2021 REGIONAL MOBILITY SURVEY METHODOLOGY MEMO

December 29, 2021

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1.0 INTRODUCTION

The Saint Cloud Area Planning Organization's (APO's) 2021 Regional Mobility Survey (RMS) was a household travel survey (HTS) designed to collect demographic information, daily travel activities, and typical transportation patterns of people who live in the greater Saint Cloud region. This travel information is vital for regional and local planning agencies to understand how regional changes due to shifting demographics and community development have impacted use of the transportation system. The data and reports collected from the survey will help the APO propose practical transportation investments, produce competitive federal grant applications, and prioritize the improvements that best fit regional needs.

The RMS was a mixed mode survey with the opportunity to participate via a smartphone-based travel survey app, an online survey, or a call center. This methodology followed current HTS best practices and resulted in a final dataset that can be used for model updates and transportation planning. Complete survey data was collected from 866 households in the region from October 6, 2021, through November 24, 2021. The project schedule is provided below in Table 1.

TABLE 1: SURVEY SCHEDULE BY TASK AND DELIVERABLE

TASKS AND DELIVERABLES	SCHEDULE
Task 1: Develop Survey Design and Methodology	**March – July 2021**
Subtask 1.1: Project Kickoff Meeting	**April 2021**
Deliverable: Kickoff meeting presentation and schedule	
Subtask 1.2: Survey Questionnaire	**April – May 2021**
Deliverable: Draft and final survey questionnaire	
Subtask 1.3: Survey Programming	**June – July 2021**
Deliverable: Fully programmed and tested survey instruments	
Subtask 1.4: Sample Planning	**June – August 2021**
Deliverable: Draft and final survey sampling plan	
Subtask 1.5: Survey Outreach Planning	**August-September 2021**
Deliverable: Draft and final survey outreach plan	
Subtask 1.6: Participant Engagement Materials	**April – September 2021**
Deliverable: Draft and final survey invitation materials	
Deliverable: Draft and final public survey website	
Deliverable: Draft and final press release	
Task 2: Conduct Survey	**October-November 2021**
Subtask 2.1: Survey Monitoring and QA/QC	**October – November 2021**
Deliverable: Online real-time survey results dashboard	
Subtask 2.2: Survey Administration	**October – November 2021**
Deliverable: 1,200 complete household survey responses	
Task 3: Data Processing and Weighting	**November-December 2021**
Subtask 3.1: Data Processing and QA/QC	**December 2021**
Deliverable: Unweighted frequency tabulations of the dataset	
Subtask 3.2: Data Weighting	**December 2021**
Deliverable: Weighted dataset	
Deliverable: Weighted frequency tabulations of the dataset	
Deliverable: Dataset users' guide	

Deliverable: Dataset codebook	
Task 4: Prepare Documentation and Analysis	**November-December 2021**
Deliverable: Survey summary presentation	
Deliverable: Survey appendices	
Task 5: Advise on HTS and Origin-Destination Data Use	**November - December 2021**
Deliverable: Advisement memo on HTS and O-D data use	

2.0 SURVEY DESIGN

The following section outlines key elements of the survey design process, including development of the survey questionnaire and information about the survey instruments that were used for data collection.

2.1 SURVEY QUESTIONNAIRE

RSG used our industry best-practice questionnaire template as the starting point for the RMS survey instrument design. Leveraging RSG's well-refined and tested template questionnaire helped to reduce cost and provide time for the project team to focus on identifying a set of locally based questions to address the APO's specific data needs (e.g., visioning questions, transportation barriers questions). The final RMS questionnaire captured all essential household travel survey data needed for use in four-step, hybrid, and activity-based models as well as information on emerging behavioral changes of interest to agencies (e.g., electric vehicle adoption, teleworking frequency). Additionally, the questionnaire addressed the ongoing impacts of COVID-19 on participants' typical travel behavior. The survey instrument provided RMS respondents with the ability to report their current travel behavior easily and accurately while also providing valuable information on their pre-COVID-19 behavior and expected future behavior. The RMS survey questionnaire has been included as an appendix to this memo.

The survey questionnaire was translated from English into both Spanish and Somali for this survey effort and participants were able to complete the survey through all three participation modes in all three languages. Ninety-nine percent of participants opted to participate in English and five participants completed the survey in Spanish. There were no participants that completed in Somali.

2.2 SURVEY INSTRUMENTS

Over the past seven years, the majority of HTS conducted in the US have been mixed mode with the opportunity to participate via a smartphone travel survey app, an online survey, or a call center. This methodology is efficient, cost-effective, less burdensome on survey respondents, and yields a robust dataset ideal for model updates and transportation planning. The 2021 RMS followed these HTS best practices by offering a mixed mode survey with options to use a smartphone app, online survey, or call center.

Households that participated in the survey via smartphone provided travel data for seven days through RSG's smartphone-based travel survey app, rMove™, and the remaining share of

participants provided their responses through rMove for Web™ which offered a one-day weekday survey that was self-administered online or completed via a call center interview. Travel data were collected for all household members, regardless of age or participation method. Table 2 below summarizes the count of households that participated in the survey and their participation method. Fifty-five percent of households completed their travel diary using the smartphone app, rMove.

TABLE 2: SURVEY PARTICIPATION MODE

SIGNUP SURVEY MODE	DIARY SURVEY MODE	HOUSEHOLD COUNT	PERCENT
Online or Call Center	Online or Call Center	352	41%
Online or Call Center	Smartphone	159	18%
Smartphone	Online or Call Center	35	4%
Smartphone	Smartphone	320	37%
Total		**866**	**100%**

rMove

During recruitment participants were asked whether all adults in their household owned smartphones. If all adults were smartphone owners, the household was assigned to complete their travel diary through the rMove app and log their travel for seven days. Only adults (age 18+) were asked to download rMove. For households with children (ages 17 and under), one adult household member was asked to report any of their children's trips where an adult was not present (e.g., walked home from soccer practice with friends), for a single weekday, as well as provide summary-level data for that day (e.g., child went to school, went to COVID-19 "pod" learning). Many children accompany adult household members on trips, and thus, that data is already reported by the adult participants during the assigned travel week (i.e., each trip survey asks which household members are on a given trip). This approach ensures a complete single travel day for all household members (including members under age 18) without overly burdening the reporting adult.

rMove for Web

RSG's proprietary survey technology, rMove for Web, served as the online equivalent to rMove. Participants who completed the one-day diary were assigned a Tuesday, Wednesday, or Thursday to report their travel. Call center interviewers used rMove for Web to collect responses over the telephone to ensure consistent real-time data validation and survey alignment regardless of participation mode. By using integrated survey platforms (rMove and rMove for Web), survey responses from all three participation modes (smartphone, online, call center) were processed through identical logic, validation, and real-time quality assurance checks.

