



2013 Metropolitan Area Planning Agency External Travel Survey

SUMMARY REPORT

Prepared by

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DECEMBER 2013

Acknowledgments

There were a number of individuals who contributed to and assisted with this study and the preparation of the final report. Michael Felschow, the MAPA project director, provided guidance and assistance throughout the duration of the study. Robert Nassour and Patricia Nassour at Gram Traffic Counting Inc. were instrumental in the development and execution of a data collection plan to meet the needs of this study. Darrell Borchardt, Darryl Puckett, and Mike Vickich, of the Texas A&M Transportation Institute, provided invaluable expertise for the Bluetooth data collection. Other key Texas A&M Transportation Institute personnel involved in this study include Rick Davenport who assisted with the development and implementation of the public awareness campaign, Brad Hoover who developed the web-based survey interface, and Chris Simek who assisted with the survey development and survey public awareness. John Henry, also of the Texas A&M Transportation Institute, helped with the preparation of the final report. The contributions of these individuals are acknowledged and appreciated.



U.S. Department
of Transportation
**Federal Highway
Administration**



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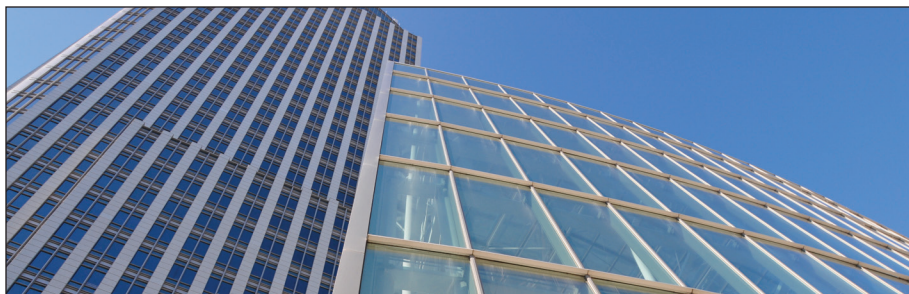
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INTRODUCTION

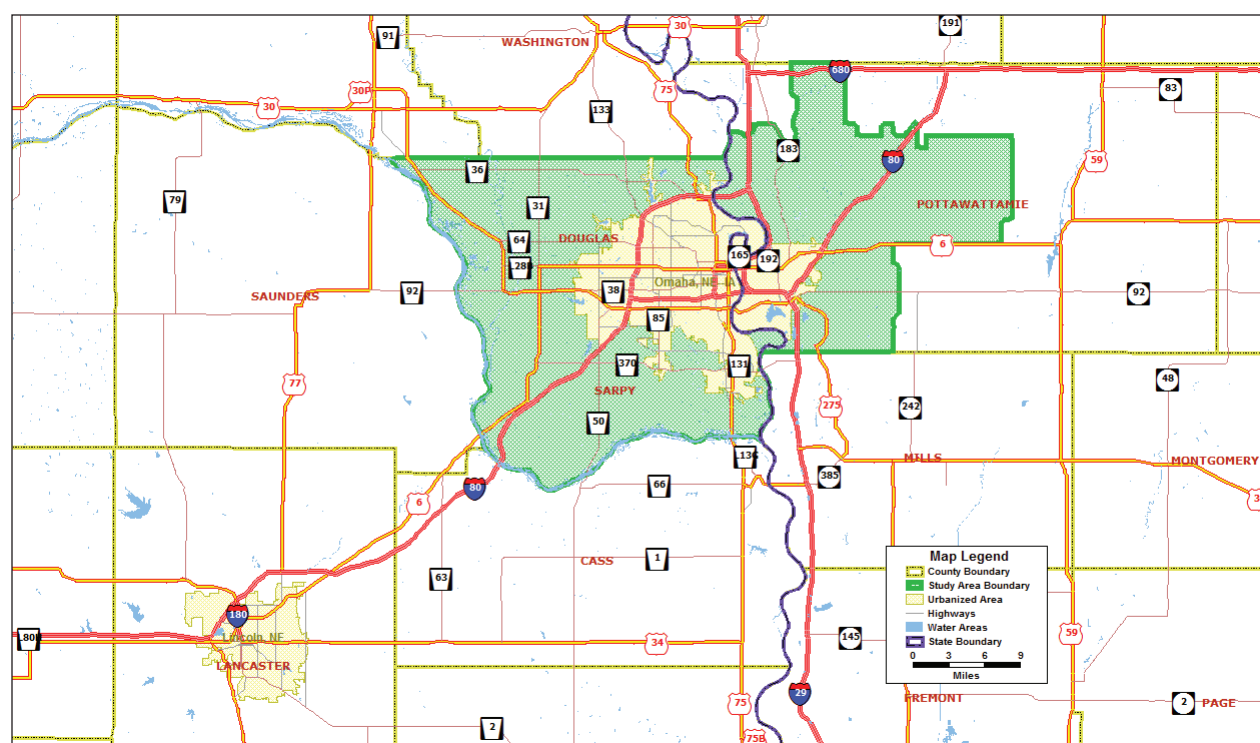
In 2013, the Metropolitan Area Planning Agency (MAPA), in conjunction with the Federal Highway Administration (FHWA), the Nebraska Department of Roads (NDOR), and the Iowa Department of Transportation (IDOT), sponsored an external travel survey for the Omaha/Council Bluffs metropolitan area. The purpose of the survey was to measure and identify travel patterns into, within, and out of the greater Omaha metropolitan area, which is comprised of the entirety of Douglas and Sarpy counties (Nebraska) and portions of Mills and Pottawattamie counties (Iowa). This report presents a summary of the 2013 MAPA External Travel Survey and documents the data collected and the analysis results for the area.

MAPA STUDY AREA

The study area, as shown in Figure 1, is comprised of Douglas and Sarpy counties in Nebraska and portions of Pottawattamie and Mills counties in Iowa. The city of Omaha has a 2012 estimated population of 419,000, while the city of Council Bluffs has a 2012 estimated population of 62,100.

The purpose of the survey was to measure and identify travel patterns into, within, and out of the greater Omaha metropolitan area, which is comprised of the entirety of Douglas and Sarpy counties (Nebraska) and portions of Mills and Pottawattamie counties (Iowa).

Figure 1. MAPA Study Area.



There are 25 locations on the border of the MAPA study area identified as external stations.



EXTERNAL STATIONS

There are 25 locations on the border of the MAPA study area identified as external stations. These locations are transportation facilities that cross the study area boundary and represent where travelers may enter and exit the study area. Figure 2 shows the location of the external stations in the Omaha metropolitan area, and Table 1 identifies the external station locations and the 24-hour traffic count at the location. Of the 25 locations, three were not included in the data collection plan due to their low traffic volumes. Those locations are stations 122-124.

Figure 2. MAPA External Station Locations.

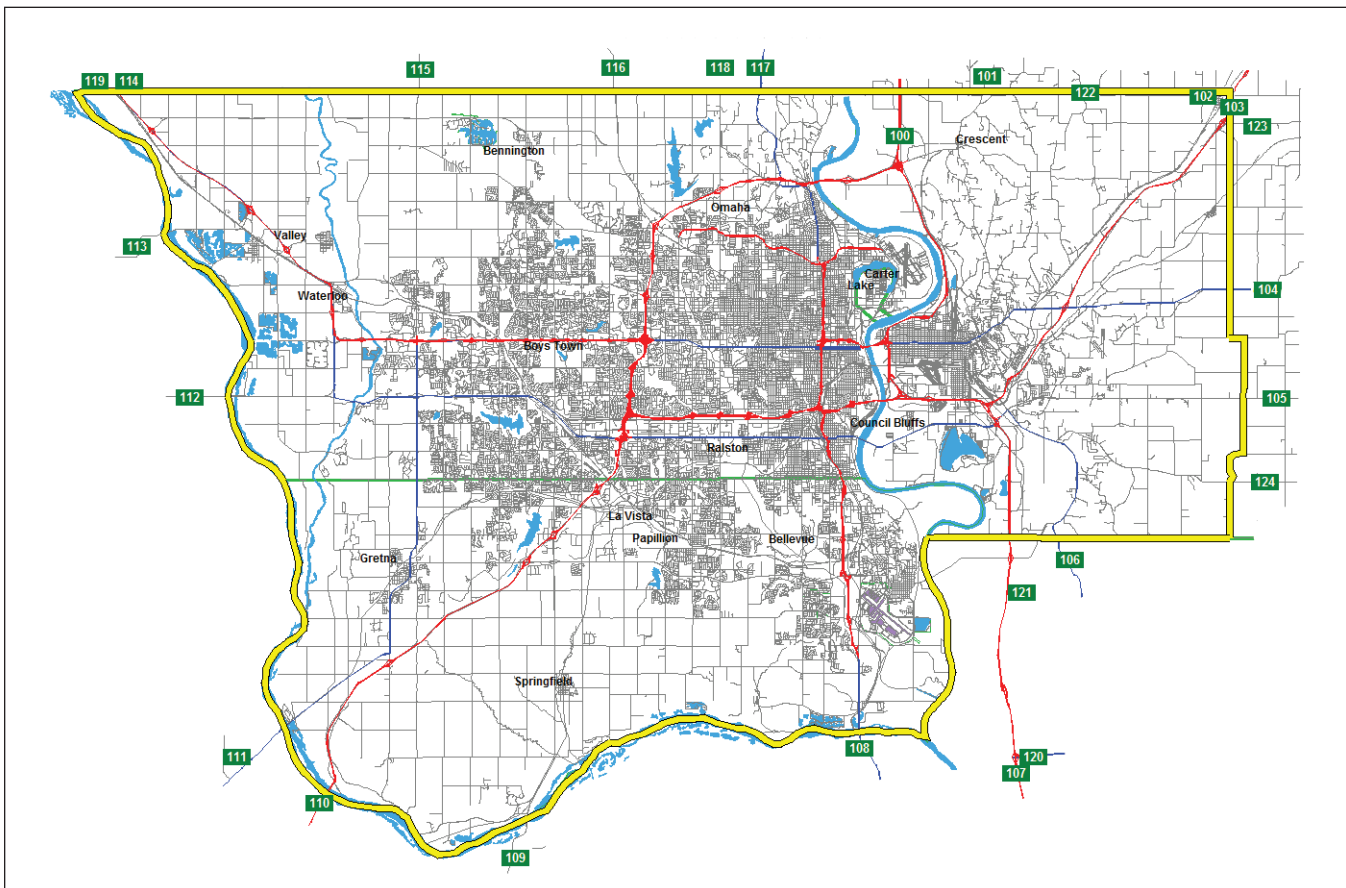


Table 1. MAPA External Stations.

Site #	External Sites	Inbound Count	Outbound Count	Total
100	I-29	12,948	11,665	24,613
101	Lincoln Highway (Old 183)	1,549	1,570	3,119
102	Railroad Highway	1,011	984	1,995
103	I-80	11,224	11,805	23,029
104	US 6	1,840	1,839	3,679
105	IA 92	3,967	4,655	8,622
106	Wabash (Old 275)	1,784	1,889	3,673
107	I-29	11,693	12,332	24,025
108	US 75	10,197	11,708	21,905
109	NE 50	4,040	4,058	8,098
110	I-80	24,428	22,356	46,784
111	US 6	3,681	3,674	7,355
112	NE 92	4,148	3,309	7,457
113	NE 64	1,088	828	1,916
114	US 275	7,789	7,790	15,579
115	NE 31	1,289	1,311	2,600
116	NE 133	5,421	4,801	10,222
117	US 75	3,736	3,761	7,497
118	72nd St	846	826	1,672
119	Old Hwy 275 (Reichmuth)	2,258	2,253	4,511
120	US 34	5,349	5,283	10,632
121	195th St	699	733	1,432
122	Mahogany	N/A	N/A	N/A
123	Magnolia	N/A	N/A	N/A
124	Pioneer Trail	N/A	N/A	N/A
Total		120,985	119,429	240,414

The MAPA survey project included a media and public outreach plan to help educate the public and local community leaders about the survey and its importance.



MEDIA AND PUBLIC OUTREACH

The MAPA survey project included a media and public outreach plan to help educate the public and local community leaders about the survey and its importance. The plan provided public-friendly information about the purpose of the survey, an overview of the methods used to collect data, and its uses and benefits. The following efforts and activities were conducted as part of the media and public outreach plan.

- A media advisory and a media release were developed and issued prior to data collection and activation of the web survey.
- A press conference was held by MAPA and the project team for print, radio, and television media.
- A survey ‘Talking Points’ information sheet was developed and provided to agency officials, community leaders, and the media. This write-up provided summary information and key points about the survey that were used for answering questions from the public and media.

On Thursday, April 18, 2013, a media advisory was sent to print, radio, and television media outlets to announce a ‘first-of-its-kind’ region-wide travel survey in the Omaha-Council Bluffs metropolitan area.

- Contact was made with local and state law enforcement agencies to inform them about the survey and to provide them the information they needed to ensure the public that the survey was legitimate and important.
- Extensive efforts were made to contact local business and agencies in the MAPA study area to request their assistance in the survey by asking them to encourage their employees to take the survey. As part of this effort, a letter to local business and agency leaders was sent to all members of the Greater Omaha Chamber of Commerce. Separate letters were developed and sent to the Mayors of Omaha and Council Bluffs and the President of the Chamber of Commerce.
- A postcard handout about the survey was developed and it was distributed to area businesses, hotels/motels, and the public. It provided key information about the survey and a link where the survey could be taken on-line.
- A toll-free number was established to answer questions from the public about the survey.

Figure 3. Press Conference at MAPA Office.



Media Release and Press Conference

On Thursday, April 18, 2013, a media advisory was sent to print, radio, and television media outlets to announce a ‘first-of-its-kind’ region-wide travel survey in the Omaha-Council Bluffs metropolitan area. The purpose of the advisory was to inform the media that a news conference would be held at the MAPA offices on Monday, April 22 to discuss the upcoming survey. Prior to the news conference, a press release was issued by MAPA providing more information and detail about the travel survey to be discussed at the news conference. A copy of the press release is included in the Appendix.

Key officials from MAPA, NDOR, IDOT, the City of Omaha, and the Project Team attended the press conference and provided information about the survey and answered questions from the media. MAPA’s Executive Director, Mr. Greg Youell, led the press conference. As a result of the news conference, several of the area’s media outlets printed or aired stories about the travel survey. Omaha television news stations KETV – Channel 7, KMTV – Channel 3, and WOWT – Channel 6, all aired positive, substantive stories about the survey and encouraged public participation. After the stories had initially aired early in the week when the survey began, the stations re-aired their respective stories later in the week upon request by the project team.

SURVEY METHODOLOGY

In the past 5 to 10 years, traditional roadside intercept interviews have become a rarely used method for external surveys in the U.S. and abroad due to concerns related to traffic safety and delay. Similarly, the use of video mail-out/mail-back surveys are also being used less in recent years due to privacy concerns raised by obtaining addresses of vehicle registrants from state motor vehicle records. The inability to utilize these (previous) traditional survey methods have state agencies and MPOs across the country grappling with how to collect external travel that is needed for model input. In many areas, they are simply not collecting this data or are using old data, or are borrowing data from another community.

The practice of how to conduct external surveys is in a state of transition. While there have been numerous external studies across the country using new technologies such as cellular data mining, GPS, and Bluetooth, there is currently no standardized or widely accepted means of collecting or developing external travel survey data within the travel survey community.

The purpose of the MAPA external survey was to collect information and data elements that are needed as input to MAPA's travel demand model. Key data and information needed from the survey included:

- External to External (E-E) trips – E-E Trips are those that travel through the study area, where the trip starts and ends outside of the study area. E-E trips enter the study area at one external station and then exit the study area at another external station.
- External to Internal (E-I) trips – E-I Trips are those that begin outside of the study area and end inside the study area.
- Internal to External (I-E) trips – I-E Trips are those that begin inside the study area and then end outside of the study area.
- Residency Information – Information to determine if the person responding to the survey lived inside or outside of the study area.
- Trip Purpose – Information to determine if the trip was home-based work (HBW), home-based non-work (HBNW), or non-home-based (NHB).

A combination of nine (9) survey methods and data collection activities were utilized to conduct the MAPA external survey and collect all information and data needed. Bluetooth technology was used for collecting E-E trip data. Intercept surveys, a post-card handout, and a web based survey were primarily used to capture data on I-E/E-I trips (although these methods picked up a small amount of E-E trips).

The MAPA survey is the first external survey in the country to utilize this combination of survey methods. It is also the first external survey in the country to utilize a community web survey as part of an external survey. Table 2 summarizes the survey methods and data collection activities used, where they were used, and what data were collected, and Figure 4 shows the general data collection approach utilized for the MAPA external survey.

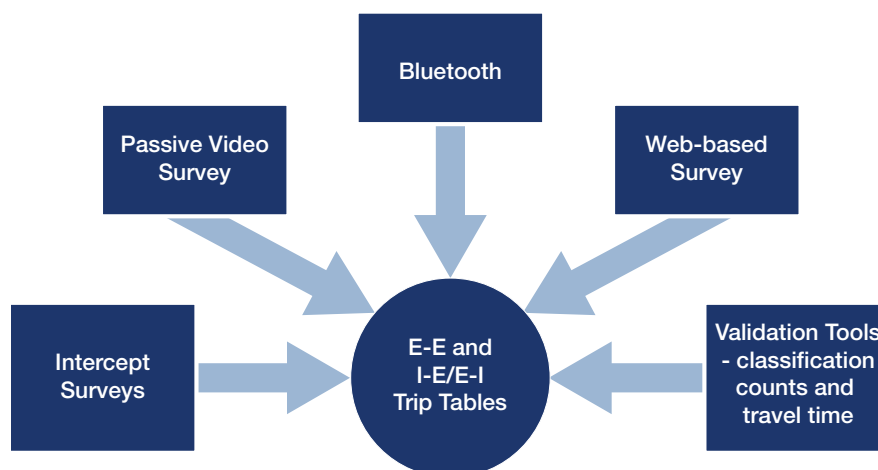


The purpose of the MAPA external survey was to collect information and data elements that are needed as input to MAPA's travel demand model.

Table 2. Survey Methods and Data Collected.

Survey Method	Location	Data Collected
Bluetooth Data Collection, External Locations	At 25 external survey sites around periphery of study area	E-E trip movements
Bluetooth Data Collection, Internal Locations	At 9 highway site locations inside of study area	Travel patterns on selected routes inside study area
Community Web Survey	Community wide, hosted on MAPA's web site	E-E and I-E trip movements, trip purpose, residency
Video Data Collection and License Matching	Primarily external highway survey locations, but some internal highway locations	Residency information
External Intercept Surveys	At rest areas, truck stops, convenience store/gas stations near external stations that agreed to participate in study	E-E and I-E trip movements, trip purpose, residency
Internal Intercept Surveys	At major retailers inside the study area that agreed to participate in the survey	E-E and I-E trip movements, trip purpose, residency
Postcard Handouts	Distributed at all major hotels/motels inside the study area	E-E and I-E trip movements, trip purpose, residency
Travel Time and Delay Studies	Travel time runs between a sample of nine (9) external station pairs	Acceptable travel time thresholds between external stations
Vehicle Classification Counts	At all external Bluetooth survey locations as well as some locations inside the study area	24-hour vehicle classification counts in 1 hour increments by direction.

Figure 4. Survey Methods and Data Collection Approach.



Prior to implementing the data collection activities, permits were obtained from the appropriate jurisdictions. The permits allowed for the deployment of the various data collection equipment that was utilized in this study. Since some of the equipment was deployed and left unattended during the data collection window, it was important that those agencies that might receive inquiries about the equipment be notified. As a result, state and local law enforcement agencies were also notified about the survey effort. The notification also included the dates of the survey, the location where equipment was deployed, and a brief description of the equipment.

The following sections provide more detail on the survey methods and data collection activities in the MAPA survey. For each method or activity, information is provided on survey preparation, coordination, and site selection.

