FTA RESEARCH

FEDERAL TRANSIT ADMINISTRATION

Mobility on Demand (MOD) Sandbox Demonstration: Vermont Agency of Transportation (VTrans) OpenTripPlanner

Evaluation Report

FEBRUARY 2021

FTA Report No. 0185
Federal Transit Administration

PREPARED BY

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U.S. Department of Transportation
Federal Transit Administration

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Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liter	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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ABSTRACT

This report documents the results of an independent evaluation of the Vermont Agency of Transportation's (VTrans) OpenTripPlanner (OTP), called Go! Vermont, part of the Federal Transit Administration (FTA) Mobility on Demand (MOD) Sandbox Demonstration program. The project intended to serve as an alternative to other trip planners by including flexible transit options such as route deviation, dial-a-ride, and other demand-responsive alternatives and to analyze web traffic data to determine the level of user activity attracted by Go! Vermont since its launch. The evaluation compared the trip itineraries of Google Maps and the OTP and explored the inclusion of flexible transit options. Eight hypotheses were evaluated, and expert (stakeholder/project partner) interviews highlighted VTrans partnerships with employment services and vocational rehabilitation to leverage the trip planner for improving access to jobs, training, and healthcare for carless and car-lite households. Interviewees noted how the trip planner improved how telephone dispatchers and case workers provided transportation information.

EXECUTIVE SUMMARY

The Federal Transit Administration (FTA) is leading an initiative, the MOD Sandbox Program, to explore how public transit agencies could incorporate innovative technologies that complement and support the traditional functions of public transit. A project in the program was the Vermont Agency of Transportation (VTrans) OpenTripPlanner (OTP), also called Flexible Trip Planner. VTrans, in conjunction with Cambridge Systematics and Trillium Solutions, Inc., developed a trip planner that was intended to advance the state of practice with respect to presenting schedule and trip planning information in support of flexible transit systems. The new trip planner developed, called Go! Vermont, uses General Transit Feed Specification (GTFS)-Flex data to display flexible transit services in trip itineraries for input origins and destinations. It was implemented exclusively as a website that could thematically adapt to a mobile platforms. Go! Vermont's target user audience was all residents of Vermont, and the trip planner was intended to be of special use to residents who live in rural areas, residents with disabilities, and older adults.

The VTrans OTP MOD Sandbox Demonstration project aimed to be an example to other states and local municipalities of the benefit derived from integrating flexible transit data into publicly- available trip planners. With this project, VTrans had eight core goals:

1. Develop an online trip planner for both "fixed" and "flexible" services.
2. Improve the data presentation for transit agencies in Vermont.
3. Improve the information for transit riders in Vermont.
4. Improve mobility for Vermont transit riders.
5. Increase public transit use in Vermont.
6. Use of the statewide planner by Vermont transit riders.
7. Cut call/response time on relevant inquiries pertaining to route info and travel options.
8. Obtain lessons learned about project implementation.

This report includes the results of an independent evaluation of Go! Vermont web application, and explored eight hypotheses. The methods for addressing each hypothesis including trip planning analysis, surveys, and expert (stakeholder/ project partner) interviews. Survey samples were limited in size due to the available collection methods. The results are further discussed below.

Hypothesis 1: The application will allow users to define an origin and destination within the state and receive transit itineraries including such flexible options as flag stops, deviated fixed routes, and dial-a-ride.

One of the primary motivations behind the development of Go! Vermont was that it would be able to better provide trip itineraries that integrate flexible transit services with the fixed-route options traditionally offered on other trip

planners. A set of 61 origin-destination (O-D) pairs were input into both Go! Vermont and Google Maps to compare results and gauge whether the VTrans planner was able to provide effective flexible transit information for trips that would otherwise be comparable to the results of a conventional trip planner. A performance metric was developed to measure the difference in options presented by the two planners—the number of transit operators and services that are presented on Go! Vermont relative to Google Maps for a series of 61 pre-defined searches. The findings of the analysis suggest that more options were presented in the Go! Vermont trip planner for the 61 randomly-generated O-D pairs, supporting Hypothesis 1.

Hypothesis 2: Transit agencies will consider the State planner as an improvement.

The evaluation explored the perceptions of Go! Vermont among transit operators. An online survey (N = 13) was administered to transit operators that contained questions asking them to provide their opinions of the tool and also to compare the tool's features and functionality to that of Google Maps. Several questions were asked to gauge how public transit agencies perceived the Go! Vermont trip planner. Across those questions, about half of respondents reported that they felt the Go! Vermont trip planner was improvement over Google Maps, considered to be a leading trip planner. The remaining sample did not think the trip planner was an improvement. The results of the survey found that Hypothesis 2 was partially supported.

Hypothesis 3: Riders will consider the new planner to be an improvement over existing planning tools.

The perceptions of the Go! Vermont trip planner held by users in the general public were evaluated through a user survey (N = 8), which consisted of questions exploring product perception pertaining to specific features of the planner such as appearance, formatting, and display of information. Overall, the results found mixed perceptions of the platform, suggesting that its comparability to Google Maps was about the same or weaker in some areas. It is important to note that the sample size of the user survey was very small (N = 8). Nonetheless, the findings did not support a confirmation of Hypothesis 3.

Hypothesis 4: The new planner will improve rider mobility among planner users.

Hypothesis 4 evaluated whether users perceived improved mobility as a result of the planner. The hypothesis was evaluated through the user survey that asked questions related to functionality of the Go! Vermont trip planner. A question was asked of users whether Go! Vermont had improved their mobility, and two additional questions explored how the tool influenced their travel. Seven of

eight survey respondents reported that the trip planner had not influenced their travel to date, and six of eight respondents reported that they thought it could influence their travel (at some point in the future). The user survey sample size was small (N=8), so the results could not be generalized to a broader population. The results suggested an inconclusive finding for Hypothesis 4.

Hypothesis 5: Due to improved information, the new planner will increase transit ridership among users in Vermont.

The survey was also designed to evaluate whether the use of Go! Vermont would enable greater ridership of public transit. The survey asked users whether they had changed their public transit use due to the trip planner. All respondents to the question reported that their use of public transit was about the same due to the trip planner, suggesting that transit ridership was not influenced by the trip planner. The findings suggest that Hypothesis 5 was not supported.

Hypothesis 6: Web traffic to the State planner will see, on average, at least 10 queries per day that constitute actual users searching the platform.

Web traffic is an important level of use indicator of the trip planner. Data were evaluated to measure the level of use that Go! Vermont experienced during the evaluation period. This spanned site activity from March 1, 2018 to March 31, 2019. Analysis of the data showed that the average users per day was 5.3, with a minimum of 0 and maximum of 55. Use of the trip planner was relatively steady during most of the evaluation period, with occasional surges in use observed. It also increased slightly during latter part of the period, although the averages still did not exceed during the final months. Overall, the average level of users per day was less than 10; thus, the data did not support Hypothesis 6.

Hypothesis 7: The new planner will lead to a reduced call/response time on relevant inquiries pertaining to route info and travel options.

The intent of this hypothesis was to examine the performance of the customer support infrastructure, particularly the Call Center, behind Go! Vermont in terms of answering user questions concerning the tool's outputs. Because of data limitations, this hypothesis was not answerable, leading Hypothesis 7 to be inconclusive.

Hypothesis 8: Lessons from project implementation can inform future project and system designs and implementation.

Several insights were drawn from the series of expert interviews that were made with project stakeholders. Key recommendations emerging from these interviews were for the FTA to 1) invest in transit technology in rural communities to bridge the technological gap between those areas and urban centers, 2) take a

leadership role in integrated trip planning across public transit agencies, and 3) develop strategic methodologies that focus on the longer-term performance and success of projects. Building on these insights and lessons learned, Hypothesis 8 was found to be supported.

The report that follows presents the detailed findings of the evaluation of the VTrans project, with lessons learned that can potentially help advance similar initiatives with other transit systems

Table ES-1

Summary of Findings

Hypothesis	Status	Key Findings
1. The application will allow users to define an origin and destination within the state and receive transit itineraries including such flexible options as flag stops, deviated fixed routes, and dial-a-ride.	Supported	The VTrans trip planner was found to provide more flexible trip options for comparative trips planned within Vermont.
2. Transit agencies will see the State planner as an improvement.	Partially Supported	A small sample of transit operators considered the trip planner to be an improvement
3. Riders will consider the new planner to be an improvement over existing planning tools.	Not Supported	A small sample of riders did not consider the trip planner to be an improvement.
4. The new planner will improve rider mobility among planner users.	Inconclusive	A small sample of riders reported that the planner had not improved their mobility, but it could potentially influence their ways of travel.
5. Due to improved information, the new planner will increase transit ridership among users in Vermont.	Not supported	A small sample of respondents reported that they used transit about the same as a result of the trip planner
6. Web traffic to the State planner will see, on average, at least 10 queries per day that constitute actual users searching the platform.	Not supported	Web traffic increased during the evaluation period, but neither the average nor moving average exceeded 10 users per day.
7. The new planner will lead to a reduced call/response time on relevant inquiries pertaining to route info and travel options.	Inconclusive	Data were not available to sufficiently evaluate this hypothesis.
8. Lessons from project implementation can inform future project and system designs and implementation.	Supported	A number of challenges were evaluated by the team that produced several key lessons learned.

SECTION

1

Introduction

Overview of MOD Sandbox Demonstrations

The Federal Transit Administration (FTA)'s Mobility on Demand (MOD) effort developed around a vision of a multimodal, integrated, automated, accessible, and connected transportation system in which personalized mobility is a key feature. FTA selected 11 MOD Sandbox Demonstration projects that are testing strategies that advance the MOD vision. In partnership with public transportation agencies, the MOD Sandbox is demonstrating the potential for emerging innovations to support and enhance public transportation services by allowing agencies to explore partnerships, develop new business models, integrate transit with MOD strategies, and investigate new, enabling technical capabilities.

Ultimately, the evaluation of each project's benefits and impacts will guide the future implementation of innovations throughout the U.S. Broadly, MOD Sandbox projects take several approaches, including the development of new or improved trip planners, integration of new mobility services with traditional public transportation functions, and implementation of new integrated payment and incentive structures for travel using public transportation. Several Sandbox projects focus on improving first/last-mile access to public transportation through collaboration with private sector operators, including bikesharing, carsharing, transportation network companies (TNCs, also known as ride-sourcing and ride-hailing), and other shared mobility operators.

More information about the MOD Sandbox Program can be found at https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program.

Table 1-1 provides a summary of all projects in the MOD Sandbox Program.

Table 1-1

Overview of MOD Sandbox Projects

Region	Project	Description
Chicago	Incorporation of Bikesharing Company Divvy	Releases updated version of Chicago Transit Authority's (CTA) existing trip planning app. New version incorporates Divvy, a bikesharing service, and allows users to reserve and pay for bikes within the app.
Dallas	Integration of Shared-Ride Services into GoPass Ticketing Application	Releases updated version of Dallas Area Rapid Transit's (DART) existing trip planning app. Updated version incorporates shared-ride services to provide first/last-mile connections to public transportation stations and allows users to pay for services within the app.
Los Angeles and Puget Sound	Two-Region Mobility on Demand	Establishes partnership between Via and LA Metro. Via provides first/last-mile connections for passengers going to or leaving from transit stations. There is a companion project in Seattle, WA.
Phoenix	Smart Phone Mobility Platform	Releases updated version of Valley Metro's existing trip planning app. New version updates trip planning features and enables payments.
Pinellas County (Florida)	Paratransit Mobility on Demand	Improves paratransit service by combining services from taxi, ridesourcing/TNCs, and traditional paratransit companies.
Portland	OpenTripPlanner Share Use Mobility	Releases updated version of TriMet's existing multimodal app. New version provides more sophisticated functionality and features, including options for shared mobility.
San Francisco Bay Area	Bay Area Fair Value Commuting (Palo Alto)	Reduces SOV use within Bay Area through commuter trip reduction software, a multimodal app, workplace parking rebates, and first/last-mile connections in areas with poor access to public transportation.
	Integrated Carpool to Transit (BART System)	Establishes partnership between Scoop and Bay Area Rapid Transit (BART). Scoop matches carpoolers and facilitates carpooling trips for passengers going to or leaving from BART stations with guaranteed parking.
Tacoma	Limited Access Connections	Establishes partnerships between local ridesourcing companies/TNCs and Pierce Transit. Ridesourcing companies provide first/last-mile connections to public transportation stations and park-and-ride lots with guaranteed rides home.
Tucson	Adaptive Mobility with Reliability and Efficiency	Built integrated data platform that incorporates ridesourcing/TNC and carpooling services to support first/last-mile connections and reduce congestion.
Vermont	Statewide Transit Trip Planner	Releases new multimodal app for VTrans that employs fixed and flexible (non-fixed) transportation modes to route trips in cities and rural areas.

An independent evaluation (IE) is required by Federal Public Transportation Law (49 U.S.C. § 5312(e)(4)) for demonstration projects receiving FTA Public Transportation Innovation funding. The IE for the MOD Sandbox Demonstration projects was sponsored by the USDOT Intelligent Transportation Systems Joint Program Office (ITS JPO) and FTA.

This report focuses on the independent evaluation of the project with the Vermont Agency of Transportation's (VTrans) OpenTripPlanner (OTP), also called Flexible Trip Planner, as implemented in the state. The VTrans OTP was intended to serve as an alternative to other trip planners such as Google Maps by including flexible transit options such as route deviation, dial-a-ride, and other demand-responsive alternatives. The evaluation compared the trip itineraries of Google Maps and the OTP, called Go! Vermont, and explored the inclusion of flexible transit options. To evaluate user response to the trip planner, a survey was implemented of users and transit operators on their experience with the Go! Vermont trip planner. Finally, a series of expert (stakeholder/project partner) interviews was conducted to learn best practices and gather recommendations for improving the transit planner in the future. Following a more detailed overview of the project, these hypotheses are explored in the sections that follow.

Evaluation Framework

For each of the 11 MOD Sandbox projects, the IE team developed an evaluation framework in coordination with the project team. The framework is a project-specific logic model that contains the following entries:

1. **MOD Sandbox Project** – denotes the specific MOD Sandbox project.
2. **Project Goals** – denotes each project goal for the specific MOD Sandbox project and captures what each MOD Sandbox project is trying to achieve.
3. **Evaluation Hypothesis** – denotes each evaluation hypothesis for the specific MOD Sandbox project. The evaluation hypotheses flow from the project-specific goals.
4. **Performance Metric** – denotes the performance metrics used to measure impact in line with the evaluation hypotheses for the specific MOD Sandbox project.
5. **Data Types and Sources** – denotes each data source used for the identified performance metrics.
6. **Method of Evaluation** – denotes quantitative and qualitative evaluation methods used.

SECTION

2

Vermont MOD Sandbox Project Summary

Vermont is one of the smallest states in the U.S., ranking 49th in population size. It is characterized by a geography that is sparsely populated and mostly rural in nature. Because of its rural environment, travel is primarily auto-dependent, and transit coverage is very limited. In response to its land use, many transit services in Vermont are implemented through flexible scheduling and routing. This is done through deviated fixed routes, which can make door-to-door stops within a short distance of a schedule fixed route. The problem with deviated fixed routes is that traditional transit trip planners do not handle them very well. For example, traditional General Transit Feed Specification (GTFS) formats were designed for conventional fixed-route transit, with well- defined scheduled stops and routes. However, flexible transit service that deviates from a fixed route to appropriately serve rural environments cannot be easily represented by the conventional GTFS data formats. Hence, a major goal was to provide an advanced statewide trip planner that could present more of these flexible transit services. In February 2018, VTrans introduced the Go! Vermont Flexible Trip Planner, developed as an integration of two existing platforms—GTFS-Flex specification and the OTP. Key project partners included VTrans, Cambridge Systematics, Trillium Solutions, the Vermont Center for Independent Living, Creative Workforce Solutions, and Go! Vermont.

This report focuses on the evaluation of the VTrans OTP MOD Sandbox Demonstration, specifically perceptions of the service and performance of the tool.

Project Timeline

The main project milestones were as follows:

- **January 30, 2017**– Cooperative Agreement execution date
- **February 2018** – Application public launch and demonstration start
- **September 2018** – Marketing campaign start (Video/TV, web, and print ads)
- **March 2019** – Demonstration completion and final report

Data relevant to this MOD Sandbox Demonstration (as outlined in the Evaluation Plan) were during 2018 and 2019.

SECTION

3

Evaluation Approach, Planning, and Execution

The evaluation of each MOD Sandbox project was guided by an evaluation plan developed at the outset of the project. The evaluation plan was built primarily on a logic model constructed by the IE team. The logic model had five basic components:

1. **Project Goal** – The stated goal of the project; project goals were defined from the proposal, project summary, and discussion with project team members.
2. **Evaluation Hypothesis** – Each project goal had a corresponding hypothesis, a stated question that could be answered with a "Yes" or a "No" that was related to measuring the achievement of the associated project goal.
3. **Performance Metric** – Described the measurement that was proposed to be used to evaluate the hypothesis.
4. **Data Sources** – Data sources that followed from the performance metric and described the data type and source necessary to compute or evaluate the performance metric.
5. **Method of Evaluation** – Defined how the hypothesis would be evaluated; with the logic model, this was very general, declaring whether the evaluation would be completed via survey analysis, activity data analysis, time series analysis, or other methods.

The logic model was presented as a table, with one row containing five cells, each populated with the components described above. The content of the logic model was populated in advance of project implementation, where knowledge of the project trajectory and exact data collected were uncertain. The components of the logic model constructed for the evaluation of the Go! Vermont project are presented in Table 3-1.

