- Draft -

Soak Length Activity Factors for Start Emissions

Report Number M6.FLT.003

Edward L. Glover
David J. Brzezinski

U.S.EPA Assessment and Modeling Division

1.0 INTRODUCTION

MOBILE6 will compute and report (as a user option) hourly emission factors for start, running, and evaporative emissions. These outputs will be in addition to the standard daily emission estimates which are currently calculated by MOBILE5. The hourly emission factors will allow the MOBILE6 model to provide more precise output that accounts for the time of day that vehicle emissions occur. The temporal distribution of emissions is an important factor in the formation of diurnal evaporative and start emissions.

The hourly emission estimates require considerable vehicle activity information and analysis. The term "activity" refers to the vehicle's operating mode such as running, idling, parked (soaking), etc. The specific activity information needed fro emissions estimates includes soak durations, time of soak, trip lengths in minute and miles, time of trip, timing of the soak with respect to the engine operation (before or after) and other information. This document (M6.FLT.003) discusses the issue of vehicle soak time only as it pertains to start emissions. Other activity estimates needed to develop daily emission factors for exhaust, diurnal, running loss or resting loss emissions will be documented in other MOBILE6 documents with the report numbers "M6.FLT.XXX".

2.0 DATA SOURCES USED

The primary data source for this analysis are the EPA instrumented vehicle studies conducted in Baltimore and Spokane. In these studies, instrumentation to monitor vehicle usage was installed with the motorists' permission on 168 randomly selected vehicles while they were tested at an Inspection / Maintenance (I/M) station. The motorists returned one or two weeks later to have the instrumentation removed. Information from more than 8,500 vehicle-trips was recorded. The raw data collected from the studies were processed by the Radian Corporation under EPA contract to create a "trip characteristics" file. This processed file was used to develop the hourly soak time distributions. For more details regarding the instrumented vehicle studies and the data processing, please refer to the document "Travel Trip Characteristics Analysis" Final Report under EPA Contract 68-C1-0079 WA 2-05 with Sierra Research.

3.0 METHODOLOGY

This section describes the basic methodology used to develop the soak activity estimates used to calculate start emissions. The process consisted of several steps. These are discussed below.

3.1 Definition of a Soak

For the purpose of activity estimates for start emissions, a soak is defined as the duration of time preceding a vehicle start in which the vehicle's engine is not operating, and the ensuing vehicle start did not result in a stall (stalls were removed from the database). Throughout this document the duration of the soak in units of time will be referred to as the "soak length". Also, by convention, if this soak period preceding the vehicle start is less than 12 hours then the engine start is a "hot start". If the soak period preceding the vehicle start is more than 12 hours then the engine start is a "cold start". Vehicle start emissions which are defined as "cold start" are assumed not to vary based on the prior soak length (as long as the length exceeds 12 hours). The 12 hour period was chosen for consistency with the Federal Test Procedure definition of hot and cold start.

3.2 Hourly Intervals

The 24 hour day was divided into 14 different hourly groups. Thirteen of these groups have a duration of one hour. These start at 6:00AM and run through 7:59:59PM. The fourteenth hour contains the remaining nighttime and early morning hours as one

interval. Collapsing these hours into one was done for three reasons: (1) the emissions contributed during the night have a relatively smaller impact on daily ozone or CO formation than those contributed during the morning or day, (2) there were relatively little data for these time periods, and (3) what data were available produced results which showed very little hour to hour variance. The hourly intervals are shown in Table 1.

3.3 Factors Affecting Start Activity Values

3.3.1 Weekdays Versus Weekends

For a number of the soak parameters, a significant difference existed between the value for the weekday and the value for the weekend. Conceptually this make sense since most motorists have different usage patterns for their vehicles on weekdays than on weekends. Differences may also exist for the various days of the week; however, the database was too small to reliably discern these differences.

The MOBILE6 model will distinguish between weekend and weekday in terms of activity and emissions, and a user input will be required to tell the model which one is to be reported. The default will likely be the "weekday."

Table 1
Hourly Intervals

Nominal Name	Hourly Range	Time
6	6 - 7	6 am to 7 am
7	7 - 8	7 am to 8 am
8	8 - 9	8 am to 9 am
9	9 - 10	9 am to 10 am
10	10 - 11	10 am to 11 am
11	11 - 12	11 am to noon
12	12 - 13	noon to 1 pm
13	13 - 14	1 pm to 2 pm
14	14 - 15	2 pm to 3 pm

15	15 - 16	3 pm to 4 pm
16	16 - 17	4 pm to 5 pm
17	17 - 18	5 pm to 6 pm
18	18 - 19	6 pm to 7 pm
24	19 - 24 and 24 - 5	7 pm to 6 am

3.3.2 Vehicle Type and Model Year

The vehicle "start" activity parameters such as the number of trips per day, and the distribution of soak time after the trip end were also investigated by vehicle type or vehicle age. Slight differences were found between cars and trucks in terms of starts per day, with trucks having slightly more starts per day (shown in Table 2a). However, little significant difference in the hourly soak length distributions were found between cars and trucks or even by vehicle model year. The lack of difference in the hourly distributions between cars and trucks was not particularly surprising since the number of trips per day are fairly similar, and most light trucks today play virtually the same role as cars. Exceptions might be in rural areas or heavily industrial areas where trucks frequently are used to haul equipment or products.