Bluetooth Data Collection

Bluetooth is a widely used, open standard, wireless technology for exchanging data over short distances. The technology is frequently embedded in mobile telephones, Global Positioning Systems (GPS), computers, and in-vehicle applications such as navigation systems. Each Bluetooth device uses a unique electronic identifier known as a Media Access Control (MAC) address. Mobile Bluetooth readers were deployed at the 25 external survey stations illustrated in Figure 2 and listed in Table 1. At each location, the Bluetooth units captured the MAC addresses of vehicles that emitted a Bluetooth signal as they passed by the station. By comparing and matching the MAC addresses between all stations, the Bluetooth data collected (in combination with vehicle classification counts) was used to develop the estimated E-E movements for the MAPA study area. This data collection method provided estimates of the amount of travel between each external station and all other external stations, which is a key piece of information needed for model input. A more detailed explanation and discussion of how and when the Bluetooth data were collected and analyzed is provided in the *Development of External Travel Estimates* section of this report.

In addition to placement of Bluetooth readers at all 25 external survey stations, mobile Bluetooth readers were also deployed at 11 locations inside the study area. Data collected from these locations were used to assess travel movements on many interstates and highways within the MAPA study area. Similar to the external locations, the exact locations for internal Bluetooth sites were established by MAPA and the project team and the data were collected on the same day that Bluetooth data were collected at the external locations.

Community Web Survey

A community-wide web-based survey was developed in conjunction with MAPA and it served as an important component of the MAPA external survey project. The web survey was designed to capture I-E/E-I trips that in years past were captured at roadside intercept survey (external station) locations. The survey began with a welcome screen that explained the purpose of the survey. The survey included a map of the MAPA study area that highlighted the study area boundary and identified the locations of the 25 external stations around the periphery of the study area. Referring to the map, the survey asked persons about information on a trip they made into or out of the study area for the previous day's travel. At the beginning of the survey it was requested that the survey was "only to be taken by persons who had crossed the study area boundary" via a trip that went into or out of the study area. Persons who traveled inside the study area but who did not cross the study area boundary were not requested to participate in the survey. The web survey was accessed via a link on MAPA's website. The survey included a total of 12 questions; key among these included:

- The approximate location of where they lived;
- The approximate location of where they worked;
- If their trip was 'into' or 'out of' the study area;
- Locations where their trip began and/or ended; and
- Questions on travel mode, vehicle type, vehicle occupancy, and trip purpose.



**Bluetooth is a widely used,
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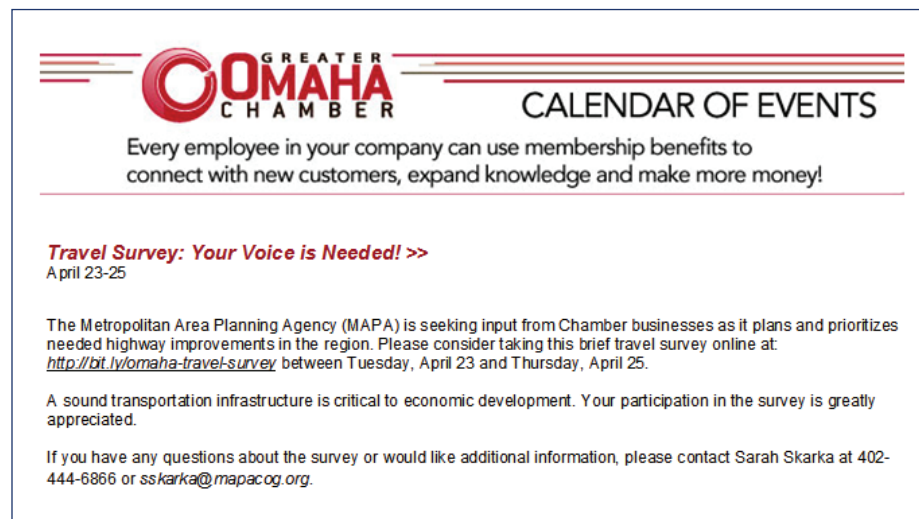
A draft of the web survey was developed for MAPA's review and input prior to it being finalized and activated. The survey was designed for persons to proceed through it as quickly and seamlessly as possible. It was developed using an interactive Google map, which allowed persons to click on the map to provide the approximate location of their trip origin or destination (depending on their direction of travel). This point and click method facilitated taking the survey since it did away with the need for persons to type in cross streets or street names and numbers. The logos of the survey sponsors – MAPA, NDOR, IDOT, and FHWA – were included on the first screen and throughout of the survey to add legitimacy to the survey and provide a 'local' and 'official' look.

Various methods were used to help publicize the web survey (and other survey efforts) and direct the public to its link on the MAPA's website. As previously noted, a press conference was held that resulted in television and radio coverage that publicized the link and MAPA developed a letter to area business leaders, which was distributed by the Omaha Chamber of Commerce. This letter encouraged businesses to send an e-mail to their employees encouraging them to take the survey via a link provided in the e-mail. A copy of the e-mail that the Chamber sent to its members about the survey is shown in Figure 5.



The survey was designed for persons to proceed through it as quickly and seamlessly as possible.

Figure 5. Chamber of Commerce E-mail to Local Businesses.



The primary means to obtain public participation in the web survey was through the area's major employers. This approach involved contacting employers, explaining the purpose and importance of the travel survey, and requesting that they send (broadcast) an e-mail to their employees asking them to take the survey via a link provided in the e-mail. To determine which employers to contact to request assistance with the survey, a listing of the Omaha region's top 54 employers (in terms of number of persons employed) was obtained from the Greater Omaha Economic Development Partnerships. Contact information for a top or key person or official was obtained via the internet or a call to the company or agency. MAPA personnel were able to provide the contact information for most of the public agencies on the listing. Table 3 provides a list of the area's top employers and the outcome of the contact that was made with each.

Table 3. Major Employers for MAPA Survey.

No.	Company	Employees	Notes
1	Offutt Air Force Base	7,500+	No contact made. Attempted and make contact by phone.
2	Alegent Health	7,500+	E-mail sent, also visited site spoke with a manager/official.
3	Omaha Public Schools	5,000-7,499	Phone contact made and e-mail sent.
4	The Nebraska Medical Center	5,000-7,499	E-mail sent, also visited site spoke and with a manager/official.
5	Methodist Health System	5,000-7,499	No contact made.
6	University of Nebraska Medical Center	2,500-4,999	E-mail sent, also visited site spoke and with a manager/official.
7	First Data Corp.	2,500-4,999	Visited site and was able to speak with contact from reception area.
8	Union Pacific	2,500-4,999	Visited site, but was unable to speak with someone without appointment.
9	First National Bank of Omaha	2,500-4,999	Visited site, but was unable to speak with someone without appointment.
10	West Corp.	2,500-4,999	No contact made.
11	ConAgra Foods	2,500-4,999	E-mail sent.
12	Mutual of Omaha	2,500-4,999	No contact made.
13	Creighton University	2,500-4,999	E-mail sent and called and left voicemail.
14	University of Nebraska at Omaha	2,500-4,999	Called and left voicemail. Also visited site and spoke with a manager.
15	Millard Public Schools	2,500-4,999	Spoke by phone with contact and also sent e-mail.
16	City of Omaha	2,500-4,999	Sent MAPA letter and e-mail to offices of Mayor and three other city officials. Also visited Mayor's office and spoke with a representative.
17	PayPal Inc.	2,500-4,999	No contact made.
18	Omaha Public Power District	1,000-2,499	E-mail sent and called and left voicemail.
19	Omaha World-Herald	1,000-2,499	E-mail sent.
20	Douglas County	1,000-2,499	Spoke by phone with contact and also visited county offices.
21	TD Ameritrade	1,000-2,499	E-mail sent.
22	Metropolitan Community College	1,000-2,499	Spoke by phone with contact.
23	Omaha Airport Authority	1,000-2,499	Spoke by phone with contact.
24	Nebraska Furniture Mart	1,000-2,499	E-mail sent.
25	Papillion-LaVista Schools	1,000-2,499	Spoke by phone with contact.
26	Children's Hospital & Medical Center	1,000-2,499	
27	Harrah's Council Bluffs	1,000-2,499	E-mail sent.
28	Valmont Industries	1,000-2,499	E-mail sent.
29	Boys Town	1,000-2,499	E-mail sent.
30	Bellevue Public Schools	1,000-2,499	Spoke by phone with contact and sent e-mail.
31	Lozier Corp.	1,000-2,499	No contact made.
32	Ameristar Casino Council Bluffs	1,000-2,499	E-mail sent.
33	Marriott Worldwide Reservations	1,000-2,499	No contact made.
34	CSG Systems	1,000-2,499	No contact made.
35	Blue Cross & Blue Shield of Nebraska	1,000-2,499	E-mail sent.
36	Creighton University Medical Center	1,000-2,499	E-mail sent.
37	US Army Corps of Engineers	1,000-2,499	Called and spoke with an administrative assistant.
38	Council Bluffs Community Schools	1,000-2,499	Spoke by phone with contact and sent e-mail.
39	Cox Communications	1,000-2,499	No contact made.
40	Westside Community Schools	1,000-2,499	Talked to administrative assistant and sent email.
41	Verizon Wireless	1,000-2,499	No contact made.
42	ACI Worldwide	1,000-2,499	E-mail sent.
43	Bank of the West	1,000-2,499	E-mail sent.
44	HDR	1,000-2,499	No contact made.
45	InfoGroup	1,000-2,499	E-mail sent.
46	Bellevue University	500-999	Talked to administrative assistant and sent email.
47	Tyson Foods	500-999	No contact made.
48	Wells Fargo	500-999	E-mail sent and called and left voicemail.
49	Elkhorn Public Schools	500-999	Called and left voicemail.
50	Gallup	500-999	No contact made.
51	Iowa Western Community College	500-999	Left VM and sent email.
52	Sarpy County	500-999	Called contact and left voicemail.
NA	MAPA	< 500	Sponsor - no contact needed.
NA	NDOR	< 500	Phone, e-mail, and in-person contact made.
NA	Iowa DOT	< 500	Phone, e-mail, and in-person contact made.
NA	Omaha Chamber of Commerce	< 500	Letter sent to Chamber President by MAPA.
NA	City of Council Bluffs	< 500	Sent letter developed by MAPA and e-mail to Mayor. Also visited Mayor's office and spoke with a representative.
NA	Pottawattamie County	< 500	Spoke by phone with contact and sent e-mail.



Prior to traveling to Omaha to field the survey, an attempt was made to contact each major employer by phone and/or e-mail to inform them about the survey and request that they assist with the survey.

Prior to traveling to Omaha to field the survey, an attempt was made to contact each major employer by phone and/or e-mail to inform them about the survey and request that they assist with the survey. For employers where there was an e-mail contact, an electronic version of a letter developed by MAPA for *Local Business and Agency Leaders* was also sent to help lend credibility and legitimacy to the study. This letter, included in the Appendix, included the following key message:

“Participation in this survey is key to its success – and MAPA, NDOR and IDOT request and encourage the participation of your business/agency in this community wide effort....by sending an e-mail to your employees. The e-mail would include a link to the online survey on MAPA’s website and would encourage your employees to complete the survey online.”

In addition, an example e-mail that employers could send out to their employees about the survey was also provided.

“Hello:

You are invited to take part in a travel survey being sponsored by the Omaha-Council Bluffs Metropolitan Area Planning Agency (MAPA). Your input is important and will help shape transportation planning and improvements in Omaha, Council Bluffs, and surrounding areas. The survey is anonymous and will take about 5 minutes to complete. Your participation in this survey is vital in helping plan for the future. Please click on the link below to take the survey. Thank you for assisting us in this study!”

Oftentimes multiple attempts were made to speak (via telephone) to the person who had been identified as the establishment contact. However, at most of the major corporations, this was not possible, due to the numerous layers of authority and ‘chain of command’ that had to be followed or a schedule conflict (contact in a meeting, out of the office, etc.). In these instances, a voice mail was delivered and an e-mail address was obtained. Attempts were also made to visit the offices of many of the major employers in order to speak with the contact person or other top official about having them send out an e-mail to their employees about the survey. At each site visit, the individual spoken to was provided with a copy of MAPA’s *Letter to Business and Agency Leaders* and was also provided copies of the postcard handout.

While all of the major employers contacted were polite and seemed interested in assisting, based on the modest number of surveys completed on-line (discussed in the results section of the report), it appears that very few sent an e-mail out to their employee’s asking them to take the survey. Common responses and challenges encountered by the project team when requesting employer assistance included:

- the contact not knowing who in the agency had authority to send out a company/agency-wide broadcast e-mail;
- not able to speak to the person who had the authority to send out an e-mail or company/agency-wide broadcast e-mail; and
- the request would have to be reviewed by their legal department/team before it could be considered, which could take weeks.

Video License Capture

The primary purpose for the video license capture method was to collect data on the percentage of resident versus non-resident traffic that travels into and out of the MAPA study area. Automatic License Plate Reader (ALPR) video cameras were deployed at 10 of the 25 MAPA external locations. In general, the 10 external locations with the highest average weekday traffic volumes were selected for camera placement. Ideally, ALPR cameras would have been placed at all external stations in order to capture resident versus non-resident distributions. However, due to cost implications, it was decided to capture a sample of video license data at 10 sites and use the data from these sites to estimate resident/non-resident apportionment at the remaining 15 non-video sites. The cameras were installed for a five-hour period at each selected location during a period of time when Bluetooth data was also being collected. A picture of an ALPR camera used for the study is shown in Figure 6.

Figure 6. ALPR Camera.



External Intercept Surveys

External intercept surveys were conducted at select locations around the periphery of the study area near the study area boundary. The surveys were conducted at or near the study area boundary in order to survey persons who were traveling into, out of, or through the study area. Since roadside intercept surveys were not a viable option, MAPA approved the selection of various locations at or near the study area boundary where personal intercept surveys of non-commercial and cargo/freight vehicles could be conducted. Prior to fielding the survey, all 25 external locations were visited to determine if a convenience store/gas station, rest area, or truck stop was located near the external station where intercept surveys could be conducted. Six locations were identified and intercept surveys were performed at all of these locations.

Two survey instruments were used at external intercept locations: one for non-commercial vehicles (Form A) and another for freight/cargo vehicles (Form B). Both forms were designed so that they could be conducted in two-to-three minutes, and both forms included six questions. The Form A survey collected information on the residency status, the trip origin, the trip purpose, and the intended destination. The

External intercept surveys were conducted at select locations around the periphery of the study area near the study area boundary.

freight/cargo external survey instrument asked most of the same questions as the non-commercial form, except it did not collect residency information. The survey instrument did include questions about the cargo being carried and the frequency that they made the trip. Personnel administering the survey recorded auto occupancy and vehicle type/class information through visual observation as part of the external survey. Copies of the non-commercial and cargo/freight survey instruments used at external intercept locations are included in the Appendix.

Internal Intercept Surveys

Intercept surveys were conducted at malls and other regional retail locations inside of the MAPA study area as another means to capture I-E/E-I trip data. This survey was designed to capture trips that traveled into or out of the study area from residents and non-resident/commuters, and visitors. At retailers that agreed to participate in the survey, trained interviewers asked persons entering or exiting the business if they would be willing to participate in a brief travel survey. If the patron agreed, they were shown a large map of the study area with the survey area boundary, and then asked if they had made a trip into or out of the MAPA study area. For those who had not made a trip that day that crossed the study area boundary, they were not asked any further questions and were thanked for their time. For persons who had made an I-E/E-I trip, the interviewer proceeded with the survey. In addition, surveyors at internal locations also handed out a postcard that contained information about the survey, a map of the study area, and a link to the web survey. Retail patrons and employees who did not have time to take the survey at the present time, were asked to visit the web site and take the survey on-line at a later time.



To determine retail locations where internal intercept surveys could be conducted, a list and map of 37 big box retailers, malls, home improvement stores, and other regional retail attractions that were located inside of the MAPA study area was developed.

The internal intercept survey was designed similar to the web survey. The same map used for the web survey that depicted the study area boundary and external station locations, was also used for the internal intercept surveys. The internal intercept survey instrument included 10 questions and collected information on general home and work locations, trip origin and destination, trip purpose, trip mode, and auto occupancy. A key question on the survey was “Referring to the study area map, what was/will be the number or name of the road or highway you were on when you crossed the study area boundary.” A copy of the internal intercept survey (Form C) is included in the Appendix.

To determine retail locations where internal intercept surveys could be conducted, a list and map of 37 big box retailers, malls, home improvement stores, and other regional retail attractions that were located inside of the MAPA study area was developed. Of the 37 retailers, 19 were selected to be surveyed based on the geographic location and the type of business. Geographic location was a key consideration to ensure that surveys were collected from all parts of the study area. Table 4 lists the location of the 37 retailers considered. The retailers shaded are those that were selected for internal intercept surveys.

Despite a vigorous effort and many follow-ups, only nine retailers agreed to permit intercept surveys to be conducted at their stores. The primary reason why intercept surveys were conducted at fewer than expected retail locations was because none of the national big box retailers and home improvement stores agreed to allow surveys to

Table 4. Retail Locations Considered and Selected for Internal Intercept Surveys.

Site #	Company	Address	City	State
1	Target Stores	4001 N 132nd St, Omaha, NE, 68164	Omaha	NE
2	Target Stores	16959 Evans Plz, Omaha, NE, 68116	Omaha	NE
3	Target Stores	7200 Dodge St, Omaha, NE, 68114	Omaha	NE
4	Wal-Mart	1900 S Highway 30, Blair, NE, 68008	BLAIR	NE
5	Wal-Mart	3201 Manawa Centre Dr, Council Bluffs, IA, 51501	Council Bluffs	IA
6	Wal-Mart	3010 E 23rd St, Fremont, NE, 68025	Fremont	NE
7	Wal-Mart	11350 Wickersham Blvd, Gretna, NE, 68028	Gretna	NE
8	Wal-Mart	2101 S 11th St, Nebraska City, NE, 68410	Nebraska City	NE
9	Wal-Mart	16960 W Maple Rd, Omaha, NE, 68116	Omaha	NE
10	Wal-Mart	1606 S 72nd St, Omaha, NE, 68124	Omaha	NE
11	Wal-Mart	18201 Wright St, Omaha, NE, 68130	Omaha	NE
12	Wal-Mart	6304 N 99th St, Omaha, NE, 68134	Omaha	NE
13	Wal-Mart	12850 L St, Omaha, NE, 68137	Omaha	NE
14	Wal-Mart	13105 Birch Dr, Omaha, NE, 68164	Omaha	NE
15	Wal-Mart	8525 S 71st Plz, Papillion, NE, 68133	Papillion	NE
16	Home Depot	3101 Manawa Centre Dr, Council Bluffs, IA, 51501	Council Bluffs	IA
17	Home Depot	4545 N 72nd St, Omaha, NE, 68134	Omaha	NE
18	Home Depot	712 N Washington St, Papillion, NE, 68046	Papillion	NE
19	Home Depot	12710 L St, Omaha, NE, 68137	Omaha	NE
20	Home Depot	3950 N 144th St, Omaha, NE, 68116	Omaha	NE
21	Home Depot	3300 N 27th St, Lincoln, NE, 68521	Lincoln	NE
22	Lowe's	7525 Dodge St, Omaha, NE, 68114	Omaha	NE
23	Lowe's	8707 S 71st Plz, Papillion, NE, 68133	Papillion	NE
24	Lowe's	3333 N 147th St, Omaha, NE, 68116	Omaha	NE
25	Lowe's	18375 Wright St, Omaha, NE, 68130	Omaha	NE
26	Cabella's	12703 Westport Pky, LA Vista, NE, 68138	La Vista	NE
27	Bass Pro Shop	2901 Bass Pro Dr, Council Bluffs, IA, 51501	Council Bluffs	IA
28	Crossroads Mall	7400 Dodge St	Omaha	NE
29	Mall of the Bluffs	1751 Madison Ave	Council Bluffs	IA
30	Oak View Mall	3001 S. 144th St	Omaha	NE
31	Plaza at Mid America Center	1032 Woodbury Ave	Council Bluffs	IA
32	Westroads Mall	10000 California St	Omaha	NE
33	Village Pointe	168th and Dodge	Omaha	NE
34	Rockbrook Village	2800 South 110 Ct	Omaha	NE
35	The Shops of Legacy	W. Center Rd and 168th St	Omaha	NE
36	Mall of the Bluffs	1751 Madison Ave	Council Bluffs	IA
37	Old Market Area	Downtown Omaha	Omaha	NE

be conducted. All cited that they had a policy that prohibited such surveys from being conducted at their stores. The results of the internal intercept surveys, along with a listing of the retailers where these surveys were conducted, are provided in the *Data Collection and Analysis* section of this report.