Survey responses were stored in a single database to ensure that data collected were consistent, regardless of participation mode.

3.0 SAMPLE DESIGN

Alongside the evolution of survey participation modes, HTS sampling methods have simultaneously evolved to address the decline in survey response rates observed nationally, to decrease survey costs and to increase participation from historically underrepresented groups. RSG recommended a combination of industry best practices and innovative sampling methods to increase the representativeness of the sample. Address-based sampling (ABS) was used as the primary sampling method while supplements to ABS were leveraged as an additional means of outreach to hard-to-survey households.

3.1 ADDRESS-BASED SAMPLING

Sampling Frame and Method

The RMS region is comprised of the greater Saint Cloud region including the City of Sartell, the City of Sauk Rapids, the City of Saint Cloud, the City of Saint Joseph, the City of Waite Park, and regions within Haven Township, Stearns County, and Benton County. The sampling frame for this survey included all households in the RMS region, excluding any households living in group quarters. RSG primarily used ABS to select households for participation. ABS involves drawing a random sample of addresses from all residential addresses in a defined geographic area. Using this method, all households within each defined area have an equal chance of selection for the sample. Once the sample plan was finalized, RSG purchased household mailing addresses from Marketing Systems Group (MSG), which maintains the Computer Delivery Sequence file from the U.S. Postal Service.

RSG geographically stratified the sample using Census Block Group data from the most recently available 2015-2019 American Community Survey 5-year estimates (ACS). This is the most detailed way to stratify the sample because Census Block Groups (CBGs) are the smallest geography for which most Census and ACS tables are publicly available. The 2015-2019 ACS data for the region reported a population of 55,030 households and 144,066 persons. Group Quarters are a relatively small segment of the population and, as mentioned previously, were excluded from the sampling frame.

ABS Invitations were sent via first-class mail to each randomly selected address and batched into two mail groups. Table 3 provides the letter and reminder postcard schedule for each mail group.

TABLE 3: MAILING DATES

MAIL GROUP	LETTER MAIL DATE	POSTCARD REMINDER 1 MAIL DATE	POSTCARD REMINDER 2 MAIL DATE
1	10/1/2021	10/8/2021	10/15/2021
2	10/4/2021	10/8/2021	10/15/2021

Sample Plan Development and Segmentation

The project team used the following mutually exclusive and collectively exhaustive sample segments. The hard-to-survey sample segment was developed to compensate for historically lower response rates observed from people of color and from low-income households – defined as having an annual household income less than $35,000. The criteria for each of the sample segments are defined below:

1) **Hard-to-survey CBGs:** Comprised of the CBGs in the sample frame whose population is at least 50% Hispanic or people of color and/or at least 50% low income.

2) **Urban CBGs:** Comprised of CBGs in the St. Cloud region which have a population density of at least 600 persons per square kilometer and are not designated as hard-to-survey.

3) **Rural CBGs:** Comprised of CBGs in the St. Cloud region which have a population density of less than 600 persons per square kilometer and are not designated as hard-to-survey.

The resulting number of CBGs, households, persons, and persons-per-household for each segment are listed in Table 2. An RMS region map illustrating the sample segments is provided in Figure 1.

TABLE 2: SURVEY REGION HOUSEHOLDS AND PERSONS, BY SAMPLE SEGMENT[1]

SAMPLE SEGMENT	NUMBER OF CBGS	TOTAL HOUSEHOLDS	TOTAL POPULATION	ADULTS PER HOUSEHOLD	ESTIMATED PEOPLE OF COLOR AND/OR HISPANIC SHARE OF POPULATION
Hard-to-survey CBGs	10	5,082	14,549	2.18	52%
Urban CBGs	40	23,410	59,818	2.06	16%
Rural CBGs	36	26,538	69,699	1.98	12%
Total	**86**	**55,030**	**144,066**	**2.03**	**17%**

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[1] Based on 2015-2019 ACS 5-year estimates.

FIGURE 1: MAP OF RMS REGION
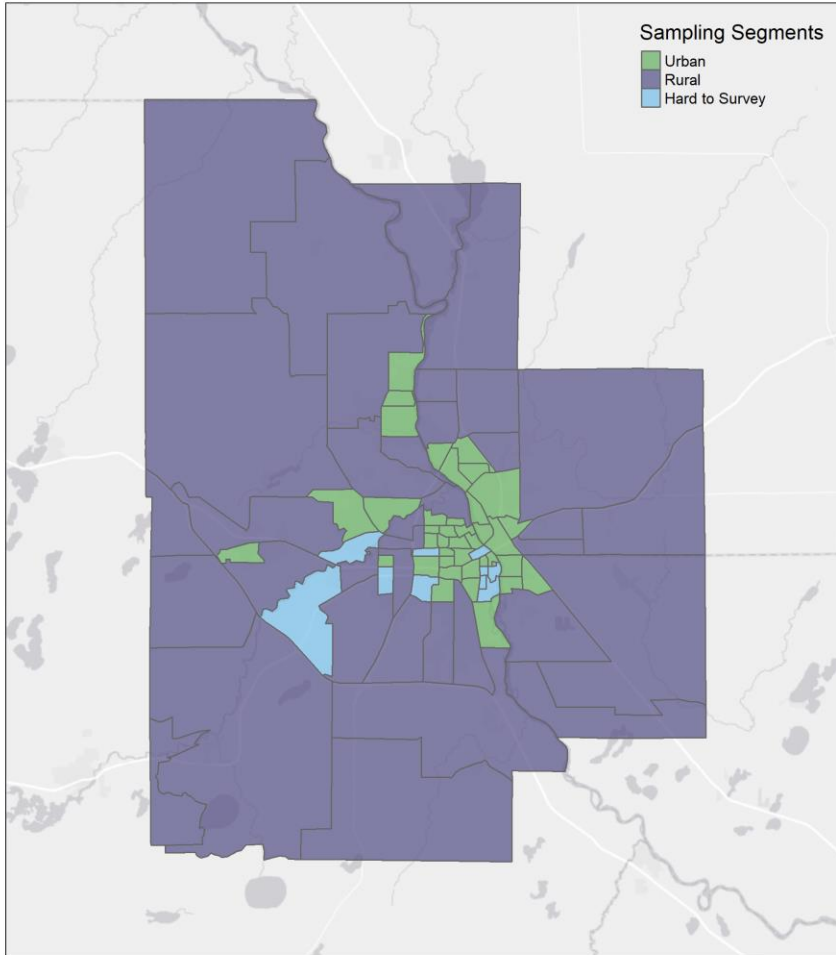
Response Rates

