AECOM

Memorandum

Date: October 10, 2016
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To: Jason Learned (FDOT District 5)
From: Jiji Kottommannil, Tushar Patel, Tim Palermo

RE: CFRPM 6.1 Polk Update

The District 1 Regional Planning Model (D1RPM) was recently updated based on the latest available data. Most of the data in the latest CFRPM 6.1 model were updated recently except for the Polk County portion of the model. AECOM was retained to update the Polk County related data in the CFRPM 61 model using information from the latest D1RPM. This memorandum describes the various updates performed by AECOM.

Zone Structure

D1RPM has 691 zones in Polk County whereas CFRPM 6.1 has 629 zones. Based on discussions between AECOM and District 5 staff, it was decided to retain the zone structure of CFRPM 6.1 in Polk County.

Socioeconomic Data

The socioeconomic data in the D1RPM was available for the base year 2010 and future year 2040. As the D1RPM has a finer zone structure than the CFRPM 6.1, the data in the CFRPM 6.1 model was updated for Polk County for the base year 2010 and future year 2040 by either aggregating or averaging the zonal data in the D1RPM after developing a correspondence between the two zone systems. Data such as housing units, population and employment numbers were aggregated whereas data pertaining to percentages such as percent vacant homes, percent occupancy of vacant homes or percent households by auto ownership were aggregated via weighted averaging based on housing units. As intermediate year data for 2015, 2020, 2025, 2030 and 2035 were not available from the D1RPM, the data for these years for the CFRPM 6.1 was determined by interpolating between the updated data for Polk County. Table 1 shows a comparison of the original and updated socioeconomic data for Polk County in the CFRPM for only major attributes. Note that the changes were considerable for many zones and also at the county level. We noticed that the percent distribution of single-family vs multi-family population was very different in the D1RPM and CFRPM 6.1 models. We compared this distribution with those from the census and noticed that the percent distribution of single-family vs multi-family population in the D1RPM was somewhat closer to that from the census. Table 2 contains the census population data by various categories along with a comparison of the census population distribution with those based on the original CFRPM 6.1 data and the revised data (i.e. D1RPM). One of the reasons for the difference in population distribution could be the way mobile homes are categorized in the two models.

The CFRPM 6.1 files updated were ZDATA1.dbf (contains housing and hotel/motel related data) and ZDATA2.dbf (contains employment and school related data).

Table 1: Socioeconomic Data Summary

Year	Scenario	Single Family Population	Multi Family Population	Hotel-Motel Population	Total Employment	School Enrollment
2010	**Original**	498,852	118,518	23,148	270,250	109,447
	Revised	374,851	214,960	10,805	255,593	97,395
2015	**Original**	554,809	125,585	25,496	304,063	123,420
	Revised	415,521	240,360	15,221	285,655	113,427
2020	**Original**	610,662	132,582	27,840	337,743	137,470
	Revised	456,101	265,677	19,614	315,616	129,427
2025	**Original**	666,710	139,722	30,188	371,730	151,452
	Revised	496,869	291,174	24,041	345,785	145,498
2030	**Original**	722,498	146,678	32,532	405,233	165,385
	Revised	537,353	316,412	28,415	375,670	161,376
2035	**Original**	778,443	153,735	34,877	439,074	179,435
	Revised	578,024	341,816	32,833	405,703	177,412
2040	**Original**	834,308	160,742	37,224	472,726	193,408
	Revised	618,603	367,129	37,224	435,693	193,408
2045	**Original**	890,173	167,994	39,571	506,378	207,381
	Revised	659,463	392,704	41,638	478,862	209,298

Table 2: Population Data from Census and population distribution comparison with CFRPM 6.1

