Comparison of Four-Step Versus Tour-Based Models in Predicting Travel Behavior Before and After Transportation System Changes – Results Interpretation and Recommendations

Nazneen Ferdous and Chandra Bhat, *Center for Transportation Research, The University of Texas at Austin*

Lakshmi Vana and David Schmitt, *AECOM Consult*

John L. Bowman, *Bowman Research and Consulting*

Mark Bradley, *Mark Bradley Research and Consulting*

Ram Pendyala, *Arizona State University*

for the
Ohio Department of Transportation
Office of Research and Development

State Job Number
134368

February 2011

Prepared in cooperation with the Ohio Department of Transportation and the U.S. Department Transportation, Federal Highway Administration.

CENTER FOR TRANSPORTATION RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

FHWA

RESEARCH & DEVELOPMENT

1. Report No. **FHWA/OH-2011/4**	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and subtitle **Comparison of Four-Step Versus Tour-Based Models in Predicting Travel Behavior Before and After Transportation System Changes – Results Interpretation and Recommendations**		5. Report Date **February 2011** 6. Performing Organization Code
7. Author(s) **Nazneen Ferdous, Chandra Bhat, Lakshmi Vana, David Schmitt, John Bowman, Mark Bradley, Ram Pendyala**		8. Performing Organization Report No. 10. Work Unit No. (TRAIS)
9. Performing Organization Name and Address **The University of Texas at Austin Center for Transportation Research 1616 Guadalupe Street, Suite 4.202 Austin, TX 78701**		11. Contract or Grant No. **134368** 13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address **Ohio Department of Transportation 1980 West Broad Street Columbus, OH 43223**		14. Sponsoring Agency Code

15. Supplementary Notes
Prepared in cooperation with the Ohio Department of Transportation and the U.S. Department Transportation, Federal Highway Administration.

16. Abstract

The main objective of this study was to examine the performance of the Mid-Ohio Regional Planning Commission's (MORPC) trip-based and tour-based frameworks in the context of three specific projects started and completed within the past 15 years in the Columbus metropolitan area. The three specific projects included (1) Polaris project, (2) Hilliard-Rome project, and (3) Spring-Sandusky interchange project. The performance evaluation of the trip-based and tour-based models was pursued at two levels. The first level corresponded to a region-level analysis (independent of specific projects) that compared selected model outputs from each of the trip-based and tour-based model systems with corresponding region-level observed data. The second level corresponded to a local-level analysis (specific to each of the three projects identified earlier) that compared the trip volume outputs on selected roadway links in and around the project region with corresponding link counts. For both the region-level and local-level analysis, the research team considered three years for analysis: 1990, 2000, and 2005. The results indicate that the tour-based model performed better overall than the trip-based model in the region-level analysis, while the predictive abilities from the trip and tour-based models were about equal in the local-level analysis. This project is a significant first step toward a better understanding of the tangible benefits of disaggregate tour-based modeling methods. But it would be imprudent to judge all model systems strictly on the results of this one project, since the transportation planning community has accumulated four decades of learning and experience on trip-based models while this particular tour-based model represents only one attempt, and one of the earliest, at implementing the tour-based or activity-based approach for practical use. Regardless, this project should serve as an important reference in the assessment of the potential practical benefits of disaggregate tour-based modeling approaches vis-à-vis aggregate trip-based methods.

17. Key Words	18. Distribution Statement
Tour-based model, trip-based model, sensitivity analysis, transportation system, evaluation	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	138	

Form DOT F 1700.7 (8-72) **Reproduction of completed pages authorized**

Comparison of Four-Step Versus Tour-Based Models in Predicting Travel Behavior Before and After Transportation System Changes – Results Interpretation and Recommendations

by

Nazneen Ferdous and Chandra Bhat, *Center for Transportation Research, The University of Texas at Austin*

Lakshmi Vana and David Schmitt, *AECOM Consult*

John L. Bowman, *Bowman Research and Consulting*

Mark Bradley, *Mark Bradley Research and Consulting*

Ram Pendyala, *Arizona State University*

Prepared in cooperation with the Ohio Department of Transportation and the U.S. Department Transportation, Federal Highway Administration.

February 2011

Project Title: Sensitivity of Four-Step Versus Tour-Based Models to Transportation System Changes
Agreement Number: 21741
State Job Number 134368
Sponsor: Ohio Department of Transportation

ACKNOWLEDGMENTS

The support of Rebekah Anderson and Greg Giaimo is greatly appreciated. The authors are grateful to Lisa Macias for her help in formatting this document.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

1. INTRODUCTION

Over the past three decades, there has been a realization that simply enhancing the capacity (or supply) of transportation facilities is not a sustainable solution to meet the growing levels of travel demand. Consequently, the supply-oriented focus of transportation planning has expanded to include a range of travel demand management strategies and policy measures to address transportation problems and promote sustainable growth.

The interest in demand management policies stems from a desire to control aggregate-level travel demand and enhance the efficiency of transport infrastructure usage through strategies that fundamentally influence disaggregate-level (*i.e.*, individual-level) travel behavior. Accordingly, there has been a shift in travel demand modeling from the statistical prediction of aggregate-level, long-term, travel demand to understanding disaggregate-level behavioral responses to short-term demand management policies (Bhat *et al.*, 2004). Also, the socioeconomic composition of the population in many metropolitan areas is changing quite rapidly over time, which implies that aggregate-level models (and disaggregate-level models that do not consider the range of relevant demographic variables affecting travel behavior) are not likely to provide accurate long term travel demand forecasts.

The need to examine individual-level behavioral responses, and accurately forecast long-term travel demand in a rapidly changing demographic context, has led to a behaviorally-oriented tour-based approach to travel demand modeling. The potential benefits of the tour-based approach, combined with the increasing levels of demands placed by legislations on the abilities of travel demand models, has led several planning agencies in the United States to shift (or consider the shift) to the tour-based approach.[1] The Mid-Ohio Regional Planning Commission (MORPC) is one of the agencies that adopted a fully operational tour-based model for the Columbus region. For the purposes of this study, the Ohio Department of Transportation (ODOT) developed a traditional trip-based model from the same data. This presence of both a trip-based and fully operational tour-based model provides a unique opportunity to test and compare the models for their policy sensitivity and forecasting ability, especially at a time when several planning agencies (including Northeast Ohio Areawide Coordinating Agency (NOACA) and Ohio Kentucky Indiana Council of Governments (OKI)) are considering the move toward the activity-based/tour-based modeling approach for operational purposes. Accordingly, the main objective of this study is to examine and compare the performance of the MORPC trip-based and tour-based frameworks in the context of specific highway projects. It is expected that the overall

[1] Planning agencies within the United States that have developed a tour-based or an activity-based travel model include Portland METRO, New York NYMTC, Columbus MORPC, Sacramento SACOG, the Los Angeles SCAG, Denver DRCOG, and the San Francisco SFCTA. Planning agencies that are in the process of either moving toward or considering the move toward the activity-based modeling approach include ARC of Atlanta GA, NCTCOG of Dallas-Fort Worth TX, CMAP of Chicago ILPSRC of Seattle WA, MAG of Phoenix AZ, El Paso MPO, and SBCAG of Santa Barbara CA. Also, the reader is referred to Bowman and Bradley (2005-2006) for a summary of the design features of several of the activity based models developed (or under development) for practice. In addition, there have been activity based models developed in the research community, which include TRANSIMS, ILUTE (Miller and Salvini, 2000), CEMDAP (Bhat *et al.*, 2004; Bhat *et al.*, 2006; and Pinjari *et al.*, 2006), FAMOS (Pendyala *et al.*, 2005; and Pendyala 2004), and ALBATROSS (Arentze and Timmermans, 2001).

findings from this project will aid NOACA and OKICOG in determining what modeling techniques to implement in their future forecasting efforts. The results of the assessment exercises undertaken in this project will also benefit the modeling community at large. Toward this end, the current report presents an analysis and assessment of the accuracy of predicted travel patterns by the trip-based and the tour-based models of MORPC before and after several highway projects.

The rest of the report is organized as follows. Section 2 provides an overview of the MORPC model systems, while Section 3 discusses study projects and a control area identified for the analysis. Data preparation tasks undertaken for the study projects are discussed in Section 4. Empirical comparison exercises between model outputs and observed data are presented in Section 5. The final section concludes the report by summarizing important findings and recommendations.

2. AN OVERVIEW OF THE MORPC MODEL SYSTEMS

MORPC has developed a tour-based model that has been in operation since 2004. In addition, the Ohio Department of Transportation (ODOT) developed a traditional trip-based model from the same data solely for the purpose of this study. A brief description of the MORPC model systems is presented in the following sections.

2.1 Tour-Based Model

The MORPC tour-based model system was developed for the Mid Ohio Regional Planning Commission, the MPO for Columbus, Ohio. A key feature of this tour-based model is explicit incorporation of household interactions. The model system comprises nine separate models that are linked and applied sequentially. These nine models are: Population Synthesis, Auto Ownership, Daily Activity Pattern (mandatory tour generation), Joint Tour Generation, Individual Non-Mandatory Tour Generation, Tour Destination Choice, Time of Day Choice, Tour Mode Choice, and Stops and Trip Mode Choice. The model system provides as outputs all the tours and trip-related information undertaken by each (and every) individual in the synthetic population on the travel day, along with the information on the mode and timing, and the accompanying persons (if, any) for each trip. This information is aggregated into origin-destination trip tables for four time periods (a.m. peak, midday, p.m. peak, and night). These trip tables are augmented with external traffic trip tables and heavy and light truck trip tables, and passed as inputs to the highway and transit assignment modules. The assignment modules provide the traffic volumes and level-of-service skims as outputs ready to be input to the core demand model for the next iteration.

The model development and calibration efforts are undertaken for the year 2000, using a 1999 Household Interview Survey (HIS) that collected data from 5,555 households. The validation of models for the base year (2000) involves the comparison of the activity-travel outputs (as predicted by the tour-based model using a synthesized population for the base year) with (a) the 2000 Census Transportation Planning Package (CTPP) journey-to-work data (for

work flow patterns), (b) roadway volume counts (for link volumes), and (c) transit boardings (for transit use patterns).

The MORPC model system was developed in the period 2002-2004. Since 2004, the model has been used to assess all projects including the North Corridor Transit Project, regional air quality conformity analysis, central business district parking study, alternative transit scenarios (without/with LRT) testing for 2030 forecast year, and several corridor studies for highway extensions.

2.2 Trip-Based Model

Prior to the adoption of their tour-based model, MORPC maintained a traditional "four-step" trip-based model. This model was very different from the tour-based model in many important dimensions: geographic coverage (including differences in networks and the number of traffic analysis zones), external and commercial vehicle modeling, highway assignment (temporal resolution and equilibrium convergence), and the handling of transit trips and mode choice. Consequently, in 2008-2009 ODOT developed a new trip-based model for the MORPC area specifically for this research effort.

The new trip-based model now shares many features with the tour-based model. Its geography, zone structure, and networks (both highway and transit) are identical to the tour-based model. Socio-economic variables are not completely identical because of the aggregate nature of the trip-based model, but the aggregate input values are based on the disaggregate tour-based variables (Anderson and Giaimo, 2009).

Trip generation is undertaken for the three income groups used by the tour-based model: low income group (less than $30,000), medium income group ($30,000-$74,999), and high income group (equal to or higher than $75,000). Trip distribution is achieved using a gravity model on an uncongested network. The mode choice model structure is the same as the original trip-based model, but it is being applied for each income group and peak/off-peak period. Certain coefficients, such as in-vehicle time and out-of-vehicle time, were set equal to the tour-based model. Travel impedances are being produced using the same path-building procedures as for the tour-based model. However, one feedback iteration is performed in the trip-based model (there are two performed for the tour-based model), so the impedances will be slightly different between the two models. Updated travel impedances are fed back to mode choice in the trip-based model, but not to the trip generation and trip distribution stages.

The time-of-day periods are those used in the tour-based model (although no peak-spreading model is applied), with the 24-hour origin-destination trip matrix by trip purpose from the trip-based model being disaggregated into each of four time-of-day period-specific origin-destination matrix by trip purpose based on the 1999 Household Survey data. The traffic assignment procedures are also identical to the tour-based model. The external and commercial vehicle patterns are taken directly from the tour-based model, so only internal trip patterns vary between the two models.

The model was calibrated and validated for the year 2000. Highway validation was performed using several checks including (but not limited to) the relative and RMSE differences by volume group, VMT data compared to counts data (regionwide comparison, and by functional class), screenline checks, and developing coincidence ratios to compare trip length frequency distribution. The mode choice model was calibrated using travel behavior from the 1993 COTA Systemwide On-Board Survey, the most recent one available at the time. Transit validation used relative and absolute differences between route-level boardings. The observed route-level boardings were based on a 2000 systemwide ridecheck.

3. STUDY PROJECTS AND CONTROL AREA

The emphasis of the current project is to compare predictions of travel behavior before and after major developments and roadway projects that have started and been completed in the past 15 years or so in the Columbus metropolitan area. Travel behavior is compared before projects, and again after projects, although changes in behavior from before to after are not compared due to the reasons mentioned later in Section 5. Based on discussions with the ODOT staff, the following projects were identified for undertaking before-and-after effects analysis: (1) Polaris, (2) Hilliard-Rome project, and (3) Spring-Sandusky interchange project (see Figure 1 for geographic locations of the selected projects). In the subsequent discussion, we present more details on the selected study projects.

Polaris: The Polaris region has seen large retail and employment growth in the last 20 years. The roadway improvements that coincide with this land-use growth include: (1) I-71 interchange with Polaris Parkway and new Polaris Parkway completed in 1993, (2) Polaris parkway widening completed in early 2000, and (3) I-71 split interchanges with Polaris Parkway and Gemini Parkway completed in 2007.

Hilliard-Rome project: Hilliard-Rome is the name of the first exit on I-70 west of I-270. No major roadway improvements were undertaken in this study area between 1990 and 2005. However, the Hilliard-Rome Road and the region on the west side of Columbus around I-70/I-270 have experienced large land-use related developmental changes in the late 1990s and early 2000s.

Spring-Sandusky interchange project: The Spring-Sandusky interchange project involved (1) reconstruction of SR 315 between I-670 and I-70/71, (2) new construction of the portion of I-670 between I-70 and SR 315 and (3) reconstruction and widening of I-670 between SR 315 and I-71. The new roadways allow easier access/egress into the downtown area and help avoid traffic delays on I-70/I-71. The project did not directly attract any substantial land use related changes even though there was some extremely-driven land use changes in the surround area. The project started in 1995 and was completed in 2003.

In addition, a control area, where large land use and network changes did not occur to promote significant changes in travel pattern in the time period under consideration, was identified. The control area was selected in consultation with ODOT staff as the best area that met the following conditions:

- Relatively little change in land use in 1990-2005,
- Little to no infrastructure changes in 1990-2005,
- Includes a section of freeway (to coincide with the three freeway-oriented projects to be studied),
- Traffic volumes in the area are reasonably well reflected by both the models, and
- Reliable traffic counts are available for 1990, 2000 and 2005 (these were the three analysis years used in the current project, as discussed further in Sections 4 and 5).

The selected control area is I-71 bounded by Harrisburg Pike (SR 3) and I-270 in southern Franklin County (see Figure 1).

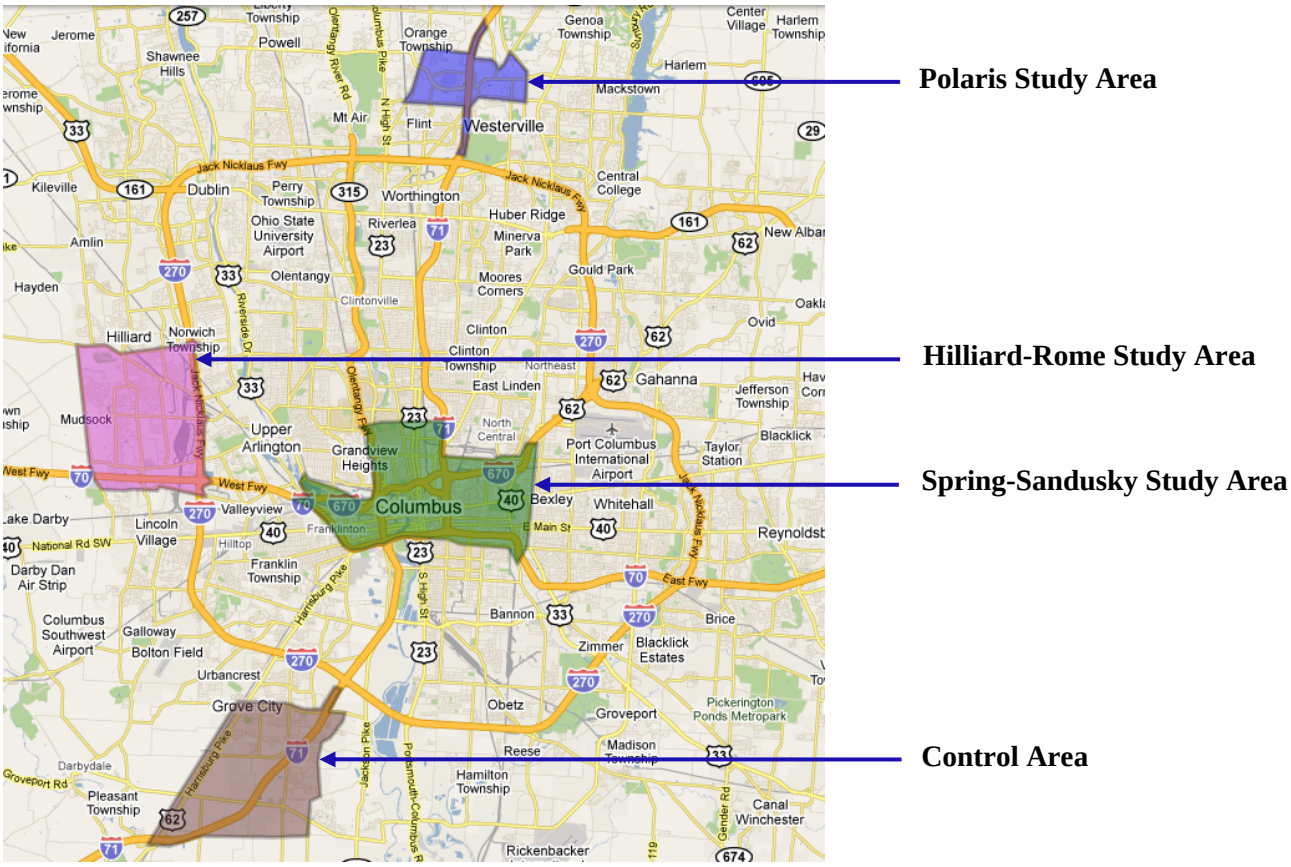


Figure 1: Selected Study Projects and Control Area

4. DATA PREPARATION EFFORTS FOR STUDY AREAS

A study area was established for each project (and control area) to reflect the geographic location within which roadway link volumes would most substantially be impacted directly from the

planned developments. The study area boundaries were developed by the project team and finalized after consultations with ODOT staff. A detailed review of the roadways was undertaken for each study area associated with the selected projects and the control area. The detailed review included verifying the accuracy of the roadway connectivity, lane configuration, and traffic counts. ODOT and MORPC staff created transportation networks for the three analysis years (1990, 2000, and 2005) incorporating the appropriate status of the study projects for the corresponding analysis year. The project team made further minor changes to the networks based on a detailed roadway review. Both the trip-based and tour-based models used identical highway networks for each analysis year.

Demographic data was generated for both models by MORPC staff. Both models use the same dataset based on the appropriate Census year (1990 and 2000) for the analysis. Some variables were added to the trip-based model dataset to reflect the travel generation needs for that model. Income is represented in year 2000 dollars in all analysis years.

Six model runs were developed: one for each analysis year and model. The project team developed the trip-based model runs, while MORPC staff developed the tour-based model runs. The trip-based model runs one iteration of feedback to mode choice with no convergence criteria. The tour-based model runs two iterations of feedback to travel generation with no convergence criteria.[2] Both models use the identical equilibrium highway assignment closure criteria during the initial highway assignment(s) (a relative gap of 10^{-3} or 200 iterations, whichever is reached first). For the final highway assignment procedures, 500-iterations of equilibrium were specified.

After each model run, post-processing scripts were applied to the output files to generate the required datasets. The post-processing scripts varied slightly for each model to account for the different units of travel and trip purposes.

5. EMPIRICAL COMPARISON EXERCISE

This section discusses the performance of the MORPC trip-based and tour-based models. Note that the tour-based model outputs, which fundamentally are in the form of tour predictions, are translated (as part of a routine inbuilt in the tour-based system) into trips for assignment.[3] The resulting trips from the tour-based model were then repackaged to develop hourly trip origin-destination (O-D) tables by vehicle occupancy (single-occupancy vehicle (SOV) and high-occupancy vehicle (HOV)). These tables were combined with external trips and truck trip tables used in the four-step model to form the O-D matrices by mode (SOV, HOV, Medium Truck (MTK), and Heavy Truck (HTK)) and by four time periods: a.m. peak (6:30 a.m. to 9:29 a.m.), midday (9:30 a.m. to 3:29 p.m.), p.m. peak (3:30 p.m. to 6:29 p.m.), and night (6:30 p.m. to 6:29

[2] Future efforts should examine convergence criteria-related considerations carefully, since it is likely that several iterations will be needed to bring supply and demand to anything close to an equilibrium solution.

[3] The trips in the trip-based model are classified as Home Based Work (HBW), Home Based School (HBSc), Home Based Shop (HBSh), Home Based Other (HBO), Non Home Based Work (NHBW), and Non Home Based Other (NHBO) trips. The tours (and sub-tours) in the tour-based model are classified as Work, School, University, Shopping, Maintenance, Discretionary, Eating Out, Escort, and At Work.

a.m.). The resulting matrices were assigned to the highway network using the static assignment procedure.

The performance evaluation of the models is pursued at two levels. The first level corresponds to a region-level analysis (independent of the specific project identified in Section 3) that compares selected model outputs from each of the trip-based and tour-based model systems with corresponding region-level observed data. The second level corresponds to a local-level analysis (specific to each of the three projects and the control area identified in Section 3) that compares the model predicted link volume outputs on selected roadways in and around the project region with corresponding observed link counts. For both the region-level and local-level analysis, we consider three years for analysis, as identified below:

- Model year 1990: This is the base year/ no-build case; construction of the selected study projects did not begin prior to this year.
- Model year 2000: The Hilliard-Rome project was complete, the Polaris Interchange (Phases 1 and 2 of 3) was complete, while the Spring-Sandusky interchange was under construction.
- Model year 2005: The Hilliard-Rome project, Spring-Sandusky interchange, and the first two phases of the Polaris project were complete, while Phase 3 of the Polaris project was not yet constructed.

The year 1990 represents the "before project" case for all the three study projects (*i.e.*, Polaris, Hilliard-Rome, and Spring-Sandusky), while the year 2005 represents the "after project" case for the Hilliard-Rome and Spring-Sandusky projects. The year 2000 was included in the "before-after" project analysis because of the availability of the 2000 Census data, as well as the 1999 Household Interview Survey (HIS), that contributed toward our region-level analysis comparison of the trip-based and tour-based model system outputs. Further, the year 2000 represented the completion of the Polaris Parkway widening (even though the I-71 split interchanges were not completed by then). Thus, we undertook a local-level analysis comparison on roadway links in and around the project areas for the Hilliard-Rome project (the year 2000 represents the immediate "after" situation for the Hilliard-Rome project) and for the Polaris project (the year 2000 marked the end of a clear phase of the project, as just discussed). The roadway network was appropriately coded to represent the completion of the Polaris Parkway widening in 2000 during the analysis. However, no local-level analysis was undertaken for the year 2000 for the Spring-Sandusky project since this project was still ongoing at that time.

For the region-level analysis, several travel dimensions were identified for which near-compatible observed data were available. The analysis then entailed a comparison of the model-generated outputs for each travel dimension with the corresponding observed data. For the local-level analysis, a number of roadway links with available volume count data were selected, and the model-generated link volume predictions were compared with the observed link count volumes. This local-level analysis was conducted by roadway functional class.

The fit measures employed for comparison of model attributes with the observed data (for both the region-level and local-level analyses) are the Absolute Percentage Error (APE) measure and the Root Squared Error (RSE) measure, defined as follows:

$$APE = \frac{|\,(\text{Observed Data} - \text{Predicted Data})\,|}{\text{Observed Data}} \times 100$$

$$RSE = \sqrt{(\text{Observed Data} - \text{Predicted Data})^2}$$

We also developed a weighted mean of the absolute percentage error statistic that was computed as the sum of the absolute percentage error for each cell weighted by the fraction of observations in that cell. Similarly, we computed a root weighted mean square error as the root of the sum of the squared error for each cell weighted by the fraction of observations in that cell. The results of the comparison exercise allow us to understand the relative predictive capabilities of the trip-based and tour-based model frameworks. In the subsequent sections, we present comparative performance assessment of the trip-based and the tour-based models with the observed data.

5.1 Region-Level Comparison

A number of data sources were used to undertake the comparison between the model outputs and the observed data. These included, for the most part, the Census Summary Files 3 (SF3) (for the years 1990 and 2000), the 1999 Household Interview Survey (HIS) (for the year 2000), and the American Community Survey (ACS) (for the year 2005). In the rest of this report, we will refer to the Census SF3 data simply as the Census data. The Census data are sampling rich (approximate sampling rate of 16.7% from the population), but do not provide travel information at a fine spatial scale of resolution. The ACS data are not as sampling rich as the Census (approximate sampling rate of 2.5% from the population of households), and also do not provide travel information at a fine spatial scale. The HIS data have the lowest sampling rate (1% of the population of households), but are very rich in the spatial resolution at which trip information is collected. Also, the Census and the ACS data sources are not conventional travel surveys and provide information only on trip-making for work trips. Note also that the geographic coverage of the HIS survey matches up with the MORPC study region that includes Delaware, Franklin, and Licking county completely and Fairfield, Madison, Pickaway, and Union county partially (see Figure 2). However, the Census and the ACS data correspond to entire counties in the region.[4] As a result, the comparisons between the HIS data and the trip/tour-based model are one-to-one from a spatial coverage standpoint, while the comparisons between the Census/ACS data and the trip/tour-based model for Fairfield, Madison, Pickaway, and Union county (these are the counties represented only partially in the study region) need to be interpreted with caution. For these counties that are only partially contained in the study region, the travel quantities (such

[4] The Census data are available for all seven counties under consideration here. However, the ACS data are available only for Delaware, Fairfield, Franklin, and Licking counties.

as car ownership levels and total work flows in and out of counties) as obtained from the Census and ACS data are factored down based on the percentage area of the county in the study region relative to the total area of the county (alternative factoring methods, such as those based on number of county households in the study region relative to total county households in the county, county population in the study region relative to total county population, and number of county workers in the study region relative to total workers in the county, were also considered, but these alternative methods provided similar results).

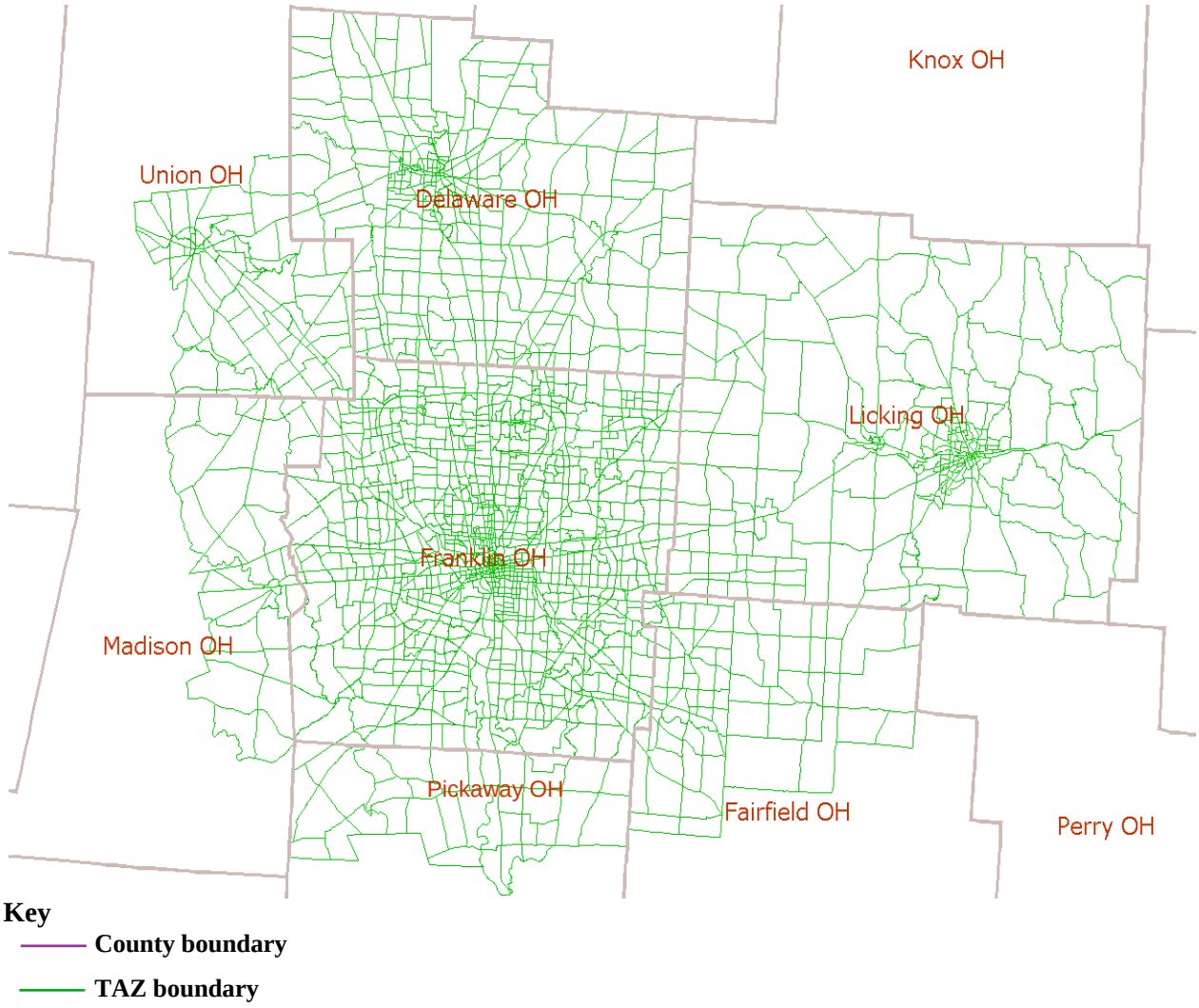


Figure 2: Model Study Region

The model attributes evaluated in this section include household vehicle ownership level, county level O-D work flow distribution, district-level O-D work flow distribution within Franklin County (which is the dominant county in the study region), split in work trip start time distribution by time of day (peak and off-peak period) and county of residence, average travel

time for work trips by county of residence, and average trip distance distribution (by trip type and by county of residence). The results corresponding to these model attributes are presented and discussed in the subsequent sections.

An important point is in order here. The evaluation of the trip-based and tour-based model systems is undertaken in this project in the context of comparisons of predicted travel dimensions from the two systems with corresponding observed travel data at each of three cross-sectional points in time (these three cross-sectional points refer to the years 1990, 2000, and 2005). In contrast, the original intent of the project was to undertake before-after project analysis in terms of comparing the predicted changes (from each model system) in the travel dimensions from before to after each project with the predicted changes in corresponding observed travel data. But we did not pursue such a rigorous "before-after" model sensitivity evaluation effort because the Census data from 1990 and 2000 are independent cross-sectional data sets and not elements of a larger systematic panel data collection effort. As such, there were several differences in the design and data collection efforts between these two cross-sectional data sets. Further, for the year 2005, the survey design of the ACS data, which constitutes the observed data for 2005 in our analysis, is quite different from the Census data design. As indicated earlier, the ACS does not even have data on three of the counties partially included in the MORPC study region (see discussion in Section 5.1). Besides, the sampling rates are very different between the Census (16.7% of the population) and the ACS (2.5% of the population). With these several differences in survey design and data collection efforts across the years, it was felt that keeping the benchmark data (that is, the 1990 Census, the 2000 Census, and the 2005 ACS) as cross-sectional "before-after" points of reference with which to compare the corresponding cross-sectional predictions from the trip- and tour-based model systems would be much more appropriate than comparing changes between the years.

5.1.1 Vehicle Ownership

Table 1a presents the results for vehicle ownership level by county for the year 1990. As indicated earlier, the comparisons are undertaken using the absolute percentage error (APE) and root squared error (RSE) metrics. For each county, a weighted mean error value is computed based on the error value (APE or RSE) for each vehicle ownership level weighted by the number of households within the county in each vehicle ownership level. The final row of the table provides an overall weighted mean error value across all counties obtained by weighting the county-specific weighted means by the proportion of the number of households within each county. For completeness, the actual model prediction numbers from the trip-based model and the tour-based model, and the numbers from the observed data, are provided in Appendix A for the year 1990 (the tables in Appendix A.1 form the basis for Table 1a). In addition, Figure 3a provides a visual representation of the contribution of each county-specific weighted mean APE value to the overall weighted mean APE value, as well as the overall weighted mean APE value across all counties, from the trip-based and the tour-based models. Table 1b and Figure 3b similarly show the results of the performance metrics of the trip-based and tour-based models in

comparison to the 2000 Census, and Table 1c and Figure 3c provide the performance metrics for the year 2000 with respect to the Household Interview Survey (HIS) (the tables in Appendix A.2 provide the raw numbers for the computations in Tables 1b and 1c). Table 1d (and Figure 3d) present the results for the year 2005 compared to the 2005 American Community Survey (ACS), with the tables in Appendix A.3 providing the raw numbers for Table 1d.

Before proceeding to the discussion of the results, it should be pointed out that the tour-based model considers vehicle ownership for both households and group quarters, while the trip-based model prediction considers vehicle ownership primarily for households.[5] The 1990 and 2000 Census data, as well as the 1999 HIS and the 2005 ACS, consider only households and not group quarters. So, to make all the data sets and model predictions compatible, we factored down the prediction outputs from the tour-based model by the percentage of households relative to the total number of households and group quarter units.

Several interesting observations may be made from Tables 1a through 1d (and the corresponding Figures 3a through 3d). Across all years, the tour-based model outperforms the trip-based model in terms of vehicle ownership model predictions for Franklin County. This is important, because Franklin County represents about 80% of the population of households and overall activity-level in the study region. Given that vehicle ownership impacts several other activity-travel decisions downstream in the modeling framework, and the vehicle ownership prediction for a substantial fraction of the study region is better from the tour-based model, it may be expected that the tour-based model would provide better disaggregate-level predictions for specific activity-travel dimensions and may better be able to examine policy response effects.[6] Interestingly, the trip-based model predictions of vehicle ownership are superior to the tour-based model predictions for essentially all non-Franklin counties and for all years and all data sets. This consistent underperformance of the tour-based model for non-Franklin counties is an issue that needs to be tagged for further examination in future model development efforts. Overall, across the entire study region, the tour-based model performs somewhat better than the trip-based model in 1990 and 2000 when compared with the Census data, while the trip-based model performs somewhat better than the tour-based model in 2000 (compared to the HIS data) and in 2005 (compared to the ACS data). It is also interesting to note that the error measures are about the same magnitude across the many years, suggesting that the vehicle ownership components of the trip-based and tour-based models perform reasonably well when temporally transferred to other years.

[5] In the trip-based model, the group quarters are not considered explicitly. However, the number of households in zones with significant number of group quarters were appropriately inflated to recognize the auto ownership patterns of the group quarters.

[6] This immediately brings attention to the aggregate-level modeling approach of the MORPC trip-based model relative to the disaggregate-level modeling approach of the MORPC tour-based model. Note that the vehicle ownership model in the trip-based modeling framework is implemented for each TAZ using the Iterative Proportional Fitting (IPF) technique to predict household vehicle ownership level within each TAZ by household size and income group, while vehicle ownership is estimated at the household level (using a discrete choice model) and also applied at the household level in the activity-based modeling framework. It is important to emphasize that the comparison being undertaken in this project is between the aggregate-level trip-based and disaggregate-level tour-based modeling frameworks as represented in the MORPC efforts.

