Trip Generation Characteristics of Discount/Home Improvement Superstores, Major Distribution Centers, and Small Box Stores

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Executive Summary

The Florida Department of Transportation (FDOT) has the responsibility of determining the traffic impact of development along the State Highway System. With changes in the present economy, FDOT saw the need to revisit trip generation of several prominent retail and supporting land uses. Recent Florida and ITE Journal studies have shown higher trip generation rates for Free-Standing Discount Superstores (ITE Land Use 813) and Home Improvement Superstores (ITE Land Use 862) than published rates in Trip Generation 8th Edition. If traffic studies use trip generation rates that are too low, appropriate improvements will not be recommended. In addition, the Trip Generation 8th Edition has no data on major single retailer Distribution Centers and free-standing dollar or Small Box Stores. Both of these land uses have impacts on the State Highway System.

FDOT chose the 54 study sites to reflect geographical diversity for each of the four land uses. A steering team of FDOT District Growth Management Coordinators also provided study site recommendations. Several sites were previously studied during the economic boom before the downturn in 2008 and provided an excellent base for comparison.

Retail Uses

The trip generation results of three retail land uses in this study suggest that there has been a significant reduction in trip making activity in the retail sector since the most recent studies were completed. Free-Standing Discount Superstores LU 813 and Home Improvement Superstore LU 862 both showed approximately 40% decline from the 2007 FDOT District 7 study of 16 stores in central Florida. Interestingly, because of this decline, the rates found in this study are relatively consistent with Trip Generation 8th Edition. In conjunction with this decline, studies of the regional Distribution Centers which supply the Superstores, Small Box and grocery stores, reflect a modest decline of about 6% in trip making from 2006 levels.

Exhibit 1 – Trip Generation Rates of Retail Uses

Trip Generation Rate Summary			
	FDOT Central Office Study 2010	Recent FL Study	ITE 8th Edition
Discount Superstores		District 7 3/2007	LU 813
Weekday Daily	**45.41**	76.7	53.13
Home Improvement Superstores		District 7 3/2007	LU 862
Weekday Daily	**31.51**	49.5	29.8
Small Box Stores		Polk 4/2009	LU 815**
Weekday Daily	**64.01**	81.08	57.24

*per 1000 Sq. Feet Gross Leasable Area

** ITE LU 815- Free-Standing Discount Store

Small Box Stores like Dollar General or Family Dollar typically provide health & beauty aids, cleaning supplies, snack food, household items and some apparel. They have been a burgeoning land use even in a tough economy. With no ITE land use code, Land Uses 814 Specialty Retail, 815 Free-Standing Discount Store and 820 Shopping Center are often used to

predict trip generation for these stores. With 15 studies from around Florida, this study identifies that trip generation is roughly 30% higher than the commonly cited ITE LU 814 and 820 which are much larger and not convenience oriented. In addition to traffic counts, pass-by interviews were conducted at five sites yielding 723 usable interviews. These showed an average daily pass-by rate of 34%, which is considerably higher than the 23% average for ITE Land Use 815 and consistent with ITE LU 820.

Large Distribution Centers

Large Distribution Centers of approximately one million sq. ft. are of extreme importance to the Department because they typically locate at critical freeway interchange locations to facilitate truck movement. Some trip generation studies utilize ITE Land Use 152 High Cube Warehouse, which has the closest characteristics to these large Distribution Centers. The primary difference is the weekday daily rate of only 1.44 compared to the 1.86 average from this study of nine Distribution Centers in Florida. This could be a result of the larger warehouses focusing more on distribution and less on storage. As a result, the number of trips generated by Distribution Centers may have been underestimated if they were using this category as a guide.

Exhibit 2 – Trip Generation Rates of Distribution Centers

Trip Generation Rate Summary			
	FDOT Central Office Study 2010	Recent FL Study	ITE 8th Edition
Distribution Centers		Polk 4/2009	LU 152
Weekday Daily	**1.86**	1.95	1.44

*per 1000 Sq. Feet Gross Leasable Area

As a result of this study, more accurate and fair transportation impact assessments can be made and appropriate improvements can be recommended. In addition, with these robust results, it will be easier for government and the development community to come to agreement on projected transportation impacts of these evolving and emerging land uses.