Category	2010	2015
Total Population	576,965	637,512
Population in Owner occupied units:	407,379	408,166
1 unit, detached or attached	315,353	329,013
2 to 4 units	1,703	4,306
5 or more units	3,061	2,137
Mobile home	85,655	71,997
Boat, RV, van, etc.	1,607	713
Population in Renter occupied units:	169,586	229,346
1 unit, detached or attached	77,986	122,056
2 to 4 units	31,823	35,613
5 or more units	29,313	31,437
Mobile home	30,332	40,177
Boat, RV, van, etc.	132	63
Single Family Population	393,339	451,069
Multi Family Population	183,626	186,443
% Single Family - Census	68%	71%
% Multi-Family - Census	32%	29%
% Single Family - CFRPM6 Original	81%	82%
% Multi-Family - CFRPM6 Original	19%	18%
% Single Family - CFRPM6 Revised	64%	63%
% Multi-Family - CFRPM6 Revised	36%	37%

Highway Network

The input highway networks of both models were compared for differences in primary attributes such as facility type, area type and number of lanes and for presence of links in D1RPM that are not in CFRPM 6.1. This was performed for the base year 2010 and future year 2040 and described in detail below.

Lanes

If there were differences in the number of lanes between the model highway networks for the 2010 base year scenario, Google Earth imagery from 2010 was reviewed to determine the accurate number of lanes. In a few instances, the number of lanes in the CFRPM 6.1 network was accurate although it was different from that in the D1RPM, and therefore unchanged.

If the number of lanes in the 2040 network was lower in the D1RPM compared to that in the CFRPM 6.1, the number of lanes in 2010 in the D1RPM was referred to along with Google Earth imagery to determine whether to implement the decrease in the number of lanes in the CFRPM 2040 network. The decrease was not implemented in the CFRPM 6.1 network if it involved a reduction in lanes between 2010 and 2040 in the D1RPM and if the 2010 number of lanes were accurate per Google Earth imagery.

Area Type

The D1RPM model uses a two-digit area type field (ATYPE) on the input highway network which is based on FSUTMS standards. Table 3 shows the definitions of the area types.

Table 3: FSUTMS Area Types

Area Type	Description
11	Urbanized Area (over 500,000) Primary City Central Business District
12	Urbanized Area (under 500,000) Primary City Central Business District
13	Other Urbanized Area Central Business District and Small City Downtown
14	Non-Urbanized Area Small City Downtown
21	All Central Business District Fringe Areas
31	Residential Areas of Urbanized Areas
32	Undeveloped Portions of Urbanized Areas
33	Transitioning Areas/Urban Areas over 5,000 Population
34	Residential Beach Areas
41	High Density Outlying Business District
42	Other Outlying Business District
43	Beach Outlying Business District
51	Developed Rural Areas/Small Cities under 5,000 Population
52	Undeveloped Rural Areas

The CFRPM 6.1 model uses two area type codes. The two-digit area type field (AREA_TYPE) coded on the input highway network is used only in the trip generation step to read attraction rates by area type for Volusia County (although only the first digit is actually used). Note that only the area types coded on the centroid connectors are used for this purpose. A one-digit area type field is also computed in the model chain as a density-based calculation and used for capacity calculations.

The definitions of the two-digit area types coded on the CFRPM 6.1 highway networks were not available. However, based on a comparison of the two-digit area types coded on the D1RPM and CFRPM 6.1 highway networks, it appeared that they follow the same system. Therefore, AECOM updated the area types coded on the CFRPM 6.1 input 2010 and 2040 highway networks only for the centroid connectors, only if there was a difference in the first digit of the area type (as the second digit is not used in the model, as mentioned above).

Facility Type

The D1RPM input highway network uses two-digit facility type codes (FTYPE) that follow FSUTMS standards. The CFRPM 6.1 input highway network also has two-digit facility type codes (FACILITY) on the links. Table 4 shows a comparison of the facility type descriptions of the two models. For the most part, they follow the same system although they are presented/grouped somewhat differently. AECOM compared the facility type coded on the links in Polk County and updated the CFRPM 6.1 2010 and 2040 input networks using the D1RPM facility type wherever there were differences.