Table 1a: Vehicle Ownership Level by County – Comparison with the Census Data (Year 1990)

County	Vehicle ownership level (VOL)	Number of households in vehicle ownership level from Census	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean
Delaware	**No vehicle**	918	54.36	19.07	98.79	50.65	499	1,606	907	3,796
	1 vehicle	5,363	4.34		70.70		233		3,792	
	2 vehicles	10,525	18.65		43.12		1,963		4,538	
	3+ vehicles	6,310	27.16		39.15		1,714		2,470	
Fairfield	**No vehicle**	805	32.56	31.80	10.05	34.07	262	1,425	81	2,308
	1 vehicle	3,835	32.26		0.74		1,237		29	
	2 vehicles	6,319	20.14		52.15		1,273		3,295	
	3+ vehicles	3,766	50.72		42.83		1,910		1,613	
Franklin	**No vehicle**	38,414	32.62	15.41	16.59	7.82	12,532	14,719	6,372	7,417
	1 vehicle	136,598	10.65		6.54		14,549		8,939	
	2 vehicles	147,952	9.88		2.28		14,624		3,380	
	3+ vehicles	55,759	29.86		19.61		16,650		10,936	
Licking	**No vehicle**	3,090	42.23	15.09	133.67	37.49	1,305	2,036	4,131	6,025
	1 vehicle	13,901	7.96		3.79		1,107		527	
	2 vehicles	19,644	12.56		43.67		2,468		8,578	
	3+ vehicles	10,619	21.21		42.20		2,252		4,481	
Madison	**No vehicle**	210	31.03	25.99	138.89	49.38	65	350	291	590
	1 vehicle	1,019	3.08		7.06		31		72	
	2 vehicles	1,539	17.45		36.39		268		560	
	3+ vehicles	950	63.29		96.04		601		912	
Pickaway	**No vehicle**	249	63.89	12.85	565.86	121.34	159	161	1,409	1,261
	1 vehicle	1,173	3.51		132.42		41		1,553	
	2 vehicles	1,785	1.42		22.21		25		396	
	3+ vehicles	1,006	31.41		174.28		316		1,753	
Union	**No vehicle**	186	140.59	82.69	554.21	115.67	261	914	1,030	1,119
	1 vehicle	954	83.92		128.32		800		1,224	
	2 vehicles	1,557	64.71		14.22		1,008		222	
	3+ vehicles	945	99.69		183.83		943		1,738	
Overall weighted mean error			**16.64**		**15.82**		**13,160**		**6,951**	

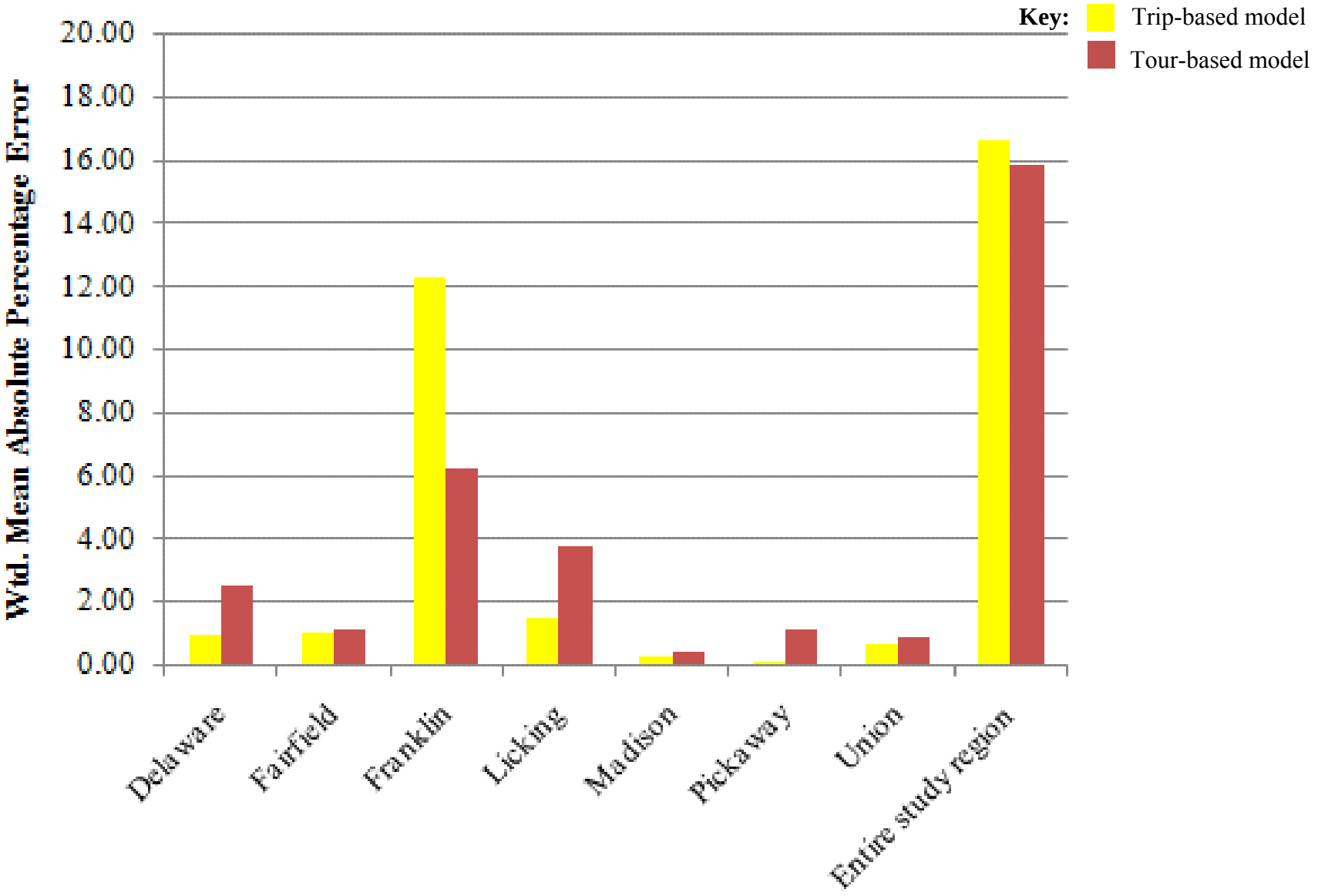


Figure 3a: Relative Weighted Mean Absolute Percentage Error (WMAPE) by County and the Overall WMAPE for the Study Region - Comparison with the Census Data (Year 1990)

Table 1b: Vehicle Ownership Level by County – Comparison with the Census Data (Year 2000)

County	Vehicle ownership level (VOL)	Number of households in vehicle ownership level from Census	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean
Delaware	**No vehicle**	1,153	130.44	27.08	197.49	49.88	1,504	4,047	2,277	7,574
	1 vehicle	8,576	10.40		66.48		892		5,702	
	2 vehicles	20,294	25.50		48.33		5,174		9,808	
	3+ vehicles	9,651	32.88		20.75		3,173		2,003	
Fairfield	**No vehicle**	846	1.49	18.26	140.57	47.34	13	1,481	1,189	2,800
	1 vehicle	4,660	9.24		27.99		431		1,304	
	2 vehicles	7,855	0.35		46.33		27		3,639	
	3+ vehicles	4,810	59.20		51.35		2,847		2,470	
Franklin	**No vehicle**	37,656	55.13	15.41	13.06	7.08	20,761	16,448	4,918	7,828
	1 vehicle	168,620	10.15		4.96		17,121		8,365	
	2 vehicles	171,804	8.93		2.58		15,346		4,440	
	3+ vehicles	60,698	23.73		21.97		14,401		13,333	
Licking	**No vehicle**	3,408	25.06	9.76	161.98	31.96	854	1,763	5,520	6,158
	1 vehicle	15,580	2.82		1.59		439		248	
	2 vehicles	23,152	9.92		38.97		2,296		9,022	
	3+ vehicles	13,469	13.63		22.13		1,836		2,980	
Madison	**No vehicle**	265	7.28	24.48	182.43	49.35	19	367	483	587
	1 vehicle	1,159	8.99		16.79		104		195	
	2 vehicles	1,732	18.79		36.84		325		638	
	3+ vehicles	1,083	54.37		71.66		589		776	
Pickaway	**No vehicle**	232	17.85	17.30	1085.47	123.72	41	310	2,515	1,230
	1 vehicle	1,245	5.38		91.81		67		1,143	
	2 vehicles	2,040	6.60		55.98		135		1,142	
	3+ vehicles	1,235	46.92		87.38		579		1,079	
Union	**No vehicle**	193	186.97	95.16	853.41	126.87	361	1,374	1,648	1,468
	1 vehicle	1,115	111.85		165.02		1,248		1,841	
	2 vehicles	2,094	69.04		24.49		1,446		513	
	3+ vehicles	1,332	108.93		150.60		1,450		2,005	
Overall weighted mean error			**16.52**		**16.11**		**14,536**		**7,453**	

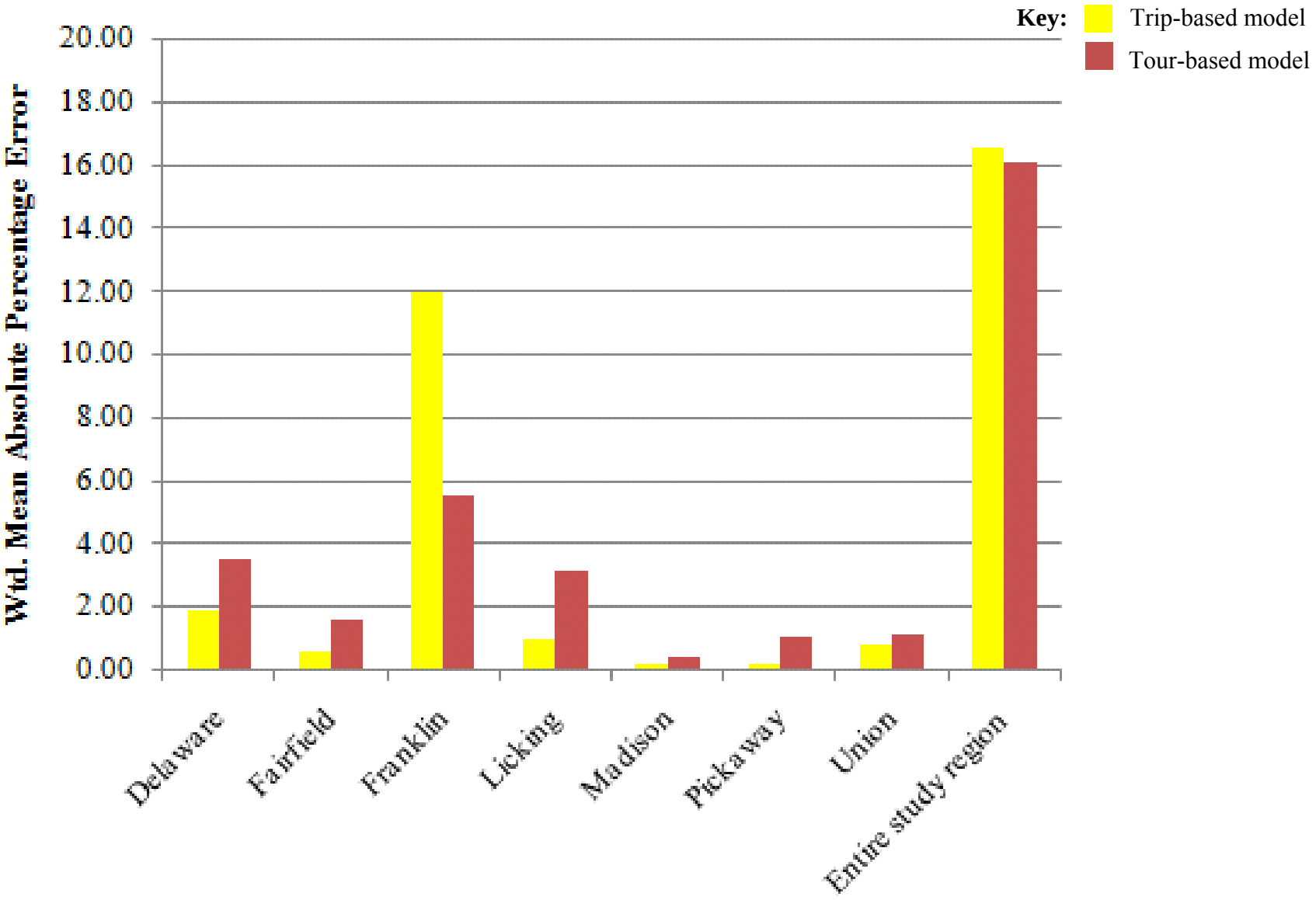


Figure 3b: Relative Weighted Mean Absolute Percentage Error (WMAPE) by County and the Overall WMAPE for the Study Region - Comparison with the Census Data (Year 2000)

Table 1c: Vehicle Ownership Level by County – Comparison with the HIS Data (Year 2000)

County	Vehicle ownership level (VOL)	Number of households in vehicle ownership level from HIS	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean
Delaware	**No vehicle**	0	-	29.47	-	42.14	2,657	2,623	3,430	4,166
	1 vehicle	4,719	100.64		202.56		4,749		9,559	
	2 vehicles	12,813	18.01		18.16		2,307		2,327	
	3+ vehicles	11,364	12.85		2.55		1,460		290	
Fairfield	**No vehicle**	0	-	93.48	-	76.67	833	3,376	2,034	2,742
	1 vehicle	1,832	130.84		225.53		2,397		4,132	
	2 vehicles	4,487	74.46		6.03		3,341		271	
	3+ vehicles	3,870	97.86		88.10		3,787		3,409	
Franklin	**No vehicle**	40,236	45.19	14.01	18.64	9.99	18,181	12,195	7,498	14,274
	1 vehicle	158,956	4.69		11.34		7,457		18,029	
	2 vehicles	162,742	3.86		8.30		6,284		13,502	
	3+ vehicles	49,410	51.99		4.14		25,689		2,045	
Licking	**No vehicle**	2,868	48.61	9.42	211.30	34.53	1,394	1,310	6,060	5,477
	1 vehicle	14,715	2.90		7.56		426		1,113	
	2 vehicles	21,886	4.71		35.44		1,030		7,756	
	3+ vehicles	13,193	16.01		24.68		2,112		3,256	
Madison	**No vehicle**	114	149.12	192.46	555.88	180.17	170	1,097	634	865
	1 vehicle	217	482.03		523.68		1,046		1,136	
	2 vehicles	747	175.37		46.43		1,310		347	
	3+ vehicles	726	130.30		156.11		946		1,133	
Pickaway	**No vehicle**	0	-	91.10	-	184.22	273	899	2,746	1,730
	1 vehicle	760	72.63		214.20		552		1,628	
	2 vehicles	900	141.67		253.63		1,275		2,283	
	3+ vehicles	1,114	62.84		107.69		700		1,200	
Union	**No vehicle**	0	-	2.23	-	25.60	554	69	1,841	785
	1 vehicle	2,244	5.30		31.73		119		712	
	2 vehicles	3,583	1.20		27.24		43		976	
	3+ vehicles	2,813	1.10		18.62		31		524	
Overall weighted mean error			**16.81**		**17.40**		**10,921**		**12,905**	

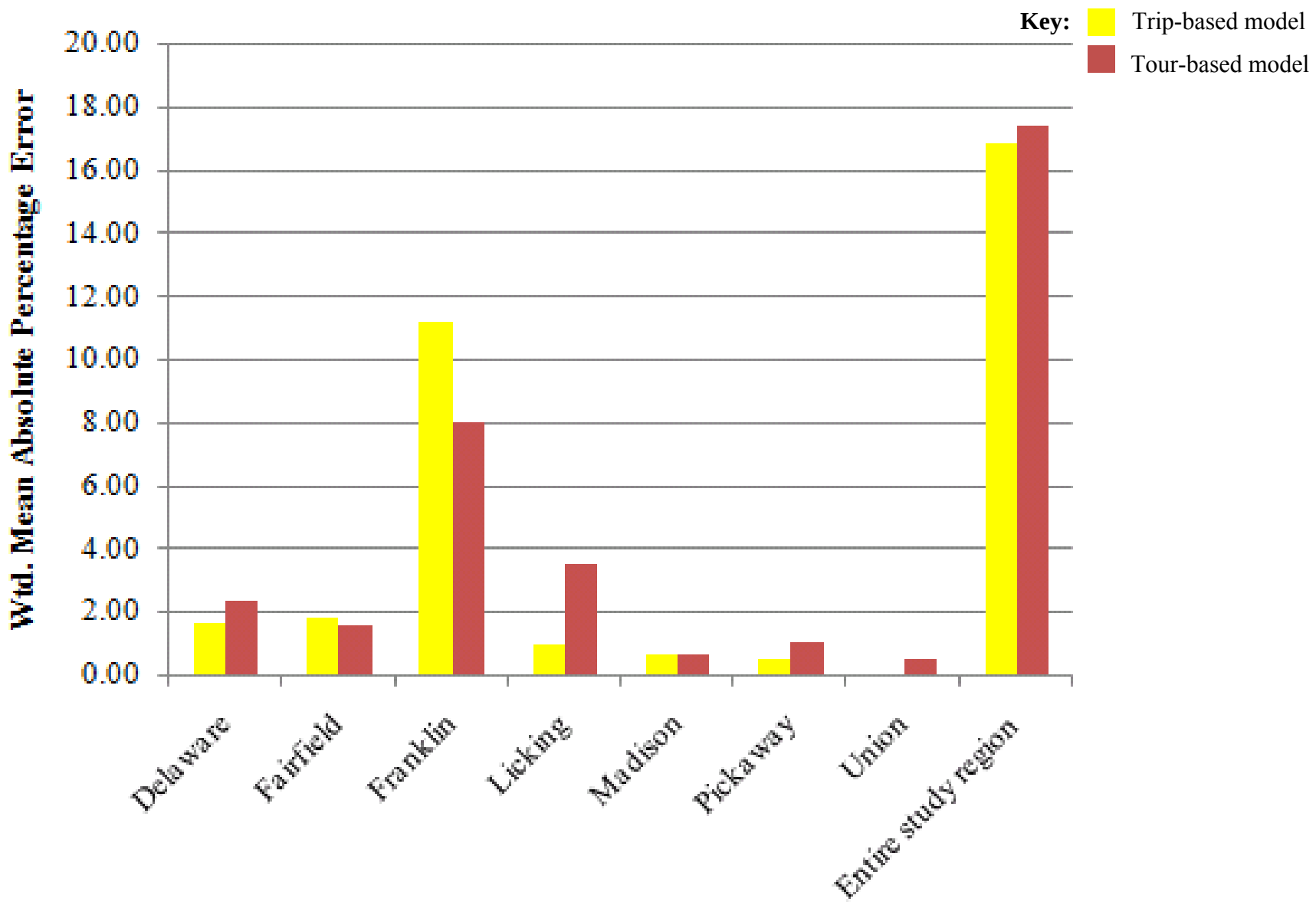


Figure 3c: Relative Weighted Mean Absolute Percentage Error (WMAPE) by County and the Overall WMAPE for the Study Region - Comparison with the HIS Data (Year 2000)

Table 1d: Vehicle Ownership Level by County – Comparison with the ACS Data (Year 2005)

County	Vehicle ownership level (VOL)	Number of households in vehicle ownership level from ACS	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean	By VOL	Wtd. Mean
Delaware	**No vehicle**	1,040	187.12	23.69	153.13	56.64	1,946	5,124	1,593	11,991
	1 vehicle	12,325	0.20		72.51		25		8,937	
	2 vehicles	26,856	24.71		57.74		6,637		15,508	
	3+ vehicles	13,196	30.65		31.97		4,044		4,219	
Fairfield	**No vehicle**	910	9.01	17.86	184.12	56.18	82	1,675	1,676	3,345
	1 vehicle	4,624	4.16		58.65		193		2,712	
	2 vehicles	8,813	0.58		46.45		51		4,093	
	3+ vehicles	5,390	59.35		48.38		3,199		2,608	
Franklin	**No vehicle**	31,839	96.97	14.03	7.35	11.19	30,874	12,929	2,339	17,722
	1 vehicle	166,746	2.07		8.76		3,448		14,603	
	2 vehicles	181,284	6.14		12.84		11,139		23,272	
	3+ vehicles	67,010	25.70		14.62		17,224		9,799	
Licking	**No vehicle**	2,958	60.55	11.46	243.85	35.73	1,791	2,089	7,213	7,707
	1 vehicle	14,696	6.50		14.39		955		2,115	
	2 vehicles	24,432	12.18		47.56		2,975		11,621	
	3+ vehicles	17,174	6.22		1.31		1,068		225	
Overall weighted mean error			**14.79**		**19.43**		**11,486**		**16,186**	

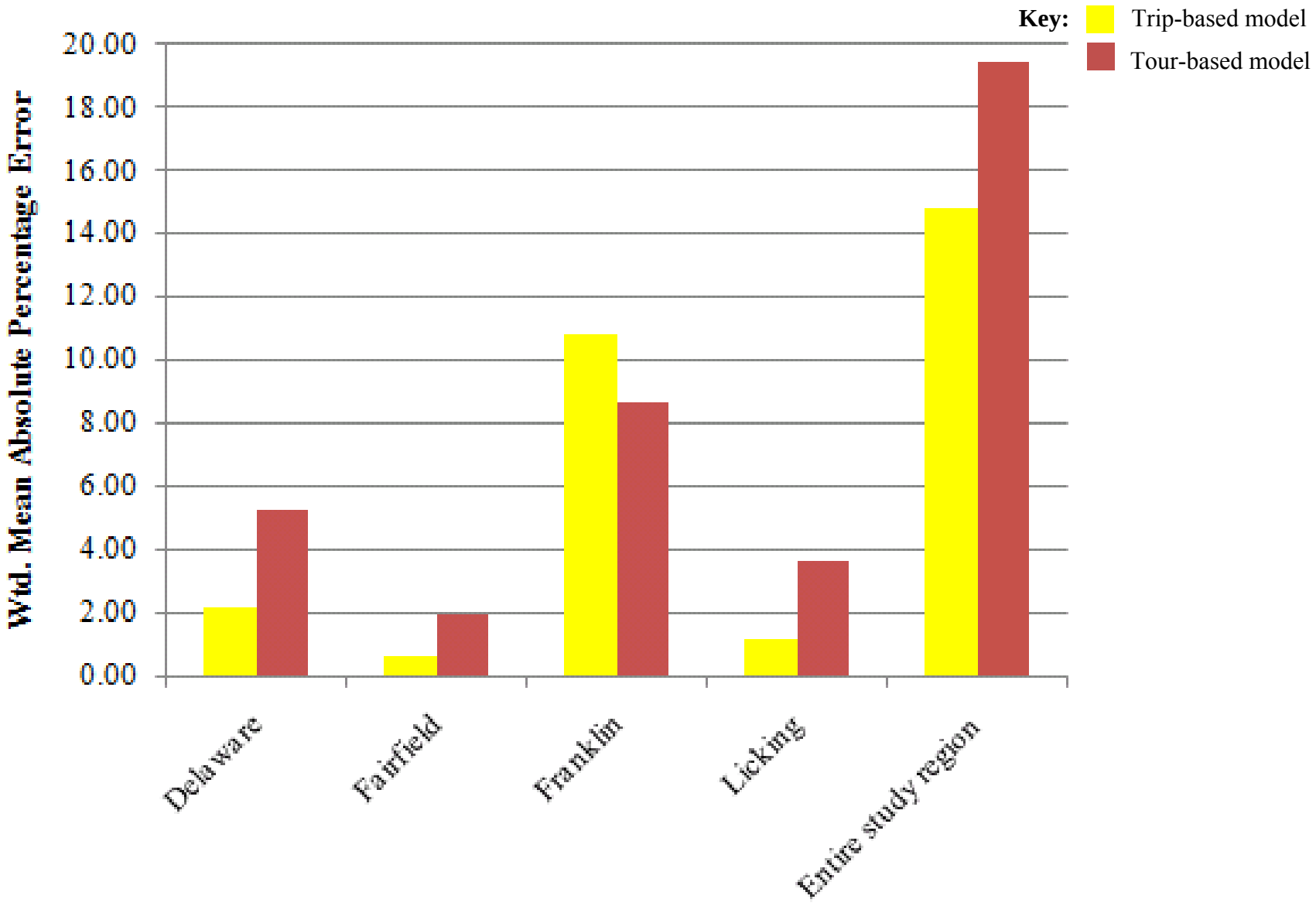


Figure 3d: Relative Weighted Mean Absolute Percentage Error (WMAPE) by County and the Overall WMAPE for the Study Region - Comparison with the ACS Data (Year 2005)

5.1.2 Work Flow Distributions

Tables 2a through 2d present performance measures for person work flow distribution in a county-level origin-destination format. Table 2a compares the trip-based and tour-based model predictions with the 1990 Census work flow data, which provides work flow information in terms of the residential locations and work locations of workers from each county to (a) within the county, and (b) all other counties combined. For the tour-based model, the research team had access to the predicted "log files" of individual daily activity-travel patterns, which contained tour-level information for each individual, including information on tour purpose (*i.e.*, the purpose of the primary stop on the tour), tour origin TAZ (except for the at-work sub-tours, home is the origin for all tours), and the destination TAZ of the primary stop in the tour. From these files, the home location TAZ and the work location TAZ for each individual pursuing work outside home were extracted, and then aggregated up to obtain TAZ-level home-to-work person flows. Subsequently, the TAZ-level work flows were aggregated to obtain county-level person work flows. For the trip-based model, production-attraction (P-A) matrices for peak and off-peak periods were available (from the trip distribution step) at a TAZ-to-TAZ level by trip purpose. The home-based work peak and off-peak P-A matrices were selected out, added up, multiplied by a factor of 0.5, and then aggregated up to the county level to obtain an initial estimate of county-level person work flows. However, this procedure is not adequate, because it does not appropriately consider the work flows of individuals who make non-work stops (such as grocery shopping or picking up/dropping off children) during one or both of the morning and evening commutes. To obtain a better estimate of person home-to-work flows from the trip-based model, the proportion of the number of work tours with stops relative to the number of work tours with no stops was used to adjust the initial work flow matrix estimate.[7] The resulting work flows computed from the trip-based and tour-based models were compared to the 1990 Census work flows. The analysis indicated that the total work flow in the study area (across all counties) from the trip-based model was about 11% less than that from the 1990 Census (the total trip-based model predicted work flow was 543,200 compared to the 1990 Census value of 609,900). Also,

[7] Specifically, assume that, from the tour-based model, the number of work tours with a stop in either the morning commute or evening commute (but not in both commutes) is *x*% of the number of work tours with no stop in both the morning and evening commutes. Also, let the number of work tours with a stop in both the morning and evening commutes be *y*% of the number of work tours with no stop in both the morning and evening commutes. Let the initial work flow estimate from the trip-based model for a particular county pair be *a*. This estimate partially accounts for the work flows corresponding to the work-tours of those individuals who make stops during either the morning commute or the evening commute (but not in both commutes). To obtain the work flow estimate *b* corresponding only to individuals who have no stops in both commutes, the following formula is applied:

$$b = \frac{a}{\left(1 + \frac{x}{200}\right)}$$

Then, the refined work flow estimate from the trip-based model for the county pair is obtained as follows: $c = b\left(1 + \frac{x}{100} + \frac{y}{100}\right)$. The assumption made here is that the location of any stop made by an individual during the morning commute is in the same county as the home location of the individual.

the total work flow predicted by the tour-based model was about 8.1% less than that from the 1990 Census (560,098 from the tour-based model relative to 609,900 from the 1990 Census). Clearly, the tour-based model prediction is closer to the Census data than the trip-based model prediction of total work flow. The smaller predicted values of total work flow from the trip-based and tour-based models (relative to the 1990 Census work flows) may be attributable to some workers not traveling to work on a particular day (due to illness or vacation or other personal reasons, or because of telecommuting or being out of town). So, to compare work flow distribution predictions from the trip and tour-based model predictions with the 1990 Census data, we used a final adjustment to the trip-based and tour-based work flows by inflating all the county-level work flow values so that the total of all of these flows matched the total work flow from the 1990 Census.

A similar procedure as above was undertaken for Table 2b (for comparison with the 2000 Census). As with the 1990 Census data comparison, the total work flow predictions from the tour-based and trip-based models were lower than the 2000 Census total work flow values. The tour-based model total work flow prediction (669,611) was again closer to the Census value (716,100) than the trip-based model total work flow prediction (643,000) (the absolute percentage error for total work flow prediction is 6.5% from the tour-based model relative to 10.2% from the trip-based model). Table 2d (for comparison with the 2005 ACS) takes the same form as Tables 2a and 2b, except that data is available only for four of the seven counties in the study region. The total work flow prediction contained within the four county area from the trip-based model was closer to the ACS data (712,800 versus 690,600 from the ACS data; APE of 3%) than from the tour based model (739,700 versus 690,600 from the ACS data; APE of 7%).[8]

For Tables 2a, 2b, and 2d, the trip-based and the tour-based model outputs are compared with the observed person work flows from each county to within that county and to outside that county. This was because flow information was available only at this level from the Census SF3 data and the ACS data. However, for Table 2c, the models are compared with the observed county-to-county person work flows, since county-to-county work flows are available from the 1999 HIS. To compute the person trip flows to work from the HIS (see Appendix Table B.2b), all trip segments with a work or work-related purpose at the trip destination end were considered and aggregated up to obtain the county-to-county trip flow to work. In doing so, the residence location is considered as the origin end of these work trips (regardless of the actual origin of the work trip on the survey day) and the primary work location is considered as the destination end (regardless of the destination of the work trip on the survey day). Note that, for comparison with the HIS data, there was no need to apply the adjustment factor to the trip-based and tour-based

[8] The ACS 2005 work flows show the expected upward trend for all non-Franklin counties relative to the Census 2000 work flows (a similar trend can also be observed between Census 2000 and Census 1990 work flow distributions). However, the ACS 2005 work flow from Franklin county (in particular, the intra-county work flow) shows a downward trend relative to the Census 2000 work flow from this county (the Census 2000 and the ACS 2005 intra-county work flow from Franklin county were 508,400 and 471,300 respectively, and the work flows from the entire county were 545,700 and 516,000 respectively). This apparent underestimation of work flows from Franklin County in the ACS 2005 survey is surprising, and suggests some caution in interpreting work flow results for 2005.

model outputs to match total work flows (as done for the Census and ACS data comparisons) because the HIS provided county-to-county person trip flows to work on the survey day (as opposed to the "synthetic" work flows obtained based on residence location and work location in the Census and the ACS data sets).

The raw numbers that form the basis for the computation of the error measures in Tables 2a through 2d are available in Appendix B.[9] The results in Tables 2a through 2d indicate that, in general, the tour-based model performs better than the trip-based model. This is particularly so for inter-county flows, as can be observed from the final row entitled "Total flows/overall weighted mean error" for the column entitled "outside origin county" in Tables 2a, 2b, and 2d (for comparison with the 1990 Census, the 2000 Census, and the 2005 ACS, respectively). Specifically, the overall weighted mean error measures for the tour-based model are consistently lower for the "outside origin county" flows than the corresponding flows from the trip-based model. In particular, the flows originating in Franklin, Licking, and Delaware counties (the three largest counties in the study area in terms of work trip generation) and destined outside these counties are substantially better predicted by the tour-based model for all years (*i.e.*, 1990, 2000, and 2005). For work flows originating from the remaining counties (Fairfield, Madison, Pickaway, and Union) and terminating outside these counties, the tour-based model provides somewhat better results in 1990 and the trip-based model provides clearly better results for 2000 and 2005. For intra-county flows, both the trip-based and tour-based models provide about the same results for Franklin and Licking counties (the largest two counties in terms of work trip generation), while the trip-based model clearly performs better for Delaware and Fairfield counties. The trip-based model also performs better in 2000 for Madison and Pickaway counties, while the tour-based model is superior for Union county in that year. The comparison with the HIS data in Table 2c again indicates the better overall performance of the tour-based model for work flows originating from Franklin County (the largest county in terms of work flow), though the trip-based model performs better for work flows from Licking County (especially, the work flow from Licking to Franklin County). But, overall, even from the HIS data comparison, the tour-based model performs better than the trip-based model for county-to-county work flows, as can be observed from the final row of Table 2c.

Finally, in the context of work flow distributions, Table 2e presents the performance of the trip-based and tour-based model systems for district-to-district flows within Franklin County. Data from the 2000 Census Transportation Planning Products (CTPP 2000) were used for this performance comparison of the two model systems at the district level for the year 2000, given the higher sampling rate of the CTPP data compared to the HIS (the higher sampling rate of the

[9] The trip-based and tour-based model predicted flows to work used for comparison with the HIS flows are not the same as those provided in Appendix Tables B.2c and B.2d (these tables are the adjusted tables to be consistent with the total work flow from the 2000 Census in Table B.2a). For the sake of compactness, Appendix B does not present the unadjusted trip-based and tour-based model flows for comparison with the HIS flows.

CTPP should provide more precise district-to-district flow estimates).[10,11] Several interesting observations may be made from Table 2e. The tour-based model performs noticeably better than the trip-based model when predicting district-to-district work flows from (1) West of CBD to other districts (except to Northeast of CBD, East of CBD, and German Village, though these flows are small in magnitude relative to other flows from West of CBD), (2) German Village to other districts (except to Ohio State University, Northeast of CBD, and Southwest Franklin), (3) Northwest of CBD to other districts (except to Northeast of CBD and East of CBD, both of which are relatively small in magnitude in terms of work flow), and (4) Southeast Franklin to other districts (except to Ohio State University and Southwest Franklin, where the trip-based model performs much better). Also, the tour-based model, in general, performs better than the trip-based model in the district-to-district work flow prediction for Northeast of CBD, Northwest of Franklin, Along High Street district, Northeast of Franklin, and Southwest Franklin. The trip-based model predicts better than the tour-based model in terms of overall district level performance for Ohio State University, while the results are about even for the CBD district and East of CBD district. Across both the trip-based and tour-based models, the prediction is quite poor for the work flows originating from the CBD district (the weighted mean absolute percentage error is over 50%). This is a result of a consistent underestimation of work flows from the CBD to other districts (the total work trip flow from the CBD district is 3,201 person trips/day from the CTPP, while the corresponding numbers from the trip-based and the tour-based models are 1,594 person trips/day (see Table B.2c) and 1,624 person trips/day (see Table B.2d), respectively). But the relative magnitude of the work flow from the CBD is also low (only 0.63% of work flow within Franklin county is from the CBD district), However, the work trip flow into the CBD district from other Franklin County districts is predicted with much better accuracy by the tour-based model relative to the trip-based model (except for the CBD-to-CBD flow; note also that the CBD is by far the highest attractor for work flows within Franklin county, accounting for about 15% of the total works flow within Franklin County). Overall, the tour-based model significantly out-performs the trip-based model in district-level work flow prediction and distribution.

[10] We could have also used the CTPP data rather than the Census SF3 data for the county-to-county work flow comparisons in Tables 2a and 2b, but, as discussed earlier, we wanted to keep Tables 2a, 2b, and 2d (for the years 1990, 2000, and 2005, respectively) compatible in terms of information, and the ACS data that forms the basis for Table 2d provides spatial information only at the scale of the SF3 data.

[11] Note that the sum of all the district-to-district work flows in the third column of Table 2e (see last row of this table) matches up to the overall Franklin County-to-Franklin County work flow of 508.40×10^3 in Table 2b, as one would expect (since the CTPP data and the Census SF3 data are drawn from the same survey source). The district-to-district flow predictions from the trip-based and the tour-based models that formed the basis for Table 2e are provided in Tables B.2c and B.2d, respectively, of Appendix B.

Table 2a: Work Flow Distribution by County – Comparison with the Census Data (Year 1990)

Origin county	Destination												
	Within origin county					Outside origin county					Overall Weighted Mean Absolute Percentage Error (OWMAPE) by origin county		Overall Weighted Mean Root Squared Error (OWMRSE) by origin county	
	Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)		Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)					
		Trip-based model	Tour-based model	Trip-based model	Tour-based model		Trip-based model	Tour-based model	Trip-based model	Tour-based model	Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	14.00	80.97	87.33	11,336	12,226	18.90	55.97	51.23	10,579	9,682	66.61	66.59	10,907	10,838
Fairfield	9.24	85.44	91.32	7,895	8,438	9.84	97.97	94.82	9,640	9,330	91.90	93.12	8,838	8,909
Franklin	464.10	1.69	0.83	7,833	3,861	20.20	74.45	61.27	15,038	12,377	4.72	3.35	8,260	4,547
Licking	39.40	12.64	10.04	4,978	3,957	19.00	28.06	6.26	5,332	1,190	17.65	8.81	5,096	3,320
Madison	2.17	100.00	100.00	2,170	2,170	2.85	140.69	126.39	4,013	3,605	123.11	114.99	3,343	3,068
Pickaway	2.65	100.00	100.00	2,646	2,646	2.62	137.77	126.00	3,608	3,300	118.79	112.93	3,161	2,989
Union	3.14	100.00	100.00	3,135	3,135	1.75	394.63	346.86	6,902	6,067	205.51	188.40	4,834	4,415
Total flow/overall weighted mean error	**534.70**	**7.48**	**6.81**	**7,722**	**4,399**	**75.16**	**73.33**	**60.60**	**10,510**	**8,844**	**15.59**	**13.44**	**8,117**	**5,158**

Table 2b: Work Flow Distribution by County – Comparison with the Census Data (Year 2000)

Origin county	Destination										Overall Weighted Mean Absolute Percentage Error (OWMAPE) by origin county		Overall Weighted Mean Root Squared Error (OWMRSE) by origin county	
	Within origin county					Outside origin county								
	Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)		Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)					
		Trip-based model	Tour-based model	Trip-based model	Tour-based model		Trip-based model	Tour-based model	Trip-based model	Tour-based model	Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	21.10	1.87	16.93	395	3,572	36.30	6.23	1.05	2,260	382	4.63	6.89	1,813	2,187
Fairfield	10.68	56.51	71.16	6,035	7,600	13.36	86.41	91.65	11,544	12,244	73.13	82.55	9,500	10,439
Franklin	508.40	0.32	1.70	1,624	8,658	37.30	31.38	11.64	11,704	4,340	2.44	2.38	3,438	8,433
Licking	42.40	15.47	17.75	6,560	7,525	28.40	28.92	12.13	8,212	3,445	20.86	15.49	7,268	6,218
Madison	2.36	38.60	65.50	909	1,543	3.16	79.64	93.18	2,518	2,946	62.12	81.36	1,997	2,448
Pickaway	2.65	25.96	57.28	687	1,516	3.24	60.23	80.77	1,951	2,617	44.82	70.21	1,519	2,192
Union	3.86	60.56	37.66	2,338	1,454	2.87	100.19	122.07	2,876	3,505	77.46	73.66	2,581	2,540
Total flow/overall weighted mean error	**591.45**	**3.14**	**5.39**	**2,461**	**8,368**	**124.63**	**32.95**	**23.65**	**8,520**	**5,014**	**8.33**	**8.57**	**4,200**	**7,887**

Table 2c: Work Trip Flow Distribution by County – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS flow (in 1000s of trips)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Delaware	Delaware	13.08	47.59	24.08	25.34	11.80	6,223	4,979	3,313	2,136
	Fairfield	0.00	-		-		54		58	
	Franklin	33.23	13.57		4.48		4,508		1,489	
	Licking	0.25	183.37		163.00		467		415	
	Madison	0.00	-		-		208		272	
	Pickaway	0.00	-		-		27		42	
	Union	1.12	25.10		36.52		280		408	
Fairfield	Delaware	0.39	38.12	79.17	38.93	96.77	149	6,880	152	8,001
	Fairfield	4.85	14.09		40.67		684		1,974	
	Franklin	10.03	86.53		99.86		8,681		10,018	
	Licking	0.19	1409.89		1512.40		2,633		2,824	
	Madison	0.59	95.67		96.08		562		564	
	Pickaway	0.00	-		-		543		612	
	Union	0.00	-		-		19		8	
Franklin	Delaware	20.54	38.97	7.07	16.33	4.70	8,003	24,379	3,353	15,249
	Fairfield	1.58	35.10		95.45		554		1,508	
	Franklin	483.00	5.19		3.25		25,053		15,689	
	Licking	2.94	31.95		30.65		939		901	
	Madison	1.21	26.33		90.13		319		1,093	
	Pickaway	0.75	80.56		194.44		605		1,461	
	Union	2.29	32.26		4.13		738		94	

Table 2c (continued): Work Trip Flow Distribution by County – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS flow (in 1000s of trips)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Licking	Delaware	0.91	2.17		68.57		20		624	
	Fairfield	0.55	28.02		149.76		155		827	
	Franklin	14.21	15.39		42.47		2,187		6,036	
	Licking	48.27	8.92	10.43	3.28	14.18	4,305	3,880	1,581	3,162
	Madison	0.00	-		-		26		20	
	Pickaway	0.00	-		-		61		108	
	Union	0.00	-		-		43		45	
Madison	Delaware	0.25	40.16		5.62		101		14	
	Fairfield	0.00	-		-		8		5	
	Franklin	1.45	218.27		247.02		3,175		3,593	
	Licking	0.00	-	118.70	-	143.62	13	2,217	14	2,523
	Madison	1.20	8.36		36.59		100		439	
	Pickaway	0.00	-		-		49		84	
	Union	0.08	206.14		296.87		169		243	
Pickaway	Delaware	0.00	-		-		43		38	
	Fairfield	0.10	40.63		7.53		42		8	
	Franklin	2.62	70.83		99.83		1,856		2,616	
	Licking	0.00	-	98.65	-	98.63	41	1,710	30	2,322
	Madison	0.16	83.71		68.22		132		107	
	Pickaway	0.48	269.41		121.97		1,283		581	
	Union	0.00	-		-		13		10	
Union	Delaware	0.55	13.85		141.14		76		773	
	Fairfield	0.00	-		-		3		1	
	Franklin	4.01	4.20		7.09		168		284	
	Licking	0.00	-	29.55	-	31.76	13	1,076	17	843
	Madison	1.85	81.61		82.55		1,511		1,528	
	Pickaway	0.00	-		-		7		10	
	Union	4.19	32.85		18.62		1,376		780	
Total flow/overall weighted mean error		**656.92**	**11.73**		**9.94**		**21,633**		**13,575**	

Table 2d: Work Flow Distribution by County – Comparison with the ACS Data (Year 2005)

Origin county	Destination												
	Within origin county					Outside origin county					Overall Weighted Mean Absolute Percentage Error (OWMAPE) by origin county		Overall Weighted Mean Root Squared Error (OWMRSE) by origin county	
	ACS flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)		ACS flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)					
		Trip-based model	Tour-based model	Trip-based model	Tour-based model		Trip-based model	Tour-based model	Trip-based model	Tour-based model	Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	28.29	4.67	21.52	1,321	6,088	45.73	9.78	3.76	4,472	1,719	7.83	10.55	3,609	3,999
Fairfield	12.36	55.08	69.58	6,808	8,602	14.51	69.94	78.91	10,151	11,453	63.10	74.62	8,773	10,241
Franklin	471.31	6.49	4.45	30,579	20,959	44.68	42.64	28.28	19,051	12,635	9.62	6.51	29,758	20,373
Licking	40.82	4.93	4.84	2,013	1,974	32.90	21.47	4.24	7,065	1,395	12.31	4.57	4,951	1,740
Total flow/overall weighted mean error	**552.78**	**7.37**	**6.81**	**28,261**	**19,452**	**137.82**	**29.56**	**19.74**	**12,127**	**8,186**	**11.80**	**9.39**	**25,858**	**17,783**

Table 2e: Intra-County Work Trip Flow Distribution for Franklin County – Comparison with the CTPP Data (Year 2000)

Origin district	Destination district	CTPP flow	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean
CBD	CBD	1,037	17.86	51.35	75.56	52.18	185	214	783	463
	West of CBD	291	61.76		36.36		180		106	
	Ohio State University	484	73.89		51.20		358		248	
	Northeast of CBD	21	26.51		123.60		5		25	
	East of CBD	74	17.76		2.26		13		2	
	German Village	123	50.59		24.10		62		30	
	Northwest of Franklin	140	80.69		67.95		113		95	
	Northwest of CBD	206	87.50		72.50		180		149	
	Along High Street	128	67.20		34.79		86		44	
	Northeast Franklin	342	82.79		49.01		283		168	
	Southeast Franklin	163	72.32		6.41		118		10	
	Southwest Franklin	193	31.31		4.90		60		9	
West of CBD	CBD	5,475	12.67	21.67	0.41	11.30	694	1,167	22	757
	West of CBD	6,676	33.49		23.46		2,236		1,566	
	Ohio State University	4,255	14.98		2.23		637		95	
	Northeast of CBD	289	18.12		81.03		52		235	
	East of CBD	412	25.18		69.48		104		286	
	German Village	649	15.42		22.27		100		145	
	Northwest of Franklin	2,618	7.06		5.82		185		152	
	Northwest of CBD	2,714	15.34		0.67		416		18	
	Along High Street	2,087	19.94		2.26		416		47	
	Northeast Franklin	2,091	53.42		4.03		1,117		84	
	Southeast Franklin	1,089	34.01		14.40		370		157	
	Southwest Franklin	2,213	13.43		29.20		297		646	

Table 2e (continued): Intra-County Work Trip Flow Distribution for Franklin County – Comparison with the CTPP Data (Year 2000)