Table 3-1

Project Goals, Evaluation Hypotheses, Performance Metrics, and Data Sources for the VTrans OTP Project

Project Goals	Evaluation Hypothesis	Performance Metric	Data Elements	Data Sources
1. Develop an online trip planner for both "fixed" and "flexible" services.	1. The application will allow users to define an origin and destination within the state and receive transit itineraries including such flexible options as flag stops, deviated fixed routes, and dial-a-ride	For a series of pre-defined searches that number 30 or more, number of transit operators and services reported on planner that are not presentable on Google Maps with standard GTFS data	O-D trip data	VTrans OTP; opensource or external (e.g., Google Maps)
2. Improve the data presentation for transit agencies in Vermont.	2. Transit agencies will consider the State planner as an improvement.	Transit operator survey responses	Survey data	VTrans (surveyed public transit providers)
3. Improve information for transit riders in Vermont; improvements to Pass2Go Pilot.	3. Riders will consider the new planner to be an improvement over existing planning tools.	User survey responses to product perception questions	Survey data	VTrans (surveyed users)
4. Improve mobility for Vermont transit riders.	4. The new planner will improve rider mobility among planner users.	User survey responses to mobility perception questions	Survey data	VTrans (surveyed users)
5. Increase public transit use in Vermont.	5. Due to improved information, the new planner will increase transit ridership among users in Vermont.	User survey responses to mobility perception questions; number of general public trips arranged using scheduled demand response trips	Survey data; transit ridership data	Transit ridership data from VTrans (surveyed users, ridership from Vermont transit providers)
6. The statewide planner is used by Vermont transit riders.	6. Web traffic to the State planner will see, on average, at least 10 queries per day that constitute actual users searching the platform.	Web traffic data (e.g., count of IP addresses in Vermont, distribution at local level, basic query count data)	Web traffic data	VTrans (web analytics)
7. Cut call/ response time on relevant inquiries pertaining to route info and travel options.	7. The new planner will lead to a reduced call/response time on relevant inquiries pertaining to route info and travel options.	Call/response time on relevant inquiries pertaining to route info and travel options, before and after planner implementation	Call Center inquiries data	VTrans (Call Center)
8. Obtain lessons learned about project implementation.	8. Obtain lessons learned about project implementation.	Qualitative documentation from stakeholder interviews	Stakeholder interview data	VTrans (interviewees)

The quantitative and qualitative evaluation methods used in the VTrans IE included the following:

- Comparative testing of Go! Vermont trip planner and Google Maps
- Data verification
- Survey analysis
- Summary of expert interviews

The content of the logic model was translated into a data collection plan, which was incorporated into a broader evaluation plan. The evaluation plan contains further details on the proposed data structures and analytical approaches to address each hypothesis. The evaluation plan was reviewed by project stakeholders and finalized toward the inception of the project. The project team then executed the project, working with the evaluation team to collect and transfer data at key junctures of the project. In the sections that follow, the report presents background on the data collected in support of the evaluation and presentation and discussion of the results from the evaluation.

Data Collected

A variety of datasets was used to conduct the evaluation. VTrans and the IE team collaborated on survey development and deployment. VTrans supplied transit operator survey data, using the design proposed in the evaluation plan, which also supported the evaluation of specific hypotheses. The remainder of the project components could be evaluated and tested independently. Descriptions of the available datasets are as follows:

- **Trip Planner Input Simulation Data** – In total, 61 O-D pairs were generated and input into both Google Maps and Go! Vermont. The number of options including flexible transit services was measured and recorded for each pair in each respective planner.
- **Survey Data** – Two surveys were administered to collect opinions on the features of the Go! Vermont trip planner. The first survey was administered to transit operators; the second was administered to the general public. Dissemination of the surveys was passive and somewhat challenging. In the case of users, VTrans did not have a way to contact users of the system to invite them to take a survey; as a result, the sample sizes of both surveys were relatively small but still could provide useful insights. The user survey sample size was N = 8, and the transit operator survey sample size was N = 13.
- **Transit Agency Data** – The IE team was provided access to historical ridership and web traffic data through the analytics platform of the Go! Vermont trip planner to analyze web traffic activity. Call Center data were requested but not available in a disaggregate form that was usable for the analysis planned.

- **Stakeholder Interview Data** – The IE team conducted six expert interviews with people directly connected to the project team and who had deep knowledge of the project. These interviews were conducted in August 2019 and covered lessons learned, challenges and barriers, and key institutional findings.

These datasets were applied to evaluate the hypotheses defined in the evaluation plan. In the sections that follow, these hypotheses are explored and evaluated using the data available.

SECTION

4

Evaluation Results

This section presents the results of the evaluation of hypotheses as defined in the project evaluation plan. The hypotheses evaluated explored the system from several angles, including technical function and performance as well as user perception and impact on behavior. The report presents figures with data supporting the findings of the evaluation. (*Note*: Data labels in the figures are rounded to the nearest whole percent, and equal values may differ slightly in graphical presentation due to differences in tenths of a percent.) The discussion that follows introduces each hypothesis and describes the analysis supporting the findings and conclusions of the IE team.

Hypothesis 1: The application will allow users to define an origin and destination within the state and receive transit itineraries including such flexible options as flag stops, deviated fixed routes, and dial-a-ride

Performance Metric	Key Finding
For a series of pre-defined searches that number 30 or more, number of transit operators and services reported on the planner that are not presentable on Google Maps with standard GTFS data.	The VTrans trip planner was found to provide more flexible trip options for comparative trips planned within Vermont.

The first hypothesis of the evaluation sought to evaluate the function of the system. To implement the test, 61 O-D pairs were input manually into both Google Maps and Go! Vermont. These exact pairs tested are presented in Appendix B, List of Origins and Destinations Input into Trip Planner for Comparative Testing of the report. In total, 20 O-D pairs were trips that both began and terminated within the most populated metropolitan areas in Vermont. Next, over 40 O-D pairs were selected that started and ended in different cities. These pairs varied in geographic distance, and care was placed on ensuring that the selected pairs were inclusive of all regions in Vermont, including rural and low-density environments. Results varied across the selected O-D pairs. Selected cases where Google appeared to perform better included pairs where the origins and destinations were both located in populated areas. In cases where either the origin or destination appeared to exist in a more rural environment, the Go! Vermont planner appeared to produce outputs that were more effective, accurate, or favorable to the traveler (e.g., presenting shorter travel times). These results did not yield consistent generalizations across all location pairs but, in general, these distinctions in performance were observed.

The metric of consideration was the number of itineraries presented by each planner. Other features of the planners such as total travel time, total time on public transit, time spent walking, travel distance, walking distance, trip cost,

etc., also were collected and evaluated. Many of these features were more useful for explaining the strength of fixed and flexible public transit options in Vermont rather than the ability, or lack thereof, of Go! Vermont to display flexible transit options. For example, the number of trips containing flexible transit options was considered when examining trip itineraries.

Considerable thought was given to the configuration of the settings for each trip planner. As with many contemporary trip planners, several customizable options can impact how itineraries are displayed, including but not limited to time of day, day of week, and other features specific to either of the trip planners. The IE team decided to run the 61 O-D pairs into both planners with the same pre-defined preferences and at the same pre-specified time and date to minimize the impact that time could have on the team's ability to compare the ability of the two planners to display flexible transit options. All pairs were tested with the same time and date to ensure comparability across trip search results. Times were within typical travel and transit operating hours.

Some features specific to Google Maps or Go! Vermont ultimately led to two particular cases being devised. For Go! Vermont, the trip planner has three unique options that will impact display features—1) the maximum walking distance that any displayed itinerary will include, 2) including trips that require making a reservation in advance, and 3) including trips that have eligibility requirements. For transit directions provided by Google Maps, two features will impact which trip options are displayed—modal preference, which allows users to select one or more bus, subway, train, or train and light rail, and route preference, which allows the user to select from the options of best route, fewer transfers, less walking, and wheelchair accessible. Two use cases were developed that are intended to best capture how users of each system would likely use the respective trip planners, as described in Table 4-1.

Table 4-1

Use Cases for Trip Planner Evaluation

Use Case 1	• Go! Vermont: Maximum walk distance set to five miles
	• Go! Vermont: "Show services requiring reservation" selected
	• Go! Vermont: "Show services with eligibility requirements" not selected
	• Google Maps: No modal preference given
	• Google Maps: "Best route" selected
Use Case 2	• Go! Vermont: Maximum walk distance set to five miles
	• Go! Vermont: "Show services requiring reservation" selected
	• Go! Vermont: "Show services with eligibility requirements" selected
	• Google Maps: No modal preference given
	• Google Maps: "Wheelchair accessible" selected

Case 1 was intended to simulate use of the planners by persons who do not have accessibility requirements, and Case 2 is the opposite. In both cases, the maximum walking distance was set to five miles, which was the maximum permitted. A five-mile walk to catch transit would be a long distance for anyone

to travel; the point was not to suggest that this was a common or acceptable way to access public transit, particularly for persons with disabilities, but to ensure that the VTrans trip planner would capture all transit trips possibly available to users. Google Maps was observed to tolerate varying walking distances, up to about an hour. Such a tolerance would amount to an estimated four miles of walking given an assumed walking speed of four miles per hour. Drawing an exact match across these platforms in terms of walking tolerances was not possible due to the differences in interface design and input. The approach taken was intended to maximize the catchment area from any given location and thus capture the maximum presentable transit options available to users by each platform.

Results of the simulation are summarized below in Table 4-2, which shows the number of trip options returned containing flexible transit options for each O-D pair.

Table 4-2

Trip Planner Evaluation Results

Pair #	1	2	3	4	5	6	7	8	9	#
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	0	0	0	0	1	2	2	3	2	1
Pair #	**11**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	1	0	0	0	0	0
Go! Vermont	1	0	0	0	2	0	3	3	3	3
Pair #	**21**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	3	2	0	0	2	1	0	3	3	3
Pair #	**31**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	3	0	0	0	4	0
Go! Vermont	3	3	3	1	0	0	3	1	0	0
Pair #	**41**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	0	3	3	0	1	0	0	1	0	1
Pair #	**51**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	2	0	1	2	0	0	0	0	0	0
Pair #	**61**	**CASE1**			Google Maps			Go! Vermont		
Google Maps	0	**Average**			0.13			1.20		
Go! Vermont	2	**S.D.**			0.64			1.25		

Pair #	1	2	3	4	5	6	7	8	9	#
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	0	0	1	0	1	2	3	3	2	1
Pair #	**11**	**12**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	4	0	0	0	0	0
Go! Vermont	1	0	0	0	2	0	3	3	3	3
Pair #	**21**	**22**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	3	3	0	0	2	1	0	3	3	0
Pair #	**31**	**32**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	2	0	0	0	3	0
Go! Vermont	3	3	3	2	0	0	3	1	0	0
Pair #	**41**	**42**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	0	3	3	0	1	0	0	1	0	1
Pair #	**51**	**52**	**#**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Google Maps	0	0	0	0	0	0	0	0	0	0
Go! Vermont	2	0	1	2	0	0	0	0	0	1
Pair #	**61**	**CASE 2**			Google Maps			Go! Vermont		
Google Maps	0	**Average**			0.15			1.23		
Go! Vermont	2	**S.D.**			0.68			1.26		

S.D. = standard deviation

As seen in Table 4-2, the average number of trips displayed for Case 1 that contained flexible transit options was 1.20 for Go! Vermont vs. 0.13 for Google Maps. The metrics were very similar for Case 2. The sign test was employed to gauge statistical significance. The null hypothesis was that the mean difference in number of flexible transit options displayed is equal to zero. The alternative hypothesis was that the mean difference is greater than zero, i.e., the number of flexible transit options displayed by Go! Vermont is greater than that displayed by Google Maps. Employing a binomial distribution calculator, the calculated p-value was 6.17E-08 for both Case 1 and Case 2. The null hypothesis was rejected in favor of the alternative hypothesis for both cases, which holds for an alpha of 0.01 (1% level) and confirms that Hypothesis 1 was supported.

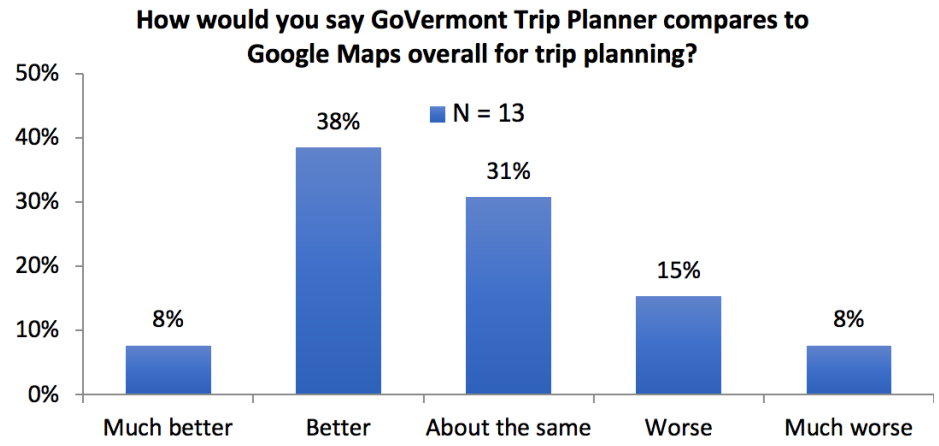
Hypothesis 2: Transit agencies will consider the State planner as an improvement,

Performance Metric	Key Finding
Transit operator survey responses	A small sample of transit operators considered the trip planner to be an improvement

To evaluate the perspectives of Vermont transit operators on the Go! Vermont trip planner, a survey was administered that asked several questions to gauge whether they believed the Go! Vermont trip planner was an improvement. This hypothesis was informed by data from the operator survey. Several additional questions were asked to gauge how transit agencies perceived the Go! Vermont trip planner. As shown in Figure 4-1, 6 of 13 (46%) respondents reported that Go! Vermont was better or much better for trip planning than Google Maps, while about a third (31%) considered it to be about the same; the remaining 23% felt it was worse. With respect to appearance (shown in Figure 4-2), 5 of 12 (42%) respondents reported that the Go! Vermont trip planner had a better or much better aesthetic appearance, and 6 of 12 (50%) felt it had a comparable or equivalently appealing appearance. Figure 4-3 and Figure 4-4 show that two-thirds of 12 respondents reported that the two trip planners were comparable in terms of format and display of information as well as quality of travel options presented.

Figure 4-1

Transit Operator Survey – Go! Vermont Trip Planning Comparison to Google Maps



*Data labels in charts have been rounded to the nearest whole number for display purposes.

Figure 4-2

Transit Operator Survey – Go! Vermont Overall Appearance Comparison to Google Maps

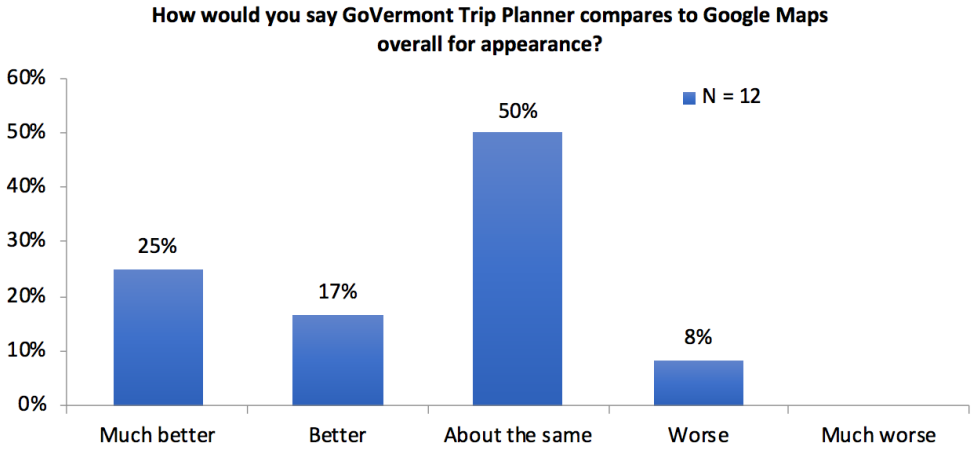


Figure 4-3

Transit Operator Survey – Go! Vermont Display of Information Comparison to Google Maps

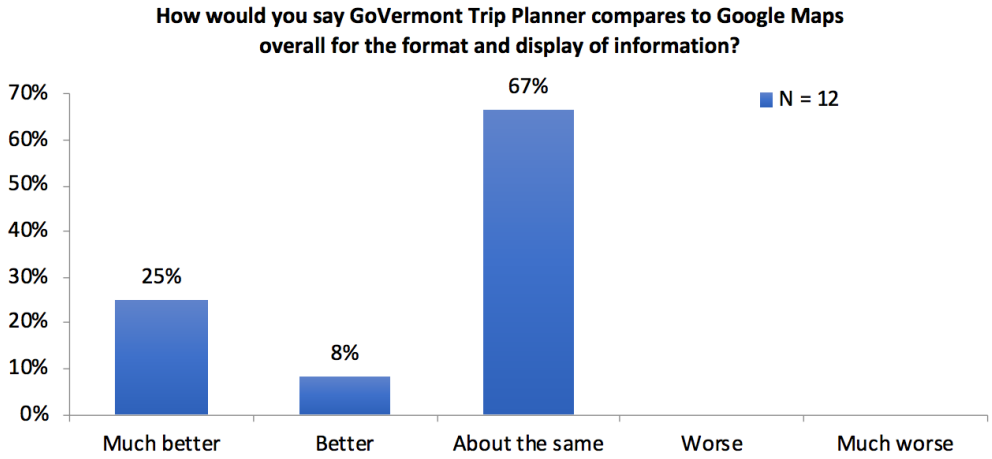
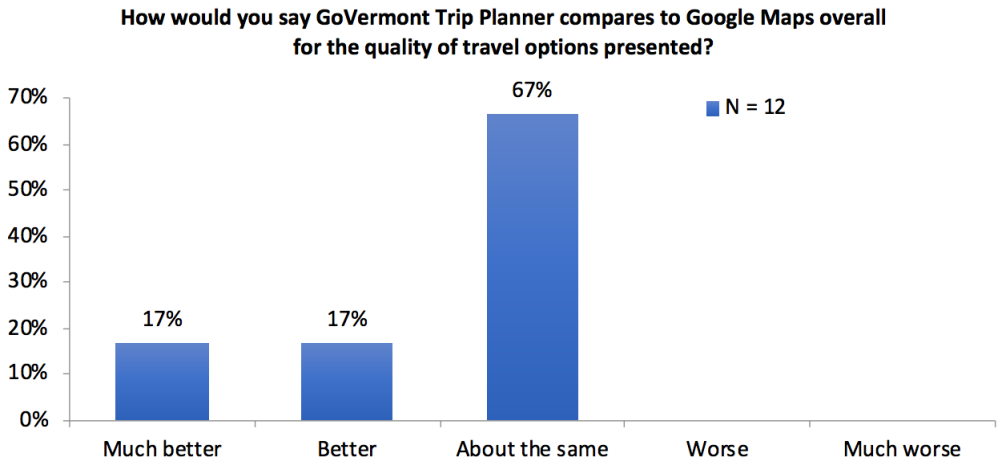


Figure 4-4

Transit Operator Survey – Go! Vermont Quality of Travel Options Comparison to Google Maps



The sample size collected was relatively small; therefore, it was difficult to draw definitive conclusions from these results. Overall, the results across the survey responses suggested that, on balance, the respondents felt that the Go! Vermont trip planner was generally at least not worse than Google Maps in several regards. However, the small sample size and distribution of results suggest that Hypothesis 2 is, at best, partially supported.