Table 4: Facility Type Definitions in D1RPM and CFRPM 6.1

D1RPM		CFRPM6	
Facility Type	**Description**	**Facility Type**	**Description**
1X - Freeways and Expressways		**1X - Freeways and Expressways**	
11	Freeway Group 1 - within urban area over 500,000 population	11	Urban Freeway Group 1 (cities of 500,000 or more)
12	Other Freeway - all other freeways not in Group 1	12	Other Freeway (not in Group 1)
15	Collector/Distributor Lane		
16	Controlled-Access Expressway	16	Controlled Access Expressways
17	Controlled-Access Parkway	17	Controlled Access Parkways
2X, 3X - Arterials		**2X - Divided Arterials**	
21, 22, 31, 35	Unsignalized - no signalized intersections	21	Divided Arterial Unsignalized (55 mph)
23, 32, 36	Class Ia - upto 2.49 signalized intersections/mile in urban	22	Divided Arterial Unsignalized (45 mph)
	areas or upto 1.5 signalized intersections/mile in rural areas	23	Divided Arterial Class I
24, 33, 37	Class 1b - 2.5 -4.5 signalized intersections/mile in urban areas	24	Divided Arterial Class II
	or more than 1.5 signalized intersections/mile in rural areas	25	Divided Arterial Class III / IV
25, 34, 38	Class II/III - More than 4.5 signalized intersections/mile	26	Divided Signalized Arterial with High Capacity
		3X - Undivided Arterials	
		31	Undivided Arterial Unsignalized with Turn Bays
		32	Undivided Arterial Class I with Turn Bays
		33	Undivided Arterial Class II with Turn Bays
		34	Undivided Arterial Class III / IV with Turn Bays
		35	Undivided Arterial Unsignalized without Turn Bays
		36	Undivided Arterial Class I without Turn Bays
		37	Undivided Arterial Class II without Turn Bays
		38	Undivided Arterial Class III / IV without Turn Bays
		39	Undivided Signalized Arterial with High Capacity
4X - Collectors		**4X - Collectors**	
41-43	Major Collector	41	Major Local Divided Roadway
		42	Major Local Undivided Roadway with Turn Bays
		43	Major Local Undivided Roadway without Turn Bays
44-46	Other Collector	44	Other Local Divided Roadway
		45	Other Local Undivided Roadway with Turn Bays
		46	Other Local Divided Roadway without Turn Bays
47	Low Speed Local	47	Low Speed Local Collector
48	Very Low Speed Local	48	Very Low Speed Local Collector
5X - Centroid Connectors		**5X - Centroid Connectors**	
51	Basic - all centroid connectors except those at externals	51	Basic Centroid Connector
52	External - external station connectors	52	External Station Centroid Connector
		53	Dummy Zone Centroid Connector
		54	Dummy Link for Dummy Centroid