Origin district	Destination district	CTPP flow	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean
Ohio State University	CBD	7,022	19.87	20.56	19.74	35.72	1,396	951	1,386	3,568
	West of CBD	2,906	30.76		54.38		894		1,580	
	Ohio State University	13,797	5.98		42.54		825		5,869	
	Northeast of CBD	505	136.49		128.22		689		648	
	East of CBD	661	45.70		82.70		302		547	
	German Village	768	9.12		65.20		70		501	
	Northwest of Franklin	1,499	48.71		22.69		730		340	
	Northwest of CBD	2,351	21.11		6.75		496		159	
	Along High Street	3,123	28.09		24.83		877		776	
	Northeast Franklin	3,979	29.87		9.30		1,189		370	
	Southeast Franklin	1,633	37.51		23.81		613		389	
	Southwest Franklin	1,233	2.84		124.71		35		1,538	
Northeast of CBD	CBD	2,710	52.79	33.33	2.21	22.32	1,431	791	60	468
	West of CBD	1,181	20.19		34.87		238		412	
	Ohio State University	1,627	91.87		70.72		1,495		1,150	
	Northeast of CBD	1,424	30.17		49.85		430		710	
	East of CBD	482	41.28		19.09		199		92	
	German Village	555	23.49		1.68		130		9	
	Northwest of Franklin	660	62.14		16.93		410		112	
	Northwest of CBD	597	1.72		62.40		10		372	
	Along High Street	1,589	19.05		26.39		303		419	
	Northeast Franklin	3,246	1.77		3.94		58		128	
	Southeast Franklin	1,120	36.49		0.92		409		10	
	Southwest Franklin	844	27.41		12.28		231		104	

Table 2e (continued): Intra-County Work Trip Flow Distribution for Franklin County – Comparison with the CTPP Data (Year 2000)

Origin district	Destination district	CTPP flow	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean
East of CBD	CBD	1,919	61.47	32.61	27.23	34.99	1,180	596	523	337
	West of CBD	518	2.81		61.38		15		318	
	Ohio State University	732	26.05		53.61		191		393	
	Northeast of CBD	301	25.75		13.76		77		41	
	East of CBD	817	27.70		31.96		226		261	
	German Village	357	67.03		60.75		239		217	
	Northwest of Franklin	348	62.73		27.54		218		96	
	Northwest of CBD	199	13.46		41.42		27		82	
	Along High Street	356	0.34		56.59		1		202	
	Northeast Franklin	1,030	15.76		21.37		162		220	
	Southeast Franklin	864	22.32		28.92		193		250	
	Southwest Franklin	571	14.61		35.27		83		201	
German Village	CBD	3,164	77.06	49.61	12.02	20.82	2,438	1,237	380	373
	West of CBD	1,280	24.54		22.43		314		287	
	Ohio State University	1,417	15.52		40.63		220		576	
	Northeast of CBD	306	0.76		44.35		2		136	
	East of CBD	564	161.76		57.68		912		325	
	German Village	1,936	56.66		27.25		1,097		528	
	Northwest of Franklin	675	57.28		22.66		387		153	
	Northwest of CBD	518	48.14		3.38		249		18	
	Along High Street	808	46.50		1.41		376		11	
	Northeast Franklin	1,700	52.61		7.69		894		131	
	Southeast Franklin	2,121	27.17		12.42		576		263	
	Southwest Franklin	1,478	30.83		34.98		456		517	

Table 2e (continued): Intra-County Work Trip Flow Distribution for Franklin County – Comparison with the CTPP Data (Year 2000)

Origin district	Destination district	CTPP flow	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean
Northwest of Franklin	CBD	5,514	31.06	28.92	5.48	20.70	1,713	1,568	302	1,522
	West of CBD	4,821	46.27		23.00		2,231		1,109	
	Ohio State University	3,124	26.64		16.33		832		510	
	Northeast of CBD	245	15.09		58.30		37		143	
	East of CBD	499	5.39		17.85		27		89	
	German Village	768	10.03		2.21		77		17	
	Northwest of Franklin	10,123	19.10		25.72		1,934		2,604	
	Northwest of CBD	5,183	26.84		30.23		1,391		1,567	
	Along High Street	2,833	27.13		3.68		769		104	
	Northeast Franklin	2,700	43.32		17.00		1,170		459	
	Southeast Franklin	1,577	26.93		17.22		425		272	
	Southwest Franklin	3,004	35.85		39.42		1,077		1,184	
Northwest of CBD	CBD	6,823	51.28	34.96	19.15	14.52	3,499	3,564	1,307	935
	West of CBD	4,634	12.75		6.13		591		284	
	Ohio State University	5,904	25.44		28.20		1,502		1,665	
	Northeast of CBD	433	9.58		34.18		41		148	
	East of CBD	429	3.19		37.21		14		160	
	German Village	827	48.81		27.36		404		226	
	Northwest of Franklin	5,098	8.81		5.34		449		272	
	Northwest of CBD	10,870	62.20		1.41		6,761		153	
	Along High Street	5,661	21.36		24.49		1,209		1,386	
	Northeast Franklin	3,993	26.84		15.44		1,072		616	
	Southeast Franklin	1,594	50.79		34.32		810		547	
	Southwest Franklin	1,810	25.25		11.89		457		215	

Table 2e (continued): Intra-County Work Trip Flow Distribution for Franklin County – Comparison with the CTPP Data (Year 2000)

Origin district	Destination district	CTPP flow	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean
Along High Street	CBD	5,808	42.66	26.67	19.22	20.87	2,478	1,961	1,116	1,286
	West of CBD	2,105	21.60		5.89		455		124	
	Ohio State University	5,052	17.29		29.74		873		1,502	
	Northeast of CBD	533	20.42		18.42		109		98	
	East of CBD	471	1.68		17.90		8		84	
	German Village	514	21.59		12.53		111		64	
	Northwest of Franklin	1,946	46.59		18.25		907		355	
	Northwest of CBD	3,331	19.60		36.47		653		1,215	
	Along High Street	9,657	33.08		18.70		3,194		1,806	
	Northeast Franklin	5,124	2.26		20.71		116		1,061	
	Southeast Franklin	1,322	42.26		16.67		559		220	
	Southwest Franklin	1,112	35.76		6.38		398		71	
Northeast Franklin	CBD	14,655	22.29	16.71	4.52	13.75	3,267	3,393	663	4,835
	West of CBD	5,376	39.04		11.76		2,099		632	
	Ohio State University	7,601	1.54		13.98		117		1,062	
	Northeast of CBD	2,358	32.83		9.01		774		212	
	East of CBD	2,117	5.63		9.09		119		192	
	German Village	2,193	21.59		6.53		474		143	
	Northwest of Franklin	3,703	53.18		37.87		1,969		1,402	
	Northwest of CBD	4,909	9.36		20.18		459		991	
	Along High Street	12,820	13.24		7.11		1,697		911	
	Northeast Franklin	39,987	12.43		19.63		4,971		7,849	
	Southeast Franklin	7,995	12.22		6.72		977		537	
	Southwest Franklin	3,473	28.57		3.97		992		138	

Table 2e (continued): Intra-County Work Trip Flow Distribution for Franklin County – Comparison with the CTPP Data (Year 2000)

Origin district	Destination district	CTPP flow	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean	By destination	Wtd. Mean
Southeast Franklin	CBD	14,329	7.24	23.42	4.30	12.84	1,037	4,604	617	1,270
	West of CBD	6,064	40.78		18.38		2,472		1,114	
	Ohio State University	4,778	2.89		32.12		138		1,535	
	Northeast of CBD	1,674	15.90		8.78		266		147	
	East of CBD	2,255	39.32		39.59		886		893	
	German Village	4,446	24.00		12.62		1,067		561	
	Northwest of Franklin	3,090	57.39		47.74		1,773		1,475	
	Northwest of CBD	2,517	43.56		33.81		1,097		851	
	Along High Street	4,406	45.69		29.25		2,013		1,288	
	Northeast Franklin	17,382	15.90		13.90		2,763		2,417	
	Southeast Franklin	26,752	30.34		0.91		8,117		243	
	Southwest Franklin	5,993	5.25		14.89		315		893	
Southwest Franklin	CBD	8,630	33.06	25.17	8.72	16.44	2,853	2,561	753	1,303
	West of CBD	10,342	17.73		0.03		1,833		3	
	Ohio State University	3,931	10.02		65.71		394		2,583	
	Northeast of CBD	996	37.52		8.30		374		83	
	East of CBD	927	60.08		124.81		557		1,157	
	German Village	2,367	12.92		26.42		306		625	
	Northwest of Franklin	7,067	22.15		16.03		1,565		1,133	
	Northwest of CBD	3,068	10.84		30.52		333		936	
	Along High Street	3,356	57.04		25.75		1,914		864	
	Northeast Franklin	4,677	53.97		15.33		2,524		717	
	Southeast Franklin	5,290	13.83		10.74		731		568	
	Southwest Franklin	18,174	21.69		10.43		3,942		1,895	
Total flow/overall weighted mean error		**508.40**	**25.14**		**17.72**		**3,020**		**2,623**	

5.1.3 Work Flow Distribution by Time-of-Day of Trip Start

Tables 3a, 3b, and 3e present the error statistics for the work flow distribution by county of origin and two times of the day of the work trip start from the home end: the peak period (6:30 am to 9:29 am and 3:30 pm to 6:29 pm) and the off-peak period (all times that do not fall within the peak period). The Census and ACS data provide information on work flows by time-of-day of trip start only at the level of origin county, and hence the analysis here is conducted at the level of the origin county (rather than disaggregating work flows from the origin county to within the county and outside the county as undertaken in the previous section). For the tour-based model, the work flows computed in the previous section were aggregated across all destinations by origin county, and the work flows by time of day of trip start were obtained based on the work tour start time (at home) of individuals (as obtained from the "log files" of individual activity-travel patterns). For the trip-based model, the work trip flows were obtained by origin county as discussed in the previous section, except that the procedure was applied to each of the peak and off-peak periods separately. The predicted and observed work flows by trip start time by residence county in percentage form were then compared to obtain prediction error measures. In this computation, note that the total percentage of person work trips starting from different counties and across the two time periods of the day add up to 100% for each of the predicted and observed work flow distribution matrices (please see Appendix C for the work flows by residence county and trip start time on which Tables 3a, 3b, and 3d are based).

The results from Tables 3a, 3b, and 3e consistently and across years show the tour-based model to be a better match overall of the observed peak period and off-peak period work flow distributions compared to the trip-based model (see the final row of Tables 3a, 3b, and 3e). This is not surprising, given that the tour-based model consistently outperforms the trip-based model predictions of work flow distribution by time of day of trip start for work trips originating in Franklin county. The tour-based model also does better for work trip flow distribution by trip start time for trips from Fairfield County (except for the off-peak period in 1990). Interestingly, though, for Licking County (the second largest generator of work trips), the trip-based model performs better than the tour model in 1990 and 2000, though things get reversed in 2005. Table 3c compares the work flow distributions by trip start time with the corresponding results from the 2000 HIS data. The results indicate an about even performance from both models, though the trip-based model does perform somewhat better than the tour-based model for the off-peak period. Much of this improved performance of the trip-based model in the off-peak period may be traced back to the better performance of the trip-based model for work trips originating from Franklin County.

In summary, the work flow distribution by time of day forecasting ability of the tour-based model is consistently better than the trip-based model for all years based on the Census/ACS data, though its performance is about the same to somewhat worse off than the trip-based model based on the HIS data.

Table 3a: Work Flow Distribution by Trip Start Time – Comparison with the Census Data (Year 1990)

Origin county	Peak period					Off-peak period				
	Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)		Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)	
		Trip-based model	Tour-based model	Trip-based model	Tour-based model		Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	22.37	10.93	18.71	2,446	4,185	10.53	16.04	15.59	1,689	1,641
Fairfield	12.00	7.59	0.76	911	91	7.08	11.79	13.90	835	984
Franklin	336.38	12.07	9.71	40,587	32,646	147.92	22.57	16.31	33,381	24,131
Licking	36.00	0.03	9.89	12	3,562	22.40	1.52	7.08	341	1,586
Madison	3.15	35.07	19.29	1,105	608	1.87	39.41	44.20	737	827
Pickaway	3.24	19.13	6.37	620	206	2.02	16.90	22.10	342	447
Union	2.89	85.66	59.39	2,475	1,716	2.00	64.77	60.94	1,292	1,216
Overall weighted mean error		**11.57**	**10.34**	**36,500**	**29,390**	-	**19.93**	**15.91**	**29,166**	**21,093**

Table 3b: Work Flow Distribution by Trip Start Time – Comparison with the Census Data (Year 2000)

Origin county	Peak period					Off-peak period				
	Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)		Census flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)	
		Trip-based model	Tour-based model	Trip-based model	Tour-based model		Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	41.13	16.30	18.16	6,703	7,468	16.27	29.75	26.31	4,838	4,279
Fairfield	14.88	23.15	18.78	3,444	2,794	9.16	22.53	20.20	2,065	1,851
Franklin	366.76	9.45	7.31	34,671	26,808	178.94	13.74	7.72	24,591	13,811
Licking	42.70	0.39	8.93	168	3,813	28.10	6.48	0.95	1,821	267
Madison	3.32	33.09	26.39	1,099	876	2.20	23.21	23.97	510	527
Pickaway	3.51	26.37	15.93	925	559	2.38	14.27	22.82	339	543
Union	3.98	85.99	81.15	3,424	3,232	2.75	65.10	62.80	1,790	1,727
Overall weighted mean error		**10.59**	**9.56**	**30,496**	**23,662**	-	**14.99**	**9.59**	**21,294**	**11,990**

Table 3c: Work Flow Distribution by Trip Start Time: Peak Period – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS flow (in 1000s of trips)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Delaware	Delaware	6.50	105.17	27.19	68.60	21.15	6,832	3,322	4,456	2,332
	Fairfield	0.00	-		-		37		38	
	Franklin	20.06	1.17		5.10		234		1,024	
	Licking	0.25	95.63		71.27		244		182	
	Madison	0.00	-		-		143		188	
	Pickaway	0.00	-		-		19		26	
	Union	0.77	24.80		22.32		190		171	
Fairfield	Delaware	0.00	-	107.04	-	106.24	167	5,664	156	6,011
	Fairfield	2.14	34.44		13.38		738		287	
	Franklin	6.23	107.46		114.28		6,693		7,118	
	Licking	0.19	942.47		915.90		1,760		1,710	
	Madison	0.20	91.04		93.99		178		184	
	Pickaway	0.00	-		-		375		398	
	Union	0.00	-		-		13		5	
Franklin	Delaware	12.08	28.35	19.73	4.10	20.44	3,424	48,306	495	51,340
	Fairfield	0.70	110.43		195.50		773		1,369	
	Franklin	266.43	18.69		19.86		49,786		52,920	
	Licking	2.02	32.53		26.30		657		531	
	Madison	0.62	71.35		150.23		440		927	
	Pickaway	0.43	117.80		242.03		507		1,041	
	Union	0.80	33.87		72.54		271		580	

Table 3c (continued): Work Flow Distribution by Trip Start Time: Peak Period – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS flow (in 1000s of trips)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Licking	Delaware	0.45	35.69	34.20	105.93	45.63	162	5,464	480	6,686
	Fairfield	0.31	57.68		186.70		179		578	
	Franklin	6.45	75.55		103.97		4,873		6,706	
	Licking	24.67	23.07		27.50		5,689		6,783	
	Madison	0.00	-		-		18		11	
	Pickaway	0.00	-		-		42		58	
	Union	0.00	-		-		30		21	
Madison	Delaware	0.20	46.89	135.28	28.18	157.80	91	1,537	55	1,608
	Fairfield	0.00	-		-		6		2	
	Franklin	0.79	306.11		316.31		2,409		2,490	
	Licking	0.00	-		-		9		9	
	Madison	0.87	2.96		43.16		26		376	
	Pickaway	0.00	-		-		34		59	
	Union	0.08	111.44		162.48		91		133	
Pickaway	Delaware	0.00	-	234.19	-	203.36	30	1,819	21	1,896
	Fairfield	0.10	58.89		31.21		61		33	
	Franklin	0.89	248.59		265.53		2,204		2,355	
	Licking	0.00	-		-		29		18	
	Madison	0.08	77.54		60.58		61		48	
	Pickaway	0.31	291.61		119.62		904		371	
	Union	0.00	-		-		9		2	
Union	Delaware	0.38	12.30	49.39	120.49	46.51	47	1,086	462	836
	Fairfield	0.00	-		-		2		0	
	Franklin	2.40	20.10		14.27		483		343	
	Licking	0.00	-		-		9		10	
	Madison	1.20	80.49		81.08		969		976	
	Pickaway	0.00	-		-		5		7	
	Union	2.26	70.25		49.78		1,586		1,124	
Overall weighted mean error			**25.65**		**26.69**		**42,835**		**45,530**	

Table 3d: Work Flow Distribution by Trip Start Time: Off-Peak Period – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS flow (in 1000s of trips)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Delaware	Delaware	6.58	24.10	12.94	0.08	3.27	1,586	1,221	5	255
	Fairfield	0.00	-		-		23		24	
	Franklin	13.16	7.66		2.36		1,008		311	
	Licking	0.00	-		-		306		280	
	Madison	0.00	-		-		88		103	
	Pickaway	0.00	-		-		11		19	
	Union	0.35	1.50		98.09		5		342	
Fairfield	Delaware	0.39	73.85	78.55	74.59	88.37	289	3,029	292	3,230
	Fairfield	2.71	34.93		54.85		947		1,488	
	Franklin	3.80	108.21		112.83		4,116		4,292	
	Licking	0.00	-		-		1,193		1,323	
	Madison	0.39	97.24		96.72		381		378	
	Pickaway	0.00	-		-		230		257	
	Union	0.00	-		-		8		3	
Franklin	Delaware	8.46	37.29	12.13	19.69	17.56	3,154	22,137	1,665	35,169
	Fairfield	0.88	2.71		40.16		24		353	
	Franklin	216.58	10.51		16.71		22,766		36,181	
	Licking	0.92	78.69		69.22		723		636	
	Madison	0.60	8.90		54.70		53		326	
	Pickaway	0.32	78.73		178.52		253		574	
	Union	1.49	55.94		35.08		832		522	

Table 3d (continued): Work Flow Distribution by Trip Start Time: Off-Peak Period – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS flow (in 1000s of trips)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Licking	Delaware	0.46	17.55	18.57	54.82	20.13	80	4,305	251	4,411
	Fairfield	0.24	23.30		142.06		57		345	
	Franklin	7.76	10.58		9.46		822		735	
	Licking	23.60	21.17		21.71		4,996		5,124	
	Madison	0.00	-		-		11		11	
	Pickaway	0.00	-		-		26		58	
	Union	0.00	-		-		18		27	
Madison	Delaware	0.06	13.76	144.77	102.24	144.68	8	1,037	57	1,158
	Fairfield	0.00	-		-		4		3	
	Franklin	0.67	193.56		217.78		1,292		1,453	
	Licking	0.00	-		-		5		6	
	Madison	0.33	67.81		3.04		222		10	
	Pickaway	0.00	-		-		21		31	
	Union	0.00	-		-		106		133	
Pickaway	Delaware	0.00	-	40.79	-	48.74	18	226	19	591
	Fairfield	0.00	-		-		26		48	
	Franklin	1.73	9.28		36.05		161		625	
	Licking	0.00	-		-		17		14	
	Madison	0.08	86.18		71.45		68		56	
	Pickaway	0.17	348.42		170.52		578		283	
	Union	0.00	-		-		5		9	
Union	Delaware	0.16	60.63	27.27	245.07	26.95	100	356	403	263
	Fairfield	0.00	-		-		1		1	
	Franklin	1.61	9.99		14.91		160		239	
	Licking	0.00	-		-		5		9	
	Madison	0.65	77.71		81.81		503		529	
	Pickaway	0.00	-		-		3		3	
	Union	1.93	21.91		0.06		423		1	
Overall weighted mean error			**15.40**		**19.41**		**19,539**		**30,985**	

Table 3e: Work Flow Distribution by Trip Start Time– Comparison with the ACS Data (Year 2005)

Origin county	Peak period					Off-peak period				
	ACS flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)		ACS flow (in 1000s)	Absolute Percentage Error (APE)		Root Squared Error (RSE)	
		Trip-based model	Tour-based model	Trip-based model	Tour-based model		Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	52.40	19.28	21.03	10,104	11,022	21.61	19.95	14.88	4,311	3,216
Fairfield	16.03	16.87	15.90	2,705	2,549	10.84	5.88	2.79	637	302
Franklin	347.34	5.84	3.75	20,275	13,036	168.66	18.86	12.67	31,803	21,360
Licking	43.79	8.47	1.18	3,707	515	29.94	17.94	9.53	5,370	2,854
Overall weighted mean error		**8.01**	**5.90**	**17,997**	**11,939**	-	**18.23**	**12.00**	**27,272**	**18,305**

5.1.4 Average (Person) Work Trip Travel Time

The average (person) work trip travel time from the trip-based and tour-based models were compared next with the corresponding values from the Census, HIS, and ACS data sets. For the comparison with the Census and ACS data sets, the average work trip travel time for the journey to work from the tour-based and trip-based models were computed by origin county. For the tour-based model, the "log files" of individual daily activity-travel patterns included work tour start time information by four times of the day (6:30 am-9:29 am or am peak, 9:30 am-3:29 pm or midday, 3:30 pm-6:29 pm or pm peak, and 6:30 pm-6:29 am or night) and the tour mode (single occupancy vehicle or high occupancy vehicle). From these, the traffic analysis zone (TAZ)-to-traffic analysis zone (TAZ) person work flows (to work) by mode and time of day were obtained using the procedure discussed in Section 5.1.2. Next, the TAZ-to-TAZ travel time (skim) matrices from the trip assignment stage were obtained (these travel time matrices were the same regardless of mode, because there are no high occupancy vehicle lanes in the study region). Subsequently, the TAZ-to-TAZ person work flows were added up across modes for each time of day, multiplied by the TAZ-to-TAZ travel time matrix corresponding to that time of day, and summed across all times of the day to obtain total TAZ-to-TAZ person-minutes of travel to work.[12] These TAZ-to-TAZ level person-minutes were then aggregated up by origin county and divided by the total number of person work trips originating from each origin county to obtain the average work trip travel time by origin county. For the trip-based model calculation, the peak

[12] TAZ-to-TAZ person-minutes of travel to work is calculated as follows:

$Person-minutes of\ travel to work_{ij} = \sum_{k=1}^{M} (Work trip_{ijk} \times Travel time_{ijk})$ where i and j are indices for origin TAZ and destination TAZ, respectively, and k is an index for the time of day (in the current case, $M = 4$).

period and the off-peak period TAZ-to-TAZ work trip flows were obtained based on the procedure discussed in Section 5.1.2 (note that the production-attraction trip matrices, on which the procedure in Section 5.1.2 is based, are available only for peak and off-peak periods). Next, the traffic assignment skim matrices for the four time periods were collapsed to two periods by appropriate averaging (note that there are trips from home to work even in the evening peak and night periods, though these are lesser than those in the morning peak and mid-day periods). Subsequently, the TAZ-to-TAZ work trip flow matrix by time of day was multiplied by the corresponding travel time skim matrices and added up to obtain the total TAZ-to-TAZ person-minutes of travel to work. The rest of the procedure is the same as for the tour-based model. The average travel time to work from the Census, HIS, and ACS data sets were obtained in a fashion similar to the procedure discussed above, but using the work flows from the Census, HIS, and ACS data sets, respectively, and the reported travel times at the individual level instead of the TAZ-to-TAZ travel times.[13] For comparison with the HIS data, which has county-to-county level work flow information, the average work trip travel time by origin county and destination county was obtained by aggregating the TAZ-to-TAZ level person-minutes by origin county and destination county, and dividing by the total number of origin county-to-destination county person work trips.

The error measures for the comparison of the trip-based and tour-based models with the 1990 census (Table 4a), the 2000 Census (Table 4b), and the 2005 ACS (Table 4d) are computed by origin county (see Appendix D for the raw numbers that form the basis for the tables in this section). The results indicate that, except for Fairfield county for the year 1990 (Table 4a), the average work trip travel time predictions for other counties and all years from the tour-based model are better than or about the same or only marginally worse than from the trip-based model. This generally superior performance of the tour-based model is also clear from the overall weighted (by flow from origin county) mean error in the final row of the tables. A similar result may be observed from the final row of Table 4c, which compares the trip-based and tour-based model results with the HIS data. Also, from Table 4c, the tour-based model provides better predictions of travel time for work trips originating in all counties except Licking and Union (the error measures for Pickaway County are about the same from the two models). For these two counties, the average work travel time predictions from the trip-based model are particularly better than the tour-based model for (a) intra-county flows, (b) travel to Franklin and Licking Counties for trips originating in Licking County, and (c) travel to Franklin and Madison Counties for trips originating in Union County.

Overall, the results from Tables 4a through 4d indicate an edge for the tour-based model over the trip-based model (across all years) in terms of average work trip travel time prediction.

[13] It is now well established that individuals tend to round off activity and travel time durations when reporting time-use patterns in surveys (Bhat, 1996, Hautsch, 1999). For instance, individuals tend to round off to the closest five minutes for any activity and travel time durations less than an hour, and then round off to the closest 10-15 minutes beyond an hour. This has led to some concerns in the research community regarding the reliability of reported travel time duration.

Table 4a: Travel Time for Work Trips – Comparison with the Census Data (Year 1990)

Origin county	Census average travel time from origin county (in mins)	Absolute Percentage Error (APE)		Root Squared Error (RSE)	
		Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	22.74	28.88	30.70	6.57	6.98
Fairfield	24.75	10.94	16.19	2.71	4.01
Franklin	20.04	37.61	16.36	7.54	3.28
Licking	22.1	28.87	10.48	6.38	2.32
Madison	22.75	8.04	10.96	1.83	2.49
Pickaway	23.72	15.83	17.41	3.76	4.13
Union	20.97	50.82	46.83	10.66	9.82
Overall weighted mean error		**35.14**	**16.77**	**7.25**	**3.63**

Table 4b: Travel Time for Work Trips – Comparison with the Census Data (Year 2000)

Origin county	Census average travel time from origin county (in mins)	Absolute Percentage Error (APE)		Root Squared Error (RSE)	
		Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	25.45	20.46	19.38	5.21	4.93
Fairfield	26.95	1.73	2.19	0.47	0.59
Franklin	21.41	26.74	21.53	5.73	4.61
Licking	24.12	20.32	22.70	4.90	5.48
Madison	25.01	7.11	7.15	1.78	1.79
Pickaway	26.19	9.13	4.72	2.39	1.24
Union	22.29	15.80	17.66	3.52	3.94
Overall weighted mean error		**24.36**	**20.54**	**5.45**	**4.62**

Table 4c: Travel Time for Work Trips – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS average travel time (in mins)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
Delaware	Delaware	16.08	35.39	20.01	27.30	12.77	5.69	6.02	4.39	4.99
	Fairfield	0.00	-		-		40.47		36.58	
	Franklin	23.39	11.71		4.28		2.74		1.00	
	Licking	40.00	3.60		10.38		1.44		4.15	
	Madison	0.00	-		-		30.77		28.61	
	Pickaway	0.00	-		-		51.14		47.75	
	Union	36.40	31.87		30.58		11.60		11.13	
Fairfield	Delaware	27.50	63.75	18.90	55.02	18.50	17.53	4.51	15.13	4.57
	Fairfield	16.00	43.31		30.88		6.93		4.94	
	Franklin	32.65	8.42		12.99		2.75		4.24	
	Licking	30.00	3.67		12.87		1.10		3.86	
	Madison	4.67	1004.50		893.15		46.91		41.71	
	Pickaway	0.00	-		-		19.27		24.90	
	Union	0.00	-		-		56.74		50.74	
Franklin	Delaware	23.19	16.21	25.52	14.23	19.94	3.76	5.86	3.30	4.91
	Fairfield	24.32	19.78		23.31		4.81		5.67	
	Franklin	20.50	25.41		19.80		5.21		4.06	
	Licking	26.57	37.49		17.20		9.96		4.57	
	Madison	29.66	22.45		25.32		6.66		7.51	
	Pickaway	28.41	7.57		9.96		2.15		2.83	
	Union	63.13	54.59		57.66		34.46		36.40	

Table 4c (continued): Travel Time for Work Trips – Comparison with the HIS Data (Year 2000)

Origin county	Destination county	HIS average travel time (in mins)	Absolute Percentage Error (APE)				Root Squared Error (RSE)			
			Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean	Destination county	Wtd. Mean
	Delaware	26.33	37.56		31.30		9.89		8.24	
	Fairfield	28.27	19.07		19.99		5.39		5.65	
	Franklin	36.29	7.33		13.36		2.66		4.85	
Licking	Licking	15.89	15.98	14.13	22.28	20.15	2.54	4.01	3.54	4.88
	Madison	0.00	-		-		51.96		51.27	
	Pickaway	0.00	-		-		46.15		44.77	
	Union	0.00	-		-		52.79		51.74	
	Delaware	21.07	59.99		45.94		12.64		9.68	
	Fairfield	0.00	-		-		44.34		38.17	
	Franklin	19.61	39.32		27.33		7.71		5.36	
Madison	Licking	0.00	-	36.24	-	25.48	56.97	5.94	52.89	4.11
	Madison	12.12	34.57		24.92		4.19		3.02	
	Pickaway	0.00	-		-		28.46		27.60	
	Union	25.00	30.72		15.72		7.68		3.93	
	Delaware	0.00	-		-		48.11		49.04	
	Fairfield	30.00	13.23		9.60		3.97		2.88	
	Franklin	38.46	24.41		28.21		9.39		10.85	
Pickaway	Licking	0.00	-	39.54	-	40.27	51.88	14.95	46.50	15.14
	Madison	45.00	20.73		27.69		9.33		12.46	
	Pickaway	23.29	62.69		59.34		14.60		13.82	
	Union	0.00	-		-		49.86		49.31	
	Delaware	14.40	72.36		76.88		10.42		11.07	
	Fairfield	0.00	-		-		53.52		38.03	
	Franklin	38.74	17.45		27.44		6.76		10.63	
Union	Licking	0.00	-	20.37	-	28.66	58.18	8.11	53.61	8.24
	Madison	10.29	47.23		80.95		4.86		8.33	
	Pickaway	0.00	-		-		52.23		51.76	
	Union	9.94	16.90		21.23		1.68		2.11	
Overall weighted mean error			**23.96**		**19.80**		**5.80**		**5.06**	

Table 4d: Travel Time for Work Trips – Comparison with the ACS Data (Year 2005)

Origin county	ACS average travel time from origin county (in mins)	Absolute Percentage Error (APE)		Root Squared Error (RSE)	
		Trip-based model	Tour-based model	Trip-based model	Tour-based model
Delaware	22.87	11.16	10.88	2.55	2.49
Fairfield	25.04	3.08	5.68	0.77	1.42
Franklin	18.76	15.93	11.69	2.99	2.19
Licking	24.28	9.02	11.67	2.19	2.83
Overall weighted mean error		**14.18**	**11.37**	**2.81**	**2.28**

5.1.5 Average Trip Distance by County of Origin

The Census, ACS, and HIS data sets do not provide observed information on trip distances. However, in this section, we compare the average person trip length predictions from the trip-based and tour-based models by trip purpose (Table 5a) and by county of origin (Table 5b) to examine general trends in these predictions. The procedure to compute the average trip distance is similar to the one discussed in the earlier section for average work trip time, except that travel times are replaced with travel distances and all trips are considered rather than only the work tours or the home-based work production-attraction tables.

As expected, both the trip-based and tour-based models indicate relatively long home-based work trip lengths compared to other non-work purposes, as can be observed from Table 5a. The tour-based model predicts longer home-based work and home-based school trip lengths, and shorter home-based shopping and home-based other trip lengths, relative to the trip-based model. The shorter lengths of home-based shopping and home-based other trips from the tour-based model may be due to a better recognition of trip chaining tendencies, especially on the journey back from work. Interestingly though, the tour-based model also predicts longer average trip lengths for the non-home based trip categories.

Table 5b, which provides the average person trip length predictions by origin county, indicates longer trip length predictions for Franklin and Pickaway counties from the tour-based model compared to the trip-based model. It also indicates shorter trip length predictions for other origin counties from the tour-based model compared to the trip-based model.

Table 5a: Average Person Trip Length (in miles) by Trip Type (Year 2000)

Trip purpose	Trip-based model	Tour-based model
Home-based work	8.41	9.01
Home-based school	4.55	4.83
Home-based shop	5.20	4.68
Home-based other	5.97	5.93
Non-home based work	6.09	9.01
Non-home based other	4.64	5.36

Table 5b: Average Person Trip Length (in miles) by County (Year 2000)

County	Trip-based model	Tour-based model
Delaware	7.76	7.38
Fairfield	9.60	8.33
Franklin	5.01	6.16
Licking	6.44	6.33
Madison	10.09	9.96
Pickaway	9.34	10.11
Union	6.45	6.30

5.2 Project-Level Comparison

This section presents a comparative assessment of the predicted link volumes from the trip-based and the tour-based models with the observed link counts. The observed link counts were available only at an annual average daily traffic (AADT) level. Also, the project team, in consultation with MORPC and ODOT staff, decided that only available link count data would be used in the project, without any additional data collection specific to this project. In this regard, Figure 4 presents a visual of the links for which count data were available for each study area and the control area (represented as rows) and model year (represented as columns). Appendix E provides the observed link flows, the predicted trip-based model flows, and the tour-based model flows on each of these links. The fit measures employed for comparison of model predicted link volumes with the observed counts are the Absolute Percentage Error (the APE error measure was also used in the region-level comparison) and the Percentage Root Mean Squared Error (%RMSE), defined as follows:

$$\%RMSE = \frac{\sqrt{\frac{\sum_{i=1}^{N}(\text{Observed Count}_i - \text{Predicted Count}_i)^2}{N-1}}}{\frac{\sum_{i=1}^{N}\text{Observed Count}_i}{N}} \times 100$$

where i is an index for road link (i = 1, 2, …, N). We also calculated a weighted mean of the %RMSE statistic that was computed as the sum of the percentage root mean squared error for each cell weighted by the fraction of observations in that cell.

Table 6 presents the observed link volumes and the model results for each study project and model year, aggregated by roadway functional class.[14] Specifically, the APE measure is computed link-by-link within each functional class and then a weighted (by link flow) mean APE is computed for the functional class. These APE values are then further weighted by the flow contribution of each class to obtain the weighted mean for each project and year. In addition to Table 6, a visual representation of the Absolute Percentage Error statistics on each section of roadway for which counts were available is presented in Figure 5. Unlike Table 6 in which a link has directionality, Figure 5 provides the APE for the case of non-directional flows on each roadway segment (except for roadways that were coded using different start and end nodes for each direction, such as would be the case for freeway type and other divided facilities). In Figure 5, black, yellow, green, and blue shades indicate the superior performance of the tour-based model, while the brown, orange, red, and dark red shades indicate the superior performance of the trip-based model (see color key at the bottom of the Figure).

For the Polaris project (Table 6), the tour-based model provides clearly better results than the trip-based model for 1990, while the two models perform about equally well for 2000 and 2005 (based on the overall weighted mean across all links). Across all years, the tour-based model provides better predictions for the freeway functional class. Figure 5 indicates this particularly better performance of the freeway links (I-71 links) in 1990 (green and blue shades on the I-71 links). It also shows that the volume on the southern stretch of I-71 in the region in 2000 for both directions is better predicted by the tour-based model, and the northern stretch by the trip-based model. However, in 2005, the relative performances of the two models differ based on direction in the southern stretch of the I-71. Another finding from the Polaris project results is that the trip-based model is better than the tour-based model in terms of predicting flows on major arterial links.

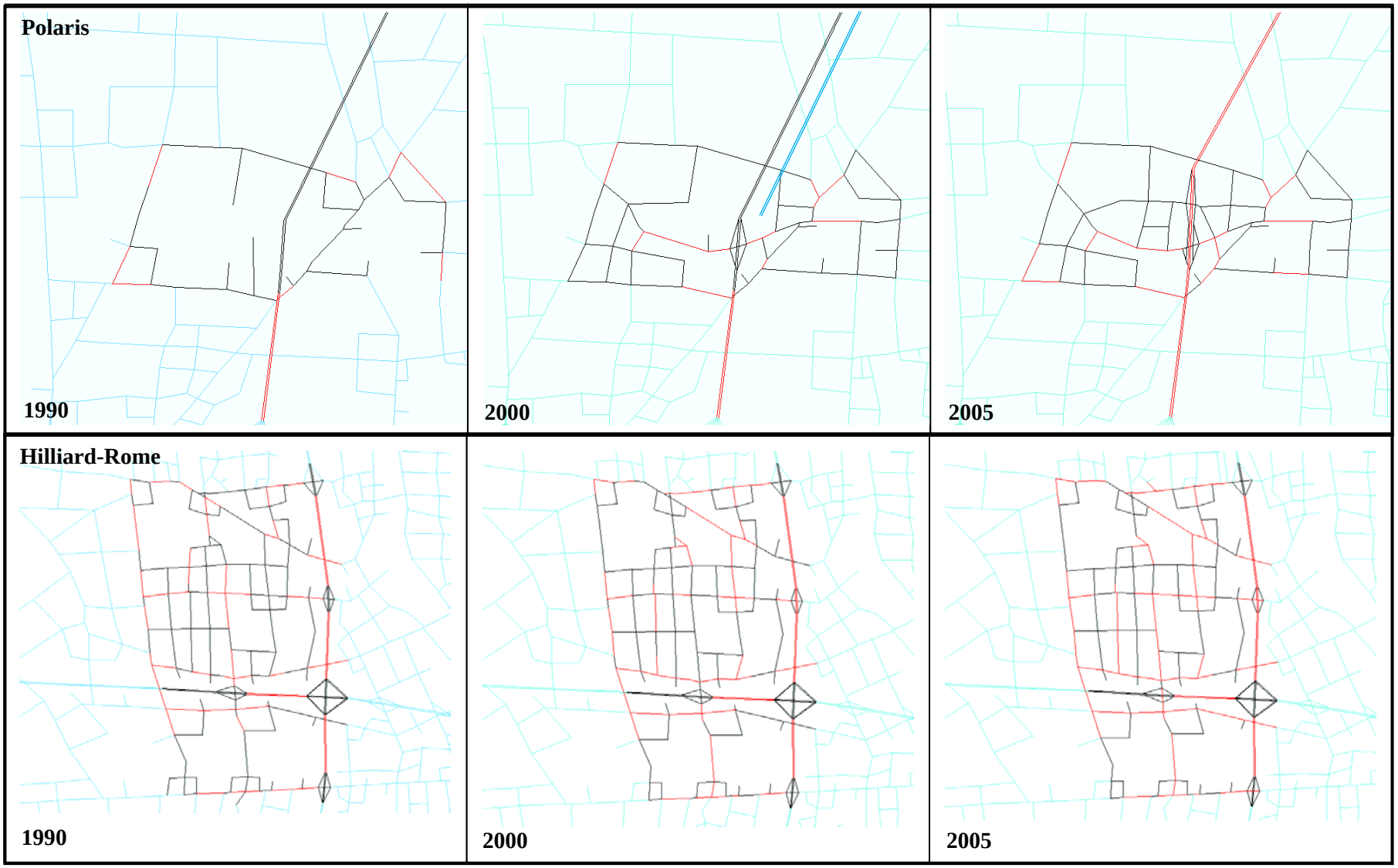
For the Hilliard-Rome project, the tour-based model provides better results (relative to the trip-based model) for the freeway functional class in 1990 and 2005, but worse results (relative to the trip-based model) for the freeway functional class in 2000 (this may also be observed from Figure 5, where there is more of a blue shade along I-270 and I-70 in 1990 and 2005, while there is more mix of colors along I-270 and I-70 in 2000). The tour-based model also provides better results for the major arterial class in 2000 and 2005, which also can be discerned from the somewhat higher blue density presence for the non-freeway links for the Hilliard-Rome "row" in the figures for 2000 and 2005 compared to the figure for 1990.

[14] In discussions with MORPC and ODOT staff, it was decided that, as the Spring-Sandusky project was incomplete in the year 2000, no comparison will be undertaken for this project for this year. However, as the Polaris project was undertaken in phases and the year 2000 marked the completion of the parkway widening phase of the project, we undertook a comparative analysis for the Polaris project for the year 2000 even though the entire project was not complete until 2007 (see also discussion earlier on this).