Hypothesis 3: Riders will consider the new planner to be an improvement over existing planning tools.

Performance Metric	Key Finding
User survey responses to product perception questions	A small sample of riders did not consider the trip planner to be an improvement.

A survey was developed to measure user assessments of the Go! Vermont trip planner. Several questions were asked that required respondents to make direct comparisons between the State-developed tool and Google Maps. The most relevant questions are presented in Figures 4-5 through 4-12. Overall, the results did not present an immediately clear trend. Interestingly, half of the eight respondents answered that Go! Vermont was "about the same" as Google Maps when used for trip planning. Similarly, half of the eight respondents said that Go! Vermont was "about as useful" as Google Maps. However, when asked about the utility of Go! Vermont relative to alternative trip planning platforms including Google Maps, only a single respondent out of five indicated that Go! Vermont was most useful. The sample size of the survey was very small, and the data available do not support Hypothesis 3.

Figure 4-5

User Survey – Most Useful Trip Planning Platform

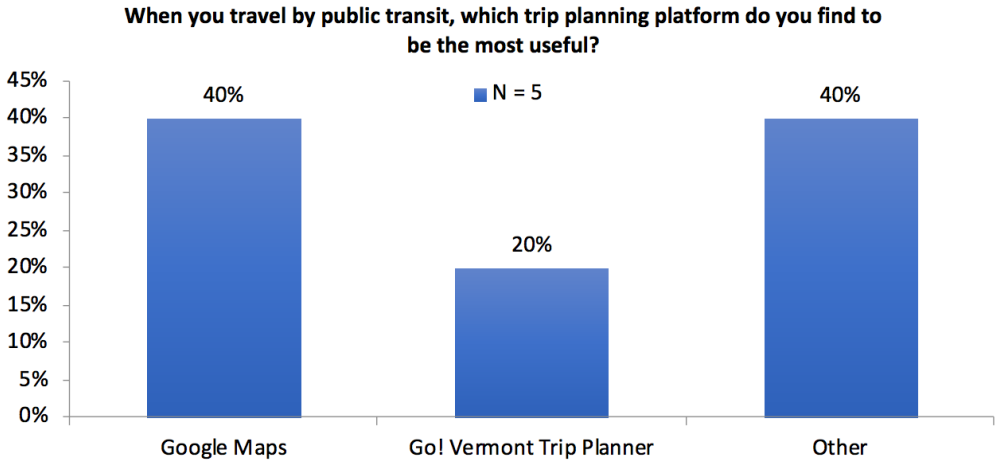


Figure 4-6

User Survey – Go! Vermont Trip Planning Comparison to Google Maps

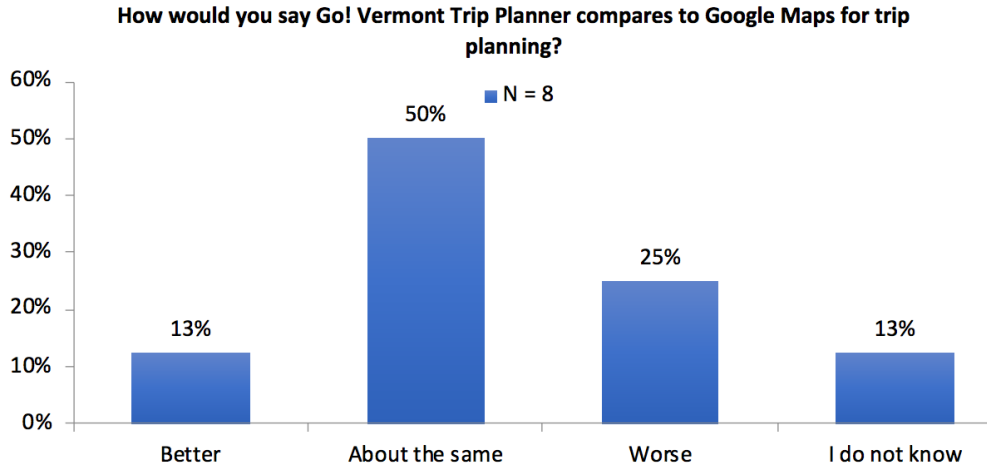


Figure 4-7

User Survey – Go! Vermont Overall Appearance Comparison to Google Maps

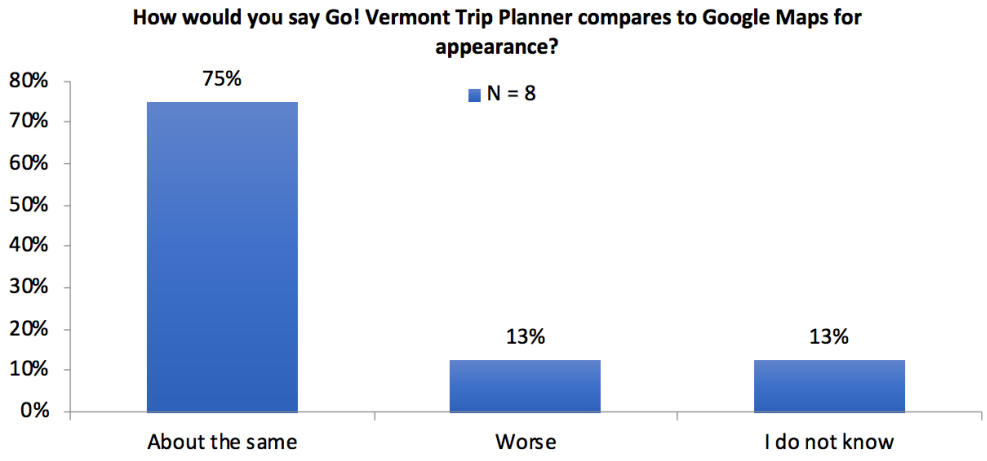


Figure 4-8

User Survey – Go! Vermont Display of Information Comparison to Google Maps

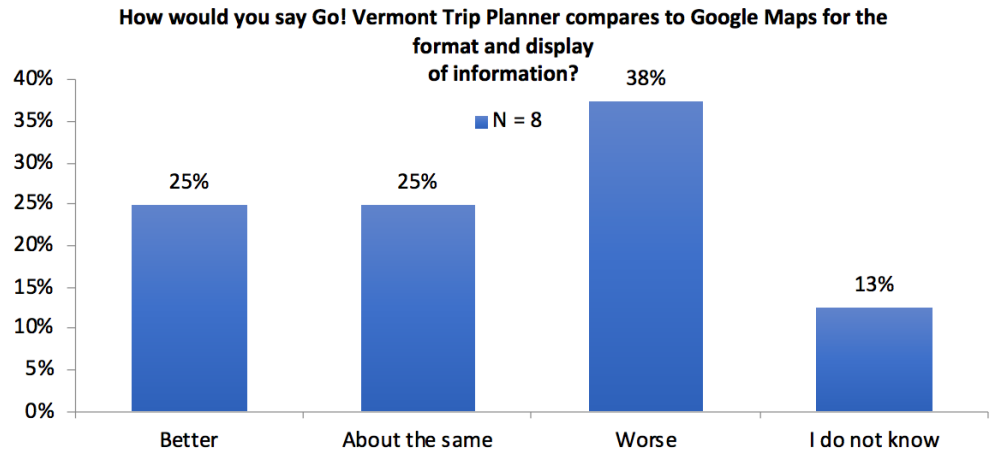


Figure 4-9

User Survey – Go! Vermont Quality of Travel Comparison to Google Maps

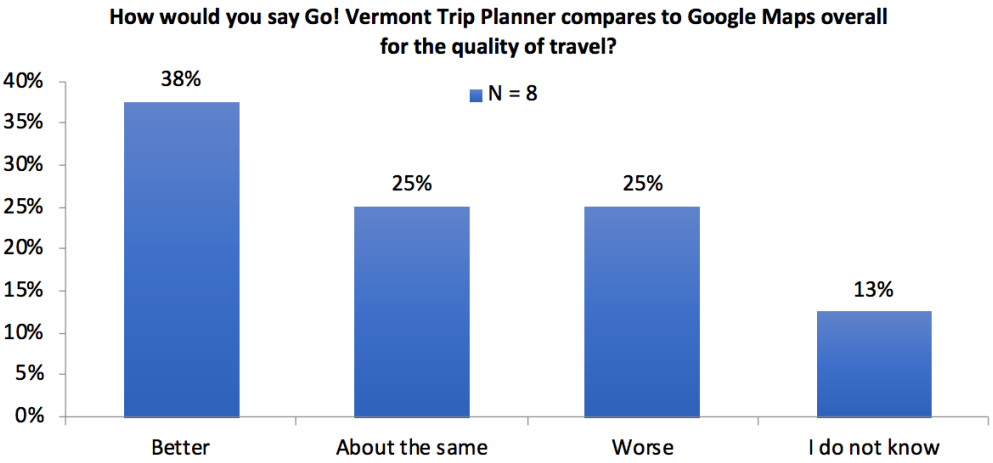


Figure 4-10

User Survey – Go! Vermont Comparison to Google Maps Based on Usefulness

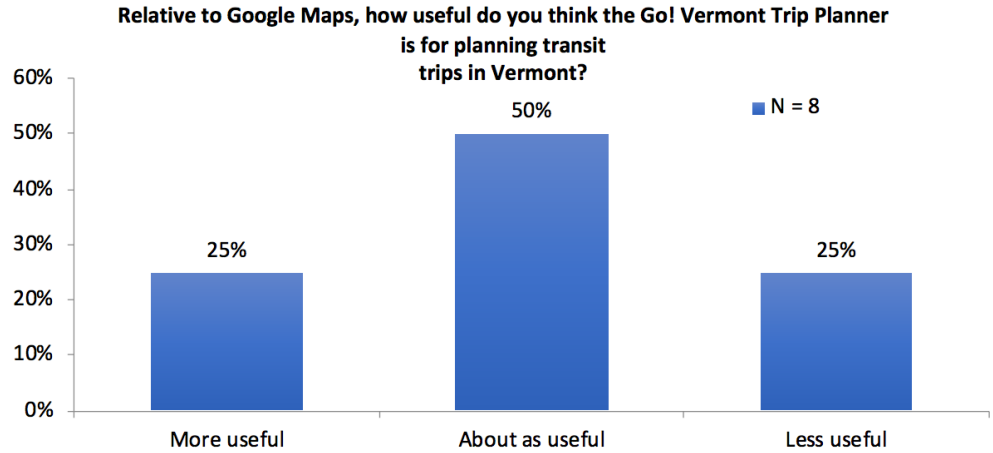


Figure 4-11

User Survey – Go! Vermont Improvement for Flex-Transit Planning

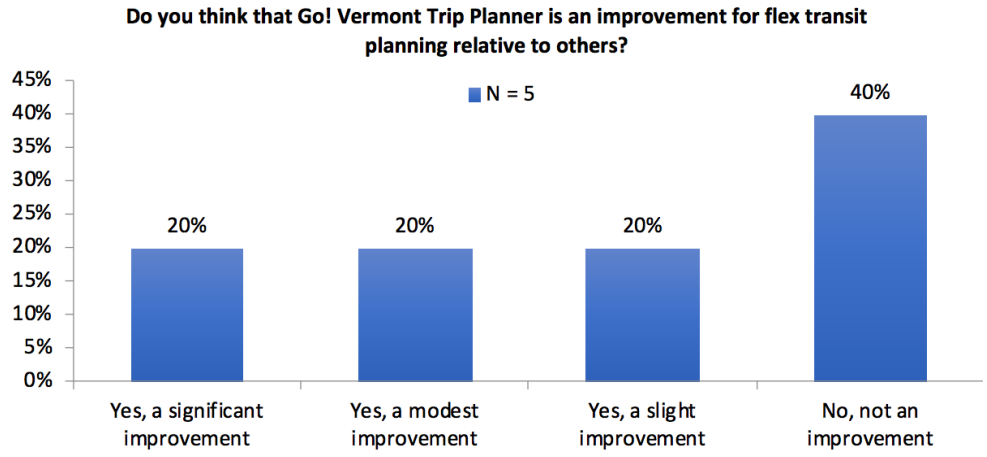
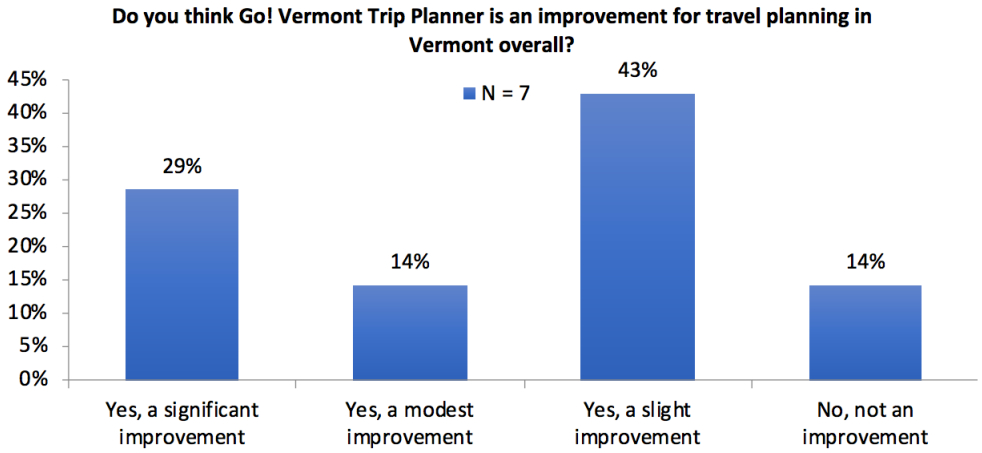


Figure 4-12

User Survey – Go! Vermont Improvement for Overall Travel Planning



Hypothesis 4: The new planner will improve rider mobility among planner users.

Performance Metric	Key Finding
User survey responses to mobility perception questions	A small sample of riders reported that the planner had not improved their mobility but it could potentially influence their ways of travel.

Several questions were asked to assess the impact of the Go! Vermont planner on rider mobility. Most respondents felt that it was possible that the trip planner could have some influence on their travel; however, only eight respondents addressed this question. Figure 4-13 shows that seven of the eight reported that the trip planner had not influenced how they had traveled to date, and one respondent reported that the trip planner had slightly influenced their travel. Overall, the limited responses suggest that at the time of the evaluation, the trip planner was not having a significant impact on rider mobility. However, the results also suggest that it could in the future.

