

# **CFRPM Version 6.0**

## **FDOT District 5**

### **A Comparison of Model Projected Growth for 2040**

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## 1.0 GENERAL OVERVIEW OF CFRPM 6.0 YEAR 2010 MODEL

The Florida Department of Transportation (FDOT) District Five Central Florida Regional Planning Model (CFRPM) Version 6.0 follows the traditional four step process:

- **Trip Generation** defines the number of person trips based on socio-economic data assigned to the Traffic Analysis Zones (TAZs) within the model. A total number of trips are generated for individual TAZs based on dwelling unit and population data (e.g. Productions). Employment and school enrollment data relates to the opportunities individual TAZs have for satisfying the produced trips (e.g. Attractions).
- **Trip Distribution** is based on a gravity model which is used to simulate travelers' destination choices with respect to distance and/or travel time from those destinations. In general, production trip ends are more likely to be satisfied by attraction ends that are closer in distance/travel time than those attraction ends further away.
- **Mode Split** determines the mode by which the trips travel by. The split is based on auto occupancy for highway trips and type of transit (local bus, express bus, or fixed guide-way transit) for non-highway trips.
- **Trip Assignment** next assigns the individual trip pairings to the highway and transit networks. This involves selecting the path that an actual traveler would take. Generally, the route is based on being either the shortest or the fastest means for assigning the trip.

## 2.0 DATA USED FOR VALIDATION

Travel demand forecasting models use current data for socio-economic (SE) files (zdata 1 for population and zdata2 for employment). Specifically, the CFRPM 6.0 SE data is based on information provided by the various local agencies comprising each of the 9 counties within District Five, plus all of Polk County and a portion of Indian River County. This applies both for the existing 2010 base year and the 2040 future horizon year.

The model uses many checks and balances to help review the data. Current surveys are used if available and/or information is utilized from previous surveys as needed. The best and most up-to-date resources are referenced to ensure that the most accurate information is developed.

For any new model validation, the base year traffic counts are always referenced since this is collected on an annual basis by FDOT and the various county and local municipality agencies. Travel demand models use the current traffic counts to validate the model. This means that the basis of the validation is to obtain a base year assignment which replicates reasonably the observed local traffic. One of the measures used to check how closely the traffic patterns are validated to is the Percent Root Mean Square Error (%RMSE). There are different ranges set for different traffic count ranges such that the higher the traffic count, the lower the allowed %RMSE. This is based on the basis that the higher volume roads such as freeways and higher count arterials should most closely match between the validated model volume and the observed traffic count. For lower count volumes, the differences between the two can be higher. On a daily basis the allowable deviation, or % RMSE, for the CFRPM 6.0 validation was established as being between 32 and 39 percent based on general model guidelines. The actual model validation was 34.72 percent which means is more than adequately meets the standard established.

Individual count ranges closely follow the allowed %RMSE ranges, as well. For an 11 county model, it is reasonable that not all count ranges be exactly within their ranges as long as the overall %RMSE is achieved. Notably, the only count ranges slightly outside the range are 1-5000, 5-1000, and 90000-100000 (the later has only 2 links with counts). Table 1 illustrates the daily %RMSE achieved. As noted, the model utilized 6907 traffic counts to validate to.