The lack of difference between model years is a little more surprising. One would expect an older vehicle to have a higher percentage of longer soaks, and possibly shorter trips (i.e., the vehicle sits more and goes on fewer long trips because it is a second vehicle). However, a limited analysis of the data did not conclusively demonstrate these hypotheses. One reason might be the relatively small sample of older vehicles. For example, less than 15 percent of the vehicle sample were more than 10 years old at the time of the testing. This was also too small a sub-sample to further split into 28 hourly and weekday/weekend groups, and still obtain reasonable results. The other reason might be recruitment process which was biased to obtain vehicles which were a motorists' primary vehicles rather than spare second vehicles. As a result, the hourly distributions of soak length shown in Tables 3a and 3b and 4a and 4b represent both cars and trucks and all vehicle ages.

Since the default MOBILE6 hourly activity estimates are based exclusively on 168 vehicles, and thus cannot possibility reflect all geographical areas, times, or other variables, the user will have the option of providing data on soak length prior to vehicle starts into the MOBILE6 model from an external file.

3.4 Starts per Car-Day

The first necessary parameter in the model is the estimate for starts/car-day. Four different estimates were developed. There is one estimate for each combination of car versus truck and weekday versus weekend. These are average values obtained from the instrumented vehicle database. The values are shown in Table 2a.

Table 2a
Starts per Car per Day

Cars		**Trucks**	
Weekday	Weekend	Weekday	Weekend
7.28	5.41	8.06	5.68

These estimates based on the instrumented car data are subject to revision pending completion of a thorough analysis of national trip data by an EPA contractor. The values could potentially vary considerably from those presented here.

3.5 Daily Start Distribution by Time of Day Increment

Table 2b contains the distribution of the vehicle starts by hourly group. An estimate is provided for each of the fourteen groups, and separate estimates are provided for weekends and weekdays. For example, Table 2b shows that approximately 2.04 percent of the starts occur during the period from 6:00 AM to 6:59:59 AM. The data which underlies Table 2b were obtained from the instrument vehicle database. Each column sums to 100 percent.

Table 2b **Distribution of Starts by Hour** (in percent)		
Hour	**Weekday**	**Weekend**
6	2.04	0.91
7	5.54	1.93
8	6.02	3.10
9	4.73	6.45
10	5.16	6.91
11	6.72	7.97
12	8.07	10.16
13	7.30	7.26
14	8.04	8.89
15	8.98	7.36
16	8.41	8.02
17	7.73	7.11
18	6.02	6.15
24	15.24	17.78

3.6 Soak Length Distribution Within Each Hourly Group

The MOBILE6 model will contain a soak length distribution for each of the 14 hourly groups, and for both weekdays and weekends. As a result, there will be 28 soak length distributions. Each of the 28 distributions contains 70 values. The use of 70 values to represent the entire 720 minute distribution saves computing time and memory. The time intervals represented by these 70 soak lengths are shown in the leftmost column in Table 3a and 3b and Table 4a and 4b. Tables 3a and 3b show the soak length distributions for weekdays, and Table 4a and 4b show the soak length distributions for weekends. The first column in the tables is the soak length interval in minutes.

The remaining columns in Tables 3a and 3b and Tables 4a and 4b are the soak length distributions. Each entry in a given column represents the precentage of the distribution for a given interval. For example, in Table 3a the column labeled "six" represents 6:00AM to 6:59:59 AM. The first entry in the column (1.55039%) is the percent of soaks that occur between 6:00AM to 6:59:59 AM that are less than one minute which were not stalls. The remaining entries in the column are analogous. The final entry at 720+ is the percent of soak which are longer than 720 minutes (45.7364%). Summing the column should give a total value of 100 percent. Vehicle stalls will be handled separately.

The use of a lookup table to contain the cumulative soak length distribution of each hourly group was necessary because no smooth functional form could be found which adequately fit the data for all of the groups. This can be seen in Figure 1 which shows the cumulative distribution versus soak length for the weekday 6 - 7 AM group (denoted as "six" in the legend), the weekday 8 - 9 AM group (denoted as "eight" in the legend), and the weekday 1 - 2 PM group (denoted as "thirteen" in the legend). Notice the considerable differences between these distributions, and their difficult to fit data profiles. For example, the 6 to 7 AM distribution tends to rise quickly to 20 percent, level off around 20 percent until 450 minutes, and then start an upward movement. This is in direct contrast to the cumulative distribution of the 1 to 2 PM group which shows very rapid rise at first and an asymptotic shape as 720 minutes is approached.