Figure 4-13

Influence of Trip Planner on User Travel to Date

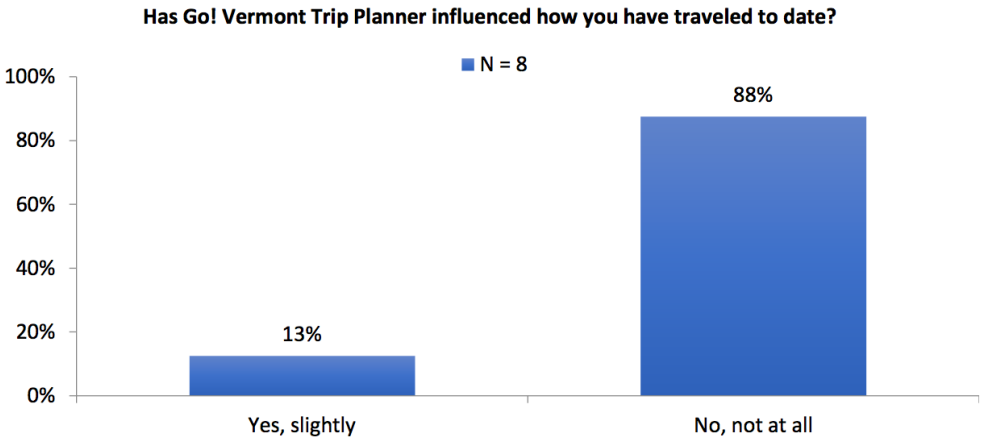
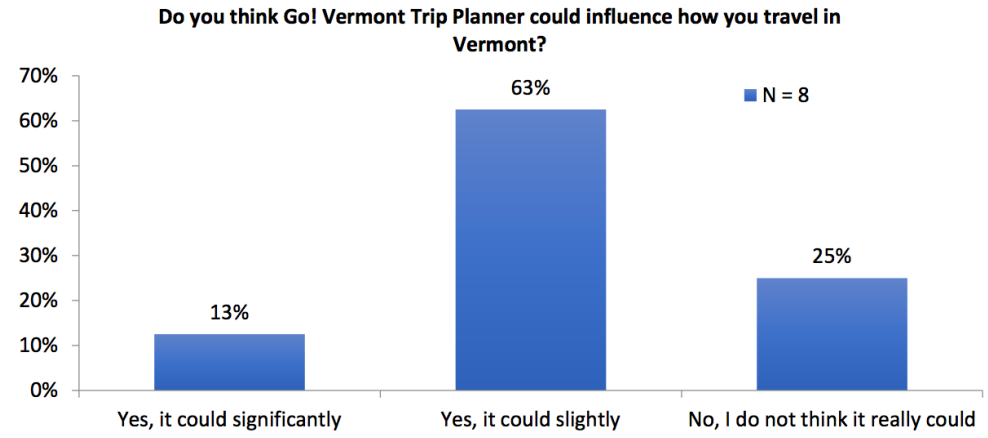


Figure 4-14 shows that six of eight respondents felt that Go! Vermont could slightly or significantly influence their travel, even though the vast majority said it had not done so yet. In addition, to probe how the trip planner influenced their mobility, respondents were asked if, as a result of the information in Go! Vermont trip planner, they had much worse mobility, worse mobility, better mobility, much better mobility, or that their mobility had not changed. All seven respondents reported that their mobility had not changed. As a result of these mixed findings, Hypothesis 4 was found to be inconclusive.

Figure 4-14

Potential Influence of Trip Planner on User Travel in the Future



Hypothesis 5: Due to improved information, the new planner will increase transit ridership among users in Vermont.

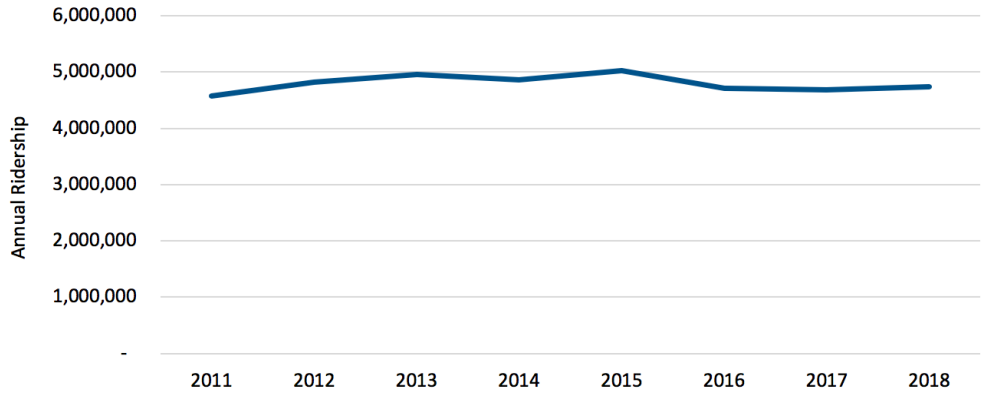
Performance Metric	Key Finding
User survey responses to mobility perception questions	A small sample of respondents reported that they used transit about the same as a result of the trip planner

Enabling better mobility and increased public transit ridership is a central objective any trip planner that improves information on available transit options. As part of the evaluation plan, VTrans provided ridership data for transit agencies in Vermont. During the course of the project, it became clear that the scale of user engagement (further explored in Hypothesis 6) was not likely to be large enough to impact public transit. Ridership trends in Vermont for 2011–2018 are shown Figure 4-15.

Generally, public transit ridership in Vermont has been relatively stable, perhaps experiencing a slight downward trend starting in 2016. In 2011, public transit ridership was at 4.58 million one-way trips, rising to a maximum of 5.03 million and declining to 4.74 million. Ridership effectively stabilized at about 4.7 million trips from 2016 to 2018. Overall, Vermont public transit ridership has been relatively stable throughout the decade.

Figure 4-15

Annual Public Transit Ridership in Vermont, 2011–2018



Because the scale of the project was not found (or expected) to influence ridership to a degree that would be detectable (or verifiable) within aggregate ridership, survey data were also employed to evaluate this hypothesis. A question in the user survey asked respondents if the information available in Go! Vermont had influenced their use of public transit; respondents were asked whether they changed their use of transit due to the Go! Vermont trip planner. All respondents (N = 7) said that their use was about the same in response to the trip planner. Collectively, the data suggest that trip planner did not influence public transit ridership; thus, Hypothesis 5 was not supported.

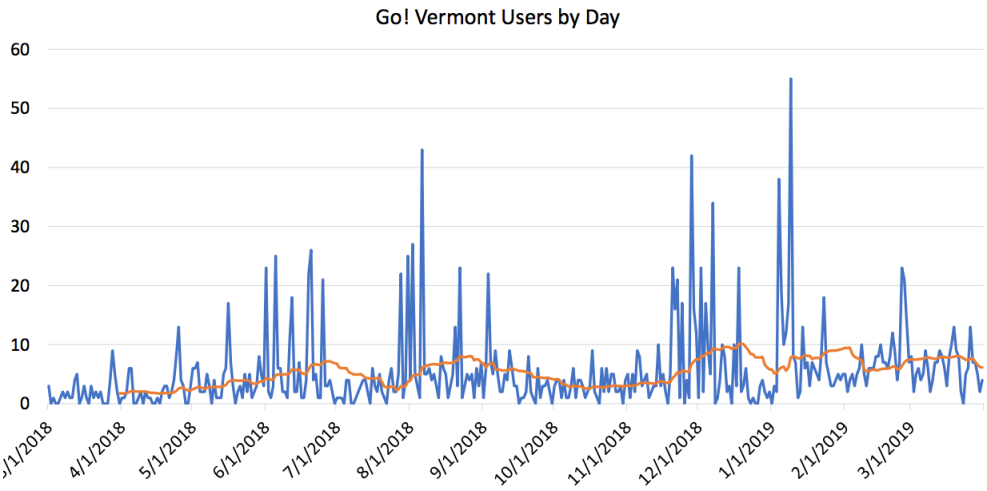
Hypothesis 6: Web traffic to the State planner will see, on average, at least 10 queries per day that constitute users searching the platform.

Performance Metric	Key Finding
Web traffic data (e.g., count of IP addresses in Vermont, distribution at local level, basic query count data)	Web traffic increased during the evaluation period, but neither the average nor moving average exceeded 10 users per day.

The evaluation sought to assess the level of web traffic that the State planner system would experience during the project. The IE team was provided access to the analytics platform of the Go! Vermont trip planner, which provided data on users visiting the site over time from March 1, 2018 to March 31, 2019. These data were exclusively web traffic and did not include any other forms of communication with the planner (such as by phone). The use trend is shown in Figure 4-16, which presents users by day during this period. The average users per day was 5.3, with a minimum of 0 and maximum of 55. The blue line shows the plot of users by day, and the orange line shows a 31-day moving average. This moving average shows a slight increase in average users during the moving average window. At the end of the evaluation period, the moving average finished at 6.13. The results do not support Hypothesis 6, that the platform sustained, on average, 10 users a day, but they do show that web traffic was generally increasing through the evaluation period.

Figure 4-16

Users of Go! Vermont by Day



Hypothesis 7: The new planner will lead to a reduced call/response time on relevant inquiries pertaining to route info and travel options.

Performance Metric	Key Finding
Call/response time on relevant inquiries pertaining to route info and travel options, before and after planner implementation	Data were not available to sufficiently evaluate this hypothesis.

Call Center data were not available to the degree needed to address this hypothesis. Therefore, Hypothesis 7 could not be addressed and is inconclusive.

Hypothesis 8: Lessons from project implementation can inform future project and system designs and implementation.

Performance Metric	Key Finding
Qualitative documentation from stakeholder interviews	Several challenges were evaluated that produced several key lessons learned.

The IE team conducted interviews with several experts who were directly connected to the project team and had deep knowledge of the project to better understand challenges, barriers, successes, and broader lessons learned from the implementation of the project. Section 5 is a synthesis of those interviews and the findings related to Hypothesis 8.

SECTION

5

Lessons Learned from Program Partners

The organizations interviewed for this section included VTrans, the Vermont Center for Independent Living (VCIL), and the Vermont Energy Investment Corporation. Insights provided by the six experts interviewed may be useful to inform future iterations of the planning tool.

Background

In 2014, VTrans issued a statewide GTFS management Request for Proposal (RFP) with a task to build data for more demand-responsive and rural transit agencies. GTFS defines a common format for public transportation schedules and related geographic information systems (GIS). GTFS is typically used to supply data on public transit for use in multi-modal journey planner applications. In most cases, GTFS is combined with a detailed representation of the street/pedestrian network to allow routing to take place from point to point rather than only between stops. Cambridge Systematics and Trillium were awarded the RFP and had maintained GTFS data for VTrans and Vermont agencies since 2014.

Around the same time, VTrans had Trillium build a prototype of GTFS-Flex data and conducted a small feasibility study for what it would look like to expand GTFS-Flex statewide. GTFS-Flex is an extension of GTFS that proposes adding the capability to model various demand-responsive transportation services to GTFS, which, at the time, was capable only of modeling fixed-route public transportation. Both of these early efforts laid the groundwork for Vermont's MOD Sandbox Demonstration project, funding for which was awarded near the end of VTrans' first contract with Cambridge Systematics and Trillium and has since been renewed twice in other contexts.

Project Partners and Contracting

VTrans had an ongoing relationship with all project partners that predated the MOD Sandbox Program. According to interviewees, VTrans asked to work with the same contractors due to its pre-existing relationships and long-term trust between partners based on past experience.

VTrans proposed this MOD Sandbox project with the goal of developing a trip planner designed for a rural community to enhance traveler access to a variety of existing mobility options (including fixed-route, on-demand, and demand-responsive services). Additionally, VTrans wanted to develop a platform that could be updated and adapted as needed. Key project partners included VTrans,

Cambridge Systematics, Trillium Solutions, the Vermont Center for Independent Living, Creative Workforce Solutions, and Go! Vermont. Project partners attribute the MOD Sandbox Demonstration to enabling a new trip planning initiative that had long been sought but was unfunded and to breaking down silos of individual funding sources.

VTrans stakeholders identified four key lessons learned during the bidding and contracting process:

- Smaller project partners noted that it was important that FTA allowed grantees to name project partners prior to submitting a MOD Sandbox application. Smaller project partners emphasized the need for a trusted pre-existing relationship with grantees because of the uncertainty of project award coupled with the fact that they would have to commit a large portion of future business capacity to the MOD Sandbox project if awarded.
- Only project partners with funding can be counted on to follow through with actual performance commitments. Partners who lack a specific funding commitment should not be relied upon.
- Numerous challenges were encountered related to procurement policies and intellectual property in the context of the open software platform. Standard VTrans contractual language that designates ownership of the software and code generated as part of the MOD Sandbox Demonstration was not workable in the context of the OTP. Interviewees noted that there needs to be a standard for stating how to contract for open source software rather than relying on contractual language that assumes proprietary ownership. Additionally, milestone or deliverable-based contracting may help reduce the need for technical staff on the contracting side to review and validate time and materials invoicing.
- Handling data is expensive and requires strong public agency data management practices. In many cases, public agencies lack the institutional capability and/or financial resources to properly invest in data management.

OTP Development

As part of OTP development and implementation, staff with visual disabilities tested it to make sure it was compatible with screen readers. Developers went to Vermont for two weeks as part of an early release of the platform and gave presentations to small groups of volunteer beta users (4–16 people) and watched new users work through trip plans. Project partners attribute this beta testing process as key to testing usability and refining user interfaces to be accessible to users that reflect a variety of socio-demographic characteristics. The project team determined that, in some cases, using the trip planner was a greater barrier than having access to a smartphone or the Internet. In particular, people who had access to a smartphone and the Internet did not always find the trip planner to be intuitive without some type of user training, particularly early in its

development. Project partners emphasized the need to understand the end-user experience as part of designing trip planners to be equitable and accessible.

An additional challenges was recruitment of survey respondents. The project did not have a simple pathway to outreach to invite users to take the survey and provide feedback. Because the trip planner was a website, contact information on users was never obtained. As such, invitation to the user survey was simply a link on the website that an interested user would have to find and click. This limitation was a major reason that the sample size was small. For applications that are strictly websites, this is a common limitation; this contrasts with apps for which sign-up can involve providing at least an email address. Because of the nature of the trip planner and the anonymous engagement that is typical of websites, it was not clear there were any easy ways around this limitation. It might be worth noting that another MOD Sandbox Project, conducted by TriMet in Portland, Oregon, also deployed a web-based trip planner. TriMet was able to circumvent this recruitment limitation by engaging its Rider's Club, a group of TriMet transit users who volunteer to be beta testers of TriMet applications and communicators of feedback. VTrans did not have any such group to invite for review of the trip planner. One lesson that might emerge from this differential in engagement is for projects to identify or create such a group for a project where engagement is otherwise anonymous. This would provide a more direct mechanism for feedback during the evaluation, even when the nature of the product being tested does not collect any contact information during its normal function.

OTP Implementation, Outreach, and Use

Once the trip planner was rolled out, there were several ways it could be used, including 1) use by institutional users (i.e., case workers), 2) use by phone dispatchers to provide transit information over the phone to end-users, and 3) direct use by end users (through an Internet browser that could be accessed on a computer or mobile device). There was no mobile app, but the website would adaptively theme to fit a mobile screen. Direct end-user experiences with the OTP were assessed through other evaluation methods (i.e., the user survey).

Typically, rural communities have higher levels of unemployment and under-employment due to a lack of transportation options coupled with the high cost and inefficiency of providing fixed-route transit. Employers had been increasingly struggling with transportation for workers (particularly outside the I-89 corridor), and both the Vermont Center for Independent Living and Creative Workforce Solutions expressed interested in transportation strategies to help employers meet their staffing needs.

To help overcome these challenges, VTrans partnered with employment services and vocation rehabilitation providers to leverage the trip planner as a mechanism for improving access to jobs, training, and healthcare for carless and car-lite households. Creative Workforce Solutions was created approximately 10 years ago to help consolidate State agency workforce development and job placement programs under one organization. As part of this reorganization, the State began employing business account managers to focus on employer engagement and case managers to help facilitate employment for individuals at the local level. The Vermont Center for Independent Living is a non-profit organization that works toward the independence and civil rights of people with disabilities.

Recognizing the link between transportation and workforce development, VTrans, the Vermont Center for Independent Living, and Creative Workforce Solutions began to explore ways the OTP could help secure employment for people with disabilities and people recovering from substance abuse. As part of this effort, both organizations began training their case workers on using the Go! Vermont trip planner. Although case workers could (and often did) share the trip planner with their clients, interviewees said the trip planner was particularly effective at improving how case workers provide transportation information over the phone. Prior to the trip planner, case workers would get telephone inquiries from clients on transportation options and either provide information based on memory or spend time consulting multiple sources to develop a unique trip plan for each person's use case. The OTP provided a systematic and streamlined way for case workers to quickly plan trips for their clients, both reducing time spent trip planning and providing additional integrated travel options for end users.

In addition to institutional use by case workers, the trip planner was also an instrumental tool for Go! Vermont telephone dispatchers. Go! Vermont's website and telephone number are advertised in public places, online, on freeway signs, and at bus stops and park-and-ride facilities. The purpose of Go! Vermont is to provide telephone and online resources for trip planning, carpooling, vanpooling, and volunteer drivers. Go! Vermont telephone dispatchers typically provide trip concierge services, answering inquiries for low-income travelers and travelers without Internet or an insufficient cellular signal. Most travelers call Go! Vermont seeking a ride for non-medical appointments, such as going to the grocery store. For the telephone dispatchers, the OTP provided an additional integrated travel planning tool to use alongside Google and other existing resources. For institutional and dispatch users, interviewees expressed that the OTP is a work in progress and that technical improvements could still be made. For example, one interviewee said that when no public transportation option is available, the trip planner does not tell users how long it will take to drive. This would cause dispatchers to cross-reference multiple trip planning resources, such as comparing OTP to driving times in Google Maps. Other improvements interviewees said would be helpful is the ability to choose more than one trip

option (e.g., being able to select routes by arrival and departure time, rather than just one option).

Finally, the consultant for Go! Vermont conducted a variety of education and outreach activities as part of a multilayer marketing plan to demonstrate the trip planner to employers, business leaders, and community members to encourage use. Overall, project partners said they had success in establishing connections and getting travelers to and from where they need to go and attributed the trip planner to helping combat poverty where training and employment access for carless households is often dependent on the mobility of friends and relatives. As such, stakeholders viewed OTP as an additional transportation tool for underserved communities.

Recommendations

Interviewees expressed the following recommendations for FTA:

- There remains a notable digital divide between urban and rural communities that could be exacerbated with the roll out of 5G services. The private sector continues to focus on transportation technology in urban areas due to a higher number of potential users and use cases. FTA should explore grants, subsidies, and other programs to invest in transit technology in rural communities.
- The way public transit agencies procure and operate technology is inefficient and does not benefit riders because individual agency-specific RFPs lead to disjointed trip planning systems that do not encourage multimodal trips. FTA should take a leadership role in integrated trip planning.
- FTA should not be concerned with the short term (1–3 year project performance period) but should be more strategically-focused on creating longer-term successes (e.g., processes, data specifications, and trip planning resources) that can be made available to all public transit agencies. For example, it was suggested that FTA could take the findings from this MOD Sandbox Demonstration project to develop universal standards for trip planning, such as common programming languages, web interfaces, etc.

