

Appendix E Road Based GHG Methodology

On-Road Mobile Sources Technical Documentation

The primary activity used in the emissions calculation for on-road transportation is vehicle miles of travel (VMT). To be consistent with the direct emissions or link-based process currently in the North Jersey region, VMT was estimated using NJTPA's North Jersey Regional Transportation Model – Enhanced (NJRTME) which provides link-based VMT by vehicle type. NJRTME provides traffic volume and logistical information, which are necessary inputs for calculating emissions. However, post-processing is required to convert the physical, operating, and traffic volume data contained in NJRTME to a form and format that can be input into MOVES. AECOM's PPSUITE software package is designed to provide a flexible framework for linking traffic demand models to MOVES, and for computing a variety of transportation system performance measures. PPSUITE has been used to establish consistency between the Federal Highway Administration's (FHWA's) Highway Performance Monitoring System (HPMS) VMT estimates and methods used by various agencies in calculating emissions.

The adjustment factors that are the input to the PPSUITE process are typically applied at an individual County and Facility Group basis. For example, all Freeway/Ramp links within Monmouth County are assumed to follow the same monthly or seasonal distribution. There are three sets of factors that convert the average annual daily traffic on each transportation model link to a series of monthly average values. As part of this process, the model traffic data is also normalized to match the HPMS VMT data for each county (mostly to account for the fact that the NJRTM-E does not include most local roads). As shown in Table 1, the highest HPMS adjustment factors for Monmouth County are for the month of July. For example, a July adjustment factor of 1.1 means that July average daily traffic volumes are 10 percent higher than annual average daily traffic volumes.

Table 1 Monmouth County HPMS Adjustment Factors

	Facility Group 1	Facility Group 2	Facility Group 3
	Freeways and Ramps	Arterials	Local Streets
January	1.0204	0.9818	0.9852
February	1.0563	0.9915	0.9950
March	1.0239	1.0145	1.0204
April	1.0714	1.0542	1.0582
May	1.1194	1.0736	1.0753
June	1.1029	1.0972	1.0989
July	1.1364	1.1076	1.1050
August	1.0870	1.0886	1.0870
September	1.0601	1.0703	1.0695
October	1.0453	1.0417	1.0417
November	1.0563	1.0309	1.0363
December	1.0417	1.0086	1.0152

Source: Stump Hausman

Using average data for an entire County provides reasonable results at a County-level however it fails to provide insight into the different conditions that exist in Monmouth County where the shore communities exhibit much higher summer seasonal travel than the inland communities. For this study, all available traffic data from the County, the NJDOT, and the Turnpike Authority were reviewed in order to develop separate monthly or seasonal distributions for each municipality in Monmouth County. The structure of the municipal distribution files is exactly the same as the County file so that there are no changes to the estimation process currently used by the NJTPA. One advantage of the flexibility of the PPSUITE software is that it is not difficult to modify the software to expand the current analysis to apply seasonal distribution on a municipal as well as on a county basis. It is hoped that this additional step could be accomplished as part of the next Conformity process. One major advantage of applying the seasonal factors on a municipal basis within PPSUITE is that the PPSUITE would then utilize these factors to adjust travel speeds to better reflect actual summer conditions. By applying the factors after the PPSUITE process is completed, it is not possible to adjust travel speeds on an individual link basis.

Adjustments to NJTPA Annual VMT

The following changes were made to the NJTPA direct forecast data for consistency with the methodology used in this report.

- The NJTPA link assignment is a two-step process. The assignment of the County number is a manual process. The assignment of a TAZ is an automatic process – which TAZ Centroid is closest to the Centroid of the link. For this reason, some links that are part of Monmouth County are identified as being part of non-Monmouth County municipalities. Specifically, the NJTPA data for Monmouth County includes some VMT and emissions for the following non-Monmouth County municipalities: Hamilton (Mercer County), Jackson (Ocean County), Plumstead (Ocean County) and Washington (Warren County). The VMT and emissions for these four municipalities were reassigned to the appropriate Monmouth County municipality for the summary presented in Section 5.c of the main body of the report (Jackson and Washington to Millstone, Hamilton and Plumstead to Upper Freehold).

Methodology for the Development of Revised Monthly Factors

To generate the data for this (Task 4) analysis, two primary sources of data for county travel patterns were consulted. The New Jersey Turnpike Authority maintains a database for the Garden State Parkway that includes daily traffic volumes by month for each mainline segment and ramp in both the northbound and southbound directions. Toll plaza volume data are collected on a daily basis. Non-toll plaza locations are generally counted several times per year. From this primary data, the Authority synthesizes the complete data set. There are approximately fifty links between the Toms River Toll Plaza in Ocean County and the Raritan Toll Plaza in Middlesex County, with about half of the links being mainline segments and half being entrance and exit ramps.

