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Cape Cod National Seashore
Massachusetts

Visitor Vehicle Air and Noise Emissions Study
Cape Cod National Seashore
Final Report

September 2005

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Acknowledgements

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1 INTRODUCTION

Massachusetts' Cape Cod National Seashore (Cape Cod) is set to establish the FlexRoute passenger bus shuttle service in the summer of 2006. The FlexRoute bus will fill the Cape transit gap - year-round - between Orleans and Provincetown along Route 6, and in Harwich and Brewster. It will connect with Plymouth and Brockton (P&B) coach service, as well as with the airport and ferry docks in Provincetown. The main goal of the Cape Cod shuttle program is to attract new visitors to the park while providing public transportation options for visitors without automobiles.

Cape Cod, a non-attainment area for ozone, includes national park land, state park land, and private property. The Commonwealth of Massachusetts maintains an air quality monitoring station at Truro. It should be noted that Route 6 is the primary arterial in this area, with a substantial amount of traffic not directly associated with the park.

This study establishes the baseline air and noise emissions for a portion of Route 6 between Orleans and Provincetown on Cape Cod before the implementation of shuttle service.The report consists of an Introduction, a section describing Cape Cod, a section on Air Emissions, a section on Noise Emissions, a Results section, a Conclusions and Recommendations section, and a References section. All input data for the air and noise emissions prediction models are presented in Appendix A, and all outputs for the air emissions prediction model are presented in Appendix B.

2 NATIONAL PARK DESCRIPTION

Cape Cod NATIONAL SEASHORE is located 70 miles south of Boston, Massachusetts. The park features historic landscapes such as Fort Hill and Nauset Light Beach. A sunset scene from the Cape Cod shoreline is presented in Figure 1. A map of the park is presented in Figure 2.

Figure 1. Cove Light at sunset.

Figure 2. Map of Cape Cod National Seashore

3 AIR EMISSION FACTORS

3.1 MOBILE6

MOBILE Version 6.2 ("MOBILE6") is the latest version of the Environmental Protection Agency's (EPA) MOBILE-series vehicular emission factor modeling software [EPA]. Typically, states and various local/regional agencies use the model for developing vehicular emissions inventories as a requisite for state implementation plans and conformity analyses.

MOBILE6 was developed through emissions measurements using a Federal Test Procedure (FTP) driving cycle with a length of 7.5 miles and a speed averaged over one cycle of 19.6 miles per hour (mph). The basic emission rates derived from these measurements are modified within the model to account for changes in various scenario parameters.

MOBILE6 predicts emission factors (e.g., g/vehicle-mile) for several pollutants such as several hydrocarbon (HC) categories, including volatile organic compounds (VOC), carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO_2), and 10-micron particulate matter (PM_{10}). The model takes into account various parameters, including vehicle types, temperature, vehicle speeds, and inspection/maintenance (I/M) programs to generate current emission factors. In addition, future scenarios can also be modeled. A basic schematic of the inputs and outputs to the model are shown in Figure 3.

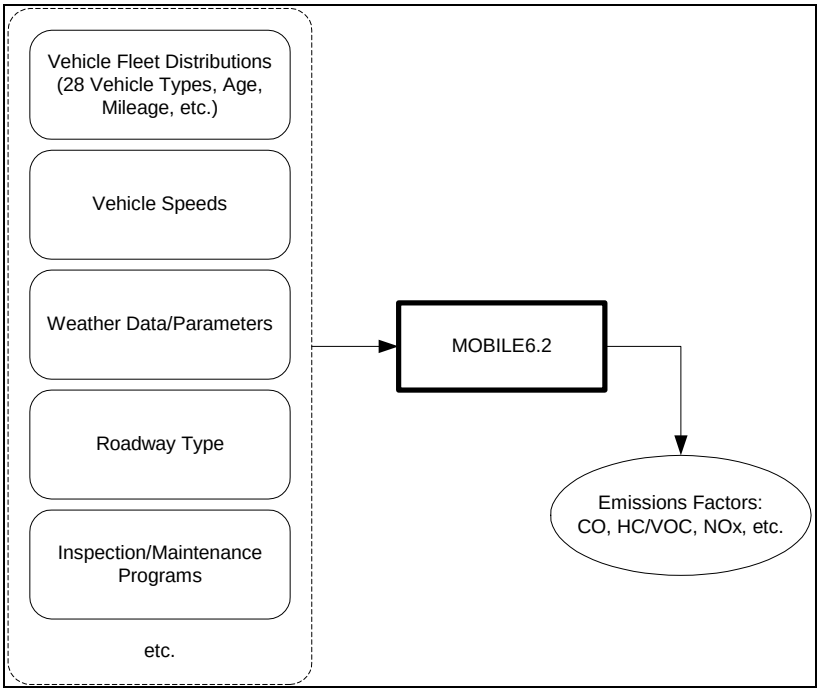

Figure 3. Schematic of the MOBILE6 inputs and outputs

The emission factors from the model are averages for a facility type and provided for up to 28 different vehicle types:

- 1 - LDGV Light-Duty Gasoline Vehicles (Passenger Cars)
- 2 - LDGT1 Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
- 3 - LDGT2 Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
- 4 - LDGT3 Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
- 5 - LDGT4 Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, greater than 5,751 lbs. ALVW)
- 6 - HDGV2b Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
- 7 - HDGV3 Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
- 8 - HDGV4 Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
- 9 - HDGV5 Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
- 10 - HDGV6 Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
- 11 - HDGV7 Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
- 12 - HDGV8a Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
- 13 - HDGV8b Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
- 14 - LDDV Light-Duty Diesel Vehicles (Passenger Cars)
- 15 - LDDT12 Light-Duty Diesel Trucks 1and 2 (0-6,000 lbs. GVWR)
- 16 - HDDV2b Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
- 17 - HDDV3 Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
- 18 - HDDV4 Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
- 19 - HDDV5 Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
- 20 - HDDV6 Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
- 21 - HDDV7 Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
- 22 - HDDV8a Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
- 23 - HDDV8b Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
- 24 - MC Motorcycles (Gasoline)
- 25 - HDGB Gasoline Buses (School, Transit and Urban)
- 26 - HDDBT Diesel Transit and Urban Buses
- 27 - HDDBS Diesel School Buses
- 28 - LDDT34 Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

3.2 Cape Cod National Seashore in MOBILE6.2

The Cape Cod emissions inventory was developed using emission factors modeled by MOBILE6.2. The pollutants modeled for the emissions inventory are VOC, CO, NOx, SO_2, and $PM_{2.5}$. There were separate emission factors modeled representing the summer and winter conditions. Both of these seasons were modeled to take into account the difference in meterological [NRCC] as well as daylight [NAVY] conditions when modeling emission factors. The summer season was modeled using vehicle-type distribution information from Pt. Reyes National Seashore in California [VOLPE]. This distribution was used under the assumption that the Pt. Reyes vehicle distribution is similar to the Cape Cod vehicle distribution during the summer season. For the winter seasons, the national average within MOBILE6.2 was used. The Commonwealth of Massachusetts also operates a vehicle inspection and maintenance program which was taken into account in modeling emission factors [MA].

Emission factors were also modeled for weekday and weekend driving activity. A composite emission factor combining the the weekday and weekend emission factors was derived for the two seasons. The composite emission factor is defined as:

$$C_{EF} = [(WDA_{EF}*5) + (WEND_{EF}*2)]/7 \quad (1)$$

where

C_{EF} represents the composite emission factor,

WDA_{EF} represents the weekday emissions factor, and

$WEND_{EF}$ represents the weekend emissions factor.

4 NOISE EMISSONS

4.1 TRAFFIC NOISE MODEL

In March 1998, the Federal Highway Administration (FHWA) released the Traffic Noise Model, Version 1.0 (FHWA TNM®). The current version, Version 2.5, was released in April 2004. TNM is an entirely new, state-of-the-art computer program used for predicting noise impacts in the vicinity of highways. It uses advances in personal computer hardware and software to improve upon the accuracy and ease of modeling highway noise, including the design of effective, cost-efficient highway noise barriers.

The main TNM output consists of L_{Aeq1h}, the A-weighted[1], energy equivalent sound level over a one-hour time period. L_{Aeq1h} has units of A-weighted decibels, or dBA.

TNM contains the following components:

- Modeling of five standard vehicle types, including automobiles, medium trucks, heavy trucks, buses, and motorcycles, as well as user-defined vehicles.
- Modeling of both constant-flow and interrupted-flow traffic using a 1994/1995 field-measured data base.
- Modeling of the effects of different pavement types, as well as the effects of graded roadways.
- Sound level computations based on a one-third octave-band data base and algorithms.
- Graphically-interactive noise barrier design and optimization.
- Attenuation over/through rows of buildings and dense vegetation.
- Multiple diffraction analysis.
- Parallel barrier analysis.
- Contour analysis, including sound level contours, barrier insertion loss contours, and sound-level difference contours.

These components are supported by a scientifically founded and experimentally calibrated acoustic computation methodology, as well as a database made up of over 6,000 individual motor vehicle pass-by events measured at 40 sites across the US.

4.2 Cape Cod National Seashore in TNM

Modeled in TNM 2.5, Cape Cod features a variety of inputs, including roadways (Routes 6 and 6A), 10 location point receivers, a noise barrier[2], ground zones, building rows, and tree zones. Input data for this analysis are based on historical traffic counts [CACO], recommended roadway speeds [CACO], and US Geological Survey map coordinates

[1] Applying A-weighting to noise data involves adding empirically-derived coefficients to the third-octave bands within the spectral data to adjust for the sensitivity of human hearing.

[2] The single noise barrier included in the TNM CCNS analysis had no impact on the L_{Aeq1h} noise level results due to its shortness of height and distance from the roadway. It was only included to allow a contour analysis, which requires the presence of at least one TNM noise barrier. The writers of this report are not aware of any actual barriers that exist in the vicinity of CCNS and therefore did not investigate any noise barrier impact predictions.

[USGS]. Since vehicle-type distribution information was not available for Cape Cod, vehicle-type distribution information from Pt. Reyes National Seashore in California [VOLPE] was used under the assumption that the Pt. Reyes vehicle distribution is similar to Cape Cod vehicle distribution information. This assumption is based on the tendency for newer passenger cars to dominate travel in both the park and the highways passing through the park.

In Figure 4, a view of Cape Cod as modeled in TNM is presented. A complete list of TNM inputs for Cape Cod is presented in Appendix A.

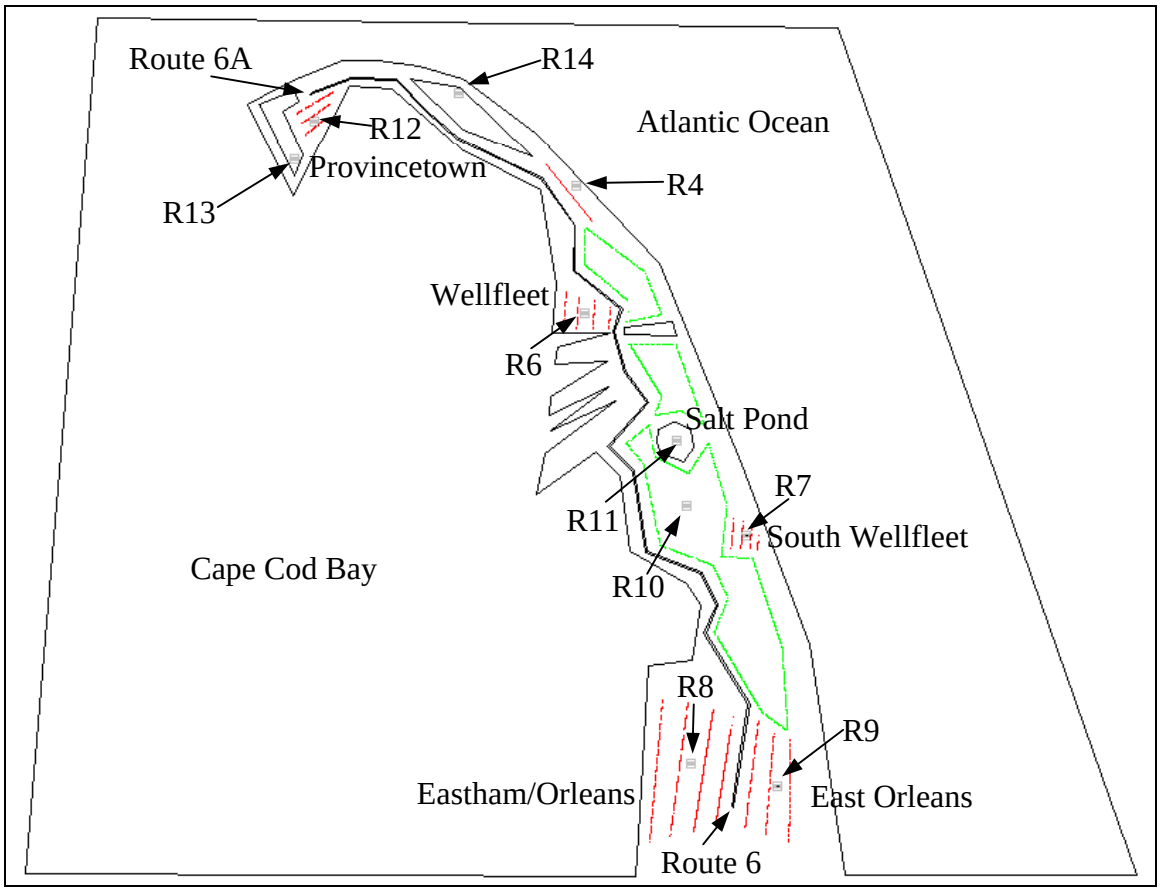

Figure 4. Cape Cod as mapped in TNM

A location point analysis of 10 receiver locations (R4, R6, R7, R8, R9, R10, R11, R12, R13, and R14 in Figure 4) was run in TNM, resulting in an L_{Aeq1h} sound level [FHWA] for each receiver location. L_{Aeq1h}, the A-weighted, energy equivalent sound level over a one-hour time period, is defined as:

$$L_{Aeq1h} = EL_i + A_{traff(i)} + A_d + A_s \qquad (2)$$

where

EL_i represents the vehicle noise emission level for the ith vehicle type,

$A_{traff(i)}$ represents the adjustment for traffic flow, the vehicle volume and speed for the ith vehicle type,

A_d represents the adjustment for distance between the roadway and receiver and for the length of the roadway, and

A_s represents the adjustment for all shielding and ground effects between the roadway and the receiver.