SECTION

6

Conclusions

The results of the evaluation found that the Go! Vermont trip planner achieved its primary objective of generating trip itineraries that take into consideration the various flexible transit options available in Vermont. The sign test was employed to prove a statistically-significant difference in the mean number of trip itineraries, including flexible transit options generated by Go! Vermont relative to Google Maps.

A survey was administered to transit operators and users, and results showed that the Go! Vermont trip planner received more positive than negative reviews from transit operators. Although the sample sizes for the transit operator survey were small, respondents, on balance, said that Go! Vermont had an equivalent or better appearance and display of information compared to Google Maps. The user survey, also with a very limited sample size, had more mixed responses, with respondents, on balance, favoring Google Maps or considering the two planners to be about the same. However, because of data limitations, only limited interpretations can be made with respect to the perceptions of the transit planner as related to the broader user population. The Go! Vermont trip planner showed limited but relatively steady use during the evaluation period.

Several important findings resulted from the interviews conducted with key project participants. First, interviewees acknowledged the enduring technological gaps between urban centers and more rural communities. Second, there is room for improvement in how public transit agencies operate emerging technologies. Third, it was recommended that FTA focus more intently on laying the proper groundwork that will allow projects to flourish over the longer term. Based on these findings, the evaluation found that there were limited and mixed results on user perceptions of the platform. However, from a technical perspective, the Go! Vermont trip planner demonstrated successful implementation of an advanced functionality for displaying flexible-route transit information.

As of October 2020, the trip planner is being hosted and managed by AgileMile (https://govermont.agilemile.com/index.php?rides=true). The new version of the trip planner offers additional mode choices including carpool, vanpool, and buses. Additionally, VTrans staff claim that the updated trip planner provides a more seamless interface for Go! Vermont users to find and schedule a ride.

In the future, VTrans plans to continue the use of open source data from the project for its recent statewide automated vehicle location project. In addition, the Go! Vermont trip planner will soon be incorporating information from a pilot microtransit service currently operating in the capital city of Montpelier. Other projects are currently working on a payment component, which will be

incorporated into the broader trip planning application once developed and tested. VTrans staff also indicated that future modifications to the trip planner could include adding paratransit, dial-a-ride, and on demand vehicles to the mode choices; incorporation of TNC vehicles (such as Uber); expansion of trip scheduling and payment; and improvements to the agency's GTFS-Flex data and options to improve trip planning.

Overall, VTrans believes that the project paved the way for other IT projects with the agency and established the foundation for others in the industry to replicate and apply a cost-effective approach to building a trip planner that can better deliver information on multimodal options for rural environments.

APPENDIX

A

Additional Survey Results

Transit Operator Survey

The following graphs show raw summaries of results of the transit operator survey in the general order of questions asked. Only questions not presented in the report are presented in this appendix. Where applicable, data labels for the figures have been rounded to the nearest whole number for display purposes.

Figure A-1

Transit Operator Survey – Modes of Transportation

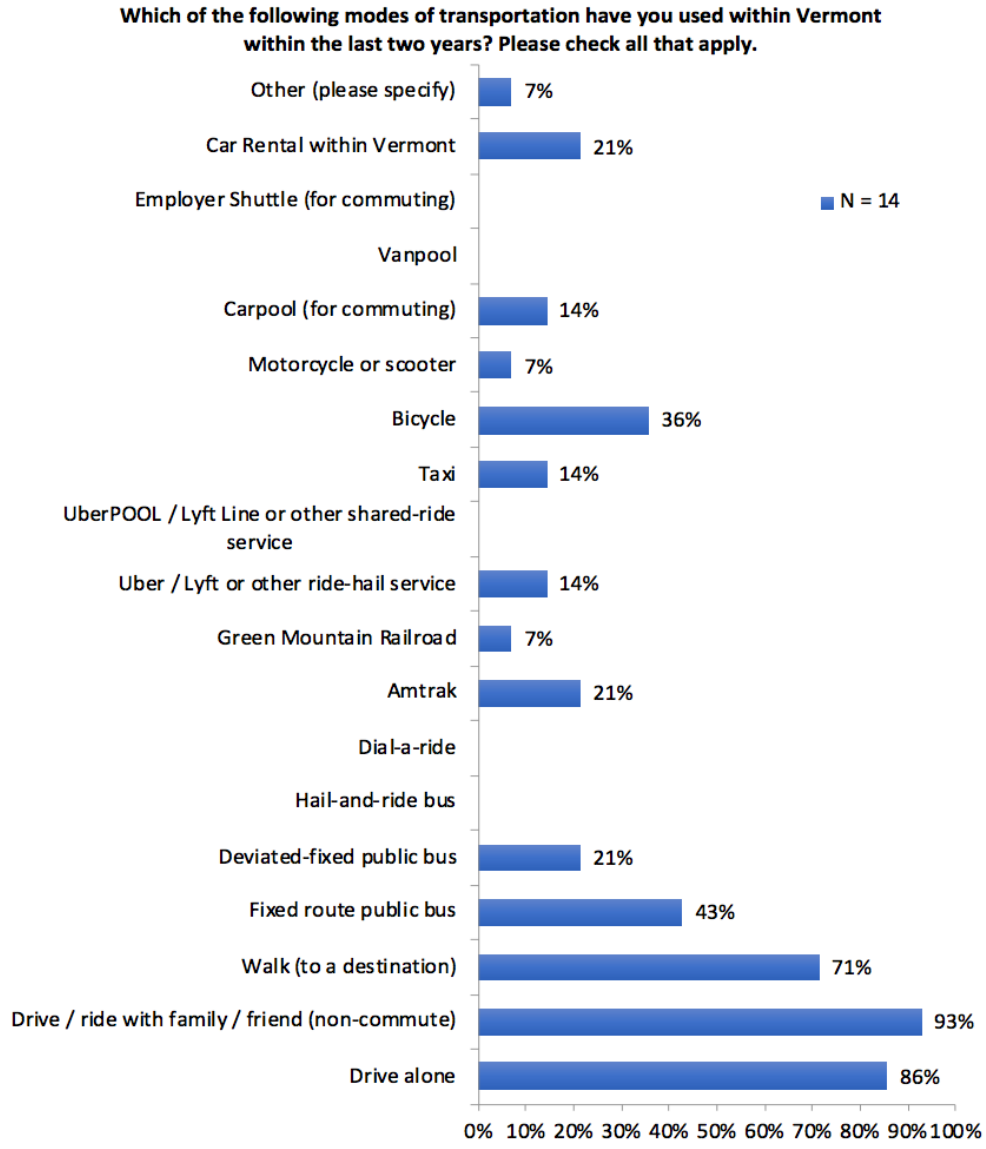


Figure A-2

Transit Operator Survey – Importance of Flexible Transit Services

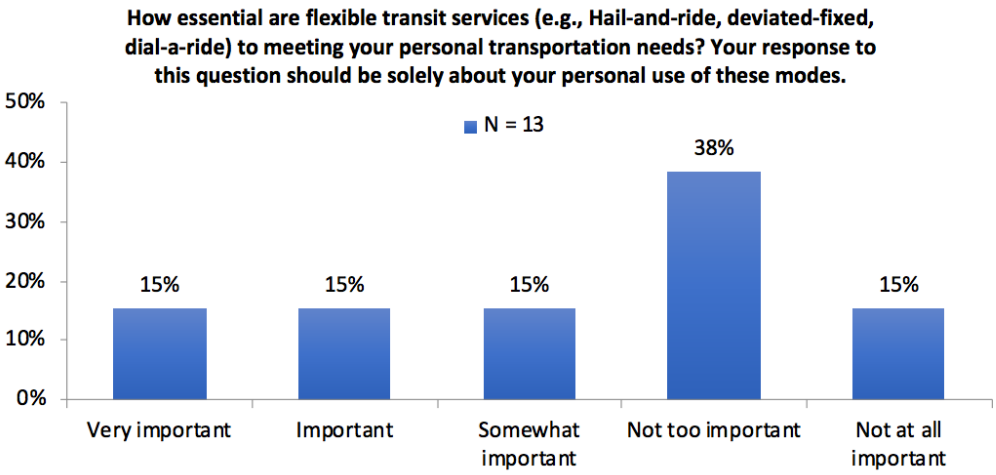


Figure A-3

Transit Operator Survey – Trip Planning Platforms Used

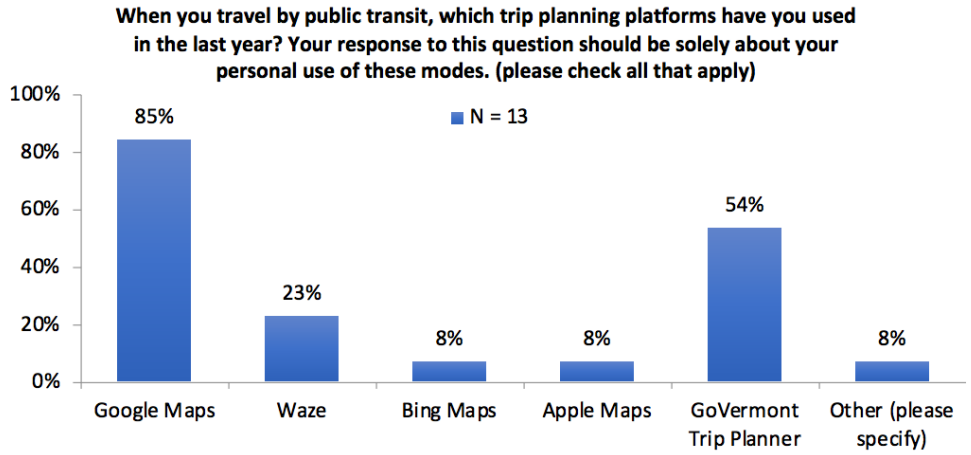


Figure A-4

Transit Operator Survey – Most Useful Trip Planning Platform

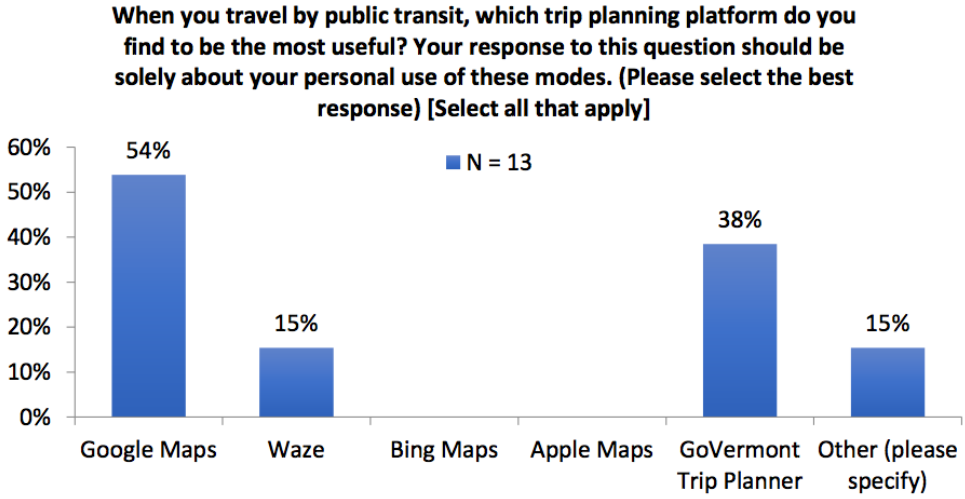


Figure A-5

Transit Operator Survey – Go! Vermont Use

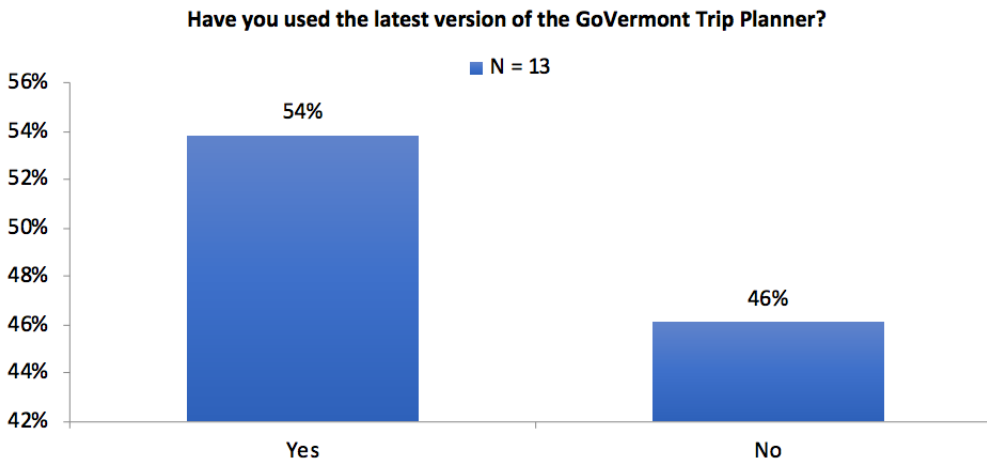


Figure A-6

Transit Operator Survey – Go! Vermont Frequency of Use

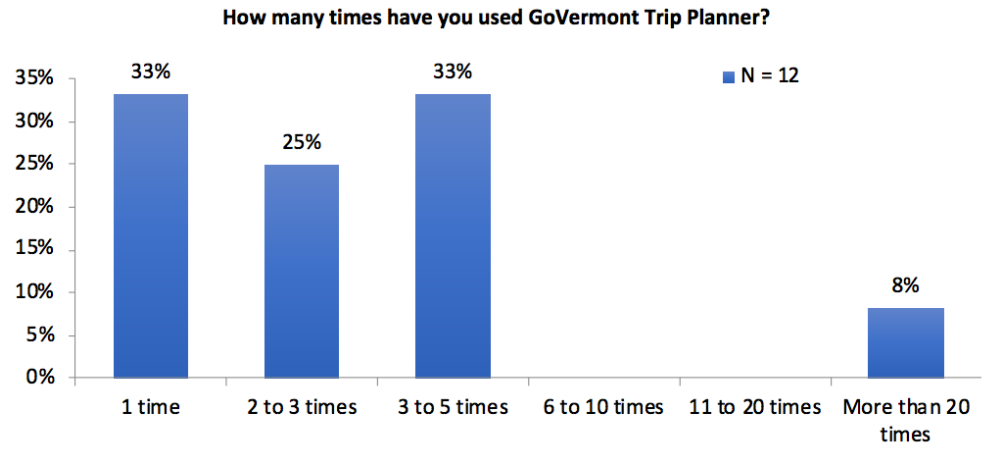


Figure A-7

Transit Operator Survey – Go! Vermont Impression

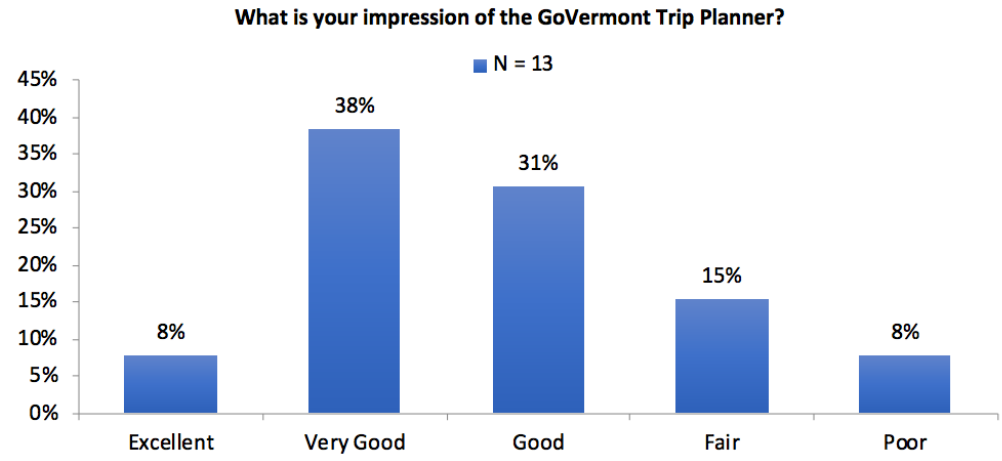


Figure A-8

Transit Operator Survey – Go! Vermont Use for Flex-Transit Trips

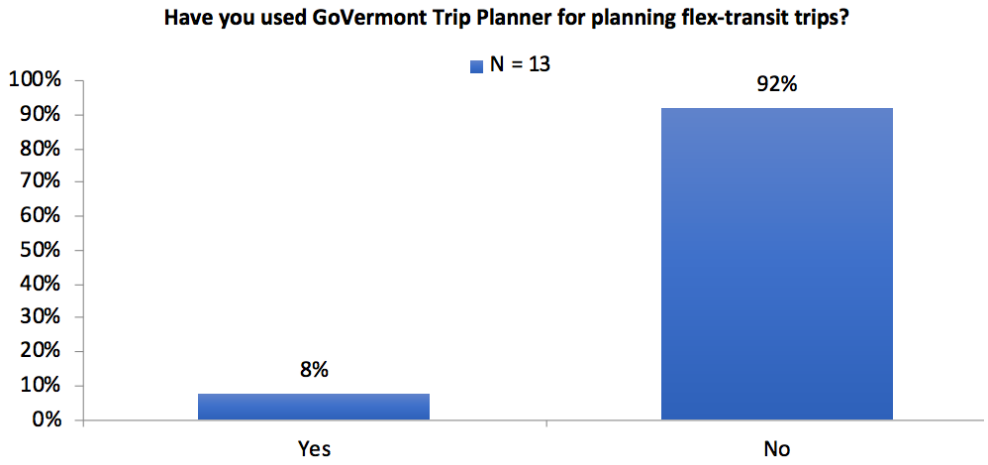


Figure A-9

Transit Operator Survey – Go! Vermont Trip Planning Usefulness Comparison to Google Maps