The second primary source comes from the New Jersey Department of Transportation (NJDOT), which collects monthly traffic volume and speed data at 57 continuous monitoring sites throughout the state, including seven within Monmouth County:

- US 9, MP 111.8, Freehold Township (**US901**)
- NJ 18, MP 16.0, Colts Neck Township (**NJ1801**)
- NJ 18, MP 26.6, Marlboro Township (**NJ1802**)
- NJ 33, MP 23.5, Manalapan Township (**NJ3301**)
- NJ 34, MP 5.7, Wall Township (**NJ3401**)
- NJ 138, MP 2.6, Wall Township (**NJ13801**)
- I-195, MP 10.2, Upper Freehold Township (**I19501**)

In addition, a search of the NJDOT traffic count website identified three additional locations within Monmouth County where monthly traffic data was available:

- NJ 33, MP 35.9, Wall Township (**NJ3302**)
- NJ 36, MP 9.5, Sea Bright Boro (**NJ3601**)
- Old Mill Rd, Between Ocean Ave and Warren Ave, Spring Lake Heights Boro (**Local01**)

For each location, monthly factors were developed.

Table 2 summarizes the number of roadway links in the NJRTM-E that are within each Monmouth County municipality organized by the facility groups. Note that a single roadway link may refer to both two-way roadways, in the case of most arterials and local streets, as well as one-way roadways, in the case of divided highways such as the Garden State Parkway mainline and ramps. Table 2 shows that the NJRTM-E primarily represents freeway and arterial roadways in Monmouth County, smaller local streets are not included in the model.

Table 2 Count of Monmouth County NJRTM-E Links by Municipality and Facility Group

	Facility Group 1	Facility Group 2	Facility Group 3	All Groups
Municipality	Freeways and Ramps	Arterials	Local Streets	
Aberdeen	9	64	0	73
Allenhurst	0	6	0	6
Allentown	0	12	0	12
Asbury Park	0	22	0	22
Atlantic Highlands	0	8	0	8
Avon-by-the-Sea	0	8	0	8
Belmar	0	16	0	16
Bradley Beach	0	6	0	6
Brielle	2	23	0	25

	Facility Group 1	Facility Group 2	Facility Group 3	All Groups
Municipality	Freeways and Ramps	Arterials	Local Streets	
Colts Neck	34	54	0	88
Deal	0	10	0	10
Eatontown	19	79	0	98
Englishtown	0	10	0	10
Fair Haven	0	8	0	8
Farmingdale	0	6	0	6
Freehold Twp	9	172	0	181
Freehold Borough	5	63	0	68
Hazlet	5	53	3	61
Highlands	0	8	0	8
Holmdel	16	66	0	82
Howell	38	121	0	159
Interlaken	0	2	0	2
Keansburg	0	2	0	2
Keyport	5	49	0	54
Little Silver	0	20	0	20
Loch Arbour	0	6	0	6
Long Branch	0	66	0	66
Manalapan	7	96	0	103
Manasquan	0	8	0	8
Marlboro	36	88	0	124
Matawan	1	22	0	23
Middletown	19	192	0	211
Millstone	13	44	0	57
Monmouth Beach	0	4	0	4
Neptune	31	104	0	135
Neptune City	0	23	0	23
Ocean	30	92	0	122
Oceanport	0	22	0	22
Red Bank	0	58	0	58
Roosevelt	0	6	0	6
Rumson	0	20	0	20
Sea Bright	0	10	0	10
Sea Girt	0	2	0	2
Shrewsbury Boro	0	16	0	16
Shrewsbury Twp	0	0	0	0
Lake Como	0	2	0	2
Spring Lake	0	2	0	2
Spring Lake Heights	0	16	0	16

	Facility Group 1	Facility Group 2	Facility Group 3	All Groups
Municipality	Freeways and Ramps	Arterials	Local Streets	
Tinton Falls	75	100	0	175
Union Beach	0	4	0	4
Upper Freehold	31	56	0	87
Wall	82	204	0	286
West Long Branch	0	26	0	26
All Municipalities	467	2,177	3	2,647

For each municipality, the NJDOT straight line diagrams were reviewed to identify the major roadways located within each municipality (See Table 3). This summary provided the basis for identifying the roadways to obtain traffic counts for in order to develop the monthly factors for each municipality. The traffic count locations selected to represent each municipality are summarized in Table 4. When more than one traffic count was selected, the values were weighted based on daily traffic volumes.

