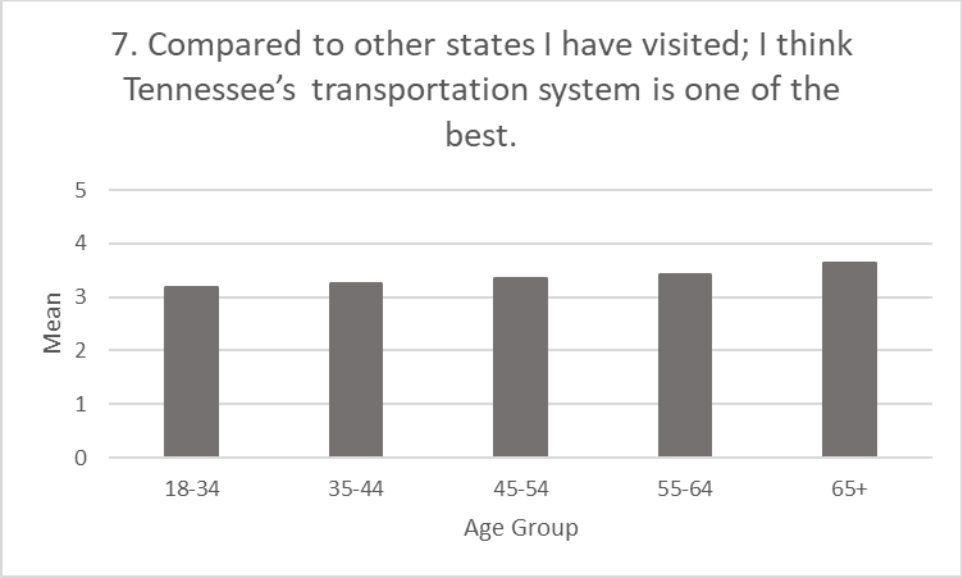

Figure 4.7.3. Mean Responses for Question 17.7 by Age

4.7.3. County Economic Status

For all parts of Question 17, the respondents within at-risk counties had the greatest mean response in 2016, while those in distressed counties had the lowest mean response. Of interest is the decrease in rating across all economic status groups related to familiarity with services that TDOT provided in 2016 as compared to 2013. There was a decline in rating for distressed counties of nearly 1.0 point, which may warrant further investigation.

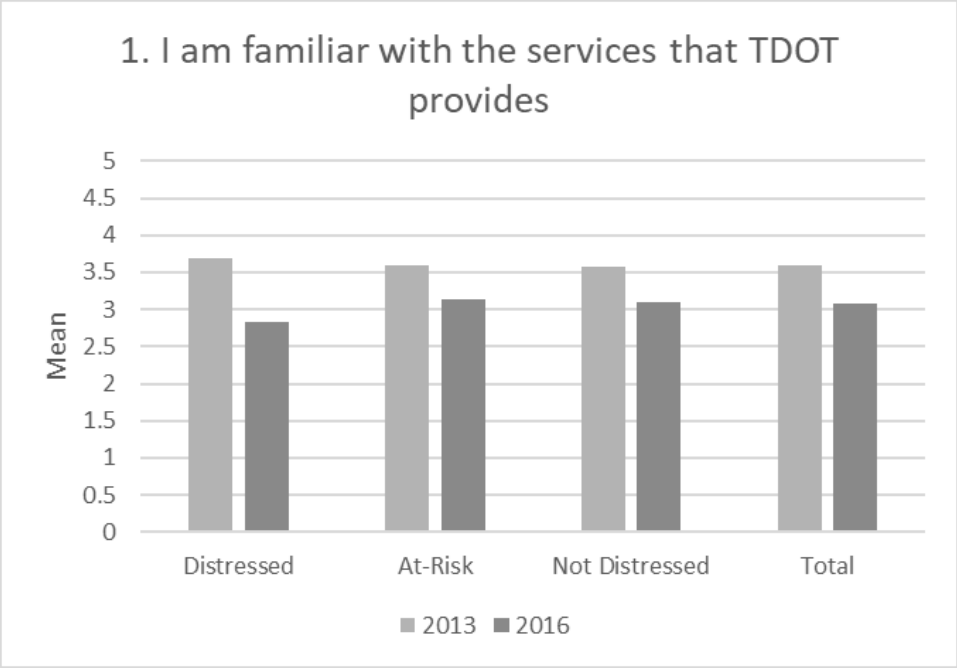

Figure 4.7.4. Mean Responses for Question 17.1 by Economic Status

The Not Distressed counties had the largest percentage of "Don't Know" responses in 2016; however, the differences between status categories were less than 5%, as shown in Figure 4.7.5.

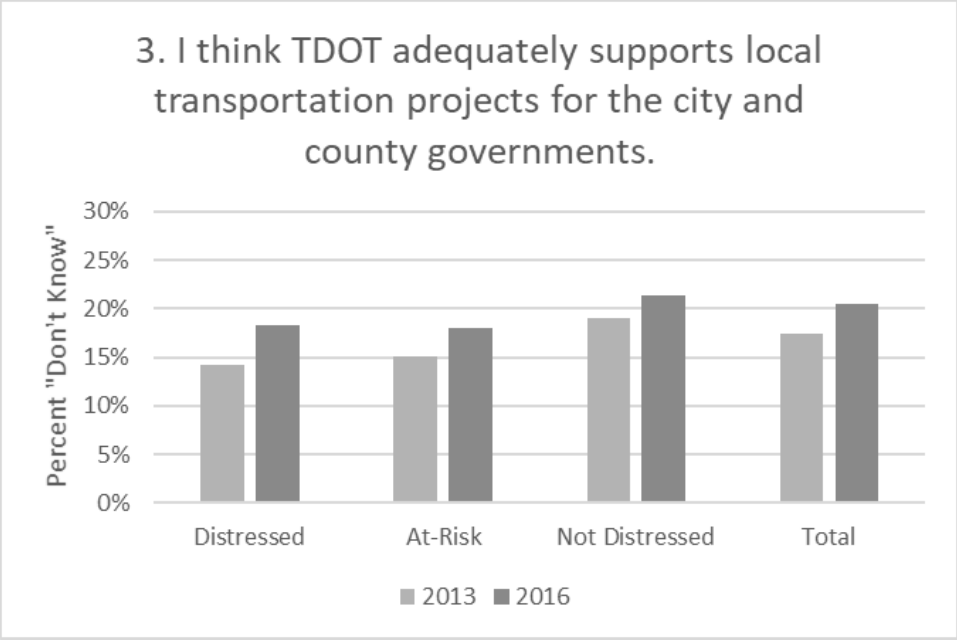

Figure 4.7.5. "Don't Know" Responses for Question 17.3 by Economic Status

4.7.4. Gender

Female respondents consistently had a larger percentage of "Don't Know" responses through both Question 16 and 17. Responses to question 16 are shown in Figure 4.7.6 as an example.

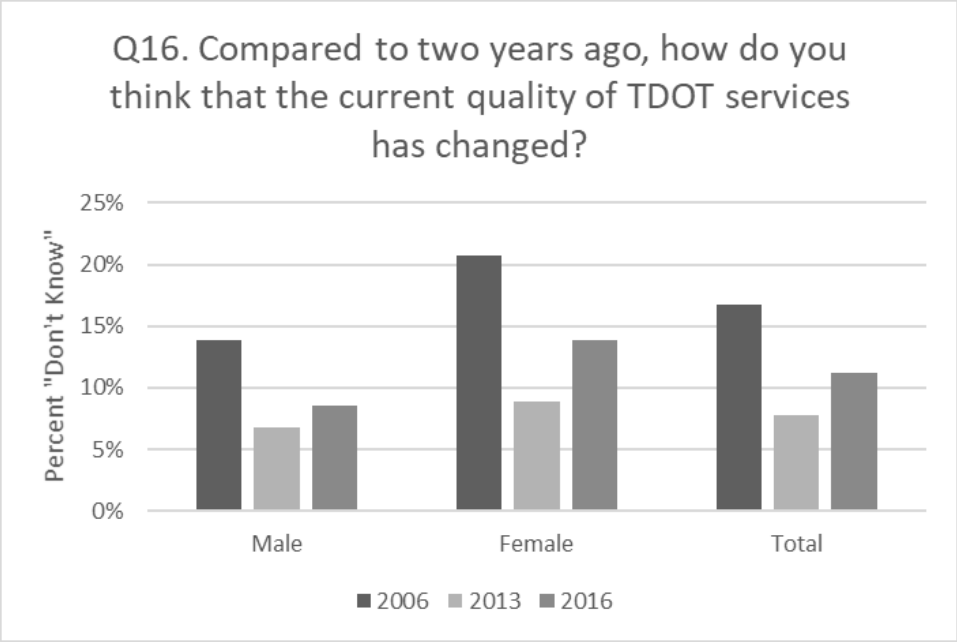

Figure 4.7.6. "Don't Know" Responses for Question 16 by Gender

4.7.5. Hispanic vs. Non-Hispanic

No significant differences were found in overall rating responses of Hispanic and Non-Hispanic residents.

4.7.6. Income

For Question 17.1, the percentage of "Don't Know" responses decreased from 2013 to 2016 for individuals with an income less than $25,000 but remained relatively constant for those with higher incomes, as shown in Figure 4.7.7. This suggests that TDOT may have improved communication within lower income communities and, as a result, the awareness of TDOT's services may have increased.

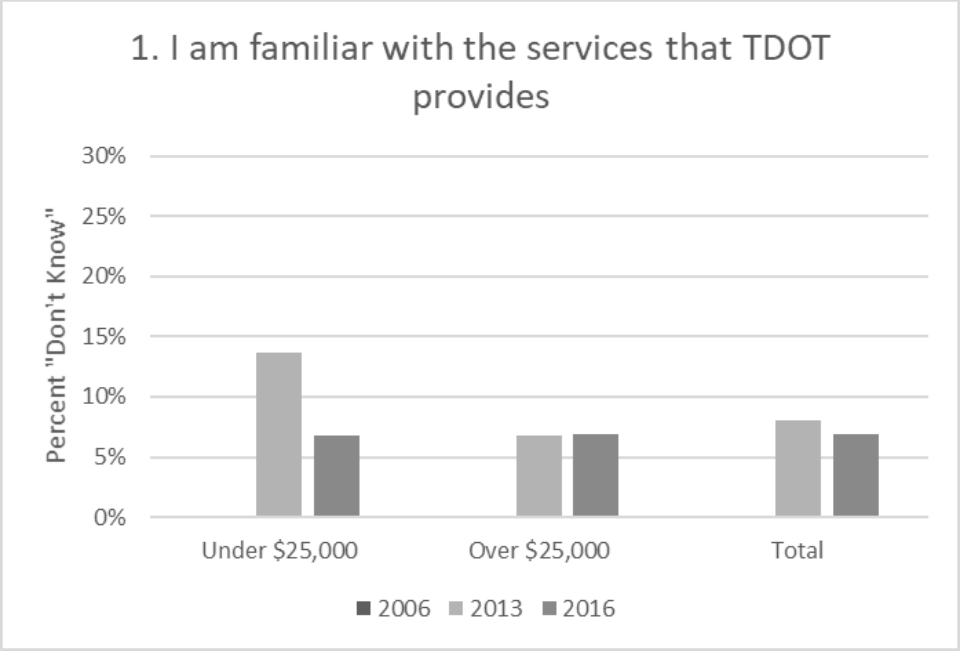

Figure 4.7.7. "Don't Know" Responses for Question 17.1 by Income

4.7.7. Physical Disability

No significant differences were found for respondents with and without physical disabilities for overall rating responses.

4.7.8. Primary Language

No significant differences were found for overall responses between people who primarily speak English and people who primarily speak other languages.

4.7.9. Race and Ethnicity

No significant differences were identified for overall rating responses between any of the race and ethnicity groupings.

4.7.10. Super District

No significant differences were found in responses across Super Districts for overall ratings. For a discussion on the use of Super Districts, refer to page 36.

4.7.11. TDOT Region

No significant differences were found across TDOT Regions for overall ratings.

4.7.12. Urban vs. Rural

No significant differences between urban and rural respondents were identified for overall ratings. There was a slight trend of greater 'Don't Know' frequency for urban respondents across all categories for Question 17, but the differences were typically less than 5%.

4.8. TDOT Investments

The survey respondents are asked to respond to twelve (12) questions regarding the management and importance of transportation improvements to Tennessee transportation systems. Table 4.8.1 displays these twelve questions/sub-questions and the topic areas for each.

Table 4.8.1. Survey Questions Concerning TDOT Investments

TDOT Investments			
2006	**2013**	**2016**	**Topic**
27	29	23	Value of transportation taxes
19F	15D	24.1	Improving Interstate highways
19F	15L	24.2	Repairing and maintaining existing highways
19L	15A	24.3	Expanding use of ITS to improve traffic flow
19A	---	24.4	Expanding public transportation
---	---	24.5	Improving rural access
---	15C	24.6	Enhancing safety on highways
19D	---	24.7	Relieving congestion
---	---	24.8	Investing in transportation projects that will support economic development
19M	15I	24.9	Increasing availability of pedestrian facilities
19M	15I	24.10	Expanding availability of bicycle facilities
20	16	25	State's top funding priority (from Question 24)

Note: Question 23 is scaled 1-3 ("Low Value for Your Money" to "Good Value for Your Money"). Question 24 is scaled 1-5 ("Not at All Supportive" to "Very Supportive"). Question 25 requires respondent to rank (1st to 3rd).

4.8.1. General Findings

The "Don't Know" responses increase significantly to roughly one quarter of all respondents on Question 23 as compared to most other questions within the survey in 2016, as shown in Figure 4.8.1 and indicated by the red line. This suggests a lack of awareness with the value of services provided from transportation taxes or lack of respondent awareness with transportation taxes in general.

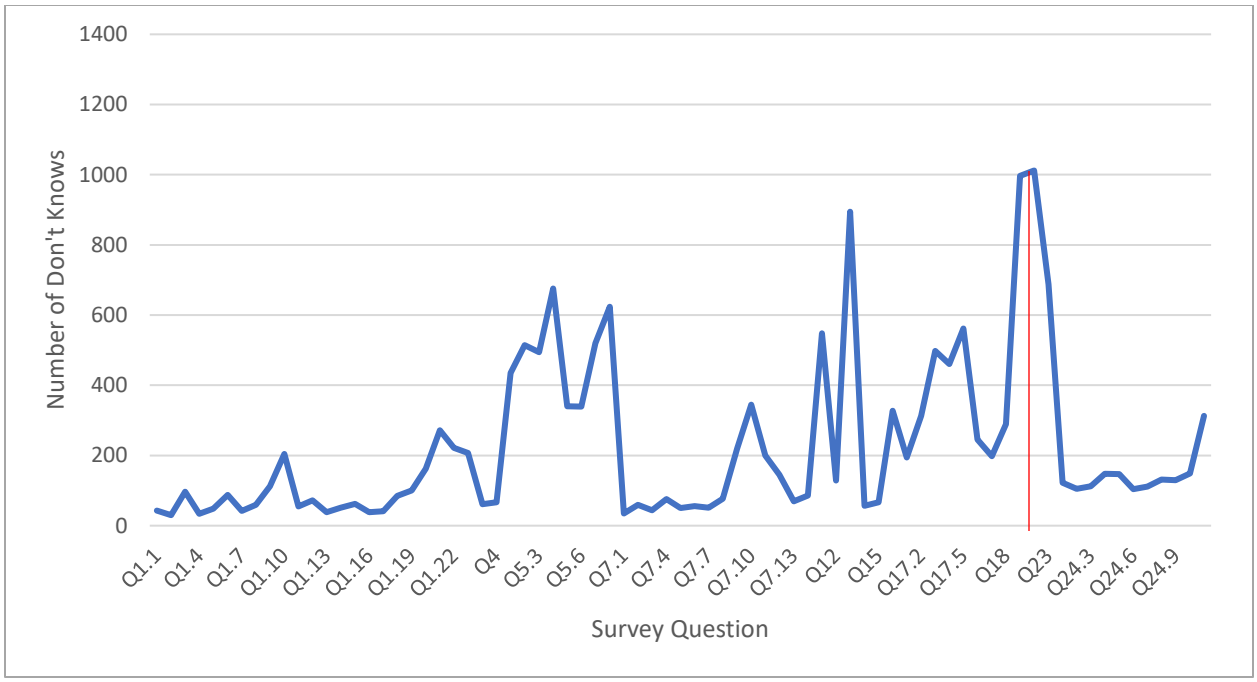

Figure 4.8.1. Don't Know Responses for Each Item on the 2016 Survey

Question 25 asked for respondents to rank funding priorities for different periods of time (2 years, 25 year, and 10 years for the 2006, 2013, and 2016 surveys, respectively) for each survey year, so no trends over time were analyzed. Nevertheless, some similarities exist between survey results. Two of the top priorities for survey respondents were consistently "repairing and maintaining existing highways" and "relieving/reducing congestion".

4.8.2. Age

The greatest variation in mean response occurs in Questions 24.9 (increasing availability of pedestrian facilities) and 24.10 (expanding availability of bicycle facilities), where the 18-34 age group responds more positively than other respondent groups, as shown in Figure 4.8.2. These questions coincide with pedestrian facilities and bike lanes, indicating that young adults are supportive of increasing funding for more environmentally friendly transportation alternatives.

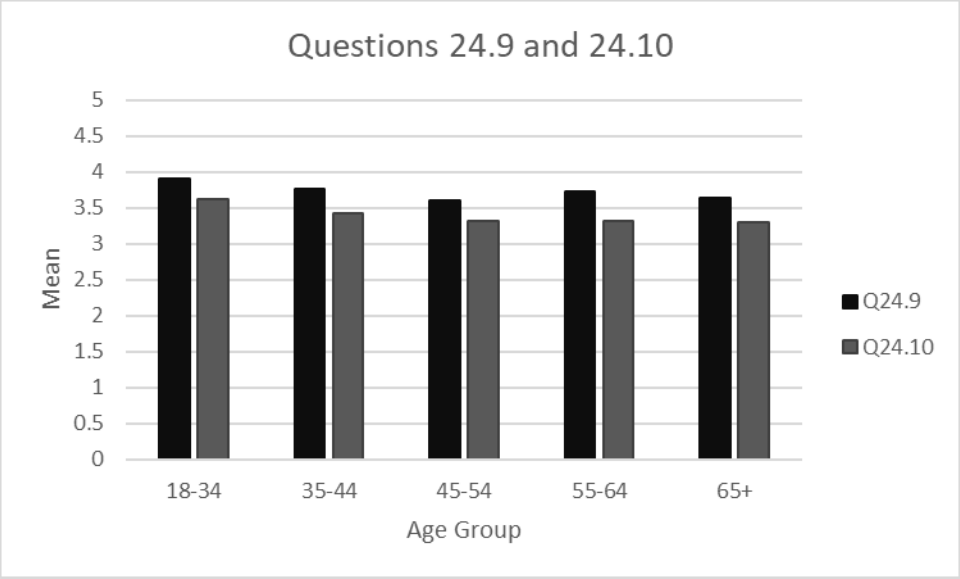

Figure 4.8.2. Mean Responses for Question 24.9 and 24.10 by Age

No significant differences were found in responses related to transportation improvements between the various age groups.

4.8.3. County Economic Status

For Questions 23 and 24, respondents within distressed counties consistently have the lowest mean responses, while respondents in counties that are not distressed have the largest mean response to TDOT investments in 2016. This indicates that the distressed counties are not as supportive of funding transportation improvements while the counties that are not distressed are more supportive than other demographics.

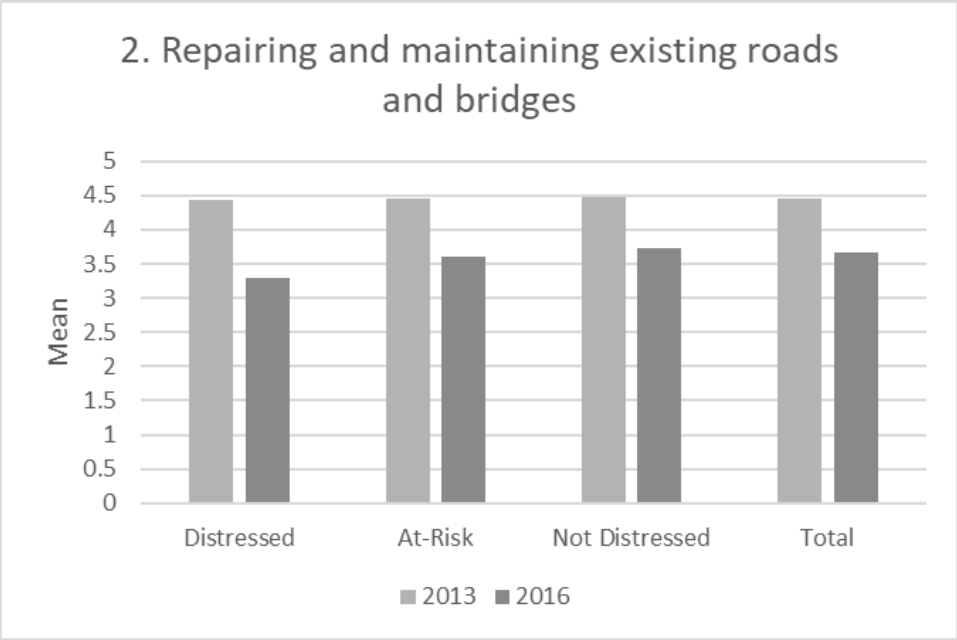

Figure 4.8.3. Mean Responses for Question 24.2 by Economic Status

Figure 4.8.3 shows that in 2013 the support was relatively constant across the three groups but has become more divided as time progressed, with respondents in distressed counties having fewer positive opinions than those in non-distressed counties.

For Question 25, relieving congestion was a greater priority in non-distressed counties, as shown in Table 4.8.2.

Table 4.8.2. Top 5 Priorities for Question 25 by Economic Status

	Rank	2013	2016
Distressed	1	Repairing and maintaining existing highways	Repairing and maintaining existing highways`
	2	Expanding public transportation	Improving Interstate highways
	3	Developing dedicated lanes for trucks on Interstates	Improving rural access
	4	Expanding transportation services for seniors and persons w/disabilities	Enhancing safety on highways
	5	Relieving congestion (in urban areas)	Investing in transportation projects that will support economic development
At Risk	1	Repairing and maintaining existing highways	Repairing and maintaining existing highways
	2	Developing dedicated lanes for trucks on Interstates	Improving Interstate highways

	Rank	2013	2016
	3	Expanding transportation services for seniors and persons w/disabilities	Enhancing safety on highways
	4	Relieving congestion (in urban areas)	Improving rural access
	5	Expanding public transportation	Relieving congestion (in urban areas)
Not Distressed	1	Repairing and maintaining existing highways	Repairing and maintaining existing highways
	2	Relieving congestion (in urban areas)	Improving Interstate highways
	3	Expanding public transportation	Relieving congestion (in urban areas)
	4	Developing dedicated lanes for trucks on Interstates	Expanding public transportation
	5	Expanding transportation services for seniors and persons w/disabilities	Enhancing safety on highways

4.8.4. Gender

No significant differences were found in responses related to transportation improvements between genders.

