4.0 Revised Work Plan

A. Overall Work Plan

This section provides a detailed work plan and schedule for the six tasks discussed under the Scope of Services in the RFP. This revised work plan incorporates all the changes discussed in mid-to-late October by Cambridge Systematics' staff and the City of Madison staff related to technology use for the on-board survey, and introduction of on-to-off survey counts.

Understanding

The most recent on-board study was conducted six years ago in 2008 and FTA requirements include the need for current and up-to-date on-board rider data in order to calibrate and validate travel forecasting models. The Madison Metro on-board survey will study Metro riders' travel behavior, including their origins, boardings, alightings, and destinations; mode of access and travel purpose; routes used and transferring patterns; and rider demographics. The collected on-board survey data will provide useful insights into the characteristics and behavior of riders and will be used to compare against and complement the data collected in the 2008 on-board survey.

The purpose of this study is to update the existing survey and collect statistically valid and highly reliable data that can be used to make improvements and refinements to the Dane County travel demand model. The survey data collected will also aid in transit service planning for the proposed BRT corridors and will fulfill the needs of FTA's Title VI requirements.

From 2010 to 2013, Dane County has seen a four percent population increase from 488,073 to 509,939 according to U.S. Census estimates. In 2011, Metro recorded its highest annual ridership with 14.9 million rides. In 2013, Metro recorded its second highest annual with 14.7 million rides. With population growth, travel demand increase, economic changes, and need to study enhanced transit service in the region up-to-date transit rider data will be put to good use.

The 2015 on-board survey will include representation of all Metro Transit weekday main line fixed routes excluding University of Wisconsin circulators (Routes 80-84) and Supplemental School Day Service (Roues E, L, M, and W). The survey will include trips between 6:00 am and 9:00 pm.

Approach

Following the award of the contract, a kick off meeting will be organized in late November or early December in Madison to finalize the schedule and the survey technology options to use for the on-board survey, on-to-off counts, and the boarding and alighting counts. This meeting will provide the team with a final opportunity to refine the ideas laid out in this revised work plan proposal and suggest recommendations, if any, to the final data collection approach.

We expect to produce three technical memorandums during the course of the project:

- The Work Plan and Schedule memorandum will be finalized at the end of Task 1 in late December;
- A Survey Plan memorandum that describes both the On-to-Off surveys and the On-board survey will be finalized at the end of Task 2 in mid-January 2015; and
- A memorandum on Survey Design and Boarding and Alighting Counts Design will be developed in late January/Early February.

A complete survey dataset will be developed by early-to-mid-July 2015, followed by a Final Report on September 25, 2015.

Task 1. Overall Work Plan and Project Schedule

The overall work plan will build on the 2008 Madison survey effort carried out by Cambridge Systematics (CS) and UW staff from the TOPS laboratory. CS staff will manage this effort, conduct the analysis and prepare the report relying on the local expertise of UW staff. We also propose to leverage the field supervision and data collection technology options offered by Dikita staff.

The key test will be to identify and customize the technologies that will be used in data collection.

- For the on-board survey, we are proposing a hybrid approach of using a tablet-based personal interview approach for all high priority routes identified by the MPO, and pen and paper-based self-administered survey instruments on all remaining routes. In later sections, we outline the routes selected for the tablet-based approach.
- For the on-to-off counts as well as for boarding and alighting counts, a GPS-driven handheld device will be utilized in conjunction with barcoded paper forms handed out to riders. This device will need to be customized for the routes that are being surveyed and as such will be pre-programmed to improve survey performance.

As we customize the tablet and the handheld options, we will test both the logistics of the effort (especially on busy routes) and the ability to geocode the survey successfully and efficiently. These tests will inform the final work plan and schedule and will influence the deployment of crew staff to maximize the effectiveness of the study.

The implementation schedule and budget will be built around a realistic sampling plan that covers the entire region while focusing on corridors of greater interest. A corresponding resource deployment plan will be developed to optimize team resources. Data from Metro and the Madison MPO, an on-to-off survey of selected routes, and boarding/alighting counts of other routes will be used to develop expansion factors and support the analysis.

The project team will consist of:

- Cambridge Systematics (CS), who will be responsible for the overall administration of the project. In addition, CS staff will manage the development of the sampling plan for both the on-board and on-to-off surveys. Finally, CS staff will oversee the QA/QC process and will be responsible for survey expansion and analysis.

- Dikita Enterprises, who will provide survey supervisors for all survey efforts. In addition, Dikita staff will provide the technology for conducting on-to-off surveys and tablet interviews. In addition, they will conduct training for field interviewers prior to survey implementation.

- UW TOPS lab, who will provide fieldworkers for conducting the different surveys, supervisors to monitor the survey efforts, and manage the day-to-day logistics of the survey effort. In addition, TOPS lab staff will serve as a key local resource for the study.

Task 1 deliverables: Overall work plan memorandum.

Task 2. Develop a Survey Administration Plan

The development of the sampling plan will be the building block for this task. The 2008 survey developed a sophisticated route and block sampling approach that will be further refined for the 2015 survey. The objective will be to cover the entire region while also sampling at a higher rate key routes that will be surveyed using a tablet approach and focusing geographically to sample potentially underserved segments of the population.

The key issues that will be addressed early in the project will include the development of a Quality Assurance/Quality Control approach that includes the sampling plan, the definition of a "complete survey," the representativeness of the sample, and the quality of the data. We will build on the 2008 survey and the plan will address the following elements:

Survey Management Plan

The surveys will be administered in Spring 2015. Surveys will be conducted Monday through Thursday, and we will not survey on holidays or when school is out of session. Surveys will be conducted in English, Spanish, and Hmong on all service types. If there are certain routes with large Spanish and Hmong speaking riders, we will assess the need for having surveyors that speak the language on these routes.

Surveying teams will be deployed on assignments from the early morning hours to the late night hours in order to capture an adequate sample from all time-of-day periods. Our team will train surveyors described in Task 4 (Recruitment and Training of Survey Field Personnel) in order to collect surveys in accordance to the sampling plan. Surveyor crew sizes will vary on an assignment basis and we will ensure that routes/trips with higher ridership will have additional surveyor staff and routes/trips with lower ridership have minimal surveyor staff in order to adequately capture data in a cost efficient manner.

Past experience has shown us that staging data collection operations out of the agency's garage(s) and following the driver runs and vehicle blocks as closely as possible is the most effective and efficient course of action. We also intend to use transfer points and other major transfer locations across the service area as assignment starting locations, as necessary. Regardless of the designated beginning point, staff will be met at that location by their supervisor to distribute their materials/equipment and to ensure that they have boarded the correct bus. Surveyors will typically return to their beginning locations and be met by the supervisors to return all material and debrief.