Table 3 Major Roadways by Municipality and Facility Group

Municipality	Facility Group 1	Facility Group 2
	Freeways and Ramps	Arterials
Aberdeen	GSP	NJ3401, NJ3501
Allenhurst		NJ 71
Allentown		CR524, CR526, CR539
Asbury Park		NJ 71
Atlantic Highlands		NJ 36
Avon-by-the-Sea		NJ 71
Belmar		NJ 35, NJ 71
Bradley Beach		NJ 71
Brielle	NJ 35 Bridge	NJ 71, NJ 35
Colts Neck	NJ 18	NJ 34, NJ 35
Deal		NJ 71
Eatontown	NJ 18	NJ 35, NJ 36, NJ 71
Englishtown		NJ 33
Fair Haven		CR 520
Farmingdale		CR 524
Freehold Twp	US 9, NJ 18	NJ 33, NJ 79
Freehold Borough	US 9	NJ 33, NJ 79
Hazlet	GSP	NJ 35, NJ 36
Highlands		NJ 36
Holmdel	GSP	NJ 34, NJ 35
Howell	US 9, I-195	NJ 33, NJ 34, NJ 35
Interlaken		NJ 71

Municipality	Facility Group 1	Facility Group 2
	Freeways and Ramps	Arterials
Keansburg		NJ 36
Keyport		NJ35, NJ 36
Little Silver		CR 520
Loch Arbour		NJ 71
Long Branch		NJ 36, NJ 71
Manalapan	US 9	NJ 33
Manasquan		NJ 71
Marlboro	US 9, NJ 18	NJ 34, NJ 79
Matawan	GSP	NJ 34, NJ 79
Middletown	GSP	NJ 35, NJ 36
Millstone	I-195	NJ 33
Monmouth Beach		NJ 36
Neptune	NJ 18	NJ 33, NJ 35, NJ 71
Neptune City		NJ 33, NJ 35, NJ 71
Ocean	NJ 18	NJ 35, NJ 71
Oceanport		NJ 36, NJ 71
Red Bank		NJ 35
Roosevelt		CR 571
Rumson		CR 520
Sea Bright		NJ 36
Sea Girt		NJ 71
Shrewsbury Boro		NJ 35
Shrewsbury Twp		
South Belmar (Lake Como)		NJ 71
Spring Lake		NJ 71
Spring Lake Heights		NJ 71
Tinton Falls	GSP, NJ 18	NJ 33
Union Beach		NJ 36
Upper Freehold	I-195	CR 524, CR 539
Wall	GSP, I-195, NJ 18	NJ 33, NJ 34, NJ 35, NJ 70, NJ 71
West Long Branch		NJ 36, NJ 71

Table 4 Traffic Count Stations Used to Compute Monthly Factors

Municipality	Facility Group 1	Facility Group 2	Facility Group 3
	Freeways and Ramps	Arterials	Local Streets
Aberdeen	GSP	NJ3401	
Allenhurst		Local01	
Allentown		NJ3301	
Asbury Park		Local01	
Atlantic Highlands		NJ3601	
Avon-by-the-Sea		Local01	
Belmar		NJ13801, Local01	
Bradley Beach		Local01	
Brielle	NJ3601	NJ3601, Local01	
Colts Neck	NJ1801	NJ3401	
Deal		Local01	
Eatontown	NJ1801	NJ3601, Local01	
Englishtown		NJ 3301	
Fair Haven		NJ3601	
Farmingdale		NJ 3301	
Freehold Twp	US901, NJ1802	NJ 3301	
Freehold Borough	US901	NJ 3301	
Hazlet	GSP	NJ3601	Local01
Highlands		NJ3601	
Holmdel	GSP	NJ3401	
Howell	US901, I19501	NJ3302, NJ3401	
Interlaken		Local01	
Keansburg		NJ3601	
Keyport		NJ3601	
Little Silver		NJ3601	
Loch Arbour		NJ13801, Local01	
Long Branch		NJ3601, Local01	
Manalapan	US901	NJ 3301	
Manasquan		NJ13801, Local01	
Marlboro	US901, NJ1802	NJ3401	
Matawan	GSP	NJ3401	
Middletown	GSP	NJ3601	
Millstone	I19501	NJ 3301	
Monmouth Beach		NJ3601	

Municipality	Facility Group 1	Facility Group 2	Facility Group 3
	Freeways and Ramps	Arterials	Local Streets
Neptune	NJ1801	Local01	
Neptune City		Local01	
Ocean	NJ1801	NJ3601, Local01	
Oceanport		NJ3601, Local01	
Red Bank		NJ3601	
Roosevelt		NJ3301	
Rumson		NJ3601	
Sea Bright		NJ3601	
Sea Girt		NJ13801, Local01	
Shrewsbury Boro		NJ3601	
Shrewsbury Twp			
South Belmar (Lake Como)		NJ13801, Local01	
Spring Lake		NJ13801, Local01	
Spring Lake Heights		NJ13801, Local01	
Tinton Falls	GSP, NJ1801	NJ3301	
Union Beach		NJ3601	
Upper Freehold	I19501	NJ3301	
Wall	GSP, I-195, NJ1801	NJ3302, NJ3401, NJ3601, NJ13801, Local01	
West Long Branch		NJ3601, Local01	

Notes:

US901- US 9, MP 111.8, Freehold Township
 NJ1801-NJ 18, MP 16.0, Colts Neck Township
 NJ1802-NJ 18, MP 26.6, Marlboro Township
 NJ3301-NJ 33, MP 23.5, Manalapan Township
 NJ3401-NJ 34, MP 5.7, Wall Township
 NJ13801- NJ 138, MP 2.6, Wall Township
 I19501- I-195, MP 10.2, Upper Freehold Township
 NJ3302- NJ 33, MP 35.9, Wall Township