4.8.5. Hispanic vs. Non-Hispanic

No significant differences were found in responses related to transportation improvements between Hispanic and non-Hispanic residents.

4.8.6. Income

As shown in Table 4.8.3, for Question 25, people with lower income prioritized public transportation investments over congestion mitigation investments for all three survey years. The converse was true for people with higher income.

Table 4.8.3. Top 5 Transportation Investment Priorities from Question 25 by Income

Under $25,000			
Rank	**2006**	**2013**	**2016**
1	Repairing and maintaining existing highways	Repairing and maintaining existing highways	Repairing and maintaining existing highways
2	Developing dedicated lanes for trucks on Interstates	Expanding transportation services for seniors and persons w/disabilities	Improving Interstate highways
3	Expanding transportation services for seniors and persons w/disabilities	Expanding public transportation	Expanding public transportation

4	Adding shoulders to highways	Relieving congestion (in urban areas)	Relieving congestion (in urban areas)
5	Adding more HELP trucks	Developing dedicated lanes for trucks on Interstates	Improving rural access
Over $25,000			
Rank	**2006**	**2013**	**2016**
1	Repairing and maintaining existing highways	Repairing and maintaining existing highways	Repairing and maintaining existing highways
2	Developing dedicated lanes for trucks on Interstates	Relieving congestion (in urban areas)	Improving Interstate highways
3	Relieving congestion (in urban areas)	Expanding public transportation	Relieving congestion (in urban areas)
4	Adding passing lanes to state highways	Developing dedicated lanes for trucks on Interstates	Expanding public transportation
5	Adding shoulders to highways	Expanding transportation services for seniors and persons w/disabilities	Enhancing safety on highways

4.8.7. Physical Disability

No significant differences were found for respondents with and without physical disabilities for transportation investment priorities.

4.8.8. Primary Language

For Question 25 in 2013, people whose primary language is not English prioritized public transportation higher than those whose primary language is English, as shown in Table 4.8.4.

Table 4.8.4. Top 5 Priorities for Question 25 in 2013 by Primary Language

Rank	English	Other
1	Repairing and maintaining existing highways	Expanding public transportation
2	Relieving congestion (in urban areas)	Repairing and maintaining existing highways
3	Expanding public transportation	Relieving congestion (in urban areas)
4	Developing dedicated lanes for trucks on Interstates	Expanding transportation services for seniors and persons w/disabilities
5	Expanding transportation services for seniors and persons w/disabilities	Adding shoulders to highways

4.8.9. Race and Ethnicity

No significant differences were found between race and ethnicity groupings for transportation investment priorities.

4.8.10. Super District

For a discussion on the use of Super Districts, refer to page 36.

As exemplified in Figure 4.8.4, Super District 3S consistently had the lowest percentage of "Don't Know" responses in 2016, indicating that respondents in Super District 3S may be more familiar with TDOT transportation spending than the other Super Districts.

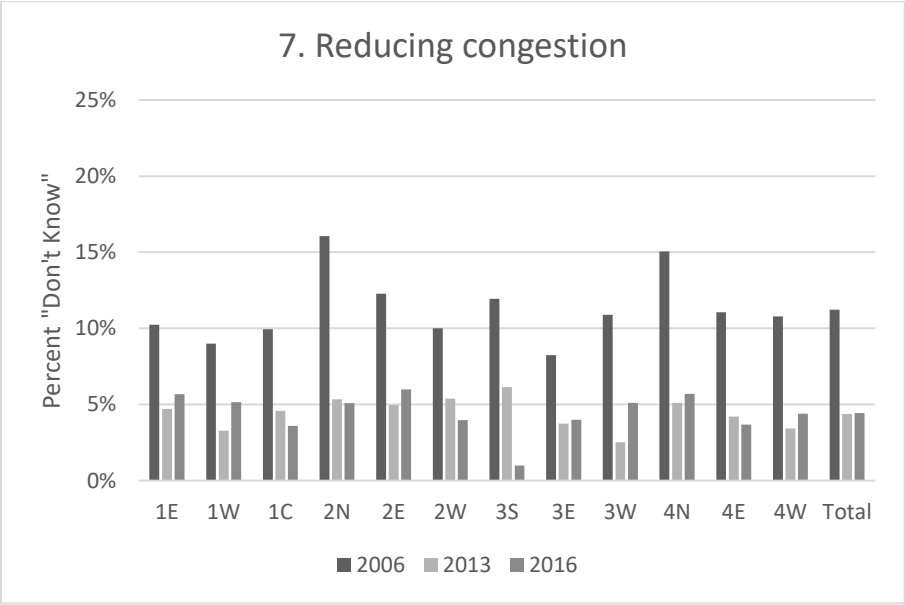

Figure 4.8.4. “Don’t Know” Responses for Question 24.7 by Super District

For Question 25, Districts 3S and 3E were the only super districts to prioritize reducing congestion over repairing and maintaining existing highways.

4.8.11. TDOT Region

As with Super Districts, Region 3 prioritized reducing congestion over maintaining and repairing existing highways.

4.8.12. Urban vs. Rural

For most parts of Question 24, the respondents from urban areas are more supportive of TDOT spending for transportation improvements. However, for Question 24.5 (Improving rural access), the rural

respondents are slightly more supportive which makes sense given that these are the investments that would directly impact them the most. This question was not asked in 2006 or 2013.

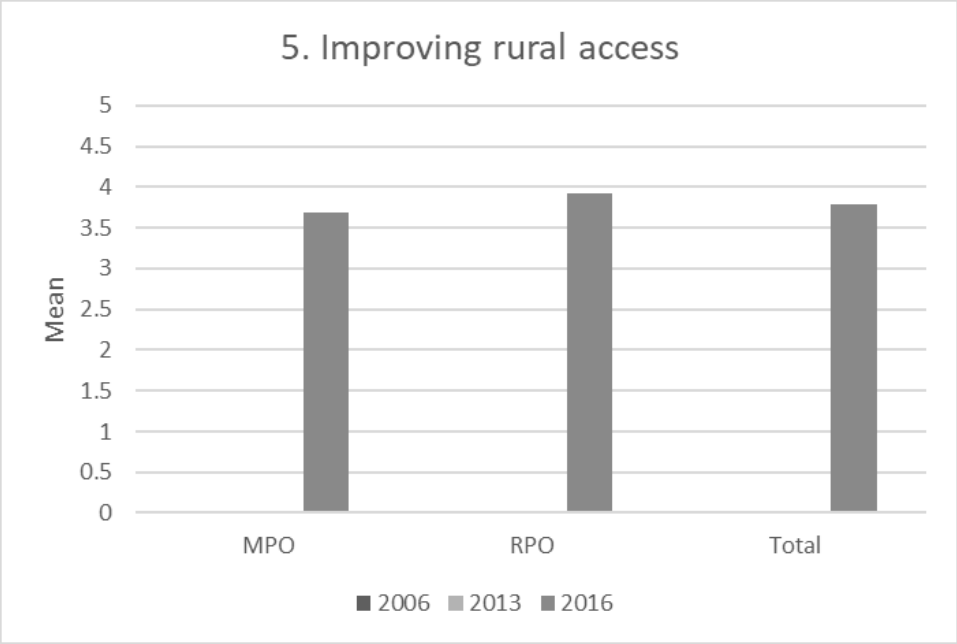

Figure 4.8.5. Mean Response for Question 24.5 by Urban vs. Rural

4.9. Spatial Analysis

To further understand trends identified in the survey results, four spatial comparison groupings were examined: urban and rural areas, county economic status, the four TDOT regions and the twelve TDOT maintenance Super Districts (districts). Table 4.9.1 lists the questions that were included in the statistical analysis and visualization of trends. These questions were selected because of differences that met the initial screening threshold (difference of 0.5 or more). The questions include four categories from the TDOT surveys: highway maintenance, transportation options, overall ratings, and transportation investments. Due to changes in the survey design over time, each question is represented by a different item number and/or letter combination on each survey. Questions 7.13 and 17.7 do not have a corresponding question for 2006.

Table 4.9.1. Questions Identified for Practical Significance

2016	2013	2006	Question
Highway Maintenance			
1.3	3	3	Q1. Maintaining and Managing the Transportation System: Please circle the number that best describes your level of satisfaction with TDOT's efforts to provide the following services on Interstates (e.g., I-55, I-40, I-75), state highways (e.g., US-64, US-70, SR-96) and other numbered highways in the area where you live. Please DO NOT CONSIDER city and county streets in your responses. 3. Removing snow and ice from highways
1.7	1F	1G	7. Keeping the surface of Interstate highways in good condition (smooth & free of potholes)
1.8	1G	1H	8. Keeping the surface of other state highways in good condition (smooth & free of potholes)
1.18	1Q	1R	18. Minimizing congestion on highways in urban areas

2016	2013	2006	Question
Transportation Options			
5.7	5G	2	Q5. Transportation Options: Please circle the number that best describes your level of satisfaction with the adequacy of the following transportation services and alternatives where you live: 7. Providing park and ride facilities where residents can park their car and access public transportation or carpool/vanpool services
Overall Ratings			
7.13	7J	--	13. Overall, the level of traffic congestion on Interstate highways is acceptable
17.7	30G	--	7. Compared to other states I have visited; I think Tennessee's transportation system is one of the best.

The following sections highlight practically and statistically significant trends discovered in the survey data for each spatial demographic group. A complete set of the statistical analyses performed for this research can be found in Dataset IV.

4.9.1. Urban and Rural Trends

Initial screening identified three practically significant survey questions (1.7, 5.7, and 7.13) for urban and rural residents related to highway maintenance, transportation options, and overall ratings. Further analysis revealed that each item was also statistically significant for at least one trend in time for either urban or rural respondents. Table 4.9.2 and Table 4.9.3 provide results for questions that have statistical and practical significance. Each table reports the difference in mean response for the indicated years, along with the p-value indicating statistical significance. The p-value represents the lowest level of significance at which the null hypothesis of no difference between the means can be rejected. Typically, a p-value of less than 0.05 is considered to represent a significant difference between means. In the case of the examples in Table 4.9.2, the p-value of 0 means the difference in means between survey years was very significant. There were no practical trends observed between the respondents from the urban and

rural categories for any survey year although perception ratings were somewhat higher for all years for residents in rural areas. Thus, no further testing was conducted comparing urban and rural responses.

Table 4.9.2. Urban Trends: Practical Screening

Urban			
Question	**Difference**	**Trend**	**P-Value**
1.7	-0.56	2016-2006	0
1.7	-0.57	2016-2013	0
7.13	-0.59	2016-2013	0

Table 4.9.3. Rural Trends: Practical Screening

Rural			
Question	**Difference**	**Trend**	**P-Value**
1.7	-0.50	2016-2006	0
5.7	-0.71	2016-2006	0

All of the significant findings for urban and rural residents indicate that perceptions have degraded over time. Question 1.7 (condition of interstate surfaces) shows drops for both urban and rural residents of 0.5 - 0.57 points. Question 7.13 (level of congestion) revealed significant declines (0.5 points) only for urban residents. Perceptions of rural residents regarding park and ride facilities declined the most, at 0.71 points. This may be reflective of additional congestion in urban areas where rural residents work, and an increased desire for alternative transportation options.

To further explore why urban residents may have experienced declines in satisfaction related to congestion, construction projects that were active over the relevant time periods were compared with urban and rural locations to look for trends. From 2006 to 2016, there were active interstate construction projects in all counties across the state, with the heaviest activity in urban areas. When looking at individual years, the number of construction projects in urban areas was lower in 2006 than in 2016. At the same time, population in Tennessee's largest urban areas has increased, and for some areas, very rapidly. Nashville, for example, was growing at the rate of 100 persons per day at the time of the 2016 survey event (Reicher 2019). The decline in resident perception is likely due to a combination of increased population, and thus drivers, as well as increases in construction activity.

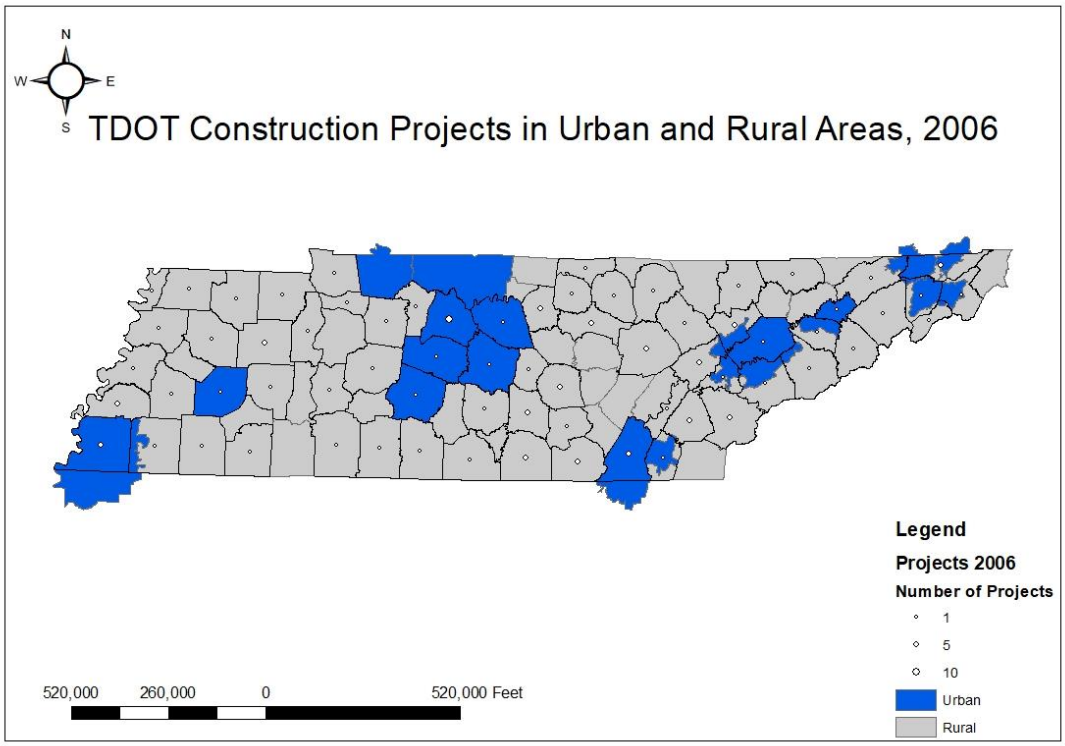

Figure 4.9.1. Project Distribution in Urban and Rural Areas, 2006

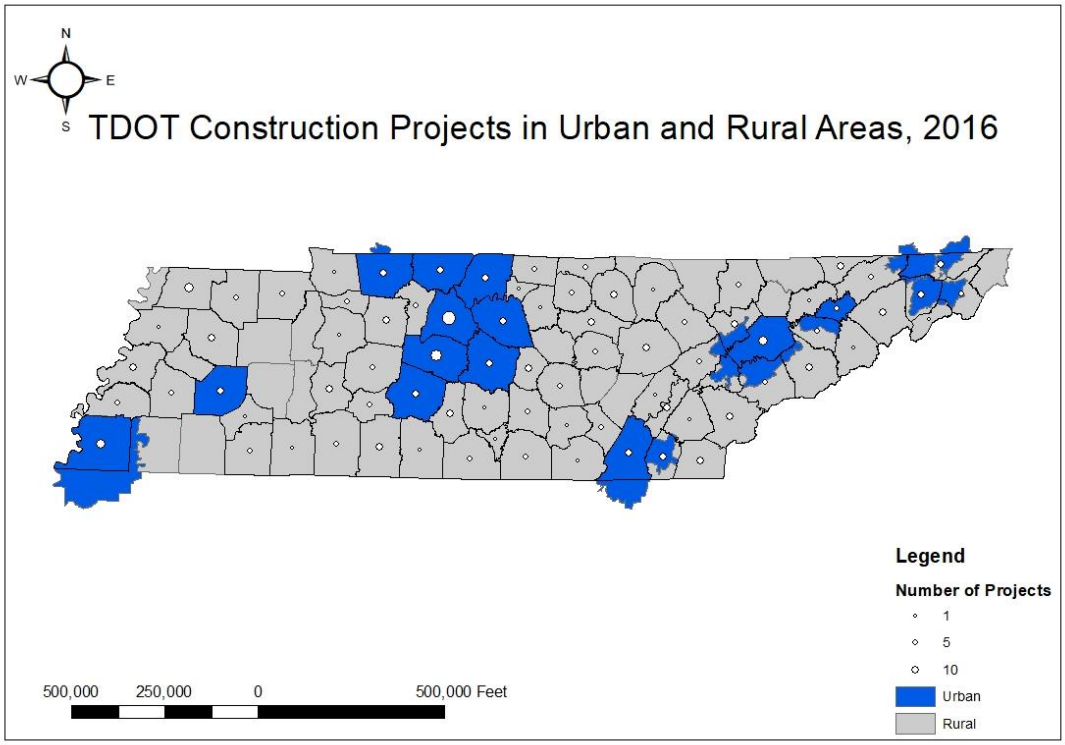

Figure 4.9.2. Project Distribution in Urban and Rural Areas, 2016

4.9.2. Economic Trends

Trends were examined for economically distressed, non-distressed and at-risk counties. There were four questions where differences were observed that had practical significance. The data was tested for statistical significance for trends over time and trends within each data set. Table 4.9.4 through Table 4.9.6 show the p-values for the trends over time. Trends within the 3 demographic categories are also shown below. Question 1.18 (minimizing congestion) for survey year 2013 and Question 7.13 (overall congestion) for survey year 2016 both were considered statistically significant in the non-distressed category. The trends observed for these questions can be found in Table 4.9.7 and Table 4.9.8, respectively.

Table 4.9.4. Distressed County Trends

Distressed			
Question	**Difference**	**Trend**	**P-Value**
1.3	-1.02	2016-2013	0.007
1.7	-1.02	2016-2013	0
1.8	-1.03	2016-2013	0
1.18	-0.92	2016-2013	0

Table 4.9.5. At Risk County Trends

At Risk			
Question	**Difference**	**Trend**	**P-Value**
1.3	-0.84	2016-2013	0.037
1.7	-0.70	2016-2013	0
1.8	-0.67	2016-2013	0
1.18	-0.64	2016-2013	0

Table 4.9.6. Non-Distressed County Trends

Non-Distressed			
Question	**Difference**	**Trend**	**P-Value**
1.3	-0.71	2016-2013	0
1.7	-0.84	2016-2013	0
1.8	-0.75	2016-2013	0
1.18	-0.68	2016-2013	0

Table 4.9.7. Economic Status Comparison: Question 1.18

P Values: Economic Status 2013				
		Comparison	**Mean Difference**	**P Value**
Q 1.18	Non-Distressed	At-Risk	-0.50*	0
		Distressed	-0.46*	0

Table 4.9.8. Economic Status Comparison: Question 7.13

P Values: Economic Status 2016				
		Comparison	**Mean Difference**	**P Value**
Q 7.13	Non-Distressed	At-Risk	-0.51*	0
		Distressed	-0.47*	0

All of the significant findings for distressed, at-risk, and non-distressed counties indicate that perceptions have degraded over time. Question 1.3 (removal of snow and ice), Questions 1.7 and 1.8 (condition of interstate and highway surfaces), and Question 1.18 (minimizing congestion) shows drops of 0.6 – 1.0 points. Perceptions of residents in distressed counties have declined the most. The highest difference observed within the economically distressed category was perception of highway maintenance with a decline of 1.03 between the means from 2013 and 2016. Residents of at-risk counties had the highest decrease in perception for question 1.3 related to keeping the interstate clear of snow and ice. Residents of non-distressed counties had the highest decrease in satisfaction for question 1.7, satisfaction of interstate maintenance. TDOT should examine maintenance investments over these time periods to

determine if there may be a discrepancy between counties with varying economic status that could account for these results.

There were also two statistically significant trends among the economic demographic groups. Questions 1.18, congestion on urban highways and question 7.1, overall perception of congestion on the interstate showed differences in perception for residents in distressed counties vs at-risk and non-distressed counties. Residents in non-distressed counties had significantly more negative perceptions of congestion than did those in at-risk or distressed counties. Visualizations were made to represent each economic category. TDOT construction projects were overlaid on the economic categories to show where most projects were occurring. More projects occurred in economically non-distressed areas showing a possible correlation between construction delays causing congestion in urban areas between 2013 and 2016, as shown in Figure 4.9.3. The number of active construction projects in 2013 and 2016, respectively, are shown in Figure 4.9.4 and Figure 4.9.5.