We will have supervisory staff in the field managing the survey crews, ensuring that individuals are properly trained, equipped, dressed accordingly, and performing as expected.

We will monitor surveying and sampling on a daily basis in order to meet all sample goals:

- If we find that the goal has not been met, we will conduct additional research, within reason, where there was an inadequate number of surveys and possibly sample 1-2 extra trips.
- We will also monitor status on short trip riders and underrepresented populations daily to ensure that we are capturing a true and accurate representation of Madison Metro riders.
- We will also ensure that interviewers are handing out surveys and/or conducting interviews without any bias by examining the data as collected by individuals and also through supervisor spot checks (ride-alongs) in the field.

Staffing Plan

In concert with the City of Madison project manager, the Cambridge Systematics team will design a staffing and dispatch plan that covers all time periods and ensures complete coverage of routes. Due to the wide range of time periods that need to be sampled, the Cambridge Systematics team will establish a secure survey handling approach that will ensure that the right number of surveys is distributed on the right routes. In case there is a missed route, or a surveyor is unable to complete their planned shift, the UW team will identify a replacement for another comparable date and time on that route.

A minimum of two surveyors will be assigned to each shift allowing for maximum coverage of riders. For trips that are expected to have 30 or more riders per trip, we may need to have a third person on the bus to record boarding and alighting count data. We will finalize the crew allocation after completing the pretest and Task 2.

Sampling Plans

On-to-Off Sampling Plan. The on-to-off sampling plan will be limited to only those routes for which the on-to-off counts will be conducted.

- The routes covered include: 2, 3, 4, 5, 6, 10, 13, 14, 15, 16, 18, 19, 28, 30, 38, 40, 47 and 70. The routes selected either have over 500 riders a day or were deemed as critical routes by the City of Madison.

- About 20 percent of all trips between 6:00 a.m. and 9:00 p.m. on routes listed above will be surveyed with a goal of collecting on-to-off data from a majority of riders on these trips.

- The sampling will be conducted by route, direction, and time-of-day to ensure that the data collected from the on-to-off survey are truly representative of transit rider patterns in the region.

On-board Sampling Plan. The on-board sampling plan will be broken down into two categories – one each for the tablet routes and the pen-and-paper survey. The key elements of the sampling plans include the following:

- Both plans will be block-based to take advantage of bus interlining in Madison.

- The plans will cover all time periods between 6 00 a.m. and 9:00 p.m.

- The surveying will be distributed by route, direction, and time-of-day to ensure that the data collected are truly representative of transit rider patterns in the region.

- Data collected through the pen and paper surveys will be substantially the same as data collected through the tablet surveys.

- Boarding and alighting counts will be conducted during the interviews for routes not included in the on-to-off sampling plan.

- Since routes that will be surveyed by personal interview (tablet) will have a lower completion rate per trip, more trips for these routes will be included in the sampling plan. Routes that will be included in the tablet portion of the survey include: 2, 4, 5, 6, 13, 16, 18, 20, 21, 22, 32, 40, 50, 51, 52, 67, and 70. Routes 1, 3, 10, 11, 12, 14, 15, 17, 19, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 44, 47, 48, 49, 55, 56, 57, 58, 71, 72, 73, and 75 will use pen and paper surveys.

- We will target collecting nearly 4,500 usable surveys from this effort. It must be noted that these 4,500 surveys will be distributed among tablet and pen-and-paper based surveys. As part of the sampling plan, CS staff will analyze the data from the previous on-board survey in greater detail to determine the completion rate by route group. This information will be used to determine the number of trips that will need to be sampled.

- Crew allocation plans will also be developed based on a combination of key considerations including: ridership per trip, on-to-off counts on that route, and tablet vs. self-administered route.

Definition of Usable Surveys

Complete Survey. One of the primary uses of the on-board survey will be to help validate the Dane County regional travel model and properly reflect the transit flows in and around the Madison area. To meet these objectives, the on-board survey needs to describe the transit trip in its entirety. A complete survey also requires some critical socioeconomic characteristics and trip purpose information as follows:

- "Full" information is provided on the origin, boarding, alighting, and destination questions. Data will be provided through direct answers, responses inferred during the coding process, or responses aided by the handheld laptops.
- Trip purpose questions including "COME FROM" and "GOING TO."
- Data on modes of access and egress.
- Extent and patterns of transferring between buses.
- Auto availability in the household.

In addition to the minimum information included in this list, data on household size, household income, age, gender, and race will be very useful to better describe the riders' socioeconomic profile.

Model Usable Survey. For clients in Minneapolis and Cincinnati, we have developed two datasets – one for modeling and planning that require complete information about the trip and a second dataset that can be used for customer segmentation and overview that do not require complete information about the trip. We will apply a similar approach in Madison.

Operational Plans and Coordination

Tracking Performance. By utilizing technology during data collection, we will be able to monitor surveyors and counters performance. We run reports on a daily basis to ensure that productivity requirements are being met, there is no associated bias in passenger selection, and that the data being collected is legitimate, reasonable and qualified to be included in the final sample. Additionally, the Field Supervisors will conduct spot-checks on survey staff in the field in order to observe performance and ensure that proper procedures and protocol are being adhered to. Documentation recorded by the supervisors is collected each day by the project manager, including missed assignments, personnel issues or subpar performance, bus breakdowns, and assignment makeups.

FTA Review. FTA staff will review the survey instrument and the sampling plan and their comments will be incorporated in the survey design and fieldwork to the extent possible.

Design Considerations. Surveys will be serially numbered and also have two barcodes to allow scanning of the surveys at the boarding and alighting locations of each respondent. The barcode scanners will provide better control of survey logistics, provide QA/QC on provided boarding and alighting information, and could help augment missing information on boarding and alighting locations.

Technology Overview

On-Board Tablet Surveys. As Origin and Destination studies have evolved within the last few years, technology now allows for the capturing and scrutinizing of passenger travel patterns in real time using tablet-based data collection. Dikita has been able to program the survey

questionnaire into a proprietary tablet software solution. The most recent version of the tablet software (eTrip©) does not require the Internet to interactively geocode in the field.

An important feature of Dikita's program is the illustration of passenger-supplied geographical addresses at the POI, using maps to visually display a narrative that reviews the passenger's geographic responses (in-field geocoding). With each agency, Dikita customizes their software to meet the needs of the service area.

The key benefits from using personal computer tablets for data collection include the following:

- Capability of preloading all stops with latitude and longitude data;
- Origin and Destination locations can be geocoded in real time;
- Self-selecting survey bias can be reduced, particularly relating to riders with low English proficiency;
- Instant validation routines allow the interviewer/respondent to make fewer errors;
- Data entry is eliminated and post-data collection processing is minimized; and
- Daily evaluation of route-by-route adherence to the target sample size is possible for each route, time-of-day, and direction.