The observed response rates are shown in Table 4. These response rates are slightly lower than those observed for studies of a similar design in the region (such as the Metropolitan Council's Travel Behavior Inventory), which may be due to the impact of using an assignment method to increase smartphone participation. This method assigned households to provide travel information via the smartphone app whenever the household was eligible (all household adults reported having an eligible smartphone). While this assignment method may have contributed to lower response rates, it was successful in boosting the overall share of smartphone app participants in the final sample – and those participants provided more days of travel data overall than online or call center participants.

TABLE 4: RESPONSE RATES BY SAMPLE SEGMENT

SAMPLE SEGMENT	RESPONSE RATE
Hard-to-survey CBGs	1.2%
Urban CBGs	1.7%
Rural CBGs	1.5%
Total	**1.5%**

3.2 SUPPLEMENTAL SAMPLING

Supplemental sampling methods were implemented in the RMS with the intention of improving recruitment rates from demographic groups that are often underrepresented or who respond at lower rates to mailed invitation efforts, particularly people with low-income, people with disabilities, people of color, people who are recent immigrants and/or new Americans, and people who do not own a personal vehicle. Working closely together, SRF, RSG, and the APO coordinated an effort to invite members of community-based organizations (CBOs) to participate in the RMS, with a focus on CBOs that are primarily composed of historically underrepresented community members. CBO recruitment efforts were be made in October and November 2021. SRF coordinated with organizations to determine the best means to invite community members to participate in the survey. Thirty-two households completed the survey as a result of the supplemental recruitment efforts. Section 4.5 Public Outreach provides further detail on the outreach efforts that were implemented.

4.0 SURVEY IMPLEMENTATION

4.1 PARTICIPANT ENGAGEMENT

A custom survey logo and color palette were developed for the RMS and used in all public facing materials, including the survey invitation mailings, public website, participant email templates, and public outreach materials (see Figure 2). This set of engaging, professional materials connected all invitations, reminders, and other notices about the project to support the survey's credibility and response rate.

FIGURE 2: REGIONAL MOBILITY SURVEY LOGO AND BRANDING

The majority of completed households recruited via first-class mailed invitations. These mailing materials are provided as an appendix to this memo for documentation purposes. RSG mailed an invitation letter followed by two reminder postcards to maximize response rates. This approach was consistent with RSG's standard HTS mailing approach and other, similar survey efforts also conducted by RSG. Each invited household was provided a unique access code for the survey in their mailed invitation materials or in outreach recruitment materials/efforts. This access code was then used across all materials (print and online) and survey platforms (smartphone, online, call center) to streamline survey participation and reduce attrition. The mailings included English, Somali, and Spanish content to communicate each of the available survey participation options to all invited households.

RSG developed a public website for the survey that was both the entryway to the online survey as well as a validating resource for participants with questions about the survey. This website provided information about the project, including frequently asked questions, contact information, and more. Screenshots of the survey website have been provided as an appendix to this memo. At survey launch, a press release was also issued by the APO to announce the survey to the public, build awareness, and further bolster the survey's credibility. The press release emphasized the importance of the RMS and its impacts on future transportation planning decisions

4.2 PUBLIC OUTREACH

Public outreach was conducted to promote the RMS and recruit residents to participate as a supplement to ABS recruitment efforts. The survey was open for community participation from October through November of 2021 and was actively promoted through a press release, social media notifications, and mailed invitations. During the data collection period, promotional efforts were supplemented with targeted outreach to bolster community participation particularly from populations of interest to the APO. Through conversations with APO staff, and following guidance for inclusive participation identified in the APO's Stakeholder Engagement Plan (SEP), the following audiences were identified by the APO as populations of interest:

- Low-income populations.
- People with disabilities.
- People of color.
- People who are recent immigrants and/or new Americans.
- People who do not own a personal vehicle.

These demographic groups have been shown to have lower overall recruitment rates and conversion rates (the rate of recruits that go on to complete) in HTS. There is a great deal of publicly available information that documents the challenges of participation among hard-to-survey populations and the higher costs for obtaining this participation (i.e., from the Census Bureau). The RMS' approach to targeted outreach supported the following goals identified in the APO's SEP:

- **Opportunities for Involvement**: Provide early, accessible, and continuous opportunities for public involvement from a diversity of stakeholders and interested public.

- **Access to Information**: Provide reasonable public access to technical and policy information used in the development of plans and projects.

- **Review of Materials**: Provide a reasonable amount of time to review materials and comment prior to adoption of any plan or amendment.

To improve opportunities for involvement particularly from populations of interest, increase access to information, and refine approaches as needed to encourage broad community participation, the consultant team recommended the following outreach approach:

- **Build community partnerships and survey awareness**: Lead efforts to build partnerships with community-based organizations (CBOs). Communicate and connect with targeted demographics through outreach, with support from CBOs.

- **Refine recruitment strategies based on feedback and results**: Evaluate initial response to the RMS and refine outreach strategies based on feedback from CBOs and survey response particularly from populations of interest.

Building community partnerships and survey awareness

Targeted outreach began in September of 2021 with the development of a list of potential community-based organizations (CBOs) that could be partners in promoting the RMS and helping to recruit participants from targeted populations. The outreach team, in partnership with the APO, identified 44 potential CBOs and categorized each organization by affiliation into the following categories:

- Non-profits

- Religious Institutions

- College

- Transit

- Food Access

- Local Government Agencies

Each of the identified CBOs received an introductory email from the APO explaining the importance of the RMS, the APO's intent to bolster participation amongst traditionally underrepresented populations, as well as a request for CBO to support the APO's recruitment efforts. Over the next month, the outreach team followed up with phone calls and emails to gauge each CBO's willingness to support recruitment efforts, discuss opportunities to promote the RMS via email listservs or other communications channels, and ask for any additional recommendations CBOs may have for survey recruitment.