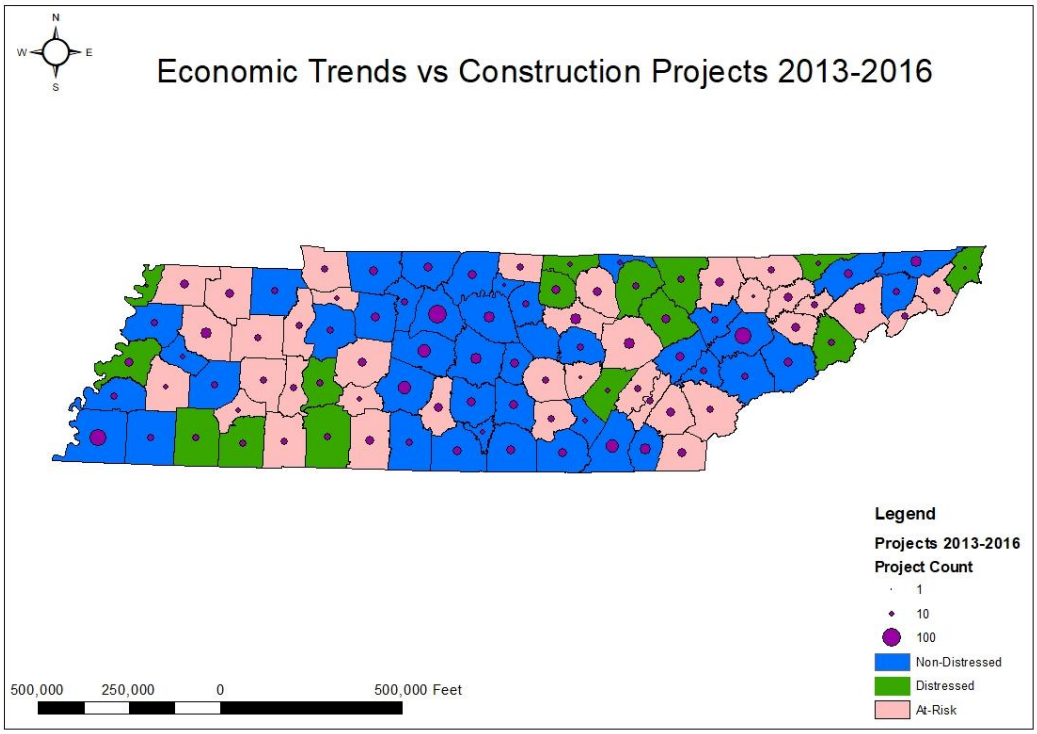

Figure 4.9.3. Construction Project Activity by Economic Status, 2013-2016

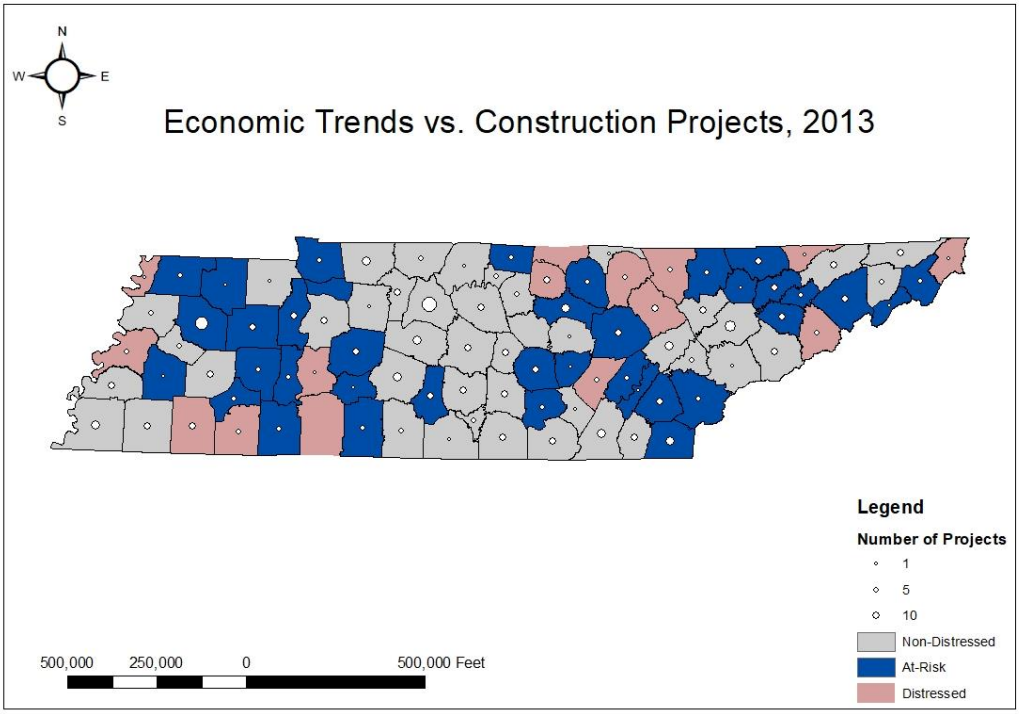

Figure 4.9.4. Construction Project Activity by Economic Status, 2013

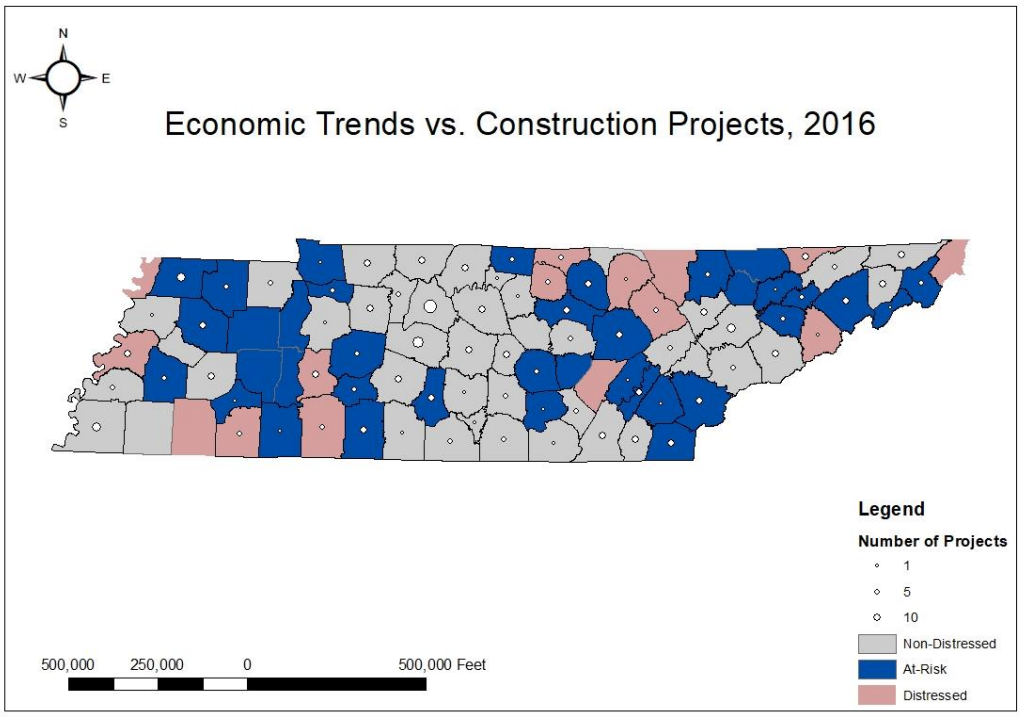

Figure 4.9.5. Construction Project Activity by Economic Status, 2016

4.9.3. Regional Trends

Trends over time were tracked for each region. After the differences were taken from 2016 to 2006 and 2016 to 2013, the practically significant trends were identified, and tests for statistical significance were conducted. Table 4.9.9 through Table 4.9.12 show the significant trends.

Table 4.9.9. Region 1 Trends Over Time

Region 1			
Question	**Difference**	**Trend**	**P-Value**
1.7	-0.52	2016-2006	0
5.7	-0.62	2016-2006	0

Table 4.9.10. Region 2 Trends Over Time

Region 2			
Question	**Difference**	**Trend**	**P-Value**
5.7	-0.57	2016-2006	0

Table 4.9.11. Region 3 Trends Over Time

Region 3			
Question	**Difference**	**Trend**	**P-Value**
1.3	-0.58	2016-2013	0
1.7	-0.72	2016-2013	0
1.18	-0.76	2016-2006	0
1.18	-0.66	2016-2013	0
7.13	-0.83	2016-2013	0

Table 4.9.12. Region 4 Trends Over Time

Region 4			
Question	**Difference**	**Trend**	**P-Value**
1.7	-0.74	2016-2006	0
1.8	-0.59	2016-2006	0
5.7	-0.57	2016-2006	0
1.7	-0.54	2016-2013	0
7.13	-0.53	2016-2013	0

There was an overall decline of user perception for all the questions where significant changes over time occurred. Region 3 and 4 produced the most significant results for differences in perceptions across all survey years. For question 1.3 (keeping the interstate free of snow and ice), residents of Region 3 showed a decline in perception from 2013 to 2016. For question 1.7, (conditions of interstates), Regions 1, 3 and 4 all had declining trends in perception. Region 1 and Region 4 saw a practical and statistical decline from 2006 to 2016 while Region 3 saw a practical and statistical decline from 2013 to 2016. Region 3 showed a decline in user perception related to minimizing congestion on highways in urban areas as well as the overall perception of congestion on the interstate. Region 4 also reported a decline in perception for overall satisfaction of interstate congestion for the 2013-2016 trend. Question 5.7 (availability of park and ride facilities) showed a decline in Regions 1, 2, and 4 for the 2006-2016 trend. Each trend was visualized in ArcGIS to show the differences in each region, as shown in Figure 4.9.6 through Figure 4.9.13.

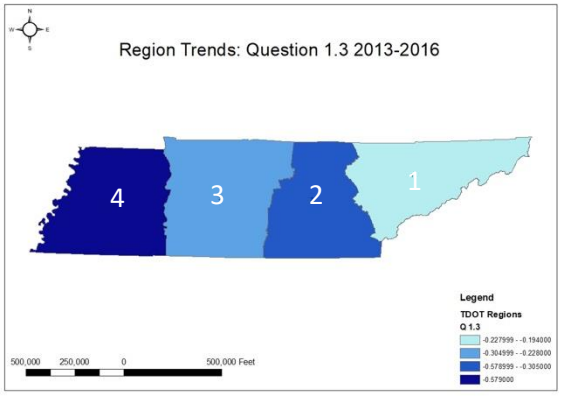

Figure 4.9.6. Resident Perceptions in Regions for Snow and Ice Removal, 2013-2016

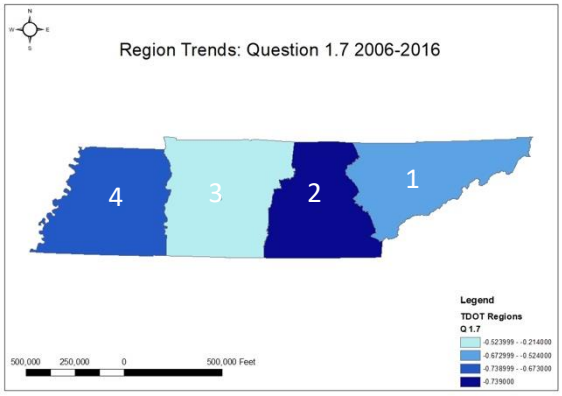

Figure 4.9.7. Resident Perceptions of Interstate Conditions in Regions, 2006-2016

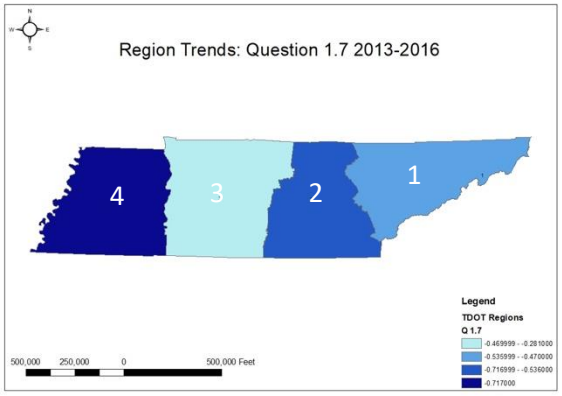

Figure 4.9.8. Resident Perceptions in Regions for Maintaining Interstate Conditions, 2013-2016

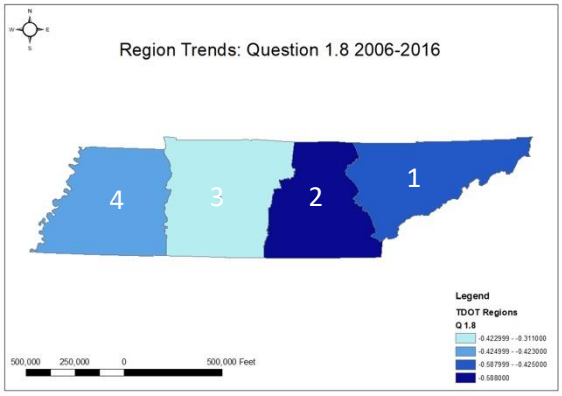

Figure 4.9.9. Resident Perceptions of State Highway Conditions in Regions, 2006-2016

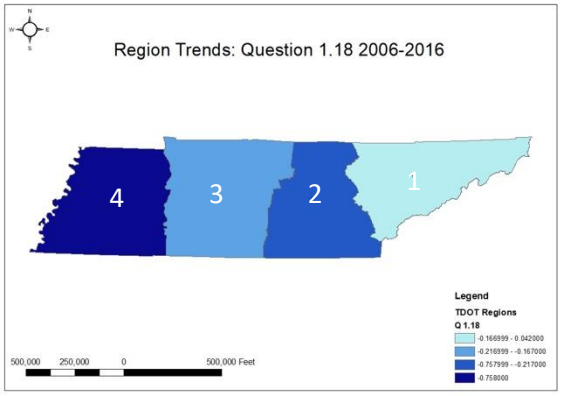

Figure 4.9.10. Resident Perceptions of Congestion in Regions, 2006-2016

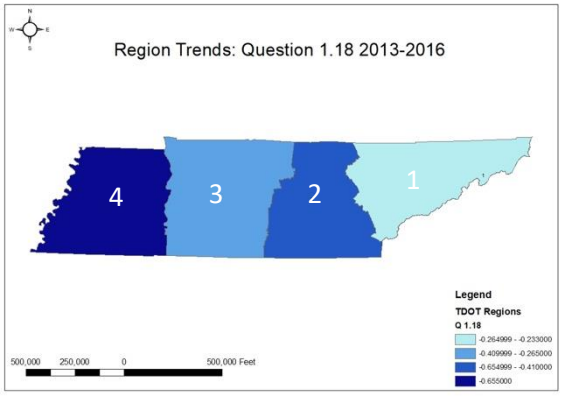

Figure 4.9.11. Resident Perceptions of Congestion in Regions, 2013-2016

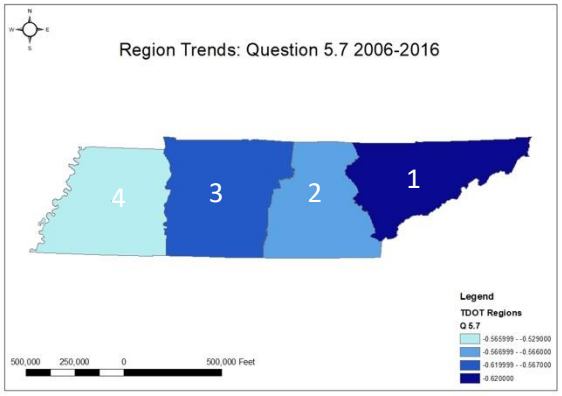

Figure 4.9.12. Resident Perceptions of Providing Park and Ride Facilities in Regions, 2006-2016

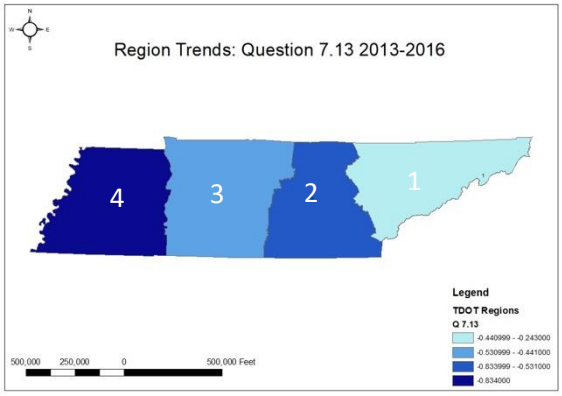

Figure 4.9.13. Resident Perceptions of Overall Traffic Congestion on Interstate Highways in Regions, 2013-2016

TDOT construction projects were overlaid to examine correlation with question 1.18, perception of congestion in urban areas. Only Region 3 had a significant decline for this question. There is no obvious correlation when examining the number of active projects for Region 3 versus the other regions, as shown in Figure 4.9.14. Further examination of the data was conducted to determine the sample makeup for each region. Figure 4.9.15 through Figure 4.9.17 show the relative number of responses to the survey in each county for each year. From these figures, it is obvious that respondents tend to be clustered in urban areas, especially in the greater Nashville area. In future survey events, TDOT should consider the spatial discretization that will result in the most valuable input for decision-making. It may be that obtaining representative samples at the county level provides greatest insight. However, this sampling approach

would likely require more resources, so understanding limitations of spatial analyses and other data sources that can be integrated to provide deeper insight is important.

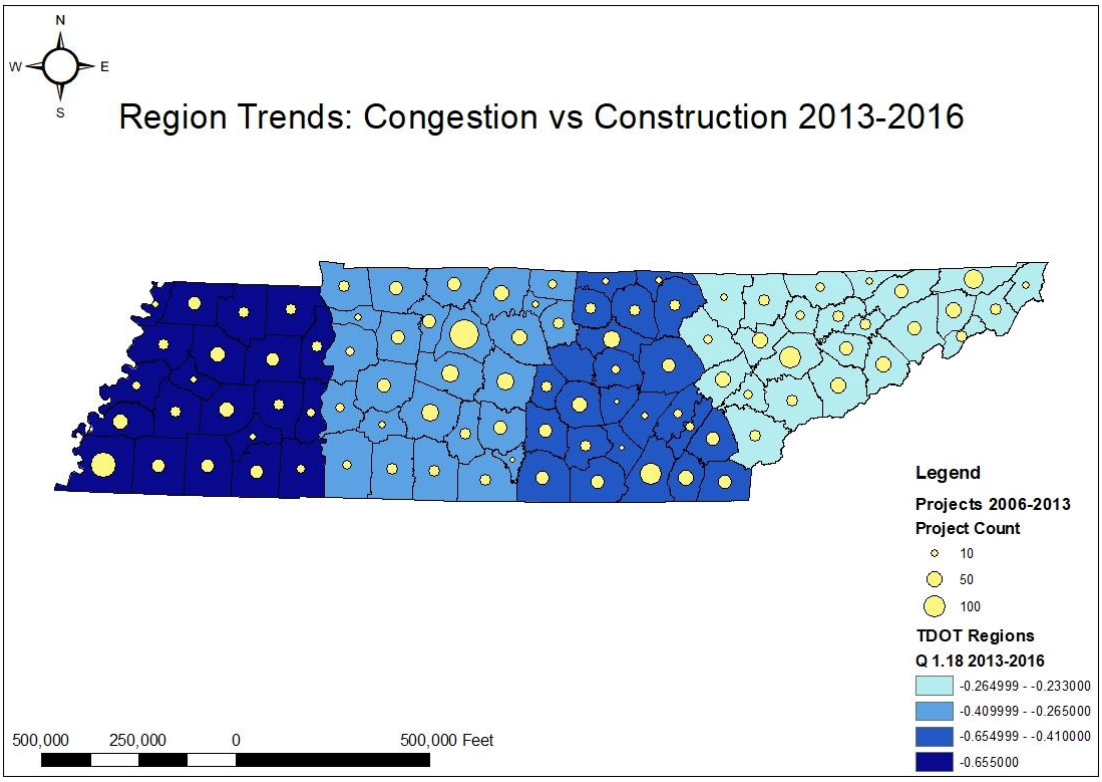

Figure 4.9.14. Congestion and Construction Trends by Region, 2013-2016

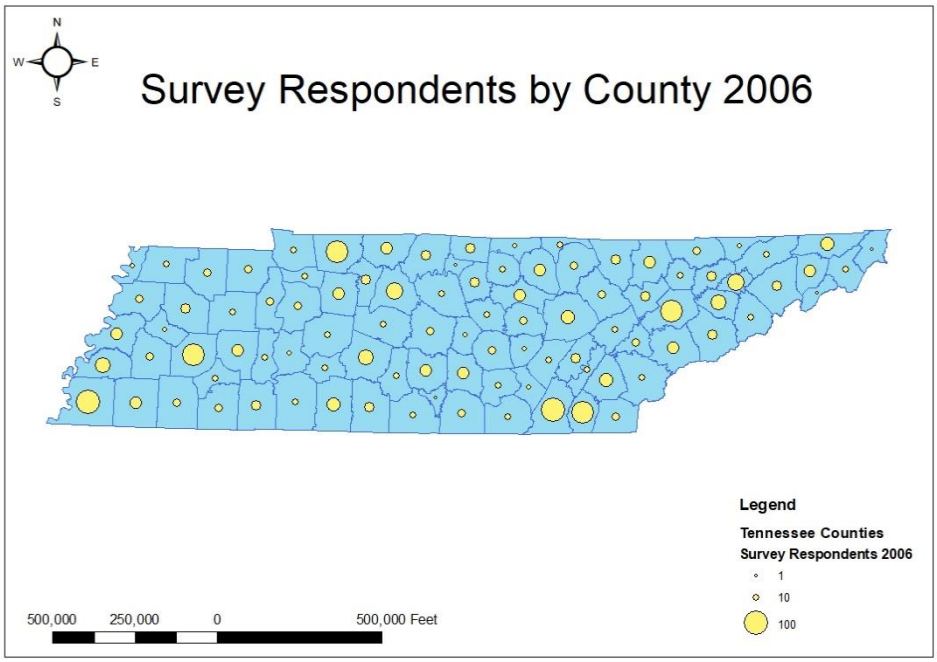

Figure 4.9.15. Dot Density for Survey Respondents by County, 2006

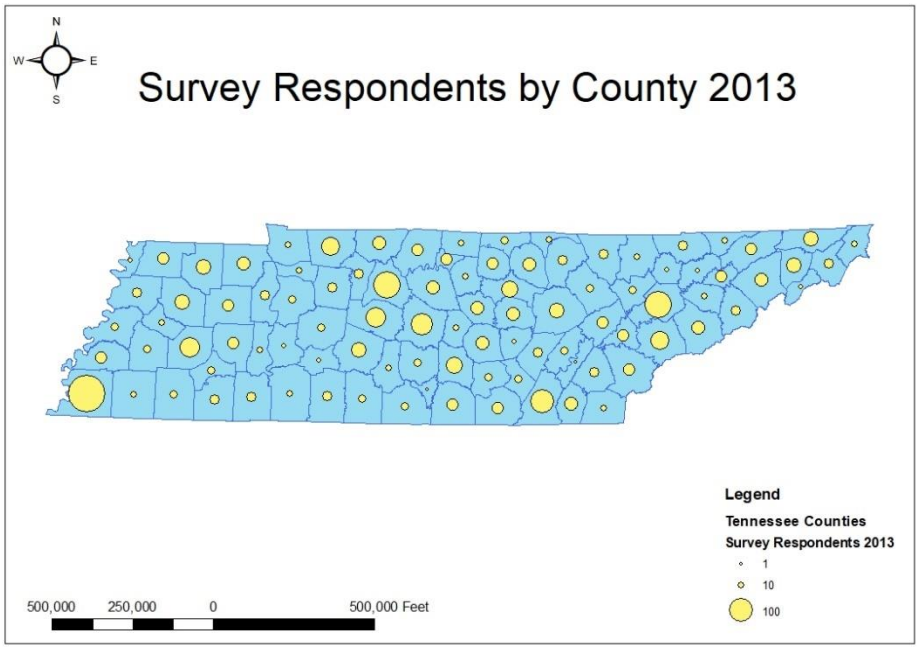

Figure 4.9.16. Dot Density for Survey Respondents by County, 2013

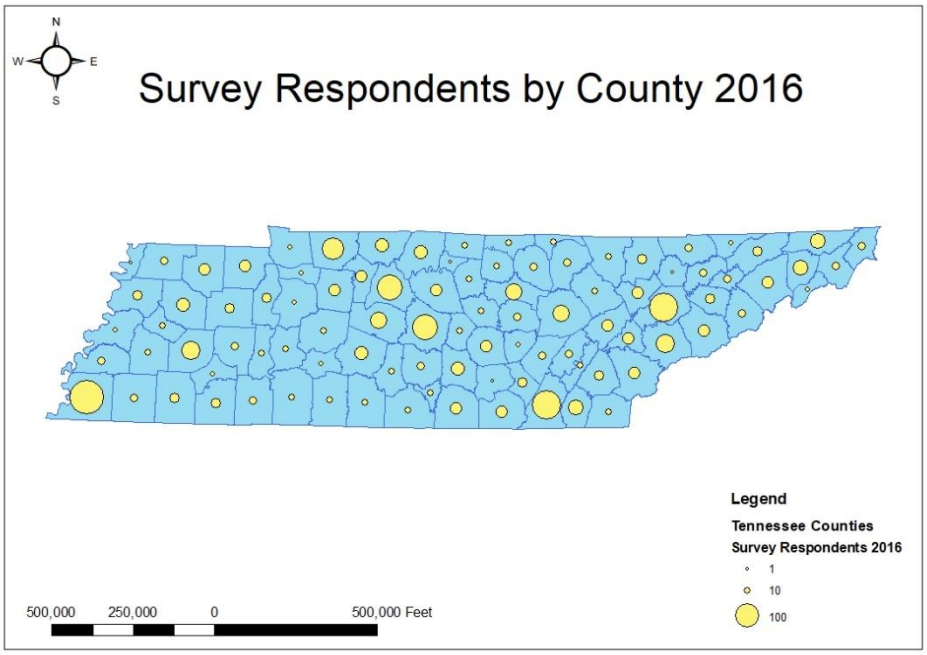

Figure 4.9.17. Dot Density for Survey Respondents by County, 2016

There were no statistically significant trends between regions for 2006. There were statistically significant trends in Region 3 compared to the other regions for questions 1.18 and 7.13 in 2013 but there were no practical differences in the means for each question. Questions 1.3, 1.18, and 7. 13 included statistically significant trends for Region 3 in 2016, but only questions 1.18 and 7.13 met the practical significance threshold, as shown in Table 4.9.13 below.

