

Task Work Order 080 – Draft Final Report

Florida Department of Transportation – Bicycle and Pedestrian Level of Service Evaluation

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For the
Florida Department of Transportation
Transportation Statistics Office

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Overview

Sprinkle Consulting was tasked with calculating both bicycle and pedestrian level of service using the FDOT Q/LOS Handbook Generalized Tables and the Level of Service Model. Bicycle and pedestrian level of service measures a roadway's fit for purpose and is scored with a letter grade of A, B, C, D, E, or F. The highest obtainable score of "A" indicates the optimal perception by bicyclists or pedestrians, while an "F" indicates the facility is perceived as poor by users. The following report compares the results of both methods and suggests modifications to be made to the Generalized Service Volume Tables to improve accuracy.

Process

Using Microsoft Excel workbooks in addition to data obtained via Cambridge Systematics, level of service scores were calculated separately using the FDOT Generalized Service Volume Tables and then again using the Sprinkle Level of Service (LOS) Model. This process was repeated for each of the 67 counties in Florida. In order for a finer, more detailed comparison, results were assessed based on a classification of area type: urban, rural, or transitioning.

Initial Trends

Note that a Level of Service score of "A" is not obtainable using the Generalized Service Volume Table (GSVTs) method.

Also note that not all development patterns are present in all counties. For instance, Hardee County contains no urban roadways and Leon County contains no rural roadways.

A few general trends can be seen in comparing the Generalized Service Volume Tables to Sprinkle LOS model results for pedestrian level of service. As evidenced by Figures 1, 2, and 3, Generalized Tables resulted in worse scores whereas the Sprinkle LOS Model resulted in better scores. (It should be noted that an LOS A is not possible using the generalized tables.)

Different trends can be seen from comparisons of bicycle level of service (these will be illustrated using Hardee and Leon Counties). For urban areas the Sprinkle LOS model appears to result in better LOS scores than the Generalized Service Volume Tables. However, for outside urban areas Generalized Service Volume Tables resulted in a significant skew towards better scores whereas the Sprinkle LOS Model resulted in a skew towards worse scores. (Figures 4, 5, and 6).

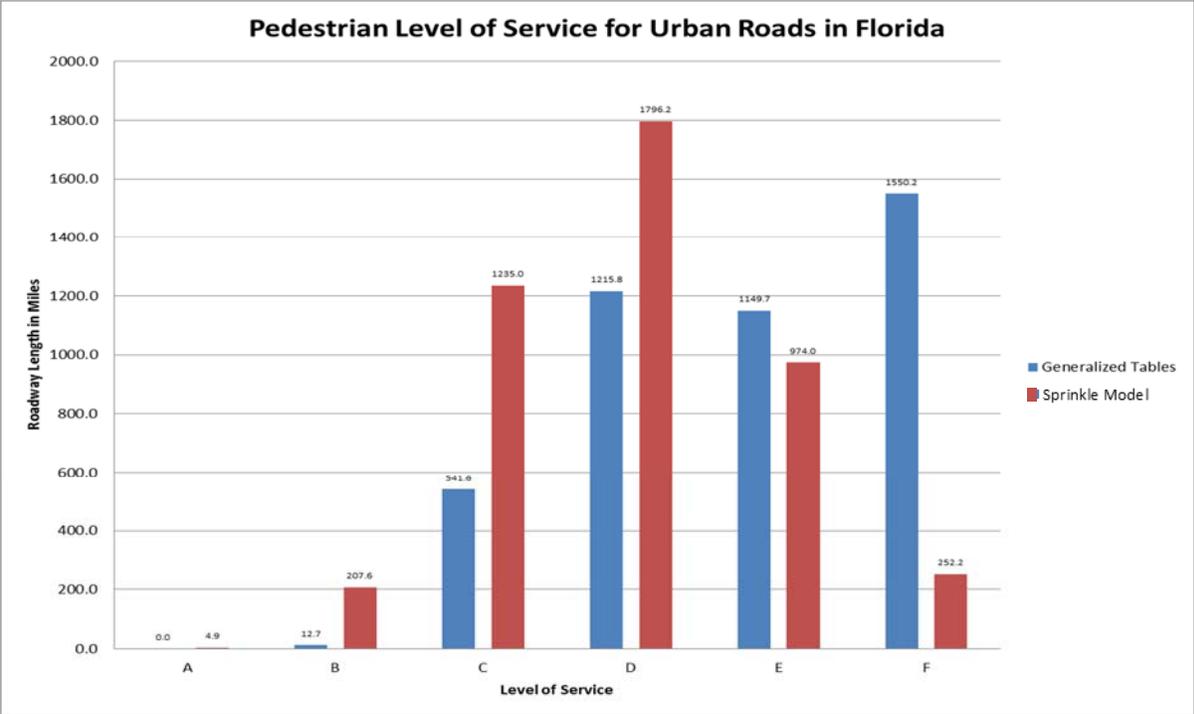


Figure 1: Comparison of Pedestrian LOS from Generalized Tables and Sprinkle LOS Model for Urban Roads

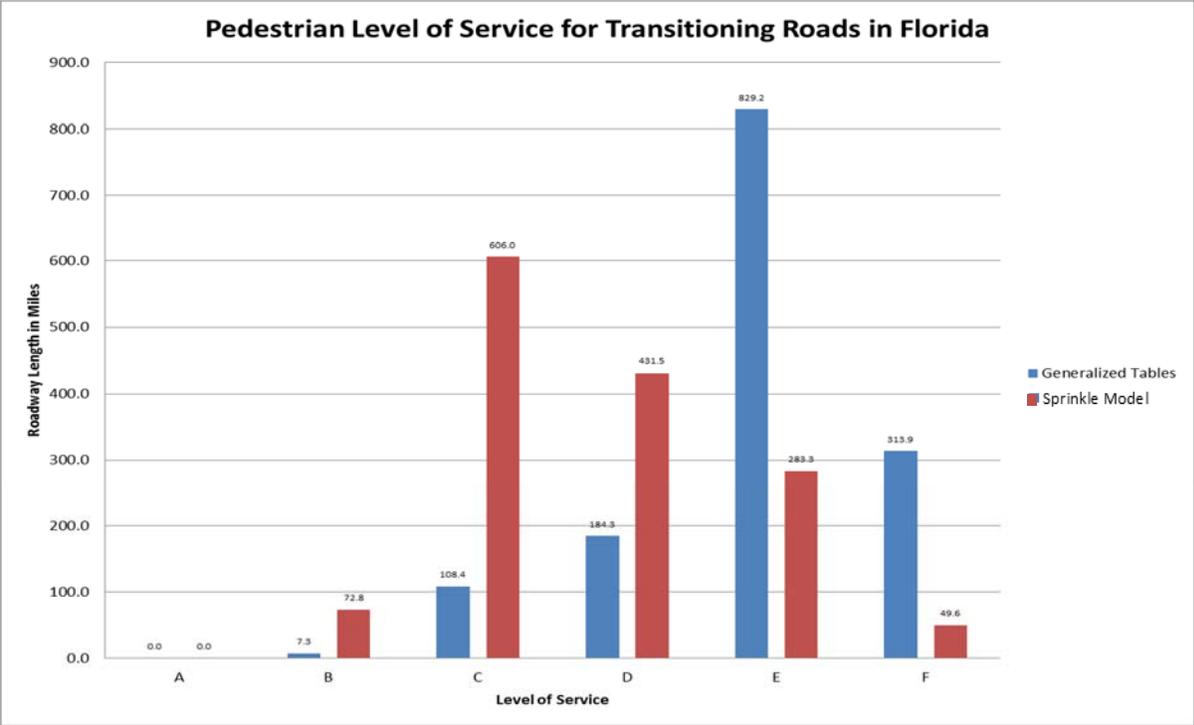


Figure 2: Comparison of Pedestrian LOS from Generalized Tables and Sprinkle LOS Model for Transitioning Roads

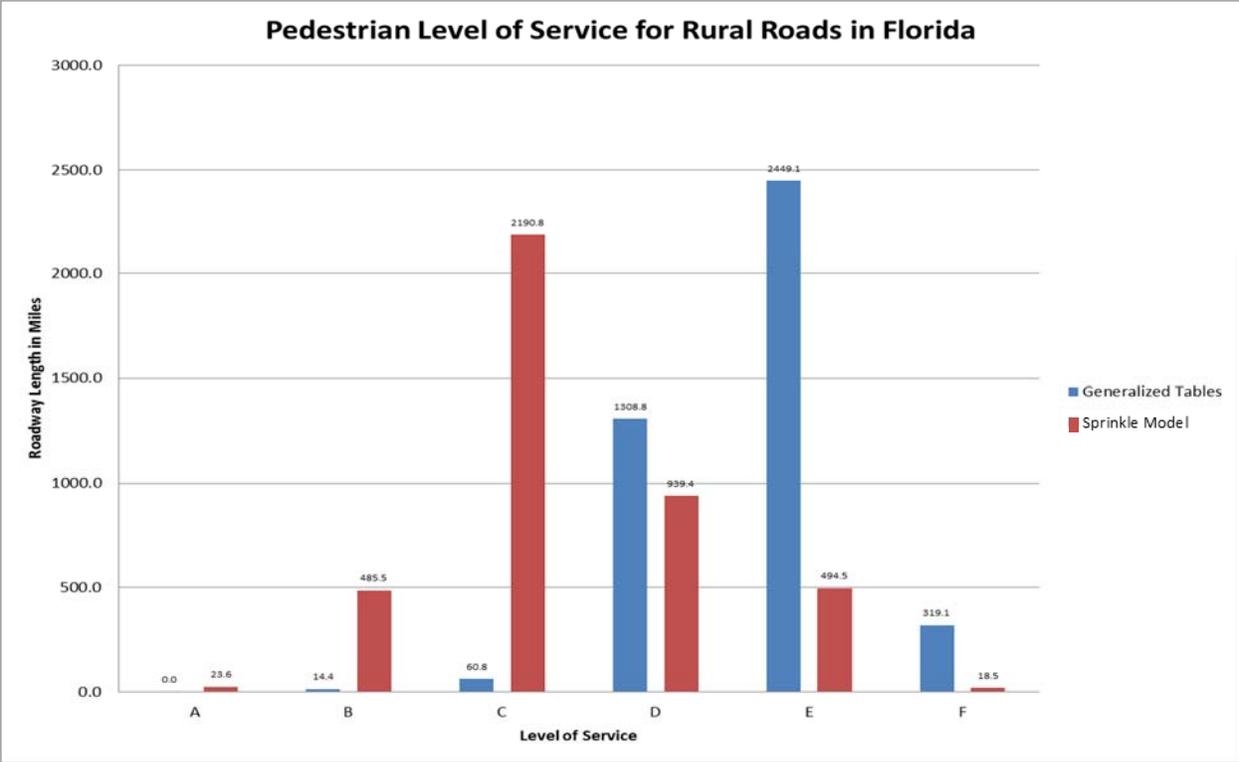


Figure 3: Comparison of Pedestrian LOS from Generalized Tables and Sprinkle LOS Model for Rural Roads

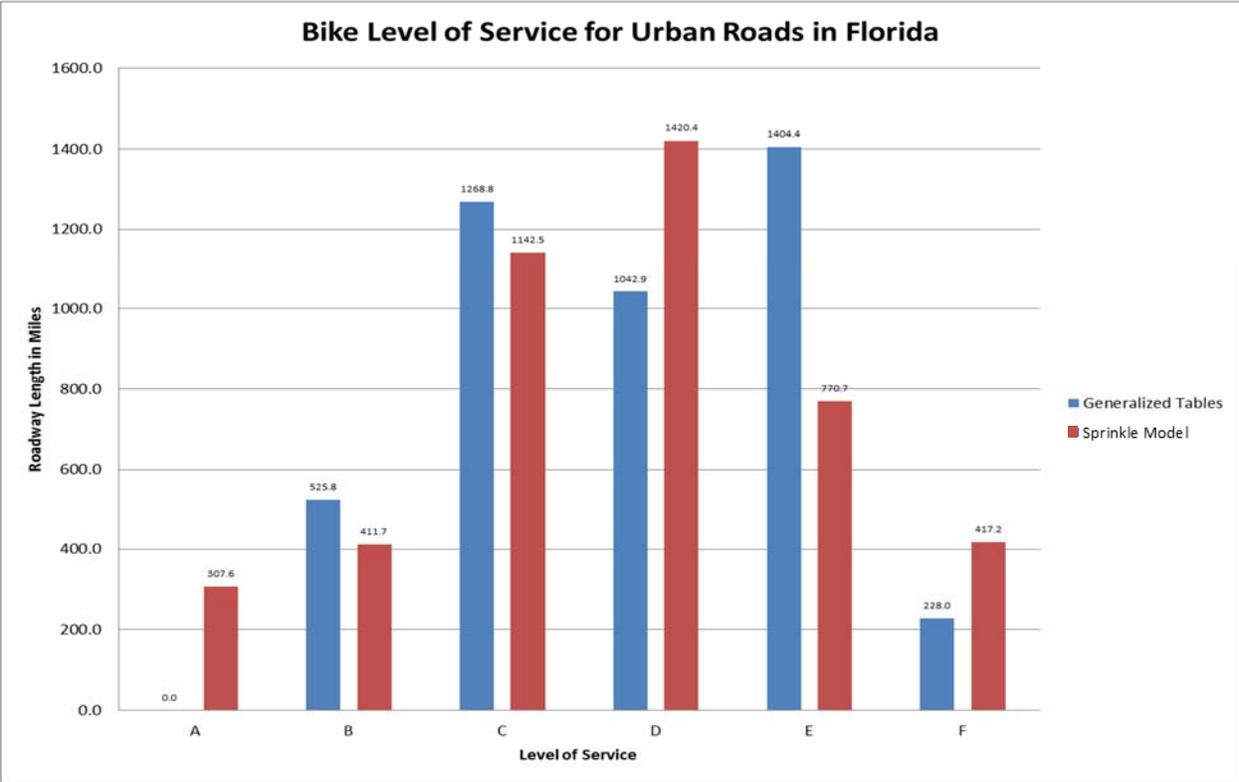


Figure 4: Comparison of Bike LOS from Generalized Tables and Sprinkle LOS Model for Urban Roads

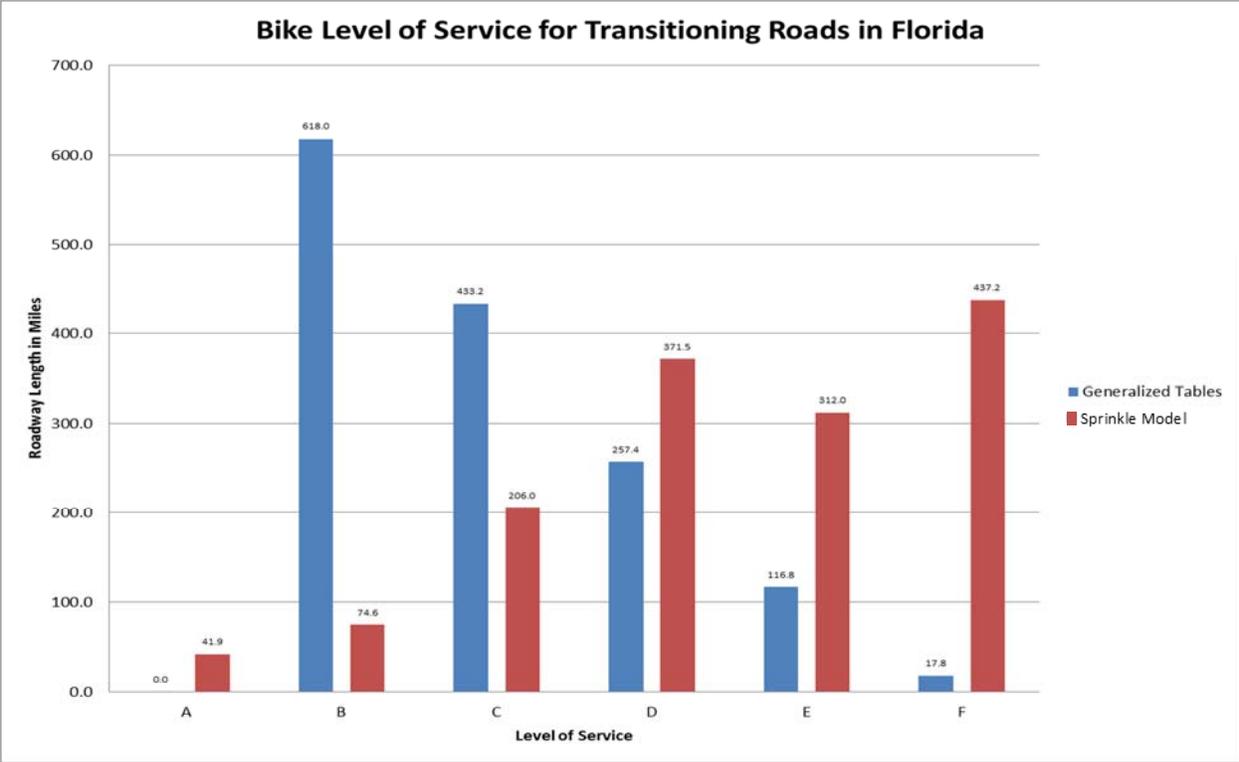


Figure 5: Comparison of Bike LOS from Generalized Tables and Sprinkle LOS Model for Transitioning Roads

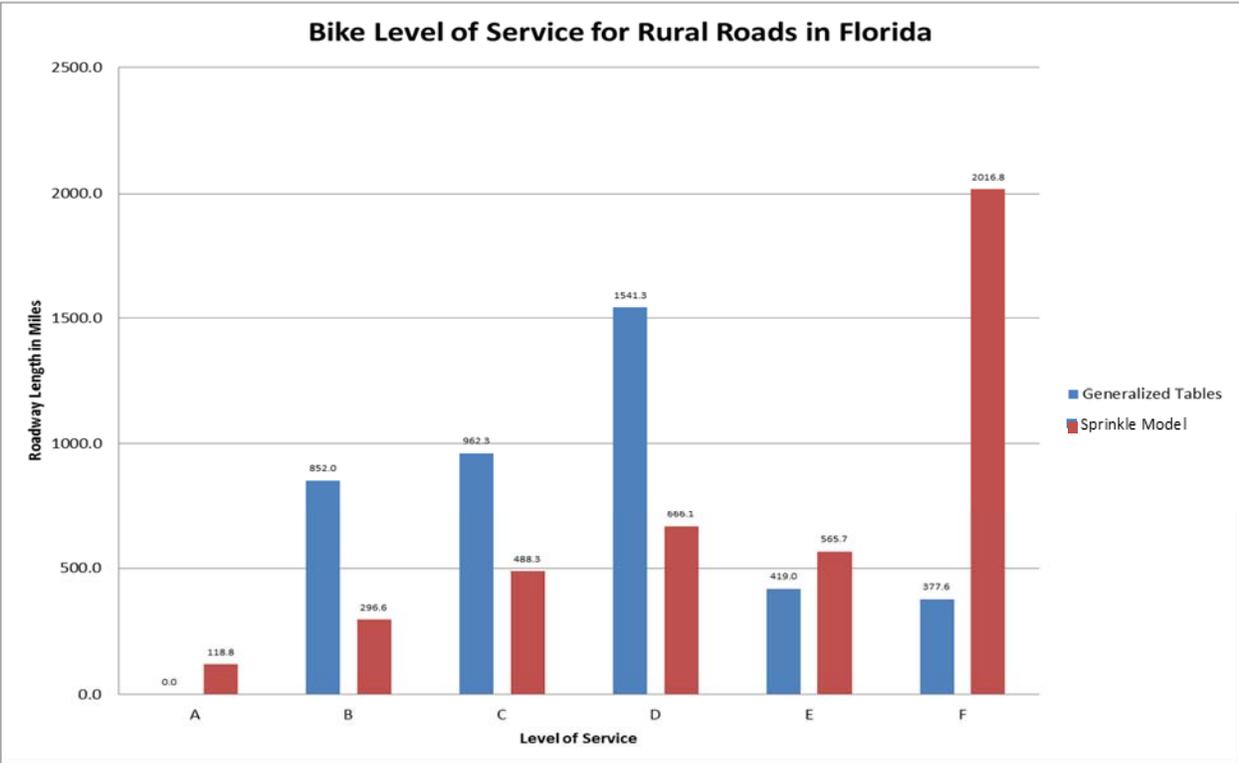


Figure 6: Comparison of Bike LOS from Generalized Tables and Sprinkle LOS Model for Rural Roads

Modifications to the Process

Based on comparisons between the Generalized Tables and the Sprinkle LOS Model, some conclusions were drawn regarding how scores are calculated.

For bicycle level of service, it was found that heavy vehicle (truck) percent was a major influence on level of service scores. For this reason, the LOS Sprinkle Model was run again in several counties changing 24-hour truck percentages as reported on the FDOT Traffic Information DVD to one-third their original values. The hypothesis is that this better represents the peak hour truck volumes. A reanalysis of the roadways resulted in shifting the calculated LOS scores (as opposed to the Generalized Tables). The bike and pedestrian LOS calculated scores now both result in more favorable results than the Generalized Service Volume Tables. See Figures 7 through 10.

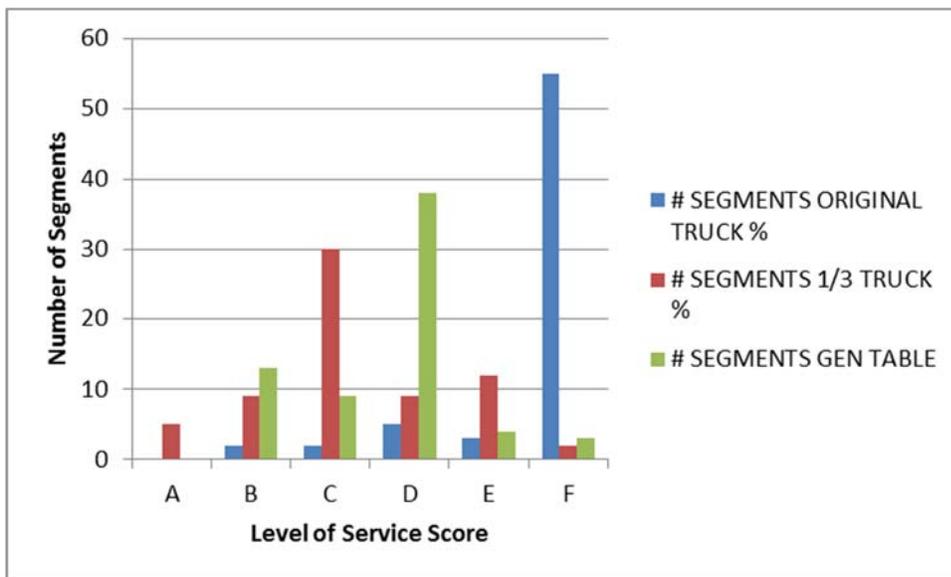


Figure 7: Bicycle Level of Service Scores Based on Truck Volumes for Rural Roads in Hardee County

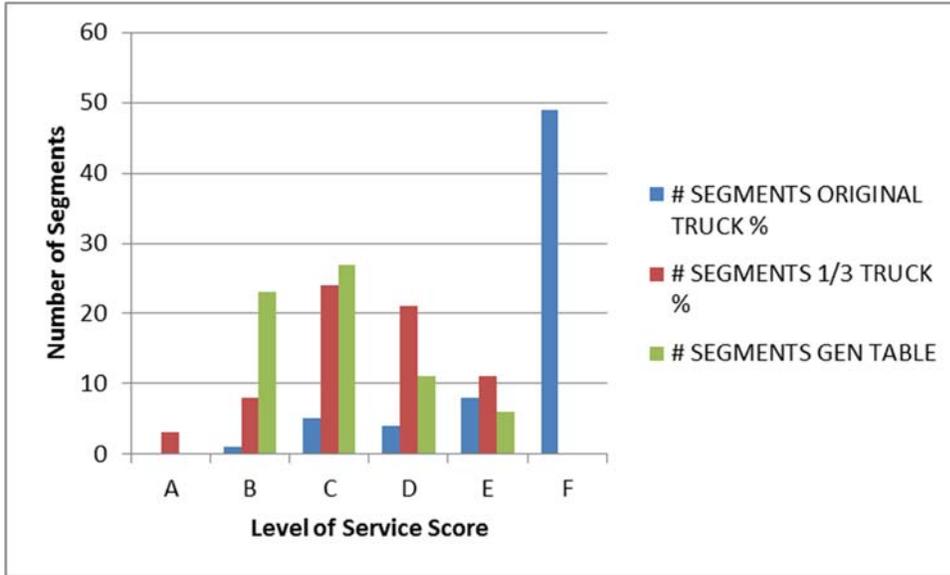


Figure 8: Bicycle Level of Service Scores Based on Truck Volumes for Transitioning Roads in Hardee County

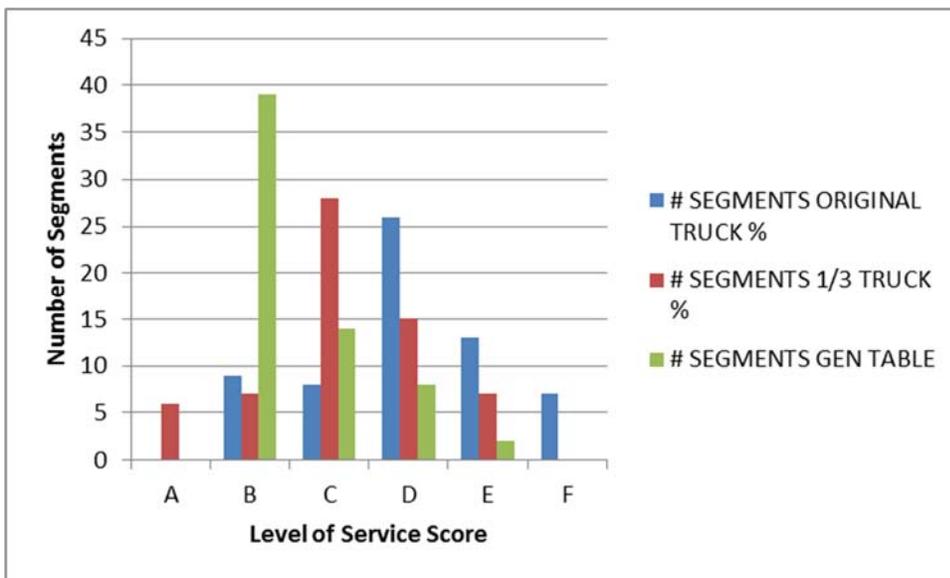


Figure 9: Bicycle Level of Service Scores Based on Truck Volumes for Transitioning Roads in Leon County

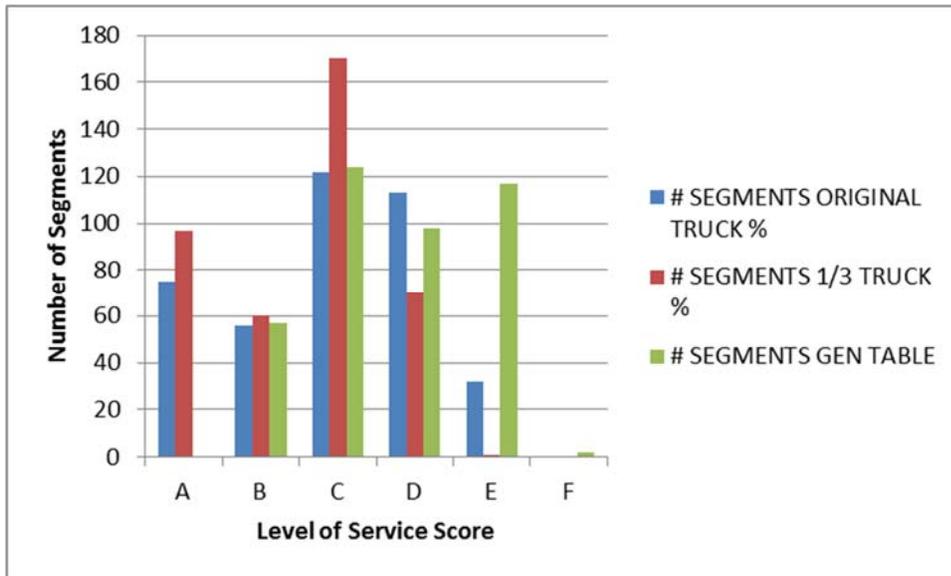


Figure 10: Bicycle Level of Service Scores Based on Truck Volumes for Urban Roads in Leon County

We believe the reason the calculated LOS scores result in better overall scores than the Generalized Service Volume Table is due to the assumed percent facilities on a roadway. The percent facilities is calculated based on the presence of a paved shoulder for bikes, or sidewalk or shared use path for pedestrians, for any given road segment. The Generalized Service Volume Tables provides three options for percent coverage. Any coverage less than 50% is rounded down to 0%, any greater or equal to 50% but less than 85% to is rounded down to 50%, and any greater than or equal to 85% to 100%. This means that all values except those at 85% or higher were rounded down. By rounding percent coverage down, Generalized Service Volume Tables largely yielded poorer scores for level of service than the Sprinkle LOS Model, which used actual weighted averages representing true percent coverage values and no rounding. Figures 12 and 13 illustrate the amount of over and under estimation of the percent facilities for bikes and pedestrians in Leon County urbanized areas.

