

1. Report No. FHWA/TX-86/76+282-2F	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle THE DEVELOPMENT OF TRAFFIC INFORMATION FOR ESTIMATION OF MOBILE SOURCE EMISSIONS FOR AIR QUALITY MODELING - VOLUME II IMPACT: USER'S GUIDE		5. Report Date October 1986	6. Performing Organization Code
7. Author(s) George B. Dresser and Charles E. Bell		8. Performing Organization Report No. Research Report 282-2F	
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 78743		10. Work Unit No.	11. Contract or Grant No. 2-8-80-282
12. Sponsoring Agency Name and Address Texas State Department of Highways and Public Transportation Transportation Planning Division P.O. Box 505, Austin, Texas 78763		13. Type of Report and Period Covered Final - September 1979 October 1986	
15. Supplementary Notes Study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration. Study title: The Development of Traffic Information for Estimation of Mobile Source Emissions		14. Sponsoring Agency Code	
16. Abstract Estimation of mobile source emissions for metropolitan areas is required on a continuing basis for assessing the impact of highway projects on urban air quality, for preparation of State Implementation Plans (SIPs) and for monitoring progress toward air quality standards. This study examined several approaches to the problem of estimating mobile source emissions for a metropolitan area. The result of that examination was a decision to complete development of a computer model called IMPACT. The IMPACT User's Guide, the Appendix to this report, is the principal product of this study. IMPACT: Highway Pollutant Emission Model provides an improved method for estimating mobile source emissions for an urbanized area. IMPACT was initiated by UMTA for use with the UMTA/FHWA Urban Transportation Planning System (UTPS). IMPACT was extensively modified and completed as part of this study. IMPACT is a macroscale computer model that uses a loaded highway network and MOBILE3 emission factors to compute mobile source emissions. Application is for urban areas that maintain travel demand models utilizing the trip generation, trip distribution, and traffic assignment methodology. IMPACT computes hydrocarbon (HC), and carbon monoxide (CO), and oxides of nitrogen (NOX) for each traffic zone in the study area or each grid in a user-specified grid square. IMPACT is used with an assigned highway network. Typically, IMPACT would be used with a base year validated traffic assignment to model existing conditions and a forecast traffic assignment to estimate future mobile source emissions. Copies of IMPACT may be obtained by sending a 9-track tape to the Texas Transportation Institute, Attention: George Dresser.			
17. Key Words Mobile Source Emissions Emission Models Air Quality Models		18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 101	22. Price



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THE DEVELOPMENT OF TRAFFIC INFORMATION FOR  
ESTIMATION OF MOBILE SOURCE EMISSIONS  
FOR AIR QUALITY MODELING, VOLUME II  
IMPACT: USER'S GUIDE

by

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and

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Research Report 282-2F  
Research Study Number 2-8-80-282

Sponsored by

State Department of Highways and Public Transportation

in cooperation with the

U.S. Department of Transportation  
Federal Highway Administration

Texas Transportation Institute  
The Texas A&M University System  
College Station, Texas

October 1986

6. 15. 1971



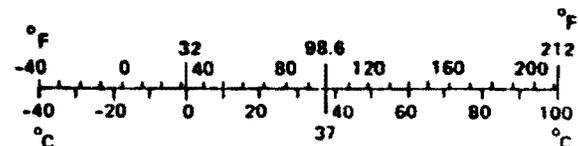
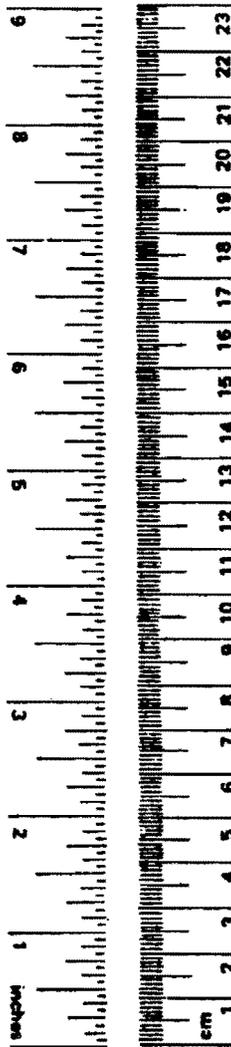
## METRIC CONVERSION FACTORS

### Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
<b>AREA</b>				
in <sup>2</sup>	square inches	6.5	square centimeters	cm <sup>2</sup>
ft <sup>2</sup>	square feet	0.09	square meters	m <sup>2</sup>
yd <sup>2</sup>	square yards	0.8	square meters	m <sup>2</sup>
mi <sup>2</sup>	square miles	2.6	square kilometers	km <sup>2</sup>
	acres	0.4	hectares	ha
<b>MASS (weight)</b>				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
<b>VOLUME</b>				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft <sup>3</sup>	cubic feet	0.03	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.76	cubic meters	m <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

### Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
<b>AREA</b>				
cm <sup>2</sup>	square centimeters	0.16	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	1.2	square yards	yd <sup>2</sup>
km <sup>2</sup>	square kilometers	0.4	square miles	mi <sup>2</sup>
ha	hectares (10,000 m <sup>2</sup> )	2.5	acres	
<b>MASS (weight)</b>				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
<b>VOLUME</b>				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m <sup>3</sup>	cubic meters	35	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.3	cubic yards	yd <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



\* 1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10:286.



ACKNOWLEDGEMENTS

The authors wish to acknowledge Mr. Rod Moe, D-8E, State Department of Highways and Public Transportation, who guided this study. The contribution of Mr. Joe Ossi, Urban Mass Transportation Administration, U.S. Department of Transportation for providing earlier versions of the IMPACT programs to the authors is also acknowledged.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the State Department of Highways and Public Transportation. This report does not constitute a standard, specification, or regulation.



## SUMMARY

Estimation of daily or annual mobile source emissions for metropolitan areas is a continuing requirement for assessing the impact of highway projects or urban air quality, for preparation of State Implementation Plans (SIPs) and for monitoring progress toward air quality standards. A fundamental problem with estimation of mobile source emissions is that estimates are made indirectly based on vehicle traffic characteristics and use of the vehicle emission factor model MOBILE3. Mobile source emissions are not measured directly. The estimation of traffic characteristics are in turn based on field measurements such as vehicle counts, vehicle classification, and vehicle speed studies. The traffic characteristics of volume, mix, and speed vary by type of facility, by time of day, day of week, month of year, etc. The characterization of an average daily vehicle population or an average yearly vehicle population for a metropolitan area by traffic descriptors such as vehicle miles of travel (VMT), average speed, etc., is subject to considerable uncertainty. This study provides an improved method of analyzing mobile source emissions using the disaggregated data available from the traffic assignments.

IMPACT is a macroscale computer model that uses a loaded highway network and MOBILE3 emission factors to compute mobile source emissions. Application is for urban areas that maintain travel demand models utilizing the traditional trip generation, trip distribution, and traffic assignment methodology. IMPACT computes total hydrocarbons (HC) or nonmethane hydrocarbons (NMHC), carbon monoxide (CO), and oxides of nitrogen (NOX) for each traffic zone in the study area or for each grid in a user-specified grid square superimposed on the study area. IMPACT uses emissions factors derived from MOBILE3 but applies these factors on a vehicle trip basis rather than the vehicle miles of travel basis traditionally used with MOBILE3.

IMPACT computes the excess start-up emissions associated with the trip-start and assigns these emissions to the zone of trip origin; the hot soak emissions associated with the trip end and assigns these emissions to the zone of trip destination; the hot running emissions associated with the path of the trip and assigns these emissions on a vehicle hours of travel basis to the zones traversed during the trip. The diurnal emissions which are independent of the trip are assigned in proportion to the number of trip ends occurring in a zone.

When using grids the start-up and hot soak emissions are assigned to the grids containing the zone centroids for the trip starts and trip ends, the hot running emissions are assigned to the grids traversed, and diurnal emissions are assigned to the grid containing the zone centroid in proportion to the number of trip ends occurring in a zone.

IMPACT is designed to be used with an assigned highway network, and its application is appropriate for the same types of analysis for which traffic assignments are appropriate. Typically IMPACT would be used with a base year validated traffic assignment to model existing conditions. IMPACT would then be used with a forecast traffic assignment to estimate future mobile source emissions.

IMPLEMENTATION STATEMENT

IMPACT is designed to function as part of the Texas Travel Demand Package. The data conversion programs developed as part of this study reformat the output of the Texas Large Network Assignment Models to the Urban Transportation Planning Study (UTPS) format used by IMPACT. IMPACT can be integrated into the ongoing urban transportation study process. It is recommended that IMPACT be used to prepare an analysis of mobile source emissions in conjunction with the calibration and validation of a base year traffic assignment to model existing conditions. IMPACT would then be used with forecast assignments to estimate future levels of mobile source emissions. These types of analyses are particularly important for those urban areas (Dallas-Fort Worth, Houston, El Paso, for example) that presently do not meet National Ambient Air Quality Standards. However, monitoring of mobile source emissions should be encouraged for all urban areas to insure that national standards continue to be maintained.

IMPACT is appropriate for analysis of an entire urban area or for major traffic corridor studies. IMPACT is not designed to be used for intersection analysis nor for specific highway projects. IMPACT can be used to assess the combined effect of a number of highway and transit projects completed over a 10 or 20 year planning horizon in conjunction with simultaneous changes in land use and trip making characteristics.

Copies of IMPACT may be obtained by sending a 9-track tape to the Texas Transportation Institute, Attention: George B. Dresser.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	iii
DISCLAIMER.....	iii
SUMMARY.....	v
IMPLEMENTATION STATEMENT.....	vi
TABLE OF CONTENTS.....	vii
INTRODUCTION.....	1
BACKGROUND.....	1
IMPACT.....	2
APPENDIX -	
IMPACT: HIGHWAY POLLUTANT EMISSION MODEL USER'S GUIDE .....	17
INTRODUCTION.....	18
INPUTS.....	18
OUTPUTS.....	19
METHODOLOGY.....	19
1. CATEGORIES OF POLLUTANTS AND VEHICLES.....	20
2. RELATIONSHIP BETWEEN EMISSIONS AND VEHICLE ACTIVITY.....	21
3. EMISSION FACTOR CALCULATIONS.....	22
4. SPECIFICATION OF VEHICLE MIXES.....	25
5. APPLICATION OF EMISSION FACTORS TO TRAVEL DATA.....	25
6. FINAL ALLOCATION OF IMPACT.....	30
REPORTS.....	32
FILE TABLE.....	43
1. IMPACT1.....	43
2. MOBILE2 or MOBILE3.....	44
3. IMPACT2.....	45
KEYWORD TABLE.....	46
NOTES.....	49
1. &PARM.....	49
2. &OPTIONS.....	54
3. &SELECT.....	55
4. &TRAVEL.....	55
DATA CARD FORMATS FOR A GRID RUN.....	57

CORE REQUIREMENTS.....	61
SAMPLE TEST RUN SETUPS.....	61
CATALOGED PROCEDURE.....	65
MESSAGES.....	70
PROGRAM FLOW.....	77
IMPACT SYSTEM DESIGN - SYSTEM FLOW.....	79
PROGRAM TREE FOR IMPACT1.....	84
PROGRAM TREE FOR IMPACT2.....	85
BUILD Z FILES.....	88
1. Build Z1 File.....	88
2. Build Z2 File.....	89
3. Build Z3 File.....	90

## INTRODUCTION

Estimation of daily or annual mobile source emissions for metropolitan areas is a continuing requirement. Mobile source emission estimates for metropolitan areas are prepared for State Implementation Plans (SIPs) and for monitoring Reasonable Further Progress (RFP). A fundamental problem with estimation of mobile source emissions is that estimates are made indirectly based on vehicle traffic characteristics and use of the vehicle emission factor model MOBILE3. Mobile source emissions are not measured directly. The estimation of traffic characteristics are in turn based on limited field measurements such as vehicle counts, vehicle classification, and vehicle speed studies conducted on a sampling basis. The traffic characteristics of volume, mix, and speed vary by type of facility (freeway, arterial, collector, or local street), by time of day, day of week, and month of year, etc. As a result, the characterization of an average daily vehicle population or an average yearly vehicle population for a metropolitan area by a few traffic descriptors such as vehicle miles of travel (VMT), average speed, etc., is subject to considerable uncertainty.

To provide one example: Mobile source emissions are sensitive to speed and consequently average speed may not provide a good estimate of the mobile source emissions produced by a population of vehicles. To illustrate, if one light duty vehicle is operating at 15 miles per hour and a second vehicle is operating at 55 miles per hour, the average speed is 35 miles per hour. The composite hydrocarbon emission factors for a temperature of 90 degrees Fahrenheit obtained from MOBILE2 are 2.12 g/m for 15 mph, 0.65 g/m for 55 mph, and 0.94 g/m for 35 mph. Using the average speed underestimates the emission rate by 0.45 g/m. The use of aggregate traffic characteristics may seriously misrepresent the contribution of mobile source emissions to an area's emission inventory.

## BACKGROUND

This study examined several approaches reported in the literature to the problem of estimating mobile source emissions for a metropolitan area. See "The Development of Traffic Information for Estimation of Mobile Source Emissions for Air Quality Modeling, Volume 1 - Annotated Bibliography," Research Report 282-1, Texas Transportation Institute, January 1981. The results of this examination coupled with a sensitivity evaluation of EPA's emission factor model MOBILE2 led to a conclusion that the more disaggregate the traffic used for analysis, the better the estimate of regional mobile source emissions. The study therefore focused attention on those approaches that provided for examination of traffic in a disaggregated form.

Coincident with the early phases of this study, UMTA was attempting to develop a computer program for estimating mobile source emissions that was compatible with their Urban Transportation Planning System (UTPS). An early version of this program called IMPACT1 was made available by UMTA to the researchers in June 1981. An examination of IMPACT1 showed that the approach used by UMTA provided for the analysis of traffic on an individual trip basis with emissions calculated separately for the trip start, running, and trip end portions of the trip. Moreover, the program methodology provided for geographic aggregation of emissions by traffic zone or grid square, a

Table I. IMPACT user-furnished inputs.

1. Region of country (high or low altitude)
2. Study year (1970 < year < 2020)
3. Temperature (noontime temperature)
4. Altitude of study area
5. Relative humidity (noontime)
6. Vehicle type by trip purpose
  - Vehicle Type**
    - Light-duty gasoline autos
    - Light-duty gasoline trucks (GVW <6001 pounds)
    - Light-duty gasoline trucks (GVW 6001-8500 pounds)
    - Heavy-duty gasoline trucks
    - Light-duty diesel autos
    - Light-duty diesel trucks
    - Heavy-duty diesel trucks
    - Motorcycles
  - Trip Purpose**
    - Up to eight trip purposes, for example, home based work, home based non-work, non-home based, etc. The user must provide an assignment for each trip purpose.
7. Number of registered or counted vehicles in study area by vehicle type.
8. Model year registration percent by vehicle type (default table provided).
9. Average annual mileage accrual rate by vehicle type (default table provided).
10. Beginning year for inspection/maintenance program.
11. Inspection/maintenance light-duty vehicle failure rate.
12. Size of grid square to which link related emissions are assigned.
13. Average number of trips per day per vehicle (not needed if vehicle registration data is provided in 7 above).
14. Time period (1 up to 24 time periods). The user must provide an assignment for each time period.
15. Percent of vehicle starts which are parked less than one hour and more than four hours. (These hot/cold start fractions must be estimated by the user.)