Table 4.9.13. Region Comparison for 2016: Questions 1.3, 1.7, 1.18 and 7.13

P Values: Regions 2016 α= 0.005					
		Comparison	**Mean Difference**	**Standard Error**	**P Value**
Q 1.3	Region 3	Region 1	-0.33*	0.08	0
		Region 2	-0.41*	0.08	0
		Region 4	-0.38*	0.08	0
		Comparison	**Mean Difference**	**Standard Error**	**P Value**
Q 1.7	Region 2	Region 1	0.41*	0.08	0
		Region 3	0.49*	0.08	0
		Region 4	0.37*	0.08	0

	Comparison	Mean Difference	Standard Error	P Value
Q 1.18 Region 3	Region 1	-0.77*	0.09	0
	Region 2	-0.81*	0.09	0
	Region 4	-0.73*	0.09	0
	Comparison	**Mean Difference**	**Standard Error**	**P Value**
Q 7.13 Region 3	Region 1	-1.03*	0.08	0
	Region 2	-0.84*	0.08	0
	Region 4	-0.78*	0.08	0

Region 3 had a significantly lower rating for Question 1.18 and 7.13, both of which focused on congestion. This again follows the trends seen in previous analyses where the urban congestion in the Nashville area due to population growth and construction activity degrades resident perceptions.

4.9.4. Super District Trends

For a discussion on the use of Super Districts, refer to page 36.

Table 4.9.14 through Table 4.9.25 below show the practically significant trends over time as well as the p-value for each of the relevant questions for each Super District. All Super Districts showed significant trends over time except Super District 2E. Super District 1W showed a decline for question 5.7, availability of park and ride facilities, and a decline in perception of 1.16 between 2006 and 2016, the highest reported difference for this demographic.

Table 4.9.14. Super District: 1C

Super District: 1C			
Question	**Difference**	**Trend**	**P Value**
1.7	-0.59	2016-2006	0
1.7	-0.55	2016-2013	0

Table 4.9.15. Super District: 1E

Super District: 1E			
Question	**Difference**	**Trend**	**P Value**
1.7	-0.55	2016-2006	0.001
5.7	-0.62	2016-2006	0.004

Table 4.9.16. Super District: 1W

Super District: 1W			
Question	**Difference**	**Trend**	**P Value**
1.7	-0.55	2016-2013	0
1.8	-0.59	2016-2006	0
1.8	-0.53	2016-2013	0
5.7	-1.16	2016-2006	0

Table 4.9.17. Super District: 2E

Super District: 2E			
Question	**Difference**	**Trend**	**P Value**
Nothing to Report			

Table 4.9.18. Super District: 2N

Super District: 2N			
Question	**Difference**	**Trend**	**P Value**
5.7	-0.66	2016-2006	0

Table 4.9.19. Super District: 2W

Super District: 2W			
Question	**Difference**	**Trend**	**P Value**
5.7	-0.85	2016-2006	0.001
7.13	-0.51	2016-2013	0.001

Table 4.9.20. Super District: 3E

Super District: 3E			
Question	**Difference**	**Trend**	**P Value**
1.3	-0.63	2016-2013	0
1.7	-0.77	2016-2006	0
1.7	-0.79	2016-2013	0
1.8	-0.59	2016-2006	0
1.18	-0.83	2016-2006	0

Table 4.9.21. Super District: 3S

Super District: 3S			
Question	**Difference**	**Trend**	**P Value**
1.7	-0.62	2016-2006	0
1.7	-0.67	2016-2013	0
1.18	-0.80	2016-2006	0
5.7	-0.55	2016-2006	0
17.7	-0.60	2016-2013	0

Table 4.9.22. Super District: 3W

Super District: 3W			
Question	**Difference**	**Trend**	**P Value**
1.3	-0.62	2016-2013	0
1.7	-0.57	2016-2006	0
1.7	-0.65	2016-2013	0
1.8	-0.56	2016-2006	0
7.13	-0.66	2016-2013	0.003

Table 4.9.23. Super District: 4E

Super District: 4E			
Question	**Difference**	**Trend**	**P Value**
1.7	-0.92	2016-2006	0
1.7	-0.69	2016-2013	0
1.8	-0.66	2016-2006	0
5.7	-0.56	2016-2006	0
7.13	-0.58	2016-2013	0

Table 4.9.24. Super District: 4N

Super District: 4N			
Question	**Difference**	**Trend**	**P Value**
1.7	-0.57	2016-2013	0
1.7	-0.89	2016-2006	0
1.8	-0.71	2016-2006	0
5.7	-0.58	2016-2006	0.001

Table 4.9.25. Super District: 4W

Super District: 4W			
Question	**Difference**	**Trend**	**P Value**
1.18	-0.53	2016-2013	0
5.7	-0.54	2016-2006	0.001
7.13	-0.63	2016-2013	0
17.7	-0.50	2016-2013	0.001

Figure 4.9.18 shows the locations of each of the 12 Super Districts. Super Districts 1C, 1E, 1W, 3E, 3S, 3W, 4E, 4N, and 4W all reported significant declines in perceptions related to maintenance of roadway surfaces. It is not clear why all districts in Regions 1, 3, and 4 would show significantly different results and Region 2 would not. TDOT could explore maintenance investments for the pertinent timeframes to determine if there is any difference that might explain this result.

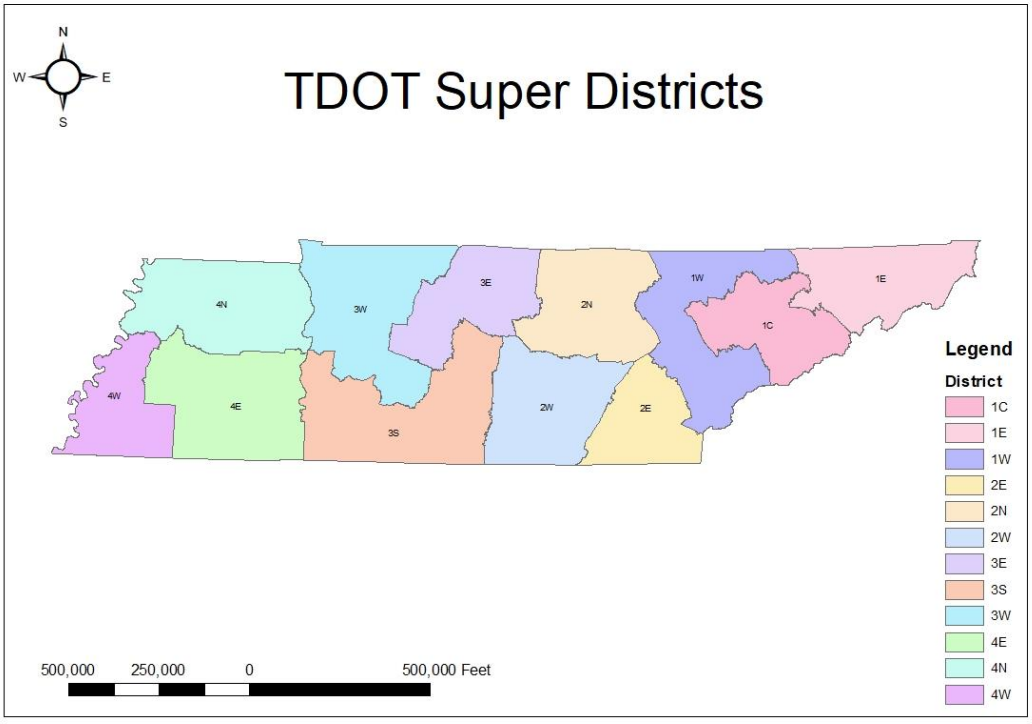

Figure 4.9.18. Tennessee Super Districts

Super Districts 2W, 3E, 3S, 4E, 4W showed declines in perceptions related to congestion. Each of these districts contains or is adjacent to the largest metropolitan areas for its region. This trend makes sense

given overall results indicating urban areas have seen significant increases in congestion and declines in resident perception since 2006.

Additionally, Super Districts 3S and 4W showed significant declines in ratings of Tennessee's interstate system as compared to systems in other states. Super District 3S is south of Nashville, and 4W contains the Memphis/Shelby County metropolitan area. It is unclear what other changes may have occurred during the survey time periods that may have influenced these results. However, there are some plausible explanations. For District 3S, population growth may have influenced perception of the interstate system. As shown in Figure 4.9.19, Middle Tennessee had the largest rate of population change in 2010-2018 (dark blue is 2.0% or greater, light yellow is less than 0%), with Rutherford County in District 3S increasing at a compound annual rate of 2.64%, the second highest in the state. Also, as shown in Figure 4.9.20, net migration was greatest in Middle Tennessee as well, with Rutherford County showing the largest increase of all counties. The increasing population may have exacerbated the effects of congestion as people in Williamson, Wilson, and Rutherford counties commute into Nashville for work.

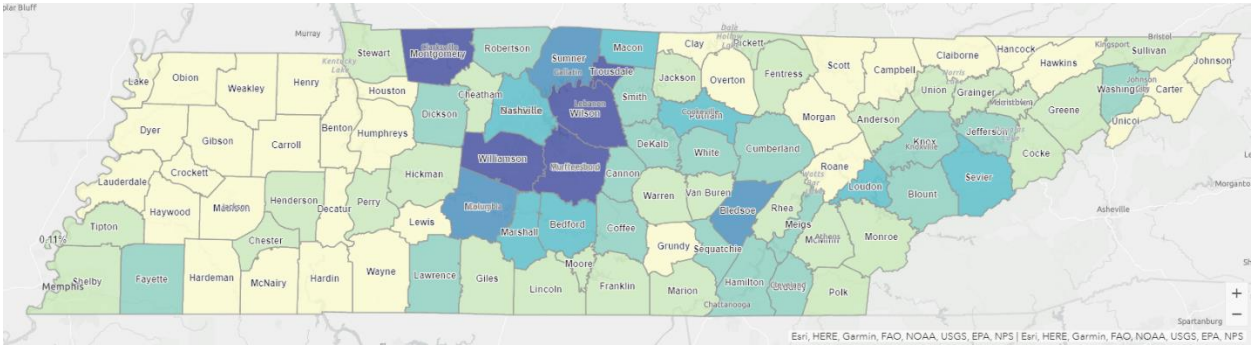

Figure 4.9.19. Tennessee Rate of Population Change 2010-2018 (TN State Data Center 2020)

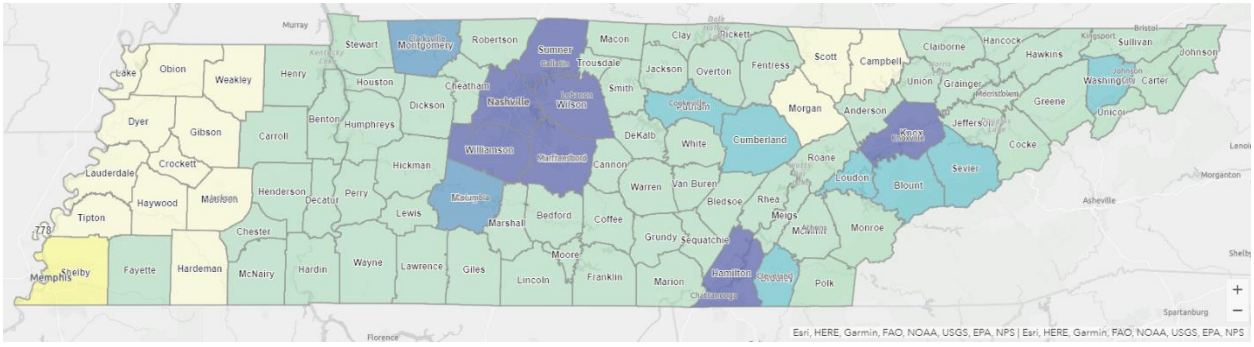

Figure 4.9.20. Tennessee Net Migration 2010-2018 (TN State Data Center 2020)

Construction on the I-40/I-240 flyover began in 2013 and was completed in 2016, causing commuter delays for residents of the Memphis metropolitan areas as well as other residents of Shelby County. This

may have been a factor in the decline in ratings due to timing of interviews for the 2016 event. Additionally, many residents do not know the difference between local roads and TDOT-owned roads. Therefore, the aging local roads in the Memphis area may have contributed to the decline of ratings in District 4W. We recommend providing a map of TDOT roads to survey participants to avoid this problem for future survey events.

The only item where a statistically significant difference was observed between districts was Question 1.18 (minimizing congestion) for the survey year. Super district 3E met the criteria for practical and statistical significance when compared to all the other super districts except for super district 3S, as shown in Table 4.9.26.

Table 4.9.26. Super District Comparison for 2016: Questions 1.18

P Values: Super District 2016 α= 0.005					
		Comparison	**Mean Difference**	**Standard Error**	**P Value**
Q1.18	3E	1C	-0.89*	0.14	0
		1E	-1.36*	0.15	0
		1W	-0.89*	0.15	0
		2E	-1.06*	0.14	0
		2N	-1.19*	0.15	0
		2W	-0.93*	0.16	0
		3S	-0.31	0.15	0.6
		3W	-0.48*	0.14	0.03
		4E	-1.13*	0.16	0
		4N	-1.38*	0.16	0
		4W	-0.66*	0.14	0

This result is particularly revealing because it underscores and better delineates findings reported in previous sections. Super District 3E contains Nashville. Super District 3S is immediately south of 3E and is an area with a significant extension of the Nashville metropolitan area. Super District 3W, however, contains less populous counties, as well as those with less construction activity in 2016, as shown in Figure 4.9.21. Thus, this further underscores the impact of the Nashville area on survey results.

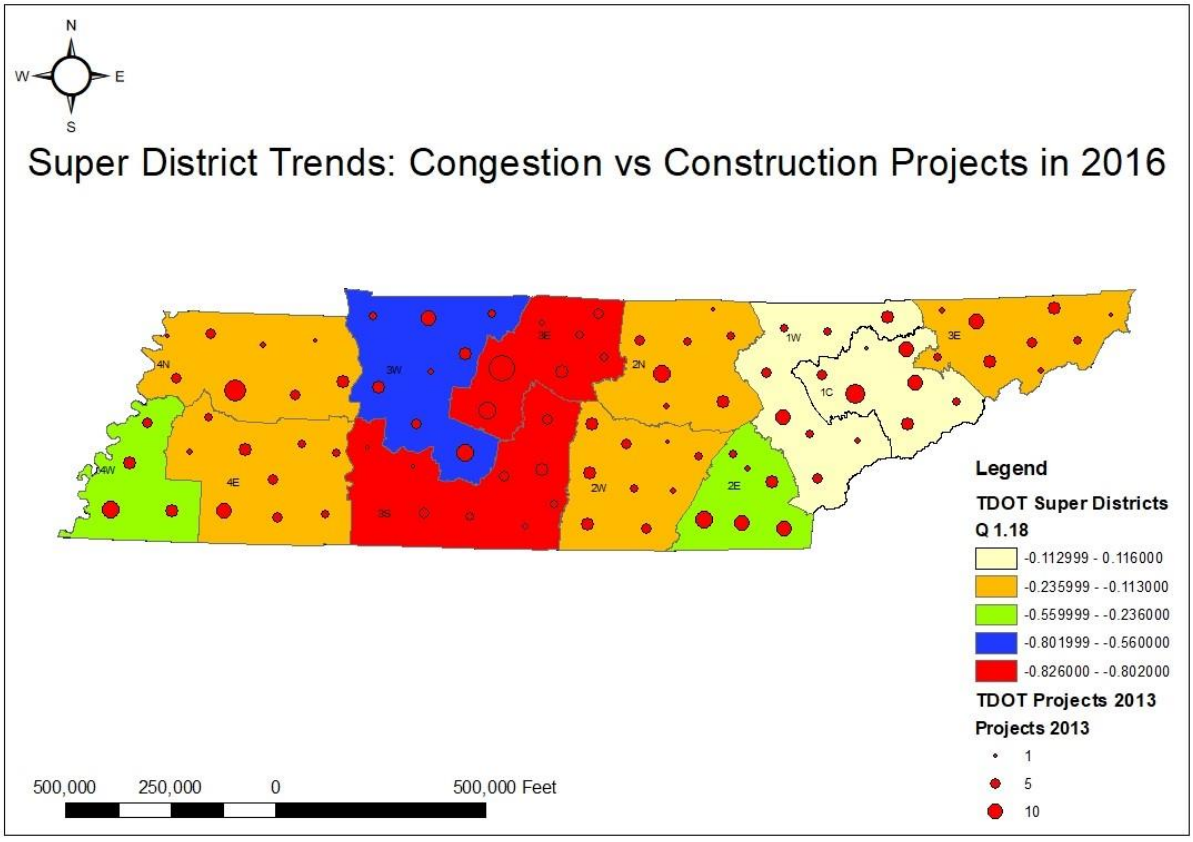

Figure 4.9.21. Congestion and Construction Projects by Super District, 2016

TDOT project information was overlaid with congestion within the state to represent a correlation between reduction of satisfaction based on the number of projects occurring within the super districts. From the period of 2006 to 2016, super districts 3S and 3E experienced the most negative trend in resident perception as well as the period of 2013 to 2016.

Chapter 5. State DOT Interview Results and Discussion

In order to make recommendations for future customer service events, a total of 22 DOTs throughout the country were contacted. Of the 22 organizations, 18 granted an interview, 2 declined an interview and 2 did not respond after multiple attempts, resulting in an agreement rate of 81%. Table 4.9.1 lists all the DOT participants who agreed to an interview.

Table 4.9.1. Interview Participants

DOT Name	State	Date of Interview	Copy of Report	Complete
IDOT	Illinois	3/25/20	Yes	Yes
MDT	Montana	3/25/20	Yes	Yes
ODOT	Oregon	3/25/20	Yes	Yes
KYTC	Kentucky	3/26/20	Yes	Yes
ADOT	Arizona	3/31/20	Yes	Yes
Caltrans	California	4/17/20	Yes	Yes
FDOT	Florida	4/30/20	Yes	Yes
NCDOT	North Carolina	5/5/20	Yes	Yes
CDOT	Colorado	5/13/20	Yes	Yes
WYDOT	Wyoming	5/13/20	Yes	Yes
MoDOT	Missouri	5/18/20	Yes	Yes
TxDOT	Texas	5/28/20	Yes	Yes
Vtrans	Vermont	6/1/20	Yes	Yes
MDOT	Michigan	6/2/20	Yes	Yes
DelDOT	Delaware	6/3/20	Yes	Yes
MnDOT	Minnesota	6/4/20	Yes	Yes
WaDOT	Washington	6/15/20	Yes	Yes

5.1. Synthesis of Interview Responses

All interviewees provided responses to each of the thirteen questions. Some respondents participated in online or phone interviews, and a few states provided written responses to the questionnaire. Response data was analyzed for each question and is summarized in the following sections.

Question 1: *What are your agency's goals for stakeholder survey events? Is the resulting data used for strategic planning?*

Interview participants were tasked to describe the ways in which they have implemented a survey event. The majority of the participants conduct comprehensive surveys to track customer service and also to aid

in strategic planning as shown in Table 5.1.1. Major goals for the organizations represented were to determine resident perception of services related to maintenance, construction practices, and safety concerns, priorities for investments, and required input for federal or other state mandates. Several also add questions related to 'hot topics' to understand stakeholder thinking related to topics such as integration of new technologies for managing highway operations or use of rideshare services. The ultimate goal in most cases is to gauge how well the DOT is addressing customer needs and concerns, and results are used to guide decision making and strategic planning. Survey events are typically held in advance of regular strategic plan update periods. The participants that do not engage in broad customer survey events use surveys specifically for project planning.

