SOCIOECONOMIC DATA AND TRAVEL DEMAND MODEL

Travel Demand Model Development

A travel demand model is a forecasting tool used to assess travel supply and demand. The existing road and public transit networks represent the supply side of the metric. The demand side is the product of urban data to determine where trips are generated from, how they are distributed, and what the mode choice will be.

Using existing verifiable information like population numbers tied to geographic zones and employers with validated employee populations, the model can be calibrated for accuracy. From that accurate base, projections can be made that relate to changes anticipated within the planning horizon (through 2035). With the new data inputs, the model will generate findings that identify trouble spots within the network where the existing design capacities of the road or transit network will be exceeded.

Travel demand modeling can aid in policy suggestions for long range planning and short range studies (corridor studies and sub-area studies) because the results highlight the imperfections and inadequacies that will need to be addressed.

The travel demand modeling process was a collaborative effort between the SWMPC and the MDOT Statewide and Urban Travel Analysis Section. MDOT has taken the lead role in the travel demand modeling for "small MPO" areas throughout the state. Both entities collectively reach consensus on critical decisions in the development of the model with data largely generated and validated by the SWMPC.

Modeling Area

The modeling area consists of the Cities of Benton Harbor, St. Joseph, and Bridgman, the Villages of Shoreham and Stevensville, and the Townships of Benton Charter, Lincoln Charter, Sodus, Royalton, Lake Charter, and St. Joseph Charter. An additional four jurisdictions that are not part of the MPO include the Villages of Baroda and Berrien Springs as well as Baroda and Oronoko Townships. These areas have been included for two primary reasons. First, though they are not within metropolitan area as defined by the U.S. Census, they currently have an important impact on the transportation characteristics inside that area. Secondly, it is likely that these jurisdictions will be included within the next iteration of the urban geographic definition. The Villages of

Grand Beach and Michiana, while part of the MPO, were not included in the model. They are not geographically contiguous to the rest of the TwinCATS study area. The two communities were included with the statewide travel demand model.

The entire TwinCATS travel demand model area totals 177.25 square miles. Within that area, the smallest subsection or Traffic Analysis Zone (TAZ) of the model is 0.40 square miles and the largest TAZ is 5.71 square miles. Water bodies contained in the modeling area total 4.27 square miles. The total transportation network including all roads consists of approximately 486 miles.

Model Development

TwinCATS travel demand modeling is developed using TransCAD, transportation Geographic Information Systems (GIS) software. The computer simulation generates current and future traffic conditions. Deficiencies in the transportation network are identified as "generalized 24-hour" (daily) deficiencies, based on generalized 24-hour road and transit capacities and traffic assignment volumes.

The urban travel demand forecasting process has six phases, which are described in detail in the sections that follow:

1. Data Collection, in which socioeconomic and facility inventory data are collected;
2. Trip Generation, which calculates the number of trips produced within or attracted into a the basic geographic unit of the model, the TAZ;
3. Trip Distribution, studies the trips produced in a TAZ and distributes them to all other TAZs, based on the attraction of those zones;
4. Traffic Assignment, determines what routes are utilized for trips;
5. Model Calibration/validation involves verifying that the volumes (trips) simulated in traffic assignment and authenticates traffic counts; and
6. System Analysis, which tests alternatives and analyzes changes in order to improve the transportation system.

There are two basic systems of data organization in the travel demand forecasting process. The first system of data is organized based on the street system. Roads with a National Functional Class (NFC) designation as "Minor Collector" and higher are included in the network. The unit of analysis is called a "link." Usually, a link is a segment of roadway that is terminated at each end by an intersection. In a traffic assignment network, intersections are called "nodes." Therefore, a link has a node at each end.

