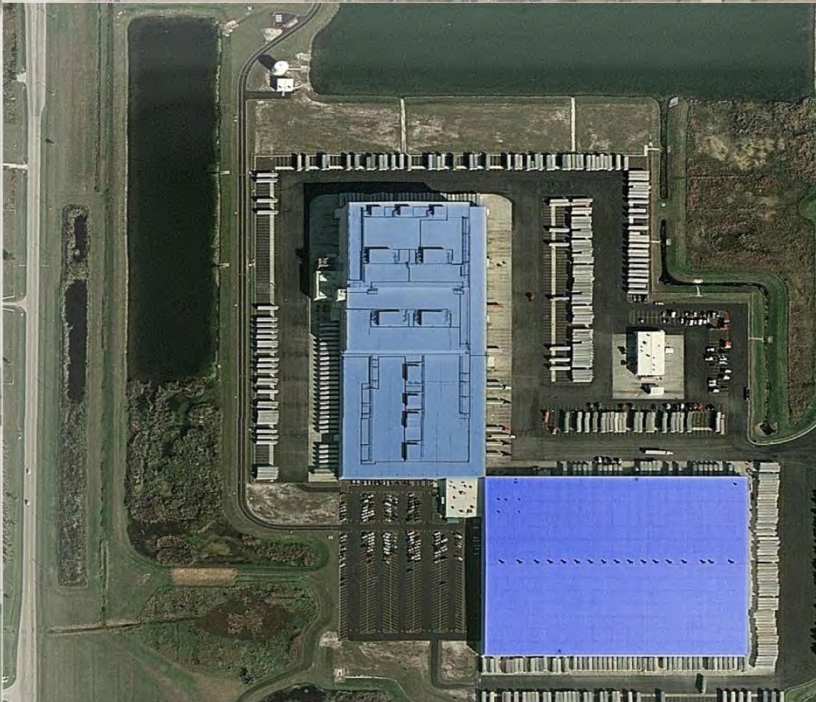
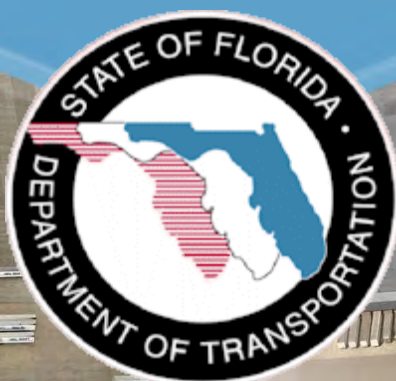


# Trip Generation Characteristics of Discount/Home Improvement Superstores, Major Distribution Centers, and Small Box Stores

Prepared for:  
Florida Department of Transportation  
Systems Planning Office

February 2, 2011



PREPARED BY:

**WilburSmith**  
ASSOCIATES

This guide was prepared by the Wilbur Smith Associates for the Florida Department of Transportation.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Florida Department of Transportation.

## **Table of Contents**

---

	<b><u>Page</u></b>
Executive Summary .....	3
Background.....	5
Independent Variables .....	7
Site Characteristics by Land Use .....	8
Free-Standing Discount Superstores .....	8
Home Improvement Superstores .....	12
Small Box Stores .....	15
Distribution Centers .....	21
Summary of Results .....	25
 Appendix A- Site Aerials .....	 26
Appendix B- Vehicle Counts.....	54
Appendix C- Multimodal Counts .....	403
Appendix D- FDOT Districts .....	417

## **Exhibits**

---

	<b><u>Page</u></b>
Exhibit 1 – Trip Generation Rates of Retail Uses .....	3
Exhibit 2 – Trip Generation Rates of Distribution Centers .....	4
Exhibit 3 – Selected Study Sites .....	6
Exhibit 4 – Discount Superstore Trip Generation.....	9
Exhibit 5 – Discount Superstores Trip Generation Rate Comparison Table.....	10
Exhibit 6 – Comparison of 2007 and 2010 Volumes.....	11
Exhibit 7 - Pass-by Trips at Discount Superstores.....	11
Exhibit 8 - Comparison of Trip Generation Rates by Retailer .....	12
Exhibit 9 - Home Improvement Superstore Trip Generation .....	13
Exhibit 10 - Home Improvement Superstore Trip Generation Comparison Table .....	14
Exhibit 11 - Pass-by Trips for LU 862 Home Improvement Superstores.....	15
Exhibit 12 - Small Box Store Trip Generation .....	16
Exhibit 13 - Small Box Store Trip Generation Comparison Table .....	17
Exhibit 14 - Pass-by Interviews for Small Box Stores .....	18
Exhibit 15 - Comparison of Trip Generation Rates by Region .....	19
Exhibit 16 - Location of District 5 and 7 Selected Sites Used in Comparison.....	20
Exhibit 17 - Distribution Center Trip Generation .....	22
Exhibit 18 - Distribution Center Trip Generation Rate Comparison Table.....	23



## 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			
	<b>FDOT Central Office Study 2010</b>	<b>Recent FL Study</b>	<b>ITE 8<sup>th</sup> Edition</b>
Discount Superstores		District 7 3/2007	LU 813
Weekday Daily	<b>45.41</b>	76.7	53.13
Home Improvement Superstores		District 7 3/2007	LU 862
Weekday Daily	<b>31.51</b>	49.5	29.8
Small Box Stores		Polk 4/2009	LU 815**
Weekday Daily	<b>64.01</b>	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			
	<b>FDOT Central Office Study 2010</b>	Recent FL Study	ITE 8 <sup>th</sup> Edition
Distribution Centers		Polk 4/2009	LU 152
Weekday Daily	<b>1.86</b>	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 8<sup>th</sup> 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.

