6. Land Use and Travel Demand Model Forecasts

6.1 Land Use Forecasting

As with traffic forecasting, land use forecasts should ideally be based on existing and planned future land developments rather than historical trend lines. However, given the long time period needed for the plan horizon and the current "down economy," formula-based land use forecasting and allocation to small areas is a necessarily large portion of the forecast needed for this metro transportation plan update.

The forecasting of land use is divided into two parts – a county-wide economic and demographic forecast, and then allocation of the county total into small zones for the purpose of forecasting future traffic volumes and travel times. The small portion of Lorain county (in and near the city of Vermilion) that is included in the plan study area has forecasts developed not based on any countywide totals, but estimated to "mirror" adjacent portions of Erie County.

Traffic forecasts are needed for, among other things, guidance for design of transportation, for which a 20-year forecast is typically required beyond the date that the project is complete and open to traffic. Therefore, transportation plan horizons that include traffic forecasting should extend at least 30 years, to provide forecasts for projects that may have design work currently in progress but for which the final year of construction may still be 5-10 years into the future. Since the base year for traffic forecasting was set to Year 2010 due to data availability, the Plan horizon year is established as 2040. (Since in general there was very little growth between the year 2005 and 2010 in Erie County, levels of growth forecast for years 2005-2035 from the sources discussed below are applied as levels of growth from 2010-2040 for this transportation plan.)

The Ohio Department of Development has an ongoing program to develop population forecasts by county statewide for 30 years beyond the date of the most recent Census. Details of this program which provides forecasts of population for Erie County at five-year intervals out to Year 2040 by five-year age and gender cohorts can be found on the web at http://development.ohio.gov/reports/reports_pop_proj_map.htm . This detail is valuable for the added forecasting of school kids and local workforce (via age and gender-specific workforce participation rates from the U.S. Bureau of Labor Statistics (BLS)). The population totals in addition to historical trend lines in persons and vehicles per household also allows for the forecast of dwelling units and private vehicle ownership that determines future trip generation and rates of travel.

As shown on the ODOD website, the forecasted 30-year decline in population for Erie County is about 19% (from 77,079 in the 2010 Census to 62,300 for the Year 2040). Given historical trends in persons per household, it is forecasted that persons per household countywide will continue its downward trend into the future. In the absence of any previously-developed and adopted employment forecasts for the county locally, a variety of forecasts are available. Forecasts available from public-sector employment agencies, however, are typically short-term (8-10 years) and not sufficient for the needs of transportation planning.

A nationally based interregional economic model called Impact Analysis for Planning (IMPLAN), is being used for the Ohio statewide traffic forecasting model and was utilized here. While the IMPLAN forecasts are full state and not county-specific, forecasted growth rates by 20 general industrial categories can be applied to current county-wide employment levels by industry to develop forecasts of employment

by industry for the future. These 20 industrial categories were then collapsed down into 4 categories (retail, two service groups, and industry/warehouse/other) for ease of analysis.

Due to "inter-county" commuting where workers cross county lines to travel to work, there can be and are gaps between the number of jobs in a county and the workforce living within the county, both now and in the future. However, to ensure that this gap is not forecast to grow excessively large in the future, a check of inter-county commuting gaps for other small metro areas in northern Ohio was reviewed to provide a "reasonability check" of the initially generated forecasts of employment vs. workforce as a function of local population. According to the 2000 Census, there was a net in-commuting difference of 7100 persons in Allen County (Lima) and 2400 in Richland County (Mansfield), compared to less than a thousand for Erie County. Initial forecasts of employment and workforce for Erie County registered a gap of about 10,000 for the Plan horizon year, which should be scaled back to levels at least no higher than currently is the case for Allen County. This was done with the following adjustments: 1.) Change the workforce participation rates for individuals aged 60-80 to those initially used for ages 55-75 i.e. postponement of retirement on average five years longer than what has been done in the past, due to general economic, pension, and workforce availability issues; 2.) Eliminate the forecasted growth in employment for K-12 schools due to the forecasted decline in school age children in the ODOD population forecast; and 3.) An additional reduction in industrial employment of 3,000 to match the recent 3-year reduction in jobs at the two largest industrial employers in the county. These adjustments combined bring the gap between workforce and jobs to around 6000, within the current levels observed in comparable metro areas.