Information is also passed to IMPACT from UTPS or similar programs, Table II.

Table II. IMPACT UTPS-furnished inputs.

For each link.

1. Link lengths.
2. A node numbers.
3. B node numbers.
4. Link speed.
5. Link volume.

**For each zone.**

6. Associated zone of link.
7. Intrazonal trips.
8. Intrazonal average trip length.
9. Intrazonal speed.
10. Trip productions.
11. Trip attractions.
12. Zone number.

**For each node.**

13. X-coordinate.
14. Y-coordinate.

IMPACT output data is shown on Table III. The user furnished input parameters, emission factor values obtained from MOBILE3, and emission values calculations for the study area by zone or grid broken down by the trip component (trip start, hot running, trip end, and diurnal) are printed. The data on links, zones, and nodes, passed by UTPS, is not printed.

Table III. IMPACT outputs.

1. User furnished input parameters are printed.
2. Vehicle hours travel (VHT) emission factors for HC, CO, NOx, in pounds/minute or grams/minute, for each speed specified.
3. Start up emission factors for HC, CO, NOx, in pounds/trip start or grams/trip start, for vehicles parked less than four hours, one to four hours, and more than four hours.
4. Hot soak emission factor for HC in pounds/trip or grams/trip.
5. Diurnal emission factors for HC in pounds/vehicle/degree temperature change, by vehicle type.
6. Total emissions for the study area for HC, CO, NOx, in pounds or grams per time period and subtotals for each emission element subtotal (hot running interzonal, hot running intrazonal, trip production excess start up emissions for cold and hot starts, trip attraction excess start up emissions for cold and hot starts, trip production hot soak emissions, trip attraction hot soak emissions, and diurnal).
7. Total emissions by traffic zones or by grid square for HC, CO, NOx, in pounds or grams per time period.

**Emission Factor Calculations**

See Equations 1-17 in the Appendix for a discussion of the equations used to calculate mobile source emissions.

**Houston/Harris County Example**

Houston is Texas' largest metropolitan area. In 1980 Houston had a population of 1,600,000, the fifth largest city in the United States. The Houston-Galveston-Brazoria Consolidated Metropolitan Statistical Area had a 1980 population of 3,100,000. Houston is highly

industrialized with more than 3,600 manufacturing plants and the nation's largest concentration of petrochemical plants. The Port of Houston ranks among the busiest in the country. The city is a medical research and treatment center and the home of Rice University, the University of Houston, and several other schools. Harris County includes some 28 other incorporated cities, the largest of which is Pasadena with a 1980 population of 112,560. Total 1980 Harris County population was 2,410,000. There were 2,055,000 registered motor vehicles. Harris County is forecast to increase in population to 3,121,000 persons and have 2,750,000 registered motor vehicles by 1990.

#### 1990 Network and Assignment Description

The network used to illustrate IMPACT is a 1990 highway network with assigned vehicle trips for Harris County. The assignment does not represent any agency's "official" forecast of the travel conditions in 1990 but it is realistic. The network and assignment characteristics are summarized in Table IV.

Table IV. Houston/Harris County 1990 Network/Assignment.

Study area	1,723 square miles
Number of traffic zones	627
Number of two-way links including centroid connectors	4,540
Daily vehicle miles of travel (VMT)	
Centroid connectors	9,307,755
Intrazonal	1,166,696
Interzonal	82,688,382
Total	93,162,833
Daily vehicle hours of travel (VHT)	
Centroid connectors	543,479
Intrazonal	63,984
Interzonal	2,164,667
Total	2,772,130
Average speed (MPH)	
Centroid connectors	17.1
Intrazonal	18.2
Interzonal	38.2
Network	33.6

(Note: IMPACT does not use those average speeds. The link times or speeds are calculated for each link by the assignment program using the volume/capacity ratio or may be specified by the analyst based on field observation.)

## Link miles

Centroid connectors	883.5
Intrazonal (uses zone radii travel time)	
Interzonal	2,082.7
Total	2,966.2

Average trip length 16.52 minutes

Trip productions 10,065,351 trips

Trip attractions 10,067,268 trips (Note: productions and attractions were balanced over an area larger than Harris County.)

## Input Parameters and Output Reports

The user controlled input data is described in Table V. The output estimates are printed on six reports. Report 1 provides travel related emission factors by vehicle mix for NO<sub>x</sub>, CO, and HC. Report 2 provides trip origin related emission factors by parking duration. Report 3 provides evaporative emission factors for each vehicle mix. Report 4 provides emission subtotals by vehicle operating mode for each pollutant. Report 7 provides emissions by zone. Report 8 provides emissions by grid square. Example output reports are shown on Figure 1. Figure 2 shows a three-dimension plot of the hydrocarbon emissions by grid square. Figure 2 is not an IMPACT product but is an example of one type of plot which can be produced using emissions estimates by grid.

## IMPACT versus MOBILE3

Estimation of mobile source emissions requires some degree of vehicle aggregations. It is simply not feasible to put a measuring device on every vehicle or to model each trip as an individual event. Generally the higher the level of aggregation, the greater the possibility of underestimating the mobile source emissions. The reason for this is that emissions, particularly hydrocarbon emissions, are not distributed symmetrically about average speeds, average trip lengths, or any other average traffic characteristics. Vehicles traveling slower than the average emit proportionally higher levels of hydrocarbons than vehicles traveling faster than average, vehicles making trips shorter than the average trip length produce proportionally higher levels of hydrocarbons than vehicles making trips longer than the average trip length. Similarly, travel during peak periods under forced flow, Level of Service D & E driving, produces proportionally greater levels of hydrocarbons than does travel during off-peak periods under unrestricted flow, Level of Service A & B.

To illustrate the underestimation of mobile source emissions that may occur when using high levels of aggregation, that is averages, the 1990 mobile source emissions for Harris County were estimated using composite emission factors obtained directly from MOBILE3, using an average speed of 33 MPH, the network average speed. All other IMPACT and MOBILE3 input parameters were essentially the same.

Study area HC emissions were 28 percent greater, CO emissions were 45 percent greater, and NOx emissions were eight percent greater using IMPACT than those estimated using the average network speed to calculate MOBILE3 composite emission factors and multiplying by network VMT.

The use of average speeds instead of link speeds results in underestimation of mobile source emissions. Similarly disaggregating the analysis by trip purposes and time of day also can be expected to improve the accuracy of mobile source emission estimates. Hot and cold start fractions, for example, can be more easily estimated by trip purpose. In general, the greater the degree of disaggregation of the traffic data, the more accurate the mobile source emission estimates.

IMPACT provides the capability to estimate mobile source emissions using traffic data in its most disaggregate form. UTPS or the Texas Travel Demand Package, which provide the traffic assignments for IMPACT, can handle assignments with up to 16,000 nodes and 65,000 two-way links. This means that even very large urban areas can be modeled with a high degree of refinement. IMPACT will handle up to 24 time periods, eight trip purposes, and eight vehicle types. Disaggregation of traffic data by trip purpose and time of day is probably warranted only in those urban areas that have or are expected to have significant air quality problems and then only in conjunction with an in-place travel demand modeling capability. For these areas, where the economic impacts of SIP implementation decisions are measured in the millions of dollars, the costs involved with data collection, travel demand modeling, and emission analysis are warranted. For urban areas without significant air quality problems, IMPACT can be used with traffic data that is aggregated by time of day and trip purpose, similar to the example above, in conjunction with an ongoing travel demand modeling process to provide very usable estimates of mobile source emissions.

Table V. Houston/Harris County Inputs

**PARAM Input Data**

Region = 1	(49 state low altitude)
Year = 90	(study year 1990)
Temp = 95	(noontime temperature 95 degrees F)
Alt = 100	(altitude of study area)
Hum = 70	(relative humidity 70 %)
IMYEAR = 84	(I/M initiated 1984)
IMFAIL = 10	(I/M failure rate 10%)
MIXI = (1, 78.24), (2, 8.25)	(LDGV = 78.24%, LDGTI = 8.25%, etc.)
(3, 4.68), (4, 4.19),	
(5, 0.21), (6, 0.04),	
(7, 3.54), (8, 0.85)	
VCOUNT = (1, 1876),	(1990 LDGV registrations are
1,876,000,	
(2, 479), (3, 190),	LDGTI registrations are 479,000,
etc.)	

(4, 30), (5, 72),	
(6, 39), (7, 44),	
(8, 22)	
MYRP 1 = 6.5, 8.3, 9.8...	(1990-1970 registration % for LDGV)
MYRP 2 = 6.8, 8.7, 11.2...	(1990-1970 registration % for LDGT1)
	(repeated for eight vehicle types, default available)
USAGE 1 = 128, 121, 114...	(annual average mileage accumulation rate for LDGV is 12,800, 12,100, etc.)
	(annual average mileage accumulation rate for LDGT1 is 17,400, 16,100, etc.)
	(repeated for eight vehicle types, default available)
	(grid squares are 3 coordinate units)
GRID = 3.0	(coordinate of southeast corner grids)
REF = 190, 255	(trips per day per vehicle - used only if VCOUNT not used)
TRIPS = None	(ATP implemented in 1984)
ATPIM = 84	(1980 and later model years subject to ATP)
ATPFMY = 80	(HDGV not covered by ATP)
ATPHGV = 1	(LDGV covered by ATP)
ATPLGV = 2	(LDGV1 not covered by ATP)
ATPLG1 = 1	(LDGV2 not covered by ATP)
ATPLG2 = 1	(ATP last model year is 1990)
ATPLMY = 90	(mechanics program a part of LDV I/M program)
IMMECH = T	

**&TRAVEL Input Data (need one set of &TRAVEL Input Data for each time period)**

PERIOD = (0001., 2400)	(time for assignment period is 24 hours)
VOLUME = 'V2'	(link volume LAV name)
SPEED = 'S1'	(link speed LAV name)
VFAC = 100.0	(100% of link volumes occurs in the time period)
VMIX = 1	(vehicle mix 1 corresponds to link volume)
P = 'P'	(production LAV name)
A = 'A'	(attraction LAV name)
TFAC = 100.0	(100% of productions and attractions occur in this time period).
STARTS = 50.0	(50 % of trip productions are trip starts)
TMIX = 1	(vehicle mix 1 corresponds to productions and attractions)
PPARK = 57,22	(57% of productions are by vehicles parked less than one hour and 22% of productions are by vehicles parked greater than four hours)

PAGE 10

APARK = 57,22

(57% of attractions are by vehicles parked less than one hour and 22% of attractions are by vehicles parked greater than four hours)

ATEMP = 95

(ambient temperature across all zones for time period)

INTRA = 'INTRA'

(intrazonal trips LAV names)

SPIN = 'SPIN'

(intrazonal speed LAV names)

ATL = 'ATL'

(intrazonal trip length LAV names)

NOTE: In this example, one time period with one assignment is modeled. The program will handle up to 24 time periods with up to eight assignments per time period. It is therefore necessary to name the LAV files containing the link volume, link speed, productions, attractions, intrazonal trips, intrazonal speeds, and intrazonal trip lengths, associated with each of the up to eight assignments.

Figure 1. Houston/Harris County Sample Reports.

## S T A R T - U P E M I S S I O N F A C T O R S

PARKING DURATION		POLLUTANT HC (IN POUNDS/TRIP-START)
	MIX1	
<1 HR	.00455	
1-4 HR	.01126	
>4 HR	.01060	

PARKING DURATION		POLLUTANT CO (IN POUNDS/TRIP-START)
	MIX1	
<1 HR	0.0092	
1-4 HR	0.0245	
>4 HR	0.0231	

PARKING DURATION		POLLUTANT NOX (IN POUNDS/TRIP-START)
	MIX1	
<1 HR	.00251	
1-4 HR	.00309	
>4 HR	.00256	

## V H T E M I S S I O N F A C T O R S

SPEED (MI/H)		POLLUTANT HC (IN POUNDS/MINUTE)
	MIX1	
5	.00071	
10	.00094	
15	.00105	
20	.00110	
25	.00110	
30	.00109	
35	.00106	
40	.00104	
45	.00105	
50	.00106	
55	.00071	

POLLUTANT CO (IN POUNDS/MINUTE)

SPEED (MI/H)	MIX1
5	0.0116
10	0.0153
15	0.0171
20	0.0177
25	0.0174
30	0.0165
35	0.0154
40	0.0144
45	0.0138
50	0.0136
55	0.0097

POLLUTANT NOX (IN POUNDS/MINUTE)

SPEED (MI/H)	MIX1
5	.00022
10	.00038
15	.00053
20	.00067
25	.00081
30	.00095
35	.00112
40	.00130
45	.00153
50	.00182
55	.00109

M I S C E L L A N E O U S H C E M I S S I O N F A C T O R S

EMISSION SOURCE	MIX1
HOT-SOAK (POUNDS/TRIP)	.0076

EMISSION SOURCE	LDGV	LDGT1	LDGT2	HDTV	LDDV	LDDT	HDDV	MC
DIURNAL (POUNDS/VEH/DEG-F-INCREMENT)	.0005	.0005	.0006	.0018	.0000	.0000	.0000	.0004