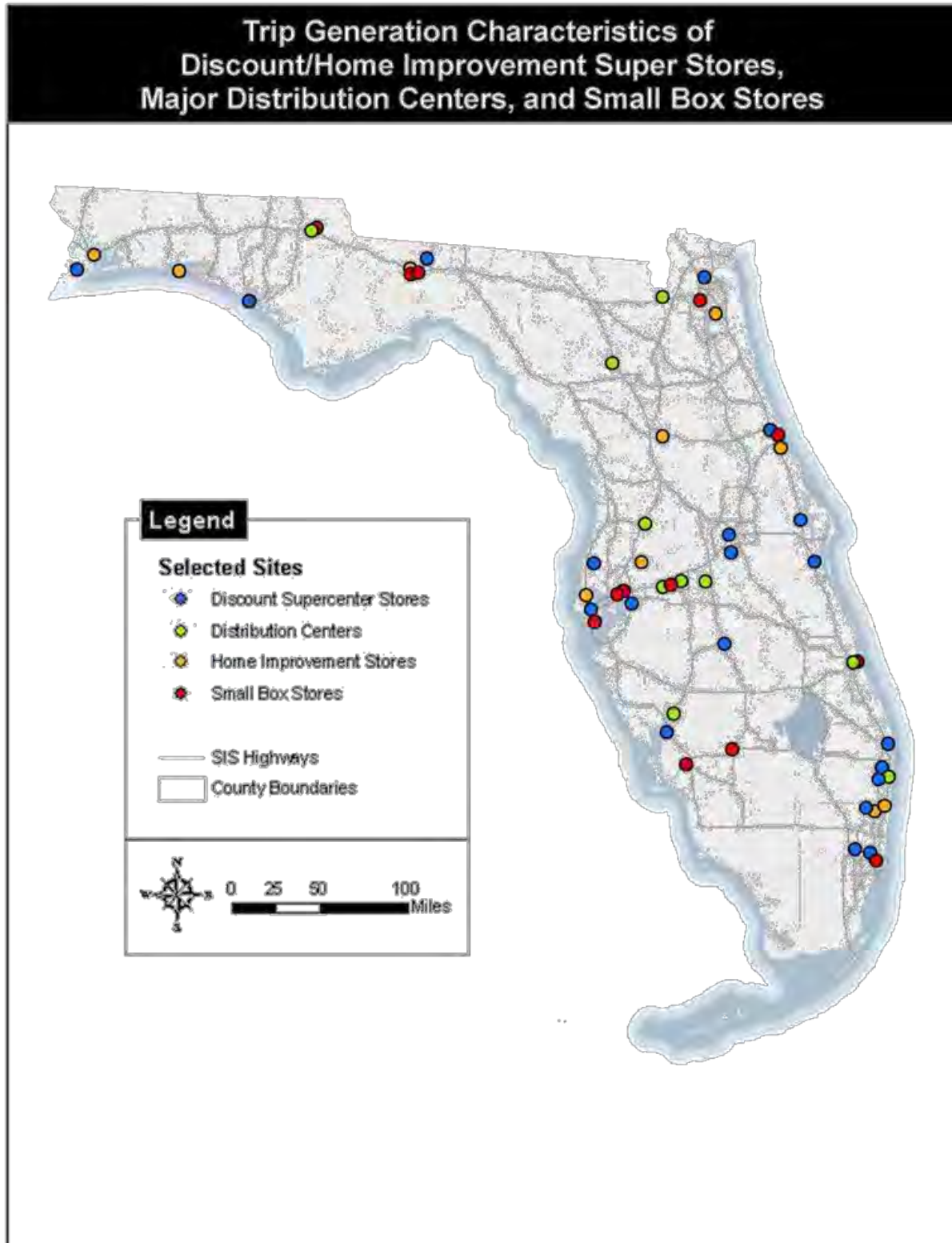
## **Related Studies**

In addition to ITE Trip Generation 8<sup>th</sup> 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 7<sup>th</sup> 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.

## **Site Characteristics by Land Use**

### **Free-Standing Discount Superstores**

This land use is distinguished from LU 815, Free-Standing Discount Stores by the presence of a full service grocery store and thus a larger footprint as well. As a result, the trip making characteristics differ.

#### **Site Selection**

The 20 sites studied were chosen to reflect geographical diversity across the state. The sites measured typically had from 2-6 entry points that could be counted in order to isolate counts from any adjacent parcels, etc. Sites ranged in size from roughly 125,000 square feet to 240,000 square feet, with most Wal-Mart Superstores in excess of 200,000 square feet.

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.

Driveway counts showed an average of approximately 1,900 to 6,000 vehicles entering or exiting during a 24 hour period. The Super Target stores, which were significantly smaller than the Wal-Mart stores, were at the low end of the range.

#### **Trip Generation Rates**

The average weekday daily trip generation rate was 45.41 vehicles per 1,000 square feet gross leasable area. The PM peak of the adjacent street was 3.56 vehicles and the PM peak of the generator was 3.76 vehicles per 1,000 square feet gross leasable area. The PM peak of the adjacent street is shown in the scatter plot in Exhibit 4.