Background

Recent Florida and other studies documented in the ITE Journal point to higher trip generation rates for Free-Standing Discount Superstores (ITE land Use 813) and Home Improvement Superstores (ITE Land Use 862) than published rates in Trip Generation 8th Edition. In addition, Florida Department of Transportation and local governments in the state were encountering rapid development of two land use types not specifically listed in the ITE Trip Generation Report. These uses are large single retailer Distribution Centers and free-standing dollar or Small Box Stores. The trip generation characteristics of these new uses are often approximated by LU 152 High Cube Warehouses and LU 815 Free-Standing Discount Store, respectively.

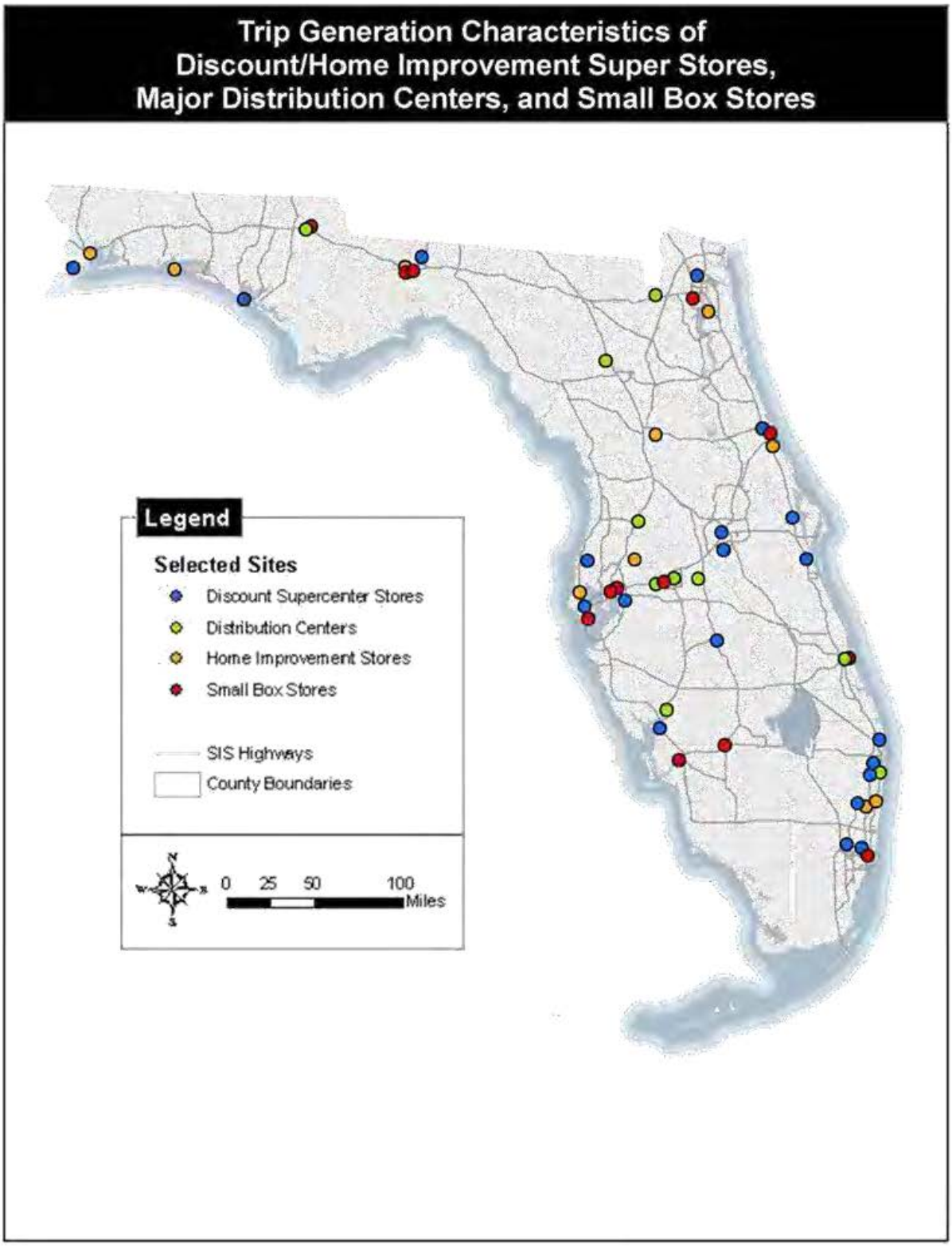
Related Studies

In addition to ITE Trip Generation 8th Edition, a number of state and national studies were reviewed to note baseline and trend information. ITE Journal published two articles on trip making of Free-Standing Discount Superstores in June of 2009 and August 2006. At that time, both studies demonstrated higher rates of trip making than ITE Trip Generation 7th Edition. In March of 2007, FDOT District 7, in the Tampa area, completed analyses of LU 813 Free-Standing Discount Superstore and LU 862 Home Improvement Superstore trip generation rates in central Florida. This study also found significantly higher rates than those in ITE Trip Generation. A trip generation analysis of three Small Box Stores in Polk County in March of 2009 and a study on a potential Distribution Center in Putnam County provided comparison information for this study. A Texas DOT study by the Texas Transportation Institute published in January of 2010 examined a variety of Distribution Centers across Texas and provided comparison data and methodological background for this study.