The L_{Aeq1h} sound levels for the Cape Cod baseline are presented in the Results section below. An L_{Aeq1h} contour analysis of the Cape Cod baseline was also run; a map of this contour analysis is presented in the Results section.

5 RESULTS

The baseline emission factors generated for Cape Cod using MOBILE6.2 are presented in Tables 1 and 2 in Section 5.1. The baseline noise emission levels for Cape Cod using TNM are presented in Figures 5 through 8 in Section 5.2.

5.1 Air Quality Emissions

Results from the MOBILE6.2 emissions analysis are presented below. Results are based on historical traffic counts [CACO], recommended speeds [NPS], and US Geological Survey [USGS] map coordinates. The composite emission factors modeled by mobile for each season are presented in Table 1.

Table 1. MOBILE6.2 Summer and Winter Emission Factors

	Summer					Winter				
Speed mph	CO gram/mi	NOx gram/mi	VOC gram/mi	PM_{10} gram/mi	SO_2 gram/mi	CO gram/mi	NOx gram/mi	VOC gram/mi	PM_{10} gram/mi	SO_2 gram/mi
40	23.4743	1.0209	2.1957	0.032	0.0338	20.6319	2.2671	1.1184	0.0626	0.0688
45	24.122	1.0433	2.1316	0.032	0.0338	21.2529	2.3511	1.0944	0.0626	0.0688
50	24.7774	1.0681	2.279	0.032	0.0338	21.9101	2.4731	1.0724	0.0626	0.0688

The 2004 Emission Inventory for study area is presented in Table 2 in tons per year. The study area along Rt. 6 is defined as from the Orleans Rotary in Eastham to the intersection of Rt. 6 and Conwell Street in Provincetown, spanning a total distance of 25.3 miles.

Table 2. 2004 Emission Inventory

CO tons/year	NOx tons/year	VOC tons/year	PM10 tons/year	SO2 tons/year
4198.2	314.5	306.9	8.8	9.5

5.2 Noise Emissions

Results from a TNM location point receiver analysis and a contour analysis are presented below. All results are in units of L_{Aeq1h}, the A-weighted, energy equivalent sound level over a one-hour time period. Results are based on historical traffic counts, recommended speeds, and US Geological Survey map coordinates.

5.2.1 Location Point Receiver Analysis

The following 10 Cape Cod receiver locations were analyzed in TNM:

R4 = Beach location behind barrier wall

R6 = Wellfleet
R7 = South Wellfleet
R8 = Eastham/Orleans
R9 = East Orleans
R10 = Tree Zone
R11 = Gull Pond
R12 = Provincetown
R13 = Beach location at the end of Cape Cod
R14 = Beach location at Pilgrim Heights

The baseline L_{Aeq1h} results for each receiver are presented in Table 3.

Table 3. Location point receiver analysis results.

Receiver No.	Location Point L_{Aeq1h} (dBA)
R4	36.3
R6	40.6
R7	25.7
R8	36.4
R9	34.2
R10	29.2
R11	31.6
R12	35.6
R13	31.4
R14	36.9

These receiver locations were chosen for their proximity to points of interest for park visitors. Since these noise levels were modeled some distance away from the roadway, they are not particularly high. In fact, it is possible that many of the noise levels from modeled roadway traffic reported for the locations in Table 3 may not be perceptible at those locations due to the park's ambient noise at those locations[3]. However, as can be seen in the contour maps of Section 5.2.2, noise levels within 50 ft of Route 6 consistently rise as high as 60 dBA.

[3] The Volpe Center has collected ambient noise level data for several National Park units, including Badlands, an inland continental US park, and Haleakala, a park situated in the Hawaiian islands. Typical ambient noise levels were in the range of 35 – 45 dBA at Badlands [LEE1] and 35 – 50 dBA at Haleakala [LEE2].

5.2.2 Contour Analysis

In addition to a baseline contour analysis of Cape Cod in its entirety in Figure 5, close-ups of Provincetown, Wellfleet, and Eastham/Orleans analyses are also presented in Figures 6, 7, and 8. All results are in units of L_{Aeq1h}, the A-weighted, energy equivalent sound level over a one-hour time period.

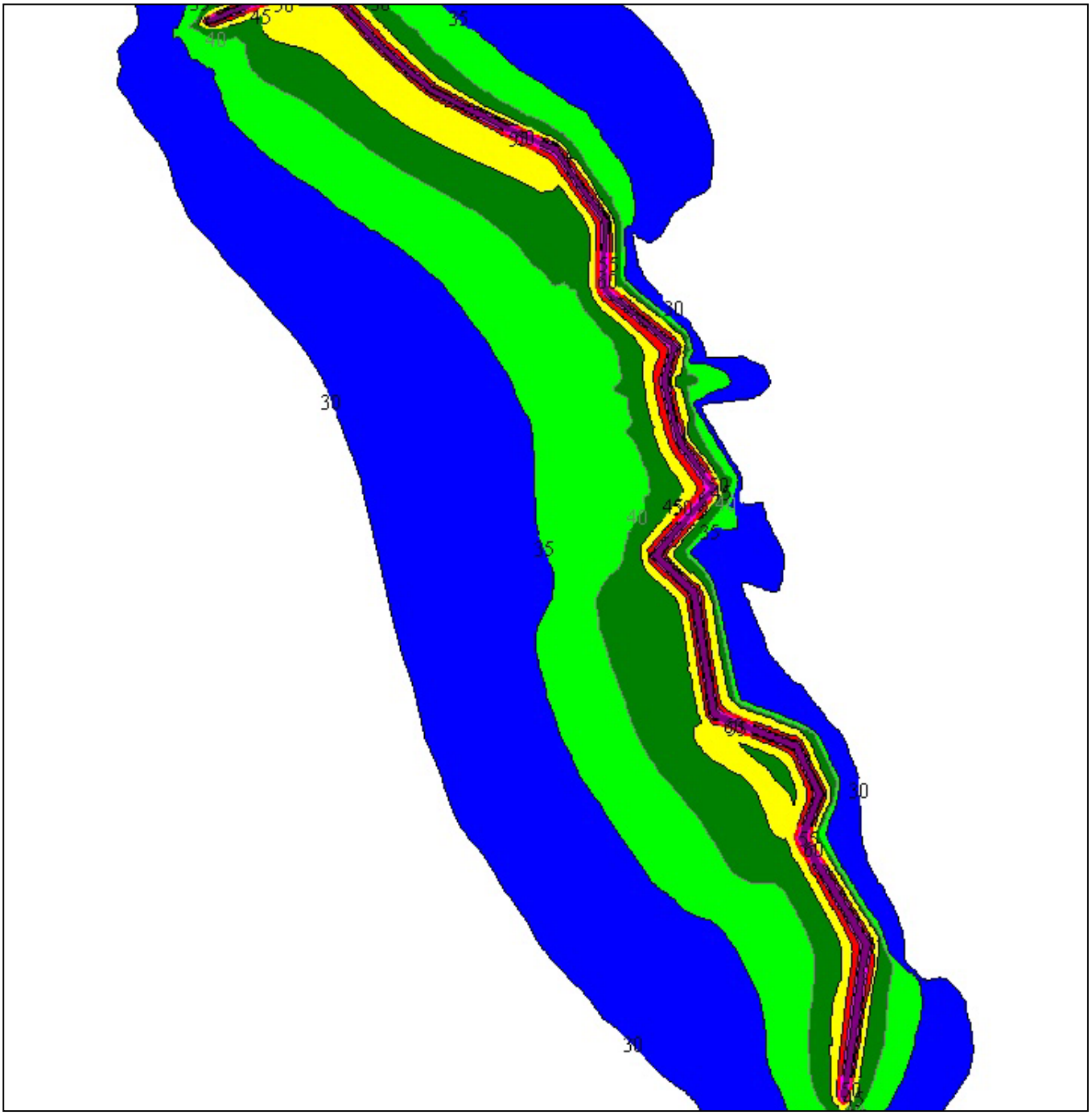

Figure 5. A baseline contour map of Cape Cod, in L_{Aeq1h}

Table 4 shows the surface area of the earth inside each contour[4], in units of square miles.

Table 4. Surface area inside each contour.

L_{Aeq1h} (dBA)	Area (square miles)
25	249.96
30	127.65
35	66.345
40	34.889
45	16.145
50	6.7556
55	3.8183
60	2.3621
65	0.95854
70	0.19378

Higher sound levels are concentrated inside smaller areas, whereas lower sound levels propagate out over larger areas, particularly over acoustically hard surfaces such as water. The highest sound levels occur in smaller areas on or near the roadway, as depicted in the localized views of the contour map presented in Figures 6, 7, and 8. Again, many of the noise levels from modeled roadway traffic may not be perceptible at locations away from the roadway due to the ambient noise in the park.

[4] Since the contours were cut off by a TNM processing boundary to save processing time, contours are left open. Using a wider processing boundary would have allowed for contours to enclose definitive areas, but TNM processing time would have increased exponentially.