**Exhibit 4- Average Vehicle Trip Ends vs. 1,000 Sq. Feet GFA, Weekday PM Peak Hour of Adjacent Street for LU 813 – Free-Standing Discount Superstores**

## Free-Standing Discount Superstores

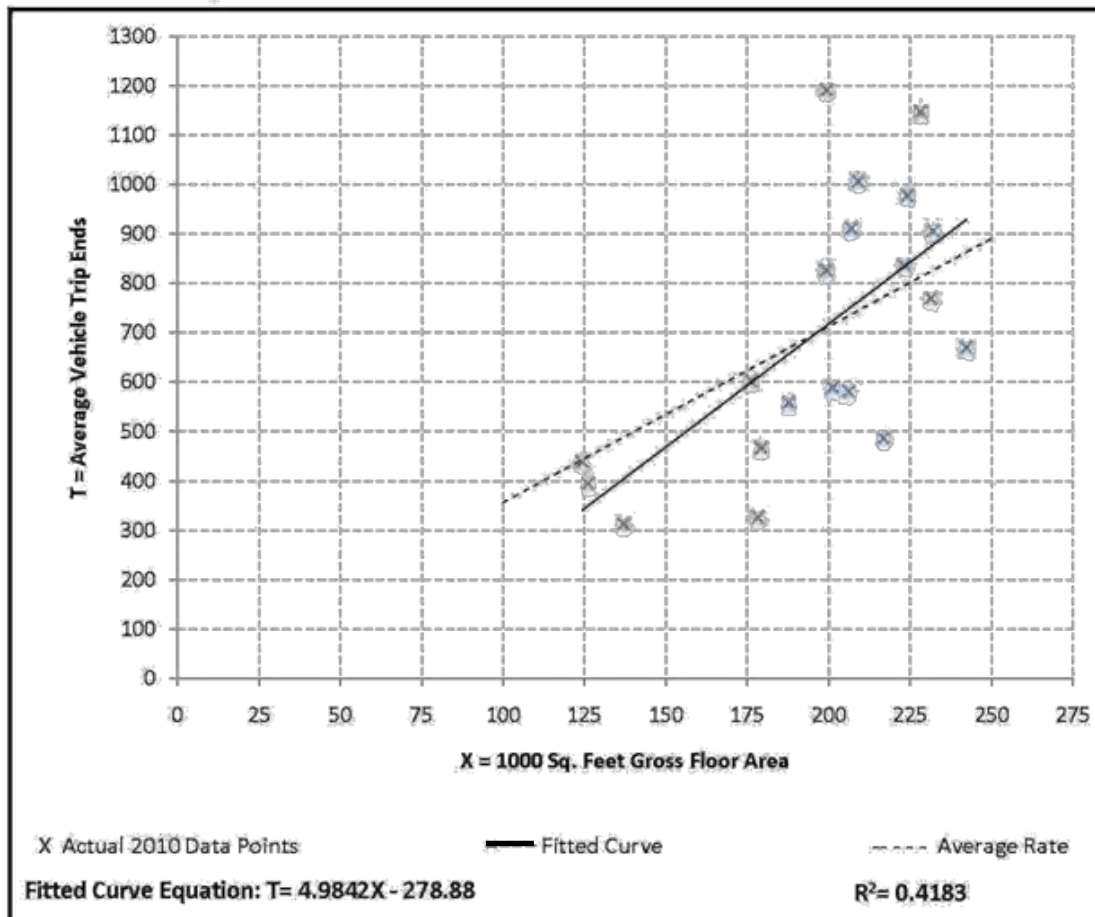
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 4 and 6 p.m.

Number of Studies: 20  
Average 1000 Sq. Feet GFA: 196

### Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
3.56	1.83 - 5.98	2.24

### Data Plot and Equation



## Analysis of Results

As shown in Exhibit 5 below, there was a marked decline in the average counts of about 40% from the FDOT District 7 study in 2007. Interestingly, the 2010 values are about 15% lower than the ITE Land Use 813, Free-Standing Discount Superstore. Generator peak hours were around noon and again at around 4:00-5:00 PM.

**Exhibit 5 – Discount Superstore Trip Generation Rate Comparison Table**

Free-Standing Discount Superstore Trip Generation Rates						
	FDOT Central Office Study 2010	FDOT District 7 Study 3/2007	ITE Journal Article 6/2009	ITE Journal Article 8/2006	ITE Trip Generation Report 8 <sup>th</sup> Edition	
					Land Use 813 Free- Standing Discount Superstore	Land Use 815 Free- Standing Discount Store
Weekday Daily	45.41	76.7	53.04		53.13	57.24
PM peak hour of adjacent street	3.56	5.7	4.50	5.50	4.61	5.00
PM peak hour of generator	3.76	6.1	4.77		4.68	5.57

## Sites in Common with Previous Studies

Exhibit 6 displays several sites which were common to the FDOT District 7 study, showing changes over time and the effect of changing economic conditions. Of the 11 superstore sites investigated in the District 7 study, sites 24, 39, and 47 were free of cut-through traffic and could be counted for this project. There was a 29% decline in the trip generation rate for these 3 stores.

**Exhibit 6 – Comparison of 2007 and 2010 Volumes**

2007 FDOT District 7 Study and 2010 FDOT Central Office Study Comparison					
Rate Type	Common Site	Percent Change	FDOT CO Study 2010	FDOT D7 Study 3/2007	ITE Trip Generation Report 8 <sup>th</sup> Edition
Weekday Daily	Free-Standing Discount Superstore A	-15%	77.8	91.4	53.1
Weekday Daily	Free-Standing Discount Superstore B	-40%	59.4	99.1	
Weekday Daily	Free-Standing Discount Superstore C	-31%	21.4	31.1	
Weekday Daily	Home Improvement Superstore A	-40%	40.1	83.3	29.8
PM Peak of Adjacent Street	Free-Standing Discount Superstore A	-21%	5.0	6.3	4.6
PM Peak of Adjacent Street	Free-Standing Discount Superstore B	-41%	4.4	7.5	
PM Peak of Adjacent Street	Free-Standing Discount Superstore C	-29%	1.8	2.6	
PM Peak of Adjacent Street	Home Improvement Superstore A	-47%	2.7	6.4	2.5

\*per 1000 Sq. Feet Gross Leasable Area

**Pass-by Surveys**

In addition to traffic counts, we conducted interviews with a sample of customers to determine their travel patterns. The questions helped us determine departure location type, trip type (primary, pass-by or diverted link), and trip length. Pass-by trips are made by traffic already using a roadway adjacent to the site that stop before continuing on to their final destination.

