

California Environmental Protection Agency



Vapor Recovery Test Procedure

TP - 201.2A

**DETERMINATION OF VEHICLE MATRIX FOR
PHASE II SYSTEMS**

Adopted: April 12, 1996
Amended: February 1, 2001

**CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD**

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Determination of Vehicle Matrix for Phase II Systems

1 Applicability

Definitions common to all certification and test procedures are in:

D-200 Definitions for Vapor Recovery Test Procedures

For the purpose of this procedure, the term "ARB" refers to the State of California Air Resources Board, and the term "ARB Executive Officer" refers to the Executive Officer of the ARB or his or her authorized representative or designate.

This test procedure can be used to determine the characteristics of a test fleet of vehicles which, when tested by other test procedures, can yield data representative of the total vehicle fleet.

2 Principle and Summary of Testing Procedure

A representative matrix of vehicle counts in various categories is calculated from registered vehicle data and other information. Vehicles are categorized by model year and by make and/or vehicle type. The number of vehicles specified in the matrix for each category is such that the average number of miles traveled in California by vehicles in each category is substantially similar.

3 Biases and Interferences

The number of vehicle miles traveled is not identical to the amount of gasoline used by vehicles in a category because gasoline consumption per mile will vary. Correction for differences in gasoline consumption rate is considered impractical. It is also impractical to calculate a matrix where the vehicle miles traveled in each category is identical because of the need to round values off to integer vehicle counts in the matrix and include entire model years in categories.

4 Calculating the Vehicle Matrix

The criteria defining vehicle categories and the information on which calculations are based shall be chosen as reasonable and appropriate for the purposes described in sections 1 and 2. The same matrix shall be used for all testing performed in any calendar year, except that the Executive Officer may approve an alternative matrix to be used in special cases where a vapor recovery system is demonstrated to serve a vehicle population substantially different from the California vehicle population as a whole.

The vehicle makes and types, and models, and the number of vehicles per cell in the examples below are for illustration purposes only. More cells and other models, or vehicle makes and/or types, and different numbers of vehicles or categories shall be included at the discretion of the ARB Executive Officer.

The calculation procedures described below are illustrative only and other reasonable and appropriate procedures may be specified or approved by the Executive Officer provided only that the resulting matrix delineates a diverse and representative variety of vehicles and vehicle counts are determined considering estimated vehicle miles traveled by vehicles in each category.

At the Executive Officer's discretion, testing of any particular vapor recovery system may be required to include, in addition to the vehicle matrix, a supplementary list of vehicles or vehicle categories having features or equipment which may pose particular challenges or incompatibilities with that vapor recovery system.

4.1 Obtain Vehicle Make, Model, and Type Information

Obtain the number of vehicles in various categories from an appropriate source such as annual reports from the California Department of Motor Vehicles. An example of data for automobile categories defined by model year and make is illustrated by the following:

	Number of Vehicles						
MODEL (e.g.)	CHRYSLER	FORD	GM	TOYOTA	HONDA	OTHER	TOTAL
YEAR							
1991	109,563	344,867	334,974	218,577	191,174	378,731	1,577,886
1990	138,427	352,293	323,953	203,156	189,973	460,906	1,668,708
etc.							

4.2 Obtain Vehicle Miles Traveled Information By Model Year

Obtain data for the projected values for the number of vehicle miles traveled or percent of vehicle miles traveled in various model years expected in the current calendar year from an appropriate source such as projected values provided by ARB=s EMFAC modeling program. Include only gasoline fueled vehicles. An example of such data is illustrated by the following:

Percent of Vehicle Miles Traveled by Vehicle Model Year

MODEL YEAR	PERCENT OF VEHICLE MILES TRAVELED
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1991	6.9
1990	10.5
1989	10.7
1988	10.3
1987	9.3
1986	8.2
1985	7.4

etcetera (percentages should add up to 100)

4.3 Calculate Estimated Vehicle Miles Traveled for Each Make and/or Type Category and Each Model Year

Calculate the estimated vehicle miles traveled or percentage of vehicle miles traveled for each category of vehicle make or type in each model year using the data obtained above. For example, calculate that because there were 109563 1991 model Chrysler vehicles and 1,577,886 total 1991 model vehicles, and projected vehicle miles traveled for 1991 vehicles is 6.9% of all vehicle miles traveled, the projected percentage of vehicle miles traveled by 1991 model Chrysler vehicles will be $6.9\% \times (109563/1577886)$ or 0.4791%.

4.4 Calculate the Cumulative Percentage of Vehicle Miles Traveled for each Model Year

Calculate the number of vehicle miles traveled in each model year as a percentage of vehicle miles traveled in all model years and, for each model year, the cumulative percentage of vehicle miles traveled by vehicles as new or newer than vehicles in that

model year.

Model Year	Percent of Total	Cumulative Percent
1991	6.9	6.9
1990	10.5	17.4
1989	10.7	28.1
1988	10.3	38.4
1987	9.3	47.7
1986	8.2	55.9
1985	7.4	63.3
etc		

4.5 Divide Model Years into Category Groups

Using the cumulative percentages of vehicle miles traveled previously calculated for each model year, divide the model years into groups each representing approximately the same percentage of vehicle miles traveled. As an illustrative example, dividing model years into 5 groups each representing approximately 20% of vehicle miles traveled would be done as follows using the example data above: 1990-1991 model years represent 17.4% of vehicle miles traveled, 1988-1989 model years represent 21.0%, 1985-1987 model years represent 24.9% of vehicle miles traveled, etc. Trial and error selection of model years may be necessary to arrive at an arrangement with the most equal division of vehicle miles traveled in each category group of model years. Do not subdivide model years. The groups will normally represent percentages of vehicle miles traveled which are only approximately equal.

4.6 Calculate Percentage of Vehicle Miles Traveled In Each Model Year Category by Vehicles in Each Vehicle Make or Type Category

Sum the percentage of vehicle miles traveled for each category of vehicle in each model year category. For example using data above, because 1991 Chrysler vehicles represent 0.4791% of total vehicle miles traveled and 1990 Chrysler vehicles represent 0.8710%, the total percentage of vehicle miles traveled by Chrysler vehicles for the 1990-1991 model year category is 1.3501%.

4.7 Calculate the Vehicle Count Matrix

Select a constant $AK@$ with a value of approximately 2. Calculate a count of vehicles to be tested in each category of vehicle make or type and each model year range by rounding off the product the constant $AK@$ and the percentage of vehicle miles traveled by vehicles in that category of make or type and model year range. Calculate the total of the resulting counts of vehicles in all categories of vehicle make or type and all model year ranges (the total will be approximately 200). Adjust the value of the constant $AK@$ in small increments by trial and error, and recalculate the total, until the

total is exactly 200. This is best done using a spreadsheet program.

An illustrative example of a completed table of vehicle counts is shown below.

1992 200-VEHICLE MATRIX							
Model Yr	Chrysler	Ford	GM	Toyota	Honda	Other	Totals
89-92	3	12	11	8	7	13	54
86-88	6	9	10	9	4	16	54
82-85	5	9	11	6	4	13	48
77-81	3	6	9	3	2	9	32
< 77	3	4	5	0	0	2	12
TOTALS	18	40	46	26	17	54	200