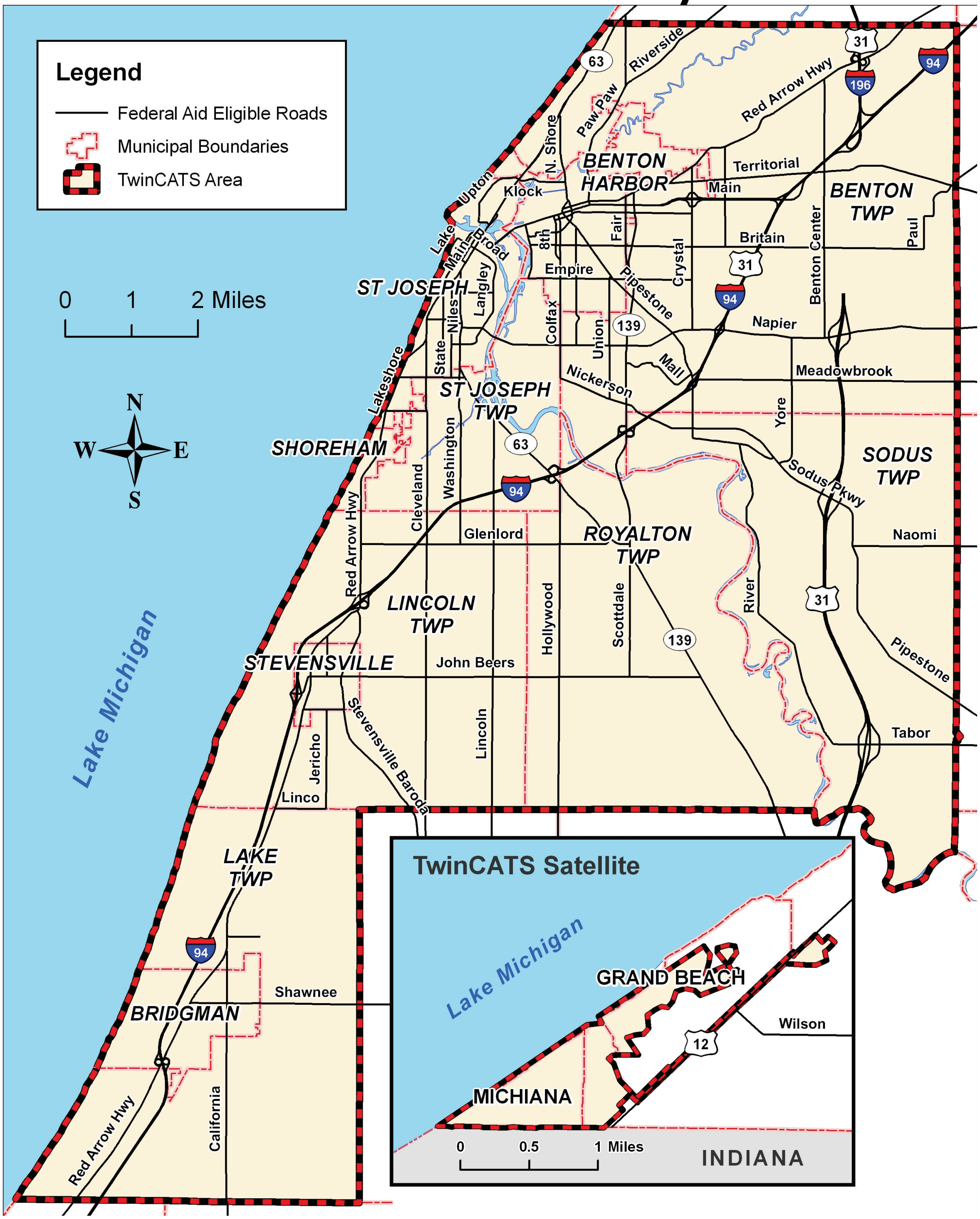
The second data organization mechanism is the TAZ. TAZs are determined based upon similarity of land use, compatibility with jurisdictional boundaries, the presence of physical boundaries, and compatibility with the street system. Streets are generally used as zone boundary edges. All socioeconomic and trip generation information for both the base year and future year are summarized by TAZ. **Table 2.0** below depicts the TwinCATS TAZ structure.