**Table 1  
CFRPM 6.0 Year 2010 %RMSE**

CFRPM6 v6.0 Daily Counts							
Vol Group	Count Range	Model %RMSE	Allowed RMSE Range	Volume	Count	Volume/Count	No of Links
1	1-5,000	75.06%	45 - 55%	7,453,920	6,478,237	1.15	1,796
2	5,000-10,000	49.15%	35 - 45%	16,783,788	15,533,502	1.08	2,136
3	10,000-20,000	29.02%	27 - 35%	31,625,659	31,212,820	1.01	2,186
4	20,000-30,000	22.22%	24 - 27%	14,273,279	13,838,456	1.03	582
5	30,000-40,000	15.03%	22 - 24%	3,781,668	3,979,018	0.95	116
6	40,000-50,000	19.40%	20 - 22%	788,500	848,284	0.93	19
7	50,000-60,000	5.84%	18 - 20%	999,395	997,914	1.00	18
8	60,000-70,000	14.41%	17 - 18%	1,114,197	1,174,721	0.95	18
9	70,000-80,000	10.63%	16 - 17%	1,265,822	1,338,590	0.95	18
10	80,000-90,000	12.68%	15 - 16%	1,189,186	1,327,908	0.90	16
11	90,000-100,000	18.38%	14 - 15%	158,411	182,000	0.87	2
<b>ALL</b>	<b>1-500,000</b>	<b>34.72%</b>	<b>32 - 39%</b>	<b>79,433,825</b>	<b>76,911,450</b>	<b>1.03</b>	<b>6,907</b>

### 3.0 GROWTH TRENDS

From the 1980's up until year 2005, traffic counts have mostly increased within the District. For future years, new development reflected extensive new development (Developments of Regional Impact, etc.).

Following the 2008 Recession, which had not only local but global impact, the trends observed in the preceding past changed drastically. When comparing the 2010 traffic counts to the year 2005 traffic counts, 78% of the 2010 counts were lower than the 2005 counts. That is more than 3/4 of all the counts. This means that the area had still not recovered fully from the impact of the Recession.

#### Trip Productions

Table 2 was prepared to show the comparison of the existing and the future model volumes, for respectively the CFRPM 5.5 and the CFRPM 6.0 models. The CFRPM 5.5 model was based on data relative to the 2005 base year, whereas the CFRPM 6.0 reflects a 2010 base year. Specifically, Table 2 has four columns of daily model results:

- Base Year 2005 CFRPM 5.5 Model with Polk County
- Base Year 2010 CFRPM 6.0 Model with Polk County
- Future Year 2040 CFRPM 5.5 Model with Polk County
- Future Year 2040 CFRPM 6.0 Model with Polk County

**Table 2**  
**Comparison of CFRPM 5.5 and CFRPM 6.0 Daily Model Statistics**

Description	CFRPM 5.5 2005 Base	CFRPM 6.0 2010 Base	CFRPM 5.5 2040 SE Data	CFRPM 6.0 2040 SE Data
Productions	15,211,528	15,214,558	29,150,797	23,601,722
Population	4,425,234	4,850,497	7,641,804	7,525,942
Dwelling Units	1,999,287	2,259,205	3,664,100	3,437,549
Occupied Dwelling Units	1,725,336	1,960,941	3,211,209	2,999,037
Average Trip Rate	8.82	7.76	9.08	7.87
System Miles	8,572	8,716	9,275	8,848
Average Volume	13,682	13,122	25,496	19,075
Lane Miles	21,195	22,263	26,184	23,251
VMT Using Volumes	115,589,884	110,051,268	261,625,974	179,470,000
Volume All Links	288,228,644	287,402,573	573,996,050	435,995,495

Within the short time frame of the two models being developed, future year land use projections have drastically reduced as noted in the table. Table 2 was prepared to demonstrate the basis for the land use projections between the two model forecasts. As shown, base years 2005 and 2010 trip production statistics for the two models are essentially the same even though there is a five year difference. In fact the average trip rate reduced from 8.82 to 7.76, which means that individual dwelling units are making fewer trips than in year 2005. The future traffic projections show slightly higher average trip rates for both, but the general trip production trends remain; resulting in a reduction in the year 2040 forecasted trip productions for the CFRPM 6.0 model as compared to the CFRPM 5.5 model. The result is a reduction from about 29.1 million to 23.6 million (a negative 19 percent difference). The total volumes for all the links also went down from about 574 million to 436 million trips (a negative 24 percent difference).