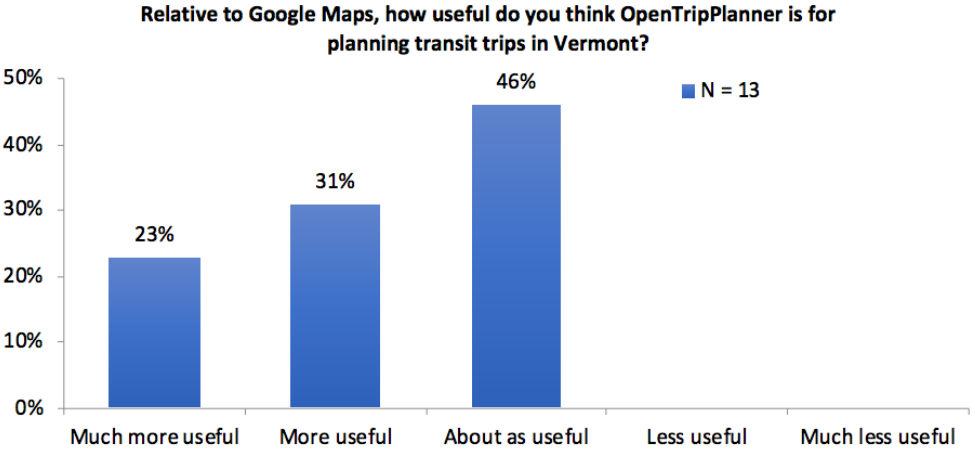


Figure A-10

Transit Operator Survey – Importance of Flex-Transit Services within Agency

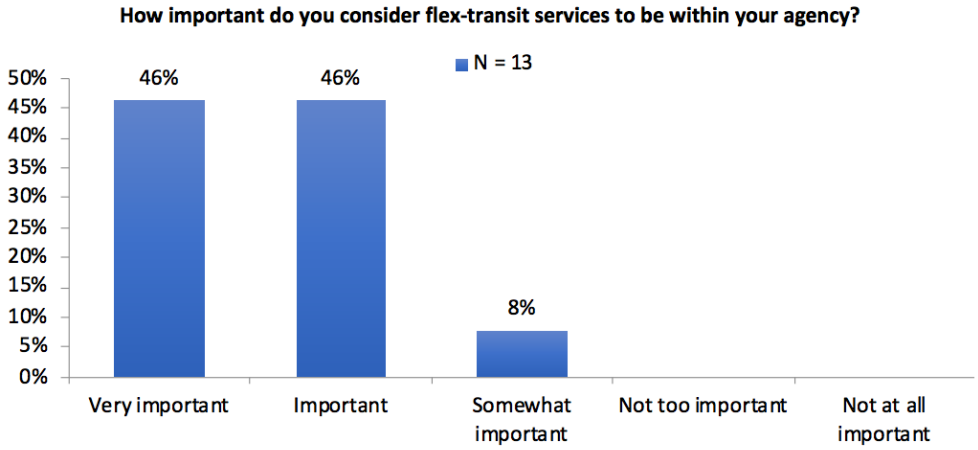


Figure A-11

Transit Operator Survey – Go! Vermont Improvement for Flex-Transit Planning

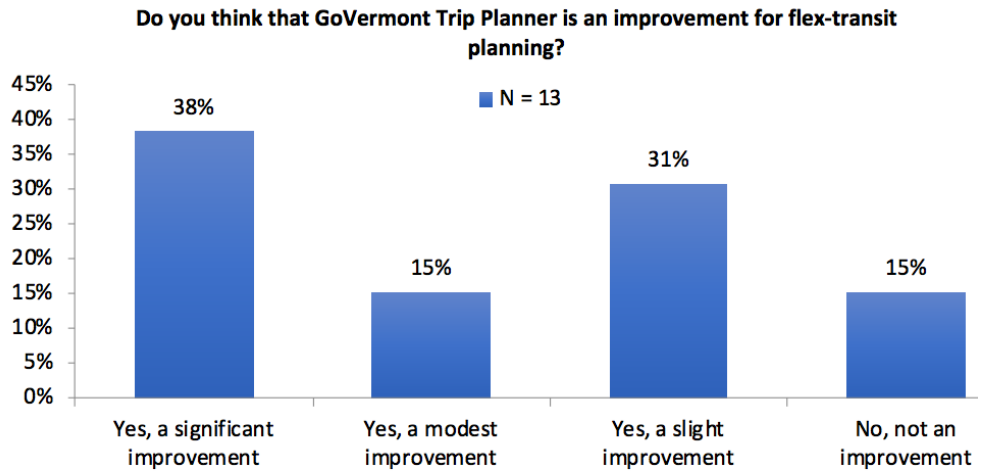


Figure A-12

Transit Operator Survey – Go! Vermont Improvement for Overall Travel Planning

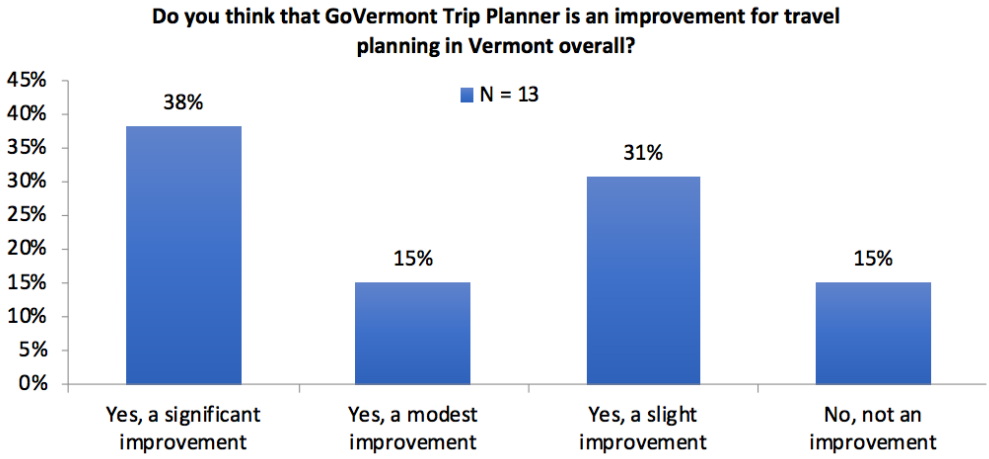


Figure A-13

Transit Operator Survey – Go! Vermont Improvement for Transit Agencies

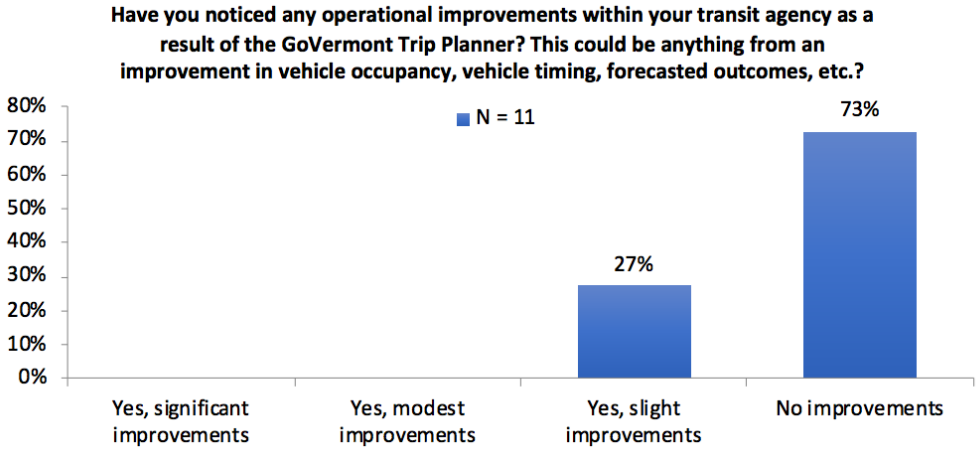


Figure A-14

Transit Operator Survey – Effect of Go! Vermont on Ridership

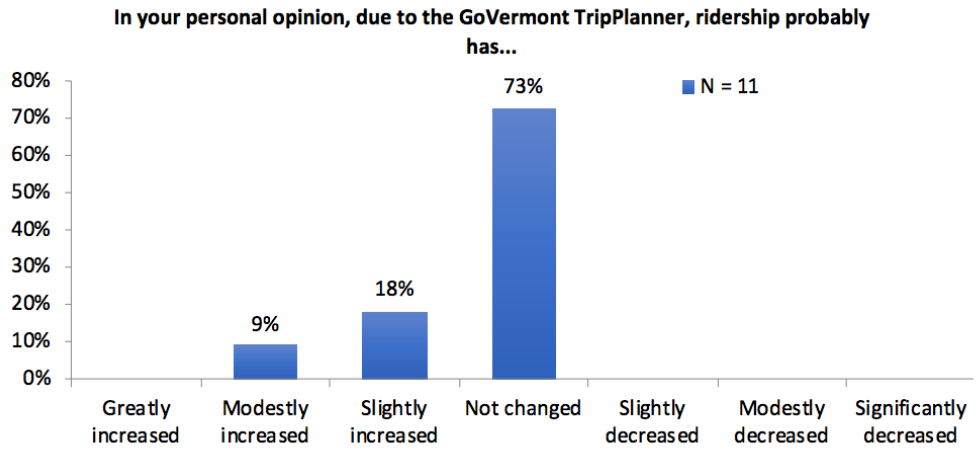


Figure A-15

Transit Operator Survey – Effect of Go! Vermont on Available Information

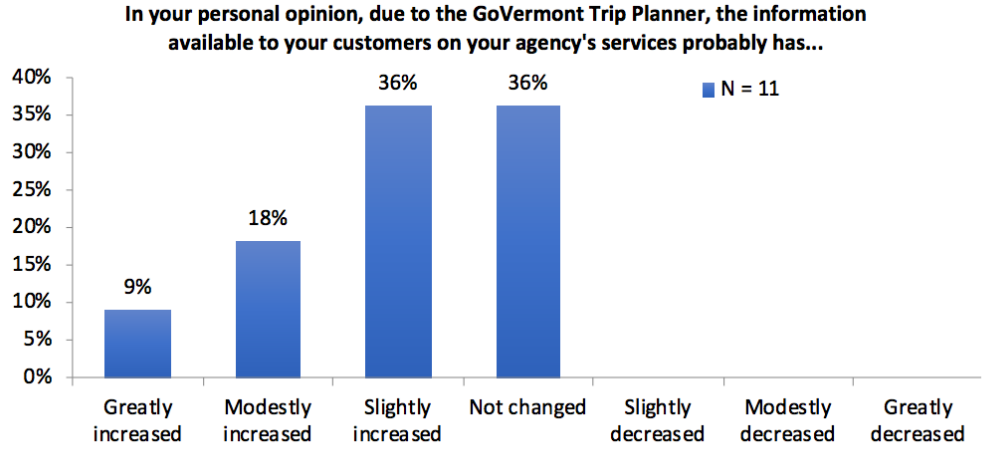
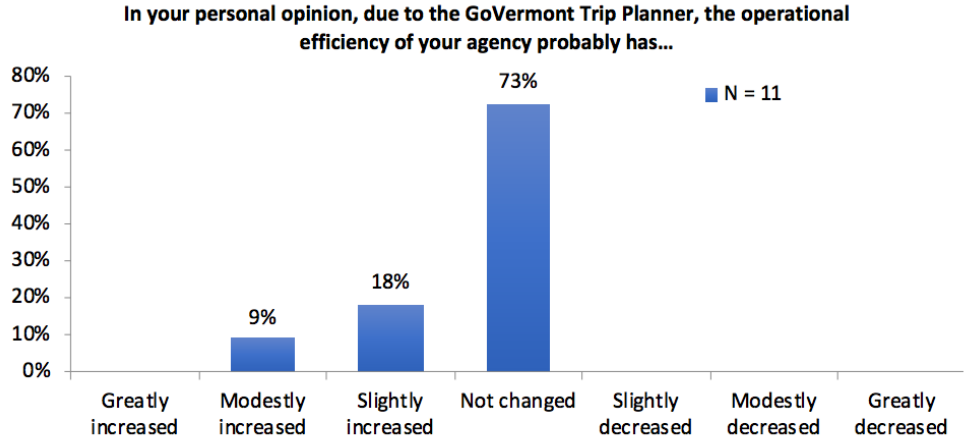


Figure A-16

Transit Operator Survey – Effect of Go! Vermont on Operational Efficiency



User Survey

The following graphs show raw summaries of results of the user survey in the general order of questions asked. Only questions not presented in the report are presented in this appendix. Where applicable, data labels for the figures have been rounded to the nearest whole number for display purposes.