Selected retailers were contacted approximately two weeks prior to the survey to request their participation. To assist in the recruitment process, a letter to *Local Business and Agency Leaders* was prepared. The letter explained the purpose of the survey, the importance of community participation, and how results from the survey were imperative for regional transportation planning in the Omaha area. A copy of this letter was provided to retailers when they were being asked to participate. A copy of the letter to *Local Business and Agency Leaders* is included in the Appendix.

Survey Postcard Handouts

A postcard handout was developed to help publicize the MAPA external survey and serve as a means to direct persons to the web-based survey. Figure 7 provides an illustration of the front side of the post card handout. The back side of the postcard included a map of the MAPA study area boundary and external locations. This illustration was the same survey area map that is provided in Figure 2 in this report. The postcards were distributed at internal intercept locations as well as at local hotels. At local hotels that agreed to participate, the postcards were provided to hotel patrons when they checked in or out of the establishment.



Traffic counts represent a benchmark of the amount of vehicular activity at locations where the counts are performed.

Figure 7. Postcard Survey Handout.

OMAHA AREA TRAVEL SURVEY

Did you travel into or out of the Omaha/Council Bluffs area today?



If you traveled into or out of the greater Omaha area (see map on the backside of this card) at any time between Tuesday, April 23, and Thursday, April 25, the Metropolitan Area Planning Agency (MAPA) would appreciate your participation in this important travel survey.

Please visit the following website and complete a few questions about your travel.

<http://bit.ly/omaha-travel-survey>

Your participation will help local transportation planners and engineers prioritize and select roadway projects that are most needed in the Omaha metropolitan area.

This survey is completely voluntary and all survey responses are anonymous. For more information about this survey, please call 888-315-6141.


DATA COLLECTION AND ANALYSIS

Data obtained as part of this project were collected using various methods. The following sections provide a summary of the data collection methods and the results that were obtained for each respective method.

Vehicle Classification Counts

Traffic counts represent a benchmark of the amount of vehicular activity at locations where the counts are performed. They are also important tools to use as control totals when expanding samples of survey data. As part of the travel survey, 24-hour traffic counts were performed at locations in and around the study area. For the external locations identified in Table 1, vehicle classification count data were collected for a 72-hour period that coincided with the Bluetooth data collection. The results of vehicle classification count data collection are provided in Table 5. The results are pro-

Table 5. MAPA External Station Classification Count Summary.

Site	Direction	April 23			April 24			April 25		
		NC	COM	Total	NC	COM	Total	NC	COM	Total
100	Inbound	11,129	1,979	13,108	9,620	3,602	13,222	9,292	3,223	12,515
	Outbound	10,103	1,798	11,901	6,866	3,425	10,291	8,736	4,068	12,804
101	Inbound	951	615	1,566	889	634	1,523	937	621	1,558
	Outbound	1,397	280	1,677	1,326	225	1,551	1,290	193	1,483
102	Inbound	883	79	962	898	91	989	962	121	1,083
	Outbound	900	61	961	898	75	973	913	106	1,019
103	Inbound	9,638	1,720	11,358	9,584	1,550	11,134	9,634	1,547	11,181
	Outbound	11,048	828	11,876	10,974	896	11,870	10,781	887	11,668
104	Inbound	1,546	255	1,801	1,583	263	1,846	1,589	284	1,873
	Outbound	1,405	428	1,833	1,338	482	1,820	1,373	492	1,865
105	Inbound	3,806	297	4,103	3,693	228	3,921	3,681	195	3,876
	Outbound	4,194	445	4,639	4,335	524	4,859	3,897	570	4,467
106	Inbound	1,435	294	1,729	1,504	335	1,839	N/A	N/A	N/A
	Outbound	1,643	224	1,867	1,639	272	1,911	N/A	N/A	N/A
107	Inbound	9,971	1,852	11,823	9,919	1,691	11,610	9,968	1,677	11,645
	Outbound	11,068	828	11,896	10,985	896	11,881	12,216	1,003	13,219
108	Inbound	8,389	1,385	9,774	8,650	1,491	10,141	9,063	1,612	10,675
	Outbound	10,948	805	11,753	10,818	851	11,669	10,838	865	11,703
109	Inbound	3,019	778	3,797	3,217	735	3,952	3,420	951	4,371
	Outbound	2,550	1,189	3,739	2,776	1,244	4,020	2,921	1,493	4,414
110	Inbound	15,575	8,668	24,243	14,935	8,317	23,252	17,746	8,043	25,789
	Outbound	17,606	3,646	21,252	17,638	3,909	21,547	20,094	4,174	24,268
111	Inbound	3,110	616	3,726	3,034	674	3,708	3,025	585	3,610
	Outbound	3,057	540	3,597	3,154	526	3,680	3,239	507	3,746
112	Inbound	4,127	253	4,380	3,707	239	3,946	3,841	278	4,119
	Outbound	2,836	483	3,319	2,795	566	3,361	2,737	509	3,246
113	Inbound	940	100	1,040	929	103	1,032	1,085	107	1,192
	Outbound	643	171	814	679	135	814	690	165	855
114	Inbound	6,575	1,305	7,880	6,546	1,200	7,746	6,562	1,180	7,742
	Outbound	6,340	1,154	7,494	6,788	1,167	7,955	6,779	1,141	7,920
115	Inbound	1,118	94	1,212	1,211	80	1,291	1,252	111	1,363
	Outbound	1,058	164	1,222	1,185	161	1,346	1,188	176	1,364
116	Inbound	4,277	932	5,209	4,307	1,000	5,307	4,781	965	5,746
	Outbound	2,920	1,975	4,895	2,906	1,941	4,847	3,152	1,510	4,662
117	Inbound	2,956	743	3,699	3,401	262	3,663	3,422	424	3,846
	Outbound	3,222	457	3,679	3,520	301	3,821	3,448	334	3,782
118	Inbound	704	149	853	684	168	852	674	158	832
	Outbound	688	117	805	722	111	833	734	107	841
119	Inbound	1,759	494	2,253	1,674	552	2,226	1,725	570	2,295
	Outbound	1,936	271	2,207	1,979	275	2,254	2,002	296	2,298
120	Inbound	5,122	102	5,224	5,170	303	5,473	N/A	N/A	N/A
	Outbound	4,171	900	5,071	4,562	932	5,494	N/A	N/A	N/A
121	Inbound	581	111	692	591	104	695	613	98	711
	Outbound	608	129	737	598	144	742	590	129	719
Total	Inbound	97,611	22,821	120,432	95,746	23,622	119,368	93,272	22,750	116,022
	Outbound	100,341	16,893	117,234	98,481	19,058	117,539	97,618	18,725	116,343

vided by day and by direction as well as disaggregated by commercial (COM) and non-commercial (NC) vehicle type. Vehicles were classified using the FHWA Scheme F classification system. Using this system, classes 1-3 were considered non-commercial vehicles and classes 4-13 were considered commercial vehicles.

The purpose for collecting multiple days of traffic data was to allow for daily variations that might result from weather or other factors that may impact traffic volumes. Therefore, the results provided in the previous table were combined to create daily averages per location. Those results are provided in Table 6. Additionally, the table provides the percentage of commercial and non-commercial vehicles by location and direction.

Table 6. Classification Count Daily Averages.

Site #	Inbound Count					Outbound Count				
	NC	COM	Total	% NC	% COM	NC	COM	Total	% NC	% COM
100	10,014	2,935	12,948	77.3	22.7	8,568	3,097	11,665	73.5	26.5
101	926	623	1,549	59.8	40.2	1,338	233	1,570	85.2	14.8
102	914	97	1,011	90.4	9.6	904	81	984	91.8	8.2
103	9,619	1,606	11,224	85.7	14.3	10,934	870	11,805	92.6	7.4
104	1,573	267	1,840	85.5	14.5	1,372	467	1,839	74.6	25.4
105	3,727	240	3,967	93.9	6.1	4,142	513	4,655	89.0	11.0
106	1,470	315	1,784	82.4	17.6	1,641	248	1,889	86.9	13.1
107	9,953	1,740	11,693	85.1	14.9	11,423	909	12,332	92.6	7.4
108	8,701	1,496	10,197	85.3	14.7	10,868	840	11,708	92.8	7.2
109	3,219	821	4,040	79.7	20.3	2,749	1,309	4,058	67.7	32.3
110	16,085	8,343	24,428	65.8	34.2	18,446	3,910	22,356	82.5	17.5
111	3,056	625	3,681	83.0	17.0	3,150	524	3,674	85.7	14.3
112	3,892	257	4,148	93.8	6.2	2,789	519	3,309	84.3	15.7
113	985	103	1,088	90.5	9.5	671	157	828	81.0	19.0
114	6,561	1,228	7,789	84.2	15.8	6,636	1,154	7,790	85.2	14.8
115	1,194	95	1,289	92.6	7.4	1,144	167	1,311	87.3	12.7
116	4,455	966	5,421	82.2	17.8	2,993	1,809	4,801	62.3	37.7
117	3,260	476	3,736	87.3	12.7	3,397	364	3,761	90.3	9.7
118	687	158	846	81.3	18.7	715	112	826	86.5	13.5
119	1,719	539	2,258	76.1	23.9	1,972	281	2,253	87.5	12.5
120	5,146	203	5,349	96.2	3.8	4,367	916	5,283	82.7	17.3
121	595	104	699	85.1	14.9	599	134	733	81.7	18.3
Total	97,748	23,237	120,985	80.8	19.2	100,816	18,613	119,429	84.4	15.6

Vehicle classification count data is primarily used for expanding the survey data, but it is also useful to examine the distribution of vehicles by time-of-day. Figure 8 and Figure 9 provide the distribution of non-commercial and commercial vehicles by time-of-day for all of the external locations by inbound and outbound direction, respectively.

For inbound vehicles (Figure 8), the morning peak occurs between 7:30 a.m. and 8:00 a.m. for non-commercial vehicles. There is an afternoon peak period for non-commercial vehicles between 5:00 p.m. and 5:30 p.m. While inbound commercial vehicle levels remain fairly constant from 8:00 a.m. to 5:00 p.m., a slight peak occurs between 2:00 p.m. and 2:30 p.m. For outbound traffic (Figure 9), the morning peak period for non-commercial vehicles is not as significant as the peak for the inbound direction, and it occurs between 7:30 a.m. and 8:00 a.m. The afternoon peak for non-commercial vehicles traveling outbound is slightly longer than the inbound morning peak. For outbound commercial vehicles, there appears to be no significant peak. The traffic levels remain fairly constant between 8:00 a.m. and 6:00 p.m.

For inbound vehicles (Figure 8), the morning peak occurs between 7:30 a.m. and 8:00 a.m. for non-commercial vehicles.

Figure 8. Time-of-Day Summary - Inbound Direction.

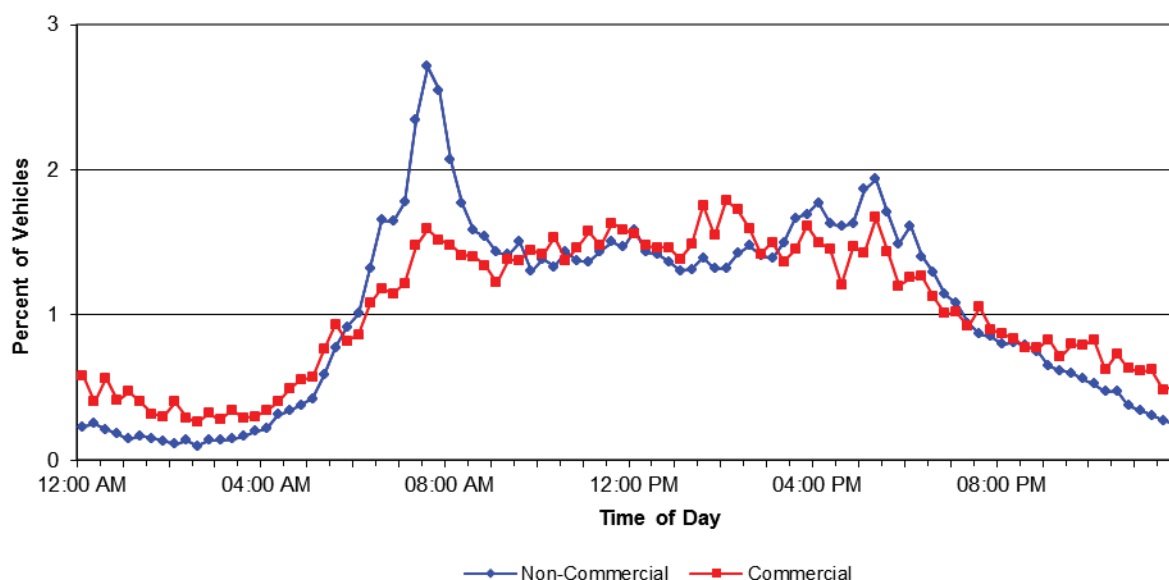
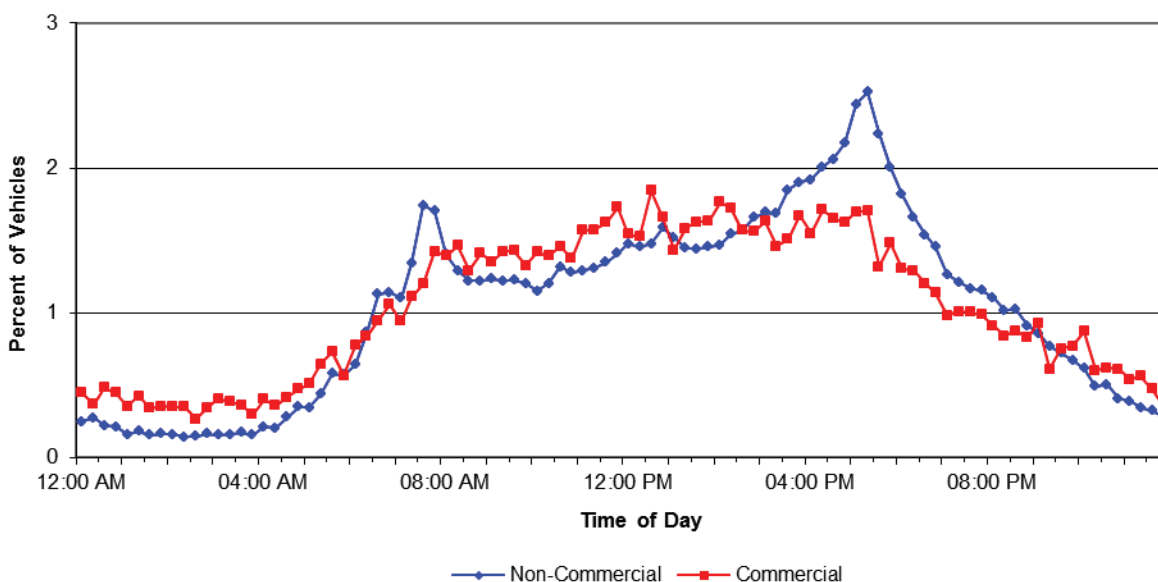


Figure 9. Time-of-Day Summary - Outbound Direction.



Additionally, traffic counts were performed at a number of locations within the study area. These locations were selected by MAPA for their internal use. The counts for the internal locations were for a 24-hour period and were not classified. The results of these counts are provided in Table 7. Results are provided by direction for each location.

Table 7. Traffic Count Summary for Internal Locations.

Site	Description	Direction				Total
		EB	WB	NB	SB	
1	I-80 @ Douglas/Sarpy Co line	48,096	45,686	–	–	93,782
2	I-680 North of I-80	–	–	76,387	79,731	156,118
3	Hwy 370 @ 48th St	17,378	17,221	–	–	34,599
4	US 75 South of I-80	–	–	43,562	44,302	87,864
5	Platteview Rd East of 132nd St	2,351	2,426	–	–	4,777
6	Veterans Bridge	5,450	5,251	–	–	10,701
7	I-80 Missouri River Bridge	45,800	44,539	–	–	90,339
8	I-480 Missouri River Bridge	26,147	28,213	–	–	54,360
9	I-680 Missouri River Bridge	9,166	9,170	–	–	18,336
10	Hwy 6 West of 132nd St	42,095	39,931	–	–	82,026
11	I-680 between 6th & 64th	–	–	33,112	31,764	64,876
Total		196,483	192,437	153,061	155,797	697,778



Another function of the travel survey was to ascertain the residency status of individuals entering and exiting the study area on a daily basis.

MAPA Residency

Another function of the travel survey was to ascertain the residency status of individuals entering and exiting the study area on a daily basis. The primary method used to make this assessment was the use of ALPR technology. The ALPR cameras were deployed at select external locations around the periphery of the study area. Cameras were deployed for approximately five hours at each location and they recorded all non-commercial vehicle license plates in the direction of travel being monitored. Generally, cameras were deployed to capture non-commercial vehicles traveling in the inbound (toward Omaha) direction in the morning and in the outbound (away from Omaha) in the afternoon.

After the data collection period, the license plate data were transcribed to a file that contained the plate numbers/characters, the plate state, a timestamp for when the plate was recorded, and the external station number where the plate was observed. Since the study area falls in two states, contacts were established with each state's agency responsible for motor vehicle records. The overriding concern with this data collection method was to complete it while maintaining the privacy of the motorists. The following provides a summary of the methods used to determine residency for Nebraska and Iowa motorists.

- **Nebraska** – a contact with the Nebraska Department of Motor Vehicles (DMV) was established. The Nebraska DMV provided a list of license plates registered to persons residing in Douglas and Sarpy counties. The list contained only the plate number and a county code so there were no means to identify any personal

information about the motorist. The DMV list of plates was compared to the Nebraska license plates that were recorded using the ALPR cameras. If a license plate from the ALPR data collection was on the list provided by the DMV it was assumed that the vehicle belonged to a resident of the study area.

- **Iowa** – MAPA established a contact person with the Iowa Department of Transportation (DOT) to assist with the process of establishing residency. A list of all Iowa license plates that were recorded were provided to the Iowa DOT. The DOT processed the list and appended the county of the vehicle registrant and the registrant's zip code to the file. The purpose of the zip code was to narrow down the residency status since the MAPA study area does not cover the entirety of Pottawattamie County.

After the license plate data were appended with residency status, summary statistics were prepared for each data collection location. Those results are provided in Table 8. The table provides the number of license plates recorded at each site broken down by Iowa plates, Nebraska plates, and all other states combined. Additionally, the number and percent of recorded license plates per site that matched motor vehicle record databases are provided, as is the overall residency percentage per site.

After the license plate data were appended with residency status, summary statistics were prepared for each data collection location.

Table 8. Summary of License Plate Data and Residency.