3.7 Using the Soak Activities in the MOBILE6 Model

3.7.1 Hourly Start Emission Calculations

The start emission effects for each of the 70 soak length intervals in grams (see document M6.STE.003) are multiplied by the analogous soak length activity percentages shown in Tables 3a through 4b. As noted in Section 3.6 there are 70 intervals, some of which last longer than one minute, rather than 720 one minute intervals. An average start emission value (in grams) for a given hourly group is obtained by summing the 70 start emission and activity products together. This sum is then multiplied by the number of starts per day per vehicle which occur in the given hourly group to produce the average start emission emission level for the given hourly group. This procedure was repeated for all of the 28 hourly and weekday - weekend groups to produce an average hourly start emission value for each group. These hourly average start emission values will be reported by the MOBILE6 model directly.

As an example calculation: the number of starts per vehicle for a given hourly group is calculated for the 10 to 11 AM weekday hourly group for cars by multiplying 7.28 starts/day-car x 5.16 percent (Table 2b) = 0.376 starts/vehicle.

3.7.2 Daily Start Emission Calculations

The individual hourly start emission values will also be used to calculate an average daily start emission value in MOBILE6. This value is analogous to those reported by MOBILE4 and MOBILE5. It is the product of the number of starts per day, and a weighted average of the average hourly start emissions. The average number of starts per day are shown in Table 2a. The hourly weighting factors used to weight the hourly groups together are the values shown in Table 2b.