CBO contacts encouraged the APO to seek more inclusive participation by showing up in the places where targeted populations live and work to build relationships and recruit participants. Unfortunately, most CBOs did not have resources or capacity to support recruitment efforts in

their own email listservs – which has been a successful means of recruitment in past HTS efforts. In addition to encouraging in-person recruitment, several CBOs expressed a willingness to help the APO promote the survey and encourage participation. Table 5 provides a summary of the CBOs that supported RMS recruitment efforts and offered suggestions for improved outreach.

TABLE 5: SUMMARY OF CBO SUPPORT AND/OR FEEDBACK PROVIDED FOR THE RMS

COMMUNITY-BASED ORGANIZATION	RMS SUPPORT AND/OR FEEDBACK PROVIDED
Latino Economic Development Center	Provided a list of regional businesses to engage with and post information about the RMS.
UniteCloud	Promoted the RMS via social media and offered suggestions for engaging community.
MetroBus	Promoted the RMS via social media, suggested alternative approaches to recruitment and offered to work with the APO to provide on-route promotion.
Connectability MN	Promoted the RMS via social media and suggested alternative approaches to recruitment.
Catholic Charities Emergency Services	Promoted the RMS via social media and conducted targeted outreach with potential recruits.
Community Giving	Suggested potential CBOs and community liaisons to support recruitment efforts.

Refining recruitment strategies

After evaluating initial outreach strategies, survey response, and listening to recommendations received from CBOs, the team refined its approach and sought to recruit participants through social media promotion on the APO's Facebook page, a pop-up engagement event, paid advertising in local papers, and distributing flyers and postcards around the region at community gathering spaces. Outreach materials were translated into English, Spanish and Somali. The following recruitment strategies were efficient ways to communicate with targeted groups as well as the broader community to build awareness. Recruitment strategies that were utilized included:

- **Social media advertising**: The APO conducted paid social media advertising via Facebook ad boosts. These targeted advertisements were promoted in coordination with several partner CBOs to help recruit participation and build community awareness.

- **Pop-up engagement event**: A pop-up event was held at the Saint Cloud State student union to bolster survey participation amongst young adults. The pop-up event was held at the Atwood Student Center over the lunch hour during a school day. A total of sixty-six

students were engaged during the pop-up event. In addition to pop-up engagement at the Atwood Student Center, the RMS was promoted at the College of Public Affairs' student lounge.

- **Paid advertising in local papers**: Online and print advertisements were created to encourage community participation, promote incentives for completing the RMS as well as to share the importance of the survey on future transportation planning decisions. Paid advertisements were posted in the St. Cloud Times (print and digital advertising) as well as the Sauk Rapid Herald.

- **Notifications in popular community locations**: In response to recommendations received from CBOs, the team pivoted recruitment efforts for the RMS and prepared a series of notification flyers and instruction cards that were shared in popular community locations. Instruction cards were coded to track participation, and notification materials and survey instructions were translated in English, Spanish and Somali. Staff visited 22 community locations to promote the survey and request permission to post flyers and instructional postcards at local businesses and community destinations. Materials were posted at the following community locations documented in Table 6. In addition to posting flyers and instructional postcards at targeted community locations, follow-up outreach was conducted with several CBOs to provide printed instructional materials for distribution amongst CBO clientele.

TABLE 6: LIST OF COMMUNITY LOCATIONS WHERE OUTREACH MATERIALS WERE POSTED

COMMUNITY LOCATION
St. Cloud Technical College
St. Cloud State University
Central Mn Islamic Center
Catholic Charities Emergency Services
Kipps Laundry Mat
Clean Machine Laundry Mat
Laundry Depot
Kismayo Coffee and Grill
Central Minnesota Islamic Center - Masjid Imaam Al-Shaafi'i
Chua Giac Lam
Thao Market
Mogadishu Grocery
Iftin Grocery Store: Halal & Meat
Viet-Tien International Market & Deli
Higher Ground
Islamic Center of St. Cloud
Añejos - Waite Park - Restaurant
La Perla - Market
El Torito Market
Green Market
Añejos Sartell restaurant

The targeted outreach conducted to promote the RMS was refined and evaluated throughout the data collection period. Feedback from CBOs noted the importance of showing up in places where populations of interest live and work to continue to build relationships with community members and establish two-way communication with the APO.

4.3 PARTICIPANT SUPPORT

Outbound communication about the RMS was initiated by mailed invitations or public outreach efforts and complemented by reminders via email, telephone, and/or within the smartphone app itself once a household completed the signup/recruitment survey. Reminder emails were thoughtfully scheduled throughout the survey period with the intent of maximizing response. Inbound communication (both calls and emails) from participants was typically related to incentives and/or requests for technical help (e.g., requesting an access code). A summary of participant inquiries received is documented below in Table 7. Regardless of the communication channel, project support staff aimed to respond to participant inquiries within one business day. RSG worked closely with our call center, WestGroup Research, on this project to streamline the participant experience.

**TABLE 7: SUMMARY OF PARTICIPANT INQUIRIES RECEIVED**

TYPE OF SUPPORT	COUNT	SHARE
Online participant inquiries	466	46%
Call center participant inquiries	538	54%
Total	**1,004**	**100%**

Includes inquiries from October 1, 2021, through December 20, 2021.

4.4 SURVEY MONITORING

During survey fielding, RSG continuously monitored the survey database and performed regular QA/QC. To provide the APO with full transparency and real-time access to survey response throughout data collection, RSG developed an online monitoring dashboard with real-time results, including response rates and a comparison of participants to ACS demographic data for the region (see Figure 3).