Site Selection

A steering team composed primarily of FDOT District Growth Management Coordinators from around the state provided site recommendations. Sites were chosen to reflect geographical diversity of the state, as illustrated in Exhibit 3. Aerial photos were used to plan where traffic counter tubes would be placed at each site. Mechanical counts were taken at driveways which isolated the study site. Many planned sites were eliminated due to cut-through traffic which did not go to the store being studied.

Exhibit 3– Selected Study Sites



Count Procedure

For Distribution Centers, 7 day classification counts were taken. Data was analyzed for weekday, weekend and a combined 7 day period to allow for comparison with previous studies. Truck data was also analyzed in a similar fashion.

For the remaining land uses, mechanical traffic counts were taken for 48 or 72 hours on at least two consecutive weekdays from Tuesday to Thursday. Counts were calibrated with 15 minute manual counts. In areas with pedestrian, bicycle and transit activity, multimodal counts were conducted from 3PM to 7PM on at least two consecutive weekdays between Tuesday and Thursday on days corresponding with driveway counts. Counts were conducted in May and June of 2010. No counts were taken during the weeks affected by the Memorial Day or Father's Day Holidays.

Pass-by studies and pedestrian, bicycle and transit counts were performed at about one third of these remaining land uses.

Independent Variables

In trip generation, a good independent variable is both predictable and quantifiable. As none of the existing ITE land use categories fully capture the nature of major Distribution Centers and Small Box Stores, we created two new categories and were tasked to evaluate the current variables and rates that best predict trip generation. The new land use category for Large Distribution Centers was most similar to ITE Land Use 152, High Cube Warehousing. LU 152 utilizes gross square footage for the independent variable. Due to it being easily determined and reasonably well accepted, gross square footage was chosen for this new category as well. Similarly, the land use categories most like Small Box Stores were ITE LU 815, Free-Standing Discount Stores or ITE LU 820 Shopping Centers. As these currently use gross square footage as the independent variable, it seemed logical to follow this convention for the reasons described above.

Notes: In some instances, stores with smaller gross floor area had higher trip generation than stores with larger gross floor area. This implies that there are other factors (location urban/rural, population, presence of other similar retail nearby) that influence the trip.

Distribution Centers

Large single retailer Distribution Centers of approximately one million sq. ft. are not specifically addressed in ITE Trip Generation 8th Edition. These large Distribution Centers are of extreme importance to FDOT because they typically locate near critical freeway interchange locations to facilitate truck movement.

Site Selection

Currently, analysts use either the LU 152 High Cube Warehouse or the LU 150 Warehouse category. ITE describes LU 152 as facilities that "are used for the storage of manufactured goods prior to their distribution to retail outlets…often subdivided for individual tenants." These facilities are about the same size as the large single retailer Distribution Centers, but they have a higher storage function resulting in different trip making characteristics. LU 150 rates are averaged from much smaller warehouses, not major Distribution Centers. Thus these have different characteristics and a much wider range of rates. Daily rates range from 1.51 – 17.00 per sq. ft., making LU 150 a less reliable predictor of performance.

The nine sites were chosen to reflect geographical diversity across the state. They varied in size, but were all still much larger than recommended for the ITE High Cube Warehouse category. The largest was just under 1.5 million and the smallest not quite 0.5 million gross square feet.

Trip Generation Rates

The weekday daily rate for all Distribution Centers was 1.86 trips per 1,000 square feet, with a lower 1.26 average for weekends. The weighted PM peak of the adjacent street averaged a rate of 0.13. At 0.16, the rate of the PM peak of the generator was only slightly higher. The weekday daily rate is illustrated in Exhibit 17. This scatter plot shows some correlation, but not enough for a fitted curve.