Site	Location	Plates Recorded				Nebraska Matches		Iowa Matches		% Resident
		Iowa	Neb.	Other	Total	Matches	% Match	Matches	% Match	
100	I-29 NB-PM	1,552	207	1,021	2,780	128	61.8	89	5.7	7.8
	I-29 SB-AM	1,367	136	1,159	2,662	73	53.7	78	5.7	5.7
101	Lincoln Hwy-AM	546	32	72	650	29	90.6	419	76.7	68.9
102	Railroad Hwy-AM	202	9	129	340	5	55.6	63	31.2	20.0
103	I-80 Rest Area-PM	774	85	926	1,785	56	65.9	93	12.0	8.4
104	Hwy 6-PM	558	39	79	676	34	87.2	85	15.2	17.6
105	92 -AM	1,824	88	334	2,246	79	89.8	996	54.6	47.9
106	US 275 -AM	753	49	157	959	44	89.8	87	11.6	13.7
107	I-29 -PM	1,514	40	1,611	3,165	12	30.0	145	9.6	5.0
108	SH 75 -PM	82	3,743	188	4,013	605	16.2	21	25.6	15.6
109	Hwy 50 -AM	10	1,297	198	1,505	215	16.6	2	20.0	14.4
110	I-80 EB-PM	8	447	268	723	87	19.5	3	37.5	12.5
	I-80 WB-AM	19	1,799	690	2,508	229	12.7	3	15.8	9.3
111	Hwy 6 -PM	2	1,048	60	1,110	182	17.4	1	50.0	16.4
112	NE 92 -PM	12	1,801	385	2,198	465	25.8	3	25.0	21.3
113	NE 64 -AM	1	363	49	413	78	21.5	0	0.0	18.9
114	US 275 -AM	16	2,106	320	2,442	298	14.1	4	25.0	12.4
115	Hwy 31 -PM	10	374	109	493	84	22.5	1	10.0	17.2
116	Hwy 131 -AM	17	1,514	65	1,596	189	12.5	5	29.4	12.2
117	US 75 -AM	17	998	92	1,107	206	20.6	6	35.3	19.2
119	Old Hwy 275-PM	11	1,397	260	1,668	421	30.1	7	63.6	25.7
120	US 34 -PM	1,612	122	421	2,155	96	78.7	168	10.4	12.3
Total		10,907	17,694	8,593	37,194	3,615	20.4	2279	20.9	15.9

For comparative purposes, the residency status of individuals surveyed in and around the study area was also reviewed. While the methodology used to perform these surveys will be detailed in other sections, the results as they relate to residency are provided here. Personal interviews of motorists at or near external stations (external intercepts) and at various locations within the greater Omaha metropolitan area (internal intercepts) included a question asking whether or not the respondent resided within the survey area. Additionally, residency status as determined from the web-based survey is also included. The results have been compiled and are provided in Table 9. Given the low number of responses per site and the fact that not all sites had responses, it was determined that using the residency percentages resulting from the intercept surveys was not advisable.

Table 9. Summary of Residency Status from Intercept Surveys.

Site	External Intercept			Internal Intercept			Web Survey			Total			% Total	
	Res	Non-Res	Total	Res	Non-Res	Total	Res	Non-Res	Total	Res	Non-Res	Total	Res	Non-Res
100	–	–	–	7	8	15	32	6	38	39	14	53	73.6	26.4
101	44	11	55	–	–	–	7	2	9	51	13	64	79.7	20.3
102	–	–	–	–	–	–	2	1	3	2	1	3	66.7	33.3
103	2	38	40	20	11	31	48	18	66	70	67	137	51.1	48.9
104	–	–	–	1	2	3	24	10	34	25	12	37	67.6	32.4
105	15	46	61	1	1	2	13	3	16	29	50	79	36.7	63.3
106	–	–	–	–	–	–	5	5	10	5	5	10	50.0	50.0
107	8	83	91	15	29	44	17	6	23	40	118	158	25.3	74.7
108	31	11	42	6	9	15	23	8	31	60	28	88	68.2	31.8
109	–	–	–	1	0	1	7	0	7	8	0	8	100.0	0.0
110	4	32	36	36	20	56	78	11	89	118	63	181	65.2	34.8
111	–	–	–	1	2	3	13	3	16	14	5	19	73.7	26.3
112	–	–	–	1	1	2	12	1	13	13	2	15	86.7	13.3
113	–	–	–	–	–	–	8	0	8	8	0	8	100.0	0.0
114	–	–	–	7	13	20	12	3	15	19	16	35	54.3	45.7
115	–	–	–	1	0	1	5	1	6	6	1	7	85.7	14.3
116	–	–	–	1	1	2	6	4	10	7	5	12	58.3	41.7
117	–	–	–	0	2	2	11	7	18	11	9	20	55.0	45.0
118	–	–	–	–	–	–	8	4	12	8	4	12	66.7	33.3
119	–	–	–	1	3	4	2	1	3	3	4	7	42.9	57.1
120	–	–	–	1	1	2	2	0	2	3	1	4	75.0	25.0
121	–	–	–	–	–	–	3	3	6	3	3	6	50.0	50.0
Total	104	221	325	100	103	203	338	97	435	542	421	963	56.3	43.7

In order to compare the results of residency as determined by the ALPR data collection and the various survey methods, Table 10 provides an overview by site of the results. The table provides the total number of resident and non-resident responses as determined from the intercept and web survey by location, the percent of residents and non-residents from survey results for each location, and the corresponding results as derived from the ALPR analyses.



For comparative purposes, the residency status of individuals surveyed in and around the study area was also reviewed.

Table 10. Comparison of Survey and ALPR Residency Results.

Site	Location	Survey Total			Surveys		ALPR	
		Res	Non-Res	Total	% Res	% Non-Res	% Res	% Non-Res
100	I-29	39	14	53	73.6	26.4	7.8	92.2
101	Lincoln Hwy	51	13	64	79.7	20.3	68.9	31.1
102	Railroad Hwy	2	1	3	66.7	33.3	20.0	80.0
103	I-80	70	67	137	51.1	48.9	8.3	91.7
104	US 6	25	12	37	67.6	32.4	17.6	82.4
105	IA 92	29	50	79	36.7	63.3	47.9	52.1
106	Wabash	5	5	10	50.0	50.0	13.7	86.3
107	I-29	40	118	158	25.3	74.7	5.0	95.0
108	US 75	60	28	88	68.2	31.8	15.6	84.4
109	NE 50	8	0	8	100.0	0.0	14.4	85.6
110	I-80	118	63	181	65.2	34.8	12.4	87.6
111	US 6	14	5	19	73.7	26.3	16.5	83.5
112	NE 92	13	2	15	86.7	13.3	21.3	78.7
113	NE 64	8	0	8	100.0	0.0	18.9	81.1
114	US 275	19	16	35	54.3	45.7	12.4	87.6
115	NE 31	6	1	7	85.7	14.3	17.2	82.8
116	NE 133	7	5	12	58.3	41.7	12.2	87.8
117	US 75	11	9	20	55.0	45.0	19.2	80.8
118	72nd St	8	4	12	66.7	33.3	–	–
119	Old Hwy 275	3	4	7	42.9	57.1	25.7	74.3
120	US 34	3	1	4	75.0	25.0	12.3	87.7
121	195th St	3	3	6	50.0	50.0	–	–
Total		542	421	963	56.3	43.7	15.8	84.2

MAPA Intercept Travel Survey

Intercept travel surveys are a useful technique for obtaining information on the travel patterns of individuals in and around a study area. As part of the MAPA External Travel Survey, intercept surveys were administered by trained surveyors at various external and internal locations. External locations were those sites at businesses or rest areas near or adjacent to MAPA external stations. Internal locations were comprised of businesses and public attractions within the greater Omaha metropolitan area. A list of the external and internal locations as well as the number of survey responses per site are provided in Table 11. At the external locations, commercial and non-commercial vehicles were surveyed using different survey instruments. At the internal locations, only those persons operating non-commercial vehicles were surveyed.

Table 11. Intercept Survey Summary.

Site	Description	Month	Day	External – Non-com	External - Com	Internal	Total
101	Casey's (Crescent, IA)	4	23	55	–	–	55
103	Rest Area NB I-80	4	23	40	25	–	65
105	Casey's (Treyner, IA)	4	24	61	–	–	61
107	Rest Area NB I-29	4	24	60	11	–	71
	Rest Area SB I-29	4	24	31	25	–	56
108	Shell Station (Bellevue, NE)	4	25	42	–	–	42
110	Rest Area I-80	4	25	36	20	–	56
	Mall of the Bluffs	4	23	–	–	13	13
	Westroads Mall-Day 1	4	23	–	–	59	59
	Bass Pro Shop	4	23	–	–	30	30
	Westroads Mall-Day 2	4	24	–	–	54	54
	Crossroads Mall	4	24	–	–	32	32
	Old Market-Zoo	4	24	–	–	28	28
	Westroads Mall-Day 3	4	25	–	–	40	40
	Rockbrook Village	4	25	–	–	13	13
	Village Pointe Shop Center	4	25	–	–	30	30
Total				325	81	299	705

Commercial Vehicle Intercept Survey Results

In conjunction with the intercept surveys of non-commercial vehicle drivers conducted at locations adjacent to external sites, operators of commercial vehicles were also surveyed in order to obtain travel-related information. The number of respondents was relatively low (81 total participants), but the results of the responses are provided below.

Of the 81 commercial vehicle respondents, 52 (64 percent) reported making E-E trips and 29 (38 percent) made I-E/E-I trips. The average vehicle occupancy was 1.23 persons per commercial vehicle. No respondent indicated more than two persons in a vehicle.

The trip purpose for commercial vehicles at the trip origin and destination was also reviewed and the results are provided in Table 12. At both the origin and the destination, the overwhelming majority of respondents indicated a purpose of ‘delivery/pick-up’.

Table 12. Commercial Vehicle Trip Purpose Summary.

Trip Purpose	Origin		Destination	
	Number	% Total	Number	% Total
Base Location	5	6.2	7	8.6
Delivery/Pick-Up	56	69.1	69	85.3
Fuel/Vehicle Maintenance	8	9.9	1	1.2
Driver Needs	12	14.8	3	3.7
Other	0	0.0	1	1.2
Total	81	100.0	81	100.0

In addition to trip purpose, survey respondents also provided the cargo that was being transported. The result of the distribution of cargo types is provided in Table 13. Five cargo categories each garnered approximately the same percentage of responses (in the 13-18 percent range). Those categories include agriculture and livestock, automotive vehicles and parts, construction materials, food products, and miscellaneous cargos.

Table 13. Commercial Vehicle Cargo Summary.

Cargo	Number	% of Total
Agriculture, livestock	13	16.0
Auto, trucks, machines, parts	11	13.6
Construction materials	14	17.3
Food products	15	18.5
Household goods	6	7.4
Medical supplies	2	2.5
Military	1	1.2
Miscellaneous	11	13.6
Wood, paper products	3	3.7
Empty	3	3.7
No response	2	2.5
Total	81	100.0

Web-Based Travel Survey

A web-based survey was developed in an effort to ascertain the travel patterns of people traveling into, out of, and through the greater Omaha metropolitan area (Figure 10). Working in conjunction with MAPA, an online travel survey instrument was developed. The primary intent of the survey was to obtain origin-destination data in a manner that protected the privacy of those persons that chose to participate. More detail pertaining to the web survey development and advertisement is provided in the methodology section.



Intercept travel surveys are a useful technique for obtaining information on the travel patterns of individuals in and around a study area.

Figure 10. Web Survey Welcome Page.



There were a total of 729 survey respondents, but not all respondents completed the entire survey.

While certain components of the web survey were used to assist in the development of trip tables, the following information provides a summary of the responses to the various questions asked in the web survey. The survey contained a welcome page (Figure 10), four intermediate pages, and a final page that thanked respondents for their participation. There were a total of 729 survey respondents, but not all respondents completed the entire survey. Table 14 provides a summary of the level of completeness for the web survey.

Table 14. Web Survey Page Completed.

Page	Respondents that Completed	% Completing Page
Page 1 – Welcome	721	98.9
Page 2 – Study information	720	98.8
Page 3 – Demographic information	671	92.0
Page 4 – Travel direction	561	77.0
Page 5 – Trip information	561	77.0

For those respondents that agreed to participate in the survey, information pertaining to the respondent's home and work locations were requested (Figure 11). To protect respondent privacy, specific addresses were not requested. Respondent were asked to provide approximate locations or two intersecting streets near their home/work locations. This data was used in the development/verification of O-D data.



Figure 11. Web Survey Home Location.

Demographic Information	
Approximately where do you live? Please provide the names of two intersecting streets near your home along with the city, state and zip code.	
Street 1	
Street 2	
City	
State	
Zip Code	

Next, respondents were asked which direction they were traveling when they crossed the study area boundary (see Figure 7). Table 15 provides a summary of responses to the question of direction of travel. Overall, approximately 53 percent of the respondents were traveling in the inbound direction, 40 percent were traveling out of the area, and seven percent did not respond to the question. For those responding to the question of direction traveled, 57 percent were traveling into the area and 43 percent were traveling out of the area.

Table 15. Web Survey Travel Direction Summary.

Travel Direction	Number	% Total	% of Those Responding
Into	383	52.5	56.7
Out of	292	40.1	43.3
No Response	54	7.4	-
Total	729	100.0	100.0

For those responding to the question of direction traveled, 57 percent were traveling into the area and 43 percent were traveling out of the area.

Figure 12. Web Survey Travel Direction.

Travel Direction

* Referring to the map below, when you crossed the study area boundary (green line) were you traveling into or out of the Omaha/Council Bluffs area?
Choose one of the following answers

☐ Into the study area

☐ Out of the study area

Map data ©2013 Google

Page 5 of the web survey (Trip Information) collected the largest amount of information from the respondents. In addition to providing a format for the respondent to identify the location within the study area where their trip began or ended (depending on the direction of travel), the survey requested information on the following:

- Mode of travel;
- Whether or not respondent was driver or passenger;
- Vehicle occupancy;
- Trip purpose (at trip origin and destination);
- Residency and work status;
- How respondent heard about the survey; and
- Comments about survey or transportation related issues.

Respondents provided information pertaining to their mode of travel and those results are provided in Table 16. The majority of the respondents (74 percent) traveled via passenger vehicles. When the non-responses were removed, the percentage of those that selected passenger vehicle as their mode of travel was 98 percent.

Table 16. Web Survey Mode of Travel Summary.

Travel Direction	Number	% Total	% of Those Responding
Passenger Vehicle	537	73.7	97.6
Public Transit	2	0.3	0.4
Other	11	1.5	2.0
No response	179	24.5	–
Total	729	100.0	100.0

In addition to the travel mode, respondents also provided information on whether or not they were the driver of the vehicle as well as the number of vehicle occupants. The results of those questions are provided in Table 17 and Table 18, respectively. Approximately 90 percent of respondents indicated they were the driver of their vehicle. With regard to vehicle occupancy, approximately 57 percent of the respondents indicated they were the only occupant. Six respondents indicated a response of zero, however the question asked for the number of people that were in the vehicle, including yourself. As a result, when determining the average vehicle occupancy, it was assumed that there was one person per vehicle for those responses that indicated that there were no passengers. Overall, the average vehicle occupancy was 1.63 occupants per vehicle.

Table 17. Web Survey Driver Summary.

Is Respondent Driver?	Number	% Total	% of Those Responding
Yes	480	65.9	89.7
No	55	7.5	10.3
No Response	194	26.6	–
Total	729	100.0	100.0

Table 18. Web Survey Vehicle Occupancy.

Occupancy (includes respondent)	Number	% Total	% of Those Responding
0	6	0.8	1.2
1	294	40.4	57.1
2	125	17.1	24.3
3	44	6.0	8.5
4 or more	46	6.3	8.9
No Response	214	29.4	–
Total	729	100.0	100.0



In addition to the travel mode, respondents also provided information on whether or not they were the driver of the vehicle as well as the number of vehicle occupants.

For the trip destination, over one-half (53 percent) of those that responded to the question indicated that the purpose at the trip destination was work or work related.

The next question that was asked pertained to the purpose of the trip at both the origin and the destination. The results of the trip purpose at the origin are provided in Table 19 while the trip purpose at the destination results are shown in Table 20. At the origin, 60 percent of those that responded to the question indicated that home was the purpose. An additional 23 percent indicated a work or work-related trip purpose at the origin.

Table 19. Web Survey Trip Purpose at Origin.

Origin Purpose	Number	% Total	% of Those Responding
Home	327	44.9	59.6
Work or Work Related	124	17.0	22.6
School	6	0.8	1.1
Eat	3	0.4	0.5
Shop	4	0.5	0.7
Personal Business	64	8.8	11.7
Other	21	2.9	3.8
No Response	180	24.7	–
Total	729	100.0	100.0

For the trip destination, over one-half (53 percent) of those that responded to the question indicated that the purpose at the trip destination was work or work related. Additionally, approximately 21 percent of the destination trip purposes were for personal business.

Table 20. Web Survey Trip Purpose at Destination.

Destination Purpose	Number	% Total	% of Those Responding
Home	49	6.7	9.0
Work or Work Related	290	39.8	53.4
School	5	0.7	0.9
Eat	8	1.1	1.5
Shop	14	1.9	2.6
Personal Business	113	15.5	20.8
Other	64	8.8	11.8
No Response	186	25.5	–
Total	729	100.0	100.0

The web survey included a question that provided information on the residency status of the respondents. The question inquired as to the residency and work relationship to the greater Omaha metropolitan area. Those results are provided in Table 21. Of those persons that responded to the question, 78 percent were residents of the area. Approximately 22 percent were non-residents.

Table 21. Web Survey Relationship to Study Area.

Type	Number	% Total	% of Those Responding
Live and Work in Area	389	53.4	74.0
Live Inside, Work Outside	21	2.9	4.0
Live Outside, Travel Into	110	15.1	20.9
Visitor to Area	6	0.8	1.1
No Response	203	27.8	–
Total	729	100.0	100.0

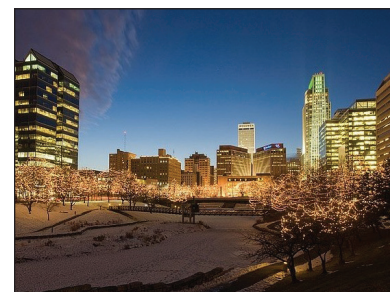
Since the survey was publicized via multiple methods, a question was included to determine how the individual respondents heard about the survey. A summary of the results is provided in Table 22. For those that responded to the question, the majority (71 percent) heard about the survey from their employer. An additional 20 percent cited “other” and a break-down of those responses are provided in Table 23. Over one-half (57 percent) of the “other” responses cited that notice about the survey was received via the Omaha Chamber of Commerce. Relative to all of the survey responses for this question, receiving notice from the Chamber of Commerce accounted for 11 percent (60 out of 539) of the responses.

Table 22. Web Survey Advertisement.

Method	Number	% Total	% of Those Responding
From Employer	380	52.1	70.4
Newspaper	10	1.4	1.9
Radio	1	0.1	0.2
Television	16	2.2	3.0
Social Media	23	3.2	4.3
Survey Interviewer	3	0.4	0.6
Other	106	14.5	19.6
No Response	190	26.1	–
Total	729	100.0	100.0

Table 23. Web Survey Summary of “Other” Responses.

“Other” Responses	Number	% Total
Chamber of Commerce	60	56.6
Colleagues	2	1.9
Email (unspecified source)	18	17.0
Family/Friend	6	5.7
Hotel	1	0.9
MAPA	4	3.8
Miscellaneous	14	13.2
No response	1	0.9
Total	106	100.0



The web survey included a question that provided information on the residency status of the respondents.

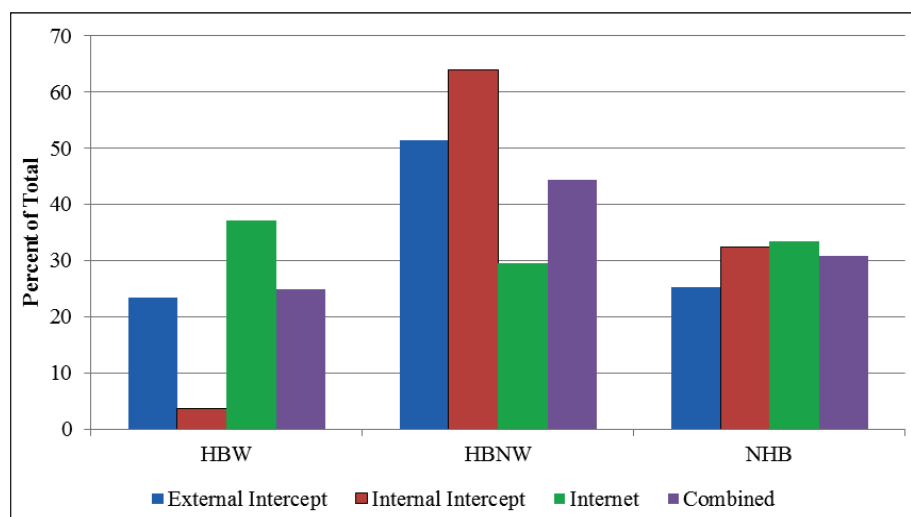
The analysis reviewed the origin and destination trip purpose information for each respondent.