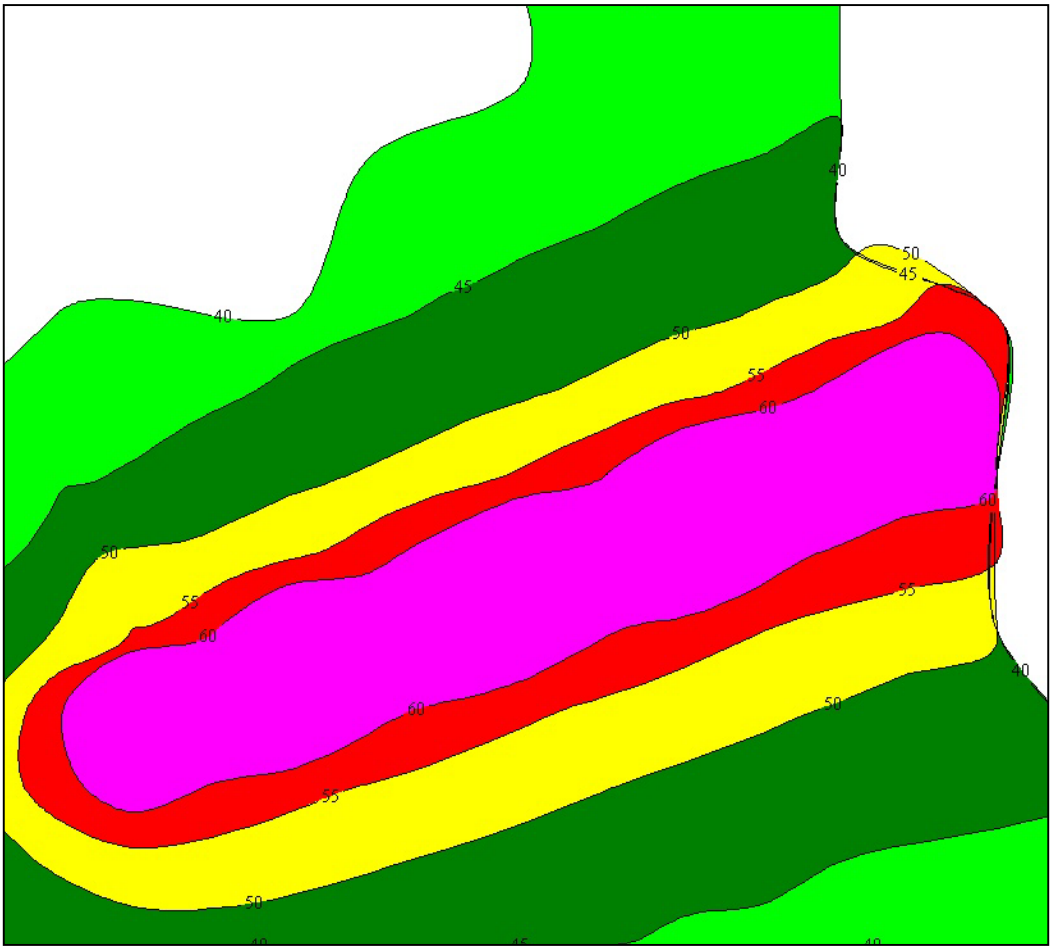

Figure 6. A baseline contour map of Provincetown, in L_{Aeq1h}

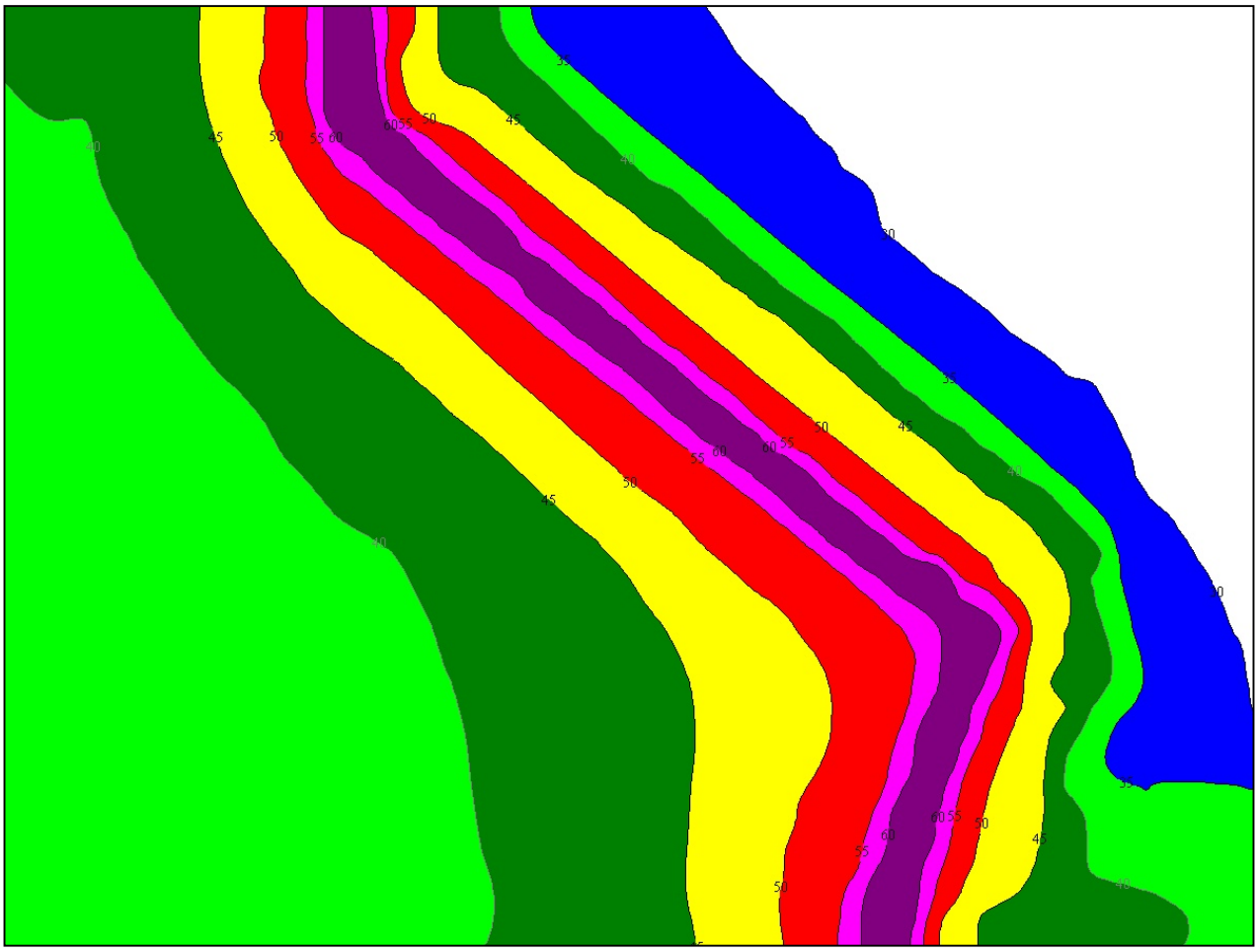

Figure 7. A baseline contour map of Wellfleet, in L_{Aeq1h}

Figure 8. A baseline contour map of Eastham/Orleans, in L_{Aeq1h}

6 CONCLUSIONS AND NEXT STEPS

6.1 Conclusions

AIR

Based on MOBILE6.2 results, vehicles traveling along the Rt. 6 corridor produce annually 4,198.2 tons of CO, 314.5 tons of NOx, 306.9 tons of VOC's, 8.8 tons of PM_{10}, and 9.5 tons of SO_2. Note that passenger vehicles that use gasoline produce a higher amount of CO emissions, while vehicles using diesel fuel emit lower levels of CO compared to vehicles that use gasoline but produce a higher amount of NOx than gasoline-powered vehicles. High amounts of these emissions can lead to health problems.

NOISE

Based on the TNM results in this study, areas close to the highway are hearing noise levels approaching 55 dBA – 60 dBA. However, these levels drop off quickly with increased distance away from the roadway. Residential areas on Cape Cod (Provincetown, Wellfleet, Eastham, and Orleans) are hearing noise levels at around 35 dBA as a result of Routes 6 and 6A, and some areas well off the highway are seeing noise levels at around 30 dBA (South Wellfleet, Salt Pond). After defining what noise levels are compatible with an enjoyable park experience, the NPS may want to consider whether Cape Cod National Seashore is too loud.

6.2 Next Steps

The foregoing report provided a baseline for air and noise emissions produced by all vehicles traveling along the FlexRoute shuttle route. Recommendations for assessing the air and noise impact of the shuttle include the following:

AIR

Given the high traffic volumes on these roads and the difficulties in performing precise traffic counts, the FlexRoute shuttle is not likely to lead to a significant reduction in measured traffic volumes. However, by measuring ridership, and by assessing what these riders would have done had the shuttle not been available, it is possible to estimate a shuttle-caused reduction in vehicle miles traveled. The impact of the shuttle would then be a combination of the following factors:

- Private vehicle miles forgone by riders who parked their vehicles in the area × private vehicle emissions per mile
- Private vehicle miles forgone by rides who reached Cape Cod by public transit × private vehicle emissions per mile
- Emissions produced by the FlexRoute shuttle itself

NOISE

Given the already existing high traffic volumes along most of the shuttle route, the FlexRoute shuttle is not likely to create a significant impact on noise on these roads. However, when the shuttle leaves the main road to enter a parking area, it may have a noticeable noise impact[5].Therefore, a recommendation is to:

- Identify current noise-sensitive areas where the shuttle itself might have an impact
- Perform noise measurements, both when the shuttle is present and not present, and compare the noise levels

The Cape Cod noise emissions analysis could be improved by using high-refinement, high-resolution data, as would be gathered through a Cape Cod site survey, including actual traffic counts, a geographic location study, and actual vehicle-type information. Furthermore, noise levels generated in TNM could be validated by setting up microphones at location points like those identified in Table 3 and comparing the results.

[5] What impact the shuttle will have in areas away from the roadway depends upon ambient noise levels in those areas. It would be useful to collect ambient noise level data for the park, particularly along the shuttle route, as part of any future noise modeling and analysis.

7 REFERENCES

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APPENDIX A.   INPUT FILES

Presented below are the main MOBILE6.2 and TNM input and external data files for the Cape Cod National Seashore modeling.

A.1   Air Emissions Input (MOBILE6.2)

A.1.1   Cape Cod Summer Weekday Input File

```
MOBILE6 INPUT FILE :

REPORT FILE        : CACO_WDA.TXT
POLLUTANTS         : HC CO NOX CO2
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE VEHICLES  : 22221 12111211 2 222 22222111 111
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : CACO_WDA.TB1
PARTICULATES       :

RUN DATA

NO REFUELING       :

CLOUD COVER        : 0.58

PEAK SUN           : 1 3

SUNRISE/SUNSET     : 5 8

REG DIST           : REGDATA1.D

DIESEL FRACTIONS   :
0.0000 0.2500 0.2500 0.2500 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.2500 0.0000 0.0000 0.0000
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MILE ACCUM RATE    : miledat1.d

VMT FRACTIONS      :
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0.002 0.002 0.001 0.000 0.000 0.000 0.000 0.002

ABSOLUTE HUMIDITY  : 75.1

STAGE II REFUELING : 97 3 84. 84.

FUEL PROGRAM       : 1

SEASON             : 1

I/M PROGRAM        : 1 1999 2040 2 T/O IM240

I/M CUTPOINTS      : 1 C:\MOBILE\CUTPOINT1.D

I/M STRINGENCY     : 1 20.0

I/M MODEL YEARS    : 1 1984 2004

I/M VEHICLES       : 1 22222 22222222 1

I/M COMPLIANCE     : 1 98.0

I/M WAIVER RATES   : 1 0.0 1.0

I/M EXEMPTION AGE  : 1 21


SCENARIO REC       : CACO WEEKDAY SEGMENT 1-4

EVALUATION MONTH   : 7

FUEL RVP           : 11.5
```

```
MIN/MAX TEMPERATURE: 55. 72.

AVERAGE SPEED      : 40.0 Arterial

PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV

PARTICLE SIZE      : 10.0

DIESEL SULFUR      : 500.0

CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKDAY SEGMENT 5-7

EVALUATION MONTH   : 7

FUEL RVP           : 11.5

MIN/MAX TEMPERATURE: 55. 72.

AVERAGE SPEED      : 45.0 Arterial

PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV

PARTICLE SIZE      : 10.0

DIESEL SULFUR      : 500.0

CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKDAY SEGMENT 8-9

EVALUATION MONTH   : 7

FUEL RVP           : 11.5

MIN/MAX TEMPERATURE: 55. 72.

AVERAGE SPEED      : 50.0 Arterial

PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV

PARTICLE SIZE      : 10.0

DIESEL SULFUR      : 500.0

CALENDAR YEAR      : 2004

END OF RUN
```

A.1.2 Cape Cod Summer Weekend Input File

```
MOBILE6 INPUT FILE :

REPORT FILE        : CACO_WEND.TXT
POLLUTANTS         : HC CO NOX CO2
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE VEHICLES  : 22221 12111211 2 222 22222111 111
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : CACO_WEND.TB1
PARTICULATES       :

RUN DATA

NO REFUELING       :

CLOUD COVER        : 0.58

PEAK SUN           : 1 3

SUNRISE/SUNSET     : 5 8

REG DIST           : REGDATA2.D

DIESEL FRACTIONS   :
0.0000 0.0000 0.0000 0.1666 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.1667
0.0000 0.1667 0.0000 0.1667 0.3333

0.0000 0.3333 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.6667 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
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0.3333 0.3333 0.1667 0.0000 0.1667 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
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0.0000 0.0000 0.0000 0.0000 0.0000

MILE ACCUM RATE    : miledat2.d

VMT FRACTIONS      :
```

```
0.889 0.049 0.049 0.012 0.000 0.000 0.000 0.000
0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000

ABSOLUTE HUMIDITY  : 75.1

STAGE II REFUELING : 97 3 84. 84.

FUEL PROGRAM       : 1

SEASON             : 1

I/M PROGRAM        : 1 1999 2040 2 T/O IM240

I/M CUTPOINTS      : 1 C:\MOBILE\CUTPOINT1.D

I/M STRINGENCY     : 1 20.0

I/M MODEL YEARS    : 1 1984 2004

I/M VEHICLES       : 1 22222 22222222 1

I/M COMPLIANCE     : 1 98.0

I/M WAIVER RATES   : 1 0.0 1.0

I/M EXEMPTION AGE  : 1 21


SCENARIO REC       : CACO WEEKEND SEGMENT 1-4

EVALUATION MONTH   : 7

FUEL RVP           : 11.5

MIN/MAX TEMPERATURE: 55. 72.

AVERAGE SPEED      : 40.0 Arterial

PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV

PARTICLE SIZE      : 10.0

DIESEL SULFUR      : 500.0

CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKEND SEGMENT 5-7

EVALUATION MONTH   : 7

FUEL RVP           : 11.5

MIN/MAX TEMPERATURE: 55. 72.

AVERAGE SPEED      : 45.0 Arterial

PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV

PARTICLE SIZE      : 10.0

DIESEL SULFUR      : 500.0

CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKEND SEGMENT 8-9

EVALUATION MONTH   : 7

FUEL RVP           : 11.5

MIN/MAX TEMPERATURE: 55. 72.

AVERAGE SPEED      : 50.0 Arterial

PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV

PARTICLE SIZE      : 10.0

DIESEL SULFUR      : 500.0

CALENDAR YEAR      : 2004

END OF RUN
```

A.1.3 Cape Cod Winter Weekday Input File

```
MOBILE6 INPUT FILE :

REPORT FILE        : CACO_WDA.TXT
POLLUTANTS         : HC CO NOX CO2
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE VEHICLES  : 22221 12111211 2 222 22222111 111
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : CACO_WDA.TB1
PARTICULATES       :

RUN DATA

NO REFUELING       :

CLOUD COVER        : 0.55

PEAK SUN           : 11 1

SUNRISE/SUNSET     : 7 5

ABSOLUTE HUMIDITY  : 30.1

STAGE II REFUELING : 97 3 84. 84.

FUEL PROGRAM       : 1

SEASON             : 2

I/M PROGRAM        : 1 1999 2040 2 T/O IM240

I/M CUTPOINTS      : 1 C:\MOBILE\CUTPOINT1.D

I/M STRINGENCY     : 1 20.0
```

```
I/M MODEL YEARS    : 1 1984 2004
I/M VEHICLES       : 1 22222 22222222 1
I/M COMPLIANCE     : 1 98.0
I/M WAIVER RATES   : 1 0.0 1.0
I/M EXEMPTION AGE  : 1 21


SCENARIO REC       : CACO WEEKDAY WINTER SEGMENT 1-4
EVALUATION MONTH   : 1
FUEL RVP           : 13.5
MIN/MAX TEMPERATURE: 31. 46.
AVERAGE SPEED      : 40.0 Arterial
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKDAY WINTER SEGMENT 5-7
EVALUATION MONTH   : 1
FUEL RVP           : 13.5
MIN/MAX TEMPERATURE: 31. 46.
AVERAGE SPEED      : 45.0 Arterial
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKDAY WINTER SEGMENT 8-9
EVALUATION MONTH   : 1
FUEL RVP           : 13.5
MIN/MAX TEMPERATURE: 31. 46.
AVERAGE SPEED      : 50.0 Arterial
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
CALENDAR YEAR      : 2004

END OF RUN
```