The most important factor influencing the letter grades produced by the GSVTs is the presence of a facility e.g. a bike lane or sidewalk. When a sidewalk is present it is nearly impossible to go below LOS D and where there are no sidewalks it is as equally unlikely to produce a LOS letter grade better than E. The Sprinkle LOS Model reports more favorable results than the GSVTs when there are no sidewalks present. This may result from the presence of shoulders which favorably impact the pedestrian LOS. Florida DOT has determined the presence of a sidewalk is the most important factor to an individual who is walking. Furthermore the GSVTs inability to produce an LOS A letter grade skews LOS results downward. These two explanations help account for the differences between the GSVTs pedestrian LOS scores and the Sprinkle LOS mode.

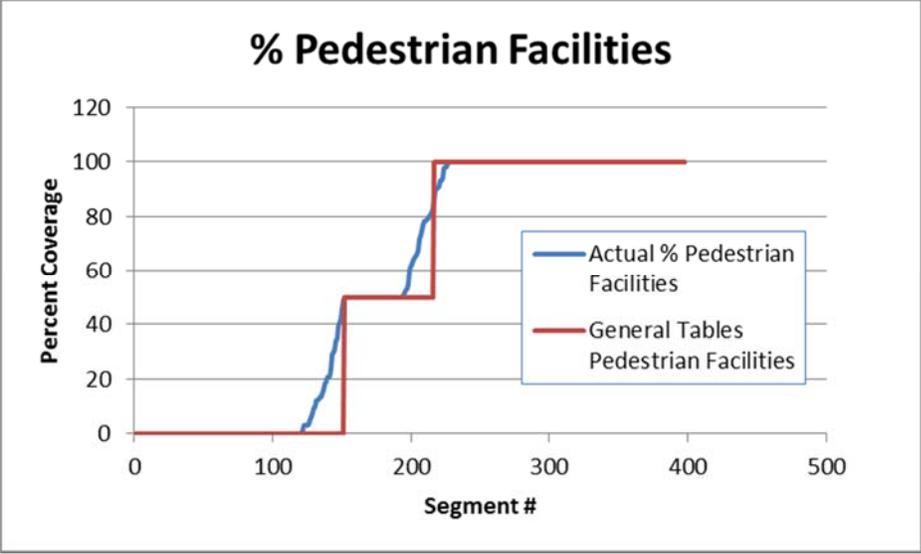


Figure 11: Percent Pedestrian Facilities Comparison for Urban Roads in Leon County

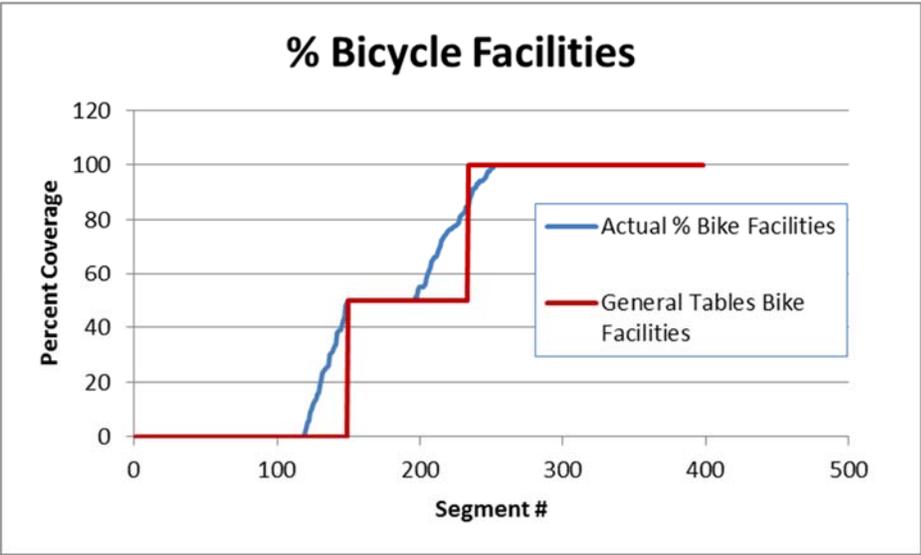


Figure 12: Percent Bicycle Facilities Comparison for Urban Roads in Leon County

A review of Figures 11 and 12 reveals that the percent coverage of bicycle and pedestrian facilities is under represented by the GSVTs more often than it is over represented. Thus it makes sense that the calculated Sprinkle Model LOS scores would be more favorable than those obtained from the GSVTs.

Similar Figures for Miami-Dade County urbanized areas are shown below:

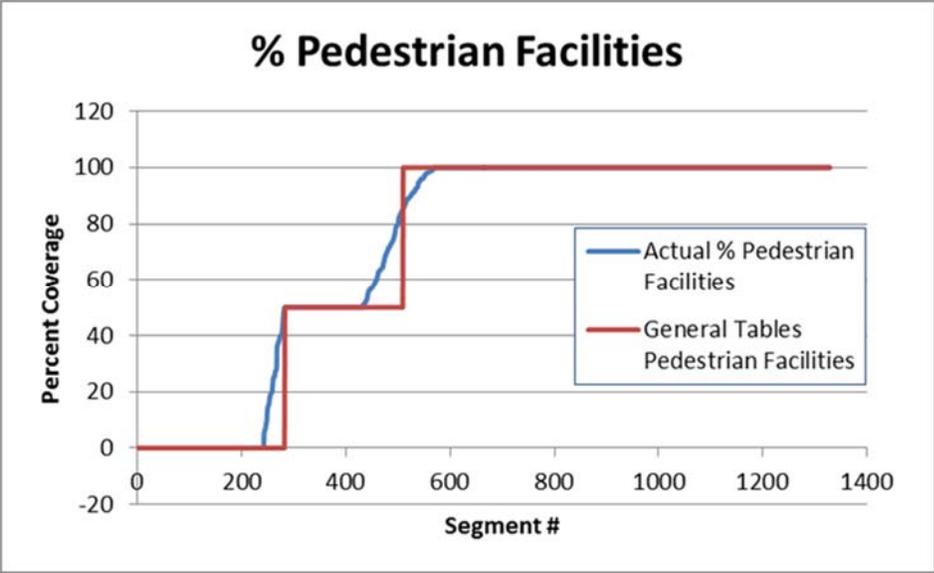


Figure 15: Percent Pedestrian Facilities Comparison for Urban Roads in Miami-Dade County

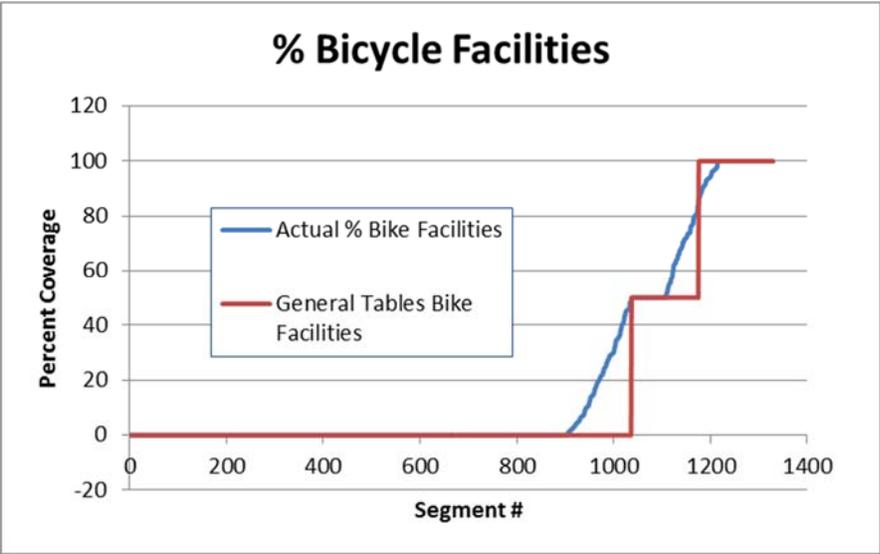


Figure 15: Percent Bicycle Facilities Comparison for Urban Roads in Miami-Dade County

Recommendations for the Generalized Service Volume Tables

The Generalized Service Volume Tables provide LOS results that are quite conservative when compared to the more in-depth Sprinkle Model LOS analysis. This may be acceptable for users’ purposes. Any changes to the GSVTs resulting in significant improvements to LOS scores’ accuracy would likely involve adding more options to the Generalized Service Volume Tables. To significantly improve the fidelity of GSVTs, one would likely implement five categories of facility coverage; this would make the Generalize Service Volume Tables more complicated to use and may not be desirable. There are a significant number or roadway segments that have no facilities or 100 percent facilities. There are also a significant number that have 50% facilities (for pedestrians this often results from having facilities on only one side

of the roadway). Thus three natural categories for percent coverage would be *essentially none*, *essentially 100 percent*, and *about 50 percent*. The last two categories would be *less than 50%* and *more than 50%*. The defaults for these last two categories should be set based upon actual averages (or a sampling of averages) from these categories.

Recommendations for Statewide Model Analysis

The truck percentage reduction from the transportation statistics database to 1/3 that value seemed to provide more intuitive results. This adjustment only impacts the bicycle level of service results.

Statewide and District Summaries of Level of Service Results

Summaries of the level of service results are provided below. Some districts do not have an area type, e.g. rural undeveloped, in those instances a zero value for mileage is displayed. The slight variation in mileage between the two tables is due to rounding.

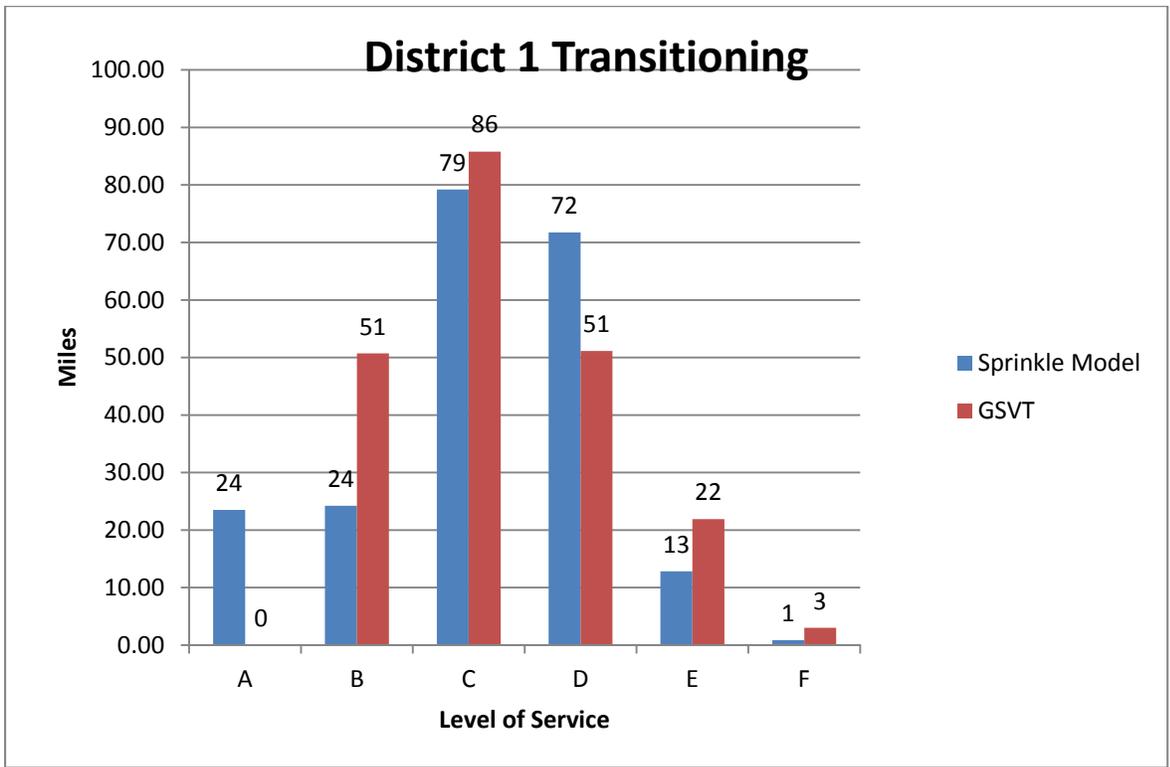
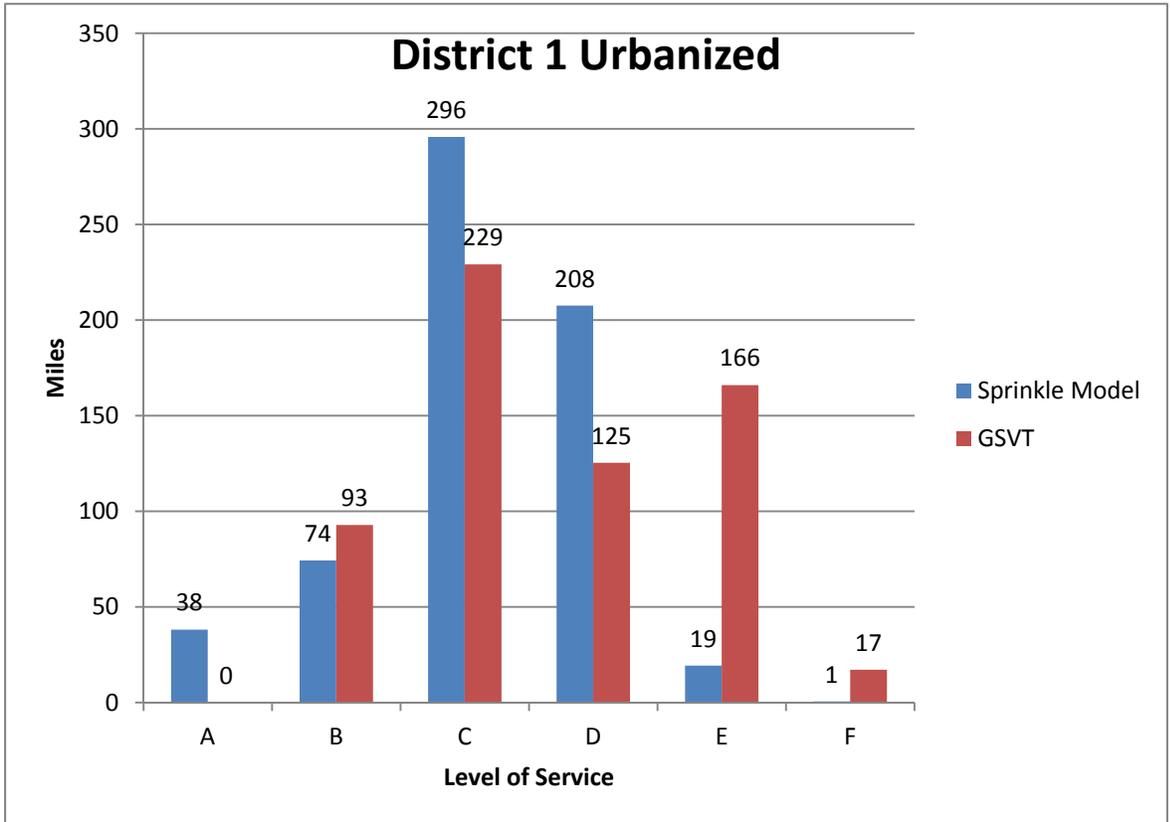
Statewide

Generalized Tables			
Area Type	Level of Service	Bike (facilities in miles)	Pedestrian (facilities in miles)
Urban	A	0.00	0.00
	B	531.52	18.72
	C	1264.41	620.63
	D	1048.83	1303.70
	E	1395.87	1112.54
	F	229.36	1414.40
Transitioning	A	0.00	0.00
	B	621.89	10.15
	C	431.75	138.83
	D	256.88	182.02
	E	114.90	805.99
	F	17.76	306.18
Rural Developed	A	0.00	0.00
	B	234.07	12.82
	C	262.55	56.10
	D	560.32	408.21
	E	213.36	842.44
	F	195.86	146.58
Rural Undeveloped	A	0.00	0.00
	B	693.08	4.37
	C	643.32	21.07
	D	962.07	977.53
	E	206.94	1506.08
	F	180.74	177.09

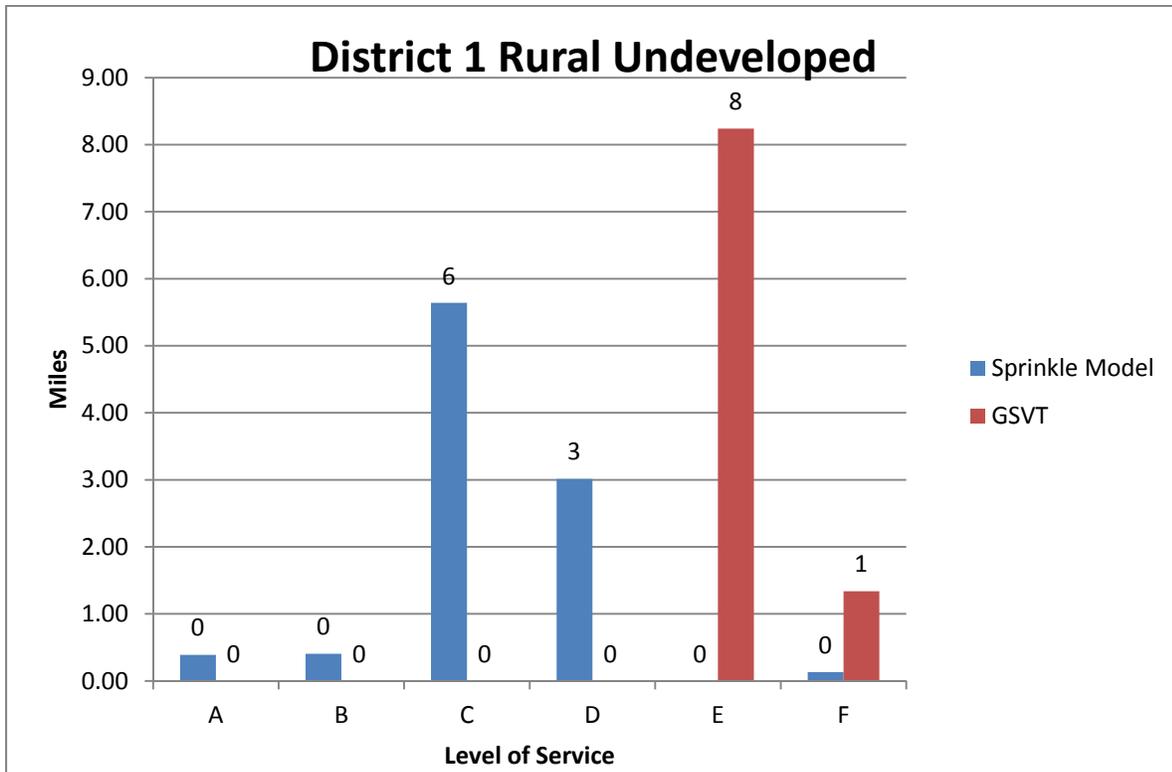
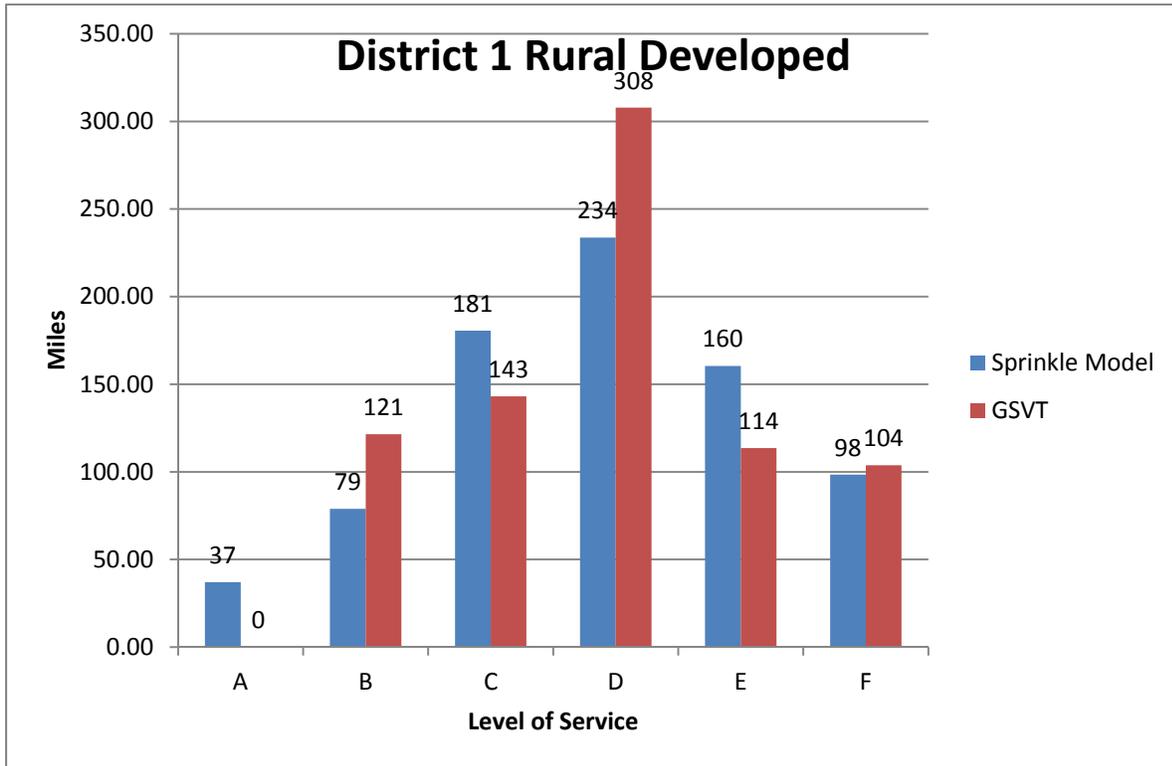
Statewide

Calculated LOS			
Area Type	Level of Service	Bike (facilities in miles)	Pedestrian (facilities in miles)
Urban	A	790.19	32.88
	B	901.12	356.16
	C	2051.53	1586.84
	D	631.06	1618.85
	E	87.39	684.13
	F	7.93	190.35
Transitioning	A	183.17	2.57
	B	506.32	149.65
	C	518.65	712.45
	D	189.03	343.50
	E	34.34	201.11
	F	8.28	30.51
Rural Developed	A	215.79	23.58
	B	313.56	324.31
	C	375.99	713.32
	D	276.97	290.84
	E	177.15	102.71
	F	104.31	9.02
Rural Undeveloped	A	507.54	14.86
	B	1200.40	385.93
	C	665.87	1474.99
	D	197.26	491.06
	E	87.55	311.57
	F	23.81	4.02