Trip Purpose Summary

The trip purposes normally used in travel demand modeling are home-based work (HBW), home-based non-work (HBNW), and non-home-based (NHB). HBW trips are those that have one end of the trip at home and the other end of the trip at work. Trips that begin at home and end at work or those that begin at work and end at home are HBW. A HBNW trip is one that one end of the trip is at home and the other trip end is any location other than work. A NHB trip is a trip that does not begin or end at home.

Using data from the external and internal intercept surveys and the web-based survey, an analysis of the trip purpose was performed. The analysis reviewed the origin and destination trip purpose information for each respondent. The distribution of trips by trip purpose for the three survey methods individually as well as all three methods combined is provided in Figure 13. For the external and internal surveys, HBNW trips were the most commonly cited trip purpose (51 percent and 64 percent, respectively). For the web survey, HBW trips were the most commonly cited trip purpose (37 percent of the trips).

Figure 13. Trip Purpose Summary.

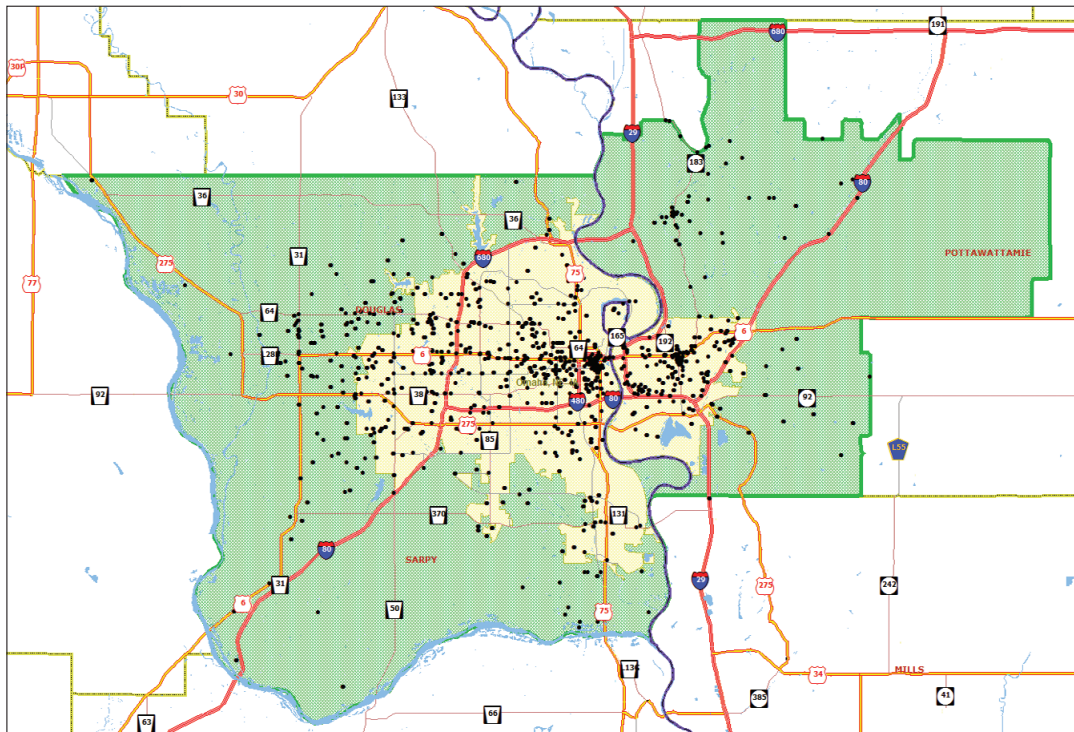


Spatial Distribution of Intercept and Web Survey Results

After processing the intercept and web survey results, the locational information provided by respondents was geocoded to the longitude and latitude of the location provided. Those coordinates were used to correlate the location to a traffic analysis zone (TAZ) in the MAPA travel demand model. The trip origin or destination TAZ is utilized in the development of trip tables, trip length frequency distributions (TLFD), and vehicle miles of travel (VMT) estimates. Those estimates will be discussed in the following sections.

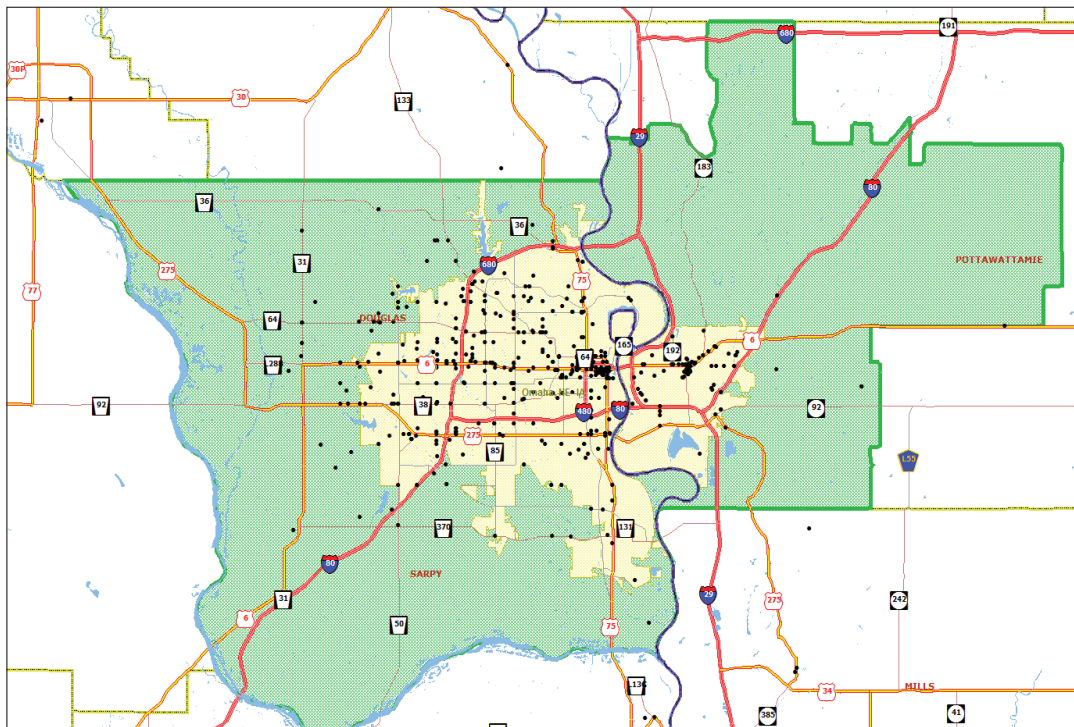
Origin and destination locations obtained via the intercept and web survey were compiled and mapped to illustrate the spatial distribution of trip ends that either began or ended (depending on the direction of travel) within the MAPA study area. Those results are shown in Figure 14.

Figure 14. MAPA Origins and Destinations within the Study Area.



Similar to the origins and destinations described previously, an identical process was performed for the work locations that were provided by the survey respondents. The spatial distribution of work locations provided in the survey are illustrated in Figure 15.

Figure 15. Work Locations Provided in Intercept and Web Surveys.

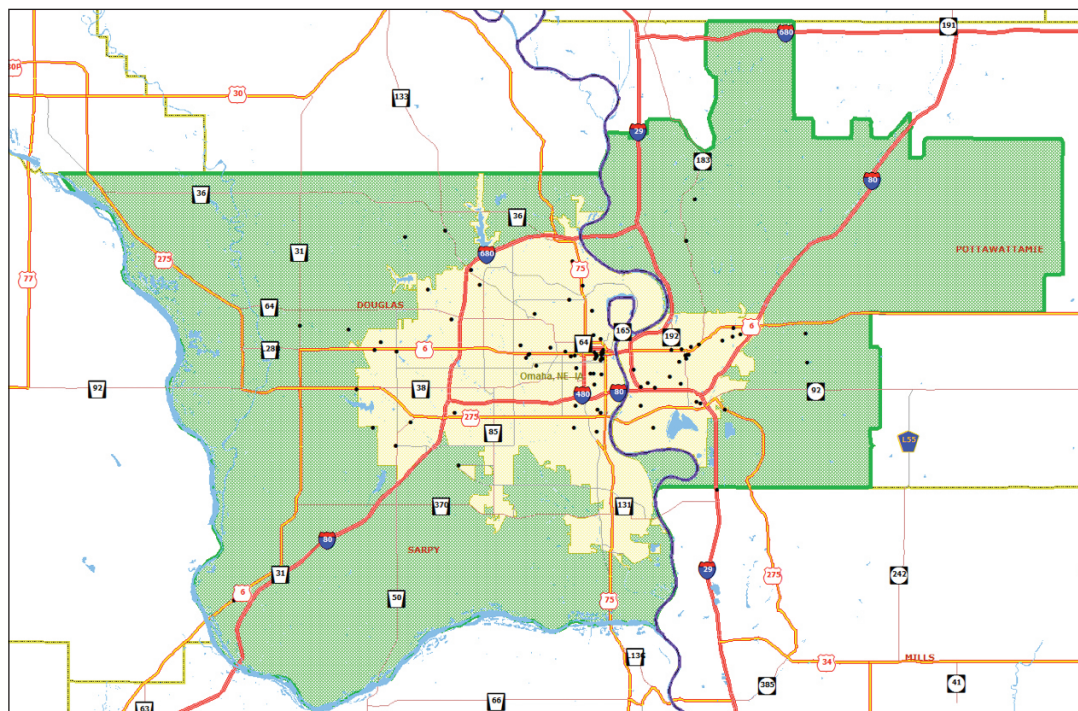


The premise of the Bluetooth data collection was to position the readers at select locations around the periphery of the study area.



An additional assessment was performed that provided the spatial distribution of the 110 web survey respondents that indicated that they lived outside of the area and traveled into the area during the survey period. The destinations for those individuals are provided in Figure 16.

Figure 16. Distribution of Non-Resident Trip Destinations.



DEVELOPMENT OF EXTERNAL TRAVEL ESTIMATES

One of the primary intended outputs of the MAPA travel survey was the development of external trip tables and TLFID that could be used to further planning and programming needs for the agency. The methodology used to collect the data necessary to meet this need was multi-faceted and involved extracting key pieces of data from various sources. The following sections detail the development of E-E and I-E/E-I trip characteristics.

In general terms, the process for developing the external estimates involved the following sequence of events:

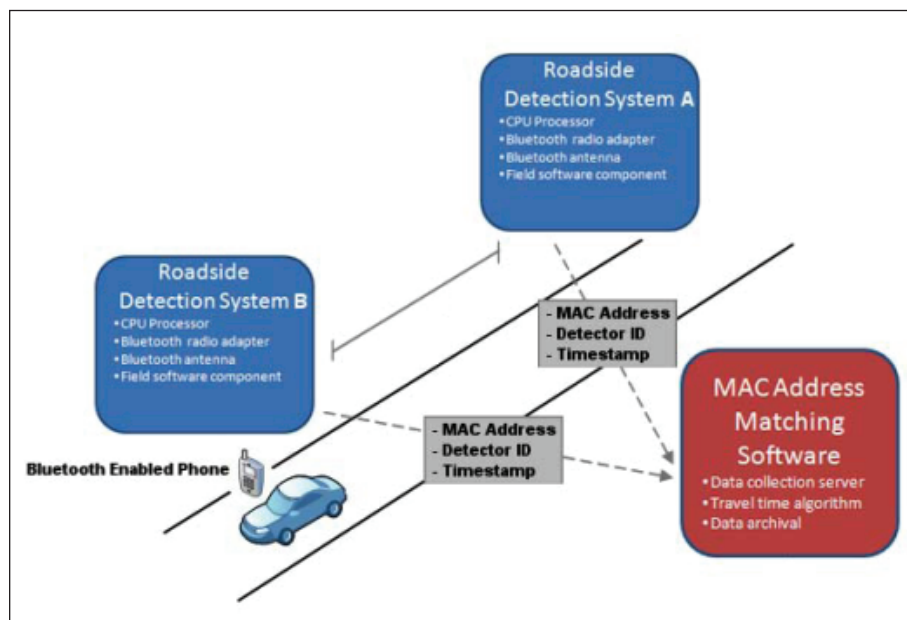
1. Develop E-E estimates using Bluetooth data;
2. Expand results (using traffic counts as control totals);
3. Subtract E-E trips from corresponding site traffic counts (remaining count volume is considered I-E/E-I);
4. Develop I-E/E-I estimates using intercept and web survey results; and
5. Review number of E-E and I-E/E-I trips per site as compared to traffic volumes.

Summary of Bluetooth Data Collection

As described in the Methodology section, portable Bluetooth devices were deployed at all of the external station locations around the greater Omaha metropolitan area. Bluetooth readers recorded media access control (MAC) addresses of devices that passed by the readers. Bluetooth devices could be either incorporated into vehicle navigation or diagnostic systems or in the portable communication devices of vehicle occupants. The premise of the Bluetooth data collection was to position the readers at select locations around the periphery of the study area, record the MAC addresses of those Bluetooth devices that pass by the readers, and then analyze the results to ascertain if and where a particular MAC address is recorded at more than one location (see Figure 17).

The methodology used to collect the data necessary to meet this need was multi-faceted and involved extracting key pieces of data from various sources.

Figure 17. Bluetooth Data Collection Concept.



Bluetooth data were collected for a 72-hour period (April 23-25, 2013). Special algorithms were written to match MAC address results and produce a trip matrix of matches between data collection locations. However, prior to expanding the raw Bluetooth results, the data had to be processed to account for time variations.

Screening of Bluetooth Data

Since the purpose of the Bluetooth data collection portion of the study was to develop estimates of E-E travel, the data that were collected had to be processed to remove those matches that took longer than a predetermined amount of time to travel between two locations. The rationale is that if a vehicle was detected at two data collection locations with a time difference that exceeded a specified time threshold, then it was assumed that the vehicle stopped somewhere between the two locations and therefore it was not an E-E trip, but rather two I-E/E-I trips.

To screen the matched Bluetooth results, the length of time each matched MAC address took to traverse the distance between the locations at which it was recorded was compared against the travel time separation (skim) value. The time values from the travel demand model separation matrix served as the basis for determining a reasonable amount of time to travel between two locations. To verify how reasonable the separation matrix time values were, a field test was conducted. The field test involved performing travel time runs between a sample of external locations and then comparing the field test results against the separation matrix time results for the same external pairs. The results of the field study are provided below in Table 24.

Table 24. Travel Time Field Test Results.

Route 1 – I-29 (Ext #100) to I-29 (Ext #107)	
Travel Time	22:47
Skim Time	27:41
Route 2 – I-29 (Ext #107) to US 34 (Ext #120)	
Travel Time	4:54
Skim Time	3:17
Route 3 – I-29 (Ext #107) to US 75 (Ext #108)	
Travel Time	20:40
Skim Time	24:49
Route 4 – US 75 (Ext #108) to NE 50 (Ext #109)	
Travel Time	21:48
Skim Time	27:30
Route 5 – NE 50 (Ext #109) to I-80 (Ext #110)	
Travel Time	14:01
Skim Time	23:25
Route 6 – I-80 (Ext #110) to I-80 (Ext #103)	
Travel Time	42:30
Skim Time	45:10
Route 7 – I-80 (Ext #103) to US 6 (Ext #104)	
Travel Time	10:15
Skim Time	13:45
Route 8 – 72nd St (Ext #118) to US 75 (Ext #117)	
Travel Time	8:03
Skim Time	10:24
Route 9 – US 75 (Ext #117) to I-29 (Ext #100)	
Travel Time	11:02
Skim Time	13:12



As described in the Methodology section, portable Bluetooth devices were deployed at all of the external station locations around the greater Omaha metropolitan area.



While not provided in Table 24, travel times were recorded at intermediate points along the routes. These times were also compared against travel time skims for the area. With the exception of route 2, all travel times observed during the field test were less than the time values provided in the skim matrix. As a result, the skim matrix time values were used to assess the Bluetooth data that were collected.

Each MAC address was recorded with a time stamp when the address was observed. For those MAC addresses that were recorded at two external locations, the time difference for the two observations was determined. That time difference was compared to the skim matrix time value for the same two external locations. If the observed value was less than the skim matrix value for the corresponding externals, the two matched MAC addresses were deemed a valid E-E trip. If the observed value was more than the skim matrix value for the same two externals, the matched MAC addresses were assumed to be two I-E/E-I trips. That is, the vehicle was assumed to have stopped somewhere between the two external locations. This process was performed for every instance where a MAC address was observed more than one time.

Development of E-E Trip Tables

The development of E-E trip tables was performed by using Bluetooth data and vehicle classification counts. As previously described, Bluetooth readers deployed at each of the area's external locations recorded the MAC addresses of Bluetooth devices in vehicles that passed by the data collection locations. The number of daily observations, the 3-day traffic count, and the percent of vehicles counted that had Bluetooth devices is provided in Table 25. Overall, slightly over four percent of the vehicles entering and exiting the study area had an enabled Bluetooth device.

The development of E-E trip tables was performed by using Bluetooth data and vehicle classification counts.

Table 25. Summary of Bluetooth Observations per External.

Site	Site Description	23-Apr Tue	24-Apr Wed	25-Apr Thu	Total Reads	3-day Count	3-day % Read
100	I-29	1,229	1,293	1,290	3,812	73,481	5.19
101	Lincoln Highway (Old 183)	70	100	91	261	9,358	2.79
102	Railroad Highway	70	80	60	210	5,987	3.51
103	I-80	1,684	790	1,831	4,305	69,087	6.23
104	US 6	106	105	97	308	11,038	2.79
105	IA 92	110	108	130	348	25,865	1.35
106	Wabash (Old 275)	117	94	91	302	7,346	4.11
107	I-29	1,250	1,278	1,224	3,752	72,074	5.21
108	US 75	609	639	703	1,951	65,715	2.97
109	NE 50	237	239	252	728	24,293	3.00
110	I-80	2,474	2,694	2,681	7,849	140,351	5.59
111	US 6	213	241	244	698	22,067	3.16
112	NE 92	201	270	249	720	22,371	3.22
113	NE 64	41	65	65	171	5,747	2.98
114	US 275	624	629	634	1,887	46,737	4.04
115	NE 31	82	80	86	248	7,798	3.18
116	NE 133	329	325	336	990	30,666	3.23
117	US 75	279	302	279	860	22,490	3.82
118	72nd St	93	99	116	380	5,016	6.14
119	Old Hwy 275 (Reichmuth)	195	188	207	590	13,533	4.36
120	US 34	351	343	318	1,012	21,262	4.76
121	195th St	31	27	42	100	4,296	2.33
Total		10,395	9,989	11,026	31,410	706,578	4.45

The results of the Bluetooth data collection represent the survey sample. After screening the matched Bluetooth results using the process described in the section “Screening of Bluetooth Data,” an origin-destination (O-D) matrix was developed. The matrix provided the number of interchanges between each of the 22 external locations. Since the O-D matrix represented the survey sample, the results were then expanded to represent the overall level of travel for the area. Using the number of Bluetooth observations and the traffic counts that were collected on the same days, expansion factors were developed for each external location. The expansion factor results are provided in Table 26.

Table 26. Bluetooth Expansion Factors.