To allocate county-level population and employment growth (or decline) figures by zone, first priority goes to known land development plans. As was the case in the last Long Range Plan update, the down economy has led to the abandonment of many such plans, only a small percentage of the forecasted growth over the plan horizon can be absorbed by these developments. Therefore, most of this requires the development of a formula-based allocation to zone. The allocation scheme developed is ultimately based on two criteria - the amount of "vacant" land available by land use category, and a zone's relative level of accessibility to other population and employment within the county. The latter criteria are an indirect reflection of both infrastructure availability and access to customers and complementary services needed to sustain a business. (This criterion is applied more strongly to employment location than new residential location.) Beyond specific known local development plans, no redevelopment of currently-occupied land is assumed due to both the lack of data of local history on this and lack of limits on how such developments could theoretically be done (beyond such considerations as firefighting capability in multi-story buildings).

The countywide digital land parcel file is used to determine (via the Use Code) where "vacant" land is available by general land use code (residential, commercial, industrial) along with agricultural use land that could be converted to residential use or employment centers. Digital files of 100-year floodplain and floodways are also used to discount, where appropriate, the amount of land available due to prohibitions on development or added expense to meet floodplain development requirements.

After employment industrial categories are allocated to either commercial or industrial, needed acreages for development by all three categories (including residential) are calculated, based on trip generation studies conducted by land use where both employment and acreages were known. Also, given the much larger amounts of land in the agriculture Use Code compared to vacant, there's a need to pre-specify what percentage of acreage for residential and employment development goes into land currently designated for

agriculture. Based on general historical growth patterns which have remained the same if not scaled slightly back from the last plan update, 20% of new acreage for residential development is allocated to parcels with Agriculture use codes, and a more minimal 5% figure is used for employment. Ag land is then allocated to either residential, commercial, or industrial based on probabilities tied to the type and jurisdiction of the adjacent roadway (federal, state, or local. Probabilities were calculated based on the use of currently developed parcels and their adjacent roadways.) This leads to the table below summarizing, by land use category, acreage needed, acreage available, and formulas by which development by acreage is allocated by zone. The maps below this table show, by zone, the weighted average travel time in minutes to all the current population in the county (average time to current commercial and industrial employment countywide has also been calculated and mapped) and estimated amounts of acreage to be developed within the planning period.

Table 1 – Vacant land available and needed to serve 30-year development forecasts

Use	acres available	acres needed	Percent of each zone's vacant acres developed:
Residential	3,712	1663.1	1.16 / (ln (weighted avg travel time - 5))
Commercial	1,229	682.8	5.1 / (weighted avg travel time - 4)
Industrial	421	98.1	1.67 / (weighted avg travel time - 4)
Residential from ag	49,638	415.8	0.032 / (ln (weighted avg travel time - 5))
Commercial from ag	10,056	35.9	0.18 / (weighted avg travel time - 4)
Industrial from ag	9,105	5.2	0.066 / (weighted avg travel time - 4)

Finally, translating these figures to employment by category by zone (as well as population, school kids, vehicles, and workers as well as housing units) then using these acreage figures with existing distributions of population and employment within these zones, with adjustments as necessary to ensure that overall county-level forecasts are achieved. What is manually added in as the last step in the land forecasting process are the specific land developments for which dwelling unit or employment forecasts were made separately.

