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TRANSPORTATION AIR POLLUTANT EMISSIONS HANDBOOK

by

T. D. Wolsko, M. T. Matthies, and R. E. Wendell

ARGONNE NATIONAL LABORATORY

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July 1972

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Abstract

The objective of this report is to describe a procedure that can be used to quantify the air pollutant emissions (carbon monoxide, hydrocarbons, nitrogen oxides) from transportation sources. The report is designed to enable someone not familiar with air pollution problems from transportation systems to quantify such emissions with the aid of the background information, emission data, computer program descriptions, and manual calculation procedures contained herein. Although emissions from transportation vehicles are not completely understood, the state-of-the-art of measuring air pollutant emissions from transportation sources is presented. This report will be revised if and when a more complete understanding of emissions from transportation sources evolves.

Section 1 provides a brief background on the sources of air pollution from transportation vehicles. The basic emission data used to calculate transportation emissions are described in Section 2. Two computer programs that can be used to calculate emissions are described in Section 3. The first program, TREFACT, calculates emission factors for widely varying vehicle characteristics and transportation system operation. The second program, TREMISS, uses regional transportation simulation data to calculate emissions for large transportation networks. Complete source listings of both programs are given in Appendix A.

Manual emission calculation procedures are illustrated by means of sample problems in Section 4. These procedures are designed to provide a simple method for calculating air pollutant emissions from roadways. A fairly complete set of emission factors is tabulated in Appendix B, so that transportation emissions can be calculated without using either of the computer programs.

1. Background

Air is polluted as a result of combustion, and the majority of transportation systems today use the combustion of fossil fuels as their main source of energy. Therefore, these transportation systems have a significant impact upon the air quality of their operating environment. The first step in determining the extent of the direct impact of transportation systems on air quality is to identify the emissions by transportation vehicles of the airborne pollutants which degrade the air quality.

Carbon monoxide, hydrocarbons, and oxides of nitrogen are the three major air pollutants released by motored vehicles. These vehicles emit only a small percentage of two other pollutants usually considered in overall air pollution problems, sulfur oxides and suspended particulates. Most of the lead salts which are released in suspended particulate form will be eliminated with the use of lead-free gasolines.

The majority of emissions come from gasoline-powered motor vehicles. When gasoline is mixed with air in proper proportions, a combustible mixture is formed. The proportion of air to gasoline can vary from 8 to 1 up to 20 to 1. Even at the theoretically perfect air-fuel ration of 14.5 to 1, combustion is not 100% complete. As a result of the incomplete combustion, by-products which are considered pollutants are formed. This situation is characteristic of any combustion process using fossil fuels (electrical generating stations, space heating, transportation).

The equation for fuel combustion is shown in Fig. 1. Carbon dioxide, water vapor, and free hydrogen, oxygen, and nitrogen make up the bulk of the products of combustion, but carbon monoxide, oxides of nitrogen (NO, NO_2) and unburned hydrocarbons are also produced. More than 200 unburned hydrocarbons have been detected in vehicle exhaust. The majority of hydrocarbon emissions from automobiles come from the unburned fuel-air mixture released in the exhaust gases. Carbon monoxide emissions result from incomplete combustion due to insufficient oxygen in the fuel-air mixture. Nitrogen oxides result from the combustion of the free nitrogen present in the air.

Fig. 1. Fuel Combustion Equation for Gasoline

Gasoline + Air $\xrightarrow{\text{Combustion}}$ Combustion Products + Pollutants

$$(HC)_m + (O_2, N_2) \longrightarrow CO_2 + H_2O + H_2 + CO + NO + NO_2 + O_2 + N_2 + (HC)_m$$

Because of the many different types of vehicles and their different ages and degrees of operating efficiency, emissions vary widely from vehicle to vehicle. In addition to differences in vehicle emission characteristics, the operating cycle is also an important determinant of pollutant emissions from transportation sources. Speed, cold starts, acceleration, deceleration, starts, and stops are some parts of the vehicle operating cycle that affect emissions. The dependence of air pollutant emissions upon vehicle type and operating mode requires that these characteristics of the transportation system be identified in order to assess the air pollution impact.

At this time, the air pollution emission factors for automobiles and trucks have not been uniformly accepted. The federal Environmental Protection Agency (EPA) has published emission factors which represent the weighted emissions for a standard distribution of vehicles. These emission factors are based upon a driving cycle that is assumed to be the typical driving cycle for an urban area. These emission factors include startups, accelerations and decelerations, and a total trip length of 7.5 miles. The emission factors reported by the federal EPA represent an average emission factor for the entire test cycle, although the rate of emissions varies quite widely during the different parts of the cycle. Therefore, the emission factors published by the federal EPA are applicable only where the driving cycle is similar to the federal cycle and the distribution of vehicles approximates the nationwide distribution. The emission factors and analyses presented in this report are intended to furnish the reader with emission factors which are flexible enough to fit the driving patterns and vehicle distributions of most areas of the country.

The federal EPA emission factors discussed above are the recommended factors that should be used to develop implementation plans for the federal EPA. However, several private and public groups have taken opposition to these factors and have shown data which conflict with the federal data. General Motors has reported emission data[2] which show that automobiles release a disproportionate fraction of their carbon monoxide and hydrocarbon emissions in the first four minutes of operation when the automobile is cold (cold-start emissions). This time dependence in the emissions for a typical driving cycle could distribute the emissions quite differently in an urban region when the cold-start bias is considered rather than an average emission factor for the entire cycle.

Another part of the reported emission factors have been challenged by a group in California. This data, reported by the California Air Resource Board,[3] contradicts the speed-dependent emission curves reported in McGraw and Duprey.[1] The California study is based on a very small sample (5 cars) and could be rebuked because of its lack of data, but the procedures used seem to be reliable and so the federally reported speed curves are open to question.

Because of this non-uniform acceptance of emission factors, a great deal of data are being taken by federal, state, and local agencies and private industry at the time of this report. The federal EPA will be publishing revised emission factors[4] based on an extensive testing program that is being performed at this time. Oil companies, General Motors, and state and local control agencies all have extensive emission testing programs underway, and consensus on emission factors should probably be available in the fall of 1972. The emission factors described in this report represent for the most part data supplied by the federal EPA, but it has been modified using other data where appropriate.

2. Emission Factors

Federal Environmental Protection Agency Emission Factors

The most recent emission factors for motor vehicles published by the U.S. Environmental Protection Agency are given in Table 1 (revised Table 14 of [1]). These emission factors represent the weighted emission factors for a national vehicle distribution (age and vehicle type), but were calculated using emission factor data from individual vehicles. Urban and rural emission factors in Table 1 only reflect the differences in driving speed and actually were developed from the same experimental data. A national estimate of the effect of installing control devices on older cars (retrofit) is shown in Figs. 2, 3, and 4.[5] The local effect of a retrofit abatement strategy would, of course, depend upon the distribution of vehicles in the local area.

These federal emission factors (Table 2) are based upon the 1972 federal test cycle and therefore assume that every 7.5 mile trip includes a "cold start". The first few minutes of "cold-start" operation release a disproportionate amount of the total emissions (carbon monoxide and hydrocarbons) in the average 23-minute cycle, as illustrated by Figs. 5 and 6. These extra emissions are caused by the non-gaseous state of the heavier hydrocarbons during start and warm-up period. Since every vehicle trip does not include cold-start operation and certain local environments (i.e. urban freeways) probably do not receive "cold-start" emissions, the driving cycle emissions should not be aggregated but separated, so that emissions characteristic of the operation of the road or roads can be obtained. Even with the new 1975 federal test cycle, which tries to approximate the average urban trip, it is unreasonable to assume that all segments of the transportation system receive "average" emissions. As was previously explained,

Table 1. Emission Factors for Gasoline-Powered Motor Vehicles (lb per 1000 vehicle mi)[a]

Emissions	1960	1965	1970	1971	1972	1973	1974	1975	1980	1985	1990
Carbon Monoxide[b]											
Urban (25)	265	265	220	200	185	170	160	130	80	60	50
Rural (45)	150	150	130	120	110	100	90	80	40	20	20
Hydrocarbons[b]											
Evaporation	6	6	6	5	5	4	4	3	0.9	0.1	Neg.
Crankcase[c]	9	6	2	1	1	0.7	0.5	0.5	Neg.	Neg.	Neg.
Exhausts											
Urban	36	36	26	24	21	19	16	13	4	2	2
Nitrogen Oxides (NO_2)[b]	23	23	17	16	14	13	11	9	2	1	0.8
Urban	18	19	20	20	20	18	17	15	11	5	4
Rural	21	22	23	23	23	21	20	18	13	7	5
Particulates[d,e]	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.4	0.4	0.4	0.4
Sulfur Oxides (SO_2)[f]	0.4				No legislation is in effect or has been proposed for						
Aldehydes (HCHO)[g]	0.8				these pollutants and thus only one factor is presented.						
Organic Acids (Acetic)[h]	0.3										

a - To convert emission factors to lb/1000 gal, assume the average gasoline-powered engine gets 12.5 miles per gal.

b - Reference 86

c - Crankcase emissions for vehicles after 1962 are neglible. These factors are based on pre-1962 vehicles left in the vehicle population.

d - Reference 94

e - Urban Factor = Rural Factor

f - Based on sulfur content of 0.04% and a density of 6.17 lb/gal.

g - References 23, 38, 95

h - References 23, 95, 96, 97

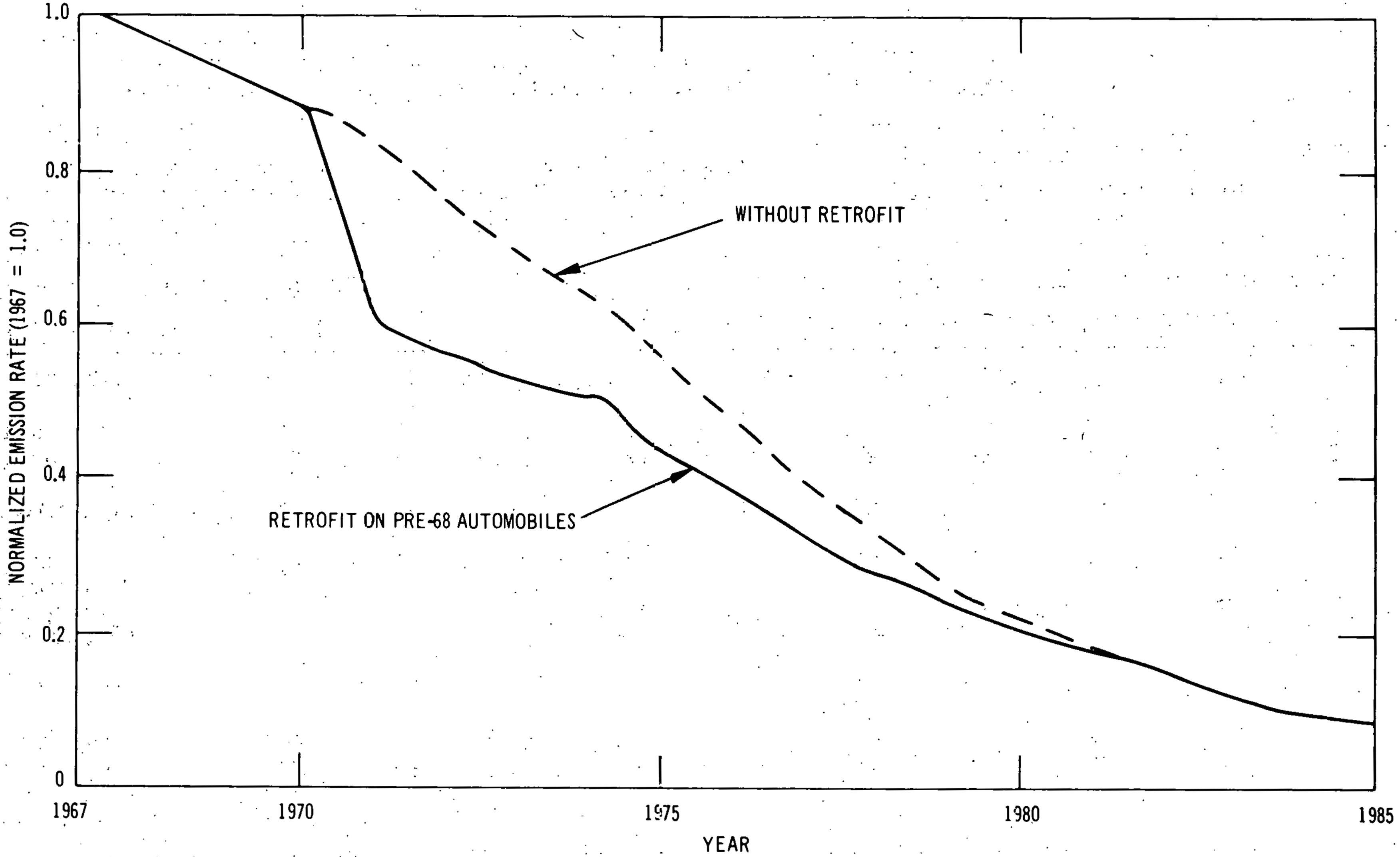

Fig. 2. Projected National Urban Normalized Hydrocarbon Emissions

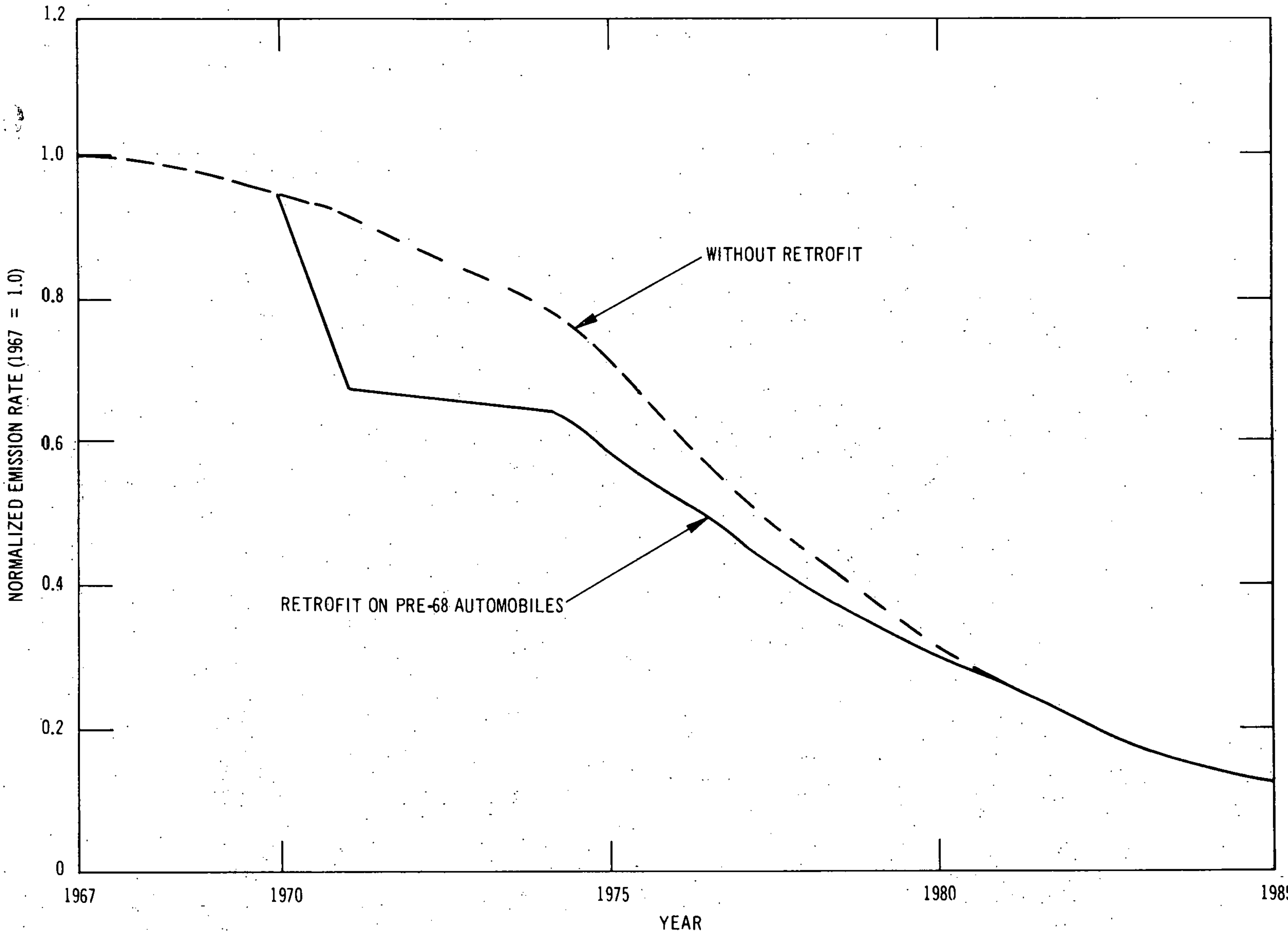

Fig. 3. Projected National Urban Normalized Carbon Monoxide Emissions

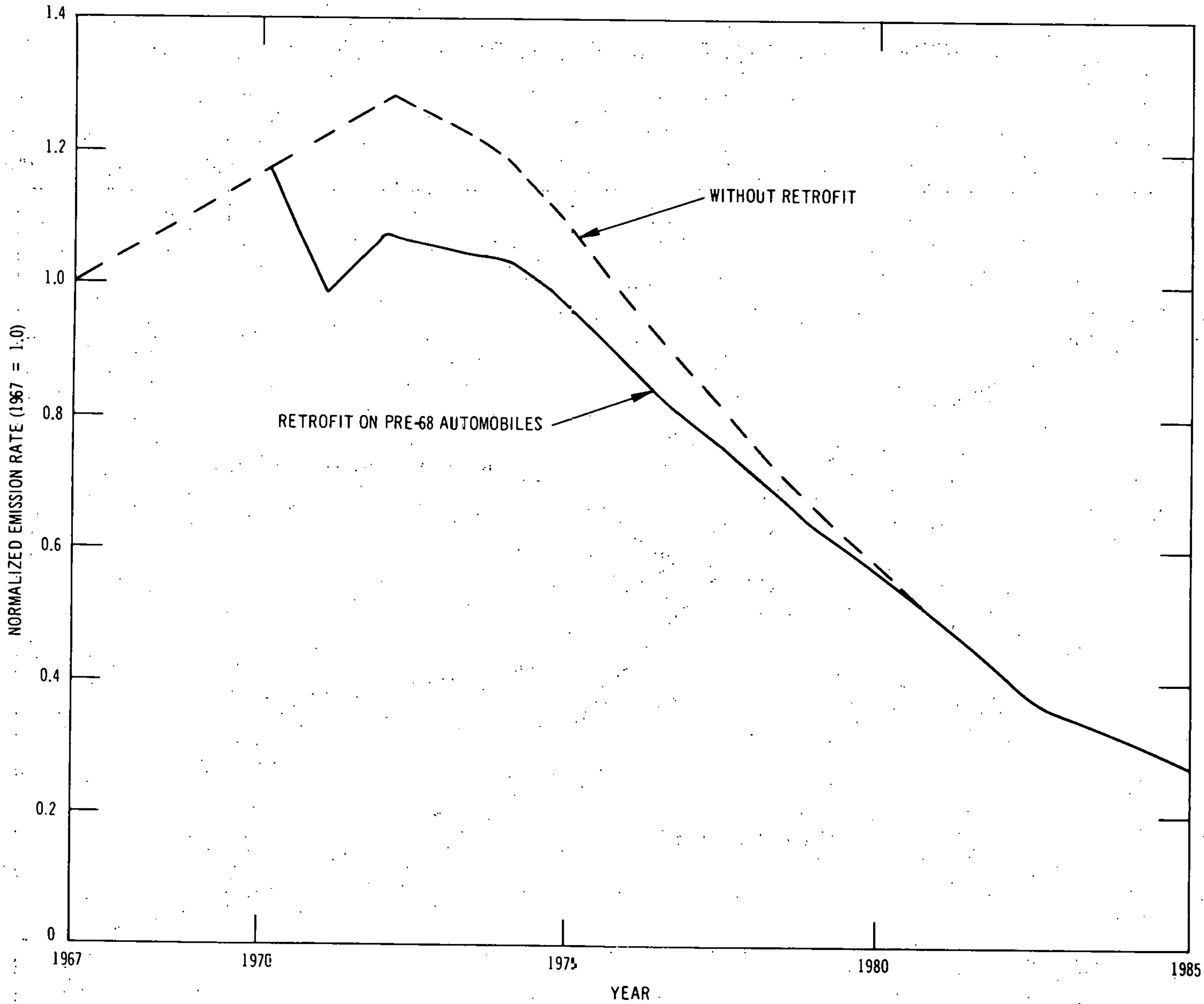

Fig. 4. Projected National Urban Normalized Nitrogen Oxide Emissions

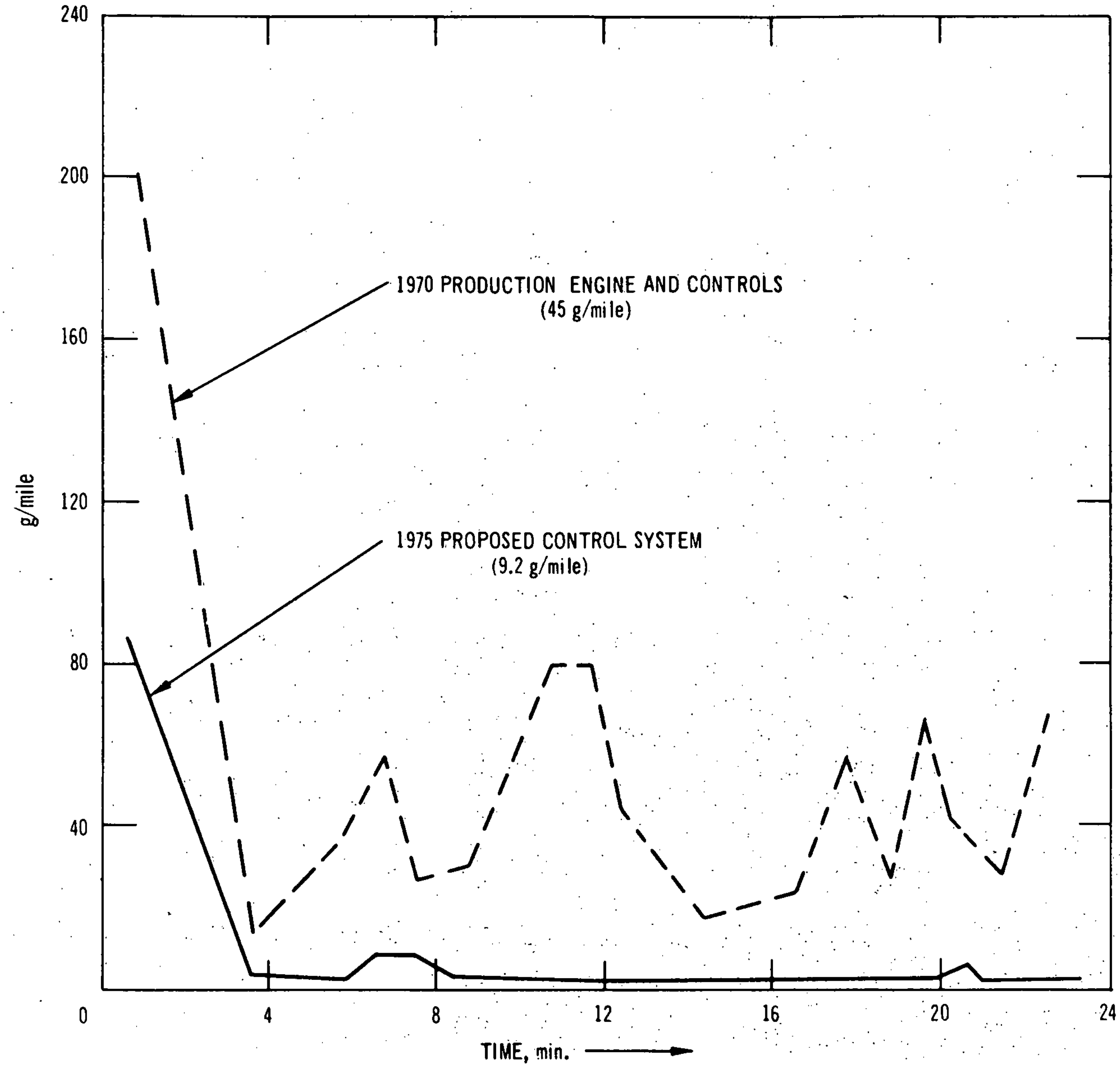

Fig. 5. Emission System Performance 1972 Fed Test Procedure Carbon Monoxide

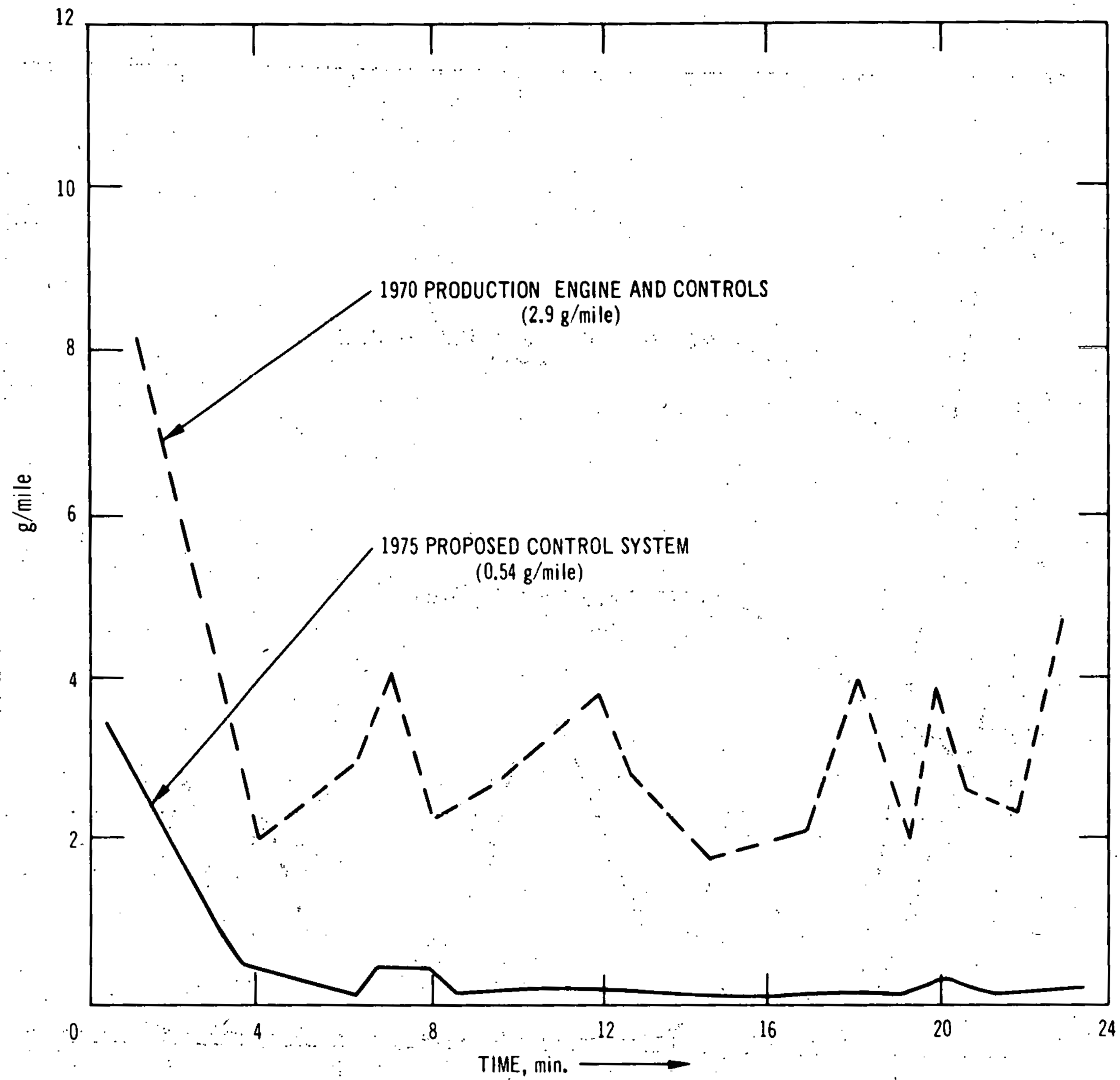

Fig. 6. Emission System Performance 1972 Fed Test Performance Hydrocarbons

the philosophy will be to provide emission factors which will reflect the different operating characteristics of urban and rural transportation systems.

2.1 Light-Duty Vehicle Emission Factors

Light-duty vehicles form a class (Class I) that contains all passenger cars and all trucks whose gross vehicle weight (GVW) is less than 6,000 pounds. The only difference in the estimated emission factors between the cars and light-duty trucks arises through differences in deterioration estimates. There does not appear to be any consistent trend in emission factors for the many different sizes of engines in light-duty vehicles. Federal test results for 1971 cars and trucks[8] showed a wide variation in emissions from vehicle to vehicle, but there was no correlation between size and emissions.

Table 2[7] gives emission factors for light-duty vehicles under the 1972 federal test procedure. Carbon monoxide and nitrogen oxide emission factors are for the exhaust, while the hydrocarbon emission factors are given for all three vehicular emission sources: exhaust, crankcase, and evaporative. These emission factors represent the emissions from vehicles in their production years and do not take into account the deterioration due to age. Deterioration factors for light-duty vehicles (cars and light-duty trucks) are given in Table 3. These deterioration factors are supposed to apply in any given year, so that a 1970 car in 1975 has the same deterioration factor as a 1965 car in 1970. This, of course, may not be a valid assumption, since the deterioration of control devices is not yet known.

Control devices have been progressively added to light- and heavy-duty vehicles since 1963. Figure 7 shows the exhaust, crankcase, and evaporative control devices added to automobiles in 1963, 1968, and 1971.

Table 2

Light-Duty Vehicle (<6,000# GVW)
Air Emission Factors

Model	Carbon Monoxide (gm/mi)	Nitrogen Oxides (gm/mi)	Hydrocarbons (gm/mi		
			Exhaust	Crankcase	Evaporative
1960	110.	6.4	13.1	4.1	3.0
1961	110.	6.4	13.1	4.1	3.0
1962	110.	6.4	13.1	4.1	3.0
1963	110.	6.4	13.1	.8	3.0
1964	110.	6.4	13.1	.8	3.0
1965	110.	6.4	13.1	.8	3.0
1966	110.	6.4	13.1	.8	3.0
1967	110.	6.4	13.1	0	3.0
1968	50.	7.1	5.6	0	3.0
1969	50.	7.1	5.6	0	3.0
1970	35.	5.5	3.5	0	3.0
1971	35.	5.5	3.5	0	.5
1972	31.	4.4	3.1	0	.5
1973	31.	2.7	3.1	0	.2
1974	31.	2.7	3.1	0	.2
1975	4.7	2.7	.5	0	.2
1976	4.1	.4	.4	0	.2
1977	4.1	.4	.4	0	.2
1978	4.1	.4	.4	0	.2

Table 3

LIGHT-DUTY VEHICLE DETERIORATION FACTORS

AGE (years)	LIGHT DUTY DETERIORATION Carbon Monoxide	LIGHT DUTY DETERIORATION Hydro-carbons	LIGHT DUTY TRUCK DETERIORATION Carbon Monoxide	LIGHT DUTY TRUCK DETERIORATION Hydro-carbons
0	1.063	1.055	1.075	1.065
1	1.165	1.145	1.170	1.150
2	1.210	1.175	1.215	1.178
3	1.235	1.190	1.242	1.192
4	1.252	1.195	1.257	1.198
5	1.265	1.198	1.268	1.200
6	1.275	1.200	1.280	1.200
7	1.285	1.200	1.288	1.200
8	1.292	1.201	1.295	1.201
9	1.296	1.201	1.300	1.201
10	1.299	1.202	1.302	1.202
11	1.301	1.202	1.303	1.202
12	1.302	1.203	1.304	1.203
13	1.302	1.203	1.305	1.203
14	1.302	1.203	1.305	1.203
15	1.302	1.203	1.305	1.203

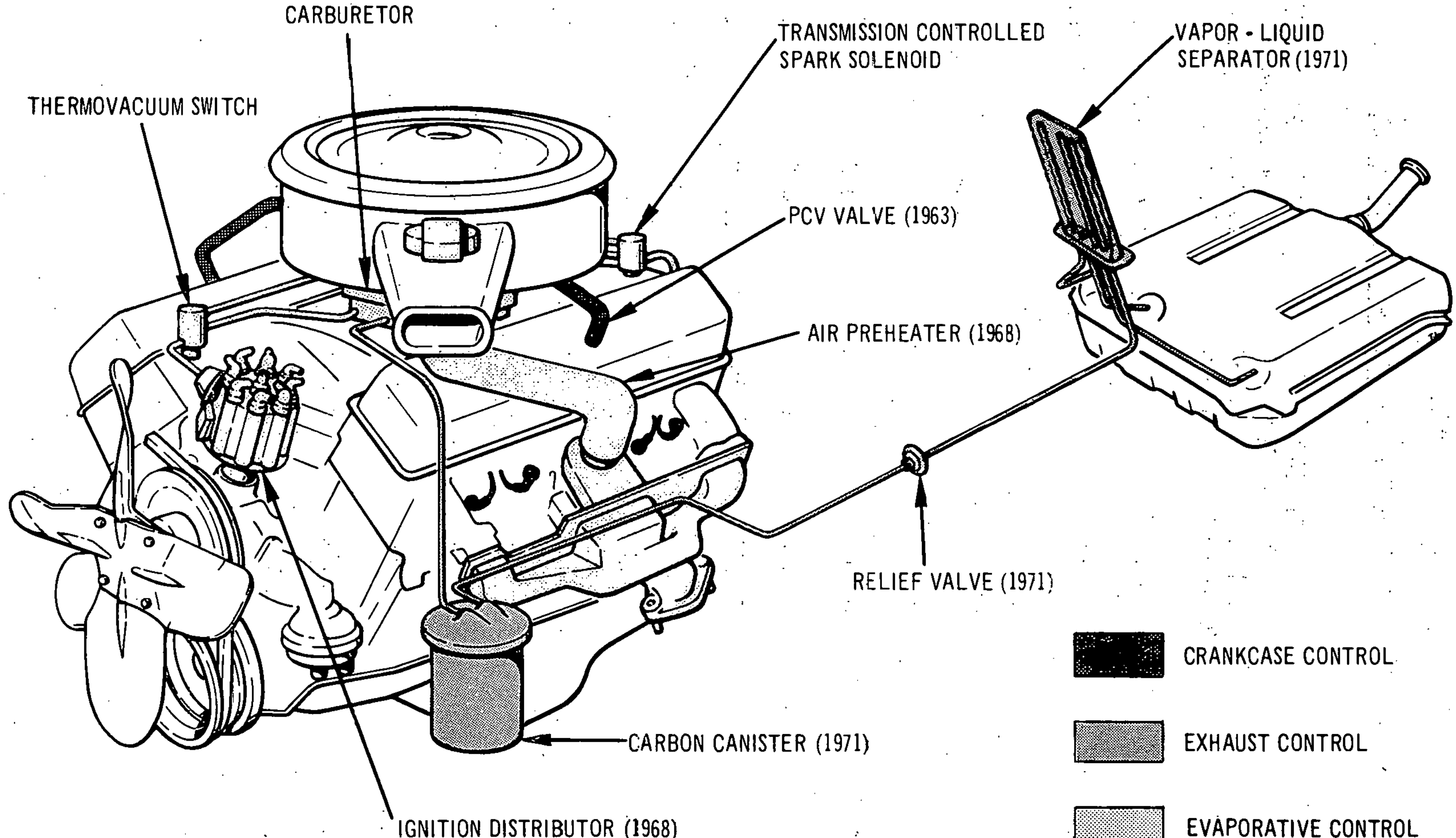

Fig. 7. 1971 Emission Control Systems

A. Hydrocarbons

Exhaust Emissions

The exhaust gases are one source of hydrocarbon emissions from motor vehicles. The emission factors will distinguish between urban and rural driving conditions. Differences between urban and rural emission factors consist solely of corrections for vehicle speed and do not correct for any other operating characteristics which may differ between urban and rural vehicle driving cycles. Urban and rural emission factors are calculated using a series of factors which account for vehicle deterioration and operating conditions. Equations 1 and 2 below are used to calculate the hydrocarbon exhaust emissions.