As shown in Exhibit 7 below, pass-by interviews were conducted at one Discount Superstore site on Tuesday May 25-Thursdays May 27, 2010 from 3:00 – 7:00 PM. A total of 341 usable interviews were completed. The pass-by rate of 29% is highly consistent with the 28% average for ITE Land Use 813.

**Exhibit 7 – Pass-by Trips at Discount Superstores**

Pass-by Trips Tues-Thurs, PM Peak Period Land Use – Free-Standing Discount Superstores							
Size (1,000 sq. ft.)	Site Location (Florida)	2010 Weekday Survey Date	Total Number of Interviews	Time Period (PM)	Adj. Street Peak Hour Volumes	Percent Pass-By Trips	Avg. Trip (mi.)
199	Pensacola	05/25-05/27	341	3 - 6	1,360	29%	7.4



## Variation by Retailer

When documenting the range of rates for Free-Standing Discount Superstores, it became apparent there was a significant difference in the rates between Wal-Mart and Target/Super Target superstores. In general, Wal-Marts are larger than Targets and Super Targets and this may contribute to the difference in rates. Perhaps further research should be done to determine if these stores should actually be treated as the same land use type.

**Exhibit 8 – Comparison of Trip Generation Rates by Retailer**

Free-Standing Discount Superstore Trip Generation Rates by Retailer						
	FDOT CO Study 2010	Wal-Mart Supercenters		Target & Super Targets		Target vs. Wal- Mart
	Rate	Rate	Deviation	Rate	Deviation	Deviation
Weekday Daily	<b>45.41</b>	50.43	11%	32.64	-28%	-35%
PM peak hour of adjacent street	<b>3.56</b>	3.87	8%	2.80	-22%	-28%
PM peak hour of generator	<b>3.76</b>	4.04	7%	3.04	-19%	-25%

## Conclusions

Unless there is an upward spike in the economy, we would recommend continuing to use the ITE LU 813 and 815 rates for this land use type.

## Home Improvement Superstores

### Site Selection

Ten sites studied were chosen to reflect geographical diversity across the state. The ten measured sites chosen typically had from 2-4 entry points that could be counted in order to isolate counts from any adjacent parcels, etc. Sites ranged in size from roughly 100,000 square feet to 138,000 square feet, with Lowe's Stores on the higher range and Home Depot stores on the lower range.

No counts were taken during the weeks affected by the Memorial Day or Father's Day Holidays in keeping with corporate interviews which stated that these were among the busiest weeks of the year. Driveway counts showed an average of approximately 1,700 to 2,500 vehicles entering or exiting during a 24 hour period.

### Trip Generation Rates

The average weekday daily trip generation rate was 31.51 vehicles per 1,000 square feet gross leasable area. The PM peak of the adjacent street was 2.31 vehicles and the PM peak of the generator was 3.03 vehicles per 1,000 square feet gross leasable area. The PM peak of the adjacent street is shown in Exhibit 9. The scatter plot shows some correlation, but not enough for a fitted curve.

**Exhibit 9- Average Vehicle Trip Ends vs. 1,000 Sq. Feet GFA, Weekday PM Peak Hour of Adjacent Street for Home Improvement Superstores.**

**Home Improvement Superstores**

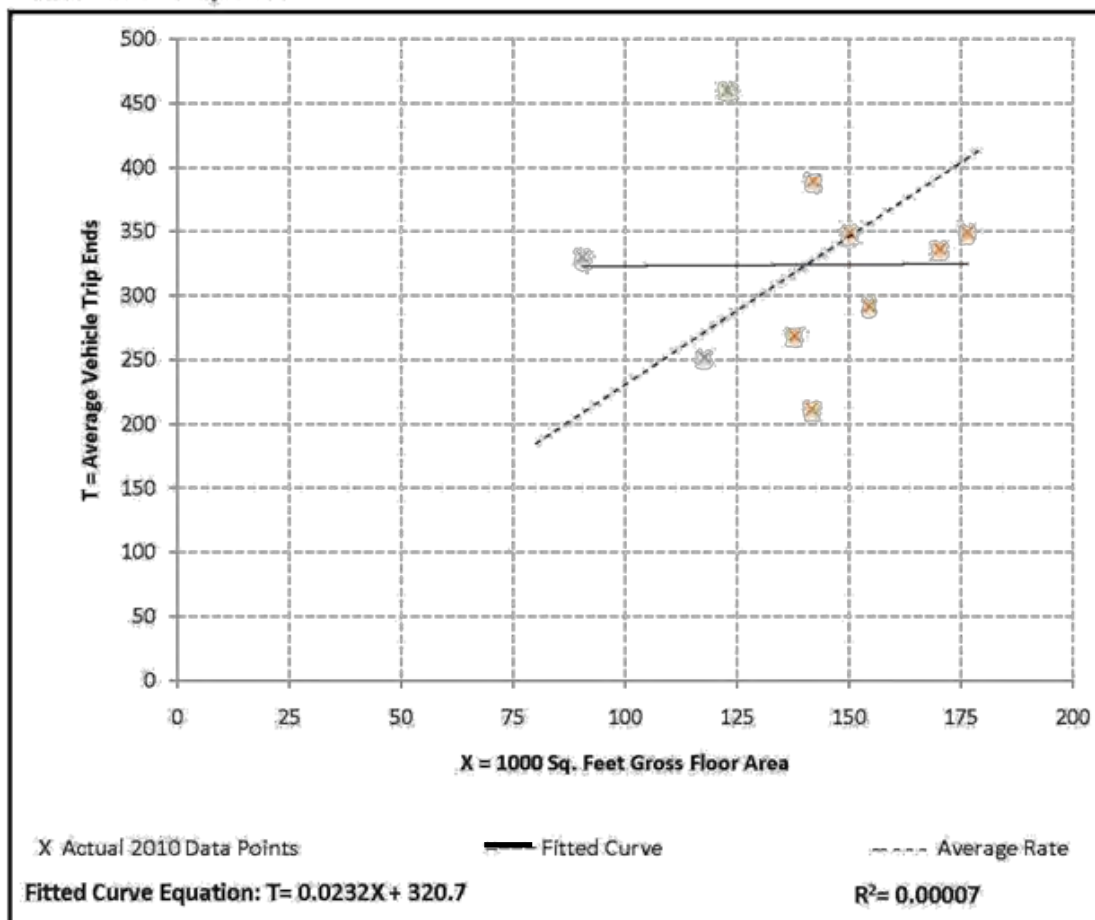
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 4 and 6 p.m.