Figure 1 – Weighted average travel time to population countywide

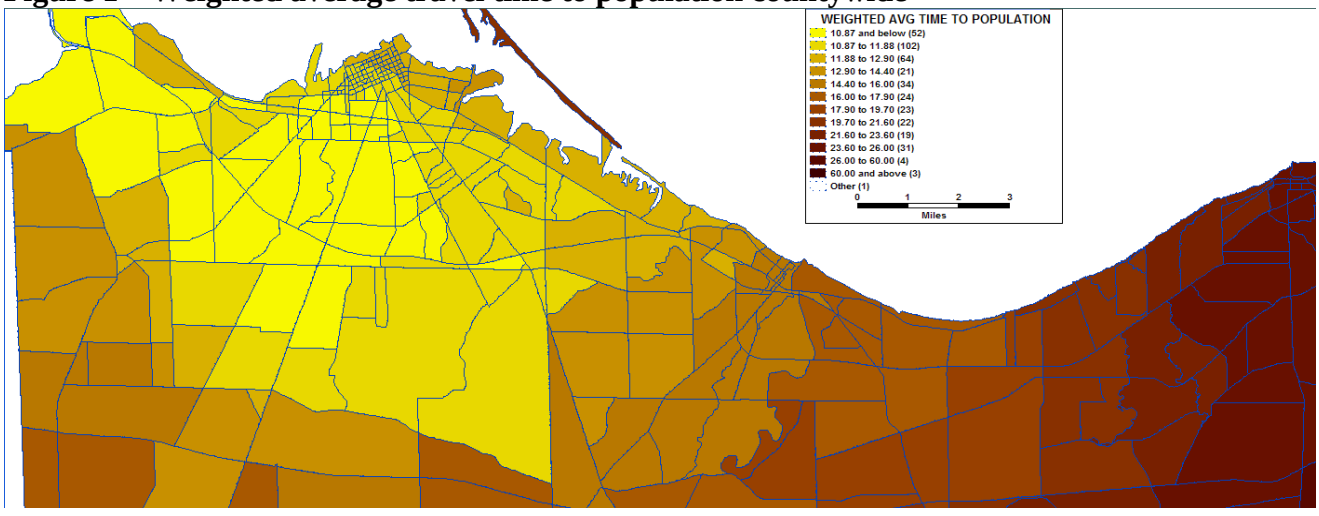
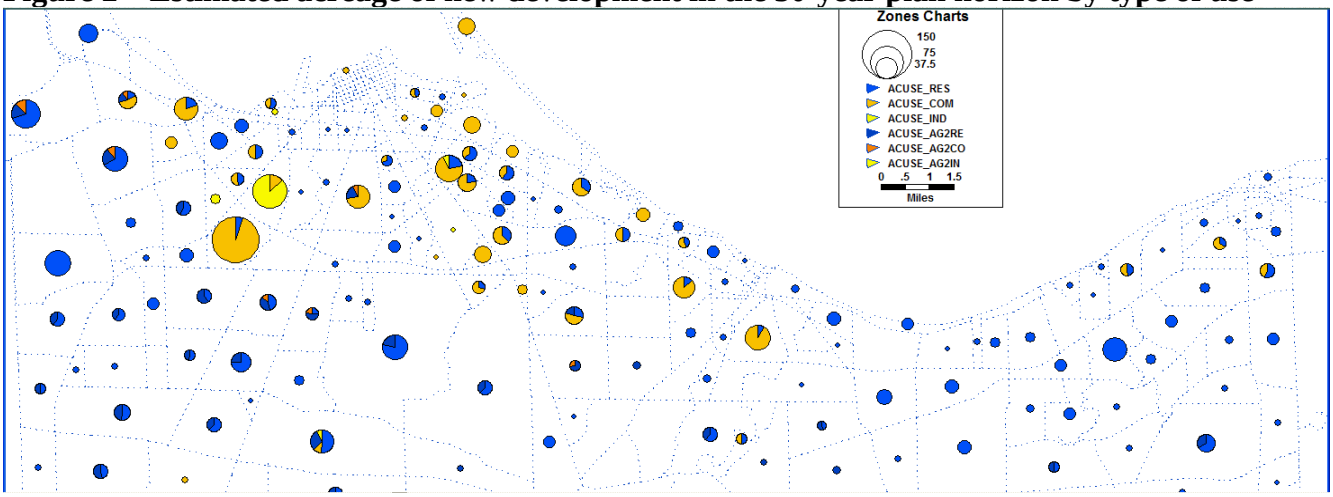