EMISSIONS SUBTOTALS

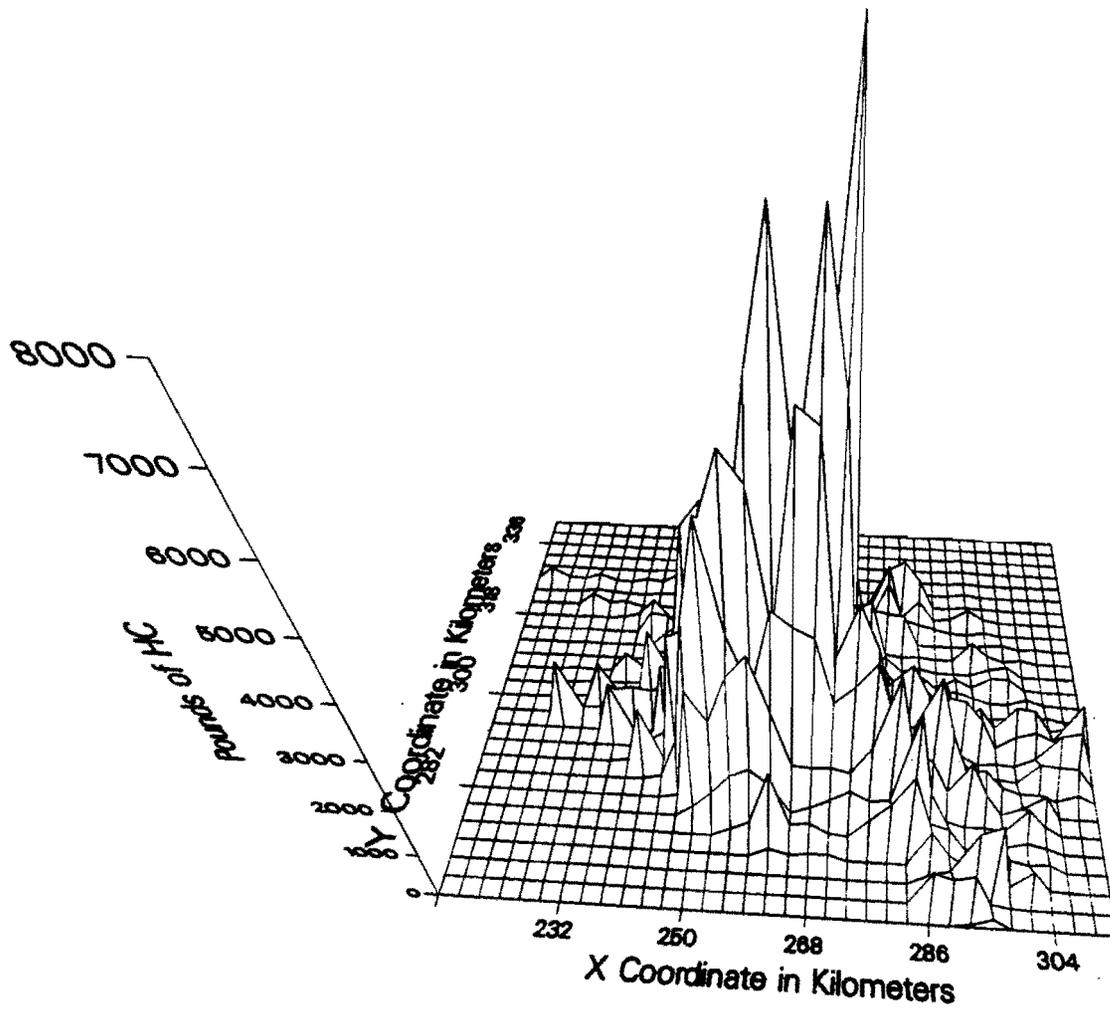
DESCRIPTION	HC POUNDS	CO POUNDS	NOX POUNDS
HOT RUNNING INTERZONAL	300003.84	4611610.45	242120.89
HOT RUNNING INTRAZONAL	3775.03	61853.16	1149.40
PRODUCTION EXCESS STARTUP HOT	18755.08	37852.26	10332.37
PROD EXCESS STARTUP 1 TO 4 HR	16870.75	36747.56	4075.82
PROD EXCESS STARTUP COLDSTART	17116.97	37292.79	4694.21
ATTR EXCESS STARTUP HOTSTART	18755.08	37852.26	10332.37
ATTR EXCESS STARTUP 1 TO 4 HR	16870.75	36747.56	4075.82
ATTR EXCESS STARTUP COLDSTART	17116.97	37292.79	4694.21
PRODUCTION HOTSOAK	55218.36	0.00	0.00
ATTRACTION HOTSOAK	55218.36	0.00	0.00
ALTERNATIVE DIURNAL	0.00	0.00	0.00
MAIN DIURNAL	59465.74	0.00	0.00
TOTAL	579166.93	4897248.82	281475.07

EMISSIONS BY GRID SQUARES  
FOR HARRIS COUNTY  
FROM 00:01 TO 24:00 HOURS  
STUDY YEAR 1990

49-STATE  
PERIOD 1

X GRID	Y GRID	HC POUNDS	CO POUNDS	NOX POUNDS
286	306	83.89	1301.74	67.17
286	309	85.39	1326.67	67.86
286	312	43.04	666.80	34.64
286	318	178.13	2532.79	210.84
286	321	417.65	640.35	70.90
286	324	618.44	1477.07	122.16
286	327	15.61	252.18	9.48

Figure 2. Harris County 1990 HC Emissions.





A P P E N D I X

I M P A C T: HIGHWAY POLLUTANT EMISSION MODEL USER'S GUIDE

I M P A C T : HIGHWAY POLLUTANT EMISSION MODEL USER'S GUIDE

INTRODUCTION

IMPACT computes highway based pollutant emissions for an input loaded highway network. Emission estimates for the major highway pollutants total (HC) or non-methane (NMHC) hydrocarbons, carbon monoxide (CO), and oxides of nitrogen (NOX)

may be aggregated either to the zone level, or into user-specified grid squares. (Grids are often required by atmospheric dispersion or diffusion models.)

IMPACT outputs several reports containing information on the above three pollutants. These reports may be generated for any study year between 1970 and 2020, inclusively, and for any of three regions of the country (California, the other 49 states, or high altitude areas.) Emission factors are computed for up to eight user-specified vehicle mixes and for the following vehicle types:

- Light-duty gasoline autos
- Light-duty gasoline trucks (2700 KG) (GVW <6001 pounds)
- Light-duty gasoline trucks (3900 KG) (GVW between 6001 and 8500 pounds)
- Heavy-duty gasoline trucks
- Light-duty diesel autos
- Light-duty diesel trucks
- Heavy-duty diesel trucks
- Motorcycles.

IMPACT will optionally include the effects of a light-duty vehicle inspection/maintenance program or anti-tampering programs on the appropriate emission factors.

The emission factors for HC, CO, and NOX produced by IMPACT are derived from MOBILE2 or MOBILE3. This report assumes the reader has some knowledge of emission modeling. See "User's Guide to MOBILE2 (Mobile Source Emission Model)", EPA-460/3-81-006, 1981, and "User's Guide to MOBILE3 (Mobile Source Emissions Model)," EPA 460/3-84-0, 1984.

INPUTS

IMPACT requires the following inputs:

1. &PARAM, &OPTION, &SELECT, cards to set parameters such as study year and region of the country, to set program options, and to request reports;
2. &TRAVEL cards to define the travel occurring during each user-specified time period for calculation of emissions during that time period;

3. &DATA cards to specify user-desired grid information.
4. A link Z-file containing lists-of-attribute-values, or LAVS, providing the assigned volume, length and speed of each link, and the zone in which each link is located;
5. A node Z-file containing X-Y coordinates of each nodes.
6. A zonal Z-file containing LAVS of trip productions and attractions, intrazonal VHT and (optionally) intrazonal speed for each zone.
7. If MOBILE3 is being used, then optionally an antitampering program (ATP) or an IMN program can be included.

#### OUTPUTS

IMPACT produces the following (optional) outputs:

1. Printed reports giving:

For each vehicle mix

- A. a table of VHT-related emission factors,
- B. a table of start-up emission factors,
- C. miscellaneous emission factors, including:
  - (1) diurnal HC emission factors,
  - (2) hot soak HC emission factors, and
  - (3) crankcase blow-by HC factors.

For each time period

- D. total emissions of each selected pollutant at the zonal or grid square level.

2. A LAV for each selected pollutant providing total emissions of the pollutant at the zonal or grid square level.
3. A card-image output file of total emissions for each selected pollutant by grid square.

#### METHODOLOGY

Among the variables which affect emission rates are the vehicle characteristics such as age, type, inspection/maintenance programs, and region of the country in which the vehicle is used, the ambient characteristics of temperature, altitude, and humidity, and the operating characteristics of speed and parking duration.

Vehicle age, as measured by annual accrual of kilometers (miles) driven,

accounts for the deterioration of engine parts and emission control devices, leading to an increase in emissions over time. Vehicle type accounts for weight, engine size, and type of fuel used, each of which affects fuel consumption rates as well as the species and quantity of pollutants emitted. An inspection/maintenance program slows deterioration due to mileage accrual, while the region (low altitude, high altitude, or California) determines the stringency of new vehicle control standards which in turn affects both emissions and fuel consumption.

Temperature and humidity heavily influence ozone formation from its precursors (hydrocarbons and oxides of nitrogen). Altitude is important not only because of changing barometric pressure, which affects NOX production, but also because the new vehicle emission standard timetable is different for high altitude regions than for other areas.

Traffic flow conditions, which affect the quantity of emissions, are tracked by vehicle speed. Duration of parking prior to starting a vehicle also affects the engine and catalyst temperatures and, therefore, the quantity of emissions produced by that vehicle type.

1. CATEGORIES OF POLLUTANTS AND VEHICLES

The three major categories of mobile source pollutants are hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOX).

IMPACT computes emission factors for these pollutants for the following vehicle types:

TYPE NO.	VEHICLE TYPE	FUEL	* GVW	EPA SYMBOL
1	Light-duty automobile	gas	3900 KG	LDGV
2	Light-duty truck	gas	2700 KG	LDGT1
3	Light-duty truck	gas	3900 KG	LDGT2
4	Heavy-duty truck	gas	3899 KG	HdGV
5	Light-duty automobile	diesel	3900 KG	LDDV
6	Light-duty truck	diesel	3900 KG	LDDT
7	Heavy-duty truck	diesel	3899 KG	HDDV
8	Motorcycle	gas		MC

\*gross vehicle weight

Composite factors are then developed for user-specified mixes of vehicle types for speeds ranging from 0 to 88 kph (0-55 mph) at temperatures ranging

from -18 to 43 degrees celsius (0-110 deg. F).

2. RELATIONSHIP BETWEEN EMISSIONS AND VEHICLE ACTIVITY

Emissions of pollutants from motor vehicles may be categorized according to vehicle use. In such a breakdown there are three categories of vehicle emissions:

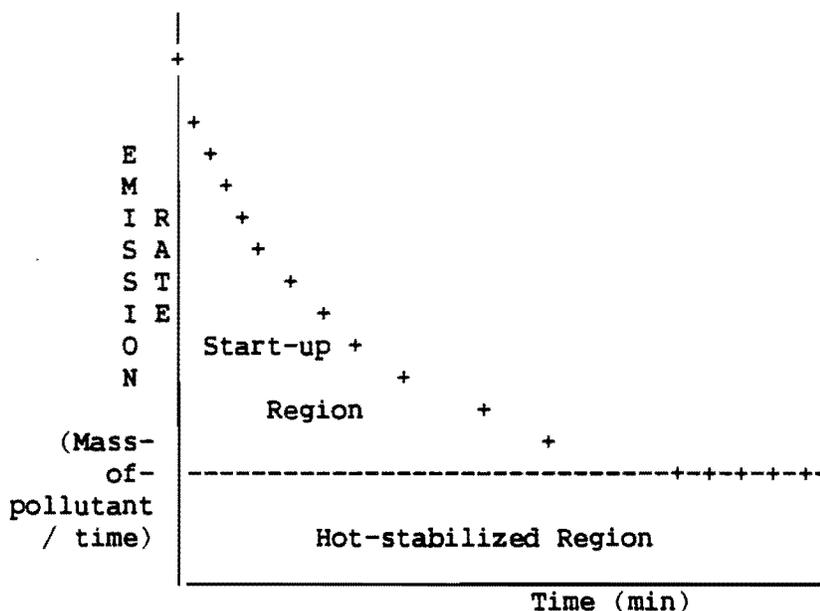
- A. VHT-related (VHT = vehicle-hours traveled)
- B. trip end related
- C. vehicle (diurnal) related.

A. VHT RELATED emissions include tailpipe emissions from engines and exhaust systems at normal operating temperatures and HC emissions produced by older vehicles due to crankcase blow-by (exhaust emissions from an idling vehicle are a special case of VHT-related emissions in which the VHT is the idling time and the speed is zero).

B. TRIP END RELATED emissions consist of two distinct types:

(1) TRIP-START EMISSIONS

Emissions from a vehicle starting a trip may be significantly larger than emissions from a warmed-up vehicle. As depicted in the following diagram, emissions represented by the area under the curve are excess emissions due to engine start-up:



Exhaust Emission Rate As A Function Of Engine Running Time

The excess emissions due to start-up are computed for HC, CO, and NOX.

(2) TRIP STOP EMISSIONS

Hot-soak evaporative HC emissions result from the evaporation of unburned fuel from the carburetor at the destination end of a trip.

C. DIURNAL EVAPORATIVE HC EMISSIONS are a function of the number of vehicles present in the study area and are not related to VHT or trips. Diurnal temperature fluctuations force gasoline vapors from any gas tank containing gasoline.

Although the categorizations enumerated above generally are applicable to all vehicle types, the methodology assumes the following exceptions:

Heavy-duty vehicles, both gasoline and diesel powered, are assumed to be operating in a hot-stabilized mode only, and therefore do not have any "excess" emissions associated with them due to start-up.

Because of engine design and low volatility of the fuel, diesel vehicles of all types do not contribute crankcase blow-by or evaporative HC emissions.

3. EMISSION FACTOR CALCULATIONS

A. VHT RELATED EMISSION FACTORS

For pollutants HC and CO, the travel exhaust emission factor is given by:

$$EF(S) = \sum_{M=SY-19}^{SY} ( C(M) * R(S,M) * FR(M) ) \quad (1)$$

where:

- EF(S) = travel emission factor (units: mass of pollutant per vehicle hour traveled) for study year at speed S.
- C(M) = base emission rate (units: mass per vehicle hour traveled) for model year M.
- R(S,M) = correction factor for travel at speed S, for model year M.
- FR(M) = fraction of vehicles for model year M
- SY = study year

For vehicle types 1-4, the crankcase blow-by HC emission factor is given by:

$$BB(S) = S * \sum_{M=SY-19}^{SY} ( CC(M) * FR(M) ) \quad (2)$$

where:

- BB(S) = crankcase blow-by HC emission factor for study year at speed S (units = mass of pollutant per vehicle hour traveled)
- S = speed (units = distance per unit time)
- CC(M) = crankcase blow-by HC emission factor for model

year M (units = mass per unit time)

For pollutant NOX, the emission rate is given by equation (1) above for vehicle types 5 through 7, but for types 1-4 and 8 (i.e., all gasoline-powered vehicles) the equation is:

$$EF(S,T,U) = HUM(T,U) * \sum_{M=SY-19}^{SY} (C(M) * R(S,M) * FR(M)) \quad (3)$$

Where all symbols are as in equation 1, except:

HUM(T,U) = correction factor for the humidity ratio corresponding to temperature T, relative humidity U, and atmospheric pressure of 760 mm hg.

## B. TRIP END RELATED EMISSION FACTORS

### (1) START-UP EMISSIONS

Excess start-up emission rates are computed for pollutants HC, CO, and NOX and apply to vehicle types 1, 2, 3, 5, 6, and 8.

Start-up emissions for vehicles parked one hour or less are given by:

$$ESU1(T) = \sum_{M=SY-19}^{SY} (FR(M) * C(M) * (RHS(T) - RSTAB(T)) * 3.59 \text{ miles per trip}) \quad (4)$$

where:

ESU1(T) = excess start-up emission factor (units: mass of pollutant per trip-start for study year at temperature T)  
 FR(M) = fraction of vehicles for model year M  
 C(M) = base emission rate for model year M. (units: mass per unit distance)  
 RHS(T) = correction factor for travel at 25.6 MPH 100% hot start operation, at temperature T  
 RSTAB(T) = correction factor for travel at 25.6 MPH \* 3.59 miles per trip 100% stabilized operation, at temperature T

Start-up emissions for vehicles parked four hours or more are given by:

$$ESU2(T) = \sum_{M=SY-19}^{SY} (FR(M) * C(M) * (RCS(T) - RSTAB(T)) * 3.59 \text{ miles per trip}) \quad (5)$$

where:

ESU2(T) = excess start-up emission factor (units: mass of pollutant per trip-start for study year at temperature T)

FR(M) = fraction of vehicles for model year M  
 C(M) = base emission rate for model year M  
 (units: mass per unit distance)  
 RCS(T) = correction factor for travel at 25.6 MPH, 100%  
 cold start operation, at temperature T  
 RSTAB(T) = correction factor for travel at 25.6 MPH, 100%  
 stabilized operation, at temperature T

Start-up emissions for vehicles parked between one and four hours are given by:

$$\begin{aligned}
 \text{ESU3(T)} = & \sum_{M=\text{SY}-19}^{1974} (\text{FR(M)} * \text{C(M)} * (\text{RHS(T)} - \text{RSTAB(T)}) \\
 & * 3.59 \text{ miles per trip} + \sum_{\text{ME}=1975}^{\text{SY}} (\text{FR(M)} * \text{C(M)} * \\
 & (\text{RCS(T)} - \text{RSTAB(T)}) * 3.59 \text{ miles per trip} \quad (6)
 \end{aligned}$$

where:

SUM1( ) = summation over model year, from 19 years prior  
 to study year up to and including 1974.  
 SUM2( ) = summation over model year, from 1975 up to and  
 including study year  
 ESU3(T) = excess start-up emission factor mass of pollutant  
 per trip-start for study year at temperature T  
 FR(M) = fraction of vehicles for model year M  
 C(M) = base emission rate for model year M  
 (units: mass per unit distance)  
 RHS(T) = correction factor for travel at 25.6 MPH,  
 100% hot start operation, at temperature T  
 RCS(T) = correction factor for travel at 25.6 MPH, 100%  
 cold start operation, at temperature T  
 RSTAB(T) = correction factor for travel at 25.6 MPH, 100%  
 stabilized operation, at temperature T

This equation assumes that all vehicles after 1974, if parked between one and four hours, are cold starts.

