memorandum

Date: April 9, 2020

To: Bill Huotari, PE
From: Sara Merrill, PE, PTOE & Stephen Dearing, PE, PTOE

Re: Trip Generation & Traffic Impact Assessment
General Information

Nearly all developments, whether new or redevelopment, result in some impacts to the adjacent transportation network. In suburban vehicle-centric areas like the City of Troy, most often new developments lead to an increase in vehicular trips.

For residential developments, these are typically “new trips”, constituting new points of origin / destination. For other types of development, such as a gas station, most vehicular trips are the result of existing traffic driving directly by and stopping (“pass-by trips”), or nearby traffic rerouting (“diverted trips”) slightly from their primary destination. In the gas station example, the development is not generally in itself a destination, but rather an intermediate stop. Traffic generated by a development can consist of combinations of new, pass-by, and/or diverted trips, depending on the land use.

- Pass-by trips do not result increased traffic volumes, and the impacts of these trips are typically limited to the site driveway.
- Diverted traffic involves vehicles that alter routes (turning off one road to another) specifically to reach a development. This adds traffic to some roads, but may remove it from others, resulting in changes to traffic patterns.
- New trips are those trips generated with the specific purpose of visiting the site. New trips increase traffic volumes on all roadways associated with the trips.

Traffic impact analysis provides a means to objectively evaluate the traffic impacts of a development. In the City of Troy, a traffic impact analysis may be requested to evaluate a variety of potential concerns, such as trip generation, traffic flow, impacts on adjacent roads or intersections, parking, and traffic safety – as well as potential ways to mitigate the traffic impacts of development. The ultimate goal of a traffic impact analysis is to provide sufficient information to inform the City in its planning decisions.

Developments that create primarily new trips are often the most scrutinized, as the public readily associates more traffic with more delays, particularly on already congested roadways. Recent scrutiny in Troy has heavily focused on new residential developments, with a combination of astute observations and anecdotal experiences leading to questions on how trip generation estimates are derived (and indirectly, the validity of these values), and the extent to which site-generated traffic will result in additional traffic delays and congestion, contribute to traffic crashes, or other traffic-safety concerns.

The following sections offer additional information to address many of the common questions surrounding these issues.

Estimating Trip Generation for Residential Developments

The Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition, provides trip generation rates for numerous land uses, based on data collected from thousands of study sites throughout the United States and Canada. Generally, the study sites were in suburban areas and so reflect the anticipated trips for communities like Troy. These rates can then be used to estimate the number of vehicle trips generated by a development.

For residential housing, traffic impacts are usually most noticeable during the peak hour of adjacent street traffic – that is, during morning and evening "rush hour", when traffic on the roads is most congested. In most areas, the morning (AM) peak is a one hour period that occurs between 7 am – 9 am, and the evening (PM) peak is a one hour period usually between 4 pm – 6 pm.

Most residential developments in Troy can be categorized into one of three ITE Land Use classifications.

- Single-Family Detached Housing
- Multi-Family Housing (Low-Rise)
- Multi-Family Housing (Mid-Rise)

The ITE Trip Generation Manual states that Multi-Family housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units. Multi-Family housing that consists of only one or two levels is classified as Low-Rise, while those with between three and 10 levels is considered Mid-Rise. One source of ambiguity involves residential developments of row houses, also known as townhouses. They are multi-story units for single family occupancy that share common walls between the units, e.g. are not detached units. These are generally considered low-rise even if they have three stories, as the lowest level is often wholly or in part a garage for vehicles.

Below is a table showing trip generation estimates for a theoretical 3.5-acre residential development. This table is intended for illustrative purposes only and does not correspond with a specific project. The actual number of dwelling units that can be accommodated on a particular site will vary based on individual site conditions and zoning requirements for setbacks, parking, etc.

Table 1: Example of Trip Generation Comparison for 3.5-acre Residential Development

Number of Dwelling Units	ITE Land Use Classification	Number of Site-Generated Trips								
		AM Peak Hour			PM Peak Hour			Daily		
		In	Out	Total	In	Out	Total	In	Out	Total
100	Multi-Family (Mid-Rise)	9	27	36	27	17	44	272	272	544
100	Multi-Family (Low-Rise)	11	37	48	37	22	59	358	358	716
20	Single-Family Detached	5	14	19	14	8	22	119	119	238

As the table above shows, higher density housing results in fewer vehicle trips for the same number of dwelling units. Single-family Detached housing generates significantly more trips per dwelling unit than multi-family housing. Low-Rise Multi-Family generates more trips per dwelling unit than Mid-Rise Multi-Family developments.