Truck Trip Generation Rates

Daily truck percentages averaged about 24%, with greater variation during the peak hours. This translates into a weekday daily rate of 0.42 trucks per 1000 square feet, and a 0.31 average for weekends. Daily peaks for trucks varied by Distribution Center and by day, but generally were in the late morning or shortly before and after normal PM peak hours of 4-6 PM.

Exhibit 17 - Average Vehicle Trip Ends vs. 1,000 Sq. Feet GFA, Weekday for Distribution Centers

Distribution Centers

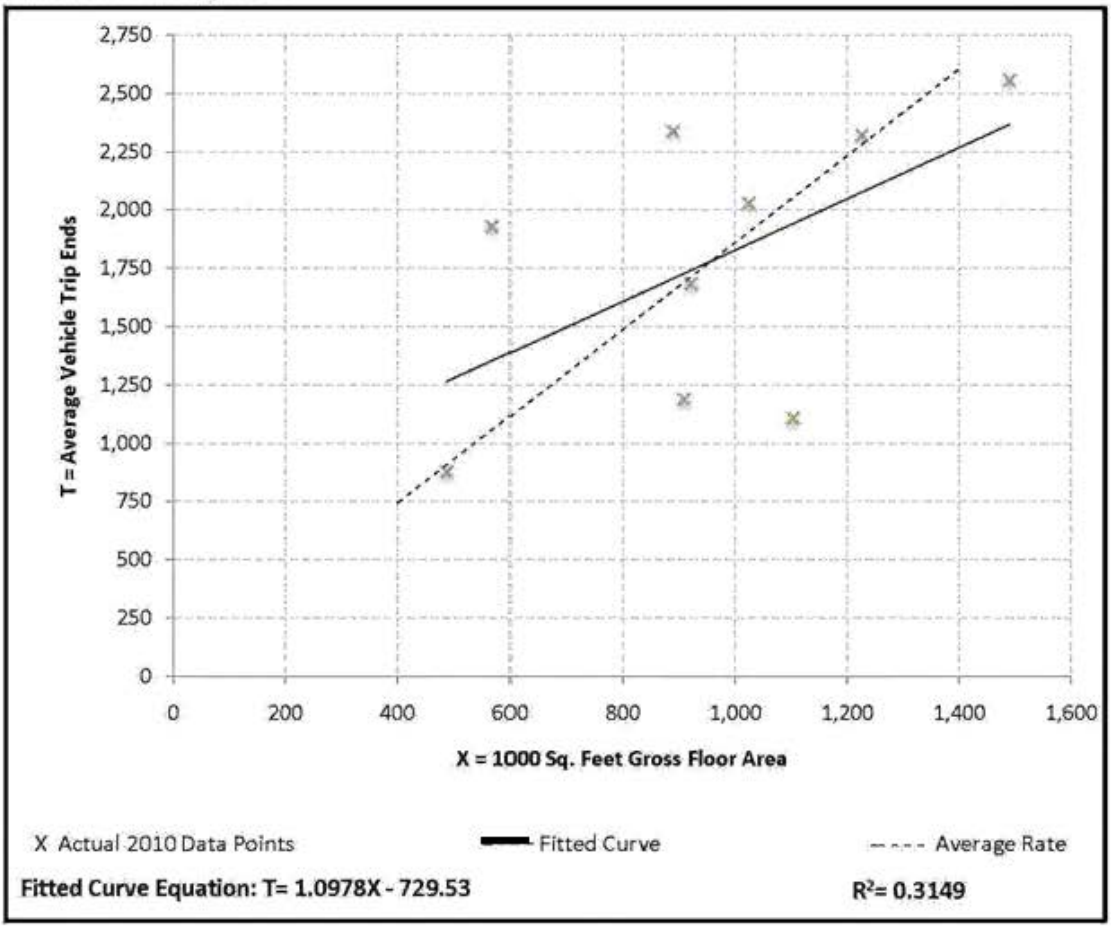
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday**

Number of Studies: 9
Average 1000 Sq. Feet GFA: 958

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.86	1.00 - 3.40	1.98

Data Plot and Equation



Analysis of Results

Comparisons between the 2010 rates, the 2009 Polk County study, the FDOT Districts 2 and 5 studies, the TTI/TXDOT study, and ITE Land Use 152 are shown in Exhibit 18. As noted previously, the High Cube Warehouse, ITE Land Use 152 has the closest characteristics to these large Distribution Centers. However a comparison of the rates to our findings shows how different these uses are in reality. The PM peak rates are similar to those found in this study, but have a greater difference in adjacent street and generator traffic. The primary difference is the weekday daily rate of only 1.44 compared to the 1.86 average from this study. This could be a result of the larger warehouses focusing more on distribution and less on storage. The subtle differences in purpose of the two development types may be enough to encourage this higher rate, and should be noted as the number of trips generated by Distribution Centers may have been underestimated if they were using this category as a guide.