## (2) HOT-SOAK EMISSIONS

Hot-soak evaporative HC emissions (for vehicle types 1-3 only) are given by:

$$\text{EHS(M)} = \sum_{M=\text{SY}-19}^{\text{SY}} (\text{FR(M)} * \text{C(M)}) \quad (7)$$

where:

EHS = hot soak evaporative HC emission factor  
 mass of pollutant per trip stop)  
 FR(M) = fraction of vehicles for model year M  
 C(M) = hot soak evaporative HC emission factor  
 (units: mass per trip stop)

## C. DIURNAL EVAPORATIVE HC EMISSION FACTORS

For vehicle types 1-4 and 8 only, the equation is:

$$EDE = \sum_{M=SY-19}^{SY} (FR(M) * EVAP(M)) \quad (8)$$

where:

EDE = diurnal evaporative HC emission factor mass of pollutant per vehicle per unit change in temperature)  
 FR(M) = fraction of total vehicles in model year M.  
 EVAP(M) = diurnal evaporative HC emission factor (units: mass per vehicle per unit change in temperature)

#### 4. SPECIFICATION OF VEHICLE MIXES

Vehicle mixes may be specified for assignments by trip purpose (e.g.: home based work, home based other, non-home based, etc.), or assignments by vehicle type (e.g.: auto, truck). As shown in the keyword tables, the user enters pairs of numbers for all vehicle types in a particular mix. These number pairs have the following form: ('vehicle type', '% in the mix'). The user must keep track of the "meaning" of each mix.

In combining the emission factors of different vehicle types, the program assumes that each mix is homogeneous with respect to travel characteristics; i.e. differences in average trip length and trip frequencies of the vehicle types comprising the mix are negligible.

Emission factors are computed for each vehicle type for each speed or temperature. Then composite factors for each pollutant are computed by vehicle mix for use in applying the emission factors to actual link volumes or trip counts. All vehicle mix factors are derived as follows:

$$CF(P, VMIX) = \sum_{TYPE=1}^8 (EF(P, TYPE) * FV(TYPE)) \quad (9)$$

where:

CF(P, VMIX) = the composite factor for pollutant 'P' and vehicle mix 'MIX',  
 EF(P, TYPE) = the emission factor for pollutant 'P' and vehicle type 'TYPE',  
 FV(TYPE) = fraction of vehicles of type 'TYPE' in the mix, and sum is taken over all vehicle types.

#### 5. APPLICATION OF EMISSION FACTORS TO TRAVEL DATA

IMPACT optionally applies the emission factors described above to the travel data specified by the user on &TRAVEL cards.

##### A. APPLICATION OF VHT FACTORS

In order to provide the diurnal variations in emissions, IMPACT computes emissions for each time period specified by the user with the &TRAVEL

keyword, 'PERIOD'. Within each time period the user specifies up to 8 link volume LAVS with the keyword, 'VOLUME'. 'VOLUME' may indicate a single LAV of link volumes from a 24-hour assignment of total trips, or it may indicate several volume LAVS corresponding to the assignment of different vehicle types (auto and truck) or different trip purposes (work and nonwork). See UTPS UROAD for stratified assignment techniques. 'VOLUME' also may indicate a LAV of bus volumes output by INET. The user also provides the name of a link speed LAV (keyword 'SPEED') which corresponds to each volume LAV. Volume factors (keyword 'VFAC') are used to factor assignments which do not correspond to the specified time period. That is, for each volume LAV, 'VFAC' gives the percent of the link volume which occurs in this time period. 'VMIX' indicates, for each volume LAV, which of the vehicle mixes specified by the &PARAM keyword 'MIX N' is appropriate to each volume LAV.

IMPACT accepts the traffic assignment data (volumes and speeds) as provided by the user. It makes no assumptions about the type of assignment performed. It is therefore the user's responsibility to insure that:

Speeds are reasonable.

Each link volume LAV represents a homogeneous mix of vehicle types, since a single vehicle mix is assumed to apply to all link volumes in a particular LAV.

The diurnal distribution of the volumes in the LAV is the same for all links, since the volume factor 'VFAC' is applied to all links in the corresponding volume LAV.

For each time period specified and each link in the network, IMPACT sums in the following fashion over all volume LAVS:

$$E(L) = V(L) * VFAC * (D(L)/SPEED(L)) * EF(VMIX, SPEED(L)) \quad (10)$$

where:

E(L) = emissions of a particular pollutant on link L  
 V(L) = vehicle volume on link L  
 VFAC = fraction of volume in the time period  
 D(L) = link distance  
 SPEED(L) = speed on link L  
 EF(.,.) = VHT-related emission factor for vehicle mix 'VMIX' at the speed on link L.

This equation is used for the VHT-related portion of the following impacts:

HC (both gasoline and diesel)  
 CO  
 NOX (both gasoline and diesel)

For emissions of crankcase blow-by of HC equation (10) differs slightly in that these factors are not a function of speed:

$$E(L) = V(L) * VFAC * D(L) * EF(VMIX) \quad (11)$$

Where all variables are as in equation (10) and EF is a function of vehicle mix only.

#### B. APPLICATION OF START-UP EMISSIONS

Start-up emissions are computed at the zone level for each time period. A zonal Z-File (Z3 file) is input containing productions and attractions in LAVS designated by the user with &TRAVEL keywords 'P' and 'A'. Up to eight P and A LAVS may be specified for each time period. The 'TFAC' values give the proportion of the corresponding trip P's and A's which occur in the specified time period. 'STARTS' values are the proportion of each production LAV which are trip-starts. (1.0-'STARTS') is, therefore, the proportion of attractions which are starts.

Up to eight 'TFAC' and 'STARTS' values are allowed to accommodate different trip purposes, which usually have different diurnal distributions (i.e., different 'TFAC' values), different percentages which are starts in a particular time period, and different vehicle mixes. Vehicle mixes for trip P's and A's are given by 'TMIX' which, like 'VMIX', indicates which of the vehicle mixes in &PARAM 'MIX N' applies to each set of P and A lavs.

'PPARK' is a set of up to eight couplets giving the proportion of trip production starts which were parked (1) less than one hour, and (2) greater than four hours. The quantity (1.0-'PPARK(1)' -'PPARK(2)') is, therefore, the proportion parked between 1 and 4 hours. 'APARK' are similar proportions for the trip attraction starts.

Finally, 'ATEMP' gives average ambient air temperature during each time period.

In each time period, for each zone IMPACT sums over all P and A LAVS specified as follows:

$$\begin{aligned}
 E(Z) &= P(Z)*TFAC*STARTS*(PPARK(S)*EF(TMIX, ATEMP(Z),S) \\
 &+ PPARK(M)*EF(TMIX,ATEMP(Z),M) \\
 &+ PPARK(L)*EF(TMIX,ATEMP(Z),L)) \\
 &+ A(Z)*TFAC*(1-STARTS)*(APARK(S)*EF(TMIX,ATEMP(Z),S) \\
 &+ APARK(M)*EF(TMIX,ATEMP(Z),M) \\
 &+ APARK(L)*EF(TMIX,ATEMP(Z),L)) \quad (12)
 \end{aligned}$$

where

$$\begin{aligned}
 E(Z) &= \text{impact in zone Z} \\
 P(Z) &= \text{productions in zone Z} \\
 A(Z) &= \text{attractions in zone Z} \\
 ATEMP(Z) &= \text{temperature in zone Z} \\
 TFAC &= \text{fractions of P's and A's in this time period} \\
 STARTS &= \text{fraction of P's which are trip-starts} \\
 PPARK(S) &= \text{fraction of production starts parked } < \text{ 1 hour} \\
 &\quad \text{(short park)} \\
 PPARK(L) &= \text{fraction of production starts parked } > \text{ 4 hours} \\
 &\quad \text{(long park)} \\
 PPARK(M) &= 1.0-PPARK(S)-PPARK(L)
 \end{aligned}$$

- = fraction of production starts parked from 1-4 hours  
APARK(S), (L), and (M) are the corresponding attraction starts
- TMIX = N where MIX N gives the vehicle mix for these P's and A's
- EF( ) = start-up factor for vehicle mix TMIX, temperature ATEMP(Z), and short, medium or long parking duration.

Start-up impacts are computed for:

- HC gasoline
- CO
- NOX gasoline

Intrazonal trips are assumed to be included in the P and A totals.

**C. INTRAZONAL VHT-RELATED EMISSIONS**

Intrazonal travel is not represented in the link volume LAVS produced by a traffic assignment but its impacts must be accounted for. These additional &TRAVEL keywords indicate the source of information needed.

'INTRA' is a set of up to 8 LAV names giving intrazonal trips in each zone. The number of LAVS must be equal to the number of production LAVS specified. 'SPIN' is either a constant intrazonal speed applicable to all zones or a LAV containing intrazonal speeds by zone. If not coded, 14.9 mph is assumed. 'ATL' is either a constant average intrazonal trip length or LAV of intrazonal trip lengths.

$$ATL = 0.5 * \text{SQRT}(\text{AREA} / \pi).$$

The impacts due to intrazonal trips are computed as follows:

$$E(Z) = \text{INTRA}(Z) * (\text{ATL}(Z) / \text{SPIN}(Z)) * \text{TFAC} * \text{EF}(\text{TMIX}, \text{SPIN}(Z)) \tag{13}$$

where

- E(Z) = impacts due to intrazonal VHT in zone Z
- INTRA(Z) = no. of intrazonal trips in zone Z
- ATL(Z) = average trip length in Z
- SPIN(Z) = intrazonal speed in Z
- TFAC = proportion of trips occurring in this time period
- TMIX = vehicle mix indicator of the intrazonal trips given in intra
- EF = VHT-related factor for vehicle mix TMIX and speed SPIN(Z).

Note that the same TFAC and TMIX which apply to the P's and A's in this time period are assumed to apply to the corresponding intrazonal trips.

**D. HOT SOAK EMISSIONS**

Hot soak evaporation of HC at the end of each gasoline vehicle trip is computed with the same information used for start-up impacts discussed above. The equation is:

$$E(Z) = P(Z)*TFAC*(1.0-STARTS)*EF(TMIX) + A(Z)*TFAC*STARTS(EF(TMIX)) \quad (14)$$

where

E(Z) = hot soak evaporation in zone Z  
 P(Z),A(Z) = P's and A's in zone Z  
 TFAC = proportion of P's and A's in this time period  
 STARTS = proportion of productions which are starts  
 1-STARTS = proportion of attractions which are stops.  
 EF = hot soak factor for vehicle mix TMIX.

This calculation is performed for HC emissions only, and results in HC evaporative emissions which are separated from exhaust HC emissions to facilitate decomposition into species.

#### E. DIURNAL EVAPORATIVE EMISSIONS

Diurnal evaporation of fuel can account for a significant percentage of the highway HC emissions in a study area. It is not a function of either VHT or of the number of trips but of the number of vehicles present in the study area. Although diurnal evaporation factors can be computed for the user-specified vehicle mixes, such factors are not very useful because a single vehicle may be used for several trip purposes in the course of a day and therefore may be included in several mixes, but it is still one vehicle generating diurnal HC emissions. Thus, if applied on a vehicle mix basis, the diurnal impacts would be overstated.

IMPACT therefore generates diurnal HC factors for the eight EPA vehicle types given above and applies those factors in either of two ways.

##### (1) &PARAM VCOUNT

If the user provides vehicle counts of each EPA vehicle type in the study area through the &PARAM keyword 'VCOUNT', IMPACT uses those counts as described below.

Once VCOUNT values are available, total diurnal evaporation per degree-fahrenheit temperature rise by all vehicles in the study area is determined by

$$DTOT = \sum_{E=1}^8 (VCOUNT(E)*EF(E)) \quad (15)$$

where

DTOT = total diurnal evaporation per degree-fahrenheit temperature rise  
 VCOUNT(E) = vehicle count for vehicle type E  
 EF(E) = diurnal emission factor for EPA vehicle type E per degree-fahrenheit temperature rise

Areas of this country which experience ozone problems (caused by HC emissions) do so on sunny days with rising temperatures during morning and early afternoon hours which force evaporative HC from gas tanks and other

engine nooks.

Allocation of diurnal evaporative HC to zones requires another justifiable assumption, that the diurnal evaporation in a zone is proportional to the hot soak emissions in that zone. Both emissions are produced by parked vehicles. Since hot soaks are a result of trip stops, this assumption is the same as assuming that the number of vehicles parked in a zone is proportional to the number of trip stops in that zone.

The equation which results is:

$$D(P,Z) = \sum_{E=1}^8 \text{VCOUNT}(E) * \text{EF}(E) * \text{delta-T} * \text{TFAC} * \text{HS}(P,Z) / \sum_{Z=1}^{\text{NZ}} \text{HS}(P,Z) \quad (16)$$

where

D(P,Z) = diurnal evaporative emissions in zone Z in period P  
 VCOUNT(E) = vehicle count for vehicle type E  
 EF(E) = diurnal emission factor for EPA vehicle type E  
           per degree temperature rise  
 delta-T = temperature rise in period P  
 TFAC = proportion of P's and A's in period P  
 HS(P,Z) = hot soak emissions in zone Z in period P

## (2) ALTERNATE DIURNAL CALCULATIONS

If VCOUNT is not coded, diurnal evaporation is estimated by using a single estimate of trips/day/vehicle combined with productions and attractions.

$$D(P,Z) = 0.5 * \text{TFAC} * \sum_{\text{TMIX}=1}^8 (\text{A}(Z) * \text{EF}(\text{TMIX}) + \text{P}(Z) * \text{EF}(\text{TMIX})) * \text{delta-T} / \text{TRIPS} \quad (17)$$

where

D(P,Z) = diurnal evap emissions in zone Z in period P  
 TFAC = proportion of P's and A's in this time period  
 A(Z) = attractions  
 P(Z) = productions  
 delta-T = temperature increment for period P  
 TRIPS = estimated trips per day per vehicle  
           averaged over all vehicle types

## 6. FINAL ALLOCATION OF IMPACTS

Recall that the main purpose of IMPACT is to provide information about emissions at the level of geographic and temporal detail required by many air quality models. The temporal detail is defined by the user through the &TRAVEL 'PERIOD' keywords. IMPACT outputs its final estimate of the selected emissions occurring in each time period so defined.