Urban

Urban exhaust emission factor of hydrocarbons (HC) in any year y (1960-1990) for cars of age i are calculated using Equation (1):

$$UEHC_i = (HCER_i)\ (SA)\ (THS)\ (DET_i), \tag{1}$$

where

$UEHC_i$ = urban exhaust emission factor (gm/mi) in year y for cars built in the year y-i.

$HCER_i$ = exhaust factor (gm/mi) for HC for year y-i from Table 2;

SA = a conversion factor from summer (e.g. test conditions) to annual temperature (factor is given in Table 4).

THS = a conversion factor (.825) which converts the emission factor from a test speed of 18 mph to the average urban speed of 25 mph;

DET = deterioration factor for vehicle of age i (Table 3).

Rural

Rural emission factors for hydrocarbons are calculated using Equation (2):

$$REHC_i = (HCER_i)\ (SA)\ (THS)\ (HUR)\ (DET_i) \qquad (2)$$

where

$REHC_i$ = rural exhaust emission factor (gm/mi) in year y for cars built in the year y-i;

HUR = a conversion factor (.67) which converts the emission factor from the average urban speed of 25 mph to the average rural speed of 45 mph.

Crankcase Emissions

Crankcase hydrocarbon emissions are a result of vapors which are released through the "breather" of the crankcase ventilation system. A Positive Crankcase Ventilation (PCV) control system was installed on California cars in 1961 and on 1963 models nationwide. The resulting cutbacks in hydrocarbon emissions from the crankcase can be seen in Table 2. Additional emission controls which virtually eliminated hydrocarbon emissions from the crankcase were added to cars in 1968.

Crankcase emissions for a car of age i in year y are described by Equation (3):

$$CR_i = (CRANK_i)\ (DET_i), \qquad (3)$$

where

CR_i = the crankcase emissions (gm/mi) for a car of age i in year y;

CRANK = the emission factor (gm/mi) for a car of year y-i from Table 2.

Evaporative Emissions

Evaporative hydrocarbon emissions are a result of the evaporation of gasoline from the fuel system. Controls to reduce hydrocarbon evaporative losses were installed on 1970-model California cars and nationwide on 1971 models.

The evaporative emissions EV_i in the given year y for vehicles of age i is just the value in Table 2 corresponding to year y-i.

B. Carbon Monoxide

Unlike hydrocarbons, carbon monoxide is emitted exclusively from the exhaust. A control system was added to 1971 model cars (Fig. 7) which reduced hydrocarbon and carbon monoxide exhaust emissions.

Urban

The urban exhaust emission factors of carbon monoxide (CO) are calculated using Equation (4):

$$UECO_i = (COER_i)\ (SA)\ (TCS)\ (DET_i), \qquad (4)$$

where

$UECO_i$ = the urban emission factor (gm/mi) for a vehicle of age i in year y;

$COER_i$ = the emission factor (gm/mi) for cars of year y-i in Table 2;

TCS = a conversion factor (.766) for CO from the test speed of 18 mph to the average urban speed of 25 mph.

Rural

Rural carbon monoxide factors are calculated using Equation (5):

$$RECO_i = (COER_i)\ (SA)\ (TCS)\ (CUR)\ (DET_i), \qquad (5)$$

where

$RECO_i$ = rural emission factor (gm/mi) for a vehicle of age i in year y;

CUR = a conversion factor (.61) for CO from the average urban speed of 25 mph to the average rural speed of 45 mph.

C. Nitrogen Oxides

Like carbon monoxide, nitrogen oxides are emitted exclusively from the exhaust.

Urban

Urban emission factors for nitrogen oxides can be calculated from Equation (6):

$$UENO_i = (NOER_i)\ (SA), \tag{6}$$

where

$UENO_i$ = the urban emission factors (gm/mi) for a vehicle of age i in year y (Table 2);

$NOER_i$ = the emission factor for cars of year y-i.

Rural

The rural emission factor for nitrogen oxides is calculated in the same way as the urban factor. The only difference is in the value of SA (summer-to-annual conversion) from Table 4. The conversion factor from urban to rural driving speeds is 1.0 for nitrogen oxides (no speed dependence).

2.2 Heavy-Duty Vehicle Emission Factors

Heavy duty vehicles are divided into three classes:

Class II	(6,000 - 10,000 lb., GVW)
Class III	(10,000 - 19,000 lb., GVW)
Class IV	(Over 19,000 lb., GVW)

A distinction between diesel and gasoline heavy-duty vehicles is made, so that the classification listed above is used for heavy-duty gasoline vehicles only. The heavy-duty vehicle weight classifications range from 6,000 to over 19,000 lb., GVW, yet the engine designs are basically similar. One school of thought concerning emission factors for heavy-duty gasoline vehicles is that they are proportional to weight; however, there has not been enough data to support or contradict this assumption. Although it seems reasonable that the emissions from heavy-duty vehicles are weight-dependent, a proportional factor probably overcompensates for the differences

Table 4. Summer-to-Annual Conversion Factors

	URBAN	RURAL
HC	1.12	1.0
CO	1.085	.920
NO_x	1.260	1.295

due to weight. Some studies[6] have shown this weight dependence, but not a proportional dependence.

The present position taken by the U.S. Environmental Protection Agency is that there is no weight dependence for heavy-duty gasoline trucks. Emission factors presently used by the EPA for heavy-duty trucks[7] are given in Table 5. Since heavy-duty gasoline trucks (> 6,000 lb., GVW) have engines very similar and in many cases indentical to those of light-duty trucks, the deterioration factors for light-duty trucks are also used for the heavy-duty vehicles. Emission factor calculations for heavy-duty gasoline trucks are made in the same way as for light-duty vehicles, except the basic emission factors are taken from Table 5.

2.3 Diesel Vehicle Emission Factors

Although diesel trucks represent a small percentage of the motor vehicles in the U.S. (.7%), their emissions are quite high and they may actually make up a high fraction of the vehicles on a particular road. Basic emission factors for diesel trucks and buses are given in Table 6. The emission factors found in Table 6 distinguish between pre-1970 and post-1970 diesel engines. This change in emissions came as a result of the addition of a new needle valve injector which reduced the amount of fuel which can be burned. The result of this engine modification was to decrease the level of hydrocarbon and carbon monoxide emissions, but the improved engine combustion efficiency is reflected in the increase in nitrogen oxide emissions.

Emission factors in Table 6 are dependent upon fuel usage. To convert emissions to a per-vehicle-mile scale, a mileage factor of 3 miles/gal is assumed for diesel trucks and buses. The actual mileage for diesel trucks probably varies from 2 to 5 miles/gal, depending upon the operation of the vehicle. Three miles per gallon represents an average number, but if the

Table 5. Heavy-Duty Gasoline Trucks (>6,000# GVW)
Air Emission Factors

Model Year	Carbon Monoxide (gm/mi)	Nitrogen Oxides (gm/mi)	Hydrocarbons (gm/mi)		
			Exhaust	Crankcase	Evaporative
1960	128.5	9.5	18.7	5.2	3.0
1961	"	"	"	"	"
1962	"	"	"	"	"
1963	"	"	"	"	"
1964	"	"	"	"	"
1965	"	"	"	"	"
1966	"	"	"	"	"
1967	"	"	"	5.2	"
1968	"	"	"	0	"
1969	"	"	18.7	"	"
1970	80.0	"	15.1	"	"
1971	"	"	"	"	"
1972	"	"	"	"	3.0
1973	43.0	8.5	7.8	"	.8
1974	43.0	8.5	"	"	"
1975	37.0	6.4	5.3	"	"
1976	30.0	3.3	2.7	"	"
1977	27.0	3.0	2.4	"	"
1978	27.0	3.0	2.4	"	"

roadway being examined has continuously moving traffic at a moderate speed, the emission factors should probably be adjusted for the differences in fuel usage.

Table 6
Diesel Engine Air Emission Factors[1]
(Grams per vehicle mile)

Pollutant	Engine Prior to 1970	After 1970
Carbon Monoxide (gm/mi)	49.2	32.5
Hydrocarbons (gm/mi)	9.84	3.8
Oxides of Nitrogen (NO_2) (gm/mi)	51.5	76.4

2.4 Speed Adjustments to Emission Factors

The emission factors previously described are calculated at one vehicle speed, 25 mph for urban or 45 mph for rural. Since the average vehicle speed on roadways can vary quite widely in both the urban and rural environment, some correction should be made for the differences in speed. Speed adjustment curves for carbon monoxide and hydrocarbons are given in Figs. 8 and 9 respectively. These curves are reported along with the weighted emission factors found in McGraw and Duprey.[1] A recent study in California shows a speed dependence to the emission factors, but emissions do not continue to decrease with increasing vehicle speed as the curves in Figures 8 and 9 indicate. However, the California data was based on a very small sample of cars using a dynamometer and does not necessarily contradict the federal speed-dependent data, which was taken in traffic and therefore included congestion effects. Because the federal data is based on urban traffic situations, it represents the congestion effects which occur in typical urban traffic. For a free-flowing highway the federal speed correction will overestimate the effects of speed on the emission factors. Until more data

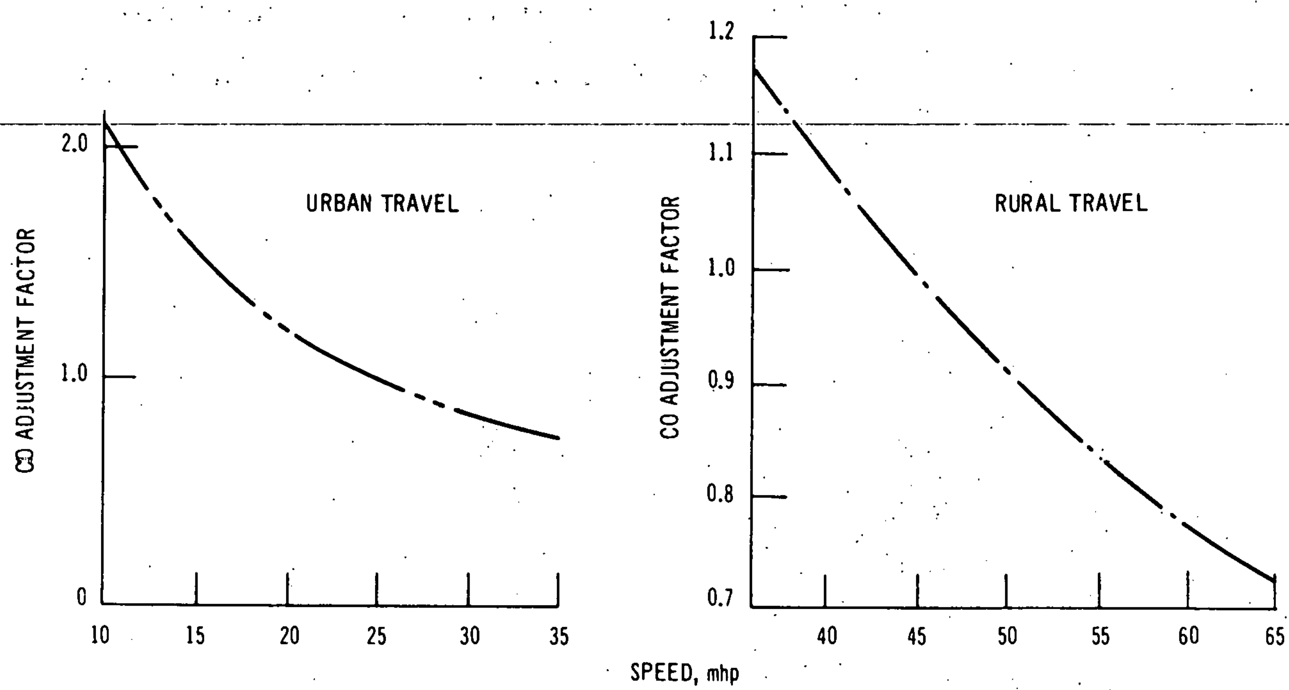

Fig. 8. Speed Adjustment Factors for Carbon Monoxide Emission Factors

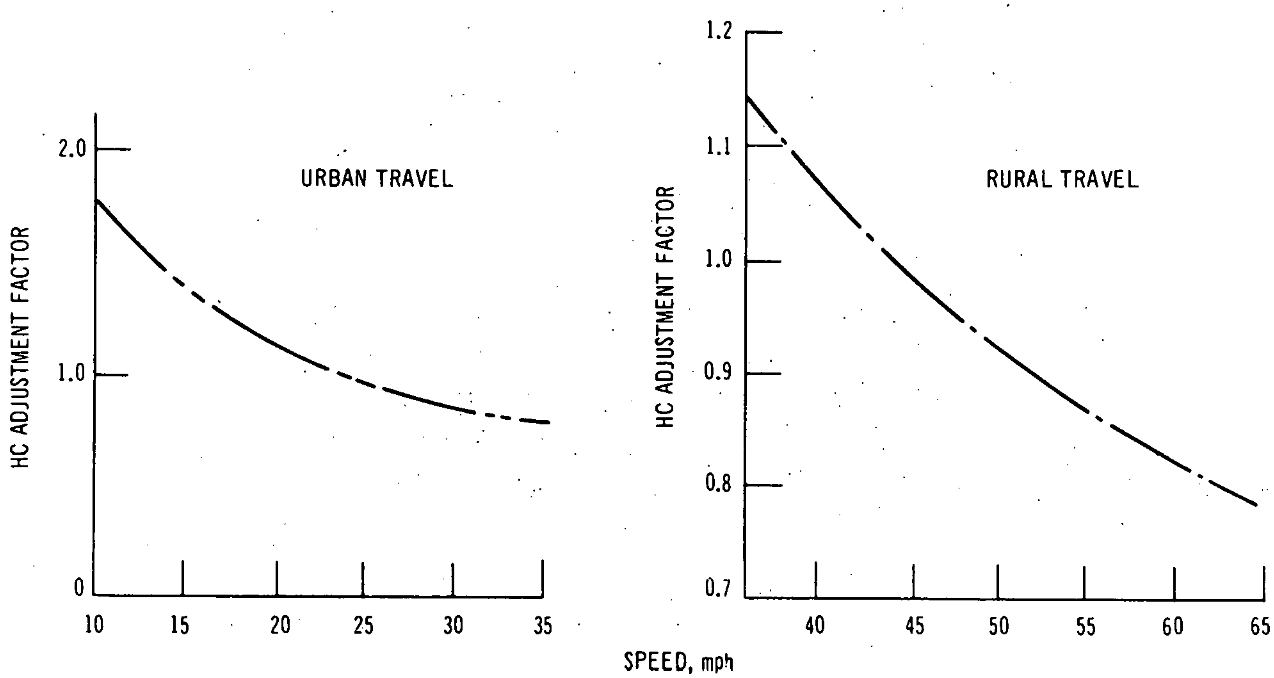

Fig. 9. Speed Adjustment Factors for Hydrocarbon Exhaust Emission Factors

becomes available, it is best to use the speed-dependent curves given in McGraw and Duprey,[1] but the speed correction curves should not be used above 55 mph.

3. Air Pollutant Emission Computer Programs

Air pollutant emissions from ground transportation sources vary quite widely, depending upon the type of sources and the transportation system. Two computer programs were written to relieve the environmental impact analyst of the emission calculation burden. The first program, TREFACT, calculates the emission rates for vehicles or mixes of vehicles based on vehicle usage (speed, vehicle miles, type of trip). The second program, TREMISS, was developed to calculate emissions for the complex traffic simulation grid used by urban regional transportation planners. The outputs from a typical regional traffic simulation model (origins, vehicle miles, speed) and TREFACT outputs are used to calculate grid-dependent emissions for the entire urban region. A detailed description of each of these programs follows, along with input descriptions and sample problems. Complete listings of both programs are contained in Appendix A.

3.1 Transportation Emission Factors (TREFACT)

TREFACT calculates emission factors for transportation systems with widely varying vehicle types and operating conditions. Emission factors can be calculated for any year between 1960-1990 for 6 classes of vehicles. A vehicle-class-weighted emission factor is also calculated. Options are available to include the effects of cold-start operation, retrofitting control devices on pre-1968 vehicles (class 1 only), and consideration of diesel-powered vehicles.

Automobiles are assigned Class 1, light-duty trucks (<6,000# GVW) Class 2, heavy-duty trucks (>6,000# GVW) Classes 3-5, and diesel trucks Class 6. Any of Classes 1-5 can be changed to represent any type of vehicle, providing the appropriate emission factors and deterioration rates are changed in the input data. Emission factors for each year from 1970 to 1985 are given in Appendix B, for both Cook County and federal age and mileage factors, with and without cold-start emissions calculated separately.

Sample input, problems, and outputs will be given at the end of the input description to illustrate the program options, input data setup, and output formats available.

3.1.1 Input Data Description

The basic input data deck for TREFACT is schematically shown in Fig. 10. The basic input deck will have 46 cards unless default data are selected on card 2, in which cases cards 29-32,45, and 46 could be omitted. All other cards must be inserted in the basic deck. A Year/Option card must be inserted for every case. The cold-start cards, retrofit card, and diesel card represent additional data required for options selected on the Year/Option card. If the option data (cold-start, retrofit, diesel) does not change from the previous case; then the option cards are not required and the program uses the data from the previous case. If any of the basic input data must be changed, then the entire basic data deck of 46 cards must be assembled and the program rerun.

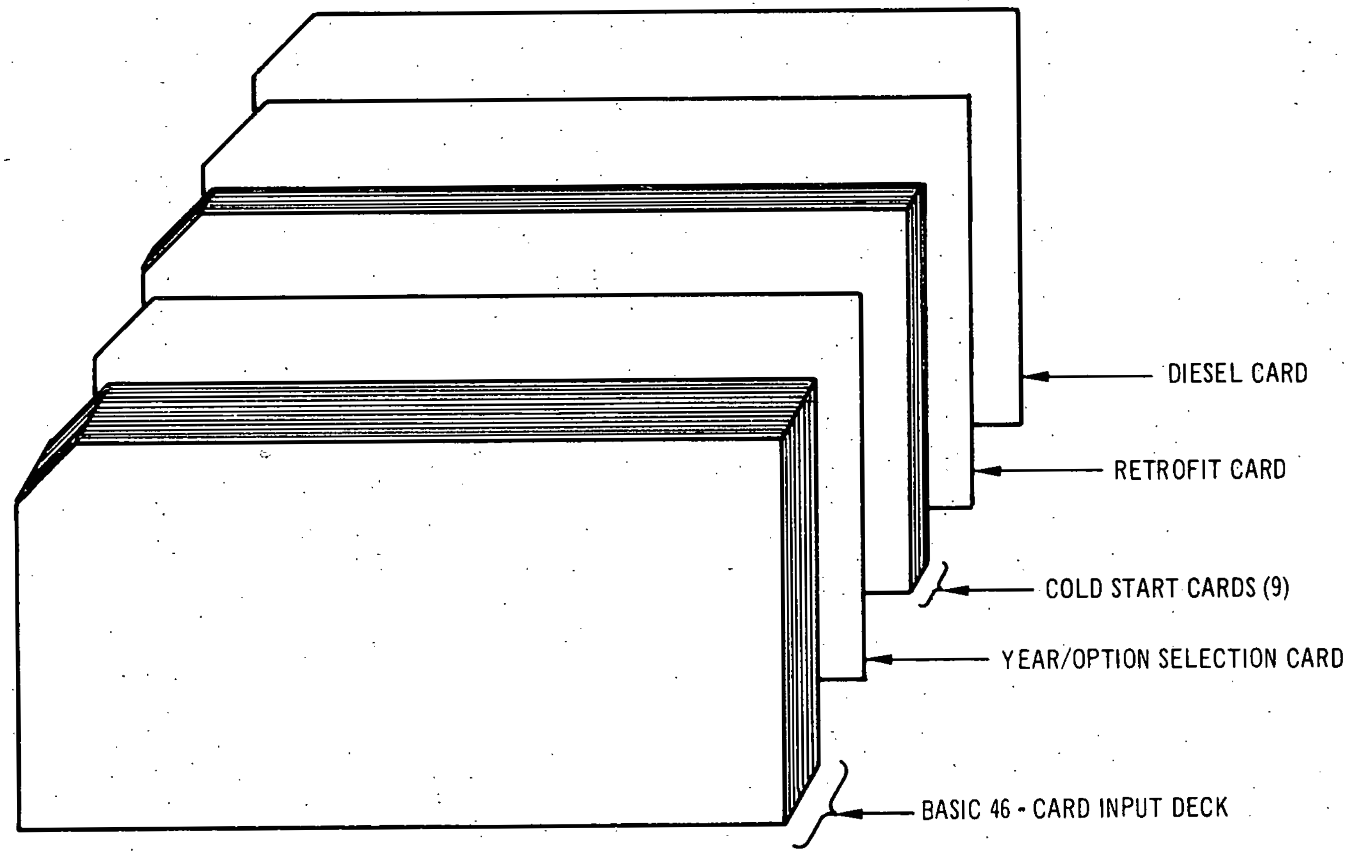

Fig. 10. TREFACT Input Data Deck Structure

Basic 46 Data Cards

CARD 1 Title Card (9A8)

Variable	Columns	Contents
TITLE	1-72	Identifying information printed at the top of each output (maximum 72 characters)

CARD 2 Vehicle Distribution Options (3I4)

Variable	Columns	Contents
CHANGE(1)	1-4	If nonzero, automobile age and usage data will be input on cards 29-32.*
CHANGE(2)	5-8	If nonzero, distribution for Classes 1-5 will be input on card 45.*
CHANGE(3)	9-12	If nonzero, distribution for Classes 1-6 will be input on card 46.*

CARDS 3-6 Carbon Monoxide Exhaust Emission Factors, Classes 1 and 2 (9F8.0)

Carbon monoxide exhaust emission factors (grams/mile) for light-duty vehicles (Classes 1 and 2) for years 1960-1990 (31 values). These emission factors are for light-duty vehicles (cars, light-duty trucks) in their model years (i.e., 1960 car in 1960, 1970 car in 1970, etc.)

Variable	Card	Columns	Contents
BYEFCO(1,1)	3	1-8	CO emission factor for 1960 vehicles
.	.	.	
.	.	.	
.	.	.	
BYEFCO(1,31)	6	25-32	CO emission factor for 1990 vehicles

*Default data in Table 7 is used if CHANGE is zero.

CARDS 7-10	Hydrocarbon Exhaust Emission Factors, Classes 1 and 2 (9F8.0)	Same as cards 3 to 6 except for hydrocarbon emissions

Variable	Card	Columns	Contents
BYEFHC(1,1)	7	1-8	HC exhaust emission factor for 1960 vehicle.
.	.	.	.
.	.	.	.
.	.	.	.
BYEFHC(1,31)	10	25-32	HC exhaust emission factor for 1990 vehicle.

CARDS 11-14	Nitrogen Oxide Exhaust Emission Factors, Classes 1 and 2 (9F8.0)	Same as cards 3 to 6 and 7 to 10 except for nitrogen oxide emissions

Variable	Card	Columns	Contents
BYEFNO(1,1)	11	1-8	NO_x emission factor for 1960 vehicles.
.	.	.	.
.	.	.	.
.	.	.	.
BYEFNO(1,31)	14	25-32	NO_x emission factor for 1990 vehicles.

CARDS 15-18	Carbon Monoxide Exhaust Emission Factors, Classes 3-5 (9F8.0)

Carbon monoxide exhaust emission factors (grams/mile) for Classes 3-5 for the years 1960-1990 (31 values). These emission factors again represent the vehicle in its production year.

Variable	Card	Columns	Contents
BYEFCO(2,1)	15	1-8	CO emission factor for 1960 vehicles (Classes 3-5)
.	.	.	.
.	.	.	.
.	.	.	.
BYEFCO(2,31)	18	25-32	CO emission factors for 1990 vehicles (Classes 3-5)

CARDS 19-22	Hydrocarbon Exhaust Emission Factors, Classes 3-5, (9F8.0)	Same as cards 15 to 18 except for hydrocarbon emissions

Variable	Card	Columns	Contents
BYEFHC(2,1)	19	1-8	HC exhaust emission factor for 1960 vehicles (Classes 3-5)
.	.	.	.
.	.	.	.
.	.	.	.
BYEFHC(2,31)	22	25-32	HC exhaust emission factor for 1990 vehicles (Classes 3-5)

CARDS 23-26 — Nitrogen Oxide Exhaust Factors, Classes 3-5, (9F8.0)

Same as cards 15 to 18 and 19 to 22 except for nitrogen oxide emissions

Variable	Card	Columns	Contents
BYEFNO(2,1)	23	1-8	NO emission factor for 1960 vehicles (Classes 3-5)
.	.	.	.
.	.	.	.
.	.	.	.
BYEFNO(2,31)	26	25-32	NO emission factor for 1990 vehicles (Classes 3-5)

CARD 27 — Speed Conversion Factors (5F8.0)

Variable	Columns	Contents
TUCO	1-8	Speed adjustment factor for CO from test speed of 18 mph to the urban speed of 25 mph
TUHC	9-16	Speed adjustment factor for HC from 18 to 25 mph
URCO	17-24	Speed adjustment factor for CO from urban speed of 25 mph to rural speed of 45 mph
URHC	25-32	Adjustment factor for HC from 25 to 45 mph
URNO	33-40	Adjustment factor for NO from 25 to 45 mph

CARD 28 — Summer to Annual Conversion Factors (6F8.0)

Variable	Columns	Contents
SAUCO	1-8	CO Conversion factor from summer (test conditions) to annual temperature for urban driving.
SAUHC	9-16	HC conversion factor from summer (test conditions) to annual temperatures for urban driving
SAUNO	17-24	NO conversion factor for summer-to-annual temperatures for urban driving
SARCO	25-32	Rural equivalent of SAUCO
SARHC	33-40	Rural equivalent of SAUHC
SARNO	41-48	Rural equivalent of SAUNO

If CHANGE(1) (Card 2) is nonzero, Cards 29-32 must be included.

CARDS 29-30 Distribution of automobiles by age for 14 years (9F8.0)

Variable	Card	Columns	Contents
REGIS(1)	29	1-8	Fraction of automobiles that are of age 0 (new)
REGIS(2)	29	9-16	Fraction of automobiles that are one year old
.	.	.	.
.	.	.	.
.	.	.	.
REGIS(13)	30	25-32	Fraction of automobiles that are 12 years old
REGIS(14)	30	33-40	Fraction of automobiles that are 13 years old or older

CARDS 31-32 Automobile annual travel (miles) for 14 years (9F8.0)

Variable	Card	Columns	Contents
AAT(1)	31	1-8	Average annual travel (miles) for automobiles of age 0 (new)
.	.	.	.
.	.	.	.
.	.	.	.
AAT(14)	32	33-40	Average annual travel (miles) by automobiles 13 years old or older

REGIS and AAT are used to determine the fraction of miles traveled by vehicle age

CARDS 33-34 Fraction of travel of vehicles in Classes 2-5 for 16 years (9F8.0)

Variable	Card	Columns	Contents
PTRVLT(1)	33	1-8	Fraction of travel of Classes 2-5 that are of age 0 (new)
.	.	.	.
.	.	.	.
.	.	.	.
PTRVLT(16)	34	49-56	Fraction of travel of Classes 2-5 that are 15 years old or older

CARDS 35-36 Deterioration rates for carbon monoxide for automobiles (9F8.0)

Variable	Card	Columns	Contents
DCCO(1)	35	1-8	CO deterioration factor for automobiles that are of age 0 (new)
.	.	.	.
.	.	.	.
.	.	.	.
DCCO(13)	36	25-32	CO deterioration factor for automobiles that are 12 years old
DCCO(14)	36	33-40	CO deterioration factor for automobiles that are 13 years old or older

CARDS 37-38 Deterioration factors for hydrocarbons for automobiles (9F8.0)

Variable	Card	Columns	Contents
DCHC(1)	37	1-8	HC equivalent of DCCO(1)
.	.	.	.
.	.	.	.
.	.	.	.
DCHC(14)	38	33-40	HC equivalent of DCCO(14)

CARDS 39-40 Deterioration factors for carbon monoxide for Classes 2-5 (9F8.0)

Variable	Card	Columns	Contents
DTCO(1)	39	1-8	CO deterioration factor for trucks of age 0 (new)
DTCO(2)	39	9-16	CO deterioration factor for trucks of age one
.	.	.	.
.	.	.	.
.	.	.	.
DTCO(16)	40	49-56	CO deterioration factor for trucks that are 15 years and older

CARDS 41-42 Deterioration factors for hydrocarbons for Classes 2-5 (9F8.0)

Variable	Card	Columns	Contents
DTHC(1)	41	1-8	HC equivalent of DTCO(1)
.	.	.	.
.	.	.	.
.	.	.	.
DTHC(16)	42	49-56	HC equivalent of DTCO(16)

CARD 43 Crankcase and evaporative (HC) emission factors for light-duty vehicles (Classes 1 and 2) (5F8.0)

Variable	Columns	Contents
CREF(1,1)	1-8	Crankcase emission factor for pre-1963 vehicles
CREF(1,2)	9-16	Crankcase emission factor for vehicles built in the years 1963-1967
EVEF(1,1)	17-24	Evaporative emission factor for pre-1971 vehicles
EVEF(1,2)	25-32	Evaporative emission factor for vehicles built in the years 1971 and 1972
EVEF(1,3)	33-40	Evaporative emission factor for post-1972 vehicles

CARD 44 Crankcase and evaporative (HC) emission factors for vehicles in Classes 3-5 (5F8.0)

Variable	Columns		
CREF(2,1)	1-8	Classes 2-5 equivalents of	CREF(1,1)
CREF(2,2)	9-16	Classes 2-5 equivalents of	CREF(1,2)
EVEF(2,1)	17-24	Classes 2-5 equivalents of	EVEF(1,1)
EVEF(2,2)	25-32	Classes 2-5 equivalents of	EVEF(1,2)
EVEF(2,3)	33-40	Classes 2-5 equivalents of	EVEF(1,3)

In addition to calculating emission factors for each individual class of vehicles, a "weighted" emission factor is also calculated as a linear combination of the individual class emission factors and a class weighting factor. If CHANGE(2) is nonzero, then weighting factors for Classes 1-5 must be included on Card 45 in order to calculate a weighted emission factor.

CARD 45 — Class weighting factors for Classes 1-5 only (5F8.0)

Variable	Columns	Contents
WFCTR(1)	1-8	Weighting factor for Class 1
.	.	.
.	.	.
.	.	.
WFCTR(5)	33-40	Weighting factor for Class 5

If CHANGE(3) (Card 2) is nonzero, then weighting factors for Classes 1-6 must be included on Card 46 in order to calculate a weighted emission factor.

CARD 46 — Class weighting factors for Classes 1-6 (6F8.0)

Variable	Columns	Contents
DWFCTR(1)	1-8	Weighting factor for Class 1
.	.	.
.	.	.
.	.	.
DWFCTR(6)	41-48	Weighting factor for Class 6

The previous 46 cards represent the basic data which will be used to calculate emission factors for any year and/or for cold-start, retro-fit, and diesel options. If any of the basic data requires changing, the program must be rerun.

YEAR SELECTION/OPTION CARD (4I6)

Variable	Columns	Contents
YEAR	1-6	Year between 1960 and 1990 for which emission factors will be calculated.
CLDSTR	7-12	Cold-start selection paramater. If <0, cold-start emission factors will be calculated. (Cold-start calculation parameters are input; see the Cold Start Parameter Cards.) If = 0, cold start is not included. If >0, cold-start emission factors will be calculated but not input. For cold-start emission factors, CLDSTR must be <0 the first time cold start is calculated, and whenever changes in the cold-start parameters are required.
RTROFT	13-18	Retrofit selection parameter. If <0, retrofit for automobiles is included and the parameters are input; see Retrofit Parameter Card. If = 0, no retrofit occurs. If >0, retrofit is included but no input occurs. For retrofit cases RTROFT must be <0 the first time retrofit is calculated and whenever changes in the retrofit parameters are required.
DIESEL	19-24	Diesel selection parameter. If <0, diesel (Class 6) emission factors are calculated and the diesel factors are input; see Diesel Parameter Card. If = 0, no calculation for diesels is done. If >0, emission factors are calculated for diesels, but no input of diesel parameters takes place.

If CLDSTR <0, the following 9 cards must be included:

COLD START PARAMETER CARDS (9F8.0)

CARDS 1-4 Cold Start Fractions for CO

Variable	Card	Columns	Contents
FCSECO(1)	1	1-8	Fraction of CO emissions (from a 1972 federal test cycle) for 1960 vehicles due to cold start.
.	.	.	.
.	.	.	.
.	.	.	.
FCSECO(31)	4	25-32	Fraction of CO emissions (from a federal test cycle) for 1990 vehicles due to cold start.

CARDS 5-8 Cold Start Fractions for HC

Variable	Card	Columns	Contents
FCSEHC(1)	5	1-8	HC equivalent of FCSECO(1).
.	.	.	.
.	.	.	.
.	.	.	.
FCSEHC(31)	8	25-32	HC equivalent of FCSECO(31).