NJ3601- NJ 36, MP 9.5, Sea Bright Boro
 Local01- Old Mill Rd, Between Ocean Ave and Warren Ave, Spring Lake Heights Boro

Based on the analysis of the traffic data, revised monthly factors were applied to each Monmouth County roadway link in the NJRTM-E based on its municipality and facility group. As stated earlier, the NJTPA analysis begins the regional model (NJRTM-E) output and then uses the PPSUITE software to factor the VMT on a County and Facility Group basis to be consistent with the FHWA Highway Performance Monitoring System (HPMS) data. For this analysis, separate seasonal adjustment factors were developed for each municipality and these municipal factors were then adjusted to again be consistent with the HPMS data. The resulting factors for each municipality for the month of July are shown in Table 5 and are compared to the county-based factors currently used for Monmouth County by NJTPA for all municipalities. Figure 1 compares the NJTPA average monthly distribution for all of Monmouth County with the individual municipal-based distributions computed for a few different municipalities within the County: Brielle (Shore); Freehold (Inland) and Upper Freehold (Western).

Table 5 Revised July Adjustment Factors

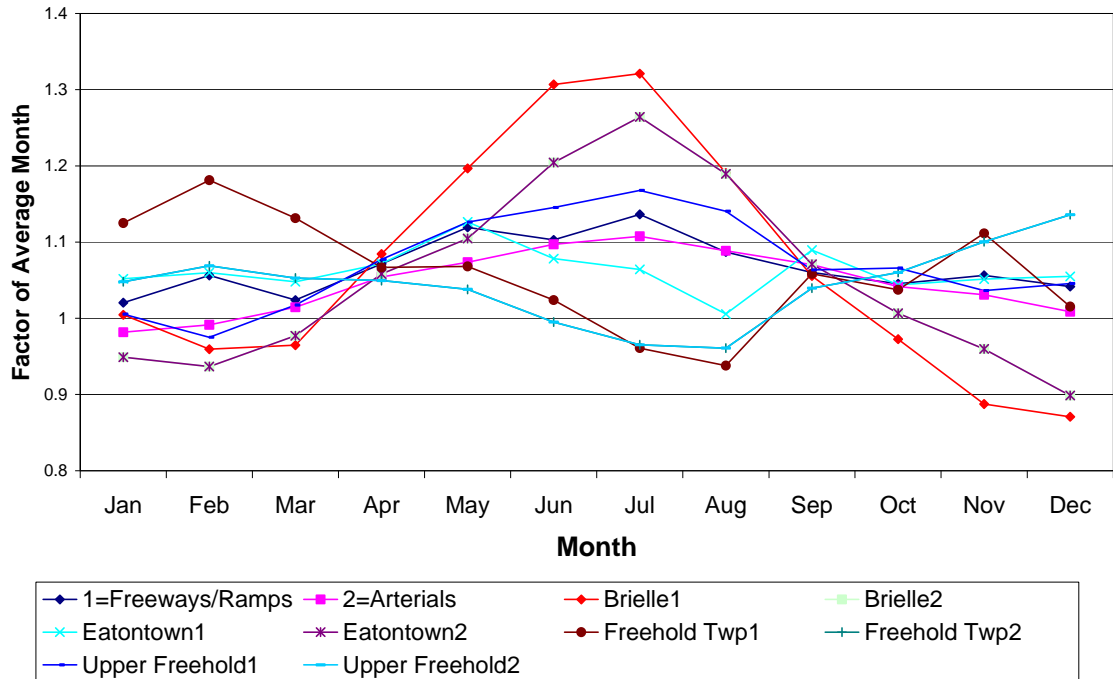
Municipality	Facility Group 1	Facility Group 2	Facility Group 3
	Freeways and Ramps	Arterials	Local Streets
Current NJRTM-E	1.1364	1.1076	1.1050
Aberdeen	1.1410	0.9656	
Allenhurst		1.1246	
Allentown		0.9773	
Asbury Park		1.1246	
Atlantic Highlands		1.3038	
Avon-by-the-Sea		1.1247	
Belmar		1.2453	
Bradley Beach		1.1246	
Brielle	1.3250	1.2797	
Colts Neck	1.0676	0.9656	
Deal		1.1246	
Eatontown	1.0676	1.2797	
Englishtown		0.9772	
Fair Haven		1.3037	
Farmingdale		0.9774	
Freehold Twp	0.9637	0.9772	
Freehold Borough	0.9997	0.9772	
Hazlet	1.2208	1.3037	1.1050
Highlands		1.3038	
Holmdel	1.1006	0.9656	