The level of geographic detail is also controlled by the user. IMPACT outputs are by traffic zone if the &PARAM values 'GRID' and 'REF' are not set, or by grid square if these keywords are set.

#### A. OUTPUTS AT ZONE LEVEL

IMPACT calculations discussed above result in estimates of impacts either by zone or by link. To produce zonal totals for each impact selected, nothing needs to be done to the estimates already at the zone level. The link level impacts must be allocated to zones. IMPACT uses a user-supplied Z-LAV in the Z1 file to do this allocation. The Z-LAV indicates in which zone each one-way link is located. Given such a LAV, link impacts may easily be added to the corresponding zonal impacts and the results reported and output.

The user who wishes to summarize impacts at the zone level should code his network accordingly. Major links which cross zone boundaries should be decomposed into two links. Links on zone boundaries may be assigned directionally, i.e., (A,B) direction to the zone on the right, (B,A) to the zone on the left.

#### B. OUTPUTS AT GRID LEVEL

Many air quality models require emissions estimates within each square of an imaginary grid overlaid on the study area. The user specifies this grid by giving a reference point (&PARAM REF') in the same coordinate units in which the network is coded, and a grid size (&PARAM GRID) also in coordinate units. IMPACT then uses point ref as the southwest corner of a square shaped set of 2500 grid squares. The grid lines are generated to the east of ref for a total of 50 lines by adding the grid value to the X coordinate of ref. Also, 50 grid lines are created north of ref by adding the value grid to the Y coordinate value of ref. These grid lines mark the southwest corner of each of 2500 grid squares. Only grid squares which have a non zero pollution value are printed in reports. The pollution values which fall outside of these 2500 grid squares are summed as a subtotal with the name outside in Report 7.

IMPACT then uses the coordinates (from the X and Y LAVS of the Z2 file) of the Anode and Bnode of each link to assign link impacts to the grid squares. If both A and B are located within the same square, that square is assigned all the link's impacts. If the link crosses grid lines, the link is segmented at the grid line and each square takes a part of the link impacts proportional to the length of the link within that square. Zone impacts are allocated to the grid containing the zone centroid.

## REPORTS

Report 1 presents the travel related emission factors for the pollutant(s) selected by the user with &SELECT keywords. Factors are calculated and reported by vehicle mix for the 'region' and 'year' specified. Factors are reported in grams/mile, grams/kilometer, or grams/minute, depending on the values of the 'UNITS' and 'METRIC' keywords. Optionally, factors may be reported in pounds/minute.

2APR85 0.43.52

IMPACT2 REPORT 1

PAGE --

V H T E M I S S I O N F A C T O R S  
 49-STATE STUDY YEAR 1990  
 TEMPERATURE= 95.0 DEG-F

## POLLUTANT HC (IN POUNDS/MINUTE)

SPEED (MI/H)	MIX1
5	.00071
10	.00094
15	.00105
20	.00110
25	.00110
30	.00109
35	.00106
40	.00104
45	.00105
50	.00106
55	.00071

## POLLUTANT CO (IN POUNDS/MINUTE)

SPEED (MI/H)	MIX1
5	0.0116
10	0.0153
15	0.0171
20	0.0177
25	0.0174
30	0.0165
35	0.0154
40	0.0144
45	0.0138
50	0.0136
55	0.0097

## POLLUTANT NOX (IN POUNDS/MINUTE)

SPEED (MI/H)	MIX1
5	.00022
10	.00038
15	.00053
20	.00067
25	.00081
30	.00095
35	.00112
40	.00130
45	.00153
50	.00182
55	.00109

Report 2 presents the excess start-up emissions by pollutant, vehicle mix and parking duration. Excess start-up emissions only apply to vehicle types 1 through 3.

HOUSTON / HARRIS COUNTY 1990 ASSIGNMENT USING MOBILE3

2APR85 0.43.52

IMPACT2 REPORT 2

PAGE --

START - UP EMISSION FACTORS  
 49-STATE STUDY YEAR 1990  
 TEMPERATURE= 95.0 DEG-F

POLLUTANT HC (IN POUNDS/TRIP-START)

PARKING DURATION	MIX1
<1 HR	.00455
1-4 HR	.01126
>4 HR	.01060

POLLUTANT CO (IN POUNDS/TRIP-START)

PARKING DURATION	MIX1
<1 HR	0.0092
1-4 HR	0.0245
>4 HR	0.0231

POLLUTANT NOX (IN POUNDS/TRIP-START)

PARKING DURATION	MIX1
<1 HR	.00251
1-4 HR	.00309
>4 HR	.00256

Report 3 presents the balance of the emission factors. These factors have a single value per vehicle mix.

2APR85 0.43.52 IMPACT2 REPORT 3 PAGE --  
 MISCELLANEOUS HC EMISSION FACTORS  
 49-STATE STUDY YEAR 1990

EMISSION SOURCE	MIX1
HOT-SOAK (POUNDS/TRIP)	.0076

EMISSION SOURCE	LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC
DIURNAL (POUNDS/VEH/DEG-F-INCREMENT)	.0005	.0005	.0006	.0018	.0000	.0000	.0000	.0004

Report 4 is the emissions subtotals by the type of calculation. This report is produced for an impact run by zones and an impact run by grids.

2APR85 0.43.52

IMPACT2 REPORT 4

PAGE --

## EMISSIONS SUBTOTALS

DESCRIPTION	HC POUNDS	CO POUNDS	NOX POUNDS
HOT RUNNING INTERZONAL	300003.84	4611610.45	242120.89
HOT RUNNING INTRAZONAL	3775.03	61853.16	1149.40
PRODUCTION EXCESS STARTUP HOT	18755.08	37852.26	10332.37
PROD EXCESS STARTUP 1 TO 4 HR	16870.75	36747.56	4075.82
PROD EXCESS STARTUP COLDSTART	17116.97	37292.79	4694.21
ATTR EXCESS STARTUP HOTSTART	18755.08	37852.26	10332.37
ATTR EXCESS STARTUP 1 TO 4 HR	16870.75	36747.56	4075.82
ATTR EXCESS STARTUP COLDSTART	17116.97	37292.79	4694.21
PRODUCTION HOTSOAK	55218.36	0.00	0.00
ATTRACTION HOTSOAK	55218.36	0.00	0.00
ALTERNATIVE DIURNAL	0.00	0.00	0.00
MAIN DIURNAL	59465.74	0.00	0.00
TOTAL	579166.93	4897248.82	281475.07

Report 5 presents the emissions sorted by zones.  
 Report 5 and Report 7 are mutually exclusive. In this example  
 all three pollutants are requested and the units are pounds.  
 There are 805 zones in this network.

16DEC85 10.53.11

IMPACT2 REPORT 5

PAGE --

E M I S S I O N S B Y Z O N E S  
 49-STATE STUDY YEAR 1990  
 FROM 00:01 TO 24:00 HOURS

PERIOD	ZONE	HC POUNDS	CO POUNDS	NOX POUNDS
1	1	783.92	7636.12	307.64
1	2	1626.98	22592.40	1380.98
1	3	1161.45	15600.37	1412.11
1	4	295.25	3374.16	210.08
1	5	204.29	2469.07	134.95
1	6	1223.86	16828.37	1256.99
1	7	1170.86	15229.86	1342.17
1	8	414.53	3779.32	234.11
1	9	657.14	7984.40	608.34
1	10	333.97	3675.25	247.50
1	11	266.24	2524.10	143.31
		...	...	...
1	37	869.61	12163.38	1233.64
1	38	165.99	1562.08	85.82
1	39	978.33	13668.34	1471.03
1	40	548.51	7095.86	797.91

16DEC85 10.53.11

IMPACT2 REPORT 5

PAGE --

E M I S S I O N S B Y Z O N E S  
 49-STATE STUDY YEAR 1990  
 FROM 00:01 TO 24:00 HOURS

PERIOD	ZONE	HC POUNDS	CO POUNDS	NOX POUNDS
1	801	47.08	241.22	15.13
1	802	309.86	4724.02	718.47
1	803	124.04	635.52	39.86
1	804	198.44	3033.59	461.75
1	805	137.17	702.78	44.08
SECTOR	1 SUBTOTAL	533312.28	6436429.30	475852.37
	1 TOTAL	533312.28	6436429.30	475852.37

LAV NAME(S) CORRESPONDING TO POLLUTANT(S) ABOVE:

HC	<--->	HC16
CO	<--->	CO16
NOX	<--->	NO16

Report 6 is produced only if Report 5 is produced. It is an inventory of the LAVS in the Z3 File after emission LAVS have been written to that file.

16DEC85 10.53.11 IMPACT2 REPORT 6 PAGE --

C O N T E N T S O F Z - F I L E Z 3

ZONES= 805 CREATION: DATE=23AUG83 TIME=17.05.08 PROG=Z3OUT

SPACE TOTAL UNUSED EMBEDDED  
(WORDS): DATA=152000 USED= 46900 AVAILABLE=105100 FREE SPACE= 0

ATTRIBUTE ENTRIES: LAVS PRESENT= 54 MAX R\*4 LAVS POSSIBLE=137

-----CREATION-----						
LAV NAME	UNITS	TYPE	DATE	TIME	PROGRAM	DESCRIPTION
A	VEH	R*4	23AUG83	17.05	Z3OUT	ATTRACTION
ATL	MILE	R*4	23AUG83	17.05	Z3OUT	INTRAZONAL ATL
CO01	POUNDS	I*4	31AUG83	12.58	IMPACT2	EMISSION TYPE 2
CO02	POUNDS	I*4	26FEB84	19.42	IMPACT2	EMISSION TYPE 2
CO03	POUNDS	I*4	27FEB84	16.34	IMPACT2	EMISSION TYPE 2
CO04	POUNDS	I*4	28FEB84	10.03	IMPACT2	EMISSION TYPE 2
CO05	POUNDS	I*4	28FEB84	12.48	IMPACT2	EMISSION TYPE 2
CO06	POUNDS	I*4	28FEB84	13.31	IMPACT2	EMISSION TYPE 2
CO07	POUNDS	I*4	28FEB84	14.45	IMPACT2	EMISSION TYPE 2
CO08	POUNDS	I*4	29FEB84	16.25	IMPACT2	EMISSION TYPE 2
CO09	POUNDS	I*4	1MAR84	18.20	IMPACT2	EMISSION TYPE 2
CO10	POUNDS	I*4	1MAR84	18.47	IMPACT2	EMISSION TYPE 2
CO11	POUNDS	I*4	2MAR84	0.06	IMPACT2	EMISSION TYPE 2
CO12	POUNDS	I*4	7MAR84	13.37	IMPACT2	EMISSION TYPE 2
CO13	POUNDS	I*4	7MAR84	14.49	IMPACT2	EMISSION TYPE 2
CO14	POUNDS	I*4	7MAR84	16.03	IMPACT2	EMISSION TYPE 2
CO15	POUNDS	I*4	7MAR84	17.22	IMPACT2	EMISSION TYPE 2
CO16	POUNDS	I*4	16DEC85	10.53	IMPACT2	EMISSION TYPE 2
HC01	POUNDS	I*4	31AUG83	12.58	IMPACT2	EMISSION TYPE 1
HC02	POUNDS	I*4	26FEB84	19.42	IMPACT2	EMISSION TYPE 1
HC03	POUNDS	I*4	27FEB84	16.34	IMPACT2	EMISSION TYPE 1
HC04	POUNDS	I*4	28FEB84	10.03	IMPACT2	EMISSION TYPE 1
HC05	POUNDS	I*4	28FEB84	12.48	IMPACT2	EMISSION TYPE 1
HC06	POUNDS	I*4	28FEB84	13.31	IMPACT2	EMISSION TYPE 1
HC07	POUNDS	I*4	28FEB84	14.45	IMPACT2	EMISSION TYPE 1
HC08	POUNDS	I*4	29FEB84	16.25	IMPACT2	EMISSION TYPE 1
HC09	POUNDS	I*4	1MAR84	18.20	IMPACT2	EMISSION TYPE 1
HC10	POUNDS	I*4	1MAR84	18.47	IMPACT2	EMISSION TYPE 1
HC11	POUNDS	I*4	2MAR84	0.06	IMPACT2	EMISSION TYPE 1
HC12	POUNDS	I*4	7MAR84	13.37	IMPACT2	EMISSION TYPE 1
HC13	POUNDS	I*4	7MAR84	14.49	IMPACT2	EMISSION TYPE 1
HC14	POUNDS	I*4	7MAR84	16.03	IMPACT2	EMISSION TYPE 1

HC15	POUNDS	I*4	7MAR84	17.22	IMPACT2	EMISSION TYPE 1
HC16	POUNDS	I*4	16DEC85	10.53	IMPACT2	EMISSION TYPE 1
INTRA	VEH	R*4	23AUG83	17.05	Z3OUT	INTRAZONAL TRIPS
NO01	POUNDS	I*4	31AUG83	12.58	IMPACT2	EMISSION TYPE 3
NO02	POUNDS	I*4	26FEB84	19.42	IMPACT2	EMISSION TYPE 3

16DEC85 10.53.11

IMPACT2 REPORT 6

PAGE --

## CONTENTS OF Z - FILE Z 3

-----CREATION-----						
LAV NAME	UNITS	TYPE	DATE	TIME	PROGRAM	DESCRIPTION
-----						
NO03	POUNDS	I*4	27FEB84	16.34	IMPACT2	EMISSION TYPE 3
NO04	POUNDS	I*4	28FEB84	10.03	IMPACT2	EMISSION TYPE 3
NO05	POUNDS	I*4	28FEB84	12.48	IMPACT2	EMISSION TYPE 3
NO06	POUNDS	I*4	28FEB84	13.31	IMPACT2	EMISSION TYPE 3
NO07	POUNDS	I*4	28FEB84	14.45	IMPACT2	EMISSION TYPE 3
NO08	POUNDS	I*4	29FEB84	16.25	IMPACT2	EMISSION TYPE 3
NO09	POUNDS	I*4	1MAR84	18.20	IMPACT2	EMISSION TYPE 3
NO10	POUNDS	I*4	1MAR84	18.47	IMPACT2	EMISSION TYPE 3
NO11	POUNDS	I*4	2MAR84	0.06	IMPACT2	EMISSION TYPE 3
NO12	POUNDS	I*4	7MAR84	13.37	IMPACT2	EMISSION TYPE 3
NO13	POUNDS	I*4	7MAR84	14.49	IMPACT2	EMISSION TYPE 3
NO14	POUNDS	I*4	7MAR84	16.03	IMPACT2	EMISSION TYPE 3
NO15	POUNDS	I*4	7MAR84	17.22	IMPACT2	EMISSION TYPE 3
NO16	POUNDS	I*4	16DEC85	10.53	IMPACT2	EMISSION TYPE 3
P	VEH	R*4	23AUG83	17.05	Z3OUT	PRODUCTION
SPIN	MPH	R*4	23AUG83	17.05	Z3OUT	SPEED, INTRAZONAL
T	F	R*4	23AUG83	17.05	Z3OUT	TEMPERATURE

Report 7 is the emissions summed by grid squares. This report is produced when the grid parameter in the &PARAM data is set to a positive value. This value sets the size of each grid square in terms of the coordinate units. The two values in the &PARAM parameter ref set the southwest corner of the area which is summed by grid squares. This area is 50 grids in the X coordinates and 50 grids in the Y coordinates for a total of 2500 grid squares. Only the grid squares which have non zero emissions are reported. The emissions which fall outside of these 2500 grid squares are summed into the output line labeled outside.