A study done by Polk County in April of 2009 found that the weekday daily rate was even higher at 1.95 trips per 1,000 square feet. Similarly, a study done by Putnam County and FDOT Districts 2 and 5 found that the average weekday daily rate was 1.98 based on 2006 data. Their findings on the PM peak hour rates were similar to the ITE guidance on High Cube Warehouses.

TTI and TXDOT also did a study on Distribution Center trip generation rates. They found the weekday daily rate to be 1.58, which is higher than the ITE guidance on High Cube Warehouses but not quite as high as recent studies. Their findings on PM peak hour rates were fairly high, but as they were based on different sets of sites they may be hard to compare. This study was also the only one not conducted on Distribution Centers in Florida. A point to note is the difference in truck percentages from the TTI/TXDOT study. The difference in truck percentage of the daily trips from weekday to weekend is much smaller in this 2010 study. This may reflect any number of circumstances from changes in product mix and cost to changes in numbers and hours of employees. A comparison of these studies is shown in Exhibit 18.

Generator peak hours varied, but fell generally around 2:00-4:00 PM.

Exhibit 18 – Distribution Center Trip Generation Rate Comparison Table

Distribution Center Trip Generation Rates					
	FDOT CO Study 2010	Polk Co. Study 04/09	Putnam Co./ FDOT D-2 & 5 Study	TTI/ TXDOT Study	ITE 152 High Cube Warehouse
Weekday Daily	**1.86**	1.95	1.98	1.58	1.44
Weekend Daily	**1.26**				
7 Day Daily	**1.68**				
PM peak hour of adjacent street	**0.14**		0.118	0.229	0.10
PM peak hour of generator	**0.17**		0.192	0.197	0.18

Values based on different sets of sites

Conclusions

While PM peak rates do not seem to be largely affected by the differences between ITE 152 High Cube Warehouses and the larger Distribution Centers, the weekday daily rates for the past few years have been much higher. Exhibit 18 shows a peak in daily rates a few years ago, and accordingly a decrease in this study.

The highest counts seem to coincide with the economic prosperity of a few years ago. This would explain why the rates have gone down slightly since the Polk and Putnam County studies. With as much as Distribution Centers rely on the demand for goods, it would make sense for the trip generation to be affected by economic forces. Perhaps some research into the possible link to economic indicators would be helpful. The trend in daily trip generation rates could continue to fall back toward TTI/TXDOT and ITE High Cube Warehouse levels in the next few years if the economy does not rebound.

Summary of Results

The trip generation results of three land uses in this study suggest that there is a significant reduction in trip making activity in the retail sector since the most recent studies were completed. Free-Standing Discount Superstores LU 813 and Home Improvement Superstore LU 862 both showed approximately 40% decline from the 2007 FDOT District 7 study of 16 stores in central Florida. Interestingly, because of this decline, the rates found in this study are relatively consistent with Trip Generation 8th Edition. In conjunction with this decline, studies of the regional Distribution Centers which supply the Superstores, Small Box and grocery stores, seem to reflect a modest decline of about 6% in trip making from 2006 levels.

With 15 studies from around Florida, this study shows that trip generation for Small Box Stores is roughly 30% higher than the commonly cited ITE LU 814 Specialty Retail and ITE LU 820 Shopping Center, which are much larger and not convenience oriented. In addition to traffic counts, pass-by interviews conducted at five sites showed an average rate of 34%, which is considerably higher than the 23% average for ITE Land Use 815 and consistent with ITE LU 820.

Small Box Stores are a distinct land use type and trip generation rates may have been underestimated in the past. Trip generation rates for Small Box Stores remain quite a bit higher than the compared ITE land uses. These high rates observed are quite the opposite of the Free-Standing Discount Superstore and Home Improvement Superstore results. Both of these land use types showed rates lower or near what ITE recommends.

Trip generation rates for large single retailer Distribution Centers may have been underreported in the past. Those trip generation studies utilizing ITE Land Use 152 High Cube Warehouse, which has the closest characteristics to these large Distribution Centers, were closest to this study. The primary difference is the weekday daily rate of only 1.44 compared to the 1.86 average from this study.