Site	Location	Traffic Count		Bluetooth Reads		Exp. Factor
		3-day	1-day	3-day	1-day	
100	I-29	73,481	24,494	3,812	1,271	19.276
101	Lincoln Highway (Old 183)	9,358	3,119	261	87	35.854
102	Railroad Highway	5,987	1,996	210	70	28.510
103	I-80	69,087	23,029	4,305	1,435	16.048
104	US 6	11,038	3,679	348	116	35.838
105	IA 92	25,865	8,622	471	157	74.325
106	Wabash (Old 275)	7,346	2,449	302	101	24.325
107	I-29	72,074	24,025	3,752	1,251	19.209
108	US 75	65,715	21,905	1,951	650	33.683
109	NE 50	24,293	8,098	728	243	33.370
110	I-80	140,351	46,784	7,849	2,616	17.881
111	US 6	22,067	7,356	698	233	31.615
112	NE 92	22,371	7,457	720	240	31.071
113	NE 64	5,747	1,916	171	57	33.608
114	US 275	46,737	15,579	1,887	629	24.768
115	NE 31	7,798	2,599	248	83	31.444
116	NE 133	30,666	10,222	990	330	30.976
117	US 75	22,490	7,497	860	287	26.151
118	72nd St	5,016	1,672	308	103	16.286
119	Old Hwy 275 (Reichmuth)	13,533	4,511	590	197	22.937
120	US 34	21,262	7,087	1,012	337	21.010
121	195th St	4,296	1,432	100	33	42.960
Total		706,578	235,526	31,410	10,470	

Based on the results of the matching programs that were developed to identify MAC addresses that were recorded at two different external locations, an O-D matrix was produced. As previously noted, the matrix results contain only those matches that took less than prescribed amount of time (from the skim matrix) to be recorded at the respective data collection locations. An unexpanded average daily O-D matrix of these results is provided in Table 27. Using the expansion factors provided in Table 26, the expanded O-D results are provided in Table 28. The results shown in Table 28 have been balanced to eliminate migration inequities.

The results of the analysis estimate that there are over 20,500 daily E-E trips for commercial and non-commercial vehicles combined. In order to develop estimates of the number of E-E trips for commercial and non-commercial vehicles separately, the percentage of those vehicle types as determined from the vehicle classification counts was used. The resulting O-D matrix for commercial vehicle E-E trips is provided in Table 29 and the O-D matrix for non-commercial vehicle E-E trips is shown in Table 30.

The results of the analysis estimate that there are over 20,500 daily E-E trips for commercial and non-commercial vehicles combined.



Table 27. Average Daily Bluetooth Match Matrix (E-E trips only).

DESTINATION EXTERNAL																									
ORIGIN EXTERNAL	O/D	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	Total	
	100	0	1	0	0	0	0	0	139	2	0	43	0	2	0	0	0	0	2	0	0	3	0	194	
	101	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	102	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	
	103	0	0	2	0	0	0	0	14	1	0	247	1	1	0	0	0	0	0	0	0	2	0	268	
	104	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
	105	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	107	139	0	0	16	1	1	0	0	0	0	7	0	0	0	11	0	1	2	0	0	0	3	181	
	108	1	0	0	2	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	1	0	0	9	
	109	3	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	7	
	110	46	1	1	230	1	0	0	5	2	1	0	0	0	0	0	2	2	2	1	0	3	1	298	
	111	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	
	112	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	
	113	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	
	114	0	0	0	0	0	0	0	10	1	1	1	1	1	0	0	1	0	0	1	0	1	0	17	
	115	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	
	116	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	4	
	117	2	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	2	0	0	0	9	
	118	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	0	0	0	5	
	119	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	
	120	4	0	0	1	0	0	0	0	0	0	2	0	1	0	1	0	0	1	0	1	0	5	15	
	121	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	
	Total	200	3	5	253	3	2	1	176	8	5	311	2	6	1	18	3	6	10	4	2	12	8	1,041	



These data are can be used to model the travel between external and internal zones and the building of an I-E-E/I trip table for travel assignment to the network.

Table 28. Expanded Bluetooth Match Matrix for E-E Trips (all vehicles).

DESTINATION EXTERNAL																								
ORIGIN EXTERNAL	O/D	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	Total
	100	0	24	0	3	0	3	0	2,675	52	31	831	13	36	3	0	0	8	45	9	0	74	6	3,814
	101	24	0	15	0	0	0	4	0	6	0	15	0	0	0	0	0	0	0	0	0	0	0	64
	102	0	15	0	47	11	0	0	0	0	0	37	5	0	0	0	0	0	0	0	0	0	0	114
	103	3	0	47	0	0	0	4	263	25	3	4,054	27	24	0	0	0	0	0	0	0	26	0	4,473
	104	0	0	11	0	0	43	0	24	6	0	21	6	0	0	0	0	0	0	0	0	0	0	111
	105	3	0	0	0	43	0	0	47	0	12	0	0	5	0	0	0	5	0	0	0	0	0	116
	106	0	4	0	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	8	19
	107	2,675	0	0	263	24	47	3	0	6	3	111	6	3	0	232	0	10	36	0	13	350	76	3,859
	108	52	6	0	25	6	0	0	6	0	11	46	11	6	0	35	0	10	29	0	8	0	0	249
	109	31	0	0	3	0	12	0	3	11	0	26	0	6	0	37	0	11	11	0	6	0	0	157
	110	831	15	37	4,054	21	0	0	111	46	26	0	3	3	0	6	38	60	42	8	0	49	14	5,363
	111	13	0	5	27	6	0	0	6	11	0	3	0	0	0	16	5	0	5	0	0	0	0	97
	112	36	0	0	24	0	5	0	3	6	6	3	0	0	16	23	10	0	0	0	9	19	0	159
	113	3	0	0	0	0	0	0	0	0	0	0	0	16	0	4	0	0	0	0	17	0	0	40
	114	0	0	0	0	0	0	0	232	35	37	6	16	23	4	0	10	8	0	26	4	19	0	420
	115	0	0	0	0	0	0	0	0	0	0	38	5	10	0	10	0	0	0	0	0	0	0	64
	116	8	0	0	0	0	5	0	10	10	11	60	0	0	0	8	0	0	0	15	0	0	0	129
	117	45	0	0	0	0	0	0	36	29	11	42	5	0	0	0	0	0	0	41	0	12	0	222
	118	9	0	0	0	0	0	0	0	0	0	8	0	0	0	26	0	15	41	0	3	0	0	103
	119	0	0	0	0	0	0	0	13	8	6	0	0	9	17	4	0	0	0	3	0	8	0	66
	120	74	0	0	26	0	0	0	350	0	0	49	0	19	0	19	0	0	12	0	8	0	128	684
	121	6	0	0	0	0	0	8	76	0	0	14	0	0	0	0	0	0	0	0	0	128	0	234
	Total	3,814	64	114	4,473	111	116	19	3,859	249	157	5,363	97	159	40	420	64	129	222	103	66	684	234	20,557

Table 29. Expanded Bluetooth Match Matrix – For Commercial Vehicle E-E Trips.

DESTINATION EXTERNAL																									
ORIGIN EXTERNAL	O/D	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	Total	
	100	0	4	0	1	0	1	0	454	6	9	186	3	7	1	0	0	3	8	2	0	16	2	701	
	101	4	0	2	0	0	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	9	
	102	0	2	0	4	2	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	12	
	103	1	0	4	0	0	0	1	19	2	0	522	3	3	0	0	0	0	0	0	0	4	0	558	
	104	0	0	2	0	0	6	0	5	2	0	5	2	0	0	0	0	0	0	0	0	0	0	21	
	105	1	0	0	0	6	0	0	5	0	1	0	0	1	0	0	0	2	0	0	0	0	0	15	
	106	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	
	107	454	0	0	19	5	5	0	0	0	0	14	0	0	0	27	0	4	3	0	1	44	12	590	
	108	6	1	0	2	2	0	0	0	0	4	5	1	0	0	3	0	4	2	0	1	0	0	31	
	109	9	0	0	0	0	1	0	0	4	0	7	0	2	0	8	0	4	4	0	2	0	0	40	
	110	186	2	5	522	5	0	0	14	5	7	0	1	1	0	1	5	18	5	1	0	9	3	788	
	111	3	0	0	3	2	0	0	0	1	0	1	0	0	0	2	1	0	1	0	0	0	0	14	
	112	7	0	0	3	0	1	0	0	0	2	1	0	0	3	3	2	0	0	0	1	3	0	26	
	113	1	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	3	0	0	7	
	114	0	0	0	0	0	0	0	27	3	8	1	2	3	1	0	1	1	0	4	0	3	0	56	
	115	0	0	0	0	0	0	0	0	0	0	5	1	2	0	1	0	0	0	0	0	0	0	9	
	116	3	0	0	0	0	2	0	4	4	4	18	0	0	0	1	0	0	0	6	0	0	0	41	
	117	8	0	0	0	0	0	0	3	2	4	5	1	0	0	0	0	0	0	5	0	1	0	29	
	118	2	0	0	0	0	0	0	0	0	0	1	0	0	0	4	0	6	5	0	0	0	0	18	
	119	0	0	0	0	0	0	0	1	1	2	0	0	1	3	0	0	0	0	0	0	1	0	10	
	120	16	0	0	4	0	0	0	44	0	0	9	0	3	0	3	0	0	1	0	1	0	23	104	
	121	2	0	0	0	0	0	1	12	0	0	3	0	0	0	0	0	0	0	0	0	23	0	40	
	Total	701	9	12	558	21	15	2	590	31	40	788	14	26	7	56	9	41	29	18	10	104	40	3,123	

The resulting O-D matrix for commercial vehicle E-E trips is provided in Table 29 and the O-D matrix for non-commercial vehicle E-E trips is shown in Table 30.





In addition to the external locations, Bluetooth readers were deployed at 11 locations within the greater Omaha metropolitan area.

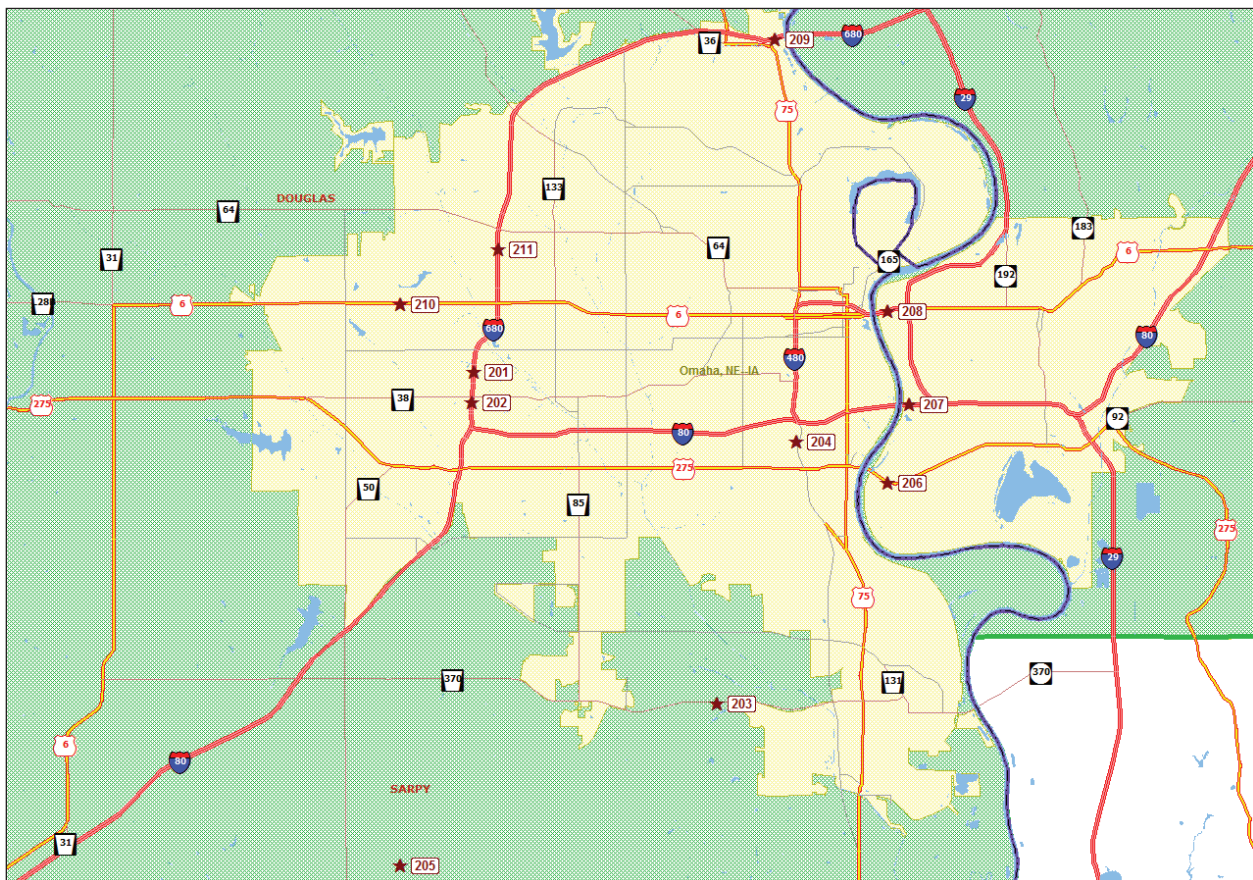
Table 30. Expanded Bluetooth Match Matrix – For Non-Commercial Vehicle E-E Trips.

DESTINATION EXTERNAL																								
ORIGIN EXTERNAL	O/D	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	Total
	100	0	20	0	2	0	2	0	2,221	46	23	645	9	29	2	0	0	6	38	7	0	57	5	3,113
	101	20	0	14	0	0	0	4	0	5	0	13	0	0	0	0	0	0	0	0	0	0	0	55
	102	0	14	0	43	9	0	0	0	0	0	32	4	0	0	0	0	0	0	0	0	0	0	102
	103	2	0	43	0	0	0	4	243	23	2	3,532	23	21	0	0	0	0	0	0	0	22	0	3,915
	104	0	0	9	0	0	38	0	19	4	0	16	4	0	0	0	0	0	0	0	0	0	0	90
	105	2	0	0	0	38	0	0	42	0	11	0	0	4	0	0	0	3	0	0	0	0	0	100
	106	0	4	0	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7	17
	107	2,221	0	0	243	19	42	3	0	5	3	96	6	3	0	205	0	6	33	0	12	307	65	3,269
	108	46	5	0	23	4	0	0	5	0	8	41	10	5	0	31	0	6	26	0	7	0	0	218
	109	23	0	0	2	0	11	0	3	8	0	19	0	4	0	29	0	7	8	0	4	0	0	116
	110	645	13	32	3,532	16	0	0	96	41	19	0	2	2	0	5	33	42	37	7	0	40	12	4,575
	111	9	0	4	23	4	0	0	6	10	0	2	0	0	0	14	5	0	5	0	0	0	0	83
	112	29	0	0	21	0	4	0	3	5	4	2	0	0	13	19	9	0	0	0	8	16	0	133
	113	2	0	0	0	0	0	0	0	0	0	0	0	13	0	4	0	0	0	0	14	0	0	33
	114	0	0	0	0	0	0	0	205	31	29	5	14	19	4	0	9	7	0	22	3	16	0	364
	115	0	0	0	0	0	0	0	0	0	0	33	5	9	0	9	0	0	0	0	0	0	0	55
	116	6	0	0	0	0	3	0	6	6	7	42	0	0	0	7	0	0	0	10	0	0	0	88
	117	38	0	0	0	0	0	0	33	26	8	37	5	0	0	0	0	0	0	36	0	11	0	193
	118	7	0	0	0	0	0	0	0	0	0	7	0	0	0	22	0	10	36	0	2	0	0	85
	119	0	0	0	0	0	0	0	12	7	4	0	0	8	14	3	0	0	0	2	0	7	0	56
	120	57	0	0	22	0	0	0	307	0	0	40	0	16	0	16	0	0	11	0	7	0	105	580
	121	5	0	0	0	0	0	7	65	0	0	12	0	0	0	0	0	0	0	0	0	105	0	193
	Total	3,113	55	102	3,915	90	100	17	3,269	218	116	4,575	83	133	33	364	55	88	193	85	56	580	193	17,434

Summary of Internal Trip Movements

In addition to the external locations, Bluetooth readers were deployed at 11 locations within the greater Omaha metropolitan area. Those locations are illustrated in Figure 18. The purpose of this data collection effort was to assess the movement of vehicles between select locations within the area. A process similar to that used for the E-E trip matrix development was followed with one exception. The difference was that there was no screening of the matches based on travel time when matching MAC addresses between the various locations. That is, the time it took a recorded MAC address in a vehicle to travel between data collection locations was not used. All matched MAC addresses, regardless of the time variable, were utilized in developing the trip matrix for internal trip movements.

Figure 18. MAPA Internal Data Collection Locations.



Similar to the E-E trip matrix development, a matrix of daily matched MAC addresses was developed. Since the matched results represent a sample of the traveling public, the data had to be expanded. Expansion factors were developed using the number of observations and the daily traffic counts for each location. Those results are provided in Table 31.

Table 31. Bluetooth Observations and Expansion Factors for Internal Sites.

Site	Site Description	23-Apr Tue	24-Apr Wed	25-Apr Thu	3-day Total	1-day Avg.	1-day Count	Exp. Factor
201	I-80 @ Douglas/Sarpy Co line	3,885	5,875	6,426	16,186	5,395	93,782	17.382
202	I-680 North of I-80	3,634	5,138	5,168	13,940	4,647	156,118	33.598
203	Hwy 370 @ 48th St	1,502	1,640	1,545	4,687	1,562	34,599	22.146
204	US 75 South of I-80	2,495	2,678	2,477	7,650	2,550	87,864	34.456
205	Platteview Rd East of 132nd St	120	135	138	393	131	4,777	36.466
206	Veterans Bridge	353	348	384	1,085	362	10,701	29.588
207	I-80 Missouri River Bridge	2,848	3,959	3,932	10,739	3,580	90,339	25.237
208	I-480 Missouri River Bridge	1,363	1,895	1,945	5,203	1,734	54,360	31.343
209	I-680 Missouri River Bridge	750	767	801	2,318	773	18,336	23.731
210	Hwy 6 West of 132nd St	4,942	4,672	4,377	13,991	4,664	82,026	17.588
211	I-680 between 6th & 64th	3,072	3,113	3,063	9,248	3,083	64,876	21.045
Total		24,964	30,220	30,256	85,440	28,480	697,778	

Algorithms developed especially for this study were used to process the Bluetooth data and produce a matrix of MAC addresses that were recorded at the various internal locations. The results of the matching are provided in Table 32. These results represent a daily average of matches from the 3-day data collection period.

Table 32. Unexpanded Daily Average of Matches for Internal Locations.

DESTINATION EXTERNAL													
ORIGIN EXTERNAL	O/D	201	202	203	204	205	206	207	208	209	210	211	Total
	201	0	708	49	108	14	13	721	85	102	159	340	2,299
	202	630	0	53	266	10	17	329	87	151	683	980	3,206
	203	52	63	0	128	6	8	47	14	3	22	25	367
	204	117	337	121	0	5	30	275	78	12	123	133	1,232
	205	11	11	6	2	0	0	2	0	0	3	4	39
	206	14	17	7	32	1	0	35	22	2	5	7	142
	207	659	315	41	224	1	39	0	153	52	126	107	1,717
	208	70	95	17	77	1	21	164	0	36	44	42	567
	209	95	125	2	12	1	3	45	30	0	54	181	549
	210	199	764	24	131	4	7	176	57	52	0	362	1,775
	211	339	883	21	124	4	8	124	53	204	350	0	2,110
	Total	2,187	3,318	341	1,103	47	147	1,916	579	615	1,569	2,182	14,003

Using the expansion factors provided in Table 31, the matrix values in Table 32 were expanded to provide an estimated daily number of matches between each of the internal locations. Those estimates are provided in Table 33.

Table 33. Expanded Daily Number of Matches for Internal Locations.

DESTINATION EXTERNAL													
ORIGIN EXTERNAL	O/D	201	202	203	204	205	206	207	208	209	210	211	Total
	201	0	23,776	1,093	3,710	511	395	18,187	2,675	2,421	2,797	7,148	62,711
	202	10,956	0	1,181	9,165	353	503	8,303	2,716	3,575	12,019	20,632	69,403
	203	904	2,128	0	4,422	219	227	1,178	439	63	381	526	10,486
	204	2,039	11,322	2,680	0	194	888	6,932	2,434	293	2,163	2,806	31,752
	205	185	358	125	69	0	0	50	10	8	47	91	945
	206	249	560	162	1,091	24	0	875	679	55	94	154	3,944
	207	11,449	10,595	901	7,707	49	1,164	0	4,806	1,242	2,210	2,245	42,366
	208	1,217	3,203	369	2,642	36	621	4,139	0	862	774	884	14,747
	209	1,657	4,211	52	413	24	99	1,127	940	0	950	3,816	13,290
	210	3,465	25,658	524	4,502	146	197	4,442	1,787	1,242	0	7,618	49,581
	211	5,893	29,656	458	4,273	158	247	3,129	1,661	4,833	6,156	0	56,463
	Total	38,015	111,466	7,544	37,994	1,714	4,340	48,362	18,148	14,594	27,590	45,921	355,688

These data are can be used to model the travel between external and internal zones and the building of an I-E-E/I trip table for travel assignment to the network.



