Current and Forecasted Truck Parking Needs Assessment - Appendixes

WA 3 Tasks 2.8 and 2.10

Final: March 23, 2020

Appendix B: Truck Parking Forecasting Methodology

Estimation and Calibration Procedure

This section describes the process of creating a future prediction of truck parking, largely an extension of the earlier processing of ATRI data. This involved creating linked trips from that dataset and then comparing it to the Transearch forecasts.

Input Data

The inventory of ATRI-based stops provided the parking stops with point locations in the base year. These were over 12 million stops made by ATRI trucks. Stops for which the majority of the duration was not during the weekdays were filtered out, leaving 12 days for each month. SAM projections provided base and future year truck trips for the state. The SAM trip tables were organized by the statewide TAZs.

Exhibit B.1: ATRI Time Periods

	Start		End	
February	2/1/2018	Thu	2/15/2018	Thu
May	5/1/2018	Tue	5/15/2018	Tue
July	7/16/2018	Mon	7/30/2018	Mon
October	10/16/2018	Tue	10/31/2018	Wed

Methodology

The goal of this exercise is to establish how truck travel produces a need to stop based on travel activity. Therefore the observed parking stops needed to be related to the trip table in a way that would allow projection of future parking and locations thereof.

One of the main determinates of parking location is the time already traveled and/or left to travel. Using distance from origin and destination was considered. However this can vary based on the route, so it could create unclear results and put trucks in zones in which none park. An alternative was devised which could capture the distance implicitly and use more information about where trucks actually parked when traveling on certain routes.

Determining Stop Type and Linking Trips

First stops were divided into origins/destinations (OD) and parking based on a few rules. After testing different values we settled on stops being parking if they were:

1. In a known truck parking location.
   OR
2. Between 4 and 14 hours in duration AND caused a detour (of straight line distance) less than the threshold percentage.

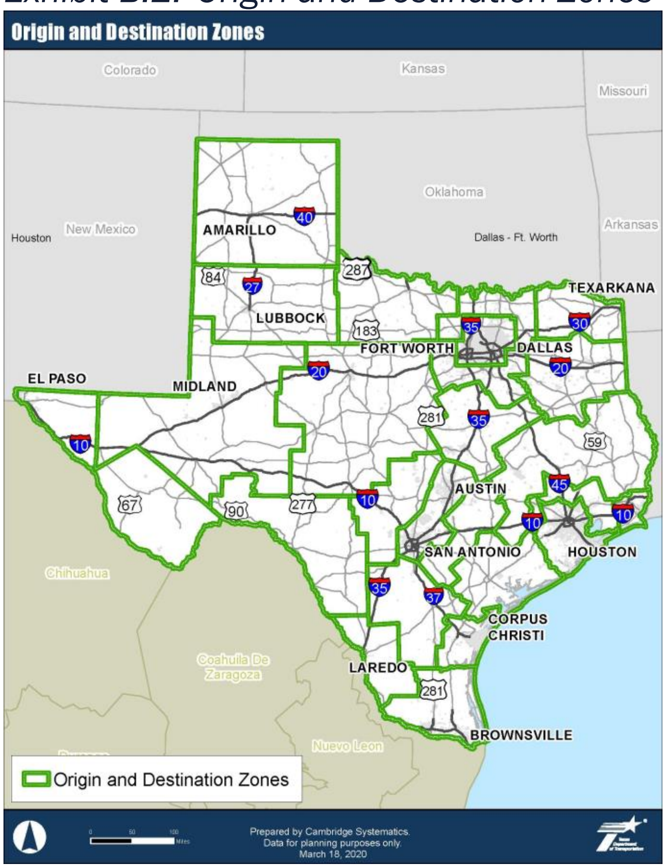
The threshold percentage varied by the (straight line) distance between origin and destination. If that distance was less than 50 miles, the detour threshold was not applied. If the straight line distance was 50 to 275 miles, detours of up to 12% were permitted for parking. For longer trips, 275+ miles, there was only a 5% increase in distance allowed. By doing this second level of filtering, stops which were otherwise considering parking but required drivers go an unreasonable distance to park, were changed to OD. The parameter values chosen were high enough to account for curves in interstates and indirect routes on which a truck would reasonably stop.

With the stops divided up into the ODs and parking stops between ODs, parking stops were linked to preceding origin and succeeding destination. A linked trip would include the OD and their parking stops, assuming that the truck's purpose determined the location of the ODs and the parking stop locations were determined by the ODs of their trips.

Zonal Structure

To create a trip table, we designated a set of zones for ODs (ODAZ) and another for parking location (PAZ). The OD zones were large and regional - an aggregation of counties. There were 25 inside the state and 4 more outside. Using smaller zones would result in a sparse trip table that would complicate projection. Counties were used as parking zones.

Exhibit B.2: Origin and Destination Zones



Applying Parking to SAM Trips and Projecting

By assigning parking stops to PAZs and ODs to ODAZs, the relationships required between trip activity and parking could be calculated. Each PAZ had a sum of parking stops by ODAZ pair. Each ODAZ pair had a number of trips, i.e. a trip table. This could then be related to the SAM trip table, which modeled the commercial activity-related trucks stop but not parking.