Table 2.0
TwinCATS Traffic Analysis Zone Structure

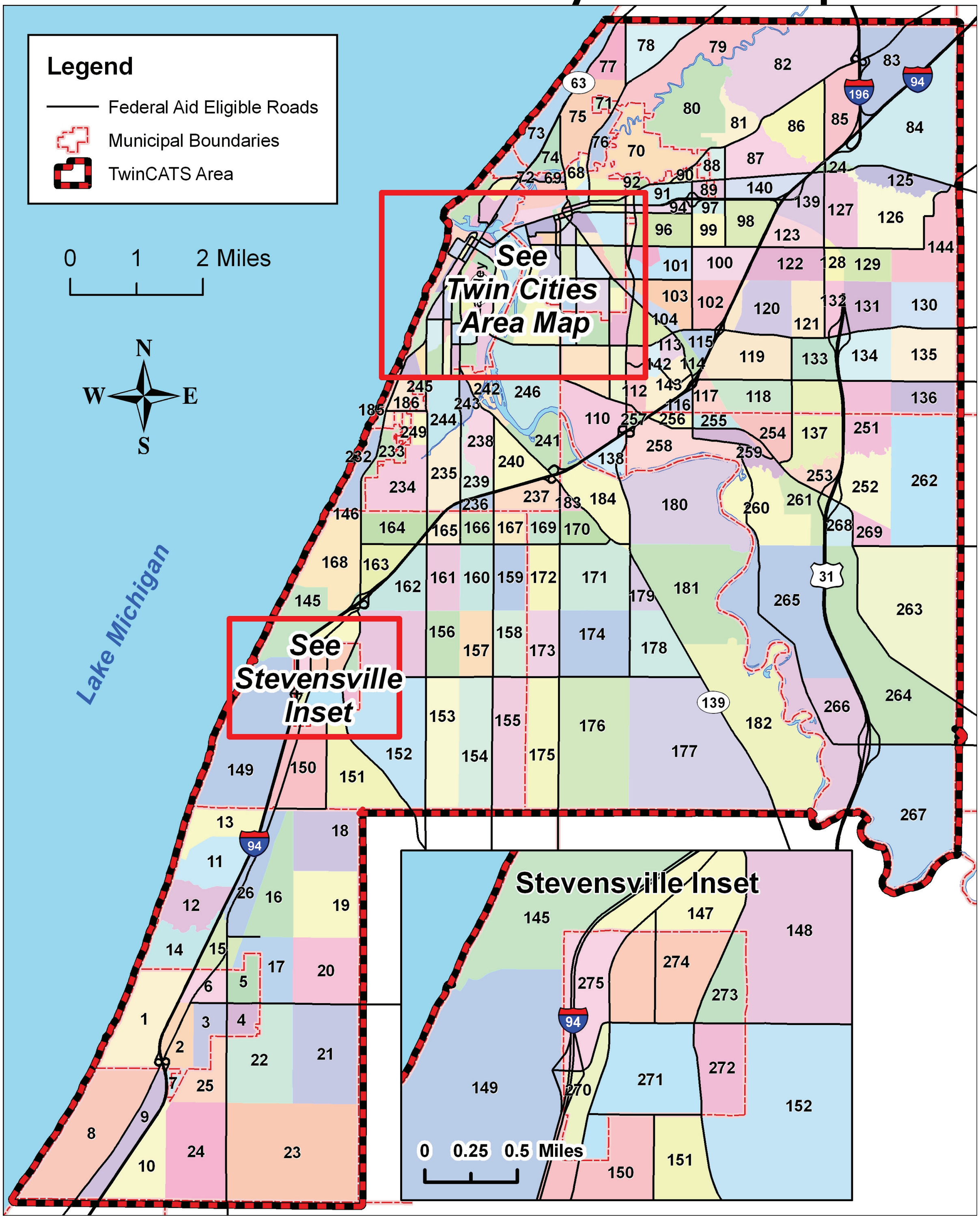
TAZ ID	JURISDICTION
1-7	Bridgman - City
8-26	Lake Charter Twp
27-72	Benton Harbor - City
73-144	Benton Charter Twp
145-168	Lincoln Charter Twp
169-184	Royalton Twp
185-231	St. Joseph - City
232-233	Shoreham Village
234-250	St. Joseph Charter Twp
251-269	Sodus Twp
270-275	Stevensville - City
276-280	Berrien Springs - City
281-284	Baroda Village
285-298	Baroda Twp
299-316	Oronoko Charter Twp
317-340	External Stations

The two data systems - the street system (network) and the zone system (socioeconomic data) - are interrelated through the use of "centroids." Each zone is portrayed on the network by a point (centroid), which represents the weighted center of activity for that zone. A centroid is connected by a set of links to the adjacent street system. That is, the network is provided with a special set of links for each zone, which connect the zone to the street system. Since every zone is connected to the street system by these "centroid connectors," it is possible for trips from each zone to reach every other zone by way of a number of paths through the street system. Maps of the two data systems (street system and zone system) are shown on the following two pages.