Figure A-17

User Survey – Household Size

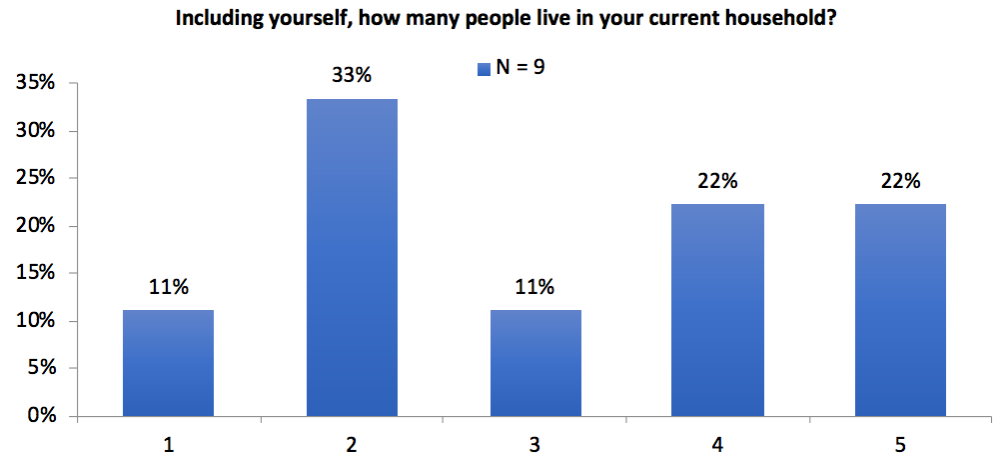


Figure A-18

User Survey – Household Relationships

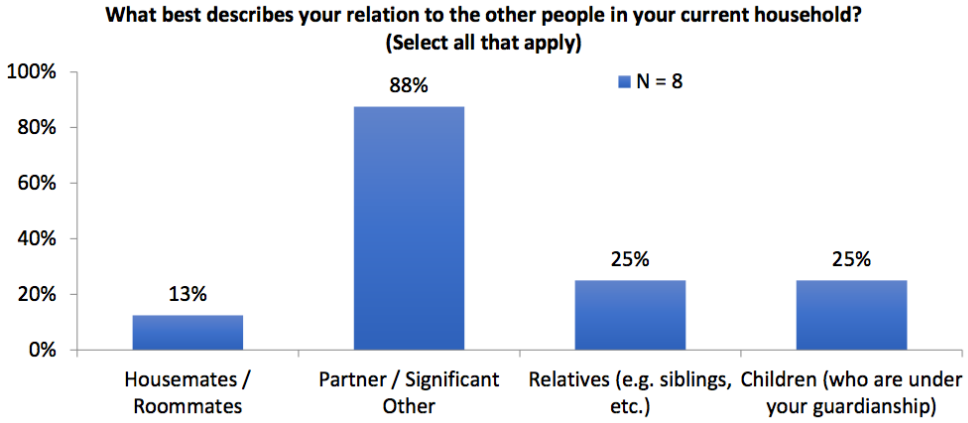


Figure A-19

User Survey – Household Expenses

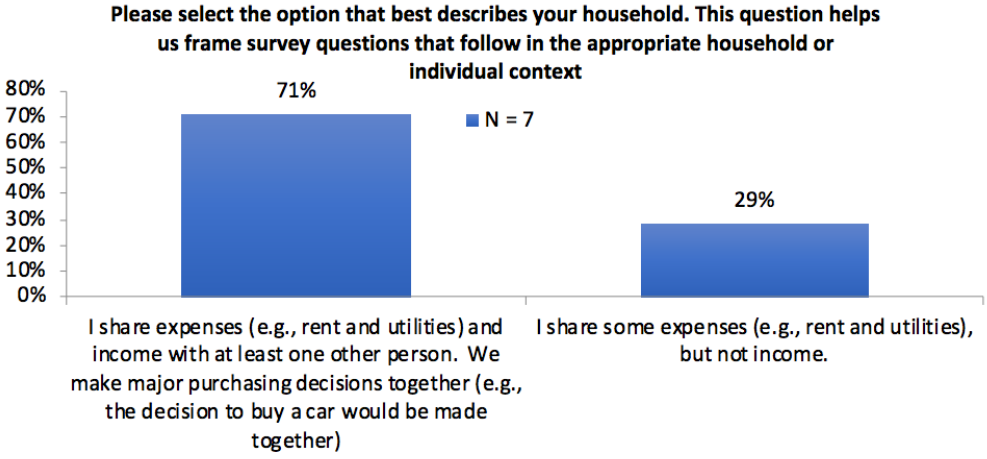


Figure A-20

User Survey – Vehicle Ownership

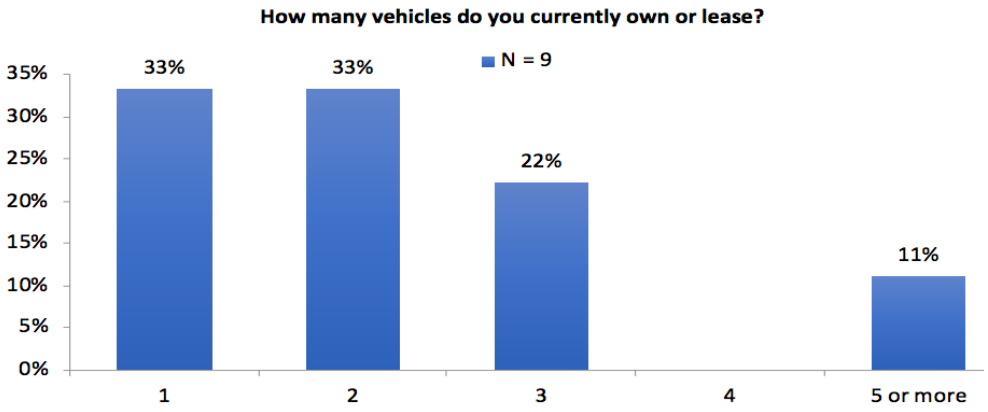


Figure A-21

User Survey – Vehicle Ownership

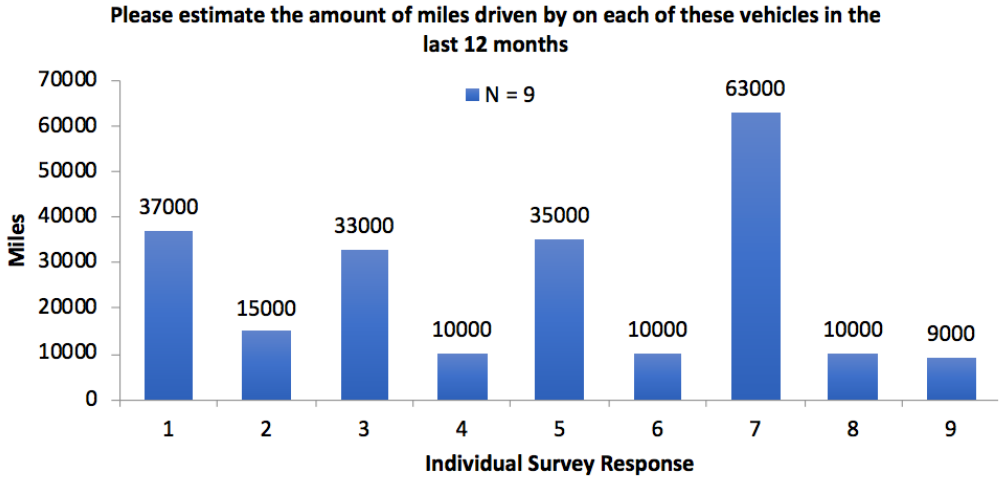


Figure A-22

User Survey – Modes of Transportation

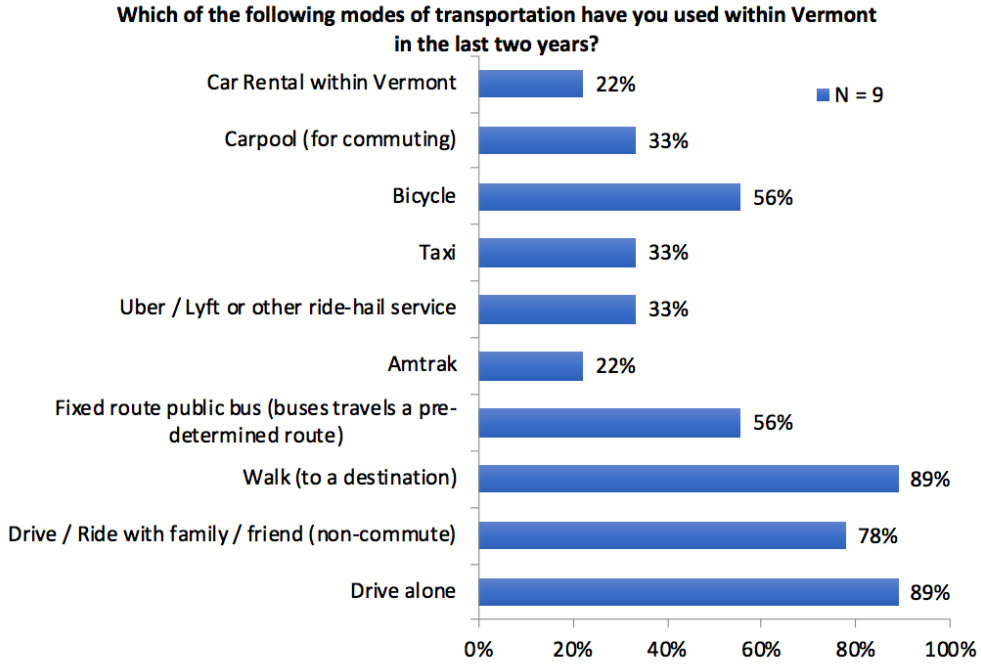


Figure A-23

User Survey – Frequency of Modes of Transportation

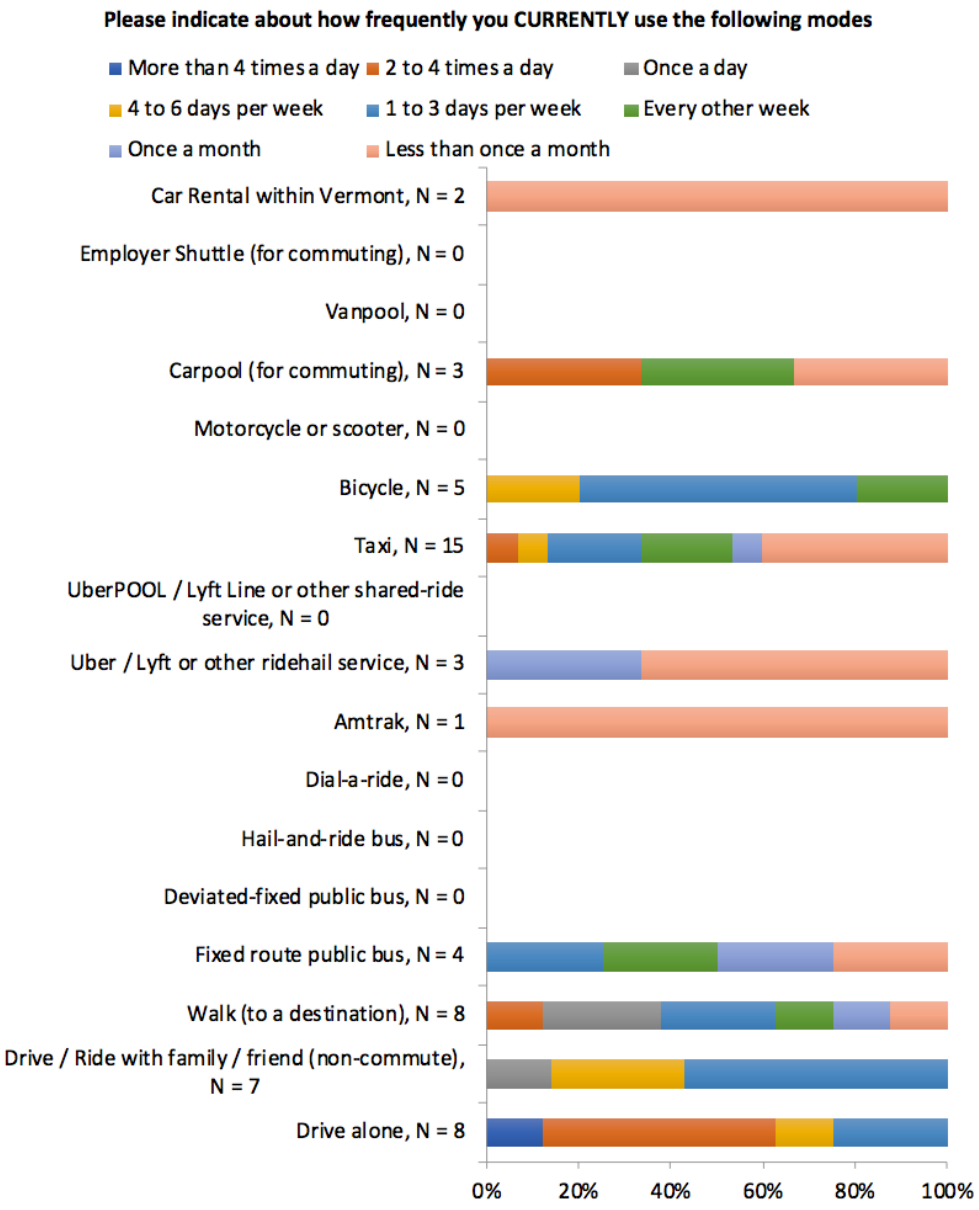


Figure A-24

User Survey – Trip Planning Platforms Used

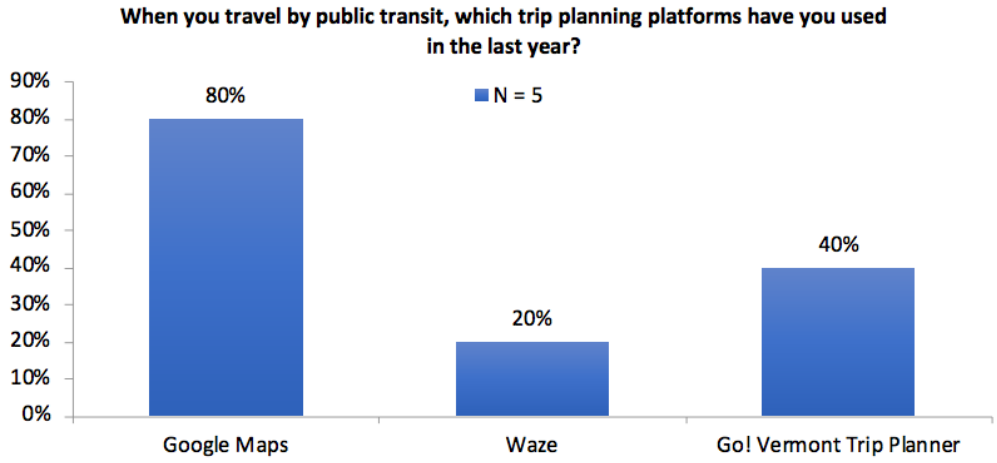


Figure A-25

User Survey – Go! Vermont Use

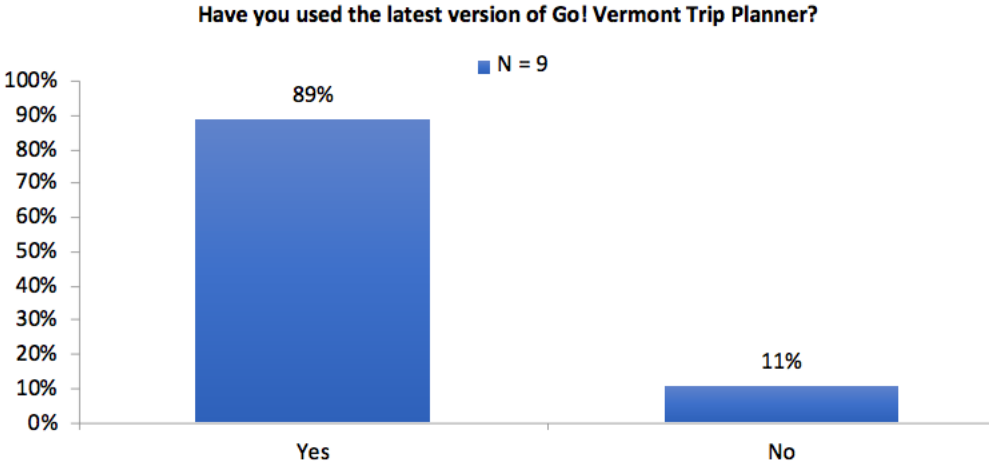


Figure A-26

User Survey – Go! Vermont Frequency of Use

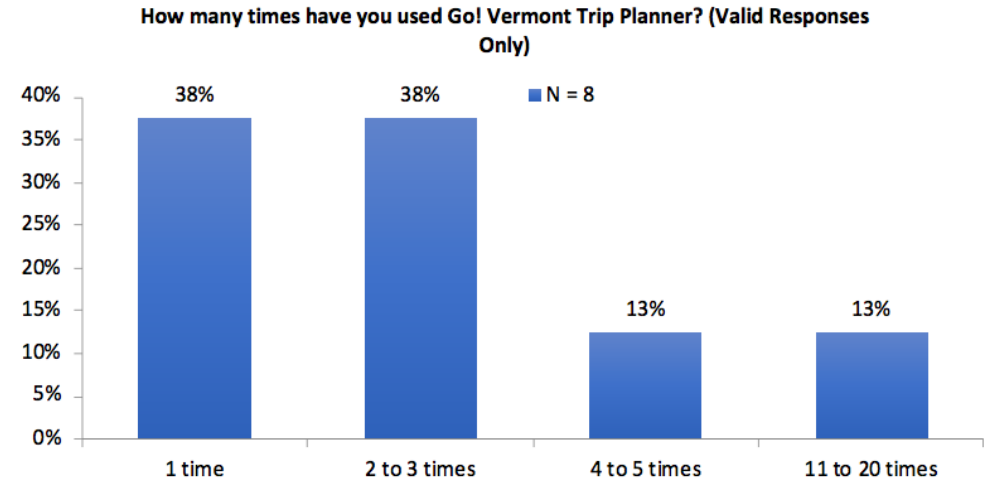


Figure A-27

User Survey – Go! Vermont Impression

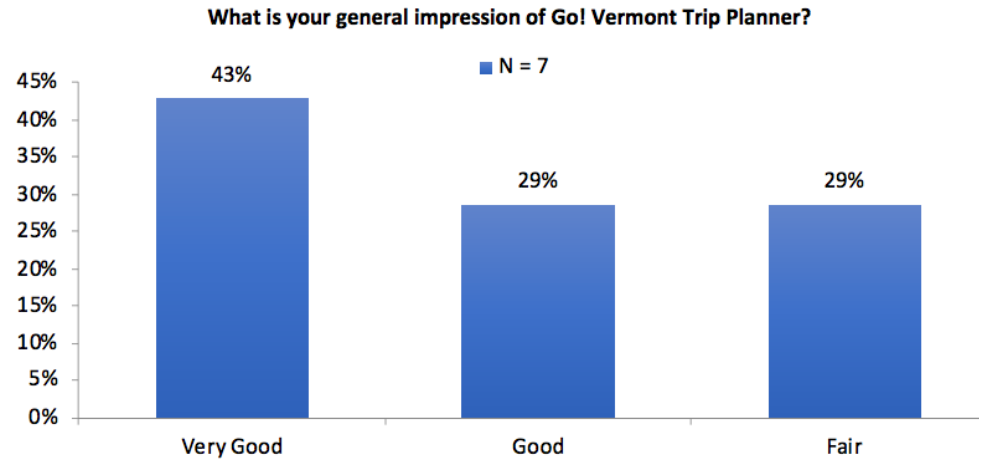


Figure A-28

User Survey – Go! Vermont Use for Flex-Transit Trips

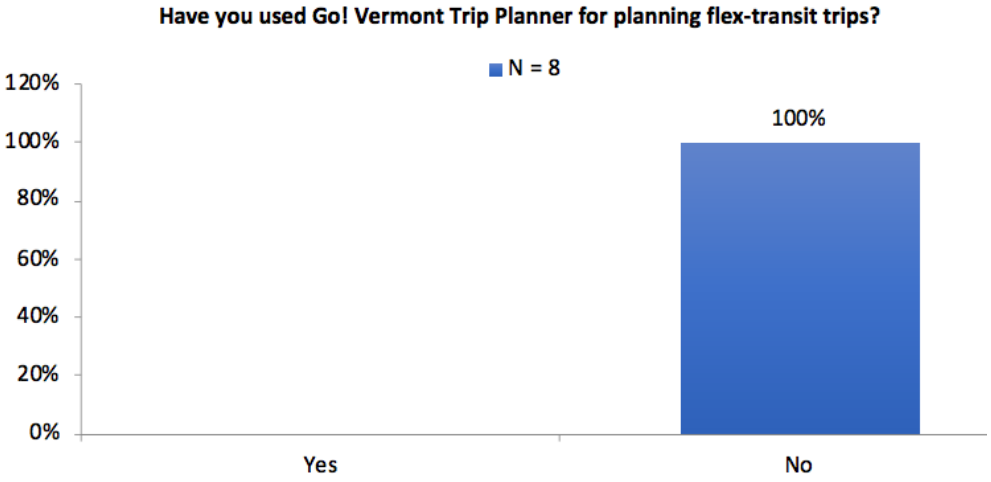


Figure A-29

User Survey – Gender

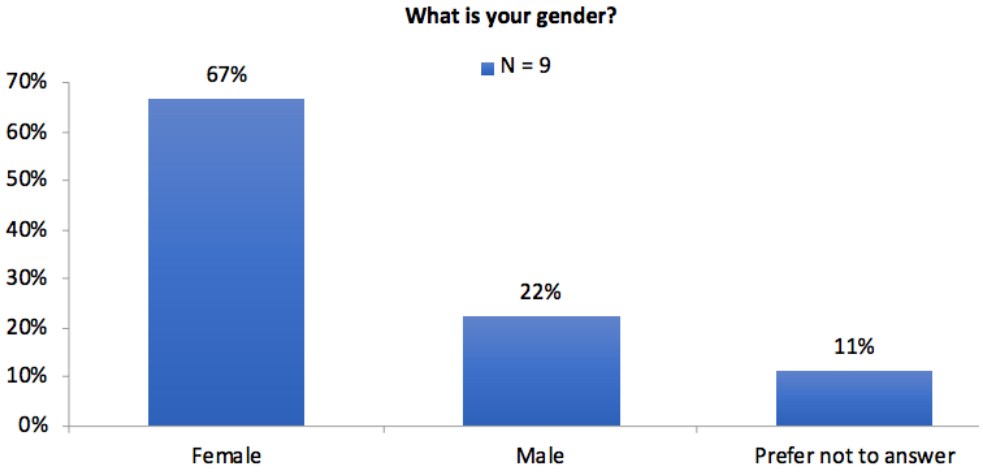


Figure A-30

User Survey – Wheelchair Use

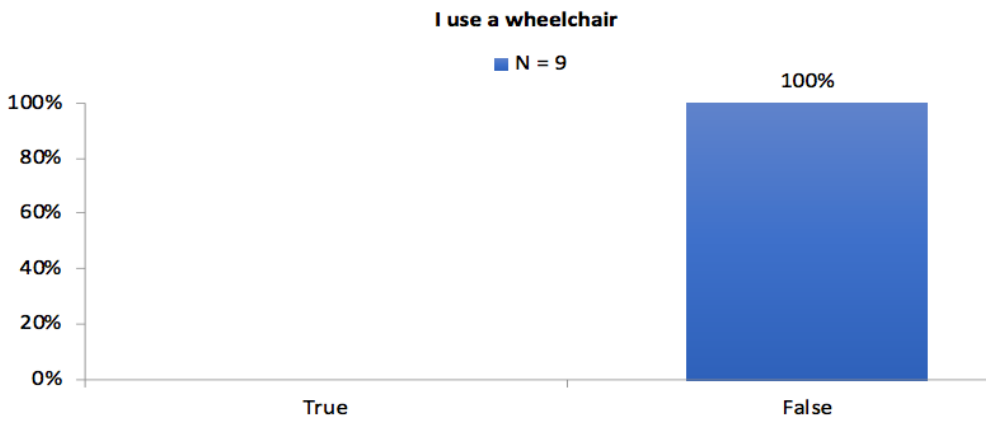


Figure A-31

User Survey – Specialized Accommodations for Transportation

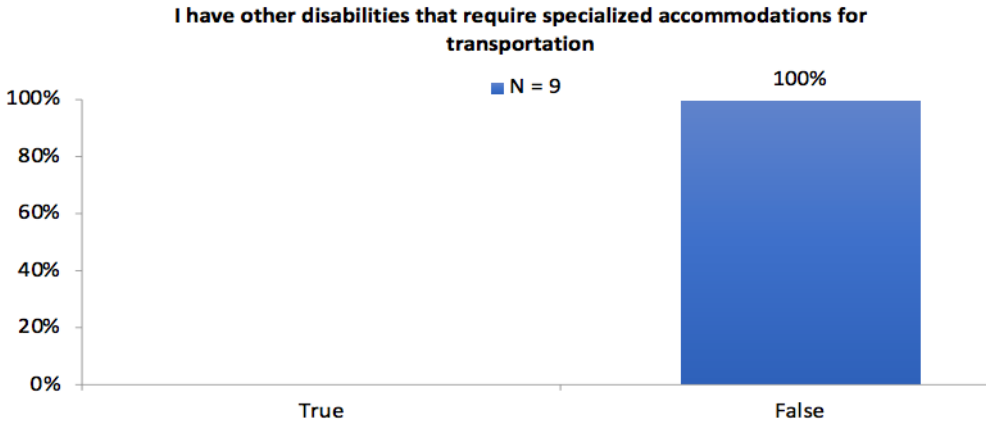


Figure A-32

User Survey – Level of Education

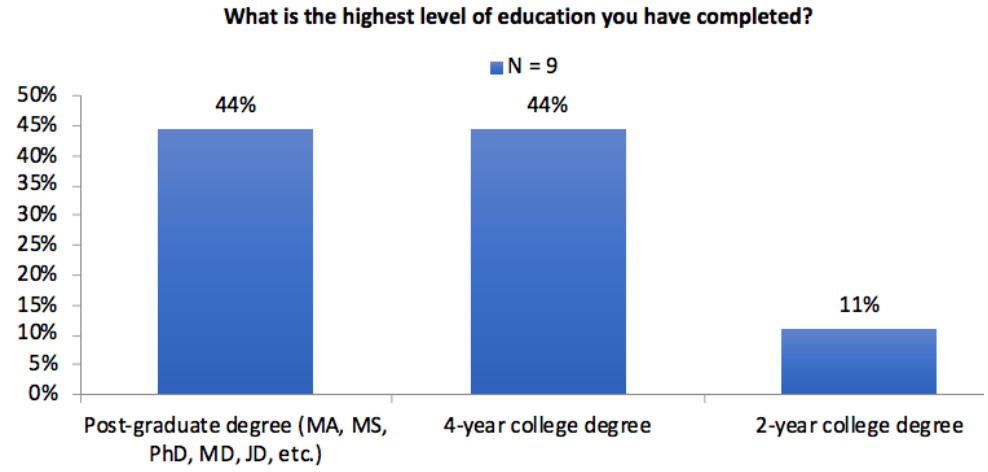


Figure A-33

User Survey – Race or Ethnicity

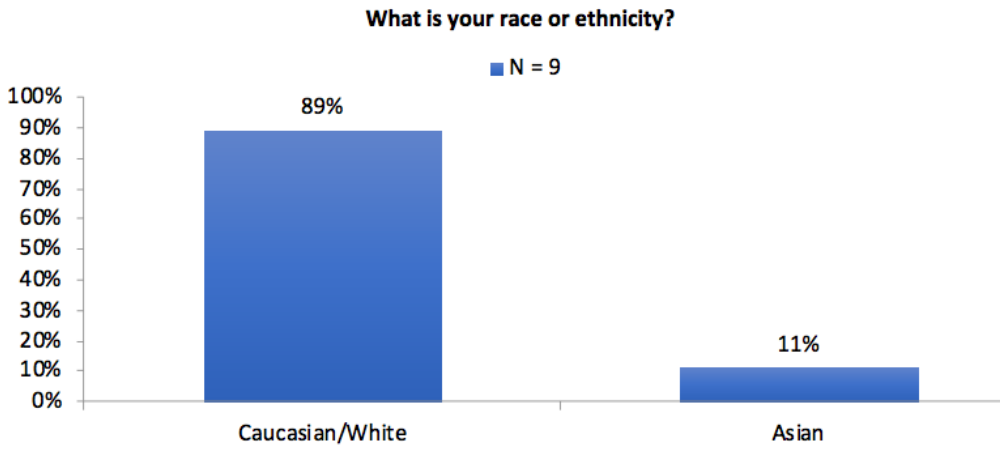


Figure A-34

User Survey – Housing Type

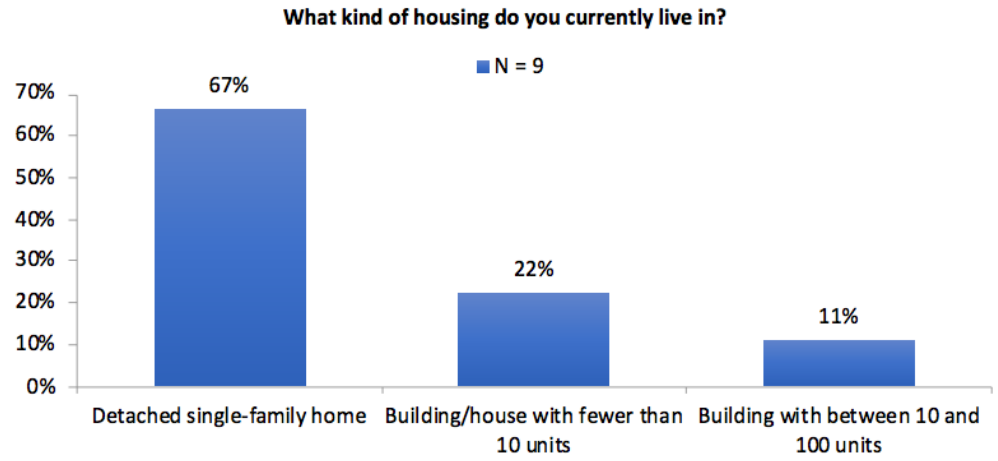


Figure A-35

User Survey – Household Income

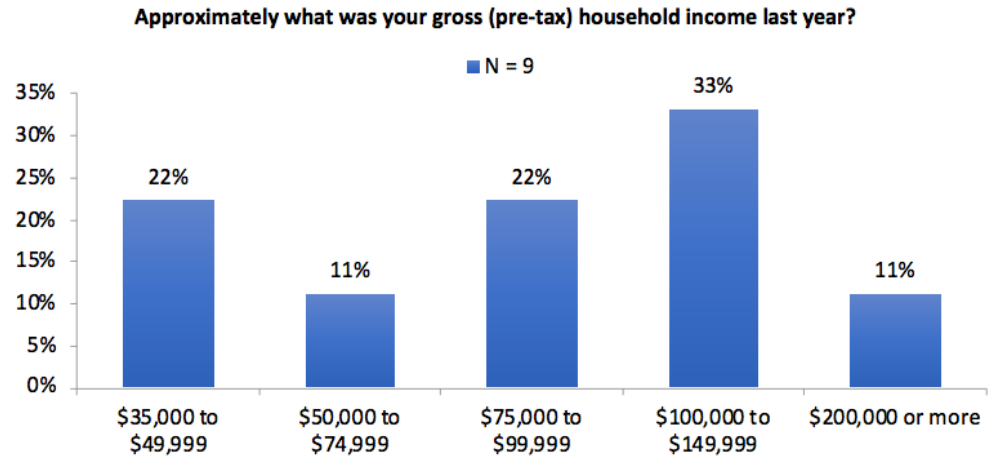
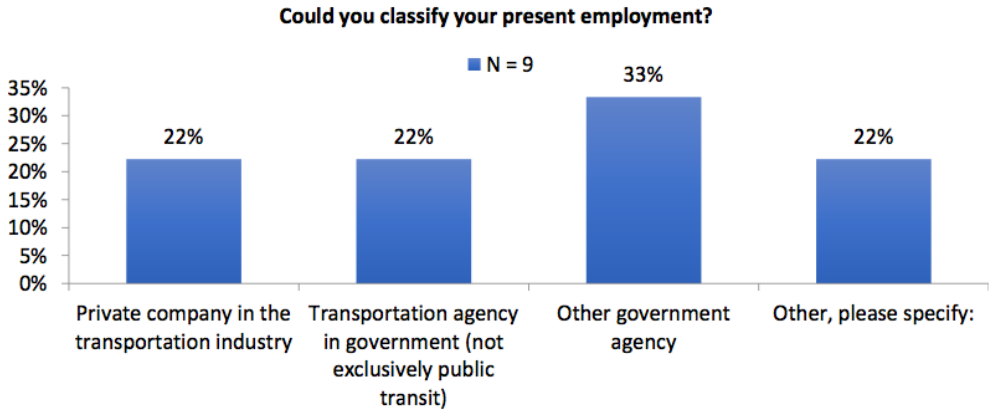


Figure A-36

User Survey – Present Employment



APPENDIX

B

List of Origins and Destinations Input into Trip Planner for Comparative Testing

Table B-1

Comparative Testing – Origins and Destinations

Pair #	Origins	Destinations
1	4 Central Ave, South Burlington, VT 05403	52 Institute Rd, Burlington, VT 05408
2	130 Gosse Ct, Burlington, VT 05408	1200 Airport Circle, South Burlington, VT 05403
3	220 Colchester Rd, Essex Junction, VT 05452	57 River Rd #1023, Essex Junction, VT 05452
4	21 Essex Way #116, Essex Junction, VT 05452	30 Hiawatha Ave, Essex Junction, VT 05452
5	71 Clement Road Rd, Rutland, VT 05701	47 Farrell Road, Rutland, VT 05701
6	5 Best Western Pl, Rutland, VT 05701	2 Oak St Ext, Rutland, VT 05701
7	15 Monument Cir, Bennington, VT 05201	604 US-7, Bennington, VT 05201
8	699 Burgess Rd, Bennington, VT 05201	220 Northside Dr, Bennington, VT 05201
9	278 S Main St, Barre, VT 05641	7 Jones Brothers Way, Barre, VT 05641
10	248 Prospect St, Barre, VT 05641	194 Merchant St, Barre, VT 05641
11	203 Country Club Rd, Montpelier, VT 05602	115 State St, Montpelier, VT 05633
12	115 State St, Montpelier, VT 05633	660 Elm St, Montpelier, VT 05602
13	150 W Canal St, Winooski, VT 05404	2 Tigan St, Winooski, VT 05404
14	276 E Allen St, Winooski, VT 05404	264 Malletts Bay Ave, Winooski, VT 05404
15	1197 Exchange St # 3, Middlebury, VT 05753	297 Lower Foote St, Middlebury, VT 05753
16	2815 S Street Extension, Middlebury, VT 05753	14 Old Chapel Rd, Middlebury, VT 05753
17	865 Putney Rd, Brattleboro, VT 05301	99 Stafford Farm Hill, Brattleboro, VT 05301
18	8 O'Bryan Dr, Brattleboro, VT 05301	131 Fairground Rd, Brattleboro, VT 05301