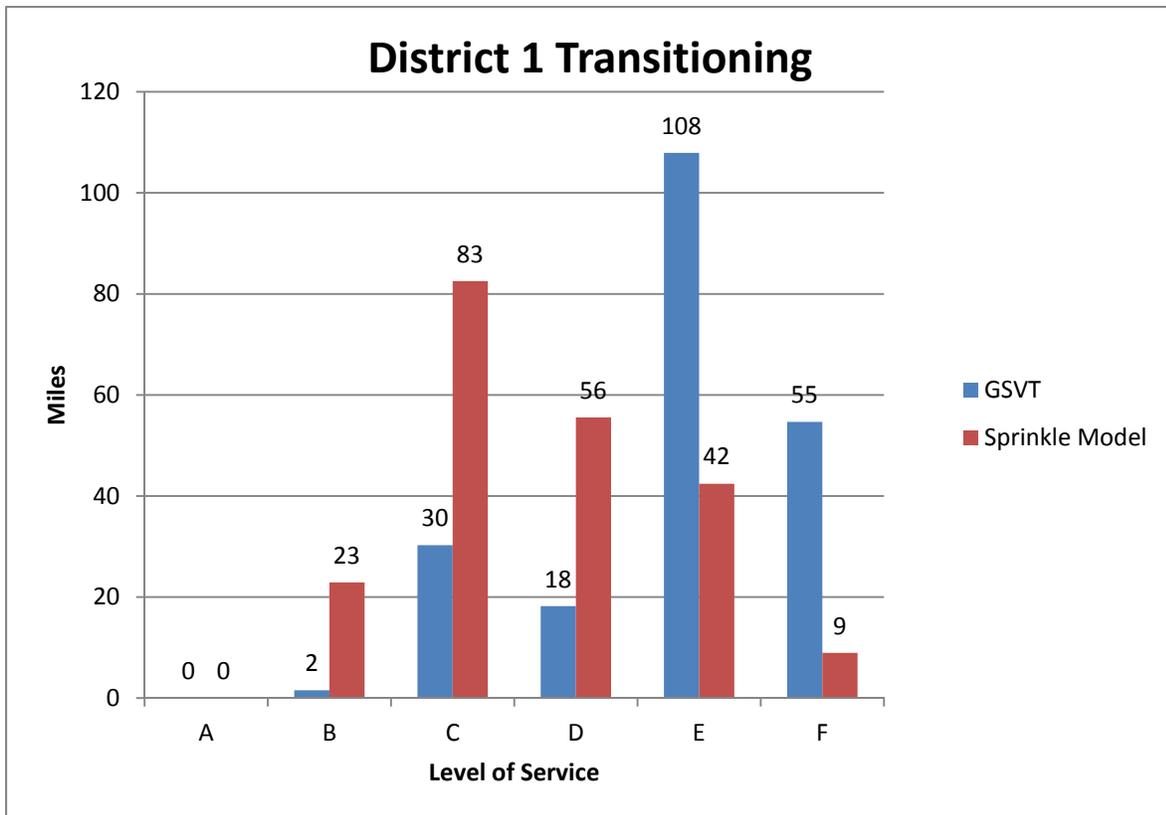
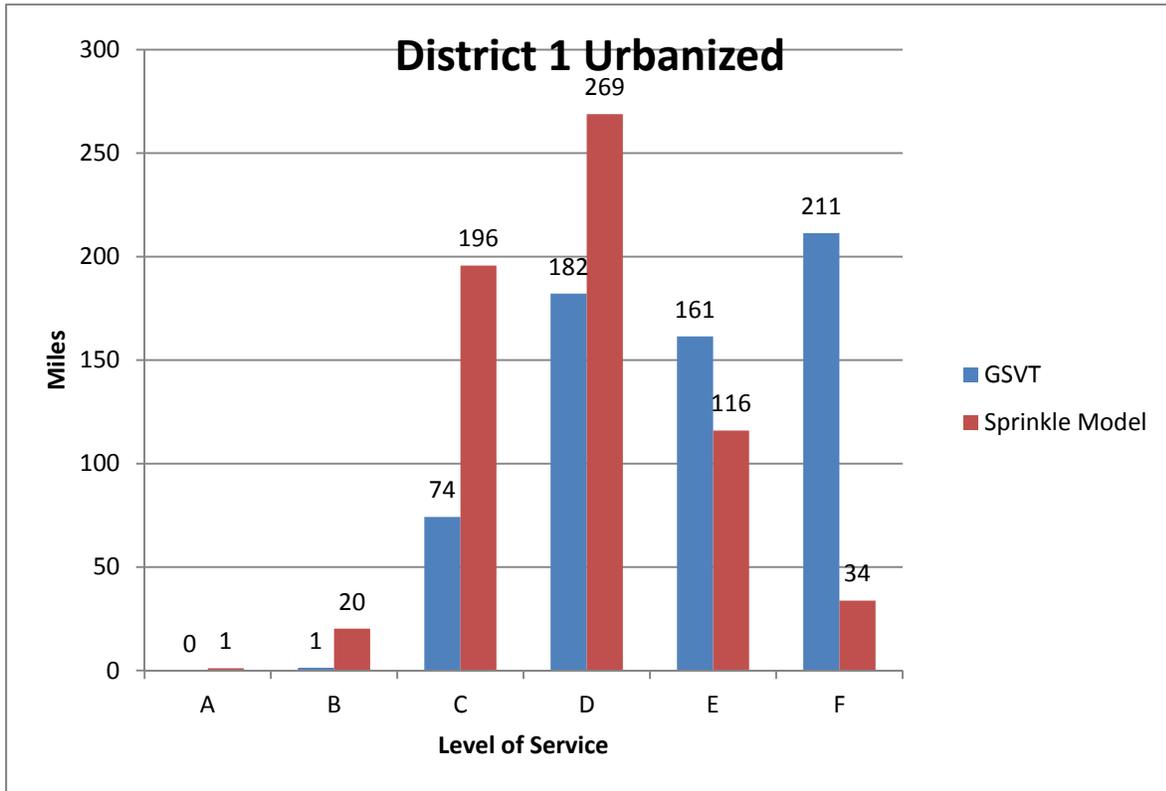
Bike LOS



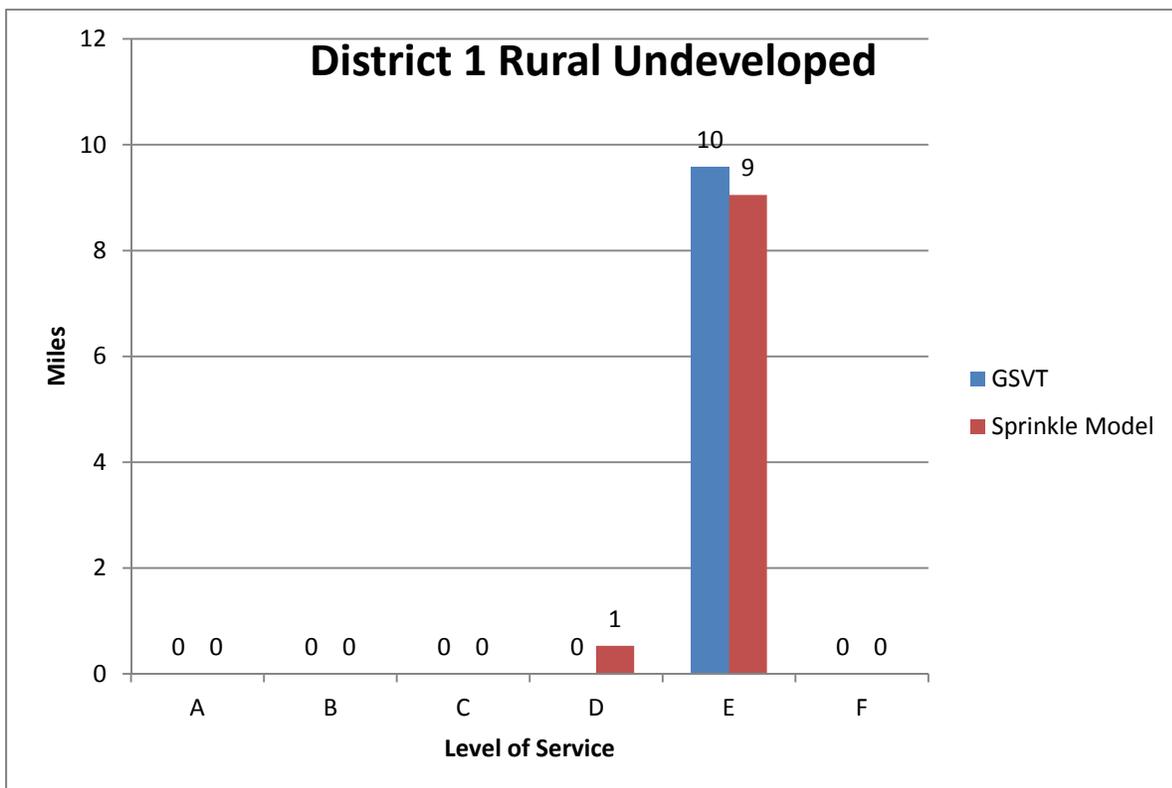
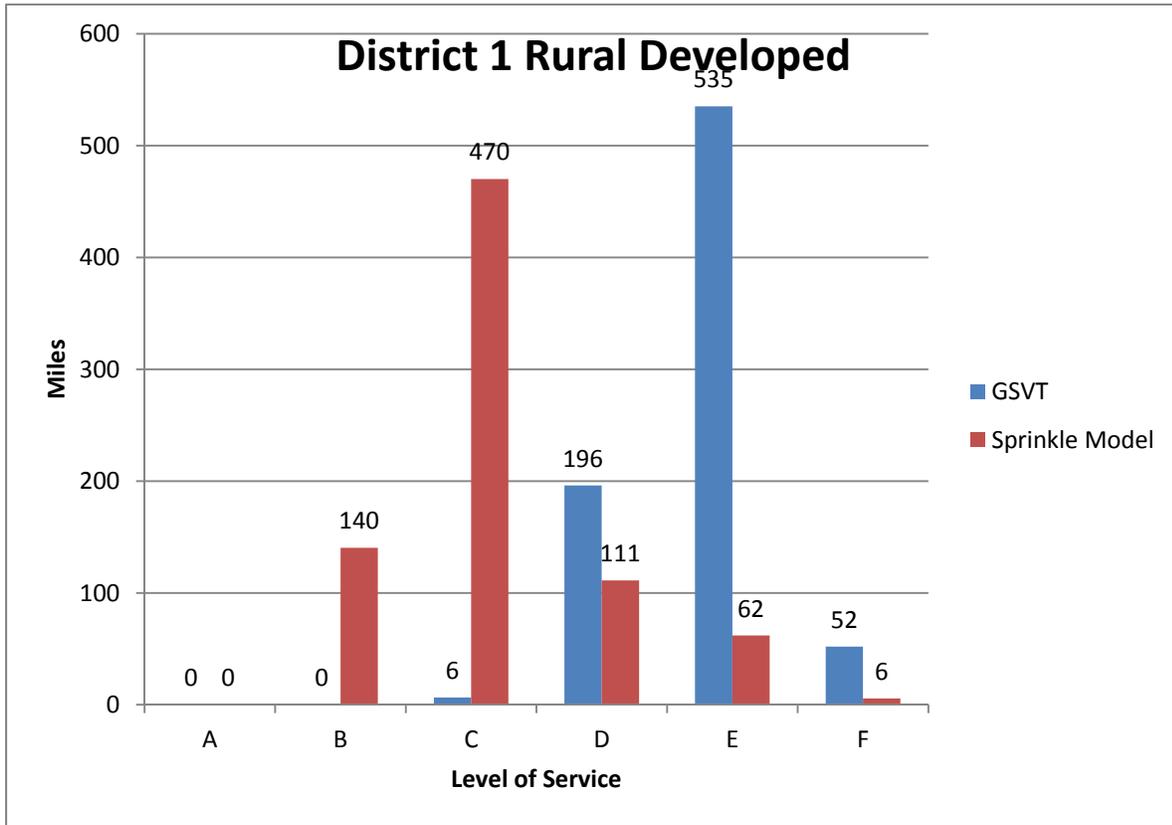
Bike LOS



Pedestrian LOS



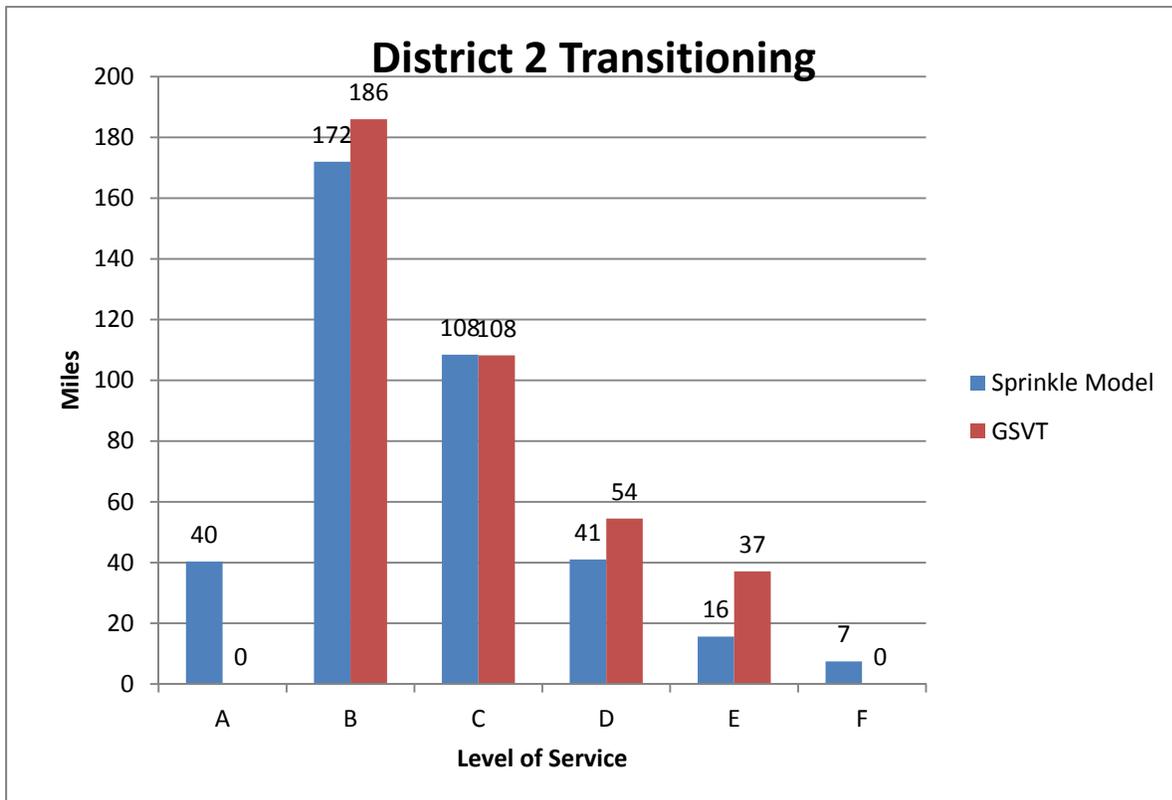
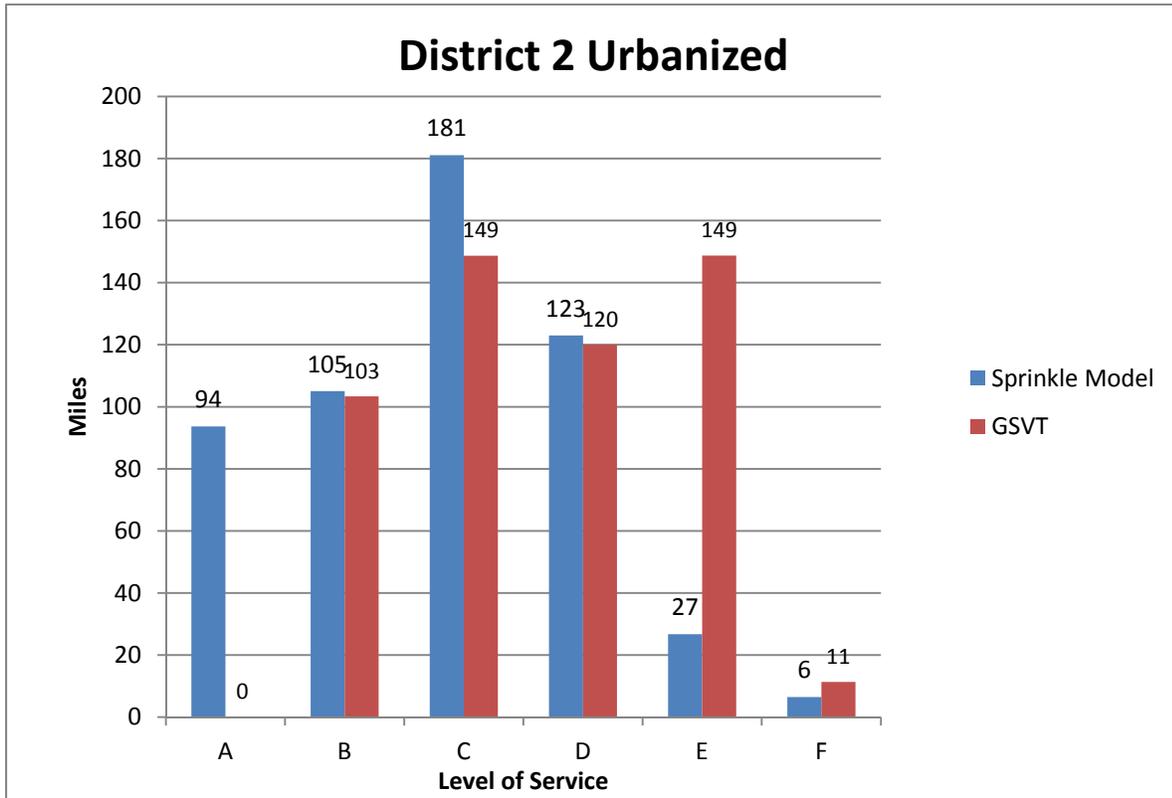
Pedestrian LOS



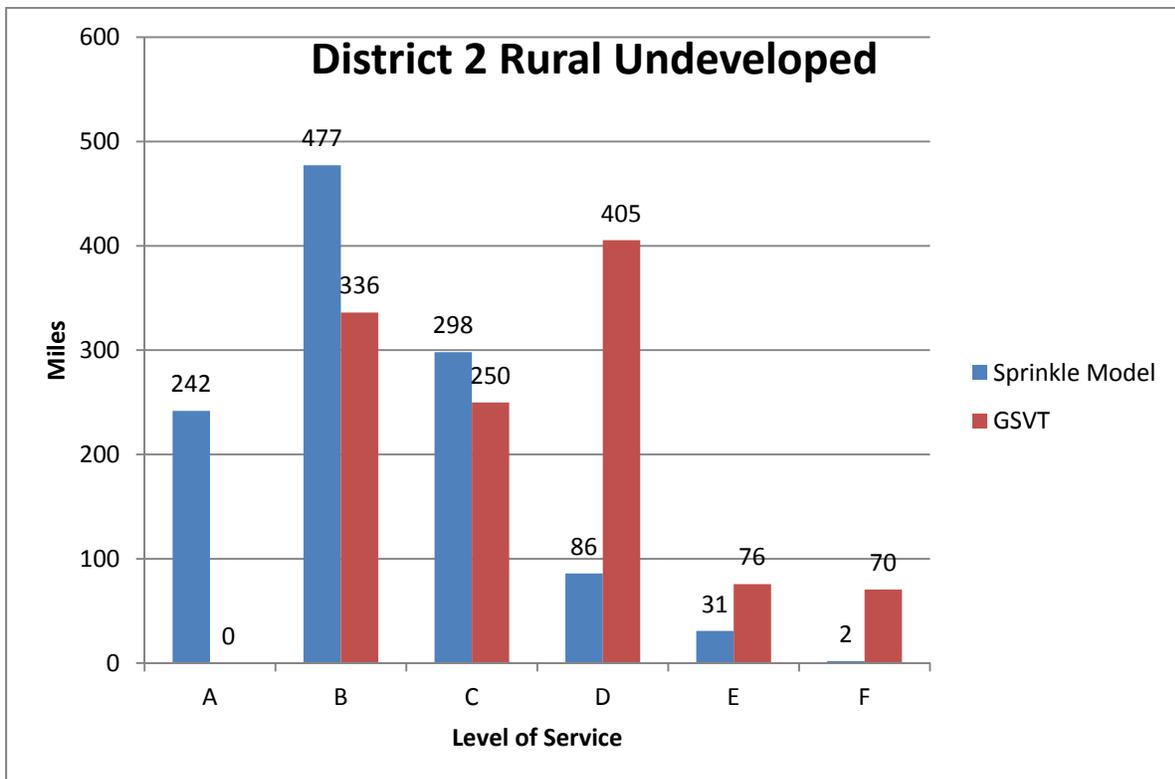
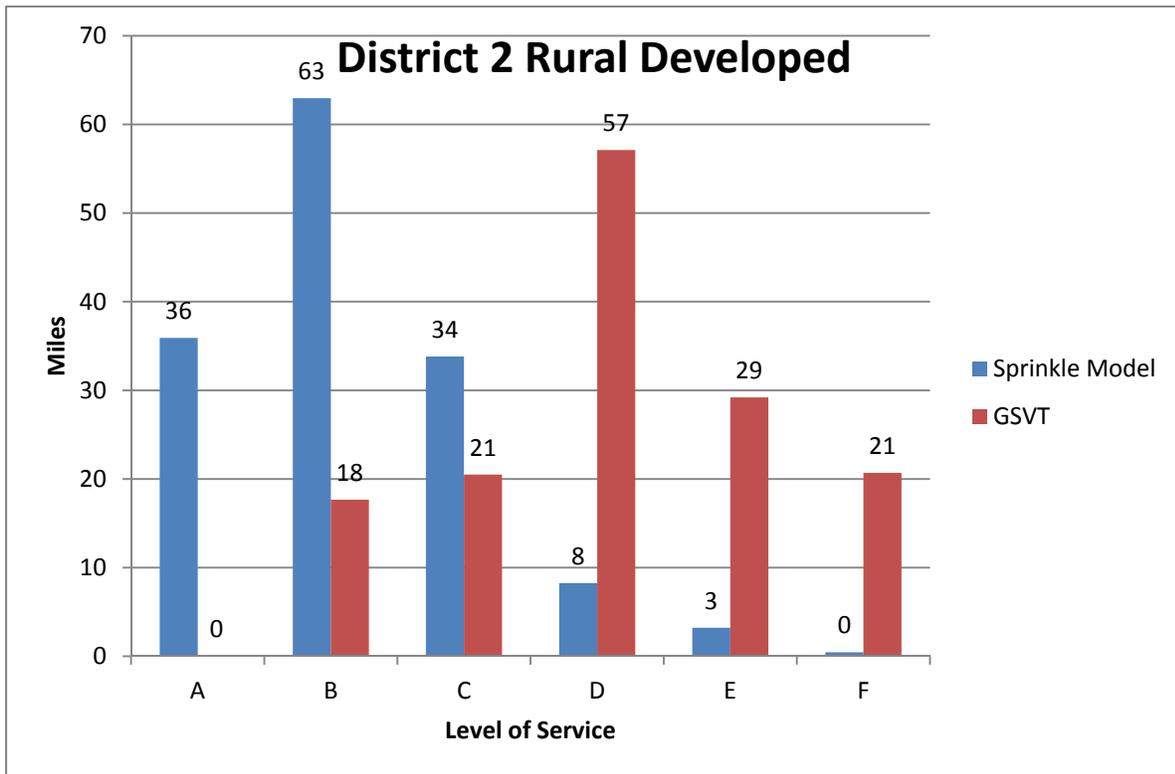
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Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	92.83	1.34
	C	229.17	74.22
	D	125.35	182.12
	E	166.01	161.44
	F	17.16	211.39
Transitioning	A	0	0
	B	50.72	1.53
	C	85.8	30.26
	D	51.12	18.18
	E	21.91	107.91
	F	2.99	54.65
Rural Developed	A	0	0
	B	121.47	0.08
	C	143.04	6.39
	D	307.87	196.11
	E	113.56	535.16
	F	103.76	51.95
Rural Undevelope	A	0	0
	B	0	0
	C	0	0
	D	0	0
	E	8.24	9.57
	F	1.33	0

District 1			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	38.13	1.09
	B	74.27	20.25
	C	295.75	195.69
	D	207.58	268.84
	E	19.33	115.96
	F	0.59	33.79
Transitioning	A	23.51	0
	B	24.21	22.9
	C	79.2	82.54
	D	71.75	55.55
	E	12.84	42.42
	F	0.85	8.93
Rural Developed	A	37.04	0
	B	78.93	140.4
	C	180.63	470.12
	D	233.7	111.1
	E	160.44	61.95
	F	98.41	5.55
Rural Undeveloped	A	0.39	0
	B	0.4	0
	C	5.64	0
	D	3.01	0.52
	E	0	9.05
	F	0.13	0

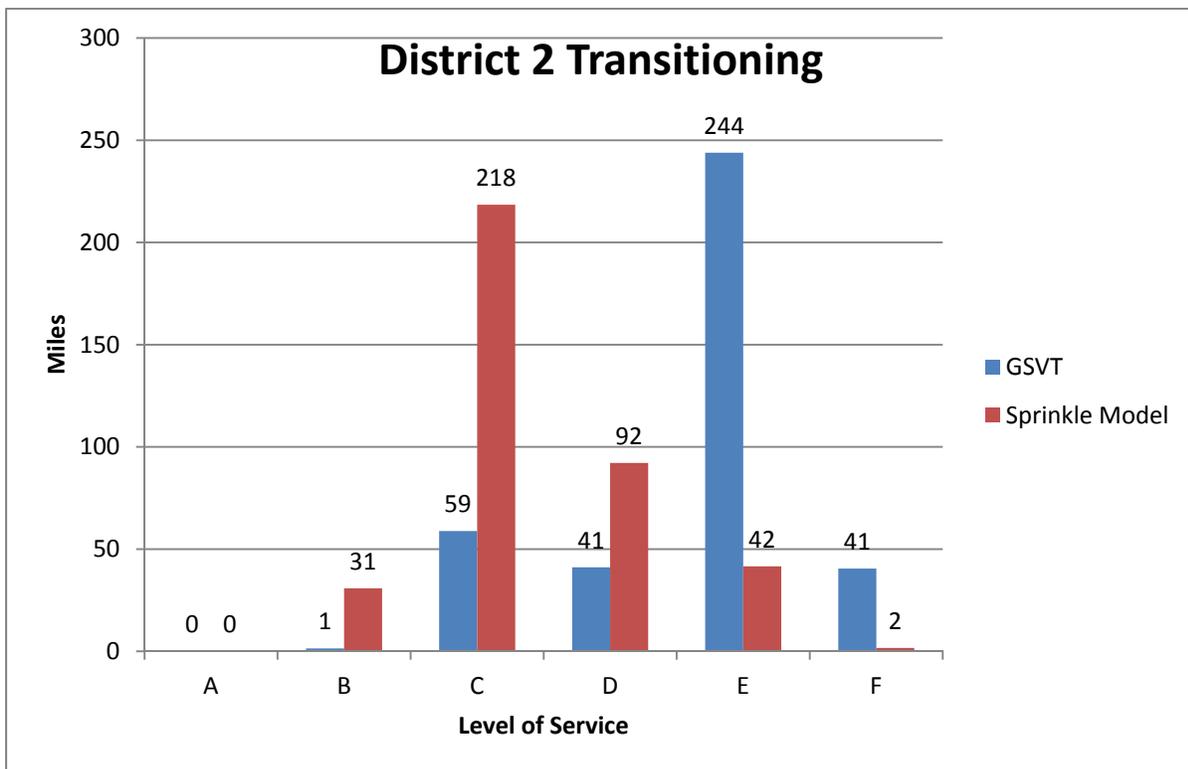
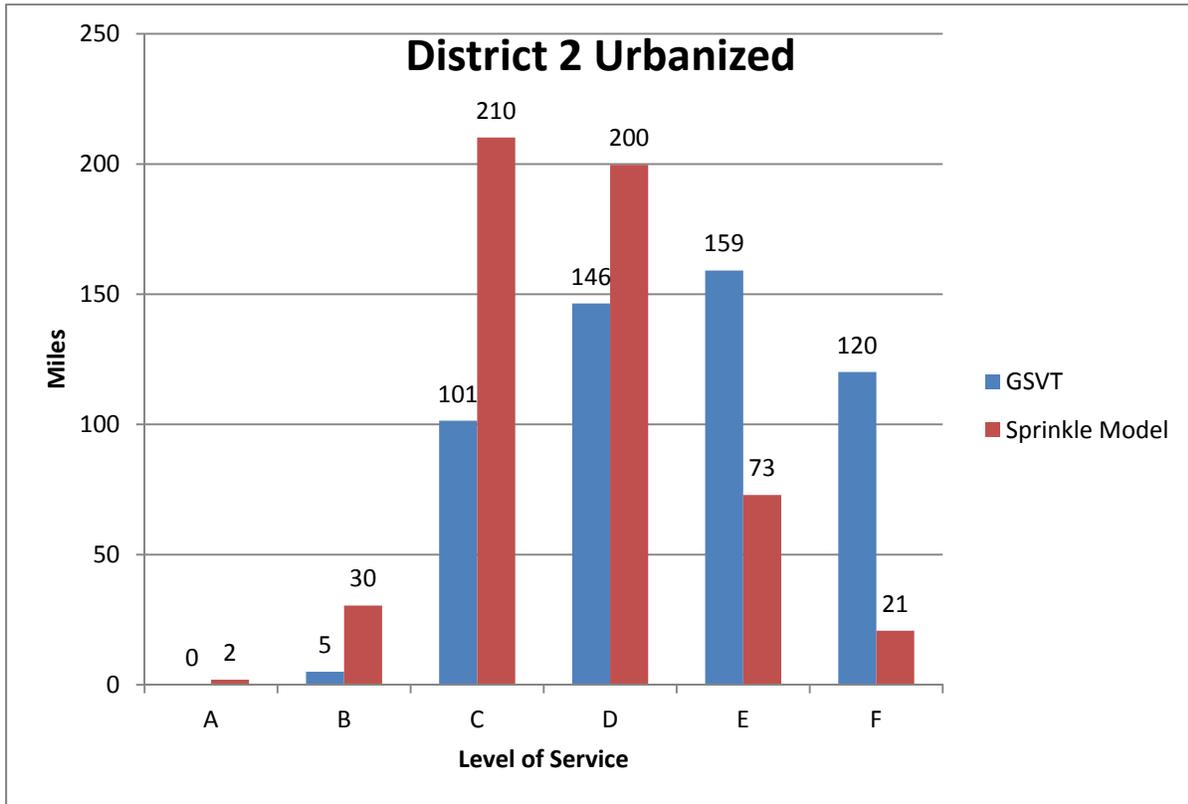
Bike LOS