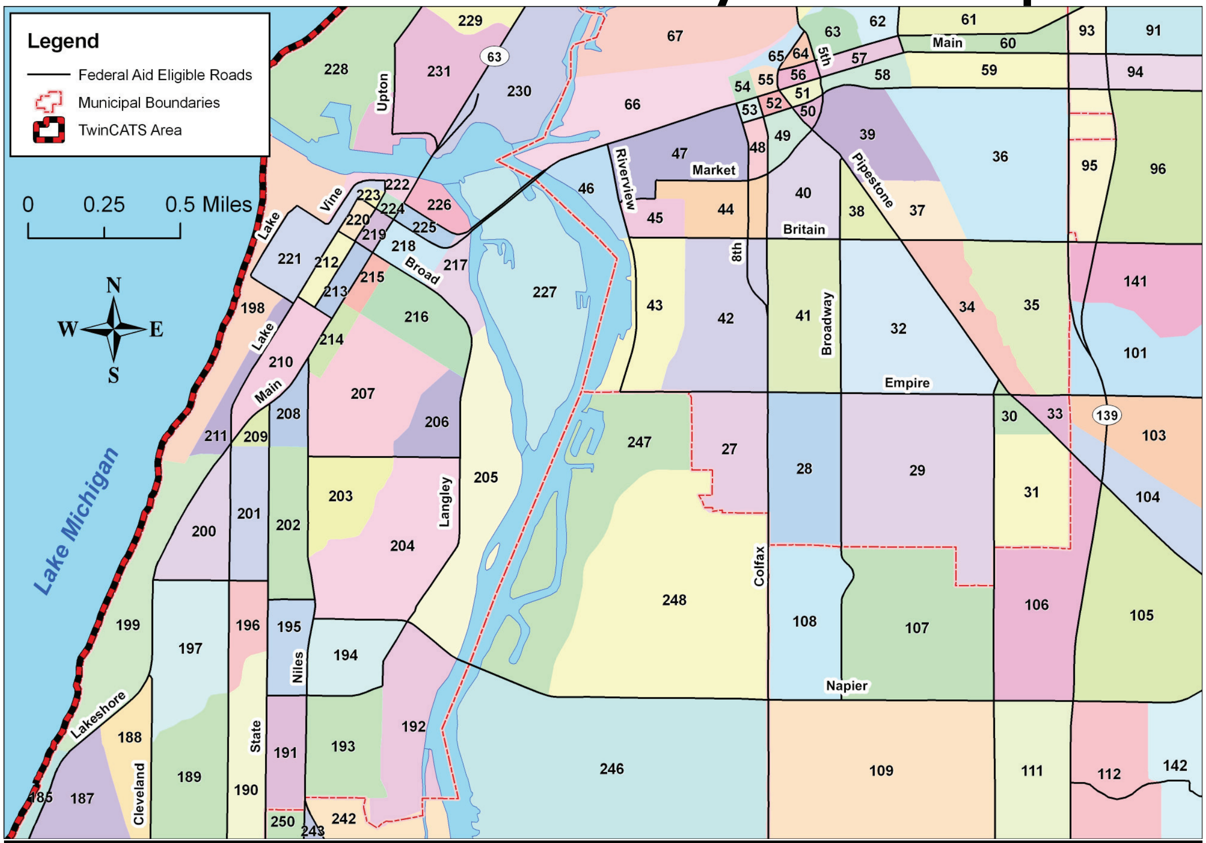
TwinCATS Model Street System



TwinCATS Traffic Analysis Zone Map



Twin Cities Traffic Analysis Zone Map



<u>Phase 1: Socioeconomic Data Collection</u>

Travel demand models are driven, in part, by the relationship of land use activities and characteristics of the transportation network. Inputs to the modeling process include the number of households, population-in-households, vehicles, and employment located in a given TAZ. These characteristics are generally referred to as socioeconomic data. The modeling process translates this data into vehicle trips on the modeled transportation network. Therefore, it is a necessary step in the long range planning process to evaluate local socioeconomic data.

Base Year Data

Socioeconomic data collection and verification was a collaborative effort between MDOT and SWMPC. Household, population, and employment data from the 2000 Census, the 2005 American Community Survey, Claritas, and Michigan Employment Security Administration (MESA) were collected, broken down into individual TAZ and compiled into tables and maps. Beginning in the summer of 2007, the tables and maps were sent to representatives from each local government for review and comment in order to bring the data up-to-date through data year 2006, the model's base year. Local partners were asked to provide detailed information about new development that had occurred since 2000 and where employers or population had been lost.

The SWMPC engaged in additional efforts to verify employment numbers. During the summer of 2007, staff members conducted "ground truth" verifications of employer location in the field to ensure that employers were listed in the correct TAZ. Additionally, during the fall of 2007, staff telephoned employers with 100 employees or more to verify the number of employees working at the listed locations. Staff participated in phone calls, e-mail exchanges, and in-person meetings with many local units whose representatives were available to evaluate the data.

When the local revisions were recorded, the revised data was presented to the TwinCATS Technical Advisory and Policy Committees in December of 2007. Committee members worked with SMWPC, local units of government, and MDOT travel demand modeling staff for one additional month to make final revisions to the base year data. The revised socioeconomic data was approved by the TAC and Policy Committees in January of 2008. The data were then provided to MDOT for inclusion in the travel demand model.

Future Year Data

Verification of future year data covering the years from 2006 to 2035, began in January of 2008. The method was similar to efforts used to verify the base year data. Demographic and economic forecasts were sourced from Regional Economic Models, Inc. (REMI). The data was broken down by jurisdiction and forecasted in five-year increments. A percent change for each five-year period was applied against the 2006 base data

Data was then further subdivided geographically by local TAZ. To do this, aerial photographs from 1998 and 2005 were compared to determine growth patterns and seek out areas where land use approximated a maximum build-out scenario. Local future land use maps and master plans were examined to determine where each municipality expected their additional growth to occur. Additionally, areas were identified that demonstrated a growth trend that was likely to continue. The magnitude of the growth in each TAZ was assessed against the total growth in the area. Each TAZ was thus represented as a percent of the total overall growth. Any loss in population, households, or employment was expressed as a negative percentage.

Data were then compiled into maps and tables and distributed to local government representatives and committee members for review and comment. Local partners were asked to use local knowledge, local plans, and projection efforts to determine where population, household, and employment growth (or decline) was likely to occur in their communities, and whether the REMI forecasts seemed reasonable. As with the base year verification efforts, local efforts to review the data were mixed. Staff pursued the highest possible input through phone calls, e-mail exchanges, and in-person meetings with representatives of local governmental units willing to evaluate the data. Where there was no local response to repeated requests the SWMPC conceded that no local follow-up was possible.