19	133 Fairfield St, St Albans City, VT 05478	29 Bellows St, St Albans City, VT 05478
20	5 Lemnah Dr, St Albans City, VT 05478	266 N Main St, St Albans City, VT 05478
21	205 South St, Bennington, VT 05201	127 Main St., Putney, VT 05346
22	181 Business Route 4, Rutland, Vermont 05736	96 Main St, Springfield, VT 05156
23	4982 Main St S, Newbury, VT 05051	75 Town Common Rd, Fairlee, VT 05045
24	7 Summer St, Randolph, VT 05060	149 Websterville Rd, Barre, VT 05641
25	222 Main St, Newport, VT 05855	49 Mill St, Island Pond, VT 05846
26	100 N Main St, St Albans City, VT 05478	1 Academy St, Swanton, VT 05488
27	120 Main St, Vergennes, VT 05491	77 Main St, Middlebury, VT 05753
28	9 Main St, Poultney, VT 05764	3 N Park Pl #2, Fair Haven, VT 05743
29	6039 Main St, Manchester Center, VT 05255	3828 VT Route 7A, Arlington, VT

Table B-1 (cont.)

Comparative Testing – Origins and Destinations

Pair #	Origins	Destinations
30	45 Main St, Proctor, VT 05765	2706 River Rd, Killington, VT 05751
31	51 Depot Square, St Johnsbury, VT 05819	96 Main St, Springfield, VT 05156
32	120 Main St, Vergennes, VT 05491	130 Brook Rd, Danby, VT 05739
33	149 Church St, Burlington, VT 05401	119 Park Ave, Lyndonville, VT 05851
34	100 N Main St, St Albans City, VT 05478	3828 VT-7A, Arlington, VT 05250
35	230 Main St #108, Brattleboro, VT 05301	67 School St, Rochester, VT 05767
36	9 Hyde Rd, Grand Isle, VT 05458	13 Courthouse Dr, Guildhall, VT 05905
37	6 N Main St # 6, Barre, VT 05641	222 Main St, Newport, VT 05855
38	51 S Main St, Northfield, VT 05663	467 Center St, Pownal, VT 05261
39	1 Academy St, Swanton, VT 05488	172 N Main St, Bradford, VT 05033
40	827 Main St, Albany, VT 05820	4982 Main St S, Newbury, VT 05051
41	121 VT-17, Addison, VT 05491	210 Quaker Village Rd, Weybridge, VT 05753
42	864 Harwood Hill Rd, Bennington, VT 05201	262 Lake Shaftsbury Rd, Shaftsbury, VT 05262
43	21 Memorial Dr, St Johnsbury, VT 05819	2661 Duck Pond Rd, Waterford, VT 05819
44	1022 W Lakeshore Dr, Colchester, VT 05446	906 Middle Rd, Colchester, VT 05446
45	429 Breault Rd, Guildhall, VT 05905	47 Transfer Station, Lunenburg, VT 05906
46	1452 Barry Rd, Fairfield, VT 05455	1943 Ridge Rd N, Fairfield, VT 05455
47	769 South End Rd, North Hero, VT 05474	31 Parker Lodge Dr, North Hero, VT 05474
48	141 Hemingway Dr, Hyde Park, VT 05655	2460 VT-100C, Johnson, VT 05656
49	10368 VT-113, Vershire, VT 05079	6946 VT-113, Vershire, VT 05079
50	155 Fishing Access Rd, Derby Line, VT 05830	5463 Lake Rd, Newport Center, VT 05857
51	190 Sandy Meadow, Pittsford, VT 05763	8163 Whipple Hollow Rd, Florence, VT 05744
52	571 Vincent Flats Rd, East Montpelier, VT 05651	3410 Center Rd, East Montpelier, VT 05651
53	35 Fawn Ledge Ln, Jamaica, VT 05343	153 Lorch's Hill Rd, Wardsboro, VT 05355
54	5851 S Rd, South Woodstock, VT 05071	35 Wayside Rd, Woodstock, VT 05091
55	1254 Border Rd, Alburg, VT 05440	787 Greenwoods Rd, Alburg, VT 05440
56	190 W Shore Rd #4617, South Hero, VT 05486	50 Lighthouse Rd, South Hero, VT 05486
57	14 Bell Hill Rd, Grand Isle, VT 05458	53 Lovers Ln, Grand Isle, VT 05458
58	509 Lakeview Dr, North Hero, VT 05474	98 Bridge Rd, North Hero, VT 05474
59	543 Lamb Hill Rd, Wells, VT 05774	69 South St, Wells, VT 05774
60	3067 Hapgood Pond Rd, Peru, VT 05152	81 VT-11, Peru, VT 05152
61	US First Service Rd 48, Mt Tabor, VT 05739	352 South End Rd, Mt Tabor, VT 05739

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