HOUSTON / HARRIS COUNTY 1990 ASSIGNMENT USING MOBILE3  
 2APR85 0.43.52 IMPACT2 REPORT 7

PAGE --

49-STATE PERIOD 1 EMISSIONS BY GRID SQUARES FOR HARRIS COUNTY FROM 00:01 TO 24:00 HOURS STUDY YEAR 1990

X GRID	Y GRID	HC POUNDS	CO POUNDS	NOX POUNDS
217	327	242.05	1041.68	101.03
217	330	1.33	17.88	1.84
217	333	1.67	22.49	2.30
217	336	1.67	22.49	2.30
220	312	8.22	133.29	4.37
220	324	2.12	28.11	3.37
220	327	58.36	766.43	95.58
220	330	8.60	116.04	11.72
220	333	8.60	116.04	11.72
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

## HOUSTON / HARRIS COUNTY 1990 ASSIGNMENT USING MOBILE3

2APR85 0.43.52

IMPACT2 REPORT 7

PAGE --

E M I S S I O N S B Y G R I D S Q U A R E S

49-STATE                      FOR OTHER                      STUDY YEAR 1990  
 PERIOD 1                      FROM 00:01 TO 24:00 HOURS

X GRID	Y GRID	HC POUNDS	CO POUNDS	NOX POUNDS
316	294	47.69	642.66	68.77
316	297	30.05	405.09	43.25
316	300	226.41	3060.59	331.27
316	303	15.05	200.11	23.27
316	309	16.59	220.80	26.53
316	312	16.59	220.80	26.53
316	315	16.59	220.80	26.53
316	327	13.05	169.56	21.88
319	294	1.84	24.55	2.95
319	297	79.57	1072.30	114.97
319	300	417.10	5807.65	569.34
319	303	18.01	240.63	28.52
319	306	16.59	220.80	26.53
322	300	3473.07	6261.07	545.33
SUBTOTAL		98221.23	350698.71	28053.50
OUTSIDE		43197.24	646986.84	41311.96
TOTAL		579161.89	4897230.30	281474.23

## FILE TABLE

## 1. IMPACT1

	FILE NAME	DDNAME	CONTENTS OR FUNCTION
I N P U T	SYSIN	FT03F001 FT05F001 FT08F001	MOBILE3 ATP PROGRAM DATA CONTROL CARD INPUTS &TRAVEL CARD INPUTS
	LINK	Z1	LINK Z-FILE FOR IMPACT2
	NODE	Z2	NODE Z-FILE FOR IMPACT2
	ZONE	Z3	ZONE Z-FILE FOR IMPACT2
O U T P U T	SYSOUT	FT06F001	REPORTS AND MESSAGES
	&&FILE1	FT11F001	INPUT CARD IMAGES FOR STEP 1 OF MOBILE2
	&&FILE2	FT12F001	INPUT CARD IMAGES FOR STEP 2 OF MOBILE2
	&&FILE3	FT13F001	INPUT CARD IMAGES FOR STEP 3 OF MOBILE2
	&&FILE4	FT14F001	INPUT CARD IMAGES FOR STEP 4 OF MOBILE2
	&&FILE5	FT15F001	INPUT CARD IMAGES FOR STEP 5 OF MOBILE2
	&&DATA	FT19F001	FILE CONTAINING CONTROL FLAGS FOR CONTROL CARDS AND ANY &DATA CARDS INPUT BY THE USER
	&&CONT	FT20F001 FT21F001	CONTROL CARD IMAGES LOG FILE
	&&TRAVEL	FT22F001	&TRAVEL CARD IMAGES
	&&PAGE	FT49F001	SCRATCH FILE FOR SIGNON
&&ATP	FT33F001	FILE CONTAINING COPIED ATP DATA FOR MOBILE3	
O T H E R	GRID	FT23F001	GRID FILE FOR IMPACT2

## 2. MOBILE2 OR MOBILE3

	FILE NAME	DDNAME	CONTENTS OR FUNCTION
I N P U T	SYSIN	FT03F001 FT05F001	&&ATP FOR ATP DATA FOR MOBILE3 &&FILE1 FOR STEP 1 EXECUTION &&FILE2 FOR STEP 2 EXECUTION &&FILE3 FOR STEP 3 EXECUTION &&FILE4 FOR STEP 4 EXECUTION &&FILE5 FOR STEP 5 EXECUTION
O U T P U T		FT07F001 FT08F001	EMISSION FACTORS PASSED TO IMPACT2 ERROR MSG FILE PASSED TO IMPACT2
O T H E R	&&PAGE	FT15F001 FT20F001 FT21F001 FT49F001	DUMMIES FOR SIGNON IN MOBILE2... LOG FILE SCRATCH FILE FOR SIGNON

## 3. IMPACT2

	FILE NAME	DDNAME	CONTENTS OR FUNCTION
I N P U T	SYSIN	FT01F001	EMISSION FACTORS FILE FROM MOBILE2
		FT02F001	ERROR MESSAGE FILE FROM MOBILE2
	&&ATP	FT03F001	FILE CONTAINING ATP DATA FOR MOBILE3 RUN.
	&&DATA	FT19F001	FILE CONTAINING CONTROL FLAGS FOR CONTROL CARDS AND ANY &DATA CARDS INPUT BY THE USER
	&&CONT	FT20F001	CONTROL CARD IMAGES
	&&TRAVEL	FT22F001	&TRAVEL CARD IMAGES
	&&PAGE	FT49F001	SCRATCH FILE FOR SIGNON
	LINK	Z1	LINK Z-FILE
	NODE	Z2	NODE Z-FILE
ZONE	Z3	ZONE Z-FILE	
O U T P U T		FT21F001	LOG FILE
	GRID	FT23F001	GRID FILE
	ZONE	Z3	ZONE Z-FILE
O T H E R		Z4	SCRATCH Z-FILES FOR EMISSION FACTORS AGGREGATION...
		Z5	
		Z6	

KEYWORD TABLE

KEYWORD	TYPE	DEFAULT	MAX	VALUE OR PURPOSE
ATPFMY	I	NONE	2020	ATP FIRST MODEL YEAR FOR MOBILE3 (SEE PAGE 21 OF MOBILE3 MANUAL)
ATPHGV	I	NONE	2	FLAG INDICATING IF HDGV VEHICLES ARE COVERED BY A MOBILE3 ATP, 1=NO, 2=YES
ATPIM	I	NONE	2020	ATP START YEAR
ATPLGV	I	NONE	2	FLAG INDICATING IF LDGV VEHICLES ARE COVERED BY A MOBILE3 ATP, 1=NO, 2=YES
ATPLG1	I	NONE	2	FLAG INDICATING IF LDGT1 VEHICLES ARE COVERED BY A MOBILE3 ATP, 1=NO, 2=YES
ATPLG2	I	NONE	2	FLAG INDICATING IF LDGT2 VEHICLES ARE COVERED BY A MOBILE3 ATP, 1=NO, 2=YES
ATPLMY REGION	I	NONE	2020	ATP LAST MODEL YEAR FOR MOBILE3 LOCATION OF STUDY AREA: 1 = 49-STATE 2 = CALIFORNIA 3 = HIGH ALTITUDE
	I	1	3	
YEAR	I	NONE	2020	STUDY YEAR (1970<YEAR<2020)
TEMP	I	24C	43C	NOONTIME TEMPERATURE FOR NOX HUMIDITY CORRECTION FACTOR
		(75F)	(110F)	
ALT	I	0		ALTITUDE OF STUDY SITE
HUM	I	NONE	100	RELATIVE HUMIDITY AT NOONTIME
				TEMPERATURE (FOR NOX HUMIDITY CORRECTION FACTOR)
MIX<P>	D(8,2)	MIX1=(1,100)	(1-8), 100.0	VEHICLE MIX BY TRIP PURPOSE, <P> MIX<P> := (<VEHICLE-TYPE>, <%-IN-MIX>); <P> = 1,8
VCOUNT	I(8)	(1-8),0	(1-8), IMAX	NUMBER OF REGISTERED OR "COUNTED" VEHICLES IN STUDY AREA BY EPA VEHICLE TYPE
MYRP<T>	D(20)	SEE NOTES	100.	MODEL YEAR REGISTRATION PERCENTAGE BY VEHICLE TYPE, <T> = 1,8
USAGE<T>	I(20)	SEE NOTES	199,999	ANNUAL ACCRUAL RATE (MILES OR KM) BY VEHICLE TYPE, <T> = 1,8
IMYEAR	I	NONE	2020	BEGINNING YEAR FOR INSPECTION/ MAINTENANCE PROGRAM (>1969)
IMFAIL GRID	I	10	50	I/M PROGRAM LDV FAILURE RATE (%) SIZE OF GRID SQUARE TO WHICH LINK IMPACTS MAY BE ASSIGNED
		D	SEE NOTES	
REF	D(2)	X=Y=-1.	SEE NOTES	IF REF>=0., ASSIGNMENT TO "GRID" SQUARES WILL BE MADE
TRIPS	I	NONE		TRIPS PER DAY PER VEHICLE

KEYWORD TABLE (CONTINUED)					
	KEYWORD	TYPE	DEFAULT	MAX	VALUE OR PURPOSE
O P T I O N	DRYRUN	L	F		= T TO GET DRYRUN FEATURES
	METRIC	L	F		= T TO GET METRIC UNITS (CELSIUS "TEMP" KILOMETERS, MILLILITERS)
	OUTREV	L	F		= T TO REVERSE METRIC OPTION ON REPORTS AND OUTPUT FILES
	IMMECH	L	F		= T IF MECHANICS TRAINING A PART OF LDV I/M PROGRAM
	INISPD	I	5		INITIAL SPEED
	MAXSPD	I	55	SEE	MAXIMUM SPEED
	STPSPD	I	5	NOTES	SPEED STEP(INCREMENT)
	MAXTEM	I	110(F)		MAXIMUM TEMPERATURE
	STPTM	I	5		TEMPERATURE STEP(INCREMENT)
	WIPOUT	L	F		= T TO DELETE LAVS FROM ZONE Z-FILE
	MOBIL3	F			IF TRUE RUN MOBILE3.
S E L E C T	REPORT	R(8)	NONE	(1-8)	REPORT SELECTION: 1= TRAVEL RELATED FACTORS ONLY 2= TRIP-START RELATED ONLY 3= MISCELLANEOUS ONLY 4= EMISSION SUBTOTALS 5= EMISSIONS BY ZONES 6= CONTENTS OF A Z FILE 7= EMISSIONS BY GRID SQUARES
	POL	A(7)	NONE	---	POLLUTANT SELECTION: 'HC' = TOTAL HYDROCARBONS 'NMHC' = NON-METHANE HC ONLY 'CO' = CARBON MONOXIDE 'NOX' = OXIDES OF NITROGEN

KEYWORD	TYPE	DEFAULT	MAX	VALUE OR PURPOSE
PERIOD(H)	D(1, 2)	NONE	2400	(START,STOP) TIME FOR EACH IMPACT ASSIGNMENT PERIOD, H:=1-24.
VOLUME(H)	A(8)	NONE	---	LINK VOLUME LAV NAMES FOR PERIOD.
SPEED(H)	A(8)	NONE	---	LINK SPEED LAV NAMES CORRESPONDING TO EACH VOLUME LAV.
VFAC(H)	D(8)	VFAC(1) :=100.	100.	PERCENT OF "VOLUME(I)" OCCURRING IN "PERIOD" H (I:=1-8).
VMIX(H)	I(8)	NONE	8	MIX<N> NUMBER (FROM &PARAM INPUT) TO BE ASSOCIATED WITH A GIVEN VOLUME LAV.
P(H)	A(8)	NONE	---	PRODUCTION AND ATTRACTION LAV
& A(H)	A(8)	NONE	---	NAMES ASSOCIATED WITH PERIOD H.
T TFAC(H)	D(8)	TFAC(1) :=100.	100.	TFAC(I:=1-8) GIVES PERCENT OF CORRESPONDING TRIP "P(I)" AND "A(I)" IN PERIOD H.
R STARTS(H)	D(8)	NONE	100.	STARTS(I:=1-8) GIVES PERCENT OF TRIP "P(I)" WHICH ARE STARTS. (100 - STARTS(I)) IS THUS THE PERCENT OF TRIP "A(I)" WHICH ARE STARTS.
A				
V TMIX(H)	I(8)	NONE	---	INDICATES WHICH MIX<N> APPLIES TO EACH SET OF "P" AND "A" LAVS
E PPARK(2, H)	D(8)	NONE	100.	PERCENT OF "P(I)" ("A(I)") STARTS IN PERIOD H BY VEHICLES PARKED <
L APARK(2, H)	D(8)	NONE	100.	1 HOUR (PPARK(1), APARK(1)) OR > 4 HOURS (PPARK(2), APARK(2)).
ATEMP(H)	A	NONE	---	AMBIENT TEMPERATURE ACROSS ALL ZONES IN PERIOD H
INTRA(H)	A(8)	NONE	---	NUMBER OF INTRAZONAL TRIPS IN EACH ZONE (ONE LAV FOR EACH P(I)
SPIN(H)		15 MPH	65 MPH	(LAV OF) INTRAZONAL SPEED(S)
ATL(H)	A	SEE NOTES	SEE NOTES	(LAV OF) AVERAGE INTRAZONAL TRIP LENGTH(S)

## NOTES

## 1. &amp;PARAM

ATPIM LAST TWO DIGITS OF THE YEAR OF ATP IMPLEMENTATION (60-99, 00-20). IF THIS PARAMETER IS INCLUDED IT IS FOR A MOBILE3 ANTI-TAMPERING PROGRAM. IT WILL BE IGNORED IF THE RUN IS FOR MOBILE2. AN ATP PROGRAM SET OF DATA MUST BE INCLUDED AFTER THE "//IMPL.INPUT3 DD \* " JCL STATEMENT. ALSO THE PARAMETERS ATPFMY, ATPLMY, ATPLDGV, ATPLG1, ATPLG2, AND ATPHGV MUST BE INCLUDED ON THE &PARAM DATA.

ATPFMY FIRST MODEL YEAR INCLUDED IN ATP (41-99, 00-20).

ATPLMY LAST MODEL YEAR INCLUDED IN ATP (41-99, 00-20).

ATPLGV IS LDGV VEHICLE; 1 = NOT COVERED, 2 = COVERED IN ATP.

ATPLG1 IS LDGT1 VEHICLE 1 = NOT COVERED, 2 = COVERED IN ATP.

ATPLG2 IS LDGT2 VEHICLE; 1 = NOT COVERED, 2 = COVERED IN ATP.

ATPHGV IS HDGV VEHICLE; 1 = NOT COVERED, 2 = COVERED IN ATP.