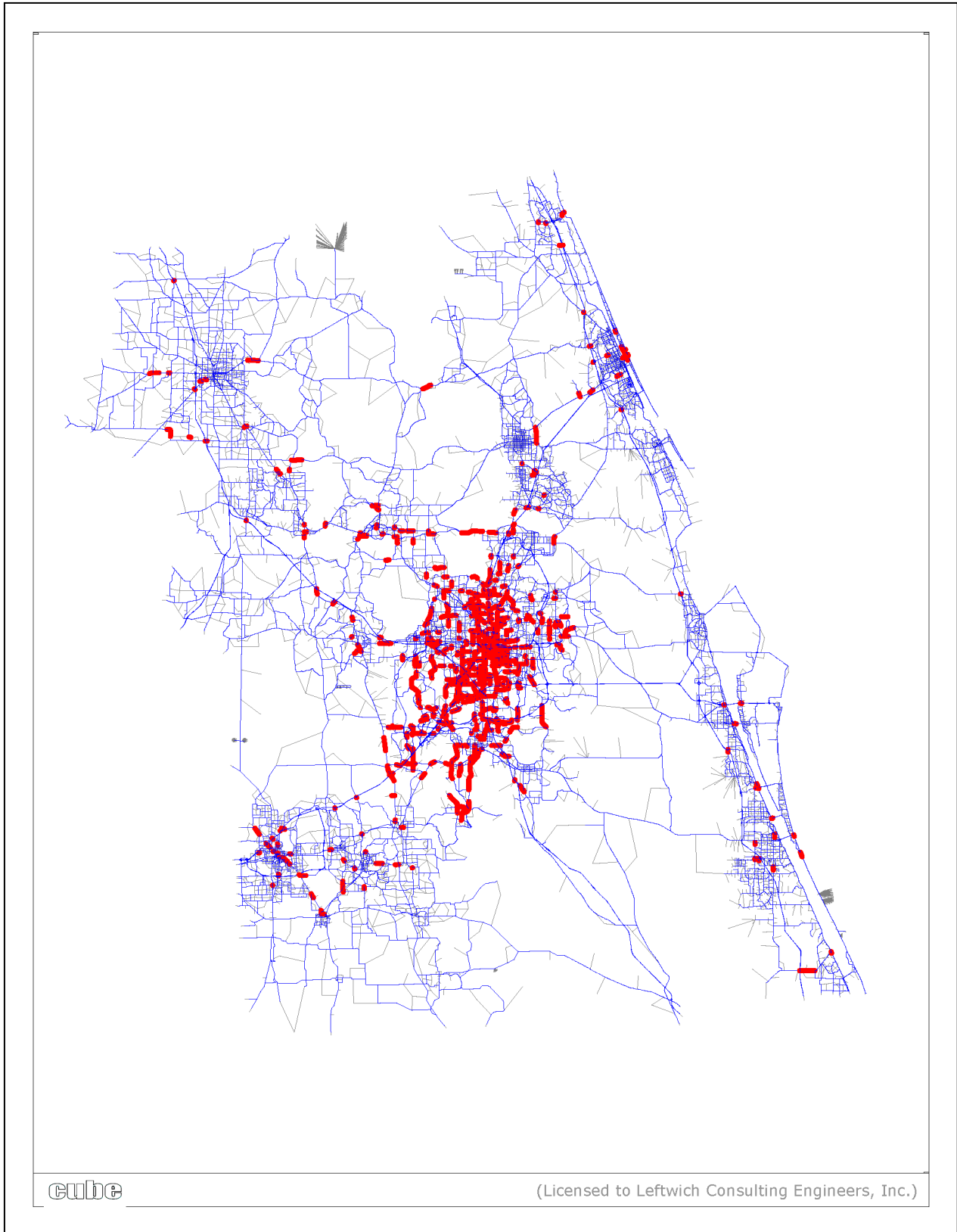
### **Volume-to-Count Ratios**

Figure 1 shows the base year 2010 CFRPM 6.0 on 2010 network volume-to-capacity (V/C) ratios and illustrate where current congestion occurs (V/C > 1.0). As observed, the majority of congestion within District Five occurs in the Orlando area with dispersed congestion on links in surrounding areas.