Table 5.1.1. Survey Event Goals and Utility

Consistent	By Project	Used for Strategic Planning?	
		Yes	No
76%	24%	71%	29%

Question 2: *How frequently do you conduct your stakeholder surveys (and what stakeholder groups are included)? Describe your survey design (comprehensive, micro by topic, etc.; item type, etc.)*

Participating DOTs who conduct comprehensive customer surveys do so at varying frequencies. As shown in Table 5.1.2, the majority of the interview participants conduct bi-annual surveys. The participants that conduct their surveys on an as-needed basis described varying reasons that will be explored later in the results. Stakeholders surveys typically were focused on obtaining a representative sample of state residents, however some states also specifically targeted public officials as well as industry representatives. A majority of the surveys are designed using Likert Scale questions in either 3-point or 5-point scales. The use of open-ended questions is not as prevalent among participants due to concerns related to survey length and survey fatigue.

Table 5.1.2. Frequency of Survey Events

Annual	Bi-Annual	Less Frequent
21%	64%	7%

Question 3: *How is stakeholder sampling conducted? How are surveys administered? Who (university, consultant, etc.) administers the surveys and analyzes the data?*

Participants use various methods to collect customer information to represent the population within their respective state. The main methods were phone lists, address lists, census and voter data, and online panels. One state reported utilizing cell phone data in addition to landline data to balance the shift from home-phone to cell phone use. The use of an online panel was also mentioned by several states, who have adopted this practice to ensure representation from all stakeholder types, and particularly those that may be underrepresented when using traditional survey methods. Online panel providers have pre-screened pools of people who take surveys in return for some type of incentive. DOTs can contract with the panel providers to target certain demographics and locations for survey participants. One state has used Dynata, Innotas, and Amazon Turk most recently. The DOT representative remarked, 'It's a lot more cost effective for statistically significant results than convenience or address-based sampling but if you're targeting a smaller geographic area (say a particular county or a city), it would be tough for one panel provider to have enough respondents in that location.' Another state who now uses online panels regularly also indicated that an online panel "is more convenient and more representative of a population on a statewide scale," and several states have found this approach to be more cost effective than other methods. Other states have also found social media and online open houses to be effective platforms for distributing surveys. States that produce surveys only on a project basis reach out to residents and other stakeholders in areas near to where the project will be on-going rather than across the entire state.

Organizations utilize various conveyance methods to administer surveys to their target population. The majority are web-based, giving participants the option to complete surveys online through a weblink. Some states still offer surveys through the mail and over the phone to accommodate users that may not have access to the internet. But there are some participants who cannot be reached by any of these methods. For example, there are Native American tribes in some states that have limited interaction outside of the reservation, and there is a need to have surveyors perform door to door inquiries.

As shown in Table 5.1.3, a majority of the states interviewed used a consultant or university to conduct their user survey and also to produce the results. A few organizations partner with a consulting firm to design their survey and produce the sampling information while the DOT conducts the survey. One state emphasized that using a consultant was integral to ensuring proper survey design and dissemination. Another DOT indicated that partnering with a university helps alleviate bias due to negative perceptions residents have of a survey administered by the government.

Table 5.1.3. Survey Administration Agency

University	Consultant	In-House
29%	76%	24%

Question 4: *What subgroups are analyzed within residential surveys? (i.e., location, demographics, etc.)*

A majority of the participants look at both demographic information and location data. Demographic data that is tracked includes age, race, gender, language spoken in the home, income, employment, typical mode of travel, and education. Location of residence of respondents, relating to the different districts, regions, or counties within each state, is also collected. DOTs require representative samples from each of the subgroups that will be included in the data analysis.

Question 5: *What types of analyses are conducted with residential survey data (please describe statistical methods, GIS, other)? Do you track changes over time?*

The methods of data analysis varied with each organization. All include descriptive statistical analysis but only a few use inferential statistics and test for significant differences between subgroups. The DOTs that utilized online commercial platforms such as SurveyMonkey took advantage of the analytics tools offered within the software. Other methods of data analysis included cross tabulation using a variety of software packages. GIS was primarily used within organizations to visualize spatial differences by creating heatmaps. One state employs ArcGIS StoryMaps to show projects occurring throughout the state. A majority of the organizations track changes over time as shown in Table 5.1.4.

Table 5.1.4. Tracking Changes over Time

Do you track changes over time	
Yes	No
88%	13%

Question 6: *How are these results used to support the department's mission? How are results communicated (and with what populations)?*

Overall, participants used the results from the surveys to improve the level of customer service and prioritize improvements that need to be made to better serve the state residents. Below are examples of responses from participants of the DOT interviews. The majority of the participants are open to offering results online to remain transparent to their constituents.

Table 5.1.5. Use of Survey Results by Interviewed DOTs

Responses
External Partner survey is shared through management to share with subordinates and executive staff. Employee survey is shared with all employees. Information is used to support strategic plan to be a great organization (Organizational Improvement)
Used as a benchmark to see progress (satisfaction) between districts and statewide. Used to fulfill long-range planning goals. Champions stakeholders and others to distribute results.
Have not used results much yet. We will when we have the results that include the online panel. Can use it for talking to leadership about where to go in terms of policy. Can share information with staff to improve morale; can help focus attention regarding dangerous behaviors and traffic safety; can direct focus for maintenance. Hopefully will see impact of construction investments over time.
Corridor Planning: The results are given great deference within the agency's mission to "provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life." Results are communicated within the body of reports/studies, with more detail in the appendices. Statewide Transportation Planning: A survey report was completed to show the general public a breakdown of these results and made available for several years following the completion of the current LRSTP.
Our mission focuses on customer service and the annual survey gauges how successful we are in this area. It's gauged by geographical area so we can see satisfaction levels across the state for various DOT services. Results are first communicated internally, and then provided to our state legislature, and finally published online and sent out via a media news release.
Because we have narrowed down the questions, we use these to prioritize or deprioritize the metrics or measures that will be in the strategic plan. For example, if everyone is very satisfied with rest areas, we continue what we are doing, but don't make this a priority for improvements/changes. From the open-ended piece at the end, if a topic keeps coming up (i.e., I didn't like the way traffic were cones set up), then we add this to our internal tracking so that we can address it. Communicate through public affairs – de-identified data. Will post to website. Our transportation commission has to approve any data or research that we do before it is posted or published, so they review first. Each commissioner is from a different area of the state. They are some of the biggest stakeholders.
Very open and transparent. Survey results are public. DOT communicates to the public when projects or other improvement are taking place. By keeping the public informed, the DOT is accountable.

Responses
Omnibus is benchmark for how our DOT is doing across the state, overall quality of roads and bridges, how satisfied (customers are) with how we are fulfilling the mission. First communicated to senior leadership, then groups within the DOT. We are better at communicating results internally vs externally.
Supports mission to fulfill federal requirement for performance management and helps DOT understand generally where we have to do a better job. Results are in annual report for both surveys and are available online.

Question 7: *Please share any lessons learned or innovative practices that you currently employ that have resulted in significant value to your organization's planning process.*

Below are some examples of lessons learned and innovative practices utilized by organizations to collect resident data. The growing concern due to the COVID-19 pandemic has prompted DOTs to try new methods to obtain public feedback in a safe way, such as use of virtual meetings.

Table 5.1.6. Lessons Learned by Interviewed DOTs regarding Surveys

Responses
Moving to an online panel - more economical, more flexible to change questions, more statistical significance (data matches census); weight data for more accurate sampling. Moving away from legacy questions.
It is important to have a variety of tools in the toolbox to solicit input. We have expanded that toolbox recently to include online GIS weblets, story maps, Metro Quest (or similar interactive surveys), USPS Every Door Direct Mailing, traditional mail and email, webinars, virtual meetings, and traditional town halls.
Conducting both a public and a stakeholder (public officials, industry, environmental groups, persons with disabilities, etc.) survey has enabled us to understand the general public preferences as they relate to the focused interests of various stakeholder groups.
For project development we use online forums and streaming to collect public comments. This has become more prevalent during the pandemic and I don't envision us going back to always having in-person hearings. We also have a subscription to ***publicinput.com*** *that has been a great tool for collecting customer and citizen feedback.*

Responses
Biggest thing we have learned is making sure a non-biased party conducts the survey. You get better answers and quicker responses. Makes data much more meaningful. Keep surveys short and simple. Make everything very transparent in DOT- one of our biggest goals. So, implementation of strategic plan is always public, and we write articles about, etc., always show how we are connecting what we have learned from stakeholders to what we are doing/priorities. We have a dedicated strategic planning staff dedicated to this.
The surveys have been an innovative process. The open houses are good, but surveys give more information and more ideas. We have worked to give projects in the same area surveys that had the same look and feel to create consistency and place it on every platform (Facebook, twitter). Also using stakeholders to distribute surveys to get information.

Question 8: *Are you willing to share a copy of your stakeholder surveys with TDOT? Are you willing to share final survey reports?*

All participants who conducted a comprehensive survey were willing to share a copy of their survey with TDOT and the University of Memphis research team. These are included as Dataset III.

Question 9: *Are you happy with how frequently your surveys are conducted?*

A majority of the participants were happy with the frequency of the surveys they produced as shown in Table 5.1.7. The main reasons reported for satisfaction with frequency were not burdening respondents with surveys and mitigating survey fatigue. Three states expressed interest in conducting more frequent surveys.

Table 5.1.7. Satisfaction with Survey Frequency

Are you happy with how frequently your surveys are conducted?	
Yes	**No**
73%	27%

Question 10: *Besides the survey, what other customer information do you collect? How do you blend this data to identify customer requirements, satisfaction, and/or engagement?*

A common method for DOTs to gather other customer service information is to use feedback from concerns and comments submitted via email, websites, social media, and other public forums. There is some concern in utilizing this information that is collected from customers. One DOT is very sensitive to collecting information from customers in order to respect data privacy laws. The data typically collected through comment cards or web forms includes phone numbers, physical addresses, and email address.

Question 11: *Do you utilize other mechanisms to gather customer information? If so, what do you use and for what purpose?*

Many of the participants utilized focus groups to collect customer information. One DOT implemented a focus group to launch their application for tracking user perceptions for summer and winter driving experiences. Two DOTs have implemented virtual focus groups to gather customer information and stay connected with the public. Another uses Mentimeter in combination with PowerPoint to conduct polling of participants in meetings. Examples of other responses can be found in Table 5.1.8.

Table 5.1.8. Alternative Mechanisms for Gathering Customer Information

Responses
Surveys are a kick-off for the statewide transportation plan. In 2017 we used surveys in combination with online focus groups. Residents participated in a summer and winter driving experience that consisted of 4 questions. Participants were paid to download an app, complete activities and a survey.
For project development feedback, we use the local media to spread the word of an upcoming or release of a study and also the good old-fashioned public meeting. Outside of those two, we rely very heavily on our local partners (county, city, MPO) to speak for their populations.
No other statewide mechanisms. Our DOT does engage in gathering information on local projects at the district levels.
We also use on-line interactive maps as part of our surveys to collect data.
For the state long-range transportation plan, we targeted environmental justice populations, and also used a hybrid of engagement methods (including telephone town-hall meetings, in-person events where we provide surveys, etc.).
Throughout statewide planning efforts a number of tools and resources are used depending on the effort being undertaken including focus groups, surveys, advisory committees etc. We also have a robust public involvement process for project development activities.

Responses
*More community meetings, listening sessions, more project engagement meetings. **Commercial web panels do not do a great job screening for bogus responses and non-relevant responses. There can be a lot of outliers.*
Our DOT has 15-20-person local working group (elected officials, citizens, business owners) Monthly, Bi-monthly for 2 years. These groups help to gather local data. Get detailed list of where change needs to happen.
Open-Houses for planning-studies.

Question 12: *Is there anything else you would like to share related to stakeholder surveys that I did not ask?*

Below is a sample of responses from the participants. Overall themes included producing a survey that allowed for actionable items, ensuring valid, statistically significant data is collected and figuring out the best way to implement changes within the community based on survey results.

Table 5.1.9. Suggestions from Interviewed DOTs

Responses
Inform population how the survey results influence the projects. Population will suggest project ideas. The DOT will inform public why things will work or why things won't work based on suggestions. Also building an understanding of where people are. What are the impacts in the community in the short term? How to move commerce more efficiently. Also how are people's lives impacted by projects? DATA with Validity is key.
*Surveying is getting harder and harder - if you are going to ask a question, make sure it is **actionable**!*
Stakeholders are very passionate about their area and offering surveys lets people express their opinion and open-ended questions are important.
Overall, trend to more virtual stuff. In the statewide projects, even if you go out, it is hard to get people to come out. Our DOT is focused on equity and just started a new position that focuses on equity. Will also do focus groups in evenings, bring food, to try to get input from specific underserved groups. Do need to make a conscious effort to get involvement. Also trying to work more with community-based organizations to have them get the word out about opportunities to provide input.
Biggest frequency items give a sense of what is important to customers and continuous improvements.

Responses
Have a lot of different missions throughout the DOT – aeronautics, highway patrol, engineering. All have different ways of polling stakeholders. Between these entities we get a representative sample by going to the commission members – these are prominent members of community- for additional input. Have a unique tight-knit community, unique from other states. We have a small population, so everyone is connected.
Surveying is an art not a science. Focus on audience. Methodology is important. Focus on what to do with the data when received.
Paid Facebook posts since you can reach specific populations. Nextdoor is also a way to let people know about local projects. Reddit is also a way to gauge perception and gather information.

Chapter 6. Options for Advanced Analyses

A variety of additional analyses options were also examined for potential to enhance TDOT's future survey events. These options included new platforms for engaging survey participants, alternate means of analyzing data with advanced statistical methods, and emerging data sources that may provide additional insight into residential stakeholder perceptions. The most promising of these methods are described in the following sections.

6.1. Deploying New Online Platforms

Maptionnaire is an emerging map-based survey tool based in Helsinki, Finland, with an U.S. office in San Francisco, CA. Surveys designed with Maptionnaire are entirely web-based and can be completed on desktop computers, smartphones, and tablets. In addition to traditional survey question types, respondents can draw points, lines, and polygons over a base map and answer questions linked to those shapes. Survey designers can add their own layers to the survey's base map, such as the locations of ongoing projects or planning areas. Survey results can be analyzed with the Maptionnaire API or be exported into a common file type for import into other software. The platform was recently used by the City of Denver for its "Denveright" comprehensive plan for 2040 and was well-received. TDOT should consider Maptionnaire for future survey events to better engage residents and facilitate incorporation of spatial context.

Another option designed specifically for government agencies is Publicinput.com. This platform provides a full suite of virtual stakeholder engagement options, including surveys, public meetings, interactive mapping and a stakeholder database management system. The system also facilitates two-way communication and conversation tracking. Social media tools are also incorporated into the system, with all components designed especially for government agency needs.

6.2. Designing Surveys for Regression Analysis

In previous survey analyses, Importance-Satisfaction matrices were developed which reveal factors that are important to customer satisfaction ratings. However, the approach does not consider customer demographics. TDOT could consider a redesign of its survey to support a predictive analysis related to customer preferences and satisfaction ratings. Other DOTs are currently pursuing this approach. The Wyoming DOT completely revised their survey to not only limit the number of questions to crucial topics (to prevent survey fatigue), but they also revised their scale from a 3-point to a 5-point Likert system. With careful survey design, specialized regression methodologies can be used to determine the factors

influencing customer satisfaction ratings and identify key differences between demographics. The goal of such an approach is to provide DOTs with insight regarding changes that should be considered to improve overall satisfaction or perceptions and experiences of a particular demographic groups. In the case of Wyoming, they are developing questions that specifically correlate to changes made in construction practices in hopes of revealing how these changes are shaping public perceptions (Newlin, 2020).

6.3. A New Approach for Assessing Customer Satisfaction

Previously statistical models have placed more emphasis on using satisfaction features that are easily mapped to human behavior and well understood causal relationships and correlations. Yet, evolving methods aim to exploit the power of pattern recognition models in prediction accuracy and appraising the potential of interpreting the causal relationship among the satisfaction features through an interactive system. It is anticipated that in the future, the public will not be required to fill out surveys for manifesting their preferences, as data mining of social media posts can reveal much about customer preferences and satisfaction. This is particularly true if DOTs develop relationships with the public where there is an expectation of two-way conversation regarding customer service topics via social media. The approach could also augment current methods as a pre-survey approach to determine expectations, gaps, and services that need to be targeted in actual survey and executive planning.

Research on estimating public satisfaction and performance measures based on reviews via the Twitter platform is mainly at the academic level. A limited number of research works have been focused on a local government study. For instance, Collins et al. (2013) demonstrated the use of Twitter social media-based data sources to evaluate transit rider satisfaction. Accordingly, transit authorities have access to vast amounts of performance metrics that measure ridership, timeliness, efficiency, safety, cleanliness, and service to name a few. However, these performance metrics are generally one-sided presenting the interest of the business and are non-customer based. The paper recognized the limitation of standard performance metrics and attempted to gauge transit rider sentiments by measuring Twitter feeds. After using the sentiment analysis for classifying a population of rider sentiments over a period of time, the authors drew conclusions from total of positive and negative sentiments, normalized average sentiments, and the total number of tweets collected over a time period (Collins, 2013).

In a U.S. DOT university transportation center, Chen and Krishnan (2013), developed a real-time Twitter monitoring system to automatically retrieve tweets related to transportation safety, extract the potential safety topics, calculate public sentiments, and ultimately visualize the topics and sentiments using word clouds, OpenStreetMap, and graph tools. The results indicate that there are a significant number of tweets

discussing or reporting information related to transportation safety. The prototype system was able to retrieve high quality tweets in real-time and geocode them to streets or geo-locate to latitude/longitude. The web-based, interactive interface allows users to quickly view the summary statistics of raw tweets and to identify potential safety bottlenecks using the advanced topic discovery and sentiment analysis functions.

Hao et al. (2016) investigated relevant tweets from 2009 to mid-2015, analyzing how public sentiment evolves over time and examined the general sentiment for the five alternatives of the 710 Corridor Project to provide Caltrans with opinions from Twitter users. The results were anticipated to support decision-makers in selecting the most acceptable alternative for the 710 Corridor Project.

Zavattaro et al. (2015) attempted to discover a way to use social media platforms to create meaningful citizen-government collaboration. The research aim was to determine if sentiment (tone) can positively influence citizen participation with government via social media. Using a systematic random sample of 125 U.S. cities, they found that positive sentiment is more likely to engender digital participation; however, this was not an ideal one-to-one relationship. Some cities that had an overall positive sentiment score and displayed a participatory style of social media use did not have positive citizen sentiment scores. Zavattaro et al. (2015) argued that positive tone is only one part of a successful social media interaction plan and encouraged social media managers to actively manage platforms to use activities that spur participation.

Numerous articles related to residential customer satisfaction are focused on extracting residents' preferences from surveys or activity inventories. The first application of a review analysis package based on publicly stated preferences in the transportation planning domain was developed by Sarram and Ivey (2017; 2018; 2020). Most recently, a data-driven satisfaction package has been tested on the marketing structure of transportation network products with residential nodes as the center of the structure (Sarram and Ivey, 2020). This framework has provided an efficient online text classification and visualization approach for adopting subjective performance measures used in planning. The approach was applied to pilot data extracted from tweets related to TDOT to determine potential use cases.

6.3.1. Methodology

The focus of this research is to evaluate the potential of Twitter datasets for providing insight useful for transportation planning related to TDOT services assessment. This is based on developing a review

analysis package of users' stated preferences in the transportation planning domain using research concepts from Sarram and Ivey (2020).

The intent of using this framework is to test an efficient online text classification and visualization approach for automating extraction of user-defined performance measures that can be used in planning decision-making. This data-driven satisfaction package defines the marketing structure of transportation network products using residential nodes as the center of the structure.

6.3.1.1. Data Collection

Satisfaction reviews from the Twitter API platform in the state of Tennessee (TN) were appraised to determine if the social media outlet can be used to indicate public satisfaction of TDOT transportation services and to identify the key user-defined performance measures related to this subjective metric.

6.3.1.2. TDOT Tweets

The Twitter API platform offers three tiers of search APIs: standard, premium, and enterprise. The platform provides free and paid access to either the last 30 days of the tweets or access to tweets as early as 2006 with full data fidelity. However, the private company halts searches in situations when individual queries overload the system. According to the Twitter guidance, the analysts and developers are allowed to accommodate different searches of 1,500 tweets, and Twitter does not archive the searches for more than three to seven days' query on the API depending on their numbers (Twitter, 2018). Text from tweets with customer satisfaction topics were collected during an approximately 10-month period between July 2019 and May 2020 to obtain a representative number of data samples. As collected tweets span a 10-day time period, the inquiries were continuously submitted every 10 days.

The goal of the data collection activity was to extract a variety of TDOT reviews following a word choice strategy. Therefore, the tweets were queried from Twitter public API using @myTDOT, TDOT and NashTheTraffic hashtags (Twitter, Inc 2020). Later, the data was preprocessed based on first person pronouns (me/my). This experimental approach of extracting the data was chosen in order to reduce the number of irrelevant tweets, traffic news and advertisements. Entries in the tweet text datasets are locations and possible stated performance measures. The rtweet package was used as the open-source software R (Schweitzer, 2014).

Jupyter notebooks for fastText training, validation, and testing, as well as descriptive and sentiment visualization codes are customized into a single package to develop a data-driven planning decision-

making tool. Additional information on this package can be found at NextUrban. More details regarding the code availability and analysis can be found in Sarram and Ivey, 2020.

6.3.2. Results and Discussion

For the Twitter data to be useable for performance measurement applications, it is necessary that tweets be associated with a specific geo-location. The total collected dataset during the 10-month period contained 9,207 tweets that was reduced to 800 tweets after preprocessing. Further extracting tweets with geo-location information reduced this count to 75 within Tennessee. Aggregated datasets were used separately as a test set during the fastText training. Pertinent attributes include several types of user information, retweets, place names, and latitude/longitude. Running an analysis with a larger dataset would produce better results. TDOT is able to access much larger datasets through buy-in options within the Twitter API or alternatively through targeted public outreach campaigns using special hashtags.

A subset of tweets targeting the Nashville area is presented in Table 6.3.1. Additional information on the methodology used can be found in Sarram and Ivey (2020). A review of the performance attributes for the total dataset indicates:

1. **Safety** concerns include text flags such as traffic, accident and highway maintenance.
2. *Transit* is indicated along with other **Mobility** aspects.
3. Having a supportive and active **community** emerged as important themes for positive sentiment.
4. Regional TDOT update meetings that update citizens on projects, activities, etc. are beneficial.