Here are answers to a few commonly asked questions related to trip generation:

1. **Why are there different rates for Single Family & Multi-Family Residential?**

   This is a complicated question, with many contributing factors.
   - Multi-family dwellings share more services (lawn maintenance, snow removal, exterior building maintenance & repairs), whereas each family in detached dwellings more commonly hire their own. A large multi-family development may be serviced by one full-service lawn company once a week, compared to a traditional residential subdivision that may have several different lawn services (mowing, landscaping, weed & pesticide applications) each servicing a handful of homes weekly. This same concept applies for many other facilities maintenance items as well – plumbing, roofing, painting, window cleaning or replacements, general household repairs, etc.
   - Detached single-family homes have more instances of multi-generational households and families with children. This often means more cars per household.

   The residential land use categories included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within these categories. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

2. **How does a lack of public transit affect these rates?**
   The underlying ITE Trip Generation data was collected primarily at suburban locations with little to no transit service and either lacking pedestrian amenities or only having rudimentary ones. Therefore, the values shown are the "base" condition, without transit. Where there is sufficient supplemental data, ITE also provides trip generation rates for dense urban and city-core location settings. In a walkable dense urban area with robust public transit, the number of trips generated by residential units is significantly less, regardless if single family detached or multi-family styles of housing.

3. **Does the number of bedrooms matter? Does a switch from studio to 1-bedroom units affect traffic?**
   As most multi-family properties have a mix of studio and one bedroom units, it is very difficult to tease out the variation in trips based on this factor. While it is expected that the number of bedrooms and number of residents are likely correlated to the number of trips generated by a residential site, most of the studies included in this land use did not indicate the total number of bedrooms.

4. **How does owner-occupied vs. rental affect the number of trips?**
   An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and owner-occupied sites within the ITE database.

5. **Does the lack of other transportation options affect the traffic numbers?**
   None of the recent trip generation studies submitted for inclusion in the ITE database have clear information regarding non-traditional vehicle trips using services such as Uber or Lyft. There is no consensus on the impacts that autonomous vehicles will have on the future of transportation, though many believe that the overall number of trips will increase while the number of needed parking stalls will decrease.

6. **What is considered more important, the absolute number of new trips or the 'context' of where the new trips are occurring?**
   This actually gets to two key questions: what should the threshold be for requiring something more than a simple calculation of trip generation, and when is more traffic too much traffic? Both these facets are interrelated, and the answers to both are "it depends".

Generally, the City of Troy would start with considering the anticipated number of trips a development may generate. It recognizes that there are times when a full analysis of the impacts to capacity at one or more key intersections is required. As the City of Troy does not have a formal policy that directly addresses the issue of what the threshold should be, it relies on the professional judgment of its staff and their consultants. Many communities in southeast Michigan use somewhere between 50 to 100 new peak hour trips or 750 trips or more per day as the trip wire for requiring a full capacity analysis. Larger cities tend toward the higher value and smaller cities and villages tend to the lower value. And somewhere in the 50 to 100 trips in the peak hour is about where Troy tends to fall. But we also look at the context. For example, if a proposed development is directly located on a major mile road, one with average daily traffic (ADT) in the range of 35,000 or more a day, adding 75 new trips in the peak hour is only about 3 percent or less of what that roadway is currently carrying. Daily fluctuations are generally more than that (± 5% are common), so the new trips would be unnoticed in the already heavy flows. On the other hand, the same size development on a corridor with only 15,000 ADT should certainly be required to do an in-depth study.

As for the question of when is more traffic too much traffic, again the City of Troy does not have a formal policy regarding this question. But in this case, the decision makers are not city staff. Rather, that is a decision to be considered by the Planning Commission and City Council. There is an equity issue of whether to penalize the 'last one in' when other property owners in an otherwise fully-developed corridor were approved for plans with comparable density, which is best dealt with on a policy level by community leaders.