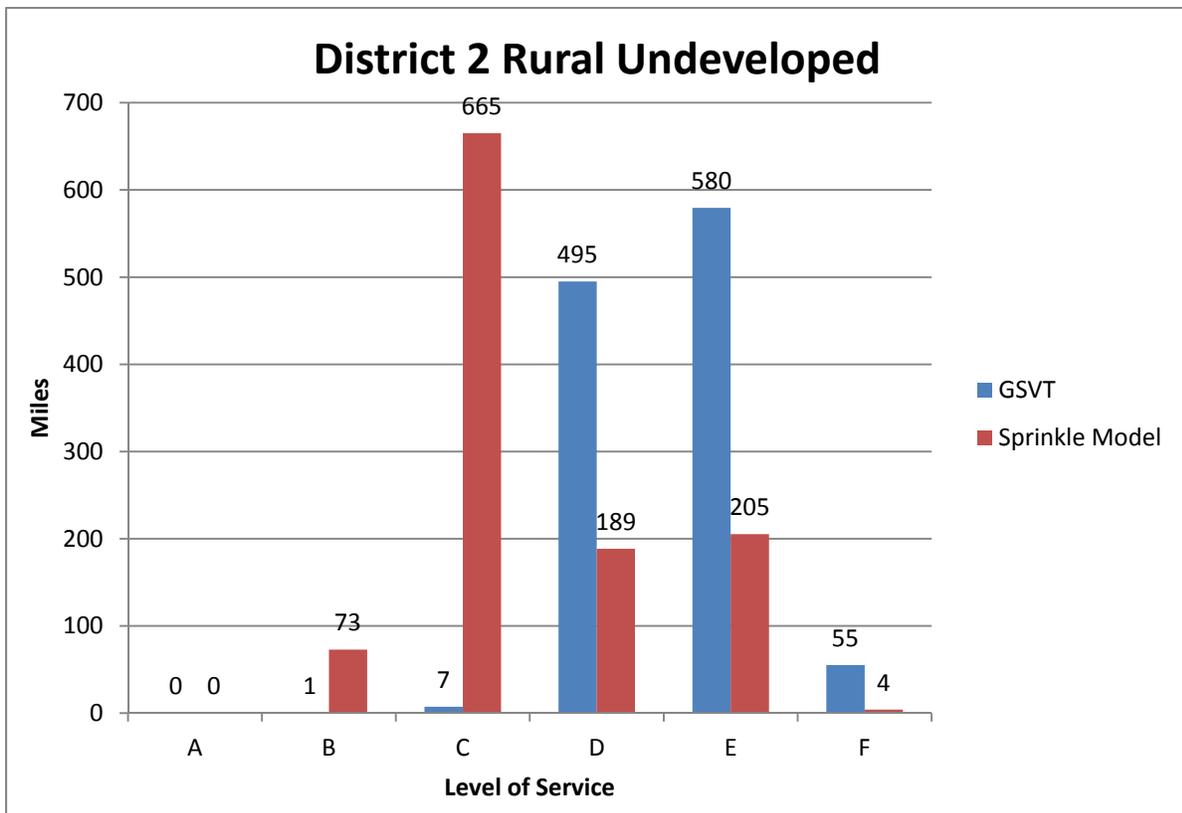
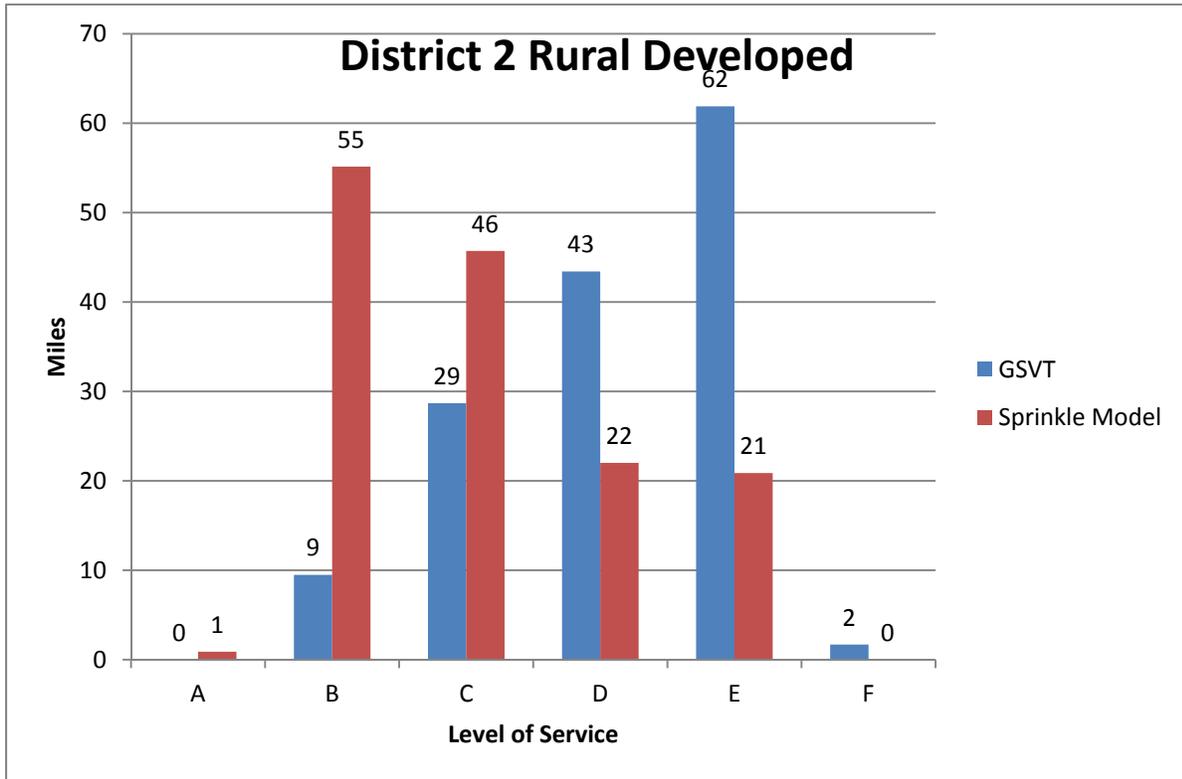
Bike LOS



Pedestrian LOS



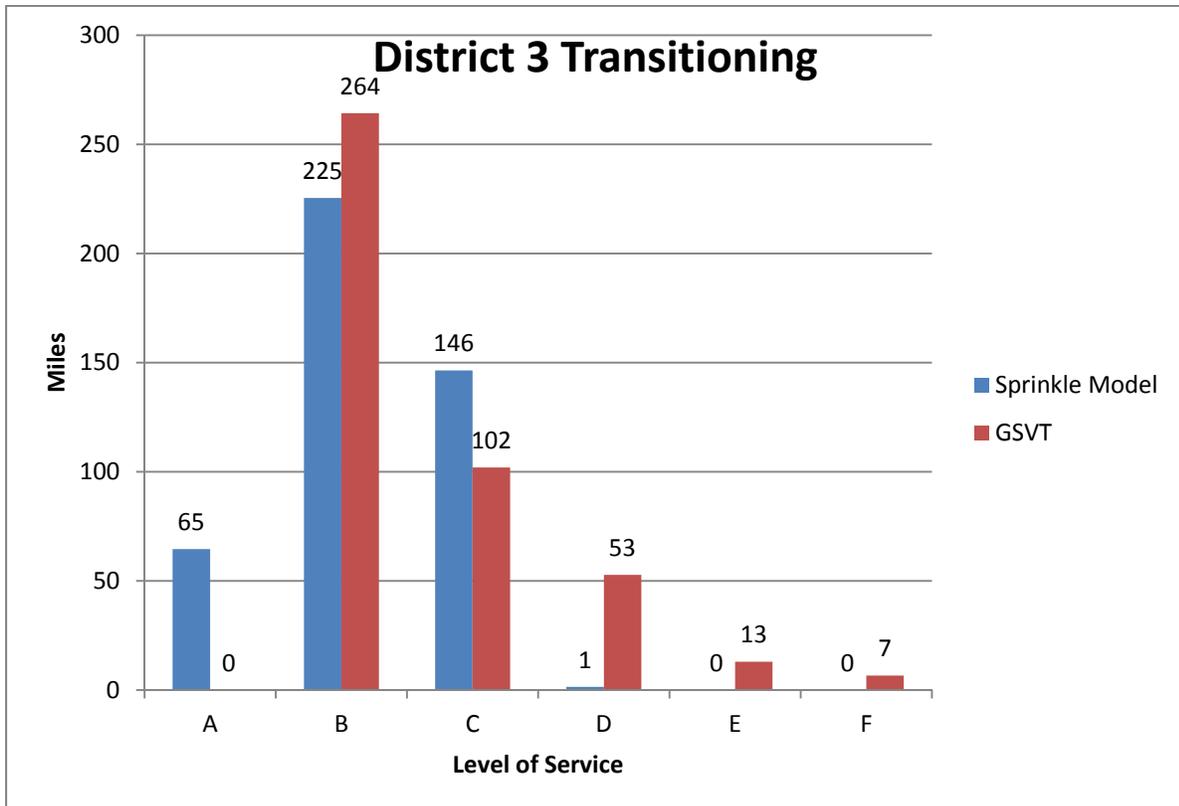
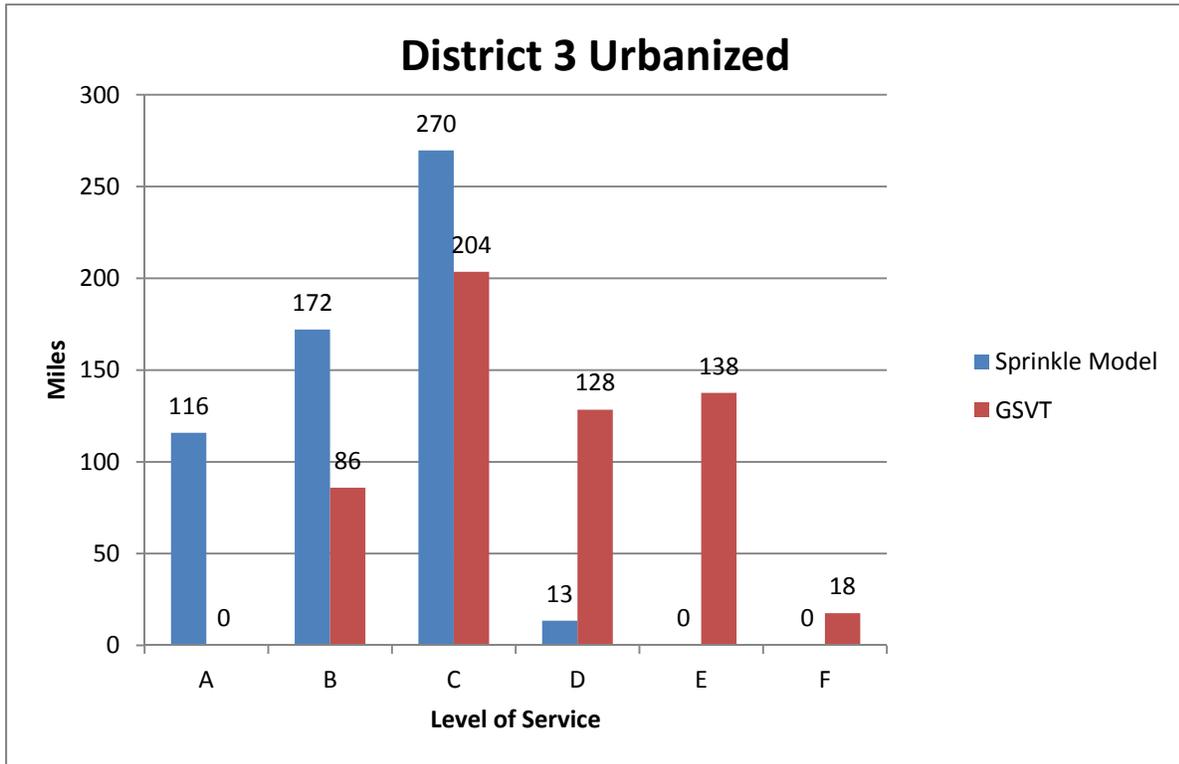
Pedestrian LOS



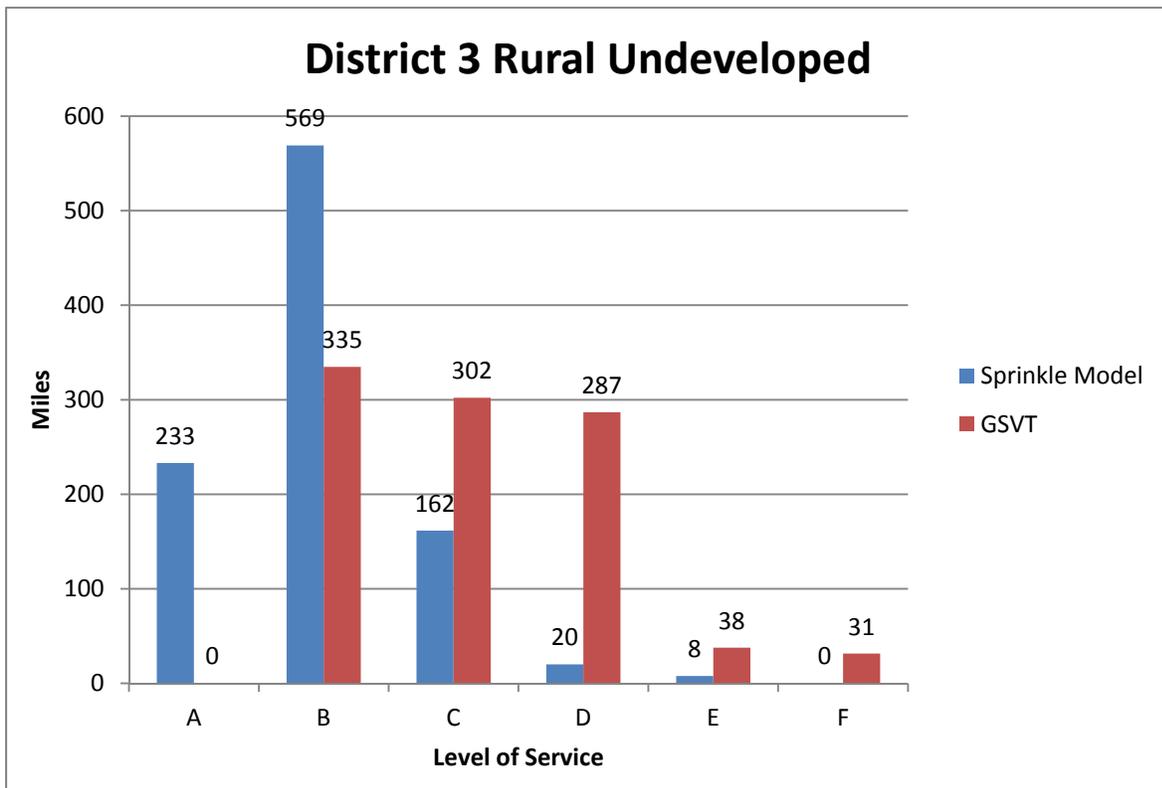
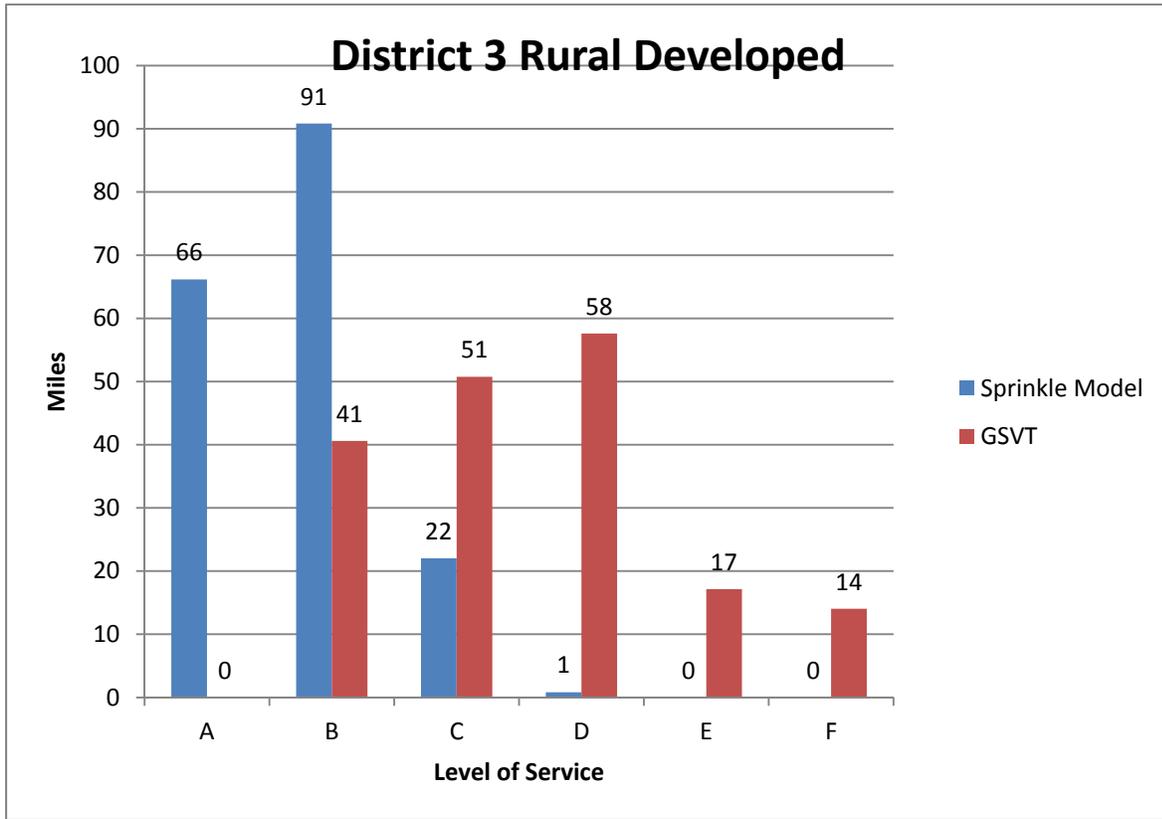
District 2			
Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	103.37	5.03
	C	148.69	101.43
	D	120.01	146.45
	E	148.71	159.09
	F	11.32	120.1
Transitioning	A	0	0
	B	185.98	1.39
	C	108.21	58.86
	D	54.46	41.07
	E	37.1	243.94
	F	0.01	40.51
Rural Developed	A	0	0
	B	17.65	9.49
	C	20.5	28.68
	D	57.11	43.41
	E	29.2	61.88
	F	20.69	1.69
Rural Undevelope	A	0	0
	B	336.09	0.57
	C	249.9	7.36
	D	405.43	494.99
	E	75.66	579.53
	F	70.49	55.1

District 2			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	93.68	1.97
	B	105.03	30.42
	C	181.05	210.18
	D	122.99	199.66
	E	26.7	72.88
	F	6.46	20.77
Transitioning	A	40.36	0.19
	B	171.96	30.79
	C	108.46	218.42
	D	41.02	92.15
	E	15.6	41.59
	F	7.43	1.66
Rural Developed	A	35.92	0.88
	B	62.96	55.13
	C	33.82	45.7
	D	8.26	22.02
	E	3.21	20.87
	F	0.45	0
Rural Undevelope	A	241.82	0.34
	B	477.31	72.71
	C	298.07	665.09
	D	85.9	188.51
	E	30.86	205.18
	F	1.9	4.01

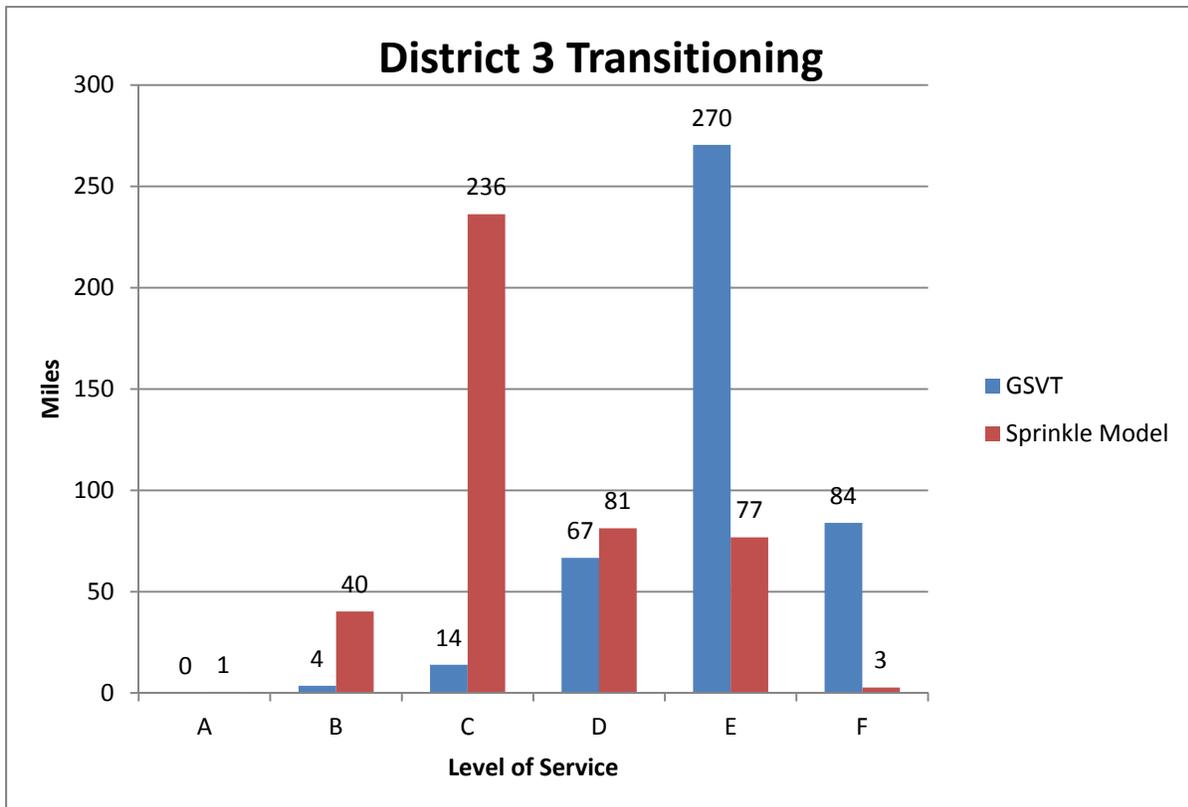
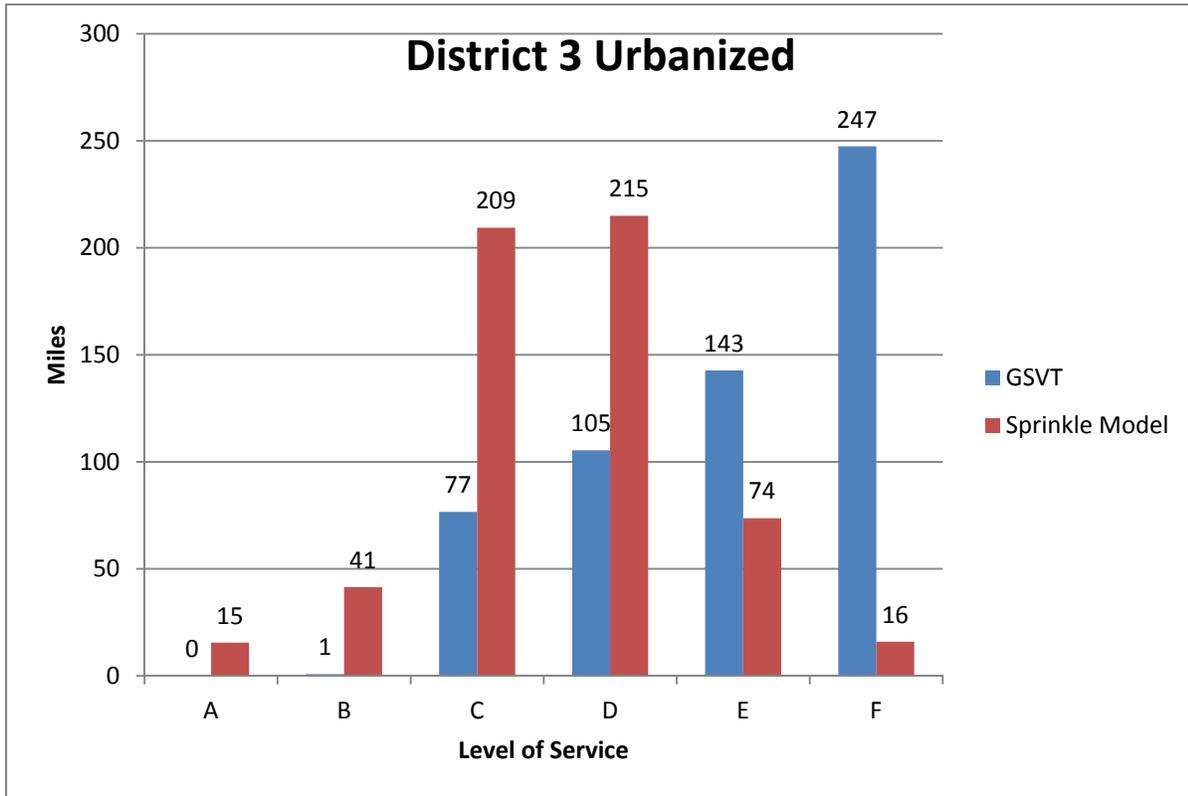
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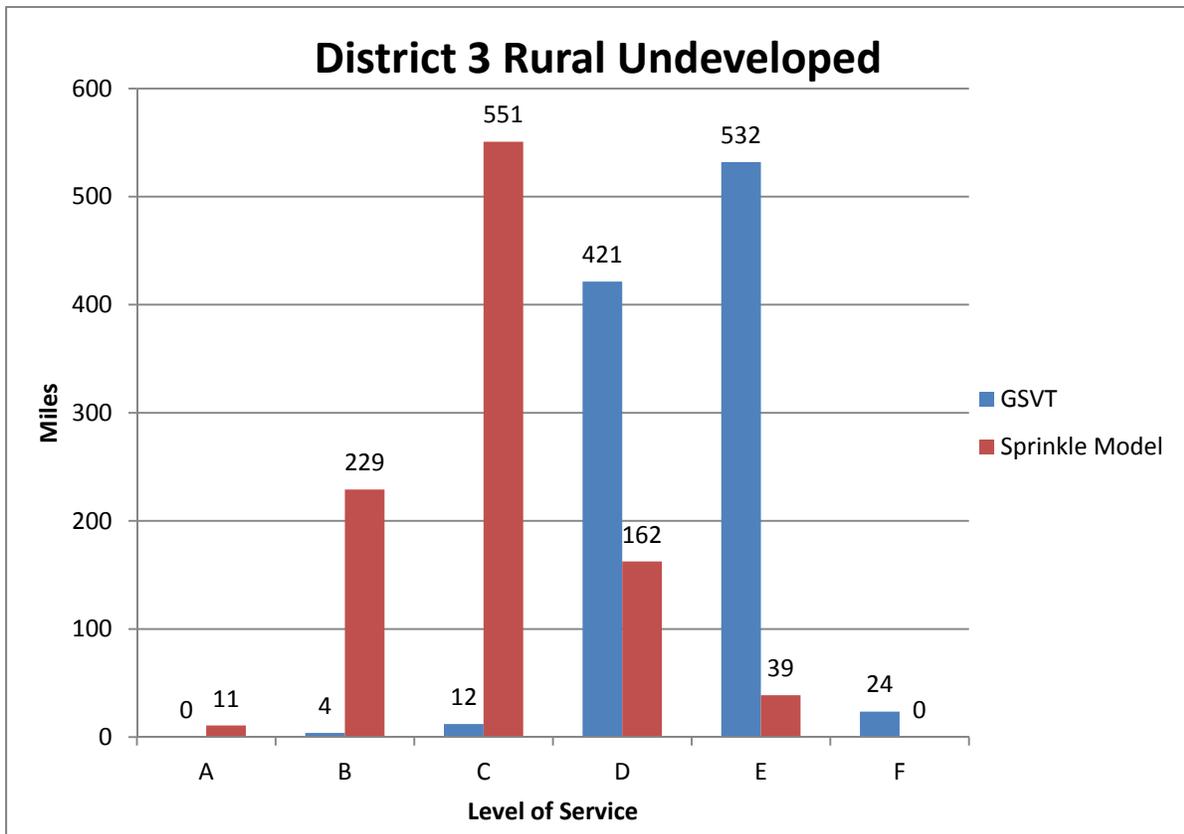
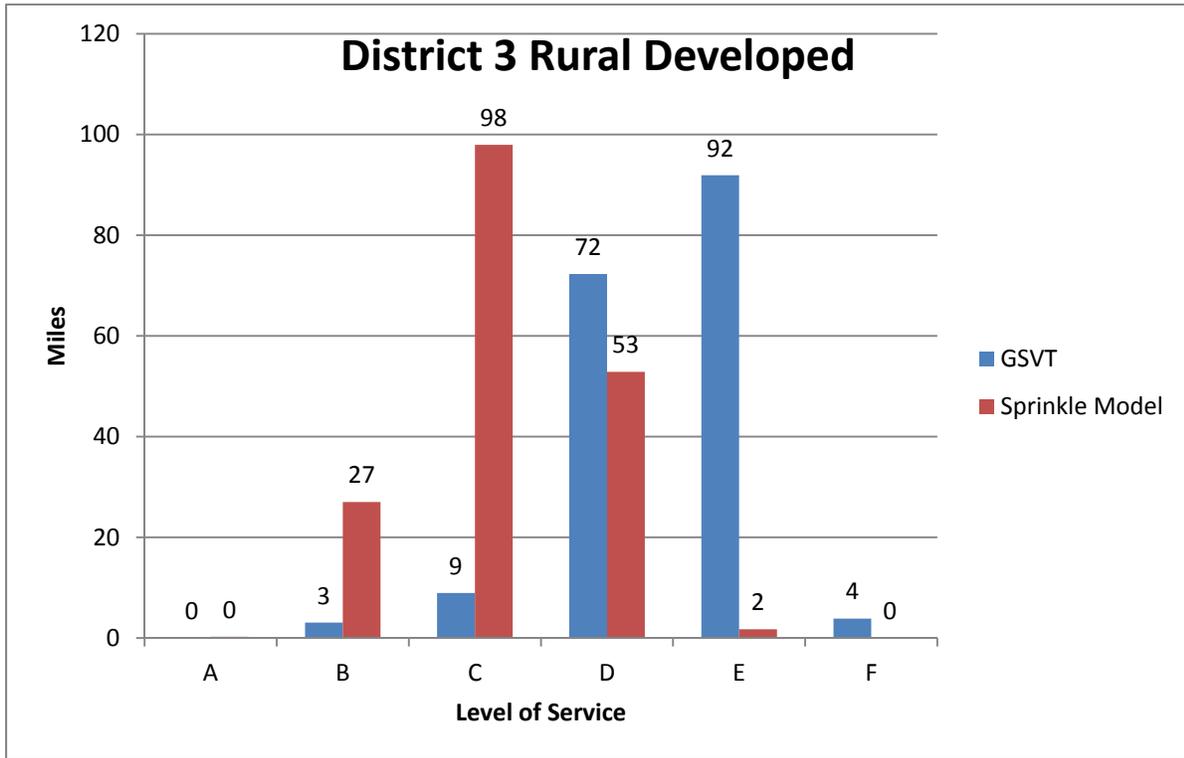
Bike LOS