Table 4 (Continued): Facility Type Definitions in D1RPM and CFRPM 6.1

D1RPM		CFRPM6	
6X - One-Way Facilities		**6X - One-Way Facilities**	
61, 65	Unsignalized - no signalized intersection	61	One-Way Facilities Unsignalized
62, 66	Class Ia - upto 2.49 signalized intersections/mile in urban	62	One-Way Facilities Class I
	areas or upto 1.5 signalized intersections/mile in rural areas	63	One-Way Facilities Class II
63, 67	Class 1b - 2.5 to 4.5 signalized intersections/mile in urban	64	One-Way Facilities Class III / IV
	areas or more than 1.5 signalized intersections/mile in rural a	66	Frontage Road Class I
64, 68	Class II/III - More than 4.5 signalized intersections/mile	68	Frontage Road Class III / IV
65-68	One-way frontage roads parallel to freeways and expressway		
7X - Ramps		**7X - Ramps**	
71, 73, 75, 77	Diamond and slip ramps with speeds > 30 mph	71	FreewayOn/OffRamp
72, 74, 76, 78	Loop ramps and cloverleaf ramps with speeds<30 mph	72	Freeway On /Off Loop Ramp
		73	OtherOn/OffRamp
		74	Other On /Off Loop Ramp
		75	Freeway-to-Freeway Ramp
79	Freeway-Freeway Ramps - high speed and capacity ramps connecting two freeways		
8X - HOV Facilities		**8X - HOV Facilities**	
81-82	Barrier Separated	81	Freeway Group 1 HOV Lane (Barrier Separated)
		82	Other Freeway HOV Lane (Barrier Separated)
83-84	Non-barrier separated	83	Freeway Group 1 HOV Lane (Non-Barrier Separated)
		84	Other Freeway HOV Lane (Non-Barrier Separated)
85	Non-Freeway HOV lane	85	Non Freeway HOV Lane
86-89	HOV Ramps by time of day restrictions	86	AM & PM Peak HOV Ramp
		87	AM Peak Only HOV Ramp
		88	PM Peak Only HOV Ramp
		89	AllDayHOVRamp
9X - Toll Facilities		**9X - Toll Facilities**	
		91	Toll Facility– Florida Turnpike
		92	Toll Facility – SR 408
		93	Toll Facility – SR 417
94	Divided Arterial Toll Facility	94	Toll Facility – SR 429
95	Undivided Arterial Toll Facility	95	Toll Facility–SR 528
		96	Toll Facility–Osceola Parkway
97	Toll On-Ramp	97	Acceleration Lanes - Toll Facility
98	Toll Off-Ramp	98	Deceleration Lanes - Toll Facility
99	Toll Plazas		

New Links

Based on a comparison of the links coded in Polk County, it was observed that the D1RPM had several more links than CFRPM 6.1. However, majority of those are related to D1RPM having a finer zonal structure which in turn requires the coding of additional lower level roadways. As it was decided to retain the CFRPM 6.1 zone system, most of those lower level roadways were not added in the CFRPM 6.1 to maintain compatibility between the granularity of the zone and networks. However, AECOM added a few new links in CFRPM 6.1 that were included in the D1RPM if they seemed relevant. Adjustment to the centroid connectors in the immediate vicinity of the new links were also made as needed.

The above changes were made first for 2010 pertaining to links representing roadways that currently exist and carried forward to the future year 2040 network. There were several new links in the 2040 D1RPM network that reflect a future roadway improvement that were not included in the 2040 CFRPM 6.1 network. AECOM added these roadways into the 2040 CFRPM 6.1 network. The major projects among these were the CPP toll road from Polk Parkway to I-4 and the I-4 managed lanes from county line road to US-27. The opening years of almost all of these projects were determined from the 2040 Polk TPO Long Range Plan (LRP) to be 2040. The

link attribute information for these new links were taken from the D1RPM 2040 network. Attributes pertaining to the toll links were specified in the link toll file 'TOLLLINK_40C.dbf'.

All network updates were tracked and can be reviewed via the new attribute NETEDIT, the definitions of which are shown in Table 5.

Table 5: Network Edit Codes

NETEDIT	Description
1	New link
2	Lane change
3	Link/centroid connector change/shift
4	Area type change
5	Facility type change
23	Lane change and link shift
25	Lane and Facility type change
35	Link/Centroid connector/Facility type change
235	Lane/Facility type change and link shift

Note that none of the link edits impacted the transit routes coded in 2010; therefore the transit line file in 2010 remains unchanged. However, the 2040 link edits, specifically link splits, required some change to the 2040 transit line file 'TROUTE_40C.lin'.