FIGURE 3: REAL-TIME DATA COLLECTION MONITORING DASHBOARD
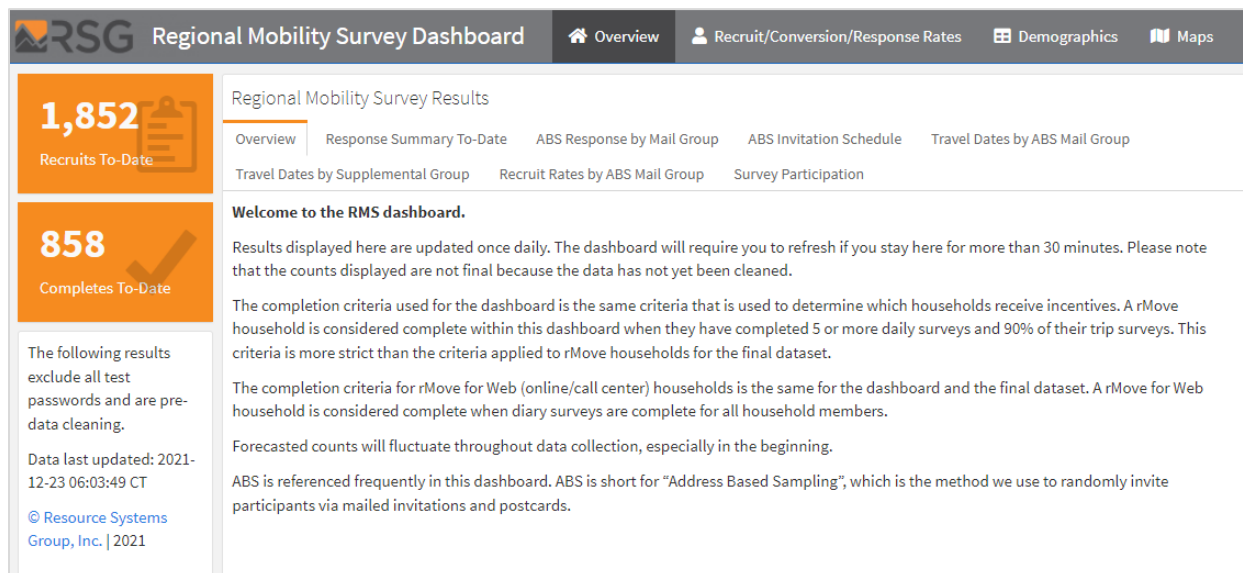
Survey Response

After the first three weeks of data collection, it became clear that response rates to the RMS were lower than initial projections. Unfortunately, there was not an option to mail to more households as nearly every household in the region had initially been mailed an invitation. To address the below target recruitment rates that were being observed, the consultant team implemented the following survey design changes in an effort to improve response to the RMS and obtain as many complete households as possible within the available data collection timeframe:

- Expanding and increasing the differential incentive offerings on 10/25/2021 (4 weeks prior to the end of data collection) and 11/2/2021 (3 weeks prior to the end of data collection), these are detail in Section 4.5 Participant Incentives.

- Refining outreach recruitment strategies and survey awareness efforts.

- Changing survey participation mode assignment. On 11/2/2021 (3 weeks prior to the end of data collection), a survey change was implemented so that any household who signed up online or through the call center, would be assigned that participation mode for the diary. Previously, diary participation mode was assigned based on the smartphone ownership status of household adults.

- Offering a second chance to participate for any household dropped out of the survey after recruitment and didn't fully complete. On 11/2/2021 (3 weeks prior to the end of data collection), these households were re-contacted and provided a second opportunity to complete with a higher incentive offering.

These efforts did further bolster survey response, but unfortunately the RMS fell short of its overall response target of 1,000 households collecting complete data from 866 households overall.

4.5 PARTICIPANT INCENTIVES

Participants who fully completed the survey were offered the following incentive options: a Visa gift card, a donation option to the local Catholic Charities Emergency Food Shelf, and a no-incentive option. Incentives were distributed to participants within two to three weeks of the day they completed the survey. Differential incentive offerings were implemented based on survey participation mode (smartphone vs online/call center) and participant demographics. Differential incentive offerings based on participation mode were recommended because those participating via smartphone were asked to provide a full week of travel information rather than a single day. Differential incentive offerings based on participant demographics were also offered to improve survey representation from historically hard-to-survey groups. The criteria used to determine the type of incentive a household was offered is provided below:

A household qualified for the higher hard-to-reach incentive if it had any of these characteristics:

- Member 1 is Hispanic (offered at end of signup survey)

- Member 1 is a Person of Color (offered at end of signup survey)

- Household income is less than $35,000 (offered at end of signup survey)

- Household has 4 or more members (offered at end of signup survey) **– This was an additional characteristic added in the middle of fielding starting 10/25/2021.**

- Member 1 is age 18-24 (offered at end of signup survey) **– This was an additional characteristic added in the middle of fielding starting 10/25/2021.**

- Household recruited using the public outreach access code (offered in recruitment).

Incentive amounts:

- Online/call center standard offering was $10 per household.

- Online/call center hard-to-reach offering was $25 per household **– This was a $5 increase from the first half of fielding prior to 10/25/2021.**

- Smartphone standard offering was $15 per adult participant.

- Smartphone hard-to-reach offering was $35 per adult participant **– This was a $10 increase from the first half of fielding prior to 10/25/2021.**

On November 2, 2021, the survey team began offering hard-to-reach offerings to all participants to further boost conversion and overall completion rates for the survey. A summary of incentives distribution is provided in Table 8.

TABLE 8: SUMMARY OF INCENTIVES DISTRIBUTION

INCENTIVE OFFERING	COUNT OF INCENTIVES ISSUED	COST OF INCENTIVES ISSUED
Virtual Visa gift card	907	$16,753.25

Physical Visa gift card	101	$1,766.03
Donation to Catholic Charities Emergency Food Shelf	122	$1,935.00
Total	**1,130**	**$20,454.28**

The APO requested at survey completion that incentives be issued to participants who didn't initially qualify for an incentive because one of their adult household members did not fully complete the survey. This request was made by the APO to reduce any potential negative perceptions about the survey from these participants. Despite this not being within the initial scope, RSG was able to fulfill this request with additional expense budget that was available given the lower than target response rates to the RMS.

5.0 LESSONS LEARNED AND FUTURE RECOMMENDATIONS

Based on the 2021 RMS data collection effort, the consultant team has noted important lessons learned and future recommendations for the APO to consider regarding key aspects of survey design and implementation.

5.1 SURVEY DESIGN

Participation mode assignment

One key recommendation to consider is whether households are asked to "opt-in" to the smartphone diary, or if they are "assigned" to participate in the diary using their smartphone, because some populations may be more or less comfortable participating using a smartphone app. In future HTS efforts, the APO may consider offering those participants who complete the recruitment stage of the survey online the option to "opt-in" to the smartphone diary and if they prefer not to complete the diary via smartphone then offer the option to complete their travel diary on the website or via the call center. With this design, information on variable incentive offerings (with higher incentive offerings for those that complete using the smartphone app) is provided to the participants alongside the option to "opt-in" to the smartphone diary or not, to still incentivize smartphone participation.