At the conclusion of the process, the locally reviewed data projections were presented to the TwinCATS Technical Advisory and Policy Committees and were approved in May of 2008. The data were then provided to MDOT for inclusion in the travel demand model.

It is important to note that the forecasting and distribution of future population, households, and employment data cannot be made with pin-point accuracy. The general nature of the data sources, changes in development plans, unforeseen economic or population factors, and the limits imposed by time and financial resources all conspire to impart elements of unpredictability into the process. Although efforts were made to allocate the data as accurately as possible, in a few instances, some minor errors in address coding or unidentifiable employer names or addresses are predictable. As a result, some of the employment data allocated to one zone may actually belong in an adjacent zone. This does not change the overall effect of travel demand on the model because the net overall travel activity would be loaded onto the same adjacent network corridor. Therefore, household and employment data for individual zones should be considered as an estimate to be used as a guideline and not an exact total.

Population and Households

In 2006, the TwinCATS area had a population of 86,999. By 2035, the area is projected to grow to a total population of 92,814, a 3.14 percent increase. Comparatively, the total population of the State of Michigan is projected to increase by 8.7 percent between 2005 and 2035 (REMI). Households in the TwinCATS area are projected to total 39,562 by 2035, or a 14.44 percent increase from the 2006 base year. By comparison the State of Michigan is projected to have a twenty percent increase in households from 2005 to 2035 (REMI). The rate of growth for households in the TwinCATS area and in the State as a whole is considerably higher than that of the population, likely because the average household size is projected to continue to decline. (**Table 2.1 and 2.2**)

Table 2.1

TOTAL POPULATION BY JURISDICTION

JURISDICTION	2006	2010	2015	2020	2025	2030	2035	% Change
BRIDGMAN	2428	2418	2422	2437	2450	2465	2471	1.76
LAKE CHARTER TWP	3180	3229	3294	3369	3441	3511	3520	10.68
BENTON HARBOR CITY	10807	10919	10715	10623	10556	10528	10554	-2.34
BENTON CHARTER TWP	15686	15375	15196	15131	15099	15106	15143	-3.46
LINCOLN CHARTER TWP	14431	14665	14938	15256	15490	15691	15750	9.14
STEVENSVILLE VILLAGE	1170	1183	1199	1215	1231	1239	1242	6.15
ROYALTON TWP	4543	4743	4920	5061	5181	5281	5294	16.52
SAINT JOSEPH CITY	9159	9066	9063	9145	9272	9472	9777	6.75
SHOREHAM VILLAGE	990	976	972	975	979	984	987	-0.34
SAINT JOSEPH TWP	10105	9965	9923	9998	10124	10298	10383	2.75
SODUS TWP	2091	2153	2168	2250	2293	2330	2350	12.41
BERRIEN SPRINGS	1898	1912	1912	1926	1931	1937	1942	2.32
BARODA VILLAGE	878	900	923	947	966	977	982	11.80
BARODA TWP	2934	2961	2991	3022	3045	3059	3065	4.48
ORONOKO CHARTER TWP	6699	9450	9363	9340	9323	9333	9356	39.66
TOTAL	86999	89914	90001	90694	91378	92209	92814	6.68

Table 2.2

TOTAL HOUSEHOLDS BY JURISDICTION

JURISDICTION	2006	2010	2015	2020	2025	2030	2035	% Change
BRIDGMAN	1019	1048	1094	1131	1168	1204	1215	19.23
LAKE CHARTER TWP	1183	1244	1324	1394	1464	1533	1547	30.77
BENTON HARBOR CITY	3591	3817	3862	3874	3888	3897	3931	9.48
BENTON CHARTER TWP	6368	6380	6497	6558	6620	6674	6736	5.79
LINCOLN CHARTER TWP	5333	5486	5771	5985	6201	6406	6489	21.68
STEVENSVILLE VILLAGE	515	524	539	551	563	575	580	12.53
ROYALTON TWP	1542	1635	1754	1859	1964	2067	2086	35.29
SAINT JOSEPH CITY	4236	4274	4467	4565	4666	4754	4859	14.70
SHOREHAM VILLAGE	520	527	542	553	564	574	579	11.40
SAINT JOSEPH TWP	3965	4024	4150	4240	4331	4416	4458	12.44
SODUS TWP	880	944	1020	1043	1067	1090	1099	24.84
BERRIEN SPRINGS	770	775	793	804	815	826	833	8.22
BARODA VILLAGE	372	384	405	421	437	453	459	23.30
BARODA TWP	1093	1115	1152	1180	1209	1237	1247	14.10
ORONOKO CHARTER TWP	3182	3204	3277	3323	3370	3412	3444	8.22
TOTAL	34569	35380	36648	37482	38328	39116	39562	14.44

(Highlighted jurisdictions listed were included in the model though some lie outside the TwinCATS boundaries- see Modeling Area section for more detail)

Jurisdictions within the TwinCATS MPO boundary that are expected to see the greatest growth in population through 2035 include Royalton and Sodus Townships. Specifically, Royalton projections show 35.29 percent growth and Sodus 30.77 percent growth. Jurisdictions that are expected to see declines include Benton Charter Township at -3.46 percent and Benton Harbor City at -2.34 percent.