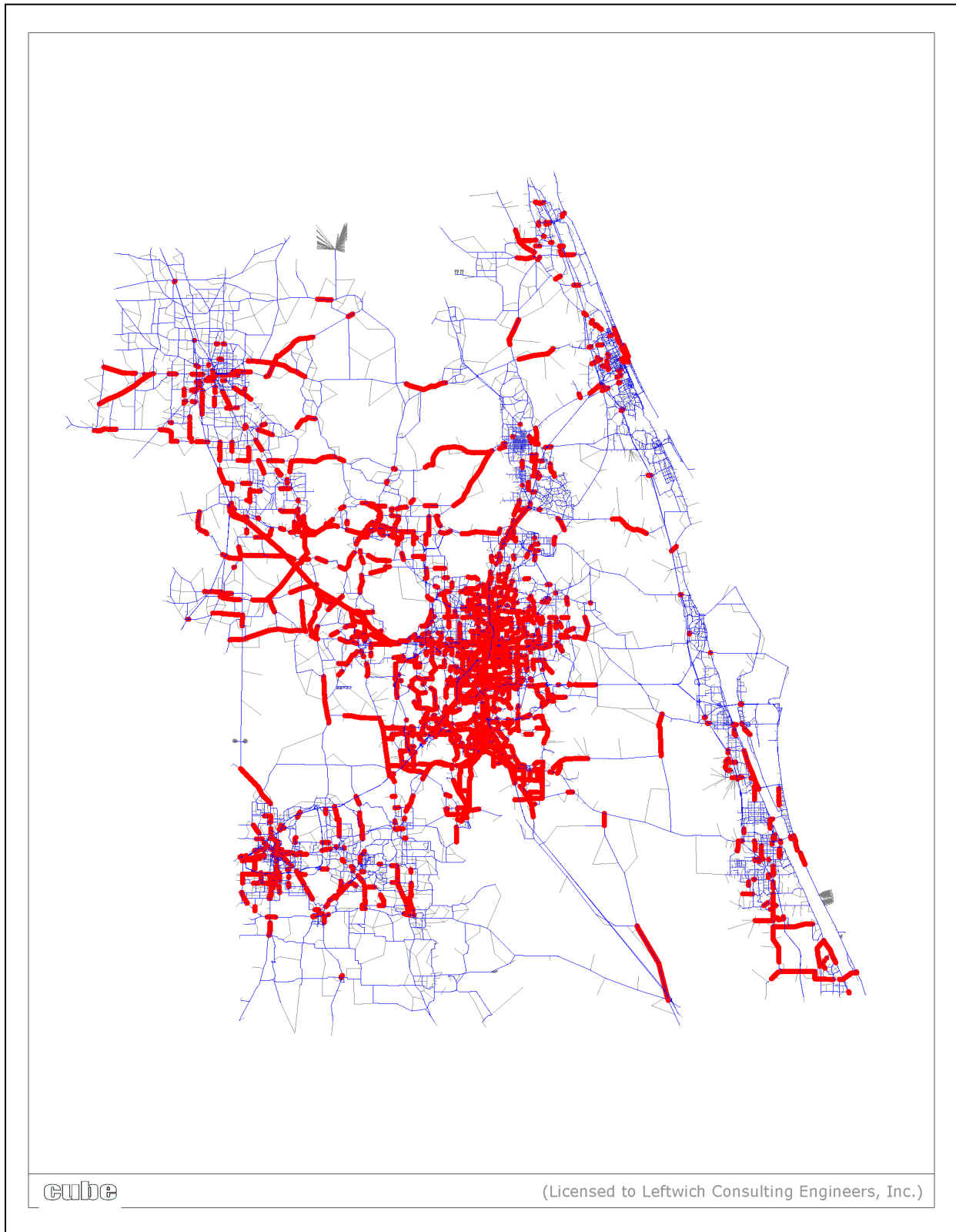
Figure 2 shows the horizon year 2040 CFRPM 6.0 on 2019 Existing-Plus-Committed (E+C) network V/C ratios and highlights areas where congestion is projected, prior to any additional improvements being implemented from year 2020 through 2040. Notably, Figure 2 illustrates extensive additional roadway congestion within the model area. The Orlando area is even more congested and congestion occurs distinctly throughout other areas of the District.