Some of the weaknesses of using tablets for data collection include the following:

- A personal interview is required on-board the bus, which could pose a problem especially on busy routes with considerable crowding.
- Surveyor productivity based on past studies is estimated at four complete surveys per hour, significantly less than paper surveys, with a higher associated cost per survey.
- There is a tradeoff between survey quality and quantity.
- Surveyors need to undergo specialized training with the tablets and sensitivity training when dealing with information that may be overheard by other riders.

For routes surveyed with tablets, surveying staff will choose random individuals to survey based on a pre-defined algorithm. They will ride with the person and personally ask them the questions on the survey form and enter the data in real time. Individuals who refuse to take the survey will be offered an opportunity to fill out the survey via paper to be mailed via pre-paid envelope or online at their own time.

On-Board Self-Administered Pen/Paper Surveys. For routes surveyed with self administered pen and paper survey forms, surveying staff will attempt to hand out a survey to each person who boards the bus. Passengers will be encouraged to fill out the survey and return it when they get off. If they are not willing to do that, they will be offered an opportunity to mail the

form back via pre-paid envelope or enter the data online at their own time. This procedure has been implemented in Madison for past surveys.

On-to-Off Counts. For the on-to-off counts, we will develop a barcoded handout that will be scanned twice by surveyors: first at the bus-stop that the rider boards the bus, and second at the bus-stop where the rider alights from the bus. This will allow the survey team to develop a boarding-to-alighting database for every rider that participates in the survey. For routes where the on-to-off counts will not be conducted, surveyors will count boardings and alightings by bus-stop.

Task 2 deliverables: Survey plan memorandum.

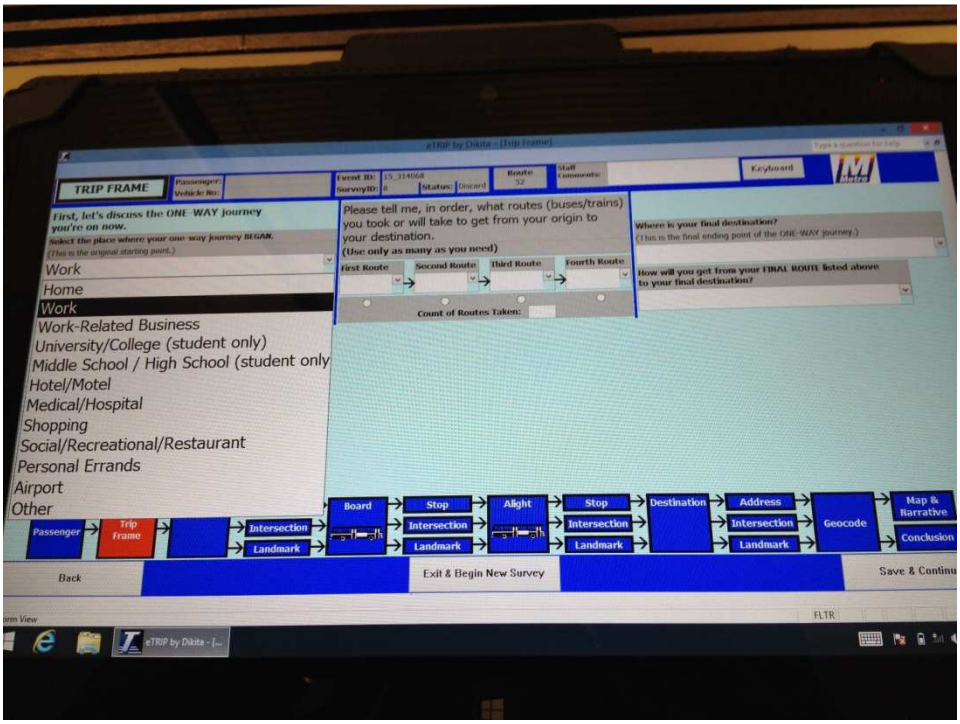
Task 3. On-board Survey and Boarding and Alighting Counts Design

Survey Design. Cambridge Systematics will lead the design of the survey form and will present a draft to the City of Madison using as a starting point the 2008 Madison survey. Information that is customarily collected in on-board surveys and has already been coded in the tablet option is not expected to significantly change and includes the following:

- Origin and destination;
- Modes of access and egress;
- Boarding and alighting points;
- Trip purpose and mix of activities;
- Bus lines used in today's trip with emphasis on the extent of transferring;
- Fare payment used
- Frequency of travel and use of transit in a typical week; and
- Socioeconomic characteristics (sex, age, race/ethnicity, household size, number of workers, household income, driver's license, and cars available).
- Finally, we will collect e-mail addresses from riders interested in participating in future marketing research. This will provide Madison Metro with an electronic dataset of riders likely to participate in future survey research studies.

Figure 4.1 shows the an example layout of the tablet-based survey.

Figure 4.1 Layout of Tablet-Based Survey



In the 2008 on-board survey, the boarding and alighting locations of the "first" bus on the trip were collected. In the recent past, there is a growing awareness of the need to expand survey data by groups of bus-stops. To facilitate this type of expansion, we recommend collecting boarding and alighting location on the route on which the survey was administered.

In addition to these traditional questions, some very limited *attitudinal statements* collected in earlier Metro survey efforts may be used. Riders will be given an opportunity to express feedback or general comments as well.

On-to-Off Counts.

For the on-to-off counts, we will develop a barcoded handout that will be scanned twice by surveyors: first at the bus-stop that the rider boards the bus, and second at the bus-stop where the rider alights from the bus. This will allow the survey team to develop a boarding-to-alighting database for every rider that participates in the survey. This database will then be used to support survey expansion. Based on references suggested by the FTA, we anticipate that we will collect on-to-off counts from 75-90 percent of riders on trips where the on-to-off counts are administered. A full list of routes on which the on-to-off counts will be conducted is included under Task 1. The on-to-off counts will be conducted separately from the on-board survey.

Boarding and Alighting Counts

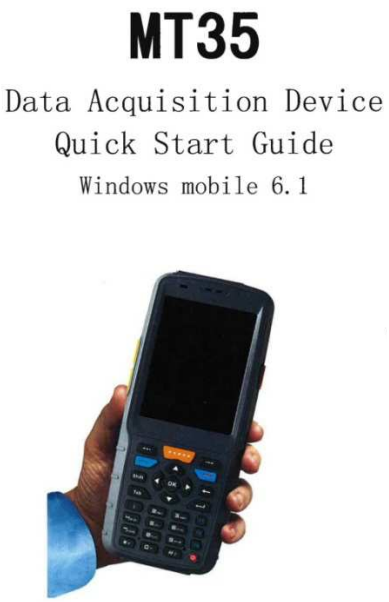
Boarding and alighting counts will only be conducted on routes for which on-to-off counts were not administered by the on-board survey crews. Complete farebox boarding count data and

some APC alighting count data will be provided by Metro Transit. The 2008 survey used a combination of fare card data for boardings and direct counting of alightings to come up with detailed patterns of ons and offs at the route, direction, time of day and stop level. Crew members were asked to keep track of the number of alightings at a bus stop level, and to record the survey numbers that were handed out on each route of their bus block run.