The greatest rate of household growth is anticipated in Royalton Township at 35.29 percent and Lake Charter Township at 30.77 percent. Jurisdictions with the slowest household growth through 2035 include Benton Charter Township at 5.79 percent growth and Benton Harbor City at 9.48 percent.

Employment

In 2006, the total number of individuals employed in the TwinCATS area was 64,040. By 2035, TwinCATS area employment is projected to dip to a total of 63,229 employees, a small decrease of 1.27 percent from the 2006 year base data. Conversely, the State of Michigan is expected to experience a modest 5.31 percent growth from 2005 to 2035 (REMI)**.** (**Table 2.3**)

Table 2.3 TOTAL EMPLOYMENT BY JURISDICTION								
JURISDICTION	**2006**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**% Change**
BRIDGMAN	1912	1903	1929	1916	1908	1900	1901	-0.58
LAKE CHARTER TWP	3193	3119	3132	3090	3064	3039	3019	-5.44
BENTON HARBOR CITY	6574	6742	6840	6866	6911	6960	7017	6.73
BENTON CHARTER TWP	17023	16686	16677	16412	16275	16148	16042	-5.76
LINCOLN CHARTER TWP	5081	4493	4472	4396	4345	4300	4271	-15.94
STEVENSVILLE VILLAGE	1240	1219	1220	1202	1191	1182	1177	-5.06
ROYALTON TWP	2250	2275	2333	2348	2375	2402	2435	8.23
SAINT JOSEPH CITY	14550	14491	14706	14666	14704	14754	14832	1.94
SHOREHAM VILLAGE	197	195	195	192	191	190	190	-3.70
SAINT JOSEPH TWP	4958	4983	5062	5100	5161	5238	5329	7.49
SODUS TWP	1439	1424	1415	1382	1356	1332	1315	-8.58
BERRIEN SPRINGS	1820	1838	1881	1889	1905	1922	1942	6.72
BARODA VILLAGE	421	409	404	394	385	377	371	-11.82
BARODA TWP	351	342	338	331	327	324	325	-7.29
ORONOKO CHARTER TWP	2552	3019	3059	3046	3048	3051	3061	19.95
TOTAL	63561	63139	63665	63230	63144	63120	63229	-0.52

(Highlighted jurisdictions listed were included in the model though some lie outside the TwinCATS boundaries- see Modeling Area section for more detail)

TwinCATS jurisdictions that expect to see employment growth include Royalton Township with an 8.23 percent increase and Saint Joseph Township at 7.49 percent growth. Jurisdictions that expect to see declines are Lincoln Charter Township at -15.94 percent and Sodus Township at -8.58 percent.

Phase 2: Trip Generation

The trip generation process aims to determine the frequency of trips into and out of each TAZ. Those trips are defined as "person-trips" (trips per person). The calculation of person-trips is based on the socioeconomic characteristics of each zone and the number of autos and dwellings. It should be explained that there are limitations to the detail of trip generation projections. The person-trips generated from or to each TAZ are not assigned characteristics such as direction, length, or time of occurrence. Analysis of relevant data is ultimately reduced to mathematical expressions for use in the modeling process. The TwinCATS model uses the trip generation formulas specified in the "Travel Estimation Techniques for Urban Planning" [6] to generate trips produced

[6] Martin, W.A., and N.A. McGuckin, Barton-Aschman Associates, Inc. (January 1996). NCHRP 365: "Travel Estimation Techniques for Urban Planning. Transportation Research Board, National Research Council, Washington D.C.

from and trips attracted to a TAZ. National Cooperative Highway Research Program (NCHRP), dated January 1996, provides detailed discussions on the development of the formulas in the Travel Estimation Techniques for Urban Planning.

Trips that begin or end beyond the TwinCATS study area boundary are called "cordon trips." These trips are made up of two components: external to internal (EI), internal to external (IE) trips, and through-trips (EE). EI trips are those trips which start outside the study area and end in the study area. IE trips start inside the study area and end outside the study area. EE trips are those trips that pass through the study area without stopping. A summary of the cordon volumes and distribution of those volumes is shown in the following **table 2.4**.