Pedestrian LOS



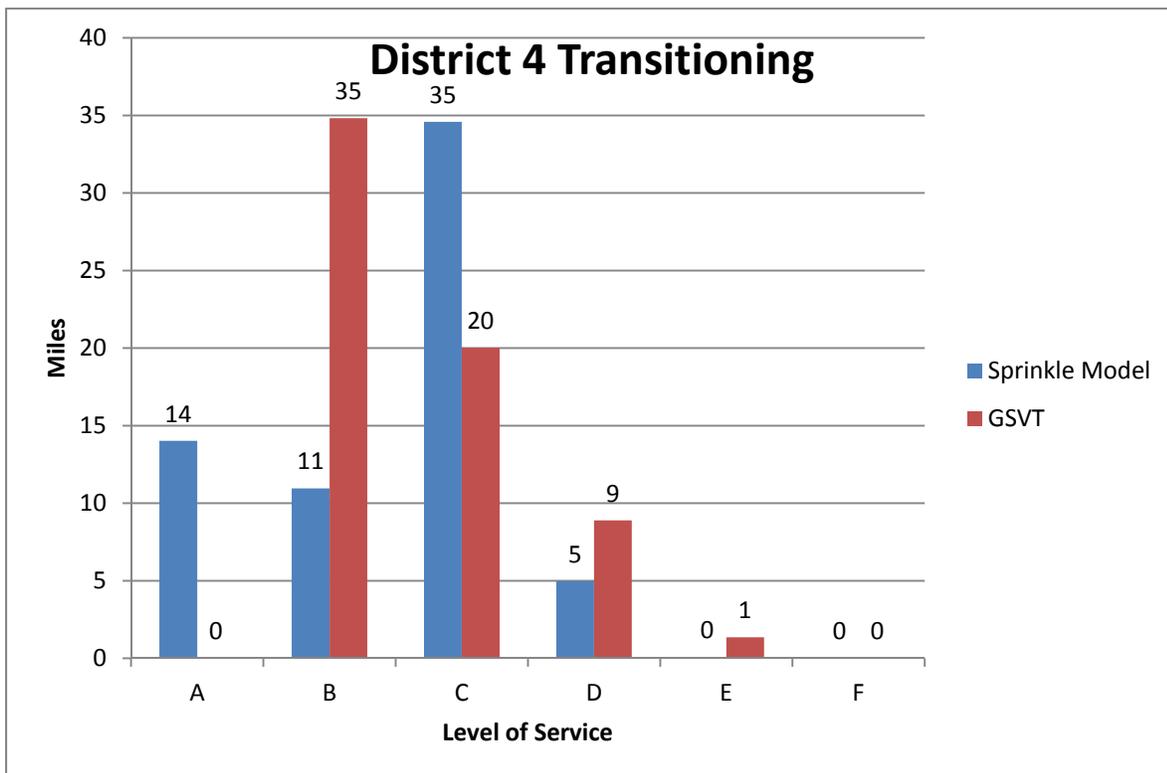
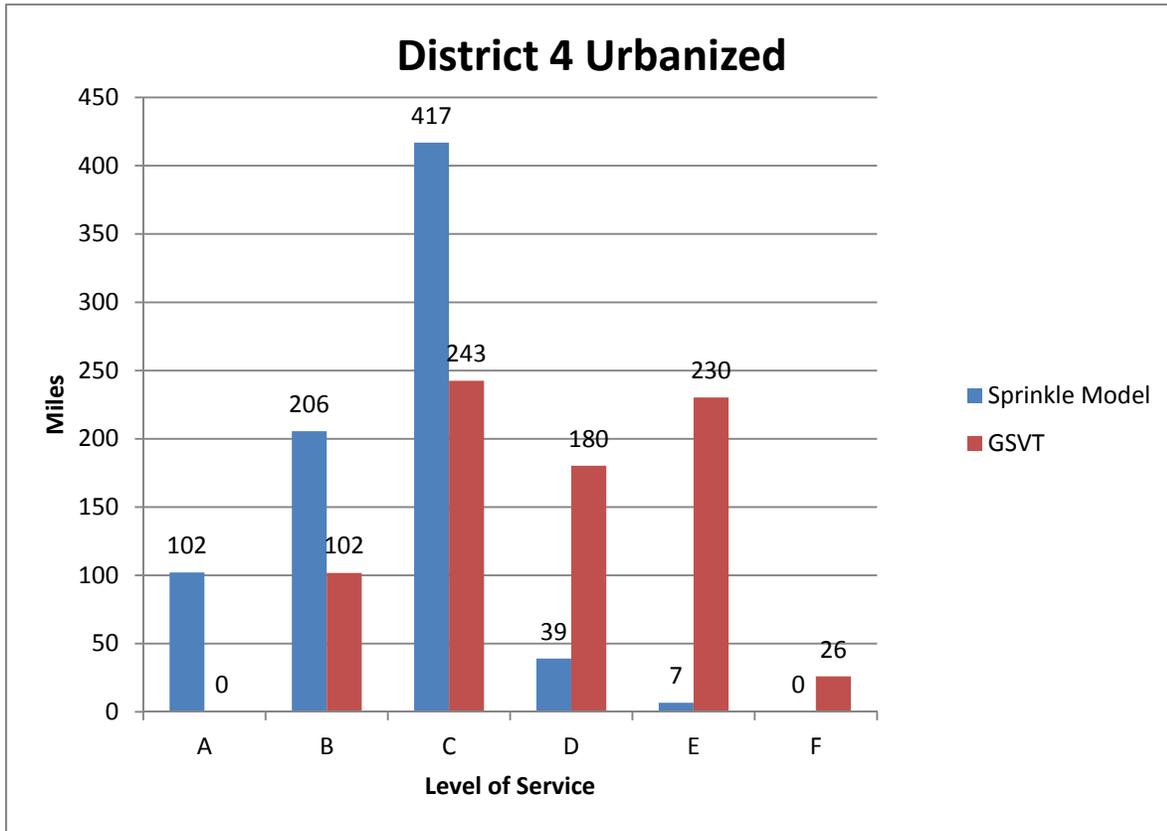
Pedestrian LOS



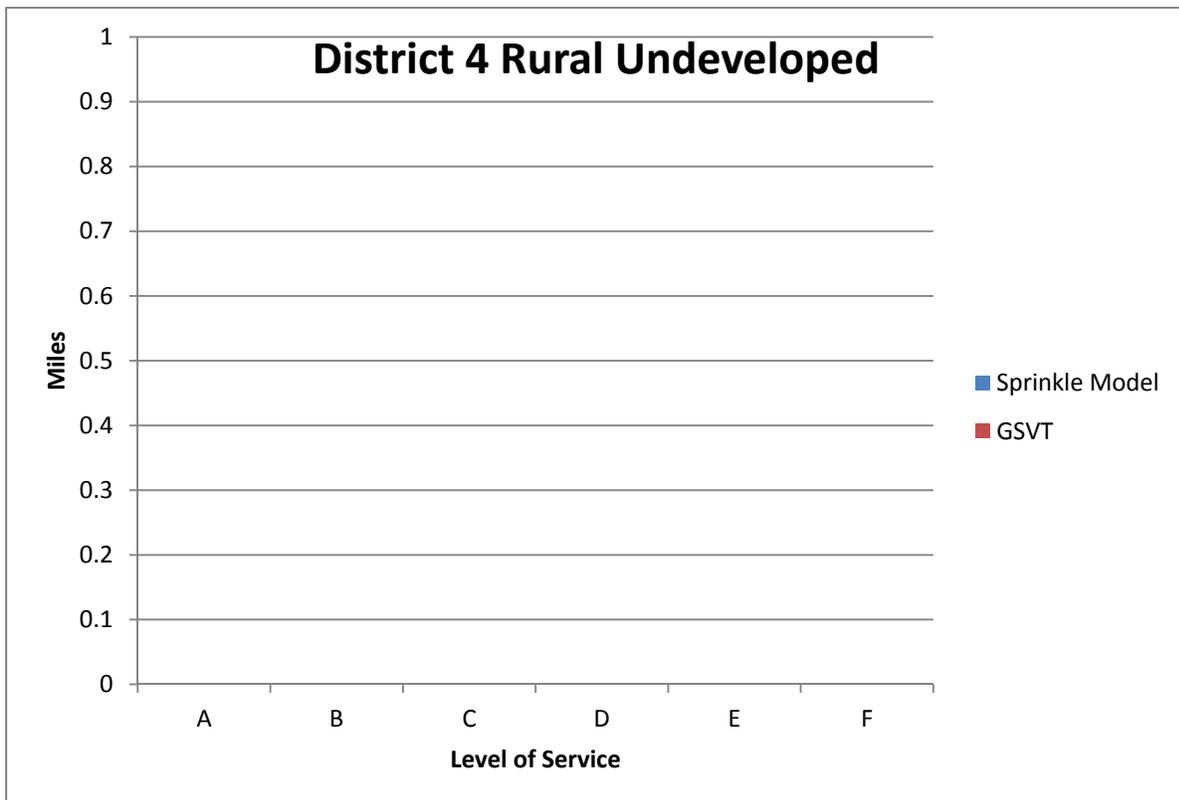
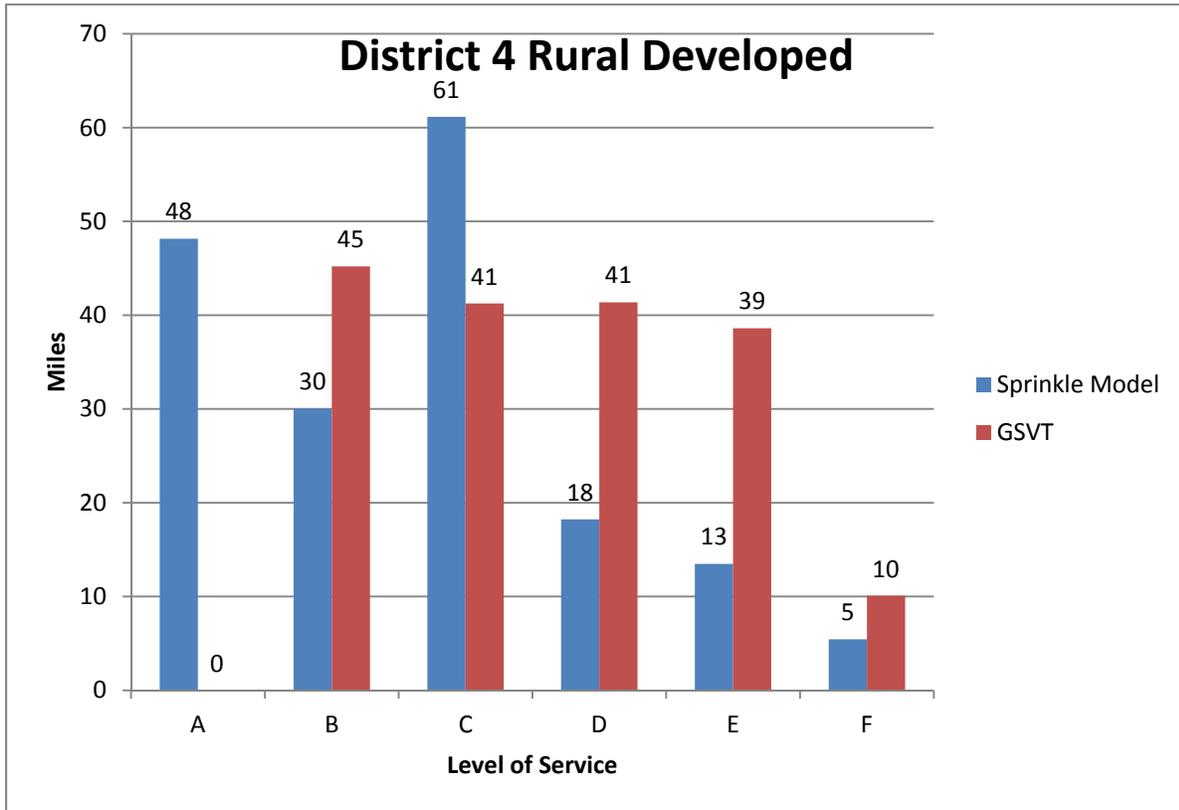
District 3			
Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	85.9	0.79
	C	203.53	76.63
	D	128.42	105.36
	E	137.56	142.72
	F	17.5	247.42
Transitioning	A	0	0
	B	264.31	3.55
	C	101.94	13.89
	D	52.76	66.71
	E	12.97	270.49
	F	6.63	83.98
Rural Developed	A	0	0
	B	40.59	3.05
	C	50.75	8.95
	D	57.59	72.11
	E	17.12	91.9
	F	14.02	3.86
Rural Undevelope	A	0	0
	B	334.841	3.8
	C	302.11	12.15
	D	286.81	421.46
	E	37.73	531.88
	F	31.45	23.63

District 3			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	115.79	15.48
	B	172.05	41.49
	C	269.73	209.4
	D	13.45	214.99
	E	0	73.68
	F	0	15.95
Transitioning	A	64.6	0.56
	B	225.42	40.25
	C	146.47	236.29
	D	1.44	81.26
	E	0	76.84
	F	0	2.71
Rural Developed	A	66.16	0.27
	B	90.83	27
	C	22.03	97.96
	D	0.83	52.85
	E	0	1.75
	F	0	0
Rural Undevelope	A	233.18	10.74
	B	569.13	229.04
	C	161.64	550.76
	D	19.99	162.49
	E	7.8	38.68
	F	0	0

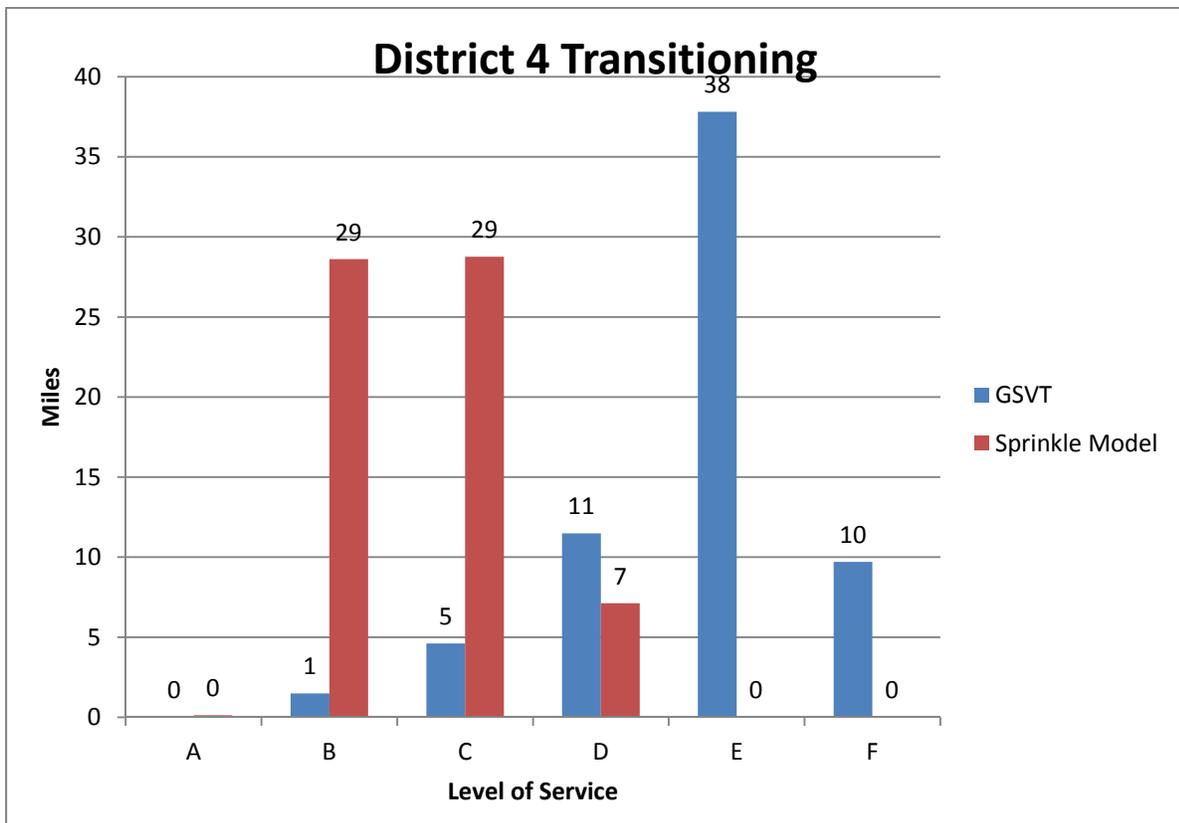
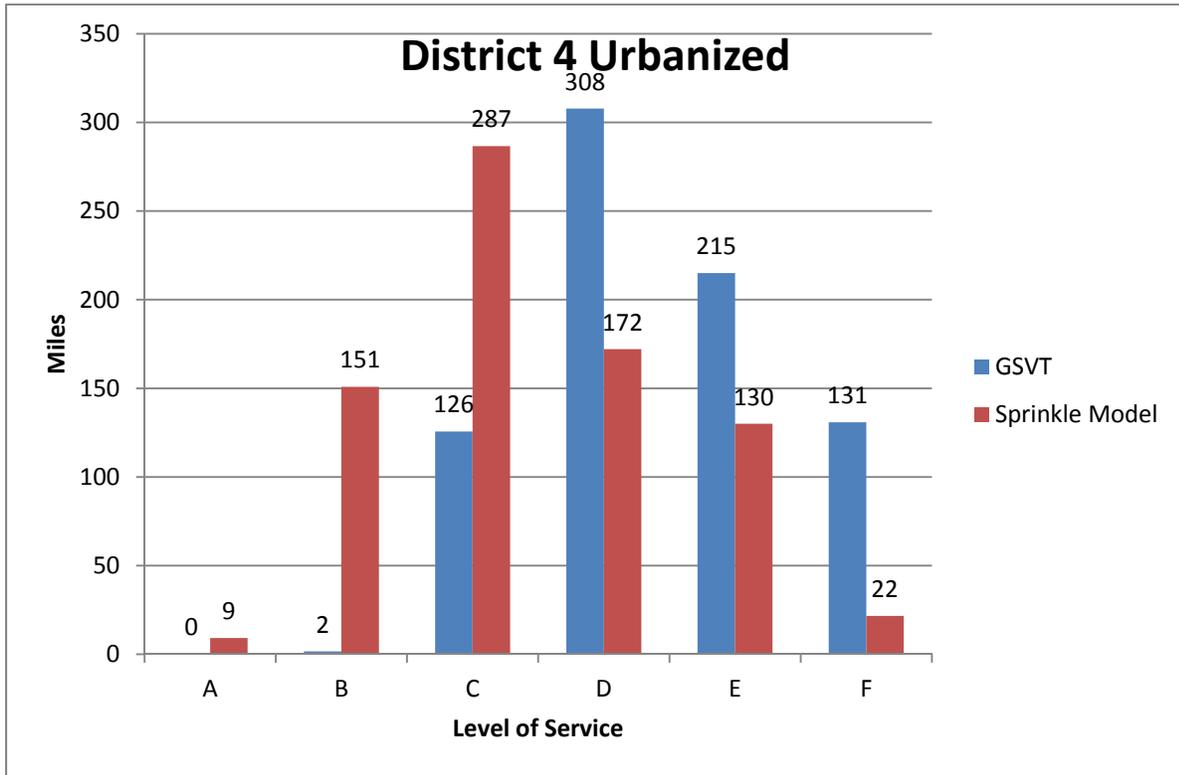
Bike LOS