For the 2015 Madison boarding and alighting counts we propose to use Ridecheck Plus, a handheld device that runs a software application. It allows us to import routes, stops, time-points, patterns, garages, blocks, runs, and scheduled trips from different scheduling software systems. This approach automates the collection, validation, cleaning, analysis, and reporting of boarding and alighting data. Furthermore, Ridecheck Plus employs GPS technology to advance each stop automatically as the bus travels along the route. This system ensures accuracy and efficiency in recording passenger counts.

Figure 4.2 shows the handheld device. This device has been used successfully in Minneapolis and Memphis. A pretest of the device will be done to evaluate the strengths and weaknesses of this approach versus the traditional pen and paper methods.

Figure 4.2 Handheld Device



CS will be responsible for providing all surveying and sampling materials, including electronic devices, pens, paper, clip boards, etc.

Task 3 deliverables: Survey form designs

Task 4. Recruitment and Training of Survey Field Personnel

To recruit surveyors, the University will post a position description through the UW Job Center and work closely with the University of Wisconsin Transportation Society student organization.

As this effort will closely mirror the successful recruitment of surveyors in 2008, we do not anticipate substantial recruitment challenges.

Once hired, each employee will be required to complete one day of classroom training and one day of technical in-field training using the selected devices. Survey staff will be tested at least once during the classroom session to ensure that they understand the information taught.

The team will develop a customized, project-specific Interviewer Training Manual and training video that will outline the project's purpose, questionnaire intent, administrative matters, transit terminology, survey equipment, data collection procedures, and daily routines. The information covered in training will include understanding the bus system, passenger schedules, how to use the handheld devices and tablet computers, what data to collect and its importance, how to read a block paddle or a driver's schedule, how to randomly sample, how to minimize bias, how to ascertain their location in order to accurately record data, military time (if necessary), instructions on how and where to board the correct bus, the importance of promptness, personnel issues, security and safety concerns, how to handle certain questions or situations, and what activity is acceptable between trips. This training will be offered at least three times, at a convenient location arranged by UW staff at the TOPS laboratory.

We will ensure that we train an appropriate amount of bi-lingual (Spanish and Hmong) survey staff in order to place on routes appropriately in comparisons with the Spanish and Hmong population. We strongly encourage employees to adhere to a uniform dress code consisting of dark pants or skirts, and collared white shirts or blouses. We avoid extremes in hairstyle or clothing, piercings, and tattoos. We also do not allow use of cell phones, MP3 players, or any other distractive items while working. Surveyors will also be trained to use other techniques to promote participation by stressing the importance of data collection to the specific route they are surveying and appealing to community pride.

Our supervisors will be seasoned individuals from our current staff. We conduct a training exercise with all field employees in order to get acquainted with the transit system, personnel, questionnaire, expectations, and sampling targets.**Task 4 deliverables**: Interviewer training manual and videos.

Task 5. Survey Administration

UW staff and students will carry out the proposed sampling plan, supervise and conduct all aspects of on-to-off and on-board survey data collection, and supervise and conduct both the data entry (for paper survey responses) and the quality assurance/quality control of the survey data entered. All the survey field personnel would have received training before administering the surveys. Dikita will provide supervisors for the survey effort as well.

All Metro Transit main-line fixed-routes will be sampled and surveys will be spread throughout the service span on weekdays. An on-board survey will be handed out to bus riders. Respondents will be asked to fill out the survey form while on board and will be given the option of returning it via prepaid mail or filling it out online using a computer. On pre-determined routes, personal interviews will be conducted using tablets by the survey teams.

Additionally, passenger boardings and alightings by bus stop will be counted for routes with no on-to-off counts.

The project team will follow the sampling plan outlined in Task 2. UW staff will board the buses and will hand out surveys to all riders boarding the bus. UW staff will also use spreadsheets with route and stop information provided by Cambridge Systematics to record the number of riders getting on and off at each bus stop. Tablets will also be used on selected routes to conduct personal interviews of the riders. In addition, the project team will:

- Collect, group together and store the paper versions of the survey for subsequent data entry.
- Forms documenting nonresponse rates will be stored together with the survey returns from each block.
- UW staff will enter data for all collected surveys using the web-based data entry form that will be developed by Cambridge Systematics and will be hosted on the web using a Cambridge Systematics server.
- The Ridecheck data will directly upload boarding and alighting count data into an electronic database.
- UW staff will summarize profile of non-respondents for each sampled block. UW senior staff will conduct quality assurance/quality control checks to ensure the quality of data entered and to help resolve any questions.

Contingency. If the equipment malfunctions, we will employ a contingency plan to collect the data by paper. We will continuously recruit students to mitigate any shortage of surveyors (UW students). If we have vehicles that breakdown in the field, we will reassign missed work. To ensure that sufficient number of well trained personnel is available for survey conduct, the Cambridge Systematics team will conduct detailed sessions with student personnel at the University of Wisconsin. Team member Jason Bittner, who supervised the 2008 survey during his employment at the University, will oversee the training sessions.

Task 5 deliverables: Scans of completed paper forms.

Task 6. Data Processing and Analysis

The lasting value of the survey will depend on meeting a number of objectives during the database development and analysis of the survey data:

6.1. Data Entry. Data collected using the tablet approach will be uploaded electronically at the time of data collection. For routes where surveys are collected using self-administered pen and paper surveys, data will be entered by UW students to an internet-driven data management engine. CS will manage the design and maintenance of this program. This data management software will also provide respondents with a means to complete their surveys

online if not enough time was available to complete the personal interview on the bus. This will help capture information from riders that are on the bus for a very short duration.

6.2. Sample Expansion. The dataset will be carefully weighted by route and by direction, time of day, and geography so that the expanded survey dataset reflects the transit rider population and transit trip making pattern/characteristics (?) in the region.

This sophisticated approach to weighting and expansion was first introduced in the 2008 on-board survey. It results in a more representative sample and helps address in part the under-representation of riders on short transit trips.

The same expansion approach is proposed to be used in the 2015 survey and will be presented to the FTA for its review and approval. We also propose extending this methodology by conducting expansion for groups of bus-stops (as opposed to large planning districts). Further, for routes where the on-to-off counts were collected, we will use these data in expansion.

6.3. Geocoding. For surveys that use computerized tablets, geocoding will be conducted in real-time and no additional processing will be necessary. For the pen and paper surveys, detailed geocoding is critical. We propose using a combination of ArcGIS, TransCAD and Google-based platforms to successfully conduct geocoding. We will download either from the Web or from Madison Metro, a list of places of interest that can greatly enhance our landmark-based address mapping.