Table 2.4
2006 External Station (Cordon) Trips

TAZ	Route Name	External Station Count	I-E Trips	% E-E Trips	E-E Trips	Count Source
317	Old US-12 (Red Arrow Hwy)	6,930	6,583.50	5.00	346.50	Berrien County
318	I-94 (Southwest)	38,000	11,400.00	70.00	26,600.00	MDOT
319	California Road	1,811	1,756.67	3.00	27.16	Berrien County
320	Cleveland Avenue	2,058	1,955.10	5.00	102.90	Berrien County
321	Hills Road	229	229.00	0.00	0.00	Berrien County
322	Garr Road	155	155.00	0.00	0.00	Berrien County
323	Red Bud Trail	1,534	1520.92	0.85	13.08	Berrien County
324	US-31 (South)	16,022	12,016.50	25.00	4005.50	MDOT
325	Old US-31 (Ferry St)	11,074	10,298.82	7.00	775.18	MDOT
326	Hipps Hollow Road	413	413.00	0.00	0.00	Berrien County
327	Tabor Road	276	270.48	2.00	5.52	Berrien County
328	Pipestone Road	3,393	3,223.35	5.00	84.83	Berrien County
329	Shanghai Road	142	139.16	2.00	2.84	Berrien County
330	Naomi Road	1,470	1,396.50	5.00	73.50	Berrien County
331	Meadowbrook Road	1,852	1,759.40	5.00	92.60	Berrien County

332	Napier Avenue	4,409	4,144.46	6.00	264.54	Berrien County
333	Empire Avenue	342	331.74	3.00	10.26	Berrien County
334	Territorial Road	1,588	1,508.60	5.00	79.40	Berrien County
335	North Branch Road	1,290	1,290.00	0.00	0.00	Berrien County
336	I-94 (Northeast)	36,550	11,696.00	68.00	24,854.00	MDOT
337	Old US-12 (Red Arrow Hwy)	2,163	2,011.59	7.00	151.41	Berrien County
338	I-196/US-31 (North)	19,779	10,878.45	45.00	8,900.55	MDOT
339	Riverside Road	1,092	1,059.24	3.00	32.76	Berrien County
340	M-63	5,400	5,130.00	5.00	270.00	MDOT
TOTAL		**157,972**	**91,167.48**	**42.29**	**66,804.52**	

Sources: MDOT, Berrien County Road Commission

The objective of this trip generation phase is to develop a trip table. An accurate trip table will show a balance between trips produced and trips attracted. To accomplish this, the study area's total attractions are factored to equal the study area's total productions. This balance is called normalization. The attractions are normalized based on trips produced because the trip production equations use household data, which generally provide a more accurate estimate of home-based trip making. The use of more accurate base data tends to produce greater reliability for the table as a whole. The TwinCATS Area Trip Generation Summary identifies productions, attractions, and normalization factors for the study area, for both 2006 and 2035.

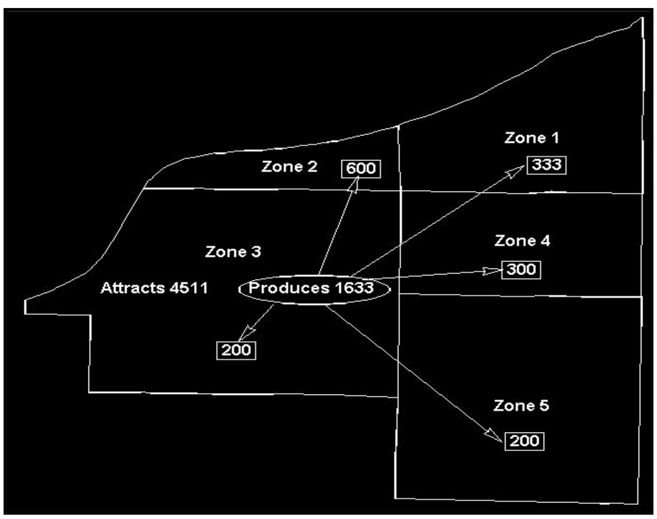
Phase 3: Trip Distribution

Trip distribution incorporates standardized equations used to determine how many of the trips produced in a zone will be attracted to each of the other zones. Potential connections are analyzed at the ends of trips produced in one zone to the ends of trips attracted to (in) other zones. The equations are based on variables that include travel time between zones and the frequency of activity in each zone. Trip purpose is an important factor in the analysis of these relationships. The trip relationship formula developed in this process is based on principles and algorithms commonly referred to as the Gravity Model.

The Gravity Model is the most widely used and documented technique for developing trip generation. It is originally derived from Newton's Law of Gravity. Newton's Law states that the attractive force between any two bodies is directly related to the masses of the bodies and inversely related to the distance between them. Thus, in the trip distribution model, the number of trips between two areas is directly related to the level of activity in an area (represented by its trip generation) and inversely related to the distance between the areas (represented as a function of travel time) (see diagram below).

Research has determined that the Gravity Model equation alone does not adequately predict the distribution of trips between zones. In most models the value of time for each purpose is modified by an exponentially determined "travel time factor" or "F factor" --also known as a "Friction Factor." "F factors" represent the average area-wide effect that various levels of travel time have on travel between zones. The "F factors" used were developed from the process described in "Travel Estimation Techniques for Urban Planning", NCHRP.