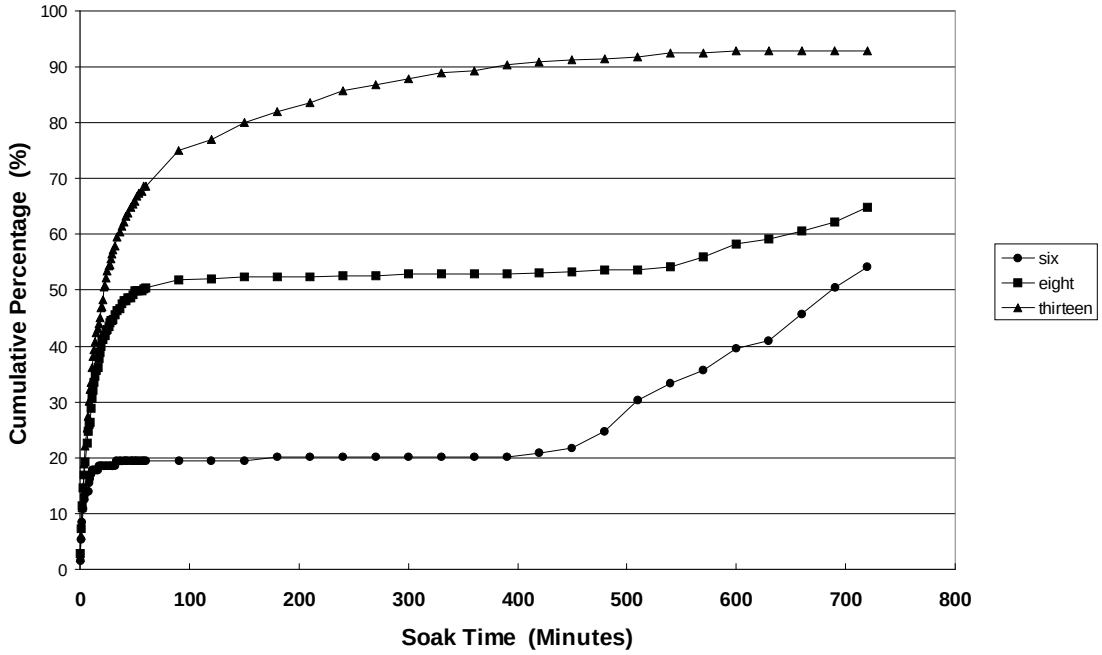
			Table 3a - Weekdays				
time	six	seven	eight	nine	ten	eleven	twelve
0	1.55039	2.51397	2.86458	0.66890	1.54321	2.10280	1.71756
1	3.87597	2.51397	4.42708	4.68227	6.17284	1.86916	4.96183
2	3.10078	6.14525	4.16667	5.01672	6.17284	4.67290	5.53435
3	2.32558	3.35196	3.12500	5.35117	4.01235	4.90654	4.96183
4	1.55039	3.07263	2.34375	2.67559	4.01235	4.67290	4.77099
5	0.77519	0.55866	2.34375	2.00669	2.16049	3.27103	2.48092
6	0.77519	0.83799	3.38542	2.34114	3.39506	3.73832	3.81679
7	0.00000	1.11732	2.08333	1.00334	1.23457	3.27103	2.09924
8	1.55039	0.55866	1.30208	1.33779	0.61728	1.16822	2.09924
9	0.77519	0.27933	0.26042	0.66890	0.92593	3.03738	1.71756
10	0.77519	0.55866	2.60417	1.67224	1.85185	0.93458	0.95420
11	0.77519	0.27933	1.82292	2.00669	2.46914	1.86916	1.90840
12	0.00000	0.55866	1.30208	2.67559	1.23457	3.27103	1.90840
13	0.00000	0.55866	1.56250	1.00334	0.30864	0.93458	0.57252
14	0.00000	0.55866	1.04167	0.66890	1.23457	0.70093	1.14504
15	0.00000	0.55866	1.04167	1.00334	0.92593	1.16822	1.52672
16	0.00000	0.00000	0.52083	1.33779	0.61728	0.93458	0.95420
17	0.77519	0.27933	1.56250	1.00334	1.23457	1.40187	1.14504
18	0.00000	0.83799	1.04167	0.33445	1.23457	0.46729	0.76336
19	0.00000	0.00000	1.04167	1.00334	0.61728	0.70093	1.90840
20	0.00000	0.55866	1.30208	1.33779	1.54321	0.70093	1.33588
21	0.00000	0.83799	0.00000	0.33445	1.23457	1.16822	0.95420
22	0.00000	0.00000	0.78125	1.00334	0.61728	0.46729	0.57252
23	0.00000	0.00000	0.00000	0.00000	1.54321	1.40187	0.76336
24	0.00000	0.00000	0.78125	2.34114	0.61728	0.46729	0.57252
25	0.00000	0.00000	0.26042	1.00334	0.00000	0.46729	0.38168
26	0.00000	0.00000	0.52083	0.66890	0.92593	0.93458	1.14504
27	0.00000	0.00000	0.78125	0.33445	0.00000	0.46729	0.57252
28	0.00000	0.27933	0.26042	0.33445	0.00000	1.16822	0.19084
29	0.00000	0.27933	0.00000	0.33445	0.92593	0.23364	0.57252
30	0.00000	0.00000	0.26042	1.00334	0.30864	0.46729	0.38168
32	0.00000	0.00000	0.78125	1.33779	0.92593	1.63551	1.14504
34	0.77519	0.55866	0.78125	0.33445	0.61728	1.40187	2.09924
36	0.00000	0.00000	0.26042	0.00000	1.23457	1.16822	1.33588
