Peak Average Daily Traffic Factor Estimation Methodology

Traffic Survey Group – NCDOT

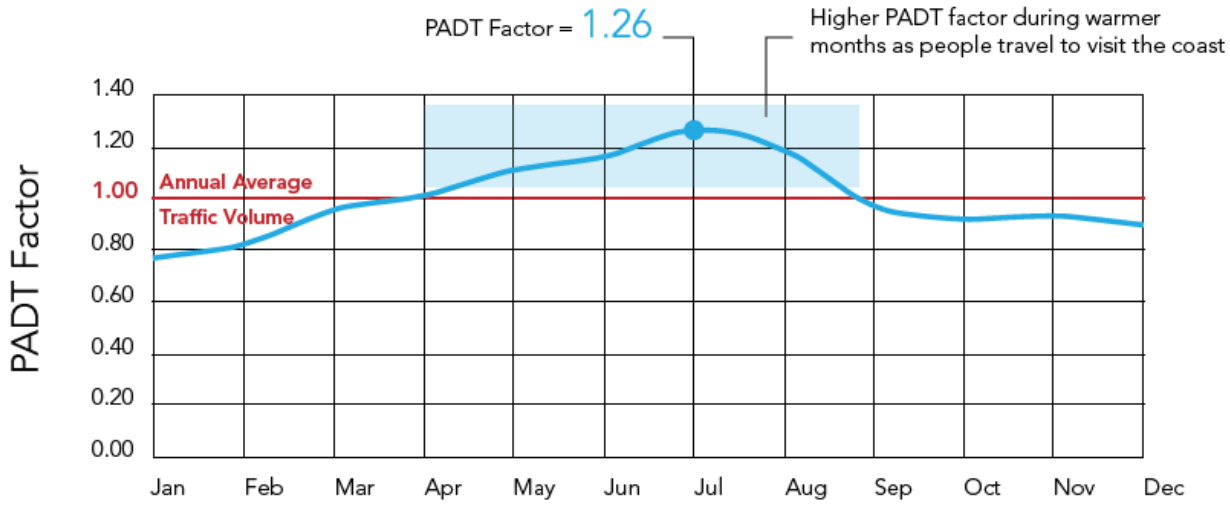
Introduction

The NCDOT uses the Peak Average Daily Traffic (PADT) statistic as an input in the project prioritization process. This statistic is an estimate of the relative monthly average daily traffic volume during the peak season of travel. Most locations have estimates based on the published Annual Average Daily Traffic (AADT) generated for traffic monitoring purposes and a factor that adjusts from the Annual ADT to the Peak ADT. The factors for primary routes are generated using seasonal counts collected at a sampling of stations on each corridor and then extrapolating or interpolating factors to nearby stations on the same route. For locations that have continuous count stations, PADT and AADT can be calculated directly from the extensive set of counts available for these monitoring stations. The basic calculations are:

PADT Factor = Highest Monthly ADT / AADT

PADT = AADT x PADT Factor

An example of PADT Factor for I-40 near Wilmington is:



PADT Factor Example

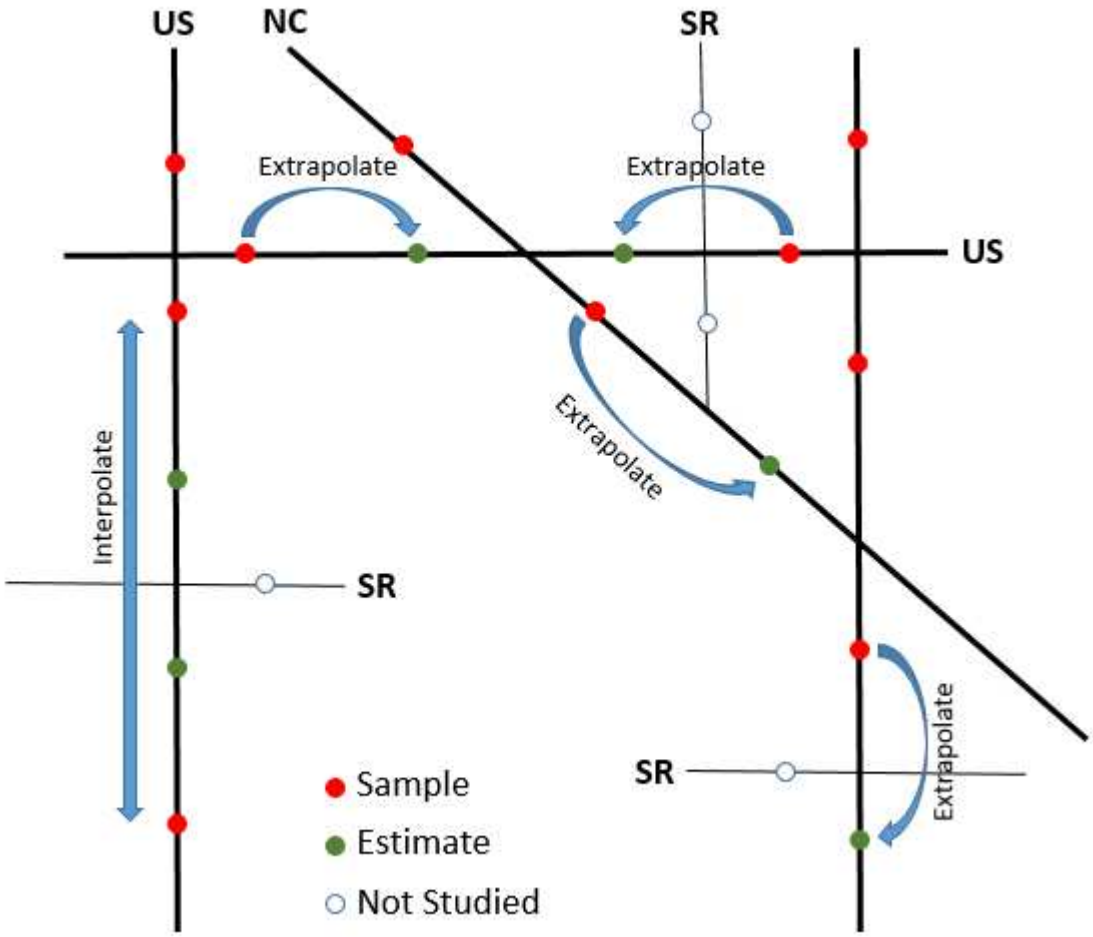
Sampling Method for PADT Factor Estimation

In the development of the PADT statistic it was found that certain attributes are indicators for differences in PADT Factor. These attributes must be considered in determining where to collect counts for sampling travel on the highway network. These are:

- Route Type – The lower order route types tend to have higher PADT factors than higher order routes. The route types are defined as Interstate, US, NC, SR, and Local.
- AADT – The AADT level impacts the relative magnitude of the PADT factor. In general, higher AADT have lower PADT factors. Large changes in AADT on a corridor indicate a need for more samples on that corridor.
- Urban/Rural Areas – In general, routes in urban areas tend to have lower PADT factors than in rural areas. As a corridor transitions from rural to urban, there is a need for more samples to properly identify this change.
- Crossing Routes – When a crossing route has high volume and/or high mobility, the PADT factor sometimes shifts substantially on the corridor due to the interaction of the corridor with the crossing route. The crossing route type and the AADT on the crossing route, relative to the AADT on the corridor, are good indicators of the potential for shifts in PADT factors. Samples should be collected on either side of these crossing routes.
- Recreational Access – Routes that provide regional access to recreational attractions have higher PADT factors than similar routes in the same area that serve other types of trips. Factors on these routes can change significantly in a short distance. Additional sampling may be needed to ensure the changes in factors are identified properly along these corridors.
- Major Land Uses – There can be a localized effect on PADT factors on a corridor in the immediate vicinity of a major land use. Additional samples may be needed in the vicinity of the land use to identify the limits of the effect they have on a corridor.

It is recommended that each route in a county be evaluated as a corridor using the attributes identified above as the basis for selecting stations to sample. In between sample stations, stations not sampled will be assigned a PADT factor either by extrapolation or interpolation using the sampled station factors.