Intermediate Year Networks

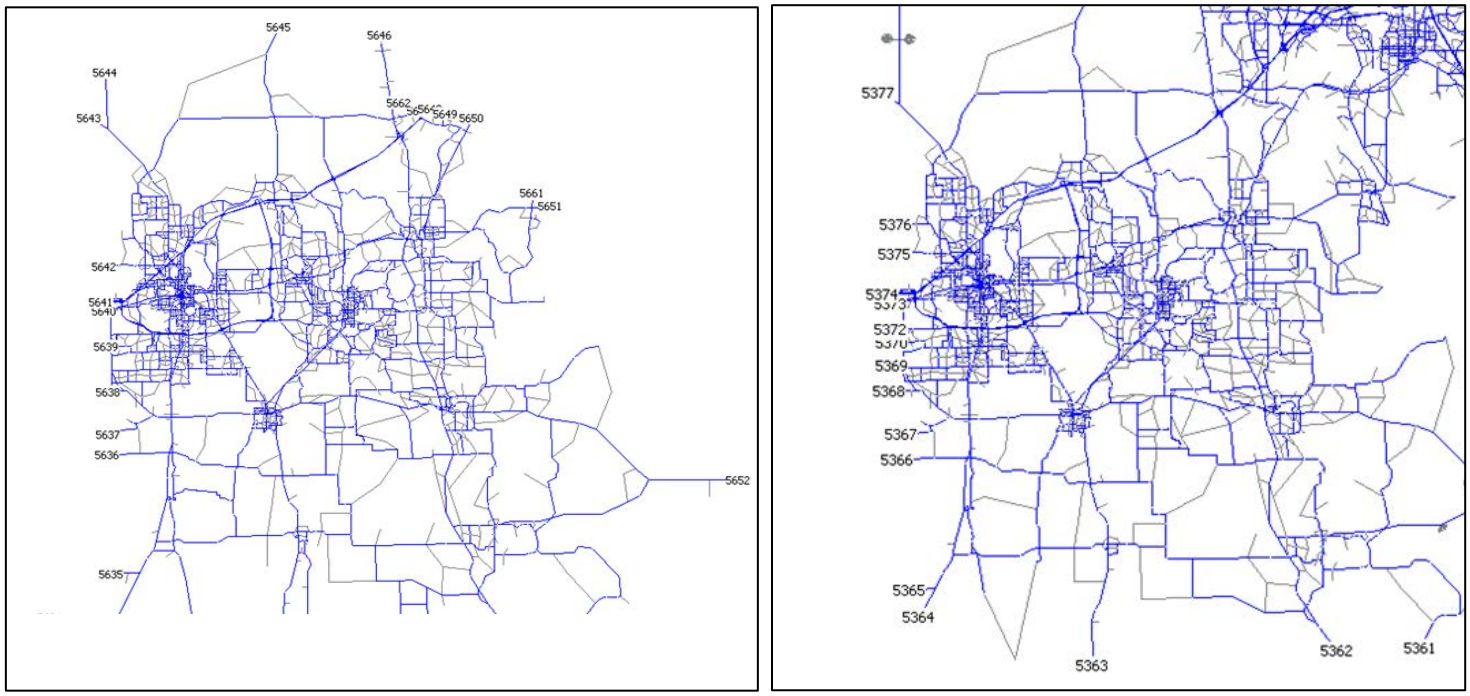
As intermediate year networks were not available from the D1RPM, the intermediate year (2015, 2020, 2025, 2030 and 2035) CFRPM 6.1 networks were updated using a different approach. The increase in number of lanes and addition of new links in 2040 were reviewed against the 2040 LRP for the opening years and implemented in the intermediate years accordingly. For example, if the opening year is 2040, it was not implemented in the intermediate years. In certain instances where the opening years could not be found in the LRP, it was assumed to be implemented only by 2040. Changes in area type for 2010 and 2040 were the same and so were applied to all intermediate networks. The changes in facility type in 2010 and 2040 were also applied to all intermediate years. The updated 2040 network was assumed to be applicable for the 2045 scenario without any changes, which is consistent with what is currently assumed in the CFRPM 6.1 for the 2045 scenario.

External Trips

The D1RPM has external stations numbered from 5,629 to 5,662. The externals in CFRPM 6.1 range from 5,351 to 5,406. AECOM's review of the external station trips in both models was focused on those externals that are common to both models in Polk County, as shown in Figure 1. As can be seen, some of the externals in D1RPM, specifically the northern and eastern portions of the county, become internal zones in the CFRPM 6.1. Also, some of the external zones in CFRPM 6.1 are internal to the D1RPM, specifically in the southern portion of the county.