Municipality	Facility Group 1	Facility Group 2	Facility Group 3
	Freeways and Ramps	Arterials	Local Streets
Current NJRTM-E	1.1364	1.1076	1.1050
Howell	1.1550	1.0275	
Interlaken		1.1252	
Keansburg		1.3037	
Keyport		1.3038	
Little Silver		1.3038	
Loch Arbour		1.2453	
Long Branch		1.2797	
Manalapan	0.9993	0.9772	
Manasquan		1.2453	
Marlboro	0.9637	0.9656	
Matawan	1.1549	0.9656	
Middletown	1.1077	1.3037	
Millstone	1.1715	0.9772	
Monmouth Beach		1.3037	
Neptune	1.0676	1.1246	
Neptune City		1.1246	
Ocean	1.0676	1.2797	
Oceanport		1.2797	
Red Bank		1.3037	
Roosevelt		1.2448	
Rumson		1.3038	
Sea Bright		1.3038	
Sea Girt		1.2448	
Shrewsbury Boro		1.3037	
Shrewsbury Twp			
South Belmar (Lake Como)		1.2432	
Spring Lake		1.2453	
Spring Lake Heights		1.2453	
Tinton Falls	1.2387	0.9772	
Union Beach		1.3037	
Upper Freehold	1.1715	0.9773	
Wall	1.1473	1.1381	
West Long Branch		1.2798	

Note: Adjustment Factor refers to (Average Daily Traffic Volume – July) / (Average Annual Daily Traffic Volume)

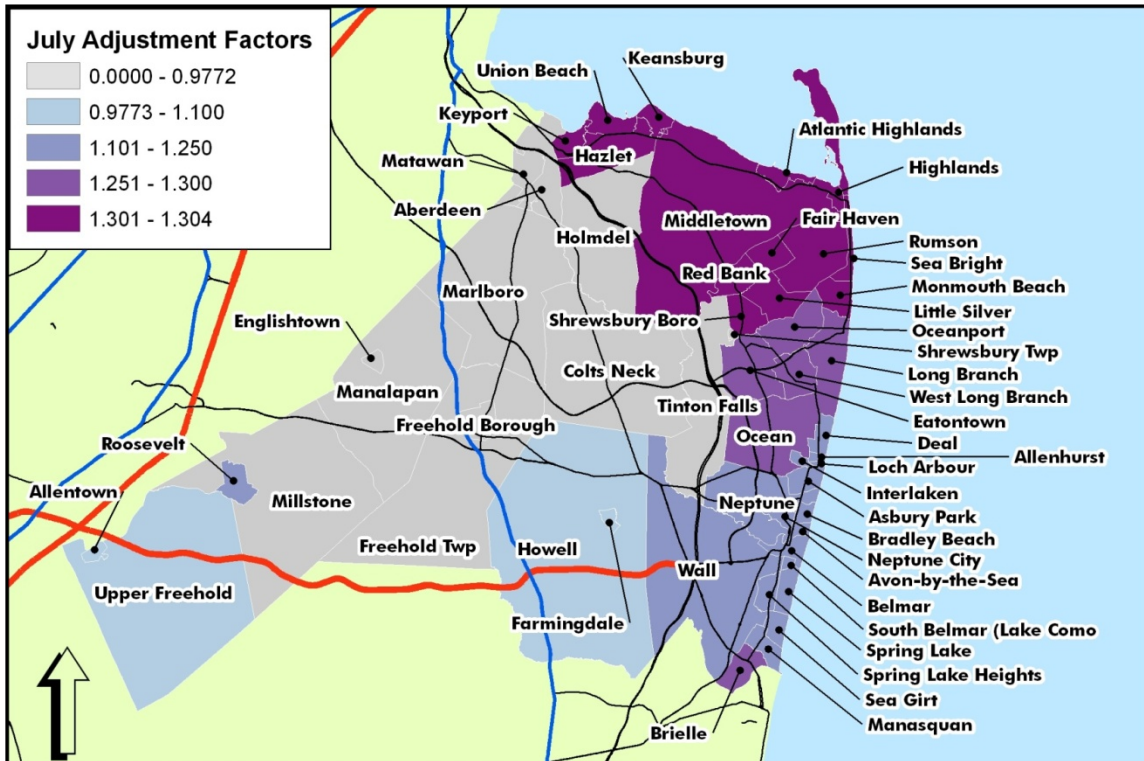
Figure 1

Comparison of Monthly Distribution



As shown in Figure 2, the shore communities have higher summer seasonal factors than other areas of Monmouth County. Communities in central and western Monmouth County such as Upper Freehold, Freehold and Marlboro all have arterial factors less than 1.0, meaning that arterial traffic in these communities is less in July than on average for the year. Shore communities from Atlantic Highlands to Sea Bright and Sea Girt all have arterial factors of about 1.3, meaning that average daily traffic volumes in July 30% higher than the annual average daily traffic volumes.. These differences should be accounted for in computing the monthly GHG emissions for each municipality in the county.