CARD 9 Cold Start Mileage Factors

Variable	Columns	Contents
CST1	1-8	Miles of cold operation.
CST2	9-16	Miles of hot operation

If RTROFT <0, include the following card:

RETROFIT PARAMETER CARD (3F8.0)

Variable	Columns	Contents
RETRO(1)	1-8	Fractional reduction of CO emissions on all pre-1968 automobiles.
RETRO(2)	9-16	HC equivalent of RETRO(1)
RETRO(3)	17-24	NO equivalent of RETRO(3)

If DIESEL <0, include the following; otherwise default values are used.

DIESEL PARAMETER CARD (7F8.0)

Variable	Columns	Contents
DIEF(1)	1-8	CO emission factor for the years preceding 1970.
DIEF(2)	9-16	HC equivalent of DIEF(1).
DIEF(3)	17-24	NO equivalent of DIEF(1).
DIEF(4)	25-32	CO emission factor for the years following 1969 (1970+).
DIEF(5)	33-40	HC equivalent of DIEF(4).
DIEF(6)	41-48	NO equivalent of DIEF(4).
DIMIF	49-56	Diesel vehicle mileage (miles/gal). If zero, 3.0 mi/gal is assumed.

Table 7. TREFACT Default Data

(used if no data is supplied in the input deck)

Automobile Age Distribution (Cards 29-30)

REGIS(1)	0.109	REGIS(8)	0.074
REGIS(2)	0.104	REGIS(9)	0.066
REGIS(3)	0.100	REGIS(10)	0.056
REGIS(4)	0.096	REGIS(11)	0.045
REGIS(5)	0.091	REGIS(12)	0.032
REGIS(6)	0.086	REGIS(13)	0.017
REGIS(7)	0.080	REGIS(14)	0.042

Automobile Travel Data (Cards 31-32)

AAT(1)	13,200	AAT(8)	8,100
AAT(2)	12,000	AAT(9)	7,300
AAT(3)	11,000	AAT(10)	7,000
AAT(4)	9,600	AAT(11)	5,700
AAT(5)	9,400	AAT(12)	4,900
AAT(6)	8,700	AAT(13)	4,300
AAT(7)	8,600	AAT(14)	4,300

Class Weighting Factors (Card 45)

WFCTR(1)	0.830
WFCTR(2)	0.087
WFCTR(3)	0.025
WFCTR(4)	0.016
WFCTR(5)	0.042

Class Weighting Factors (Card 46)

DWFCTR(1)	0.811	DWFCTR(4)	0.016
DWFCTR(2)	0.085	DWFCTR(5)	0.042
DWFCTR(3)	0.024	DWFCTR(6)	0.022

Diesel Parameters

DIEF(1)	49.2	DIEF(4)	32.5
DIEF(2)	9.84	DIEF(5)	3.78
DIEF(3)	51.5	DIEF(6)	76.4

3.1.2 TREFACT Sample Problem

Table 8 lists the input data for a typical TREFACT problem. There are 44 basic data cards and six year/option cards. (Cards 45 or 46 in the basic data deck were not included because the default weighting factors were selected on card 2.) The first three cases do not separate cold-start emissions, while the last three cases calculate cold-start emissions separately. Since the last three cases include separate cold-start calculations, the cold-start data is included after the first year/option card; it was not added for the other two cold-start cases because the data is assumed the same as in the previous case when CLDSTR on the year/option card is greater than 0. No diesel cards were input (default values were used), as is indicated by the variable DIESEL (equal to 1) on the year/option cards.

The title indicates that a Cook County vehicle age distribution was used for this problem. Table 9 lists the Cook County distribution, which differs from the default national distribution in Table 7. The vehicle age distribution is certainly one set of data which varies widely from region to region and within each region.

Figure 11 shows the sample outputs which correspond to the input data in Table 8. No basic data was changed in the six cases, only the study year and the cold-start option. If basic data were to be changed, this would require a new problem run and could not be stacked as additional case.

3.2 Transportation Emission Factors (TREMISS)

Urban regional transportation planning involves an enormous computer traffic simulation system. The typical Chicago Area Transportation Study (CATS) traffic simulation network has approximately 1,800 transportation activity grids which cover the eight-county Chicago metropolitan area. A

Table 8. TREFACT Sample Problem Input Data

```
********              COOK COUNTY  AGE & MILEAGE  FACTORS              ********
 1    Ø    Ø
 11Ø.Ø   11Ø.Ø   11Ø.Ø   11Ø.Ø   11Ø.Ø   11Ø.Ø   11Ø.Ø   11Ø.Ø    5Ø.Ø
  5Ø.Ø    35.Ø    35.Ø    31.Ø    31.Ø    31.Ø     4.7     4.1     4.1
   4.1     4.1     4.1     4.1     4.1     4.1     4.1     4.1     4.1
   4.1     4.1     4.1     4.1
  13.1    13.1    13.1    13.1    13.1    13.1    13.1    13.1     5.6
   5.6     3.5     3.5     3.1     3.1     3.1     Ø.5     Ø.4     Ø.4
   Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4
   Ø.4     Ø.4     Ø.4     Ø.4
   6.4     6.4     6.4     6.4     6.4     6.4     6.4     6.4     7.1
   7.1     5.5     5.5     4.4     2.7     2.7     2.7     Ø.4     Ø.4
   Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4     Ø.4
   Ø.4     Ø.4     Ø.4     Ø.4
 128.5   128.5   128.5   128.5   128.5   128.5   128.5   128.5   128.5
 128.5    8Ø.Ø    8Ø.Ø    8Ø.Ø    43.Ø    43.Ø    37.Ø    3Ø.Ø    27.Ø
  27.Ø    27.Ø    27.Ø    27.Ø    27.Ø    27.Ø    27.Ø    27.Ø    27.Ø
  27.Ø    27.Ø    27.Ø    27.Ø
  18.7    18.7    18.7    18.7    18.7    18.7    18.7    18.7    18.7
  18.7    15.1    15.1    15.1     7.8     7.8     5.3     2.7     2.4
   2.4     2.4     2.4     2.4     2.4     2.4     2.4     2.4     2.4
   2.4     2.4     2.4     2.4
   9.5     9.5     9.5     9.5     9.5     9.5     9.5     9.5     9.5
   9.5     9.5     9.5     9.5     8.5     8.5     6.4     3.3     3.Ø
   3.Ø     3.Ø     3.Ø     3.Ø     3.Ø     3.Ø     3.Ø     3.Ø     3.Ø
   3.Ø     3.Ø     3.Ø     3.Ø
 Ø.766   Ø.825    Ø.61    Ø.67     1.Ø
 1.Ø85   1.12Ø   1.26Ø   Ø.92Ø   1.ØØØ   1.295
Ø.1163  Ø.1444  Ø.13Ø7  Ø.1124  Ø.1Ø9Ø  Ø.1Ø47  Ø.Ø815  Ø.Ø671  Ø.Ø523
Ø.Ø296  Ø.Ø23Ø  Ø.Ø1Ø1  Ø.ØØ42  Ø.Ø149
 132ØØ   12ØØØ   11ØØØ    96ØØ    94ØØ    87ØØ    86ØØ    81ØØ    73ØØ
  7ØØØ    57ØØ    49ØØ    43ØØ    43ØØ
 Ø.1ØØ   Ø.Ø95   Ø.Ø9Ø   Ø.Ø85   Ø.Ø8Ø   Ø.Ø75   Ø.Ø7Ø   Ø.Ø65   Ø.Ø6Ø
 Ø.Ø55   Ø.Ø5Ø   Ø.Ø45   Ø.Ø4Ø   Ø.Ø35   Ø.Ø3Ø   Ø.Ø25
 1.Ø63   1.165   1.21Ø   1.235   1.252   1.265   1.275   1.285   1.292
 1.296   1.299   1.3Ø1   1.3Ø2   1.3Ø2
 1.Ø55   1.145   1.175   1.19Ø   1.195   1.198   1.2ØØ   1.2ØØ   1.2Ø1
 1.2Ø1   1.2Ø2   1.2Ø2   1.2Ø3   1.2Ø3
 1.Ø75   1.17Ø   1.215   1.242   1.257   1.268   1.28Ø   1.288   1.288
 1.295   1.3ØØ   1.3Ø2   1.3Ø3   1.3Ø4   1.3Ø5   1.3Ø5
 1.Ø65   1.15Ø   1.178   1.192   1.198   1.2ØØ   1.2ØØ   1.2ØØ   1.2Ø1
 1.2Ø2   1.2Ø2   1.2Ø2   1.2Ø3   1.2Ø3   1.2Ø3   1.2Ø3
   4.1     Ø.8     3.Ø     Ø.5     Ø.2
   5.2     5.2     3.Ø     3.Ø     Ø.8
1970      Ø       Ø       1
1971      Ø       Ø       1
1972      Ø       Ø       1
1970     -1       Ø       1
  Ø.45    Ø.45    Ø.45    Ø.45    Ø.45    Ø.45    Ø.45    Ø.45    Ø.55
  Ø.55    Ø.55    Ø.62    Ø.69    Ø.76    Ø.83    Ø.9Ø    Ø.9Ø    Ø.9Ø
  Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø
  Ø.9Ø    Ø.9Ø    Ø.9Ø    Ø.9Ø
  Ø.3Ø    Ø.3Ø    Ø.3Ø    Ø.3Ø    Ø.3Ø    Ø.3Ø    Ø.3Ø    Ø.3Ø    Ø.45
  Ø.45    Ø.45    Ø.52    Ø.59    Ø.66    Ø.73    Ø.8Ø    Ø.8Ø    Ø.8Ø
  Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø
  Ø.8Ø    Ø.8Ø    Ø.8Ø    Ø.8Ø
   1.5     6.Ø
1971      1       Ø       1
1972      1       Ø       1
```

Table 9. Cook County Vehicle Age Distribution

REGIS(1)	.1163
REGIS(2)	.1444
REGIS(3)	.1307
REGIS(4)	.1124
REGIS(5)	.1090
REGIS(6)	.1047
REGIS(7)	.0815
REGIS(8)	.0671
REGIS(9)	.0523
REGIS(10)	.0296
REGIS(11)	.0230
REGIS(12)	.0101
REGIS(13)	.0042
REGIS(14)	.0149

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1970
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	80.94	96.05	128.54	128.54	128.54	47.53	85.39
RURAL	41.86	49.68	66.49	66.49	66.49	47.53	44.67
HYDROCARBONS							
EVAPORATIONS	3.00	3.00	3.00	3.00	3.00	0.0	2.93
CRANKCASE	0.84	2.04	4.46	4.46	4.46	0.0	1.22
EXHAUSTS							
URBAN	10.01	11.84	20.03	20.03	20.03	9.23	10.97
RURAL	5.99	7.08	11.98	11.98	11.98	9.23	6.65
NITROGEN OXIDE							
URBAN	8.17	8.11	11.97	11.97	11.97	53.99	9.49
RURAL	8.40	8.34	12.30	12.30	12.30	53.99	9.72

Fig. 11. TREFACT Sample Output

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1971
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	71.61	89.40	124.06	124.06	124.06	45.94	76.85
RURAL	37.04	46.24	64.17	64.17	64.17	45.94	40.24
HYDROCARBONS							
EVAPORATIONS	2.61	2.75	3.00	3.00	3.00	0.0	2.60
CRANKCASE	0.58	1.72	3.93	3.93	3.93	0.0	0.94
EXHAUSTS							
URBAN	8.71	10.93	19.67	19.67	19.67	8.66	9.80
RURAL	5.21	6.54	11.76	11.76	11.76	8.66	5.94
NITROGEN OXIDE							
URBAN	7.91	8.00	11.97	11.97	11.97	56.36	9.32
RURAL	8.13	8.22	12.30	12.30	12.30	56.36	9.54

Fig. 11. (Contd.)

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1973
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	54.10	76.24	112.09	112.09	112.09	43.02	60.49
RURAL	27.98	39.43	57.98	57.98	57.98	43.02	31.75
HYDROCARBONS							
EVAPORATIONS	1.75	2.26	2.78	2.78	2.78	0.0	1.84
CRANKCASE	0.26	1.15	2.97	2.97	2.97	0.0	0.55
EXHAUSTS							
URBAN	6.35	9.16	18.26	18.26	18.26	7.60	7.60
RURAL	3.80	5.48	10.92	10.92	10.92	7.60	4.61
NITROGEN OXIDE							
URBAN	6.77	7.30	11.84	11.84	11.84	60.71	8.42
RURAL	6.96	7.50	12.17	12.17	12.17	60.71	8.62

Fig. 11. (Contd.)

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1970
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	53.05	64.50	84.54	84.54	84.54	47.53	56.49
RURAL	27.44	33.36	43.72	43.72	43.72	47.53	29.72
HYDROCARBONS							
EVAPORATIONS	3.00	3.00	3.00	3.00	3.00	0.0	2.93
CRANKCASE	0.84	2.04	4.46	4.46	4.46	0.0	1.22
EXHAUSTS							
URBAN	8.30	10.09	16.55	16.55	16.55	9.23	9.15
RURAL	4.96	6.04	9.90	9.90	9.90	9.23	5.55
NITROGEN OXIDE							
URBAN	8.17	8.11	11.97	11.97	11.97	53.99	9.49
RURAL	8.40	8.34	12.30	12.30	12.30	53.99	9.72

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	209.15	236.64	330.05	330.05	330.05	0.0	216.80
HYDROCARBONS	12.86	13.15	26.10	26.10	26.10	0.0	13.69

Fig. 11. (Contd.)

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1971
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	45.33	59.28	79.98	79.98	79.98	45.94	49.77
RURAL	23.70	30.66	41.37	41.37	41.37	45.94	26.23
HYDROCARBONS							
EVAPORATIONS	2.61	2.75	3.00	3.00	3.00	0.0	2.60
CRANKCASE	0.58	1.72	3.93	3.93	3.93	0.0	0.94
EXHAUSTS							
URBAN	7.06	9.20	15.84	15.84	15.84	8.66	8.00
RURAL	4.22	5.50	9.48	9.48	9.48	8.66	4.86
NITROGEN OXIDE							
URBAN	7.91	8.00	11.97	11.97	11.97	56.36	9.32
RURAL	8.13	8.22	12.30	12.30	12.30	56.36	9.54

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	193.33	225.92	330.61	330.61	330.61	0.0	203.11
HYDROCARBONS	12.39	12.96	28.68	28.68	28.68	0.0	13.50

Fig. 11. (Contd.)

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1972
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	38.27	53.84	74.89	74.89	74.89	44.44	42.73
RURAL	19.79	27.85	38.73	38.73	38.73	44.44	22.57
HYDROCARBONS							
EVAPORATIONS	2.17	2.51	3.00	3.00	3.00	0.0	2.22
CRANKCASE	0.40	1.42	3.44	3.44	3.44	0.0	0.73
EXHAUSTS							
URBAN	5.82	8.30	15.03	15.03	15.03	8.11	6.84
RURAL	3.48	4.97	8.99	8.99	8.99	8.11	4.16
NITROGEN OXIDE							
URBAN	7.49	7.75	11.97	11.97	11.97	58.60	9.01
RURAL	7.70	7.96	12.30	12.30	12.30	58.60	9.22

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	180.46	216.14	335.75	335.75	335.75	0.0	192.26
HYDROCARBONS	12.26	12.97	32.16	32.16	32.16	0.0	13.68

Fig. 11. (Contd.)

computer program was written to calculate grid-dependent air pollutant emissions (CO, HC, NO_x) from transportation sources for the CATS planning area. This program, TREMISS, uses output data files from the CATS traffic simulation model, but data from any traffic simulation program can be used.

Regional traffic simulations are quite costly and there may not always be data available for the study year. Therefore, TREMISS has the additional capability of linearly interpolating between simulation output data for two study years. This is extremely helpful when traffic data is not available for a particular year. TREMISS is structured to interpolate between 1965 and 1985 simulations for any intervening year.

Emissions can be calculated for each grid using either one set of "weighted" emission factors or six sets of emission factors, one for each class of vehicles. (Diesels (Class 6) may or may not be used in the calculation.) Additionally, the complete set of grids may be grouped into any number of subsets. Each such subset has its "own" set of emission factors. However, the mixing of "weighted" and "class" emission factors is not permitted.

Emission summaries for each grid and the totals for all grids are the major outputs. If class-dependent emission factors are used, summaries by class are also given. Emission summaries for any specified set of grids representing a county, municipality, or problem area (i.e., Cook County, Chicago, Chicago Business District) can also be calculated.

3.2.1 Input Data Description

TREMISS is coded in PL/I and control and emission factor data is input through data- and list-directed input formats. Data need only be supplied where necessary with the free data- and list-directed formats.

READ 1 (Data-directed)

Variable Name	Type	Description
OPT65	CHARACTER	If the CATS 1965 data file* is input, 'INP' should be specified; otherwise, omit this parameter. (Data file is referenced through ddname CATS65.)
OPT85	CHARACTER	If the CATS 1985 data file* is input, 'INP' should be specified; otherwise, omit this parameter. (Data file is referenced through ddname CATS85.)
OPTEDT	CHARACTER	Designate the data extracted from the original CATS files for a given TYPE as "edited." If no I/O activity is desired with the edited data, omit this parameter. If OPTEDT = 'INP', then edited data for 1965 and 1985 is input. If OPTEDT = 'OUT', edited data, once generated, is output. (Edited data file is referenced through ddname CATSEDT; OPT65 and OPT85 must both be 'INP' for this case.)
OPTMRG	CHARACTER	Data used in the emission calculation for a given year is formed as a linear combination of the 1965 and 1985 data. Designate this data as "merged." If OPTMRG = 'INP', then merged data are input If OPTMRG = 'OUT', the merged data are output. If no I/O activity is desired with the merged data, omit this parameter. (Merged data file is referenced through ddname MERGExx, e.g., for 1970 use MERGE70.)

*Refers to volume/speed information (see Table 10).

READ 1 (Contd.)

Variable Name	Type	Description
TYPE	INTEGER*	Parameter selects the type of data to be used. 1 - Daily 2 - Peak Hour 3 - Off-Peak Hour

Figure 12 schematically illustrates the three preprocessing options of traffic simulation data. Simulation data can be used directly from either the 1965 or 1985 simulations, from previously generated edited data, or for previously generated data for any intervening year. Table 10 shows the record format for the volume/speed outputs from CATS simulations and Table 11 shows sample speed/volume data for a typical problem.

If OPT65 or OPT85 is 'INP', then the following must be included; otherwise, skip to READ 3.

READ 2 (Data-directed)

Variable Name	Type	Description
MAX	INTEGER	The maximum grid index that will be considered. If all grids are to be considered, then MAX must be ≥ the highest grid index.

READ 3 (Data-directed)

YEAR	INTEGER	Study year. It must be in the form 19xx, where 65 ≤ xx ≤ 85.

*Use INTEGER to imply the PL/I data type of FIXED BINARY(31).

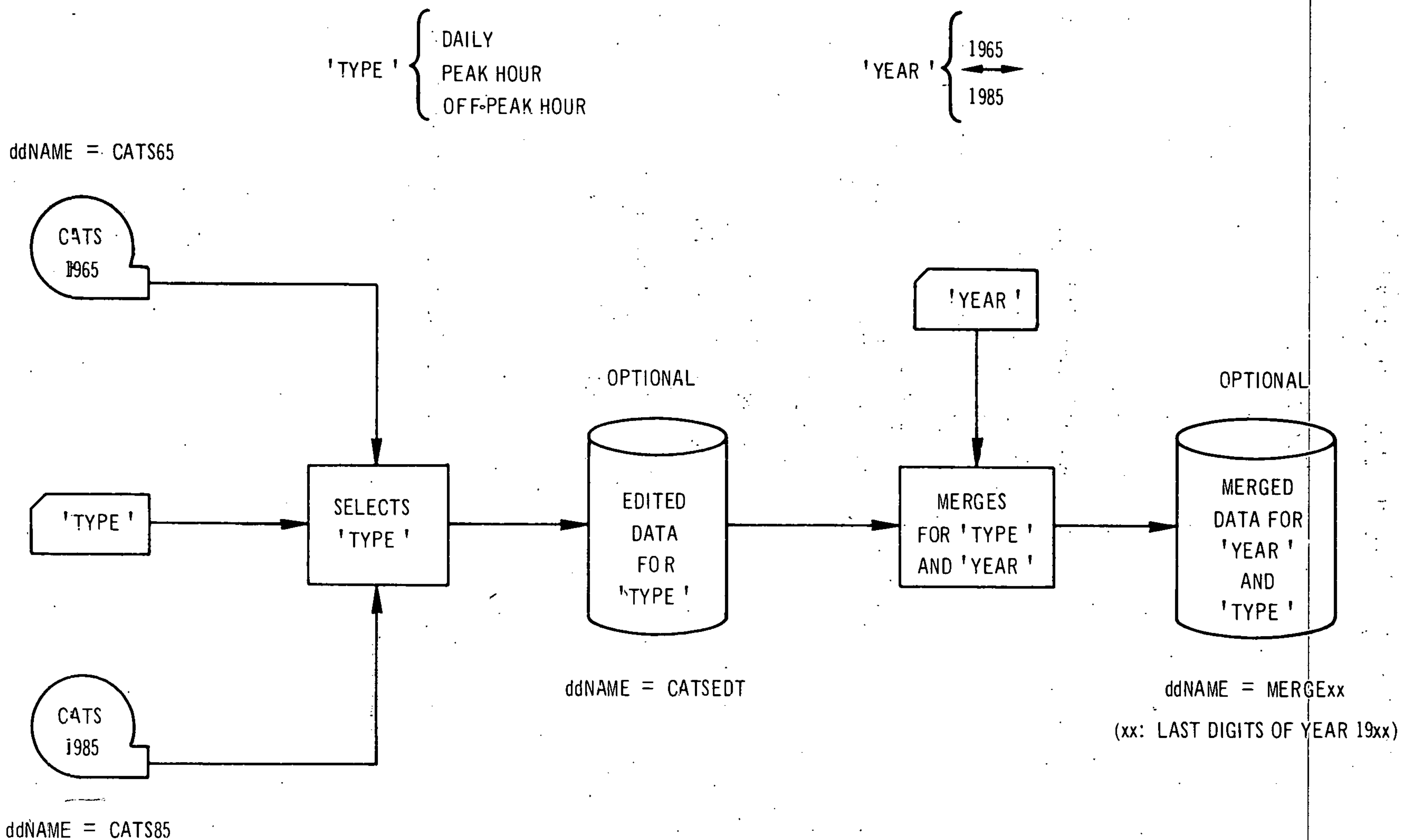

Fig. 12. Preliminary Processing of CATS Volume/Speed Data

Table 10. CATS Volume/Speed Record Format

Positions	Description
1 - 3	State
4 - 6	County
7 - 10	Township
11- 12	Record identification
	1: miles/100
	2: average speed (mph)
13- 17	Grid number
18- 25	Freeway - Daily
26- 33	Arterial - Daily
34- 41	Freeway - Peak Hour
42- 49	Arterial - Peak Hour
50- 57	Freeway - Off-Peak Hour
58- 65	Arterial - Off-Peak Hour
66- 80	Blank

Record length: 80 characters

Table 11. Sample CATS Volume/Speed Data

VOLUME DATA

1	1	1	1	1	0	685	0	56	0	32
1	1	1	1	2	0	810	0	67	0	37
1	1	1	1	3	0	106	0	9	0	5
1	1	2	1	4	916	548	78	46	44	25
1	1	2	1	5	0	316	0	25	0	15
1	1	2	1	6	0	633	0	54	0	29
1	1	2	1	7	8	816	1	67	0	38
1	1	2	1	8	0	72	0	6	0	3
1	1	2	1	9	0	133	0	12	0	6
1	1	2	1	10	0	138	0	12	0	6
						⋮				
2	8	152	1	1705	0	998	0	91	0	45
2	8	152	1	1706	0	52	0	6	0	2
2	8	153	1	1707	0	596	0	52	0	27
2	8	153	1	1708	0	67	0	7	0	3
2	8	153	1	1709	0	1148	0	98	0	53
2	8	153	1	1710	0	84	0	9	0	4
2	8	154	1	1711	0	683	0	62	0	31
2	8	154	1	1712	0	1273	0	105	0	59
2	8	154	1	1713	0	532	0	51	0	24
2	8	154	1	1714	0	886	0	76	0	41

SPEED DATA

1	1	1	2	1	0.0	18.6	0.0	9.9	0.0	22.4
1	1	1	2	2	0.0	17.5	0.0	8.9	0.0	21.6
1	1	1	2	3	0.0	24.0	0.0	22.5	0.0	24.4
1	1	2	2	4	48.5	22.1	48.1	18.0	48.5	23.2
1	1	2	2	5	0.0	21.7	0.0	13.5	0.0	24.4
1	1	2	2	6	0.0	22.8	0.0	16.5	0.0	24.7
1	1	2	2	7	48.8	16.2	48.8	6.7	48.8	21.0
1	1	2	2	8	0.0	23.6	0.0	23.6	0.0	23.6
1	1	2	2	9	0.0	24.0	0.0	19.3	0.0	25.4
1	1	2	2	10	0.0	30.8	0.0	30.8	0.0	30.8
						⋮				
2	8	152	2	1705	0.0	35.5	0.0	26.5	0.0	38.5
2	8	152	2	1706	0.0	37.3	0.0	37.3	0.0	37.3
2	8	153	2	1707	0.0	20.0	0.0	7.9	0.0	29.7
2	8	153	2	1708	0.0	33.8	0.0	33.9	0.0	33.7
2	8	153	2	1709	0.0	25.6	0.0	12.7	0.0	32.5
2	8	153	2	1710	0.0	35.9	0.0	35.9	0.0	35.9
2	8	154	2	1711	0.0	34.7	0.0	23.7	0.0	38.7
2	8	154	2	1712	0.0	13.5	0.0	9.2	0.0	14.9
2	8	154	2	1713	0.0	30.9	0.0	19.6	0.0	35.8
2	8	154	2	1714	0.0	10.8	0.0	11.5	0.0	10.7

READ 4 (List-directed)

Variable Name	Type	Description
SAVE	CHARACTER	If SAVE = 'END', no emission calculations will be made. Useful when only preliminary processing is desired. If SAVE = 'SAV', calculations and special grid displays* are made. If SAVE is anything else, only calculations will occur.
PREPR	CHARACTER	If PREPR = 'PRE', a preprocessing of the volume and speed data is made; otherwise, no such preprocessing occurs. The preprocessing is simply the modification of all selected grids by input factors**
CLDSTR	CHARACTER	This parameter specifies whether cold start emissions are included. If CLDSTR is blank, cold start is not included. If CLDSTR is nonblank, then cold start emissions are calculated. If CLDSTR is 'INP', then origin data+ for YEAR is INPUT. If CLDSTR is 'OUT', then, once generated, the origin data is output. (ddname for year 19xx is ORGINxx; similar to MERGExx.) If CLDSTR is nonblank but not 'INP' or 'OUT', then from the 1965 and 1985 origin data, data for the year 19xx is generated as a linear combination. This data is input from files with ddnames ORGN65 and ORGN85.

Figure 13 shows the merging of origin data from the 1985 and 1965 CATS simulations. Table 12 gives the origin record format and Table 13 a sample of the origin data.

*Refer to grid summaries specified in Table 14 and the county summaries specified through READ 9.
**See READ 5.
+Refers to the number of trips (short, long-residential, and long nonresidential).

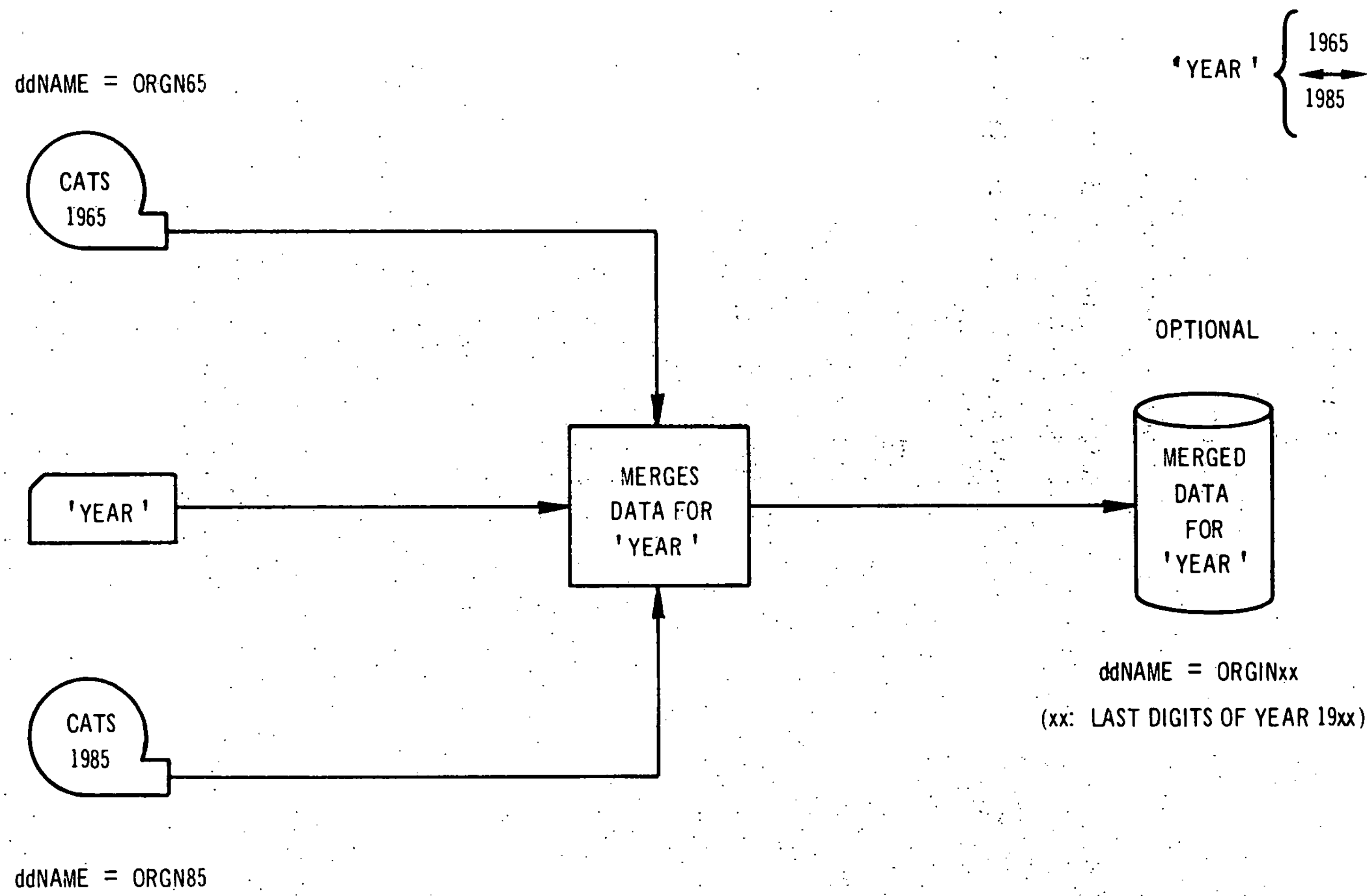

Fig. 13. Preliminary Processing of CATS Orgin Data

Table 12. CATS Origin Record Format

Positions	Description
1 - 4	Grid number
5 - 6	County
7 - 10	Township
11- 16	Number of short trips
17- 24	Number of long-residential trips (home-to-work)
25- 32	Number of long nonresidential trips (work-to-home)
33- 80	Blank

Record length: 80 characters

Table 13. Sample CATS Origin Data

1	1	1	16015	4367	2134
2	1	1	15134	5125	1449
3	1	1	2480	582	2632
4	1	2	10632	3030	1654
5	1	2	12496	2142	7078
6	1	2	10766	2357	3555
7	1	2	6757	2026	1454
8	1	2	1765	361	1145
9	1	2	8010	2380	389
10	1	2	1020	133	2591
11	1	2	1572	519	945
12	1	2	2103	714	1666
13	1	2	1034	10	100
14	1	2	4031	864	247
15	1	2	6541	1793	840
16	1	3	613	277	27
17	1	3	3707	899	929
18	1	3	945	225	29
19	1	3	13192	2642	1239
20	1	3	1090	134	75
21	1	3	5477	1441	319
22	1	3	1038	333	515
23	1	3	5324	1123	539
24	1	3	2459	658	368
25	1	3	4296	1271	251
26	1	3	4703	1167	637
27	1	3	9298	1790	1611
28	1	4	1535	345	192
29	1	4	2618	403	373
30	1	4	5676	658	1209
31	1	6	7593	2095	1028
32	1	6	28219	2899	7607

READ 4 (List-directed) (Contd.)

Variable Name	Type	Description
EMISF	CHARACTER	If EMISF = 'CLA', then emissions in each grid are calculated by vehicle class; otherwise, only one vehicle class is assumed. In the former case, 6 sets of emission factors are required, while the latter requires but one.
NSETS	INTEGER	NSETS specifies the number of subsets into which the complete set of grids will be divided.

The remainder of this input description applies if SAVE is not 'END'.

If PREPR is 'PRE', then the following must be included; otherwise, skip to READ 6.

READ 5

In order to preprocess the volume/speed data, the grids must be specified together with the adjustment factors. In each grid there are four values (freeway miles, arterial miles, freeway speed, and arterial speed); thus, there must also be four adjustment factors. (If a particular value is not to be adjusted, a value of 1.0 should be used.)

The grids are grouped by the four adjustment factors that each grid in the group requires. They can be specified in sequence and/or individually.

READ 5.1 (Data-directed)

Variable Name	Type	Description
#FSETS	INTEGER	The number of sets of adjustment factors to be input.

Include #FSETS of the following (5.2-5.5).

READ 5.2 (List-directed)

Variable Name	Type	Description
FACTOR	REAL*	1 - adjustment factor for freeway miles
		2 - adjustment factor for arterial miles
		3 - adjustment factor for freeway speed
		4 - adjustment factor for arterial speed

READ 5.3 (List-directed)

Variable Name	Type	Description
NSEQ	INTEGER	Sequences of consecutive grids are specified by a pair of values: the indices of the first and last grids in the sequence. NSEQ is the number of sequences to be input.
NINDV	INTEGER	NINDV is the number of individual grid indices to be input.

If NSEQ >0, then include NSEQ of the following:

READ 5.4 (List-directed)

Variable Name	Type	Description
ZONE1	INTEGER	Index of the first grid in this sequence.
ZONE2	INTEGER	Index of the last grid in this sequence.

If NINDV >0, then include NINDV of the following.

READ 5.5 (List-directed)

Variable Name	Type	Description
I	INTEGER	Grid index.