Table 6.3.1. Examples of tweets in the Nashville Area

Tweets
Well this happened this afternoon in Nashville rush hour traffic. Thankful for the TDOT for stopping and helping keep traffic at bay until I could get my tire changed. Thankful I had a spare. It's ugly but it does the trick.
@myTDOT Yeah, the repairs up here by mile marker 117 on I 65 south on the northside near Kentucky, it’s actually worse than what it was before you repaired it. It’s like lightning McQueen decided to repair it. #sobumpy
Love when I leave for work super early to get stuff done and @NashTheTraffic is so bad that I’m still going to be late. (FYI I’m heading out of the city. So this is not normal!)
A flat tire on the interstate is a great start to the semester tdot rescued me and i got to work okay.

Tweets
So TDOT closed the exits to both 65 and Nolensville Pike. I... I can't imagine how d… the people in charge of that decision could possibly be.
Yesterday, I got to attend a Regional TDOT update meeting for road, bridge, and highway projects in our end of the state. They are working hard to improve our roads!
There are days when I really love Nashville and using public transportation. Waiting over 15 minutes for a delayed bus due to traffic caused by construction on 440 are the days I want to move. 🙃🙃🙃

6.3.2.1. Sentiment Maps

An online Jupyter visualization package was developed to translate the Twitter reviews from qualitative data to quantitative data. This visualization tool receives the extracted tweets, preprocesses the data, builds the fastText models and visualizes the aggregated classified sentiments at the zip code level. The goal is to gain new insights about neighborhood satisfaction to facilitate the project decision-making process. More research needs to be conducted to relate individual instances of frustration or approval (i.e., tweets) to overall trends in satisfaction and engagement with TDOT. This cannot be done for the survey instances in question because the populations and time periods were different for the tweets and survey events.

In the future, to consider more reliable sentiments, only zip codes with more than 20 tweets can be taken into account. For this analysis, the binary predictions were replaced with the related labels: 0 (negative) and 1 (positive). This was done to calculate the total number of neighborhood sentiments using polar aggregation. The research results in Figure 6.3.1 reveal satisfaction maps of Twitter data in Tennessee. The Nashville area of Metro center/North Rhodes Park (zip code 37228), and the Memphis area of East Memphis (zip code 38117) have the most activity on the Twitter related to TDOT services.

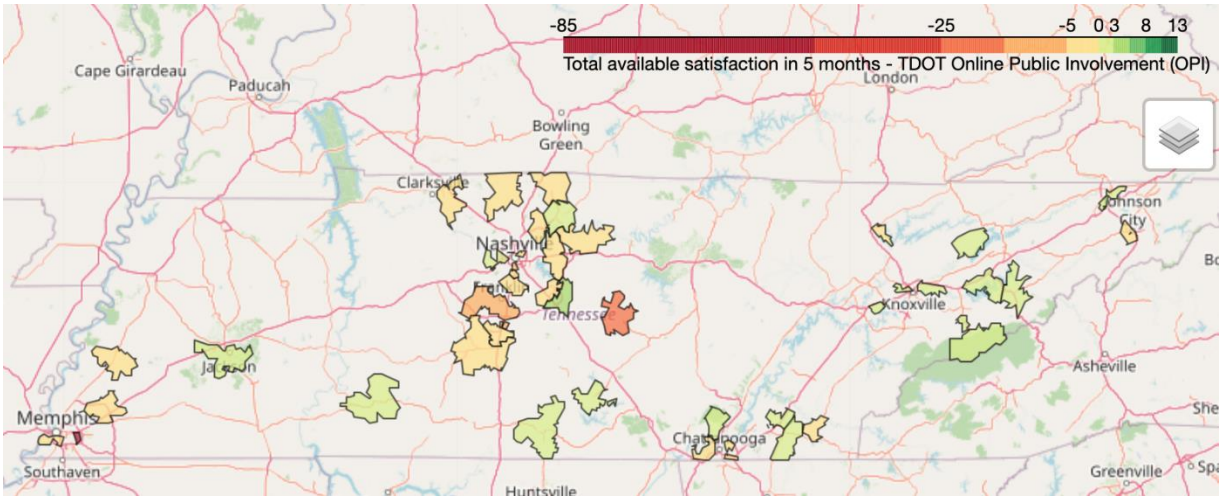

Figure 6.3.1. Sentiment-Derived Satisfaction of Zip Codes in Tennessee

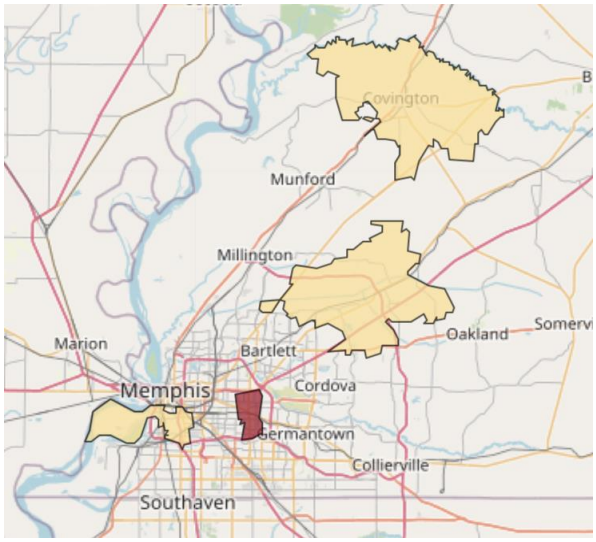

Figure 6.3.2. Sentiment-Derived Satisfaction of the Memphis Area of East Memphis (Zip Code 38117) in Tennessee

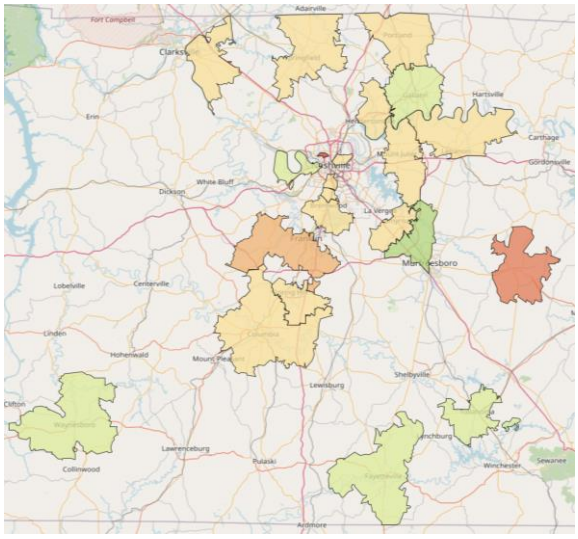

Figure 6.3.3. Sentiment-Derived Satisfaction of the Nashville Area of Metro Center/North Rhodes Park (Zip Code 37228) in Tennessee

Due to the relative size of the datasets, the visualization evaluation in Figure 6.3.1 shows only a relative proof of concept for the applicability of this methodology. As mentioned previously, TDOT can pursue acquisition of much larger data pools to improve upon the limitations of this analysis.

Chapter 7. Key Findings and Recommendations

Key findings from this research are drawn from the literature review, DOT interviews, survey data analysis, and exploration of innovative and advanced methodologies. Recommendations are designed to explicitly address the findings from this study and to improve TDOT's ability to make data driven decisions in the planning process.

7.1. Key Findings

7.1.1. Survey Design and Protocol

- **Research indicates that surveys should be designed to be short and simple for participants to complete, rating scales should be carefully considered to avoid bias, and deployment strategies should be designed to obtain significant participation.** Twenty minutes is typically the threshold beyond which quality of responses declines for surveys, thus survey length should be carefully considered to increase response validity. Because of the ease with which organizations can now distribute surveys online and via email, the number of surveys that individuals receive has dramatically increased. Recent research has also demonstrated that 60% of the population will refuse to respond to a survey that takes more than ten minutes to complete. Likert-scale ratings are frequently used to gauge perceptions of respondents. However, the order in which the ratings are presented is important. Presenting these in ascending order reduces positive rating bias and changing the order throughout the survey can also reduce bias. Microsurveys (surveys that take between 2-5 minutes to complete) have recently emerged as a survey strategy to garner much greater participation. This approach can lead to high response rates of 60% or more and can create opportunities for organizations to develop a much more frequent feedback loop with customers.
- **State DOTs across the country provided significant insight with regard to survey design and dissemination.** The majority of DOTs that conduct frequent surveys do so bi-annually to reduce survey fatigue. Interviewees indicated that they are able to get more meaningful data as well as track trends over time with this approach. Most states design surveys so that they do not require more than 20 minutes to complete, which correlates to the findings from the literature review. One state has been successful in getting valuable data from lengthier surveys, but they use an aggressive public outreach campaign, carefully timed dissemination, an online-only survey format, and an online panel to ensure representative responses. Several states indicated they remove questions from surveys that reveal 'flat' responses over time and keep core questions consistent for tracking trends over time. Another state DOT emphasized the importance of developing questions that are actionable and carefully designing the protocol so that statistically valid results are produced. One state is currently developing a survey to use for predictive analysis that will inform their construction safety practices, but they have not yet deployed it so do not know how valuable the approach will be to their decision-making process.

7.1.2. TDOT Survey Analyses

- **Overall, TDOT residential stakeholder survey results show little variation between items and demographics for any survey year.** While there may be statistically significant differences between demographic groupings, the magnitude of the difference is so small that in most cases they are not practically significant differences. The exception to this is for questions related to

public transportation and bicycle and pedestrian facilities, which had significantly lower ratings in each survey.

- **The lack of variation in responses may be due to survey fatigue or limited familiarity with question topics.** The 2016 survey contained 38 questions with a total of 89 rating, multiple choice, or ranking items when all subparts were included. Twenty-six of the items were content questions and an additional twelve questions pertained to respondent demographics. For a participant to provide thoughtful responses, it likely required more than 20 minutes to complete. When survey participants are not very familiar with a topic, it may take them longer to respond or they may choose a 'Don't Know' option. There was a slight positive trend in 'Don't Know' responses as each survey progressed, indicating that participants may have grown tired of responding and simply selected this option to complete the survey faster.
- **The question related to value residents receive from transportation taxes had the highest frequency of 'Don't Know' responses for all survey years.** This indicates TDOT may need to consider more outreach efforts to help residents understand transportation funding and to communicate how tax dollars are invested.
- **Questions related to public transportation showed lower levels of satisfaction in every survey year.** These questions also had high response frequencies for 'Don't Know' relative to other items on the survey, although the number of 'Don't Know' responses decreased from 2006 to 2016. Hispanic and African American respondents were less likely to choose a 'Don't Know' response, than were White respondents. People with incomes below $25,000 had a more positive perception of public transportation services than did people in higher income brackets. This may be due to familiarity with services, as residents in lower income groups are more likely to need to use public transportation.
- **Condition of interstate surfaces was rated significantly lower over time by both urban and rural residents.** This result indicates more resources may need to be directed toward interstate surfaces across the state.
- **Urban residents dominated responses and showed a marked decline over time in satisfaction related to congestion on interstates and highways.** This is likely due to population growth and increased construction activity in the major urban areas within the state.
- **Region 3 had the most frequent statistically significant results for decline in ratings over time related to congestion.** This makes sense given the disproportionate growth in the Nashville area over the last two decades and the significant interstate construction activity.
- **Although differences were observed between county economic status and ratings related to congestion topics, these trends are likely due to the fact that most urban residents live in non-distressed counties.** The trends over time showed decline in ratings related to congestion for respondents living in non-distressed counties.
- **Super Districts located in or adjacent to large metropolitan areas had significant declines in perceptions over time related to the availability of park and ride facilities.** This finding is likely correlated with the perceptions related to congestion. Residents who live in these areas likely have longer commuting distances and/or more congested commuting routes.
- **Even when representative samples were obtained for Super Districts, respondents living near major urban areas made up the majority of responses within the Super District.** This has implications for how TDOT may want to develop sampling strategies in future surveys.
- **Communication preferences have changed considerably over time for Tennessee residents.** While electronic message boards and radio were rated the most preferred options in all survey years, there were significant shifts for other options. Email increased in preference ranking from

2006 to 2016. Preference for receive communication via signs, local tv, newspaper, and direct mail all declined considerably in the same time period.

7.1.3. Opportunities through Innovative and Advanced Analyses

- **Maptionnaire is an emerging map-based survey tool that shows promise for transportation agencies.** Surveys designed with Maptionnaire are entirely web-based and can be completed on desktop computers and smartphones. In addition to traditional survey question types, respondents can draw points, lines, and polygons over a base map, and answer questions linked to those shapes. **Publicinput.com** is designed specifically for government agencies and includes additional features such as stakeholder database management, virtual meeting platforms, and social media tools.
- **With careful survey design, specialized regression methodologies can be used to determine the factors influencing customer satisfaction ratings and identify key differences between demographics.** The goal of such an approach is to provide insight regarding changes that should be considered to improve overall satisfaction or perceptions and experiences of a particular demographic groups.
- **A proof-of-concept study demonstrated the utility of Twitter data for extracting important factors influencing perceptions of transportation systems as well as indicating public sentiment.** Safety, mobility, and community factors emerged as important themes. Sentiment maps were created from extracted data and showed less positive sentiment concentrated in major urban areas. Findings are limited due to small samples of geolocated data, resulting from use of the free version of the Twitter API.

7.2. Recommendations

1. **TDOT should consider a comprehensive redesign of its survey to facilitate participation and increase the utility of the resulting data for informing decision-making.** This redesign should include restructuring of questions and topics, careful selection and presentation of rating scales, and dramatically reducing the survey length. One possible approach is to restrict the main customer satisfaction survey to including only targeted items that directly inform strategic planning decisions, while other topical areas and hot topics are examined through microsurvey events. Such a redesign could also support a predictive analysis related to customer preferences and satisfaction ratings. It is critical to ensure that questions are designed to be actionable for real value to be obtained from survey efforts.
2. **If survey results are to be used to inform strategic planning, survey events need to occur on a more regular and frequent schedule (such as biannual).** States that have successfully integrated information from stakeholder surveys into their decision-making process have done so through carefully planned and timed data collection events that are sequenced based on the timing of strategic plan updates.
3. **With a shift to more frequent survey events, TDOT will need to consider the best strategy for managing this effort at a reasonable cost.** Many state DOTs have moved to entirely online survey events and have obtained demographically representative results at significantly reduced cost through inclusion of online panels or focus groups.
4. **In future survey events, TDOT should consider the spatial discretization that will result in the most valuable input for decision-making.** It may be that obtaining representative samples at the county level provides greatest insight. However, this sampling approach would likely require

more resources, so understanding limitations of spatial analyses and other data sources that can be integrated to provide deeper insight is important.

5. **TDOT should consider innovative survey platforms such as Maptionnaire or PublicInput.com for future surveys.** These systems integrate both mapping and survey features that may be more engaging for participants and provide richer data, particularly related to spatial context. These platforms could be used not only for statewide survey events, but also for obtaining information from stakeholders at the project level. Additional features such as stakeholder management and virtual tools designed especially for government agencies are an added benefit with Publicinput.com.
6. **A comprehensive data inventory of information to be used in conjunction with survey results should be developed**. It is important to consider how these sources can be combined to provide deeper understanding of findings from survey data analysis. A plan should be made from the outset regarding additional data that will be intersected with survey findings to inform the planning and decision-making process.
7. **TDOT should consider deploying a social media strategy for data collection.** As demonstrated in this study, Twitter data can be extracted to identify important themes and stakeholder sentiments related to the transportation system. A limitation for this study was the sample size of geolocated data that was able to be extracted using the free API and relatively short timeframe. This limitation could be overcome through either purchase of the advanced API that provides greater data access, or by encouraging stakeholders to share specific content using specially created hashtags. This data could enhance and validate survey findings to provide greater insight into stakeholder perceptions.
8. **Visualization, such as through GIS Story Maps, should be used to share survey results both within and external to TDOT.** This approach makes results of statistical analyses more accessible, allows the opportunity for further exploration with additional data, and presents correlations to key decision areas in order to tell the story of the findings. A set of findings from the current study will be visualized in a Story Map in collaboration with TDOT to provide an example of how this approach may enrich communication with stakeholders.
9. **To increase survey participation and validity of resulting data, it is very important to establish trust with residential stakeholders.** TDOT should develop a feedback loop to ensure stakeholders are aware of survey results and how the results impact TDOT's decisions. If a microsurvey or social media campaign approach is considered, the interaction between the public and TDOT is more continuous. This creates an ongoing conversation and increases the likelihood that residents will not only be informed about topics that are critical to TDOT's strategic planning, but also that they will feel empowered and more willing to provide input.

It is expected that the results and recommendations of this study will promote more strategic and equitable investments by TDOT through a well-planned and executed survey design, data collection, and analyses process in the future.

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Thank you for taking the time to complete this important survey. Your input will be used by the Tennessee Department of Transportation (TDOT) to plan improvements to the State's transportation system. If you have questions about the survey, please call Patsy Mimms at 615-532-3560. When you are finished, please return your survey in the postage-paid envelope provided.

1. Providing Safe, Quality Highways Please circle the number that best describes your level of satisfaction with TDOT's efforts to provide the following services on Interstates (e.g., I-55, I-40, I-75), state highways (e.g., US-64, US-70, SR-96)and other numbered highways in the area where you live. Please DO NOT CONSIDER city and county streets in your responses.		Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Don't Know
A.	Removing debris, such as animals, glass, and torn tires from highways	5	4	3	2	1	9
B.	Picking up litter and trash along highways	5	4	3	2	1	9
C.	Removing snow and ice from highways	5	4	3	2	1	9
D.	Mowing and trimming trees, grass and weeds along highways	5	4	3	2	1	9
E.	Maintaining landscaping, such as flowers and plants, along highways	5	4	3	2	1	9
F.	Keeping guardrails in good condition	5	4	3	2	1	9
G.	Keeping the surface of *Interstate highways* in good condition (smooth & free of potholes)	5	4	3	2	1	9
H.	Keeping the surface of *other state highways* in good condition (smooth & free of potholes)	5	4	3	2	1	9
I.	Keeping rest areas clean	5	4	3	2	1	9
J.	Ensuring rest areas are accessible to persons with physical disabilities	5	4	3	2	1	9
K.	Keeping shoulders on highways in good condition (safe and free of drop-offs)	5	4	3	2	1	9
L.	Keeping bridges in good condition	5	4	3	2	1	9
M.	Ensuring that roadway striping on highways is visible during the DAY	5	4	3	2	1	9
N.	Ensuring that roadway striping on highways is visible at NIGHT	5	4	3	2	1	9
O.	Ensuring that roadway striping on highways is visible during WET WEATHER	5	4	3	2	1	9
P.	Ensuring that informational and warning signs along highways are easy to see	5	4	3	2	1	9
Q.	Ensuring that informational and warning signs are easy to understand	5	4	3	2	1	9
R.	Minimizing congestion on highways in urban areas	5	4	3	2	1	9
S.	Minimizing congestion on highways in rural areas	5	4	3	2	1	9
T.	Providing adequate lighting at highway interchanges in *rural areas*	5	4	3	2	1	9
U.	Providing adequate lighting at highway interchanges in *urban areas*	5	4	3	2	1	9
V.	Ensuring water drains quickly from the surface of highways during a storm	5	4	3	2	1	9
W.	Providing park and ride facilities where residents can park their car and access public transportation services	5	4	3	2	1	9
X.	Providing options for alternative modes of transportation along highways, such as biking lanes, pedestrian facilities, and public transportation services.	5	4	3	2	1	9

2. Which FOUR of the items listed above do you think should receive the most emphasis from TDOT over the next two years? [Please write the letters below using the letters from Question 1 above; if you do not think any improvements are needed circle "NONE"]

1st :____ 2nd:____ 3rd:____ 4th:_____ NONE

3. Using a 5-point scale, where 5 is "very satisfied" and 1 is "very dissatisfied," please rate your OVERALL satisfaction with the job that TDOT has done maintaining <u>INTERSTATE</u> highways in Tennessee during the past TWO years?

___(5) Very satisfied ___(3) Neutral ___(1) Very Dissatisfied
___(4) Satisfied ___(2) Dissatisfied ___(9) Don't know

4. Using a 5-point scale, where 5 is "very satisfied" and 1 is "very dissatisfied," please rate your OVERALL satisfaction with the job that TDOT has done maintaining <u>HIGHWAYS OTHER THAN INTERSTATES</u> in Tennessee during the past TWO years?

___(5) Very satisfied ___(3) Neutral ___(1) Very Dissatisfied
___(4) Satisfied ___(2) Dissatisfied ___(9) Don't know

5. Do you think major construction projects on state highways in Tennessee are usually completed in a timely manner? ("major construction projects" include things like adding lanes, building new highways, rebuilding existing highways, completing new interchanges, etc.)
___(1) Yes ___(2) No

6. Do you think basic repairs to state highways in Tennessee are usually completed in a timely manner? ("basic repairs" include things like filling pot holes, sealing cracks, etc.)
___(1) Yes ___(2) No

7. During the past three months, how frequently have you encountered highway construction or maintenance work on state highways in your area?
____(1) daily
____(2) weekly
____(3) monthly
____(4) rarely
____(5) Never [SKIP TO Q8]
____(9) Don't know [SKIP TO Q8]

7a. Did you experience a delay in your travel due to the construction or maintenance?
____(1) Yes ____(2) No [SKIP TO Q8]

[IF YES TO #7a]

7b. Approximately how long was your <u>most recent</u> delay?
____(1) Five minutes or less
____(2) 6 to 10 minutes
____(3) 11 to 15 minutes
____(3) 16 to 30 minutes
____(4) More than 30 minutes
____(9) Can't remember

7c. Was the length of your delay (indicated in #7b) acceptable?
____(1) Yes ____(2) No

8. Other Transportation Services Please circle the number that best describes your level of satisfaction with the adequacy of the following transportation services where you live:		Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Don't Know
A.	Services provided by HELP trucks that help remove congestion causing incidents on Interstates in urban areas of Tennessee by clearing accidents and providing motorist assistance to disabled vehicles	5	4	3	2	1	9
B.	Availability of public transportation (bus, rail) services where you live	5	4	3	2	1	9
C.	Frequency of public transportation (bus, rail) services where you live	5	4	3	2	1	9
D.	Availability of public transportation services for the elderly and persons with disabilities	5	4	3	2	1	9
E.	Overall quality of the State's freight rail services	5	4	3	2	1	9
F.	Overall availability of passenger air services in Tennessee	5	4	3	2	1	9
G.	Availability of recreational trails and paths for walking, hiking, and biking	5	4	3	2	1	9
H.	Availability of pedestrian facilities and sidewalks for transportation purposes along highways	5	4	3	2	1	9
I.	Availability of biking facilities and lanes for transportation purposes along highways	5	4	3	2	1	9

9. Which THREE of the transportation services listed above do you think should receive the most emphasis from the Tennessee Department of Transportation over the next TWO years? [Please write in the letters below using the letters from Question 8 above; If you do not think any improvements are needed circle "NONE"]

1st :____ 2nd:____ 3rd:____ NONE

10. Perceptions of Travel on State Highways in Tennessee Please circle the number that best describes your level of agreement with the following statements about travel on Interstates and other state highways in Tennessee.		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
A.	Overall, I feel safe traveling on highways in Tennessee	5	4	3	2	1	9
B.	I think highways in Tennessee are safer today than they were five years ago	5	4	3	2	1	9
C.	I feel safe at railroad crossings on state highways	5	4	3	2	1	9
D.	I feel safe when driving through work zones on Tennessee highways at night	5	4	3	2	1	9
E.	I feel safe when driving through work zones on Tennessee highways during the day	5	4	3	2	1	9
F.	Detours on highways are usually well marked and easy to follow	5	4	3	2	1	9
G.	Warning signs in work zones on highways are easy to read and understand	5	4	3	2	1	9
H.	The location of warning signs in advance of work zones in Tennessee gives drivers plenty of time to react	5	4	3	2	1	9
I.	Adequate access is provided to businesses that are located near work zones on state highways	5	4	3	2	1	9
J.	TDOT does a good job of minimizing delays caused by construction and maintenance of state highways	5	4	3	2	1	9
K.	Traffic enforcement is adequate in work zones on state highways	5	4	3	2	1	9
L.	I think the posted speed limits in work zones are reasonable	5	4	3	2	1	9
M.	Posted speed limits on state highways are reasonable	5	4	3	2	1	9
N.	Traffic enforcement is adequate on state highways	5	4	3	2	1	9
O.	Overall, the level of traffic congestion on state highways is acceptable	5	4	3	2	1	9

11. Has TDOT completed the construction of a new highway or the reconstruction of an existing highway that you regularly use during the past five years?