Number of Studies: 10  
Average 1000 Sq. Feet GFA: 140

**Trip Generation per 1000 Sq. Feet Gross Floor Area**

Average Rate	Range of Rates	Standard Deviation
2.31	1.49 - 3.75	2.14

**Data Plot and Equation**



## Analysis of Results

Comparisons between the 2010 rates, the 2007 District 7 study and ITE Land Use 862 are shown in Exhibit 10. There was a marked decline in the average trips of about 40% since the 2007 study. Interestingly, the 2010 values are very similar to the ITE Land Use 862, Home Improvement Superstore. Generator peak hour was consistently around midday, from 11:00 AM to 2:00 PM.

**Exhibit 10 – Home Improvement Superstore Trip Generation Rate Comparison Table**

Home Improvement Superstore Trip Generation Rates			
	<b>FDOT Central Office Study 2010</b>	<b>FDOT D-7 Study 3/ 2007</b>	<b>ITE Trip Generation Report 8<sup>th</sup> Edition Land Use 862 Home Improvement Superstore</b>
Weekday Daily	<b>31.51</b>	49.5	29.8
PM peak hour of adjacent street	<b>2.31</b>	3.9	2.37
PM peak hour of generator	<b>3.03</b>	4.5	3.32

\*per 1000 Sq. Feet Gross Leasable Area

## Comparison between 2006 and 2010 at site 30

As shown in Exhibit 6 in the previous section, one site selected was common to the March 2007 District 7 study. Traffic at this site had a dramatic decline between November 2006 and June of 2010. Daily trips decreased by 40% from 9,466 to 5,699, while PM Peak Hour of adjacent street trips went down by 47% from 732 to 390. Due to different values for the square footage of the gross leasable area between the two studies, exact comparisons of trip generation rates are difficult to ascertain. The decline at this site closely reflects the average trend between the two studies.

## Pass-by Study

As shown in Exhibit 11, pass-by interviews were conducted at a single site on Wednesday May 19 and Thursday May 20, 2010 between 3:00 and 7:00PM. There were 153 usable interviews. The daily pass-by rate of 25% is considerably lower than the 48% average for ITE Land Use 862, as reported in the ITE Trip Generation Handbook. The ITE results were based on 3 studies in central Florida from 1992 and 1993. Due to the long time span between the studies and the limited sample size, averaging these results is not recommended.

**Exhibit 11 – Pass-by Trips for LU 862 Home Improvement Superstores**

Pass-by Trips Tues-Thurs, PM Peak Period Land Use – Home Improvement Superstores							
Size (1,000 sq. ft.)	Site Location (Florida)	2010 Weekday Survey Date	Total Number of Interviews	Time Period (PM)	Adj. Street Peak Hour Volumes	Percent Pass-By Trips	Avg. Trip (mi.)
142	Clearwater	05/19-05/20	153	3 - 6	3,888	25%	5.0

**Conclusions**

Unless there is an upward spike in the economy, we would recommend continuing to use the ITE LU 862 rates for this land use type.

**Small Box Stores****Site Selection**

A Small Box Store is a discount retail store providing health & beauty aids, cleaning supplies, snack food, household items and some apparel. This is not a "dollar store" where everything is priced one dollar, but is a small neighborhood store offering value and convenience. The stores studied were free-standing and typically catered to the local neighborhood.

The 15 sites that were studied were chosen to reflect geographical diversity across the state. The sites typically had from 1-4 entry points that could be counted in order to isolate counts from any adjacent parcels, etc. Sites ranged in size from roughly 8,000 square feet to 17,000 square feet, with most stores being around 10,000 sq. ft.

Driveway counts showed approximately 175 - 500 vehicles entering or exiting during a 24 hour period. Adjacent street traffic during the count period ranged from 5,000 to 20,000 ADT in each direction.