38	0.00000	0.27933	1.04167	0.66890	0.30864	0.46729	0.57252
40	0.00000	0.00000	0.52083	1.00334	1.23457	1.40187	0.76336
42	0.00000	0.00000	0.00000	1.33779	0.92593	0.46729	1.14504
44	0.00000	0.27933	0.52083	0.66890	1.23457	1.40187	0.95420
46	0.00000	0.00000	0.00000	0.00000	0.61728	0.46729	0.95420
48	0.00000	0.55866	0.52083	2.00669	0.61728	0.93458	0.38168
50	0.00000	0.27933	0.78125	0.00000	1.85185	0.70093	0.38168
52	0.00000	0.27933	0.00000	0.33445	0.92593	0.46729	0.76336
54	0.00000	0.00000	0.00000	0.33445	0.61728	0.23364	1.52672
56	0.00000	0.27933	0.00000	0.33445	0.92593	0.70093	0.76336
58	0.00000	0.00000	0.26042	0.66890	0.30864	0.23364	1.33588
60	0.00000	0.00000	0.26042	0.00000	0.30864	0.00000	0.38168
90	0.00000	0.00000	1.30208	6.02007	7.40741	4.90654	5.15267
120	0.00000	0.27933	0.26042	4.01338	4.01235	4.90654	2.29008
150	0.00000	0.00000	0.26042	2.34114	1.85185	3.03738	1.90840
180	0.77519	0.00000	0.00000	0.00000	0.30864	3.03738	2.29008
210	0.00000	0.00000	0.00000	0.00000	0.92593	2.33645	1.71756
240	0.00000	0.27933	0.26042	0.33445	1.23457	2.80374	2.86260
270	0.00000	0.00000	0.00000	0.33445	0.30864	2.57009	3.62595
300	0.00000	0.27933	0.26042	0.00000	0.30864	0.00000	2.29008
330	0.00000	0.27933	0.00000	0.00000	0.61728	0.23364	0.38168
360	0.00000	0.27933	0.00000	0.00000	0.30864	0.00000	0.76336
390	0.00000	0.27933	0.00000	0.33445	0.30864	0.70093	0.00000
420	0.77519	0.55866	0.26042	0.00000	0.30864	0.23364	0.00000
450	0.77519	1.39665	0.26042	0.33445	0.00000	0.00000	0.38168
480	3.10078	1.11732	0.26042	0.00000	0.30864	0.23364	0.38168
510	5.42636	0.83799	0.00000	0.00000	0.00000	0.00000	0.00000
540	3.10078	1.11732	0.52083	0.66890	0.61728	0.00000	0.00000
570	2.32558	2.79330	1.82292	0.66890	0.61728	0.23364	0.00000
600	3.87597	1.67598	2.34375	0.66890	0.30864	0.00000	0.00000
630	1.55039	5.58659	0.78125	1.00334	0.61728	0.46729	0.38168
660	4.65116	3.63128	1.56250	0.66890	0.61728	0.46729	0.00000
690	4.65116	3.91061	1.56250	2.00669	1.23457	0.23364	0.19084
720	3.87597	3.35196	2.60417	0.33445	0.30864	0.00000	0.00000
720+	45.73643	42.73743	35.15625	24.08027	15.12346	8.87850	6.48855