6.4. Survey Analysis. The data will be analyzed and presented at the route level to provide a snapshot of the rider population and the profile of the riding public at the route level.

The 2014-2015 survey data will be analyzed in the same manner as the 2008 survey and contrasted with it to identify not only changes in total and route-level ridership but also to measure any potential changes in the profile of the rider segments across individual routes or routes operating in specific corridors.

This analysis is expected to focus more heavily on key routes and corridors that were considered during the BRT planning study. A larger number of observations will be targeted for collection along these routes to provide more insights on the origin-destination patterns of these riders and the advantages of BRT service to these market segments.

In preparing this proposal, Cambridge Systematics staff used a new statistical and geographic analysis software program to develop individual profiles for all Madison routes based on the 2008 survey. In this section we provide a glimpse of this analysis for selected routes which can be further customized for the upcoming study. In Figures 4.3 to 4.8, we provide a snapshot of each route in terms of the following attributes:

- Ridership patterns that include AM and midday route ridership, the distribution and number of origins, boardings, alightings and destinations of route riders;
- The trip purpose and the activities at both the origin and destination locations;

- The frequency of riding transit and the method of payment;
- The patterns of transferring from and/or to another bus route; and
- Socioeconomic characteristics including vehicle availability, number of licensed drivers in the household, income, age, race, and gender.

Figure 4.3 Riders Surveyed on Route 2

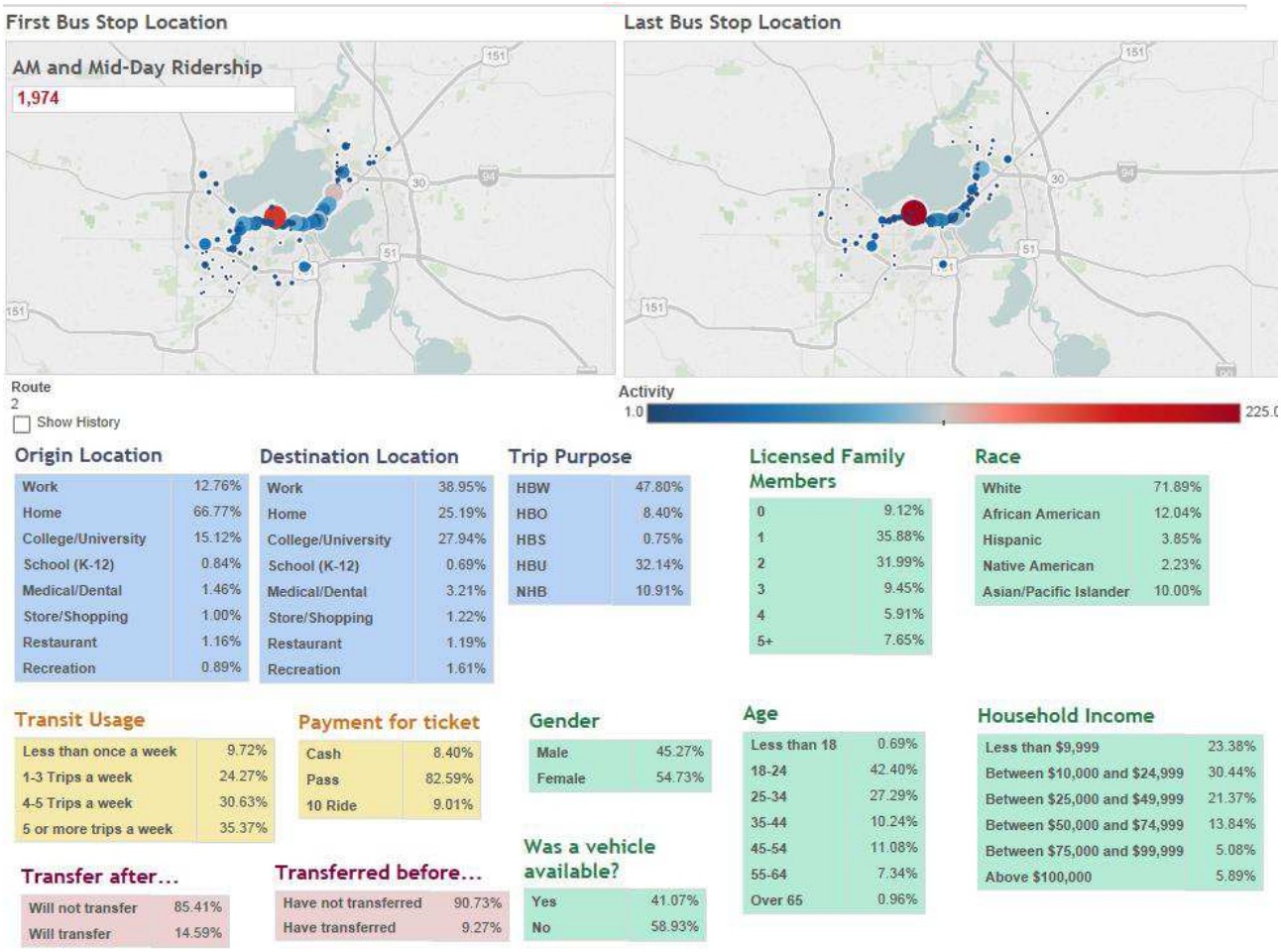


Figure 4.4 Riders Surveyed on Route 4

Origin Location

Work	10.03%
Home	69.16%
College/University	14.69%
School (K-12)	0.84%
Medical/Dental	0.87%
Store/Shopping	0.69%
Restaurant	2.16%
Recreation	1.54%

Destination Location

Work	36.56%
Home	23.31%
College/University	20.48%
School (K-12)	6.74%
Medical/Dental	4.29%
Store/Shopping	1.34%
Restaurant	5.77%
Recreation	1.51%

Trip Purpose

HBW	40.82%
HBO	12.47%
HBS	5.97%
HBU	30.00%
NHB	10.75%

Licensed Family Members

0	15.85%
1	37.36%
2	34.73%
3	6.87%
4	2.03%
5+	3.16%

Race

White	71.34%
African American	20.69%
Hispanic	3.47%
Native American	1.07%
Asian/Pacific Islander	3.44%

Transit Usage

Less than once a week	10.00%
1-3 Trips a week	28.41%
4-5 Trips a week	29.79%
5 or more trips a week	31.80%

Payment for ticket

Cash	17.14%
Pass	70.70%
10 Ride	12.16%

Gender

Male	48.44%
Female	51.56%

Age

Less than 18	4.08%
18-24	30.89%
25-34	22.46%
35-44	13.08%
45-54	15.00%
55-64	13.02%
Over 65	1.46%

Household Income

Less than $9,999	27.35%
Between $10,000 and $24,999	33.17%
Between $25,000 and $49,999	21.41%
Between $50,000 and $74,999	8.85%
Between $75,000 and $99,999	6.48%
Above $100,000	2.74%

Transfer after...