**Trip Generation Rates**

The average weekday daily trip generation rate was 64.01 vehicles per 1,000 square feet gross leasable area. The PM peak of the adjacent street was 6.82 vehicles and the PM peak of the generator was 6.99 vehicles per 1,000 square feet gross leasable area. The scatter plot shows some correlation, but not enough for a fitted curve. The PM Peak of the adjacent street is illustrated in Exhibit 12.

# Exhibit 12 - Average Vehicle Trip Ends vs. 1,000 Sq. Feet GFA, Weekday PM Peak Hour of Adjacent Street for Small Box Stores

## Small Box Stores

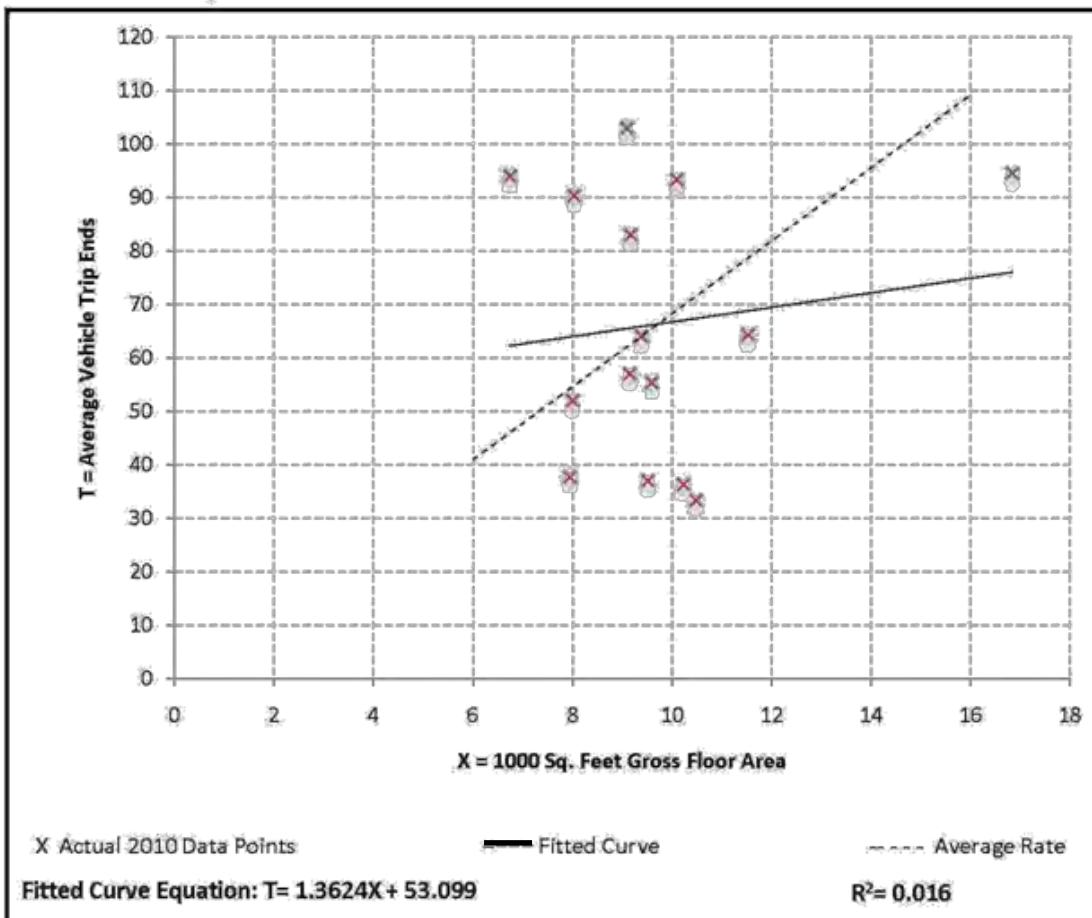
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 4 and 6 p.m.

Number of Studies: 15  
Average 1000 Sq. Feet GFA: 10

### Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
6.82	3.18 - 13.94	3.55

### Data Plot and Equation





## Analysis of Results

Comparisons between the 2010 rates, and ITE Trip Generation Report 8<sup>th</sup> Edition Land Uses 814, 815 and 820 are shown in Exhibit 13 below. These uses are typically used to represent Small Box Stores. These small neighborhood stores have some similar properties to each of these land uses, but the combination of differences appears to have a distinct effect on trip generation rates. The selection of merchandise available in a Small Box Store is more varied than ITE 814 Specialty Retail, and due to its smaller size, the location is usually more convenient than ITE 815 discount stores. Both of these factors may increase the traffic per 1,000 square feet.

The 2009 Polk County study shows rates much higher than the compared ITE land uses. Even with a 27% decrease from 2009 to 2010, trip generation rates for Small Box Stores remains quite a bit higher than the compared ITE land uses. This is in direct contrast to the Free-Standing Discount Superstore and Home Improvement Superstore results. Both of these land use types showed rates lower or very close to what ITE recommends. This suggests that Small Box Stores are a distinct land use type and trip generation rates have been potentially underestimated in the past. Generator peak hours varied for Small Boxes, but there were more trips near midday and generally around 5:00 PM.

**Exhibit 13 – Small Box Store Trip Generation Rate Comparison Table**

Small Box Store Trip Generation Rates/1000 Sq. Feet GFA					
	FDOT CO Study 2010	Polk Co. Study 04/09	ITE Trip Generation Report 8 <sup>th</sup> Edition		
			Land Use 814 Specialty Retail	Land Use 820 Shopping Center	Land Use 815 Free- Standing Discount Store
Weekday Daily	<b>64.01</b>	81.08	44.32	42.94	57.24
PM peak hour of adjacent street	<b>6.82</b>		2.71	3.73	5
PM peak hour of generator	<b>6.99</b>		5.02	3.12	5.57
Avg. Trip End Length	<b>4.7 miles</b>	1.25 miles			

## Pass-by Studies

As shown in Exhibit 14, pass-by interviews were conducted at five sites for two or three consecutive weekdays between Tuesday to Thursday in May of 2010 between 3:00 and 7:00PM. There were 723 usable interviews. The average pass-by rate of 34% is considerably higher than the 23% average for ITE Land Use 815 and consistent with ITE LU 820.