Figure 1: Comparison of External stations in Polk County

D1RPM **CFRPM 6.1**



The only externals in Polk County that are common to both models are 5,635 to 5,643 in D1RPM and 5,365 to 5,377 in CFRPM 6.1. As the input data pertaining to external-internal (E-I) and external-external (E-E) trips are specified somewhat differently by auto vs truck mode, the comparison of the external station trips was focused on the total external trips and is shown in Table 6 along with the traffic counts coded in each model. These are presented as one-way trips, i.e. trips generated at the external and entering the model area, as that is how most of the data was specified. Similar information for 2040 is shown in Table 7.

Table 6: Comparison of External Station Trips - 2010

Location	D1RPM							CFRPM6					Difference
	External	E-E		I-E	E-E + E-I	E-E + E-I	Count	External	E-E	E-I	E-E + E-I	Count	E-E + E-I
		Auto	Light Truck	Auto	Heavy Truck	Total	Total		Auto	Total	Total	Total	Total
CR 674	5635			992	1	993		5365	0	845	845	845	-149
CR 640 W	5636			3,750	21	3,771	3,523	5366	0	3,086	3,086	3,100	-686
CR 676	5637			1,109	0	1,109	1,032	5367	0	549	549	550	-561
SR 60 W	5638			11,993	42	12,035	11,180	5368	0	8,216	8,216	8,300	-3,820
Medulla Rd	5639			1,649	81	1,730	1,612	5370	0	1,139	1,139		-591
US 92 W	5640			6,829	4	6,833	6,348	5373	0	4,129	4,129	4,150	-2,705
I-4 W	5641	12,000	1,750	43,118	5,722	62,590	63,483	5374	0	56,242	56,242	56,500	-6,348
Knights Station Rd	5642			2,648	43	2,691	2,097	5375	0	2,662	2,662	2,684	-29
US 98 N	5643			4,499	106	4,605	4,255	5377	0	3,967	3,967	4,000	-639

Table 7: Comparison of External Station Trips - 2040

Location	D1RPM						CFRPM				Difference
	External	E-E		I-E	E-E + E-I	E-E + E-I	External	E-E	E-I	E-E + E-I	E-E + E-I
		Auto	Light Truck	Auto	Heavy Truck	Total		Auto	Total	Total	Total
CR 674	5635			1,941	2	1,943	5365	0	2,124	2,124	181
CR 640 W	5636			7,467	29	7,496	5366	0	5,308	5,308	-2,188
CR 676	5637			2,210	0	2,210	5367	0	1,135	1,135	-1,076
SR 60 W	5638			25,331	56	25,387	5368	0	15,000	15,000	-10,387
Medulla Rd	5639			3,271	108	3,379	5370	0	2,000	2,000	-1,379
US 92 W	5640			10,004	5	10,009	5373	0	8,000	8,000	-2,009
I-4 W	5641	22,800	3,325	59,335	11,331	96,791	5374	0	84,750	84,750	-12,041
Knights Station Rd	5642			5,269	58	5,327	5375	0	3,700	3,700	-1,627
US 98 N	5643			8,908	142	9,050	5377	0	7,328	7,328	-1,722

As can be seen, the total (E-E + E-I) external trips at the common externals are comparable with a few exceptions that exhibit large differences (highlighted in red font in Tables 6 and 7). However, note that in both models, the total external trips in 2010 at these locations (SR 60W, US 92W and I-4W) match the observed count used in the respective models, which also show large differences. AECOM checked the counts used in the CFRPM 6.1 model for these locations against the 2010 counts on FDOT Traffic count website and verified it to be accurate. The differences in total trips between the models for 2040 as shown in Table 7 are just a magnification of the differences in 2010. Therefore, no change was warranted in the CFRPM 6.1 model pertaining to the external trips in Polk County for 2010 and 2040 scenarios.