Analysis of response rates and "opt-in" rates for smartphone app data collection has indicated that providing eligible households the choice to opt-in or opt-out of smartphone participation (and thus complete the survey online or through a call center), may result in additional participation from hard-to-survey households or households who may have otherwise chosen not to participate due to privacy or other concerns. The tradeoff is between cost, data quantity, and data quality. Assigning eligible households to participate using their smartphones results in a measurably higher share of smartphone participation than with opt-in but can result in fewer recruited households completing the survey (thus requiring more effort to secure the targeted

sample size). The opt-in approach can increase overall survey conversion rates (the rate of households that signup and go on to fully complete the survey).

5.2 SURVEY IMPLEMENTATION

Incentives

Offering household and person level incentives is the most effective means to increase survey response. Incentives reduce the overall survey costs, as incentive costs more than offset printing and mailing costs. Using differential incentive offerings based on participation mode and demographic data continues to support better representation in the overall sample as was the case for the 2021 RMS.

To further improve representation and overall response in future survey efforts, the consultant team recommends offering a higher standard incentive offering from the outset and a higher differential between the standard and hard-to-reach offering. While the 2021 RMS implemented these updates mid-data collection future efforts can implement these offerings from the outset.

Public Outreach

Based on the outcomes of RMS' outreach effort and feedback received from CBOs during the effort, the consultant team has prepared the following recommendations for the APO to consider as a means to continue building stakeholder relationships and community engagement in APO activities. These recommendations align with the best practices and guidance put forth in the APO's SEP, and include:

- **Share survey results and provide a feedback loop for residents.** Highlight instances where RMS results or data are used for APO activities, so residents can have insight into the use cases for the RMS data. Consider sharing a "thank you" for participating message with the community highlighting key survey findings to continue building community awareness of the APO.

- **Maintain relationships with supporting CBOs.** Send a follow up to CBOs (see Table 5) that provided support promoting the survey to thank them and continue engaging with these CBOs to obtain feedback on additional ways to encourage inclusive participation from residents in regional planning activities.

- **Update the APO stakeholder contact list.** Share key findings from the RMS and next steps for use of the data with stakeholder contacts to keep them aware of future opportunities to be involved in the transportation planning process. Determine if maintaining a similar list of engaged residents would be useful for the APO - the list of RMS participants who reported they would be interested in future surveys could be a good starting point.

These recommendations support the priorities outlined by the APO in the SEP to continue to broaden the agency's inclusive engagement practices in places where underrepresented populations live and work, thereby strengthening two-way relationships between the APO and the communities it represents.

White River Junction & Burlington, VT

Arlington, VA

Chicago, IL

Portland, OR

San Diego, CA

![RSG — the science of insight]

CONTENTS

1.0 INTRODUCTION

Passively collected data has rapidly transformed how transportation agencies plan, operate, and maintain their transportation systems. Yet, there is little practical guidance on how transportation agencies can best use these data to support the development of travel demand models. This memorandum provides a high-level overview of passively collected data in the context of travel demand models and provides practical recommendations for the Saint Cloud APO to consider for their travel demand model update, with a particular emphasis on how StreetLight data can be used to support this effort.

This memo is organized as follows: Section 2 provides an overview of passively collected data and a general overview of how these data can be used to support travel demand models. Section 3 provides specific case study applications detailing how StreetLight data has been used to support travel demand models, and Section 4 provides specific recommendations for the Saint Cloud APO to consider for their travel demand model update.

2.0 PASSIVE DATA APPLICATIONS: CASE STUDIES

2.1 WHAT IS PASSIVELY COLLECTED DATA AND HOW IS IT COLLECTED?

Passively collected data refers to an assortment of technologies that collect location information without overt interaction with the consumer[1]. Over time, several different technologies have generated these data for transportation applications. GPS data generated by in-vehicle navigational devices, such as TomTom, have been used to produce transportation insights for over a decade. More recently, data generated by location-aware applications installed on smartphones—called location-based services data (LBS)—have transformed the passive data landscape in transportation and enabled far more detailed pictures of population movements than were possible with navigational GPS data.

In raw form, passively collected location data are not immediately useful for most transportation applications. However, these data can be processed to provide a variety of metrics for transportation agencies. Numerous techniques exist to do so, but the rudimentary steps are similar. First, trips are identified from sequential location records for a unique device. Device attributes (e.g., the device's home location) are then inferred, and devices are scaled to represent the population. Inferred trips are then joined to some geography, most often consisting of zones and a transportation network, and traffic count data may be used to scale trips to represent population-level movements.

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[1] Source: insights Association. https://www.insightsassociation.org/issues-policies/glossary/passive-data-collection

Transportation agencies rarely purchase passively collected data directly. Rather, agencies most often purchase processed data available from several data-as-a-service (DaaS) companies. DaaS companies may use multiple types of passively collected data and may combine these data with other data sources to develop transportation insights. StreetLight Data is a leading supplier of transportation insights derived from passive data, used by many MPOs across the country.

2.2 HOW CAN PASSIVELY COLLECTED DATA SUPPORT TRAVEL DEMAND MODELS?

Passively collected data can support a wide range of transportation agencies decisions, including planning, operations, and asset management. In the context of travel demand modeling, passively collected data is particularly useful in two areas: supplementing data for household travel surveys and understanding travel for specific sub-populations.

Supplementing household travel survey data

Household travel surveys provide highly detailed information, but typically only sample a relatively small portion of the population, passively collected data provide general travel information for a much larger sample. When passively collected data is paired with survey data to develop travel demand models, the larger samples provided by passively collected data provide a denser origin-destination (OD) matrix, estimate gravity models, support data-driven modeling approaches, and can provide attraction rates for special generators.

- **Passively collected data can complement sparse survey-based OD information.** While traditional household travel surveys may contain observations for 3% or less of the cells in an OD matrix, passive OD data may provide observations for a quarter to a third of the cells in a regional OD matrix. For example, a household travel survey conducted in Chattanooga, TN contained trips in 2% of the regional travel model's OD matrix. In contrast, an OD matrix derived form passively collected data in the region contained trips in 35% of the cells, providing a richer understanding of the spatial distribution of trip in the region[2].

- **Passively collected data can be used to estimate destination choice and gravity models for trip distribution.** Since passively collected provide a much richer source of origin to destination flows, these data can be used to infer friction factors and k-factors for gravity models much more reliably than traditional surveys. Additionally, passively collected data can be used to calibrate spatially-based destination choice models, or can be used in concert with a survey dataset to fully estimate and calibrate a destination choice model.