For example, assume we want to increase the speed by 20% in grids 57, 60-65, 68-73, and 75, the input is as follows:

*Use REAL to imply the PL/I data type FLOAT DECIMAL(6).

READ 5.5 (List-directed) (Contd.)

```
(5.1)     #FSETS = 1;
(5.2)            1.0    1.0    1.2  1.2
(5.3)       NSEQ = 2   NINDV = 2;
(5.4)           60     65     68    73
(5.5)           57            75
```

READ 6 (Class-Independent Emission Factors)

If emission factors are class-independent (EMISF is not 'CLA'), continue; if emission factors are class-dependent (EMISF = 'CLA'), then skip to READ 7.

READ 6.1 (List-directed)

Variable Name	Type	Description
TITLE	CHARACTER	Identifying information of at most 78 characters.

READ 6.2 (List-directed)

Variable Name	Type	Description
EMISSION_FACTORS	REAL	Emission factors in grams/mile. The following order must be used:

CO	urban	exhaust
CO	rural	exhaust
HC	evaporative	
HC	crankcase	
HC	urban	exhaust
HC	rural	exhaust
NO_x	urban	exhaust
NO_x	rural	exhaust

If CLDSTR is nonblank, the following must also be included.

READ 6.3 (List-directed)

Variable Name	Type	Description
CLDSTR_VALUES	REAL	Cold start emission factors in the following order. CO, HC: grams/trip SHORTF: fraction of short trips that are cold start. LRESF: fraction of long-residential trips (home-to-work) that are cold start. LNRESF: fraction of long-nonresidential (work-to-home) trips that are cold start.

Specification of grids is done through READ 8.

If emission factors are class-independent (EMISF ≠ 'CLA'), skip to READ 8.

READ 7 (Class-dependent emission factors)

READ 7.1 (List-directed)

Variable Name	Type	Description
TITLE	CHARACTER	Identifying information of at most 78 characters.

READ 7.2 (List-directed)

Variable Name	Type	Description
EMISSION_FACTORS	REAL	Five sets of emission factors in grams/mile: corresponding to the following vehicle classes. 1 - Cars. 2 - Light-duty Trucks (GVW <6,000 lb). 3 - Heavy-duty Trucks (6,000-10,000 lb, GVW). 4 - Heavy-duty Trucks (10,000-19,000 lb, GVW). 5 - Heavy-duty Trucks (Over 19,000 lb, GVW).

READ 7.2 (List-directed) (Contd.)

Variable Name	Type	Description
		For each vehicle class, emission factors are specified in the following order. CO - urban } exhaust CO - rural HC - evaporative HC - crankcase HC - urban } exhaust HC - rural NO_x - urban NO_x - rural
DIESEL	REAL	Emission factors in grams/mile for diesel (Class 6). The following order is used. CO } exhaust HC NO_x If DIESEL is not included in the calculation, input a value of 0.0 for each emission factor.
DISTR	REAL	DISTR contains the factors that yield the class distribution of vehicle miles and trip origins. There are six values input, corresponding to the six vehicle classes. If diesels are not included in the calculation, specify DISTR(6) as 0.0.

If CLDSTR is nonblank, the following must be included.

READ 7.3 (list-directed)

Variable Name	Type	Description
CLDSTR_EMIFCTRS	REAL	Five sets of cold start emission factors corresponding to the first five vehicle classes. Cold start is not applicable to diesels. For each vehicle class, the emission factors are input in the following order. CO } grams/trip HC

READ 7.3 (List-directed) (Contd.)

	Description (Contd.)
SHORTF:	fraction of short trips that are cold start.
LRESF:	fraction of long-residential (home-to-work) trips that are cold start.
LNRESF:	fraction of long-nonresidential (work-to-home) trips that are cold start.

READ 8 Grids are specified independent of the type of emission factors used.

READ 8.1 (Data-directed)

Variable Name	Type	Description
NSEQ	INTEGER	The number of sequences to be input. If NSETS = 1 and all grids are to use the same emission factors, then specify NSEQ <0 only.
NINDV	INTEGER	Number of individual grid indices to be input.

If NSEQ >0, then include NSEQ of the following.

READ 8.2 (List-directed)

Variable Name	Type	Description
ZONE1	INTEGER	Index of the first grid in this sequence.
ZONE2	INTEGER	Index of the last grid in this sequence.
		All grids from ZONE1 through ZONE2 will use the same set of emission factors: READ 6.2 and 6.3 if EMISF ≠ 'CLA', READ 7.2 and 7.3 if EMISF = 'CLA'.

If NINDV >0, then include NINDV of the following.

READ 8.3 (List-directed)

Variable Name	Type	Description
I	INTEGER	Grid index. (This grid uses emission factors input through READ 6.2 and 6.3.) If EMISF ≠ 'CLA', READ 7.2 and 7.3 if EMISF = 'CLA'.

If NSETS >1, then input NSETS of READ $\left\{\begin{matrix} 6.1,\ 6.2,\ 6.3 \\ 7.1,\ 7.2,\ 7.3 \end{matrix}\right\}$ 8.1, 8.2, and 8.3.

If SAVE = 'SAV', then the total emissions in each grid for the Chicago Business District and the City of Chicago are output. Additionally, the total emissions for these two subregions are given. The grids defining these two groups are given in Table 14.

The following must also be included if SAVE = 'SAV.'

READ 9 (List-directed)

Variable Name	Type	Description
COUNTY_#	CHARACTER	It is also possible to obtain grid displays and totals on a county basis. The county identified is input for each county desired. The final input (or the only input if no county summaries are desired), is a blank county identifier.

Additional cases may be run by returning to READ 1. There is no correspondence between cases within a single run.

Table 14. CATS Special Grid Summaries

I	Chicago Business District (CBD)	
	60 - 65	
	68 - 73	
		Total number of zones: 12
II	City of Chicago	
	1 - 15	523 - 527
		529 - 531
	34 -143	536 - 537
	145 -150	694
	154 -155	758
	246	764
	248	
	252 -288	
	290 -294	
	296 -300	
	302 -306	
	310 -312	
	316 -318	
	322 -324	
	328 -342	
	346 -348	
	352 -354	
	358 -360	
	377 -378	
	382 -383	
	507 -508	Total number of zones: 244
	513 -514	
	517 -519	

3.2.2 TREMISS Sample Problem

The input data listing for a sample TREMISS problem is given in Table 15. Daily emissions in the Chicago region are calculated for 1971. The merged input data were modified to increase the average vehicle speed 20% in the central business district (grids 60-65, 68-73). Separate class-dependent emission factors were input for the Extended Chicago Business District (grids 55-77, 59-65, 67-73, 75-77) and the Chicago Region excluding the extended CBD (grids 1-54, 78-1714, 58, 66, 74). Diesel emission factors in both regions were zero. The same distribution of vehicles was assumed in both regions (Class 1, .83; Class 2, .087; Class 3, .025; Class 4, .016; Class 5, 0.42; Class 6, 0.0).

Figure 14 shows part of the output from this sample problem. The class-dependent emission factors are listed, followed by the grid-dependent emissions and region summaries by class. Only the first page of the output from the Chicago Region excluding the extended CBD is given, since this region contains approximately 1700 grids.

Table 15. TREMISS Sample Input

```
OPTMRG='INP',  TYPE=1;        YEAR=1971;
  'NSV'     'PRE'         'CLA'      2
#FSETS=1;
   1.Ø    1.Ø    1.2    1.2            NSEQ = 2;
6Ø  65      68  73
                    EXTENDED CHICAGO BUSINESS DISTRICT (XCBD)
  66.77   34.53    2.61    Ø.58    8.5Ø    5.Ø8    7.91    8.13
  83.42   43.15    2.75    1.72   1Ø.25    6.13    8.ØØ    8.22
 179.39   92.79    2.75    3.27   19.48   11.65   11.11   11.42
 233.23  12Ø.64    2.75    4.18   24.9Ø   14.9Ø   22.84   23.47
 265.95  136.52    2.75    4.45   26.51   15.86   31.Ø4   31.9Ø
   Ø.Ø     Ø.Ø     Ø.Ø
  Ø.83Ø   Ø.Ø87   Ø.Ø25   Ø.Ø16   Ø.Ø42    Ø.Ø
NSEQ=4         NINDV=Ø;
55  57      59  65      67  73      75  77
                        CHICAGO REGION EXCLUDING XCBD
  71.61   37.Ø4    2.61    Ø.58    8.71    5.21    7.91    8.13
  89.4Ø   46.24    2.75    1.72   1Ø.93    6.54    8.ØØ    8.22
 192.26   99.44    2.75    3.27   2Ø.78   12.43   11.11   11.42
 249.95  129.29    2.75    4.18   26.57   15.89   22.84   23.47
 282.88  146.31    2.75    4.45   28.28   16.92   31.Ø4   31.9Ø
   Ø.Ø     Ø.Ø     Ø.Ø
  Ø.83Ø   Ø.Ø87   Ø.Ø25   Ø.Ø16   Ø.Ø42    Ø.Ø
NSEQ=2         NINDV=3;
 1  54      78 1714                  58      66      74
```

Fig. 14. TREMISS Sample Output

MOTOR VEHICLE EMISSIONS(GRAMS/100) FOR 1971 . DAILY SET NO. 1
EXTENDED CHICAGO BUSINESS DISTRICT (XCBD)

EMISSION FACTORS(GRAMS/MILE)

	CO URBAN	CO RURAL	HC EVAP	HC CRANK	HC URBAN	HC RURAL	NC URBAN	NC RURAL
1	66.77	34.53	2.61	0.58	8.50	5.08	7.91	8.13
2	83.42	43.15	2.75	1.72	10.25	6.13	8.00	8.22
3	179.39	92.79	2.75	3.27	19.48	11.65	11.11	11.42
4	233.23	120.64	2.75	4.18	24.90	14.90	22.84	23.47
5	265.95	136.52	2.75	4.45	26.51	15.86	31.04	31.90

ZONE	CO FREEWAY	CO ARTERIAL	CO TOTAL	HC FREEWAY	HC ARTERIAL	HC TOTAL	NC FREEWAY	NC ARTERIAL	NC TOTAL
55	43546.7	185148.5	228695.2	9295.9	23622.8	32918.7	8857.2	10723.8	19581.0
56	0.0	275107.6	275107.6	0.0	34792.0	34792.0	0.0	15434.7	15434.7
57	0.0	67755.9	67755.9	0.0	10607.8	10607.8	0.0	7050.7	7050.7
59	67490.3	236374.6	303864.9	14477.5	30626.0	45103.5	13858.9	14447.6	28306.5
60	0.0	25143.1	25143.1	0.0	3369.8	3369.8	0.0	1718.2	1718.2
61	0.0	90834.1	90834.1	0.0	11490.1	11490.1	0.0	5100.4	5100.4
62	0.0	71033.6	71033.6	0.0	9978.7	9978.7	0.0	5596.7	5596.7
63	22617.2	104124.8	126741.9	5279.8	13779.6	19059.4	5445.5	6831.5	12277.0
64	0.0	223342.3	223342.3	0.0	28245.4	28245.4	0.0	12530.5	12530.5
65	0.0	179325.8	178325.8	0.0	23064.6	23064.6	0.0	10834.3	10834.3
67	59746.6	201890.9	261637.5	13289.4	25532.5	38821.9	13153.8	11326.9	24480.7
68	42080.9	72213.7	114294.6	9790.2	9810.6	19600.8	10069.5	5149.2	15218.7
69	4806.7	170017.8	174824.4	1153.4	21501.6	22655.0	1217.1	9538.7	10755.8
70	0.0	144555.3	144555.3	0.0	20263.2	20263.2	0.0	11318.7	11318.7

Fig. 14. (Contd.)

MOTOR VEHICLE EMISSIONS(GRAMS/100) FOR 1971 DAILY — SET NO. 2

CHICAGO REGION EXCLUDING XCBD

EMISSION FACTORS(GRAMS/MILE)

	CO URBAN	CO RURAL	HC EVAP	HC CRANK	HC URBAN	HC RURAL	NO URBAN	NO RURAL
1	71.61	37.04	2.61	0.58	8.71	5.21	7.91	8.13
2	89.40	46.24	2.75	1.72	10.93	6.54	8.00	8.22
3	192.26	99.44	2.75	3.27	20.78	12.43	11.11	11.42
4	249.95	129.29	2.75	4.18	26.57	15.89	22.84	23.47
5	282.88	146.31	2.75	4.45	28.28	16.92	31.04	31.90

ZONE	CO FREEWAY	CO ARTERIAL	CO TOTAL	HC FREEWAY	HC ARTERIAL	HC TOTAL	NO FREEWAY	NO ARTERIAL	NO TOTAL
1	0.0	80164.4	80164.4	0.0	10881.7	10881.7	0.0	6001.0	6001.0
2	0.0	97491.9	97491.9	0.0	13164.7	13164.7	0.0	7187.9	7187.9
3	0.0	7526.6	7526.6	0.0	1148.3	1148.3	0.0	757.8	757.8
4	40540.9	53466.7	94007.6	7430.0	7913.8	15343.7	5904.3	5026.7	10931.0
5	0.0	26949.1	26949.1	0.0	4009.9	4009.9	0.0	2564.5	2564.5
6	0.0	59113.7	59113.7	0.0	8853.6	8853.6	0.0	5710.0	5710.0
7	3191.0	106779.8	109970.8	707.9	14218.5	14926.5	711.7	7552.5	8264.2
8	0.0	7285.2	7285.2	0.0	1118.0	1118.0	0.0	743.1	743.1
9	0.0	12238.7	12238.7	0.0	1860.2	1860.2	0.0	1221.9	1221.9
10	NO DATA DEFINED								
11	0.0	9116.8	9116.8	0.0	1425.0	1425.0	0.0	967.8	967.8
12	0.0	44228.1	44228.1	0.0	6591.1	6591.1	0.0	4223.8	4223.8
13	38403.7	15015.3	53419.0	4933.4	2427.4	7360.8	2428.2	1711.8	4140.0
14	0.0	25117.7	25117.7	0.0	3771.5	3771.5	0.0	2440.2	2440.2

Fig. 14. (Contd.)

71	0.0	114658.2	114658.2	0.0	14500.4	14500.4	0.0	6432.8	6432.8
72	23604.2	39458.5	63062.7	5528.4	5044.1	10572.5	5717.1	2301.1	8018.2
73	0.0	82174.0	82174.0	0.0	13214.8	13214.8	0.0	9071.0	9071.0
75	0.0	144663.9	144663.9	0.0	20120.2	20120.2	0.0	11071.0	11071.0
76	67553.5	204648.3	272201.8	14668.7	25881.2	40549.9	14204.3	11481.6	25685.9
77	0.0	123420.6	123420.6	0.0	22482.2	22482.2	0.0	17540.6	17540.6

TOTAL EMISSIONS(GRAMS/10**5)

	CO	HC	NO
	3086.3	441.4	258.0

CLASS SUMMARY

1	2084.5	315.7	184.0
2	273.0	41.4	19.5
3	168.7	20.9	7.8
4	140.4	16.8	10.2
5	419.8	46.6	36.5

4. Transportation Emission Calculations

The computer programs described in the previous section are used to calculate grid-dependent emissions for large urban transportation networks. A method for manually calculating air pollutant emissions from transportation sources is described in this section. This method is designed to calculate emissions from individual transportation links (i.e., highways.). Sample problems are presented to illustrate the procedure for calculating transportation air pollutant emissions.

Speed Adjustment Factors

The emission factors calculated by TREFACT are for the standardized urban and rural speeds. TREMISS has speed adjustment data to modify the emission factors for the speed-dependent transportation network. The speed adjustment curves from Figs. 8 and 9 have been transformed into a set of linear equations. Table 16 gives these speed adjustment equations for carbon monoxide and hydrocarbons. They will be used to adjust the emission calculations for individual roadways. Urban and rural speed adjustment factors should be used with urban and rural emission factors, respectively. It should be remembered that this speed adjustment data is representative of typical traffic and does not represent free-flowing traffic at that average speed.

4.1 Sample Problems

The three sample emission calculation problems which follow are intended to illustrate the method used to calculate emissions for typical highway projects. The transportation activity characteristics must be known by the planner before he attempts to calculate air pollutant emissions. These problems utilize emission data calculated by TREFACT and located in Appendix B. If the particular highway or arterial street does not represent the type and/or vehicle usage of the two sets of emission factors found in Appendix B, then TREFACT can be rerun to calculate emission factors with appropriate distributions.

Table 16. Speed Adjustment Factors

v - average vehicle speed (MPH)
F - adjustment factor

Carbon Monoxide

Urban

$10 \leq v \leq 20$ $\quad F = 2.825 - 0.0825\ v$

$20 \leq v \leq 35$ $\quad F = 1.828 - 0.0327\ v$

Rural

$35 \leq v \leq 50$ $\quad F = 1.793 - 0.0177\ v$

$50 \leq v \leq 55$ $\quad F = 1.51 - 0.012\ v$

Hydrocarbons

Urban

$10 \leq v \leq 20$ $\quad F = 2.35 - 0.0625\ v$

$20 \leq v \leq 35$ $\quad F = 1.567 - 0.0233\ v$

Rural

$35 \leq v \leq 50$ $\quad F = 1.585 - 0.0132\ v$

$50 \leq v \leq 55$ $\quad F = 1.392 - 0.0093\ v$

Sample Problem #1

Problem:

A suburban highway is proposed as an extension to an existing freeway. The following description represents the transportation activity as projected for the completed expressway in 1975. What are the air pollutant emissions from this highway?

Data:

Type of Highway:	Rural or suburban
Traffic Levels:	40,000 vehicles per day evenly distributed over the entire 24 hours
Vehicle Types:	75% automobiles 16% commercial vehicles 9% diesel tractor-trailers
Average vehicle speed:	50 mph

Solution:

Step 1: Determine the emission factors most appropriate for this transportation system.

Since this highway is an extension to a rural expressway, most of the vehicles will be warm when they enter this highway segment (in operation more than a few minutes); therefore, emission factors which do not include the cold-start emissions should be used. With an average speed of 50 mph, the rural emission factors are applicable. It is assumed for this problem that the vehicle age and mileage distribution are similar to the Cook County distribution given in Table 9. The emission factors from Table B.22 are

	(gm/vehicle mile)		
	CO	HC	NO_x
Automobiles:	9.58	2.88	5.59
Light-Duty Trucks	19.30	5.87	6.64
Heavy-Duty Trucks	28.30	11.21	11.66
Diesel Tractor-Trailers	40.43	6.66	64.57

Because the diesel emission factors are based upon a fuel economy of 3 miles/gal, and it is determined that diesels will get 5 miles/gal on this section of highway, the diesel emissions factors must be modified (multiply by 3/5).

The modified diesel emission factors are

	CO	HC	NO_x
Diesel	24.26	4.0	38.7

Step 2: Determine speed correction factors

From Table 16

CO   F = 1.51 - 0.012 (50) = .91

HC   F = 1.392 - 0.0093(50) = .927

Step 3: Calculate Emissions

The following equation is used to calculate emissions.

$$E_T = T \sum_{i=1}^{6} E_i F_i S_i \tag{7}$$

where E_T is the total emissions for any pollutant, T is the traffic level on the highway, E_i the emission factor for vehicle type i, F_i the fraction of travel by vehicle type i, and S_i the speed correction for vehicle type i.

The parameters for this problem are

T = 40,000 vehicles/day

F_i = .75

F_2* = .08

F_3* = .08

F_6 = .09

*Assume that half the commercial vehicles are light-duty trucks and half are heavy-duty vehicles.

	CO	HC	NO_x
E_1	9.58	2.88	5.59
E_2	19.30	5.87	6.64
E_3	28.30	11.21	11.66
E_6	24.26	4.00	38.70
S_{1-3}	.91	.927	1.00
S_6	1.00	1.00	1.00

Using Equation 7 the CO, HC, and NO_x emissions are

$$E_T(CO) = 4.87 \times 10^5 \text{ grams/mile-day} = 44.69 \text{ lb/mi-hr}$$
$$E_T(HC) = 1.427 \times 10^5 \text{ grams/mile-day} = 13.09 \text{ lb/mi-hr}$$
$$E_T(NO_x) = 3.45 \times 10^5 \text{ grams/mile-day} = 31.75 \text{ lb/mi-hr}$$

Sample Problem #2

Problem:

An urban expressway is proposed as a part of the urban regional transportation network. The transportation activity (below) is projected for the completed expressway in 1977. What are the air pollutant emissions from this expressway (daily and peak hour)?

Data:

Type of Highway:	Urban expressway
Traffic Levels:	140,000 vehicles/day 15,000 vehicle/hr at peak hour
Vehicle types:	76% automobiles 18% commercial vehicles 6% diesel tractor-trailers
Average vehicle speed:	41 mph (daily average) 21 mph (peak hr)

Solution:

Because the peak-hour traffic operation and load characteristics are quite different from the daily average, the emission calculations are almost two entirely different problems.

Step 1: <u>Determine the most appropriate emission factors</u>

A limited-access urban expressway will probably not service many vehicles during the first few minutes of operation. Therefore, emission factors which do not include the cold-start emissions should be used. Both the urban and rural emission factors will be used because of the two different average speeds in the problem (rural-daily average; urban-peak hour). The Cook County age and mileage vehicle distributions are assumed. The emission factors from Table B-24 are

	CO		HC		NO_x	
	Urban	Rural	Urban	Rural	Urban	Rural
Automobiles:	9.59	4.96	2.09	1.52	3.54	3.64
Light Duty Trucks:	26.95	13.94	5.77	4.14	5.16	5.30
Heavy Duty Trucks:	41.80	21.62	12.04	8.58	9.85	10.12
Diesel Tractor Trailer:	38.18	38.18	5.84	5.84	67.93	67.93

Step 3: <u>Determine Speed Correction Factors</u>

From Table 16

<u>Urban</u>

CO $F = 1.828 - 0.0327\ (21) = 1.141$

HC $F = 1.567 - 0.0233\ (21) = 1.078$

<u>Rural</u>

CO $F = 1.793 - 0.0177(41) = 1.0673$

HC $F = 1.585 - 0.0132(41) = 1.0438$

Step 3: Calculate Emissions

Daily Average

T = 140,000 vehicles/day

F_1= .76

F_2* = .09

F_3* = .09

F_6 = .06

*Assume that half the commercial vehicles are light-duty trucks and half are heavy-duty vehicles.

	CO	HC	NO_x
E_1	4.96	1.52	3.64
E_2	13.94	4.14	5.30
E_3	21.62	8.58	10.12
E_6	38.18	5.84	67.93
S_{1-3}	1.067	1.044	1.0
S_6	1.0	1.0	1.0

Using Equation 7 the CO, HC, and NO_x emissions are

$E_T(CO)$ = 1.362×10^6 grams/mile-day = 125#/mi-hr

$E_T(HC)$ = 3.84×10^5 " = 35.2#/mi-hr

$E_T(NO_x)$ = 1.152×10^6 " =105.7#/mi-hr

Peak Hour

T = 15,000 vehicles/day

F_1 = .76

F_2 = .09

F_3 = .09

F_6 = .06

	CO	HC	NO_x
E_1	9.59	2.09	3.54
E_2	26.95	5.77	5.16
E_3	41.80	12.04	9.85
E_6	38.18	5.84	67.93
S_{1-3}	1.141	1.078	1.0
S_6	1.0	1.0	1.0

Using Equation 7 the CO, HC, and NO_x emissions are

$E_T(CO) = 2.36 \times 10^5$ grams/mile-hr = 519.8 #/mi-hr

$E_T(HC) = 5.685 \times 10^4$ " = 125.2 #/mi-hr

$E_T(NO_x) = 1.21y \times 10^5$ " = 268. #/mi-hr

Sample Problem #3

Problem:

It is suggested that the improvement of an intersection on a major urban arterial will raise the average speed of the vehicles from 17 to 23 mph and therefore lower the air pollutant emission levels at the peak hours. What is the change in air pollutant emissions as a result of this intersection improvement in 1974?

Data:

Type of Roadway:	Urban arterial
Traffic Levels:	4,000 vehicles/hr (peak hr)
Vehicle Types:	85% automobiles 15% commercial vehicles
Average vehicle speed:	23 mph - 17 mph

Step 1: Determine the emission factors most appropriate for this transportation system.

Since this urban arterial is located near many trip origins, it is assumed that half of the vehicles which operate on this arterial will emit the cold start portion of their emissions. Therefore, the emission factors will represent a composit of the cold-start and non-cold-start emission factors (50-50 split).

The emission factors from Tables B.5 and B.21 are

	CO		HC		NO_x	
	cold	no	cold	no	cold	no
Automobiles:	47.34	24.69	7.06	6.30	6.04	6.04
Light Duty Trucks:	70.15	42.98	11.28	9.51	6.87	6.87
Heavy Duty Trucks:	104.62	61.59	22.3	17.65	11.72	11.72

COMPOSITE EMISSION FACTORS

(.5 cold-start factors + .5 non-cold start factors)

	CO	HC	NO_x
Autos	36.01	6.68	6.04
Light Duty Trucks	56.56	10.39	6.87
Heavy Duty Trucks	83.10	19.97	11.72

Step 2: Determine speed correction factors from Table 16.

23 mph

CO $F = 1.828 - 0.0327\ (23) = 1.0759$

HC $F = 1.567 - 0.0233\ (23) = 1.0311$

17 mph

CO $F = 2.824 - 0.0825\ (17) = 1.422$

HC $F = 2.35 - 0.0625\ (17) = 1.287$

Step 3: Calculate Emissions

23 mph Case

T = 4,000 vehicles/hr

F_1 = .85

F_2*= .075

F_3*= .075

*Assume that half the commercial vehicles are light-duty trucks and half are heavy-duty vehicles.

	CO	HC	NO_x
E_1	36.01	6.68	6.04
E_2	56.56	10.39	6.87
E_3	83.10	19.97	11.72
S_{1-3}	1.076	1.0311	1.0

Using Equation 7 the CO, HC and NO_x emissions are:

23 mph

$E_T(CO) = 1.768 \times 10^5$ gm/mi-hr = 389.4 #/mi-hr

$E_T(HC) = 3.281 \times 10^4$ gm/mi-hr = 72.27 #/mi-hr

$E_T(NO_x) = 2.61 \times 10^4$ gm/mi-hr = 57.49#/mi-hr

The 17 mph case differs only in the speed correction factor, therefore, the change in intersection design resulted in a reduction of CO and HC emissions of 34.6 and 25.1 percent, respectively. NO_x emissions are the same for both cases since no speed dependence is assumed.

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5. EPA, "Plans for Implementation of National Ambient Air Quality Standards," Appendix I. March 26, 1971.

6. Society of Automotive Engineers, Paper No. 690764, "Exhaust Emissions from Heavy Duty Vehicles, R. W. Olsen and K. J. Springer, Houston, Texas, Meetings, Nov. 4-7, 1969.