Figure 2 – Estimated acreage of new development in the 30-year plan horizon by type of use



6.2 Travel Demand Model

The traffic flow (and congestion) forecasting process consists of taking land use data in the form of population and employment figures by location, breaking it down into different categories, estimating vehicle trip generation rates for each category by different vehicle types (cars vs. trucks), and purpose of travel (such as work-related vs. non-work), and then aggregating this trip-end data into zones for the purpose of "assigning" traffic to and from all origins and destinations onto a roadway network suitable for simulating travel patterns. A digital road network was developed from the Location Based Response System (LBRS) road centerline file that Erie County developed in collaboration with the state of Ohio (with data added to it from other local state and federal sources, including Roadway Inventory files from the Ohio Department of Transportation (ODOT)). The traffic forecasting process for any given year (present to future) and time period (spring weekday to summer weekend) is then conducted as shown in the flowchart in Figure 1 (next page).

Several items in Figure 1 (the traffic model flow chart) require some elaboration: "OD" means origin/destination, or zone-to-zone trip tables, MSA means Method of Successive Averages (where the results of the latest iteration of a traffic assignment to the road network are averaged with past iterations in a way that provides equal weight to each iteration), and the "dynamic loop" refers to traffic being broken into and assigned in 1-hour intervals to the road network (to better estimate times of day as well as locations of forecasted traffic volumes and congestion). Finally, "path building" refers to estimating the shortest-time travel path thru the road network for every zone-to-zone travel combination, which after the first time through the flow chart process than incorporates the congestion effects and intersection delays that were estimated after the previous iteration of traffic assignment.

The boxes on the lower left summarize how trip tables for truck traffic are developed and difficult-to-locate employment (such as construction, utilities, and temp services) can get re-allocated to different zone locations, using an "OD table re-estimation" method that is done before the main model process is finalized. This method uses the traffic count figures to track and adjust the zone-to-zone traffic movements thru each of these count stations. The resulting trip table for trucks along with other thru trips made in cars on such major routes as the Ohio Turnpike (I-80/90) and State Route 2 represents the

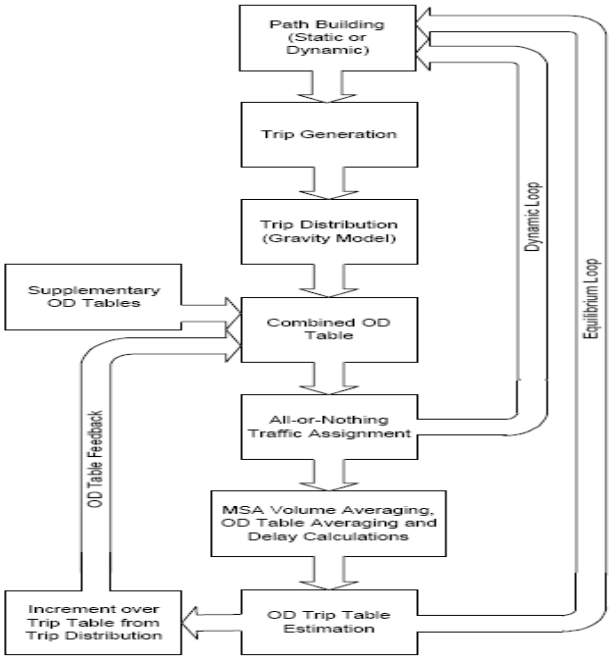
"supplemental OD tables" in the chart on the left, which is retained for later modeling steps while the two boxes on the bottom row of the chart are then discontinued and traffic assignment - after looping "dynamically" thru each hour of the day - then goes straight to the "equilibrium loop" several times. Such multiple iterations are needed due to the feedback needed between selection of an individual's travel path to a destination and the modeled travel time - which depends in part on the choices that other travelers are making.

The rationale for this type of process, rather than the more traditional use of historical trendlines in traffic along a particular road, is that the latter cannot be used for new or extended segments of roads, and often not adequate in areas where buildup of congestion tempts motorists to change their travel path to save time. The output of the forecasting process is a database that can be used to derive congested roadways, total vehicle miles traveled (VMT), and vehicle hours traveled (VHT).