- **Passively collected data can support data-driven modeling approaches.** Numerous data-driven modeling frameworks have emerged in recent years, such as constant-rich destination choice models and OD pivoting. Data-driven models have recently been implemented at the statewide (e.g., Michigan, Indiana, Tennessee, and Florida) and

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[2] http://tnmug.utk.edu/wp-content/uploads/sites/47/2017/06/Big-Data-2-7-17-Bernardin.pdf

regional scales (e.g., Chattanooga, Ann Arbor, Charleston). It is increasingly recognized that the spatial distribution of trips is among the largest sources of error in travel forecasting, and data-driven approaches have been developed to address this common deficiency of models. However, such approaches require a more robust understanding of the spatial distribution of trips within a region—the type of information that can be provided by OD matrices derived from passively collected data. Further segmentation of OD information, such as by trip purpose, provides additional power in the context of emerging data-driven modeling approaches.

- **Passively collected data can be used to develop attraction rates.** Traditionally, attraction rates for special generators have been estimated using establishment surveys. Passively collected data can provide richer, timelier, and more cost-effective information to develop attraction rates for a travel demand model.

Understanding travel for sub-populations

External, visitor, and freight travel are typically not represented in household travel surveys. In a travel demand model, these types of travel are often represented using special modules that require supplemental data collection systems, such as intercept surveys, that can be expensive, infrequent, and provide limited information. Passively collected data can be used to supplement, and in some cases entirely replace, these data collection efforts.

- **Passively collected data can provide information on external travel.** In the past, understanding external travel patterns required deployment of special equipment, such as license plate cameras and/or labor-intensive methods such as roadside intercept surveys. Passively collected data can not only provide observations on trips to and from the region, but also information on the origins and destinations of inbound and outbound trips. Today, passively collected data are used extensively to better understand and model external travel as it provides additional contextual information on inbound/outbound trips and does so in a more cost-effective manner.

- **Visitor travel can be captured using passively collected data.** Visitor travel can have significant impacts at the regional scale; however, it is often difficult to understand the nature of visitor travel to and within a region. Visitor surveys can be difficult to administer and may provide limited detail on visitor travel behavior. Passively collected data can be used to better understand visitor travel patterns in a region and do so at less cost than traditional survey methods. For example, passively collected data can provide information on the entry/exit mode (i.e., auto vs. flight vs. cruise ship), duration of stay within the region (e.g., less than a day, overnight, multiple night), visitor trip/tour rates and attraction rates, trip/tour lengths, and general OD patterns to support either trip-based or basic tour-based simulation models of visitor travel.

- **Passively collected data can inform freight demand models.** Freight movement is an important component of total transportation demand in many regions, yet data on truck movements with enough detail to support demand modeling can be difficult to obtain. In recent years, numerous freight models have been developed using passively collected commercial truck data to build data-driven freight demand models, at both statewide and

regional scales. Using passively collected data for such models may be a more cost-effective than other data collections methods and be more useful in developing freight models. However, passively collected commercial truck data may be biased towards certain fleets and contains limited information on other attributes such as payload. As a result, commercial truck data are sometimes paired with other data sources, such as commercial vehicle survey data, to provide a complete picture of freight movements in a region.

2.3 HOW CAN PASSIVELY COLLECTED DATA AND SURVEYS BE USED TOGETHER?

While passively collected data provides valuable new insights to help transportation agencies, household travel survey data still provide critical information when developing a travel demand model. Because trips in passively collected data are inferred, contextual information—such as trip mode, trip purpose, and demographics of the traveler—must be inferred. In contrast, surveys provide detailed information on these trip attributes. High-quality household travel survey data are best suited to calibrate travel model components that rely on such trip attributes, such as trip generation and mode choice models. RSG believes that household travel surveys and passively collected data are compliments, not substitutes, and travel models should be developed using all available data.

3.0 CASE STUDIES OF STREETLIGHT DATA APPLICATIONS

To illustrate some of the possible uses of passively collected data highlighted in Section 2, a brief collection of case study applications are summarized below.

Model Calibration Case Studies

- **The Houma-Thibodaux MPO:** The Houma-Thibodaux MPO used StreetLight data to calibrate several components of their travel demand model. In the trip generation component of their model, StreetLight data were used to develop time of day factors. StreetLight data were again used during trip distribution to develop friction factors, and the model trip length frequency distribution was validated using StreetLight data[3].

- **Central Virginia TPO**: A similar process of comparing StreetLight to travel demand model time of day factors was completed while developing the model for the Central Virginia TPO[4].

- **Tahoe Regional Planning Agency (TRPA):** Streetlight data was also used as part of the commuter model calibration. The calibration targets were created from the Census

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[3]http://www.htmpo.org/docs/2045MTPUpdate/finals/HT%20MTP%202045%20Tech%20Report%201%20Model%20Development%20Report%20Final%20v1.pdf
[4]https://connect.ncdot.gov/projects/planning/TPB%20Model%20User%20Groups/07_Understanding%20Model%20Uncertainty.pdf

Transportation Planning Products (CTPP) data and from the Streetlight Data. Streetlight provides data that can be used to estimate the number of work trips between a geographic zone and another geographic zone. One point to note when comparing CTPP data and StreetLight Data is that while CTPP data provides worker flow, StreetLight Data provides work trip flows. Model outputs, which are work trips, were directly comparable to the Streetlight data and for that reason Streetlight data was used as the main calibration target.

- **City of Arlington, VA:** As part of the Rosslyn Transportation Study, the city of Arlington Virginia adjusted the MWCOG travel demand model using StreetLight data to produce traffic assignment and future traffic volume forecasts[5]. O-D data from StreetLight was compared to what was produced from the MWCOG model to begin identifying potential adjustments. It was then determined that StreetLight data was a more accurate source of base year O-D travel patterns and thus the seeding tables that were incorporated into VISUM microsimulation reflected the StreetLight values.

Model Validation Case Studies

- **Madison Area Transportation Planning Board:** The Madison Area Transportation Planning Board used StreetLight to validate the Dane County travel demand model. They used StreetLight to create trip tables for over 100 planning districts in their region and used that data to validate the trip tables from their travel demand model. Prior to using the StreetLight data, they did a comparative analysis of StreetLight data and observed traffic counts to better understand StreetLight's accuracy. Their analysis demonstrated a high statistical similarity between the two data sources which gave them confidence using it in their model[6].