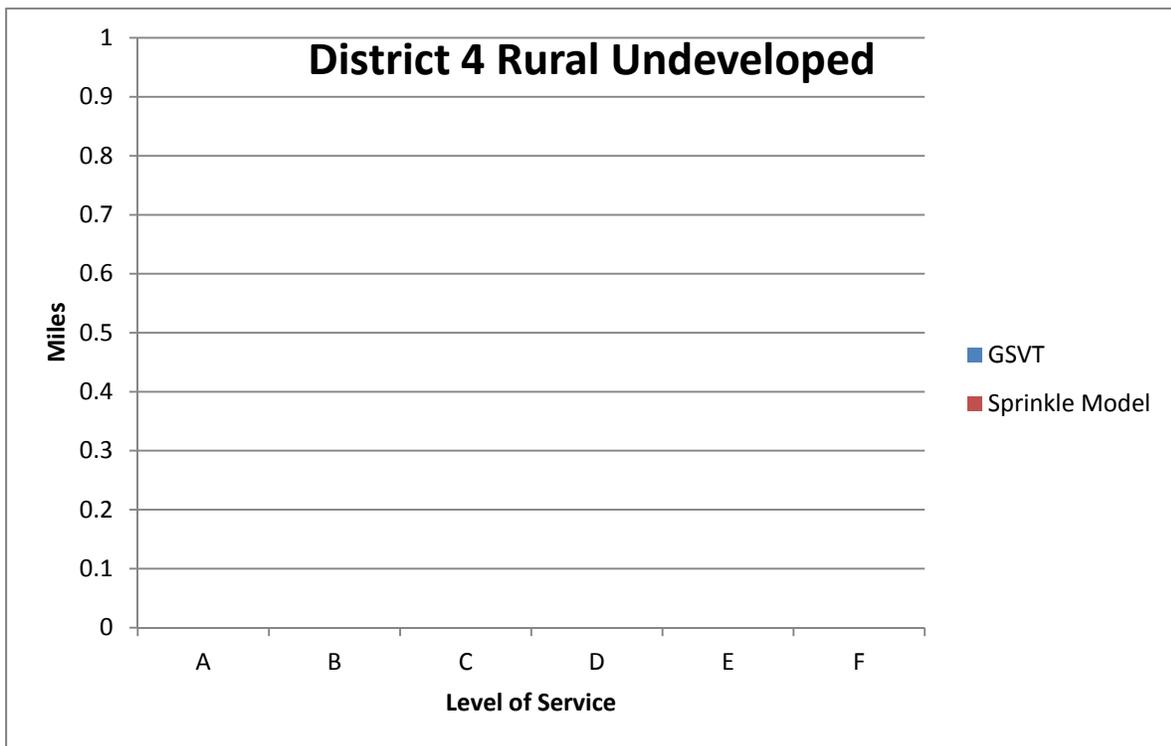
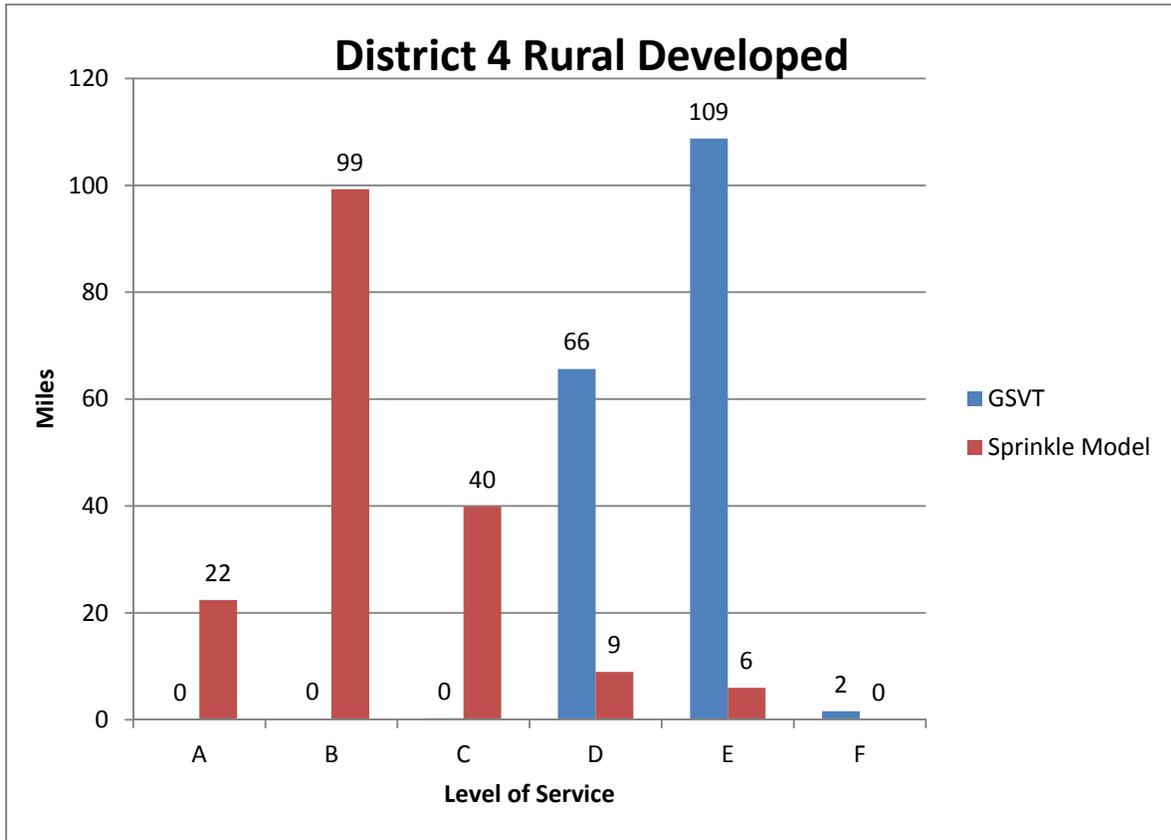
Bike LOS



Pedestrian LOS



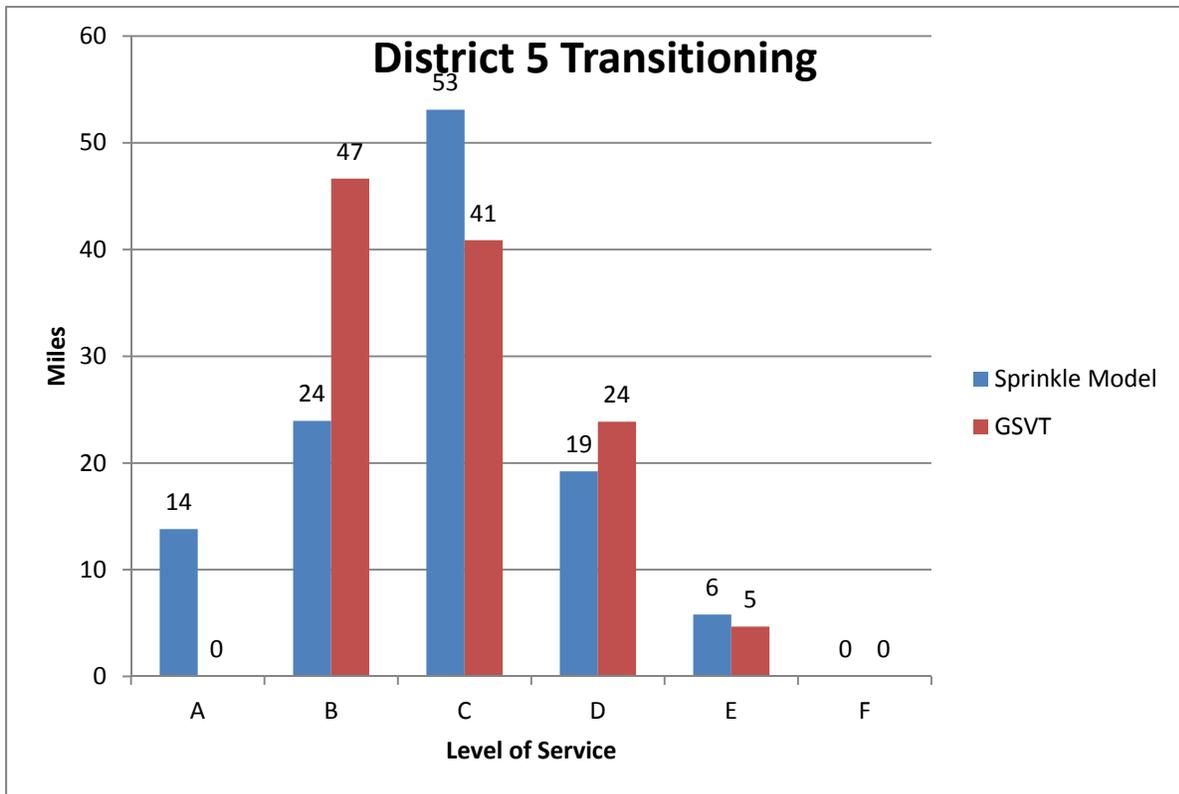
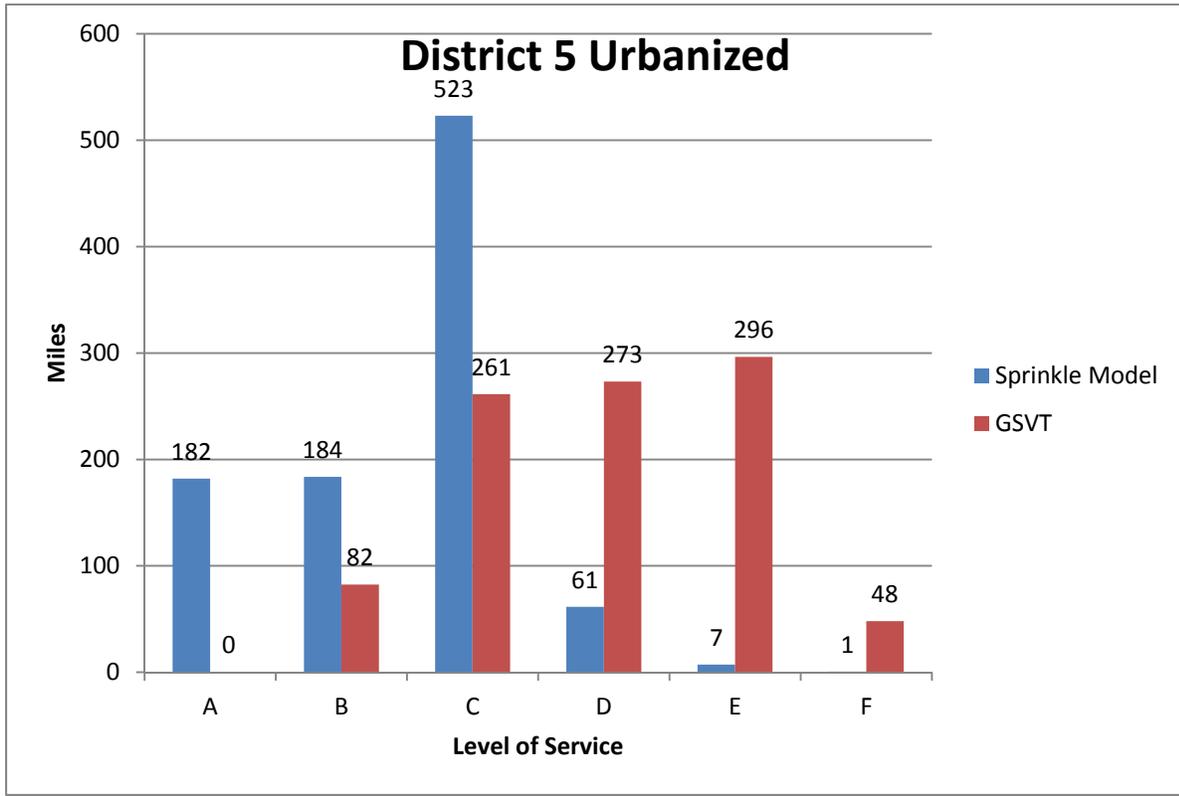
Pedestrian LOS



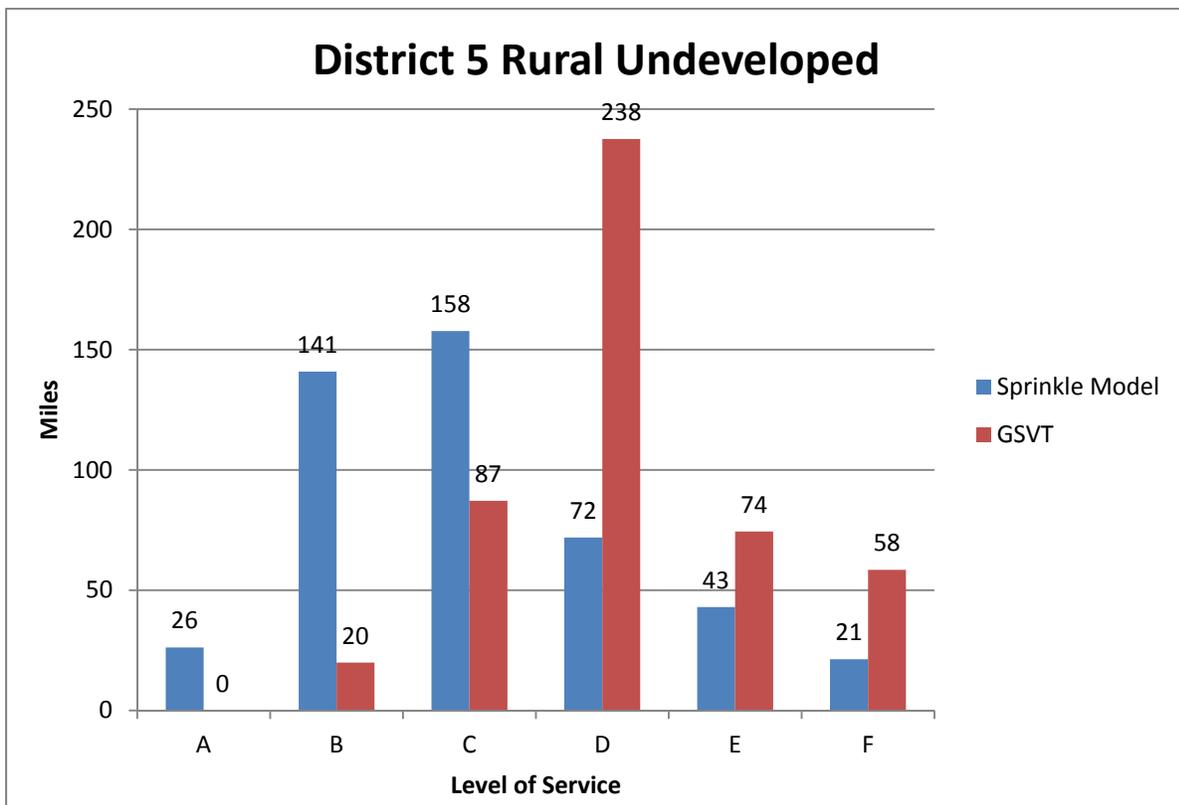
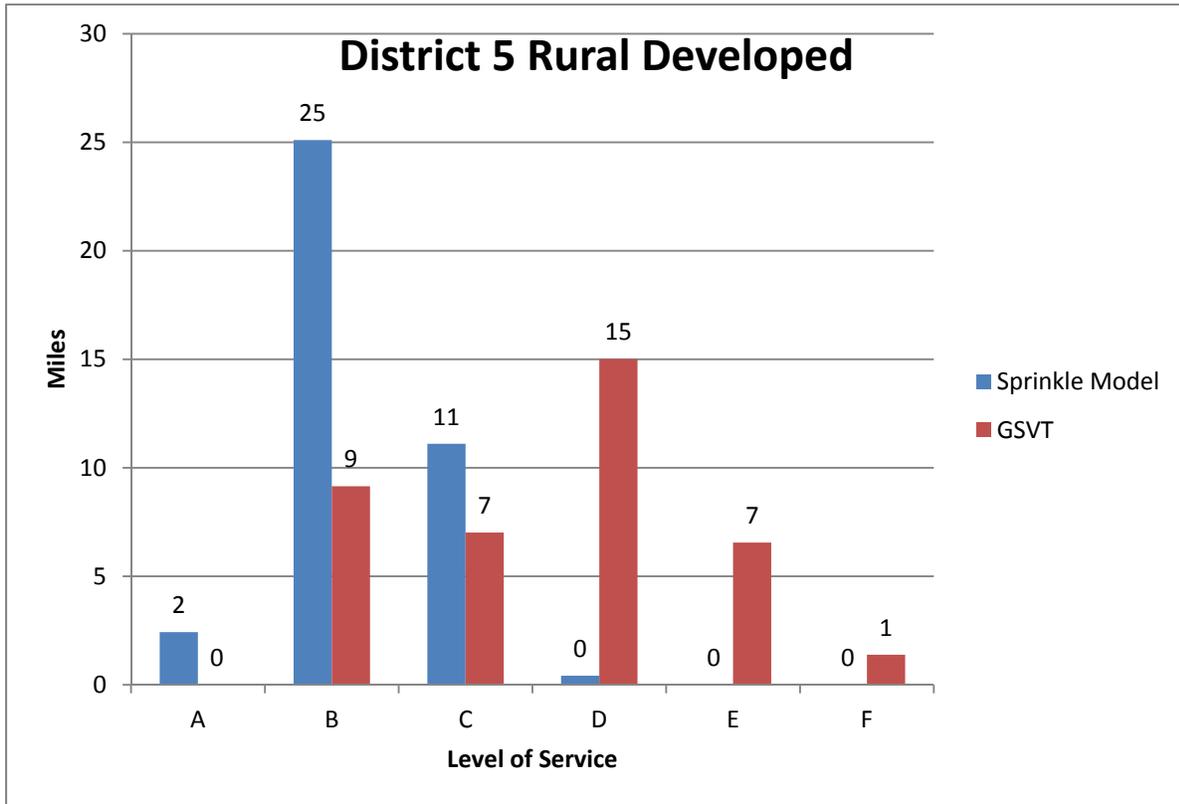
District 4			
Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	101.78	1.58
	C	242.5	125.65
	D	180.31	307.8
	E	230.27	215.05
	F	26.01	130.82
Transitioning	A	0	0
	B	34.82	1.48
	C	20.02	4.6
	D	8.89	11.48
	E	1.35	37.81
	F	0	9.7
Rural Developed	A	0	0
	B	45.19	0.19
	C	41.24	0.28
	D	41.36	65.63
	E	38.6	108.78
	F	10.08	1.59
Rural Undeveloped	A	0	0
	B	0	0
	C	0	0
	D	0	0
	E	0	0
	F	0	0

District 4			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	102.06	9.13
	B	205.63	150.85
	C	416.87	286.62
	D	39.12	172.08
	E	6.64	130.01
	F	0	21.6
Transitioning	A	14.02	0.13
	B	10.96	28.61
	C	34.58	28.72
	D	4.97	7.11
	E	0.09	0.01
	F	0	0
Rural Developed	A	48.15	22.42
	B	30.02	99.25
	C	61.14	39.87
	D	18.23	8.94
	E	13.48	5.98
	F	5.44	0
Rural Undeveloped	A	0	0
	B	0	0
	C	0	0
	D	0	0
	E	0	0
	F	0	0

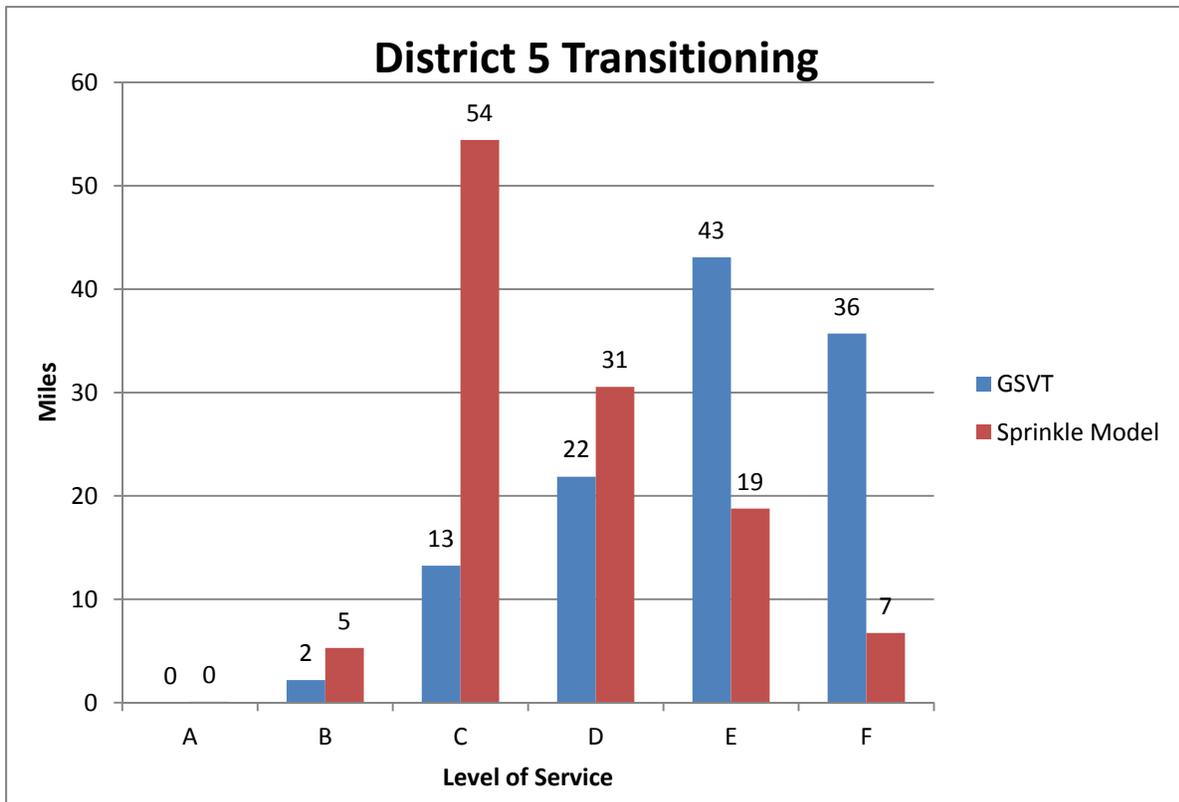
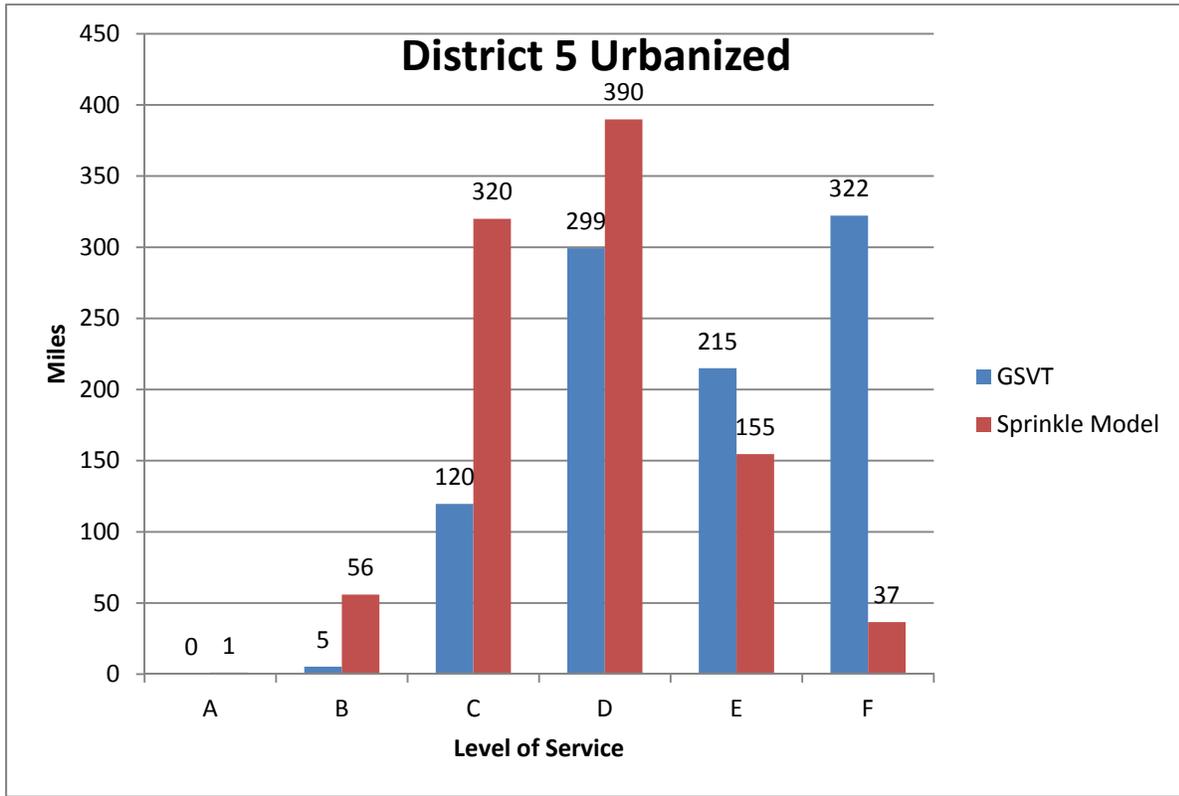
Bike LOS



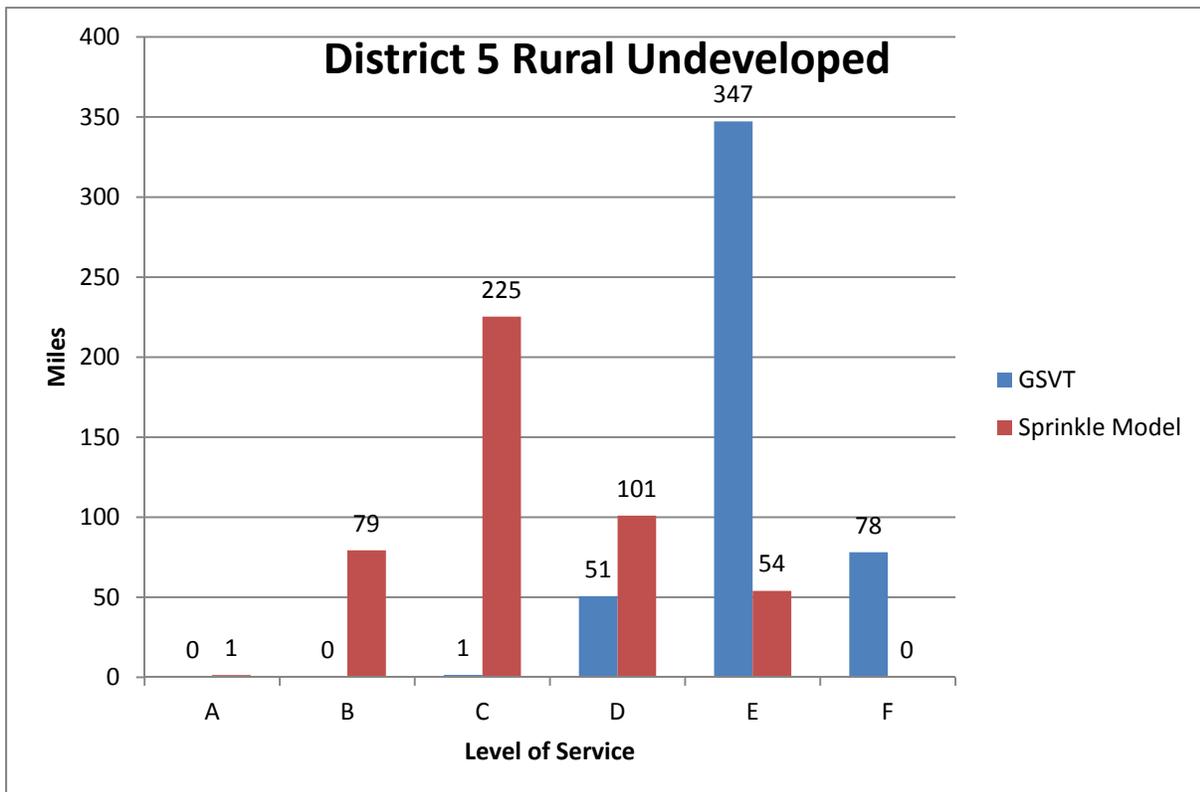
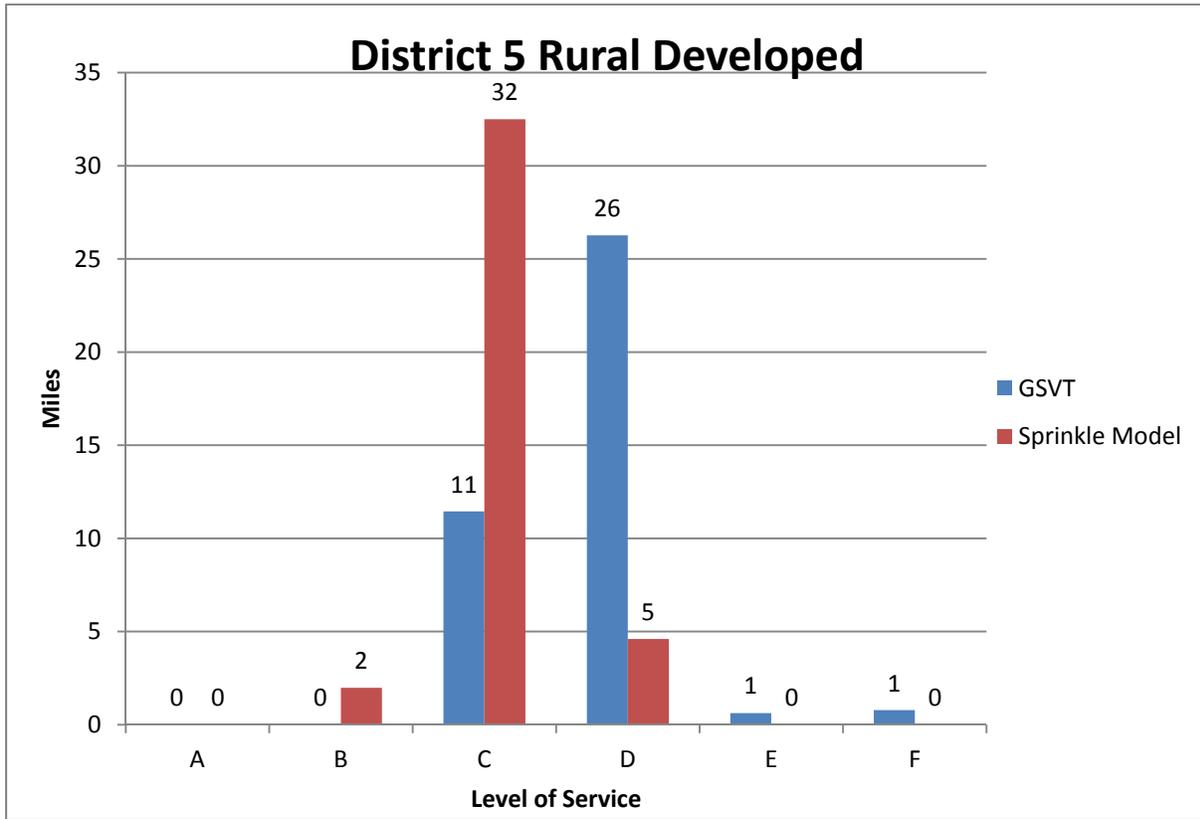
Bike LOS