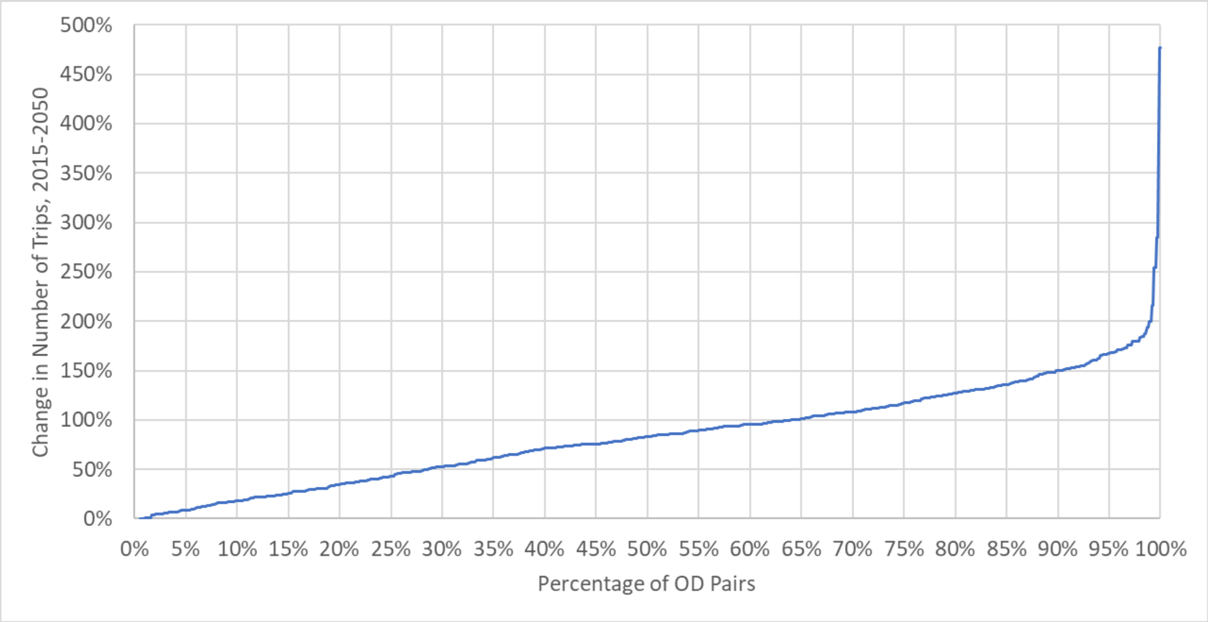
After considering and running multiple relational methodologies, we decided to weight the (ATRI) trips and their parking stops. The weighted values were considered to describe the total average daily truck movements as does SAM. This allowed parking stops to be directly applied to the base year SAM trip table. The differences between SAM and ATRI county-level estimates were accepted as they were. The ATRI totals were multiplied by a truck expansion of 10 and divided by the total number of days, 48, to arrive at the final weighted projection for each county in 2018 and 2050.

There was a number of SAM trips for each ODAZ pair (28x28) and a (weighted) count of parking stops for each PAZ + ODAZ pair (254x28x28). Having done all of the computation up front, parking is projected by calculating the change in travel between each ODAZ and the scaling the value in each PAZ contributed by those ODAZ pairs. Note that for all the PAZs, there will be many OD pairs that contribute no parking. For example, trucks traveling from Dallas to Houston will not park in West Texas counties.

To illustrate the summation of parking stops, trips from the Laredo region to Metro DFW produced approximately 1,000 parking stops in McLennan County in the base year. The volume of trips for this origin and destination increased by 150% from 2015 to 2050, so the number of parking stops in McLennan County on trips with this OD would be 2,500. The total stops in McLennan County would be the sum of the projected parking in this county from each OD.

Exhibit A.3 illustrates the percent change in parking in Texas counties between 2018 and 2050. The percent change observed ranged between 0 and nearly 500 percent. However, 99 percent of counties exhibited an increase of less than 200 percent.

Exhibit B.3: Cumulative Distribution of Change in Volume by OD (SAM 2015 to 2050)



Assigning County-Level Demand to Links

The county-level truck parking demand was then assigned to highway segments within the county using current parking levels, current truck traffic, and forecasted truck traffic as determined by the SAM model.

Current and future truck-miles traveled (TMT) were aggregated for each highway segment in the needs analysis from the SAM model. The share of the county-level TMT for each segment was calculated to determine the amount of future truck traffic absorbed by each segment. For example, if a route consists of three segments with TMT growth of 10,20, and 50 each within county A, and the total TMT growth of for county A is 240 then the share of TMT growth for the said route is (10+20+50)/240 = 0.33 or 33%. This method was used to incorporate the assumption that more truck parking will be demanded where more trucks are traveling.

The share of current truck parking demand for each route within the county was then calculated. The same methodology as above was used in this step. For example, if parking demand for the same segments above are 5,10,15 trucks per day, and total parking demand for the county is 600 trucks per day, then the share of parking demand for the route within county will be (5+10+15)/600 = 0.05 or 5%.

Finally, future truck parking demand was determined by distributing the county-level truck parking forecast across highway segments using the two shares described above: TMT and current truck parking demand. From the previous examples, a segment with 33% of the additional TMT and 5% of current parking, 2050 truck parking demand would be calculated as: (33% * new demand + 5% * new demand)/2. The outcome of this formula is added to the current demand for each segment to calculate future demand.