**Exhibit 14 – Pass-by Interviews for Small Box Stores**

Pass-by Trips Tues-Thurs, PM Peak Period Land Use - Small Box Stores							
Size (1,000 sq. ft.)	Site Location (Florida)	2010 Weekday Survey Date	Total Number of Interviews	Time Period (PM)	Adj. Street Peak Hour Volumes	Percent Pass-By Trips	Avg. Trip (mi.)
8	Tallahassee	05/18-5/20	145	3 - 7	610	30%	6.1
10	Jacksonville	5/25-5/27	127	3 - 7	1284	34%	5.8
10	Tampa	5/10,5/19-5/20	247	3 - 7	3165	40%	3.5
17	Tampa	5/19-5/20	50	3 - 7	1380	22%	4.7
10	Daytona Beach	5/25-5/27	154	3 - 7	1573	44%	3.2
<b>Average</b>						<b>34%</b>	<b>4.7</b>

**Conclusions**

The rates from this 2010 study are roughly 30% higher than the commonly cited ITE LU 814 Specialty Retail and 820 Shopping Center. With 15 studies from around Florida, we feel that these rates are a good starting point for future analysis.

## Regional Variations in Retail Uses

The rates from the central Florida District 7 superstore study differed greatly from rates found in ITE and this study. As a result, we compared the central Florida sites from our study to the average of all superstore sites statewide. It is possible that the unique characteristics of central Florida cause superstores there to produce more trips per 1000 sq ft than the national average.

The comparison table below shows that the District 7 study superstore sites had higher rates than the statewide average in both categories. We studied only 2 Home Improvement Superstore sites in District 7, so those results may be less reliable than the Discount Superstore comparison. Interestingly, the Small Box Stores in the District 7 region actually had lower rates than the average of all sites statewide. These land uses were not included in the original District 7 study, but there is an opposite trend with fewer trips in central Florida than the rest of the state.

As a result of these regional differences, it appears that regional characteristics may have an impact on the trip generation rates of these retail land uses. See Exhibit 16 for location of sites.

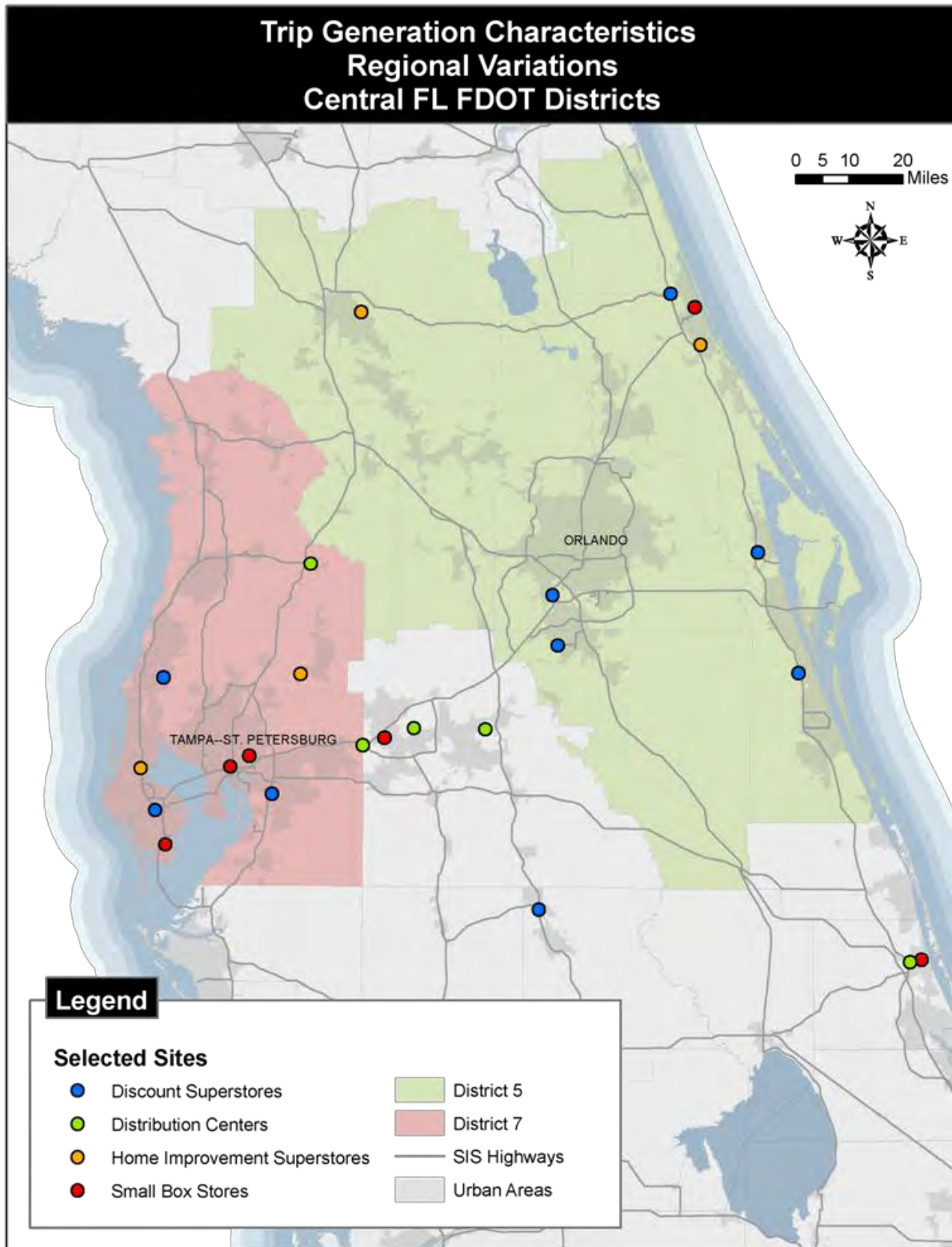
### Exhibit 15 – Comparison of Trip Generation Rates by Region