Will not transfer	78.57%
Will transfer	21.43%

Transferred before...

Have not transferred	83.25%
Have transferred	16.75%

Was a vehicle available?

Yes	39.75%
No	60.25%

Figure 4.5 Riders Surveyed on Route 18

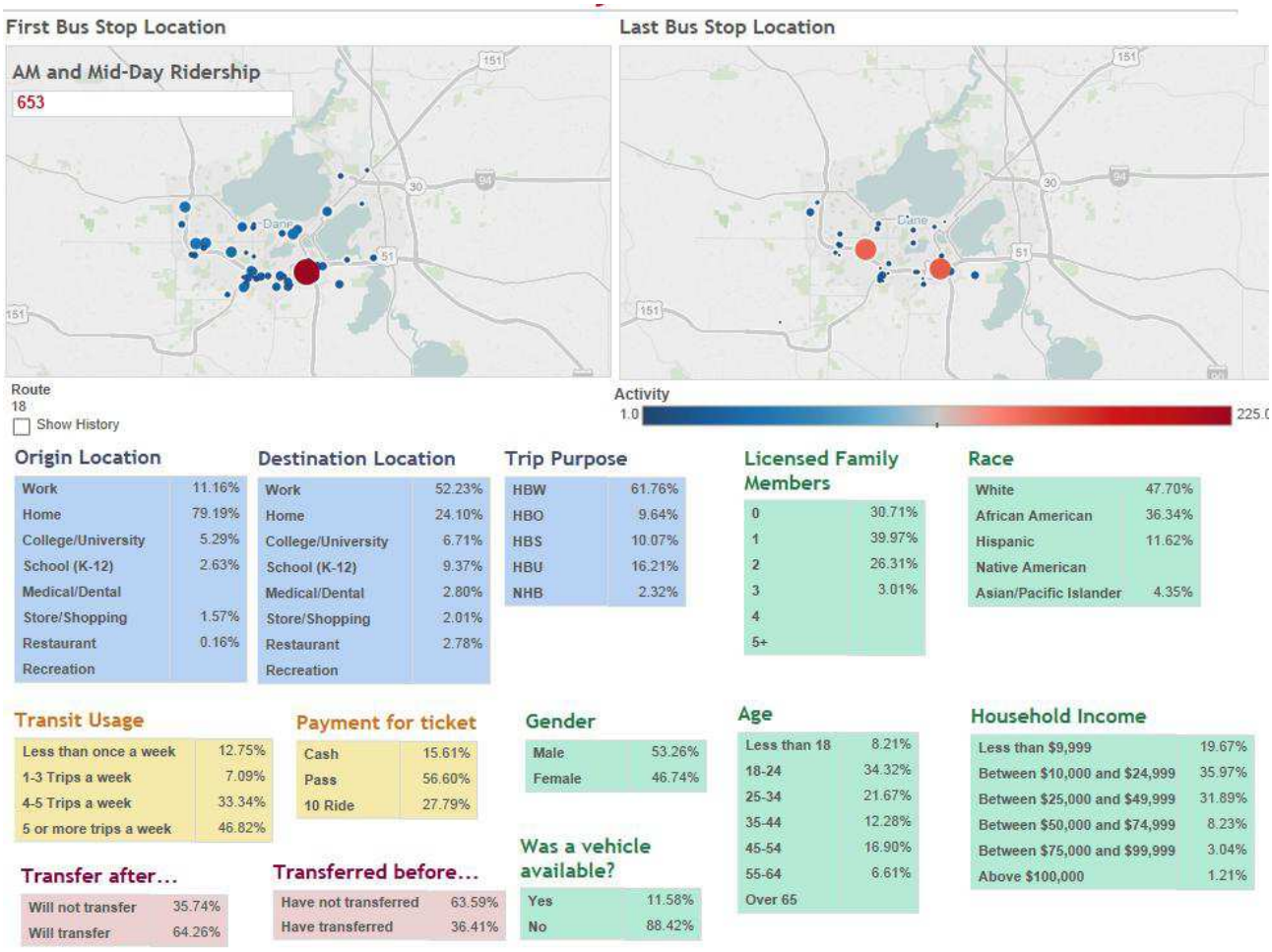
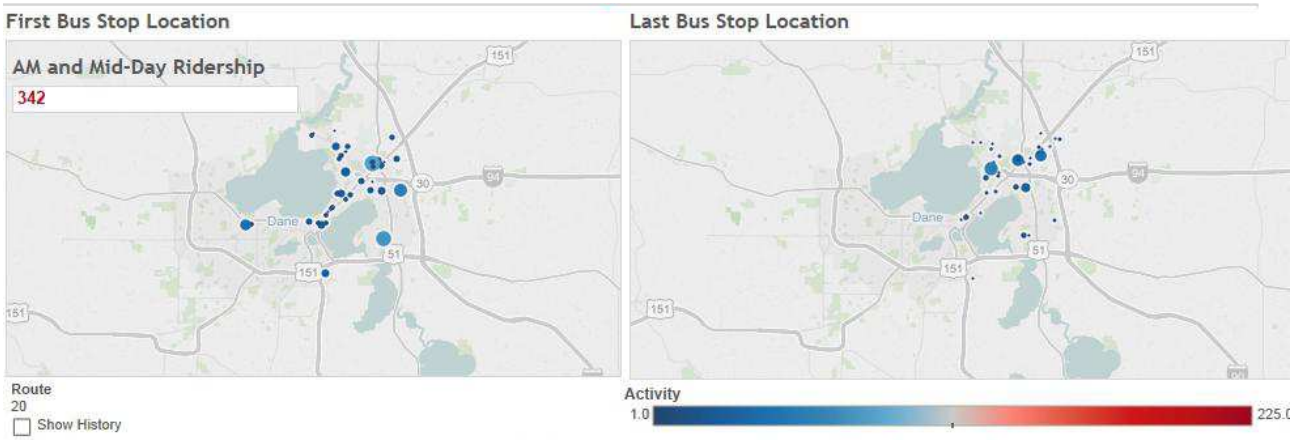


Figure 4.6 Riders Surveyed on Route 20



Origin Location

Work	5.97%
Home	58.63%
College/University	20.01%
School (K-12)	12.88%
Medical/Dental	
Store/Shopping	2.15%
Restaurant	0.37%
Recreation	

Destination Location

Work	16.26%
Home	36.36%
College/University	20.83%
School (K-12)	11.18%
Medical/Dental	
Store/Shopping	0.46%
Restaurant	12.79%
Recreation	2.14%