7. Private Communication, Kircher, Division of Control Systems, U.S. EPA.

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APPENDIX A

TREFACT PROGRAM LISTING

```
      REAL*8 TITLE(9)
      REAL NOFCTR
      INTEGER CHANGE(3), CLDSTR, DIESEL, RTROFT, YEAR
      DIMENSION AAT(14), BYEFCO(2,31), BYEFHC(2,31), BYEFNO(2,31),
     1    CRANK(6), CREF(2,2), CSCO(6), CSHC(6), DCCO(14), DCHC(14), DIEF(6),
     2    DTCO(16), DTHC(16), DWFCTR(6), EVAP(6), EVEF(2,3), EXEMI(6,6),
     3    FCSECO(31), FCSEHC(31), PTRVLC(14), PTRVLT(16), REFCO(31),
     4    REFHC(31), REFNO(31), REGIS(14), RETRO(3), TESFCO(3),
     5    TESFHC(3), TESFNO(3), WEXEMI(6), WFCTR(5), YEFCO(2,31),
     6    YEFCSC(2,31), YEFCSH(2,31), YEFHC(2,31), YEFNO(2,31)
C
      DATA DIEF, DFCTR/49.2, 9.84, 51.5, 32.5, 3.78, 76.4, 1.0/
      DATA TESFCO, TESFHC, TESFNO/ 9 * 1.0 /
C    FEDERAL FACTORS
      DATA REGIS/0.109, 0.104, 0.100, 0.096, 0.091, 0.086, 0.080,
     *          0.074, 0.066, 0.056, 0.045, 0.032, 0.017, 0.042/
      DATA AAT/13200., 12000., 11000., 9600., 9400., 8700., 8600.,
     *          8100.,  7300.,  7000., 5700., 4900., 4300., 4300./
C    WEIGHTING FACTORS
      DATA DWFCTR/0.811, 0.085, 0.024, 0.016, 0.042, 0.022/
      DATA WFCTR/0.830, 0.087, 0.025, 0.016, 0.042/
C
C***INPUT TITLE AND "CHANGES" CARDS
      READ(5,220) TITLE, CHANGE
C
C**************
C   INPUT BASIC SET OF EMISSION VALUES
C**************
C   BASIC YEARLY EXHAUST EMISSION FACTORS
C     LIGHT-DUTY VEHICLES : CLASSES 1 & 2
      READ(5,210) (BYEFCO(1,I), I=1,31)
      READ(5,210) (BYEFHC(1,I), I=1,31)
      READ(5,210) (BYEFNO(1,I), I=1,31)
C     HEAVY-DUTY VEHICLES : CLASSSS 3 - 5
      READ(5,210) (BYEFCO(2,I), I=1,31)
      READ(5,210) (BYEFHC(2,I), I=1,31)
      READ(5,210) (BYEFNO(2,I), I=1,31)
C    CONVERSION FACTORS
      READ(5,210) TUCO, TUHC, URCO, URHC, URNO
C
C****CONVERT EXHAUST EMISSION FACTORS FROM TEST SPEED(18 MPH)
C        TO URBAN SPEED(25 MPH) FOR YEARS 1960-1990
      DO 2 I = 1,31
      DO 2 K = 1,2
      BYEFCO(K,I) = BYEFCO(K,I) * TUCO
      BYEFHC(K,I) = BYEFHC(K,I) * TUHC
    2 CONTINUE
C
      READ(5,210) SAUCO, SAUHC, SAUNO, SARCO, SARHC, SARNO
      SARCO = SARCO * URCO
      SARHC = SARHC * URHC
      SARNO = SARNO * URNO
      IF (CHANGE(1) .EQ. 0) GO TO 3
C    PERCENTAGE TRAVEL VALUES
      READ(5,210) REGIS
      READ(5,210) AAT
C
C****% TRAVEL OF CARS BY AGE
    3 SUM = 0.0
```

```
      DO 4 J = 1,14
      PTRVLC(J) = REGIS(J) * AAT(J)
      SUM = SUM + PTRVLC(J)
    4 CONTINUE
      DO 6 J = 1,14
      PTRVLC(J) = PTRVLC(J)/SUM
    6 CONTINUE
C
      READ(5,210) PTRVLT
C     DETERIORATION VALUES
      READ(5,210) DCCO
      READ(5,210) DCHC
      READ(5,210) DTCO
      READ(5,210) DTHC
C     TRUCK EMISSION SCALE SCALE FACTORS
C    VALUES ARE SUPPLIED IN DATA STATEMENT : FEBRUARY 8,1972
C     READ(5,210) TESFCO,TESFHC,TESFNO
C     CRANKCASE AND EVAPORATION
      READ(5,210) (CREF(1,I), I=1,2), (EVEF(1,I), I=1,3)
      READ(5,210) (CREF(2,I), I=1,2), (EVEF(2,I), I=1,3)
C
      IF (CHANGE(2) .EQ. 0) GO TO 8
C     WEIGHT FACTORS : WITHOUT DIESEL
      READ(5,210) WFCTR
C
    8 IF (CHANGE(3) .EQ. 0) GO TO 10
C     WEIGHT FACTORS : WITH DIESEL
      READ(5,210) DWFCTR
C
C****INPUT CALCULATION-OPTIONS CARD
   10 READ(5,200,END=99) YEAR,CLDSTR,RTROFT,DIESEL
C     INITIALIZE YEARLY EMISSION FACTORS
      DO 12 I = 1,31
      DO 12 K = 1,2
      YEFCO(K,I) = BYEFCO(K,I)
      YEFHC(K,I) = BYEFHC(K,I)
      YEFNO(K,I) = BYEFNO(K,I)
   12 CONTINUE
C
      IF (CLDSTR) 13,30,14
C
C*************
C   COLD START EMISSIONS
C*************
   13 READ(5,210) FCSECO
      READ(5,210) FCSEHC
      READ(5,210) CST1,CST2
C
   14 DO 15 I = 1,31
      DO 15 K = 1,2
      COI = 7.5*YEFCO(K,I) * (1.0 - FCSECO(I))/CST2
      YEFCSC(K,I) = 7.5*YEFCO(K,I)*FCSECO(I) - CST1*COI
      YEFCO(K,I) = COI
      HCI = 7.5*YEFHC(K,I) * (1.0 - FCSEHC(I))/CST2
      YEFCSH(K,I) = 7.5*YEFHC(K,I)*FCSEHC(I) - CST1*HCI
      YEFHC(K,I) = HCI
   15 CONTINUE
C
      DO 16 L = 1,6
      CSCO(L) = 0.0
```

```
      CSHC(L) = 0.0
   16 CONTINUE
C****EMISSIONS FOR CARS   :   CLASS 1
      K = YEAR - 1958
      DO 18 J = 1,14
      K = MAX0(K-1,1)
      CSCO(1) = CSCO(1) + PTRVLC(J)*DCCO(J)*YEFCSC(1,K)
      CSHC(1) = CSHC(1) + PTRVLC(J)*DCHC(J)*YEFCSH(1,K)
   18 CONTINUE
C****EMISSIONS FOR TRUCKS   :   CLASSES 2-5
      K = YEAR - 1958
      DO 20 J = 1,16
      K = MAX0(K-1,1)
      PTRAV = PTRVLT(J)
C     LIGHT DUTY TRUCKS
      COFCTR = PTRAV * DTCO(J)
      HCFCTR = PTRAV * DTHC(J)
      CSCO(2) = CSCO(2) +  COFCTR * YEFCSC(1,K)
      CSHC(2) = CSHC(2) +  HCFCTR * YEFCSH(1,K)
      COFCTR = COFCTR * YEFCSC(2,K)
      HCFCTR = HCFCTR * YEFCSH(2,K)
C     HEAVY DUTY TRUCKS
      DO 20 L = 3,5
      LM2 = L - 2
      CSCO(L) = CSCO(L) +  COFCTR * TESFCO(LM2)
      CSHC(L) = CSHC(L) +  HCFCTR * TESFHC(LM2)
   20 CONTINUE
C
      DO 22 L = 1,5
      CSCO(L) = CSCO(L) * SAUCO
      CSHC(L) = CSHC(L) * SAUHC
   22 CONTINUE
C
   30 IF (RTROFT) 31,36,32
C
C*************
C   RETROFIT
C*************
   31 READ(5,210) RETRO
      RTROCO = 1.0 - RETRO(1)
      RTROHC = 1.0 - RETRO(2)
      RTRONO = 1.0 - RETRO(3)
C
   32 DO 34 K = 1,8
      REFCO(K) = YEFCO(1,K) * RTROCO
      REFHC(K) = YEFHC(1,K) * RTROHC
      REFNO(K) = YEFNO(1,K) * RTRONO
   34 CONTINUE
      K1 = 9
      GO TO 38
C
   36 K1 = 1
C
   38 DO 40 K = K1,31
      REFCO(K) = YEFCO(1,K)
      REFHC(K) = YEFHC(1,K)
      REFNO(K) = YEFNO(1,K)
   40 CONTINUE
C
C**************
```

```
C   CALCULATE (URBAN & RURAL) EMISSION FACTORS FOR CO, HC, AND NO
C*************
      DO 42 I = 1,6
      DO 42 J = 1,6
      EXEMI(I,J) = 0.0
   42 CONTINUE
C****CARS
      K = YEAR - 1958
      DO 44 J = 1,14
      K = MAX0(K-1,1)
      PTRAV = PTRVLC(J)
C     CO
      COFCTR = REFCO(K) * DCCO(J) * PTRAV
      EXEMI(1,1) = EXEMI(1,1) + COFCTR * SAUCO
      EXEMI(1,2) = EXEMI(1,2) + COFCTR * SARCO
C     HC
      HCFCTR = REFHC(K) * DCHC(J) * PTRAV
      EXEMI(1,3) = EXEMI(1,3) + HCFCTR * SAUHC
      EXEMI(1,4) = EXEMI(1,4) + HCFCTR * SARHC
C     NO
      NOFCTR = REFNO(K) * PTRAV
      EXEMI(1,5) = EXEMI(1,5) + NOFCTR * SAUNO
      EXEMI(1,6) = EXEMI(1,6) + NOFCTR * SARNO
   44 CONTINUE
C****TRUCKS
      K = YEAR - 1958
      DO 46 J = 1,16
      K = MAX0(K-1,1)
      PTRAV = PTRVLT(J)
C     LIGHT DUTY TRUCKS
C     CO
      COFCTR = YEFCO(1,K) * DTCO(J) * PTRAV
      EXEMI(2,1) = EXEMI(2,1) + COFCTR * SAUCO
      EXEMI(2,2) = EXEMI(2,2) + COFCTR * SARCO
      COFCTR = YEFCO(2,K) * DTCO(J) * PTRAV
C     HC
      HCFCTR = YEFHC(1,K) * DTHC(J) * PTRAV
      EXEMI(2,3) = EXEMI(2,3) + HCFCTR * SAUHC
      EXEMI(2,4) = EXEMI(2,4) + HCFCTR * SARHC
      HCFCTR = YEFHC(2,K) * DTHC(J) * PTRAV
C     NO
      NOFCTR = YEFNO(1,K) * PTRAV
      EXEMI(2,5) = EXEMI(2,5) + NOFCTR * SAUNO
      EXEMI(2,6) = EXEMI(2,6) + NOFCTR * SARNO
      NOFCTR = YEFNO(2,K) * PTRAV
C
C     HEAVY DUTY TRUCKS
      DO 46 L = 3,5
      LM2 = L - 2
C     CO
      EXEMI(L,1) = EXEMI(L,1) + COFCTR * SAUCO * TESFCO(LM2)
      EXEMI(L,2) = EXEMI(L,2) + COFCTR * SARCO * TESFCO(LM2)
C     HC
      EXEMI(L,3) = EXEMI(L,3) + HCFCTR * SAUHC * TESFHC(LM2)
      EXEMI(L,4) = EXEMI(L,4) + HCFCTR * SARHC * TESFHC(LM2)
C     NO
      EXEMI(L,5) = EXEMI(L,5) + NOFCTR * SAUNO * TESFNO(LM2)
      EXEMI(L,6) = EXEMI(L,6) + NOFCTR * SARNO * TESFNO(LM2)
   46 CONTINUE
C
```

```
      IF (DIESEL) 50,60,51
C**************
C   DIESEL EMISSION FACTORS
C**************
C   INPUT "NEW" DIESEL FACTORS
   50 READ(5,210) DIEF,DIMIF
      DFCTR = DIMIF/3.0
      IF (DFCTR .EQ. 0.0) DFCTR = 1.0
C
   51 K = MAX0(0,YEAR-1969)
      IF (K .EQ. 0) GO TO 53
C   YEARS AFTER 1969
      PTRAV = 0.0
      IF (K .GT. 16) K = 16
      DO 52 J = 1,K
      PTRAV = PTRAV + PTRVLT(J)
   52 CONTINUE
      EXEMI(6,1) = DIEF(4) * PTRAV
      EXEMI(6,3) = DIEF(5) * PTRAV
      EXEMI(6,5) = DIEF(6) * PTRAV
      IF (K .EQ. 16) GO TO 56
C   YEARS BEFORE 1970
   53 K = K + 1
      PTRAV = 0.0
      DO 54 J = K,16
      PTRAV = PTRAV + PTRVLT(J)
   54 CONTINUE
      EXEMI(6,1) = EXEMI(6,1) + DIEF(1)*PTRAV
      EXEMI(6,3) = EXEMI(6,3) + DIEF(2)*PTRAV
      EXEMI(6,5) = EXEMI(6,5) + DIEF(3)*PTRAV
C
   56 IF (DFCTR .EQ. 1.0) GO TO 58
C   MILEAGE MODIFICATION FROM 3 MI/GAL
      EXEMI(6,1) = EXEMI(6,1) * DFCTR
      EXEMI(6,3) = EXEMI(6,3) * DFCTR
      EXEMI(6,5) = EXEMI(6,5) * DFCTR
C
   58 EXEMI(6,2) = EXEMI(6,1)
      EXEMI(6,4) = EXEMI(6,3)
      EXEMI(6,6) = EXEMI(6,5)
C**************
C   CRANKCASE AND EVAPORATIVE EMISSION FACTORS
C**************
   60 DO 61 I = 1,6
      EVAP(I) = 0.0
      CRANK(I) = 0.0
   61 CONTINUE
C****CRANKCASE
C     K1 : # YEARS AFTER 1967
C     K2 : # YEARS FROM 1963 THRU 1967
C     K3 : # YEARS BEFORE 1963
C     CARS
      K1 = MAX0(YEAR-1967,0)
      IF (K1 .GT. 13) GO TO 68
      K2 = MIN0(14-K1,5)
      IF (K1 .EQ. 0) K2 = YEAR - 1962
      K3 = MAX0(14-K1-K2,0)
      J1 = K1 + 1
      J2 = K1 + K2
      S2 = 0.0
```

```
C     YEARS 1963 THRU 1967
      DO 62 J = J1,J2
      S2 = S2 +  DCHC(J) * PTRVLC(J)
   62 CONTINUE
      S1 = Ø.Ø
      IF (K3 .EQ. Ø) GO TO 66
      J1 = J2 + 1
C     PRE 1962 YEARS
      DO 64 J = J1,14
      S1 = S1 +  DCHC(J) * PTRVLC(J)
   64 CONTINUE
   66 CRANK(1) = S1*CREF(1,1) + S2*CREF(1,2)
C
      GO TO 69
C     TRUCKS
   68 IF (K1 .GT. 15) GO TO 76
   69 K2 = MINØ(16-K1,5)
      IF (K1 .EQ. Ø) K2 = YEAR - 1962
      K3 = MAXØ(16-K1-K2,Ø)
      J1 = K1 + 1
      J2 = K1 + K2
      S2 = Ø.Ø
C     YEARS 1963 THRU 1967
      DO 7Ø J = J1,J2
      S2 = S2 +  DTHC(J) * PTRVLT(J)
   7Ø CONTINUE
      S1 = Ø.Ø
      IF (K3 .EQ. Ø) GO TO 74
      J1 = J2 + 1
C     PRE 1963 YEARS
      DO 72 J = J1,16
      S1 = S1 +  DTHC(J) * PTRVLT(J)
   72 CONTINUE
C
   74 CRANK(2) = S1*CREF(1,1) + S2*CREF(1,2)
      SUM = S1*CREF(2,1) + S2*CREF(2,2)
      CRANK(3) = SUM * TESFHC(1)
      CRANK(4) = SUM * TESFHC(2)
      CRANK(5) = SUM * TESFHC(3)
C****EVAPORATIONS
C     K1 : # YEARS AFTER 1972
C     K2 : # YEARS BEFORE 1971
C     CARS
   76 K1 = MAXØ(YEAR-1972,Ø)
      S3 = Ø.Ø
      S2 = Ø.Ø
      S1 = Ø.Ø
      IF (K1 .EQ. Ø) GO TO 78
C     YEARS AFTER 1972
      K1 = MINØ(K1,14)
      DO 77 J = 1,K1
      S3 = S3 + PTRVLC(J)
   77 CONTINUE
      IF (K1 - 14) 79,82,82
   78 IF (YEAR .LT. 1972) GO TO 179
C     1972
   79 K1 = K1 + 1
      S2 = PTRVLC(K1)
      IF (K1 .EQ. 14) GO TO 82
  179 IF (YEAR .LT. 1971) GO TO 8Ø
```

```
C     1971
      K1 = K1 + 1
      S2 = S2 + PTRVLC(K1)
   80 K2 = MAXØ(14-K1,Ø)
      IF (K2 .EQ. Ø) GO TO 82
C     YEARS BEFORE 1971
      K1 = K1 + 1
      DO 81 J = K1,14
      S1 = S1 + PTRVLC(J)
   81 CONTINUE
C
   82 EVAP(1) = EVEF(1,1)*S1 + EVEF(1,2)*S2 + EVEF(1,3)*S3
C     TRUCKS
      K1 = MAXØ(YEAR-1972,Ø)
      S3 = Ø.Ø
      S2 = Ø.Ø
      S1 = Ø.Ø
      IF (K1 .EQ. Ø) GO TO 84
C     YEARS AFTER 1972
      K1 = MINØ(K1,16)
      DO 83 J = 1,K1
      S3 = S3 + PTRVLT(J)
   83 CONTINUE
      IF (K1 - 16) 85,88,88
   84 IF (YEAR .LT. 1972) GO TO 186
C     1972
   85 K1 = K1 + 1
      S2 = PTRVLT(K1)
      IF (K1 .EQ. 16) GO TO 88
  186 IF (YEAR .LT. 1971) GO TO 86
C     1971
      K1 = K1 + 1
      S2 = S2 + PTRVLT(K1)
   86 K2 = MAXØ(16-K1,Ø)
      IF (K2 .EQ. Ø) GO TO 88
C     YEARS BEFORE 1971
      K1 = K1 + 1
      DO 87 J = K1,16
      S1 = S1 + PTRVLT(J)
   87 CONTINUE
C
   88 EVAP(2) = EVEF(1,1)*S1 + EVEF(1,2)*S2 + EVEF(1,3)*S3
      SUM = EVEF(2,1)*S1 + EVEF(2,2)*S2 + EVEF(2,3)*S3
      EVAP(3) = SUM
      EVAP(4) = SUM
      EVAP(5) = SUM
C
C***************
C   WEIGHTED EMISSION FACTORS
C***************
      IF (DIESEL .GT. Ø) GO TO 92
C****EXCLUDE DIESEL EMISSIONS
      DO 9Ø I = 1,6
      WI = Ø.Ø
      DO 19Ø K = 1,5
      WI = WI + WFCTR(K)*EXEMI(K,I)
  19Ø CONTINUE
      WEXEMI(I) = WI
   9Ø CONTINUE
C
```

```
      WEVAP = 0.0
      WCRANK = 0.0
      DO 191 K = 1,5
      WT = WFCTR(K)
      WEVAP = WEVAP + WT*EVAP(K)
      WCRANK = WCRANK + WT*CRANK(K)
  191 CONTINUE
C
      IF (CLDSTR .EQ. 0) GO TO 96
C***WEIGHTED COLD START EMISSIONS
      WCSECO = 0.0
      WCSEHC = 0.0
      DO 192 K = 1,5
      WT = WFCTR(K)
      WCSECO = WCSECO + WT*CSCO(K)
      WCSEHC = WCSEHC + WT*CSHC(K)
  192 CONTINUE
      GO TO 96
C
C****INCLUDE DIESEL EMISSIONS
   92 DO 94 I = 1,6
      DWI = 0.0
      DO 193 K = 1,6
      DWI = DWI + DWFCTR(K)*EXEMI(K,I)
  193 CONTINUE
      WEXEMI(I) = DWI
   94 CONTINUE
C
      WEVAP = 0.0
      WCRANK = 0.0
      DO 194 K = 1,6
      DWT = DWFCTR(K)
      WEVAP = WEVAP + DWT*EVAP(K)
      WCRANK = WCRANK + DWT*CRANK(K)
  194 CONTINUE
C
      IF (CLDSTR .EQ. 0) GO TO 96
C***WEIGHTED COLD START EMISSIONS
      WCSECO = 0.0
      WCSEHC = 0.0
      DO 195 K = 1,6
      DWT = DWFCTR(K)
      DWT = DWFCTR(K)
      WCSECO = WCSECO + DWT*CSCO(K)
      WCSEHC = WCSEHC + DWT*CSHC(K)
  195 CONTINUE
C
C**************
C    PRINT TABLE OF EMISSION FACTORS FOR YEAR 'YEAR'
C**************
   96 WRITE(6,100) TITLE
      WRITE(6,105) YEAR,(L, L=1,6)
      WRITE(6,110)
C
C****CO
      WRITE(6,120) (EXEMI(I,1), I=1,6),WEXEMI(1),(EXEMI(I,2), I=1,6),
     *              WEXEMI(2)
C
C****HC
      WRITE(6,130) EVAP,WEVAP,CRANK,WCRANK,(EXEMI(I,3), I=1,6),
```

```
     *              WEXEMI(3),(EXEMI(I,4), I=1,6),WEXEMI(4)
C
C****NO
      WRITE(6,140) (EXEMI(I,5), I=1,6),WEXEMI(5),(EXEMI(I,6), I=1,6),
     *              WEXEMI(6)
C****COLD START EMISSIONS
      IF (CLDSTR .NE. 0) WRITE(6,160) CSCO,WCSECO,CSHC,WCSEHC
C
      IF (RTROFT .NE. 0) WRITE(6,150)
C
      GO TO 10
   99 STOP
C
  100 FORMAT(1H1,21X,9A8)
  105 FORMAT(1H0,37X,'MOTOR VEHICLE EMISSION FACTORS FOR',I6/1H ,44X,
     *     '(GRAMS PER VEHICLE MILE)'/1H0,20X,'CLASS',I7,5I12)
  110 FORMAT(1H+,102X,'WEIGHTED'/1H ,8X,'EMISSIONS')
  120 FORMAT(1H ,5X,'CARBON MONOXIDE'/1H ,7X,'URBAN',10X,6F12.2,F16.2/
     *              1H ,7X,'RURAL',10X,6F12.2,F16.2)
  130 FORMAT(1H0,5X,'HYDROCARBONS'/1H ,7X,'EVAPORATIONS',3X,6F12.2,
     1              F16.2/1H ,7X,'CRANKCASE',6X,6F12.2,F16.2/1H ,7X,
     2              'EXHAUSTS'/1H ,9X,'URBAN',8X,6F12.2,F16.2/
     3              1H ,9X,'RURAL', 8X,6F12.2,F16.2)
  140 FORMAT(1H0,5X,'NITROGEN OXIDE'/1H ,7X,'URBAN',10X,6F12.2,F16.2/
     *              1H ,7X,'RURAL',10X,6F12.2,F16.2)
  150 FORMAT(////1H ,5X,'NOTE :  RETROFIT INCLUDED FOR CLASS 1')
  160 FORMAT(////1H ,  43X,'COLD START EMISSIONS(GRAMS)'/1H0,5X,
     1     'CARBON MONOXIDE',2X,6F12.2,F16.2/1H ,5X,
     2     'HYDROCARBONS',5X,6F12.2,F16.2)
  200 FORMAT(4I6)
  210 FORMAT(9F8.0)
  220 FORMAT(9A8/3I4)
C
      END
```

TREMISS PROGRAM LISTING

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VEQEMI: PROC OPTIONS(MAIN);
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VEQEMI: PROC OPTIONS(MAIN);
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```
/*  EXTERNAL  VARIABLES  */
        DCL   1 SPDFCTR  CONTROLLED EXT,
                2 SADJF_CO(8) FLOAT DEC(6)  INIT(2.825, Ø.Ø825, 1.82834,
                      Ø.Ø32667, 1.79335, Ø.Ø17667, 1.51, Ø.Ø12),
                2 SADJF_HC(8) FLOAT DEC(6)  INIT(2.35, Ø.Ø625, 1.56667,
                      Ø.Ø23333, 1.585, Ø.Ø132, 1.39165, Ø.ØØ9333);
        DCL   1 VEQTRIP(N)  CONTROLLED EXT,
                2 (SHORT,LRES,LNRES) FLOAT DEC(6);
        DCL   1 EMIZONE(N)  CONTROLLED EXT,
                2 (COEMI_ZONE, HCEMI_ZONE, NOEMI_ZONE)
                      FLOAT DEC(6)  INIT(Ø);
        DCL   1 CLDZONE(N)  CONTROLLED EXT,
                2 (CSCO_ZONE,CSHC_ZONE) FLOAT DEC(6)  INIT(Ø);
/*  LOCAL  VARIABLES  */
        DCL   (CATSEDT,CATS65,CATS85,MERGEXX,ORGINXX) FILE RECORD;
        DCL   (PTR_XX,PTR_65,PTR_85,Q_XX,Q_65,Q_85) PTR;
        DCL   1 DATA_XX  BASED(P),
                2 (N_XX,YEAR_XX,TYPE_XX) FIXED BIN(31),
                2 DATA(LGTH REFER(N_XX)),
                  3 (MILES,SPEED) (2) FLOAT DEC(6);
        DCL   1 ID_XX  BASED(Q),
                2 I_XX  FIXED BIN(31),
                2 FLAGS(LGTH REFER(I_XX)),
                  3 FLAG  BIT(1) ALIGNED,
                  3 ID     CHAR(1Ø);
        DCL   1 EMISSION_FACTORS,
                2 (CO_URBAN, CO_RURAL,
                   EVAP, CRNK, HC_URBAN, HC_RURAL,
                   NO_URBAN, NO_RURAL) FLOAT DEC(6);
        DCL   1 CLDSTR_VALUES,
                2 (CSCOEF,CSHCEF,SHORTF,LRESF,LNRESF) FLOAT DEC(6);
        DCL   (MILES_FLAG,SPEED_FLAG) (MAX) BIT(1) ALIGNED CONTROLLED;
        DCL   (COLD_START, DOWN INIT('Ø'B), MULT_SETS, SAVE_ZONES,
                   UP INIT('1'B)) BIT(1) ALIGNED;
        DCL   XX  PICTURE'99';
        DCL   (CLDSTR,EMISF,OPTEDT,OPTMRG,OPT65,OPT85,PREPR,SAVE)
                      CHAR(3);
        DCL   UNIT_TYPE CHAR(8) INIT('ZONE');
        DCL   ROAD_TYPES(2) CHAR(8) INIT('FREEWAY','ARTERIAL');
        DCL   STARS CHAR(1Ø) INIT('**********');
        DCL   INTERVAL(3) CHAR(13) INIT('DAILY','PEAK HOUR',
                   'OFF PEAK HOUR');
        DCL   PHRASE1 CHAR(23) INIT(' DATA FILE EXPECTED BUT');
        DCL   PHRASE2 CHAR(34) INIT
                   (' DATA FILE WAS INPUT - TERMINATING');
        DCL   TITLE CHAR(8Ø);
        DCL   INDEX(N) FIXED BIN(31) CONTROLLED;
        DCL   (I,K,LGTH,M,MAX,MAX_65,MAX_85,N,NINDV,NSEQ,NSETS,NZONE,
                   N_SET,N_ZONES,ORG_YEAR,TYPE,YEAR,ZONE1,ZONE2,
                   FSET,#FSETS) FIXED BIN(31);
        DCL   (CSCO,CSHC,C1,C2,ECO(2),EHC(2),ENO(2),EVAP_CRNK,FACTOR(4),
                   HSCO,HSHC,VEQMI,VEQSP,ZECO,ZEHC,ZENO,#TRIPS)
                         FLOAT DEC(6);
        DCL   (ART_MILES,FWY_MILES,TECO,TEHC,TENO,TCSCO,TCSHC,
                   TECO_SET,TEHC_SET,TENO_SET,TCSCO_SET,TCSHC_SET)
                   FLOAT DEC(16);
        ON ENDFILE(SYSIN)  GO TO FINISH;
        ALLOCATE SPDFCTR;
```

```
NEXT_CASE:
        OPT65, OPT85, OPTEDT, OPTMRG = '    ';
        TYPE = 1;
        GET DATA(OPT65, OPT85, OPTEDT, OPTMRG, TYPE);
        IF  OPTMRG = 'INP'  THEN  GO TO INPMRG;
        IF  OPTEDT = 'INP'  THEN  GO TO INPEDT;
        IF  OPT65 = ' '  &  OPT85 = ' '  THEN  DO;
             PUT EDIT('NO INPUT DATA - EXECUTION TERMINATING')
               (R(F1));
             GO TO FINISH;
             END;
        GET DATA(MAX);
        LGTH = MAX;
        IF  OPT85 = 'INP'  THEN  Y85: DO;
 /*  INPUT CATS 1985 FILE  */
             ALLOCATE  DATA_XX, ID_XX, MILES_FLAG, SPEED_FLAG;
             YEAR_XX = 1985;
             TYPE_XX = TYPE;
             PTR_85 = P;
             Q_85 = Q;
             DO I = 1 TO MAX;
             FLAG(I) = DOWN;
             MILES_FLAG(I) = DOWN;
             SPEED_FLAG(I) = DOWN;
             END;
             YEAR = 1985;
             CALL CATSFILE(CATS85, PTR_85, Q_85, MAX_85);
             END  Y85;
        IF  OPT65 = 'INP'  THEN  Y65: DO;
 /*  INPUT CATS 1965 FILE  */
             ALLOCATE  DATA_XX, ID_XX;
             YEAR_XX = 1965;
             TYPE_XX = TYPE;
             PTR_65 = P;
             Q_65 = Q;
             IF  ^ALLOCATION(MILES_FLAG)  THEN
               ALLOCATE  MILES_FLAG, SPEED_FLAG;
             DO I = 1 TO MAX;
             FLAG(I) = DOWN;
             MILES_FLAG(I) = DOWN;
             SPEED_FLAG(I) = DOWN;
             END;
             YEAR = 1965;
             CALL CATSFILE(CATS65, PTR_65, Q_65, MAX_65);
             END  Y65;
 /*  END OF CATS INPUT  */
        IF  OPT65 = ' '  |  OPT85 = ' '  THEN  DO;
             PUT EDIT('EXECUTION CANNOT CONTINUE') (R(F1));
             IF  OPT65 = ' '  THEN  PUT EDIT('CATS 1965  NOT  INPUT')
                  (R(F2));
             IF  OPT85 = ' '  THEN  PUT EDIT('CATS 1985  NOT  INPUT')
                  (R(F2));
             GO TO FINISH;
             END;
        FREE  MILES_FLAG, SPEED_FLAG;
 /*  CHECK FOR CONSISTENCY OF INPUT FILES  */
        IF  MAX_65 ^= MAX_85  THEN  DO;
             PUT EDIT('INCONSISTENCY IN INPUT FILES') (R(F1));
             IF  MAX_65 > MAX_85  THEN  PUT EDIT('#1965 UNITS', MAX_65,
               '  EXCEEDS  #1985 UNITS', MAX_85) (R(F2));
```

```
            ELSE  PUT EDIT('#1985 UNITS',MAX_85,
               '  EXCEEDS  #1965 UNITS',MAX_65) (R(F2));
            PUT EDIT('  LOWER VALUE ASSUMED') (A);
            END;
       N = MIN(MAX_65,MAX_85);
       LGTH = N;
       ALLOCATE  DATA_XX,ID_XX;
       PTR_XX = P;
       Q_XX = Q;
 /*  CHECK FOR CONSISTENCY OF INPUT DATA  */
       PUT PAGE EDIT('INCONSISTENCY IN',UNIT_TYPE,'DATA')
            (X(19),A(16),2(X(2),A(4)));
       PUT EDIT(INTERVAL(TYPE)) (R(F3));
       PUT SKIP;
  #CHK: DO I = 1 TO N;
       IF  Q_65->FLAG(I) & Q_85->FLAG(I)  THEN  FLAG(I) = UP;
       ELSE  DO;
            FLAG(I) = DOWN;
            PUT SKIP EDIT(I) (X(10),F(4));
            IF  ^Q_65->FLAG(I)  THEN  PUT EDIT('1965 NOT DEFINED')
                 (COLUMN(20),A);
            IF  ^Q_85->FLAG(I)  THEN  PUT EDIT('1985 NOT DEFINED')
                 (COLUMN(43),A);
            END;
       END  #CHK;
       IF  OPTEDT = 'OUT'  THEN  DO;
 /*  OUTPUT EDITED CATS DATA  */
            PTR_65->N_XX = MAX_65;
            Q_65->I_XX = MAX_65;
            WRITE FILE(CATSEDT) FROM(MAX_65);
            WRITE FILE(CATSEDT) FROM(PTR_65->DATA_XX);
            WRITE FILE(CATSEDT) FROM(Q_65->ID_XX);
            PTR_85->N_XX = MAX_85;
            Q_85->I_XX = MAX_85;
            WRITE FILE(CATSEDT) FROM(MAX_85);
            WRITE FILE(CATSEDT) FROM(PTR_85->DATA_XX);
            WRITE FILE(CATSEDT) FROM(Q_85->ID_XX);
            CLOSE FILE(CATSEDT);
            END;
       GO TO MRG;
 /*  INPUT EDITED CATS DATA  */
INPEDT: READ FILE(CATSEDT) INTO(MAX_65);
       LGTH = MAX_65;
       ALLOCATE  DATA_XX,ID_XX;
       READ FILE(CATSEDT) INTO(DATA_XX);
       IF  YEAR_XX ^= 1965  THEN  DO;
            PUT EDIT(1965,PHRASE1,YEAR_XX,PHRASE2) (R(F4));
            GO TO FINISH;
            END;
       READ FILE(CATSEDT) INTO(ID_XX);
       PTR_65 = P;
       Q_65 = Q;
       READ FILE(CATSEDT) INTO(MAX_85);
       LGTH = MAX_85;
       ALLOCATE  DATA_XX,ID_XX;
       READ FILE(CATSEDT) INTO(DATA_XX);
       IF  YEAR_XX ^= 1985  THEN  DO;
            PUT EDIT(1985,PHRASE1,YEAR_XX,PHRASE2) (R(F4));
            GO TO FINISH;
            END;
```

```
        READ FILE(CATSEDT) INTO(ID_XX);
        PTR_85 = P;
        Q_85 = Q;
        CLOSE FILE(CATSEDT);
        N = MIN(MAX_65,MAX_85);
        LGTH = N;
        ALLOCATE  DATA_XX,ID_XX;
        PTR_XX = P;
        Q_XX = Q;
        DO I = 1 TO N;
        FLAG(I) = Q_65->FLAG(I) & Q_85->FLAG(I);
        END;
/*  MERGE 1965 & 1985 DATA FOR 'YEAR'  */
  MRG: GET DATA(YEAR);
        C1 = 1985 - YEAR;
        C1 = C1/20;
        C2 = YEAR - 1965;
        C2 = C2/20;
        PUT PAGE EDIT('SUMMARY BY ',UNIT_TYPE,' FOR',YEAR)
             (X(35),A,A(8),A,F(5));
        PUT EDIT(INTERVAL(TYPE)) (R(F3));
        PUT EDIT(UNIT_TYPE,ROAD_TYPES) (SKIP(2),X(12),A(4),
             X(19),A(8),X(30),A(8));
        PUT EDIT('MILES/100','SPEED(MPH)','MILES/100','SPEED(MPH)')
             (SKIP,X(26),A,X(7),A,X(12),A,X(8),A);
        FWY_MILES, ART_MILES = 0;
 #M_1: DO I = 1 TO N;
        PUT EDIT(I) (SKIP,X(12),F(4));
        IF  FLAG(I)  THEN  #M_2: DO;
             ID(I) = Q_85->ID(I);
             DO K = 1 TO 2;
             MILES(I,K) = C1 * PTR_65->MILES(I,K)  +
                                     C2 * PTR_85->MILES(I,K);
             SPEED(I,K) = C1 * PTR_65->SPEED(I,K)  +
                                     C2 * PTR_85->SPEED(I,K);
             END;
             PUT EDIT( (MILES(I,K),SPEED(I,K)  DO K = 1 TO 2) )
                  (X(9),F(6),X(11),F(5,1),X(16),F(6),X(12),F(5,1));
             FWY_MILES = FWY_MILES + MILES(I,1);
             ART_MILES = ART_MILES + MILES(I,2);
             END  #M_2;
        ELSE  PUT EDIT('NO DATA DEFINED') (COLUMN(50),A);
        END  #M_1;
        PUT EDIT('TOTAL MILES/100',ROAD_TYPES,FWY_MILES,ART_MILES)
             (SKIP(3),X(44),A,SKIP,X(11),2(X(22),A(8)),SKIP(2),
                 X(9),2(X(23),F(8)));
        IF  OPTEDT = 'OUT'  THEN  DO;
             PTR_65->N_XX = MAX;
             Q_65->I_XX = MAX;
             PTR_85->N_XX = MAX;
             Q_85->I_XX = MAX;
             END;
        FREE  PTR_65->DATA_XX,Q_65->ID_XX,PTR_85->DATA_XX,Q_85->ID_XX;
        IF  OPTMRG = 'OUT'  THEN  DO;
/*  OUTPUT  CATS_MERGED DATA FOR YEAR 'YEAR'  */
             XX = YEAR - 1900;
             OPEN FILE(MERGEXX) OUTPUT TITLE('MERGE'||XX);
             WRITE FILE(MERGEXX) FROM(N);
             YEAR_XX = YEAR;
             TYPE_XX = TYPE;
```

```
            WRITE FILE(MERGEXX) FROM(DATA_XX);
            WRITE FILE(MERGEXX) FROM(ID_XX);
            CLOSE FILE(MERGEXX);
            END;
        GO TO CALC;
  /*  INPUT DATA FOR YEAR 'YEAR'  */
INPMRG: GET DATA(YEAR);
        XX = YEAR - 1900;
        OPEN FILE(MERGEXX) TITLE('MERGE'IIXX);
        READ FILE(MERGEXX) INTO(N);
        LGTH = N;
        ALLOCATE  DATA_XX, ID_XX;
        READ FILE(MERGEXX) INTO(DATA_XX);
        IF  YEAR_XX ^= YEAR  THEN  DO;
            PUT EDIT(YEAR, PHRASE1, YEAR_XX, PHRASE2) (R(F4));
            GO TO FINISH;
            END;
        IF  TYPE_XX ^= TYPE  THEN  DO;
            PUT EDIT(INTERVAL(TYPE), PHRASE1, INTERVAL(TYPE_XX), PHRASE2)
                (R(F5));
            GO TO FINISH;
            END;
        READ FILE(MERGEXX) INTO(ID_XX);
        PTR_XX = P;
        Q_XX = Q;
        CLOSE FILE(MERGEXX);
  CALC: GET LIST(SAVE, PREPR, CLDSTR, EMISF, NSETS);
        IF  SAVE = 'END'  THEN  GO TO NEXT_CASE;
        IF  SAVE = 'SAV'  THEN  SAVE_ZONES = '1'B;
                          ELSE  SAVE_ZONES = '0'B;
        IF  PREPR = 'PRE'  THEN  #P_1: DO;
        /* PREPROCESS VOLUME/SPEED DATA */
            GET DATA(#FSETS);
            DO FSET = 1 TO #FSETS;
            GET LIST(FACTOR);
            NSEQ, NINDV = 0;
            GET DATA(NSEQ, NINDV);
            IF  NSEQ > 0  THEN  #P_2: DO;
                DO M = 1 TO NSEQ;
                    GET LIST(ZONE1, ZONE2);
                    DO I = ZONE1 TO ZONE2;
                        MILES(I, 1) = MILES(I, 1) * FACTOR(1);
                        MILES(I, 2) = MILES(I, 2) * FACTOR(2);
                        SPEED(I, 1) = SPEED(I, 1) * FACTOR(3);
                        SPEED(I, 2) = SPEED(I, 2) * FACTOR(4);
                END  #P_2;
            IF  NINDV > 0  THEN  #P_3: DO;
                DO M = 1 TO NINDV;
                    GET LIST(I);
                    MILES(I, 1) = MILES(I, 1) * FACTOR(1);
                    MILES(I, 2) = MILES(I, 2) * FACTOR(2);
                    SPEED(I, 1) = SPEED(I, 1) * FACTOR(3);
                    SPEED(I, 2) = SPEED(I, 2) * FACTOR(4);
                END  #P_3;
            END  #P_1;
        /*  END OF PREPROCESSING */
        IF  CLDSTR ^= '    '  THEN  #ORG: DO;
            COLD_START = '1'B;
            ALLOCATE  VEQTRIP;
            IF  CLDSTR ^= 'INP'  THEN  DO;
```