Trip Distribution Example (Not Actual TwinCATS TAZ)



The primary input to the gravity model is the normalized productions and attractions by trip purpose developed in the trip generation phase. The second data input is a measure of the perceived separation between zones. This measure is an estimate of travel time over the transportation network. Zone-to-zone travel times are referred to as "skims."

In order to more closely approximate actual times between zones and also to account for the travel time for intra-zonal trips, the skims were updated to include terminal and intra-zonal times. Terminal times account for the non-driving portion of each end of the trip and were generated from a look-up table based on area type. They represent that portion of the total travel time used for parking and walking to the actual destination. Intra-zonal travel time is the time of trips that begin and end within the same zone. Intra-zonal travel times were calculated utilizing a nearest neighbor routine.

The Gravity Model utilizes productions and attractions by purpose, the F factors by purpose, and the travel times, including terminal and intra-zonal. The by-purpose productions and attractions (trip table) is combined with the through-trip table and then balanced so that the zonal productions and attractions are equal. The resulting total trip table is used for subsequent analysis.

Phase 4: Traffic Assignment

The traffic assignment process takes the trips produced in a zone (trip generation) and distributed to other zones (trip distribution) and loads them onto the network via the centroid connectors. All the possible paths from each zone to all other zones are examined and all reasonable time paths from each zone (centroid) to all other zones are calculated. The TwinCATS model runs a "user equilibrium" traffic assignment. This means that trips are assigned to paths that are the shortest distance between each combination of zones. As the volumes assigned to links approach capacity, travel times on all paths are recalculated to reflect the congestion. The remaining trips are assigned to the next shortest path. This process continues through several iterations until no trip can reach its destination by taking the next shortest path. This assignment method reflects the alternative routes that motorists use as the shortest paths become congested. The assignment ultimately produces an assigned volume for each link.

Phase 5: Model Calibration/Validation

Model calibration/validation is the process of verification that the assigned volumes simulate actual traffic counts on the street system. When significant differences occur, additional analysis is conducted to determine the reason. Modifications may then be made to the network speeds and configurations, special trip generators, trip distribution, socioeconomic data, or traffic counts.

The purpose of the model calibration phase is to verify that the base year assigned volumes simulate actual base year traffic counts. When this step is completed, the model is considered statistically acceptable. This means that future socioeconomic data can be substituted for the base data. At that point the trip generation, trip distribution, and traffic assignment steps can be repeated and future trips can be simulated for systems analysis. It is assumed that the quantifiable relationships modeled in the base year will remain reasonably stable over time.

Applications of the Calibrated Model

Once the base and future trips are simulated, a number of system analysis procedures can be conducted, including the following:

- Network alternatives to relieve congestion can be tested. Future traffic can be assigned to the existing network to show what would happen in the future if no improvements were made to the present transportation system. This process is often referred to as "deficiency analysis." From this, improvements can be planned that would alleviate demonstrated capacity problems. The TwinCATS deficiency analysis can be found in the “Deficiency Analysis” section of this plan.
- The impact of planned roadway improvements or network changes can be assessed.
- A link can be analyzed to determine what zones are contributing to the travel on that link. This can be shown as a percentage breakdown of total link volume.
- The network can be tested to simulate conditions with or without a proposed bridge or new road. The assigned future volumes on adjacent links would then be compared to determine traffic flow. Thus, it is possible to appraise whether the bridge should be replaced and/or where it should be relocated.
- The impacts of land use changes on the network can be evaluated (e.g., what are the transportation impacts of a new major retail store or 200-unit housing development).
- Road closure/detour evaluation studies can be conducted to determine the effects of closing a roadway. This type of study is very useful for construction management and incident management.
- Model runs are a standard part of air quality conformity analysis.

Two issues are critical in using the model:

1. The modeling process is most effective for system-wide analysis. Although detailed volumes for individual intersection and "links" of a highway are an

output of the model, additional analysis and modification of the model output may be required for project level analysis.

2. The accuracy of the model is heavily dependent on the accuracy of the socioeconomic data and network attributes provided by the local participating agencies, and the skill of the users in interpreting the reasonableness of the results.

Generally, three different scenarios are developed for the Long Range Plan:

1. *Existing trips on the existing system*. This is the calibrated, existing network scenario founded on the base year data. This is a prerequisite for the other two scenarios.
2. *Future trips on the committed system*. This alternative displays future capacity and congestion problems if no improvements to the system are made. This is called the "do nothing" alternative and usually includes the existing system, plus any projects that are committed to be built in the future.
3. *Future trips on the future system.* This scenario is the future LRTP network. It includes suggested improvements to alleviate congested areas or corridors.

Applications of these basic procedures are important for identifying deficiencies as well as examining and evaluating the impacts of alternate solutions.