Trip Purpose

HBW	23.98%
HBO	16.47%
HBS	4.54%
HBU	42.48%
NHB	12.53%

Licensed Family Members

0	20.19%
1	36.59%
2	33.11%
3	6.31%
4	2.95%
5+	0.85%

Race

White	63.16%
African American	31.27%
Hispanic	5.58%
Native American	
Asian/Pacific Islander	

Transit Usage

Less than once a week	6.04%
1-3 Trips a week	39.81%
4-5 Trips a week	37.55%
5 or more trips a week	16.60%

Payment for ticket

Cash	19.26%
Pass	77.76%
10 Ride	2.97%

Gender

Male	63.27%
Female	36.73%

Age

Less than 18	17.27%
18-24	33.89%
25-34	9.74%
35-44	10.66%
45-54	22.19%
55-64	5.48%
Over 65	0.77%

Household Income

Less than $9,999	15.45%
Between $10,000 and $24,999	29.66%
Between $25,000 and $49,999	37.51%
Between $50,000 and $74,999	14.31%
Between $75,000 and $99,999	2.07%
Above $100,000	1.00%

Transfer after...

Will not transfer	55.63%
Will transfer	44.37%

Transferred before...

Have not transferred	54.19%
Have transferred	45.81%

Was a vehicle available?

Yes	15.33%
No	84.67%

Figure 4.7 Riders Surveyed on Route 21

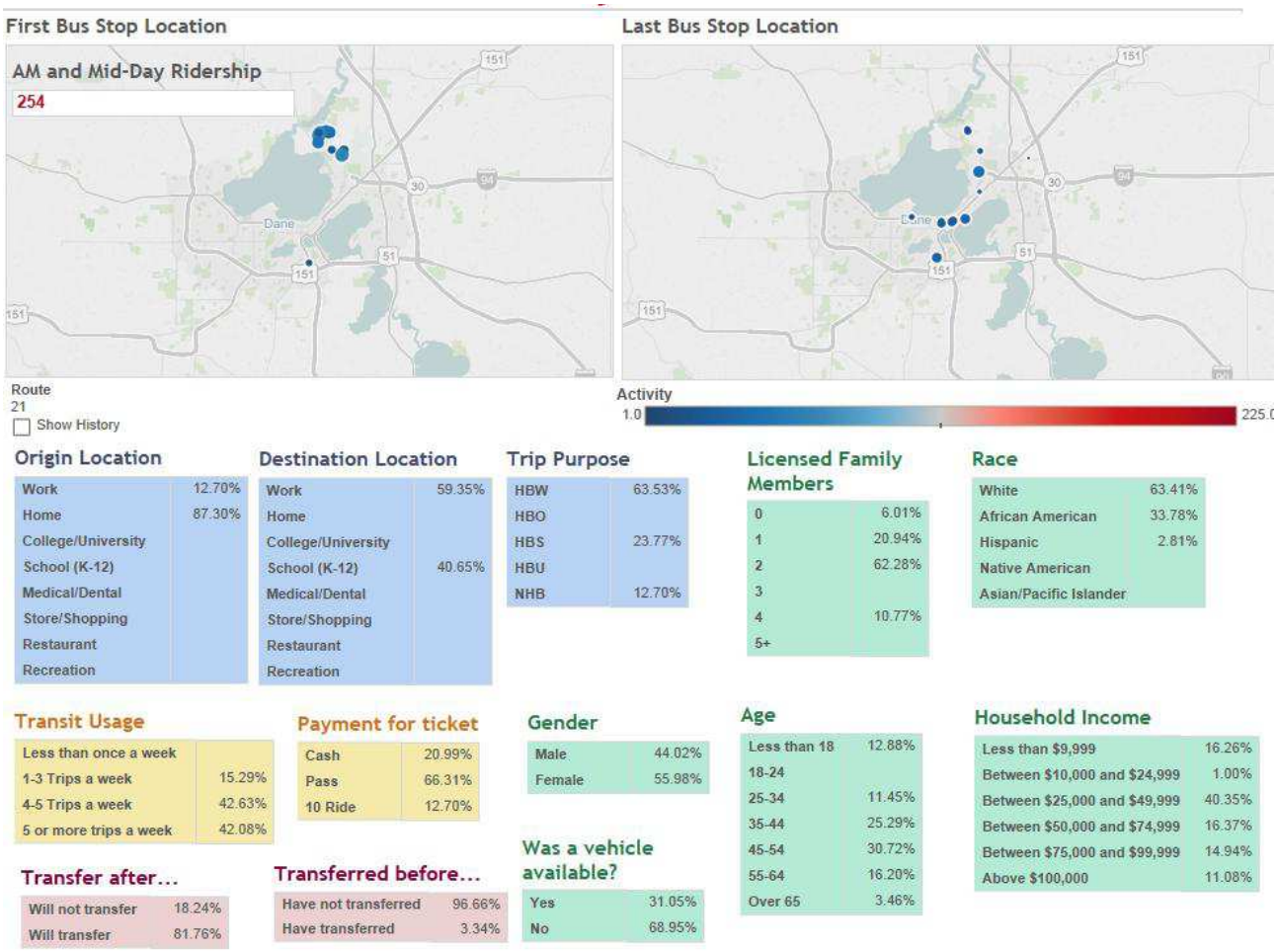
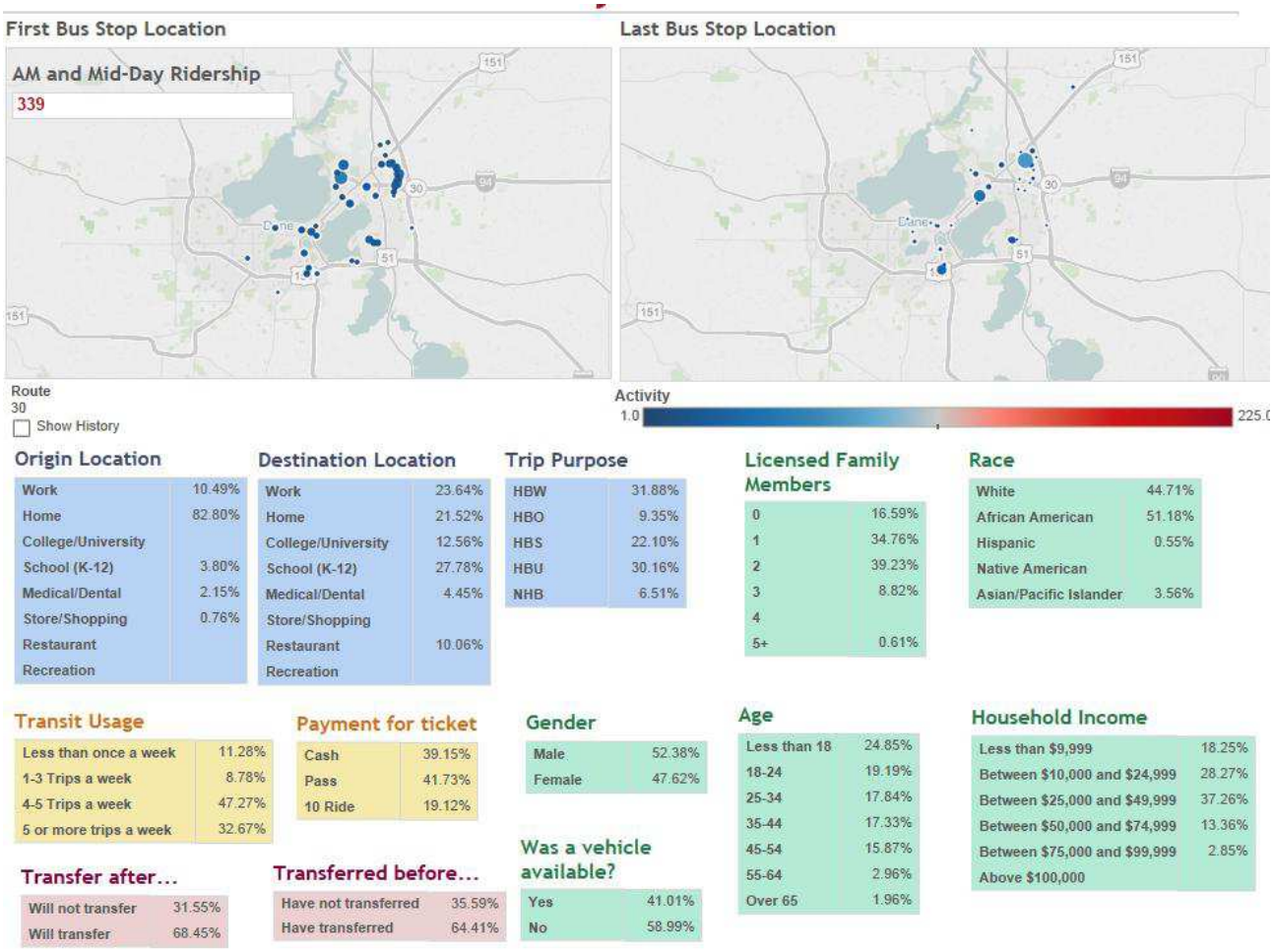