Development of I-E/E-I Trip Estimates

After the estimated number of E-E trips at each external location has been produced, the estimated number of I-E/E-I trips can be developed by subtracting the number of E-E trips from the total number of vehicles counted at each respective external location. Table 34 provides the estimated number of trips by type (E-E or I-E/E-I) for non-commercial and commercial vehicles. In the table, the column 'Count' is the 24-hour count for both directions for each vehicle type. The column titled 'E-E' is the estimated number of E-E trips developed from the Bluetooth data analysis. Since vehicles making E-E trips are counted at both the study area entry and exit locations, the E-E values are doubled and provided in the 'Balanced' column. This value is subtracted from the 'Count' value to provide the estimated number of I-E/E-I trips for each vehicle type.

Table 34. Estimate of I-E/E-I Trips by Location.

Site	Non-Commercial				Commercial			
	Count	E-E	Balanced	I-E/E-I	Count	E-E	Balanced	I-E/E-I
100	18,582	3,167	6,334	12,248	6,032	712	1,424	4,608
101	2,264	47	94	2,170	856	9	17	839
102	1,818	43	85	1,733	178	7	13	165
103	20,553	3,914	7,827	12,726	2,476	558	1,115	1,361
104	2,945	79	157	2,788	734	19	38	696
105	7,869	79	157	7,712	753	12	23	730
106	3,111	17	34	3,077	563	2	4	559
107	21,376	5,014	10,028	11,348	2,649	830	1,659	990
108	19,569	214	427	19,142	2,336	29	58	2,278
109	5,968	106	211	5,757	2,130	35	70	2,060
110	34,531	4,590	9,179	25,352	12,253	783	1,565	10,688
111	6,206	80	159	6,047	1,149	15	29	1,120
112	6,681	150	300	6,381	776	29	57	719
113	1,656	33	65	1,591	260	7	14	246
114	13,197	381	761	12,436	2,382	59	117	2,265
115	2,338	55	110	2,228	262	9	18	244
116	7,448	52	104	7,344	2,775	19	38	2,737
117	6,657	206	412	6,245	840	30	60	780
118	1,402	91	181	1,221	270	16	31	239
119	3,691	64	127	3,564	820	11	22	798
120	9,513	2,163	4,326	5,187	1,119	320	639	480
121	1,194	193	386	808	238	41	81	157
Total	198,569	20,732	41,464	157,105	41,851	3,546	7,092	34,759



The basis for the development of I-E/E-I trip estimates is predicated on the use of intercept survey and web survey results which are then expanded using traffic count data.

These data are used to model the travel between external and internal zones and the building of an I-E-E/I trip table for travel assignment to the network.

The basis for the development of I-E/E-I trip estimates is predicated on the use of intercept survey and web survey results, which are then expanded using traffic count data. Web and intercept survey results were processed for a variety of uses such as residency status, trip purpose, and vehicle occupancy. However, one of the primary intended uses is the development of O-D trip estimates.

Locations provided in the web and intercept surveys were geocoded to the TAZ in which the origin and/or destination fell. That data was compiled from the different survey types and the compiled results are provided in Table 35. For each external station, the table provides the number of I-E-E-I trips identified via the surveys, the expanded number of I-E/E-I trips as determined by the 24-hour traffic counts, and the survey percentage of total as compared to the outbound traffic count for I-E/E-I trips.

Table 35. Non-Commercial I-E/E-I Trips from Intercept and Web Surveys.

Site	Description	I-E/E-I	I-E/E-I Count*	I-E/E-I Outbound**	% of Outbound Count
100	I-29	61	12,248	6,124	1.00
101	Lincoln Highway (Old 183)	40	2,170	1,085	3.69
102	Railroad Highway	3	1,733	867	0.35
103	I-80	118	12,726	6,363	1.85
104	US 6	40	2,788	1,394	2.87
105	IA 92	51	7,712	3,856	1.32
106	Wabash (Old 275)	10	3,077	1,539	0.65
107	I-29	110	11,348	5,674	1.94
108	US 75	66	19,142	9,571	0.69
109	NE 50	9	5,757	2,879	0.31
110	I-80	170	25,352	12,676	1.34
111	US 6	21	6,047	3,024	0.69
112	NE 92	19	6,381	3,191	0.60
113	NE 64	9	1,591	796	1.13
114	US 275	32	12,436	6,218	0.51
115	NE 31	8	2,228	1,114	0.72
116	NE 133	12	7,344	3,672	0.33
117	US 75	23	6,245	3,123	0.74
118	72nd St	13	1,221	611	2.13
119	Old Hwy 275 (Reichmuth)	6	3,564	1,782	0.34
120	US 34	2	5,187	2,594	0.08
121	195th St	9	808	404	2.23
Total		832	157,105	78,553	1.06

* Number of I-E/E-I trips (both directions) as determined after removing E-E trips from overall count per site.

** I-E/E-I Outbound is I-E/E-I Count value divided by 2 (since I-E/E-I count was for both directions).

Typically, trip tables showing the number of interchanges between each external location and the internal TAZs as recorded during the data collection are developed. For each external location, the internal origin (or destination, depending on the direction of travel) zones provided in the survey responses are expanded proportionally based on the number of I-E/E-I trips as determined from the traffic counts. However, since the number of I-E/E-I trips recorded during the web and intercept surveys represents a small number of observations, they do not represent a statistically significant sample and do not provide an accurate representation of I-E/E-I travel within the area. The trips are, however, significant enough to provide an accurate estimate of the TLFD for I-E/E-I travel between all external locations and internal zones.

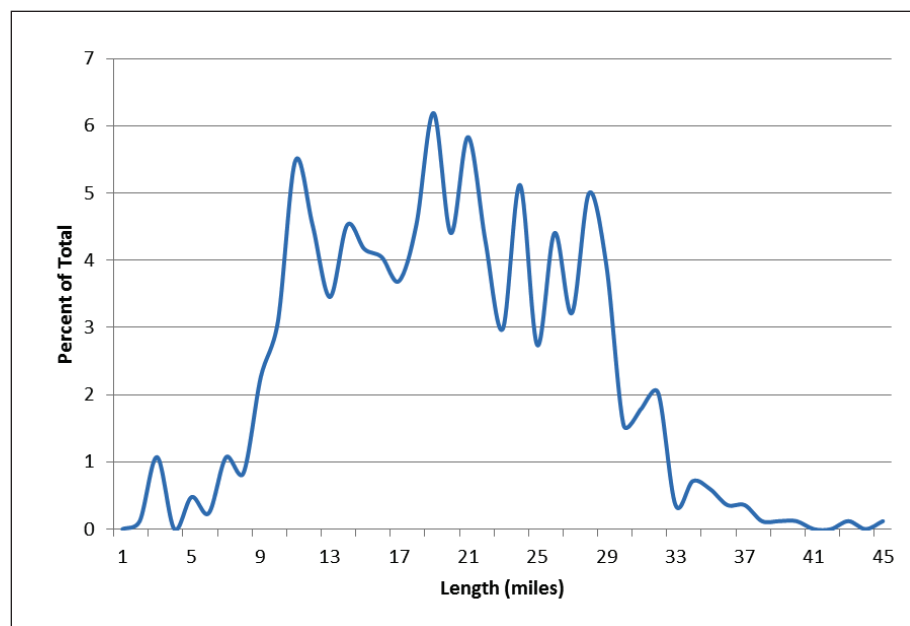
These data are used to model the travel between external and internal zones and the building of an I-E-E/I trip table for travel assignment to the network. This can be achieved by using the estimates of NHB attractions at the internal zones and the I-E/E-I TLFD developed from the web and intercept survey data combined with the number of estimated I-E/E-I trips at each external location, which will serve as trip productions used as inputs to the gravity model. The trips at external locations can be distributed to the internal zones using the gravity model, and then the distributed trips are adjusted to achieve the estimated TLFD.

Based on the results of the web and intercept surveys, a TLFD for non-commercial I-E/E-I trips was developed. Based on the travel demand model skims, the maximum separation between any two external locations is 50.76 miles. After compiling the web and intercept survey results, there were a total of 840 observations for use in developing the TLFD. The average trip length as determined from the surveys was 19.77 miles. The resulting TLFD in 1-mile increments is provided in Figure 19. The same source data were grouped in intervals (0-4 miles, 5-9 miles, 10-14 miles, etc.) and the results are illustrated in Figure 20.



These data are can be used to model the travel between external and internal zones and the building of an I-E-E/I trip table for travel assignment to the network.

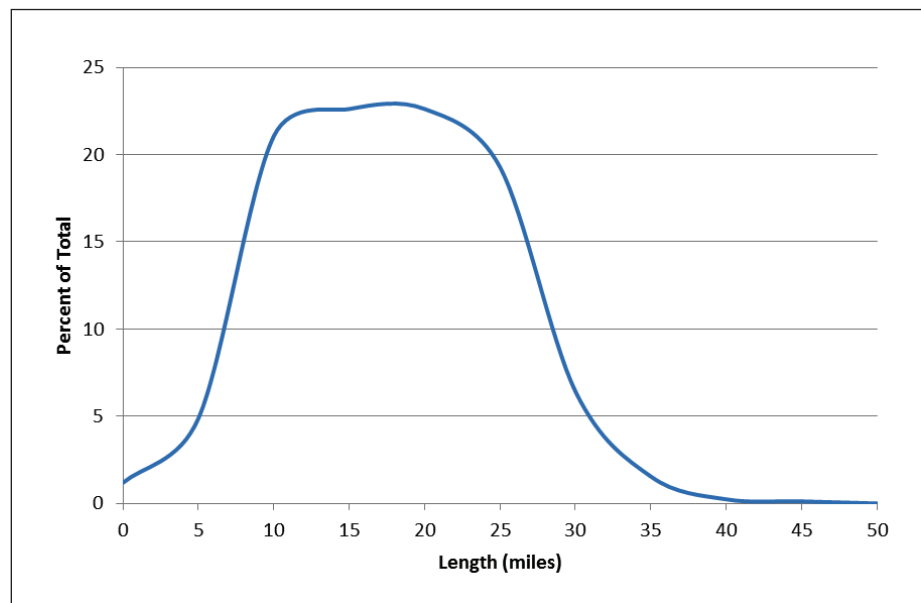
Figure 19. TLFD for Non-Commercial I-E/E-I Trips (1-mile intervals).



Based on the travel demand model skims, the maximum separation between any two external locations is 50.76 miles.



Figure 20. TLFD for Non-Commercial I-E/E-I Trips (grouped intervals).



SURVEY DATA EXPANSION

The vehicle survey data were expanded based on the 24-hour directional vehicle classification counts conducted at each external location. Table 36 presents the expanded estimates of I-E/E-I and E-E trips for non-commercial and commercial vehicles by site as well as the estimates of trips by residents and visitors (non-residents). The expanded number of residents and visitors are determined based on the ALPR results presented earlier and are based on the number of I-E/E-I non-commercial vehicle trips.

Table 36. Expanded I-E/E-I and E-E Trips by Location.

Site	Facility	Non-Commercial Vehicles			Residents	Visitors	Commercial Vehicles		
		I-E/E-I	E-E	Total			I-E/E-I	E-E	Total
100	I-29	12,357	6,225	18,582	965	11,392	4,629	1,403	6,032
101	Lincoln Hwy	2,153	111	2,264	1,484	669	838	18	856
102	Railroad Hwy	1,614	204	1,818	323	1,291	153	25	178
103	I-80	12,723	7,830	20,553	1,062	11,660	1,360	1,116	2,476
104	US 6	2,764	181	2,945	487	2,278	693	41	734
105	IA 92	7,668	201	7,869	3,670	3,998	722	31	753
106	Wabash	3,077	34	3,111	420	2,657	558	5	563
107	I-29	14,839	6,537	21,376	736	14,103	1,469	1,180	2,649
108	US 75	19,132	437	19,569	2,985	16,148	2,274	62	2,336
109	NE 50	5,735	233	5,968	827	4,908	2,049	81	2,130
110	I-80	25,381	9,150	34,531	2,348	23,034	10,676	1,577	12,253
111	US 6	6,040	166	6,206	996	5,044	1,121	28	1,149
112	NE 92	6,415	266	6,681	1,366	5,049	725	51	776
113	NE 64	1,590	66	1,656	300	1,290	245	15	260
114	US 275	12,469	728	13,197	1,542	10,926	2,269	113	2,382
115	NE 31	2,228	110	2,338	384	1,844	244	18	262
116	NE 133	7,273	175	7,448	884	6,389	2,693	82	2,775
117	US 75	6,271	386	6,657	1,201	5,070	782	58	840
118	72nd St	1,233	169	1,402	195	1,037	234	36	270
119	Old Hwy 275	3,579	112	3,691	918	2,661	800	20	820
120	US 34	8,352	1,161	9,513	1,023	7,329	912	207	1,119
121	195th St	808	386	1,194	128	680	157	81	238
Total		163,701	34,868	198,569	24,245	139,456	35,605	6,246	41,851

An additional analysis was performed to ascertain the VMT for all E-E trips. Using the expanded trip data and lengths provided in the transportation network travel distance matrix, the total amount of VMT attributable to commercial and non-commercial E-E trips was determined. The results are provided in Table 37. The overall average trip length was 34.73 miles per trip.

Table 37. Summary of E-E Trips and VMT.

Trip Type	Vehicle Type	Number of Trips	VMT	Average Trip Length
E-E	Non-Commercial	17,436	608,459	34.90
	Commercial	3,130	105,759	33.79
Total		20,566	714,218	34.73

The MAPA external travel survey was conducted to provide the local planning agency with data that could be used for multiple uses.



CONCLUSION AND KEY FINDINGS

The MAPA external travel survey was conducted to provide the local planning agency with data that could be used for multiple uses. It had been approximately 50 years since a travel survey had been conducted in the greater Omaha/Council Bluffs metropolitan area, so obtaining data on current travel patterns in the area was of great interest. The external travel survey that has been detailed in the preceding sections employed a number of data collection methods that have not been used in concert with one another in the past.

The following are key findings from the external travel survey data collection effort:

- Over 240,000 vehicles enter and exit the study area on a daily basis.
- 49 percent of vehicles entering and exiting study area are on I-29 and I-80.
- Approximately 83 percent of all vehicles entering or exiting the study area made I-E/E-I trips.
- Approximately 82 percent of vehicles entering and exiting the study area are non-commercial vehicles.
- Using ALPR cameras, it was determined that approximately 16 percent of persons entering and exiting the study area were residents of the study area.
- A total of 705 intercept surveys were collected and a total of 729 web surveys were started (but not all were completed).
- For external and internal intercept surveys, HBNW trips were the most commonly cited trip purpose (51 percent and 64 percent, respectively) and for web surveys HBW trips were the most common trip purpose (37 percent).
- There were approximately 48,000 daily E-E trips during the data collection period
- The VMT for E-E trips was over 710,000 miles for commercial and non-commercial vehicles combined.
- The average trip length for E-E trips was 34.73 miles.

Below are items to consider when developing and implementing an external travel survey using the methods employed for this data collection effort:

- Advertisement of the survey is imperative for increased public participation;
- Obtain 'buy-in' from key public officials and civic leaders;
- Clearly delineate the target survey audience; and
- Coordinate with local transportation and law enforcement officials.

APPENDIX

MAPA Press Release



For Release Monday, April 22, 2013

MAPA Explains Region Wide Travel Survey

Urges community participation in first-of-its-kind process

In a news conference today, Monday, April 22, at 10:00 a.m., the Metropolitan Area Planning Agency (MAPA) will reveal details of a unique, community-wide travel survey it will conduct over a three-day period, April 23-25, 2013. The news conference will be held at the MAPA office, [2222 Cuming Street in Omaha](#).

The survey will be multi-faceted and include a brief online questionnaire, in-person interviews and the collection of data through wireless devices set up along the highways at various points in the region. This will mark the first time that transportation planners will use Bluetooth® technology in conjunction with an online survey to gather data for a transportation analysis. (The technologies collect the data anonymously and no personal information is acquired during the data collection process.) Researchers will use the data to help transportation planners determine and prioritize future projects.

“Omaha will serve as the first location in the nation to employ these technologies for a travel survey,” says Associate Research Scientist Steve Farnsworth of the Texas A&M Transportation Institute (TTI). “They are less burdensome than the age-old, in-person roadside surveys. They’re safer, more accurate and less expensive. We’re eager to utilize these techniques in Omaha.” (Read: [Transportation Planners Find New Ways to Conduct Travel Surveys](#).)

The MAPA project is sponsored by the Federal Highway Administration in coordination with the Nebraska Department of Roads and the Iowa Department of Transportation. TTI researchers have been contracted to gather the data for the survey.

“The last time a travel survey was conducted in our area was in the 1960s — before the Interstate Highway System was completed — and there has never been a survey that has been this thorough,” says MAPA Executive Director Greg Youell. “Community participation is extremely important for the success of the project. We’ll need help from area business owners and their employees, residents, commuters and visitors to our area. A vital part of the project is an online survey that requires only a few minutes to fill out.”

The survey, located at <http://bit.ly/omaha-travel-survey>, is designed for residents who make a trip out of the area, or visitors coming into our area during the survey period. MAPA contractors will also be conducting in-person interviews at numerous locations throughout the region.

During the survey period, motorists may notice roadside equipment placed near highways inside of and around the perimeter of the four-county regional study area. The Bluetooth signal receivers and digital cameras will help estimate the amount and type of traffic traveling through the area.

Once the information is collected and analyzed, data from the surveys will go into MAPA’s travel forecasting model. Area transportation planners will use the model to help prioritize long-range transportation projects for the Omaha area.

For more information, contact:

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Omaha, NE 68102
402.444.6866, ext. 214
sskarka@mapacog.org
www.mapacog.org

Letter to Local Business and Agency Leaders

Members:

Douglas County, NE
Bennington
Boys Town
Omaha
Omaha City Council
Ralston
Valley
Waterloo
*

Sarpy County, NE
Bellevue
Gretna
La Vista
Papillion
Springfield
*

Washington County, NE
Arlington
Blair
Fort Calhoun
Herman
Kennard
Washington
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Mills County, IA
Emerson
Glenwood
Hastings
Henderson
Melvern
Pacific Junction
Silver City
*

Pottawattamie County, IA
Avoca
Casson
Carter Lake
Council Bluffs
Crescent
Hancock
Macedonia
McClelland
Minden
Neale
Oakland
Tremor
Underwood
Walnut
*

Bellevue Public Schools
Council Bluffs Planning
Commission
Fremont Public Schools
Golden Hills Resource
Conservation & Development
District
Iowa Western Community
College
Metro Transit
Metropolitan Community
College
Metropolitan Utilities District
Millard Public Schools
Millard Suburban Fire District
Omaha Airport Authority
Omaha Housing Authority
Omaha Planning Board
Omaha Public Power District
Papillion / La Vista Public
Schools
Papa - Missouri River
Natural Resources District
Pony Creek Drainage District
Ralston Public Schools
Valley Fire Protection
District # 5

METROPOLITAN AREA PLANNING AGENCY

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mapa@mapacog.org



April 9, 2013

Dear local business or agency leader,

Please mark your calendar for Tuesday, April 23 through Thursday, April 25!

During these three days, the Metropolitan Area Planning Agency (MAPA) will be conducting an important community-wide travel survey in the greater Omaha/Council Bluffs area. The survey is being sponsored by the Federal Highway Administration (FHWA) and MAPA in coordination with the Nebraska Department of Roads (NDOR) and the Iowa Department of Transportation (IDOT).

The purpose of the survey is to collect data on travel being made by residents, commuters, visitors and commercial trucks going into, out of and passing through the greater Omaha/Council Bluffs area. Information from the survey will be used by MAPA to help plan and prioritize highway improvements that are needed most in the region.