For the Spring-Sandusky project, the tour-based model provides worse results for the freeway and expressway functional class (see Table 6; Figure 5 provides the spatial distribution of these roadways), but performs marginally better for the major arterial class. Overall, the predictive power of the tour-based model is marginally lower than from the trip-based model

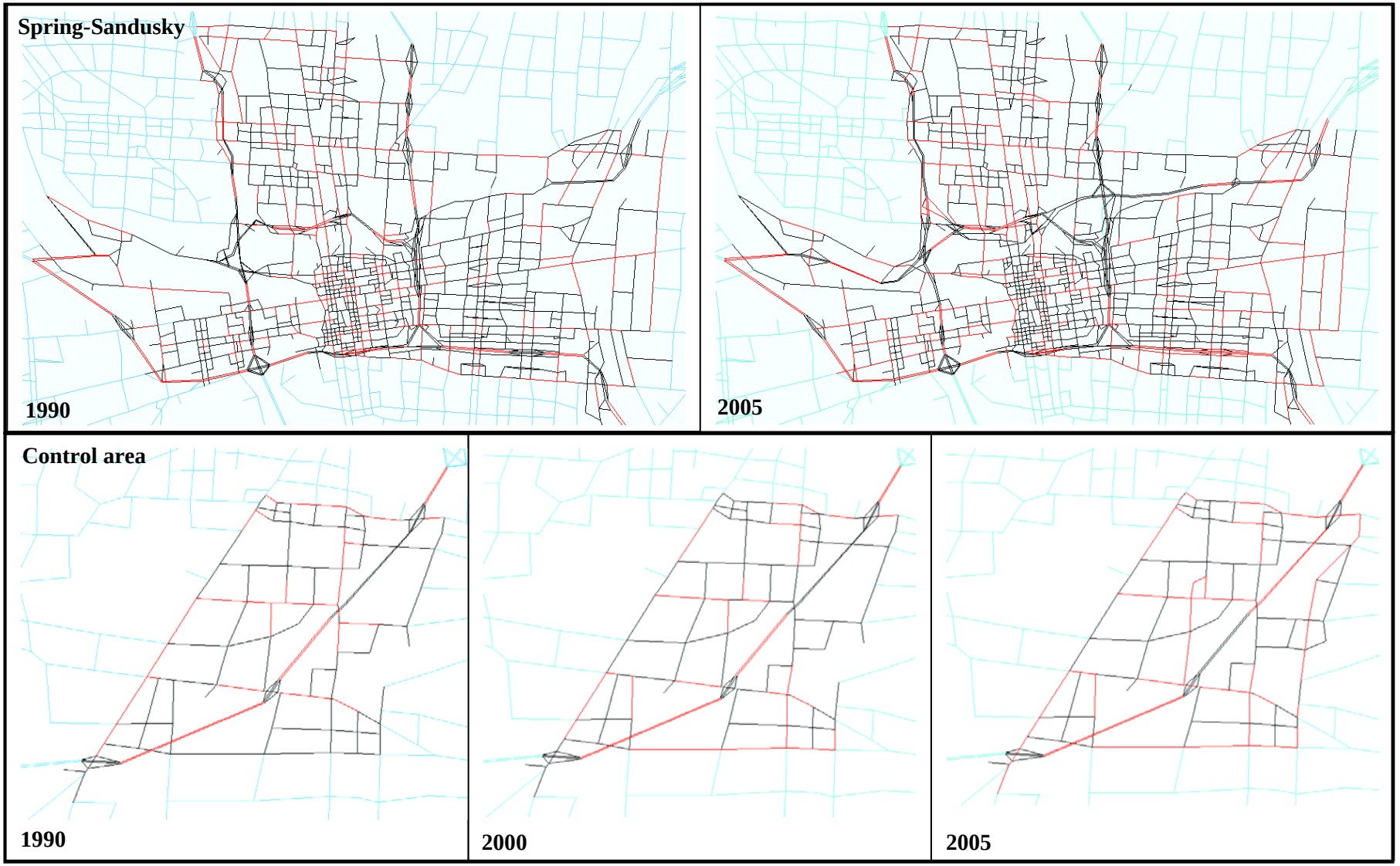
Finally, for the control area, the tour-based model predicts link flows on freeways with a better accuracy than the trip-based model for 1990, though the roles get reversed for 2005. There is no difference in predictive ability for the freeway functional class in 2000. This trend across the years is also observable from the progression from blue/green shades along the I-71 corridor in 1990 to orange/red in 2005 in Figure 5. The trip-based model's performance is also superior to that of the tour-based model for the major arterial class

In the overall, the results from the trip-based and tour-based models indicate about equal predictive abilities for both the before-project and after-project situations at the level of link predictions. (see final three rows of Table 6). It is difficult to make a strong case for one of the MORPC models being superior to the other from this standpoint. It should be noted that the use of a traditional static traffic assignment process does, to an extent, "undo" the benefits of the fine resolution of time represented in the tour model. This happens because the tours are grouped back to four aggregate time periods in the assignment stage and the static assignment process does not consider the dynamics of vehicle delays (see also Pinjari *et al.*, 2006). In general, the results in this section do provide validation that the tour-based model, being a more recent entrant to the travel demand practitioner's toolbox, is producing reasonable results at the link level.



Key: Links in the study area — Links with available count data — Link volumes correspond to volumes on I-71 just north of the study area

Figure 4: Network Links Considered in the Project-Level Attributes Analysis



Key: Links in the study area Links with available count data

Figure 4 (continued): Network Links Considered in the Project-Level Attributes Analysis

Table 6: Project Level Link Volume Comparison by Roadway Functional Class

Study project	Year	Roadway functional class	Survey data		Absolute Percentage Error (APE)				Percentage Root Mean Squared Error (%RMSE)			
					Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Number of links	Total link flow (vehs/day)	By roadway functional class	Wtd. Mean	By roadway functional class	Wtd. Mean	By roadway functional class	Wtd. Mean	By roadway functional class	Wtd. Mean
Polaris	1990	Freeway (interstate)	2	40,400	20.73	41.82	6.01	32.09	30.73	57.09	8.87	45.15
		Major roads (arterials)	6	9,410	81.36		93.69		93.87		112.97	
		Minor roads (collectors)	10	23,724	62.07		52.06		87.37		80.03	
	2000	Freeway (interstate)	4	168,300	10.45	22.13	8.45	23.31	12.92	29.22	11.88	28.59
		Major roads (arterials)	16	233,980	29.19		34.63		38.87		41.46	
		Minor roads (collectors)	8	42,438	29.47		19.78		40.64		23.97	
	2005	Freeway (interstate)	8	369,782	14.58	23.33	12.63	22.16	22.69	31.50	14.79	28.92
		Major roads (arterials)	26	343,350	28.27		28.28		35.92		39.26	
		Minor roads (collectors)	10	62,205	48.06		45.04		59.43		55.85	
Hilliard-Rome	1990	Freeway (interstate)	8	223,220	13.79	22.14	7.22	21.08	15.76	27.15	8.54	26.66
		Major roads (arterials)	42	388,064	22.27		24.90		26.41		30.70	
		Minor roads (collectors)	48	102,948	37.82		34.77		52.51		48.46	
		Local roads	4	2,808	92.04		94.44		106.36		109.09	
	2000	Freeway (interstate)	10	526,542	6.60	20.29	12.70	19.64	7.67	25.05	16.10	25.04
		Major roads (arterials)	52	570,258	26.47		19.89		33.45		26.21	
		Minor roads (collectors)	58	236,552	31.27		30.13		38.17		37.12	
		Local roads	10	15,406	90.67		86.32		106.88		102.05	
	2005	Freeway (interstate)	10	556,698	10.98	21.98	8.45	19.14	13.37	28.39	13.22	25.22
		Major roads (arterials)	65	803,945	24.07		19.57		32.20		25.26	
		Minor roads (collectors)	76	398,680	29.11		29.34		37.44		37.63	
		Local roads	14	23,206	90.90		85.58		101.51		98.23	

Table 6 (continued): Project Level Link Volume Comparison by Roadway Functional Class

Study project	Year	Roadway functional class	Survey data		Absolute Percentage Error (APE)				Percentage Root Mean Squared Error (%RMSE)			
					Trip-based model		Tour-based model		Trip-based model		Tour-based model	
			Number of links	Total link flow (vehs/day)	By roadway functional class	Wtd. Mean	By roadway functional class	Wtd. Mean	By roadway functional class	Wtd. Mean	By roadway functional class	Wtd. Mean
Spring-Sandusky	1990	Freeway (interstate)	39	1,704,739	11.95	32.62	24.87	35.73	15.20	41.71	29.71	45.40
		Expressway	10	481,194	5.10		17.90		7.17		20.83	
		On ramp	1	26,759	0.58		0.80		0.00		0.00	
		Major roads (arterials)	412	3,992,054	39.13		37.69		49.70		48.48	
		Minor roads (collectors)	103	435,751	60.47		56.67		76.33		73.59	
		Local roads	68	197,460	89.57		91.80		122.53		122.45	
	2005	Freeway (interstate)	42	2,364,702	11.00	27.36	17.34	29.13	14.69	36.21	21.85	37.93
		Expressway	10	448,944	25.45		31.50		34.19		41.45	
		On ramp	2	50,392	19.35		12.93		27.59		18.31	
		Off ramp	2	12,129	50.61		47.55		86.99		89.97	
		Major roads (arterials)	491	4,657,741	32.28		31.65		42.78		41.59	
		Minor roads (collectors)	135	530,099	47.45		47.06		60.34		58.36	
		Local roads	85	174,870	62.24		64.23		83.38		88.63	
Control Area	1990	Freeway (interstate)	6	128,604	7.86	20.33	4.65	26.91	8.90	25.04	6.21	30.43
		Major roads (arterials)	43	179,585	24.14		37.31		30.91		41.47	
		Minor roads (collectors)	14	16,496	66.18		78.09		71.45		83.59	
		Local roads	6	4,330	58.24		61.84		84.05		89.38	
	2000	Freeway (interstate)	6	175,990	7.23	16.27	7.18	17.97	8.48	19.97	8.33	22.37
		Major roads (arterials)	30	161,454	20.55		24.67		26.27		31.46	
		Minor roads (collectors)	12	16,742	60.89		57.13		68.90		68.33	
		Local roads	13	2,854	69.58		74.90		84.50		105.30	
	2005	Freeway (interstate)	8	253,258	8.30	25.22	10.05	25.90	11.22	37.07	12.04	37.82
		Major roads (arterials)	58	359,703	28.92		28.89		37.42		38.47	
		Minor roads (collectors)	24	67,545	60.19		58.24		116.94		114.99	
		Local roads	24	21,820	52.30		60.62		83.99		87.67	
Overall weighted mean error	1990	-	-	-	**31.26**		**34.01**		**39.85**		**43.09**	
	2000	-	-	-	**20.00**		**20.12**		**25.07**		**25.33**	
	2005	-	-	-	**26.13**		**26.91**		**34.73**		**35.34**	

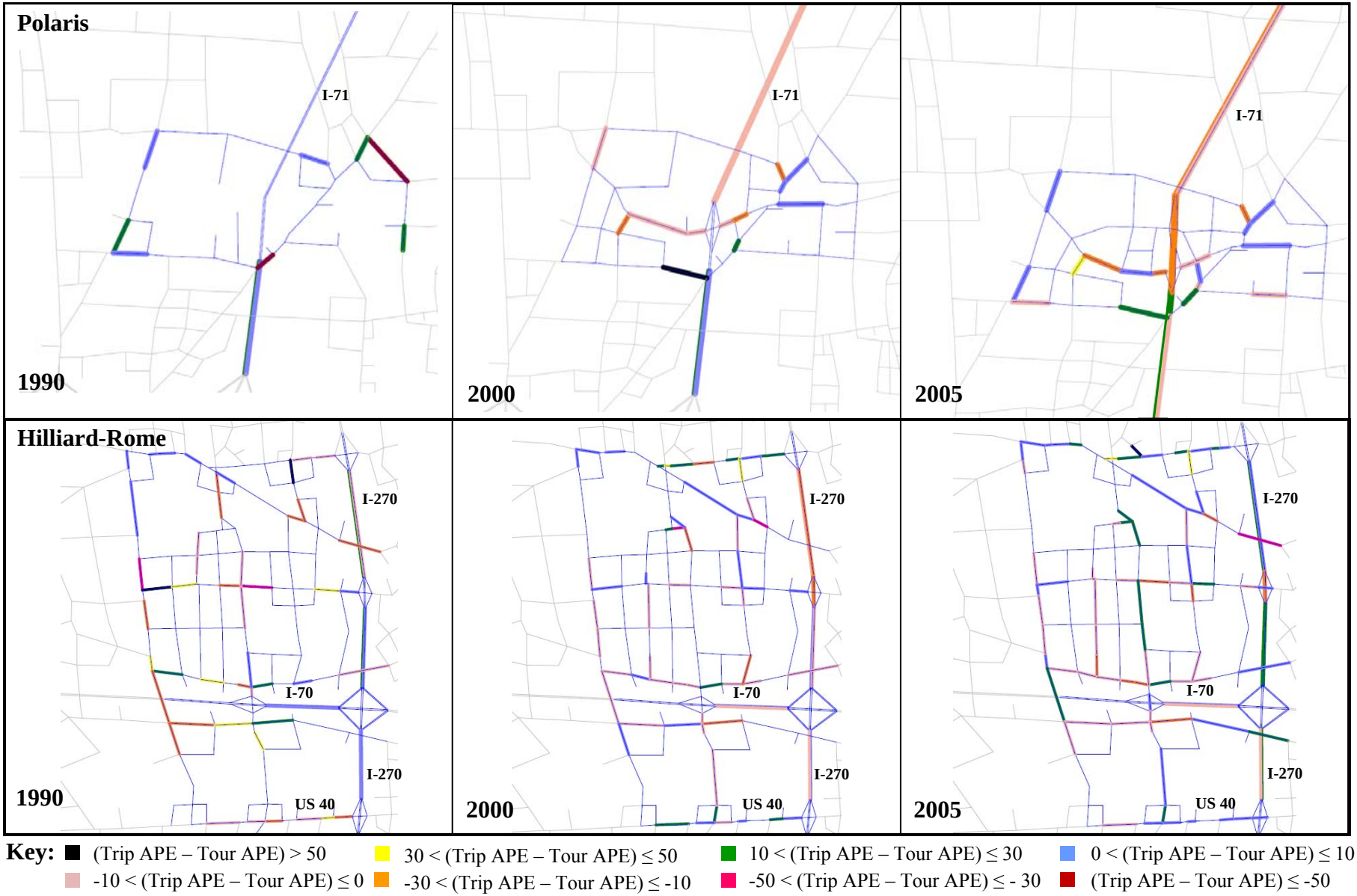


Figure 5: Absolute Percentage Error Statistic Comparison with the Observed Link Counts

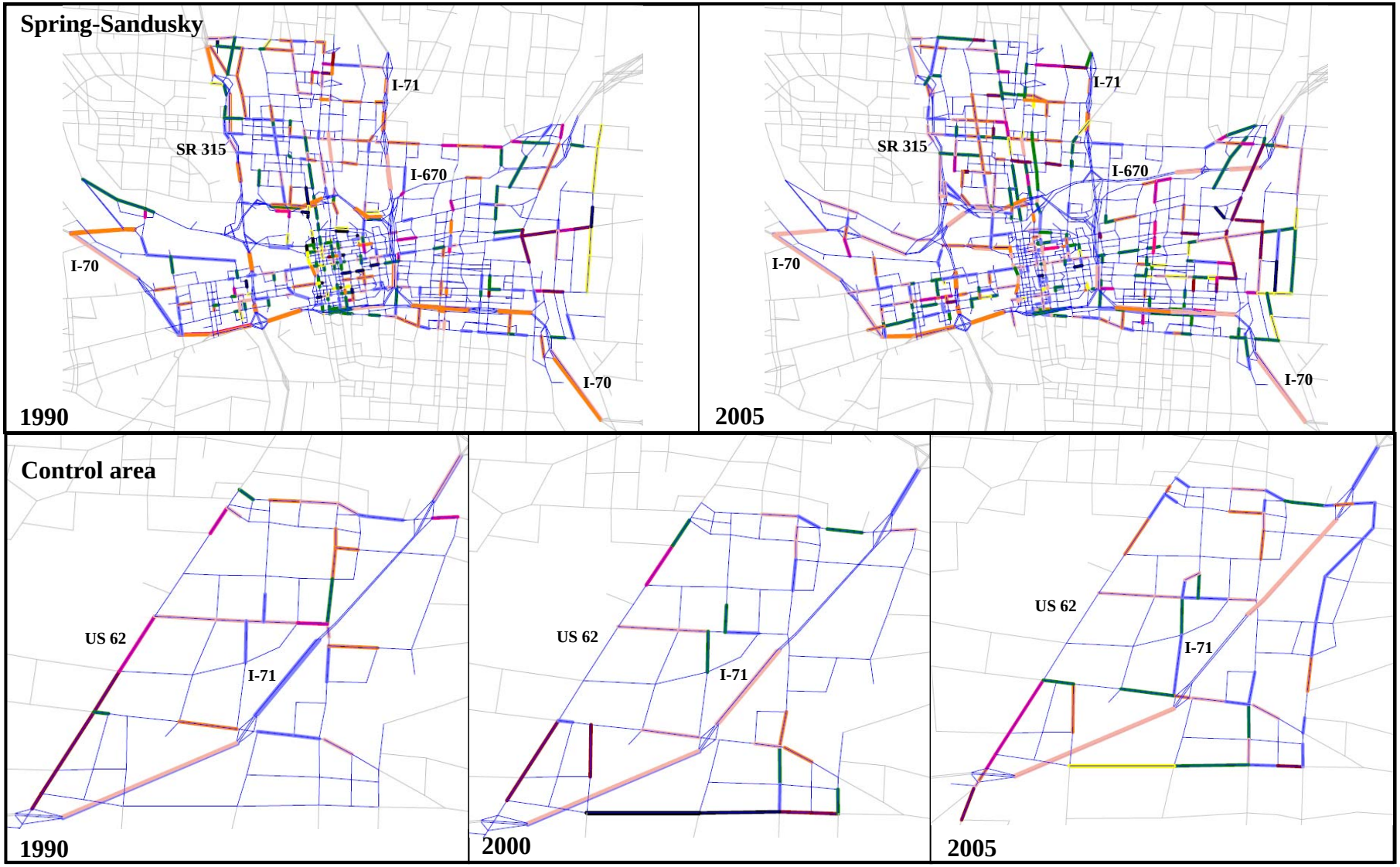


Figure 5 (continued): Absolute Percentage Error Statistic Comparison with the Observed Link Counts

6. CONCLUSIONS

This project compared the performance of the MORPC trip-based and the tour-based models with regional-level information from the Census, ACS, and HIS as well as project-level information before after projects. Such a comparative exercise provides a good opportunity for both models to be tested for their travel behavior and forecasting ability.

Regional- and project-level comparisons were made for three scenario years: 1990, 2000 and 2005. The tour-based model performed slightly better overall than the trip-based model in the regional-level comparisons. It performed better than the trip-based model, with some exceptions, in terms of vehicle ownership levels, work flow distribution, work start time distribution, and the average travel time for work trips. Neither model distinguished itself in the project-level comparison of link flows, as both models generally produced the same level of accuracy.

Through this analysis, the project team has learned firsthand the difficulties of making disaggregate model comparisons when the models have different units of travel. A major challenge is that translating the results to a common unit of travel generally causes inconsistencies except when performed at an aggregate level, because one must apply off-model rules to convert one model's data set to the other model's unit of travel. Given this challenge, definitive statements about the superiority of one model over the other are not easily made. Generally, the performance of the tour-based model in these specific tests provides evidence of the ability of these types of models to provide decision makers with better information on travel behavior. This tour-based model's vehicle ownership procedures appear to need further investigation, as they underperformed in all counties except for Franklin County.

The performance of the tour-based model in the project situations was somewhat disappointing, even if it performed about as well as the trip-based model. The results suggest that this tour-based model will not forecast better than traditional methods without additional behavioral resolution, network resolution, validation procedures or some combination thereof. It should, however, also be pointed out that the study projects selected in this analysis corresponded to land-use developments and roadway supply enhancements, not to demand-management actions. There is a need in the future to examine the performance of the trip- and tour-based models in the context of demand-management strategies.

This project proposed by ODOT is a significant step towards a better understanding of the tangible benefits of disaggregate tour-based modeling methods. But it should be viewed as only one step. It would be imprudent to judge all model systems strictly on the results of this one project, since the transportation planning community has accumulated four decades of learning and experience on trip-based models while this particular tour-based model represents only one attempt, and one of the earliest, at implementing the tour-based or activity-based approach for practical use. Regardless, this project should serve as an important reference in the assessment of the potential practical benefits of disaggregate tour-based modeling approaches vis-à-vis aggregate trip-based methods.

References

Anderson, R. and G. Giaimo (2009) On comparing aggregate trip-based and disaggregate tour-based travel demand models. Presented at 2009 TRB Planning Applications Conference. Houston, Texas.

Arentze, T. and H. Timmermans (2001) ALBATROSS: A learning based transportation oriented simulation system. Technische Universiteit Eindhoven, Netherlands.

Bhat, C.R. (1996) A generalized multiple durations proportional hazard model with an application to activity behavior during the work-to-home commute. *Transportation Research Part B*, 30(6), 465-480.

Bhat, C.R., J.Y. Guo, S. Srinivasan, and A. Sivakumar (2004) Comprehensive econometric microsimulator for daily activity-travel patterns. *Transportation Research Record*, 1894, 57-66.

Bhat, C.R., J. Guo, S. Srinivasan, A. Pinjari, N. Eluru, R. Copperman, and I.N. Sener (2006) The comprehensive econometric microsimulator for daily activity-travel patterns (CEMDAP), Report 4080-S, prepared for the Texas Department of Transportation, October.

Bowman, J.L., and M.A. Bradley (2005-2006) Activity-based travel forecasting model for SACOG: Technical memos numbers 1-11. Available at http://jbowman.net.

Hautsch, N. (1999) Analyzing the time between trades with a gamma compounded hazard model. An application to LIFFE bund future transactions. Working paper, Center of Finance and Econometrics, University of Konstanz.

Miller, E.J. and P.A. Salvini (2000) The integrated land use, transportation, environment (ILUTE) microsimulation modelling system: Description & current status. Paper presented at the 9th Meeting of the International Association of Travel Behavior Research, Queensland, Australia.

NHTS (2004) Summary of travel trends 2001 national household travel survey. U. S. Department of Transportation, Federal Highway Administration, available at: http://nhts.ornl.gov/2001/pub/STT.pdf.

Pendyala, R.M. (2004) Phased implementation of a multimodal activity-based travel demand modeling system in Florida. Final Report, Volume II: FAMOS users guide. Research Center, Florida Department of Transportation, Tallahassee, FL.

Pendyala, R.M., R. Kitamura, A. Kikuchi, T. Yamamoto, and S. Fujii (2005) FAMOS: The Florida activity mobility simulator. *Transportation Research Record*, 1921, 123-130.

Pinjari, A., N. Eluru, R. Copperman, I.N. Sener, J.Y. Guo, S. Srinivasan, and C.R. Bhat (2006) Activity-based travel-demand analysis for metropolitan areas in Texas: CEMDAP models, framework, software architecture and application results. Report 4080-8, prepared for the Texas Department of Transportation, October.

APPENDIX A: Vehicle Ownership

APPENDIX A.1: Vehicle Ownership – Model Year 1990

Table A.1a: Vehicle Ownership Level by County (Source: 1990 Census)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	918	5,363	10,525	6,310	**2.1**
Fairfield	805	3,835	6,319	3,766	**2.0**
Franklin	38,414	136,598	147,952	55,759	**1.6**
Licking	3,090	13,901	19,644	10,619	**1.9**
Madison	210	1,019	1,539	950	**2.0**
Pickaway	249	1,173	1,785	1,006	**1.9**
Union	186	954	1,557	945	**2.0**
Total number of HH with	**43,872**	**162,842**	**189,320**	**79,355**	**475,390**
Total percentage of HH with	**9.23**	**34.25**	**39.82**	**16.69**	

Table A.1b: Vehicle Ownership Level by County (Source: 1990 trip-based model)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	1,417	5,130	8,562	8,024	**2.0**
Fairfield	543	2,598	5,046	5,676	**2.1**
Franklin	50,946	122,049	133,328	72,409	**1.6**
Licking	4,395	12,794	17,176	12,871	**1.8**
Madison	275	1,050	1,807	1,551	**2.0**
Pickaway	408	1,214	1,810	1,322	**1.9**
Union	447	1,754	2,565	1,888	**1.9**
Total number of HH with	**58,430**	**146,589**	**170,295**	**103,742**	**479,056**
Total percentage of HH with	**12.20**	**30.60**	**35.55**	**21.66**	

Table A.1c: Vehicle Ownership Level by County (Source: 1990 tour-based model)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	11	9,155	5,987	8,780	**2.2**
Fairfield	724	3,864	3,024	5,379	**2.2**
Franklin	32,042	145,537	151,332	44,823	**1.6**
Licking	7,221	13,374	11,066	15,100	**1.9**
Madison	501	1,091	979	1,862	**2.2**
Pickaway	1,658	2,726	2,181	2,759	**1.7**
Union	1,215	2,177	1,779	2,683	**1.9**
Total number of HH with	**43,372**	**177,923**	**176,347**	**81,386**	**479,028**
Total percentage of HH with	**9.05**	**37.14**	**36.81**	**16.99**	

APPENDIX A.2: Vehicle Ownership – Model Year 2000

Table A.2a: Vehicle Ownership Level by County (Source: 2000 Census)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	1,153	8,576	20,294	9,651	**2.0**
Fairfield	846	4,660	7,855	4,810	**2.0**
Franklin	37,656	168,620	171,804	60,698	**1.6**
Licking	3,408	15,580	23,152	13,469	**1.9**
Madison	265	1,159	1,732	1,083	**2.0**
Pickaway	232	1,245	2,040	1,235	**2.0**
Union	193	1,115	2,094	1,332	**2.1**
Total number of HH with	**43,752**	**200,955**	**228,971**	**92,277**	**565,955**
Total percentage of HH with	**7.73**	**35.51**	**40.46**	**16.30**	

Table A.2b: Vehicle Ownership Level by County (Source: 1999 HIS)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	0	4,719	12,813	11,364	**2.4**
Fairfield	0	1,832	4,487	3,870	**2.4**
Franklin	40,236	158,956	162,742	49,410	**1.6**
Licking	2,868	14,715	21,886	13,193	**2.0**
Madison	114	217	747	726	**2.8**
Pickaway	0	760	900	1,114	**2.6**
Union	0	2,244	3,583	2,813	**2.2**
Total number of HH with	**43,218**	**183,444**	**207,158**	**82,490**	**516,309**
Total percentage of HH with	**8.4**	**35.5**	**40.1**	**16.0**	

Table A.2c: Vehicle Ownership Level by County (Source: 2000 trip-based model)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	2,657	9,468	15,120	12,824	**2.0**
Fairfield	833	4,229	7,828	7,657	**2.1**
Franklin	58,417	151,499	156,458	75,099	**1.6**
Licking	4,262	15,141	20,856	15,305	**1.8**
Madison	284	1,263	2,057	1,672	**2.0**
Pickaway	273	1,312	2,175	1,814	**2.0**
Union	554	2,363	3,540	2,782	**1.9**
Total number of HH with	**67,280**	**185,276**	**208,034**	**117,153**	**577,743**
Total percentage of HH with	**11.7**	**32.1**	**36.0**	**20.3**	

Table A.2d: Vehicle Ownership Level by County (Source: 2000 tour-based model)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	3,430	14,278	10,486	11,654	**1.9**
Fairfield	2,034	5,964	4,216	7,279	**2.0**
Franklin	32,738	176,985	176,244	47,365	**1.6**
Licking	8,928	15,828	14,130	16,449	**1.8**
Madison	748	1,353	1,094	1,859	**2.0**
Pickaway	2,746	2,388	3,183	2,314	**1.6**
Union	1,841	2,956	2,607	3,337	**1.8**
Total number of HH with	**52,465**	**219,752**	**211,960**	**90,257**	**574,433**
Total percentage of HH with	**9.13**	**38.26**	**36.90**	**15.71**	

APPENDIX A.3: Vehicle Ownership – Model Year 2005

Table A.3a: Vehicle Ownership Level by County (Source: 2005 ACS)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	1,040	12,325	26,856	13,196	**2.0**
Fairfield	910	4,624	8,813	5,390	**2.0**
Franklin	31,839	166,746	181,284	67,010	**1.7**
Licking	2,958	14,696	24,432	17,174	**2.0**
Total number of HH with	**36,747**	**198,391**	**241,385**	**102,770**	**579,293**
Total percentage of HH with	**6.34**	**34.25**	**41.67**	**17.74**	

Table A.3b: Vehicle Ownership Level by County (Source: 2005 trip-based model)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	2,986	12,350	20,219	17,240	**2.0**
Fairfield	992	4,817	8,864	8,589	**2.1**
Franklin	62,713	163,298	170,145	84,234	**1.6**
Licking	4,749	15,651	21,457	16,106	**1.8**
Madison	294	1,328	2,162	1,714	**2.0**
Pickaway	391	1,507	2,400	1,935	**1.9**
Union	647	2,654	3,980	3,143	**1.9**
Total number of HH with	**72,772**	**201,605**	**229,226**	**132,961**	**636,564**
Total percentage of HH with	**11.43**	**31.67**	**36.01**	**20.89**	

Table A.3c: Vehicle Ownership Level by County (Source: 2005 tour-based model)

County	Number of households (HH) with				Average number of vehicles
	No vehicle	1 vehicle	2 vehicles	3+ vehicles	
Delaware	2,633	21,262	11,348	17,415	**2.0**
Fairfield	2,586	7,337	4,719	7,998	**2.0**
Franklin	34,178	181,349	204,556	57,211	**1.6**
Licking	10,171	16,811	12,811	16,949	**1.8**
Madison	837	1,579	1,086	1,876	**1.9**
Pickaway	1,755	1,971	1,752	2,293	**1.7**
Union	2,194	3,566	2,800	3,523	**1.8**
Total number of HH with	**54,352**	**233,874**	**239,072**	**107,266**	**634,564**
Total percentage of HH with	**8.57**	**36.86**	**37.67**	**16.90**	

APPENDIX B: Work Flow Distributions

APPENDIX B.1: Work Flow Distributions – Model Year 1990

Table B.1a: County to County Flows to Work (in 1000s, source: 1990 Census)

From	To		Total flow to work
	Worked in county of residence	Worked outside county of residence	
Delaware	14.0	18.9	**32.9**
Fairfield	9.2	9.8	**19.1**
Franklin	464.1	20.2	**484.3**
Licking	39.4	19.0	**58.4**
Madison	2.2	2.9	**5.0**
Pickaway	2.6	2.6	**5.3**
Union	3.1	1.7	**4.9**
Total work flow	**535**	**75**	**609.9**

Table B.1b: County to County Flows to Work (in 1000s, source: 1990 trip-based model)[15]

From county/ district[16]		To county/district																	Total flow to work
		Delaware	Fairfield	Franklin											Licking	Madison	Pickaway	Union	
		13	13	1	2	3	4	5	6	7	8	9	10	11	12	13	13	13	13	
Delaware	**13**	2.7	0.0							28.9						0.6	0.0	0.0	0.0	**32.1**
Fairfield	**13**	0.0	1.3							16.6						2.9	0.0	0.0	0.0	**20.8**
Franklin	**1**	1.9	0.7	0.9	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	2.6	0.0	0.0	0.0	477.1
	2			5.8	6.5	6.8	0.3	0.4	0.6	3.0	1.2	1.4	0.5	0.5	3.1					
	3			8.8	2.6	16.9	1.2	0.7	0.6	0.6	0.7	3.1	1.5	0.6	1.4					
	4			4.6	0.6	4.3	2.7	0.8	0.5	0.3	0.3	1.7	2.9	0.6	0.6					
	5			3.2	0.2	0.9	0.3	0.9	0.6	0.1	0.0	0.2	0.5	0.5	0.4					
	6			6.2	0.5	1.3	0.3	1.1	3.5	0.2	0.1	0.3	0.5	1.4	1.9					
	7			1.8	2.1	1.1	0.1	0.2	0.3	7.5	1.9	0.7	0.5	0.4	2.5					
	8			4.3	3.1	6.1	0.5	0.4	0.5	6.2	14.1	7.2	2.4	0.7	1.9					
	9			4.2	1.3	5.8	0.8	0.5	0.5	1.2	2.7	14.6	4.7	0.6	1.0					
	10			11.4	1.9	8.9	4.0	2.2	1.9	1.9	2.4	14.4	44.5	5.9	2.3					
	11			15.0	1.9	5.0	1.3	2.9	6.8	1.1	0.5	1.4	13.7	37.3	5.5					
	12			11.3	6.3	4.2	0.5	0.9	2.4	5.4	0.9	1.0	1.0	2.7	21.6					
Licking	**13**	0.1	0.2							13.4						44.4	0.0	0.0	0.0	**58.0**
Madison	**13**	0.0	0.0							6.8						0.0	0.0	0.0	0.0	**6.9**
Pickaway	**13**	0.0	0.0							6.1						0.0	0.0	0.0	0.0	**6.2**
Union	**13**	0.2	0.0							8.4						0.0	0.0	0.0	0.0	**8.7**
Total work flow		**4.9**	**2.2**	**552.1**												**50.6**	**0.0**	**0.0**	**0.0**	**609.9**

[15] The trip-based model outputs in the Table represent inflated results after an adjustment was undertaken to match the total work flow from the Census.

[16] The districts are as follows: 1 – CBD, 2 – West of CBD, 3 – Ohio State University, 4 – Northeast of CBD, 5 – East of CBD, 6 – German Village, 7 – Northwest of Franklin County (located outside of I-270), 8 – Northwest of CBD, 9 – Along High Street, 10 – Northeast Franklin County, 11 – Southeast Franklin County, 12 – Southwest Franklin County, and 13 – Other Counties.

Table B.1c: County to County Flows to Work (in 1000s, source: 1990 tour-based model)[17]

From county/ district		To county/district																Total flow to work
		Delaware	Fairfield	Franklin											Licking	Madison	Pickaway	Union	
		13	13	1	2	3	4	5	6	7	8	9	10	11	12	13	13	13	13	
Delaware	**13**	1.8	0.0							28.0						0.6	0.0	0.0	0.0	30.4
Fairfield	**13**	0.0	0.8							16.2						2.9	0.0	0.0	0.0	20.0
Franklin	**1**	2.7	1.2	0.3	0.1	0.3	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.2	3.9	0.0	0.0	0.0	475.8
	2			6.1	3.2	5.2	0.6	0.5	0.9	2.7	1.6	2.2	2.0	1.4	3.3					
	3			6.6	2.9	9.0	1.3	1.0	1.3	1.7	1.5	3.6	4.0	2.1	3.0					
	4			3.4	1.2	3.9	1.0	0.6	0.8	0.6	0.6	2.1	3.5	1.6	1.2					
	5			1.4	0.5	1.4	0.3	0.4	0.6	0.2	0.2	0.4	1.1	1.2	0.9					
	6			3.4	1.0	2.5	0.5	0.8	1.6	0.6	0.3	0.8	1.7	2.5	2.3					
	7			2.5	1.9	2.1	0.2	0.2	0.4	4.0	2.0	1.4	1.0	0.6	2.4					
	8			6.8	3.2	5.7	0.8	0.5	0.7	5.7	6.9	7.2	4.7	1.2	2.6					
	9			5.9	1.7	4.9	0.8	0.5	0.8	2.2	3.1	7.8	6.3	1.4	1.6					
	10			16.9	3.2	11.2	3.3	1.9	2.6	3.0	4.2	13.7	27.9	8.0	4.0					
	11			16.5	3.2	7.9	2.1	2.7	5.7	1.9	1.0	2.9	14.4	25.5	7.3					
	12			7.7	5.4	7.2	1.1	1.5	2.9	5.5	2.0	2.2	3.3	5.1	14.4					
Licking	**13**	0.2	0.4							19.6						43.4	0.0	0.0	0.0	63.5
Madison	**13**	0.0	0.0							6.4						0.0	0.0	0.0	0.0	6.5
Pickaway	**13**	0.0	0.1							5.8						0.0	0.0	0.0	0.0	5.9
Union	**13**	0.3	0.0							7.5						0.0	0.0	0.0	0.0	7.8
Total work flow		**5.1**	**2.5**	**551.4**												**50.9**	**0.0**	**0.0**	**0.0**	**609.9**

[17] The tour-based model outputs in the Table represent inflated results after an adjustment was undertaken to match the total work flow from the Census.

APPENDIX B.2: Work Flow Distributions – Model Year 2000

Table B.2a: County to County Flows to Work (in 1000s, source: 2000 Census)

From	To		Total flow to work
	Worked in county of residence	Worked outside county of residence	
Delaware	21.1	36.3	**57.4**
Fairfield	10.7	13.4	**24.1**
Franklin	508.4	37.3	**545.7**
Licking	42.4	28.4	**70.8**
Madison	2.4	3.2	**5.6**
Pickaway	2.6	3.2	**5.8**
Union	3.9	2.9	**6.7**
Total work flow	**591**	**125**	**716.1**

Table B.2b: County to County Trip Flows to Work
(in 1000s of trips, source: 1999 HIS survey)

From	To							Total flow to work
	Delaware	Fairfield	Franklin	Licking	Madison	Pickaway	Union	
Delaware	13.1	0.0	33.2	0.3	0.0	0.0	1.1	**47.7**
Fairfield	0.4	4.9	10.0	0.2	0.6	0.0	0.0	**16.1**
Franklin	20.5	1.6	483.0	2.9	1.2	0.8	2.3	**512.3**
Licking	0.9	0.6	14.2	48.3	0.0	0.0	0.0	**63.9**
Madison	0.3	0.0	1.5	0.0	1.2	0.0	0.1	**3.0**
Pickaway	0.0	0.1	2.6	0.0	0.2	0.5	0.0	**3.4**
Union	0.5	0.0	4.0	0.0	1.9	0.0	4.2	**10.6**
Total work flow	**35.7**	**7.1**	**548.6**	**51.6**	**5.0**	**1.2**	**7.7**	**656.9**

Table B.2c: County to County Flows to Work (in 1000s, source: 2000 trip-based model)[18]

From county/ district		To county/district																Total flow to work
		Delaware	Fairfield	Franklin											Licking	Madison	Pickaway	Union	
		13	13	1	2	3	4	5	6	7	8	9	10	11	12	13	13	13	13	
Delaware	**13**	21.5	0.1							32.0						0.8	0.2	0.0	0.9	55.5
Fairfield	**13**	0.3	4.6							20.8						3.1	0.0	0.6	0.0	29.5
Franklin	**1**	14.0	2.4	0.9	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	4.3	1.7	1.5	1.7	535.6
	2			4.8	8.9	4.9	0.3	0.5	0.5	2.4	2.3	1.7	1.0	0.7	2.5					
	3			8.4	3.8	13.0	1.2	1.0	0.7	0.8	1.9	4.0	2.8	1.0	1.3					
	4			4.1	0.9	3.1	1.9	0.7	0.4	0.3	0.6	1.9	3.3	0.7	0.6					
	5			3.1	0.5	0.9	0.4	1.0	0.6	0.1	0.2	0.4	0.9	0.7	0.5					
	6			5.6	1.0	1.2	0.3	1.5	3.0	0.3	0.3	0.4	0.8	1.5	1.9					
	7			3.8	7.1	2.3	0.3	0.5	0.7	12.1	6.6	2.1	1.5	1.2	4.1					
	8			3.3	4.0	4.4	0.4	0.4	0.4	4.6	17.6	6.9	2.9	0.8	1.4					
	9			3.3	1.7	4.2	0.6	0.5	0.4	1.0	4.0	12.9	5.2	0.8	0.7					
	10			11.4	3.3	7.7	3.1	2.2	1.7	1.7	4.5	14.5	45.0	7.0	2.5					
	11			13.3	3.6	4.9	1.4	3.1	5.5	1.3	1.4	2.4	14.6	34.9	6.3					
	12			11.5	12.2	3.5	0.6	1.5	2.7	5.5	2.7	1.4	2.2	4.6	22.1					
Licking	**13**	1.0	0.8							18.3						49.0	0.0	0.1	0.0	69.1
Madison	**13**	0.2	0.0							5.2						0.0	1.4	0.1	0.3	7.1
Pickaway	**13**	0.0	0.1							5.0						0.0	0.0	2.0	0.0	7.2
Union	**13**	0.7	0.0							4.6						0.0	0.4	0.0	6.2	11.9
Total work flow		**37.6**	**8.0**	**595.9**												**57.3**	**3.8**	**4.2**	**9.2**	**716.1**

[18] The trip-based model outputs in the Table represent inflated results after an adjustment was undertaken to match the total work flow from the Census.