To consider a comprehensive range of congestion relief strategies during development of the LRTP alternatives, three roadway improvement time scenarios were analyzed using the statewide travel demand model. After examination of project interdependencies and the costs of the various transportation improvement projects were assessed, projects were grouped by short term, mid term, mid-long term, and long-term implementation timeframes based on the outcome of the modeling process as well as the results of other measures of effectiveness.

Three roadway scenarios were analyzed using the travel demand model to identify projected traffic volumes and congestion levels. The travel demand model runs included the Base Year Network, the Existing Network plus Committed Projects Network and the Planned and Future Projects Network. From this list of projects, recommended priority improvements were identified. The following summarizes each of the scenarios.

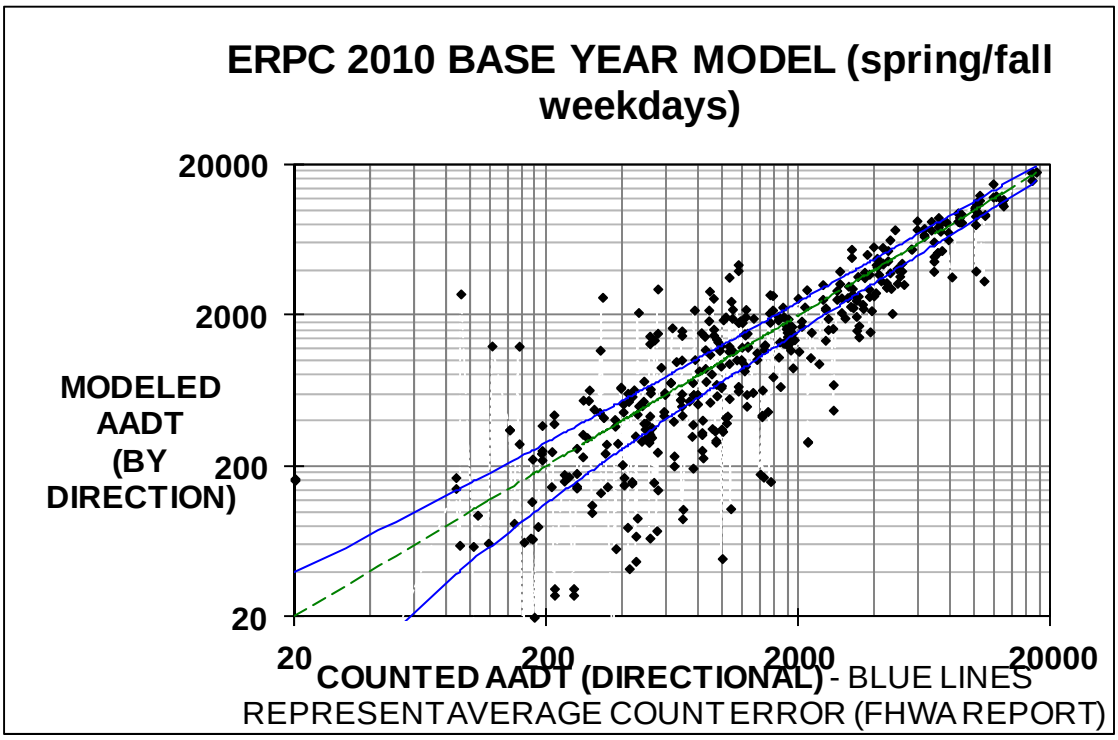
FIGURE 1

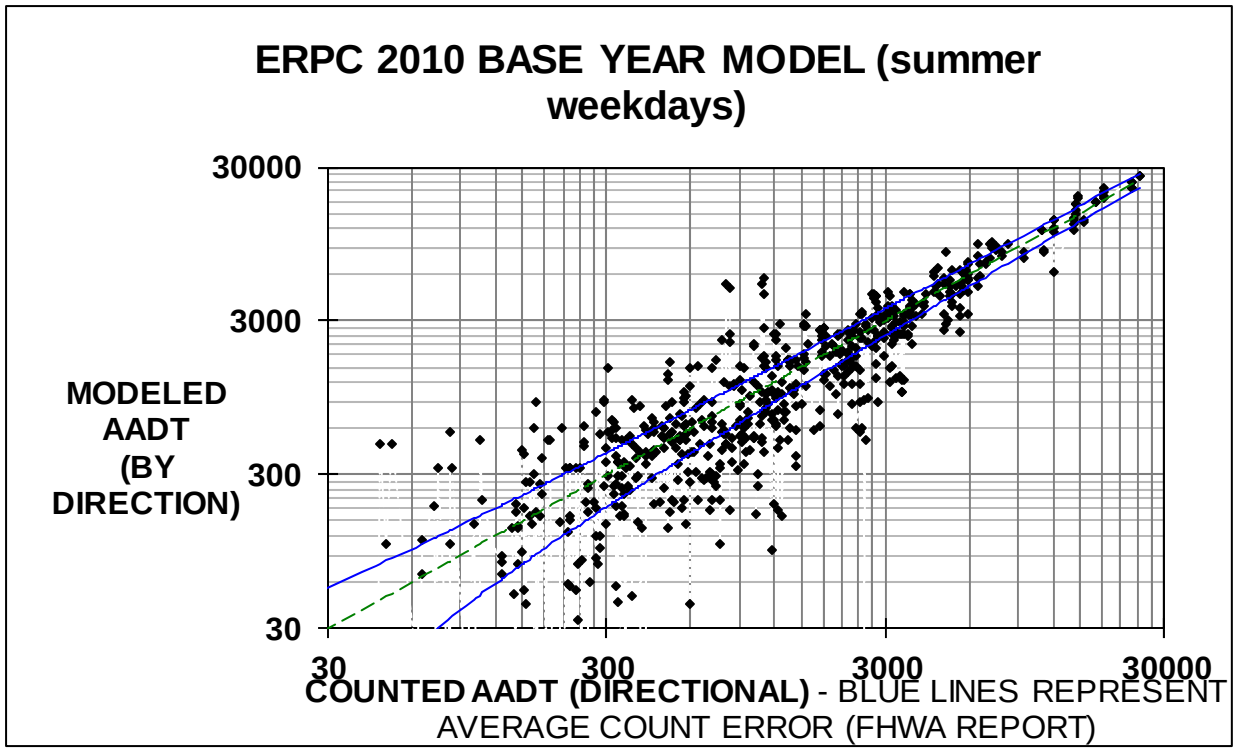


6.3 Calibrated Model Base Year

For a base year (2010), extensive testing of the modeling process is done to ensure that it produces traffic flows reasonably in accord with traffic counts conducted by both local agencies and the Ohio DOT. As shown in Figure 2, the overall pattern is found to be quite close to such counts (given the expected level of sampling error inherent in such counts) for the spring and summer weekday conditions, and summer weekend condition.

FIGURE 2





(The dashed line indicates where modeled daily traffic volume (by direction) is exactly equal to counted traffic; with the blue lines indicating expected sampling error for a one-day count.)

There are nearly 400 traffic analysis zones (TAZ) within the MPO including the zones for the City of Vermilion in Lorain County, TAZs represent the origin and destination for trips assigned to the network. The network coded for base year conditions contains all the major streets and roads that make up the MPO's transportation system.

As previously shown above, The Ohio Department of Transportation calibrated the base year TDM to meet state standards and was found to provide reasonable forecasts of travel within the ERPC MPO.