A.1.4 Cape Cod Winter Weekend Input File

```
MOBILE6 INPUT FILE :

REPORT FILE        : CACO_WEN.TXT
POLLUTANTS         : HC CO NOX CO2
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE VEHICLES  : 22221 12111211 2 222 22222111 111
AGGREGATED OUTPUT  :
EMISSIONS TABLE    : CACO_WEN.TB1
PARTICULATES       :

RUN DATA

NO REFUELING       :

CLOUD COVER        : 0.55

PEAK SUN           : 11 1

SUNRISE/SUNSET     : 7 5

ABSOLUTE HUMIDITY  : 30.1

STAGE II REFUELING : 97 3 84. 84.

FUEL PROGRAM       : 1

SEASON             : 2

I/M PROGRAM        : 1 1999 2040 2 T/O IM240

I/M CUTPOINTS      : 1 C:\MOBILE\CUTPOINT1.D

I/M STRINGENCY     : 1 20.0

I/M MODEL YEARS    : 1 1984 2004

I/M VEHICLES       : 1 22222 22222222 1

I/M COMPLIANCE     : 1 98.0

I/M WAIVER RATES   : 1 0.0 1.0

I/M EXEMPTION AGE  : 1 21


SCENARIO REC       : CACO WEEKEND WINTER SEGMENT 1-4

WE VEH US          :
```

```
EVALUATION MONTH   : 1
FUEL RVP           : 13.5
MIN/MAX TEMPERATURE: 31. 46.
AVERAGE SPEED      : 40.0 Arterial
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKEND WINTER SEGMENT 5-7
WE VEH US          :
EVALUATION MONTH   : 1
FUEL RVP           : 13.5
MIN/MAX TEMPERATURE: 31. 46.
AVERAGE SPEED      : 45.0 Arterial
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
CALENDAR YEAR      : 2004

SCENARIO REC       : CACO WEEKEND WINTER SEGMENT 8-9
WE VEH US          :
EVALUATION MONTH   : 1
FUEL RVP           : 13.5
MIN/MAX TEMPERATURE: 31. 46.
AVERAGE SPEED      : 50.0 Arterial
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV Pmddr1.CSV Pmddr2.CSV
PARTICLE SIZE      : 10.0
DIESEL SULFUR      : 500.0
CALENDAR YEAR      : 2004

END OF RUN
```

A.1.4 Massachusetts Inspection and Maintenance Program Cut Points

```
I/M CUTPOINTS
* Block 1 (LDGV, LDGT1)
  0.800   0.800   0.800   0.800   0.800   0.800   0.800   0.800   0.800   1.200
  1.200   1.200   1.200   1.200   2.000   2.000   2.000   2.000   2.000   2.000
  2.000   1.200   1.200   1.200   1.200
 15.000  15.000  15.000  15.000  15.000  15.000  15.000  15.000  15.000  20.000
 20.000  20.000  20.000  20.000  30.000  30.000  30.000  30.000  30.000  30.000
 30.000  20.000  20.000  20.000  20.000
  2.000   2.000   2.000   2.000   2.000   2.000   2.000   2.000   2.000   2.500
  2.500   2.500   2.500   2.500   3.000   3.000   3.000   3.000   3.000   3.000
  3.000   3.000   3.000   3.000   3.000

* Block 2 (LDGT2, LDGT3)
  1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   2.400
  2.400   2.400   2.400   2.400   3.200   3.200   3.200   3.200   3.200   3.200
  3.200   1.200   1.200   1.200   1.200
 20.000  20.000  20.000  20.000  20.000  20.000  20.000  20.000  20.000  60.000
 60.000  60.000  60.000  60.000  80.000  80.000  80.000  80.000  80.000  80.000
 80.000  20.000  20.000  20.000  20.000
  2.500   2.500   2.500   2.500   2.500   2.500   2.500   2.500   2.500   3.000
  3.000   3.000   3.000   3.000   3.500   3.500   3.500   7.000   7.000   7.000
  7.000   3.000   3.000   3.000   3.000

* Block 3 (LDGT4)
  2.400   2.400   2.400   2.400   2.400   2.400   2.400   2.400   2.400   2.400
  2.400   2.400   2.400   2.400   3.200   3.200   3.200   3.200   3.200   3.200
  3.200   1.200   1.200   1.200   1.200
 20.000  20.000  20.000  20.000  20.000  20.000  20.000  20.000  20.000  60.000
 60.000  60.000  60.000  60.000  80.000  80.000  80.000  80.000  80.000  80.000
 80.000  20.000  20.000  20.000  20.000
  2.500   2.500   2.500   2.500   2.500   2.500   2.500   2.500   2.500   3.000
  3.000   3.000   3.000   3.000   3.500   3.500   3.500   7.000   7.000   7.000
  7.000   3.000   3.000   3.000   3.000

* Block 4 (HDGV)
  2.400   2.400   2.400   2.400   2.400   2.400   2.400   2.400   2.400   2.400
  2.400   2.400   2.400   2.400   3.200   3.200   3.200   3.200   3.200   3.200
  3.200   1.200   1.200   1.200   1.200
 20.000  20.000  20.000  20.000  20.000  20.000  20.000  20.000  20.000  60.000
 60.000  60.000  60.000  60.000  80.000  80.000  80.000  80.000  80.000  80.000
 80.000  20.000  20.000  20.000  20.000
  2.500   2.500   2.500   2.500   2.500   2.500   2.500   2.500   2.500   3.000
  3.000   3.000   3.000   3.000   3.500   3.500   3.500   7.000   7.000   7.000
  7.000   3.000   3.000   3.000   3.000
```

A.2 Noise Emissions Input (TNM)

ROADWAYS

Table A-1. Cape Cod TNM baseline roadway input

Roadway Name	Width	Point Name	Point #	X (ft)	Y (ft)	Z (ft)	Pavement Type
Roadway1	12	point1	1	0.0	0.0	18.0	Average
		point12	12	1040.3	6892.0	49.0	Average
		point2	2	2080.7	13784.0	55.0	Average
		point3	3	-3593.7	23033.3	18.0	Average
		point4	4	-2088.0	26876.6	37.0	Average
		point5	5	-4222.6	31140.6	11.0	Average
		point17	17	-11482.4	33932.8	9.0	Average
		point18	18	-13164.5	44599.4	17.0	Average
		point21	21	-16466.3	47800.0	44.0	Average
		point6	6	-11401.5	53625.5	46.0	Average
		point22	22	-14421.2	57780.2	111.0	Average
		point7	7	-15800.3	63083.4	69.0	Average
		point14	14	-14802.1	66122.5	91.0	Average
		point15	15	-21022.1	71130.1	50.0	Average
		point16	16	-21008.1	77122.2	40.0	Average
		point8	8	-25423.5	83442.2	63.0	Average
		point19	19	-30857.9	85875.5	28.0	Average
		point11	11	-36456.3	88636.9	10.0	Average
		point20	20	-40660.4	92218.5	0.0	Average
		point9	9	-44700.3	96620.4	7.0	Average
		point13	13	-50765.8	96798.3	18.0	Average
		point10	10	-56175.0	94679.5	19.0	Average
Roadway3	12	point23	23	-56106.0	94571.5	0.0	Average
		point24	24	-50690.2	96663.4	0.0	Average
		point25	25	-44769.1	96502.9	0.0	Average
		point26	26	-40862.2	92217.5	0.0	Average
		point27	27	-36570.1	88543.9	0.0	Average
		point44	44	-31052.6	85838.1	0.0	Average
		point28	28	-25535.1	83319.6	0.0	Average
		point29	29	-21158.3	77067.4	0.0	Average
		point30	30	-21189.8	71034.0	0.0	Average
		point31	31	-15043.9	66062.5	0.0	Average
		point32	32	-16011.9	63061.4	0.0	Average
		point33	33	-14578.5	57636.0	0.0	Average
		point34	34	-11607.5	53622.8	0.0	Average
		point35	35	-16863.4	47798.3	0.0	Average
		point36	36	-13459.3	44502.0	0.0	Average
		point37	37	-11691.3	33742.8	0.0	Average
		point38	38	-4416.1	30941.4	0.0	Average

Roadway Name	Width	Point Name	Point #	X (ft)	Y (ft)	Z (ft)	Pavement Type
		point39	39	-2380.7	26882.6	0.0	Average
		point40	40	-3993.4	23026.1	0.0	Average
		point41	41	1713.2	13709.5	0.0	Average
		point42	42	747.3	6662.6	0.0	Average
		point43	43	-229.1	67.9	0.0	Average

GROUND ZONES

Table A-2. Cape Cod TNM baseline ground zone input

Ground Zone Name	Type	Flow Resistivity (cgs rayls)	Point #	X (ft)	Y(ft)
Ground Zone 2	Water	20000	6	14681.2	-8994.0
			7	10028.6	21602.4
			8	1005.8	45389.7
			9	-9821.5	71965.8
			10	-26226.5	89355.2
			11	-35905.4	96573.4
			12	-41647.2	98377.9
			13	-47224.9	99034.1
			14	-51818.3	99034.1
			15	-58380.3	96409.3
			20	-60414.5	95359.4
			21	-62448.8	94309.5
			22	-64483.0	93259.5
			24	-58327.8	81008.3
			25	-50860.3	95661.2
			26	-45197.3	95385.6
			27	-36089.2	87235.6
			23	-25504.7	81874.5
			28	-23584.2	69325.7
			29	-24124.5	62846.8
			30	-16413.5	62836.4
			31	-23400.5	60880.4
			55	-23697.4	58720.5
			56	-16866.8	58999.1
			57	-24291.4	54400.8
			58	-24400.9	52053.3
			59	-16632.4	55708.1
			60	-24244.6	49984.4

Ground Zone Name	Type	Flow Resistivity (cgs rayls)	Point #	X (ft)	Y(ft)
			61	-15725.8	53826.7
			62	-25026.1	46977.7
			32	-26073.4	41441.6
			33	-18247.1	47102.4
			34	-15178.3	43904.5
			35	-13749.9	33980.6
			36	-6251.7	29634.3
			37	-4331.3	26764.5
			38	-5527.7	19465.4
			39	-11317.6	18728.3
			40	-12678.1	-3827.5
			41	-13049.5	-9122.9
			16	-93782.8	-8770.8
			17	-84300.3	104611.8
			18	13801.8	103299.4
			19	53279.4	-9088.3
Ground Zone 3	Water	20000	42	-7872.2	51026.9
			43	-9935.4	50089.1
			44	-10123.0	48401.0
			45	-9560.3	46900.4
			46	-6559.2	45775.0
			47	-5246.2	47650.7
			48	-5621.4	50089.1
			49	-7684.6	51026.9
Ground Zone 4	Water	20000	50	-14437.1	63594.0
			51	-8059.7	64344.3
			52	-7497.0	62468.6
			53	-14437.1	62656.2
			54	-14437.1	63406.4
Ground Zone 6	Loose Soil	500	68	-62829.7	93229.8
			69	-58140.5	95105.5
			70	-57577.8	93605.0
			71	-59641.1	92292.0
			72	-57015.1	86477.4
			73	-58140.5	83663.8
			74	-62642.2	93042.3
Ground Zone 7	Loose Soil	500	75	-42829.2	96603.6

Ground Zone Name	Type	Flow Resistivity (cgs rayls)	Point #	X (ft)	Y(ft)
			76	-35873.5	89841.1
			77	-26647.5	86266.6
			78	-36211.6	95396.0
			79	-42780.9	96651.9

TREE ZONES

Table A-3. Cape Cod TNM baseline tree zone input

Tree Zone Name	Average Height (ft)	Point #	Coordinates (ground)		
			X (ft)	Y (ft)	Z (ft)
Tree Zone 2	50				
		7	7133.3	10137.0	0.0
		8	6383.0	21203.5	0.0
		9	2444.1	33020.4	0.0
		10	-1682.4	33207.9	0.0
		11	-932.1	39960.4	0.0
		12	-3370.5	48213.4	0.0
		13	-5996.5	44274.5	0.0
		14	-10498.1	46525.3	0.0
		15	-11248.4	50651.8	0.0
		16	-14249.5	48213.4	0.0
		17	-11998.7	45587.4	0.0
		18	-9747.9	34708.5	0.0
		19	-2807.8	32082.5	0.0
		20	-744.6	27768.4	0.0
		21	-2620.3	23266.8	0.0
		22	3757.1	12575.4	0.0
Tree Zone3	50				
		23	-13874.4	61343.2	0.0
		24	-7684.6	61343.2	0.0
		25	-3933.2	50651.8	0.0
		26	-6934.3	52527.5	0.0
		27	-10498.1	51964.8	0.0
		28	-9560.3	54403.2	0.0
		29	-13686.8	61155.6	0.0
Tree Zone4	50				
		30	-19689.0	76723.8	0.0

Tree Zone Name	Average Height (ft)	Point #	Coordinates (ground)		
		31	-19689.0	71847.0	0.0
		32	-13874.4	66970.2	0.0
		33	-14249.5	64344.3	0.0
		34	-9560.3	65282.1	0.0
		35	-11811.1	70909.2	0.0
		36	-19501.4	76723.8	0.0

RECEIVERS

Table A-4. Cape Cod TNM baseline receiver input

Receiver Name	Point #	X (ft)	Y (ft)	Z (ft)	Height Above Ground (ft)	Active in Calculation?
Receiver4	4	-20814.4	82350.9	0.0	4.92	Y
Receiver6	6	-19689.0	65469.7	0.0	4.92	Y
Receiver7	7	1693.8	36021.5	0.0	4.92	Y
Receiver8	8	-5621.4	5822.9	0.0	4.92	Y
Receiver9	9	5820.3	2821.8	0.0	4.92	Y
Receiver10	10	-6184.1	39960.4	0.0	4.92	Y
Receiver11	11	-7497.0	48588.5	0.0	4.92	Y
Receiver12	12	-55514.6	90979.0	0.0	4.92	Y
Receiver13	13	-58140.5	85914.7	0.0	4.92	Y
Receiver14	14	-36382.6	94730.4	0.0	4.92	Y

BARRIER

Table A-5. Cape Cod TNM baseline barrier input

Barrier Name	Barrier Type	Point Name	Point #	X (ft)	Y (ft)	Z (ft)
Barrier4	W*	point14	14	-24,753.3	85,164.4	0.0
		point15	15	-18,563.6	77,474.1	0.0

* W denotes a wall barrier.