FDOT CO Study 2010 Trip Generation Rates*- Central FL FDOT Districts and Statewide						
Trip Generation Rates by Land Use	ITE 8 <sup>th</sup> Edition	FDOT CO Study 2010	District 5 Sites FDOT CO Study 2010		District 7 Sites FDOT CO Study 2010	
Free-Standing Discount Superstores	LU 813	Rate	Rate	Deviation	Rate	Deviation
Weekday Daily	53.13	<b>45.41</b>	51.34	13%	57.60	27%
PM peak hour of adj. street	4.61	<b>3.56</b>	4.10	15%	4.20	18%
PM peak hour of generator	4.68	<b>3.76</b>	4.17	11%	4.49	20%
Small Box Stores	LU 815**					
Weekday Daily	57.24	<b>64.01</b>			51.46	-20%
PM peak hour of adj. street	5.00	<b>6.82</b>			5.06	-26%
PM peak hour of generator	5.57	<b>6.99</b>			5.21	-25%

\*per 1000 Sq. Feet Gross Leasable Area

\*\* ITE LU 815- Free-Standing Discount Store

Exhibit 16 Location of District 5 and 7 Selected Sites Used in Comparison



Note- See Appendix D for a map of all FDOT Districts

## **Distribution Centers**

Large single retailer Distribution Centers of approximately one million sq. ft. are not specifically addressed in ITE Trip Generation 8<sup>th</sup> 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

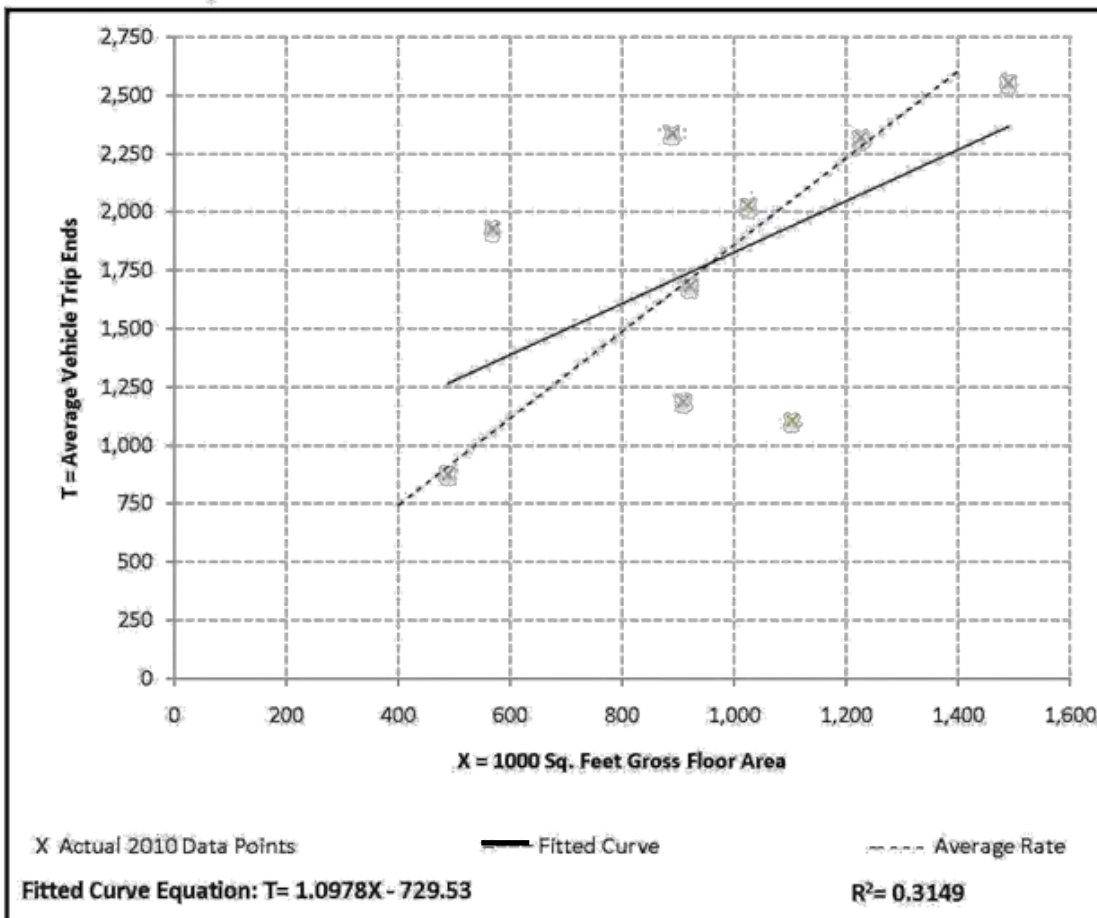
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area  
On a: Weekday

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