			Table 3b - Weekdays				
time	thirteen	fourteen	fifteen	sixteen	seventeen	eighteen	twenty-four
0	2.15054	1.36452	1.39616	2.02578	2.61044	1.29870	1.75077
1	3.87097	4.87329	3.83944	4.41989	3.61446	3.37662	3.39856
2	4.94624	4.87329	5.93368	4.60405	6.02410	3.63636	3.70752
3	3.87097	4.67836	4.71204	4.41989	6.62651	3.89610	2.88363
4	4.08602	1.94932	3.49040	3.49908	3.61446	3.11688	2.26571
5	3.22581	4.67836	3.66492	4.05157	2.00803	3.37662	1.75077
6	3.22581	2.72904	4.01396	2.39411	2.20884	3.89610	1.54480
7	2.15054	3.11891	2.61780	1.84162	2.40964	2.33766	1.64779
8	2.58065	2.53411	2.61780	2.02578	1.80723	3.11688	0.72091
9	2.15054	2.33918	1.74520	2.02578	1.40562	0.25974	0.41195
10	1.29032	1.94932	2.44328	1.47330	1.00402	1.81818	0.72091
11	2.58065	1.75439	1.57068	2.20994	1.40562	1.03896	0.72091
12	1.93548	1.36452	1.57068	0.92081	1.00402	2.07792	0.72091
13	1.29032	1.75439	1.22164	1.28913	1.20482	1.55844	0.51493
14	1.50538	0.97466	0.69808	0.55249	1.00402	0.77922	0.92688
15	1.50538	0.38986	1.04712	1.47330	1.40562	1.29870	1.33883
16	0.86022	0.19493	1.04712	0.92081	0.80321	1.81818	0.61792
17	0.86022	1.36452	0.34904	0.36832	0.40161	1.03896	0.41195
18	1.07527	1.55945	1.22164	1.10497	0.80321	0.00000	1.13285
19	1.72043	0.38986	0.69808	1.10497	1.40562	1.03896	0.61792
20	0.21505	0.77973	1.04712	1.10497	0.60241	0.25974	1.02987
21	1.29032	0.38986	0.87260	0.92081	0.60241	0.77922	0.41195
22	2.15054	1.16959	1.04712	0.55249	0.40161	1.03896	0.72091
23	0.21505	0.77973	1.04712	0.73665	1.20482	1.29870	1.13285
24	1.50538	0.77973	0.69808	1.10497	1.20482	0.25974	0.82389
25	1.29032	0.58480	0.69808	0.55249	0.20080	0.25974	0.30896
26	0.86022	0.77973	0.17452	0.92081	0.80321	0.25974	0.30896
27	0.21505	1.16959	0.34904	0.73665	1.20482	0.77922	0.41195
28	1.07527	0.77973	0.52356	0.55249	0.80321	0.51948	0.41195
29	0.86022	0.19493	0.34904	0.36832	0.40161	1.55844	0.30896
30	0.64516	0.58480	0.52356	1.28913	0.20080	0.51948	0.61792
32	0.64516	1.36452	1.22164	1.10497	1.20482	0.51948	1.13285
34	1.72043	1.36452	0.69808	0.73665	1.60643	0.77922	0.82389
36	0.86022	1.75439	0.34904	1.28913	0.80321	0.77922	0.92688
38	1.07527	0.97466	1.22164	0.55249	0.80321	0.77922	0.51493
40	0.64516	0.97466	1.39616	0.92081	0.80321	0.77922	0.92688
42	1.07527	0.77973	0.52356	0.73665	1.00402	0.77922	0.20597
44	0.64516	0.58480	1.04712	0.36832	0.80321	1.29870	0.41195
46	1.07527	0.77973	1.22164	0.73665	0.40161	0.51948	0.72091
48	0.43011	1.75439	0.34904	0.73665	0.60241	0.51948	0.92688
50	0.64516	0.00000	0.17452	0.92081	0.60241	0.51948	0.30896
52	0.86022	0.58480	0.34904	0.92081	0.00000	1.03896	1.23584
54	0.43011	0.58480	0.52356	0.55249	1.00402	1.03896	0.92688
56	0.43011	0.97466	0.87260	1.28913	0.80321	0.77922	0.82389
58	0.86022	0.97466	0.52356	0.36832	0.20080	0.77922	0.82389
60	0.00000	0.38986	0.17452	0.18416	1.00402	0.51948	0.51493
90	6.45161	7.21248	5.58464	6.62983	5.42169	10.90909	8.44490
120	1.93548	4.67836	4.01396	4.78821	4.81928	4.41558	6.48816
150	3.01075	4.28850	2.44328	2.57827	2.20884	5.71429	5.87024
180	1.93548	2.33918	3.14136	1.84162	2.40964	4.67532	4.84037
210	1.72043	1.36452	1.22164	1.65746	2.20884	1.81818	3.29557
240	2.15054	1.36452	1.04712	3.13076	0.60241	1.03896	2.88363
270	1.07527	0.77973	0.69808	1.28913	2.40964	1.81818	1.64779
300	1.07527	0.97466	0.52356	1.28913	1.60643	1.03896	1.33883
330	1.07527	0.58480	0.52356	0.55249	0.60241	0.25974	2.16272
360	0.21505	0.19493	1.04712	0.36832	1.00402	0.51948	1.13285
390	1.07527	1.16959	1.91972	0.36832	0.20080	0.51948	0.92688
420	0.64516	0.97466	1.57068	0.00000	0.20080	0.00000	1.02987
450	0.21505	1.36452	0.87260	0.18416	0.00000	0.25974	0.72091
480	0.21505	0.19493	1.57068	1.65746	1.40562	0.00000	1.54480
510	0.43011	0.38986	1.39616	1.84162	2.61044	0.00000	1.95675
540	0.64516	0.77973	3.83944	4.78821	2.61044	0.25974	2.26571
570	0.00000	0.38986	1.91972	0.92081	3.21285	0.77922	0.92688
600	0.43011	0.00000	0.17452	0.36832	1.60643	3.11688	0.30896
630	0.00000	0.00000	0.34904	0.18416	1.40562	0.25974	0.61792
660	0.00000	0.19493	0.00000	0.36832	0.00000	0.51948	0.92688
690	0.00000	0.00000	0.00000	0.00000	0.00000	0.77922	0.61792
720	0.00000	0.00000	0.00000	0.18416	0.00000	0.00000	0.41195
720+	7.09677	4.09357	2.26876	2.02578	1.40562	1.55844	4.11946