TRAFFIC

Table A-6. Cape Cod TNM baseline traffic input

Roadway Name	Point Name	Point #	Autos, Veh./hr	Speed, mph	Med. Trucks, Veh./hr	Speed, mph	Heavy Trucks, Veh./hr	Speed, mph	Motorcycles, Veh./hr	Speed, mph

Roadway Name	Point Name	Point #	Autos, Veh./hr	Speed, mph	Med. Trucks, Veh./hr	Speed, mph	Heavy Trucks, Veh./hr	Speed, mph	Motorcycles, Veh./hr	Speed, mph
Roadway1	point1	1	1287	40	249	40	11	40	2	40
	point12	12	1287	40	249	40	11	40	2	40
	point2	2	1181	40	228	40	10	40	2	40
	point3	3	1263	40	244	40	11	40	2	40
	point4	4	1221	40	236	40	10	40	2	40
	point5	5	978	45	189	45	8	45	1	45
	point17	17	978	45	189	45	8	45	1	45
	point18	18	746	45	144	45	6	45	1	45
	point21	21	746	45	144	45	6	45	1	45
	point6	6	746	45	144	45	6	45	1	45
	point22	22	746	45	144	45	6	45	1	45
	point7	7	630	45	121	45	5	45	1	45
	point14	14	630	45	121	45	5	45	1	45
	point15	15	630	45	121	45	5	45	1	45
	point16	16	630	45	121	45	5	45	1	45
	point8	8	630	50	121	50	5	50	1	50
	point19	19	630	50	121	50	5	50	1	50
	point11	11	630	50	121	50	5	50	1	50
	point20	20	655	50	126	50	5	50	1	50
	point9	9	655	50	126	50	5	50	1	50
	point13	13	655	50	126	50	5	50	1	50
Roadway3	point23	23	661	50	128	50	5	50	1	50
	point24	24	661	50	128	50	5	50	1	50
	point25	25	661	50	128	50	5	50	1	50
	point26	26	661	50	128	50	5	50	1	50
	point27	27	771	50	149	50	6	50	1	50
	point44	44	771	50	149	50	6	50	1	50
	point28	28	771	45	149	45	6	45	1	45
	point29	29	771	45	149	45	6	45	1	45
	point30	30	771	45	149	45	6	45	1	45
	point31	31	959	45	185	45	8	45	1	45
	point32	32	959	45	185	45	8	45	1	45
	point33	33	959	45	185	45	8	45	1	45
	point34	34	959	45	185	45	8	45	1	45
	point35	35	1029	45	199	45	9	45	1	45
	point36	36	1029	45	199	45	9	45	1	45
	point37	37	1029	45	199	45	9	45	1	45
	point38	38	954	40	184	40	8	40	1	40
	point39	39	954	40	184	40	8	40	1	40
	point40	40	1057	40	204	40	9	40	1	40

Roadway Name	Point Name	Point #	Autos, Veh./hr	Speed, mph	Med. Trucks, Veh./hr	Speed, mph	Heavy Trucks, Veh./hr	Speed, mph	Motorcycles, Veh./hr	Speed, mph
	point41	41	1238	40	239	40	11	40	2	40
	point42	42	1361	40	263	40	12	40	2	40

BUILDINGS

Table A-7. Cape Cod TNM baseline building zone input

Building Row Name	Average Height (ft)	Building Percent (%)	Point #	X (ft)	Y (ft)	Z (ft)
Building8	20	25	33	3231.9	11375.5	0.0
			34	1454.4	-2803.5	0.0
Building9	20	25	35	5298.8	9804.6	0.0
			36	4182.7	-3671.6	0.0
Building10	20	25	37	7489.7	8977.8	0.0
			38	7283.0	-5035.8	0.0
Building12	20	25	42	-157.8	12160.9	0.0
			43	-2390.1	-2100.8	0.0
Building13	20	25	44	-2762.1	12863.6	0.0
			45	-5366.4	-3423.6	0.0
Building14	20	25	46	-6110.5	13814.4	0.0
			47	-8508.1	-4209.0	0.0
Building15	20	25	48	-9458.9	14310.5	0.0
			49	-11195.1	-4870.4	0.0
Building18	20	20	58	-16419.2	66292.5	0.0
			59	-16560.9	63221.7	0.0
Building19	20	20	60	-18474.3	67142.9	0.0
			61	-18663.3	63174.4	0.0
Building20	20	20	62	-20482.1	67780.7	0.0
			63	-20883.7	63174.4	0.0
Building21	20	20	64	-22182.9	68560.2	0.0
			65	-22631.7	63127.2	0.0
Building22	15	20	66	-0.9	38353.8	0.0
			67	-429.8	34134.0	0.0
Building23	15	20	68	1234.2	37890.7	0.0
			69	856.8	34099.6	0.0
Building24	15	20	70	2417.8	37650.5	0.0
			71	2074.7	34048.2	0.0
Building25	15	20	72	3292.7	36003.7	0.0
			73	3086.8	33979.6	0.0

Building29	20	25	80	-53097.1	94881.3	0.0
			81	-58045.4	91931.4	0.0
Building30	20	25	82	-53620.5	93168.5	0.0
			83	-57379.3	90599.1	0.0
Building31	20	25	84	-54524.5	90932.2	0.0
			85	-56903.5	89124.2	0.0

APPENDIX B. MODELED OUTPUT

B.1 Air Emissions Output (MOBILE6.2)

B.1.1 Cape Cod Summer Weekday Report File

```
************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                           *
* Input file: CACOWDAY.IN (file 1, run 1).                             *
************************************************************************
  M603 Comment:
               User has disabled the calculation of REFUELING emissions.

  M617 Comment:
               User supplied alternate AC input: Cloud Cover Fraction set to 0.58.
  M619 Comment:
               User supplied alternate AC input: Peak Sun between  1 AM, and  3 PM.
  M618 Comment:
               User supplied alternate AC input: Sunrise at  5 AM, Sunset at  8 PM.

* Reading Registration Distributions from the following external
* data file: REGDATA1.D
  M614 Comment:
               User supplied diesel sale fractions.

* Reading non-default MILEAGE ACCUMULATION RATES from the following external
* data file: MILEDAT1.D
  M615 Comment:
               User supplied VMT mix.
  M601 Comment:
               User has enabled STAGE II REFUELING.

  M616 Comment:
               User has supplied post-1999 sulfur levels.

* Reading non-default I/M CUTPOINTS from the following external
* data file: C:\MOBILE\CUTPOINT1.D

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 40.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
               there are no sales for vehicle class HDDV7
  M 48 Warning:
               there are no sales for vehicle class HDDV8a
  M 48 Warning:
               there are no sales for vehicle class HDDV8b
  M 48 Warning:
               there are no sales for vehicle class HDDBS

* Reading Ammonia (NH3) Basic Emission Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

                    Calendar Year:  2004
                            Month:  July
                         Altitude:  Low
               Minimum Temperature:  55.0 (F)
               Maximum Temperature:  72.0 (F)
                 Absolute Humidity:   75. grains/lb
                   Nominal Fuel RVP:  11.5 psi
                      Weathered RVP:  11.5 psi
               Fuel Sulfur Content:  121. ppm

               Exhaust I/M Program:  Yes
                  Evap I/M Program:  No
                       ATP Program:  No
                  Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                 <6000     >6000     (All)
                    ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.7815    0.1513    0.0086                0.0063    0.0255    0.0210    0.0037    0.0020    1.0000
Fuel Economy (mpg):      24.0      18.9      14.2      18.6       8.3      32.4      20.5      10.2      50.0      22.6
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :       1.779     1.938    72.985     5.774     2.055     0.097     2.091     0.348     14.03     2.402
    Composite CO  :       18.91     24.00    757.35     63.59     23.36     1.539     6.785     0.885     21.16     25.322
    Composite NOX :       0.860     0.993    20.469     2.044     5.222     0.182     1.352     5.552      2.02     1.090
    Composite CO2 :       354.1     448.9     -17.8     423.7     991.6     310.6     477.5     991.2     104.9     372.56
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 45.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.
```

```
* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
               there are no sales for vehicle class HDDV7
  M 48 Warning:
               there are no sales for vehicle class HDDV8a
  M 48 Warning:
               there are no sales for vehicle class HDDV8b
  M 48 Warning:
               there are no sales for vehicle class HDDBS

                    Calendar Year:  2004
                            Month:  July
                         Altitude:  Low
               Minimum Temperature:  55.0 (F)
               Maximum Temperature:  72.0 (F)
                 Absolute Humidity:   75. grains/lb
                  Nominal Fuel RVP:  11.5 psi
                     Weathered RVP:  11.5 psi
               Fuel Sulfur Content:  121. ppm

               Exhaust I/M Program:  Yes
                  Evap I/M Program:  No
                       ATP Program:  No
                  Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.7815    0.1513    0.0086                0.0063    0.0255    0.0210    0.0037    0.0020    1.0000
Fuel Economy (mpg):     24.0      18.9      14.2      18.6       8.3      32.4      20.5      10.2      50.0      22.6
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :     1.706     1.897    72.987     5.735     1.902     0.095     2.077     0.318    13.87     2.337
    Composite CO  :     19.61     24.70    757.50     64.27     22.84     1.517     6.768     0.839    20.26     25.972
    Composite NOX :     0.881     1.015    20.491     2.067     5.418     0.192     1.396     5.906     2.04     1.113
    Composite CO2 :     354.1     448.9     -17.8     423.7     991.6     310.6     477.5     991.2     104.9     372.56
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
           The user supplied arterial average speed of 50.0
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
               there are no sales for vehicle class HDDV7
  M 48 Warning:
               there are no sales for vehicle class HDDV8a
  M 48 Warning:
               there are no sales for vehicle class HDDV8b
  M 48 Warning:
               there are no sales for vehicle class HDDBS

                    Calendar Year:  2004
                            Month:  July
                         Altitude:  Low
               Minimum Temperature:  55.0 (F)
               Maximum Temperature:  72.0 (F)
                 Absolute Humidity:   75. grains/lb
                  Nominal Fuel RVP:  11.5 psi
                     Weathered RVP:  11.5 psi
               Fuel Sulfur Content:  121. ppm

               Exhaust I/M Program:  Yes
                  Evap I/M Program:  No
                       ATP Program:  No
                  Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.7815    0.1513    0.0086                0.0063    0.0255    0.0210    0.0037    0.0020    1.0000
Fuel Economy (mpg):     24.0      18.9      14.2      18.6       8.3      32.4      20.5      10.2      50.0      22.6
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :     1.641     1.853    72.990     5.694     1.790     0.093     2.067     0.298    13.81     2.279
    Composite CO  :     20.31     25.41    757.65     64.95     23.59     1.514     6.765     0.833    19.89     26.632
    Composite NOX :     0.901     1.038    20.512     2.089     5.613     0.209     1.471     6.509     2.12     1.139
    Composite CO2 :     354.1     448.9     -17.8     423.7     991.6     310.6     477.5     991.2     104.9     372.56
 ---------------------------------------------------------------------------------------------------------------------
```