____(1) Yes ____(2) No [SKIP TO 12] ____(9) Don't know

ONLY IF YES to Q11:

11a. Do you feel that the overall quality of transportation in the area where you live has improved since the completion of this (these) project(s)?

____(1) Yes ____(2) No ____(9) Don't know

11b. Do you feel that TDOT adequately involved your community during the planning and implementation of highway improvements in your area?

____(1) Yes ____(2) No ____(9) Don't know

Customer Service and Information

12. Have you contacted a TDOT employee by letter, telephone, e-mail, or in person, during the past two years?

____(1) Yes
____(2) No [SKIP TO 13]

12a. How easy/difficult was it to contact the right person the last time you contacted TDOT?

____(1) Very easy
____(2) Easy
____(3) Difficult
____(4) Very difficult
____(9) Don't remember/don't know

12b. Were you able to get your question answered or get the information you needed the last time you contacted TDOT?

____(1) Yes ____(2) No ____(9) Don't remember/don't know

12c. Did you receive a response in a timely manner?

____(1) Yes ____(2) No ____(9) Don't remember/don't know

13. Which of the following would be the <u>most</u> effective way for TDOT to provide you with information? (CHECK ALL THAT APPLY)

___(01) Electronic message boards along highways
___(02) Signs on roadways with phone numbers for motorist assistance information
___(03) Flyers
___(04) Internet/web page
___(05) Direct mailings/newsletters
___(06) Newspapers
___(07) Radio
___(08) TV local public access channel
___(09) Public officials
___(10) Public meetings
___(11) E-mail
___(12) Other: _____

14. Did you know TDOT has a toll-free road condition number (1-800-858-6349) that provides Information about road conditions on state highways?

____(1) Yes ____(2) No [SKIP to 15]

14a. [If Yes to 14] **Have you called TDOT's Road Condition Hotline during the past year?**

_____(1) Yes [answer 14b] ____(2) No [go to 15]

14b. [If Yes to 14a] **Overall, how satisfied were you with TDOT's Road Condition Hotline?**

____(5) very satisfied
____(4) satisfied
____(3) neutral
____(2) dissatisfied
____(1) very dissatisfied

15. Have you seen signs featuring a toll-free Record-A-Comment phone number (1-877-SmartWay) posted in state highway construction zones during the past year?

____(1) Yes ____(2) No

16. Did you know the TDOT has a website? (www.tdot.state.tn.us)

____(1) Yes ____(2) No [SKIP to 17]

16a. [If Yes to 16] **Have you visited TDOT's web site during the past year?**

_____(1) Yes ____(2) No [SKIP to 17]

16b. [If Yes to 16a] **How easy was the website to use?**

____(1) Very easy
____(2) Easy
____(3) OK
____(4) Difficult
____(9) Don't remember

17. How interested would you be in using TDOT's website to do the following? (Check all)

____(01) To get ***current*** construction project information
____(02) To get ***future*** project planning information
____(03) To obtain current weather and road condition information about specific highways
____(04) To view webcams that allow you to see current road conditions on specific highways
____(05) To get detour or work zone information
____(06) To get public transit information
____(07) To contact an employee
____(08) To get a response to a specific question or concern
____(09) Other _____

18. Using a 5-point scale, where 5 is "very satisfied" and 1 is "very dissatisfied," how satisfied are you with TDOT's overall efforts to keep residents informed about transportation related issues in Tennessee?

___(5) Very Satisfied
___(4) Satisfied
___(3) Neutral
___(2) Dissatisfied
___(1) Very Dissatisfied
___(9) Don't know

19. Transportation Investment Options Please indicate how important the following transportation investment options should be in Tennessee over the next two years:		Extremely Important	Very Important	Important	Less Important	Not Important	Don't Know
A.	Expanding public transportation (bus and rail) services in urban areas	5	4	3	2	1	9
B.	Expanding public transportation (bus) services in rural areas	5	4	3	2	1	9
C.	Expanding transportation services for seniors and persons with disabilities	5	4	3	2	1	9
D.	Relieving congestion in urban areas	5	4	3	2	1	9
E.	Adding passing lanes to state highways that would allow motorists to pass slower moving vehicles	5	4	3	2	1	9
F.	Repairing and maintaining existing highways	5	4	3	2	1	9
G.	Adding shoulders to highways that do not have them	5	4	3	2	1	9
H.	Widening shoulders on highways	5	4	3	2	1	9
I.	Constructing new or improving existing highways to provide more direct links between communities	5	4	3	2	1	9
J.	Improving freight rail services	5	4	3	2	1	9
K.	Developing high speed rail service between cities	5	4	3	2	1	9
L.	Investing in information technology, such as electronic message boards to inform residents about alternate routes when there are accidents or construction delays	5	4	3	2	1	9
M.	Providing pedestrian and bicycle facilities	5	4	3	2	1	9
N.	Developing HOV (high occupancy vehicle) lanes on Interstates in urban areas	5	4	3	2	1	9
O.	Developing dedicated lanes for trucks on Interstates	5	4	3	2	1	9
P.	Adding more HELP trucks to assist motorists and remove congestion causing incidents from Interstate highways	5	4	3	2	1	9

20. Which THREE of the items above do you think are the most important for the Tennessee Department of Transportation to focus on over the next TWO years? [Please write in the letters below using the letters from Question 19 above; If you do not think any improvements are needed circle "NONE"]

1st :____ 2nd:____ 3rd:____ NONE

21. How do you think the current level of funding for transportation in Tennessee should change over the next two years?

___(1) It should be increased
___(2) It should stay about the same
___(3) It should be reduced
___(9) Don't know

22. Environmental Considerations Please indicate how well you think TDOT is doing the following when planning and building transportation projects in Tennessee:		Very Well	Well	OK	Poor	Very Poor	Don't Know
A.	Preserving and protecting the quality of water in lakes and streams	5	4	3	2	1	9
B.	Preserving and protecting air quality	5	4	3	2	1	9
C.	Preserving and protecting historic buildings and cultural areas	5	4	3	2	1	9
D.	Preserving wetlands	5	4	3	2	1	9
E.	Preserving quality of life in local communities	5	4	3	2	1	9

23. How do you feel about TDOT's current level of emphasis on preserving and protecting the environment in planning and building transportation projects?

___(1) It should be increased
___(2) It should stay about the same
___(3) It should be reduced
___(9) Don't know

24. OVERALL RATINGS Please circle the number that best describes your level of agreement with the following statements:		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
A.	I trust TDOT officials to make good decisions about the State's future transportation system	5	4	3	2	1	9
B.	I think TDOT is moving in the right direction	5	4	3	2	1	9
C.	I have more confidence in TDOT today than I did three years ago	5	4	3	2	1	9
D.	TDOT does a good job prioritizing highway improvements in Tennessee	5	4	3	2	1	9
E.	I think TDOT adequately supports local transportation projects for the city and county governments	5	4	3	2	1	9
F.	I think TDOT is responsive to the concerns of local communities	5	4	3	2	1	9

OVERALL INDICATORS

25. Overall, how easy do you think it is to travel <u>between cities</u> in Tennessee?

___(5) Very easy
___(4) Easy
___(3) Neutral
___(2) Difficult
___(1) Very difficult
___(9) Don't know

26. Overall, how easy do you think it is to travel <u>within urban areas</u> of Tennessee?

___(5) Very easy
___(4) Easy
___(3) Neutral
___(2) Difficult
___(1) Very difficult
___(9) Don't know

27. Overall, how would you rate the value provided by TDOT for the transportation taxes paid by Tennessee residents?

___(1) Good value for your money
___(2) OK value for your money
___(3) Low value for your money
___(9) Don't know

28. Compared to two years ago, how do you think that the <u>current quality</u> of TDOT services has changed?

___(1) Better
___(2) About the same
___(3) Worse
___(9) Don't know

DEMOGRAPHICS

The following questions are designed to help us better understand the needs of particular groups of people and to ensure that the results of our survey are representative of the State's residents. Your individual responses will remain confidential.

29. What is your current employment status?

____(1) Employed full-time
____(2) Employed part-time
____(3) Student
____(4) Retired
____(5) Not employed outside home
____(6) Unemployed, looking for work

30. Which of the following best describes your race/ethnicity?

____(1) African American/Black
____(2) American Indian/Eskimo
____(3) Asian/Pacific Islander
____(4) Caucasian/White
____(5) Other_____

31. Are you or other members of your household of Hispanic, Latino, or other Spanish ancestry?
____(1) Yes
____(2) No

32. Do you speak a language other than English as the primary language?
____(1) Yes: **If YES: what language do you speak?** _____
____(2) No

33. How many years have you been a resident of Tennessee?
____(1) Less than 1 year
____(2) 1 to 5 years
____(3) 6-10 years
____(4) 11-20 years
____(5) More than 20 years

34. In which county do you live? _____

35. Do you have a physical disability? ____(1) Yes ____(2) No

36. What is your total household income?
____(1) Under $25,000
____(2) $25,000 to $49,999
____(3) $50,000 to $74,999
____(4) $75,000 to $99,999
____(5) $100,000 plus

37. How many persons living in your household (counting yourself) are in each of the following age groups? (write the number of people in each group in the space provided)

____Under 5 years	____20 to 24 years	____55 to 64 years
____5 to 9 years	____25 to 34 years	____65+ years
____10 to 14 years	____35 to 44 years	
____15 to 19 years	____45 to 54 years	

38. How many vehicles do you have in your household? (please only include motorized vehicles that are currently operational)
_____ vehicles

39. What is your Gender? ____(1) Male ____(2) Female

<u>OTHER COMMENTS</u>. If you have any other comments that you would like to share with TDOT, please provide them in the space below.

This concludes the survey. Thank you for your time!

Please Return Your Completed Survey in the Enclosed Postage Paid Envelope Addressed to:
ETC Institute, 725 W. Frontier Circle, Olathe, KS 66061

<u>Your responses will remain completely confidential</u>. The information printed to the right will ONLY be used to help identify areas of Tennessee where transportation services can be improved. If your address is not correct, please write the correct information above the label. Thank you.

TDOT 2013 Statewide Customer Survey

Thank you for taking the time to complete this important survey. Your input will be used by the Tennessee Department of Transportation (TDOT) to plan improvements to the State's transportation system. If you have questions about the survey, please call Patsy Mimms at 615-532-3507. When you are finished, please return your survey in the postage-paid envelope provided. Or you may complete the survey on-line at www.TDOTResidentSurvey.org.

1. Maintaining and Managing the Transportation System Please circle the number that best describes your level of satisfaction with TDOT's efforts to provide the following services on Interstates (e.g., I-55, I-40, I-75), state highways (e.g., US-64, US-70, SR-96)and other numbered highways in the area where you live. Please DO NOT CONSIDER city and county streets in your responses.		Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Don't Know
A.	Removing debris, such as animals, glass, and torn tires from highways	5	4	3	2	1	9
B.	Picking up litter and trash along highways	5	4	3	2	1	9
C.	Removing snow and ice from highways	5	4	3	2	1	9
D.	Mowing and trimming trees, grass and weeds along highways	5	4	3	2	1	9
E.	Keeping guardrails in good condition	5	4	3	2	1	9
F.	Keeping the surface of *Interstate highways* in good condition (smooth & free of potholes)	5	4	3	2	1	9
G.	Keeping the surface of *other state highways* in good condition (smooth & free of potholes)	5	4	3	2	1	9
H.	Providing rest areas and welcome centers along highways	5	4	3	2	1	9
I.	Keeping rest areas clean	5	4	3	2	1	9
J.	Keeping shoulders on highways in good condition (safe and free of drop-offs)	5	4	3	2	1	9
K.	Keeping bridges in good condition	5	4	3	2	1	9
L.	Ensuring that roadway striping on highways is visible during the DAY	5	4	3	2	1	9
M.	Ensuring that roadway striping on highways is visible at NIGHT	5	4	3	2	1	9
N.	Ensuring that roadway striping on highways is visible during WET WEATHER	5	4	3	2	1	9
O.	Ensuring that informational and warning signs along highways are easy to see	5	4	3	2	1	9
P.	Ensuring that informational and warning signs are easy to understand	5	4	3	2	1	9
Q.	Minimizing congestion on highways in urban areas	5	4	3	2	1	9
R.	Minimizing congestion on highways in rural areas	5	4	3	2	1	9
S.	Providing adequate lighting at highway interchanges in *rural areas*	5	4	3	2	1	9
T.	Providing adequate lighting at highway interchanges in *urban areas*	5	4	3	2	1	9
U.	Ensuring water drains quickly from the surface of highways during a storm	5	4	3	2	1	9
V.	Providing incident clearance and motorist assistance services on Interstates in urban areas (TDOT HELP trucks) to help reduce congestion and secondary incidents	5	4	3	2	1	9
W.	Providing options for alternative modes of transportation along highways, such as biking lanes, pedestrian facilities, and public transportation services.	5	4	3	2	1	9

2. Which FOUR of the it ems listed above do y ou think s hould receive the mos t emphasis from TDOT over the next t wo y ears? [Please write the letters below using the letters from Question 1 above; if you do not think any improvements are needed circle "NONE"]

1st.____ 2nd.____ 3rd.____ 4th._____ NONE

3. Using a 5-point scale, where 5 is "very satisfied" and 1 is "very dissatisfied," please rate your OVERALL satisfaction with the job that TDOT has done maintaining <u>INTERSTATE</u> highways in Tennessee during the past TWO years?

___(5) Very satisfied ___(3) Neutral ___(1) Very Dissatisfied
___(4) Satisfied ___(2) Dissatisfied ___(9) Don't know

4. Using a 5-point scale, where 5 is "very satisfied" and 1 is "very dissatisfied," please rate your OVERALL satisfaction with the job that TDOT has done maintaining <u>STATE HIGHWAYS OTHER THAN INTERSTATES</u> in Tennessee during the past TWO years?

___(5) Very satisfied ___(3) Neutral ___(1) Very Dissatisfied
___(4) Satisfied ___(2) Dissatisfied ___(9) Don't know

5. Transportation Options Please circle the number that best describes your level of satisfaction with the adequacy of the following transportation services and alternatives where you live:		Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Don't Know
A.	Availability of public transportation services where you live	5	4	3	2	1	9
B.	Frequency of public transportation services where you live	5	4	3	2	1	9
C.	Proximity (ease of access/convenience) to public transportation services where you live	5	4	3	2	1	9
D.	Availability of public transportation services for the elderly and persons with disabilities	5	4	3	2	1	9
E.	Availability of pedestrian facilities and sidewalks for transportation purposes along highways	5	4	3	2	1	9
F.	Availability of biking facilities and lanes along highways	5	4	3	2	1	9
G.	Providing park and ride facilities where residents can park their car and access public transportation or carpool/vanpool services	5	4	3	2	1	9

6. Which THREE of the transportation options for services listed above do you think should receive the most emphasis from the Tennessee Department of Transportation over the next TWO years? [Please write in the letters below using the letters from Question 5 above; If you do not think any improvements are needed circle "NONE"]

1st :____ 2nd:____ 3rd:____ NONE

7. Perceptions of Travel on Highways in Tennessee Please circle the number that best describes your level of agreement with the following statements about travel on Interstates and other state highways in Tennessee.		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
A.	Overall, I feel safe traveling on highways in Tennessee	5	4	3	2	1	9
B.	I feel safe when driving through work zones on Tennessee highways at night	5	4	3	2	1	9
C.	I feel safe when driving through work zones on Tennessee highways during the day	5	4	3	2	1	9
D.	Detours on highways are usually well marked and easy to follow	5	4	3	2	1	9
E.	Warning signs in work zones on highways are easy to read and understand	5	4	3	2	1	9
F.	The location of warning signs in advance of work zones in Tennessee gives drivers plenty of time to react	5	4	3	2	1	9
G.	TDOT does a good job of minimizing delays caused by construction and maintenance of state highways	5	4	3	2	1	9
H.	TDOT quickly responds to incidents and roadway obstructions on Interstates.	5	4	3	2	1	9
I.	TDOT does a good job of clearing incidents on Interstates to minimize travel delays.	5	4	3	2	1	9
J.	Overall, the level of traffic congestion on state highways is acceptable	5	4	3	2	1	9

8. Has TDOT completed the construction of a new highway or the reconstruction of an existing highway that you regularly use during the past five years?

____(1) Yes ____(2) No [SKIP TO 9] ____(9) Don't know

ONLY IF YES to Q8:

8a. Do you feel that the overall quality of transportation in the area where you live has improved since the completion of this (these) project(s)?

____(1) Yes ____(2) No ____(9) Don't know

8b. Do you feel that TDOT adequately involved your community during the planning and implementation of highway improvements in your area?

____(1) Yes ____(2) No ____(9) Don't know

Customer Service and Information

9. Have you contacted a TDOT employee by letter, telephone, e-mail, or in person, during the past two years?

____(1) Yes ____(2) No [SKIP TO 10]

9a. Why did you contact TDOT most recently? _____

9b. Was the employee courteous? ___(1) Yes ____(2) No

9c. Overall, how satisfied were you with the service provided by the TDOT employee who helped you most recently?

____(5) Very satisfied
____(4) Satisfied
____(3) Neutral
____(2) Dissatisfied
____(1) Very Dissatisfied
____(9) Don't know

10. How helpful is the highway advisory radio system (AM station) for getting reports of current construction and incident information?

____(1) Very helpful
____(2) Somewhat helpful
____(3) Not helpful
____(4) Don't know/have never used it

11. Have you visited TDOT's web site during the past year? ___(1) Yes ____(2) No [SKIP to 12]

11a. [If Yes to 11a] **Why did you visit TDOT's website?** _____

11b. [If Yes to 11a] **How easy was the website to use?**

____(1) Very easy ____(2) Easy ____(3) OK ____(4) Difficult ____(9) Don't remember

12. Which of the following are the <u>most</u> effective ways for TDOT to provide you with information? (CHECK ALL THAT APPLY)

___(01) Electronic message boards on highways
___(02) Signs on roadways with phone numbers for information
___(03) Flyers
___(04) Tennessee "511"
___(05) TDOT web page
___(06) TDOT SmartWay
___(07) TDOT SmartWay mobile
___(08) Direct mailings/newsletters
___(09) Newspapers
___(10) Radio
___(11) TV local public access channel
___(12) Social media (Facebook, Twitter, etc.)
___(13) Text messages
___(14) Public officials
___(15) Public meetings/hearings
___(16) E-mail
___(17) Other: _____

13. Please indicate if you would be interested in using the TDOT website for the following? (Check all)

____(01) To get ***current*** construction project information
____(02) To get ***future*** project planning information
____(03) To obtain road condition information about interstates and state routes
____(04) To view TDOT cameras that allow you to see current traffic on interstates and state routes
____(05) To get detour or work zone information
____(06) To get public transit information
____(07) To get information on public meetings
____(08) To contact an employee
____(09) To get a response to a specific question or concern
____(10) Other _____

14. Using a 5-point scale, where 5 is "very satisfied" and 1 is "very dissatisfied," how satisfied are you with TDOT's overall efforts to keep residents informed about transportation related issues in Tennessee?

___(5) Very Satisfied
___(4) Satisfied
___(3) Neutral
___(2) Dissatisfied
___(1) Very Dissatisfied
___(9) Don't know

15. Long Range Transportation Priorities Please indicate how important the following transportation investments should be in Tennessee over the next 25 years:		Extremely Important	Very Important	Important	Less Important	Not Important	Don't Know
A.	Expanding public transportation services	5	4	3	2	1	9
B.	Addressing mobility needs for seniors and persons with disabilities	5	4	3	2	1	9
C.	Relieving congestion	5	4	3	2	1	9
D.	Repairing and maintaining existing roads and bridges (transportation infrastructure)	5	4	3	2	1	9
E.	Adding shoulders to highways that do not have them	5	4	3	2	1	9
F.	Widening shoulders on highways	5	4	3	2	1	9
G.	Constructing new or improving existing highways to provide more direct links between communities	5	4	3	2	1	9
H.	Improving freight rail services	5	4	3	2	1	9
I.	Providing pedestrian and bicycle facilities	5	4	3	2	1	9
J.	Developing dedicated lanes for large commercial trucks (tractor trailers) on Interstates	5	4	3	2	1	9
K.	Adding more HELP trucks to assist motorists and remove congestion causing incidents from Interstate highways	5	4	3	2	1	9
L.	Using technology (ITS) to improve traffic flow on highways	5	4	3	2	1	9

16. Which THREE of the items above do you think are the most important for the Tennessee Department of Transportation to focus on over the next 25 years? [Please write in the letters below using the letters from Question 15 above; If you do not think any improvements are needed circle "NONE"]

1st :____ 2nd:____ 3rd:____ NONE

17. Which ONE of the following statements about Tennessee's economy and transportation system, which includes roads, highways, buses, trains, airports, and shipping ports in the State, comes closest to your own view? (select one)

___(1) The transportation system is basically **as good as it needs to be** in order to support economic growth in the next 5 to 10 years
___(2) The transportation system needs **minor improvements and investments** in order to support economic growth in the next 5 to 10 years
___(3) The transportation system needs **major improvements and investments** in order to support economic growth in the next 5 to 10 years
___(4) None of these
___(9) Don't know

18. In the future, if there is a gap between existing revenue and the cost of maintaining Tennessee's transportation system, how would you rank the priority that should be placed on funding the FOUR transportation items listed below. Please write the letters that correspond to your rankings in the spaces provided.