			Table 4a - Weekends				
time	six	seven	eight	nine	ten	eleven	twelve
0	0.00000	0.05263	0.00000	0.03937	0.00000	0.02548	0.01500
1	0.11111	0.02632	0.03279	0.02362	0.05147	0.02548	0.05500
2	0.05556	0.07895	0.01639	0.05512	0.05147	0.01911	0.05500
3	0.16667	0.05263	0.03279	0.05512	0.05147	0.05096	0.03500
4	0.05556	0.00000	0.06557	0.00787	0.03676	0.02548	0.04000
5	0.00000	0.02632	0.03279	0.06299	0.02206	0.03822	0.04000
6	0.05556	0.00000	0.01639	0.00000	0.03676	0.00637	0.02500
7	0.00000	0.05263	0.01639	0.00787	0.01471	0.01911	0.04500
8	0.00000	0.00000	0.01639	0.01575	0.02941	0.01911	0.03500
9	0.00000	0.00000	0.03279	0.00787	0.02206	0.03185	0.01500
10	0.00000	0.00000	0.00000	0.00787	0.00000	0.00637	0.01500
11	0.00000	0.00000	0.00000	0.00787	0.00000	0.00637	0.03500
12	0.00000	0.00000	0.00000	0.02362	0.01471	0.02548	0.01500
13	0.00000	0.00000	0.00000	0.00787	0.01471	0.01274	0.00000
14	0.05556	0.00000	0.00000	0.00787	0.02206	0.01274	0.01500
15	0.00000	0.00000	0.00000	0.00000	0.01471	0.00000	0.01500
16	0.00000	0.00000	0.00000	0.01575	0.00000	0.00000	0.00500
17	0.00000	0.00000	0.01639	0.02362	0.00735	0.02548	0.01500
18	0.00000	0.00000	0.01639	0.00000	0.01471	0.00637	0.00500
19	0.00000	0.00000	0.01639	0.00787	0.00000	0.01274	0.01000
20	0.00000	0.00000	0.00000	0.00787	0.00735	0.00637	0.01500
21	0.00000	0.00000	0.00000	0.00000	0.00000	0.00637	0.01000
22	0.00000	0.00000	0.00000	0.02362	0.00000	0.01274	0.01000
23	0.00000	0.00000	0.00000	0.01575	0.00000	0.01274	0.00000
24	0.00000	0.00000	0.00000	0.00000	0.00000	0.00637	0.00000
25	0.00000	0.00000	0.03279	0.00000	0.00000	0.00637	0.01500
26	0.00000	0.00000	0.00000	0.00000	0.00735	0.00000	0.00500
27	0.00000	0.00000	0.01639	0.01575	0.01471	0.01274	0.00500
28	0.00000	0.00000	0.00000	0.00787	0.00000	0.00637	0.00500
29	0.00000	0.00000	0.00000	0.00000	0.00000	0.00637	0.00000
30	0.00000	0.00000	0.00000	0.00000	0.00735	0.02548	0.01000
32	0.00000	0.00000	0.00000	0.00787	0.02206	0.04459	0.00000
34	0.00000	0.00000	0.01639	0.00000	0.03676	0.00000	0.00500
36	0.00000	0.00000	0.01639	0.01575	0.00735	0.00637	0.00500
38	0.00000	0.00000	0.00000	0.00000	0.00000	0.00637	0.02500
40	0.00000	0.00000	0.00000	0.01575	0.02941	0.01274	0.00500
42	0.00000	0.00000	0.01639	0.00000	0.00000	0.00637	0.00000
44	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02000
46	0.00000	0.00000	0.00000	0.00787	0.00000	0.00000	0.01500
48	0.00000	0.00000	0.01639	0.00000	0.00000	0.01911	0.00000
50	0.00000	0.00000	0.00000	0.00787	0.00735	0.01274	0.00000
52	0.00000	0.00000	0.00000	0.00000	0.02206	0.01274	0.00000
54	0.00000	0.00000	0.00000	0.00000	0.00735	0.00637	0.02000
56	0.00000	0.00000	0.00000	0.00000	0.00735	0.00000	0.00500
58	0.00000	0.00000	0.01639	0.00787	0.00000	0.00000	0.01000
60	0.00000	0.00000	0.00000	0.00787	0.00735	0.00637	0.00500
90	0.00000	0.00000	0.03279	0.03150	0.04412	0.08917	0.04000
120	0.00000	0.00000	0.00000	0.02362	0.00735	0.01911	0.03500
150	0.00000	0.00000	0.00000	0.00787	0.00735	0.02548	0.02500
180	0.00000	0.00000	0.00000	0.00000	0.02206	0.00000	0.02500
210	0.00000	0.00000	0.00000	0.00000	0.00000	0.00637	0.01000
240	0.00000	0.00000	0.00000	0.01575	0.00000	0.01274	0.00500
270	0.00000	0.00000	0.00000	0.00000	0.00735	0.00000	0.00000
300	0.00000	0.02632	0.00000	0.00000	0.00000	0.00000	0.00500
330	0.00000	0.02632	0.00000	0.00000	0.00000	0.00637	0.01000
360	0.05556	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
390	0.05556	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
420	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
450	0.05556	0.02632	0.01639	0.01575	0.00000	0.00000	0.00000
480	0.00000	0.02632	0.00000	0.00787	0.00000	0.00000	0.00000
510	0.05556	0.02632	0.00000	0.00787	0.01471	0.00000	0.00500
540	0.05556	0.05263	0.01639	0.01575	0.00735	0.00000	0.00000
570	0.00000	0.00000	0.04918	0.02362	0.00735	0.00637	0.00500
600	0.00000	0.02632	0.01639	0.00787	0.00735	0.00637	0.00000
630	0.00000	0.00000	0.01639	0.03150	0.00735	0.01274	0.00500
660	0.00000	0.05263	0.03279	0.00000	0.00000	0.00637	0.00000
690	0.00000	0.00000	0.00000	0.00787	0.00000	0.00000	0.00500
720	0.00000	0.02632	0.03279	0.00787	0.01471	0.00000	0.00000
>720	0.22222	0.42105	0.34426	0.27559	0.26471	0.20382	0.14500