Figure 2 Monmouth County July Adjustment Factors for Arterials



Source: Louis Berger Group, Stump Hausman

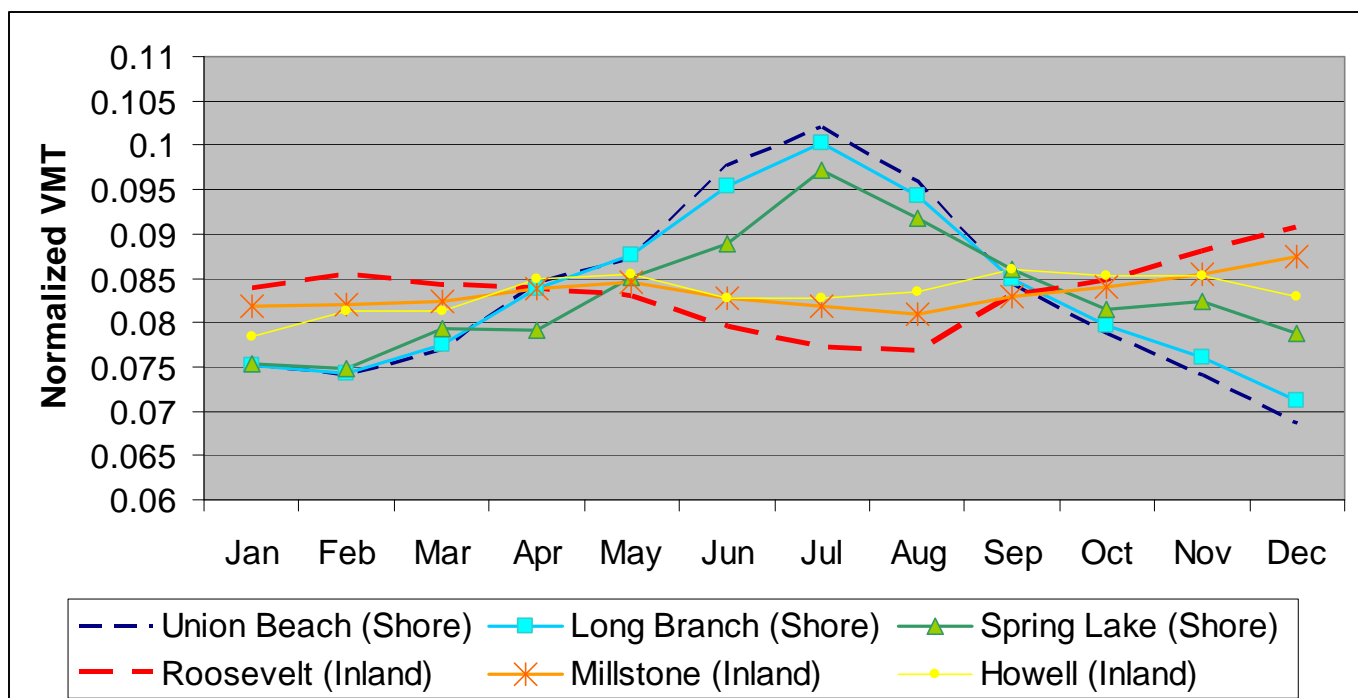
Monthly VMT was revised using the updated factors described above. The revised VMT by month was then normalized to match the NJTPA 2009 forecast annual VMT at the municipal-level. In other words, the methodology held the municipal-level annual VMT total from the NJTPA analysis constant, varying only on the seasonal distribution of the annual VMT (e.g. the proportion occurring in each month).

One way of illustrating the seasonal variation in VMT between municipalities is through graphing of normalized VMT (monthly VMT / annual average VMT). This allows for the relative monthly variations to be more easily compared between municipalities with different levels of annual VMT. Figure 3 shows normalized VMT for three example shore communities and three inland communities. There is a consistent pattern of peak monthly VMT in July in the shore communities compared to the inland communities, many of which experience a decline in VMT in the summer months of 10% or more relative to the winter. July VMT is nearly 50% greater than December VMT in the following municipalities, indicating a highly seasonal VMT distribution:

- Monmouth Beach
- Atlantic Highlands
- Sea Bright
- Rumson

- Red Bank
- Keyport
- Union Beach
- Shrewsbury Borough
- Little Silver
- Fair Haven
- Highlands
- Keansburg

Figure 3 2009 Normalized Monthly VMT: Shore vs Inland Municipalities



Greenhouse Gas Emissions

The objective of the on-road mobile source portion of Task 4 is to refine the NJTPA analysis for Monmouth County’s needs, not to create an entirely new forecast based on different assumptions. For this reason, the project team decided to use the NJTPA annual direct emissions at the municipal-level as a control total and reallocate these emissions to specific months in proportion to the analysis of seasonal VMT patterns described above. Holding all other factors constant (speed, temperatures etc.) it is

reasonable to assume GHG emissions will be proportional to VMT.¹ The revised estimate of the percent of VMT occurring in each municipality in each month was multiplied by the NJTPA forecasted annual direct emissions for each municipality to obtain the revised GHG emissions estimate by month, while remaining consistent with NJTPA's annual direct emissions estimate at the municipal-level. The revised municipal-level forecast for CO₂e is provided in Table 6.