Table B.2d: County to County Flows to Work (in 1000s, source: 2000 tour-based model)[19]

From county/ district		To county/district																	Total flow to work
		Delaware	Fairfield	Franklin											Licking	Madison	Pickaway	Union	
		13	13	1	2	3	4	5	6	7	8	9	10	11	12	13	13	13	13	
Delaware	**13**	17.5	0.1							33.9						0.7	0.3	0.0	1.6	54.2
Fairfield	**13**	0.3	3.1							21.4						3.2	0.0	0.7	0.0	28.7
Franklin	**1**	18.4	3.3	0.3	0.2	0.2	0.0	0.1	0.1	0.0	0.1	0.1	0.2	0.2	0.2	4.1	2.5	2.4	2.3	532.7
	2			5.5	5.1	4.2	0.5	0.7	0.8	2.5	2.7	2.1	2.0	1.2	2.9					
	3			5.6	4.5	7.9	1.2	1.2	1.3	1.8	2.5	3.9	4.3	2.0	2.8					
	4			2.6	1.6	2.8	0.7	0.6	0.6	0.5	1.0	2.0	3.4	1.1	0.9					
	5			1.4	0.8	1.1	0.3	0.6	0.6	0.3	0.3	0.6	1.3	1.1	0.8					
	6			2.8	1.6	2.0	0.4	0.9	1.4	0.5	0.5	0.8	1.8	2.4	2.0					
	7			5.2	5.9	3.6	0.4	0.6	0.8	7.5	6.7	2.9	2.2	1.3	4.2					
	8			5.5	4.4	4.2	0.6	0.6	0.6	4.8	10.7	7.0	4.6	1.0	2.0					
	9			4.7	2.2	3.5	0.6	0.6	0.6	1.6	4.5	7.9	6.2	1.1	1.2					
	10			15.3	4.7	8.7	2.6	2.3	2.3	2.3	5.9	13.7	32.1	8.5	3.6					
	11			14.9	4.9	6.3	1.8	3.1	5.0	1.6	1.7	3.1	15.0	26.5	6.9					
	12			7.9	10.3	6.5	1.1	2.1	3.0	5.9	4.0	2.5	4.0	5.9	16.3					
Licking	**13**	1.6	1.5							21.7						49.9	0.0	0.1	0.0	74.9
Madison	**13**	0.3	0.0							5.4						0.0	0.8	0.1	0.3	6.9
Pickaway	**13**	0.0	0.1							5.6						0.0	0.1	1.1	0.0	7.0
Union	**13**	1.4	0.0							4.6						0.0	0.3	0.0	5.3	11.7
Total work flow		**39.5**	**8.0**							**592.4**						**58.0**	**4.0**	**4.4**	**9.7**	**716.1**

[19] The tour-based model outputs in the Table represent inflated results after an adjustment was undertaken to match the total work flow from the Census.

APPENDIX B.3: Work Flow Distributions – Model Year 2005

Table B.3a: County to County Flows to Work (in 1000s, source: 2005 ACS)

From	To		Total flow to work
	Worked in county of residence	Worked outside county of residence	
Delaware	28.3	45.7	**74.0**
Fairfield	12.4	14.5	**26.9**
Franklin	471.3	44.7	**516.0**
Licking	40.8	32.9	**73.7**
Total work flow	**553**	**138**	**690.6**

Table B.3b: County to County Flows to Work (in 1000s, source: 2005 trip-based model)[20]

From county/ district		To county/district														Total flow to work
		Delaware	Fairfield	Franklin											Licking	
		13	13	1	2	3	4	5	6	7	8	9	10	11	12	13	
Delaware	**13**	27.0	0.1	40.5												0.7	68.2
Fairfield	**13**	0.4	5.6	22.2												2.0	30.2
Franklin	**1**	18.9	3.1	1.0	0.2	0.2	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2	3.6	527.5
	2			4.2	7.9	5.0	0.3	0.4	0.5	2.6	2.0	1.6	1.0	0.8	2.5		
	3			6.6	3.5	11.3	1.0	0.7	0.6	1.0	1.5	3.5	2.4	1.0	1.6		
	4			3.7	1.1	3.1	1.8	0.6	0.4	0.4	0.5	1.8	3.3	0.8	0.7		
	5			2.9	0.6	1.0	0.4	1.0	0.6	0.2	0.2	0.4	0.9	0.7	0.5		
	6			4.8	1.0	1.3	0.3	1.2	2.9	0.3	0.3	0.5	0.8	1.6	1.9		
	7			3.8	6.7	3.0	0.4	0.5	0.7	14.5	5.9	2.2	1.8	1.3	4.3		
	8			2.9	3.9	4.1	0.4	0.3	0.4	6.0	15.9	6.5	3.1	0.8	1.6		
	9			2.6	1.6	3.7	0.5	0.4	0.4	1.2	3.3	11.2	4.8	0.7	0.9		
	10			10.3	3.7	7.7	3.1	2.1	1.8	2.4	4.1	13.9	48.1	8.4	2.9		
	11			11.6	3.7	5.2	1.3	2.8	5.4	1.6	1.3	2.5	13.4	36.9	6.5		
	12			9.8	10.8	5.3	0.6	1.2	2.5	5.9	2.4	1.8	2.1	4.6	22.2		
Licking	**13**	1.6	1.2	23.1												38.8	64.6
Total work flow		**47.9**	**10.0**	**587.7**												**45.1**	**690.6**

[20] The trip-based model outputs in the Table represent deflated results after an adjustment was undertaken to match the total work flow from the ACS.

Table B.3c: County to County Flows to Work (in 1000s, source: 2005 tour-based model)[21]

From county/ district		To county/district													Total flow to work
		Delaware	Fairfield	Franklin										Licking	
		13	13	1	2	3	4	5	6	7	8	9	10	11	12	13	
Delaware	**13**	22.2	0.1	43.2												0.6	66.2
Fairfield	**13**	0.4	3.8	23.4												2.2	29.7
Franklin	**1**	24.5	4.2	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	3.4	524.3
	2			4.6	4.7	4.2	0.5	0.6	0.8	2.7	2.4	2.1	1.8	1.2	2.8		
	3			4.6	3.8	7.3	1.1	0.9	1.1	1.7	1.9	3.3	3.8	1.9	2.6		
	4			2.3	1.5	3.0	0.7	0.5	0.6	0.6	0.9	1.9	3.6	1.3	1.0		
	5			1.3	0.8	1.2	0.3	0.5	0.6	0.3	0.3	0.5	1.3	1.2	0.8		
	6			2.5	1.5	2.0	0.4	0.7	1.3	0.6	0.5	0.8	1.6	2.4	2.1		
	7			4.8	6.3	3.8	0.4	0.6	0.8	9.7	6.4	3.1	2.3	1.5	4.6		
	8			4.6	4.2	4.3	0.6	0.4	0.6	6.0	9.7	6.7	4.3	1.0	2.1		
	9			3.8	1.9	3.4	0.6	0.4	0.5	1.8	3.7	6.9	5.7	1.0	1.1		
	10			14.1	5.1	9.1	2.7	2.2	2.4	2.9	5.3	13.5	34.8	9.9	3.8		
	11			13.3	5.0	6.7	1.8	2.9	5.0	1.9	1.6	3.1	14.6	27.9	7.3		
	12			6.7	9.9	6.9	1.0	1.6	2.9	6.9	3.4	2.5	3.7	6.1	16.6		
Licking	**13**	2.3	2.2	27.0												38.8	70.4
Total work flow		**49.3**	**10.3**	**586.0**												**45.1**	**690.6**

[21] The tour-based model outputs in the Table represent deflated results after an adjustment was undertaken to match the total work flow from the ACS.

APPENDIX C: Work Trip Start Time Distribution

APPENDIX C.1: Work Trip Start Time Distribution – Model 1990

Table C.1a: Work Trip Start Time Distribution (in %) by Time of Day (Source: 1990 Census)

Origin county	Time period	Total percentage distribution
Delaware	**Peak**	3.28
	Off-peak	1.54
Fairfield	**Peak**	4.43
	Off-peak	2.61
Franklin	**Peak**	50.05
	Off-peak	22.01
Licking	**Peak**	5.34
	Off-peak	3.32
Madison	**Peak**	1.49
	Off-peak	0.88
Pickaway	**Peak**	1.76
	Off-peak	1.10
Union	**Peak**	1.28
	Off-peak	0.88
Total percentage distribution		**100.00**

Table C.1b: County-to-County Work Trip Start Time Distribution (in %) by Time of Day (Source: 1990 trip-based model)

From	Time period	To							Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	Madison	Pickaway	Union	
Delaware	**Peak**	0.27	0.00	2.93	0.06	0.00	0.00	0.00	**3.27**
	Off-peak	0.17	0.00	1.80	0.04	0.00	0.00	0.00	**2.00**
Fairfield	**Peak**	0.00	0.14	1.68	0.29	0.00	0.00	0.00	**2.12**
	Off-peak	0.00	0.08	1.03	0.18	0.00	0.00	0.00	**1.30**
Franklin	**Peak**	0.19	0.07	47.98	0.27	0.00	0.00	0.00	**48.50**
	Off-peak	0.12	0.04	29.41	0.16	0.00	0.00	0.00	**29.73**
Licking	**Peak**	0.01	0.02	1.36	4.51	0.00	0.00	0.00	**5.90**
	Off-peak	0.01	0.01	0.83	2.77	0.00	0.00	0.00	**3.62**
Madison	**Peak**	0.00	0.00	0.69	0.00	0.00	0.00	0.00	**0.70**
	Off-peak	0.00	0.00	0.43	0.00	0.00	0.00	0.00	**0.43**
Pickaway	**Peak**	0.00	0.00	0.62	0.00	0.00	0.00	0.00	**0.63**
	Off-peak	0.00	0.00	0.38	0.00	0.00	0.00	0.00	**0.39**
Union	**Peak**	0.02	0.00	0.86	0.00	0.00	0.00	0.00	**0.88**
	Off-peak	0.01	0.00	0.53	0.00	0.00	0.00	0.00	**0.54**
Total percentage distribution		**0.80**	**0.37**	**90.54**	**8.29**	**0.00**	**0.00**	**0.00**	**100.00**

Table C.1c: County-to-County Work Trip Start Time Distribution (in %) by Time of Day (Source: 1990 tour-based model)

From	Time period	To							Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	Madison	Pickaway	Union	
Delaware	**Peak**	0.17	0.00	2.75	0.06	0.00	0.00	0.00	**2.98**
	Off-peak	0.12	0.00	1.84	0.04	0.00	0.00	0.00	**2.00**
Fairfield	**Peak**	0.00	0.08	1.59	0.28	0.00	0.00	0.00	**1.95**
	Off-peak	0.00	0.05	1.07	0.20	0.00	0.00	0.00	**1.32**
Franklin	**Peak**	0.28	0.12	49.00	0.40	0.00	0.00	0.00	**49.81**
	Off-peak	0.17	0.07	27.73	0.24	0.00	0.00	0.00	**28.21**
Licking	**Peak**	0.02	0.04	1.89	4.54	0.00	0.00	0.00	**6.49**
	Off-peak	0.01	0.03	1.32	2.57	0.00	0.00	0.00	**3.93**
Madison	**Peak**	0.00	0.00	0.61	0.00	0.00	0.00	0.00	**0.62**
	Off-peak	0.00	0.00	0.44	0.00	0.00	0.00	0.00	**0.44**
Pickaway	**Peak**	0.00	0.01	0.56	0.00	0.00	0.00	0.00	**0.57**
	Off-peak	0.00	0.00	0.40	0.00	0.00	0.00	0.00	**0.41**
Union	**Peak**	0.03	0.00	0.72	0.00	0.00	0.00	0.00	**0.76**
	Off-peak	0.02	0.00	0.50	0.00	0.00	0.00	0.00	**0.53**
Total percentage distribution		**0.83**	**0.40**	**90.42**	**8.35**	**0.00**	**0.00**	**0.00**	**100.00**

APPENDIX C.2: Work Trip Start Time Distribution – Model 2000

Table C.2a: Work Trip Start Time Distribution (in %) by Time of Day (Source: 2000 Census)

Origin county	Time period	Total percentage distribution
Delaware	**Peak**	5.13
	Off-peak	2.00
Fairfield	**Peak**	4.71
	Off-peak	2.84
Franklin	**Peak**	46.66
	Off-peak	22.25
Licking	**Peak**	5.41
	Off-peak	3.48
Madison	**Peak**	1.35
	Off-peak	0.88
Pickaway	**Peak**	1.66
	Off-peak	1.10
Union	**Peak**	1.52
	Off-peak	1.03
Total percentage distribution		**100.00**

Table C.2b: County to County Work Trip Start Time Distribution (in %) by Time of Day (Source: 1999 HIS survey)

From	Time period	To							Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	Madison	Pickaway	Union	
Delaware	**Peak**	0.99	0.00	3.05	0.04	0.00	0.00	0.12	**4.20**
	Off-peak	1.00	0.00	2.00	0.00	0.00	0.00	0.05	**3.06**
Fairfield	**Peak**	0.00	0.33	0.95	0.03	0.03	0.00	0.00	**1.33**
	Off-peak	0.06	0.41	0.58	0.00	0.06	0.00	0.00	**1.11**
Franklin	**Peak**	1.84	0.11	40.56	0.31	0.09	0.07	0.12	**43.09**
	Off-peak	1.29	0.13	32.97	0.14	0.09	0.05	0.23	**34.90**
Licking	**Peak**	0.07	0.05	0.98	3.75	0.00	0.00	0.00	**4.85**
	Off-peak	0.07	0.04	1.18	3.59	0.00	0.00	0.00	**4.88**
Madison	**Peak**	0.03	0.00	0.12	0.00	0.13	0.00	0.01	**0.29**
	Off-peak	0.01	0.00	0.10	0.00	0.05	0.00	0.00	**0.16**
Pickaway	**Peak**	0.00	0.02	0.13	0.00	0.01	0.05	0.00	**0.21**
	Off-peak	0.00	0.00	0.26	0.00	0.01	0.03	0.00	**0.30**
Union	**Peak**	0.06	0.00	0.37	0.00	0.18	0.00	0.34	**0.95**
	Off-peak	0.03	0.00	0.24	0.00	0.10	0.00	0.29	**0.66**
Total percentage distribution		**5.44**	**1.08**	**83.50**	**7.86**	**0.76**	**0.19**	**1.17**	**100.00**

Table C.2c: County to County Work Trip Start Time Distribution (in %) by Time of Day (Source: 2000 trip-based model)

From	Time period	To							Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	Madison	Pickaway	Union	
Delaware	**Peak**	1.86	0.01	2.77	0.07	0.02	0.00	0.08	**4.81**
	Off-peak	1.14	0.00	1.70	0.04	0.01	0.00	0.05	**2.95**
Fairfield	**Peak**	0.02	0.40	1.80	0.27	0.00	0.05	0.00	**2.56**
	Off-peak	0.01	0.25	1.11	0.17	0.00	0.03	0.00	**1.57**
Franklin	**Peak**	1.21	0.21	44.16	0.37	0.15	0.13	0.15	**46.38**
	Off-peak	0.74	0.13	27.07	0.23	0.09	0.08	0.09	**28.42**
Licking	**Peak**	0.09	0.07	1.58	4.24	0.00	0.01	0.00	**5.99**
	Off-peak	0.05	0.04	0.97	2.60	0.00	0.00	0.00	**3.67**
Madison	**Peak**	0.01	0.00	0.45	0.00	0.13	0.00	0.02	**0.62**
	Off-peak	0.01	0.00	0.27	0.00	0.08	0.00	0.01	**0.38**
Pickaway	**Peak**	0.00	0.01	0.43	0.00	0.00	0.17	0.00	**0.62**
	Off-peak	0.00	0.00	0.26	0.00	0.00	0.10	0.00	**0.38**
Union	**Peak**	0.06	0.00	0.40	0.00	0.03	0.00	0.54	**1.03**
	Off-peak	0.04	0.00	0.25	0.00	0.02	0.00	0.33	**0.63**
Total percentage distribution		**5.25**	**1.11**	**83.22**	**8.00**	**0.54**	**0.59**	**1.29**	**100.00**

Table C.2d: County to County Work Trip Start Time Distribution (in %) by Time of Day (Source: 2000 tour-based model)

From	Time period	To							Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	Madison	Pickaway	Union	
Delaware	**Peak**	1.53	0.01	2.94	0.06	0.03	0.00	0.13	**4.70**
	Off-peak	0.92	0.00	1.79	0.04	0.01	0.00	0.10	**2.87**
Fairfield	**Peak**	0.02	0.26	1.86	0.26	0.00	0.06	0.00	**2.47**
	Off-peak	0.01	0.17	1.13	0.18	0.00	0.04	0.00	**1.54**
Franklin	**Peak**	1.62	0.29	44.60	0.36	0.22	0.21	0.19	**47.47**
	Off-peak	0.95	0.17	25.19	0.22	0.13	0.12	0.13	**26.92**
Licking	**Peak**	0.13	0.12	1.84	4.39	0.00	0.01	0.00	**6.50**
	Off-peak	0.10	0.08	1.19	2.58	0.00	0.01	0.00	**3.96**
Madison	**Peak**	0.02	0.00	0.46	0.00	0.07	0.01	0.03	**0.59**
	Off-peak	0.02	0.00	0.30	0.00	0.04	0.00	0.02	**0.38**
Pickaway	**Peak**	0.00	0.01	0.45	0.00	0.00	0.10	0.00	**0.57**
	Off-peak	0.00	0.01	0.33	0.00	0.00	0.06	0.00	**0.41**
Union	**Peak**	0.12	0.00	0.38	0.00	0.03	0.00	0.47	**1.01**
	Off-peak	0.08	0.00	0.26	0.00	0.02	0.00	0.27	**0.63**
Total percentage distribution		**5.52**	**1.12**	**82.72**	**8.10**	**0.56**	**0.62**	**1.36**	**100.00**

APPENDIX C.3: Work Trip Start Time Distribution – Model 2005

Table C.3a: Work Trip Start Time Distribution (in %) by Time of Day (Source: 2005 ACS)

Origin county	Time period	Total percentage distribution
Delaware	**Peak**	7.03
	Off-peak	2.85
Fairfield	**Peak**	5.50
	Off-peak	3.66
Franklin	**Peak**	48.03
	Off-peak	22.85
Licking	**Peak**	6.03
	Off-peak	4.04
Total percentage distribution		**100.0**

Table C.3b: Work Trip Start Time Distribution (in %) by Time of Day (Source: 2005 trip-based model)

From	Time period	To				Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	
Delaware	**Peak**	2.42	0.01	3.63	0.06	**6.12**
	Off-peak	1.48	0.01	2.23	0.04	**3.75**
Fairfield	**Peak**	0.04	0.50	2.00	0.18	**2.71**
	Off-peak	0.02	0.31	1.22	0.11	**1.66**
Franklin	**Peak**	1.70	0.28	45.06	0.32	**47.36**
	Off-peak	1.04	0.17	27.62	0.20	**29.03**
Licking	**Peak**	0.14	0.11	2.07	3.48	**5.80**
	Off-peak	0.09	0.07	1.27	2.14	**3.56**
Total percentage distribution		**6.93**	**1.45**	**85.10**	**6.53**	**100.00**

Table C.3c: Work Trip Start Time Distribution (in %) by Time of Day (Source: 2005 tour-based model)

From	Time period	To				Total percentage distribution
		Delaware	Fairfield	Franklin	Licking	
Delaware	**Peak**	2.00	0.01	3.92	0.06	**5.99**
	Off-peak	1.21	0.01	2.34	0.03	**3.60**
Fairfield	**Peak**	0.03	0.34	2.13	0.19	**2.69**
	Off-peak	0.02	0.20	1.26	0.12	**1.61**
Franklin	**Peak**	2.22	0.38	45.50	0.31	**48.41**
	Off-peak	1.32	0.23	25.78	0.19	**27.51**
Licking	**Peak**	0.19	0.18	2.33	3.56	**6.27**
	Off-peak	0.14	0.13	1.58	2.07	**3.92**
Total percentage distribution		**7.14**	**1.48**	**84.85**	**6.52**	**100.00**

APPENDIX D: Average Work Trip Travel Time

APPENDIX D.1: Person Work Trip Travel Time – Model Year 1990

Table D.1: Travel Time for Work Trips (in minutes, observed data source: Census 1990)

Origin county	Census average travel time from origin county	Trip-based model average travel time from origin county	Tour-based model average travel time from origin county
Delaware	22.74	29.31	29.72
Fairfield	24.75	27.46	28.76
Franklin	20.04	12.50	16.76
Licking	22.10	15.72	19.78
Madison	22.75	24.58	25.24
Pickaway	23.72	27.48	27.85
Union	20.97	31.63	30.79

APPENDIX D.2: Person Work Trip Travel Time – Model Year 2000

Table D.2a: Travel Time for Work Trips (in minutes, observed data source: Census 2000)

Origin county	Census average travel time from origin county	Trip-based model average travel time from origin county	Tour-based model average travel time from origin county
Delaware	25.45	20.24	20.52
Fairfield	26.95	26.48	26.36
Franklin	21.41	15.68	16.80
Licking	24.12	19.22	18.64
Madison	25.01	23.23	23.22
Pickaway	26.19	23.80	24.95
Union	22.29	18.77	18.35

Table D.2b: Travel Time for Work Trips (in minutes, observed data source: 1999 HIS)

Origin county	Destination county	HIS average travel time	Trip-based model average travel time	Tour-based model average travel time
Delaware	Delaware	16.08	10.4	11.7
	Fairfield	0.00	40.5	36.6
	Franklin	23.39	26.1	24.4
	Licking	40.00	38.6	35.9
	Madison	0.00	30.8	28.6
	Pickaway	0.00	51.1	47.8
	Union	36.40	24.8	25.3
Fairfield	Delaware	27.50	45.0	42.6
	Fairfield	16.00	9.1	11.1
	Franklin	32.65	29.9	28.4
	Licking	30.00	28.9	26.1
	Madison	4.67	51.6	46.4
	Pickaway	0.00	19.3	24.9
	Union	0.00	56.7	50.7
Franklin	Delaware	23.19	19.4	19.9
	Fairfield	24.32	19.5	18.7
	Franklin	20.50	15.3	16.4
	Licking	26.57	36.5	31.1
	Madison	29.66	23.0	22.2
	Pickaway	28.41	26.3	25.6
	Union	63.13	28.7	26.7
Licking	Delaware	26.33	36.2	34.6
	Fairfield	28.27	22.9	22.6
	Franklin	36.29	33.6	31.4
	Licking	15.89	13.4	12.4
	Madison	0.00	52.0	51.3
	Pickaway	0.00	46.2	44.8
	Union	0.00	52.8	51.7
Madison	Delaware	21.07	33.7	30.8
	Fairfield	0.00	44.3	38.2
	Franklin	19.61	27.3	25.0
	Licking	0.00	57.0	52.9
	Madison	12.12	7.9	9.1
	Pickaway	0.00	28.5	27.6
	Union	25.00	17.3	21.1
Pickaway	Delaware	0.00	48.1	49.0
	Fairfield	30.00	26.0	27.1
	Franklin	38.46	29.1	27.6
	Licking	0.00	51.9	46.5
	Madison	45.00	35.7	32.5
	Pickaway	23.29	8.7	9.5
	Union	0.00	49.9	49.3
Union	Delaware	14.40	24.8	25.5
	Fairfield	0.00	53.5	38.0
	Franklin	38.74	32.0	28.1
	Licking	0.00	58.2	53.6
	Madison	10.29	15.2	18.6
	Pickaway	0.00	52.2	51.8
	Union	9.94	8.3	7.8

APPENDIX D.3: Person Work Trip Travel Time – Model Year 2005

Table D.3: Travel Time for Work Trips (in minutes, observed data source: ACS 2005)

Origin county	ACS average travel time from origin county	Trip-based model average travel time from origin county	Tour-based model average travel time from origin county
Delaware	22.87	20.32	20.38
Fairfield	25.04	25.81	26.46
Franklin	18.76	15.77	16.57
Licking	24.28	22.09	21.45

APPENDIX E: Link Flows

APPENDIX E.1: Link Flows – Model Year 1990

Table E.1a: Link Flows – Polaris Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model
3594	3702	Freeway (Interstate)	20,200	23,066	21,050
3701	3593	Freeway (Interstate)	20,200	25,707	21,777
4407	5331	Major road (Arterial)	2,201	510	643
5005	5259	Major road (Arterial)	1,252	441	621
5259	5005	Major road (Arterial)	1,252	574	706
5331	4407	Major road (Arterial)	2,201	381	558
6062	6063	Major road (Arterial)	1,252	2,680	3,573
6063	6062	Major road (Arterial)	1,252	2,480	3,370
4400	5083	Minor road (Collector)	652	863	1,209
4400	8046	Minor road (Collector)	3,852	2,368	3,304
4829	5094	Minor road (Collector)	2,251	836	1,504
4958	6628	Minor road (Collector)	905	334	403
5005	8053	Minor road (Collector)	4,202	236	370
5083	4400	Minor road (Collector)	652	739	1,238
5094	4829	Minor road (Collector)	2,251	962	1,468
6628	4958	Minor road (Collector)	905	341	407
8046	4400	Minor road (Collector)	3,852	2,540	3,422
8053	5005	Minor road (Collector)	4,202	374	335

Table E.1b: Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3872	3870	Freeway (Interstate)	29,340	26,465	26,844	5187	6229	Minor road (Collector)	852	1,254	727
3633	3635	Freeway (Interstate)	29,800	34,337	29,133	5188	6231	Minor road (Collector)	2,402	1,137	684
3636	3634	Freeway (Interstate)	29,800	30,614	28,529	5189	6223	Minor road (Collector)	1,700	3,083	2,540
3637	3869	Freeway (Interstate)	29,770	35,551	31,477	6267	6268	Minor road (Collector)	1,951	4,740	4,999
3859	3861	Freeway (Interstate)	22,700	26,300	24,527	6269	8390	Minor road (Collector)	4,002	4,281	2,864
3860	3858	Freeway (Interstate)	22,700	26,410	25,944	6270	6269	Minor road (Collector)	4,702	4,362	3,380
3868	3638	Freeway (Interstate)	29,770	33,889	31,063	6222	4970	Minor road (Collector)	1,200	1,369	1,134
3871	3873	Freeway (Interstate)	29,340	23,985	25,734	6222	6221	Minor road (Collector)	907	2,530	2,146
6272	4967	Major road (Arterial)	6,452	10,104	6,752	6268	6267	Minor road (Collector)	1,951	4,602	4,955
6272	6282	Major road (Arterial)	11,161	12,646	9,452	6269	6270	Minor road (Collector)	4,702	3,928	3,319
6278	4750	Major road (Arterial)	4,259	4,732	4,621	4965	6225	Minor road (Collector)	3,150	2,736	2,179
6279	4751	Major road (Arterial)	4,859	6,241	6,301	4970	6222	Minor road (Collector)	1,200	1,821	1,544
6282	6272	Major road (Arterial)	11,161	13,857	9,066	4975	6218	Minor road (Collector)	758	403	416
6284	6252	Major road (Arterial)	15,150	10,750	10,657	5026	6215	Minor road (Collector)	2,859	2,381	2,492
6353	8389	Major road (Arterial)	11,500	11,545	10,372	5423	7108	Minor road (Collector)	3,250	2,043	1,784
4750	6278	Major road (Arterial)	4,259	5,599	5,282	5423	7139	Minor road (Collector)	2,558	4,549	3,224
4699	7086	Major road (Arterial)	24,850	22,707	17,583	6214	6217	Minor road (Collector)	1,400	856	968
4699	7136	Major road (Arterial)	14,750	20,177	16,104	6215	5026	Minor road (Collector)	2,859	2,720	2,643
4967	6272	Major road (Arterial)	6,452	9,612	7,260	6215	8394	Minor road (Collector)	2,309	1,676	1,799
4968	6225	Major road (Arterial)	5,450	6,940	6,192	6216	8393	Minor road (Collector)	2,809	2,783	2,708
6225	8399	Major road (Arterial)	5,500	5,252	5,849	6217	6214	Minor road (Collector)	1,400	990	1,061
6225	6226	Major road (Arterial)	14,300	12,001	10,552	6218	4975	Minor road (Collector)	758	505	565
6226	6225	Major road (Arterial)	14,300	14,392	13,547	6219	4995	Minor road (Collector)	981	915	705
6227	6231	Major road (Arterial)	7,252	5,132	5,350	6219	5187	Minor road (Collector)	408	771	431
4751	6279	Major road (Arterial)	4,859	6,814	7,069	6220	8401	Minor road (Collector)	857	754	534
4943	7136	Major road (Arterial)	12,908	13,276	10,613	6221	6222	Minor road (Collector)	907	2,282	1,805

Table E.1b (continued): Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
4969	6231	Major road (Arterial)	3,602	2,725	1,376	6222	7108	Minor road (Collector)	1,200	1,066	772
6225	4968	Major road (Arterial)	5,450	8,036	6,871	6223	5189	Minor road (Collector)	1,700	2,710	2,127
6231	4969	Major road (Arterial)	3,602	2,751	1,541	6225	4965	Minor road (Collector)	3,150	3,109	2,594
6231	6227	Major road (Arterial)	7,252	4,217	3,444	6229	5187	Minor road (Collector)	852	1,186	783
6231	6232	Major road (Arterial)	6,402	5,527	5,410	6231	5188	Minor road (Collector)	2,402	1,092	736
6232	6231	Major road (Arterial)	6,402	4,593	3,720	6238	6239	Minor road (Collector)	2,552	600	640
6236	6237	Major road (Arterial)	6,901	5,835	5,403	6239	6238	Minor road (Collector)	2,552	675	767
6237	6236	Major road (Arterial)	6,901	4,969	3,718	6262	6264	Minor road (Collector)	3,059	5,077	3,170
6237	6239	Major road (Arterial)	9,602	6,623	5,169	6264	6262	Minor road (Collector)	3,059	5,507	3,113
6239	6237	Major road (Arterial)	9,602	5,827	3,815	7108	5423	Minor road (Collector)	3,250	2,594	2,055
6252	6284	Major road (Arterial)	15,150	13,660	12,085	7108	6222	Minor road (Collector)	1,200	861	702
7086	4699	Major road (Arterial)	24,850	22,993	18,533	7108	7109	Minor road (Collector)	1,250	1,241	1,034
7112	4945	Major road (Arterial)	6,859	4,816	4,692	7109	7108	Minor road (Collector)	1,250	1,103	903
7133	7134	Major road (Arterial)	9,758	8,431	6,374	7139	5423	Minor road (Collector)	2,558	3,916	2,944
7133	8491	Major road (Arterial)	8,859	5,903	5,646	7139	7140	Minor road (Collector)	4,358	6,231	3,321
7134	7133	Major road (Arterial)	9,758	8,623	7,322	7140	7139	Minor road (Collector)	4,358	5,669	3,223
7136	4699	Major road (Arterial)	14,750	20,024	15,147	8390	6269	Minor road (Collector)	4,002	3,757	2,714
7136	4943	Major road (Arterial)	12,908	14,240	12,286	8393	6216	Minor road (Collector)	2,809	2,451	2,569
7138	7501	Major road (Arterial)	3,658	6,711	5,648	8394	6215	Minor road (Collector)	2,309	1,918	2,017
8389	6353	Major road (Arterial)	11,500	8,765	9,083	8401	6220	Minor road (Collector)	857	722	556
7501	7138	Major road (Arterial)	3,658	5,761	4,569	4995	6219	Minor road (Collector)	981	953	557
8399	6225	Major road (Arterial)	5,500	4,329	3,947	4976	8397	Local road	702	32	23
8491	7133	Major road (Arterial)	8,859	5,913	5,433	6233	8397	Local road	702	82	52
4945	7112	Major road (Arterial)	6,859	4,403	4,207	8397	4976	Local road	702	28	21
5187	6219	Minor road (Collector)	408	714	487	8397	6233	Local road	702	82	61

Table E.1c: Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3939	4652	Freeway (Interstate)	62,801	61,160	76,018	3021	3020	Major road (Arterial)	7,654	7,821	8,437
3940	3938	Freeway (Interstate)	62,801	66,947	81,775	3022	3023	Major road (Arterial)	10,259	9,475	10,174
3929	3927	Freeway (Interstate)	63,600	57,062	75,749	3023	3022	Major road (Arterial)	10,259	4,316	4,285
4745	20057	Freeway (Interstate)	14,552	12,844	15,287	3023	3193	Major road (Arterial)	8,652	5,983	7,326
3918	3920	Freeway (Interstate)	61,000	40,267	57,170	3024	3198	Major road (Arterial)	11,059	13,211	15,183
3920	3923	Freeway (Interstate)	68,300	59,335	79,133	3048	2834	Major road (Arterial)	7,302	14,250	13,677
3921	3919	Freeway (Interstate)	61,000	46,256	65,344	3058	3163	Major road (Arterial)	11,104	7,648	10,731
3926	3928	Freeway (Interstate)	63,600	60,150	76,887	3095	3100	Major road (Arterial)	15,109	11,117	14,645
3943	3971	Freeway (Interstate)	56,400	56,282	67,368	3100	3095	Major road (Arterial)	15,109	15,078	20,984
3970	3639	Freeway (Interstate)	56,400	54,163	61,101	3100	3114	Major road (Arterial)	4,409	7,630	7,608
4338	3902	Freeway (Interstate)	38,420	38,019	51,302	3102	3105	Major road (Arterial)	15,259	11,890	14,701
3935	3937	Freeway (Interstate)	61,500	68,132	85,621	3105	3102	Major road (Arterial)	15,259	13,299	17,412
3936	3934	Freeway (Interstate)	61,500	65,923	80,074	3106	2782	Major road (Arterial)	16,806	13,627	15,386
4105	4107	Freeway (Interstate)	9,290	16,182	18,941	3109	3111	Major road (Arterial)	5,700	4,904	7,596
4106	3773	Freeway (Interstate)	9,290	12,828	15,074	3111	3109	Major road (Arterial)	5,700	5,999	7,822
4267	4268	Freeway (Interstate)	24,000	30,348	36,301	3116	3120	Major road (Arterial)	4,308	7,742	8,608
3902	3900	Freeway (Interstate)	33,700	29,689	37,511	3136	3139	Major road (Arterial)	3,309	12,237	17,019
3903	3905	Freeway (Interstate)	38,420	43,444	54,617	3138	3139	Major road (Arterial)	13,651	10,417	16,611
3905	3807	Freeway (Interstate)	45,300	56,462	69,533	3139	3136	Major road (Arterial)	3,309	10,888	13,791
4335	3903	Freeway (Interstate)	33,700	29,770	35,966	3139	3138	Major road (Arterial)	13,651	10,153	15,519
3765	3763	Freeway (Interstate)	15,459	18,767	20,476	3139	3145	Major road (Arterial)	10,759	11,446	20,679
3773	3896	Freeway (Interstate)	9,245	11,636	13,632	3139	3155	Major road (Arterial)	3,309	10,554	13,058
4564	20039	Freeway (Interstate)	68,040	58,783	80,218	3145	3139	Major road (Arterial)	10,759	10,213	16,438
3897	3899	Freeway (Interstate)	31,300	31,288	32,379	3145	3150	Major road (Arterial)	11,659	10,223	19,603
3897	4105	Freeway (Interstate)	9,245	14,301	16,923	3150	3145	Major road (Arterial)	11,659	8,939	15,798
3898	3896	Freeway (Interstate)	31,300	29,813	31,763	3150	3151	Major road (Arterial)	11,659	13,229	22,716

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
4559	4565	Freeway (Interstate)	68,040	61,061	77,276	3151	3150	Major road (Arterial)	11,659	13,675	21,969
3732	3730	Freeway (Interstate)	63,000	54,579	72,104	3155	3139	Major road (Arterial)	3,309	10,174	12,978
3733	3735	Freeway (Interstate)	64,150	70,328	88,657	3163	3058	Major road (Arterial)	11,104	5,049	5,540
3736	3734	Freeway (Interstate)	64,150	59,071	80,856	6548	6557	Major road (Arterial)	10,801	13,579	13,504
3756	4267	Freeway (Interstate)	26,759	30,348	36,301	6557	6561	Major road (Arterial)	9,700	15,362	14,938
3758	3757	Freeway (Interstate)	24,000	22,180	31,566	6557	6573	Major road (Arterial)	11,001	9,525	7,881
3762	3764	Freeway (Interstate)	21,359	25,330	29,593	6801	6802	Major road (Arterial)	2,158	7,118	8,065
3763	3761	Freeway (Interstate)	21,359	27,543	33,022	6802	6801	Major road (Arterial)	2,158	7,846	9,040
3764	3766	Freeway (Interstate)	15,459	10,888	14,125	6810	6811	Major road (Arterial)	8,057	12,753	15,302
3806	4338	Freeway (Interstate)	45,300	54,001	68,974	6811	6810	Major road (Arterial)	8,057	9,987	11,979
3810	3812	Freeway (Interstate)	69,000	73,000	87,727	6817	6818	Major road (Arterial)	10,154	14,186	19,431
3811	3809	Freeway (Interstate)	69,000	64,206	83,434	6818	6817	Major road (Arterial)	10,154	12,915	16,804
3729	3731	Freeway (Interstate)	63,000	64,249	78,524	6818	6820	Major road (Arterial)	12,656	11,718	17,179
4802	7327	Expressway	40,320	41,216	50,909	6820	6818	Major road (Arterial)	12,656	11,463	16,248
7328	4803	Expressway	40,320	37,587	43,663	6820	6825	Major road (Arterial)	12,100	11,718	17,179
3771	3769	Expressway	48,150	53,469	63,724	6825	6820	Major road (Arterial)	12,100	11,463	16,248
3794	3797	Expressway	52,159	55,832	62,411	6827	6828	Major road (Arterial)	11,258	10,825	15,613
3796	20000	Expressway	52,159	59,182	65,826	6828	6827	Major road (Arterial)	11,258	12,017	16,408
3654	3770	Expressway	48,150	49,900	55,874	6828	6913	Major road (Arterial)	15,000	11,155	15,721
3656	3658	Expressway	52,259	54,296	62,409	6909	6912	Major road (Arterial)	3,109	2,509	4,258
3657	3655	Expressway	52,259	51,823	54,825	6912	6909	Major road (Arterial)	3,109	3,258	5,056
3801	3803	Expressway	47,709	47,411	52,964	6913	6828	Major road (Arterial)	15,000	12,434	16,510
3802	3800	Expressway	47,709	48,090	54,744	6913	6915	Major road (Arterial)	15,000	11,178	15,721
3757	3755	Freeway ramp	26,759	15,419	21,306	6915	6913	Major road (Arterial)	15,000	12,523	16,636
6290	7460	Major road (Arterial)	6,050	15,522	15,652	6916	6921	Major road (Arterial)	8,859	9,952	12,950
6535	6543	Major road (Arterial)	6,457	8,577	7,715	6917	4601	Major road (Arterial)	15,309	8,873	12,676
6535	6927	Major road (Arterial)	5,457	12,862	13,710	6921	6916	Major road (Arterial)	8,859	7,227	9,989

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6541	6540	Major road (Arterial)	8,750	9,720	9,264	6927	6535	Major road (Arterial)	5,457	9,345	10,177
6542	6544	Major road (Arterial)	7,157	8,018	7,731	7023	7279	Major road (Arterial)	4,391	8,801	8,805
6543	6535	Major road (Arterial)	6,457	8,652	8,146	7171	3578	Major road (Arterial)	11,159	20,328	20,588
6543	6544	Major road (Arterial)	4,757	8,073	7,713	7279	7023	Major road (Arterial)	4,391	7,328	6,828
6544	6542	Major road (Arterial)	7,157	9,021	8,758	7279	7354	Major road (Arterial)	6,301	8,392	7,034
6550	6557	Major road (Arterial)	8,201	7,703	7,388	7329	7330	Major road (Arterial)	6,659	6,419	6,184
6557	6548	Major road (Arterial)	10,801	16,707	18,669	7330	7329	Major road (Arterial)	6,659	5,539	5,857
6557	6550	Major road (Arterial)	8,201	11,293	11,026	7339	7340	Major road (Arterial)	6,309	7,688	8,132
7497	2539	Major road (Arterial)	4,659	13,752	10,900	7339	7440	Major road (Arterial)	7,009	8,217	7,611
7460	6587	Major road (Arterial)	8,006	9,178	9,712	7340	7339	Major road (Arterial)	6,309	8,522	7,709
6580	6573	Major road (Arterial)	12,109	16,548	15,444	7340	7341	Major road (Arterial)	1,759	767	640
6668	6669	Major road (Arterial)	2,906	3,132	4,873	7341	7340	Major road (Arterial)	1,759	2,693	2,307
6669	6668	Major road (Arterial)	2,906	2,356	3,316	7344	8576	Major road (Arterial)	6,309	8,739	7,847
6669	6670	Major road (Arterial)	5,272	4,856	6,746	7350	4179	Major road (Arterial)	10,659	15,818	18,120
6669	6673	Major road (Arterial)	4,356	17,455	20,150	7353	7354	Major road (Arterial)	4,801	6,924	6,635
6670	6669	Major road (Arterial)	5,272	3,726	4,862	7354	7353	Major road (Arterial)	4,801	7,557	6,424
6670	6671	Major road (Arterial)	5,559	5,406	7,348	7355	7357	Major road (Arterial)	9,555	16,423	20,768
6671	6670	Major road (Arterial)	5,559	4,432	5,310	7356	7357	Major road (Arterial)	12,202	5,101	7,837
6677	6510	Major road (Arterial)	5,701	10,963	10,735	7356	7439	Major road (Arterial)	8,609	4,276	6,234
6684	6687	Major road (Arterial)	3,506	7,053	8,161	7357	7355	Major road (Arterial)	9,555	14,736	19,063
6687	6684	Major road (Arterial)	3,506	9,930	10,698	7357	7356	Major road (Arterial)	12,202	4,111	6,237
6407	6521	Major road (Arterial)	14,151	11,152	9,882	7357	7358	Major road (Arterial)	18,152	15,328	17,710
6501	3578	Major road (Arterial)	9,757	6,155	8,325	7358	7357	Major road (Arterial)	18,152	13,388	15,133
6501	4811	Major road (Arterial)	6,207	10,282	8,428	7364	7371	Major road (Arterial)	2,957	1,722	1,961
6510	6520	Major road (Arterial)	14,801	13,877	12,174	7369	7370	Major road (Arterial)	11,555	16,533	16,089
6510	6677	Major road (Arterial)	5,701	9,143	9,098	7370	7369	Major road (Arterial)	11,555	16,139	16,548
6510	8430	Major road (Arterial)	7,401	13,348	15,399	7371	7364	Major road (Arterial)	2,957	2,164	3,070