When developing a county sampling plan, stations must be selected for data collection to generate a count based PADT factor. These are the sample stations. They are selected based on the characteristics of the network as well as having adequate data to support estimation on stations not counted. A completed sampling plan includes sample stations where counts will be collected and the estimation method and sample stations to be used for estimating non-sample stations. An example of a plan is:



Sample Plan Example

All stations on US and NC routes are either a Sample or will have an Estimate generated and the method of estimation has been selected in the plan.

PADT Factor Data Collection Specification

The PADT Factor data collection specification is designed to ensure a reliable estimate of PADT and AADT can be generated while minimizing the amount of data needed. This is done by collecting an adequate amount of data for each count so that a reliable monthly ADT can be estimated and that an adequate number of counts (months) are collected to identify the peak season and calculate a valid AADT estimate.

The specification provides requirements for the following:

- Traffic Conditions
- Count Event
- Seasonal Pattern

In general, the data obtained for a location is typical, recurring travel, with an adequate number of days for each count event, and an adequate number of events to define the seasonal pattern. If data is collected in compliance with this specification, the resulting PADT factor generated will provide reliable estimates of PADT (when using a reliable AADT estimate) at the location sampled and at other locations with similar travel characteristics.

Traffic Conditions Requirement

During the year there are changes in travel related to changes in activity and activity levels. Daily travel patterns are recurring at a particular time of the year but that pattern may change at different times of the year. These patterns drive the statistics generated to represent travel. Individual events will occur that cause deviations from the recurring pattern at that time but they have a moderate influence on monthly and annual average daily traffic statistics. The recurring pattern minimizes the impact on those statistics when a full data set is collected. As we are minimizing the data needed to generate these statistics, it is imperative that the recurring patterns be captured in the counts collected. A holiday count will be averaged with many typical days in a full data set, whereas, it will adversely impact the same statistic when using a partial data set. All data collected for PADT factor calculation must be collected when typical travel is occurring. The specifications to meet this requirement are:

- Data is not collected on holidays or holiday shoulder days (if applicable)
- Data is not collected during adverse weather (e.g. frozen precipitation, flooding)
- Data is not collected during adverse events (e.g. major accidents, temporary detours)
- Data is not collected during major social events (e.g. graduation day, sporting events)
- Data is collected with school in session if it is normally in session on that day of week
- Data is collected when schools are closed if it is normally closed on that day of week
- Data is not collected on a day that is not experiencing typical travel for that time of year

Data must be reviewed as soon as it is processed to verify that no unusual conditions occurred and that typical travel was counted. If it is determined that atypical travel was counted in a count event, there are 3 options to resolve the issue:

1. Exclude the atypical data as long as minimum count event requirements are met
2. Recount the day of week with atypical data within two weeks of the original count
3. Recount the entire count (within the seasonal scheduling requirement)

This ensures that the monthly average daily traffic estimate generated from a count event is reliable. If the analyst is unsure the travel pattern is typical, a recount of the entire count should be made to verify that the typical travel pattern is being captured.

Count Event Requirement

A count event is data collected in a particular month to identify the level of monthly ADT at that location for the month. An adequate number of days of data must be collected so that a reliable monthly ADT can be estimated. Travel patterns vary by day of week and a minimum number of days must be collected to support generating the monthly ADT estimate from the count event data. In particular, weekday travel is significantly different from weekend travel at most locations and having count data representing both patterns is key to generating a valid monthly estimate. The count event data requirements are:

Count Data Requirements

- Two days of typical traffic data for Monday, Tuesday, Wednesday, or Thursday weekday days
- Typical traffic data for the Friday weekday
- Typical traffic data for both Saturday and Sunday weekend days

A count event meeting the recommended requirements will provide a monthly ADT estimate with a high level of confidence. When resources allow, collection of a 7 day count that includes each day of the week should be collected.