¹ It should be noted that this assumption is not truly reflective of real-world conditions, as speeds are not constant when roadway volumes increase to the point of congestion. However, this simplification was necessary in order to complete the analysis within the confines of this study. Future work would be needed to account for the true impacts on GHG emissions of seasonal reductions in speed.

Table 6 Adjusted Monmouth County 2009 On-Road CO₂e Emissions (Tons)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Aberdeen	7,142	7,380	7,198	7,597	7,698	7,448	7,495	7,162	7,156	7,321	7,198	7,269	88,064
Allenhurst	188	197	210	214	234	224	241	227	230	224	225	219	2,634
Allentown	327	333	328	327	324	310	301	300	324	331	343	354	3,904
Asbury Park	1,075	1,125	1,198	1,222	1,339	1,281	1,375	1,297	1,312	1,279	1,283	1,253	15,038
Atlantic Highlands	447	440	456	501	517	579	605	569	500	467	440	407	5,927
Avon-by-the-Sea	235	246	262	267	293	280	301	284	287	280	281	274	3,289
Belmar	671	666	705	704	757	790	865	816	765	725	733	702	8,899
Bradley Beach	162	170	181	185	202	194	208	196	198	193	194	189	2,273
Brielle	1,452	1,431	1,490	1,617	1,692	1,845	1,933	1,815	1,633	1,534	1,460	1,370	19,274
Colts Neck	7,805	7,888	7,922	8,084	8,330	8,031	7,718	7,728	8,228	7,974	7,955	8,008	95,671
Deal	426	446	475	484	531	508	545	515	520	507	509	497	5,963
Eatontown	6,287	6,223	6,445	6,931	7,242	7,776	8,109	7,634	7,018	6,612	6,349	6,000	82,625
Englishtown	312	318	313	312	309	296	287	286	309	316	327	338	3,724
Fair Haven	705	694	721	790	817	914	955	898	790	737	694	643	9,359
Farmingdale	148	151	149	148	147	141	136	136	147	150	155	161	1,768
Freehold Twp	15,170	15,470	15,242	15,199	15,043	14,415	13,982	13,903	15,050	15,349	15,922	16,448	181,191
Freehold Boro	1,897	1,935	1,906	1,899	1,878	1,801	1,746	1,738	1,881	1,918	1,991	2,054	22,643
Hazlet	5,567	5,551	5,657	6,179	6,424	6,939	7,323	6,974	6,205	5,841	5,605	5,264	73,530
Highlands	250	246	256	280	290	324	339	319	280	261	246	228	3,319
Holmdel	12,495	13,092	12,785	13,280	14,079	13,930	13,514	13,389	13,993	14,140	13,878	13,967	162,542
Howell	17,104	17,736	17,747	18,537	18,653	18,039	18,036	18,219	18,755	18,595	18,585	18,080	218,087
Interlaken	48	51	54	55	60	58	62	58	59	57	58	56	676
Keansburg	282	278	289	316	327	366	382	360	316	295	278	257	3,747

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Keyport	1,535	1,511	1,568	1,720	1,778	1,989	2,079	1,955	1,719	1,603	1,511	1,400	20,367
Little Silver	819	806	837	918	948	1,061	1,109	1,043	917	855	806	747	10,864
Loch Arbour	113	112	119	119	128	133	146	138	129	122	124	118	1,500
Long Branch	3,438	3,394	3,540	3,834	4,002	4,363	4,579	4,309	3,880	3,647	3,477	3,256	45,717
Manalapan	5,762	5,876	5,789	5,771	5,710	5,473	5,309	5,282	5,716	5,829	6,049	6,246	68,812
Manasquan	888	881	933	931	1,002	1,045	1,144	1,079	1,012	958	970	928	11,770
Marlboro	9,270	9,587	9,506	9,295	9,276	8,973	8,316	8,661	9,349	9,199	9,442	9,073	109,947
Matawan	934	956	960	994	1,008	975	938	988	994	991	980	983	11,700
Middletown	18,903	19,375	19,159	20,413	21,176	22,216	22,820	21,442	19,873	19,497	19,345	18,874	243,094
Millstone	6,284	6,306	6,329	6,439	6,494	6,361	6,288	6,214	6,371	6,458	6,559	6,720	76,822
Monmouth Beach	443	436	452	496	513	574	600	564	496	462	436	404	5,876
Neptune	6,220	6,424	6,673	6,812	7,364	7,048	7,369	6,957	7,188	6,966	6,998	6,893	82,913
Neptune City	1,276	1,336	1,423	1,451	1,590	1,522	1,633	1,541	1,559	1,519	1,524	1,488	17,861
Ocean	6,059	6,030	6,160	6,529	6,833	7,111	7,312	6,890	6,618	6,266	6,101	5,872	77,781
Oceanport	974	961	1,003	1,086	1,134	1,236	1,297	1,221	1,099	1,033	985	922	12,952
Red Bank	3,328	3,275	3,400	3,729	3,854	4,312	4,507	4,239	3,727	3,475	3,275	3,034	44,155
Roosevelt	163	166	163	163	161	155	150	149	161	165	171	176	1,944
Rumson	1,011	995	1,033	1,134	1,171	1,311	1,370	1,288	1,133	1,056	995	922	13,421
Sea Bright	919	905	939	1,030	1,065	1,191	1,245	1,171	1,030	960	905	838	12,198
Sea Girt	128	127	134	134	144	151	165	156	146	138	140	134	1,697
Shrewsbury	1,964	1,932	2,006	2,200	2,274	2,544	2,659	2,501	2,199	2,051	1,932	1,790	26,054
South Belmar	39	39	41	41	44	46	51	48	45	42	43	41	522
Spring Lake	166	165	175	174	188	196	214	202	190	180	182	174	2,205
Spring Lake Heights	1,043	1,035	1,096	1,094	1,177	1,228	1,344	1,268	1,189	1,126	1,139	1,090	13,829