(A) Ensuring roads are safe
(B) Keeping highway pavement smooth
(C) Preventing congestion on highways from getting worse
(D) Providing transportation options such as public transit and bicycle paths

Highest Priority: _____ 2nd Priority: _____ 3rd Priority: _____ Lowest Priority: _____

The following describe trade-offs that must be considered by the Tennessee Department of Transportation (TDOT) when planning transportation investments. For each question, please indicate which ONE of the two options listed is most important to you.

19. Which ONE of the following do you think is more important for TDOT to address over the next 5 to 10 years? (select one)
___(1) increasing the capacity on highways to improve traffic flow
___(2) resurfacing highways to improve the condition of the driving surface without increasing capacity

20. Which ONE of the following do you think is more important for TDOT to address over the next 5 to 10 years? (select one)
___(1) building a new road to encourage economic development
___(2) expanding the capacity of an existing road that is currently heavily congested

21. Which ONE of the following do you think is more important for TDOT to address over the next 5 to 10 years? (select one)
___(1) providing additional transportation options such as public transit and bicycling
___(2) making it easier for automobiles to get where they want to go

22. Which ONE of the following do you think is more important for TDOT to address over the next 5 to 10 years? (select one)
___(1) reducing the cost of highway projects
___(2) reducing construction time of highway projects

23. Which ONE of the following do you think is more important for TDOT to fund over the next 5 to 10 years? (select one)
___(1) ensuring that transportation projects are evenly balanced across the State of **Tennessee**
___(2) focusing transportation projects in areas of the state that have the greatest needs

24. How concerned are you about the number of large commercial trucks (tractor trailers) on highways in Tennessee? (select one)
___(1) Very concerned ___(2) Somewhat Concerned __(3) Not Concerned

25. How do you think the priority that TDOT places on the management of truck traffic and freight transportation in the State of Tennessee should change over the next 25 years?
___(1) Much higher
___(2) Somewhat higher
___(3) Stay about the same
___(4) Somewhat lower
___(5) Much lower
___(9) Don't know

26. Please rank the priority that should be placed on the FIVE pavement characteristics listed below by writing the letters that correspond to your rankings in the spaces provided.
(A) Making pavement smoother
(B) Reducing the noise that you hear when you drive on pavement
(C) Improving the visibility of pavement marking (e.g., center and roadside striping)
(D) Increasing shoulder width
(E) Minimizing water build up during periods of rainfall (reducing water spray)

Highest Priority: _____ 2nd Priority: _____ 3rd Priority: _____ Lowest Priority: _____

27. Approximately how much do you think the average Tennessee resident pays annually per vehicle to support transportation projects and services provided by TDOT?
___(1) Less than $250
___(2) $250-$499
___(3) $500-$749
___(4) $750-$999
___(5) over $1,000
___(9) Don't know

28. Given declining revenue from gasoline taxes, TDOT may not be able to maintain current levels of transportation services without new sources of funding or an increase in existing sources. Knowing this, which of the following statements BEST describes your attitude about how funding for transportation services in Tennessee should change over the next five years?

___(1) I think funding should be significantly increased
___(2) I think funding should be slightly increased
___(3) I think funding should stay the same even if the condition of transportation facilities decreases
___(4) I think funding should be reduced
___(5) Don't know

29. Overall, how would you rate the value that is currently provided by TDOT for the transportation taxes paid by Tennessee residents?

___(1) Good value for your money
___(2) OK value for your money
___(3) Low value for your money
___(9) Don't know

30. OVERALL RATINGS Please circle the number that best describes your level of agreement with the following statements:		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
A.	I am familiar with the services that TDOT provides	5	4	3	2	1	9
B.	TDOT does a good job prioritizing highway improvements in Tennessee	5	4	3	2	1	9
C.	I think TDOT adequately supports local transportation projects for the city and county governments	5	4	3	2	1	9
D.	I think TDOT is responsive to the concerns of local communities	5	4	3	2	1	9
E.	TDOT incorporates environmental concerns into the design and maintenance of transportation projects.	5	4	3	2	1	9
F.	I trust TDOT to make sound professional transportation decisions	5	4	3	2	1	9
G.	Compared to other states I have visited, I think Tennessee's transportation system is one of the best.	5	4	3	2	1	9

OVERALL INDICATORS

31. Overall, how easy do you think it is to travel between cities in Tennessee?

___(5) Very easy
___(4) Easy
___(3) Neutral
___(2) Difficult
___(1) Very difficult
___(9) Don't know

32. Overall, how easy do you think it is to travel within urban areas of Tennessee?

___(5) Very easy
___(4) Easy
___(3) Neutral
___(2) Difficult
___(1) Very difficult
___(9) Don't know

33. Compared to two years ago, how do you think that the current quality of TDOT services has changed?

___(1) Better
___(2) About the same
___(3) Worse
___(9) Don't know

DEMOGRAPHICS

The following questions are designed to help us better understand the needs of particular groups of people and to ensure that the results of our survey are representative of the State's residents. Your individual responses will remain confidential.

34. What is your current employment status?

____(1) Employed full-time
____(2) Employed part-time
____(3) Student
____(4) Retired
____(5) Not employed outside home
____(6) Unemployed, looking for work

35. Which of the following best describes your race/ethnicity?

____(1) African American/Black
____(2) American Indian/Eskimo
____(3) Asian/Pacific Islander
____(4) Caucasian/White
____(5) Hispanic
____(6) Other_____

36. Do you speak a language other than English as the primary language?

____(1) Yes: **If YES: what language do you speak?** _____
____(2) No

37. How many years have you been a resident of Tennessee? _____years

38. In which county do you live? _____

39. Do you have a physical disability? ____(1) Yes ____(2) No

40. What is your total household income?

____(1) Under $25,000
____(2) $25,000 to $49,999
____(3) $50,000 to $74,999
____(4) $75,000 to $99,999
____(5) $100,000 plus

41. How many persons living in your household (counting yourself) are in each of the following age groups? (write the number of people in each group in the space provided)

____Under 5 years
____5 to 9 years
____10 to 14 years
____15 to 19 years
____20 to 24 years
____25 to 34 years
____35 to 44 years
____45 to 54 years
____55 to 64 years
____65+ years

42. How many vehicles do you have in your household? (please only include motorized vehicles that are currently operational) _____ vehicles

43. Approximately how many miles do you drive per week? _____ miles per week

44. What is your Gender? ____(1) Male ____(2) Female

This concludes the survey. Thank you for your time!

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Your responses will remain completely confidential.
The information printed to the right will ONLY be used to help identify areas of Tennessee where transportation services can be improved. If your address is not correct, please write the correct information above the label. Thank you.

TDOT 2016 Statewide Customer Survey

Thank you for taking the time to complete this important survey. Your input will be used by the Tennessee Department of Transportation (TDOT) to plan improvements to the State's transportation system. If you have questions about the survey, please call Patsy Mimms at 615-532-3507. When you are finished, please return your survey in the postage-paid envelope provided. Or you may complete the survey on-line at www.TDOTResidentSurvey.org.

1. Maintaining and Managing the Transportation System Please circle the number that best describes your level of satisfaction with TDOT's efforts to provide the following services on Interstates (e.g., I-55, I-40, I-75), state highways (e.g., US-64, US-70, SR-96)and other numbered highways in the area where you live. Please DO NOT CONSIDER city and county streets in your responses.		Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Don't Know
1.	Removing debris, such as animals, glass, and torn tires from highways	5	4	3	2	1	9
2.	Picking up litter and trash along highways	5	4	3	2	1	9
3.	Removing snow and ice from highways	5	4	3	2	1	9
4.	Mowing and trimming trees, grass and weeds along highways	5	4	3	2	1	9
5.	Keeping guardrails and cable barrier rails in good condition	5	4	3	2	1	9
6.	Ensuring water drains quickly from the surface of highways during a storm	5	4	3	2	1	9
7.	Keeping the surface of *Interstate highways* in good condition (smooth & free of potholes)	5	4	3	2	1	9
8.	Keeping the surface of *other state highways* in good condition (smooth & free of potholes)	5	4	3	2	1	9
9.	Providing rest areas and welcome centers along highways	5	4	3	2	1	9
10.	Keeping rest areas and welcome centers clean	5	4	3	2	1	9
11.	Keeping shoulders on highways in good condition (safe and free of drop-offs)	5	4	3	2	1	9
12.	Keeping bridges in good condition	5	4	3	2	1	9
13.	Ensuring that roadway striping on highways is visible during the DAY	5	4	3	2	1	9
14.	Ensuring that roadway striping on highways is visible at NIGHT	5	4	3	2	1	9
15.	Ensuring that roadway striping on highways is visible during WET WEATHER	5	4	3	2	1	9
16.	Ensuring that informational and warning signs along highways are easy to see	5	4	3	2	1	9
17.	Ensuring that informational and warning signs are easy to understand	5	4	3	2	1	9
18.	Minimizing congestion on highways in urban areas	5	4	3	2	1	9
19.	Minimizing congestion on highways in rural areas	5	4	3	2	1	9
20.	Providing incident clearance services on Interstates in urban areas (TDOT HELP trucks) to help reduce congestion and secondary incidents	5	4	3	2	1	9
21.	Providing motorist assistance services on Interstates in urban areas (TDOT HELP trucks).	5	4	3	2	1	9
22.	Providing options for alternative modes of transportation along highways, such as bicycle lanes, pedestrian facilities, and public transportation services.	5	4	3	2	1	9

2. Which FOUR of the items listed above do you think should receive the MOST emphasis from TDOT over the next two years? [Please write the numbers below from the list in Question 1 above; if you do not think any improvements are needed circle "NONE".]

1st:____ 2nd:____ 3rd:____ 4th:_____ NONE

3. Using a 5-point scale, where 5 is "Very Satisfied" and 1 is "Very Dissatisfied," please rate your OVERALL satisfaction with the job that TDOT has done maintaining INTERSTATE highways in Tennessee during the past TWO years.

___(5) Very satisfied ___(3) Neutral ___(1) Very Dissatisfied
___(4) Satisfied ___(2) Dissatisfied ___(9) Don't know

4. Using a 5-point scale, where 5 is "Very Satisfied" and 1 is "Very Dissatisfied," please rate your OVERALL satisfaction with the job that TDOT has done maintaining STATE HIGHWAYS OTHER THAN INTERSTATES in Tennessee during the past TWO years.

___(5) Very satisfied ___(2) Dissatisfied
___(4) Satisfied ___(1) Very Dissatisfied
___(3) Neutral ___(9) Don't know

5. Transportation Options Please circle the number that best describes your level of satisfaction with the adequacy of the following transportation services and alternatives where you live:		Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Don't Know
1.	Availability of public transportation services where you live	5	4	3	2	1	9
2.	Frequency of public transportation services where you live	5	4	3	2	1	9
3.	Proximity (ease of access/convenience) to public transportation services where you live	5	4	3	2	1	9
4.	Availability of public transportation services for the elderly and persons with disabilities	5	4	3	2	1	9
5.	Availability of pedestrian facilities and sidewalks for transportation purposes along highways	5	4	3	2	1	9
6.	Availability of bicycle facilities and lanes along highways	5	4	3	2	1	9
7.	Providing park and ride facilities where residents can park their car and access public transportation or carpool/vanpool services	5	4	3	2	1	9

6. Which THREE of the transportation options for services listed above do you think should receive the most emphasis from the Tennessee Department of Transportation over the next TWO years? [Please write in the numbers from the list in Question 5 above; If you do not think any improvements are needed circle "NONE"]

1st :____ 2nd:____ 3rd:____ NONE

7. Perceptions of Travel on Highways in Tennessee Please circle the number that best describes your level of agreement with the following statements about travel on Interstates and other state highways in Tennessee.		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
1.	Overall, I feel safe traveling on highways in Tennessee	5	4	3	2	1	9
2.	I feel safe when driving through work zones on Tennessee highways at night	5	4	3	2	1	9
3.	I feel safe when driving through work zones on Tennessee highways during the day	5	4	3	2	1	9
4.	Detours on highways are usually well marked and easy to follow	5	4	3	2	1	9
5.	Warning signs in work zones on highways are easy to read and understand	5	4	3	2	1	9
6.	Pavement markings for lane shifts in work zones are easy to follow and understand.	5	4	3	2	1	9
7.	The location of warning signs in advance of work zones in Tennessee gives drivers plenty of time to react	5	4	3	2	1	9
8.	TDOT does a good job of minimizing delays caused by construction and maintenance of state highways	5	4	3	2	1	9
9.	Local business access is maintained while road construction is in progress.	5	4	3	2	1	9
10.	TDOT quickly responds to incidents and roadway obstructions.	5	4	3	2	1	9
11.	TDOT does a good job of clearing incidents to minimize travel delays.	5	4	3	2	1	9
12.	TDOT does a good job of communicating construction activities to notify travelers in advance of work to be done on the roadways.	5	4	3	2	1	9
13.	Overall, the level of traffic congestion on Interstate highways is acceptable	5	4	3	2	1	9
14.	Overall, the level of traffic congestion on other state highways is acceptable.	5	4	3	2	1	9

8. Has TDOT completed the construction of a new highway or the reconstruction of an existing highway that you regularly use during the past two years?

____(1) Yes ____(2) No [SKIP TO 9] ____(9) Don't know [SKIP TO 9]

ONLY IF YES to Q8:

8a. Do you feel that the overall quality of transportation in the area where you live has improved since the completion of this (these) project(s)?
____(1) Yes ____(2) No ____(9) Don't know

8b. Do you feel that TDOT adequately involved your community during the planning and implementation of highway improvements in your area?
____(1) Yes ____(2) No ____(9) Don't know

8c. Do you feel that TDOT adequately provided information in advance during construction project activities to assist you in your travel plans?
____(1) Yes ____(2) No ____(9) Don't know

Customer Service and Information

9. Have you contacted a TDOT employee by letter, telephone, e-mail, or in person, during the past two years?
____(1) Yes ____(2) No [SKIP TO 10]

9a. Why did you contact TDOT most recently? _____

9b. Did you receive a timely response to address your request or concern?
___(1) Yes ____(2) No

9c. Was the employee helpful? ___(1) Yes ____(2) No

9d. Overall, how satisfied were you with the service provided by the TDOT employee who helped you most recently?
____(5) Very satisfied
____(4) Satisfied
____(3) Neutral
____(2) Dissatisfied
____(1) Very Dissatisfied
____(9) Don't know

10. Have you visited TDOT's web site during the past year? ___(1) Yes ____(2) No [SKIP to 11]

10a. [If Yes to 10] **Why did you visit TDOT's website?** _____

10b. [If Yes to 10] **Were you able to locate the information you wanted?** ___(1) Yes ____(2) No

10c. [If Yes to 10] **How easy was the website to use?**
____(1) Very easy ____(2) Easy ____(3) Ok ____(4) Difficult ____(9) Don't remember

11. Which of the following are the <u>most</u> effective ways for TDOT to provide you with information? (CHECK ALL THAT APPLY)
___(01) Electronic message boards on highways
___(02) Signs on roadways with phone numbers for information
___(03) Flyers
___(04) Tennessee "511"
___(05) TDOT web page
___(06) TDOT SmartWay/WAZE
___(07) Direct mailings/newsletters
___(08) Newspapers
___(09) Radio
___(10) TV local public access channel
___(11) Facebook
___(12) Twitter
___(13) Instagram
___(14) LinkedIn
___(15) YouTube
___(16) Other social media sites, such as; Pinterest, Vine, Vimeo
___(17) Text messages
___(18) Public officials
___(19) Public meetings/hearings
___(20) E-mail

12. Using a 5-point scale, where 5 is "Very Satisfied" and 1 is "Very Dissatisfied," how satisfied are you with TDOT's overall efforts to keep residents informed about transportation related issues in Tennessee?

___(5) Very Satisfied
___(4) Satisfied
___(3) Neutral
___(2) Dissatisfied
___(1) Very Dissatisfied
___(9) Don't know

13. Which social media platform do you most frequently use to obtain transportation/travel information?

_____

LEVEL OF SERVICE INDICATORS

14. Overall, how easy do you think it is to travel <u>between cities</u> in Tennessee?

___(5) Very easy
___(4) Easy
___(3) Neutral
___(2) Difficult
___(1) Very difficult
___(9) Don't know

15. Overall, how easy do you think it is to travel <u>within urban areas</u> of Tennessee?

___(5) Very easy
___(4) Easy
___(3) Neutral
___(2) Difficult
___(1) Very difficult
___(9) Don't know

16. Compared to two years ago, how do you think that the <u>current quality</u> of TDOT services has changed?

___(1) Better
___(2) About the same
___(3) Worse
___(9) Don't know

17. OVERALL RATINGS Please circle the number that best describes your level of agreement with the following statements:		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
1.	I am familiar with the services that TDOT provides	5	4	3	2	1	9
2.	TDOT does a good job prioritizing highway improvements in Tennessee	5	4	3	2	1	9
3.	I think TDOT adequately supports local transportation projects for the city and county governments	5	4	3	2	1	9
4.	I think TDOT is responsive to the concerns of local communities	5	4	3	2	1	9
5.	TDOT incorporates environmental concerns into the design and maintenance of transportation projects.	5	4	3	2	1	9
6.	I trust TDOT to make sound professional transportation decisions	5	4	3	2	1	9
7.	Compared to other states I have visited, I think Tennessee's transportation system is one of the best.	5	4	3	2	1	9

18. Whose job do you believe it is to lead on transportation issues?

___(1) Local (city/county) government
___(2) State government
___(3) Federal government
___(9) Don't know

19. Thinking about <u>your own daily life</u>, how important are roads, bridges, public transportation, to safety and quality of life?

___(1) Very important
___(2) Important
___(3) Somewhat important
___(4) Not important
___(5) Not important at all
___(9) Don't know

20. Thinking about the Tennessee economy, how important are roads, bridges, public transportation to economic development and job growth?

___(1) Very important
___(2) Important
___(3) Somewhat important
___(4) Not important
___(5) Not important at all
___(9) Don't know

21. Approximately how much do you think the average Tennessee resident pays annually per vehicle to support transportation projects and services provided by TDOT? [For more information about what you personally pay, please go to the following website: https://www.tdot.tn.gov/ProjectNeeds/TaxCalculator]

___(1) Less than $250
___(2) $250-$499
___(3) $500-$749
___(4) $750-$999
___(5) over $1,000
___(9) Don't know

22. Where do you think Tennessee's transportation spending per person ranks compared to other states?

___(1) Spends more than other states
___(2) Spends about the same as other states
___(3) Spends less than other states
___(9) Don't know

23. Overall, how would you rate the value that is currently provided by TDOT for the transportation taxes paid by Tennessee residents?

___(1) Good value for your money
___(2) Ok value for your money
___(3) Low value for your money
___(9) Don't know

24. *Transportation Improvements* How supportive would you be of increasing funding for the following types of transportation improvements in Tennessee over the next 10 years?		Very Supportive	Supportive	Neutral	Not Supportive	Not at All Supportive	Don't Know
1.	Improving Interstate highways	5	4	3	2	1	9
2.	Repairing and maintaining existing roads and bridges	5	4	3	2	1	9
3.	Expanding use of technology (ITS) to improve traffic flow *(such as: traffic cameras, message signs, traffic sensors, weather detection devices)*	5	4	3	2	1	9
4.	Expanding public transportation services	5	4	3	2	1	9
5.	Improving rural access	5	4	3	2	1	9
6.	Enhancing safety on highways	5	4	3	2	1	9
7.	Reducing congestion	5	4	3	2	1	9
8.	Investing in transportation projects that will support economic development	5	4	3	2	1	9
9.	Increasing availability of pedestrian facilities and sidewalks	5	4	3	2	1	9
10.	Expanding availability of bicycle facilities and lanes	5	4	3	2	1	9

25. Which THREE of the items listed above do you think should be the State's top transportation funding priorities over the next 10 years? [Please write the letters below from the list in Question 24 above; if you do not support any improvements circle "NONE".]

1st:____ 2nd:____ 3rd:____ NONE

DEMOGRAPHICS

The following questions are designed to help us better understand the needs of particular groups of people and to ensure that the results of our survey are representative of the State's residents. Your individual responses will remain confidential.

26. What is your current employment status?
____(1) Employed full-time
____(2) Employed part-time
____(3) Student
____(4) Retired
____(5) Unemployed but seeking paid employment
____(6) Not seeking paid employment (homemaker, etc.)

27. Which of the following best describes your race/ethnicity?
____(1) African American/Black
____(2) American Indian/Eskimo
____(3) Asian/Pacific Islander
____(4) Caucasian/White
____(5) Hispanic
____(6) Other_____

28. Do you speak a language other than English as your primary language?
____(1) Yes: **If YES: what language do you speak?** _____
____(2) No

29. How many years have you been a resident of Tennessee (enter 0 if less than 1 year)**?** ____years

30. In which county do you live? _____

31. Do you have a physical disability? ____(1) Yes ____(2) No

32. What is your total household income?
____(1) Under $25,000
____(2) $25,000 to $49,999
____(3) $50,000 to $74,999
____(4) $75,000 to $99,999
____(5) $100,000 plus

33. How many persons living in your household (counting yourself) are in each of the following age groups? (write the number of people in each group in the space provided)

____Under 5 years
____5 to 9 years
____10 to 14 years
____15 to 19 years
____20 to 24 years
____25 to 34 years
____35 to 44 years
____45 to 54 years
____55 to 64 years
____65+ years

34. What is your age? ____years

35. How many vehicles do you have in your household?
(Only include motorized vehicles that are currently operational) _____ vehicles

36. Approximately how many miles do you drive per week? _____ miles per week

37. What is your Gender? ____(1) Male ____(2) Female

OTHER COMMENTS. If you have any other comments that you would like to share with TDOT, please provide them in the space below.

This concludes the survey. Thank you for your time!

Please return your completed survey in the enclosed postage paid envelope addressed to:
ETC Institute, 725 W. Frontier Circle, Olathe, KS 66061

Your responses will remain completely confidential. The information printed to the right will ONLY be used to help identify areas of Tennessee where transportation services can be improved. If your address is not correct, please write the correct information above the label. Thank you.