```
                CALL ORIGIN;
                IF  CLDSTR = 'OUT'  THEN  DO;
                     OPEN FILE(ORGINXX) OUTPUT TITLE('ORGIN'IIXX);
                     WRITE FILE(ORGINXX) FROM(YEAR);
                     WRITE FILE(ORGINXX) FROM(VEQTRIP);
                     CLOSE FILE(ORGINXX);
                     END;
                END;
           ELSE  DO;
                OPEN FILE(ORGINXX) TITLE('ORGIN'IIXX);
                READ FILE(ORGINXX) INTO(ORG_YEAR);
                READ FILE(ORGINXX) INTO(VEQTRIP);
                IF  ORG_YEAR ^= YEAR  THEN  DO;
                     GO TO FINISH;
                     END;
                CLOSE FILE(ORGINXX);
                END;
           END  #ORG;
      ELSE  COLD_START = 'Ø'B;
      IF  SAVE_ZONES  THEN  DO;
           ALLOCATE  EMIZONE;
           IF  COLD_START  THEN  ALLOCATE CLDZONE;
           END;
      IF  EMISF = 'CLA'  THEN  #CLASS: DO;
      /* USE EMISSION FACTORS BY "CLASS" FOR EACH ZONE */
           CALL CLASS(NSETS,PTR_XX,Q_XX,COLD_START,SAVE_ZONES);
           END  #CLASS;
      ELSE     #WGHT_SET: DO;
      /*  USE THE "WEIGHTED" SET OF EMISSION FACTORS IN EACH ZONE  */
      IF  NSETS > 1  THEN  DO;
           MULT_SETS = '1'B;
           TECO, TEHC, TENO, TCSCO, TCSHC = Ø;
           END;
      ELSE  MULT_SETS='Ø'B;
      ALLOCATE INDEX;
#SET_NO:
      DO N_SET = 1 TO NSETS;
      TECO_SET, TEHC_SET, TENO_SET = Ø;
      PUT EDIT('MOTOR VEHICLE EMISSIONS(GRAMS/1ØØ) FOR',YEAR)
           (PAGE,X(33),A,F(6));
      PUT EDIT(INTERVAL(TYPE)) (R(F3));
      IF  MULT_SETS  THEN  PUT EDIT('SET NO.',N_SET) (X(18),A,F(3));
      GET LIST(TITLE);
      PUT EDIT(TITLE) (SKIP,X(3Ø),A);
      PUT EDIT( (STARS  DO K = 1 TO 1Ø) ) (SKIP(2),X(2Ø),1Ø A(1Ø));
      PUT EDIT('EMISSION FACTORS(GRAMS/MILE)','CO','HC','NO',
                'URBAN','RURAL','EVAP','CRANK','URBAN','RURAL',
                'URBAN','RURAL')
           (SKIP,X(56),A,SKIP,X(33),A(2),2(X(34),A(2)),SKIP,X(22),
                2(X(5),A(5)),X(11),A(4),3(X(5),A(5)),X(6),
                2(X(5),A(5)));
           GET LIST(EMISSION_FACTORS);
           EVAP_CRNK = EVAP + CRNK;
           PUT EDIT(EMISSION_FACTORS) (SKIP(2),X(22),2 F(1Ø,2),
                     X(5),4 F(1Ø,2),X(6),2 F(1Ø,2));
           IF  COLD_START  THEN  DO;
                TCSCO_SET, TCSHC_SET = Ø;
                GET LIST(CLDSTR_VALUES);
                PUT EDIT('COLD START EMISSION FACTORS(GRAMS/TRIP)',
                          'SHORT',' LRES','LNRES',CLDSTR_VALUES)
```

```
                    (SKIP(2),X(45),A,X( 6),3(X(5),A(5)),SKIP(2),
                          X(1),2(X(26),F(10,2)),X(17),3 F(10,1)):

                CSCOEF = CSCOEF/100:        /* EMISSIONS IN GRAMS/100 */
                CSHCEF = CSHCEF/100:
                END:
         PUT EDIT( (STARS  DO K = 1 TO 10) ) (SKIP(1),X(20),10 A(10)):
         PUT EDIT(UNIT_TYPE,'CO','HC','NO',(ROAD_TYPES  DO K = 1 TO 3))
                                        (SKIP(2),X(6),A(4),X(23),A(2),
             X(34),A(2),X(34),A(2),SKIP,X(10),3(X(12),A(8),X(8),A(8))):
         IF  COLD_START  THEN  PUT EDIT(('COLD START' DO K = 1 TO 3))
                (SKIP,X(2),3(X(26),A(10))):
         PUT EDIT(('TOTAL'  DO K = 1 TO 3)) (SKIP,3(X(31),A(5))):
     /* INPUT ZONE SELECTIONS FOR THIS SET OF EMISSION FACTORS */
         GET DATA(NSEQ,NINDV):
       /* BUILD ZONE INDEX */
         N_ZONES = 0:
         IF  ^MULT_SETS  &  NSEQ < 0  THEN  #K_1: DO:
             N_ZONES = N:
             DO I = 1 TO N:
             INDEX(I) = I:
             END  #K_1:
         ELSE  #K_2: DO:
             IF  NSEQ > 0  THEN  #K_3: DO:
                 DO M = 1 TO NSEQ:
                     GET LIST(ZONE1,ZONE2):
                     DO I = ZONE1 TO ZONE2:
                         N_ZONES = N_ZONES + 1:
                         INDEX(N_ZONES) = I:
                 END  #K_3:
             IF  NINDV > 0  THEN  #K_4: DO:
                 DO M = 1 TO NINDV:
                     GET LIST(I):
                     N_ZONES = N_ZONES + 1:
                     INDEX(N_ZONES) = I:
                 END  #K_4:
             END  #K_2:
    #L_1: DO NZONE = 1 TO N_ZONES:
         I = INDEX(NZONE):
         PUT EDIT(I) (SKIP(2),X(6),F(4)):
         IF  FLAG(I)  THEN  #L_2: DO:                 /*  UNIT DEFINED  */
       #L_3: DO K = 1 TO 2:         /*  K=1 FREEWAY:  K=2 ARTERIAL  */
             IF  MILES(I,K) > 0  THEN  DO:        /*  DATA AVAILABLE  */
                 VEQMI = MILES(I,K):
                 VEQSP = SPEED(I,K):
         /*  DETERMINE WHETHER RURAL OR URBAN CLASS  */
                 IF  VEQSP > 35  THEN  #RURAL: DO:         /*  RURAL  */
                     ENO(K) = NO_RURAL * VEQMI:
                     IF  VEQSP > 50  THEN  DO:        /*  50<SP<=65  */
                         IF  VEQSP > 65  THEN  VEQSP = 65:
                         M = 7:
                         END:
                     ELSE  M = 5:                     /*  35<SP<=50  */
                     ECO(K) = (SADJF_CO(M) - SADJF_CO(M+1)*VEQSP) *
                                 CO_RURAL * VEQMI:
                     EHC(K) = ( (SADJF_HC(M) - SADJF_HC(M+1)*VEQSP)*
                                 HC_RURAL + EVAP_CRNK ) * VEQMI:
                     END  #RURAL:
                 ELSE  #URBAN: DO:                          /*  URBAN  */
                     ENO(K) = NO_URBAN * VEQMI:
```

```
            IF  VEQSP > 20  THEN  M = 3;   /*  20<SP<=35  */
            ELSE  DO:                      /*  10<=SP<=20  */
                 IF  VEQSP < 10  THEN  VEQSP = 10;
                 M = 1;
                 END;
            ECO(K) = (SADJF_CO(M) - SADJF_CO(M+1)*VEQSP) *
                          CO_URBAN * VEQMI;
            EHC(K) = ( (SADJF_HC(M) - SADJF_HC(M+1)*VEQSP)*
                          HC_URBAN + EVAP_CRNK ) * VEQMI;
            END  #URBAN;
       END;
  ELSE  DO:                     /*  DATA IS ZERO  */
       ECO(K) = 0;
       EHC(K) = 0;
       ENO(K) = 0;
       END;
  END  #L_3;
  ZECO = ECO(1) + ECO(2);
  ZEHC = EHC(1) + EHC(2);
  ZENO = ENO(1) + ENO(2);
  PUT EDIT(ECO,EHC,ENO) (3(X(8),F(12,1),X(4),F(12,1)));
  IF  COLD_START  THEN  DO;
       #TRIPS = SHORTF*SHORT(I) + LRESF*LRES(I)
            + LNRESF*LNRES(I);
       CSCO = CSCOEF * #TRIPS;
       CSHC = CSHCEF * #TRIPS;
       PUT EDIT(CSCO,CSHC) (R(F6));
       ZECO = ZECO + CSCO;
       ZEHC = ZEHC + CSHC;
       TCSCO_SET = TCSCO_SET + CSCO;
       TCSHC_SET = TCSHC_SET + CSHC;
       END;
  PUT EDIT(ZECO,ZEHC,ZENO) (R(F6));
  TECO_SET = TECO_SET + ZECO;
  TEHC_SET = TEHC_SET + ZEHC;
  TENO_SET = TENO_SET + ZENO;
  IF  SAVE_ZONES  THEN  DO;
       COEMI_ZONE(I) = ZECO;
       HCEMI_ZONE(I) = ZEHC;
       NOEMI_ZONE(I) = ZENO;
       IF  COLD_START  THEN  DO;
            CSCO_ZONE(I) = CSCO;
            CSHC_ZONE(I) = CSHC;
            END;
       END;
  END  #L_2;
ELSE  PUT EDIT('NO DATA DEFINED') (X(53),A);
END  #L_1;
PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
         (SKIP(4),X(57),A,SKIP,3(X(34),A(2)));
TECO_SET = TECO_SET/1000;
TEHC_SET = TEHC_SET/1000;
TENO_SET = TENO_SET/1000;
IF  MULT_SETS  THEN  DO;
  TECO = TECO + TECO_SET;
  TEHC = TEHC + TEHC_SET;
  TENO = TENO + TENO_SET;
  END;
IF  COLD_START  THEN  DO;
  TCSCO_SET = TCSCO_SET/1000;
```

```
          HSCO = TECO_SET - TCSCO_SET;
          TCSHC_SET = TCSHC_SET/1000;
          HSHC = TEHC_SET - TCSHC_SET;
          PUT EDIT('HOT START',HSCO,HSHC,TENO_SET,'COLD START',
                        TCSCO_SET,TCSHC_SET,'TOTAL',TECO_SET,
                        TEHC_SET,TENO_SET) (SKIP(2),X(6),
                    A(9),X(11),F(12,1),2(X(24),F(12,1)),SKIP(2),
                    X(6),A(10),X(10),F(12,1),X(24),F(12,1),
                    SKIP(2),X(6),A(5),X(15),F(12,1),
                    2(X(24),F(12,1)));
          IF  MULT_SETS  THEN  DO;
               TCSCO = TCSCO + TCSCO_SET;
               TCSHC = TCSHC + TCSHC_SET;
               END;
          END;
     ELSE  PUT EDIT(TECO_SET,TEHC_SET,TENO_SET) (R(F6));
     END  #SET_NO;
     FREE INDEX;
     IF  MULT_SETS  THEN  #SUMMARY: DO;
 /* SUMMARY */
          PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
                    (PAGE,X(57),A,SKIP(2),3(X(34),A(2)));
          IF  COLD_START  THEN  DO;
               HSCO = TECO - TCSCO;
               HSHC = TEHC - TCSHC;
               PUT EDIT('HOT START',HSCO,HSHC,TENO,'COLD START',
                        TCSCO,TCSHC,'TOTAL',TECO,TEHC,TENO)
                    (SKIP(3),X(6),
                    A(9),X(11),F(12,1),2(X(24),F(12,1)),SKIP(2),
                    X(6),A(10),X(10),F(12,1),X(24),F(12,1),
                    SKIP(2),X(6),A(5),X(15),F(12,1),
                    2(X(24),F(12,1)));
               END;
          ELSE  PUT EDIT(TECO,TEHC,TENO) (R(F6));
          END  #SUMMARY;
     END  #WGHT_SET;
     FREE  DATA_XX,ID_XX;
     IF  COLD_START  THEN  FREE  VEQTRIP;
     IF  SAVE_ZONES  THEN  DO;
          CALL ZONES(Q_XX,COLD_START);
          FREE  EMIZONE;
          IF  COLD_START  THEN  FREE CLDZONE;
          END;
     GO TO NEXT_CASE;
FINISH: STOP;
  CATSFILE: PROC(TAPEIN,Q,R,PTRMAX);
          DCL  TAPEIN FILE RECORD,(Q,R) PTR,PTRMAX FIXED BIN(31);
          DCL  1 CARD  BASED(P),
                  2 UNIT_ID     CHAR(10),
                  2 REC_CODE    CHAR(2),
                  2 UNIT_#      CHAR(5),
                  2 VALUE(3)    CHAR(16),
                  2 BLANK       CHAR(15);
          DCL  PTR FIXED BIN(31);
          ON ENDFILE(TAPEIN)  GO TO SUMMARY;
          PTRMAX = 0;
     INPUT: READ FILE(TAPEIN) SET(P);
          IF  REC_CODE = ' 1'  THEN  #MILES: DO;
               GET STRING(UNIT_#) EDIT(PTR) (R(F1));
               IF  PTR > PTRMAX  THEN  PTRMAX = PTR;
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          IF  ^SPEED_FLAG(PTR)  THEN  R->ID(PTR) = UNIT_ID;
          MILES_FLAG(PTR) = UP;
          GET STRING(VALUE(TYPE)) EDIT(Q->MILES(PTR,1),
            Q->MILES(PTR,2)) (R(F2));
          END  #MILES;
     ELSE  #SPEED: DO;
          IF  REC_CODE ^= ' 2'  THEN  GO TO INPUT;
          GET STRING(UNIT_#) EDIT(PTR) (R(F1));
          IF  PTR > PTRMAX  THEN  PTRMAX = PTR;
          IF  ^MILES_FLAG(PTR)  THEN  R->ID(PTR) = UNIT_ID;
          SPEED_FLAG(PTR) = UP;
          GET STRING(VALUE(TYPE)) EDIT(Q->SPEED(PTR,1),
            Q->SPEED(PTR,2)) (R(F2));
          END  #SPEED;
     GO TO INPUT;
SUMMARY: CLOSE FILE(TAPEIN);
     PUT PAGE EDIT('SUMMARY BY ',UNIT_TYPE,' FOR',YEAR)
          (X(35),A,A(8),A,F(5));
     PUT EDIT(INTERVAL(TYPE)) (X(2),A(13));
     PUT EDIT(UNIT_TYPE,ROAD_TYPES) (SKIP(2),X(12),A(4),
          X(19),A(8),X(30),A(8));
     PUT EDIT('MILES/100','SPEED(MPH)','MILES/100',
          'SPEED(MPH)') (SKIP,X(26),A,X(7),A,X(12),A,X(8),A);
     FWY_MILES, ART_MILES = 0;
 #S1: DO I = 1 TO PTRMAX;
     PUT EDIT(I) (SKIP,X(12),F(4));
     IF  MILES_FLAG(I) & SPEED_FLAG(I)  THEN  #S2: DO;
          R->FLAG(I) = UP;
          PUT EDIT((Q->MILES(I,K),Q->SPEED(I,K) DO K = 1 TO 2))
               (X(9),F(6),X(11),F(5,1),X(16),F(6),
                    X(12),F(5,1));
          FWY_MILES = FWY_MILES + Q->MILES(I,1);
          ART_MILES = ART_MILES + Q->MILES(I,2);
          END  #S2;
     ELSE  DO;
          IF  ^MILES_FLAG(I)  THEN  PUT EDIT
               ('NO MILES ASSIGNED') (COLUMN(31),A);
          IF  ^SPEED_FLAG(I)  THEN  PUT EDIT
               ('NO SPEED ASSIGNED') (COLUMN(69),A);
          END;
     END  #S1;
     PUT EDIT('TOTAL MILES/100',ROAD_TYPES,FWY_MILES,ART_MILES)
         (SKIP(3),X(44),A,SKIP,X(11),2(X(22),A(8)),SKIP(2),
               X(9),2(X(23),F(8)));
     RETURN;
  F1: FORMAT(F(5));
  F2: FORMAT(2 F(8,0));
     END  CATSFILE;
ORIGIN: PROC;
     DCL  (ORGN65,ORGN85) FILE RECORD;
     DCL  1 CARD  BASED(PTR),
            2 ZONE_#      CHAR(4),
            2 FILL_1      CHAR(6),
            2 TRIPS       CHAR(18),
            2 FILL_2      CHAR(52);
     DCL  (#TRIPS_65,#TRIPS_85)(3,N) FLOAT DEC(6) CONTROLLED
            INIT((3*N)0);
     DCL  PROD FLOAT DEC(6);
     ON ENDFILE(ORGN65)  GO TO #O_2;
     ON ENDFILE(ORGN85)  GO TO #O_4;
```

```
        ALLOCATE  #TRIPS_65;
        PUT EDIT('INCONSISTENCIES FOR 1965 DATA') (R(F1));
        PUT SKIP;
#O_1:   READ FILE(ORGN65) SET(PTR);
        GET STRING(ZONE_#) EDIT(I) (F(4));
        IF  I <= N  THEN  DO;
             IF  FLAG(I)  THEN  GET STRING(TRIPS) EDIT
                  (#TRIPS_65(1,I),#TRIPS_65(2,I),#TRIPS_65(3,I))
                  (3 F(6));
             ELSE  PUT EDIT
               ('ORIGIN DATA BUT NO CATS DATA FOR ZONE',I) (R(F2));
             END;
        ELSE  PUT EDIT
               ('ORIGIN DATA BUT NO CATS DATA FOR ZONE',I) (R(F2));
        GO TO #O_1;
#O_2:   CLOSE FILE(ORGN65);
        ALLOCATE  #TRIPS_85;
        PUT EDIT('INCONSISTENCIES FOR 1985 DATA') (R(F1));
        PUT SKIP;
#O_3:   READ FILE(ORGN85) SET(PTR);
        GET STRING(ZONE_#) EDIT(I) (F(4));
        IF  I <= N  THEN  DO;
             IF  FLAG(I)  THEN  GET STRING(TRIPS) EDIT
                  (#TRIPS_85(1,I),#TRIPS_85(2,I),#TRIPS_85(3,I))
                  (3 F(6));
             ELSE  PUT EDIT
               ('ORIGIN DATA BUT NO CATS DATA FOR ZONE',I) (R(F2));
             END;
        ELSE  PUT EDIT
               ('ORIGIN DATA BUT NO CATS DATA FOR ZONE',I) (R(F2));
        GO TO #O_3;
#O_4:   CLOSE FILE(ORGN85);
        PUT EDIT('ORIGIN SUMMARY FOR',YEAR) (PAGE,X(43),A,F(5));
        PUT EDIT('ZONE','SHORT','LONG RES','LONG NONRES')
             (SKIP,X(16),A(4),X(17),A(5),X(14),A(8),X(11),A(11));
        PUT SKIP;
        IF  OPTMRG = 'INP'  THEN  DO;
             C1 = 1985 - YEAR;
             C1 = C1/20;
             C2 = YEAR - 1965;
             C2 = C2/20;
             END;
#O_5:   DO I = 1 TO N;
        PUT EDIT(I) (SKIP,X(16),F(4));
        IF  FLAG(I)  THEN  DO;
             PROD = #TRIPS_65(1,I) * #TRIPS_85(1,I);
             IF  PROD > 0  THEN  DO;
                  SHORT(I) = C1*#TRIPS_65(1,I)
                       + C2*#TRIPS_85(1,I);
                  LRES(I)  = C1*#TRIPS_65(2,I)
                       + C2*#TRIPS_85(2,I);
                  LNRES(I) = C1*#TRIPS_65(3,I)
                       + C2*#TRIPS_85(3,I);
                  PUT EDIT(SHORT(I),LRES(I),LNRES(I))
                       (3(X(7),F(15)));
                  END;
             ELSE  DO;
                  SHORT(I), LRES(I), LNRES(I) = 0;
                  IF  #TRIPS_65(1,I) = 0  THEN
                       PUT EDIT('NO 1965 ORIGINS') (COLUMN(34),A);
```

```
                IF  #TRIPS_85(1,I) = Ø  THEN
                    PUT EDIT('NO 1985 ORIGINS') (COLUMN(67),A);
                END;
        END  #O_5;
        FREE  #TRIPS_65,#TRIPS_85;
        RETURN;
     F1: FORMAT(PAGE,X(25),A);
     F2: FORMAT(SKIP,X(2Ø),A,F(6));
        END  ORIGIN;
F1: FORMAT(SKIP(4),X(1Ø),A);
F2: FORMAT(SKIP(2),X(15),2(A,F(6)));
F3: FORMAT(X(2),A(13));
F4: FORMAT(SKIP(2),X(1Ø),F(4),A,F(4),A);
F5: FORMAT(SKIP(2),X(1Ø),A(13),A,A(13),A);
F6: FORMAT(SKIP,X(2),3(X(24),F(12,1)));
    END  VEQEMI;
```

```
ZONES: PROC(PTR,COLD_START);
/*  PARAMETERS  */
        DCL  PTR POINTER;
        DCL  1 ID_XX  BASED(PTR),
               2 N FIXED BIN(31);
               2 FLAGS(LGTH_REFER(N)),
                 3 FLAG  BIT(1) ALIGNED,
                 3 ID    CHAR(10);
        DCL  COLD_START BIT(1) ALIGNED;
/*  EXTERNAL VARIABLES  */
        DCL  1 EMIZONE(N)  CONTROLLED  EXT,
               2 (COEMI_ZONE, HCEMI_ZONE, NOEMI_ZONE)
                  FLOAT DEC(6);
        DCL  1 CLDZONE(N)  CONTROLLED  EXT,
               2 (CSCO_ZONE, CSHC_ZONE) FLOAT DEC(6);
/*  LOCAL  VARIABLES  */
        DCL  COUNTY_# CHAR(1);
        DCL  NSETS_1 FIXED BIN(31) INIT(2)  STATIC,
             NSETS_2 FIXED BIN(31) INIT(28)  STATIC;
        DCL  LIST_1(2,2) FIXED BIN(31) INIT(60,65, 68,73) STATIC;
        DCL  LIST_2(28,2) FIXED BIN(31) INIT(1,15, 34,143,
             145,150, 154,155, 246,246, 248,248, 252,288,
                      290,294, 296,300, 302,306, 310,312,
             316,318, 322,324, 328,342, 346,348, 352,354,
             358,360, 377,378, 382,383, 507,508, 513,514,
             517,519, 523,527, 529,531, 536,537,
             694,694, 758,758, 764,764)  STATIC;
        DCL  (I,I1,I2,K,LGTH) FIXED BIN(31);
        DCL  (HSCO, HSHC) FLOAT DEC(6);
        DCL  (TCSZCO,TCSZHC,TZECO,TZEHC,TZENO) FLOAT DEC(16);
/*  END  OF  DECLARATIONS  */
/*  CHICAGO BUSINESS DISTRICT EMISSIONS  */
        PUT EDIT('CHICAGO BUSINESS DISTRICT')(PAGE,X(28),A);
        PUT EDIT('ZONE','CO','HC','NO') (R(Z1));
        PUT SKIP;
        TCSZCO, TCSZHC, TZECO,TZEHC, TZENO = 0;
 #Z_1:  DO K = 1 TO NSETS_1;
        I1 = LIST_1(K,1);
        I2 = LIST_1(K,2);
        DO I = I1 TO I2;
        IF  FLAG(I)  THEN  DO;
             TZECO = TZECO + COEMI_ZONE(I);
             TZEHC = TZEHC + HCEMI_ZONE(I);
             TZENO = TZENO + NOEMI_ZONE(I);
             PUT EDIT(I,COEMI_ZONE(I),HCEMI_ZONE(I),
                  NOEMI_ZONE(I)) (R(Z2));
             IF  COLD_START  THEN  DO;
                  TCSZCO = TCSZCO + CSCO_ZONE(I);
                  TCSZHC = TCSZHC + CSHC_ZONE(I);
                  PUT EDIT(CSCO_ZONE(I),CSHC_ZONE(I)) (R(Z4));
                  PUT SKIP;
                  END;
             END;
        ELSE  PUT EDIT(I,'NO DATA DEFINED')
                  (SKIP,X(10),F(6),X(23),A);
        END  #Z_1;
        TZECO = TZECO/1000;
        TZEHC = TZEHC/1000;
        TZENO = TZENO/1000;
```

```
        PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
                (R(Z3));
        IF  COLD_START  THEN  DO;
             TCSZCO = TCSZCO/1000;
             HSCO = TZECO - TCSZCO;
             TCSZHC = TCSZHC/1000;
             HSHC = TZEHC - TCSZHC;
             PUT EDIT('HOT START',HSCO,HSHC,TZENO,'COLD START',
                  TCSZCO,TCSZHC,'TOTAL',TZECO,TZEHC,TZENO)(R(Z6));
             END;
        ELSE  PUT EDIT(TZECO,TZEHC,TZENO) (R(Z7));
 /*  CHICAGO EMISSIONS  */
        PUT EDIT('CHICAGO') (PAGE,X(37),A);
        PUT EDIT('ZONE','CO','HC','NO') (R(Z1));
        PUT SKIP;
        TCSZCO, TCSZHC, TZECO,TZEHC, TZENO = 0;
  #Z_2: DO K = 1 TO NSETS_2;
        I1 = LIST_2(K,1);
        I2 = LIST_2(K,2);
        DO I = I1 TO I2;
        IF  FLAG(I)  THEN  DO;
             TZECO = TZECO + COEMI_ZONE(I);
             TZEHC = TZEHC + HCEMI_ZONE(I);
             TZENO = TZENO + NOEMI_ZONE(I);
             PUT EDIT(I,COEMI_ZONE(I),HCEMI_ZONE(I),
                  NOEMI_ZONE(I)) (R(Z2));
             IF  COLD_START  THEN  DO;
                  TCSZCO = TCSZCO + CSCO_ZONE(I);
                  TCSZHC = TCSZHC + CSHC_ZONE(I);
                  PUT EDIT(CSCO_ZONE(I),CSHC_ZONE(I)) (R(Z4));
                  PUT SKIP;
                  END;
             END;
        ELSE  PUT EDIT(I,'NO DATA DEFINED')
                (SKIP,X(10),F(6),X(23),A);
        END  #Z_2;
        TZECO = TZECO/1000;
        TZEHC = TZEHC/1000;
        TZENO = TZENO/1000;
        PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
                (R(Z3));
        IF  COLD_START  THEN  DO;
             TCSZCO = TCSZCO/1000;
             HSCO = TZECO - TCSZCO;
             TCSZHC = TCSZHC/1000;
             HSHC = TZEHC - TCSZHC;
             PUT EDIT('HOT START',HSCO,HSHC,TZENO,'COLD START',
                  TCSZCO,TCSZHC,'TOTAL',TZECO,TZEHC,TZENO)(R(Z6));
             END;
        ELSE  PUT EDIT(TZECO,TZEHC,TZENO) (R(Z7));
  #Z_3: GET LIST(COUNTY_#);
        IF  COUNTY_# = ' '  THEN  GO TO #Z_5;
 /*  EMISSION SUMMARIES BY COUNTY  */
        PUT EDIT('COUNTY',COUNTY_#) (PAGE,X(36),A,F(3));
        PUT EDIT('ZONE','CO','HC','NO') (R(Z1));
        PUT SKIP;
        TCSZCO, TCSZHC, TZECO,TZEHC, TZENO = 0;
  #Z_4: DO I = 1 TO N;
        IF  FLAG(I)  THEN  DO;
             IF  SUBSTR(ID(I),6,1) = COUNTY_#  THEN  DO;
```

```
                    TZECO = TZECO + COEMI_ZONE(I);
                    TZEHC = TZEHC + HCEMI_ZONE(I);
                    TZENO = TZENO + NOEMI_ZONE(I);
                    PUT EDIT(I,COEMI_ZONE(I),HCEMI_ZONE(I),
                         NOEMI_ZONE(I)) (R(Z2));
                    IF  COLD_START  THEN  DO;
                         TCSZCO = TCSZCO + CSCO_ZONE(I);
                         TCSZHC = TCSZHC + CSHC_ZONE(I);
                         PUT EDIT(CSCO_ZONE(I),CSHC_ZONE(I))
                              (R(Z4));
                         PUT SKIP;
                         END;
                    END;
          END  #Z_4;
          TZECO = TZECO/1000;
          TZEHC = TZEHC/1000;
          TZENO = TZENO/1000;
          PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
                    (R(Z3));
          IF  COLD_START  THEN  DO;
               TCSZCO = TCSZCO/1000;
               HSCO = TZECO - TCSZCO;
               TCSZHC = TCSZHC/1000;
               HSHC = TZEHC - TCSZHC;
               PUT EDIT('HOT START',HSCO,HSHC,TZENO,'COLD START',
                    TCSZCO,TCSZHC,'TOTAL',TZECO,TZEHC,TZENO)(R(Z6));
               END;
          ELSE  PUT EDIT(TZECO,TZEHC,TZENO) (R(Z7));
          GO TO #Z_3;
   #Z_5:  RETURN;
     Z1:  FORMAT(SKIP,X(12),A(4),X(14),A(2),2(X(16),A(2)));
     Z2:  FORMAT(SKIP(1),X(10),F(6),3 F(18,1));
     Z3:  FORMAT(SKIP(4),X(31),A,SKIP,X(14),3(X(16),A(2)));
     Z4:  FORMAT(SKIP(1),X(16),2 F(18,1));
     Z6:  FORMAT(SKIP(2),X(2),A(9),X(5),3 F(18,1),SKIP(2),X(2),
                    A(10),X(4),2 F(18,1),SKIP(2),X(2),A(5),
                    X(9),3 F(18,1));
     Z7:  FORMAT(SKIP(2),X(16),3 F(18,1));
          END  ZONES;
```

```
 CLASS: PROC(NSETS,P,Q,CLDSTR,SAVE);
/*  PARAMETERS  */
        DCL   NSETS FIXED BIN(31);
        DCL   (P, Q) PTR;
        DCL   1 DATA_XX  BASED(P),
                2 (N, YEAR, TYPE) FIXED BIN(31),
                2 DATA(LGTH REFER(N)),
                  3 (MILES, SPEED)(2) FLOAT DEC(6);
        DCL   1 ID_XX  BASED(Q),
                2 I_XX  FIXED BIN(31),
                2 FLAGS(LGTH REFER(I_XX)),
                  3 FLAG  BIT(1) ALIGNED,
                  3 ID    CHAR(10);
        DCL   (CLDSTR, SAVE) BIT(1) ALIGNED;
/*  EXTERNAL VARIABLES  */
        DCL   1 SPDFCTR  CONTROLLED EXT,
                2 SADJF_CO(8) FLOAT DEC(6),
                2 SADJF_HC(8) FLOAT DEC(6);
        DCL   1 VEQTRIP(N)  CONTROLLED EXT,
                2 (SHORT, LRES, LNRES) FLOAT DEC(6);
        DCL   1 EMIZONE(N)  CONTROLLED EXT,
                2 (COEMI_ZONE, HCEMI_ZONE, NOEMI_ZONE) FLOAT DEC(6);
        DCL   1 CLDZONE(N)  CONTROLLED EXT,
                2 (CSCO_ZONE, CSHC_ZONE) FLOAT DEC(6);
/*  LOCAL VARIABLES  */
        DCL   1 EMISSION_FACTORS(5),
                2 (CO_URBAN, CO_RURAL,
                   EVAP, CRNK, HC_URBAN, HC_RURAL,
                   NO_URBAN, NO_RURAL) FLOAT DEC(6);
        DCL   1 DIESEL,
                2 (CO_DI, HC_DI, NO_DI) FLOAT DEC(6);
        DCL   1 OLDSTR_EMIFCTRS(5),
                2 (CSCOEF, CSHCEF, SHORTF, LRESF, LNRESF) FLOAT DEC(6);
        DCL   (DIESELS, MULT_SETS) BIT(1) ALIGNED;
        DCL   UNIT_TYPE CHAR(8) INIT('ZONE')  STATIC;
        DCL   ROAD_TYPES(2) CHAR(8) INIT('FREEWAY','ARTERIAL') STATIC;
        DCL   STARS CHAR(10) INIT('**********')  STATIC;
        DCL   INTERVAL(3) CHAR(13) INIT('DAILY','PEAK HOUR',
                 'OFF PEAK HOUR')  STATIC;
        DCL   TITLE CHAR(80);
        DCL   INDEX(N) FIXED BIN(31)  CONTROLLED;
        DCL   (I,K,L,LGTH,M,NINDV,NSEQ,NZONE,N_SET,N_ZONES,ZONE1,
                 ZONE2) FIXED BIN(31);
        DCL   (CO_SPDF,ECOK,EHCK,EMISS,ENOK,HC_SPDF,SUM,VEQ_MI,VEQSP,
                 ZECO,ZEHC,ZENO,CSCO,CSHC,#LNRES,#LRES,#SHORT,
                 #TRIPS,HSCO,HSHC) FLOAT DEC(6);
        DCL   (DISTR(6),ECO(2),EHC(2),ENO(2),EVAP_CRNK(5),VEQMI(6))
                 FLOAT DEC(6);
        DCL   (CO_CLASS(6),CS_CO(5),HC_CLASS(6),CS_HC(5),NO_CLASS(6),
                 TCO_CLASS(6),THC_CLASS(6),TNO_CLASS(6),
                 TCS_CO(5),TCS_HC(5),
                 TECO,TECO_SET,TEHC,TEHC_SET,TENO,TENO_SET,
                 TCSECO,TCSECO_SET,TCSEHC,TCSEHC_SET) FLOAT DEC(16);
/*  END OF DATA DECLARATIONS  */
        ALLOCATE INDEX;
        IF  NSETS > 1  THEN  DO;
              MULT_SETS = '1'B;
          /* INITIALIZE TOTALS */
              TECO, TEHC, TENO = 0;
```

```
        DO L = 1 TO 6;
             TCO_CLASS(L) = Ø;
             THC_CLASS(L) = Ø;
             TNO_CLASS(L) = Ø;
             END;
        IF  CLDSTR  THEN  DO;
             TCSECO, TCSEHC = Ø;
             DO L = 1 TO 5;
                  TCS_CO(L) = Ø;
                  TCS_HC(L) = Ø;
                  END;
             END;
        END;
#SET_NO:
   DO N_SET = 1 TO NSETS;
   TECO_SET, TEHC_SET, TENO_SET = Ø;
   DO L = 1 TO 6;
        CO_CLASS(L) = Ø;
        HC_CLASS(L) = Ø;
        NO_CLASS(L) = Ø;
        END;
   PUT EDIT('MOTOR VEHICLE EMISSIONS(GRAMS/100) FOR',YEAR)
        (PAGE,X(33),A,F(6));
   PUT EDIT(INTERVAL(TYPE)) (X(2),A(13));
   IF  MULT_SETS  THEN  PUT EDIT('SET NO.',N_SET) (X(18),A,F(3));
   GET LIST(TITLE);
   PUT EDIT(TITLE) (SKIP(1),X(30),A);
   PUT EDIT( (STARS  DO K = 1 TO 10) ) (SKIP(2),X(20),10 A(10));
   PUT EDIT('EMISSION FACTORS(GRAMS/MILE)','CO','HC','NO',
             'URBAN','RURAL','EVAP','CRANK','URBAN','RURAL',
             'URBAN','RURAL')
        (SKIP,X(56),A,SKIP,X(33),A(2),2(X(34),A(2)),SKIP,X(22),
             2(X(5),A(5)),X(11),A(4),3(X(5),A(5)),X(6),
             2(X(5),A(5)));
 /* INPUT EMISSION FACTORS */
   GET LIST(EMISSION_FACTORS,DIESEL,DISTR);
   PUT SKIP;
   DO K = 1 TO 5;
   PUT EDIT(K,CO_URBAN(K),CO_RURAL(K),EVAP(K),CRNK(K),HC_URBAN(K),
                  HC_RURAL(K),NO_URBAN(K),NO_RURAL(K))
             (SKIP(1),X(21),F(1),2 F(10,2),X(5),4 F(10,2),
                  X(6),2 F(10,2));
   EVAP_CRNK(K) = EVAP(K) + CRNK(K);
   END;
   SUM = CO_DI + HC_DI + NO_DI;
   IF  SUM > Ø  THEN  DO;
        DIESELS = '1'B;
        PUT EDIT('6',DIESEL) (SKIP(1),X(21),A(1),X(5),F(10,2),
                      2(X(26),F(10,2)) );
        END;
   ELSE  DIESELS = 'Ø'B;
   IF  CLDSTR  THEN  #L_1: DO;
        TCSECO_SET, TCSEHC_SET = Ø;
   /* INPUT COLD START EMISSION FACTORS */
        GET LIST(CLDSTR_EMIFCTRS);
        PUT EDIT('COLD START EMISSION FACTORS(GRAMS/TRIP)',
                      'SHORT',' LRES','LNRES')
                  (SKIP(2),X(45),A,X(6),3(X(5),A(5)));
        PUT SKIP;
        DO K = 1 TO 5;
```