Seasonal Pattern Requirement

Data is collected to support generation of two estimates, the peak monthly ADT and the annual ADT. A minimum number of count events are required to adequately approximate the seasonal pattern so these two values can be estimated properly. Count events must be collected at various times during the year so that the variation in travel experienced in the different seasons is measured. The seasonal pattern data requirements are:

Minimum Requirements

- There must be at least one count event in each of the four seasons:
    - Winter – December, January, and February
    - Spring – March, April, and May
    - Summer – June, July, and August
    - Fall – September, October, and November

- One of the count events must be representative of the peak travel month
- One of the count events must be representative of the lowest travel month
- If two distinctly different travel patterns occur within a season for sustained periods, then a count event measuring each pattern is required

The seasons are oriented to reflect the traditional school year to minimize the number of count events required in a season. The count event for a season must be collected at a time consistent with school operations for that season (e.g. in session in the Spring, out of session in the Summer). The last requirement is to ensure major changes in travel within a season are measured. This applies when there are distinctly different travel patterns for sustained periods of many weeks. An example of this is the Fall Color season in the mountains. Travel increases significantly during this period and is sustained for 3 to 4 weeks. The remainder of the Fall season experiences significantly less travel. On routes that experience this type of travel, a count event when Fall Colors peak and another count event outside that period are recommended for the Fall season. Variations in travel occurring for shorter periods, such as Spring Break or the State Fair, do not require additional count events.

Summary

The data collection specification is designed to ensure a suitable data set is available for generating a valid PADT factor estimate. Field operations should be planned and conducted so that these requirements are met. Careful consideration of the character of travel in an area must be made to ensure the data collected is representative of typical travel. Review of the collected data must be made in a timely manner to verify the travel measured is typical and, if not typical, a count event is recounted within the season being measured. Observation of local conditions during data collection is also a key component for ensuring the data needed is captured.

PADT Factor Calculation Specification

The PADT is an estimate of average daily traffic for the peak season of travel at a location. The PADT factor is used to generate an estimate of PADT from AADT. PADT factor is calculated by:

Monthly ADT (MADT) = ((4 x (Wednesday + Thursday)/2) + Friday + Saturday + Sunday)/7

PADT = Maximum MADT

AADT = (Winter MADT + Spring MADT + Summer MADT + Fall MADT)/4

PADT Factor = PADT / AADT

All sample stations will have a PADT Factor calculated based on the daily volumes collected. Non-sample stations will have estimates assigned based on either extrapolation or interpolation. These methods of assignment are:

Extrapolation – Assign the same factor for a sample station to a non-sampled station. This should be used on stations on the same corridor. This should not be used across major crossing routes or if there are major differences in AADT between the stations.

Interpolation – Assign a calculated PADT factor based on interpolating between PADT factors of two sample stations. Two methods of interpolation should be used:

- Straight Line Interpolation – This method should be used when the AADT is relatively linear between the sample stations and the intervening non-sampled stations
- AADT Rate Interpolation – This method should be used when the intervening non-sampled stations vary higher and/or lower than the sampled stations. A rate is calculated based on the differences in sampled PADT Factors and AADT. An example of this method is:

Station	AADT	PADT Factor
Station 1	10000	1.12
Station 2	16000	
Station 3	8000	
Station 4	12000	1.10

Rate = (1.10 – 1.12) / (12000 – 10000) = -0.02 / 2000

Station 2 Change = (16000 – 10000) x (-0.02 / 2000) = -0.06

Station 2 PADT Factor = 1.12 + (-0.06) = 1.06

Station 3 Change = (8000 – 10000) x (-0.02 / 2000) = 0.02

Station 3 PADT Factor = 1.12 + (0.02) = 1.14

AADT Rate Interpolation Example

This method is not suitable if either the AADT or PADT Factors are the same for the sample stations. A straight line interpolation is recommended for that situation.

Developing Statewide Coverage

The process of managing the data collection and analysis is typically performed at the county level. Counties are selected across the state each year to distribute work geographically. Due to this, when developing a county sampling plan, the configuration of the network and availability of data in adjacent counties will impact the plan. If data is available in an adjacent county, extrapolation and/or interpolation across county boundaries may be used to update factors. If there is no data in an adjacent county, sampling and estimation may cross over county boundaries to provide a logical stopping point in the process. Sampling on the same route on either side of a county boundary should be avoided. As the coverage is built, checks on corridors across county boundaries should be made to verify consistency in the factors, where applicable.