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6520	6510	Major road (Arterial)	14,801	10,567	10,459	7378	7377	Major road (Arterial)	7,609	10,055	10,219
6520	6772	Major road (Arterial)	7,501	6,428	5,613	7399	3579	Major road (Arterial)	10,759	7,929	5,228
6521	6407	Major road (Arterial)	14,151	11,288	11,893	7406	7496	Major road (Arterial)	5,909	8,205	7,838
6524	6538	Major road (Arterial)	13,800	18,251	17,078	7408	7407	Major road (Arterial)	8,700	6,563	6,031
6527	6528	Major road (Arterial)	13,206	12,534	13,056	7411	7410	Major road (Arterial)	4,209	7,774	7,539
6528	6527	Major road (Arterial)	13,206	16,358	15,887	7413	2567	Major road (Arterial)	7,609	18,704	16,082
6538	6539	Major road (Arterial)	12,250	15,282	15,221	7425	7426	Major road (Arterial)	10,708	10,654	9,987
6539	6540	Major road (Arterial)	11,250	15,282	15,221	7425	7488	Major road (Arterial)	10,708	12,463	11,148
6540	6539	Major road (Arterial)	11,250	15,496	14,353	7426	7425	Major road (Arterial)	10,708	12,360	11,026
6540	6541	Major road (Arterial)	8,750	9,813	8,563	7428	7429	Major road (Arterial)	11,659	10,475	9,655
6540	6565	Major road (Arterial)	9,750	14,367	14,757	7429	7428	Major road (Arterial)	11,659	13,126	12,086
6545	6544	Major road (Arterial)	5,757	7,244	7,492	7433	7434	Major road (Arterial)	12,059	6,953	7,157
6547	6772	Major road (Arterial)	9,155	11,405	9,012	7434	7433	Major road (Arterial)	12,059	23,431	22,499
6561	6557	Major road (Arterial)	9,700	14,934	16,032	7435	7471	Major road (Arterial)	14,709	17,701	17,084
6564	6544	Major road (Arterial)	4,907	9,026	8,705	7439	7356	Major road (Arterial)	8,609	5,461	7,680
6564	6568	Major road (Arterial)	4,907	8,957	8,708	7440	7339	Major road (Arterial)	7,009	8,252	8,751
6565	6540	Major road (Arterial)	9,750	13,127	12,318	7448	2827	Major road (Arterial)	15,309	10,836	9,657
6565	6566	Major road (Arterial)	9,150	13,552	14,488	7452	7453	Major road (Arterial)	16,132	5,924	5,672
6566	6565	Major road (Arterial)	9,150	12,406	12,055	7453	7452	Major road (Arterial)	16,132	10,449	12,549
6568	6564	Major road (Arterial)	4,907	9,020	8,900	7460	7459	Major road (Arterial)	5,809	6,126	6,886
6573	6557	Major road (Arterial)	11,001	16,672	15,591	7481	7484	Major road (Arterial)	10,609	16,174	11,650
6573	6580	Major road (Arterial)	12,109	8,384	7,003	7484	7488	Major road (Arterial)	11,608	16,433	11,858
6583	6592	Major road (Arterial)	10,357	8,291	7,511	7488	2615	Major road (Arterial)	9,958	15,673	14,045
6586	6587	Major road (Arterial)	6,050	5,646	5,419	7488	7425	Major road (Arterial)	10,708	10,827	10,230
6587	6586	Major road (Arterial)	6,050	5,849	7,405	7488	7491	Major road (Arterial)	9,531	10,644	6,473
6587	7460	Major road (Arterial)	8,006	6,270	6,371	7492	7419	Major road (Arterial)	15,100	15,112	12,698
6591	7463	Major road (Arterial)	1,809	6,091	4,210	2672	2717	Major road (Arterial)	3,321	12,091	9,185

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6592	6583	Major road (Arterial)	10,357	15,814	14,147	2676	2833	Major road (Arterial)	9,209	13,107	13,438
6596	2691	Major road (Arterial)	10,357	7,154	6,664	3166	3173	Major road (Arterial)	8,852	8,060	10,597
6598	6597	Major road (Arterial)	16,909	24,571	24,751	3168	3184	Major road (Arterial)	10,559	13,594	19,869
6600	2710	Major road (Arterial)	6,109	4,190	4,994	3173	3166	Major road (Arterial)	8,852	7,314	8,082
6614	6618	Major road (Arterial)	17,600	19,433	20,471	3178	3182	Major road (Arterial)	9,252	12,649	18,153
6615	6598	Major road (Arterial)	16,909	23,111	23,716	3178	3183	Major road (Arterial)	3,202	4,621	3,901
6616	6617	Major road (Arterial)	8,409	11,192	10,622	3182	3178	Major road (Arterial)	9,252	9,488	10,212
6617	6616	Major road (Arterial)	8,409	15,451	16,705	3183	3178	Major road (Arterial)	3,202	4,266	4,401
6617	6618	Major road (Arterial)	9,700	10,879	10,581	3184	3168	Major road (Arterial)	10,559	15,880	21,266
6618	6617	Major road (Arterial)	9,700	15,623	16,829	3184	3185	Major road (Arterial)	9,009	9,047	15,577
6618	6619	Major road (Arterial)	9,600	9,522	8,942	3185	3184	Major road (Arterial)	9,009	11,315	17,794
6618	6641	Major road (Arterial)	14,709	17,635	18,569	3188	3199	Major road (Arterial)	2,741	2,376	3,082
6619	6618	Major road (Arterial)	9,600	12,469	13,289	3193	3023	Major road (Arterial)	8,652	5,338	5,395
6620	6621	Major road (Arterial)	8,182	10,278	10,101	3193	3194	Major road (Arterial)	11,802	7,615	9,017
6621	6620	Major road (Arterial)	8,182	13,004	14,019	3194	3193	Major road (Arterial)	11,802	8,305	9,413
6621	6625	Major road (Arterial)	8,209	10,015	10,213	3194	3195	Major road (Arterial)	11,802	8,307	9,500
6623	6625	Major road (Arterial)	4,859	5,890	4,935	3195	3194	Major road (Arterial)	11,802	8,792	9,835
6625	6621	Major road (Arterial)	8,209	12,575	14,051	3198	3024	Major road (Arterial)	11,059	11,710	12,169
6625	6623	Major road (Arterial)	4,859	9,149	9,350	3199	3188	Major road (Arterial)	2,741	2,333	2,920
6625	6637	Major road (Arterial)	4,859	3,709	3,930	4758	4655	Major road (Arterial)	3,321	7,188	5,615
6634	6635	Major road (Arterial)	11,009	11,444	10,885	7463	2691	Major road (Arterial)	2,859	6,128	3,726
6635	6634	Major road (Arterial)	11,009	14,920	15,664	7463	6591	Major road (Arterial)	1,809	4,038	3,082
6636	6794	Major road (Arterial)	13,809	18,805	21,629	7463	7462	Major road (Arterial)	2,859	1,731	1,199
6637	6625	Major road (Arterial)	4,859	6,385	7,607	8430	6510	Major road (Arterial)	7,401	9,743	11,216
6642	6616	Major road (Arterial)	12,409	17,370	16,404	8433	6794	Major road (Arterial)	12,201	15,033	18,121
6650	6654	Major road (Arterial)	2,659	13,597	14,224	8435	6615	Major road (Arterial)	12,709	21,314	21,381
6651	6528	Major road (Arterial)	3,854	7,246	7,398	8576	7344	Major road (Arterial)	6,309	9,736	9,936

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6652	6650	Major road (Arterial)	19,501	12,898	12,690	8577	2685	Major road (Arterial)	6,032	9,230	6,103
6654	6653	Major road (Arterial)	14,709	18,139	18,689	4601	6917	Major road (Arterial)	15,309	8,647	13,543
6655	6656	Major road (Arterial)	6,492	11,860	12,980	4656	2700	Major road (Arterial)	9,809	9,019	7,989
6656	6655	Major road (Arterial)	6,492	9,473	9,989	2751	2755	Major road (Arterial)	17,809	10,900	10,187
6657	6658	Major road (Arterial)	7,209	11,702	13,140	3578	6501	Major road (Arterial)	9,757	12,844	13,462
6658	6657	Major road (Arterial)	7,209	9,742	10,426	3578	7171	Major road (Arterial)	11,159	15,742	16,043
6666	6661	Major road (Arterial)	15,209	11,536	10,794	6539	6538	Major road (Arterial)	12,250	15,496	14,353
6667	6669	Major road (Arterial)	10,006	17,808	20,478	6544	6543	Major road (Arterial)	4,757	8,337	8,593
6538	6524	Major road (Arterial)	13,800	19,683	16,090	6544	6545	Major road (Arterial)	5,757	6,241	5,791
7463	7464	Major road (Arterial)	3,759	2,987	1,948	6544	6564	Major road (Arterial)	4,907	8,762	8,499
7464	2687	Major road (Arterial)	3,557	6,848	4,089	7354	7279	Major road (Arterial)	6,301	8,052	8,315
4179	7350	Major road (Arterial)	10,659	12,976	14,643	3579	7399	Major road (Arterial)	10,759	19,196	17,494
4227	4814	Major road (Arterial)	5,552	13,846	12,410	6536	7175	Minor road (Collector)	9,902	13,504	13,271
4811	6501	Major road (Arterial)	6,207	7,190	5,673	6537	4815	Minor road (Collector)	4,300	2,373	2,068
4814	4227	Major road (Arterial)	5,552	15,098	13,551	6538	8449	Minor road (Collector)	11,450	13,163	11,790
4873	2850	Major road (Arterial)	15,000	13,156	16,201	4749	7354	Minor road (Collector)	2,701	2,711	3,178
4922	4923	Major road (Arterial)	7,900	2,423	3,710	6536	6535	Minor road (Collector)	8,352	13,388	13,083
4923	4922	Major road (Arterial)	7,900	1,310	1,805	6537	8448	Minor road (Collector)	7,402	12,245	11,871
6687	6674	Major road (Arterial)	6,556	11,467	12,508	6566	7179	Minor road (Collector)	4,959	9,950	9,758
6772	6520	Major road (Arterial)	7,501	3,105	2,299	6571	8440	Minor road (Collector)	2,800	3,843	3,344
6772	6547	Major road (Arterial)	9,155	18,107	16,255	6572	6580	Minor road (Collector)	2,459	4,678	4,546
6794	6636	Major road (Arterial)	13,809	13,302	15,665	6580	6572	Minor road (Collector)	2,459	3,742	3,444
6794	8433	Major road (Arterial)	12,201	18,225	21,688	6580	6582	Minor road (Collector)	2,259	5,016	5,107
6797	20037	Major road (Arterial)	6,006	9,340	11,338	6582	6580	Minor road (Collector)	2,259	4,444	5,541
7458	7467	Major road (Arterial)	1,859	10,640	11,282	6612	6613	Minor road (Collector)	2,052	5,367	5,979
7464	7463	Major road (Arterial)	3,759	8,148	5,398	6613	6612	Minor road (Collector)	2,052	4,822	5,325
7465	7464	Major road (Arterial)	1,559	7,839	4,326	4813	4815	Minor road (Collector)	8,803	11,388	6,216

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
7467	7468	Major road (Arterial)	7,102	6,215	3,521	4176	7385	Minor road (Collector)	2,658	5,417	4,611
7468	7467	Major road (Arterial)	7,102	6,316	3,696	4226	2804	Minor road (Collector)	659	6,505	3,975
7469	7470	Major road (Arterial)	3,009	3,936	2,071	4811	4812	Minor road (Collector)	2,503	3,655	2,149
7470	7469	Major road (Arterial)	3,009	5,794	3,116	4812	4811	Minor road (Collector)	2,503	2,122	898
7472	7470	Major road (Arterial)	17,009	25,263	23,834	4814	4813	Minor road (Collector)	5,305	5,502	5,091
7473	7476	Major road (Arterial)	7,309	13,051	8,342	4815	4813	Minor road (Collector)	8,803	10,095	5,577
7476	7477	Major road (Arterial)	14,709	19,183	16,770	4815	6537	Minor road (Collector)	4,300	4,272	3,583
7476	7478	Major road (Arterial)	10,609	15,600	11,402	4816	7400	Minor road (Collector)	7,359	4,755	3,004
7477	2651	Major road (Arterial)	14,709	18,338	16,239	2520	2532	Minor road (Collector)	3,159	2,223	1,342
2501	2517	Major road (Arterial)	7,109	25,110	22,573	2532	7403	Minor road (Collector)	1,209	3,255	2,381
2502	2516	Major road (Arterial)	6,609	11,108	10,536	2581	2582	Minor road (Collector)	2,101	6,627	3,908
2504	2505	Major road (Arterial)	12,051	20,808	17,819	2582	2581	Minor road (Collector)	2,101	7,765	4,338
2505	2506	Major road (Arterial)	7,209	10,431	8,051	2639	3128	Minor road (Collector)	3,657	1,860	2,182
2506	2505	Major road (Arterial)	7,209	10,461	9,060	2710	2741	Minor road (Collector)	1,759	2,099	1,458
2508	2863	Major road (Arterial)	6,858	7,938	7,243	2722	2730	Minor road (Collector)	909	5,012	3,820
2514	2515	Major road (Arterial)	5,709	7,896	6,645	2723	3123	Minor road (Collector)	3,450	703	1,436
2515	2516	Major road (Arterial)	5,709	7,514	6,260	2730	2722	Minor road (Collector)	909	1,525	1,211
2516	2502	Major road (Arterial)	6,609	16,973	15,286	2733	2735	Minor road (Collector)	2,709	6,928	5,965
2516	2518	Major road (Arterial)	6,099	12,341	11,528	2735	2733	Minor road (Collector)	2,709	3,572	2,613
2517	2527	Major road (Arterial)	9,509	25,338	22,687	2741	2710	Minor road (Collector)	1,759	3,796	3,029
2518	2516	Major road (Arterial)	6,099	10,920	10,131	2750	2755	Minor road (Collector)	5,259	7,977	7,170
2519	2514	Major road (Arterial)	23,409	34,005	32,835	2755	2759	Minor road (Collector)	7,509	10,296	8,096
2521	2531	Major road (Arterial)	20,601	25,100	21,065	2759	2755	Minor road (Collector)	7,509	8,565	4,985
2529	2537	Major road (Arterial)	5,609	9,899	8,488	2783	2792	Minor road (Collector)	1,856	4,223	3,658
2530	2523	Major road (Arterial)	24,101	29,383	28,440	2792	2783	Minor road (Collector)	1,856	3,329	2,827
2533	2532	Major road (Arterial)	9,609	12,384	11,157	2800	2802	Minor road (Collector)	852	4,596	3,436
2533	2543	Major road (Arterial)	24,509	24,961	21,446	2802	2800	Minor road (Collector)	852	5,890	4,568

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2534	2533	Major road (Arterial)	8,309	13,138	12,084	2804	2821	Minor road (Collector)	9,109	8,309	6,781
2535	2534	Major road (Arterial)	8,309	13,362	12,382	2804	4226	Minor road (Collector)	659	5,497	3,882
2537	2529	Major road (Arterial)	5,609	13,287	12,687	2821	2804	Minor road (Collector)	9,109	6,799	4,207
2537	2536	Major road (Arterial)	11,660	15,065	14,657	2821	2822	Minor road (Collector)	8,559	7,873	6,242
2537	2541	Major road (Arterial)	6,009	10,656	8,016	2822	2821	Minor road (Collector)	8,559	5,937	3,405
2538	2537	Major road (Arterial)	9,309	13,859	14,068	3015	3029	Minor road (Collector)	1,750	5,683	6,172
2541	2537	Major road (Arterial)	6,609	15,250	12,803	3018	3027	Minor road (Collector)	5,609	7,158	7,596
2542	2535	Major road (Arterial)	18,609	26,545	25,223	3028	3017	Minor road (Collector)	5,409	8,419	8,713
2544	2545	Major road (Arterial)	5,611	16,997	14,345	3029	3015	Minor road (Collector)	1,750	3,235	3,384
2546	2547	Major road (Arterial)	5,709	19,155	15,872	3035	3387	Minor road (Collector)	5,407	4,744	5,658
2547	2542	Major road (Arterial)	18,609	26,534	25,077	3037	3058	Minor road (Collector)	4,404	10,436	12,933
2547	2548	Major road (Arterial)	8,509	18,286	14,034	3041	3053	Minor road (Collector)	5,205	6,857	7,678
2553	2576	Major road (Arterial)	16,909	28,057	24,044	3047	3050	Minor road (Collector)	2,309	5,605	5,518
2556	2547	Major road (Arterial)	22,409	25,665	23,240	3050	3047	Minor road (Collector)	2,309	4,231	4,181
2572	2576	Major road (Arterial)	1,252	7,245	4,921	3052	3042	Minor road (Collector)	5,205	6,045	7,087
2576	2572	Major road (Arterial)	1,252	3,288	1,450	3057	3038	Minor road (Collector)	5,507	3,144	3,817
2576	2591	Major road (Arterial)	14,509	21,595	18,045	3065	3052	Minor road (Collector)	8,900	8,911	9,971
2576	4875	Major road (Arterial)	2,609	10,419	9,470	3096	3100	Minor road (Collector)	4,999	11,339	13,291
2593	2615	Major road (Arterial)	20,971	21,841	19,302	3102	3097	Minor road (Collector)	7,208	9,127	11,080
2594	2605	Major road (Arterial)	9,321	9,528	8,090	3123	2723	Minor road (Collector)	3,450	14,973	15,443
2597	2600	Major road (Arterial)	19,809	22,500	20,098	3128	2639	Minor road (Collector)	3,657	4,364	4,726
2599	2600	Major road (Arterial)	11,859	14,283	13,608	3133	6805	Minor road (Collector)	1,705	797	973
2600	2599	Major road (Arterial)	11,859	14,021	11,416	3136	3137	Minor road (Collector)	7,852	4,058	5,320
2600	2620	Major road (Arterial)	19,809	26,476	25,935	3137	3136	Minor road (Collector)	7,852	3,439	6,289
2601	2602	Major road (Arterial)	12,559	17,134	14,549	3151	3152	Minor road (Collector)	2,058	178	1,214
2602	2596	Major road (Arterial)	25,209	31,399	27,356	3151	6923	Minor road (Collector)	2,858	1,326	2,694
2602	2601	Major road (Arterial)	12,559	19,438	17,445	3152	3151	Minor road (Collector)	2,058	237	860

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2602	2603	Major road (Arterial)	11,159	15,132	11,022	3152	3187	Minor road (Collector)	2,358	178	1,101
2603	2602	Major road (Arterial)	11,159	24,888	19,019	6805	3133	Minor road (Collector)	1,705	1,242	1,619
2605	2594	Major road (Arterial)	9,321	11,729	10,212	6805	6808	Minor road (Collector)	2,155	715	1,189
2605	2614	Major road (Arterial)	10,309	11,502	8,774	6808	6805	Minor road (Collector)	2,155	800	1,228
2614	2605	Major road (Arterial)	10,309	20,018	15,567	6908	6918	Minor road (Collector)	5,258	3,366	5,144
2614	2615	Major road (Arterial)	10,309	11,483	8,296	6918	6908	Minor road (Collector)	5,258	3,237	5,325
2615	2614	Major road (Arterial)	10,309	16,857	13,674	6918	6919	Minor road (Collector)	5,057	2,831	4,554
2615	2616	Major road (Arterial)	19,309	23,892	20,226	6919	6918	Minor road (Collector)	5,057	3,081	4,400
2615	7488	Major road (Arterial)	9,958	8,247	7,742	6923	3151	Minor road (Collector)	2,858	1,254	3,113
2619	2602	Major road (Arterial)	23,809	23,947	22,255	7175	6536	Minor road (Collector)	9,902	13,011	12,753
2622	2642	Major road (Arterial)	16,909	28,392	27,665	7179	6566	Minor road (Collector)	4,959	6,933	6,907
2627	2640	Major road (Arterial)	7,251	11,986	9,646	7305	8442	Minor road (Collector)	753	6,328	6,267
2640	2627	Major road (Arterial)	7,251	14,330	11,420	7354	4749	Minor road (Collector)	2,701	2,123	2,097
2641	2624	Major road (Arterial)	21,009	27,995	24,981	7374	2888	Minor road (Collector)	3,209	2,835	1,746
2644	2643	Major road (Arterial)	17,609	23,834	24,816	7381	7385	Minor road (Collector)	2,809	2,801	2,560
2644	2656	Major road (Arterial)	16,009	18,474	16,321	7385	4176	Minor road (Collector)	2,658	2,121	1,633
2646	2645	Major road (Arterial)	16,709	13,720	13,022	7385	6038	Minor road (Collector)	1,455	4,597	4,033
2649	2648	Major road (Arterial)	18,309	17,213	16,550	7387	7379	Minor road (Collector)	1,304	4,460	4,290
2649	2653	Major road (Arterial)	5,859	13,563	10,649	7400	4816	Minor road (Collector)	7,359	15,515	12,142
2651	2650	Major road (Arterial)	18,409	18,611	17,009	3167	3190	Minor road (Collector)	4,550	7,584	8,454
2651	2652	Major road (Arterial)	15,609	23,737	19,011	3187	3152	Minor road (Collector)	2,358	163	728
2652	2662	Major road (Arterial)	15,609	22,586	18,228	3190	3167	Minor road (Collector)	4,550	7,782	8,795
2653	2649	Major road (Arterial)	5,859	12,222	10,754	3190	3193	Minor road (Collector)	3,752	6,698	7,164
2653	2660	Major road (Arterial)	5,859	14,124	10,549	3193	3190	Minor road (Collector)	3,752	7,258	8,003
2654	2646	Major road (Arterial)	14,509	23,242	20,162	3365	3389	Minor road (Collector)	1,005	1,326	1,455
2657	2658	Major road (Arterial)	15,709	27,445	26,843	8440	6571	Minor road (Collector)	2,800	4,580	3,873
2658	4675	Major road (Arterial)	12,709	22,561	20,746	8442	7305	Minor road (Collector)	753	2,277	2,117

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2660	2653	Major road (Arterial)	5,859	12,378	10,783	8448	6537	Minor road (Collector)	7,402	13,157	13,067
2660	2664	Major road (Arterial)	8,109	14,353	11,957	8449	6538	Minor road (Collector)	11,450	16,820	14,608
2661	2662	Major road (Arterial)	17,102	18,557	16,190	2755	2750	Minor road (Collector)	5,259	4,881	3,799
2662	2663	Major road (Arterial)	7,009	16,226	11,873	4813	4814	Minor road (Collector)	5,305	5,263	2,829
2662	7473	Major road (Arterial)	19,309	24,916	22,545	6534	6535	Minor road (Collector)	5,807	12,594	12,028
2664	2660	Major road (Arterial)	8,109	11,732	9,471	6535	6534	Minor road (Collector)	5,807	10,041	9,771
2668	2658	Major road (Arterial)	11,509	18,360	14,066	6535	6536	Minor road (Collector)	8,352	12,500	12,238
2679	2688	Major road (Arterial)	10,458	15,181	12,567	6666	6667	Local road	1,505	5,856	7,612
2682	2521	Major road (Arterial)	20,609	25,064	21,990	6667	6666	Local road	1,505	3,712	4,524
2685	8577	Major road (Arterial)	6,032	8,822	4,632	6506	6772	Local road	3,853	11,679	10,644
2687	7464	Major road (Arterial)	3,557	4,170	3,214	6533	6546	Local road	1,356	1,682	1,172
2688	2679	Major road (Arterial)	10,458	10,809	8,890	6546	6533	Local road	1,356	1,764	1,336
2690	2691	Major road (Arterial)	10,458	15,181	12,567	6546	6550	Local road	1,853	1,245	889
2691	2690	Major road (Arterial)	10,458	10,809	8,890	6588	7461	Local road	356	1,649	1,560
2691	6596	Major road (Arterial)	10,357	16,938	14,069	6662	6664	Local road	2,959	2,412	1,700
2691	7463	Major road (Arterial)	2,859	645	346	6664	6662	Local road	2,959	2,330	2,235
2700	2849	Major road (Arterial)	10,609	13,782	12,461	6664	6665	Local road	1,559	10,621	10,964
2702	2847	Major road (Arterial)	14,909	19,140	18,571	6665	6664	Local road	1,559	7,037	7,819
2710	2711	Major road (Arterial)	7,809	7,921	7,921	7461	6588	Local road	356	2,299	2,575
2710	6600	Major road (Arterial)	6,109	1,604	737	4070	2666	Local road	1,909	2,013	1,585
2711	2710	Major road (Arterial)	7,809	3,638	2,094	4070	7383	Local road	409	3,574	3,509
2712	2714	Major road (Arterial)	8,109	9,549	9,307	4227	3578	Local road	553	11,738	8,877
2714	2712	Major road (Arterial)	8,109	11,401	11,279	6772	6506	Local road	3,853	8,300	6,714
2719	2729	Major road (Arterial)	6,709	7,478	7,016	6796	6797	Local road	2,957	2,919	2,834
2729	2719	Major road (Arterial)	6,709	4,414	5,201	6797	6796	Local road	2,957	1,788	2,021
2729	2730	Major road (Arterial)	12,209	21,442	21,688	2512	2514	Local road	9,509	11,182	12,029
2729	2736	Major road (Arterial)	5,309	5,337	4,048	2520	2521	Local road	2,981	3,790	1,120

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2730	2731	Major road (Arterial)	11,309	21,304	20,825	2527	2609	Local road	1,809	3,898	3,897
2735	2736	Major road (Arterial)	14,409	23,697	25,583	2558	2559	Local road	2,931	710	335
2736	2729	Major road (Arterial)	5,309	7,148	6,499	2559	2558	Local road	2,931	1,206	292
2736	2737	Major road (Arterial)	13,509	19,066	20,867	2570	2568	Local road	2,103	7,305	5,447
2736	2748	Major road (Arterial)	4,459	5,869	3,963	2609	2527	Local road	1,809	238	125
2748	2736	Major road (Arterial)	4,459	3,048	1,698	2609	7490	Local road	1,309	4,098	4,215
2755	2751	Major road (Arterial)	17,809	14,658	13,926	2621	2622	Local road	2,701	5,433	3,149
2755	2758	Major road (Arterial)	18,459	9,690	9,499	2622	2623	Local road	7,109	3,130	1,369
2758	2755	Major road (Arterial)	18,459	12,084	12,977	2623	2624	Local road	6,709	2,638	1,081
2760	2763	Major road (Arterial)	17,709	15,707	13,608	2624	2625	Local road	3,359	3,185	991
2763	2760	Major road (Arterial)	17,709	18,115	17,154	2743	2763	Local road	3,459	1,433	1,423
2763	2768	Major road (Arterial)	19,109	17,274	15,357	2763	2743	Local road	3,459	2,326	2,554
2768	2763	Major road (Arterial)	19,109	19,404	18,858	2763	2800	Local road	2,959	601	400
2768	2769	Major road (Arterial)	17,409	17,856	16,221	2800	2763	Local road	2,959	1,771	1,576
2769	2768	Major road (Arterial)	17,409	20,187	19,739	2820	2821	Local road	6,309	2,813	1,443
2769	2771	Major road (Arterial)	17,309	18,689	17,199	2821	2820	Local road	6,309	1,434	797
2771	2769	Major road (Arterial)	17,309	22,244	21,691	2821	7446	Local road	7,159	2,252	780
2779	2783	Major road (Arterial)	4,306	7,038	9,583	2824	2831	Local road	1,452	713	922
2782	3106	Major road (Arterial)	16,806	17,457	20,671	2831	2824	Local road	1,452	141	191
2783	2779	Major road (Arterial)	4,306	6,341	7,414	3058	3059	Local road	3,908	2,983	4,200
2815	2825	Major road (Arterial)	6,109	4,981	7,297	3060	3057	Local road	4,408	1,659	1,957
2825	2815	Major road (Arterial)	6,109	5,720	5,346	3135	3145	Local road	1,308	2,566	2,207
2828	2831	Major road (Arterial)	7,909	10,417	10,711	3145	3135	Local road	1,308	2,549	2,704
2831	2828	Major road (Arterial)	7,909	6,473	5,238	3145	3154	Local road	1,301	2,486	2,543
2831	2832	Major road (Arterial)	8,309	12,466	12,809	3154	3145	Local road	1,301	2,519	2,605
2832	2831	Major road (Arterial)	8,309	7,296	6,163	6550	6546	Local road	1,853	2,088	1,389
2833	2676	Major road (Arterial)	9,209	11,260	10,748	6804	6805	Local road	3,205	1,336	1,399

Table E.1c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2833	2834	Major road (Arterial)	10,152	12,923	13,359	6805	6804	Local road	3,205	1,637	1,979
2834	2833	Major road (Arterial)	10,152	11,056	10,621	6805	8570	Local road	2,005	1,347	990
2834	3048	Major road (Arterial)	7,302	9,574	10,469	6807	6914	Local road	3,900	835	1,352
2835	2851	Major road (Arterial)	11,859	6,313	7,850	6910	6911	Local road	5,900	790	795
2849	2703	Major road (Arterial)	12,800	12,500	11,932	6911	6910	Local road	5,900	780	938
2850	4873	Major road (Arterial)	15,000	10,128	12,118	6914	6807	Local road	3,900	923	1,286
2851	2835	Major road (Arterial)	11,859	7,587	9,788	7379	7412	Local road	2,609	10,314	10,316
2851	2856	Major road (Arterial)	8,159	4,908	7,272	7380	7379	Local road	2,609	5,953	6,072
2853	2856	Major road (Arterial)	7,102	4,650	3,442	7402	7410	Local road	1,150	3,300	2,815
2853	3015	Major road (Arterial)	5,209	3,501	2,940	7407	7418	Local road	5,000	640	658
2856	2851	Major road (Arterial)	8,159	7,954	11,026	7410	7402	Local road	1,150	2,007	1,930
2856	2853	Major road (Arterial)	7,102	4,814	3,661	7418	7407	Local road	5,000	2,290	2,406
2856	2862	Major road (Arterial)	5,452	5,468	4,539	7422	7428	Local road	1,221	2,084	1,605
2862	2856	Major road (Arterial)	5,452	5,820	5,191	7423	7426	Local road	3,261	629	456
2863	2508	Major road (Arterial)	6,858	7,645	6,181	7426	7423	Local road	3,261	2,464	2,340
2888	7376	Major road (Arterial)	5,909	9,104	8,501	7428	7422	Local road	1,221	1,195	1,113
3015	2853	Major road (Arterial)	5,209	3,643	2,731	7446	2821	Local road	7,159	1,298	396
3015	3016	Major road (Arterial)	5,859	3,578	3,733	7490	2609	Local road	1,309	126	2
3016	3015	Major road (Arterial)	5,859	6,806	7,300	8570	6805	Local road	2,005	2,008	2,177
3020	3021	Major road (Arterial)	7,654	5,659	5,456	3578	4227	Local road	553	9,635	8,285
-	-	-	-	-	-	3580	4070	Local road	1,959	2,227	2,080

Table E.1d: Link Flows – Control Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model
3913	3825	Freeway (Interstate)	28,950	27,580	31,065
5386	3829	Freeway (Interstate)	19,402	16,983	18,325
3831	3833	Freeway (Interstate)	15,950	14,473	14,425
3832	3830	Freeway (Interstate)	15,950	14,776	16,026
3824	3912	Freeway (Interstate)	28,950	26,835	29,229
3828	5387	Freeway (Interstate)	19,402	17,846	18,498
6579	3478	Major road (Arterial)	2,750	1,048	981
3460	3461	Major road (Arterial)	4,650	4,039	3,523
3944	3472	Major road (Arterial)	2,159	2,328	1,844
4051	3469	Major road (Arterial)	2,502	1,370	1,387
3461	3460	Major road (Arterial)	4,650	3,992	2,980
3461	3462	Major road (Arterial)	4,600	4,123	3,426
3462	3461	Major road (Arterial)	4,600	4,245	2,918
3462	3468	Major road (Arterial)	3,359	1,270	1,799
4978	3490	Major road (Arterial)	4,309	4,819	2,839
5382	5385	Major road (Arterial)	2,652	1,422	1,370
5385	5382	Major road (Arterial)	2,652	1,928	1,929
3454	3458	Major road (Arterial)	5,456	5,422	4,373
3458	3454	Major road (Arterial)	5,456	5,848	5,508
3458	3487	Major road (Arterial)	5,109	6,674	6,749
3429	3430	Major road (Arterial)	2,609	2,404	4,332
3430	3429	Major road (Arterial)	2,609	2,416	4,405
3430	3431	Major road (Arterial)	1,659	2,344	4,290
3431	3430	Major road (Arterial)	1,659	2,361	4,342
3431	3433	Major road (Arterial)	2,259	2,572	4,530
3431	9771	Major road (Arterial)	1,659	2,591	2,127
3433	3431	Major road (Arterial)	2,259	2,712	4,694
3433	3434	Major road (Arterial)	3,209	2,783	4,651
3434	3433	Major road (Arterial)	3,209	2,921	4,826
3436	3450	Major road (Arterial)	3,600	4,209	5,422
3448	3452	Major road (Arterial)	3,009	3,899	3,434
3450	3436	Major road (Arterial)	3,600	4,357	5,558
3452	3448	Major road (Arterial)	3,009	4,624	4,131
3453	3454	Major road (Arterial)	5,106	5,070	3,466

Table E.1d (continued): Link Flows – Control Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model
3454	3453	Major road (Arterial)	5,106	5,564	4,257
3478	6579	Major road (Arterial)	2,750	1,173	1,188
3487	3458	Major road (Arterial)	5,109	6,824	7,760
3487	3488	Major road (Arterial)	10,696	9,090	8,604
3488	3487	Major road (Arterial)	10,696	9,207	9,792
3468	3462	Major road (Arterial)	3,359	950	1,226
3469	4051	Major road (Arterial)	2,502	1,828	1,910
3472	3944	Major road (Arterial)	2,159	1,989	3,355
3488	3489	Major road (Arterial)	12,709	9,713	9,442
3489	3488	Major road (Arterial)	12,709	9,865	10,632
3490	4978	Major road (Arterial)	4,309	3,571	2,023
3475	3476	Major road (Arterial)	4,052	1,467	1,643
3476	3475	Major road (Arterial)	4,052	1,705	1,737
3476	3477	Major road (Arterial)	2,509	1,410	1,476
3477	3476	Major road (Arterial)	2,509	1,623	1,570
3461	3486	Minor road (Collector)	1,400	710	325
7503	3466	Minor road (Collector)	652	149	215
3464	3434	Minor road (Collector)	981	234	166
3434	3464	Minor road (Collector)	981	178	132
3465	3464	Minor road (Collector)	1,302	330	204
3486	3461	Minor road (Collector)	1,400	541	290
3464	3465	Minor road (Collector)	1,302	271	177
3465	3466	Minor road (Collector)	1,402	260	192
3466	3465	Minor road (Collector)	1,402	321	217
3466	3467	Minor road (Collector)	1,202	360	327
3466	7503	Minor road (Collector)	652	134	197
3467	3466	Minor road (Collector)	1,202	405	334
3467	3468	Minor road (Collector)	1,309	936	412
3468	3467	Minor road (Collector)	1,309	750	425
4052	3469	Local road	302	163	132
3450	3451	Local road	1,611	651	629
3451	3450	Local road	1,611	721	616
3465	3471	Local road	252	33	52
3469	4052	Local road	302	210	169
3471	3465	Local road	252	30	54

APPENDIX E.2: Link Flows – Model Year 2000

Table E.2a: Link Flows – Polaris Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model
3594	3702	Freeway (Interstate)	52,250	55,982	49,722
3701	3593	Freeway (Interstate)	52,250	59,370	52,200
4375	4955	Freeway (Interstate)	31,900	29,348	26,674
4954	4376	Freeway (Interstate)	31,900	27,716	25,478
4405	4948	Major road (Arterial)	4,500	6,872	6,428
4407	5331	Major road (Arterial)	5,161	2,986	2,557
4926	4950	Major road (Arterial)	14,109	6,898	7,414
4948	4405	Major road (Arterial)	4,500	11,557	9,784
4950	4926	Major road (Arterial)	14,109	5,621	5,985
4952	4961	Major road (Arterial)	22,050	23,034	20,231
4953	5250	Major road (Arterial)	22,036	11,521	11,339
4961	4952	Major road (Arterial)	22,050	15,495	14,396
4961	8326	Major road (Arterial)	17,200	18,610	14,547
4989	5249	Major road (Arterial)	10,000	7,198	5,493
4989	5250	Major road (Arterial)	21,934	20,400	17,624
5249	4989	Major road (Arterial)	10,000	10,271	8,196
5250	4953	Major road (Arterial)	22,036	20,815	18,457
5250	4989	Major road (Arterial)	21,934	11,056	10,505
5331	4407	Major road (Arterial)	5,161	1,692	2,092
8326	4961	Major road (Arterial)	17,200	15,838	12,332
4404	6628	Minor road (Collector)	2,368	2,978	2,960
4404	8046	Minor road (Collector)	7,719	9,178	9,062
4404	8327	Minor road (Collector)	8,382	10,212	9,638
5078	6062	Minor road (Collector)	2,750	3,181	1,840
6062	5078	Minor road (Collector)	2,750	6,855	3,852
6628	4404	Minor road (Collector)	2,368	2,282	2,914
8046	4404	Minor road (Collector)	7,719	8,788	8,106
8327	4404	Minor road (Collector)	8,382	11,298	10,641

Table E.2b: Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3633	3635	Freeway (Interstate)	58,340	62,281	51,865	5189	4965	Minor road (Collector)	4,131	2,917	3,044
3635	3637	Freeway (Interstate)	57,231	52,201	42,871	5189	6223	Minor road (Collector)	3,644	4,227	3,999
3636	3634	Freeway (Interstate)	58,340	59,455	49,978	6225	4965	Minor road (Collector)	7,418	4,512	4,332
3637	3869	Freeway (Interstate)	58,540	63,178	54,261	6271	5457	Minor road (Collector)	6,050	6,516	6,510
3638	3636	Freeway (Interstate)	57,231	50,747	42,280	7108	5423	Minor road (Collector)	3,950	3,443	2,843
3859	3861	Freeway (Interstate)	43,985	40,597	38,322	7108	6222	Minor road (Collector)	2,605	2,115	2,010
3860	3858	Freeway (Interstate)	43,985	45,015	42,988	7108	7109	Minor road (Collector)	3,505	1,664	1,801
3868	3638	Freeway (Interstate)	58,540	62,059	53,645	7109	7108	Minor road (Collector)	3,505	1,799	1,751
3871	3873	Freeway (Interstate)	45,175	42,848	39,980	4995	6219	Minor road (Collector)	2,700	1,184	985
3872	3870	Freeway (Interstate)	45,175	48,447	43,481	6219	5187	Minor road (Collector)	2,223	1,126	1,120
6236	6235	Major road (Arterial)	7,872	7,125	5,309	6262	6264	Minor road (Collector)	4,675	7,099	5,118
6242	6241	Major road (Arterial)	6,900	9,361	7,461	6222	7108	Minor road (Collector)	2,605	3,057	2,872
6242	6244	Major road (Arterial)	8,250	13,474	10,836	6223	5189	Minor road (Collector)	3,644	2,758	2,637
6241	6242	Major road (Arterial)	6,900	13,474	10,836	6231	5188	Minor road (Collector)	2,100	2,354	2,506
6225	4968	Major road (Arterial)	9,266	12,450	10,841	6264	6262	Minor road (Collector)	4,675	7,625	5,361
6272	6282	Major road (Arterial)	11,625	16,353	16,252	6269	6270	Minor road (Collector)	5,875	4,769	5,425
6353	8389	Major road (Arterial)	13,246	18,176	16,737	6269	8390	Minor road (Collector)	4,575	5,344	4,446
7083	7139	Major road (Arterial)	17,865	13,220	12,937	6269	8391	Minor road (Collector)	3,750	3,249	4,612
7086	4699	Major road (Arterial)	22,265	24,805	23,436	6270	5457	Minor road (Collector)	4,367	4,689	4,843
7112	4945	Major road (Arterial)	6,675	4,736	5,587	6270	6238	Minor road (Collector)	3,200	1,581	1,955
7133	7134	Major road (Arterial)	11,896	9,952	9,350	6270	6269	Minor road (Collector)	5,875	4,749	5,178
7133	7137	Major road (Arterial)	5,447	8,015	6,760	6271	4966	Minor road (Collector)	3,150	1,605	1,279