```
        PUT EDIT(K,CSCOEF(K),CSHCEF(K),SHORTF(K),LRESF(K),
                 LNRESF(K))
             (SKIP(1),X(21),F(1),X(5),F(10,2),X(26),F(10,2),
                  X(17),3 F(10,1));
        CSCOEF(K) = CSCOEF(K)/100;     /* EMISSIONS IN GRAMS/100 */
        CSHCEF(K) = CSHCEF(K)/100;
        END  #L_1;
    PUT EDIT( (STARS  DO K = 1 TO 10) ) (SKIP(1),X(20),10 A(10));
    PUT EDIT(UNIT_TYPE,'CO','HC','NO',(ROAD_TYPES  DO K = 1 TO 3))
                                        (SKIP(2),X(6),A(4),X(23),A(2),
        X(34),A(2),X(34),A(2),SKIP,X(10),3(X(12),A(8),X(8),A(8)));
    IF  CLDSTR  THEN  PUT EDIT( ('COLD START'  DO K = 1 TO 3) )
             (SKIP,X(2),3(X(26),A(10)));
    PUT EDIT(('TOTAL'  DO K = 1 TO 3)) (SKIP,3(X(31),A(5)));
/* INPUT ZONE SELECTIONS FOR THIS SET OF EMISSION FACTORS */
    GET DATA(NSEQ,NINDV);
  /* BUILD ZONE INDEX */
    N_ZONES = 0;
    IF  ¬MULT_SETS  &  NSEQ < 0  THEN  #K_1: DO;
        N_ZONES = N;
        DO I = 1 TO N;
        INDEX(I) = I;
        END  #K_1;
    ELSE  #K_2: DO;
        IF  NSEQ > 0  THEN  #K_3: DO;
            DO M = 1 TO NSEQ;
                GET LIST(ZONE1,ZONE2);
                DO I = ZONE1 TO ZONE2;
                    N_ZONES = N_ZONES + 1;
                    INDEX(N_ZONES) = I;
            END  #K_3;
        IF  NINDV > 0  THEN  #K_4: DO;
            DO M = 1 TO NINDV;
                GET LIST(I);
                N_ZONES = N_ZONES + 1;
                INDEX(N_ZONES) = I;
            END  #K_4;
        END  #K_2;
#C_1: DO NZONE = 1 TO N_ZONES;
    I = INDEX(NZONE);
    PUT EDIT(I) (SKIP(2),X(6),F(4));
    IF  FLAG(I)  THEN  #C_2: DO;               /* UNIT DEFINED */
  #C_3: DO K = 1 TO 2;
        IF  MILES(I,K) > 0  THEN  #C_4: DO;
                                               /* DATA AVAILABLE */
            VEQ_MI = MILES(I,K);
            DO L = 1 TO 6;
            VEQMI(L) = VEQ_MI * DISTR(L);
            END;
            VEQSP = SPEED(I,K);
        /* DETERMINE WHETHER RURAL OR URBAN */
            IF  VEQSP > 35  THEN  #RURAL: DO;
            /*  NO  */
                ENOK = 0;
                DO L = 1 TO 5;
                EMISS = NO_RURAL(L) * VEQMI(L);
                NO_CLASS(L) = NO_CLASS(L) + EMISS;
                ENOK = ENOK + EMISS;
                END;
                ENO(K) = ENOK;
```

```
        IF  VEQSP > 50  THEN  DO:      /* 50<SP<=65 */
              IF  VEQSP > 65  THEN  VEQSP = 65;
              M = 7;
              END;
        ELSE  M = 5;                     /* 35<SP<=50 */
        CO_SPDF = SADJF_CO(M) - SADJF_CO(M+1)*VEQSP;
        HC_SPDF = SADJF_HC(M) - SADJF_HC(M+1)*VEQSP;
        ECOK, EHCK = 0;
        DO L = 1 TO 5;
/*   CO  */
        EMISS = CO_SPDF*CO_RURAL(L) * VEQMI(L);
        CO_CLASS(L) = CO_CLASS(L) + EMISS;
        ECOK = ECOK + EMISS;
/*   HC  */
        EMISS = (HC_SPDF*HC_RURAL(L) + EVAP_CRNK(L))
                          * VEQMI(L);
        EHCK = EHCK + EMISS;
        HC_CLASS(L) = HC_CLASS(L) + EMISS;
        END;
        ECO(K) = ECOK;
        EHC(K) = EHCK;
        END  #RURAL;
ELSE  #URBAN: DO;
/*   NO  */
        ENOK = 0;
        DO L = 1 TO 5;
        EMISS = NO_URBAN(L) * VEQMI(L);
        NO_CLASS(L) = NO_CLASS(L) + EMISS;
        ENOK = ENOK + EMISS;
        END;
        ENO(K) = ENOK;
        IF  VEQSP > 20  THEN  M = 3;   /* 20<SP<=35 */
        ELSE  DO;                      /* 10<=SP<=20 */
              IF  VEQSP< 10  THEN  VEQSP = 10;
              M = 1;
              END;
        CO_SPDF = SADJF_CO(M) - SADJF_CO(M+1)*VEQSP;
        HC_SPDF = SADJF_HC(M) - SADJF_HC(M+1)*VEQSP;
        ECOK, EHCK = 0;
        DO L = 1 TO 5;
/*   CO  */
        EMISS = CO_SPDF*CO_URBAN(L) * VEQMI(L);
        CO_CLASS(L) = CO_CLASS(L) + EMISS;
        ECOK = ECOK + EMISS;
/*   HC  */
        EMISS = (HC_SPDF*HC_URBAN(L) + EVAP_CRNK(L))
                          * VEQMI(L);
        HC_CLASS(L) = HC_CLASS(L) + EMISS;
        EHCK = EHCK + EMISS;
        END;
        ECO(K) = ECOK;
        EHC(K) = EHCK;
        END  #URBAN;
IF   DIESELS  THEN  DO;
/*   DIESEL EMISSIONS INCLUDED  */
        VEQ_MI = VEQMI(6);
/*   CO  */
        EMISS = CO_DI * VEQ_MI;
        CO_CLASS(6) = CO_CLASS(6) + EMISS;
        ECO(K) = ECO(K) + EMISS;
```

```
              /*  HC  */
                   EMISS = HC_DI * VEQ_MI;
                   HC_CLASS(6) = HC_CLASS(6) + EMISS;
                   EHC(K) = EHC(K) + EMISS;
              /*  NO  */
                   EMISS = NO_DI * VEQ_MI;
                   NO_CLASS(6) = NO_CLASS(6) + EMISS;
                   ENO(K) = ENO(K) + EMISS;
                   END;
              END  #C_4;
         ELSE  DO;                                    /*  DATA IS ZERO  */
              ECO(K), EHC(K), ENO(K) = 0;
              END;
         END  #C_3;
         ZECO = ECO(1) + ECO(2);
         ZEHC = EHC(1) + EHC(2);
         ZENO = ENO(1) + ENO(2);
         PUT EDIT(ECO,EHC,ENO) (3(X(8),F(12,1),X(4),F(12,1)));
         IF  CLDSTR  THEN  #CLD_STR: DO;
    /*  COLD START EMISSIONS  */
              #SHORT = SHORT(I);
              #LRES = LRES(I);
              #LNRES = LNRES(I);
              CSCO, CSHC = 0;
              DO L = 1 TO 5;
              #TRIPS = (SHORTF(L)*#SHORT + LRESF(L)*#LRES
                              + LNRESF(L)*#LNRES) * DISTR(L);
         /*  CO  */
              EMISS = CSCOEF(L) * #TRIPS;
              CS_CO(L) = CS_CO(L) + EMISS;
              CSCO = CSCO + EMISS;
         /*  HC  */
              EMISS = CSHCEF(L) * #TRIPS;
              CS_HC(L) = CS_HC(L) + EMISS;
              CSHC = CSHC + EMISS;
              END;
              PUT EDIT(CSCO,CSHC) (R(F1));
              ZECO = ZECO + CSCO;
              ZEHC = ZEHC + CSHC;
              TCSECO_SET = TCSECO_SET + CSCO;
              TCSEHC_SET = TCSEHC_SET + CSHC;
              END  #CLD_STR;
         PUT EDIT(ZECO,ZEHC,ZENO) (R(F1));
         TECO_SET = TECO_SET + ZECO;
         TEHC_SET = TEHC_SET + ZEHC;
         TENO_SET = TENO_SET + ZENO;
         IF  SAVE  THEN  DO;
              COEMI_ZONE(I) = ZECO;
              HCEMI_ZONE(I) = ZEHC;
              NOEMI_ZONE(I) = ZENO;
              IF  CLDSTR  THEN  DO;
                   CSCO_ZONE(I) = CSCO;
                   CSHC_ZONE(I) = CSHC;
                   END;
              END;
         END  #C_2;
    /*  NO DATA AVAILABLE  */
    ELSE  PUT EDIT('NO DATA DEFINED') (X(53),A);
    END  #C_1;
/* OUTPUT SUMMARIES FOR THIS SET OF EMISSION FACTORS */
```

```
        PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
                (SKIP(4),X(57),A,SKIP(2),3(X(34),A(2)));
        TECO_SET = TECO_SET/1000;
        TEHC_SET = TEHC_SET/1000;
        TENO_SET = TENO_SET/1000;
        IF  MULT_SETS  THEN  DO;
             TECO = TECO + TECO_SET;
             TEHC = TEHC + TEHC_SET;
             TENO = TENO + TENO_SET;
             END;
        IF  CLDSTR  THEN  DO;
             TCSECO_SET = TCSECO_SET/1000;
             HSCO = TECO_SET - TCSECO_SET;
             TCSEHC_SET = TCSEHC_SET/1000;
             HSHC = TEHC_SET - TCSEHC_SET;
             PUT EDIT('HOT START',HSCO,HSHC,TENO_SET,'COLD START',
                            TCSECO_SET,TCSEHC_SET,'TOTAL',
                            TECO_SET,TEHC_SET,TENO_SET) (R(F2));
             IF  MULT_SETS  THEN  DO;
                  TCSECO = TCSECO + TCSECO_SET;
                  TCSEHC = TCSEHC + TCSEHC_SET;
                  END;
             END;
        ELSE  PUT EDIT(TECO_SET,TEHC_SET,TENO_SET) (R(F1));
   /* OUTPUT CLASS SUMMARY */
        PUT EDIT('CLASS SUMMARY') (SKIP(3),X(64),A);
        DO L = 1 TO 6;
        CO_CLASS(L) = CO_CLASS(L)/1000;
        HC_CLASS(L) = HC_CLASS(L)/1000;
        NO_CLASS(L) = NO_CLASS(L)/1000;
             IF  MULT_SETS  THEN  DO;
                  TCO_CLASS(L) = TCO_CLASS(L) + CO_CLASS(L);
                  THC_CLASS(L) = THC_CLASS(L) + HC_CLASS(L);
                  TNO_CLASS(L) = TNO_CLASS(L) + NO_CLASS(L);
             END;
        END;
        IF  CLDSTR  THEN  #C_5: DO;
             DO L = 1 TO 5;
             CS_CO(L) = CS_CO(L)/1000;
             CS_HC(L) = CS_HC(L)/1000;
             IF  MULT_SETS  THEN  DO;
                  TCS_CO(L) = TCS_CO(L) + CS_CO(L);
                  TCS_HC(L) = TCS_HC(L) + CS_HC(L);
                  END;
             PUT EDIT(L,CO_CLASS(L),CS_CO(L),HC_CLASS(L),CS_HC(L))
                       (R(F3));
             ZECO = CO_CLASS(L) + CS_CO(L);
             ZEHC = HC_CLASS(L) + CS_HC(L);
             PUT EDIT(ZECO,ZEHC,NO_CLASS(L)) (R(F1));
             END  #C_5;
        ELSE  #C_6: DO;
             DO L = 1 TO 5;
             PUT EDIT(L,CO_CLASS(L),HC_CLASS(L),NO_CLASS(L)) (R(F4));
             END  #C_6;
    /* DIESEL EMISSIONS */
        IF  DIESELS  THEN  PUT EDIT('6',CO_CLASS(6),HC_CLASS(6),
                  NO_CLASS(6)) (R(F5));
/* END OF SUMMARY OUTPUT FOR THIS SET */
        END  #SET_NO;
        FREE INDEX;
```