Pedestrian LOS



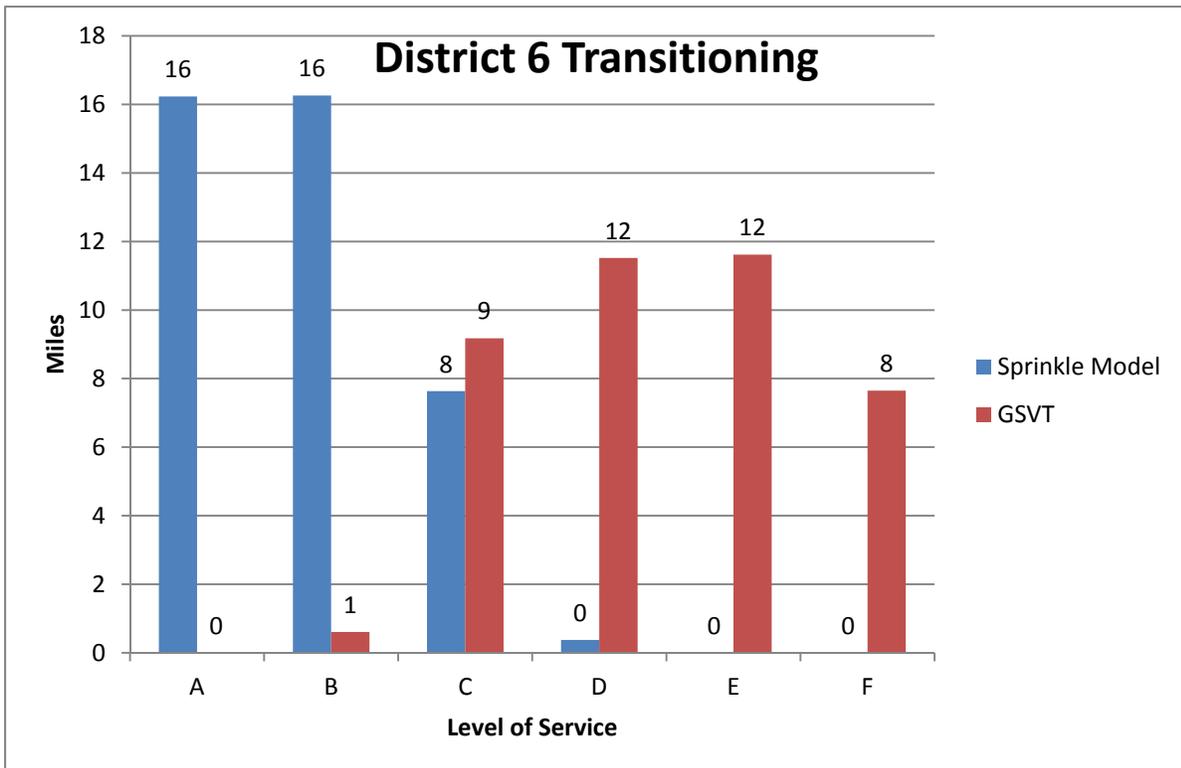
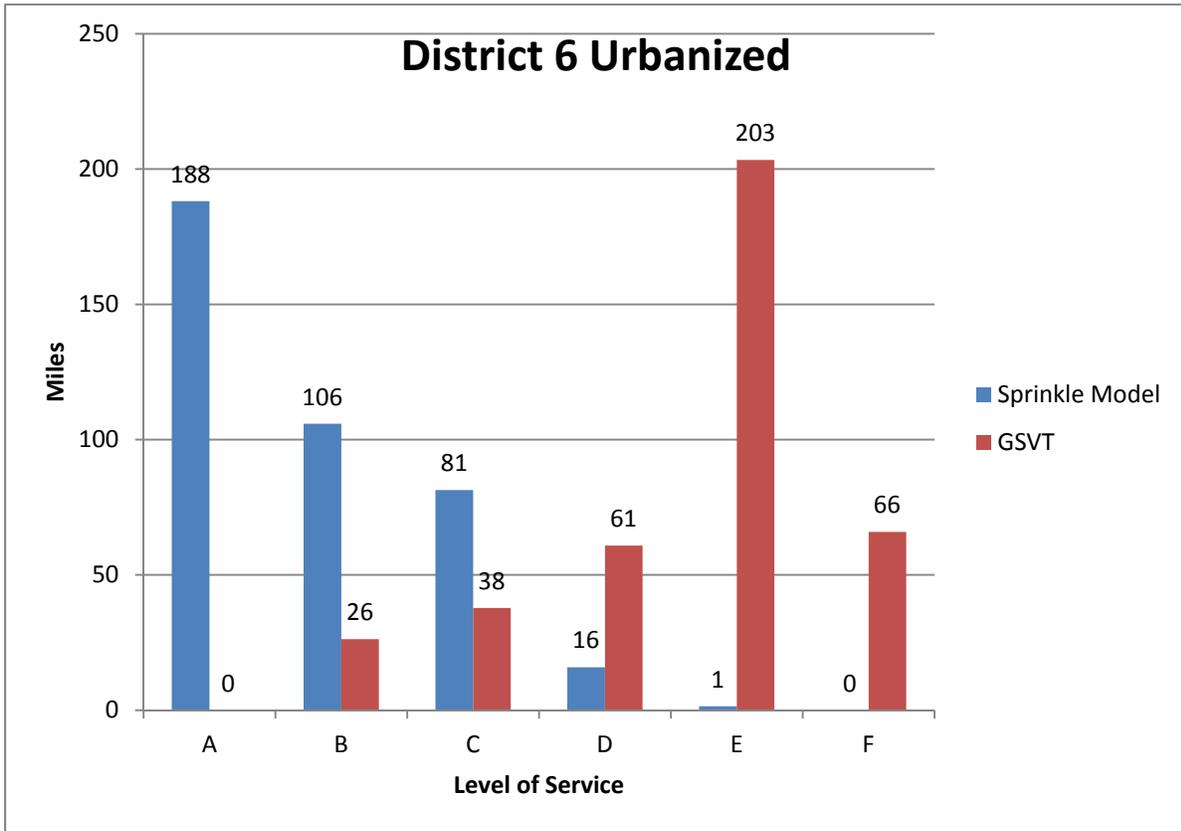
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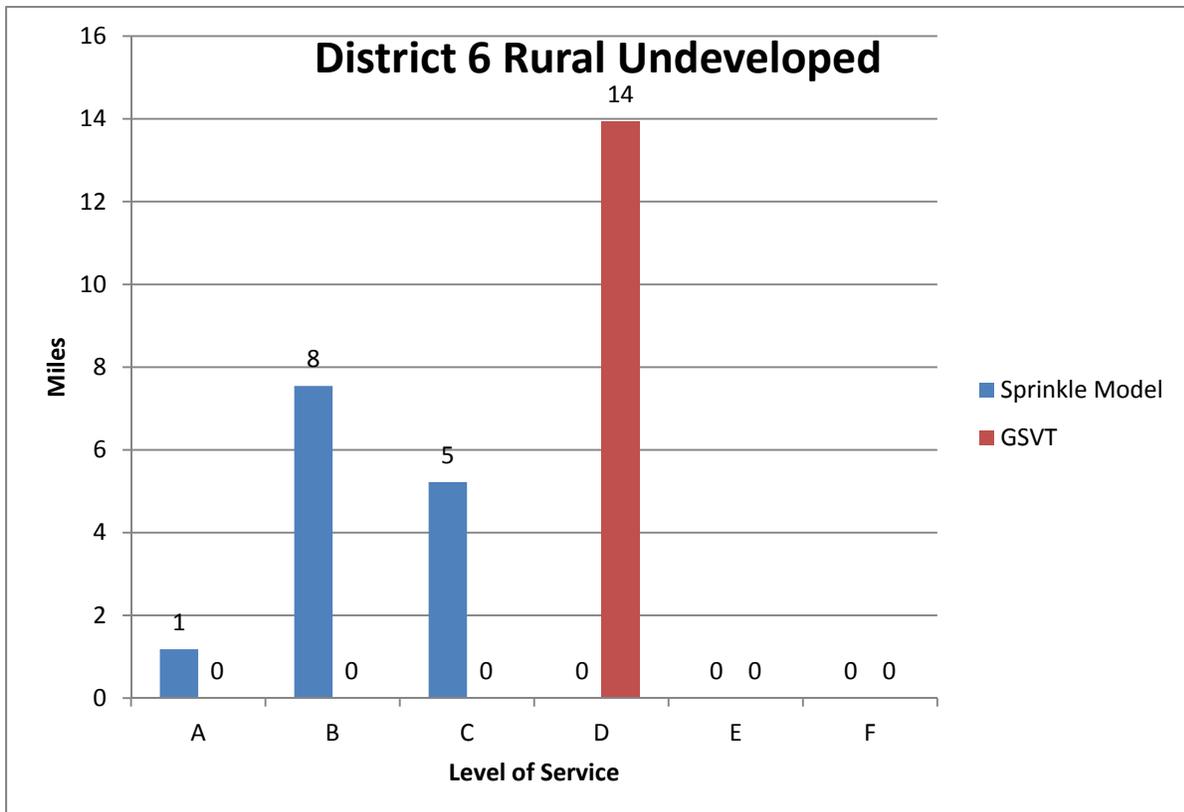
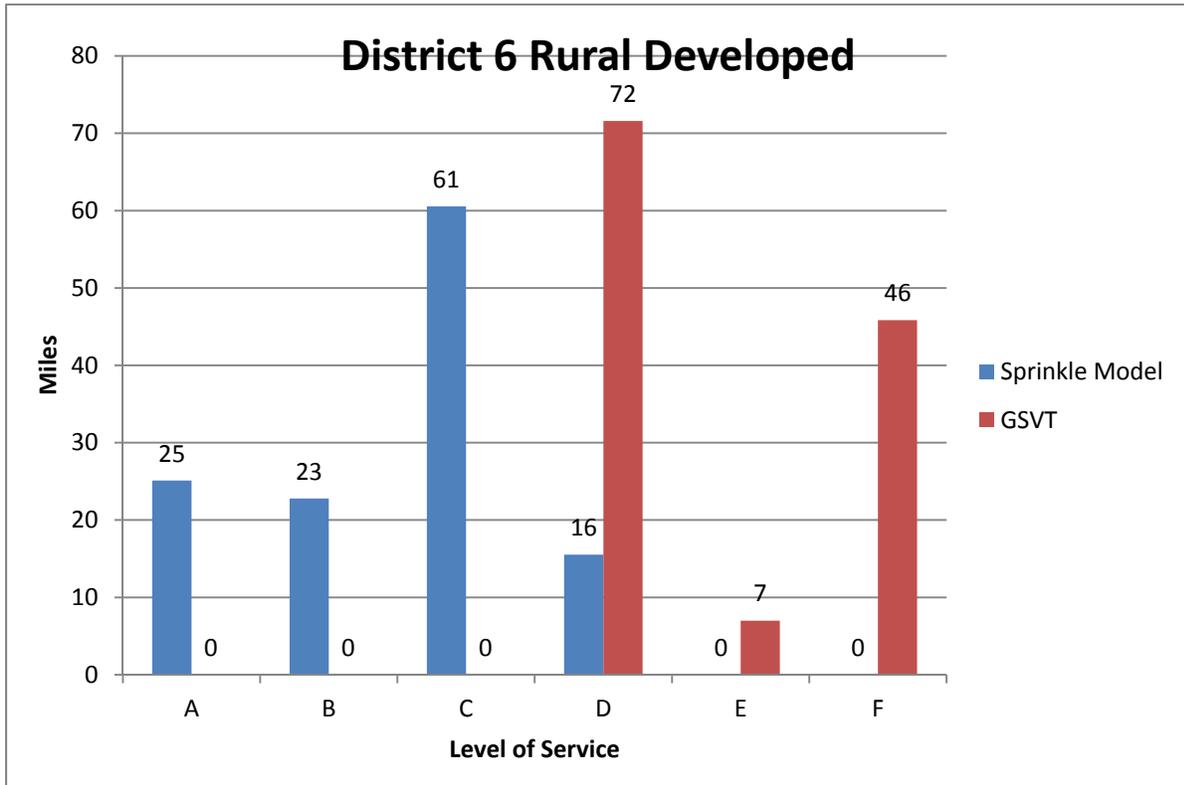
District 5			
Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	82.38	5.27
	C	261.42	119.61
	D	273.22	299.32
	E	296.39	215.04
	F	48.03	322.21
Transitioning	A	0	0
	B	46.64	2.18
	C	40.87	13.24
	D	23.87	21.85
	E	4.66	43.07
	F	0	35.7
Rural Developed	A	0	0
	B	9.14	0
	C	7.01	11.45
	D	15.01	26.26
	E	6.55	0.62
	F	1.38	0.78
Rural Undeveloped	A	0	0
	B	19.9	0
	C	87.19	1.49
	D	237.58	50.7
	E	74.41	347.24
	F	58.45	78.1

District 5			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	181.98	1.07
	B	183.7	55.87
	C	522.98	320
	D	61.42	389.84
	E	7.26	154.67
	F	0.7	36.59
Transitioning	A	13.81	0.08
	B	23.94	5.29
	C	53.09	54.44
	D	19.22	30.54
	E	5.8	18.77
	F	0	6.74
Rural Developed	A	2.42	0
	B	25.1	1.97
	C	11.11	32.49
	D	0.42	4.6
	E	0.01	0
	F	0	0
Rural Undeveloped	A	26.22	1.36
	B	140.9	79.36
	C	157.74	225.31
	D	71.93	101
	E	42.97	54
	F	21.27	0

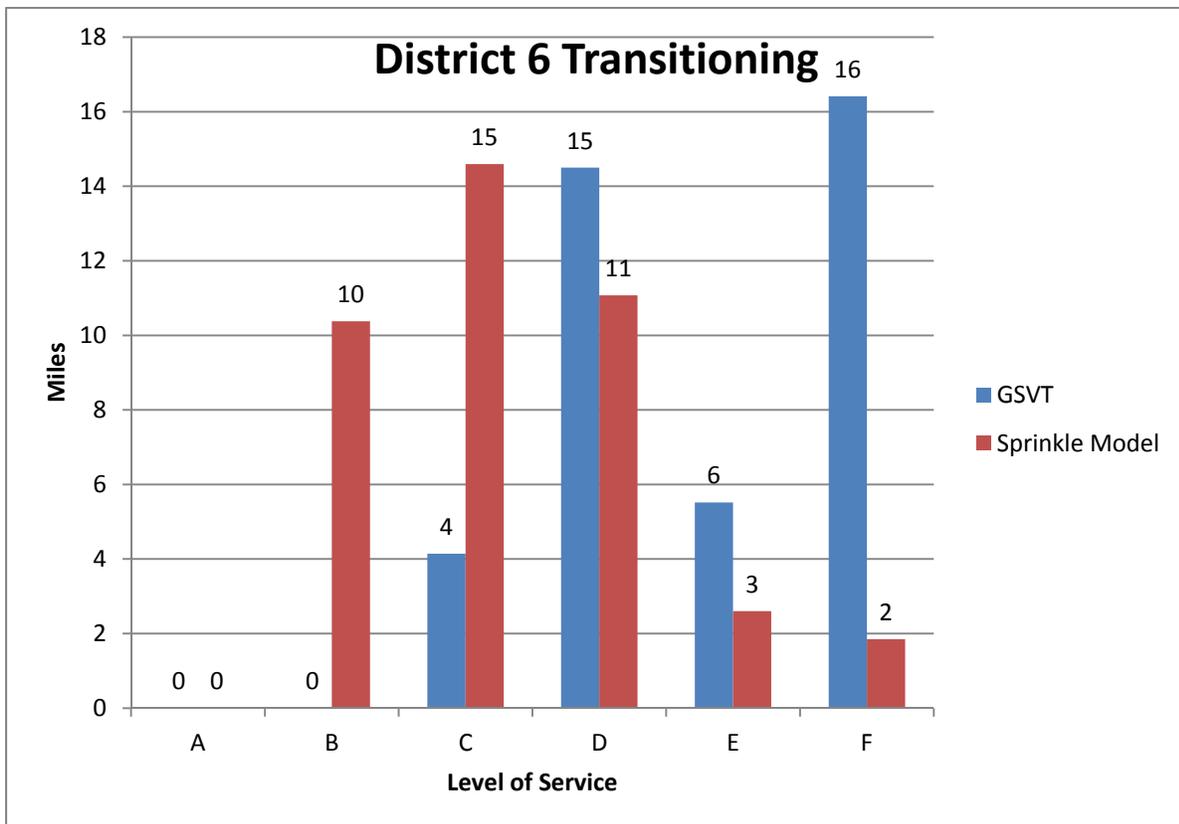
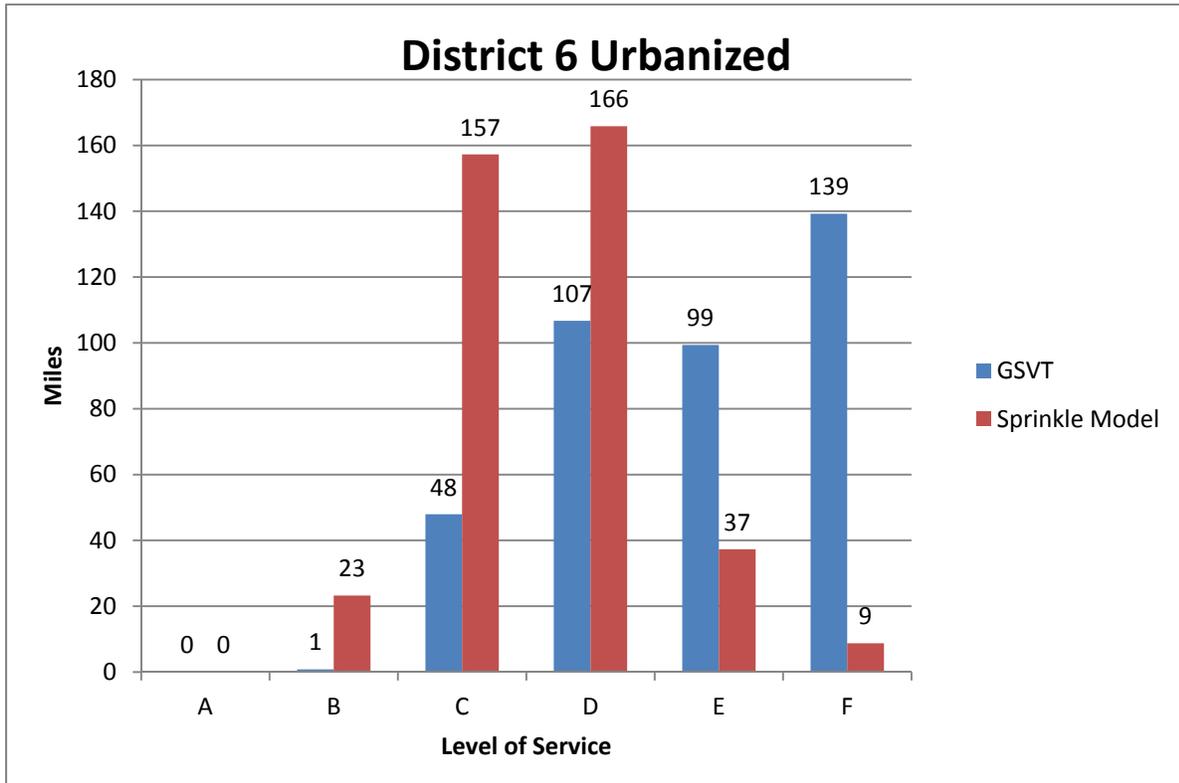
Bike LOS



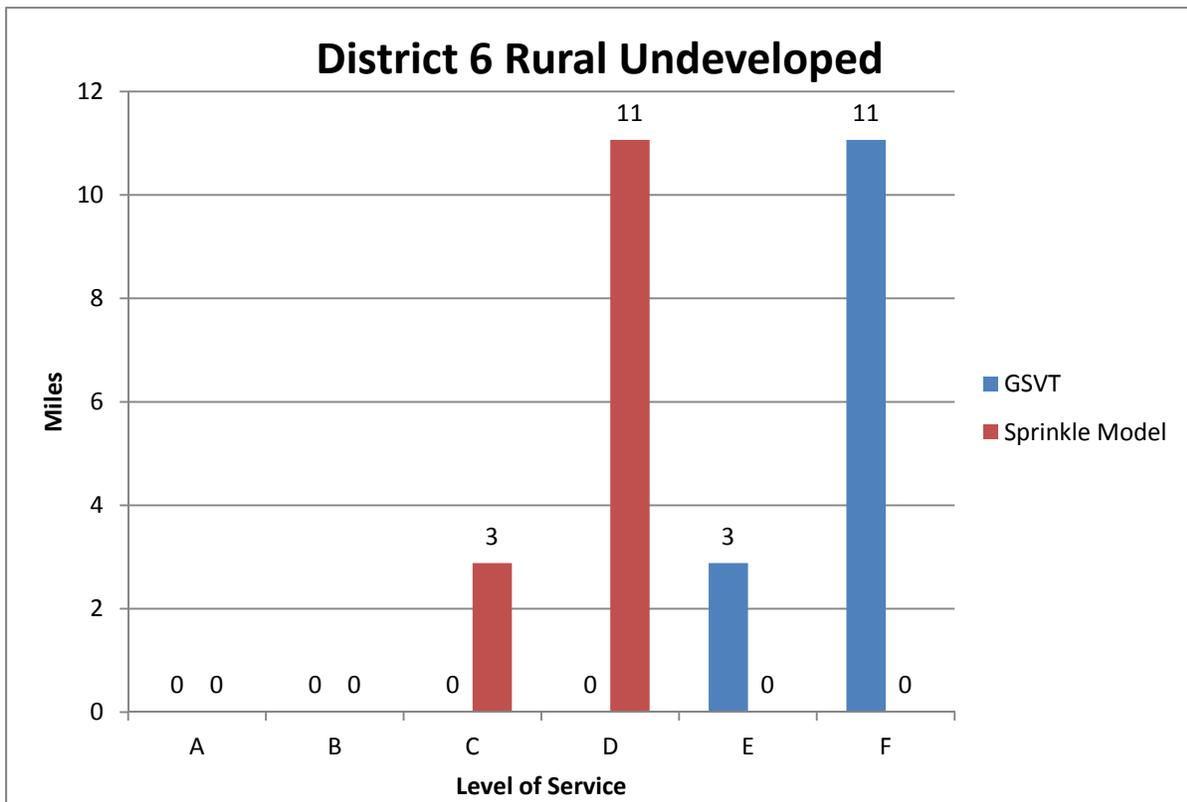
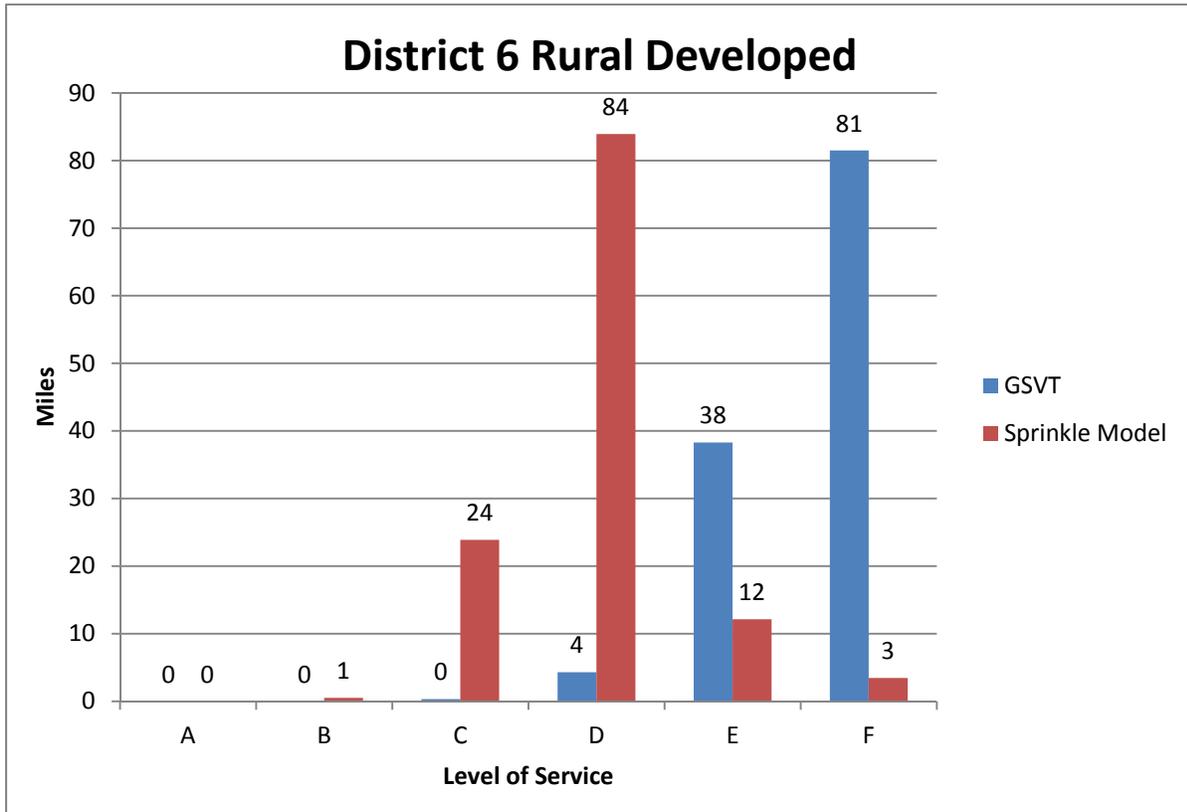
Bike LOS