Table E.2b (continued): Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
7133	8491	Major road (Arterial)	8,822	5,111	6,035	4965	6225	Minor road (Collector)	7,418	2,917	3,044
7134	7133	Major road (Arterial)	11,896	9,800	9,885	4966	6271	Minor road (Collector)	3,150	1,572	1,365
7136	4699	Major road (Arterial)	14,582	21,703	19,116	4970	6222	Minor road (Collector)	3,255	3,157	2,822
5023	6262	Major road (Arterial)	11,075	18,273	15,125	4970	6223	Minor road (Collector)	2,709	2,758	2,637
6235	6232	Major road (Arterial)	9,575	7,318	5,360	5423	7108	Minor road (Collector)	3,950	1,801	1,693
6235	6236	Major road (Arterial)	7,872	10,226	8,912	5423	7139	Minor road (Collector)	8,087	9,887	8,409
6263	6244	Major road (Arterial)	11,993	10,544	8,484	5457	6270	Minor road (Collector)	4,367	4,676	4,805
6252	8389	Major road (Arterial)	15,800	18,190	16,648	5457	6271	Minor road (Collector)	6,050	6,578	6,307
6262	5023	Major road (Arterial)	11,075	14,048	11,740	6214	6217	Minor road (Collector)	3,871	1,556	1,668
6271	4967	Major road (Arterial)	11,479	13,230	11,837	6214	8395	Minor road (Collector)	4,736	2,984	3,099
6271	4969	Major road (Arterial)	11,988	7,887	7,928	6215	5026	Minor road (Collector)	4,750	3,460	3,674
6278	4750	Major road (Arterial)	6,798	5,998	6,400	6217	6214	Minor road (Collector)	3,871	1,999	1,981
6279	4751	Major road (Arterial)	8,501	7,503	8,293	6219	4995	Minor road (Collector)	2,700	1,555	1,398
6282	6272	Major road (Arterial)	11,625	16,878	16,971	6220	8401	Minor road (Collector)	2,315	1,354	1,263
6284	6252	Major road (Arterial)	14,034	18,638	17,302	6221	8401	Minor road (Collector)	2,955	1,313	1,286
4943	7135	Major road (Arterial)	12,806	15,085	14,616	6222	4970	Minor road (Collector)	3,255	1,683	1,517
4945	7112	Major road (Arterial)	6,675	4,403	5,196	7139	5423	Minor road (Collector)	8,087	8,101	7,169
4967	6271	Major road (Arterial)	11,479	12,756	12,218	7139	7140	Minor road (Collector)	6,120	5,253	3,713
4968	4750	Major road (Arterial)	9,855	9,539	9,226	7140	7139	Minor road (Collector)	6,120	3,675	2,848
4968	6225	Major road (Arterial)	9,266	9,908	8,853	8390	6269	Minor road (Collector)	4,575	4,352	3,944
4969	6271	Major road (Arterial)	11,988	8,332	7,663	8391	6269	Minor road (Collector)	3,750	4,262	5,362
7135	4943	Major road (Arterial)	12,806	13,937	12,663	8394	8395	Minor road (Collector)	5,130	2,429	2,657
7137	7133	Major road (Arterial)	5,447	6,487	5,822	8395	6214	Minor road (Collector)	4,736	2,398	2,645

Table E.2b (continued): Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
7137	7138	Major road (Arterial)	7,807	8,370	7,701	8395	8394	Minor road (Collector)	5,130	3,007	3,106
7138	7137	Major road (Arterial)	7,807	6,454	6,459	8400	4750	Minor road (Collector)	2,980	1,838	1,522
7139	7083	Major road (Arterial)	17,865	15,652	14,921	8401	6220	Minor road (Collector)	2,315	1,308	1,291
7139	7501	Major road (Arterial)	8,707	7,190	7,012	8401	6221	Minor road (Collector)	2,955	1,472	1,351
7501	7139	Major road (Arterial)	8,707	9,414	8,622	4965	5189	Minor road (Collector)	4,131	4,512	4,332
8389	6252	Major road (Arterial)	15,800	23,152	20,215	6223	4970	Minor road (Collector)	2,709	4,227	3,999
8389	6353	Major road (Arterial)	13,246	13,599	13,448	4750	8400	Minor road (Collector)	2,980	1,641	1,343
6232	6235	Major road (Arterial)	9,575	10,377	8,974	5026	6215	Minor road (Collector)	4,750	3,203	3,399
6244	6242	Major road (Arterial)	8,250	9,361	7,461	5187	6219	Minor road (Collector)	2,223	1,445	1,505
6244	6263	Major road (Arterial)	11,993	14,500	11,997	5188	6231	Minor road (Collector)	2,100	2,164	2,036
6252	6284	Major road (Arterial)	14,034	24,538	22,205	6223	4971	Local road	1,278	0	0
8491	7133	Major road (Arterial)	8,822	5,777	6,242	6234	8398	Local road	1,850	3,354	2,786
4750	4968	Major road (Arterial)	9,855	7,196	7,248	6228	6230	Local road	2,200	0	0
4750	6278	Major road (Arterial)	6,798	8,538	8,557	6229	4976	Local road	2,050	177	165
4751	6279	Major road (Arterial)	8,501	10,333	10,646	6230	6228	Local road	2,200	0	0
4699	7086	Major road (Arterial)	22,265	24,464	21,919	6235	6234	Local road	325	151	62
4699	7136	Major road (Arterial)	14,582	21,893	20,638	4971	6223	Local road	1,278	0	0
6238	6270	Minor road (Collector)	3,200	1,574	1,746	4976	6229	Local road	2,050	170	190
6240	6241	Minor road (Collector)	3,450	4,974	4,375	8398	6234	Local road	1,850	3,300	2,975
6241	6240	Minor road (Collector)	3,450	3,952	3,347	6234	6235	Local road	325	193	51

Table E.2c: Link Flows – Control Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
5386	3829	Freeway (Interstate)	26,890	25,030	24,541	3487	3458	Major road (Arterial)	8,390	7,692	8,098
3913	3825	Freeway (Interstate)	38,395	41,845	41,577	3488	3489	Major road (Arterial)	13,227	15,342	12,675
3824	3912	Freeway (Interstate)	38,395	41,279	40,095	3489	3488	Major road (Arterial)	13,227	15,932	14,103
3828	5387	Freeway (Interstate)	26,890	25,638	25,116	3490	4978	Major road (Arterial)	4,664	4,314	3,710
3831	3833	Freeway (Interstate)	22,710	20,676	20,019	3944	3472	Major road (Arterial)	2,768	2,804	2,456
3832	3830	Freeway (Interstate)	22,710	21,469	21,763	7503	3466	Minor road (Collector)	987	201	370
6579	3478	Major road (Arterial)	3,667	2,440	1,865	2781	3477	Minor road (Collector)	1,600	1,806	1,403
9771	3431	Major road (Arterial)	2,323	2,458	2,343	2781	3479	Minor road (Collector)	1,154	1,720	1,676
3430	3431	Major road (Arterial)	2,300	3,643	4,813	3434	3464	Minor road (Collector)	1,505	230	197
3431	3430	Major road (Arterial)	2,300	3,863	5,227	3464	3434	Minor road (Collector)	1,505	325	205
3431	9771	Major road (Arterial)	2,323	2,724	2,418	3464	3465	Minor road (Collector)	1,400	326	282
3435	3436	Major road (Arterial)	3,502	4,061	5,435	3465	3464	Minor road (Collector)	1,400	425	271
3436	3435	Major road (Arterial)	3,502	4,237	5,908	3466	3467	Minor road (Collector)	1,725	443	528
3436	3450	Major road (Arterial)	6,300	5,202	6,263	3466	7503	Minor road (Collector)	987	193	381
3450	3436	Major road (Arterial)	6,300	5,405	6,772	3467	3466	Minor road (Collector)	1,725	537	517
3454	3458	Major road (Arterial)	7,016	4,752	4,184	3477	2781	Minor road (Collector)	1,600	2,055	1,588
3458	3454	Major road (Arterial)	7,016	5,456	5,325	3479	2781	Minor road (Collector)	1,154	1,568	1,505
3458	3487	Major road (Arterial)	8,390	7,732	7,407	8478	3432	Local road	432	286	916
3459	3460	Major road (Arterial)	6,376	4,931	5,242	9613	8068	Local road	5	257	372
3460	3459	Major road (Arterial)	6,376	4,944	4,116	9613	8069	Local road	155	115	162
3460	3461	Major road (Arterial)	6,105	5,048	5,235	9616	9619	Local road	345	114	256
3461	3460	Major road (Arterial)	6,105	5,082	4,246	9619	3479	Local road	172	40	139
3461	3462	Major road (Arterial)	5,300	5,567	5,384	9619	9616	Local road	345	137	366
3462	3461	Major road (Arterial)	5,300	5,803	4,482	3465	3471	Local road	333	61	94
4978	3490	Major road (Arterial)	4,664	4,516	4,330	8068	3479	Local road	201	257	372
3470	3477	Major road (Arterial)	3,221	2,559	1,815	8068	9613	Local road	5	215	331
3472	3944	Major road (Arterial)	2,768	2,612	3,316	8069	9613	Local road	155	126	173
3476	3477	Major road (Arterial)	5,568	2,562	2,354	3471	3465	Local road	333	58	105
3477	3470	Major road (Arterial)	3,221	2,045	1,654	3479	8068	Local road	201	215	331
3477	3476	Major road (Arterial)	5,568	2,283	2,035	3479	9619	Local road	172	50	147
3478	6579	Major road (Arterial)	3,667	2,986	2,161	-	-	-	-	-	-

APPENDIX E.3: Link Flows – Model Year 2005

Table E.3a: Link Flows – Polaris Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3594	3702	Freeway (Interstate)	62,025	64,597	58,071	5005	5259	Major road (Arterial)	5,229	6,490	6,598
3701	3593	Freeway (Interstate)	62,025	74,416	65,138	5249	4989	Major road (Arterial)	10,612	16,840	12,659
3702	4957	Freeway (Interstate)	52,954	64,597	58,071	5250	4989	Major road (Arterial)	24,142	17,352	11,942
4375	16013	Freeway (Interstate)	35,860	35,984	30,998	5250	16012	Major road (Arterial)	22,411	16,212	17,205
4956	3701	Freeway (Interstate)	52,954	74,416	65,138	5259	5005	Major road (Arterial)	5,229	3,177	3,192
4957	16014	Freeway (Interstate)	34,052	32,599	29,050	5331	4407	Major road (Arterial)	5,477	4,863	5,089
16013	4956	Freeway (Interstate)	34,052	33,040	28,385	6063	4405	Major road (Arterial)	7,501	9,561	9,043
16014	4376	Freeway (Interstate)	35,860	32,599	29,050	6087	6679	Major road (Arterial)	5,141	6,684	7,582
4405	4948	Major road (Arterial)	4,775	8,320	8,269	6679	6087	Major road (Arterial)	4,136	6,779	6,470
4405	6063	Major road (Arterial)	8,473	12,937	11,527	8326	4961	Major road (Arterial)	18,253	17,182	15,665
4407	5331	Major road (Arterial)	5,477	6,807	5,867	16012	4953	Major road (Arterial)	24,254	26,422	22,528
4926	4950	Major road (Arterial)	14,850	10,051	10,581	16012	5250	Major road (Arterial)	24,360	11,188	10,654
4948	4405	Major road (Arterial)	4,775	11,818	11,871	4404	6628	Minor road (Collector)	2,513	4,547	4,682
4948	4961	Major road (Arterial)	5,538	4,626	4,474	4404	8046	Minor road (Collector)	7,800	12,318	12,266
4950	4926	Major road (Arterial)	14,850	8,521	8,757	4404	8327	Minor road (Collector)	8,895	13,542	12,884
4952	4961	Major road (Arterial)	23,400	24,531	23,935	5005	8053	Minor road (Collector)	8,313	4,255	3,504
4953	16012	Major road (Arterial)	24,254	19,149	14,764	5078	6062	Minor road (Collector)	3,757	3,398	2,600
4961	4948	Major road (Arterial)	5,538	9,073	9,027	6062	5078	Minor road (Collector)	5,007	7,843	5,316
4961	4952	Major road (Arterial)	23,400	18,137	17,511	6628	4404	Minor road (Collector)	2,513	3,735	4,212
4961	8326	Major road (Arterial)	18,253	19,128	17,536	8046	4404	Minor road (Collector)	7,800	12,123	11,738
4989	5249	Major road (Arterial)	10,612	14,110	9,083	8053	5005	Minor road (Collector)	6,713	6,959	7,204
4989	5250	Major road (Arterial)	22,411	25,853	20,005	8327	4404	Minor road (Collector)	8,895	14,549	13,883

Table E.3b: Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3872	3870	Freeway (Interstate)	49,680	57,402	49,913	4965	6225	Minor road (Collector)	6,515	4,425	3,615
3638	3636	Freeway (Interstate)	60,734	54,359	44,884	4966	6271	Minor road (Collector)	4,266	2,824	1,747
3868	3638	Freeway (Interstate)	60,180	69,292	59,532	4970	6222	Minor road (Collector)	3,485	4,452	3,900
3871	3873	Freeway (Interstate)	49,680	48,947	44,276	4970	6223	Minor road (Collector)	5,560	3,620	2,996
3859	3861	Freeway (Interstate)	48,760	48,014	45,532	4975	6217	Minor road (Collector)	6,609	2,453	2,299
3860	3858	Freeway (Interstate)	48,760	54,414	51,453	4995	6219	Minor road (Collector)	5,318	2,065	1,887
3633	3635	Freeway (Interstate)	58,995	70,806	59,353	5026	6216	Minor road (Collector)	6,369	7,074	5,781
3635	3637	Freeway (Interstate)	60,734	57,353	47,947	5187	6219	Minor road (Collector)	2,893	2,174	2,282
3636	3634	Freeway (Interstate)	58,995	64,643	54,050	5188	6231	Minor road (Collector)	5,228	3,165	2,846
3637	3869	Freeway (Interstate)	60,180	70,144	61,066	5189	4965	Minor road (Collector)	6,572	4,425	3,615
4699	7086	Major road (Arterial)	20,190	27,017	25,312	5189	6223	Minor road (Collector)	4,372	5,667	5,181
4699	7136	Major road (Arterial)	15,475	23,960	23,023	5423	7108	Minor road (Collector)	5,071	2,515	2,222
4750	6278	Major road (Arterial)	12,403	10,320	9,126	5423	7139	Minor road (Collector)	11,167	12,784	11,041
6271	4967	Major road (Arterial)	12,182	14,954	12,730	5457	6270	Minor road (Collector)	5,472	5,441	5,325
6271	4969	Major road (Arterial)	9,133	9,853	9,189	5457	6271	Minor road (Collector)	6,420	7,056	6,625
6272	6282	Major road (Arterial)	20,774	18,813	18,260	6214	6217	Minor road (Collector)	6,986	2,596	2,938
6278	4750	Major road (Arterial)	12,403	6,200	5,710	6214	8395	Minor road (Collector)	8,901	4,284	4,247
6279	4751	Major road (Arterial)	8,230	7,882	7,813	6215	5026	Minor road (Collector)	4,845	4,603	4,418
6281	6282	Major road (Arterial)	12,341	17,033	17,221	6215	8394	Minor road (Collector)	5,352	4,271	4,531
6282	6272	Major road (Arterial)	22,587	22,716	21,040	6216	5026	Minor road (Collector)	5,510	6,658	5,815
6282	6281	Major road (Arterial)	12,341	13,792	12,728	6217	4975	Minor road (Collector)	6,609	1,648	1,792
6353	8389	Major road (Arterial)	14,057	19,555	18,175	6217	6214	Minor road (Collector)	6,986	3,383	3,229
6241	6242	Major road (Arterial)	7,322	15,727	12,690	6219	4995	Minor road (Collector)	5,773	2,810	2,469
4750	4968	Major road (Arterial)	10,909	7,269	6,687	6219	5187	Minor road (Collector)	2,966	1,656	1,639
4751	6279	Major road (Arterial)	8,230	12,735	11,518	6219	6220	Minor road (Collector)	4,892	3,452	3,766
4943	7135	Major road (Arterial)	13,590	17,043	16,707	6220	6219	Minor road (Collector)	5,420	3,679	3,706
4945	7112	Major road (Arterial)	6,635	6,582	7,446	6220	8401	Minor road (Collector)	4,546	2,469	2,602

Table E.3b (continued): Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
4967	6271	Major road (Arterial)	12,182	16,223	14,561	6221	8401	Minor road (Collector)	3,864	2,727	2,511
4968	4750	Major road (Arterial)	10,909	11,154	9,796	6222	6221	Minor road (Collector)	3,845	4,951	4,651
4968	6225	Major road (Arterial)	9,833	10,719	9,148	6222	7108	Minor road (Collector)	3,350	5,173	5,056
4969	6231	Major road (Arterial)	8,106	8,435	7,206	6223	4970	Minor road (Collector)	5,560	5,667	5,181
4969	6271	Major road (Arterial)	9,133	9,256	8,152	6223	5189	Minor road (Collector)	4,372	3,347	2,996
5023	6262	Major road (Arterial)	11,753	20,420	17,094	6225	4965	Minor road (Collector)	6,515	6,531	5,704
6225	4968	Major road (Arterial)	9,833	14,379	12,029	6229	6230	Minor road (Collector)	5,751	3,927	3,221
6225	8399	Major road (Arterial)	14,526	17,458	16,474	6230	6229	Minor road (Collector)	5,751	4,360	3,938
6226	7083	Major road (Arterial)	20,690	21,091	20,486	6231	5188	Minor road (Collector)	5,228	3,668	3,564
6227	6231	Major road (Arterial)	11,993	15,875	14,031	6238	6270	Minor road (Collector)	3,396	2,060	1,892
6227	8399	Major road (Arterial)	12,201	15,112	12,529	6240	6241	Minor road (Collector)	3,661	7,652	6,138
6231	4969	Major road (Arterial)	8,106	7,982	6,326	6241	6240	Minor road (Collector)	3,661	5,968	4,918
6231	6227	Major road (Arterial)	11,993	11,676	9,436	6262	6264	Minor road (Collector)	4,961	7,129	5,382
6232	6235	Major road (Arterial)	10,161	14,586	12,771	6264	6262	Minor road (Collector)	4,961	8,293	6,046
6235	6232	Major road (Arterial)	10,161	9,671	7,650	6267	6268	Minor road (Collector)	3,487	5,669	6,629
6235	6236	Major road (Arterial)	8,354	15,135	13,380	6268	6267	Minor road (Collector)	3,427	4,572	5,727
6236	6235	Major road (Arterial)	8,354	10,075	8,252	6269	6270	Minor road (Collector)	6,090	4,911	5,455
6242	6241	Major road (Arterial)	7,322	9,853	8,120	6269	8390	Minor road (Collector)	4,838	6,250	5,141
6242	6244	Major road (Arterial)	8,755	15,727	12,690	6269	8391	Minor road (Collector)	3,980	3,643	4,545
6244	6242	Major road (Arterial)	8,755	9,853	8,120	6270	5457	Minor road (Collector)	5,472	5,188	4,948
6244	6263	Major road (Arterial)	12,727	16,767	13,893	6271	4966	Minor road (Collector)	4,266	2,575	1,813
6252	8389	Major road (Arterial)	16,767	16,919	15,772	6221	6222	Minor road (Collector)	4,568	4,030	4,234
6252	8603	Major road (Arterial)	16,563	23,669	21,683	5026	6215	Minor road (Collector)	4,845	4,038	4,295
6262	5023	Major road (Arterial)	11,753	14,540	12,474	7108	5423	Minor road (Collector)	5,071	4,939	4,301
6263	6244	Major road (Arterial)	12,727	11,176	9,259	7108	6222	Minor road (Collector)	4,089	4,045	3,336
7083	7139	Major road (Arterial)	18,958	15,559	14,841	7108	7109	Minor road (Collector)	4,499	3,530	3,700
7086	4699	Major road (Arterial)	20,190	26,651	25,713	7109	7108	Minor road (Collector)	4,499	4,255	3,658
7086	7087	Major road (Arterial)	21,424	26,334	23,878	7139	5423	Minor road (Collector)	11,167	10,475	8,997

Table E.3b (continued): Link Flows – Hilliard-Rome Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
7087	7086	Major road (Arterial)	21,424	20,291	16,367	7139	7140	Minor road (Collector)	6,495	6,455	4,769
7112	4945	Major road (Arterial)	6,635	7,408	7,724	7140	4168	Minor road (Collector)	5,168	6,310	5,030
7133	7134	Major road (Arterial)	13,115	11,998	12,199	7140	7139	Minor road (Collector)	6,495	4,890	3,786
7133	7137	Major road (Arterial)	5,916	8,606	7,629	7141	4168	Minor road (Collector)	6,002	7,426	5,958
7133	8491	Major road (Arterial)	9,362	7,427	7,789	8390	6269	Minor road (Collector)	4,838	4,553	4,026
7134	7133	Major road (Arterial)	13,115	12,000	12,545	8391	6269	Minor road (Collector)	3,980	5,151	5,696
7135	4943	Major road (Arterial)	13,590	16,524	15,762	8394	6215	Minor road (Collector)	5,352	5,291	5,037
7136	4699	Major road (Arterial)	15,475	24,430	22,619	8394	8395	Minor road (Collector)	5,444	3,493	3,942
7137	7133	Major road (Arterial)	5,916	7,213	6,577	8395	6214	Minor road (Collector)	8,901	3,347	3,868
7137	7138	Major road (Arterial)	7,570	9,101	8,356	8395	8394	Minor road (Collector)	5,444	4,402	4,310
7138	7137	Major road (Arterial)	7,570	7,359	7,061	8400	4750	Minor road (Collector)	2,891	2,191	2,029
7139	7083	Major road (Arterial)	18,958	18,368	17,717	8401	6220	Minor road (Collector)	4,529	2,629	2,486
7139	7501	Major road (Arterial)	9,240	8,267	7,694	8401	6221	Minor road (Collector)	3,638	2,771	2,723
7501	7139	Major road (Arterial)	9,240	10,332	9,508	4971	6223	Local road	1,356	0	0
8389	6252	Major road (Arterial)	16,767	25,117	21,853	4971	6228	Local road	2,078	273	0
8389	6353	Major road (Arterial)	14,057	11,846	12,597	4976	6229	Local road	1,838	293	261
8399	6225	Major road (Arterial)	14,814	12,223	11,810	6223	4971	Local road	1,356	273	0
8399	6227	Major road (Arterial)	12,201	19,371	17,184	6228	4971	Local road	2,078	0	0
8491	7133	Major road (Arterial)	9,362	7,735	8,296	6228	6230	Local road	2,489	0	0
8603	6252	Major road (Arterial)	16,587	16,400	15,677	6229	4976	Local road	1,946	331	232
6222	4970	Minor road (Collector)	2,864	2,404	1,763	6230	6228	Local road	2,489	0	0
4168	7140	Minor road (Collector)	5,168	5,504	4,581	6234	6235	Local road	345	918	766
4168	7141	Minor road (Collector)	6,002	7,935	6,397	6234	8398	Local road	1,963	774	758
6270	6238	Minor road (Collector)	3,396	2,122	2,304	6235	6234	Local road	345	774	758
6270	6269	Minor road (Collector)	6,090	5,101	5,420	6244	6245	Local road	1,480	3,321	2,192
6271	5457	Minor road (Collector)	6,420	7,978	7,352	6245	6244	Local road	1,480	3,037	2,255
4750	8400	Minor road (Collector)	3,714	1,956	1,722	8398	6234	Local road	1,963	918	766
4965	5189	Minor road (Collector)	6,572	6,531	5,704	-	-	-	-	-	-

Table E.3c: Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3806	4338	Freeway (Interstate)	50,845	61,558	69,604	3155	3159	Major road (Arterial)	6,358	8,557	11,873
3897	3899	Freeway (Interstate)	36,675	36,795	35,574	3159	3155	Major road (Arterial)	6,358	8,735	12,410
3732	3730	Freeway (Interstate)	74,275	68,732	79,027	3168	3184	Major road (Arterial)	12,187	10,150	16,715
3918	3920	Freeway (Interstate)	59,570	49,637	58,921	3184	3168	Major road (Arterial)	12,052	12,977	18,404
3729	3731	Freeway (Interstate)	74,275	75,815	86,081	3184	3185	Major road (Arterial)	17,163	6,441	12,756
3733	3735	Freeway (Interstate)	77,995	85,549	98,921	3185	3184	Major road (Arterial)	17,163	8,945	14,358
3810	3812	Freeway (Interstate)	66,960	81,129	92,008	6637	6625	Major road (Arterial)	6,628	3,725	5,807
3811	3809	Freeway (Interstate)	66,960	69,740	82,000	6638	6793	Major road (Arterial)	3,820	1,309	2,167
3937	3939	Freeway (Interstate)	68,360	72,828	76,307	6642	6616	Major road (Arterial)	9,941	6,201	10,317
3970	3639	Freeway (Interstate)	62,415	66,737	66,919	3185	3186	Major road (Arterial)	15,354	4,711	9,671
4338	3902	Freeway (Interstate)	43,265	45,532	52,107	3185	3188	Major road (Arterial)	4,270	3,198	5,550
4593	4591	Freeway (Interstate)	55,831	58,225	59,273	3186	3153	Major road (Arterial)	3,575	915	2,385
3943	3971	Freeway (Interstate)	62,415	71,575	73,233	3186	3185	Major road (Arterial)	15,354	7,333	12,488
4335	3903	Freeway (Interstate)	38,755	37,264	40,279	3186	3187	Major road (Arterial)	10,543	4,208	8,111
4586	4584	Freeway (Interstate)	54,735	55,870	57,780	3187	3186	Major road (Arterial)	10,543	5,596	8,472
4590	4592	Freeway (Interstate)	55,831	57,116	57,033	3188	3185	Major road (Arterial)	4,270	3,080	4,335
4653	9801	Freeway (Interstate)	43,175	64,165	66,191	3188	3199	Major road (Arterial)	2,963	1,398	2,945
3762	3764	Freeway (Interstate)	58,930	68,570	75,834	3189	3197	Major road (Arterial)	3,980	2,222	2,815
3763	3761	Freeway (Interstate)	58,930	58,041	62,287	3195	3197	Major road (Arterial)	12,867	7,259	9,526
3764	3766	Freeway (Interstate)	50,385	56,459	61,474	3196	3198	Major road (Arterial)	11,886	6,035	7,148
3765	3763	Freeway (Interstate)	50,385	47,930	50,259	3197	3189	Major road (Arterial)	3,980	2,658	3,993
3773	3896	Freeway (Interstate)	36,510	49,617	49,746	3197	3195	Major road (Arterial)	12,867	8,912	10,730
3898	3896	Freeway (Interstate)	36,675	38,579	36,180	3197	3198	Major road (Arterial)	14,640	8,086	9,842
3902	3900	Freeway (Interstate)	38,755	38,173	40,008	3198	3024	Major road (Arterial)	16,958	11,563	12,769
3903	3905	Freeway (Interstate)	43,265	49,289	56,261	3198	3196	Major road (Arterial)	5,675	5,373	5,899
3905	3807	Freeway (Interstate)	50,845	61,466	70,963	6812	6802	Major road (Arterial)	3,714	4,759	6,729
3921	3919	Freeway (Interstate)	59,570	49,805	60,120	6829	4870	Major road (Arterial)	2,709	2,980	3,688

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3926	3928	Freeway (Interstate)	72,015	67,839	77,178	6812	6811	Major road (Arterial)	4,346	5,304	6,032
3929	3927	Freeway (Interstate)	72,015	69,126	81,727	6825	6827	Major road (Arterial)	7,370	6,099	8,724
3935	3937	Freeway (Interstate)	68,765	82,178	89,641	6827	4870	Major road (Arterial)	3,290	4,189	6,008
3936	3934	Freeway (Interstate)	68,765	74,498	80,840	6827	6825	Major road (Arterial)	7,495	6,275	8,310
3938	3936	Freeway (Interstate)	68,360	68,555	72,723	6827	6828	Major road (Arterial)	5,624	4,671	7,201
3939	4652	Freeway (Interstate)	68,360	79,008	84,094	6828	6827	Major road (Arterial)	5,624	4,789	6,808
3940	3938	Freeway (Interstate)	68,360	76,948	83,688	6828	6913	Major road (Arterial)	5,200	4,676	7,194
3736	3734	Freeway (Interstate)	77,995	77,877	92,130	6829	6910	Major road (Arterial)	2,139	1,737	2,344
4579	4581	Freeway (Interstate)	56,605	59,489	64,060	6910	6829	Major road (Arterial)	2,139	1,649	1,732
4580	4578	Freeway (Interstate)	56,605	55,195	58,283	6912	6916	Major road (Arterial)	4,114	2,686	4,103
4585	4587	Freeway (Interstate)	54,735	58,931	61,835	6913	6828	Major road (Arterial)	5,200	4,782	6,812
4760	4762	Freeway (Interstate)	37,925	45,773	49,525	6913	6915	Major road (Arterial)	5,056	4,652	7,026
4761	4759	Freeway (Interstate)	37,925	39,929	42,137	6915	6913	Major road (Arterial)	5,056	4,842	6,879
3897	4105	Freeway (Interstate)	36,510	57,367	57,439	6916	6912	Major road (Arterial)	4,114	3,286	5,393
9800	4654	Freeway (Interstate)	43,175	57,424	60,203	6916	6921	Major road (Arterial)	5,958	7,380	10,991
3802	3800	Expressway	32,457	55,141	59,024	6917	4601	Major road (Arterial)	10,858	9,601	13,071
3656	3658	Expressway	58,035	65,042	66,500	6921	6916	Major road (Arterial)	4,401	6,769	10,175
3657	3655	Expressway	58,035	60,119	58,339	6922	3134	Major road (Arterial)	5,630	6,613	10,385
3770	4766	Expressway	54,100	41,058	43,243	6927	6535	Major road (Arterial)	3,549	7,528	7,589
3797	3799	Expressway	35,740	47,840	54,836	6927	8447	Major road (Arterial)	4,892	12,985	14,449
3798	3796	Expressway	35,740	58,592	63,812	7023	7279	Major road (Arterial)	4,284	10,377	12,242
4765	3771	Expressway	54,100	55,387	58,654	7025	7023	Major road (Arterial)	7,032	15,073	16,321
4805	7328	Expressway	44,140	44,183	46,259	7025	7355	Major road (Arterial)	14,579	20,339	19,886
3801	3803	Expressway	32,457	58,046	62,813	7171	3578	Major road (Arterial)	16,068	17,050	19,742
7327	4804	Expressway	44,140	51,728	55,153	7177	6541	Major road (Arterial)	5,716	5,843	6,511
4691	3768	Freeway ramp	24,772	20,520	21,667	7177	6542	Major road (Arterial)	6,195	5,224	5,644
4272	3771	Freeway ramp	25,620	20,121	22,208	7279	7023	Major road (Arterial)	4,408	8,171	9,265
3727	6671	Non-Freeway off ramp	4,649	3,701	4,329	7305	8441	Major road (Arterial)	694	1,845	2,758

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
4766	5610	Non-Freeway off ramp	7,480	2,290	2,033	7329	7330	Major road (Arterial)	6,327	5,372	7,469
6636	6794	Major road (Arterial)	8,645	5,901	5,737	7330	7329	Major road (Arterial)	6,327	4,529	7,081
6647	6654	Major road (Arterial)	7,770	4,954	7,829	7330	7440	Major road (Arterial)	10,462	5,148	6,660
4310	3788	Major road (Arterial)	14,809	18,811	20,905	7330	7442	Major road (Arterial)	5,458	7,540	11,686
4310	7438	Major road (Arterial)	8,983	14,859	15,843	7339	7340	Major road (Arterial)	7,569	7,148	8,933
4600	4601	Major road (Arterial)	13,346	9,845	12,432	7339	7440	Major road (Arterial)	7,975	6,688	8,341
4179	7350	Major road (Arterial)	12,373	10,074	10,414	7340	7339	Major road (Arterial)	7,569	7,444	8,609
4179	7443	Major road (Arterial)	13,855	15,594	17,698	7340	7341	Major road (Arterial)	2,907	555	746
4227	4814	Major road (Arterial)	6,579	7,778	8,591	7341	7340	Major road (Arterial)	2,907	2,105	1,979
4601	4600	Major road (Arterial)	13,346	8,882	12,899	7341	7342	Major road (Arterial)	1,630	3,216	3,449
4601	6917	Major road (Arterial)	12,000	12,379	17,406	7342	3580	Major road (Arterial)	2,920	3,025	3,288
4655	2674	Major road (Arterial)	4,354	4,799	4,866	7342	7341	Major road (Arterial)	2,091	2,704	2,740
4655	4656	Major road (Arterial)	27,276	22,783	24,575	7350	4179	Major road (Arterial)	12,373	15,059	16,809
4656	2700	Major road (Arterial)	11,130	7,988	9,213	7350	7352	Major road (Arterial)	6,898	5,450	6,627
4664	4665	Major road (Arterial)	18,000	26,143	28,924	7350	7366	Major road (Arterial)	11,801	7,000	7,249
4708	3024	Major road (Arterial)	15,150	13,125	14,240	7352	7350	Major road (Arterial)	6,898	6,990	7,577
4748	4749	Major road (Arterial)	4,510	1,199	1,483	7353	7354	Major road (Arterial)	6,208	6,548	7,346
4749	4748	Major road (Arterial)	4,510	1,670	1,590	7354	7353	Major road (Arterial)	6,208	6,262	6,757
4749	8575	Major road (Arterial)	4,033	636	843	7355	7025	Major road (Arterial)	14,579	19,854	19,666
3779	6117	Major road (Arterial)	12,651	18,201	19,998	7356	7357	Major road (Arterial)	6,647	1,029	916
3788	4310	Major road (Arterial)	14,809	12,882	14,473	7357	7356	Major road (Arterial)	8,175	1,221	1,174
6290	7460	Major road (Arterial)	15,653	12,047	13,776	7357	7358	Major road (Arterial)	15,016	5,118	4,510
6407	6520	Major road (Arterial)	12,348	4,873	7,157	7358	7357	Major road (Arterial)	15,016	4,540	4,182
6407	6521	Major road (Arterial)	9,660	5,663	8,256	7366	7350	Major road (Arterial)	11,801	9,443	11,412
6501	4811	Major road (Arterial)	9,379	9,173	10,448	7367	7493	Major road (Arterial)	11,183	7,123	7,628
6501	6506	Major road (Arterial)	14,063	9,438	12,774	7367	8574	Major road (Arterial)	9,871	11,925	13,889
6506	6501	Major road (Arterial)	13,884	8,838	12,624	7369	7370	Major road (Arterial)	11,020	7,458	8,003
6506	8430	Major road (Arterial)	6,612	9,304	12,483	7370	7369	Major road (Arterial)	11,020	11,322	13,400

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6510	6520	Major road (Arterial)	12,345	6,776	9,714	7370	7371	Major road (Arterial)	11,448	3,826	4,779
6520	6407	Major road (Arterial)	9,637	8,086	9,939	7371	7370	Major road (Arterial)	11,448	9,168	11,876
6625	6637	Major road (Arterial)	6,628	1,216	2,095	7371	7372	Major road (Arterial)	13,588	3,998	5,215
6650	6654	Major road (Arterial)	7,709	12,807	15,115	7372	7371	Major road (Arterial)	13,588	10,015	12,632
6651	6528	Major road (Arterial)	8,336	5,765	6,757	7372	7434	Major road (Arterial)	8,425	5,512	5,528
6652	6650	Major road (Arterial)	15,706	6,324	9,203	7375	7376	Major road (Arterial)	1,875	3,823	4,330
6652	8445	Major road (Arterial)	8,490	6,728	7,952	7376	2888	Major road (Arterial)	3,184	3,812	4,245
6653	6652	Major road (Arterial)	6,001	6,338	7,644	7376	7375	Major road (Arterial)	1,875	4,585	5,694
6654	6653	Major road (Arterial)	10,603	7,280	10,637	7377	7378	Major road (Arterial)	3,661	3,410	4,756
6654	6655	Major road (Arterial)	9,479	10,481	12,307	7378	2567	Major road (Arterial)	3,460	3,718	4,866
6655	6653	Major road (Arterial)	9,479	9,239	11,805	7378	7377	Major road (Arterial)	3,661	6,841	8,277
6655	6656	Major road (Arterial)	7,689	10,725	12,611	7399	3579	Major road (Arterial)	12,204	5,286	4,359
6656	6655	Major road (Arterial)	7,689	9,816	11,711	7408	7407	Major road (Arterial)	6,143	1,878	2,901
6793	6638	Major road (Arterial)	3,820	3,091	5,251	7409	7408	Major road (Arterial)	3,180	1,885	2,904
6794	6636	Major road (Arterial)	8,645	8,428	9,197	7410	7409	Major road (Arterial)	6,261	4,729	5,964
6794	8433	Major road (Arterial)	7,240	6,088	6,362	7415	2571	Major road (Arterial)	12,814	14,463	15,841
4811	4816	Major road (Arterial)	6,405	7,840	7,221	7418	7417	Major road (Arterial)	12,814	11,580	12,188
4811	6501	Major road (Arterial)	9,379	5,549	6,067	7419	7492	Major road (Arterial)	3,180	2,223	2,400
4814	4227	Major road (Arterial)	6,489	8,420	10,321	7425	7426	Major road (Arterial)	20,215	8,207	8,591
4816	4811	Major road (Arterial)	6,405	10,030	9,142	7425	7488	Major road (Arterial)	10,564	10,872	11,060
4870	6827	Major road (Arterial)	3,290	3,583	4,581	7426	7425	Major road (Arterial)	20,215	9,943	10,631
4870	6829	Major road (Arterial)	2,709	3,138	4,660	7428	7429	Major road (Arterial)	7,955	5,122	5,846
4873	2850	Major road (Arterial)	14,310	11,762	16,587	7429	7428	Major road (Arterial)	7,955	8,487	9,152
4873	3199	Major road (Arterial)	14,310	9,297	12,561	7429	7433	Major road (Arterial)	11,763	5,337	5,844
6544	6542	Major road (Arterial)	5,633	5,636	6,449	7433	7429	Major road (Arterial)	11,763	9,529	9,950
6544	6543	Major road (Arterial)	4,541	6,354	7,117	7433	7434	Major road (Arterial)	13,106	5,337	5,844
6544	6545	Major road (Arterial)	5,935	4,615	5,247	7434	7372	Major road (Arterial)	8,425	13,911	13,315
6544	6564	Major road (Arterial)	8,018	7,706	8,261	7434	7433	Major road (Arterial)	13,106	9,529	9,950