To understand further the reason previous future year models had more roadway links exceeding available capacity, Figure 3 was prepared. Figure 3 illustrate the daily traffic count locations within the network with a comparison of the year 2005 versus year 2010 base year traffic counts. As indicated in the figure, and as mentioned above, traffic counts have in most cases reduced over the five year time frame. Noted in red are the 2005 counts which are higher than the 2010 counts (78 percent). Green illustrates the counts which are lower, meaning traffic counts have increased in the five year period (22 percent). Since traffic counts serve as the main variable for validating a base year model, it is reasonable that the future traffic projections decreased between the two model forecasts.

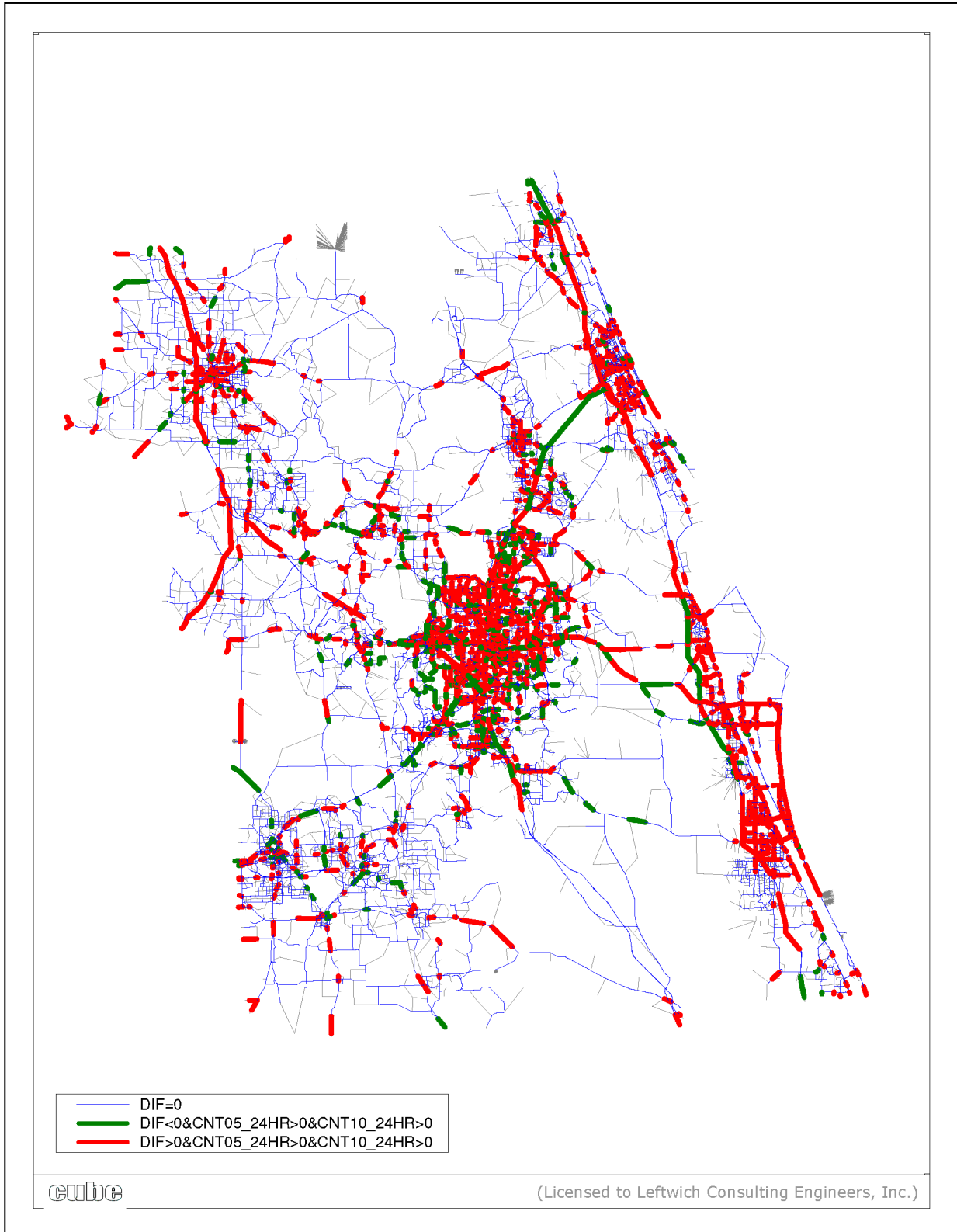
**Figure 1**  
**CFRPM 6.0 Base Year 2010 Traffic on 2010 Base Network**  
**Volume-to-Capacity Ratios > 1.0**