			Table 4b - Weekends				
time	thirteen	fourteen	fifteen	sixteen	seventeen	eighteen	twenty-four
0	0.00699	0.03429	0.01379	0.00704	0.00758	0.02542	0.01172
1	0.04196	0.06286	0.06207	0.04225	0.02273	0.04237	0.04297
2	0.05594	0.04571	0.04828	0.03521	0.03788	0.05085	0.05469
3	0.04196	0.02857	0.06207	0.04225	0.04545	0.03390	0.04688
4	0.04196	0.05143	0.02759	0.04225	0.03030	0.02542	0.05078
5	0.01399	0.02286	0.03448	0.04225	0.01515	0.00847	0.03125
6	0.03497	0.01143	0.02069	0.02817	0.01515	0.00000	0.02734
7	0.02098	0.02857	0.01379	0.03521	0.03030	0.03390	0.02344
8	0.00699	0.02857	0.04138	0.02817	0.00758	0.01695	0.00391
9	0.00699	0.01714	0.03448	0.02817	0.03030	0.01695	0.01563
10	0.01399	0.02286	0.00690	0.01408	0.01515	0.01695	0.01172
11	0.02797	0.00000	0.01379	0.00704	0.00758	0.01695	0.01953
12	0.01399	0.01143	0.00000	0.00704	0.00000	0.03390	0.00000
13	0.02797	0.00571	0.00690	0.02113	0.00758	0.00000	0.00000
14	0.00000	0.00000	0.00000	0.01408	0.04545	0.00847	0.00000
15	0.00699	0.01714	0.00000	0.00000	0.03030	0.00847	0.00000
16	0.00699	0.01143	0.02069	0.00000	0.00758	0.00000	0.01563
17	0.01399	0.00571	0.01379	0.00704	0.03030	0.01695	0.00391
18	0.01399	0.00571	0.01379	0.00704	0.00758	0.00000	0.00781
19	0.00699	0.03429	0.00000	0.02817	0.00758	0.01695	0.00391
20	0.00699	0.01143	0.00690	0.01408	0.00758	0.00847	0.00391
21	0.00000	0.01143	0.01379	0.00000	0.01515	0.00000	0.00781
22	0.01399	0.00000	0.00000	0.00704	0.03030	0.01695	0.00000
23	0.00699	0.00571	0.00690	0.01408	0.00758	0.00000	0.00391
24	0.00000	0.01143	0.02069	0.01408	0.00758	0.00847	0.00781
25	0.00000	0.00571	0.00000	0.02113	0.00000	0.00000	0.00391
26	0.00000	0.01143	0.00690	0.00000	0.00000	0.00000	0.00000
27	0.01399	0.00571	0.00000	0.00704	0.00000	0.00000	0.00000
28	0.01399	0.00571	0.00690	0.01408	0.00000	0.00847	0.00000
29	0.01399	0.00571	0.00690	0.00000	0.00000	0.00000	0.00781
30	0.01399	0.00000	0.00000	0.00704	0.00000	0.00847	0.00000
32	0.00000	0.01143	0.00690	0.02113	0.01515	0.01695	0.00781
34	0.02098	0.01714	0.00690	0.00704	0.00758	0.00847	0.00000
36	0.02098	0.01143	0.00690	0.00000	0.00000	0.00847	0.00000
38	0.01399	0.00000	0.02759	0.00704	0.00000	0.00000	0.00391
40	0.00000	0.00000	0.00690	0.04225	0.02273	0.00000	0.01172
42	0.01399	0.01714	0.02069	0.01408	0.02273	0.00000	0.00391
44	0.01399	0.00000	0.00690	0.00000	0.01515	0.02542	0.00391
46	0.01399	0.00571	0.00690	0.02817	0.00758	0.01695	0.00391
48	0.01399	0.01143	0.02759	0.00000	0.00000	0.00000	0.00781
50	0.01399	0.00571	0.00690	0.00000	0.02273	0.00000	0.00391
52	0.00699	0.01714	0.00690	0.00000	0.00758	0.00847	0.01563
54	0.01399	0.00000	0.01379	0.02113	0.01515	0.00000	0.00391
56	0.00000	0.01714	0.00690	0.00000	0.00000	0.02542	0.00000
58	0.00000	0.00571	0.01379	0.02113	0.00000	0.00000	0.00391
60	0.01399	0.00000	0.00000	0.00000	0.01515	0.00000	0.00391
90	0.06294	0.08000	0.04138	0.09155	0.09091	0.09322	0.08984
120	0.04895	0.04571	0.04828	0.04225	0.06818	0.11864	0.05469
150	0.01399	0.04000	0.04138	0.02817	0.03030	0.05932	0.05469
180	0.03497	0.02286	0.03448	0.05634	0.03030	0.01695	0.06250
210	0.02098	0.00000	0.01379	0.00000	0.00000	0.05085	0.05078
240	0.00699	0.02857	0.02759	0.02113	0.01515	0.01695	0.02734
270	0.00699	0.00000	0.00690	0.02113	0.01515	0.03390	0.03125
300	0.00699	0.01143	0.01379	0.01408	0.01515	0.01695	0.04688
330	0.00699	0.00571	0.00000	0.00704	0.04545	0.00847	0.00391
360	0.00699	0.00000	0.00000	0.00000	0.03030	0.00000	0.00781
390	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01563
420	0.00000	0.00000	0.00000	0.00000	0.01515	0.00847	0.02344
450	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
480	0.00000	0.01143	0.00690	0.01408	0.00000	0.00000	0.00391
510	0.00000	0.00571	0.00690	0.00704	0.00000	0.02542	0.01953
540	0.00000	0.00000	0.00690	0.00000	0.00758	0.00000	0.00391
570	0.00000	0.00571	0.00000	0.00000	0.00758	0.00847	0.00391
600	0.00000	0.00000	0.00000	0.00000	0.00758	0.00000	0.00781
630	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00781
660	0.00000	0.00000	0.00690	0.00000	0.00000	0.00847	0.00000
690	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00391
720	0.00699	0.00571	0.00000	0.00000	0.00000	0.00000	0.00000
>720	0.12587	0.09714	0.07586	0.00000	0.00000	0.00000	0.00000

Figure 1
Cumulative Soak Length Distribution for Selected Hourly Groups
(Soaks are Prior to Vehicle Start)



COMMENTS

Comments on this report and its proposed use in MOBILE6 should be sent to the attention of the author, and submitted electronically to mobile@epamail.epa.gov, or by fax to (313)741-7939, or by mail to MOBILE6 Review Comments, US EPA Assessment and Modeling Division, 2565 Plymouth Road, Ann Arbor MI 48105. Electronic submission of comments is preferred, since we will make any comments available on our web site. In your comments, please note clearly the document that you are commenting on including the report title and the code number listed. Please be sure to include your name, address, affiliation, and any other pertinent information.