```
        IF  ^MULT_SETS  THEN  GO TO #SAVE;
/* OUTPUT "COMPLETE" SUMMARIES */
        PUT EDIT('TOTAL EMISSIONS(GRAMS/10**5)','CO','HC','NO')
                    (PAGE,X(57),A,SKIP(2),3(X(34),A(2)));
        IF  CLDSTR  THEN  DO;
             HSCO = TECO - TCSECO;
             HSHC = TEHC - TCSEHC;
             PUT EDIT('HOT START',HSCO,HSHC,TENO,'COLD START',
                           TCSECO,TCSEHC,'TOTAL',TECO,TEHC,TENO)
                      (R(F2));
             END;
        ELSE  PUT EDIT(TECO,TEHC,TENO) (R(F1));
   /* CLASS SUMMARY */
        PUT EDIT('CLASS SUMMARY') (SKIP(4),X(64),A);
        IF  CLDSTR  THEN  #C_7: DO;
             DO L = 1 TO 5;
                  PUT EDIT(L,TCO_CLASS(L),TCS_CO(L),THC_CLASS(L),
                           TCS_HC(L)) (R(F3));
                  ZECO = TCO_CLASS(L) + TCS_CO(L);
                  ZEHC = THC_CLASS(L) + TCS_HC(L);
                  PUT EDIT(ZECO,ZEHC,TNO_CLASS(L)) (R(F1));
             END  #C_7;
        ELSE  #C_8:  DO;
             DO L = 1 TO 5;
                  PUT EDIT(L,TCO_CLASS(L),THC_CLASS(L),TNO_CLASS(L))
                           (R(F4));
             END  #C_8;
   /* DIESEL EMISSIONS */
        IF  DIESELS  THEN  PUT EDIT('6',TCO_CLASS(6),THC_CLASS(6),
                                  TNO_CLASS(6)) (R(F5));
/* END OF "COMPLETE" SUMMARIES */
 #SAVE: IF  SAVE  THEN  CALL ZONES(Q,CLDSTR);
        RETURN;
    F1: FORMAT(SKIP,X(2),3(X(24),F(12,1)));
    F2: FORMAT(SKIP(2),X(6),
                    A(9),X(11),F(12,1),2(X(24),F(12,1)),SKIP(2),
                    X(6),A(10),X(10),F(12,1),X(24),F(12,1),
                    SKIP(2),X(6),A(5),X(15),F(12,1),
                    2(X(24),F(12,1)));
    F3: FORMAT(SKIP(2),X(9),F(1),2(X(8),F(12,1),X(4),F(12,1)));
    F4: FORMAT(SKIP(2),X(9),F(1),X(16),F(12,1),2(X(24),F(12,1)));
    F5: FORMAT(SKIP(2),X(9),A(1),X(16),F(12,1),2(X(24),F(12,1)));
        END  CLASS;
```

APPENDIX B

Emission Factors

(Tables B.1-B.64)

Table B.1

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1970
(GRAMS PER VEHICLE MILE)

CLASS EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	80.94	96.05	128.54	128.54	128.54	47.53	85.39
RURAL	41.86	49.68	66.49	66.49	66.49	47.53	44.67
HYDROCARBONS							
EVAPORATIONS	3.00	3.00	3.00	3.00	3.00	0.0	2.93
CRANKCASE	0.84	2.04	4.46	4.46	4.46	0.0	1.22
EXHAUSTS							
URBAN	10.01	11.84	20.03	20.03	20.03	9.23	10.97
RURAL	5.99	7.08	11.98	11.98	11.98	9.23	6.65
NITROGEN OXIDE							
URBAN	8.17	8.11	11.97	11.97	11.97	53.99	9.49
RURAL	8.40	8.34	12.30	12.30	12.30	53.99	9.72

Table B.2

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1971
(GRAMS PER VEHICLE MILE)

CLASS EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	71.61	89.40	124.06	124.06	124.06	45.94	76.85
RURAL	37.04	46.24	64.17	64.17	64.17	45.94	40.24
HYDROCARBONS							
EVAPORATIONS	2.61	2.75	3.00	3.00	3.00	0.0	2.60
CRANKCASE	0.58	1.72	3.93	3.93	3.93	0.0	0.94
EXHAUSTS							
URBAN	8.71	10.93	19.67	19.67	19.67	8.66	9.80
RURAL	5.21	6.54	11.76	11.76	11.76	8.66	5.94
NITROGEN OXIDE							
URBAN	7.91	8.00	11.97	11.97	11.97	56.36	9.32
RURAL	8.13	8.22	12.30	12.30	12.30	56.36	9.54

Table B.3

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1973
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	54.10	76.24	112.09	112.09	112.09	43.02	60.49
RURAL	27.98	39.43	57.98	57.98	57.98	43.02	31.75
HYDROCARBONS							
EVAPORATIONS	1.75	2.26	2.78	2.78	2.78	0.0	1.84
CRANKCASE	0.26	1.15	2.97	2.97	2.97	0.0	0.55
EXHAUSTS							
URBAN	6.35	9.16	18.26	18.26	18.26	7.60	7.60
RURAL	3.80	5.48	10.92	10.92	10.92	7.60	4.61
NITROGEN OXIDE							
URBAN	6.77	7.30	11.84	11.84	11.84	60.71	8.42
RURAL	6.96	7.50	12.17	12.17	12.17	60.71	8.62

3

Table B.4

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1972
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	62.33	82.66	119.65	119.65	119.65	44.44	68.36
RURAL	32.24	42.76	61.89	61.89	61.89	44.44	35.83
HYDROCARBONS							
EVAPORATIONS	2.17	2.51	3.00	3.00	3.00	0.0	2.22
CRANKCASE	0.40	1.42	3.44	3.44	3.44	0.0	0.73
EXHAUSTS							
URBAN	7.45	10.02	19.31	19.31	19.31	8.11	8.66
RURAL	4.46	5.99	11.55	11.55	11.55	8.11	5.25
NITROGEN OXIDE							
URBAN	7.49	7.75	11.97	11.97	11.97	58.60	9.01
RURAL	7.70	7.96	12.30	12.30	12.30	58.60	9.22

Table B.5

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1974
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	47.34	70.15	104.62	104.62	104.62	41.68	53.85
RURAL	24.49	36.28	54.11	54.11	54.11	41.68	28.30
HYDROCARBONS							
EVAPORATIONS	1.43	2.02	2.57	2.57	2.57	0.0	1.54
CRANKCASE	0.17	0.91	2.53	2.53	2.53	0.0	0.42
EXHAUSTS							
URBAN	5.46	8.35	17.20	17.20	17.20	7.11	6.70
RURAL	3.26	5.00	10.29	10.29	10.29	7.11	4.07
NITROGEN OXIDE							
URBAN	6.04	6.87	11.72	11.72	11.72	62.70	7.83
RURAL	6.21	7.06	12.05	12.05	12.05	62.70	8.01

Table B.6

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1975
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	38.24	62.09	96.89	96.89	96.89	40.43	45.13
RURAL	19.78	32.11	50.11	50.11	50.11	40.43	23.77
HYDROCARBONS							
EVAPORATIONS	1.12	1.79	2.37	2.37	2.37	0.0	1.26
CRANKCASE	0.11	0.68	2.13	2.13	2.13	0.0	0.32
EXHAUSTS							
URBAN	4.33	7.34	15.94	15.94	15.94	6.66	5.59
RURAL	2.59	4.39	9.54	9.54	9.54	6.66	3.40
NITROGEN OXIDE							
URBAN	5.44	6.46	11.35	11.35	11.35	64.57	7.31
RURAL	5.59	6.64	11.66	11.66	11.66	64.57	7.48

Table B.7

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1976
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	29.59	54.30	88.85	88.85	88.85	39.26	36.76
RURAL	15.31	28.09	45.96	45.96	45.96	39.26	19.43
HYDROCARBONS							
EVAPORATIONS	0.86	1.58	2.19	2.19	2.19	0.0	1.01
CRANKCASE	0.05	0.49	1.75	1.75	1.75	0.0	0.22
EXHAUSTS							
URBAN	3.30	6.37	14.47	14.47	14.47	6.23	4.54
RURAL	1.97	3.81	8.66	8.66	8.66	6.23	2.77
NITROGEN OXIDE							
URBAN	4.50	5.79	10.60	10.60	10.60	66.32	6.47
RURAL	4.62	5.95	10.89	10.89	10.89	66.32	6.61

Table B.8

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1977
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	22.97	46.94	80.92	80.92	80.92	38.18	30.10
RURAL	11.88	24.28	41.86	41.86	41.86	38.18	15.97
HYDROCARBONS							
EVAPORATIONS	0.65	1.38	2.01	2.01	2.01	0.0	0.81
CRANKCASE	0.03	0.32	1.41	1.41	1.41	0.0	0.16
EXHAUSTS							
URBAN	2.52	5.47	13.03	13.03	13.03	5.84	3.70
RURAL	1.51	3.27	7.79	7.79	7.79	5.84	2.27
NITROGEN OXIDE							
URBAN	3.54	5.16	9.85	9.85	9.85	67.93	5.61
RURAL	3.64	5.30	10.12	10.12	10.12	67.93	5.73

Table B.9

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1978
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	18.12	40.09	73.45	73.45	73.45	37.18	24.94
RURAL	9.37	20.73	37.99	37.99	37.99	37.18	13.30
HYDROCARBONS							
EVAPORATIONS	0.48	1.19	1.84	1.84	1.84	0.0	0.64
CRANKCASE	0.01	0.17	1.09	1.09	1.09	0.0	0.11
EXHAUSTS							
URBAN	1.96	4.62	11.66	11.66	11.66	5.48	3.06
RURAL	1.17	2.77	6.98	6.98	6.98	5.48	1.88
NITROGEN OXIDE							
URBAN	2.75	4.56	9.14	9.14	9.14	69.43	4.90
RURAL	2.83	4.69	9.40	9.40	9.40	69.43	4.99

Table B.10

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1979
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	14.29	33.74	66.43	66.43	66.43	36.26	20.71
RURAL	7.39	17.45	34.36	34.36	34.36	36.26	11.09
HYDROCARBONS							
EVAPORATIONS	0.36	1.02	1.69	1.69	1.69	0.0	0.52
CRANKCASE	0.01	0.13	0.81	0.81	0.81	0.0	0.08
EXHAUSTS							
URBAN	1.53	3.85	10.38	10.38	10.38	5.14	2.53
RURAL	0.91	2.31	6.21	6.21	6.21	5.14	1.56
NITROGEN OXIDE							
URBAN	2.17	4.01	8.48	8.48	8.48	70.80	4.35
RURAL	2.23	4.12	8.71	8.71	8.71	70.80	4.43

Table B.11

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1980
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	11.16	27.95	59.91	59.91	59.91	35.42	17.12
RURAL	5.77	14.45	30.99	30.99	30.99	35.42	9.23
HYDROCARBONS							
EVAPORATIONS	0.29	0.86	1.55	1.55	1.55	0.0	0.44
CRANKCASE	0.01	0.09	0.56	0.56	0.56	0.0	0.06
EXHAUSTS							
URBAN	1.19	3.15	9.19	9.19	9.19	4.84	2.09
RURAL	0.71	1.89	5.50	5.50	5.50	4.84	1.29
NITROGEN OXIDE							
URBAN	1.67	3.49	7.85	7.85	7.85	72.04	3.88
RURAL	1.71	3.58	8.07	8.07	8.07	72.04	3.94

Table B.12

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1981
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	8.52	22.70	53.92	53.92	53.92	34.67	14.02
RURAL	4.40	11.74	27.89	27.89	27.89	34.67	7.62
HYDROCARBONS							
EVAPORATIONS	0.25	0.72	1.42	1.42	1.42	0.0	0.38
CRANKCASE	0.0	0.05	0.34	0.34	0.34	0.0	0.03
EXHAUSTS							
URBAN	0.89	2.52	8.09	8.09	8.09	4.57	1.70
RURAL	0.54	1.51	4.84	4.84	4.84	4.57	1.06
NITROGEN OXIDE							
URBAN	1.28	3.01	7.27	7.27	7.27	73.16	3.50
RURAL	1.31	3.09	7.47	7.47	7.47	73.16	3.55

Table B.13

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1982
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	6.83	18.00	48.46	48.46	48.46	34.00	11.79
RURAL	3.53	9.31	25.06	25.06	25.06	34.00	6.46
HYDROCARBONS							
EVAPORATIONS	0.23	0.59	1.29	1.29	1.29	0.0	0.34
CRANKCASE	0.0	0.02	0.16	0.16	0.16	0.0	0.01
EXHAUSTS							
URBAN	0.72	1.96	7.07	7.07	7.07	4.33	1.42
RURAL	0.43	1.17	4.23	4.23	4.23	4.33	0.89
NITROGEN OXIDE							
URBAN	1.00	2.56	6.72	6.72	6.72	74.16	3.22
RURAL	1.03	2.63	6.91	6.91	6.91	74.16	3.26

Table B.14

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1983
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	5.57	13.88	43.52	43.52	43.52	33.42	10.00
RURAL	2.88	7.18	22.51	22.51	22.51	33.42	5.53
HYDROCARBONS							
EVAPORATIONS	0.22	0.48	1.18	1.18	1.18	0.0	0.32
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.58	1.47	6.15	6.15	6.15	4.11	1.19
RURAL	0.35	0.88	3.68	3.68	3.68	4.11	0.75
NITROGEN OXIDE							
URBAN	0.80	2.16	6.22	6.22	6.22	75.03	2.99
RURAL	0.82	2.22	6.40	6.40	6.40	75.03	3.03

Table B.15

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1984
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	4.93	11.63	39.13	39.13	39.13	32.92	8.92
RURAL	2.55	6.01	20.24	20.24	20.24	32.92	4.96
HYDROCARBONS							
EVAPORATIONS	0.20	0.38	1.09	1.09	1.09	0.0	0.29
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.52	1.22	5.32	5.32	5.32	3.93	1.04
RURAL	0.31	0.73	3.18	3.18	3.18	3.93	0.66
NITROGEN OXIDE							
URBAN	0.67	1.77	5.76	5.76	5.76	75.78	2.83
RURAL	0.69	1.82	5.92	5.92	5.92	75.78	2.87

Table B.16

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1985
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	4.51	9.61	35.28	35.28	35.28	32.50	8.09
RURAL	2.33	4.97	18.25	18.25	18.25	32.50	4.53
HYDROCARBONS							
EVAPORATIONS	0.20	0.29	1.00	1.00	1.00	0.0	0.27
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.47	0.99	4.58	4.58	4.58	3.78	0.92
RURAL	0.28	0.59	2.74	2.74	2.74	3.78	0.59
NITROGEN OXIDE							
URBAN	0.60	1.43	5.34	5.34	5.34	76.40	2.72
RURAL	0.61	1.46	5.49	5.49	5.49	76.40	2.75

Table B.17

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1970
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	53.05	64.50	34.54	84.54	84.54	47.53	56.49
RURAL	27.44	33.36	43.72	43.72	43.72	47.53	29.72
HYDROCARBONS							
EVAPORATIONS	3.00	3.00	3.00	3.00	3.00	0.0	2.93
CRANKCASE	0.84	2.04	4.46	4.46	4.46	0.0	1.22
EXHAUSTS							
URBAN	8.30	10.09	16.55	16.55	16.55	9.23	9.15
RURAL	4.96	6.04	9.90	9.90	9.90	9.23	5.55
NITROGEN OXIDE							
URBAN	8.17	8.11	11.97	11.97	11.97	53.99	9.49
RURAL	8.40	8.34	12.30	12.30	12.30	53.99	9.72

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	209.15	236.64	330.05	330.05	330.05	0.0	216.80
HYDROCARBONS	12.86	13.15	26.10	26.10	26.10	0.0	13.69

Table B.18

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1971
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	45.83	59.28	79.98	79.98	79.98	45.94	49.77
RURAL	23.70	30.66	41.37	41.37	41.37	45.94	26.23
HYDROCARBONS							
EVAPORATIONS	2.61	2.75	3.00	3.00	3.00	0.0	2.60
CRANKCASE	0.58	1.72	3.93	3.93	3.93	0.0	0.94
EXHAUSTS							
URBAN	7.06	9.20	15.84	15.84	15.84	8.66	8.00
RURAL	4.22	5.50	9.48	9.48	9.48	8.66	4.86
NITROGEN OXIDE							
URBAN	7.91	8.00	11.97	11.97	11.97	56.36	9.32
RURAL	8.13	8.22	12.30	12.30	12.30	56.36	9.54

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	193.33	225.92	330.61	330.61	330.61	0.0	203.11
HYDROCARBONS	12.39	12.96	28.68	28.68	28.68	0.0	13.50

Table B.19

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1972
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	38.27	53.84	74.89	74.89	74.89	44.44	42.73
RURAL	19.79	27.85	38.73	38.73	38.73	44.44	22.57
HYDROCARBONS							
EVAPORATIONS	2.17	2.51	3.00	3.00	3.00	0.0	2.22
CRANKCASE	0.40	1.42	3.44	3.44	3.44	0.0	0.73
EXHAUSTS							
URBAN	5.82	8.30	15.03	15.03	15.03	8.11	6.84
RURAL	3.48	4.97	8.99	8.99	8.99	8.11	4.16
NITROGEN OXIDE							
URBAN	7.49	7.75	11.97	11.97	11.97	58.60	9.01
RURAL	7.70	7.96	12.30	12.30	12.30	58.60	9.22

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	180.46	216.14	335.75	335.75	335.75	0.0	192.26
HYDROCARBONS	12.26	12.87	32.16	32.16	32.16	0.0	13.68

Table B.20

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1973
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	31.07	48.40	68.32	68.32	68.32	43.02	35.86
RURAL	16.07	25.04	35.34	35.34	35.34	43.02	19.00
HYDROCARBONS							
EVAPORATIONS	1.75	2.26	2.78	2.78	2.78	0.0	1.84
CRANKCASE	0.26	1.15	2.97	2.97	2.97	0.0	0.55
EXHAUSTS							
URBAN	4.68	7.43	13.80	13.80	13.80	7.60	5.72
RURAL	2.80	4.44	8.26	8.26	8.26	7.60	3.49
NITROGEN OXIDE							
URBAN	6.77	7.30	11.84	11.84	11.84	60.71	8.42
RURAL	6.96	7.50	12.17	12.17	12.17	60.71	8.62

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	172.74	208.74	328.27	328.27	328.27	0.0	184.76
HYDROCARBONS	12.59	12.99	33.41	33.41	33.41	0.0	14.05

Table B.21

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1974
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	24.69	42.98	61.59	61.59	61.59	41.68	29.65
RURAL	12.77	22.23	31.86	31.86	31.86	41.68	15.78
HYDROCARBONS							
EVAPORATIONS	1.43	2.02	2.57	2.57	2.57	0.0	1.54
CRANKCASE	0.17	0.91	2.53	2.53	2.53	0.0	0.42
EXHAUSTS							
URBAN	3.70	6.58	12.55	12.55	12.55	7.11	4.74
RURAL	2.21	3.93	7.50	7.50	7.50	7.11	2.90
NITROGEN OXIDE							
URBAN	6.04	6.87	11.72	11.72	11.72	62.70	7.83
RURAL	6.21	7.06	12.05	12.05	12.05	62.70	8.01

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	169.86	203.78	322.74	322.74	322.74	0.0	181.54
HYDROCARBONS	13.19	13.32	34.92	34.92	34.92	0.0	14.69

Table B.22

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1975
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	18.51	37.31	54.72	54.72	54.72	40.43	23.56
RURAL	9.58	19.30	28.30	28.30	28.30	40.43	12.62
HYDROCARBONS							
EVAPORATIONS	1.12	1.79	2.37	2.37	2.37	0.0	1.26
CRANKCASE	0.11	0.68	2.13	2.13	2.13	0.0	0.32
EXHAUSTS							
URBAN	2.75	5.69	11.22	11.22	11.22	6.66	3.78
RURAL	1.65	3.40	6.71	6.71	6.71	6.66	2.32
NITROGEN OXIDE							
URBAN	5.44	6.46	11.35	11.35	11.35	64.57	7.31
RURAL	5.59	6.64	11.66	11.66	11.66	64.57	7.48

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	147.97	185.81	316.27	316.27	316.27	0.0	161.73
HYDROCARBONS	11.88	12.42	35.45	35.45	35.45	0.0	13.60

Table B.23

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1976
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	13.35	31.96	48.09	48.09	48.09	39.26	18.35
RURAL	6.91	16.53	24.88	24.88	24.88	39.26	9.91
HYDROCARBONS							
EVAPORATIONS	0.86	1.58	2.19	2.19	2.19	0.0	1.01
CRANKCASE	0.05	0.49	1.75	1.75	1.75	0.0	0.22
EXHAUSTS							
URBAN	1.97	4.85	9.89	9.89	9.89	6.23	2.95
RURAL	1.18	2.90	5.91	5.91	5.91	6.23	1.82
NITROGEN OXIDE							
URBAN	4.50	5.79	10.60	10.60	10.60	66.32	6.47
RURAL	4.62	5.95	10.89	10.89	10.89	66.32	6.61

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	121.79	167.54	305.69	305.69	305.69	0.0	138.08
HYDROCARBONS	9.99	11.42	34.38	34.38	34.38	0.0	11.89

Table B.24

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1977
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	9.59	26.95	41.80	41.80	41.80	38.18	14.34
RURAL	4.96	13.94	21.62	21.62	21.62	38.18	7.82
HYDROCARBONS							
EVAPORATIONS	0.65	1.38	2.01	2.01	2.01	0.0	0.81
CRANKCASE	0.03	0.32	1.41	1.41	1.41	0.0	0.16
EXHAUSTS							
URBAN	1.41	4.07	8.62	8.62	8.62	5.84	2.32
RURAL	0.84	2.44	5.16	5.16	5.16	5.84	1.44
NITROGEN OXIDE							
URBAN	3.54	5.16	9.85	9.85	9.85	67.93	5.61
RURAL	3.64	5.30	10.12	10.12	10.12	67.93	5.73

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	100.34	149.93	293.41	293.41	293.41	0.0	118.18
HYDROCARBONS	8.35	10.44	33.03	33.03	33.03	0.0	10.37

Table B.25

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1978
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	6.78	22.32	35.92	35.92	35.92	37.18	11.16
RURAL	3.51	11.54	18.58	18.58	18.58	37.18	6.17
HYDROCARBONS							
EVAPORATIONS	0.48	1.19	1.84	1.84	1.84	0.0	0.64
CRANKCASE	0.01	0.17	1.09	1.09	1.09	0.0	0.11
EXHAUSTS							
URBAN	1.00	3.35	7.44	7.44	7.44	5.48	1.83
RURAL	0.60	2.01	4.45	4.45	4.45	5.48	1.14
NITROGEN OXIDE							
URBAN	2.75	4.56	9.14	9.14	9.14	69.43	4.90
RURAL	2.83	4.69	9.40	9.40	9.40	69.43	4.99

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	85.08	133.23	281.45	281.45	281.45	0.0	103.40
HYDROCARBONS	7.19	9.51	31.63	31.63	31.63	0.0	9.23

Table B.26

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1979
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	4.80	18.06	30.45	30.45	30.45	36.26	8.72
RURAL	2.48	9.34	15.75	15.75	15.75	36.26	4.90
HYDROCARBONS							
EVAPORATIONS	0.36	1.02	1.69	1.69	1.69	0.0	0.52
CRANKCASE	0.01	0.13	0.81	0.81	0.81	0.0	0.08
EXHAUSTS							
URBAN	0.72	2.70	6.35	6.35	6.35	5.14	1.45
RURAL	0.43	1.62	3.80	3.80	3.80	5.14	0.91
NITROGEN OXIDE							
URBAN	2.17	4.01	8.48	8.48	8.48	70.80	4.35
RURAL	2.23	4.12	8.71	8.71	8.71	70.80	4.43

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	71.22	117.60	269.84	269.84	269.84	0.0	89.88
HYDROCARBONS	6.08	8.62	30.22	30.22	30.22	0.0	8.14

Table B.27

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1980
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	3.36	14.20	25.42	25.42	25.42	35.42	6.80
RURAL	1.74	7.34	13.15	13.15	13.15	35.42	3.89
HYDROCARBONS							
EVAPORATIONS	0.29	0.86	1.55	1.55	1.55	0.0	0.44
CRANKCASE	0.01	0.09	0.56	0.56	0.56	0.0	0.06
EXHAUSTS							
URBAN	0.52	2.11	5.34	5.34	5.34	4.84	1.14
RURAL	0.31	1.26	3.20	3.20	3.20	4.84	0.73
NITROGEN OXIDE							
URBAN	1.67	3.49	7.85	7.85	7.85	72.04	3.88
RURAL	1.71	3.58	8.07	8.07	8.07	72.04	3.94

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	58.50	103.10	258.73	258.73	258.73	0.0	77.42
HYDROCARBONS	5.03	7.79	28.84	28.84	28.84	0.0	7.10

Table B.28

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1981
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	2.09	10.73	20.83	20.83	20.83	34.67	5.08
RURAL	1.08	5.55	10.77	10.77	10.77	34.67	3.00
HYDROCARBONS							
EVAPORATIONS	0.25	0.72	1.42	1.42	1.42	0.0	0.38
CRANKCASE	0.0	0.05	0.34	0.34	0.34	0.0	0.03
EXHAUSTS							
URBAN	0.33	1.58	4.42	4.42	4.42	4.57	0.87
RURAL	0.20	0.95	2.65	2.65	2.65	4.57	0.56
NITROGEN OXIDE							
URBAN	1.28	3.01	7.27	7.27	7.27	73.16	3.50
RURAL	1.31	3.09	7.47	7.47	7.47	73.16	3.55

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	48.16	89.74	248.25	248.25	248.25	0.0	67.04
HYDROCARBONS	4.22	7.01	27.47	27.47	27.47	0.0	6.27

Table B.29

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1982
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	1.46	7.66	16.68	16.68	16.68	34.00	3.95
RURAL	0.75	3.96	8.63	8.63	8.63	34.00	2.40
HYDROCARBONS							
EVAPORATIONS	0.23	0.59	1.29	1.29	1.29	0.0	0.34
CRANKCASE	0.0	0.02	0.16	0.16	0.16	0.0	0.01
EXHAUSTS							
URBAN	0.24	1.12	3.59	3.59	3.59	4.33	0.68
RURAL	0.15	0.67	2.15	2.15	2.15	4.33	0.45
NITROGEN OXIDE							
URBAN	1.00	2.56	6.72	6.72	6.72	74.16	3.22
RURAL	1.03	2.63	6.91	6.91	6.91	74.16	3.26

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	40.26	77.54	238.33	238.33	238.33	0.0	58.79
HYDROCARBONS	3.55	6.29	26.12	26.12	26.12	0.0	5.56

Table B.30

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1983
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	1.01	5.00	12.99	12.99	12.99	33.42	3.05
RURAL	C.52	2.59	6.72	6.72	6.72	33.42	1.93
HYDROCARBONS							
EVAPORATIONS	0.22	0.48	1.18	1.18	1.18	0.0	0.32
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.18	0.72	2.85	2.85	2.85	4.11	0.53
RURAL	0.11	0.43	1.70	1.70	1.70	4.11	0.35
NITROGEN OXIDE							
URBAN	0.80	2.16	6.22	6.22	6.22	75.03	2.99
RURAL	0.82	2.22	6.40	6.40	6.40	75.03	3.03

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	34.15	66.61	229.03	229.03	229.03	0.0	52.14
HYDROCARBONS	3.02	5.63	24.79	24.79	24.79	0.0	4.96

Table B.31

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1984
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	0.79	3.77	10.10	10.10	10.10	32.92	2.51
RURAL	0.41	1.95	5.22	5.22	5.22	32.92	1.65
HYDROCARBONS							
EVAPORATIONS	0.20	0.38	1.09	1.09	1.09	0.0	0.29
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.15	0.55	2.27	2.27	2.27	3.93	0.44
RURAL	0.09	0.33	1.36	1.36	1.36	3.93	0.30
NITROGEN OXIDE							
URBAN	0.67	1.77	5.76	5.76	5.76	75.78	2.83
RURAL	0.69	1.82	5.92	5.92	5.92	75.78	2.87

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	31.10	58.90	217.76	217.76	217.76	0.0	48.08
HYDROCARBONS	2.77	5.00	22.90	22.90	22.90	0.0	4.55

Table B.32

******** COOK COUNTY AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1985
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	0.65	2.69	7.58	7.58	7.58	32.50	2.09
RURAL	0.33	1.39	3.92	3.92	3.92	32.50	1.43
HYDROCARBONS							
EVAPORATIONS	0.20	0.29	1.00	1.00	1.00	0.0	0.27
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.13	0.40	1.75	1.75	1.75	3.78	0.36
RURAL	0.08	0.24	1.05	1.05	1.05	3.78	0.25
NITROGEN OXIDE							
URBAN	0.60	1.43	5.34	5.34	5.34	76.40	2.72
RURAL	0.61	1.46	5.49	5.49	5.49	76.40	2.75

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	29.00	51.90	207.79	207.79	207.79	0.0	44.97
HYDROCARBONS	2.59	4.43	21.17	21.17	21.17	0.0	4.21

Table B.33

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1970
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	85.55	96.05	128.54	128.54	128.54	47.53	89.13
RURAL	44.25	49.68	66.49	66.49	66.49	47.53	46.61
HYDROCARBONS							
EVAPORATIONS	3.00	3.00	3.00	3.00	3.00	0.0	2.93
CRANKCASE	1.23	2.04	4.46	4.46	4.46	0.0	1.54
EXHAUSTS							
URBAN	10.57	11.84	20.03	20.03	20.03	9.23	11.42
RURAL	6.32	7.08	11.98	11.98	11.98	9.23	6.92
NITROGEN OXIDE							
URBAN	8.11	8.11	11.97	11.97	11.97	53.99	9.44
RURAL	8.34	8.34	12.30	12.30	12.30	53.99	9.67

Table B.34

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1971
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	77.36	89.40	124.06	124.06	124.06	45.94	81.52
RURAL	40.01	46.24	64.17	64.17	64.17	45.94	42.65
HYDROCARBONS							
EVAPORATIONS	2.61	2.75	3.00	3.00	3.00	0.0	2.59
CRANKCASE	0.92	1.72	3.93	3.93	3.93	0.0	1.22
EXHAUSTS							
URBAN	9.43	10.93	19.67	19.67	19.67	8.66	10.38
RURAL	5.64	6.54	11.76	11.76	11.76	8.66	6.29
NITROGEN OXIDE							
URBAN	7.93	8.00	11.97	11.97	11.97	56.36	9.33
RURAL	8.15	8.22	12.30	12.30	12.30	56.36	9.55

Table B.35

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1972
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	69.15	82.66	119.65	119.65	119.65	44.44	73.89
RURAL	35.77	42.76	61.89	61.89	61.89	44.44	38.69
HYDROCARBONS							
EVAPORATIONS	2.27	2.51	3.00	3.00	3.00	0.0	2.30
CRANKCASE	0.67	1.42	3.44	3.44	3.44	0.0	0.94
EXHAUSTS							
URBAN	8.32	10.02	19.31	19.31	19.31	8.11	9.36
RURAL	4.98	5.99	11.55	11.55	11.55	8.11	5.67
NITROGEN OXIDE							
URBAN	7.55	7.75	11.97	11.97	11.97	58.60	9.05
RURAL	7.76	7.96	12.30	12.30	12.30	58.60	9.27

Table B.36

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1973
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	61.90	75.24	112.09	112.09	112.09	43.02	66.82
RURAL	32.02	39.43	57.98	57.98	57.98	43.02	35.02
HYDROCARBONS							
EVAPORATIONS	1.92	2.26	2.78	2.78	2.78	0.0	1.97
CRANKCASE	0.48	1.15	2.97	2.97	2.97	0.0	0.73
EXHAUSTS							
URBAN	7.35	9.16	18.26	18.26	18.26	7.60	8.41
RURAL	4.40	5.48	10.92	10.92	10.92	7.60	5.10
NITROGEN OXIDE							
URBAN	6.89	7.30	11.84	11.84	11.84	60.71	8.51
RURAL	7.08	7.50	12.17	12.17	12.17	60.71	8.71

Table B.37

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1974
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	55.17	70.15	104.62	104.62	104.62	41.68	60.20
RURAL	28.54	36.28	54.11	54.11	54.11	41.68	31.58
HYDROCARBONS							
EVAPORATIONS	1.62	2.02	2.57	2.57	2.57	0.0	1.70
CRANKCASE	0.34	0.91	2.53	2.53	2.53	0.0	0.56
EXHAUSTS							
URBAN	6.46	8.35	17.20	17.20	17.20	7.11	7.51
RURAL	3.86	5.00	10.29	10.29	10.29	7.11	4.56
NITROGEN OXIDE							
URBAN	6.31	6.87	11.72	11.72	11.72	62.70	8.04
RURAL	6.48	7.06	12.05	12.05	12.05	62.70	8.23

Table B.38

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1975
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	45.61	62.09	96.89	96.89	96.89	40.43	51.10
RURAL	23.59	32.11	50.11	50.11	50.11	40.43	26.86
HYDROCARBONS							
EVAPORATIONS	1.35	1.79	2.37	2.37	2.37	0.0	1.44
CRANKCASE	0.24	0.58	2.13	2.13	2.13	0.0	0.43
EXHAUSTS							
URBAN	5.28	7.34	15.94	15.94	15.94	6.66	6.36
RURAL	3.16	4.39	9.54	9.54	9.54	6.66	3.86
NITROGEN OXIDE							
URBAN	5.80	6.46	11.35	11.35	11.35	64.57	7.61
RURAL	5.96	6.54	11.66	11.66	11.66	64.57	7.78

Table B.39

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1976
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	37.06	54.30	88.85	88.85	88.85	39.26	42.82
RURAL	19.17	28.09	45.96	45.96	45.96	39.26	22.57
HYDROCARBONS							
EVAPORATIONS	1.12	1.58	2.19	2.19	2.19	0.0	1.22
CRANKCASE	0.11	0.49	1.75	1.75	1.75	0.0	0.28
EXHAUSTS							
URBAN	4.23	6.37	14.47	14.47	14.47	6.23	5.30
RURAL	2.53	3.81	8.66	8.66	8.66	6.23	3.22
NITROGEN OXIDE							
URBAN	4.90	5.79	10.60	10.60	10.60	66.32	6.79
RURAL	5.03	5.95	10.89	10.89	10.89	66.32	6.94

Table B.40

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1977
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	29.64	46.94	80.92	80.92	80.92	38.18	35.50
RURAL	15.33	24.28	41.86	41.86	41.86	38.18	18.77
HYDROCARBONS							
EVAPORATIONS	0.90	1.38	2.01	2.01	2.01	0.0	1.01
CRANKCASE	0.07	0.32	1.41	1.41	1.41	0.0	0.20
EXHAUSTS							
URBAN	3.33	5.47	13.03	13.03	13.03	5.84	4.36
RURAL	1.99	3.27	7.79	7.79	7.79	5.84	2.66
NITROGEN OXIDE							
URBAN	4.09	5.16	9.85	9.85	9.85	67.93	6.06
RURAL	4.21	5.30	10.12	10.12	10.12	67.93	6.19

Table B.41

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1978
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	23.86	40.08	73.45	73.45	73.45	37.18	29.59
RURAL	12.34	20.73	37.99	37.99	37.99	37.18	15.70
HYDROCARBONS							
EVAPORATIONS	0.71	1.19	1.84	1.84	1.84	0.0	0.83
CRANKCASE	0.04	0.17	1.09	1.09	1.09	0.0	0.14
EXHAUSTS							
URBAN	2.64	4.62	11.66	11.66	11.66	5.48	3.61
RURAL	1.58	2.77	6.98	6.98	6.98	5.48	2.21
NITROGEN OXIDE							
URBAN	3.38	4.56	9.14	9.14	9.14	69.43	5.41
RURAL	3.48	4.69	9.40	9.40	9.40	69.43	5.52

Table B.42

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1979
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	19.15	33.74	66.43	66.43	66.43	36.26	24.64
RURAL	9.90	17.45	34.36	34.36	34.36	36.26	13.13
HYDROCARBONS							
EVAPORATIONS	0.56	1.02	1.69	1.69	1.69	0.0	0.68
CRANKCASE	0.03	0.13	0.81	0.81	0.81	0.0	0.10
EXHAUSTS							
URBAN	2.09	3.35	10.38	10.38	10.38	5.14	2.99
RURAL	1.25	2.31	6.21	6.21	6.21	5.14	1.83
NITROGEN OXIDE							
URBAN	2.77	4.01	8.48	8.48	8.48	70.80	4.84
RURAL	2.84	4.12	8.71	8.71	8.71	70.80	4.93

Table B.43

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1980
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	15.62	27.95	59.91	59.91	59.91	35.42	20.74
RURAL	8.08	14.45	30.99	30.99	30.99	35.42	11.10
HYDROCARBONS							
EVAPORATIONS	0.43	0.86	1.55	1.55	1.55	0.0	0.55
CRANKCASE	0.02	0.09	0.56	0.56	0.56	0.0	0.07
EXHAUSTS							
URBAN	1.69	3.15	9.19	9.19	9.19	4.84	2.50
RURAL	1.01	1.89	5.50	5.50	5.50	4.84	1.54
NITROGEN OXIDE							
URBAN	2.23	3.49	7.85	7.85	7.85	72.04	4.34
RURAL	2.29	3.58	8.07	8.07	8.07	72.04	4.41

Table B.44

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1981
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	11.73	22.70	53.92	53.92	53.92	34.67	16.63
RURAL	6.07	11.74	27.89	27.89	27.89	34.67	8.97
HYDROCARBONS							
EVAPORATIONS	0.35	0.72	1.42	1.42	1.42	0.0	0.46
CRANKCASE	0.0	0.05	0.34	0.34	0.34	0.0	0.03
EXHAUSTS							
URBAN	1.24	2.52	8.09	8.09	8.09	4.57	1.98
RURAL	0.74	1.51	4.84	4.84	4.84	4.57	1.23
NITROGEN OXIDE							
URBAN	1.81	3.01	7.27	7.27	7.27	73.16	3.93
RURAL	1.86	3.09	7.47	7.47	7.47	73.16	3.99

Table B.45

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSICN FACTORS FOR 1982
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	9.59	18.00	48.46	48.46	48.46	34.00	14.03
RURAL	4.96	9.31	25.06	25.06	25.06	34.00	7.62
HYDROCARBONS							
EVAPORATIONS	0.29	0.59	1.29	1.29	1.29	0.0	0.39
CRANKCASE	0.0	0.02	0.16	0.16	0.16	0.0	0.01
EXHAUSTS							
URBAN	1.01	1.96	7.07	7.07	7.07	4.33	1.66
RURAL	0.60	1.17	4.23	4.23	4.23	4.33	1.03
NITROGEN OXIDE							
URBAN	1.44	2.56	6.72	6.72	6.72	74.16	3.57
RURAL	1.48	2.63	6.91	6.91	6.91	74.16	3.62

Table B.46

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1983
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	7.66	13.88	43.52	43.52	43.52	33.42	11.70
RURAL	3.96	7.18	22.51	22.51	22.51	33.42	6.41
HYDROCARBONS							
EVAPORATIONS	0.26	0.48	1.18	1.18	1.18	0.0	0.35
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.80	1.47	6.15	6.15	6.15	4.11	1.37
RURAL	0.48	0.88	3.68	3.68	3.68	4.11	0.85
NITROGEN OXIDE							
URBAN	1.13	2.16	6.22	6.22	6.22	75.03	3.26
RURAL	1.16	2.22	6.40	6.40	6.40	75.03	3.30

Table B.47

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1964
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	6.38	11.63	39.13	39.13	39.13	32.92	10.09
RURAL	3.30	6.01	20.24	20.24	20.24	32.92	5.57
HYDROCARBONS							
EVAPORATIONS	0.21	0.38	1.09	1.09	1.09	0.0	0.29
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.66	1.22	5.32	5.32	5.32	3.93	1.16
RURAL	0.40	0.73	3.18	3.18	3.18	3.93	0.73
NITROGEN OXIDE							
URBAN	0.93	1.77	5.76	5.76	5.76	75.78	3.04
RURAL	0.95	1.82	5.92	5.92	5.92	75.78	3.08

Table B.48

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1985
(GRAMS PER VEHICLE MILE)

CLASS / EMISSIONS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	5.47	9.51	35.28	35.28	35.28	32.50	8.86
RURAL	2.83	4.97	18.25	18.25	18.25	32.50	4.93
HYDROCARBONS							
EVAPORATIONS	0.21	0.29	1.00	1.00	1.00	0.0	0.27
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.57	0.99	4.58	4.58	4.58	3.78	1.00
RURAL	0.34	0.59	2.74	2.74	2.74	3.78	0.63
NITROGEN OXIDE							
URBAN	0.76	1.43	5.34	5.34	5.34	76.40	2.85
RURAL	0.78	1.46	5.49	5.49	5.49	76.40	2.89

Table B.49

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1970
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	56.63	64.50	84.54	84.54	84.54	47.53	59.38
RURAL	29.29	33.36	43.72	43.72	43.72	47.53	31.22
HYDROCARBONS							
EVAPORATIONS	3.00	3.00	3.00	3.00	3.00	0.0	2.93
CRANKCASE	1.23	2.04	4.46	4.46	4.46	0.0	1.54
EXHAUSTS							
URBAN	8.86	10.09	16.55	16.55	16.55	9.23	9.60
RURAL	5.30	6.04	9.90	9.90	9.90	9.23	5.83
NITROGEN OXIDE							
URBAN	8.11	8.11	11.97	11.97	11.97	53.99	9.44
RURAL	8.34	8.34	12.30	12.30	12.30	53.99	9.67

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	216.95	236.64	330.05	330.05	330.05	0.0	223.13
HYDROCARBONS	12.83	13.15	26.10	26.10	26.10	0.0	13.66

Table B.50

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1971
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	50.17	59.28	79.98	79.98	79.98	45.94	53.30
RURAL	25.95	30.66	41.37	41.37	41.37	45.94	28.05
HYDROCARBONS							
EVAPORATIONS	2.61	2.75	3.00	3.00	3.00	0.0	2.59
CRANKCASE	0.92	1.72	3.93	3.93	3.93	0.0	1.22
EXHAUSTS							
URBAN	7.76	9.20	15.84	15.84	15.84	8.66	8.56
RURAL	4.64	5.50	9.48	9.48	9.48	8.66	5.20
NITROGEN OXIDE							
URBAN	7.93	8.00	11.97	11.97	11.97	56.36	9.33
RURAL	8.15	8.22	12.30	12.30	12.30	56.36	9.55

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	203.94	225.92	330.61	330.61	330.61	0.0	211.71
HYDROCARBONS	12.56	12.95	28.68	28.68	28.68	0.0	13.64

Table B.51

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1972
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	43.48	53.84	74.89	74.89	74.89	44.44	46.96
RURAL	22.49	27.85	38.73	38.73	38.73	44.44	24.76
HYDROCARBONS							
EVAPORATIONS	2.27	2.51	3.00	3.00	3.00	0.0	2.30
CRANKCASE	0.67	1.42	3.44	3.44	3.44	0.0	0.94
EXHAUSTS							
URBAN	6.66	8.30	15.03	15.03	15.03	8.11	7.52
RURAL	3.98	4.97	8.99	8.99	8.99	8.11	4.57
NITROGEN OXIDE							
URBAN	7.55	7.75	11.97	11.97	11.97	58.60	9.05
RURAL	7.76	7.96	12.30	12.30	12.30	58.60	9.27

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	192.53	216.14	335.75	335.75	335.75	0.0	202.04
HYDROCARBONS	12.47	12.87	32.16	32.16	32.16	0.0	13.84

Table B.52

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1973
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	37.16	48.40	68.32	68.32	68.32	43.02	40.80
RURAL	19.22	25.04	35.34	35.34	35.34	43.02	21.56
HYDROCARBONS							
EVAPORATIONS	1.92	2.26	2.78	2.78	2.78	0.0	1.97
CRANKCASE	0.48	1.15	2.97	2.97	2.97	0.0	0.73
EXHAUSTS							
URBAN	5.66	7.43	13.80	13.80	13.80	7.60	6.52
RURAL	3.38	4.44	8.26	8.26	8.26	7.60	3.97
NITROGEN OXIDE							
URBAN	6.89	7.30	11.84	11.84	11.84	60.71	8.51
RURAL	7.08	7.50	12.17	12.17	12.17	60.71	8.71

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	185.58	208.74	328.27	328.27	328.27	0.0	195.17
HYDROCARBONS	12.73	12.99	33.41	33.41	33.41	0.0	14.17

Table B.53

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1974
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	30.94	42.98	61.59	61.59	61.59	41.68	34.71
RURAL	16.00	22.23	31.86	31.86	31.86	41.68	18.40
HYDROCARBONS							
EVAPORATIONS	1.62	2.02	2.57	2.57	2.57	0.0	1.70
CRANKCASE	0.34	0.91	2.53	2.53	2.53	0.0	0.56
EXHAUSTS							
URBAN	4.69	6.58	12.55	12.55	12.55	7.11	5.55
RURAL	2.81	3.93	7.50	7.50	7.50	7.11	3.38
NITROGEN OXIDE							
URBAN	6.31	6.87	11.72	11.72	11.72	62.70	8.04
RURAL	6.48	7.06	12.05	12.05	12.05	62.70	8.23

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	181.76	203.78	322.74	322.74	322.74	0.0	191.19
HYDROCARBONS	13.26	13.32	34.92	34.92	34.92	0.0	14.75

Table B.54

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1975
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	24.59	37.31	54.72	54.72	54.72	40.43	28.49
RURAL	12.72	19.30	28.30	28.30	28.30	40.43	15.16
HYDROCARBONS							
EVAPORATIONS	1.35	1.79	2.37	2.37	2.37	0.0	1.44
CRANKCASE	0.24	0.68	2.13	2.13	2.13	0.0	0.43
EXHAUSTS							
URBAN	3.70	5.69	11.22	11.22	11.22	6.66	4.55
RURAL	2.21	3.40	6.71	6.71	6.71	6.66	2.78
NITROGEN OXIDE							
URBAN	5.80	6.46	11.35	11.35	11.35	64.57	7.61
RURAL	5.96	6.64	11.66	11.66	11.66	64.57	7.78

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	157.65	185.81	316.27	316.27	316.27	0.0	169.58
HYDROCARBONS	11.84	12.42	35.45	35.45	35.45	0.0	13.56

Table B.55

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1976
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	19.10	31.96	48.09	48.09	48.09	39.26	23.01
RURAL	9.88	16.53	24.88	24.88	24.88	39.26	12.32
HYDROCARBONS							
EVAPORATIONS	1.12	1.58	2.19	2.19	2.19	0.0	1.22
CRANKCASE	0.11	0.49	1.75	1.75	1.75	0.0	0.28
EXHAUSTS							
URBAN	2.85	4.85	9.89	9.89	9.89	6.23	3.67
RURAL	1.71	2.90	5.91	5.91	5.91	6.23	2.25
NITROGEN OXIDE							
URBAN	4.90	5.79	10.60	10.60	10.60	66.32	6.79
RURAL	5.03	5.95	10.89	10.89	10.89	66.32	6.94

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	134.73	167.54	305.69	305.69	305.69	0.0	148.58
HYDROCARBONS	10.36	11.42	34.38	34.38	34.38	0.0	12.19

Table B.56

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1977
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	14.39	26.95	41.80	41.80	41.80	38.18	18.23
RURAL	7.44	13.94	21.62	21.62	21.62	38.18	9.84
HYDROCARBONS							
EVAPORATIONS	0.90	1.38	2.01	2.01	2.01	0.0	1.01
CRANKCASE	0.07	0.32	1.41	1.41	1.41	0.0	0.20
EXHAUSTS							
URBAN	2.13	4.07	8.62	8.62	8.62	5.84	2.91
RURAL	1.27	2.44	5.16	5.16	5.16	5.84	1.79
NITROGEN OXIDE							
URBAN	4.09	5.16	9.85	9.85	9.85	67.93	6.06
RURAL	4.21	5.30	10.12	10.12	10.12	67.93	6.19

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	114.32	149.93	293.41	293.41	293.41	0.0	129.52
HYDROCARBONS	9.01	10.44	33.03	33.03	33.03	0.0	10.91

Table B.57

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1978
(GRAMS PER VEHICLE MILE)

EMISSIONS / CLASS	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE							
URBAN	10.77	22.32	35.92	35.92	35.92	37.18	14.39
RURAL	5.57	11.54	18.58	18.58	18.58	37.18	7.84
HYDROCARBONS							
EVAPORATIONS	0.71	1.19	1.84	1.84	1.84	0.0	0.83
CRANKCASE	0.04	0.17	1.09	1.09	1.09	0.0	0.14
EXHAUSTS							
URBAN	1.59	3.36	7.44	7.44	7.44	5.48	2.30
RURAL	0.95	2.01	4.45	4.45	4.45	5.48	1.43
NITROGEN OXIDE							
URBAN	3.38	4.56	9.14	9.14	9.14	69.43	5.41
RURAL	3.48	4.69	9.40	9.40	9.40	69.43	5.52

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	98.17	133.23	281.45	281.45	281.45	0.0	114.02
HYDROCARBONS	7.92	9.51	31.63	31.63	31.63	0.0	9.82

Table B.58

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1979
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	7.96	18.06	30.45	30.45	30.45	36.26	11.28
RURAL	4.12	9.34	15.75	15.75	15.75	36.26	6.22
HYDROCARBONS							
EVAPORATIONS	0.56	1.02	1.69	1.69	1.69	0.0	0.68
CRANKCASE	0.03	0.13	0.81	0.81	0.81	0.0	0.10
EXHAUSTS							
URBAN	1.17	2.70	6.35	6.35	6.35	5.14	1.81
RURAL	0.70	1.62	3.80	3.80	3.80	5.14	1.13
NITROGEN OXIDE							
URBAN	2.77	4.01	8.48	8.48	8.48	70.80	4.84
RURAL	2.84	4.12	8.71	8.71	8.71	70.80	4.93

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	83.92	117.60	269.84	269.84	269.84	0.0	100.18
HYDROCARBONS	6.88	8.62	30.22	30.22	30.22	0.0	8.79

Table B.59

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1980
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	5.96	14.20	25.42	25.42	25.42	35.42	8.90
RURAL	3.08	7.34	13.15	13.15	13.15	35.42	4.98
HYDROCARBONS							
EVAPORATIONS	0.43	0.86	1.55	1.55	1.55	0.0	0.55
CRANKCASE	0.02	0.09	0.56	0.56	0.56	0.0	0.07
EXHAUSTS							
URBAN	0.89	2.11	5.34	5.34	5.34	4.84	1.44
RURAL	0.53	1.26	3.20	3.20	3.20	4.84	0.91
NITROGEN OXIDE							
URBAN	2.23	3.49	7.85	7.85	7.85	72.04	4.34
RURAL	2.29	3.58	8.07	8.07	8.07	72.04	4.41

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	72.50	103.10	258.73	258.73	258.73	0.0	88.78
HYDROCARBONS	6.01	7.79	28.84	28.84	28.84	0.0	7.90

Table B.60

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1981
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	3.65	10.73	20.83	20.83	20.83	34.67	6.34
RURAL	1.89	5.55	10.77	10.77	10.77	34.67	3.65
HYDROCARBONS							
EVAPORATIONS	0.35	0.72	1.42	1.42	1.42	0.0	0.46
CRANKCASE	0.0	0.05	0.34	0.34	0.34	0.0	0.03
EXHAUSTS							
URBAN	0.54	1.58	4.42	4.42	4.42	4.57	1.04
RURAL	0.32	0.95	2.65	2.65	2.65	4.57	0.66
NITROGEN OXIDE							
URBAN	1.81	3.01	7.27	7.27	7.27	73.16	3.93
RURAL	1.86	3.09	7.47	7.47	7.47	73.16	3.99

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	60.58	89.74	248.25	248.25	248.25	0.0	77.12
HYDROCARBONS	5.21	7.01	27.47	27.47	27.47	0.0	7.08

Table B.61

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1982
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	2.68	7.66	16.68	16.68	16.68	34.00	4.94
RURAL	1.38	3.96	8.63	8.63	8.63	34.00	2.92
HYDROCARBONS							
EVAPORATIONS	0.29	0.59	1.29	1.29	1.29	0.0	0.39
CRANKCASE	0.0	0.02	0.16	0.16	0.16	0.0	0.01
EXHAUSTS							
URBAN	0.41	1.12	3.59	3.59	3.59	4.33	0.82
RURAL	0.25	0.67	2.15	2.15	2.15	4.33	0.53
NITROGEN OXIDE							
URBAN	1.44	2.56	6.72	6.72	6.72	74.16	3.57
RURAL	1.48	2.63	6.91	6.91	6.91	74.16	3.62

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	51.84	77.54	238.33	238.33	238.33	0.0	68.17
HYDROCARBONS	4.49	6.29	26.12	26.12	26.12	0.0	6.32

Table B.62

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1983
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	1.83	5.00	12.99	12.99	12.99	33.42	3.71
RURAL	0.95	2.59	6.72	6.72	6.72	33.42	2.27
HYDROCARBONS							
EVAPORATIONS	0.26	0.48	1.18	1.18	1.18	0.0	0.35
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.29	0.72	2.85	2.85	2.85	4.11	0.62
RURAL	0.17	0.43	1.70	1.70	1.70	4.11	0.41
NITROGEN OXIDE							
URBAN	1.13	2.16	6.22	6.22	6.22	75.03	3.26
RURAL	1.16	2.22	6.40	6.40	6.40	75.03	3.30

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	43.73	66.61	229.03	229.03	229.03	0.0	59.91
HYDROCARBONS	3.81	5.63	24.79	24.79	24.79	0.0	5.60

Table B.63

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1984
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	1.31	3.77	10.10	10.10	10.10	32.92	2.94
RURAL	0.68	1.95	5.22	5.22	5.22	32.92	1.87
HYDROCARBONS							
EVAPORATIONS	0.21	0.38	1.09	1.09	1.09	0.0	0.29
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.22	0.55	2.27	2.27	2.27	3.93	0.50
RURAL	0.13	0.33	1.36	1.36	1.36	3.93	0.33
NITROGEN OXIDE							
URBAN	0.93	1.77	5.76	5.76	5.76	75.78	3.04
RURAL	0.95	1.92	5.92	5.92	5.92	75.78	3.08

COLD START EMISSIONS(GRAMS)

	1	2	3	4	5	6	WEIGHTED
CARBON MONOXIDE	38.00	58.90	217.76	217.76	217.76	0.0	53.68
HYDROCARBONS	3.33	5.00	22.90	22.90	22.90	0.0	5.01

Table B.64

******** FEDERAL AGE & MILEAGE FACTORS ********

MOTOR VEHICLE EMISSION FACTORS FOR 1985
(GRAMS PER VEHICLE MILE)

CLASS	1	2	3	4	5	6	WEIGHTED
EMISSIONS							
CARBON MONOXIDE							
URBAN	0.95	2.69	7.58	7.58	7.58	32.50	2.34
RURAL	0.49	1.39	3.92	3.92	3.92	32.50	1.56
HYDROCARBONS							
EVAPORATIONS	0.21	0.29	1.00	1.00	1.00	0.0	0.27
CRANKCASE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXHAUSTS							
URBAN	0.17	0.40	1.75	1.75	1.75	3.78	0.40
RURAL	0.10	0.24	1.05	1.05	1.05	3.78	0.27
NITROGEN OXIDE							
URBAN	0.76	1.43	5.34	5.34	5.34	76.40	2.85
RURAL	0.78	1.46	5.49	5.49	5.49	76.40	2.89

COLD START EMISSIONS(GRAMS)

CARBON MONOXIDE	33.86	51.90	207.79	207.79	207.79	0.0	48.91
HYDROCARBONS	2.99	4.43	21.17	21.17	21.17	0.0	4.54