**Figure 2**  
**CFRPM 6.0 Horizon Year 2040 Traffic on 2019 E+C Network**  
**Volume-to-Capacity Ratios > 1.0**



**Figure 3**  
**Comparison of 2005 and 2010 Observed Traffic Counts**  
**Decreases vs. Increases Over the Five Year Period**



### **Decreased Growth Comparison**

A comparison of the differences between the base year model and the future year assignments for respectively the CFRPM 5.5 and the CFRPM 6.0 travel demand was also prepared.

Table 3 shows the comparison between the year 2005 and the year 2010 base year statistics. Notably, there is essentially no growth in the trip productions and many of the statistics decrease over the five year period.

**Table 3**  
**Comparison of CFRPM 5.5 to CFRPM 6.0 Base Year % Difference**

<b>Description</b>	<b>Base Difference 2005 to 2010</b>	<b>% Difference</b>
<b>Productions</b>	<b>3,030</b>	<b>0.02%</b>
<b>Population</b>	<b>425,263</b>	<b>9.61%</b>
<b>Dwelling Units</b>	<b>259,918</b>	<b>13.00%</b>
<b>Occupied Dwelling Units</b>	<b>235,605</b>	<b>13.66%</b>
<b>Average Trip Rate</b>	<b>-1.06</b>	<b>-12.02%</b>
<b>System Miles</b>	<b>144</b>	<b>1.68%</b>
<b>Average Volume</b>	<b>-560</b>	<b>-4.09%</b>
<b>Lane Miles</b>	<b>1,068</b>	<b>5.04%</b>
<b>VMT Using Volumes</b>	<b>-5,538,616</b>	<b>-4.79%</b>
<b>Volume All Links</b>	<b>-826,071</b>	<b>-0.29%</b>

To summarize, the following highlights the differences between the two base year models and their data sets and resulting statistics:

- Population increased 9.61 percent from 2005 to 2010
- Occupied Dwelling Units increased 13 percent from 2005 to 2010
- Average Trip Rate decreased 12.02 percent from 2005 to 2010
- Vehicle-Miles-Traveled (VMT) decreased 4.79 percent from 2005 to 2010

Table 4 shows the relative growth for each the CFRPM 5.5 and the CFRPM 6.0 base year to horizon year 2040 model assignments and includes a percent difference to demonstrate the overall growth. As shown, both models have projected land use growth but the amount of increase vary greatly. Since the base years growth resulted in essentially the same trip productions, a comparison was also made to show the relative reduction in percent growth differences between the CFRPM 5.5 and the CFRPM 6.0 data and corresponding statistics. The comparison further demonstrates the great variation in land use projections between the two models.