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6545	6544	Major road (Arterial)	5,935	4,412	5,816	7435	7471	Major road (Arterial)	12,260	14,214	15,133
6545	6550	Major road (Arterial)	4,788	6,211	7,140	7438	4310	Major road (Arterial)	8,795	12,709	14,379
6548	6532	Major road (Arterial)	8,029	9,702	13,984	7440	7330	Major road (Arterial)	11,070	11,304	17,243
6548	6557	Major road (Arterial)	7,027	8,852	11,712	7440	7339	Major road (Arterial)	7,975	7,892	9,857
6550	6545	Major road (Arterial)	5,390	5,426	7,209	7442	7330	Major road (Arterial)	5,458	1,947	1,949
6550	6557	Major road (Arterial)	8,755	5,828	6,719	7443	4179	Major road (Arterial)	13,855	10,686	11,302
6557	6548	Major road (Arterial)	8,543	9,206	13,365	7444	7443	Major road (Arterial)	16,083	12,721	12,567
6557	6550	Major road (Arterial)	8,755	6,570	8,255	7447	2544	Major road (Arterial)	5,396	11,455	10,040
6557	6561	Major road (Arterial)	7,029	11,530	13,818	7449	5610	Major road (Arterial)	8,358	8,574	8,680
6800	6812	Major road (Arterial)	2,601	3,532	3,764	7452	7453	Major road (Arterial)	5,250	10,869	11,997
2503	2504	Major road (Arterial)	17,650	13,159	14,004	7453	7452	Major road (Arterial)	5,250	9,472	10,570
2504	2505	Major road (Arterial)	14,440	19,699	18,716	7460	6587	Major road (Arterial)	9,367	9,638	10,155
2505	2506	Major road (Arterial)	8,687	11,165	9,892	7460	7459	Major road (Arterial)	7,610	8,562	8,913
2505	2512	Major road (Arterial)	29,498	19,547	19,048	7463	2691	Major road (Arterial)	3,231	4,946	5,792
2506	2505	Major road (Arterial)	8,687	11,012	10,224	7463	6591	Major road (Arterial)	4,298	2,506	2,830
2506	2507	Major road (Arterial)	6,118	9,799	8,779	7463	7464	Major road (Arterial)	3,180	2,033	2,338
2507	2506	Major road (Arterial)	6,118	9,248	8,556	7464	2687	Major road (Arterial)	3,243	2,034	2,416
2508	2863	Major road (Arterial)	8,649	8,623	8,464	7464	7463	Major road (Arterial)	3,243	5,074	6,163
2514	2515	Major road (Arterial)	3,748	6,812	6,245	7465	7464	Major road (Arterial)	4,064	2,795	3,072
2515	2516	Major road (Arterial)	6,670	6,566	5,988	7467	7468	Major road (Arterial)	13,902	5,219	4,502
2516	2502	Major road (Arterial)	12,409	14,929	14,776	7468	7467	Major road (Arterial)	13,902	9,662	10,043
2516	2518	Major road (Arterial)	14,871	11,469	11,450	7468	7469	Major road (Arterial)	14,114	6,205	6,424
2518	2516	Major road (Arterial)	14,871	9,664	9,837	7469	7468	Major road (Arterial)	14,114	2,978	3,905
2519	2514	Major road (Arterial)	23,501	31,665	33,222	7469	7470	Major road (Arterial)	13,424	5,213	5,112
2521	2531	Major road (Arterial)	15,700	21,217	19,798	7470	7436	Major road (Arterial)	8,530	12,535	13,954
2530	2523	Major road (Arterial)	20,320	27,911	27,963	7470	7469	Major road (Arterial)	13,424	1,749	2,494
2531	2533	Major road (Arterial)	19,585	20,730	19,279	7473	7472	Major road (Arterial)	11,330	13,417	15,682
2534	2533	Major road (Arterial)	7,780	9,234	9,644	7473	7476	Major road (Arterial)	14,429	11,931	9,340

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2536	2535	Major road (Arterial)	9,400	12,483	13,093	7476	7478	Major road (Arterial)	19,160	14,576	13,262
2542	2535	Major road (Arterial)	25,203	24,278	24,150	7484	7488	Major road (Arterial)	17,496	14,114	13,263
2545	2557	Major road (Arterial)	21,967	19,516	19,180	7488	2615	Major road (Arterial)	15,652	14,556	14,747
2546	2547	Major road (Arterial)	5,519	15,779	13,732	7488	7425	Major road (Arterial)	9,724	9,505	9,314
2559	2580	Major road (Arterial)	16,280	19,360	19,004	7488	7491	Major road (Arterial)	5,845	7,549	6,429
2561	2556	Major road (Arterial)	23,737	24,313	23,910	7489	7497	Major road (Arterial)	11,765	6,164	5,784
2567	7378	Major road (Arterial)	3,460	6,578	8,182	7489	8572	Major road (Arterial)	6,626	5,202	4,746
2571	7414	Major road (Arterial)	5,370	14,463	15,841	7491	7492	Major road (Arterial)	16,613	7,886	6,797
2579	2561	Major road (Arterial)	19,950	24,258	23,981	7492	7419	Major road (Arterial)	5,010	9,597	9,525
2593	2615	Major road (Arterial)	11,421	18,100	17,537	7492	7495	Major road (Arterial)	9,339	9,113	8,134
2594	2605	Major road (Arterial)	6,178	7,868	7,399	7493	7367	Major road (Arterial)	11,183	10,962	13,059
2597	2600	Major road (Arterial)	25,892	20,871	19,736	7496	7489	Major road (Arterial)	8,745	0	0
2598	2751	Major road (Arterial)	10,270	8,709	7,291	7497	2539	Major road (Arterial)	3,420	7,100	5,946
2599	2600	Major road (Arterial)	12,010	10,879	10,508	7504	7489	Major road (Arterial)	9,657	11,366	10,530
2600	2599	Major road (Arterial)	12,010	10,711	8,817	8430	6506	Major road (Arterial)	6,612	13,776	17,269
2600	2601	Major road (Arterial)	8,200	11,604	9,892	8433	6794	Major road (Arterial)	7,240	7,728	8,344
2600	2620	Major road (Arterial)	16,610	26,475	27,183	8437	6586	Major road (Arterial)	2,441	3,270	3,172
2601	2600	Major road (Arterial)	8,200	17,041	15,647	8441	7305	Major road (Arterial)	1,232	2,140	2,947
2602	2603	Major road (Arterial)	15,620	11,665	9,078	8443	6586	Major road (Arterial)	1,544	2,033	2,235
2603	2602	Major road (Arterial)	15,620	20,888	17,729	8447	6525	Major road (Arterial)	5,285	15,514	16,370
2605	2594	Major road (Arterial)	7,926	10,737	10,084	8447	6927	Major road (Arterial)	4,892	11,067	11,864
2614	2615	Major road (Arterial)	14,319	8,200	6,874	8574	7367	Major road (Arterial)	9,568	7,241	7,755
2615	2614	Major road (Arterial)	14,319	14,057	14,269	8575	4749	Major road (Arterial)	4,033	1,925	1,958
2615	7488	Major road (Arterial)	15,652	6,624	6,167	12014	3048	Major road (Arterial)	5,483	5,483	7,487
2619	2602	Major road (Arterial)	18,970	23,436	24,423	3223	3387	Minor road (Collector)	7,482	5,977	8,775
2631	6117	Major road (Arterial)	7,160	7,061	6,808	4071	7336	Minor road (Collector)	2,976	1,064	1,639
2641	2624	Major road (Arterial)	24,257	28,888	28,126	4176	7384	Minor road (Collector)	3,343	1,372	1,123
2642	2644	Major road (Arterial)	26,319	25,018	27,895	3224	3222	Minor road (Collector)	12,903	8,265	11,328

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2643	2734	Major road (Arterial)	8,360	14,329	17,038	3365	3028	Minor road (Collector)	5,518	7,918	9,741
2644	2643	Major road (Arterial)	18,618	14,759	17,419	3365	3389	Minor road (Collector)	3,608	1,904	1,950
2644	2656	Major road (Arterial)	18,930	24,061	25,082	3387	3061	Minor road (Collector)	7,446	6,616	9,400
2645	2644	Major road (Arterial)	19,688	13,802	14,606	3388	3033	Minor road (Collector)	11,135	6,882	8,217
2646	2641	Major road (Arterial)	24,287	29,731	29,155	4810	4813	Minor road (Collector)	7,903	12,179	10,918
2646	2645	Major road (Arterial)	11,933	10,803	12,323	4813	4810	Minor road (Collector)	6,465	6,815	5,257
2648	2647	Major road (Arterial)	11,765	15,922	16,102	2544	7403	Minor road (Collector)	874	461	404
2649	2653	Major road (Arterial)	9,300	11,424	10,020	2583	2584	Minor road (Collector)	3,243	5,914	4,404
2652	2662	Major road (Arterial)	16,770	18,738	18,103	2584	2583	Minor road (Collector)	2,754	7,664	5,013
2653	2649	Major road (Arterial)	9,300	11,620	11,257	2639	3128	Minor road (Collector)	2,043	1,146	1,238
2654	2646	Major road (Arterial)	17,120	24,444	25,022	2673	7387	Minor road (Collector)	6,686	2,801	3,635
2655	2656	Major road (Arterial)	14,767	13,356	12,293	2750	2755	Minor road (Collector)	5,200	6,427	6,866
2656	2657	Major road (Arterial)	8,370	19,320	17,817	2752	7179	Minor road (Collector)	389	1,249	1,181
2656	2669	Major road (Arterial)	23,539	18,098	19,558	2755	2750	Minor road (Collector)	5,200	4,246	4,208
2658	4675	Major road (Arterial)	9,490	20,089	20,123	2755	2759	Minor road (Collector)	4,183	8,356	7,772
2667	2668	Major road (Arterial)	23,841	25,774	27,833	2759	2755	Minor road (Collector)	3,529	6,877	5,375
2671	2672	Major road (Arterial)	19,110	19,742	20,659	2800	2802	Minor road (Collector)	1,163	3,728	3,048
2672	2717	Major road (Arterial)	5,094	5,868	5,031	2802	2800	Minor road (Collector)	1,163	4,471	3,814
2675	2672	Major road (Arterial)	6,612	9,389	9,296	2851	7091	Minor road (Collector)	3,714	1,156	1,364
2687	7464	Major road (Arterial)	4,172	2,280	3,170	2888	7374	Minor road (Collector)	1,700	1,877	1,180
2690	2691	Major road (Arterial)	10,643	9,672	11,653	3015	3029	Minor road (Collector)	3,712	5,066	5,996
2691	2690	Major road (Arterial)	10,643	7,238	7,391	3025	3222	Minor road (Collector)	5,890	4,343	5,345
2691	2692	Major road (Arterial)	6,251	5,276	4,880	3029	3015	Minor road (Collector)	3,712	2,990	3,280
2691	6596	Major road (Arterial)	13,358	10,726	13,347	3029	3365	Minor road (Collector)	4,882	3,258	3,366
2691	7463	Major road (Arterial)	3,231	1,025	590	3033	3043	Minor road (Collector)	11,135	7,219	8,642
2692	2691	Major road (Arterial)	6,251	3,687	2,412	3035	3387	Minor road (Collector)	9,720	4,305	5,847
2700	2849	Major road (Arterial)	12,092	11,176	13,733	3052	3042	Minor road (Collector)	4,882	5,657	6,982
2702	2847	Major road (Arterial)	15,623	7,121	9,919	3057	3038	Minor road (Collector)	9,367	2,529	3,800

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2703	6599	Major road (Arterial)	11,157	7,931	10,059	3059	3060	Minor road (Collector)	2,282	1,395	1,744
2710	6600	Major road (Arterial)	4,380	1,362	1,735	3059	3157	Minor road (Collector)	2,187	1,256	2,715
2719	2729	Major road (Arterial)	7,085	6,394	6,883	3060	3059	Minor road (Collector)	1,237	1,256	2,717
2728	2729	Major road (Arterial)	15,668	8,970	9,840	3060	3062	Minor road (Collector)	2,048	1,730	2,538
2729	2719	Major road (Arterial)	7,085	3,669	5,420	3061	4874	Minor road (Collector)	2,218	673	1,282
2729	2730	Major road (Arterial)	14,446	13,487	14,345	3062	3060	Minor road (Collector)	2,048	528	1,267
2732	2655	Major road (Arterial)	6,230	12,979	11,916	3062	3063	Minor road (Collector)	2,122	2,042	2,952
2735	2736	Major road (Arterial)	14,009	15,655	19,255	3063	3062	Minor road (Collector)	2,122	1,564	2,283
2736	2729	Major road (Arterial)	4,570	5,865	7,106	3066	3067	Minor road (Collector)	2,967	2,096	3,116
2736	2737	Major road (Arterial)	16,586	12,269	13,962	3067	3066	Minor road (Collector)	2,967	1,271	2,044
2736	2748	Major road (Arterial)	6,420	4,755	5,086	3067	3068	Minor road (Collector)	3,071	2,735	3,477
2748	2736	Major road (Arterial)	6,420	3,161	2,835	3068	3067	Minor road (Collector)	3,071	1,615	2,370
2748	2749	Major road (Arterial)	4,217	4,342	4,559	3074	3067	Minor road (Collector)	14,463	7,961	9,585
2749	2748	Major road (Arterial)	4,217	3,945	3,560	3075	3077	Minor road (Collector)	12,695	8,654	10,628
2749	2758	Major road (Arterial)	6,313	4,473	4,715	3096	3100	Minor road (Collector)	6,657	8,967	12,202
2751	2598	Major road (Arterial)	10,270	10,308	10,419	3097	3076	Minor road (Collector)	14,567	8,492	10,473
2751	2755	Major road (Arterial)	15,620	8,380	7,466	3119	3137	Minor road (Collector)	2,282	1,637	4,088
2755	2751	Major road (Arterial)	15,620	10,320	10,744	3122	3123	Minor road (Collector)	1,380	5,881	7,188
2755	2758	Major road (Arterial)	14,444	7,189	6,776	3123	3122	Minor road (Collector)	1,380	700	1,020
2758	2749	Major road (Arterial)	6,313	3,840	3,456	3128	2639	Minor road (Collector)	2,043	2,199	2,652
2758	2755	Major road (Arterial)	14,444	8,426	9,793	3128	3129	Minor road (Collector)	1,719	1,193	1,315
2758	2760	Major road (Arterial)	13,709	11,415	11,267	3129	3128	Minor road (Collector)	1,719	2,305	2,772
2760	2758	Major road (Arterial)	13,709	12,020	13,026	3132	6804	Minor road (Collector)	4,195	4,333	5,201
2760	2763	Major road (Arterial)	11,138	11,677	11,595	3137	3119	Minor road (Collector)	2,282	2,437	4,070
2763	2760	Major road (Arterial)	11,138	12,624	13,479	3151	3152	Minor road (Collector)	1,855	83	371
2763	2768	Major road (Arterial)	12,571	13,491	14,096	3151	6923	Minor road (Collector)	3,434	808	1,567
2768	2763	Major road (Arterial)	12,571	13,711	15,294	3152	3151	Minor road (Collector)	1,698	128	513
2773	2779	Major road (Arterial)	30,138	16,261	22,498	3152	3187	Minor road (Collector)	2,378	83	372

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
2779	2773	Major road (Arterial)	14,537	11,166	13,941	6532	6533	Minor road (Collector)	4,773	6,907	8,514
2779	2782	Major road (Arterial)	16,209	10,411	15,329	6533	6532	Minor road (Collector)	4,773	9,655	11,388
2779	2783	Major road (Arterial)	10,780	7,303	9,633	6533	6534	Minor road (Collector)	5,242	6,661	7,993
2782	2779	Major road (Arterial)	16,209	7,612	9,135	6534	6533	Minor road (Collector)	5,285	9,447	10,861
2783	2779	Major road (Arterial)	10,780	5,007	7,271	6534	6535	Minor road (Collector)	5,335	6,663	7,684
2825	2834	Major road (Arterial)	5,425	4,173	5,753	6535	6534	Minor road (Collector)	5,335	8,389	9,737
2831	2832	Major road (Arterial)	6,473	8,123	10,796	6535	6536	Minor road (Collector)	6,737	7,690	8,031
2832	2831	Major road (Arterial)	6,473	5,368	6,534	6536	6535	Minor road (Collector)	7,536	8,654	9,955
2832	2844	Major road (Arterial)	3,535	6,975	5,666	6536	7175	Minor road (Collector)	8,013	8,702	8,801
2833	2834	Major road (Arterial)	13,505	9,480	12,364	6538	8449	Minor road (Collector)	8,430	10,931	10,071
2834	2825	Major road (Arterial)	5,425	3,146	4,066	6566	7179	Minor road (Collector)	5,030	3,775	5,373
2834	2833	Major road (Arterial)	13,505	8,981	10,289	6567	6568	Minor road (Collector)	6,298	1,485	2,237
2835	2851	Major road (Arterial)	10,940	5,915	7,918	6567	7179	Minor road (Collector)	3,757	2,645	3,160
2847	2698	Major road (Arterial)	12,416	2,746	3,790	6568	6567	Minor road (Collector)	6,298	1,866	2,763
2850	4873	Major road (Arterial)	14,310	9,525	12,800	6570	6572	Minor road (Collector)	1,474	3,939	4,512
2851	2835	Major road (Arterial)	10,940	8,546	10,950	6572	6570	Minor road (Collector)	917	2,789	2,784
2853	2856	Major road (Arterial)	9,314	6,032	5,320	6580	6582	Minor road (Collector)	1,023	2,962	4,029
2853	3015	Major road (Arterial)	6,400	4,339	4,112	6582	6580	Minor road (Collector)	1,181	2,583	3,036
2856	2853	Major road (Arterial)	9,314	6,872	5,688	6582	6615	Minor road (Collector)	1,380	2,962	4,029
2856	2862	Major road (Arterial)	7,760	4,268	4,281	6612	6613	Minor road (Collector)	1,021	3,365	4,210
2862	2856	Major road (Arterial)	7,760	5,538	5,677	6613	6612	Minor road (Collector)	1,144	2,376	3,257
2862	2863	Major road (Arterial)	6,272	3,692	3,887	6615	6582	Minor road (Collector)	1,380	3,460	3,988
2863	2508	Major road (Arterial)	8,649	6,553	6,121	6615	8590	Minor road (Collector)	1,539	2,590	3,682
2863	2862	Major road (Arterial)	6,272	5,072	5,402	3389	3080	Minor road (Collector)	2,218	1,654	2,251
2888	7376	Major road (Arterial)	3,184	4,963	6,187	6804	3132	Minor road (Collector)	4,195	5,297	5,820
3015	2853	Major road (Arterial)	6,400	4,446	3,765	3157	3059	Minor road (Collector)	1,364	1,076	1,297
3015	3016	Major road (Arterial)	6,768	3,734	3,949	3157	3158	Minor road (Collector)	2,075	1,316	2,887
3016	3015	Major road (Arterial)	6,768	6,374	7,169	3158	3157	Minor road (Collector)	2,075	889	1,160

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3020	3021	Major road (Arterial)	6,771	5,110	5,804	3158	3159	Minor road (Collector)	1,656	3,274	6,447
3021	3020	Major road (Arterial)	6,771	7,209	8,155	3159	3158	Minor road (Collector)	1,656	1,651	2,933
3021	3022	Major road (Arterial)	7,110	5,760	7,111	3165	3191	Minor road (Collector)	2,865	3,365	4,352
3022	3021	Major road (Arterial)	7,110	7,900	9,663	3187	3152	Minor road (Collector)	2,378	128	374
3022	3023	Major road (Arterial)	9,485	8,003	10,007	3192	3167	Minor road (Collector)	6,049	1,921	2,468
3023	3022	Major road (Arterial)	9,485	4,877	4,862	6918	6919	Minor road (Collector)	4,581	3,561	6,555
3024	3198	Major road (Arterial)	16,958	14,217	16,869	6919	6918	Minor road (Collector)	4,925	3,771	6,021
3024	4708	Major road (Arterial)	15,150	13,944	15,182	6923	3151	Minor road (Collector)	3,434	1,018	2,327
3048	12014	Major road (Arterial)	5,483	11,072	12,490	7091	3029	Minor road (Collector)	10,303	5,403	7,155
3088	3138	Major road (Arterial)	10,435	6,500	11,249	7175	6536	Minor road (Collector)	8,013	9,050	9,927
3095	3100	Major road (Arterial)	15,299	9,372	11,725	7175	8448	Minor road (Collector)	7,896	8,530	8,273
3100	3095	Major road (Arterial)	15,299	9,525	14,894	7176	7177	Minor road (Collector)	823	1,686	1,643
3100	3102	Major road (Arterial)	17,812	10,936	14,057	7177	7176	Minor road (Collector)	797	1,748	1,511
3100	3114	Major road (Arterial)	3,820	6,362	8,054	7178	7179	Minor road (Collector)	1,380	1,656	1,734
3102	3100	Major road (Arterial)	17,812	8,485	13,078	7179	2752	Minor road (Collector)	423	2,391	2,730
3105	3106	Major road (Arterial)	15,002	10,363	12,689	7179	6566	Minor road (Collector)	4,690	3,396	4,619
3106	3105	Major road (Arterial)	15,002	10,603	15,114	7179	6567	Minor road (Collector)	4,188	2,082	2,535
3116	3120	Major road (Arterial)	3,954	6,432	8,165	7179	7178	Minor road (Collector)	1,380	1,456	1,563
3134	6922	Major road (Arterial)	5,630	6,042	9,614	7305	8442	Minor road (Collector)	1,380	2,976	3,448
3136	3139	Major road (Arterial)	6,925	9,241	14,079	7330	7337	Minor road (Collector)	4,501	2,601	3,255
3138	3088	Major road (Arterial)	10,435	7,714	11,534	7335	7336	Minor road (Collector)	2,976	367	455
3138	3139	Major road (Arterial)	9,350	6,848	12,360	7336	4071	Minor road (Collector)	2,976	1,139	1,185
3139	3136	Major road (Arterial)	6,925	9,381	13,853	7336	7335	Minor road (Collector)	2,976	527	563
3139	3138	Major road (Arterial)	9,350	7,789	11,720	7336	7337	Minor road (Collector)	3,642	990	1,657
3139	3145	Major road (Arterial)	10,510	7,628	14,299	7337	7330	Minor road (Collector)	4,501	1,195	2,019
3139	3155	Major road (Arterial)	10,336	8,939	12,493	7337	7336	Minor road (Collector)	3,665	2,266	2,845
3145	3139	Major road (Arterial)	10,510	8,541	12,975	7338	7342	Minor road (Collector)	2,310	1,137	1,143
3145	3150	Major road (Arterial)	10,510	6,235	12,680	7342	7338	Minor road (Collector)	2,310	1,194	1,838

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3150	3145	Major road (Arterial)	10,510	7,111	11,866	7342	7343	Minor road (Collector)	1,745	744	643
3150	3151	Major road (Arterial)	14,013	7,391	15,017	7343	7342	Minor road (Collector)	1,745	524	513
3150	3153	Major road (Arterial)	2,850	2,464	4,822	7343	7367	Minor road (Collector)	1,804	1,065	999
3151	3150	Major road (Arterial)	14,013	9,563	16,592	7367	7343	Minor road (Collector)	1,804	219	295
3153	3150	Major road (Arterial)	2,775	1,168	2,434	7370	7374	Minor road (Collector)	1,592	4,013	3,775
3578	7171	Major road (Arterial)	16,068	13,869	15,277	7374	2888	Minor road (Collector)	1,700	2,524	2,458
3579	7399	Major road (Arterial)	12,204	17,742	14,087	7374	7370	Minor road (Collector)	1,592	2,534	2,075
3580	7342	Major road (Arterial)	2,920	2,790	3,406	7379	7378	Minor road (Collector)	1,853	572	204
5610	6566	Major road (Arterial)	5,645	6,760	6,379	7381	7385	Minor road (Collector)	3,319	2,299	2,327
5610	7449	Major road (Arterial)	8,358	3,964	3,435	7384	4176	Minor road (Collector)	3,343	2,239	2,503
6117	2631	Major road (Arterial)	7,160	6,830	6,403	7386	7387	Minor road (Collector)	3,714	1,948	1,832
6117	3779	Major road (Arterial)	7,510	5,659	5,786	7387	7386	Minor road (Collector)	3,714	508	789
6520	6510	Major road (Arterial)	11,985	2,480	5,522	7396	7456	Minor road (Collector)	1,273	4,799	5,312
6520	6772	Major road (Arterial)	4,211	3,328	3,466	7403	2544	Minor road (Collector)	874	2,295	2,104
6521	6407	Major road (Arterial)	9,660	4,057	6,712	7456	7396	Minor road (Collector)	1,273	2,913	3,145
6524	6538	Major road (Arterial)	16,318	17,458	14,565	8442	7305	Minor road (Collector)	1,380	1,539	1,711
6525	8447	Major road (Arterial)	5,285	11,586	12,599	8448	7175	Minor road (Collector)	10,028	9,924	10,729
6527	6528	Major road (Arterial)	13,241	9,575	11,625	8449	6538	Minor road (Collector)	14,300	15,201	15,747
6528	6527	Major road (Arterial)	13,241	9,493	13,284	8590	6615	Minor road (Collector)	1,539	4,513	5,049
6529	6530	Major road (Arterial)	12,636	11,690	14,456	6646	6655	Local road	1,008	740	1,440
6530	6529	Major road (Arterial)	12,636	5,637	9,198	4687	7469	Local road	5,336	0	3
6531	6532	Major road (Arterial)	8,026	4,719	7,763	4687	8579	Local road	3,570	66	169
6532	6531	Major road (Arterial)	8,026	7,719	12,418	6655	6646	Local road	1,008	1,073	1,041
6532	6548	Major road (Arterial)	8,158	9,449	12,203	4839	3135	Local road	1,159	1,174	1,778
6535	6543	Major road (Arterial)	5,465	7,984	8,211	6546	6550	Local road	339	546	798
6535	6927	Major road (Arterial)	3,617	5,134	6,134	6550	6546	Local road	306	513	862
6538	6524	Major road (Arterial)	16,318	17,957	15,785	2512	2514	Local road	11,184	11,481	12,734
6539	6540	Major road (Arterial)	12,590	12,765	12,046	2516	2517	Local road	3,980	150	171

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6540	6539	Major road (Arterial)	10,462	10,991	9,493	2522	2523	Local road	2,509	1,641	1,798
6540	6541	Major road (Arterial)	2,672	4,641	4,619	2523	2522	Local road	2,624	200	106
6540	6565	Major road (Arterial)	12,156	12,412	13,236	2523	2524	Local road	2,282	738	597
6541	6540	Major road (Arterial)	4,584	6,577	7,313	2524	2523	Local road	2,282	2,310	2,880
6541	7177	Major road (Arterial)	6,443	5,317	5,492	2560	2561	Local road	2,910	61	0
6542	6544	Major road (Arterial)	4,267	5,338	6,077	2561	2560	Local road	1,677	6	72
6542	7177	Major road (Arterial)	6,195	6,021	6,729	2569	7372	Local road	2,175	2,380	1,375
6543	6535	Major road (Arterial)	5,465	6,351	6,884	2667	2670	Local road	2,674	1,412	944
6543	6544	Major road (Arterial)	4,155	7,153	7,321	2670	2667	Local road	979	278	342
6557	6573	Major road (Arterial)	8,269	4,226	6,136	2738	2742	Local road	1,835	778	1,508
6561	6557	Major road (Arterial)	6,225	10,620	12,814	2742	2738	Local road	1,835	1,570	1,935
6561	6616	Major road (Arterial)	11,249	11,409	13,122	2743	2763	Local road	2,269	1,174	1,991
6564	6544	Major road (Arterial)	8,018	7,408	7,860	2763	2743	Local road	2,269	1,821	2,631
6564	6568	Major road (Arterial)	4,874	7,736	8,408	2763	2800	Local road	2,417	359	542
6565	6540	Major road (Arterial)	12,156	7,434	6,568	2800	2763	Local road	2,417	1,733	1,868
6566	5610	Major road (Arterial)	10,008	13,141	13,879	2884	7487	Local road	1,592	166	4
6568	6564	Major road (Arterial)	6,091	7,338	8,028	3058	3059	Local road	2,472	2,575	3,940
6568	6569	Major road (Arterial)	5,041	7,823	8,418	3073	3076	Local road	1,987	1,435	1,914
6569	6568	Major road (Arterial)	5,041	6,851	7,838	3076	3073	Local road	1,987	2,537	2,919
6569	6586	Major road (Arterial)	6,303	8,205	9,438	3076	3077	Local road	1,634	588	1,199
6573	6557	Major road (Arterial)	8,731	6,233	10,329	3077	3076	Local road	1,634	1,684	1,911
6583	6592	Major road (Arterial)	7,937	5,097	6,447	3077	3078	Local road	1,289	518	1,075
6586	6569	Major road (Arterial)	6,938	7,093	8,191	3078	3077	Local road	1,289	875	1,418
6586	6587	Major road (Arterial)	6,116	5,570	6,839	3085	3086	Local road	2,547	1,578	2,476
6586	8437	Major road (Arterial)	2,441	3,790	4,406	3085	3156	Local road	2,122	376	468
6586	8443	Major road (Arterial)	1,544	2,453	2,541	3086	3085	Local road	2,547	368	454
6587	6586	Major road (Arterial)	6,739	5,399	7,132	3087	3088	Local road	3,575	1,734	2,760
6587	7460	Major road (Arterial)	9,367	9,464	9,387	3088	3087	Local road	3,575	2,166	3,678

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6591	6592	Major road (Arterial)	2,388	1,138	1,210	3125	3126	Local road	2,229	327	648
6591	7463	Major road (Arterial)	4,298	4,327	4,876	3126	3125	Local road	2,229	1,259	1,758
6592	6583	Major road (Arterial)	8,318	7,119	10,644	3135	3145	Local road	1,314	2,514	2,613
6592	6591	Major road (Arterial)	2,388	2,761	3,113	3135	4839	Local road	683	1,278	2,183
6592	6596	Major road (Arterial)	9,457	4,667	5,419	3145	3135	Local road	1,314	2,384	2,684
6596	2691	Major road (Arterial)	13,358	5,961	6,350	3145	3154	Local road	844	2,434	3,133
6596	6592	Major road (Arterial)	8,389	8,312	11,519	6521	6663	Local road	3,594	5,577	8,302
6597	2702	Major road (Arterial)	24,361	12,324	16,589	6526	6529	Local road	1,401	2,722	3,478
6598	6597	Major road (Arterial)	11,599	12,324	16,589	6529	6526	Local road	1,401	2,517	3,318
6599	6614	Major road (Arterial)	10,071	7,649	9,704	6588	6589	Local road	1,273	2,747	2,897
6600	2710	Major road (Arterial)	4,380	1,924	2,346	6588	7461	Local road	1,665	1,637	1,664
6601	6605	Major road (Arterial)	7,008	1,879	2,110	6589	6588	Local road	1,273	1,468	1,381
6604	6605	Major road (Arterial)	6,260	3,566	4,243	6663	6521	Local road	3,594	2,360	3,124
6605	6601	Major road (Arterial)	7,008	2,265	2,560	6806	8592	Local road	764	76	298
6605	6604	Major road (Arterial)	6,260	2,717	3,461	6807	6914	Local road	1,334	306	559
6614	6618	Major road (Arterial)	9,809	6,211	8,644	3154	3145	Local road	835	2,342	2,694
6615	6598	Major road (Arterial)	14,608	11,698	15,707	3154	3184	Local road	2,547	3,377	3,512
6616	6561	Major road (Arterial)	11,249	11,030	13,408	3155	3156	Local road	405	382	621
6616	6617	Major road (Arterial)	11,302	9,491	10,824	3156	3085	Local road	2,122	365	552
6616	8435	Major road (Arterial)	10,146	8,358	12,267	3156	3155	Local road	405	372	543
6617	6616	Major road (Arterial)	11,302	11,269	13,059	3158	3161	Local road	2,357	1,436	2,870
6617	6618	Major road (Arterial)	8,259	9,544	10,793	3161	3158	Local road	2,357	2,665	4,660
6618	6617	Major road (Arterial)	8,259	11,164	13,012	3161	3166	Local road	1,963	1,475	2,870
6618	6619	Major road (Arterial)	7,179	10,085	10,517	3166	3161	Local road	1,963	2,700	4,730
6618	6641	Major road (Arterial)	11,237	5,393	8,654	3184	3154	Local road	2,547	2,992	3,144
6619	6618	Major road (Arterial)	7,179	10,887	12,746	6911	6913	Local road	1,858	433	700
6620	6621	Major road (Arterial)	8,362	10,918	11,526	6913	6911	Local road	1,858	488	739
6621	6620	Major road (Arterial)	5,833	11,328	13,754	6913	6914	Local road	1,646	260	578

Table E.3c (continued): Link Flows – Spring-Sandusky Project Study Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
6623	6625	Major road (Arterial)	4,685	3,599	4,366	6914	6807	Local road	1,702	341	752
6625	6623	Major road (Arterial)	4,685	4,389	5,076	6914	6913	Local road	1,646	231	382
6625	6634	Major road (Arterial)	11,461	13,049	13,668	7372	2569	Local road	2,175	4,761	1,745
6634	6625	Major road (Arterial)	11,461	11,486	12,586	7379	7412	Local road	1,240	5,854	7,189
6661	6652	Major road (Arterial)	12,676	6,714	9,511	7382	7383	Local road	500	112	144
6668	6666	Major road (Arterial)	8,760	5,893	9,053	7383	7382	Local road	500	512	758
6669	6670	Major road (Arterial)	3,470	3,509	6,112	7402	7410	Local road	3,984	1,173	1,679
6670	6669	Major road (Arterial)	3,564	2,754	4,586	7409	7417	Local road	902	3,014	3,279
6670	6671	Major road (Arterial)	3,745	4,125	7,255	7410	7402	Local road	3,984	1,191	1,942
6671	6670	Major road (Arterial)	3,978	3,463	5,467	7412	7379	Local road	1,240	832	761
3198	3197	Major road (Arterial)	14,640	9,936	11,531	7417	7409	Local road	902	170	218
3199	3188	Major road (Arterial)	3,143	1,892	3,032	7417	7421	Local road	1,331	3,428	3,122
3199	4873	Major road (Arterial)	14,310	11,558	16,066	7421	7417	Local road	1,331	3,189	2,999
6772	6520	Major road (Arterial)	4,211	2,243	2,056	7423	7426	Local road	1,751	1,142	1,663
6802	6812	Major road (Arterial)	3,714	5,123	6,705	7426	7423	Local road	1,751	3,339	3,206
6811	6812	Major road (Arterial)	4,346	5,212	7,153	7461	6588	Local road	1,665	2,642	2,918
6812	6800	Major road (Arterial)	2,601	3,130	4,184	7469	4687	Local road	5,336	89	179
2729	2736	Major road (Arterial)	4,570	4,072	4,064	7487	2884	Local road	1,592	23	13
2731	2732	Major road (Arterial)	9,474	12,976	12,262	8579	4687	Local road	3,570	0	0
3153	3186	Major road (Arterial)	3,575	2,149	4,841	8592	6806	Local road	700	181	793
3155	3139	Major road (Arterial)	10,336	9,108	12,952	-	-	-	-	-	-

Table E.3d: Link Flows – Control Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3827	5384	Freeway (Interstate)	31,230	27,643	26,170	9755	3428	Major road (Arterial)	7,085	7,892	8,070
3824	3912	Freeway (Interstate)	43,915	49,243	47,411	9771	3431	Major road (Arterial)	2,465	2,877	2,455
3831	3833	Freeway (Interstate)	23,765	21,988	21,295	9771	3432	Major road (Arterial)	2,615	3,240	2,589
3832	3830	Freeway (Interstate)	23,765	22,989	22,118	16122	16123	Major road (Arterial)	4,949	2,279	2,454
3913	3825	Freeway (Interstate)	43,915	49,883	49,387	16122	16124	Major road (Arterial)	4,949	183	212
5383	3826	Freeway (Interstate)	31,230	28,589	26,599	16123	3485	Major road (Arterial)	4,949	2,268	2,454
5384	5386	Freeway (Interstate)	27,719	27,643	26,170	16123	16122	Major road (Arterial)	4,949	1,519	1,847
5387	5383	Freeway (Interstate)	27,719	28,589	26,599	16124	5111	Major road (Arterial)	4,949	1,484	528
3473	3474	Major road (Arterial)	10,096	8,091	6,869	16124	16122	Major road (Arterial)	4,949	415	421
3475	3476	Major road (Arterial)	9,912	3,633	3,650	3477	2781	Minor road (Collector)	1,698	2,453	2,159
3476	3475	Major road (Arterial)	9,912	3,510	3,361	3490	16009	Minor road (Collector)	4,949	3,557	3,769
3476	3477	Major road (Arterial)	5,909	3,256	3,407	3485	16009	Minor road (Collector)	4,949	4,284	4,248
3489	3488	Major road (Arterial)	15,643	18,430	16,736	3466	3465	Minor road (Collector)	1,842	127	162
3944	3472	Major road (Arterial)	2,937	3,585	2,861	3464	3434	Minor road (Collector)	1,856	294	200
3489	4980	Major road (Arterial)	16,711	17,666	16,618	3464	3465	Minor road (Collector)	1,774	402	443
3490	4978	Major road (Arterial)	4,949	8,449	7,744	3465	3464	Minor road (Collector)	1,774	473	411
3452	3448	Major road (Arterial)	4,845	5,606	5,177	2781	3477	Minor road (Collector)	1,698	2,323	1,858
3454	3458	Major road (Arterial)	7,243	5,343	4,877	2781	3479	Minor road (Collector)	1,959	2,131	2,283
3485	16123	Major road (Arterial)	4,949	1,514	1,847	3465	3466	Minor road (Collector)	1,842	99	151
3462	3461	Major road (Arterial)	5,624	5,498	4,364	3465	16010	Minor road (Collector)	236	327	353
3487	3458	Major road (Arterial)	8,904	8,961	9,928	3466	7503	Minor road (Collector)	1,038	265	393
3487	3488	Major road (Arterial)	11,523	13,532	11,562	3467	3466	Minor road (Collector)	10,922	392	555
3488	3487	Major road (Arterial)	11,759	15,196	13,662	3467	3468	Minor road (Collector)	2,247	1,052	822
3488	3489	Major road (Arterial)	15,643	16,808	14,709	3468	3467	Minor road (Collector)	2,247	1,004	899
3460	3459	Major road (Arterial)	6,766	4,546	4,221	3479	2781	Minor road (Collector)	1,818	2,101	1,985
3460	3461	Major road (Arterial)	5,960	4,615	5,042	3434	3464	Minor road (Collector)	1,896	218	198
3461	3462	Major road (Arterial)	5,624	5,236	5,192	3466	3467	Minor road (Collector)	10,922	335	513
3470	3477	Major road (Arterial)	3,418	1,724	1,782	7503	3466	Minor road (Collector)	1,038	236	362

Table E.3d (continued): Link Flows – Control Area

A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)			A Node	B Node	Roadway Functional Class	Link Flow (vehicles/day)		
			Count data	Trip-based model	Tour-based model				Count data	Trip-based model	Tour-based model
3472	3944	Major road (Arterial)	2,937	3,344	2,898	7503	16010	Minor road (Collector)	353	353	326
3477	3470	Major road (Arterial)	3,418	1,640	1,764	16009	3485	Minor road (Collector)	4,949	3,042	3,189
3477	3476	Major road (Arterial)	5,909	3,146	3,052	16009	3490	Minor road (Collector)	4,949	4,829	4,890
3478	6579	Major road (Arterial)	3,245	2,569	2,568	16010	3465	Minor road (Collector)	236	353	326
4978	3490	Major road (Arterial)	4,949	8,099	8,115	16010	7503	Minor road (Collector)	353	327	353
4978	4980	Major road (Arterial)	4,949	2,690	1,741	3427	3426	Local road	1,334	1,327	2,202
4980	3489	Major road (Arterial)	18,672	19,602	18,652	4301	3482	Local road	975	1,556	1,493
5111	16124	Major road (Arterial)	4,949	1,222	541	3450	3451	Local road	2,374	746	945
6579	3478	Major road (Arterial)	3,245	2,505	2,496	3451	3450	Local road	1,854	839	890
3428	3429	Major road (Arterial)	5,272	3,671	4,719	3456	3460	Local road	2,439	1,882	1,554
3428	9755	Major road (Arterial)	7,085	7,425	7,644	3460	3456	Local road	2,439	1,911	1,571
3429	3428	Major road (Arterial)	5,272	7,279	7,497	3465	3471	Local road	452	131	217
3429	3430	Major road (Arterial)	2,468	3,531	4,577	3471	3465	Local road	452	148	200
3430	3429	Major road (Arterial)	2,468	4,061	4,970	3471	3472	Local road	2,109	165	255
3430	3431	Major road (Arterial)	2,205	3,504	4,558	3472	3471	Local road	2,082	160	208
3431	3430	Major road (Arterial)	2,205	4,016	4,828	3479	8068	Local road	213	263	308
3431	9771	Major road (Arterial)	2,465	3,219	2,583	3426	3427	Local road	1,334	1,310	2,351
3432	9771	Major road (Arterial)	2,615	2,898	2,464	3432	8478	Local road	458	442	646
3435	3436	Major road (Arterial)	4,170	4,548	5,460	3479	9619	Local road	447	62	126
3436	3435	Major road (Arterial)	4,170	4,791	5,774	3482	4301	Local road	877	1,736	1,635
3458	3454	Major road (Arterial)	7,419	6,555	6,352	8068	3479	Local road	411	308	367
3458	3487	Major road (Arterial)	8,904	7,920	8,546	8068	9613	Local road	5	263	308
3459	3460	Major road (Arterial)	6,766	4,617	5,160	8069	9613	Local road	164	229	214
3461	3460	Major road (Arterial)	5,932	4,704	4,149	8478	3432	Local road	458	401	494
3436	3450	Major road (Arterial)	6,686	6,005	6,680	9613	8068	Local road	5	308	367
3448	3452	Major road (Arterial)	3,706	4,355	4,168	9613	8069	Local road	164	204	203
3449	8527	Major road (Arterial)	5,375	6,277	7,326	9616	9619	Local road	271	127	169
3450	3436	Major road (Arterial)	6,686	6,304	7,019	9619	3479	Local road	232	46	98
8527	3449	Major road (Arterial)	5,375	6,218	6,979	9619	9616	Local road	271	155	304