REGION IF THE STUDY IS BEING DONE FOR A LOCATION IN CALIFORNIA OR AT AN ALTITUDE OF 5000 FEET OR GREATER, THE EMISSION FACTORS USED IN THE CALCULATION ARE DIFFERENT FROM THOSE USED FOR THE REST OF THE COUNTRY. BECAUSE CALIFORNIA LED THE COUNTRY IN MANDATING NEW VEHICLE EMISSION STANDARDS, ITS CURRENT FLEET MEETS MORE STRINGENT STANDARDS THAN FLEETS IN THE OTHER 49 STATES. IN HIGH ALTITUDE AREAS, THE REDUCED BAROMETRIC PRESSURE RESULTS IN MODIFIED COMBUSTION STOICHIOMETRY. THIS, ALONG WITH MODIFIED EMISSION CONTROL HARDWARE FOR HIGH ALTITUDE VEHICLES RESULTS IN EMISSION FACTORS DIFFERENT FROM THOSE ASSOCIATED WITH VEHICLES USED AT LOW ALTITUDES. THE USER SPECIFIES THE VALUE OF REGION FOR MOBILE2 AS FOLLOWS:

REGION=1 FOR LOW ALTITUDE  
 REGION=2 FOR CALIFORNIA  
 REGION=3 FOR HIGH-ALTITUDE

THE DEFAULT IS REGION=1.

FOR MOBILE3 THE USER SPECIFIES REGION AS FOLLOWS:

REGION=1 FOR LOW ALTITUDE  
 REGION=2 FOR HIGH ALTITUDE

YEAR THE MODEL PERFORMS CALCULATIONS FOR STUDY YEARS 1970-2020. ANY STUDY YEAR GREATER THAN 2020 IS TREATED AS 2020, SINCE COMPLIANCE STANDARDS AND CALCULATION PROCEDURES WILL BE DIFFERENT BY THAT TIME. CODING THE LAST 2 DIGITS OF THE STUDY YEAR IS ACCEPTABLE. FOR EXAMPLE, CODING

YEAR=99

IS INTERPRETED AS "YEAR=1999". FAILURE TO CODE THE STUDY YEAR

RESULTS IN A FATAL ERROR.

TEMP IS USED TO DEVELOP A CORRECTION FACTOR FOR NOX EMISSIONS. NOX EMISSIONS ARE USUALLY LOW, BUT ALONG WITH HC AND SUNLIGHT, THEY ARE A PRECURSOR OF OZONE FORMATION. BOTH THE AMOUNT OF NOX EMISSIONS AND ITS AIR QUALITY EFFECT ARE INFLUENCED BY TEMPERATURE AND ABSOLUTE HUMIDITY. "TEMP" SHOULD BE THE NOONTIME TEMPERATURE ON THE "DAY" OF THE STUDY YEAR FOR WHICH FACTORS ARE BEING DEVELOPED. "TEMP" MAY TAKE ANY "INTEGER" VALUE BETWEEN -18 AND 43 DEGREES CELSIUS (0 TO 110 DEGREES FAHRENHEIT). CAUTION: IF METRIC=TRUE, THE VALUE OF "TEMP" IS ASSUMED TO BE IN CELSIUS DEGREES. THUS, CODING

"TEMP=50" AND "METRIC=TRUE"

RESULTS IN AN ERROR CONDITION.

ALT IS ALTITUDE IN FEET OR METERS FOR THE HUMIDITY CORRECTION. DEFAULT IS ZERO. EXAMPLE: ALT=1320

HUM IS THE RELATIVE HUMIDITY IN PERCENT AT TEMPERATURE, "TEMP", FOR USE IN COMPUTING THE NOX CORRECTION FACTOR. THIS CORRECTION FACTOR IS DETERMINED FROM ABSOLUTE HUMIDITY, WHICH CAN BE DETERMINED FROM THE RELATIVE HUMIDITY AT A GIVEN TEMPERATURE AND BAROMETRIC PRESSURE. IMPACT ASSUMES AMBIENT PRESSURE OF 760 MM OF MERCURY (FOR REGION=1). THE ASSUMPTION IS ALSO MADE THAT ABSOLUTE HUMIDITY DOES NOT VARY GREATLY IN THE COURSE OF A DAY EXCEPT FOR PRECIPITATION, IN WHICH CASE NOX IS NOT A PROBLEM AS A PRECURSOR TO OZONE FORMATION. IF BOTH KEYWORDS TEMP AND HUM ARE OMITTED THE CORRECTION CALCULATION WILL NOT BE USED; OMITTING ONLY ONE CAUSES AN ERROR. EXAMPLE: HUM=62

MIX<P> IS (<P>=1,8) THE VEHICLE MIX BY TRIP PURPOSE AND/OR ASSIGNMENT REQUIRED FOR ALLOCATION OF EMISSIONS TO THE TRANSPORTATION NETWORK. TRIP PURPOSE DETERMINES BOTH THE VMT-SPLIT AND THE PERCENT OF VEHICLES OF A GIVEN TYPE ON A GIVEN LINK AT A GIVEN TIME OF DAY AS WELL AS DEFINING THE OPERATING MODE OF THE ENGINES (EXAMPLE: COLD START, HOT SOAK, HOT STABILIZED). THE MIX USED FOR A TRIP MATRIX AND THE MIX USED FOR AN ASSIGNMENT ARE INDEPENDENTLY SPECIFIED. THE USER SHOULD BE CAREFUL TO DEFINE RELATIVELY HOMOGENEOUS VEHICLE MIXES BY TRIP PURPOSE BASED ON THE ABOVE THREE CRITERIA SO THAT THE MODEL MAY ACCURATELY ALLOCATE EMISSIONS TO TRANSPORTATION NETWORK LOCATIONS. UP TO EIGHT VEHICLE MIXES ARE ALLOWED SO THAT HOMOGENEITY OF MIX MAY BE PRESERVED. THE USER MAY SPECIFY ONE MIX FOR A TRIP MATRIX AND ANOTHER MIX FOR THE ASSIGNMENT RESULTING FROM THE TRIP MATRIX, I. E. TMIX(1)=1, VMIX(1)=8. IN MOST CASES THE USER WILL USE THE SAME MIX FOR A TRIP MATRIX AND THE RESULTING ASSIGNMENT, I. E. VMIX(2)=3, TMIX(2)=3. SINCE UP TO 24 TIME PERIODS WITH 8 ASSIGNMENTS AND 8 TRIP MATRICES MAY BE SPECIFIED (384 REFERENCES TO MIXES) AND ONLY 8 VEHICLE MIXES MAY BE SPECIFIED; MANY REFERENCES TO VEHICLE MIXES WILL BE MADE TO THE SAME VEHICLE MIX IF SEVERAL TIME PERIODS OR ASSIGNMENTS ARE USED.

VEHICLE MIXES ARE SPECIFIED BY PAIRS OF NUMBERS OF THE FORM,

( $\langle$ VEHICLE TYPE NUMBER $\rangle$ , $\langle$ PERCENT IN MIX $\rangle$ )

WHERE  $\langle$ VEHICLE TYPE NUMBER $\rangle$  IS AN INTEGER FROM 1 TO 8 ENTERED WITH A DECIMAL POINT. (SEE THE VEHICLE TYPE TABLE IN THE METHODOLOGY SECTION) AND  $\langle$ PERCENT IN MIX $\rangle$  IS A REAL NUMBER BETWEEN 0.0 AND 100.0.

FAILURE TO CODE A VEHICLE MIX RESULTS IN A DEFAULT MIX OF

MIX1=(1,100)

WITH ALL OTHER VALUES FOR ALL VEHICLE TYPES DEFAULTING TO 0.0%.

THE FOLLOWING CODE YIELDS A MIX WHICH CONTAINS NO TYPE 5 OR 6 VEHICLES (I.E., NO LIGHT DUTY DIESEL POWERED TRUCKS OR AUTOS). IT CONSISTS OF APPROXIMATELY 80% LDGV, 6% EACH LDGT1 AND LDGT2, 5% HDGV AND 3% HDDV.

MIX1=(1.,80.4),(2.,5.9),(3.,5.9),(4.,4.6),(7.,3.2).

THE PERCENTAGE OF VEHICLE TYPES WITHIN A GIVEN VMIX SHOULD SUM TO 100. HOWEVER, IMPACT ACCEPTS A RANGE OF 99.0 $\langle$ SUM(% $\rangle$ ) $\langle$ 101.0 TO ALLOW FOR ROUNDING ERRORS, AND THE SPECIFIED VEHICLE TYPE PERCENTAGES ARE INTERNALLY ADJUSTED TO SUM TO 100.

IF EMISSION FACTORS FOR A SINGLE VEHICLE TYPE ONLY ARE DESIRED (AS IN THE DEFAULT MIX), CODE

MIX $\langle$ P $\rangle$ =( $\langle$ VEHICLE TYPE NUMBER $\rangle$ .,100.)

MYRP $\langle$ T $\rangle$  IS THE MODEL YEAR REGISTRATION PERCENTAGE BY VEHICLE TYPE ( $\langle$ T $\rangle$ =1,8), USED IN THE COMPUTATION OF EVAPORATIVE EMISSION FACTORS AND THE TRAVEL CORRECTION FACTOR APPEARING IN THE EMISSION EQUATIONS. THE REGISTRATION PERCENTAGES ARE REAL NUMBERS CUMULATIVE ACROSS MODEL YEAR (MY), SO THAT FOR A GIVEN VEHICLE TYPE, T, SUM(MYRP $\langle$ T $\rangle$ )=100.%,

WHERE SUM( ) GOES FROM MY="YEAR" TO MY=("YEAR-19"). VEHICLE TYPE NUMBERS ARE LISTED UNDER PART ONE OF THE METHODOLOGY SECTION. DEFAULT VALUES FOR MOBILE2 (NATIONAL AVERAGES) ARE LISTED IN TABLE II:

MOBILE3 - IF THIS VARIABLE IS SET TO TRUE THEN DATA CARDS FOR A MOBILE3 RUN WILL BE BUILT; IF FALSE THEN DATA CARDS FOR A MOBILE2 RUN WILL BE BUILT.

STUDY YEAR MINUS:	VEHICLE TYPE							
	GASOLINE FUELED				DIESEL FUELED			GAS
	1	2	3	4	5	6	7	8
0	7.2	9.7	24.5	12.8	7.2	9.7	17.7	13.3
1	10.1	9.5	20.7	11.4	10.1	9.5	14.2	14.5
2	9.2	8.6	15.5	9.7	9.2	8.6	8.5	13.8
3	7.1	6.1	9.7	7.4	7.1	6.1	5.4	11.6
4	9.2	9.1	5.7	8.6	9.2	9.1	9.8	12.3
5	10.3	9.9	5.6	8.8	10.3	9.9	9.3	11.4
6	8.9	7.6	3.9	7.1	8.9	7.6	7.2	6.9
7	7.1	6.0	3.0	5.3	7.1	6.0	5.2	4.4
8	6.6	4.4	2.3	4.1	6.6	4.4	4.2	2.4
9	5.9	4.8	2.0	4.4	5.9	4.8	4.2	0.9
10	4.8	4.6	1.7	4.0	4.8	4.6	3.1	8.5
11	3.5	3.3	1.1	3.1	3.5	3.3	2.4	0.0
12	3.0	3.5	1.0	3.0	3.0	3.5	2.5	0.0
13	2.3	3.3	0.8	2.6	2.3	3.3	1.9	0.0
14	1.5	2.6	0.5	2.1	1.5	2.6	1.3	0.0
15	1.0	2.1	0.6	1.8	1.0	2.1	1.0	0.0
16	0.6	1.5	0.5	1.3	0.6	1.5	0.7	0.0
17	0.3	1.1	0.3	0.9	0.3	1.1	0.4	0.0
18	0.2	1.0	0.3	0.8	0.2	1.0	0.4	0.0
19	1.5	1.3	0.4	1.0	1.5	1.3	0.7	0.0

TABLE II - DEFAULT VALUES FOR MYRP&lt;T&gt; (%)

ANY DESIRED CHANGE TO A GIVEN VEHICLE TYPE REGISTRATION DISTRIBUTION REQUIRES INPUT OF UP TO 20 MODEL YEAR VALUES, FOR THAT VEHICLE TYPE ONLY. FOR EXAMPLE, TO CHANGE "YEAR-5" IN MYRP2 TO 8.0, CODE: &PARAM ...MYPR2(6)=8.0,....

(NOTE: SUM(MYRP<T>) MUST REMAIN 100%)

USAGE<T> IS THE AVERAGE ANNUAL ACCRUAL RATE FOR KILOMETERS (MILES) BY VEHICLE TYPE(<T>=1,8) FOR EACH OF THE 20 MODEL YEARS IN A STUDY. THE VALUES ARE ENTERED AS INTEGERS AND ARE USED TO DETERMINE THE TRAVEL FACTOR PORTION OF THE EMISSION EQUATIONS. DIVIDE THE ACTUAL MILEAGE BY 100 BEFORE ENTERING. EXAMPLE: 15,800 IS ENTERED AS 158.

DEFAULT VALUES FOR USAGE<T> ARE LISTED IN TABLE III. CHANGES TO THE DEFAULT VALUES ARE MADE LIKE CHANGES TO MYRP<T>.

STUDY YEAR MINUS:	VEHICLE TYPE NUMBER							
	GASOLINE FUELED				DIESEL FUELED			GAS
	1	2	3	4	5	6	7	8
0	14400	15600	15800	21000	14400	15700	70400	4100
1	13900	14000	14200	18900	13900	15100	66900	2800
2	13400	12500	12600	17200	13400	14600	60600	2100
3	12800	11200	11400	15500	12800	14000	54200	1600
4	12300	10100	10300	14100	12300	13000	47900	1200
5	11800	9400	9500	12600	11800	12100	43700	800
6	11200	8600	8700	11300	11200	11000	39400	600
7	10700	8000	8100	10300	10700	9700	36600	400
8	10200	7500	7600	9400	10200	9300	34500	200
9	9600	7000	7100	8600	9600	7400	33100	200
10	9100	6600	6600	8000	9100	6800	32400	200
11	8600	6200	6300	7300	8600	6100	31700	0
12	8000	5900	6000	6700	8000	5500	31000	0
13	7500	5500	5500	6300	7500	5000	29600	0
14	7000	5200	5200	5900	7000	4600	27500	0
15	6400	5100	5100	5500	6400	4200	24600	0
16	5900	4700	4700	5200	5900	3800	20400	0
17	5400	4400	4400	5000	5400	3100	17600	0
18	4900	4400	4400	5000	4900	3100	17600	0
19	4300	4400	4400	5000	4300	3100	17600	0

TABLE III - DEFAULT VALUES FOR USAGE<T>  
(MILES)

EXAMPLE: USAGE1(3)=134

VCOUNT ARE THE USER REGISTRATION FIGURES FOR THE 8 VEHICLE TYPES. THE DATA FROM THIS KEYWORD ARE USED FOR THE DIURNAL HYDROCARBON EMISSION CALCULATION. IF VCOUNT ARE NOT ENTERED THEN TRIPS MUST BE ENTERED. VCOUNT IS ENTERED IN UNITS OF THOUSANDS. EXAMPLE: VCOUNT(1)=500 MEANS THAT THERE ARE 500,000 VEHICLES OF TYPE 1 REGISTERED IN THE MODEL AREA. EXAMPLE: TRIPS=2

TRIPS IS USED ONLY WHEN VCOUNT IS NOT ENTERED. AN ESTIMATE OF THE NUMBER OF TRIPS PER DAY IS COMBINED WITH PRODUCTIONS AND ATTRACTIONS TO ESTIMATE VCOUNT. THERE IS ONLY ONE TRIPS KEYWORD.