- **Tahoe Regional Planning Agency (TRPA):** StreetLight data were used as part of the model validation, by filling in gaps where the available traffic count data collected by the two state DOTs was not available. As a consistency check on the DOT collected traffic counts and the StreetLight data, the two sources were compared to each other. A comparison was made against StreeLlight counts by computing the R^2, across all the links that had a roadway count information. An R^2 value of 0.97 indicated a strong match between the roadway count data, thus providing confidence in StreetLight count data. Only five of the twenty-five links that had roadway counts had a StreetLight count deviation of 25% or more from the roadway count[7].

External Travel Case Studies

- **Tahoe Regional Planning Agency (TRPA):** The Tahoe region in northern California/Nevada is characterized by a high proportion of non-resident travelers, which include visitors, seasonal residents, and commuters. Therefore, the 2018 update to the Tahoe activity-based travel demand model focused on making improvements to how the

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[5] https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2018/09/DES-Core-of-Rosslyn-2018-08-03_Transportation_Study_Final_Existing_Conditions_Report.pdf
[6] https://www.youtube.com/watch?v=Dzh_C627Hgs
[7] https://trpa-agency.github.io/travel_demand_model/StaticValidation.html

model represented external travel into and out of the region. TRPA, the MPO for the Tahoe region, hired WSP to assist in utilizing StreetLight to enhance the Tahoe model's treatment of external travel. First, StreetLight was used to estimate the external travel composition – the proportion of trips coming to and leaving the region by all different traveler types (e.g. visitor trips, commute trips, resident discretionary trips, seasonal resident trips, thru trips). An *O-D Analysis with Middle Filter* was run on the StreetLight platform to get this output. The output from the OD analysis was used in conjunction with several other datasets, including original household travel survey data to estimate trips by the different traveler types[8].

StreetLight data was also used to estimate external trip lengths. The distance that vehicles travel outside of a region as part of a trip into or out of a region is crucial to calculating total VMT, which is increasingly relevant to agencies due to policies such as California's SB 743. Using an O-D analysis, WSP used StreetLight data to estimate the trip lengths of all trips entering or exiting the Tahoe region. In conjunction with the methodology for estimating external travel composition, WSP was able estimate total VMT for all travelers entering and exiting the Tahoe region[9].

- **The Houma-Thibodaux MPO:** In addition to using StreetLight data for model calibration, The Houma-Thibodaux MPO developed EI, IE, and EE trip matrices were developed using StreetLight OD data, local traffic counts at external stations, and methods described in NCHRP 716[10].

4.0 RECOMMENDATIONS FOR THE SAINT CLOUD APO TRAVEL MODEL UPDATE

RSG recommends that the Saint Cloud APO use all available data when updating the region's travel demand model, including both household travel survey (HTS) data and StreetLight passenger and freight data. RSG also recommends that Saint Cloud APO validate StreetLight data relative to local traffic counts and, if necessary, apply corrective expansion techniques to ensure that StreetLight OD data accurately represent local conditions.

Recommendation 1: Review local traffic count data

Before updating the Saint Cloud APO travel model, RSG recommends that the APO perform a thorough review of traffic count data. Local traffic count data are critical in validating and, if necessary, expanding passively collected data to reflect local travel conditions. It is important to plan and budget for this assessment to avoid unexpected delays in the development of travel models supported by passively collected data. Specifically, RSG recommends that the Saint Cloud APO:

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[8]https://trpa-agency.github.io/travel_demand_model/ExternalStationComposition.html
[9]https://trpa-agency.github.io/travel_demand_model/StreetlightData_Summary.html
[10]http://www.htmpo.org/docs/2045MTPUpdate/finals/HT%20MTP%202045%20Tech%20Report%201%20Model%20Development%20Report%20Final%20v1.pdf

1. Perform a suitability assessment of existing traffic counts in relation to the model network. Important criteria for this assessment include:

    a. Sufficient geographic distribution of counts, by count type (cordon counts, screenline counts, and coverage counts)

    b. Sufficient representation of roadway functional classifications in coverage counts

    c. Sufficient vehicle classification data on traffic count stations that represents the minimum resolution of vehicle classes (i.e., FHWA Scheme F class 1- 3 for automobiles, class 4-7 for single-unit trucks, and class 8-12 for multi-unit trucks).

2. Perform a quality assessment of traffic count data, and clean count data if necessary. Special attention should be paid to:

    a. Appropriate placement of pneumatic counters (e.g., located away from curb cuts, located away from intersection control)

    b. Deployment methodologies of pneumatic counters that may result in poor estimation of vehicle classification (e.g., not properly securing hoses every 3 feet across the roadway, placing a single event recorder on one side of roadway in volume over 10,000 vpd)

    c. Event recorder settings that do not match local driver behavior (e.g., equipment dead-time where no events are recorded after detection for a brief period of time)

    d. Reasonableness of classification counts

Recommendation 2: Ensure StreetLight OD data are aligned with local data

RSG recommends that the Saint Cloud APO compare StreetLight data to local data and, if StreetLight data are not aligned with local data, apply corrective expansion methods. Specifically, RSG recommends that the Saint Cloud APO:

1. Compare StreetLight volumes to local count data and calculate RMSE

2. Spot-check the ten-highest producing zones in the region and ensure local land use supports StreetLight trip rates

3. If StreetLight data are not aligned with local counts and/or land use patterns, apply appropriate corrective expansion methods, including single-factor scaling, Fratar, origin-destination matrix estimation (ODME), and/or parametric scaling

Recommendation 3: Use a mixture of HTS and StreetLight data to support the travel model update

As described previously, survey data and passively collected data have their own strengths and weaknesses. RSG recommends using HTS data to:

1. Estimate trip generation regression models, using variables beyond household size and income to estimate trip generation rates

2. Calibrate mode choice model, using HTS data as calibration targets

Finally, RSG recommends that the StreetLight OD data, calibrated to match local data if necessary, be used to:

1. Calibrate components of the travel model, including trip distribution models, for which calibration using HTS is not recommended

2. Develop a data-driven freight model, integrated with the travel demand model framework using a pivot point procedure

3. Develop an external passenger trips matrix, including internal-external, external-internal, and external-external trips, for the model base year and use the Fratar method to grow these trips in future year scenarios

4. Validate overall model results, including comparisons of model trip length distributions to StreetLight trip length distributions

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