**Table 4**  
**Comparison of CFRPM 5.5 and CFRPM 6.0 Base to Horizon Year Growth**

Description	v5.5 Growth 2005 to 2040	% Difference	v6.0 Growth 2010 to 2040	% Difference	v5.5 to v6.0 Comparison
Productions	13,939,269	91.64%	8,387,164	55.13%	-36.51%
Population	3,216,570	72.69%	2,675,445	55.16%	-17.53%
Dwelling Units	1,664,813	83.27%	1,178,344	52.16%	-31.11%
Occupied Dwelling Units	1,485,873	86.12%	1,038,096	52.94%	-33.18%
Average Trip Rate	0.26	2.95%	0.11	1.42%	-1.53%
System Miles	703	8.20%	132	1.51%	-6.69%
Average Volume	11,814	86.35%	5,953	45.37%	-40.98%
Lane Miles	4,989	23.54%	988	4.44%	-19.10%
VMT Using Volumes	146,036,090	126.34%	69,418,732	63.08%	-63.26%
Volume All Links	285,767,406	99.15%	148,592,922	51.70%	-47.44%

The following summarized the major observations made when comparing the differences between the two models and their base year to future year growth patterns:

- Production growth percent difference decreased from 91.64 percent to 55.13 percent
- Population growth percent difference decreased from 72.69 percent to 55.16 percent
- Average Trip Rate percent difference reflects relatively minimal growth
- Vehicle-Miles-Traveled (VMT) decreased from 126.34 percent to 63.08 percent
- All other statistics also decreased relatively

Furthermore, even though the occupied dwelling units and the population experienced growth from 2005 to 2010 the average trip rate and VMT decreased.

#### **4.0 CONCLUSION**

The growth reflected in the CFRPM 5.5 model compared to the CFRPM 6.0 model was reduced by a factor of essentially 50 percent (126.34% vs. 63.08%). This along with the other statistical comparisons presented explains why there is a drop in both the average trip rate and the future trip projections for the CFRPM 6.0 year 2040 horizon year. If anything, the 2040 forecast made for the 2005 base year CFRPM 5.5 model may have been unrealistically high and were based on assumption that the economy would be bouncing back almost immediately and that development growth within the District would be continuing to inflate at the before Recession rates. Today, in the year 2015, there is still evidence of the slowed growth in development when reviewing traffic count volumes as compared to ten years ago and thus District-wide growth trends appear to have changed and are likely to continue long term.

## SUGGESTED METHODOLOGY FOR REVIEWING ROADWAY LINK TRAFFIC PROJECTIONS

The key to using travel demand forecasts for future years is to apply it as one of several tools for evaluating whether individual corridors need improvements, whether these improvements be in the form of roadway widening, transit expansion, Transportation System Management and Operations (TSM&O), or a combination of difference options. Various tools which may apply including, but not limited to:

1. Adjust Future Model Volumes Based on Model Validation Volume-to-Count Ratios
2. Prepare Regression Analysis
3. Apply A Growth Rate Factor
4. Check for Competing Parallel Roadway Widening
5. Evaluate Potential for Extra Development Not Reflected in SE Data
6. Local Knowledge and Traffic Expectations

Most MPO's provide adjustments to their travel demand forecasts to take into account how well an individual corridor was validated. Below is one methodology for preparing such a spreadsheet adjustment:

- **If volume-to count ratio is above 1.2 or below 0.8**, adjust the future year model volume by the difference in base year model volume and traffic count.
- **If the volume-to-count ratio is between 1.2 and 0.8**, adjust the future year model volume by the inverse of the volume-to-count ratio (for example traffic count is 10,000 and base model volume is 11,000; then future year model volume of 20,000 would be adjusted to 18,200 to adjust for the slight over-assignment).

An average of several different methodologies may provide for another review of forecasted traffic projections. Regardless of the procedure applied, local knowledge should always be considered to check for reasonability.

Notably, the above tools have been used for previous LRTP's for reviewing travel demand forecasts and were applied before any growth patterns had changed like those observed in recent times.