B.1.2 Cape Cod Summer Weekday PM10 and SO_2 Report File

```
*************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                            *
* Input file: CACOWDAY.IN (file 1, run 1).                              *
```

```
*************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                 Month:  July
                Gasoline Fuel Sulfur Content:  121. ppm
                  Diesel Fuel Sulfur Content:  500. ppm
                        Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                         ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.7815    0.1513    0.0086              0.0063    0.0255    0.0210    0.0037    0.0020    1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
                Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
              GASPM:    0.0043    0.0046    0.0042    0.0046    0.0761    ------    ------    ------    0.0205    0.0046
            ECARBON:    ------    ------    ------    ------    ------    0.0740    0.0469    0.1043    ------    0.0033
            OCARBON:    ------    ------    ------    ------    ------    0.0209    0.0675    0.1085    ------    0.0024
                SO4:    0.0014    0.0023    0.0017    0.0022    0.0036    0.0051    0.0081    0.0216    0.0004    0.0018
   Total Exhaust PM:    0.0057    0.0069    0.0059    0.0068    0.0797    0.1000    0.1226    0.2344    0.0208    0.0121
              Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
               Tire:    0.0080    0.0080    0.0080    0.0080    0.0114    0.0080    0.0080    0.0120    0.0040    0.0080
           Total PM:    0.0262    0.0274    0.0264    0.0274    0.1036    0.1206    0.1431    0.2590    0.0374    0.0326
                SO2:    0.0275    0.0347    0.0466    0.0354    0.0791    0.0981    0.1548    0.3093    0.0133    0.0346
                NH3:    0.1016    0.1006    0.1017    0.1006    0.0451    0.0068    0.0068    0.0270    0.0113    0.0962
 -------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                 Month:  July
                Gasoline Fuel Sulfur Content:  121. ppm
                  Diesel Fuel Sulfur Content:  500. ppm
                        Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                         ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.7815    0.1513    0.0086              0.0063    0.0255    0.0210    0.0037    0.0020    1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
                Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
              GASPM:    0.0043    0.0046    0.0042    0.0046    0.0761    ------    ------    ------    0.0205    0.0046
            ECARBON:    ------    ------    ------    ------    ------    0.0740    0.0469    0.1043    ------    0.0033
            OCARBON:    ------    ------    ------    ------    ------    0.0209    0.0675    0.1085    ------    0.0024
                SO4:    0.0014    0.0023    0.0017    0.0022    0.0036    0.0051    0.0081    0.0216    0.0004    0.0018
   Total Exhaust PM:    0.0057    0.0069    0.0059    0.0068    0.0797    0.1000    0.1226    0.2344    0.0208    0.0121
              Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
               Tire:    0.0080    0.0080    0.0080    0.0080    0.0114    0.0080    0.0080    0.0120    0.0040    0.0080
           Total PM:    0.0262    0.0274    0.0264    0.0274    0.1036    0.1206    0.1431    0.2590    0.0374    0.0326
                SO2:    0.0275    0.0347    0.0466    0.0354    0.0791    0.0981    0.1548    0.3093    0.0133    0.0346
                NH3:    0.1016    0.1006    0.1017    0.1006    0.0451    0.0068    0.0068    0.0270    0.0113    0.0962
 -------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                 Month:  July
                Gasoline Fuel Sulfur Content:  121. ppm
                  Diesel Fuel Sulfur Content:  500. ppm
                        Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                         ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.7815    0.1513    0.0086              0.0063    0.0255    0.0210    0.0037    0.0020    1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
                Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
              GASPM:    0.0043    0.0046    0.0042    0.0046    0.0761    ------    ------    ------    0.0205    0.0046
            ECARBON:    ------    ------    ------    ------    ------    0.0740    0.0469    0.1043    ------    0.0033
            OCARBON:    ------    ------    ------    ------    ------    0.0209    0.0675    0.1085    ------    0.0024
                SO4:    0.0014    0.0023    0.0017    0.0022    0.0036    0.0051    0.0081    0.0216    0.0004    0.0018
   Total Exhaust PM:    0.0057    0.0069    0.0059    0.0068    0.0797    0.1000    0.1226    0.2344    0.0208    0.0121
              Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
               Tire:    0.0080    0.0080    0.0080    0.0080    0.0114    0.0080    0.0080    0.0120    0.0040    0.0080
           Total PM:    0.0262    0.0274    0.0264    0.0274    0.1036    0.1206    0.1431    0.2590    0.0374    0.0326
                SO2:    0.0275    0.0347    0.0466    0.0354    0.0791    0.0981    0.1548    0.3093    0.0133    0.0346
                NH3:    0.1016    0.1006    0.1017    0.1006    0.0451    0.0068    0.0068    0.0270    0.0113    0.0962
 -------------------------------------------------------------------------------------------------------------------------
```

B.1.3 Cape Cod Summer Weekend Report File

```
*************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                            *
* Input file: CACOWEND.IN (file 1, run 1).                              *
*************************************************************************
  M603 Comment:
               User has disabled the calculation of REFUELING emissions.

  M617 Comment:
               User supplied alternate AC input: Cloud Cover Fraction set to 0.58.
  M619 Comment:
               User supplied alternate AC input: Peak Sun between  1 AM, and  3 PM.
  M618 Comment:
               User supplied alternate AC input: Sunrise at  5 AM, Sunset at  8 PM.

* Reading Registration Distributions from the following external
* data file: REGDATA2.D
  M614 Comment:
               User supplied diesel sale fractions.

* Reading non-default MILEAGE ACCUMULATION RATES from the following external
* data file: MILEDAT2.D
  M615 Comment:
               User supplied VMT mix.
  M601 Comment:
               User has enabled STAGE II REFUELING.

  M616 Comment:
```

```
             User has supplied post-1999 sulfur levels.

* Reading non-default I/M CUTPOINTS from the following external
* data file: C:\MOBILE\CUTPOINT1.D

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
           The user supplied arterial average speed of 40.0
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
           there are no sales for vehicle class HDGV5
  M 48 Warning:
           there are no sales for vehicle class HDDV2b
  M 48 Warning:
           there are no sales for vehicle class HDDV3
  M 48 Warning:
           there are no sales for vehicle class HDDV4
  M 48 Warning:
           there are no sales for vehicle class HDDV6
  M 48 Warning:
           there are no sales for vehicle class HDDV7
  M 48 Warning:
           there are no sales for vehicle class HDDV8a
  M 48 Warning:
           there are no sales for vehicle class HDDV8b
  M 48 Warning:
           there are no sales for vehicle class HDDBS

* Reading Ammonia (NH3) Basic Emission Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

                  Calendar Year:  2004
                          Month:  July
                       Altitude:  Low
             Minimum Temperature:  55.0 (F)
             Maximum Temperature:  72.0 (F)
               Absolute Humidity:   75. grains/lb
                Nominal Fuel RVP:  11.5 psi
                    Weathered RVP:  11.5 psi
             Fuel Sulfur Content:  121. ppm

             Exhaust I/M Program:  Yes
                Evap I/M Program:  No
                    ATP Program:  No
              Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
            GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.8645    0.0918    0.0068              0.0000    0.0245    0.0113    0.0010    0.0000    1.0000
Fuel Economy (mpg):      24.0      18.9      14.5      18.5       0.0      32.4      19.4       9.2       0.0      23.3
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :       1.625     1.886    13.624     2.700     0.000     0.081     0.483     0.649      0.00     1.680
    Composite CO  :       18.08     21.97    170.25     32.26      0.00     0.837     1.375     1.633      0.00    18.855
    Composite NOX :       0.818     0.956     4.544     1.204     0.000     0.182     0.948     6.614      0.00     0.848
    Composite CO2 :       355.3     451.3     471.0     452.7       0.0     311.8     518.6    1096.3       0.0    366.45
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
           The user supplied arterial average speed of 45.0
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
           there are no sales for vehicle class HDGV5
  M 48 Warning:
           there are no sales for vehicle class HDDV2b
  M 48 Warning:
           there are no sales for vehicle class HDDV3
  M 48 Warning:
           there are no sales for vehicle class HDDV4
  M 48 Warning:
           there are no sales for vehicle class HDDV6
  M 48 Warning:
           there are no sales for vehicle class HDDV7
  M 48 Warning:
           there are no sales for vehicle class HDDV8a
  M 48 Warning:
```

```
            there are no sales for vehicle class HDDV8b
 M 48 Warning:
            there are no sales for vehicle class HDDBS

                 Calendar Year:  2004
                         Month:  July
                      Altitude:  Low
            Minimum Temperature:  55.0 (F)
            Maximum Temperature:  72.0 (F)
              Absolute Humidity:   75. grains/lb
                 Nominal Fuel RVP:  11.5 psi
                    Weathered RVP:  11.5 psi
            Fuel Sulfur Content:  121. ppm

            Exhaust I/M Program:  Yes
               Evap I/M Program:  No
                    ATP Program:  No
              Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
            GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.8645    0.0918    0.0068              0.0000    0.0245    0.0113    0.0010    0.0000    1.0000
Fuel Economy (mpg):      24.0      18.9      14.5      18.5       0.0      32.4      19.4       9.2       0.0      23.3
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :      1.560     1.842    13.558     2.655     0.000     0.078     0.464     0.594      0.00     1.618
    Composite CO  :      18.75     22.67    170.56     32.93      0.00     0.815     1.354     1.549      0.00    19.497
    Composite NOX :      0.839     0.978     4.567     1.227     0.000     0.192     1.004     7.036      0.00     0.869
    Composite CO2 :      355.3     451.3     471.0     452.7       0.0     311.8     518.6    1096.3       0.0     366.45
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #
 M583 Warning:
           The user supplied arterial average speed of 50.0
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M 48 Warning:
            there are no sales for vehicle class HDGV5
 M 48 Warning:
            there are no sales for vehicle class HDDV2b
 M 48 Warning:
            there are no sales for vehicle class HDDV3
 M 48 Warning:
            there are no sales for vehicle class HDDV4
 M 48 Warning:
            there are no sales for vehicle class HDDV6
 M 48 Warning:
            there are no sales for vehicle class HDDV7
 M 48 Warning:
            there are no sales for vehicle class HDDV8a
 M 48 Warning:
            there are no sales for vehicle class HDDV8b
 M 48 Warning:
            there are no sales for vehicle class HDDBS

                 Calendar Year:  2004
                         Month:  July
                      Altitude:  Low
            Minimum Temperature:  55.0 (F)
            Maximum Temperature:  72.0 (F)
              Absolute Humidity:   75. grains/lb
                 Nominal Fuel RVP:  11.5 psi
                    Weathered RVP:  11.5 psi
            Fuel Sulfur Content:  121. ppm

            Exhaust I/M Program:  Yes
               Evap I/M Program:  No
                    ATP Program:  No
              Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
            GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.8645    0.0918    0.0068              0.0000    0.0245    0.0113    0.0010    0.0000    1.0000
Fuel Economy (mpg):      24.0      18.9      14.5      18.5       0.0      32.4      19.4       9.2       0.0      23.3
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :      1.502     1.796    13.488     2.607     0.000     0.077     0.451     0.557      0.00     1.563
    Composite CO  :      19.42     23.36    170.86     33.59      0.00     0.812     1.351     1.537      0.00    20.141
    Composite NOX :      0.859     1.001     4.591     1.250     0.000     0.209     1.098     7.754      0.00     0.891
    Composite CO2 :      355.3     451.3     471.0     452.7       0.0     311.8     518.6    1096.3       0.0     366.45
 ---------------------------------------------------------------------------------------------------------------------
```

B.1.4 Cape Cod Summer Weekend PM10 and SO_2 Report File

```
**************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                             *
* Input file: CACOWEND.IN (file 1, run 1).                               *
**************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                  Month:  July
              Gasoline Fuel Sulfur Content:  121. ppm
                Diesel Fuel Sulfur Content:  500. ppm
                       Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No
```

```
       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC   All Veh
                  GVWR:              <6000     >6000     (All)
                       ------    ------    ------    ------     ------     ------     ------     ------     ------   ------
  VMT Distribution:    0.8645    0.0918    0.0068                0.0000     0.0245     0.0113     0.0010     0.0000   1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
                Lead:    0.0000    0.0000    0.0000    0.0000     0.0000     ------     ------     ------     0.0000   0.0000
               GASPM:    0.0043    0.0048    0.0042    0.0047     0.0000     ------     ------     ------     0.0205   0.0042
             ECARBON:    ------    ------    ------    ------     ------     0.0740     0.0458     0.2833     ------   0.0026
             OCARBON:    ------    ------    ------    ------     ------     0.0209     0.0659     0.2949     ------   0.0016
                 SO4:    0.0013    0.0022    0.0023    0.0022     0.0000     0.0051     0.0085     0.0240     0.0000   0.0016
  Total Exhaust PM:    0.0056    0.0070    0.0065    0.0069     0.0000     0.1000     0.1202     0.6022     0.0205   0.0100
               Brake:    0.0125    0.0125    0.0125    0.0125     0.0000     0.0125     0.0125     0.0125     0.0000   0.0125
                Tire:    0.0080    0.0080    0.0080    0.0080     0.0000     0.0080     0.0080     0.0120     0.0000   0.0080
            Total PM:    0.0262    0.0275    0.0271    0.0275     0.0000     0.1206     0.1408     0.6268     0.0205   0.0305
                 SO2:    0.0275    0.0347    0.0453    0.0355     0.0000     0.0981     0.1634     0.3432     0.0000   0.0319
                 NH3:    0.1013    0.1003    0.1008    0.1003     0.0000     0.0068     0.0068     0.0270     0.0000   0.0978
 -------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                 Month:  July
                  Gasoline Fuel Sulfur Content:  121. ppm
                    Diesel Fuel Sulfur Content:  500. ppm
                         Particle Size Cutoff: 10.00 Microns
                            Reformulated Gas:  No

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC   All Veh
                  GVWR:              <6000     >6000     (All)
                       ------    ------    ------    ------     ------     ------     ------     ------     ------   ------
  VMT Distribution:    0.8645    0.0918    0.0068                0.0000     0.0245     0.0113     0.0010     0.0000   1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
                Lead:    0.0000    0.0000    0.0000    0.0000     0.0000     ------     ------     ------     0.0000   0.0000
               GASPM:    0.0043    0.0048    0.0042    0.0047     0.0000     ------     ------     ------     0.0205   0.0042
             ECARBON:    ------    ------    ------    ------     ------     0.0740     0.0458     0.2833     ------   0.0026
             OCARBON:    ------    ------    ------    ------     ------     0.0209     0.0659     0.2949     ------   0.0016
                 SO4:    0.0013    0.0022    0.0023    0.0022     0.0000     0.0051     0.0085     0.0240     0.0000   0.0016
  Total Exhaust PM:    0.0056    0.0070    0.0065    0.0069     0.0000     0.1000     0.1202     0.6022     0.0205   0.0100
               Brake:    0.0125    0.0125    0.0125    0.0125     0.0000     0.0125     0.0125     0.0125     0.0000   0.0125
                Tire:    0.0080    0.0080    0.0080    0.0080     0.0000     0.0080     0.0080     0.0120     0.0000   0.0080
            Total PM:    0.0262    0.0275    0.0271    0.0275     0.0000     0.1206     0.1408     0.6268     0.0205   0.0305
                 SO2:    0.0275    0.0347    0.0453    0.0355     0.0000     0.0981     0.1634     0.3432     0.0000   0.0319
                 NH3:    0.1013    0.1003    0.1008    0.1003     0.0000     0.0068     0.0068     0.0270     0.0000   0.0978
 -------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                 Month:  July
                  Gasoline Fuel Sulfur Content:  121. ppm
                    Diesel Fuel Sulfur Content:  500. ppm
                         Particle Size Cutoff: 10.00 Microns
                            Reformulated Gas:  No

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC   All Veh
                  GVWR:              <6000     >6000     (All)
                       ------    ------    ------    ------     ------     ------     ------     ------     ------   ------
  VMT Distribution:    0.8645    0.0918    0.0068                0.0000     0.0245     0.0113     0.0010     0.0000   1.0000
 -------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
                Lead:    0.0000    0.0000    0.0000    0.0000     0.0000     ------     ------     ------     0.0000   0.0000
               GASPM:    0.0043    0.0048    0.0042    0.0047     0.0000     ------     ------     ------     0.0205   0.0042
             ECARBON:    ------    ------    ------    ------     ------     0.0740     0.0458     0.2833     ------   0.0026
             OCARBON:    ------    ------    ------    ------     ------     0.0209     0.0659     0.2949     ------   0.0016
                 SO4:    0.0013    0.0022    0.0023    0.0022     0.0000     0.0051     0.0085     0.0240     0.0000   0.0016
  Total Exhaust PM:    0.0056    0.0070    0.0065    0.0069     0.0000     0.1000     0.1202     0.6022     0.0205   0.0100
               Brake:    0.0125    0.0125    0.0125    0.0125     0.0000     0.0125     0.0125     0.0125     0.0000   0.0125
                Tire:    0.0080    0.0080    0.0080    0.0080     0.0000     0.0080     0.0080     0.0120     0.0000   0.0080
            Total PM:    0.0262    0.0275    0.0271    0.0275     0.0000     0.1206     0.1408     0.6268     0.0205   0.0305
                 SO2:    0.0275    0.0347    0.0453    0.0355     0.0000     0.0981     0.1634     0.3432     0.0000   0.0319
                 NH3:    0.1013    0.1003    0.1008    0.1003     0.0000     0.0068     0.0068     0.0270     0.0000   0.0978
 -------------------------------------------------------------------------------------------------------------------------
```