Participation by area employers in this survey is key to its success – and MAPA, NDOR and IDOT request and encourage the participation of your business/agency in this community-wide effort. MAPA has contracted with the Texas A&M Transportation Institute (TTI) and Gram Traffic Counting, Inc. to assist in conducting the survey. TTI or Gram Traffic may be contacting you to request that your workplace participate in the survey in one of the following ways:

1. By sending an e-mail to your employees. The e-mail would include a link to the online survey on MAPA's website and would encourage your employees to complete the survey online.
2. By permitting Gram Traffic to conduct a brief survey of visitors at your place of employment.

Participation in the survey by your employees or visitors to your work place is totally voluntary and no personally identifiable information is collected.

Your business/agency's participation will be greatly appreciated and will assist MAPA and its partner agencies to assess current and future transportation mobility needs of our area. If you have any questions about the survey, or would like additional information please contact Sarah Skarka at (402) 444-6866 or sskarka@mapacog.org.

Sincerely,

MAPA Executive Director



U.S. Department of Transportation
Federal Highway Administration



Iowa Department
of Transportation

Non-Commercial External Intercept Survey (Form A)

MAPA EXTERNAL Non-Commercial Vehicle Survey – FORM A *to be conducted at selected locations around study area boundary*

Station # _____ Survey Date _____

Station Name/Location _____ Interviewer _____

For each vehicle you collect	Vehicle 1	Vehicle 2
Time Survey Conducted	_____ Oa.m. Op.m.	_____ Oa.m. Op.m.
Number of people in vehicle		

QUESTIONS:	Vehicle 1	Vehicle 2
1. In what city and state do you live?	_____ _____	_____ _____
2. What are the names of two streets that intersect near where you live?	_____ _____	_____ _____
3. Where was the last place you got into your vehicle (place/address or nearest intersection/city)		
4. What was your purpose for being at your last location? (Choose from trip purpose options)		
5. Where is your next destination? (place/address or nearest intersection/city)		
6. What is your purpose for being at your next location? (Choose from trip purpose options)		

Trip Purpose Options: 1) Home 2) Work or Work Related 3) School 4) Eat
 5) Shop 6) Personal Business 7) Other (specify)

Commercial External Intercept Survey (Form B)

MAPA EXTERNAL Commercial Vehicle Travel Survey – FORM B *to be conducted at selected locations around study area boundary*

Station # _____

Survey Date _____

Station Name/Location _____

Interviewer _____

For each vehicle you collect	Vehicle 1	Vehicle 2
Commercial Vehicle Type	<input type="radio"/> Cargo - tractor trailers <input type="radio"/> Service – tradesmen, delivery	<input type="radio"/> Cargo - tractor trailers <input type="radio"/> Service – tradesmen, delivery
Time Survey Conducted	_____ 0a.m. 0p.m.	_____ 0a.m. 0p.m.
Number of people in vehicle		

QUESTIONS:	Vehicle 1	Vehicle 2
1. Where was the last place you got into your vehicle? (place/address or nearest intersection/city)		
2. What was your purpose for being at your last location? (Choose from trip purpose options)		
3. Where is your next destination? (place/address or nearest intersection/city)		
4. What is your purpose for travelling to your next destination? (Choose from trip purpose options)		
5. During the past 7 days, how often have you made this trip?		
IF CARGO VEHICLE ASK: 6. What cargo are you carrying?		

Trip Purpose Options:

1) Base Location	2) Cargo Delivery/Pick-up	3) Fuel/Vehicle Maintenance
4) Driver Needs	5) Other (specify)	

Internal Intercept Survey (Form C)

1. Location taking this survey? _____ Date _____
2. Approximately where do you live? Please provide the names of two intersecting streets near your residence

Names of two intersecting streets near your home _____ City and State _____

3. What is the approximate location of where you work?

Names of two intersecting streets near where you work _____ City and State _____

4. For the trip you took *into* the area, please enter the name of the place and the names of the two intersecting streets near where this trip began. If your trip began at home, just enter home.

Name of Place _____

Names of two intersecting streets near where trip began _____ City and State _____

- 4a. Referring to the study area map, what road or highway were you on when you crossed the study area boundary?

Road/Highway Number from Map _____

Name of road/highway you used if it is not one of those shown on the map _____

5. How did you travel? Please select one of the following:

☐ Passenger vehicle (car, SUV, truck, van) ☐ Public transit/bus

☐ Other, please specify _____

6. If you traveled by passenger vehicle, Were you the driver? ☐ Yes ☐ No

How many persons were in the vehicle, including yourself? _____

7. What was your purpose for being at that location? Please select one of the following options:

☐ Home ☐ Eat ☐ Work or work related ☐ Shop ☐ School
☐ Personal Business ☐ Other (please enter your purpose) _____

8. For the trip you will take *out of* the area, please enter the name of the place and the names of the two intersecting streets near where this trip will end. If your trip will end at home, just enter home.

Name of Place _____

Names of two intersecting streets near where this trip will end. _____

City and State _____

9. What was your purpose for going to this location? Please select one of the following options:

- ☐ Home ☐ Eat ☐ Work or work related ☐ Shop ☐ School
☐ Personal Business ☐ Other (please enter your purpose) _____

10. Please choose the option below that best relates to you

- ☐ I live and work in the study area
☐ I live in the study area, but work outside of the study area
☐ I live outside of the study area, but drive into the study area for work, shopping, or services
☐ I am a visitor to the area who is here temporarily for business or another reason

Thank you very much for your participation!

If you would like to complete a survey for another trip you took into/out of the study area during the April 23th-April 25th time period, please do!

MAPA Web-Survey Screen Captures

Page 1 – Welcome Screen

Omaha Area Travel Survey of travel entering and exiting the Omaha metropolitan area



Welcome to the greater Omaha/Council Bluffs travel survey!

The purpose of this survey is to obtain information on travel into and out of the greater Omaha/Council Bluffs area. The study is being conducted by Omaha's Metropolitan Area Planning Agency (MAPA). Information from the survey will be used in MAPA's travel forecasting model and will help transportation planners and engineers plan and prioritize future transportation improvements.

This survey is voluntary and all responses are anonymous. For more information about the survey, please call 888-315-6141.

[Exit and clear survey](#)

[Load Unfinished Survey](#)

[Next >>](#)



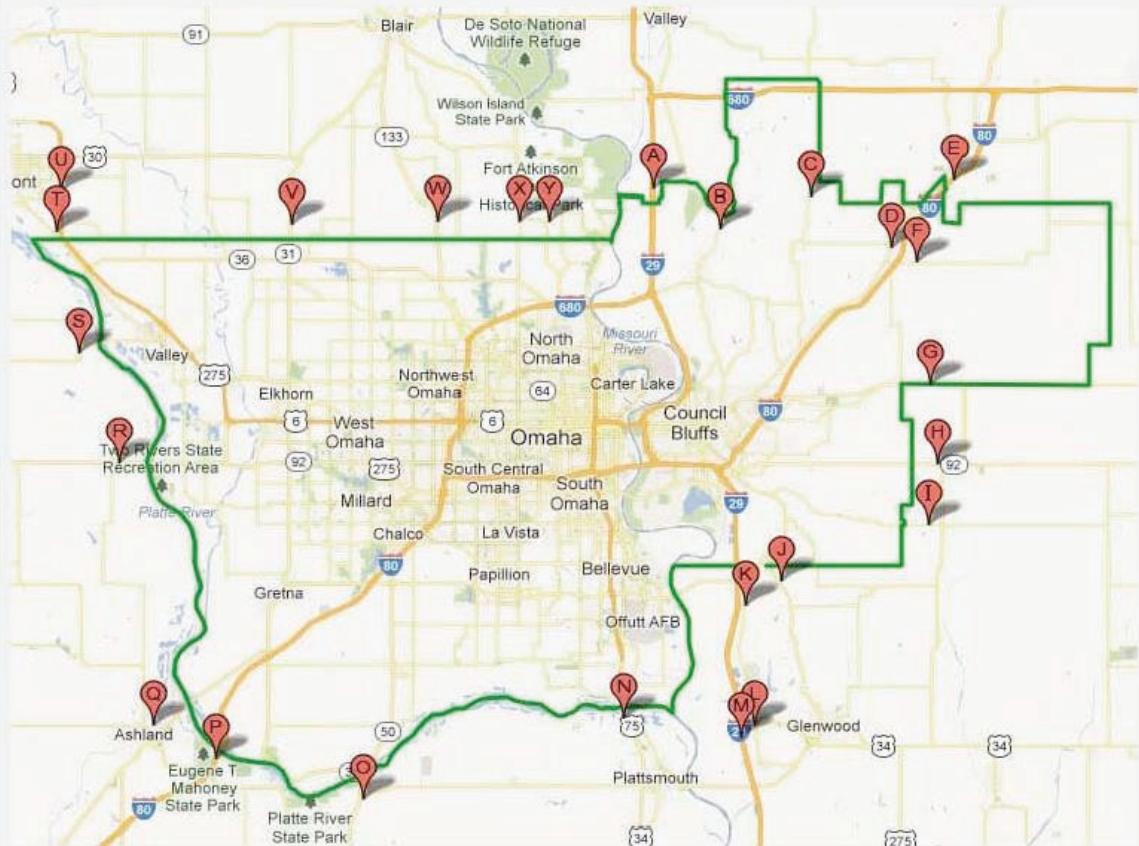
Page 2 – Study Information and Confirmation

Omaha Area Travel Survey

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Study Information

The map below illustrates the approximate boundary for the greater Omaha area. If you or a member of your family made or **will make** a trip **into or out of** the study area during the three-day period of April 23rd through April 25th and you agree with the privacy notice below, please complete the survey. If more than one trip has been or will be made during this timeframe, please complete the survey for the most recent trip.



Map data ©2013 Google

Privacy Note

This online survey is part of a study being conducted by the Metropolitan Area Planning Agency (MAPA). The purpose of the study is to collect data on the amount and type of traffic being made by residents, commuters and visitors that is coming into and out of the Omaha metropolitan area on a daily basis. Your participation, combined with that of other participants, will benefit transportation planning in the Omaha/Council Bluffs area by providing much needed data on the amount and patterns of travel in the region. If you are at least 18 years old, you are eligible to participate in this survey. Your participation is voluntary and anonymous. The survey should take less than 5 minutes to complete.

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Information provided by you will be kept confidential to the extent permitted or required by law.

If you have questions, concerns, or complaints about this study, you can contact the MAPA Communications Coordinator, Sarah Skarka, at 402-444-6866 or by email at sskarka@mapacog.org. By selecting "Yes" below, you are stating that you are 18 years of age or older and wish to continue to the survey questions.

* Do you agree to participate in this survey?

☐ Yes ☐ No

Exit and clear survey

Resume Later

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Omaha Area Travel Survey

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Demographic Information

Approximately where do you live? Please provide the names of two intersecting streets near your home along with the city, state and zip code.

Street 1

Street 2

City

State

Zip Code

What is the approximate location of where you work? Please provide the names of two intersecting streets near your workplace along with the city, state and zip code.

Street 1

Street 2

City

State


Zip Code


Exit and clear survey


Resume Later


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U.S. Department of Transportation
Federal Highway Administration

MAPA

NDOR
Nebraska
Department of Roads

Iowa Department
of Transportation

Omaha Area Travel Survey

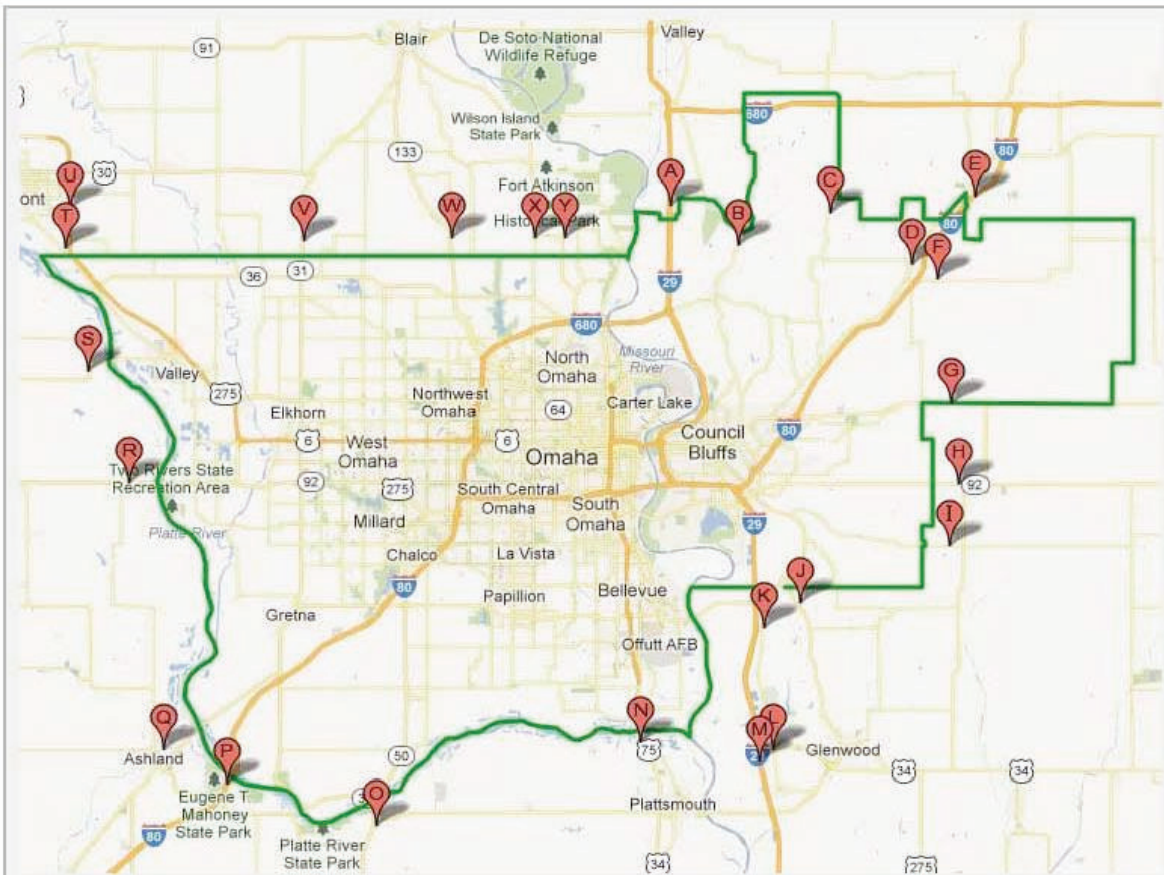
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Travel Direction

* Referring to the map below, when you crossed the study area boundary (green line) were you traveling into or out of the Omaha/Council Bluffs area?

Choose one of the following answers

- ☐ Into the study area
- ☐ Out of the study area



Map data ©2013 Google

[Exit and clear survey](#)

[Resume Later](#)

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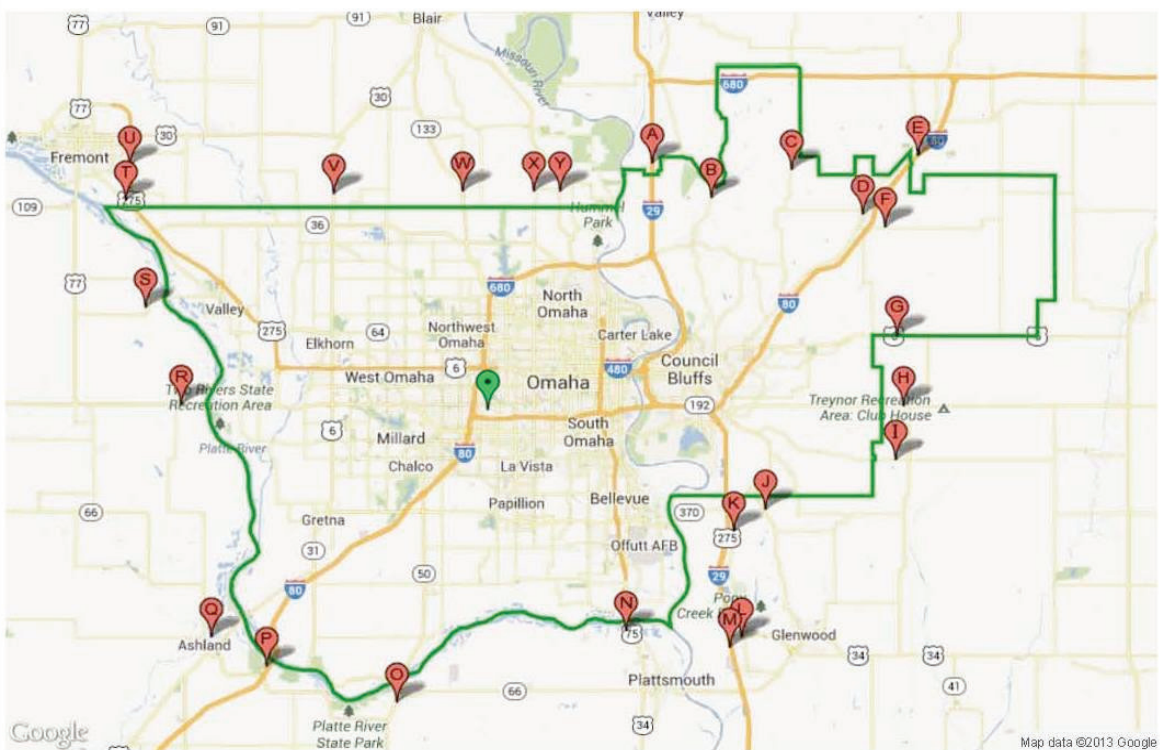
Page 5 – Trip Information

Omaha Area Travel Survey

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Trip Information

You indicated your trip was into the study area. Using the map below, please place the green marker () at the approximate location where your trip ended inside of the study area.



Drag and drop the pin to the desired location. You may also right click on the map to move the pin.

If the map above does not display please provide the names of two cross streets where your trip ended inside of the study area.

Street 1

Street 2

Referring to the study area map above, please select the letter of the pin that marks the road or highway that you were on when you entered the study area?

Choose one of the following answers

Please choose...

How did you travel? Please select one of the following:

Choose one of the following answers

- ☐ Passenger vehicle (car, SUV, truck, van)
- ☐ Public transit/bus
- ☐ Other, please specify
- ☒ No answer

If you traveled by passenger vehicle (car, SUV, truck, van), were you the driver?

- ☐ Yes
- ☐ No
- ☒ No answer

If you traveled by passenger vehicle, how many persons were in the vehicle, including yourself?

Only numbers may be entered in this field

What was your purpose for being at the location where you began your trip? Please select one of the following options:

Choose one of the following answers

- ☐ Home
- ☐ Work or work related
- ☐ School
- ☐ Eat
- ☐ Shop
- ☐ Personal Business
- ☐ Other (please enter your purpose)
- ☒ No answer

What was your purpose for being at the location where your trip ended? Please select one of the following options:

Choose one of the following answers

- ☐ Home
- ☐ Work or work related
- ☐ School
- ☐ Eat
- ☐ Shop
- ☐ Personal Business
- ☐ Other (please enter your purpose)
- ☒ No answer

Please choose the option below that best relates to you.

Choose one of the following answers

- ☐ I live and work in study area
- ☐ I live in study area, but work outside of the study area
- ☐ I live outside the study area, but drive into the study area for work, shopping, or services
- ☐ I am a visitor to the area who is here temporarily for business or another reason
- ☒ No answer

How did you hear about this survey?

Choose one of the following answers

- ☐ From my employer
- ☐ On TV
- ☐ On the radio
- ☐ Newspaper
- ☐ Survey interviewer
- ☐ Social media (Facebook, Twitter, etc.)
- ☐ Other:
- ☒ No answer

MAPA values your feedback. If you have any comments about this survey or concerns about transportation related issues in the Omaha/Council Bluffs area, please feel free to provide your comments below.

Exit and clear survey

Resume Later

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Submit



Page 6 – Thank You / Survey Conclusion

Thank you very much for your participation!

If you would like to complete a survey for another trip you took into/out of the study area during the April 23rd-April 25th time period, please do!





FOR MORE INFORMATION CONTACT:

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