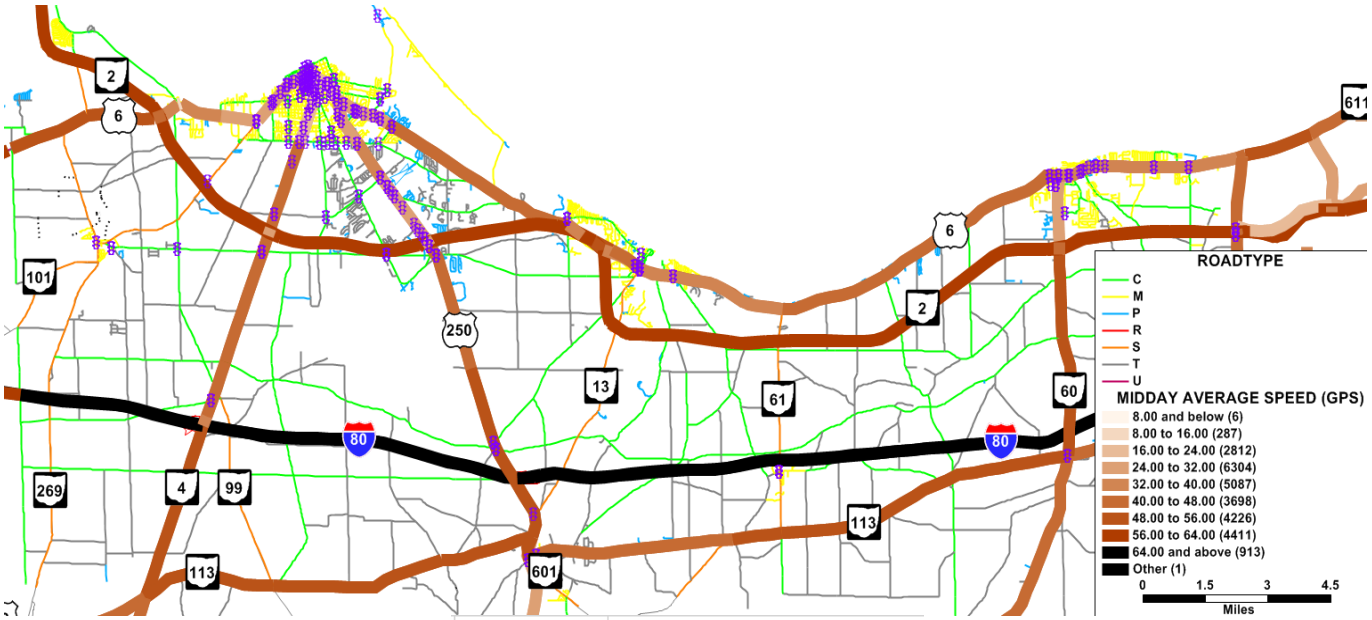
The TDM also considered recreational travel patterns for the MPO region. The tourism forecast is an important component of forecasting travel demand in the Sandusky area, and is high variable depending on time of year/day. Likely future improvements could include implementing a travel survey to capture additional information on tourist travel behavior. Tourism forecast assumptions, including daily visitation levels and parking needs for individual sites, could be used as input into the travel demand model structure in the future.

6.4 Existing Plus Committed Work

Existing and committed projects were identified through the MPO's Transportation Improvement Program list. The person trips generated through the trip generation module were run through similar trip distribution and assignment modules as the 2010 base condition. The resulting assignments from the

equilibrium assignment were adjusted based on assignment-to-count deviation observed in the 2010 base year to be used as a measure against future improvements.

Figure 3 – Summer Weekday Midday Average Travel Speeds on Major Routes



SUMMER WEEKDAY:	AVERAGE TRAVEL SPEED (MPH) (INCLD. INTERSECTION DELAY)	
ROUTE:	MODEL	INRIX
SR 2	65	65
SR 4	39	38
US 6	40	40
SR 60	45	39
SR 61	49	47
I - 80/90	70	70
SR 113	49	47
US 250	41	40

6.5 Existing Plus Committed Plus Planned

The planned and future projects represent studies and improvements that should be undertaken to help satisfy the long term arterial street system needs in the County. Many of these projects are new projects related to the continued growth of Erie County and to the county's related transportation needs. Planned/ future projects are intended to span a period of approximately 30 years and are based upon current deficiencies and the best estimates of anticipated needs, past trends, projections, and input and comments received over the last several years from elected officials, business representatives, and individuals.

*All of the above modeling information was compiled by ERPC staff and Sam Granato, Ohio DOT, Office of Statewide Planning and Research