B.1.5 Cape Cod Winter Weekday Report File

```
************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                           *
* Input file: CACOWDAY.IN (file 1, run 1).                             *
************************************************************************
  M603 Comment:
               User has disabled the calculation of REFUELING emissions.

  M617 Comment:
               User supplied alternate AC input: Cloud Cover Fraction set to 0.55.
  M619 Comment:
               User supplied alternate AC input: Peak Sun between 11 AM, and  1 PM.
  M618 Comment:
               User supplied alternate AC input: Sunrise at  7 AM, Sunset at  5 PM.
  M601 Comment:
               User has enabled STAGE II REFUELING.

  M616 Comment:
               User has supplied post-1999 sulfur levels.

* Reading non-default I/M CUTPOINTS from the following external
* data file: C:\MOBILE\CUTPOINT1.D

* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY WINTER SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 40.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV
```

```
* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
             there are no sales for vehicle class HDGV8b

* Reading Ammonia (NH3) Basic Emissiion Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

                   Calendar Year:  2004
                           Month:  Jan.
                        Altitude:  Low
              Minimum Temperature:  31.0 (F)
              Maximum Temperature:  46.0 (F)
                Absolute Humidity:   30. grains/lb
                 Nominal Fuel RVP:  13.5 psi
                    Weathered RVP:  13.5 psi
              Fuel Sulfur Content:  121. ppm

              Exhaust I/M Program:  Yes
                 Evap I/M Program:  No
                      ATP Program:  No
                   Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
            GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
Fuel Economy (mpg):      24.0      18.7      14.4      17.4       9.5      29.5      17.6       7.1      50.0      16.9
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :      1.026     1.249     2.106     1.467     1.028     0.528     0.869     0.476      1.61     1.175
    Composite CO  :      20.31     26.17     32.57     27.80     13.03     1.350     1.440     2.284     10.85    21.703
    Composite NOX :      1.137     1.470     1.979     1.599     5.017     1.244     1.394    10.745      1.78     2.288
    Composite CO2 :      355.3     453.8     585.9     487.4     896.2     340.0     569.9    1424.4     145.6     521.21
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY WINTER SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 45.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
             there are no sales for vehicle class HDGV8b

                   Calendar Year:  2004
                           Month:  Jan.
                        Altitude:  Low
              Minimum Temperature:  31.0 (F)
              Maximum Temperature:  46.0 (F)
                Absolute Humidity:   30. grains/lb
                 Nominal Fuel RVP:  13.5 psi
                    Weathered RVP:  13.5 psi
              Fuel Sulfur Content:  121. ppm

              Exhaust I/M Program:  Yes
                 Evap I/M Program:  No
                      ATP Program:  No
                   Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
            GVWR:                 <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
Fuel Economy (mpg):      24.0      18.7      14.4      17.4       9.5      29.5      17.6       7.1      50.0      16.9
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :      1.010     1.230     2.071     1.444     0.946     0.505     0.832     0.436      1.56     1.151
    Composite CO  :      20.99     26.95     33.42     28.60     12.74     1.320     1.409     2.166     10.19    22.324
    Composite NOX :      1.163     1.499     2.008     1.628     5.204     1.318     1.477    11.373      1.82     2.372
    Composite CO2 :      355.3     453.8     585.9     487.4     896.2     340.0     569.9    1424.4     145.6     521.21
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY WINTER SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 50.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
```

```
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
             there are no sales for vehicle class HDGV8b

                  Calendar Year:  2004
                          Month:  Jan.
                       Altitude:  Low
              Minimum Temperature:  31.0 (F)
              Maximum Temperature:  46.0 (F)
                Absolute Humidity:   30. grains/lb
                 Nominal Fuel RVP:  13.5 psi
                    Weathered RVP:  13.5 psi
              Fuel Sulfur Content:  121. ppm

              Exhaust I/M Program:  Yes
                 Evap I/M Program:  No
                      ATP Program:  No
                Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
Fuel Economy (mpg):      24.0      18.7      14.4      17.4       9.5      29.5      17.6       7.1      50.0      16.9
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :     0.993     1.210     2.035     1.420     0.889     0.489     0.806     0.408      1.54     1.129
    Composite CO  :     21.67     27.73     34.27     29.40     13.16     1.315     1.405     2.149      9.92    22.981
    Composite NOX :     1.189     1.528     2.036     1.657     5.392     1.445     1.620    12.445      1.92     2.494
    Composite CO2 :     355.3     453.8     585.9     487.4     896.2     340.0     569.9    1424.4     145.6    521.21
 ---------------------------------------------------------------------------------------------------------------------
```

B.1.6 Cape Cod Winter Weekday PM10 and SO_2 Report File

```
**************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                             *
* Input file: CACOWDAY.IN (file 1, run 1).                               *
**************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY WINTER SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                  Month:  Jan.
                  Gasoline Fuel Sulfur Content:  121. ppm
                    Diesel Fuel Sulfur Content:  500. ppm
                         Particle Size Cutoff: 10.00 Microns
                              Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
              Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
            GASPM:    0.0043    0.0048    0.0062    0.0052    0.0686    ------    ------    ------    0.0205    0.0067
          ECARBON:    ------    ------    ------    ------    ------    0.1739    0.0736    0.2322    ------    0.0197
          OCARBON:    ------    ------    ------    ------    ------    0.0490    0.1059    0.1161    ------    0.0100
              SO4:    0.0012    0.0019    0.0022    0.0020    0.0042    0.0056    0.0094    0.0312    0.0004    0.0042
  Total Exhaust PM:    0.0055    0.0068    0.0084    0.0072    0.0729    0.2286    0.1889    0.3794    0.0208    0.0406
           Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
            Tire:    0.0080    0.0080    0.0080    0.0080    0.0087    0.0080    0.0080    0.0260    0.0040    0.0095
        Total PM:    0.0260    0.0273    0.0290    0.0277    0.0942    0.2491    0.2095    0.4180    0.0374    0.0626
             SO2:    0.0275    0.0351    0.0459    0.0379    0.0692    0.1078    0.1801    0.4454    0.0133    0.0688
             NH3:    0.1013    0.1000    0.0962    0.0990    0.0451    0.0068    0.0068    0.0270    0.0113    0.0913
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY WINTER SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                  Month:  Jan.
                  Gasoline Fuel Sulfur Content:  121. ppm
                    Diesel Fuel Sulfur Content:  500. ppm
                         Particle Size Cutoff: 10.00 Microns
                              Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
              Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
            GASPM:    0.0043    0.0048    0.0062    0.0052    0.0686    ------    ------    ------    0.0205    0.0067
          ECARBON:    ------    ------    ------    ------    ------    0.1739    0.0736    0.2322    ------    0.0197
          OCARBON:    ------    ------    ------    ------    ------    0.0490    0.1059    0.1161    ------    0.0100
              SO4:    0.0012    0.0019    0.0022    0.0020    0.0042    0.0056    0.0094    0.0312    0.0004    0.0042
  Total Exhaust PM:    0.0055    0.0068    0.0084    0.0072    0.0729    0.2286    0.1889    0.3794    0.0208    0.0406
           Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
            Tire:    0.0080    0.0080    0.0080    0.0080    0.0087    0.0080    0.0080    0.0260    0.0040    0.0095
        Total PM:    0.0260    0.0273    0.0290    0.0277    0.0942    0.2491    0.2095    0.4180    0.0374    0.0626
             SO2:    0.0275    0.0351    0.0459    0.0379    0.0692    0.1078    0.1801    0.4454    0.0133    0.0688
             NH3:    0.1013    0.1000    0.0962    0.0990    0.0451    0.0068    0.0068    0.0270    0.0113    0.0913
 ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKDAY WINTER SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #

                          Calendar Year:  2004
                                  Month:  Jan.
                  Gasoline Fuel Sulfur Content:  121. ppm
                    Diesel Fuel Sulfur Content:  500. ppm
                         Particle Size Cutoff: 10.00 Microns
                              Reformulated Gas:  No

      Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
              Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
            GASPM:    0.0043    0.0048    0.0062    0.0052    0.0686    ------    ------    ------    0.0205    0.0067
```

```
           ECARBON:    ------    ------    ------    ------    ------    0.1739    0.0736    0.2322    ------    0.0197
           OCARBON:    ------    ------    ------    ------    ------    0.0490    0.1059    0.1161    ------    0.0100
               SO4:    0.0012    0.0019    0.0022    0.0020    0.0042    0.0056    0.0094    0.0312    0.0004    0.0042
 Total Exhaust PM:    0.0055    0.0068    0.0084    0.0072    0.0729    0.2286    0.1889    0.3794    0.0208    0.0406
             Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
              Tire:    0.0080    0.0080    0.0080    0.0080    0.0087    0.0080    0.0080    0.0260    0.0040    0.0095
          Total PM:    0.0260    0.0273    0.0290    0.0277    0.0942    0.2491    0.2095    0.4180    0.0374    0.0626
               SO2:    0.0275    0.0351    0.0459    0.0379    0.0692    0.1078    0.1801    0.4454    0.0133    0.0688
               NH3:    0.1013    0.1000    0.0962    0.0990    0.0451    0.0068    0.0068    0.0270    0.0113    0.0913
 ------------------------------------------------------------------------------------------------------------------------
```

B.1.7 Cape Cod Winter Weekend Report File

```
*****************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                                *
* Input file: CACOWEND.IN (file 1, run 1).                                  *
*****************************************************************************
  M603 Comment:
               User has disabled the calculation of REFUELING emissions.

  M617 Comment:
               User supplied alternate AC input: Cloud Cover Fraction set to 0.55.
  M619 Comment:
               User supplied alternate AC input: Peak Sun between 11 AM, and  1 PM.
  M618 Comment:
               User supplied alternate AC input: Sunrise at  7 AM, Sunset at  5 PM.
  M601 Comment:
               User has enabled STAGE II REFUELING.

  M616 Comment:
               User has supplied post-1999 sulfur levels.

* Reading non-default I/M CUTPOINTS from the following external
* data file: C:\MOBILE\CUTPOINT1.D

* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND WINTER SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 40.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
               there are no sales for vehicle class HDGV8b

* Reading Ammonia (NH3) Basic Emissiion Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

                    Calendar Year:  2004
                            Month:  Jan.
                         Altitude:  Low
               Minimum Temperature:  31.0 (F)
               Maximum Temperature:  46.0 (F)
                 Absolute Humidity:   30. grains/lb
                  Nominal Fuel RVP:  13.5 psi
                     Weathered RVP:  13.5 psi
               Fuel Sulfur Content:  121. ppm

               Exhaust I/M Program:  Yes
                  Evap I/M Program:  No
                       ATP Program:  No
                 Reformulated Gas:  No

Emissions determined from WEEKEND hourly vehicle activity fractions.

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
            GVWR:                 <6000     >6000     (All)
                       ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4358    0.3253    0.1110                0.0358    0.0006    0.0018    0.0839    0.0058    1.0000
 Fuel Economy (mpg):      24.0      18.7      14.4      17.4       9.5      29.5      17.6       7.1      50.0      16.9
 ------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :     0.861     1.005     1.690     1.179     1.029     0.459     0.735     0.476      1.57     0.977
     Composite CO  :     17.06     21.15     26.31     22.46     13.03     1.126     1.159     2.284     10.42     17.954
     Composite NOX :     1.075     1.373     1.849     1.494     5.017     1.225     1.370    10.745      1.79     2.215
     Composite CO2 :     356.7     456.9     590.9     491.0     896.2     340.5     570.8    1424.4     145.9     523.39
  ------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND WINTER SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 45.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
```

```
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
               there are no sales for vehicle class HDGV8b

                    Calendar Year:  2004
                            Month:  Jan.
                         Altitude:  Low
                  Minimum Temperature:  31.0 (F)
                  Maximum Temperature:  46.0 (F)
                    Absolute Humidity:   30. grains/lb
                     Nominal Fuel RVP:  13.5 psi
                        Weathered RVP:  13.5 psi
                  Fuel Sulfur Content:  121. ppm

                  Exhaust I/M Program:  Yes
                     Evap I/M Program:  No
                          ATP Program:  No
                     Reformulated Gas:  No

Emissions determined from WEEKEND hourly vehicle activity fractions.

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC   All Veh
                GVWR:             <6000     >6000     (All)
                       ------    ------    ------    ------    ------     ------     ------     ------     ------    ------
   VMT Distribution:    0.4358    0.3253    0.1110                0.0358     0.0006     0.0018     0.0839     0.0058    1.0000
 Fuel Economy (mpg):      24.0      18.7      14.4      17.4       9.5       29.5       17.6        7.1       50.0      16.9
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC  :     0.845     0.986     1.655     1.156     0.948     0.436      0.698     0.436      1.52     0.953
     Composite CO   :     17.74     21.93     27.16     23.26     12.74     1.096      1.128     2.166      9.76     18.575
     Composite NOX  :     1.101     1.402     1.878     1.523     5.204     1.299      1.454     11.373     1.83     2.299
     Composite CO2  :     356.7     456.9     590.9     491.0     896.2     340.5      570.8     1424.4     145.9    523.39
  --------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND WINTER SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 50.0
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types.

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M 48 Warning:
               there are no sales for vehicle class HDGV8b

                    Calendar Year:  2004
                            Month:  Jan.
                         Altitude:  Low
                  Minimum Temperature:  31.0 (F)
                  Maximum Temperature:  46.0 (F)
                    Absolute Humidity:   30. grains/lb
                     Nominal Fuel RVP:  13.5 psi
                        Weathered RVP:  13.5 psi
                  Fuel Sulfur Content:  121. ppm

                  Exhaust I/M Program:  Yes
                     Evap I/M Program:  No
                          ATP Program:  No
                     Reformulated Gas:  No

Emissions determined from WEEKEND hourly vehicle activity fractions.

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC   All Veh
                GVWR:             <6000     >6000     (All)
                       ------    ------    ------    ------    ------     ------     ------     ------     ------    ------
   VMT Distribution:    0.4358    0.3253    0.1110                0.0358     0.0006     0.0018     0.0839     0.0058    1.0000
 Fuel Economy (mpg):      24.0      18.7      14.4      17.4       9.5       29.5       17.6        7.1       50.0      16.9
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC  :     0.829     0.966     1.618     1.132     0.891     0.420      0.673     0.408      1.51     0.931
     Composite CO   :     18.42     22.71     28.01     24.06     13.16     1.092      1.124     2.149      9.49     19.233
     Composite NOX  :     1.127     1.431     1.906     1.552     5.392     1.426      1.596     12.445     1.93     2.421
     Composite CO2  :     356.7     456.9     590.9     491.0     896.2     340.5      570.8     1424.4     145.9    523.39
  --------------------------------------------------------------------------------------------------------------------------
```