Figure 4.8 Riders Surveyed on Route 30



The importance of these snapshots is that they provide not only useful information at the route level but also help us contrast routes at a given point in time. Further, these tabulations can be used to support Title VI analysis at a very detailed level:

- The large share of African American riders on Routes 30, 21, 20, and 18;
- The high incidence of low-income riders on Routes 2 and 4;
- The low percentage of riders transferring on Routes 2 and 4;
- The high percentage of Hispanics on Route 18; and
- The large number of University related travel on Routes 2, 4, 20, and 30.

These analyses are important in and of themselves since they provide a snapshot of the entire Metro system allowing us for relative comparisons across routes and rider segments. These comparisons can also yield useful insights to support the planning for the 2014-2015 survey by understanding the make-up of each corridor.

We propose to develop route-specific profile for both the 2008 and the 2015 surveys. These would be very useful to help identify changes not only in ridership but also potential changes in the underlying composition of ridership – any new socioeconomic market segments in each corridor, a new mix of purposes served, or a shift in the origins and locations of riders using the route.

6.4. Quality Assurance and Quality Control. There are various elements of quality assurance/quality control. In this section we outline our approach to Data Entry, Boarding and Alighting Counts, and Field Crew Management.

QA/QC for On-to-Off Surveys and Boarding and Alighting Counts. As discussed earlier, handheld devices will be synchronized nightly to ensure that the previous day's data will be available for review every morning. Daily review will enable the Field Supervisors to provide feedback and corrections to the ride-checkers in a timely manner. Boarding and alighting counts collected on each trip will be reviewed and checks will include:

- No boardings at the last stop of the trip. No alightings at the first stop of the trip.
- Approximately equal number of boardings and alightings per complete trip.
- Ensure that the boarding locations in the on-to-off counts are before the alighting location. This is especially critical since the Madison system employs an interlining system that switches between routes and directions.
- Comparing the boarding and alighting counts by bus stop against surveys to ensure that the surveys collected by bus-stop do not exceed the counts reported for that stop.
- Examination of the data for reasonableness based on past passenger counts.
- Ridecheck Plus checks that include:
  - Automated advancing to the current bus stop;
  - Ability for the ride-checker to record a physical count of the passenger load; and
  - Flagging of unreasonable data entered, such as 100 passengers recorded as boarding at a stop.

We will also evaluate each trip for consistency, ensuring that any passengers still on the bus at the end of one trip are carried over to the beginning of the next one, in accordance with Madison Metro's policies. All trips will be ridden from beginning to end to obtain a full passenger count. For every on-board crew completing interviews, there will be a counter counting passengers boarding and alighting at every stop.

QA/QC for the On-board Survey. As discussed earlier, the use of tablets for collecting data during the on-board passenger survey allows us to code data in real time and minimize the majority of post process coding.

Our tablet devices are preprogrammed so that all data elements are attributed with coded values as the data are being collected. To ensure completeness, required questions may not be skipped until an answer is provided by the respondent. Built-in logic checks will also be programmed in order to validate the data while the survey is being conducted. If a response is not logical, it can be corrected during the interview by the interviewer.

Our program will flag for the surveyor any nonrealistic responses:

- Boarding a stop that is not on a particular route or not in the correct sequence according to the direction of travel;
- Transfer routes are quickly evaluated by the program by employing an algorithm that calculates distance and time;
- Round trips are flagged if a passenger's purpose is the same in the origin and destination data; and
- Logical checks are flagged such as not having a license/vehicle but agreeing that a vehicle was available to drive or having more workers in the household than household size.

QA/QC for Data Entry. Our approach to data entry QA/QC will include the following steps:

- Entry of all surveys into a database;
- Downloading of data from field computers into the database;
- Associating the scanned serial and handheld information with each survey;
- Geocoding all questions with an address or intersection using the latest technologies discussed in Section 6.2;
- Obtaining latitude and longitude and code TAZ using the Madison shape files;
- Conducting quality checks based upon reasonableness, maximum and minimum limits for each variable, flagging of nonexisting route numbers, logical checks, comparison of stated boarding, and alighting with data from handhelds;
- Collecting and storing address information of previously entered landmarks;
- Conducting several different attempts to geocode through a series of different methods, depending upon the quality of the address information supplied by the respondent; and
- Cross tabulations, graphics, and tabular reports during the QA/QC and reporting phase.

Task 6 deliverables: Final report and data set.