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tinton Falls	17,964	18,824	18,156	19,497	19,982	19,866	21,489	20,896	19,214	18,311	18,544	18,791	231,535
Union Beach	528	520	539	592	611	684	715	673	591	551	520	481	7,005
Upper Freehold	8,533	8,415	8,615	8,949	9,199	9,195	9,245	9,077	8,844	8,912	8,850	8,996	106,829
Wall	25,987	26,525	26,465	27,185	28,177	28,243	29,060	28,326	27,556	26,760	27,168	25,435	326,886
West Long Branch	1,790	1,767	1,843	1,996	2,083	2,271	2,384	2,243	2,020	1,898	1,810	1,695	23,800
Total	206,676	210,744	211,045	219,856	226,274	227,960	231,997	225,343	220,925	216,135	215,686	211,559	2,624,200

Congestion Pricing Analysis

As congestion during peak hours on the GSP results in diminished speeds, and stops and starts, vehicle fuel use and GHG emissions are substantially higher than they would be in free flow conditions during non-peak hours. By encouraging users to travel during off-peak periods, an enhancement of the congestion pricing program can increase average speeds and reduce overall emissions. Table 11 shows the potential for reduction in fuel consumption as speeds improve to free flow conditions (55 mph to 60 mph). Speeds in excess of 60 mph can result in increased fuel consumption and emission however.

Table 11

<i>Change in Average Speed:</i>	From 20 mph To 55 mph	From 30 mph To 55 mph	From 40 mph to 55 mph	From 55 mph To 70 mph
<i>Estimated Change in Fuel Consumption:</i>	-43%	-20%	0%	30%

Source: Oregon DOT, Potential Effects of Tolling and Pricing Strategies on Greenhouse Gas Emissions, 2009

As noted above, a study conducted for the NJTA found 10% savings in fuel consumption and GHG emissions through implementation of a congestion pricing program. This would be consistent with an improvement in average speeds from 35 mph to 55 mph in the peak period as noted in Table 1. There are several factors which must be considered in determining the overall effectiveness of the policy.

- Diversions to local un-tolled roadways can result in worsened congestion on those facilities, offsetting benefits gained through the program on the GSP.
- Improvements in travel time have been demonstrated to induce additional travel over time, eroding the congestion improvement effect in the long term.
- The peak spreading effect can diminish if toll prices and the differential between peak and off-peak pricing are not indexed to inflation
- Vacation period trip purposes may be inelastic with respect to toll price and time of travel reducing the effectiveness of this strategy during summer season peak periods.

Area wide studies that have taken these types of factors into account show that benefits to range from 1.5 to 2.5 percent in GHG reduction through congestion pricing. (ODOT, 2009). Studies using FHWA's sketch planning tool have produced mixed findings with respect to the effectiveness of area wide congestion pricing plans on GHG emissions (-0.7 for Los Angeles but net increase of 3% for Washington, DC – FHWA TRUCE Model, 2009).

Because the effectiveness of this strategy is based on facility and area-specific factors, we recommend that the County request a detailed simulation study before supporting implementation.

Although the magnitude of the benefits is unclear, this strategy can be implemented at no net cost to county or state agencies and is likely to produce a net gain in revenue to NJTA overall . A recent study of traffic and revenue on the GSP conducted on behalf of the State of New Jersey (NJ Dept. of Treasury, 2008) indicated that traffic on the GSP is relatively inelastic to price changes. Overall price elasticity on the GSP was approximately -0.15 (for each 10 percent increase in price a 1.5 percent decrease in traffic can be expected.) When factoring in the price elasticity response, a 15 percent increase during peak periods (similar in magnitude to that evaluated by NJDOT for a 10% savings in emissions) in toll prices can be expected to an overall net gain in revenue of 12 percent.