B.1.8 Cape Cod Winter Weekend PM10 and SO_2 Report File

```
************************************************************************
* MOBILE6.2.01 (31-Oct-2002)                                           *
* Input file: CACOWEND.IN (file 1, run 1).                             *
************************************************************************

* # # # # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND WINTER SEGMENT 1-4
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # # # # #

                         Calendar Year:  2004
                                 Month:  Jan.
                Gasoline Fuel Sulfur Content:  121. ppm
                  Diesel Fuel Sulfur Content:  500. ppm
                       Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No

Emissions determined from WEEKEND hourly vehicle activity fractions.

       Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC   All Veh
                GVWR:             <6000     >6000     (All)
                       ------    ------    ------    ------    ------     ------     ------     ------     ------    ------
   VMT Distribution:    0.4358    0.3253    0.1110                0.0358     0.0006     0.0018     0.0839     0.0058    1.0000
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
```

```
              Lead:    0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
             GASPM:    0.0043    0.0048    0.0062    0.0052    0.0686    ------    ------    ------    0.0205    0.0067
           ECARBON:    ------    ------    ------    ------    ------    0.1739    0.0736    0.2322    ------    0.0197
           OCARBON:    ------    ------    ------    ------    ------    0.0490    0.1059    0.1161    ------    0.0100
               SO4:    0.0012    0.0019    0.0022    0.0020    0.0042    0.0056    0.0094    0.0312    0.0004    0.0042
  Total Exhaust PM:    0.0055    0.0068    0.0084    0.0072    0.0729    0.2286    0.1889    0.3794    0.0208    0.0406
             Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
              Tire:    0.0080    0.0080    0.0080    0.0080    0.0087    0.0080    0.0080    0.0260    0.0040    0.0095
          Total PM:    0.0260    0.0273    0.0290    0.0277    0.0942    0.2491    0.2095    0.4180    0.0374    0.0626
               SO2:    0.0275    0.0351    0.0459    0.0379    0.0692    0.1078    0.1801    0.4454    0.0133    0.0688
               NH3:    0.1013    0.1000    0.0962    0.0990    0.0451    0.0068    0.0068    0.0270    0.0113    0.0913
 ------------------------------------------------------------------------------------------------------------------------


* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND WINTER SEGMENT 5-7
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                            Calendar Year:  2004
                                    Month:  Jan.
                Gasoline Fuel Sulfur Content:  121. ppm
                  Diesel Fuel Sulfur Content:  500. ppm
                        Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No

Emissions determined from WEEKEND hourly vehicle activity fractions.

       Vehicle Type:      LDGV     LDGT12     LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC    All Veh
                GVWR:                <6000      >6000     (All)
                      ------     ------     ------     ------     ------     ------     ------     ------     ------     ------
   VMT Distribution:    0.4358     0.3253     0.1110                0.0358     0.0006     0.0018     0.0839     0.0058     1.0000
 ------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
              Lead:    0.0000     0.0000     0.0000     0.0000     0.0000     ------     ------     ------     0.0000     0.0000
             GASPM:    0.0043     0.0048     0.0062     0.0052     0.0686     ------     ------     ------     0.0205     0.0067
           ECARBON:    ------     ------     ------     ------     ------     0.1739     0.0736     0.2322     ------     0.0197
           OCARBON:    ------     ------     ------     ------     ------     0.0490     0.1059     0.1161     ------     0.0100
               SO4:    0.0012     0.0019     0.0022     0.0020     0.0042     0.0056     0.0094     0.0312     0.0004     0.0042
  Total Exhaust PM:    0.0055     0.0068     0.0084     0.0072     0.0729     0.2286     0.1889     0.3794     0.0208     0.0406
             Brake:    0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125
              Tire:    0.0080     0.0080     0.0080     0.0080     0.0087     0.0080     0.0080     0.0260     0.0040     0.0095
          Total PM:    0.0260     0.0273     0.0290     0.0277     0.0942     0.2491     0.2095     0.4180     0.0374     0.0626
               SO2:    0.0275     0.0351     0.0459     0.0379     0.0692     0.1078     0.1801     0.4454     0.0133     0.0688
               NH3:    0.1013     0.1000     0.0962     0.0990     0.0451     0.0068     0.0068     0.0270     0.0113     0.0913
 ------------------------------------------------------------------------------------------------------------------------


* # # # # # # # # # # # # # # # # # # # # # # # # #
* CACO WEEKEND WINTER SEGMENT 8-9
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #

                            Calendar Year:  2004
                                    Month:  Jan.
                Gasoline Fuel Sulfur Content:  121. ppm
                  Diesel Fuel Sulfur Content:  500. ppm
                        Particle Size Cutoff: 10.00 Microns
                           Reformulated Gas:  No

Emissions determined from WEEKEND hourly vehicle activity fractions.

       Vehicle Type:      LDGV     LDGT12     LDGT34      LDGT       HDGV       LDDV       LDDT       HDDV         MC    All Veh
                GVWR:                <6000      >6000     (All)
                      ------     ------     ------     ------     ------     ------     ------     ------     ------     ------
   VMT Distribution:    0.4358     0.3253     0.1110                0.0358     0.0006     0.0018     0.0839     0.0058     1.0000
 ------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
              Lead:    0.0000     0.0000     0.0000     0.0000     0.0000     ------     ------     ------     0.0000     0.0000
             GASPM:    0.0043     0.0048     0.0062     0.0052     0.0686     ------     ------     ------     0.0205     0.0067
           ECARBON:    ------     ------     ------     ------     ------     0.1739     0.0736     0.2322     ------     0.0197
           OCARBON:    ------     ------     ------     ------     ------     0.0490     0.1059     0.1161     ------     0.0100
               SO4:    0.0012     0.0019     0.0022     0.0020     0.0042     0.0056     0.0094     0.0312     0.0004     0.0042
  Total Exhaust PM:    0.0055     0.0068     0.0084     0.0072     0.0729     0.2286     0.1889     0.3794     0.0208     0.0406
             Brake:    0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125     0.0125
              Tire:    0.0080     0.0080     0.0080     0.0080     0.0087     0.0080     0.0080     0.0260     0.0040     0.0095
          Total PM:    0.0260     0.0273     0.0290     0.0277     0.0942     0.2491     0.2095     0.4180     0.0374     0.0626
               SO2:    0.0275     0.0351     0.0459     0.0379     0.0692     0.1078     0.1801     0.4454     0.0133     0.0688
               NH3:    0.1013     0.1000     0.0962     0.0990     0.0451     0.0068     0.0068     0.0270     0.0113     0.0913
 ------------------------------------------------------------------------------------------------------------------------
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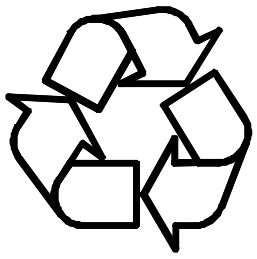
B.2 Noise Emissions Output (TNM)

(see Sections 5.2.1 and 5.2.2)



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Clay N. Reherman, George J. Noel, Scott B. Smith, Gregg G. Fleming, and Gary T. Ritter

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14. ABSTRACT (Maximum 200 words)

The U.S. Department of Transportation, John A. Volpe National Transportation Systems Center (Volpe Center), Environmental Measurement and Modeling Division (Volpe Center), provided technical support to a National Park Service (NPS) project to evaluate vehicular emissions in Cape Cod National Seashore. Air emissions were analyzed using the Environmental Protection Agency's (EPA) MOBILE6.2 emissions inventory prediction model, and noise emissions were analyzed using the Federal Highway Administration's (FHWA) Traffic Noise Model. Input data are based on historical data, US Geological Survey data, and recommended roadway speeds. An emissions inventory, location point receiver analysis, and contour analysis are presented for Cape Cod National Seashore.

15. SUBJECT TERMS

national parks, emissions, emissions inventory, MOBILE6, TNM, traffic impact, National Park Service, Cape Cod National Seashore, LAeq1h

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
			NA	64	Clay Reherman
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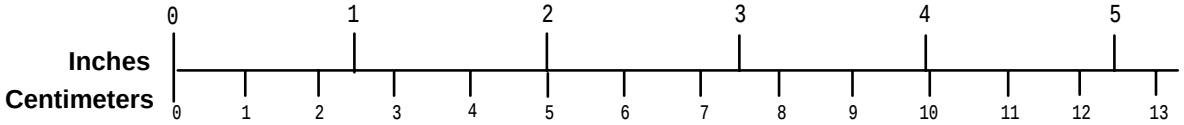
NONE	NONE	NONE			(617) 494-6341

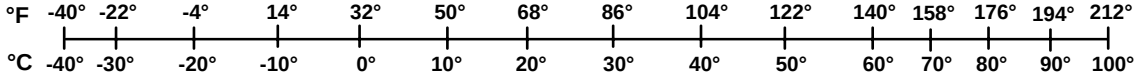
METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC	METRIC TO ENGLISH
LENGTH (APPROXIMATE)	**LENGTH (APPROXIMATE)**
1 inch (in) = 2.5 centimeters (cm)	1 millimeter (mm) = 0.04 inch (in)
1 foot (ft) = 30 centimeters (cm)	1 centimeter (cm) = 0.4 inch (in)
1 yard (yd) = 0.9 meter (m)	1 meter (m) = 3.3 feet (ft)
1 mile (mi) = 1.6 kilometers (km)	1 meter (m) = 1.1 yards (yd)
	1 kilometer (km) = 0.6 mile (mi)
AREA (APPROXIMATE)	**AREA (APPROXIMATE)**
1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)	1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)	1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)	1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)	10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres
1 acre = 0.4 hectare (he) = 4,000 square meters (m^2)	
MASS – WEIGHT (APPROXIMATE)	**MASS – WEIGHT (APPROXIMATE)**
1 ounce (oz) = 28 grams (gm)	1 gram (gm) = 0.036 ounce (oz)
1 pound (lb) = 0.45 kilogram (kg)	1 kilogram (kg) = 2.2 pounds (lb)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)	1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons
VOLUME (APPROXIMATE)	**VOLUME (APPROXIMATE)**
1 teaspoon (tsp) = 5 milliliters (ml)	1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 tablespoon (tbsp) = 15 milliliters (ml)	1 liter (l) = 2.1 pints (pt)
1 fluid ounce (fl oz) = 30 milliliters (ml)	1 liter (l) = 1.06 quarts (qt)
1 cup © = 0.24 liter (l)	1 liter (l) = 0.26 gallon (gal)
1 pint (pt) = 0.47 liter (l)	
1 quart (qt) = 0.96 liter (l)	
1 gallon (gal) = 3.8 liters (l)	
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)	1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)	1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)
TEMPERATURE (EXACT)	**TEMPERATURE (EXACT)**
[(x-32)(5/9)] °F = y °C	[(9/5) y + 32] °C = x °F

QUICK INCH - CENTIMETER LENGTH CONVERSION



QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSION



For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50 SD Catalog No. C13 10286

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As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-361 / September 2005