Pedestrian LOS



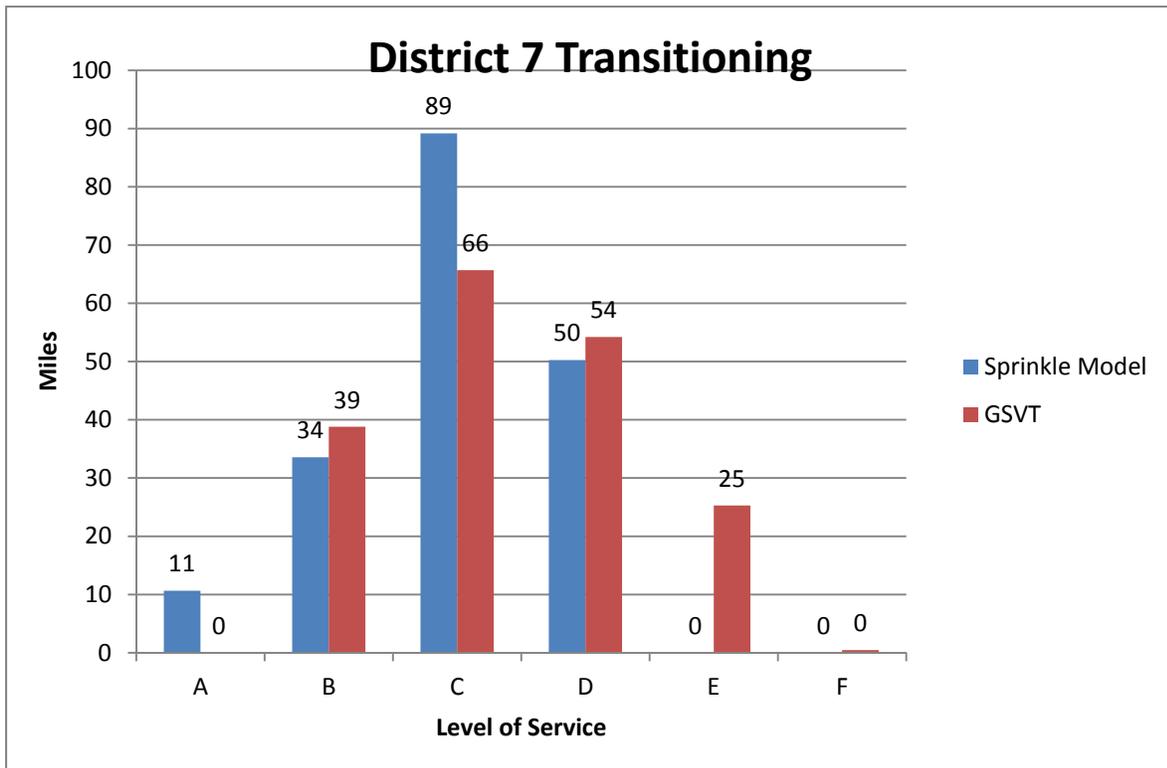
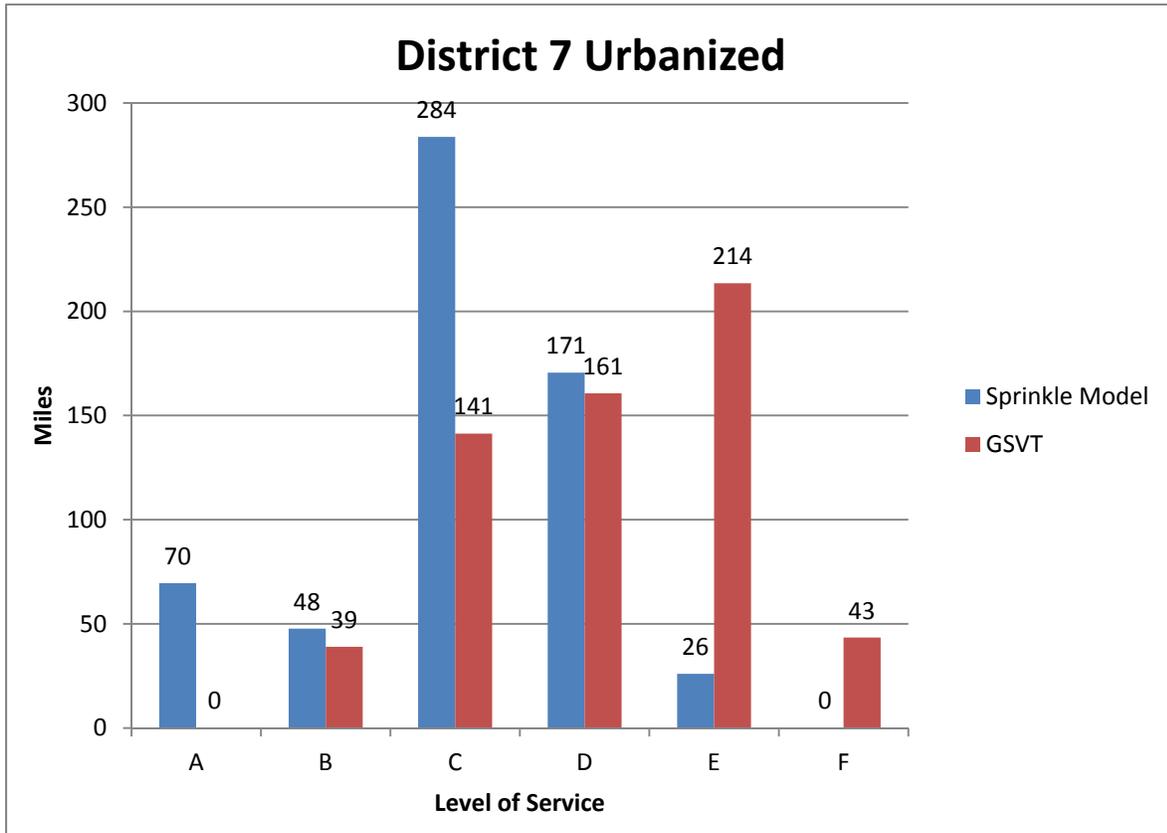
Pedestrian LOS



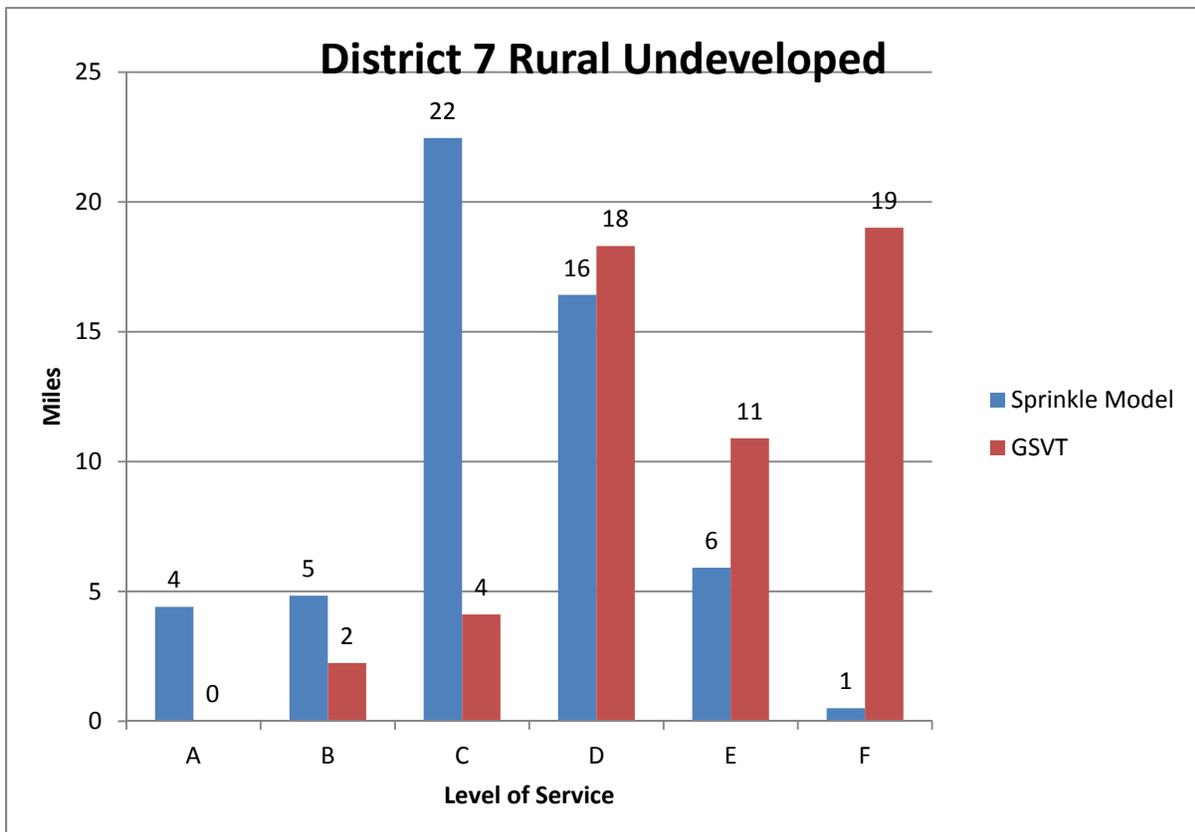
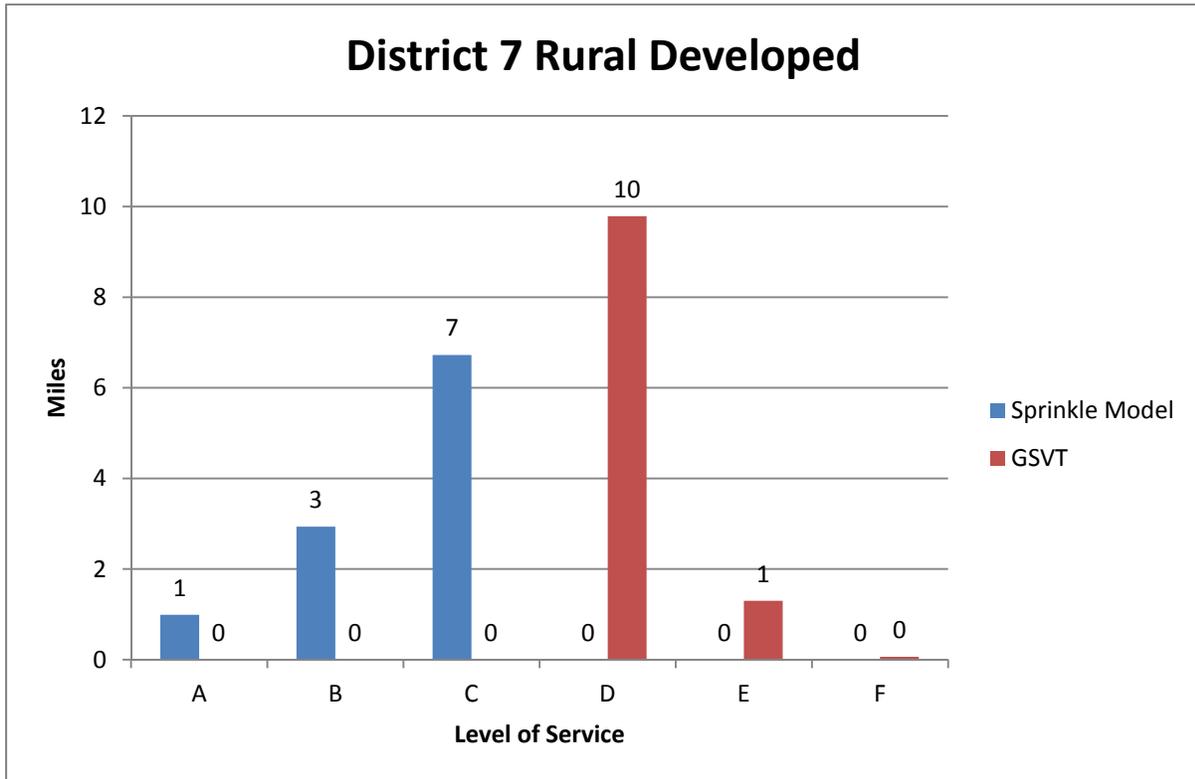
District 6			
Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	26.24	0.84
	C	37.78	47.94
	D	60.82	106.7
	E	203.37	99.39
	F	65.9	139.23
Transitioning	A	0	0
	B	0.6	0
	C	9.178	4.14
	D	11.51	14.5
	E	11.61	5.51
	F	7.64	16.41
Rural Developed	A	0	0
	B	0	0
	C	0	0.33
	D	71.58	4.29
	E	6.99	38.28
	F	45.83	81.49
Rural Undeveloped	A	0	0
	B	0	0
	C	0	0
	D	13.94	0
	E	0	2.88
	F	0	11.06

District 6			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	188.17	0.25
	B	105.85	23.23
	C	81.38	157.28
	D	15.87	165.84
	E	1.43	37.31
	F	0	8.77
Transitioning	A	16.23	0
	B	16.26	10.37
	C	7.63	14.59
	D	0.37	11.07
	E	0	2.6
	F	0	1.85
Rural Developed	A	25.1	0
	B	22.77	0.51
	C	60.53	23.87
	D	15.52	83.93
	E	0	12.15
	F	0	3.46
Rural Undeveloped	A	1.18	0
	B	7.54	0
	C	5.22	2.88
	D	0	11.06
	E	0	0
	F	0	0

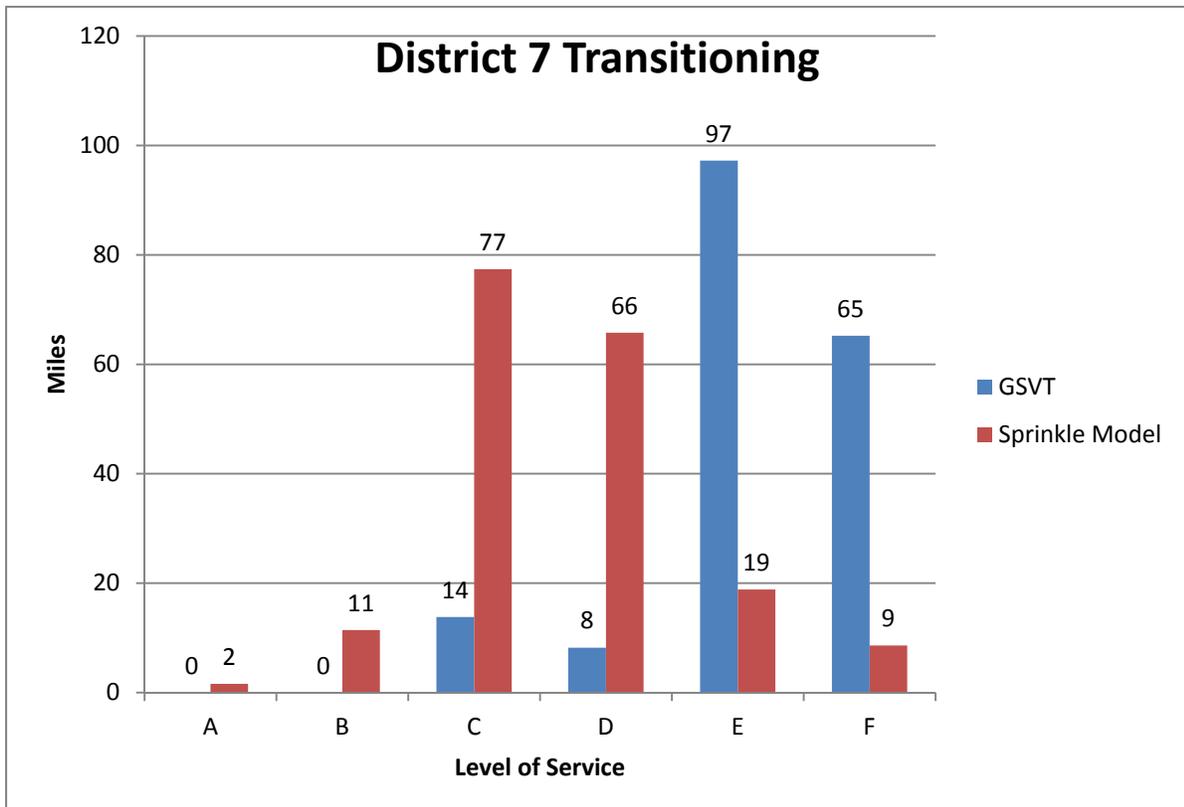
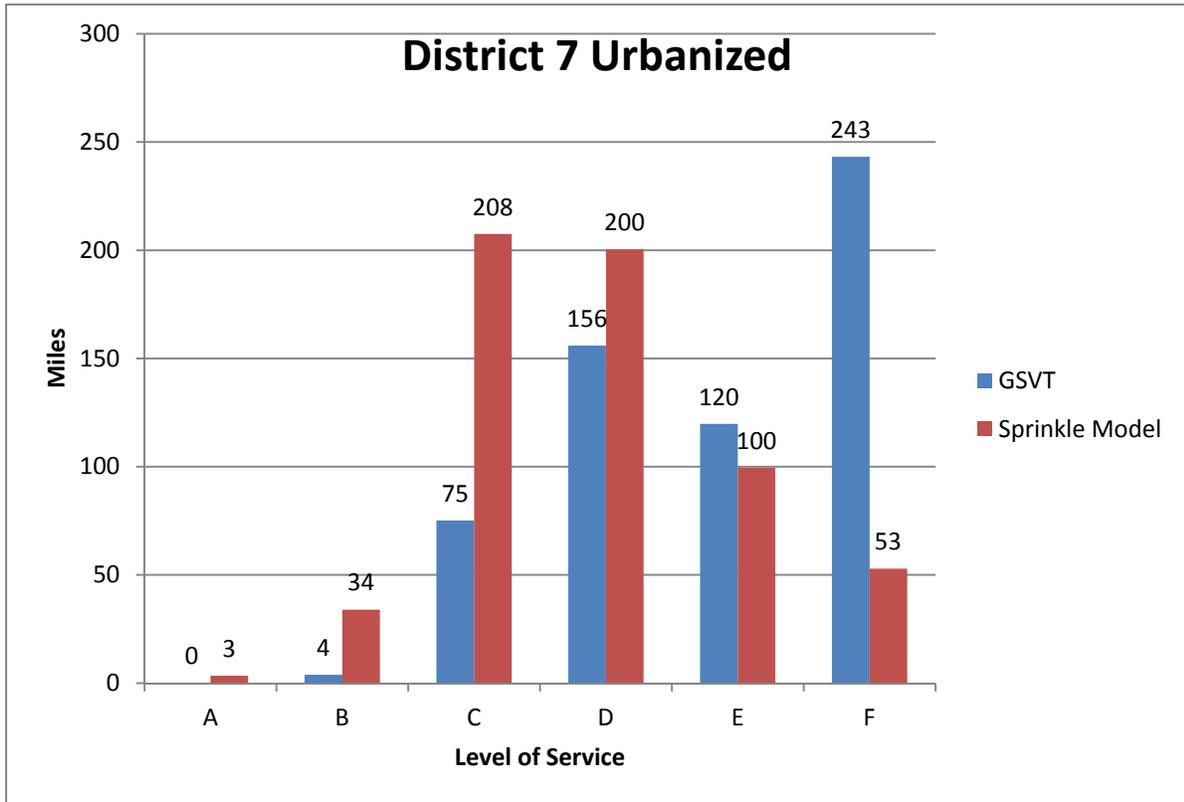
Bike LOS



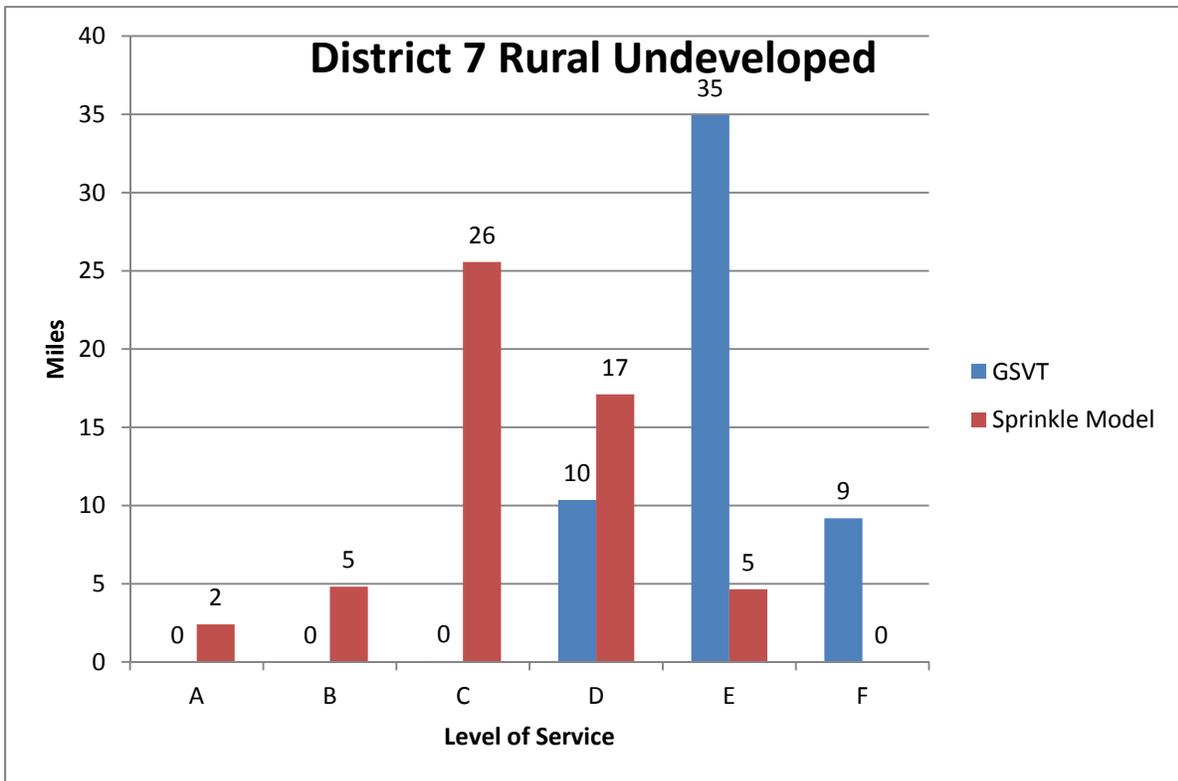
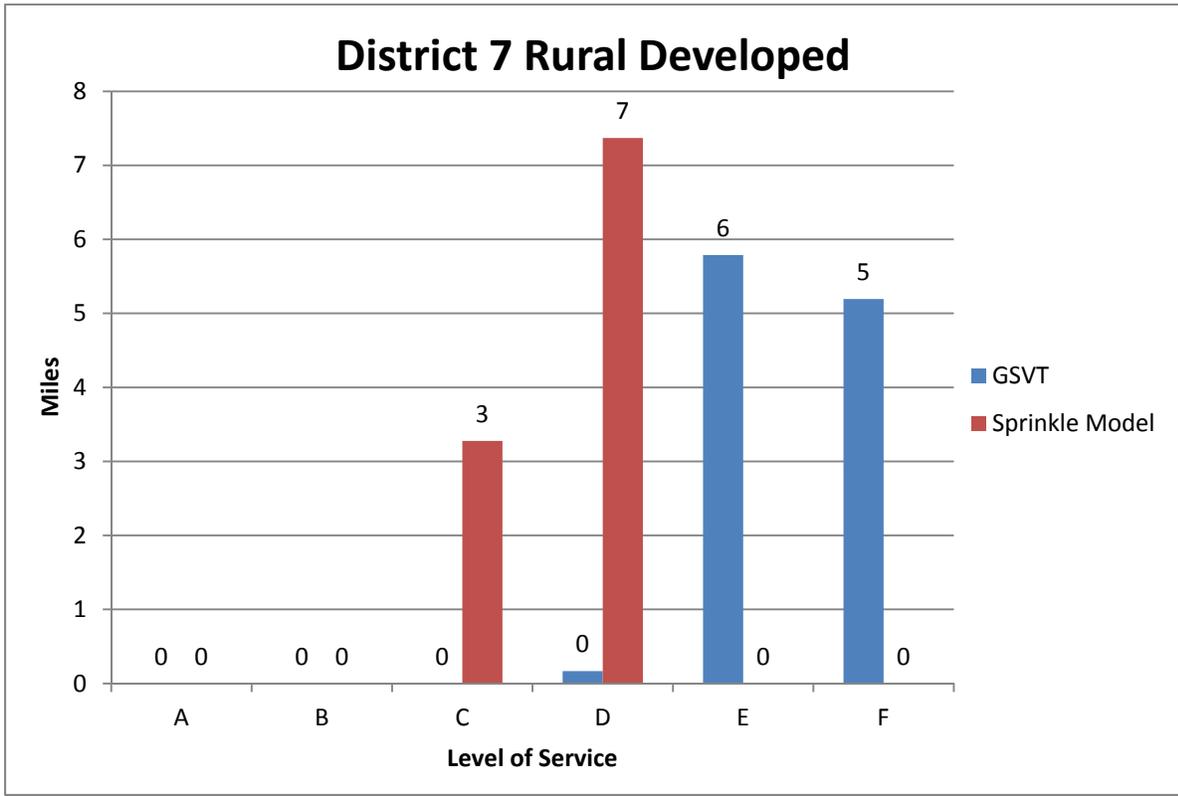
Bike LOS



Pedestrian LOS



Pedestrian LOS



District 7			
Generalized Service Volume Tables			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	0	0
	B	38.98	3.84
	C	141.29	75.12
	D	160.67	155.91
	E	213.51	119.79
	F	43.4	243.2
Transitioning	A	0	0
	B	38.79	0
	C	65.69	13.81
	D	54.22	8.2
	E	25.27	97.22
	F	0.45	65.21
Rural Developed	A	0	0
	B	0	0
	C	0	0
	D	9.78	0.16
	E	1.29	5.78
	F	0.06	5.19
Rural Undeveloped	A	0	0
	B	2.24	0
	C	4.11	0.06
	D	18.3	10.35
	E	10.89	34.95
	F	19	9.18

District 7			
Sprinkle LOS Model			
Area Type	Level of Service	Bike Miles	Pedestrian Miles
Urbanized	A	69.57	3.46
	B	47.67	33.96
	C	283.75	207.57
	D	170.61	200.4
	E	26.03	99.59
	F	0.18	52.86
Transitioning	A	10.64	1.61
	B	33.56	11.41
	C	89.19	77.39
	D	50.24	65.78
	E	0	18.85
	F	0	8.6
Rural Developed	A	0.99	0
	B	2.93	0
	C	6.72	3.28
	D	0	7.37
	E	0	0
	F	0	0
Rural Undeveloped	A	4.4	2.41
	B	4.83	4.81
	C	22.46	25.56
	D	16.42	17.11
	E	5.91	4.65
	F	0.5	0