IMYEAR IS THE YEAR IN WHICH A LIGHT-DUTY VEHICLE INSPECTION/MAINTENANCE PROGRAM WAS BEGUN IN THE AREA UNDER STUDY (1970 <IMYEAR < 2020). BECAUSE SUCH A PROGRAM HAS BEEN SHOWN TO YIELD SIGNIFICANT REDUCTIONS IN EMISSIONS, IMPACT GIVES "CREDIT", BY WEIGHTING FACTORS, FOR THE I/M PROGRAM. IF THE I/M PROGRAM WAS IMPLEMENTED AFTER JUNE 30 OF A GIVEN YEAR, THE NEXT CALENDAR YEAR SHOULD BE CODED FOR THE KEYWORD VALUE. IF IMYEAR INPUT IS OUT OF ACCEPTABLE RANGE, THE I/M PROGRAM WILL BE IGNORED. EXAMPLE: IMYEAR=1970

IMFAIL IS THE PERCENT OF VEHICLES(10<=IMFAIL<=50) FAILING INSPECTION IN AN I/M PROGRAM. THE STRINGENCY OF AN I/M PROGRAM ALSO EFFECTS A REDUCTION IN EMISSIONS. IF "IMYEAR" IS NOT INPUT, "IMFAIL" IS IGNORED. IF "IMYEAR" IS INPUT,

IMFAIL=10

IS THE DEFAULT VALUE.

## 2. &OPTIONS

DRYRUN IS THE USUAL DRYRUN OPTION. WHEN DRYRUN=TRUE, IMPACT EDITS THE KEYWORD VALUES FOR CONSISTENCY AND RANGE AND PRINTS ASSOCIATED MESSAGES.

METRIC IS THE USUAL METRIC OPTION. WHEN METRIC=TRUE THE RESULTS OF ALL CALCULATIONS ARE REPORTED AND STORED IN METRIC UNITS. THE VALUE OF THIS OPTION IS ALSO OUTPUT TO THE LOOKUP TABLE FILES SO THAT THE USER MAY BE NOTIFIED WHETHER THE EMISSION FACTORS ARE IN THE SAME UNITS AS THE TRANSPORTATION NETWORK.

THE IMMECH OPTION INDICATES WHETHER A MECHANICS TRAINING PROGRAM IS PART OF THE LDGV INSPECTION/MAINTENANCE PROGRAM. MECHANICS TRAINING PRODUCES SIGNIFICANTLY LARGER REDUCTIONS IN VEHICLE EMISSIONS COMPARED WITH AN I/M PROGRAM WHICH DOES NOT INCORPORATE SUCH TRAINING. IF "IMYEAR" IS NOT CODED, "IMMECH" IS IGNORED. EXAMPLE: IMMECH=T

IN ORDER TO REDUCE THE COSTS OF RUNS OF MOBILE2, THE SIZE OF STEPS OF SPEED AT TEMPERATURE MAY BE INCREASED. THE KEYWORDS ARE INISPD FOR LOWEST SPEED, MAXSPD FOR HIGHEST SPEED AND STSPD FOR STEP SIZE OF SPEED. THE DEFAULTS ARE INISPD=5MPH, MAXSPD=55 MPH, STSPD=5 MPH. THE COMBINATION MUST BE CHOSEN SO THAT THE STEPS ARE A MULTIPLE OF 5MPH AND THE MAXIMUM SPEED CAN

BE EXACTLY REACHED IN A MULTIPLE OF SPEED STEPS. THE KEYWORDS FOR TEMPERATURE ARE STPTM FOR TEMPERATURE STEPS AND MAXTEM FOR MAXIMUM TEMPERATURE. THE TEMPERATURE STEPS BEGIN AT ZERO DEG-F, THE DEFAULT STEP SIZE IS 5 DEG-F AND THE DEFAULT MAXIMUM TEMPERATURE IS 110 DEG-F. THE COMBINATION MUST BE CHOSEN SO THAT THE STEP SIZE IS A MULTIPLE OF 5 DEG-F AND THE MAXIMUM TEMPERATURE CAN BE EXACTLY REACHED IN A MULTIPLE OF STEP SIZES. THERE IS NO ERROR POSSIBLE. IF THE CONDITIONS ABOVE ARE NOT SATISFIED A WARNING IS PRINTED AND DEFAULTS TAKEN.

EXAMPLE: INISPD=5,MAXSPD=55,STPSD=10,STPTM=20,MAXTEM=100

OUTREV REVERSES THE UNITS OF THE OUTPUT. THE DEFAULT IS OUTREV=F. IF OUTREV=T AND METRIC=T, THEN THE INPUT IS METRIC AND THE OUTPUT IS NON-METRIC. IF OUTREV=T AND METRIC=F, THEN INPUT IS NON-METRIC AND OUTPUT IS METRIC.

WIPOUT = T ALLOWS DELETION OF LAVS FROM THE ZONAL Z-FILE, IF THE SPACE IS NEEDED FOR NEW LAVS TO BE GENERATED IN A RUN. THE REQUIRED NUMBER OF LAV SPACES IS CALCULATED FROM THE NUMBER OF POLLUTANTS REQUESTED TIMES THE NUMBER OF &TRAVEL CARDS. THE DEFAULT IS WIPOUT = F. IF WIPOUT = F AND THERE IS INSUFFICIENT SPACE FOR NEW LAVS, THE RUN IS TERMINATED WITH MESSAGES IN IMPACT1. IF WIPOUT = T AND THERE IS STILL INSUFFICIENT SPACE AFTER DELETING OLD EMISSION LAVS, THE RUN WILL ALSO TERMINATE IN IMPACT1 WITH MESSAGES.

### 3. &SELECT

REPORT SELECTION RANGES FROM 1 TO 8. ALL REPORTS ARE PRODUCED UNLESS FEWER ARE SPECIFICALLY SELECTED. REPORT=1 PRODUCES TRAVEL RELATED EMISSION FACTORS BY VEHICLE MIX AND FUEL TYPE FOR NOX, CO, AND HC. REPORT=2 PRODUCES TRIP ORIGIN-RELATED EMISSION FACTORS BY PARKING DURATION, WHILE REPORT=3 PRODUCES EVAPORATIVE EMISSION FACTORS FOR EACH VEHICLE MIX IN THE STUDY. REPORT=4 PRODUCES A GRID FILE REPORT (IMPACTS BY GRID). REPORT=5 PRODUCES A ZONES FILE REPORT (IMPACTS BY ZONE). REPORT 6 PRODUCES A ZID REPORT TO SHOW LAV ACTIVITY ON Z-FILES AND DISK SPACE AVAILABILITY. REPORTS 7 AND 8 ARE NOT AVAILABLE.

POL ALLOWS THE USER TO SELECT WHICH POLLUTANT IMPACTS ARE TO BE DETERMINED. AT LEAST ONE "POL" VALUE MUST BE ENTERED OR A FATAL ERROR RESULTS. EMISSION FACTORS AND/OR IMPACTS WILL BE DETERMINED ON THE BASIS OF THE KEYWORDS REPORT AND POL PLUS THE PRESENCE OF THE PROPER OUTPUT FILES. THE CHOICES FOR POL ARE 'HC', 'NMHC', 'CO', "NOX". TABLE VALUES MAY BE GENERATED WITHOUT PRODUCING REPORTS. NOTE THAT "HC" AND "NMHC" ARE MUTUALLY EXCLUSIVE SELECTIONS. IF BOTH ARE SELECTED, A FATAL ERROR IS GENERATED.

### 4. &TRAVEL

THERE MAY BE UP TO 24 &TRAVEL CARDS.

PERIOD IS A PAIR OF NUMBERS FOR EACH TIME PERIOD. THE FIRST NUMBER IS THE BEGINNING TIME IN MINUTES AFTER MIDNIGHT AND MUST

BE AT LEAST 1. THE SECOND NUMBER IS THE ENDING TIME OF THAT PERIOD AND MUST BE GREATER THAN THE FIRST. THE PERIOD IS INPUT AS A COMPLEX NUMBER. EXAMPLE:

PERIOD(1)=(0100.,0200.)

DEFINES THE FIRST PERIOD FROM 1 A.M. TO 2 A.M.

VOLUME IS THE ARRAY OF LINK VOLUME LAV NAMES FOR A GIVEN PERIOD. THERE MAY BE UP TO 8 DIFFERENT LINK VOLUME LAV NAMES CORRESPONDING TO EACH VEHICLE TYPE. EXAMPLE: VOLUME(1)='OV'

SPEED IS THE ARRAY OF LINK SPEED LAV NAMES FOR THIS PERIOD. THERE MAY BE UP TO 8 DIFFERENT LAV NAMES. EXAMPLE: SPEED(1)='OS'

VFAC IS THE ARRAY OF FRACTIONS OF THE VOLUMES OCCURRING IN THIS PERIOD. THERE MAY BE UP TO 8 AND THESE MUST BE IN THE RANGE FROM 0 TO 100. EXAMPLE: VFAC(1)=50.

VMIX IS THE ARRAY OF INTEGERS WHICH IDENTIFY THE MIXES CORRESPONDING TO THE ABOVE VOLUMES AND SPEEDS. THERE MAY BE UP TO 8. EACH NUMBER MUST BE LESS THAN OR EQUAL TO THE NUMBER OF MIXES ENTERED ON THE &PARAM CARD. EXAMPLE: VMIX(1)=3,VMIX(2)=8

P IS THE ARRAY OF PRODUCTION LAV NAMES ASSOCIATED WITH THIS PERIOD. THERE MAY BE UP TO 8. EXAMPLE: P(1)='OP'

A IS THE ARRAY OF ATTRACTION LAV NAME ASSOCIATED WITH THIS PERIOD. THERE MAY BE UP TO 8. EXAMPLE: A(1)='OA'

TFAC IS THE ARRAY OF PERCENTS OF TRIP PRODUCTIONS AND ATTRACTIONS OCCURRING IN THIS PERIOD. THESE MUST BE IN THE RANGE OF 0 TO 100. THERE MAY BE UP TO 8. EXAMPLE: TFAC(1)=50.

STARTS IS THE ARRAY OF PERCENTS OF TRIP PRODUCTIONS WHICH ARE STARTS. THERE MAY BE UP TO 8 AND THESE MUST BE IN THE RANGE OF 0 TO 100. EXAMPLE: STARTS(1)=15.

TMIX IS THE ARRAY OF INTEGERS WHICH INDICATE WHICH MIX APPLIES TO EACH SET OF PRODUCTION AND ATTRACTION LAVS. THERE MAY BE UP TO 8. EACH NUMBER MUST BE LESS THAN OR EQUAL TO THE NUMBER OF MIXES ENTERED ON THE &PARAM CARD. EXAMPLE: TMIX(1)=2, TMIX(2)=4

PPARK IS THE ARRAY OF PERCENTS OF THE TRIP PRODUCTIONS WHICH ARE STARTS BY VEHICLES PARKED <1 AND >4 HOURS. THIS IS AN ARRAY WHICH MAY BE UP TO 2,8. EACH ELEMENT OF THE PAIR AND THE TOTAL OF THE PAIR MUST BE IN THE RANGE 0 TO 100. EXAMPLE: PPARK(1,1)=13., PPARK(2,1)=15. (IMPLIES THAT 100-13-15=72% OF THE P'S ARE 1-4 HRS)

APARK IS THE PERCENT OF TRIP ATTRACTIONS WHICH ARE STARTS BY VEHICLES PARKED <1 AND >4 HOURS. THIS IS AN ARRAY WHICH MAY BE UP TO 2,8. EACH ELEMENT OF THE PAIR AND THE TOTAL OF THE PAIR MUST BE IN THE RANGE 0 TO 100.; APARK(1,1)=12., APARK(2,1)=14.

ATEMP IS THE VALUE OF AMBIENT TEMPERATURE ACROSS ALL ZONES. IF THERE IS ONLY ONE PER PERIOD. EXAMPLE: ATEMP=68.

INTRA IS THE ARRAY OF LAV NAMES FOR NUMBER OF INTRAZONAL TRIPS IN EACH ZONE. THERE MAY BE UP TO 8. EXAMPLE: INTRA(1)='OI'.

SPIN IS THE LAV NAME OF INTRAZONAL SPEEDS. THERE IS ONLY 1. EXAMPLE: SPIN='SP'. SPIN MAY ALSO BE ENTERED AS A FLOATING POINT NUMBER FOR ALL ZONES. EXAMPLE: SPIN=30.

ATL IS THE LAV NAME OF INTERZONAL TRIP LENGTHS. THERE IS ONLY 1. EXAMPLE: ATL='ATL'. ATL MAY ALSO BE ENTERED AS A FLOATING POINT NUMBER FOR ALL ZONES. EXAMPLE: ATL=10.

#### DATA CARD FORMATS FOR A GRID RUN

DATA CARDS HAVE FOUR FORMATS:

FORMAT 1 : SECTOR NAME CARD

VARIABLE	COLUMNS	FORMAT
SECTOR NAME	1-34	A34

FORMAT 2 : GRID CARD

VARIABLE	COLUMNS	FORMAT
X GRID COORDINATE	1-15	F15.0
Y GRID COORDINATE	16-30	F15.0

FORMAT 3 : BLOCK GRID CARD

VARIABLE	COLUMNS	FORMAT
X GRID COORDINATE FIRST POINT	1-15	F15.0
Y GRID COORDINATE FIRST POINT	16-30	F15.0
X GRID COORDINATE SECOND POINT	31-45	F15.0
Y GRID COORDINATE SECOND POINT	46-60	F15.0

FORMAT 4 : SECTOR SEPARATOR

VARIABLE	COLUMNS	FORMAT
BLANK CARD	1-80	A80

#### RULES:

- 1.) THESE DATA CARDS ARE OPTIONAL. IF THEY ARE NOT ENTERED THEN ALL GRIDS WILL PLACED INTO ONE SECTOR NAMED "OTHER" IN THE OUTPUT.

- 2.) THE ORDER OF THE DATA CARDS IS THE SECTOR NAME CARD FOLLOWED BY ONE OR MORE GRID OR BLOCK GRID CARDS. AT THE END OF THE CARDS FOR ONE SECTOR THERE IS A SEPARATOR CARD. AFTER THIS ANOTHER SECTOR MAY BE ENTERED.
- 3.) A GRID CARD ENTERS A SINGLE GRID SQUARE. THE COORDINATES ENTERED SHOULD BE THE COORDINATES OF THE SOUTHWEST CORNER OF THE GRID SQUARE. A TOLERANCE OF 20% OF GRID IS ALLOWED FOR BOTH THE X AND Y COORDINATES.
- 4.) THE BLOCK GRID CARD ENTERS A GROUP OF TWO OR MORE GRID SQUARES WHICH ARE A RECTANGULAR AREA. THE FIRST TWO COORDINATES ARE THE COORDINATES OF THE SOUTHWEST CORNER OF A GRID SQUARE. THE NEXT TWO COORDINATES ARE THE SOUTHWEST CORNER OF ANOTHER GRID SQUARE. THE SECOND GRID SQUARE MUST BE AT THE OPPOSITE CORNER OF THE BLOCK OF GRIDS BEING ENTERED. FROM THIS ALL OF THE GRID SQUARES WITHIN THE RECTANGLE FORMED BY THE TWO SETS OF COORDINATES ARE ENTERED INTO THE SECTOR. THE RECTANGLE MAY BE MADE UP A SINGLE STRING OF GRIDS.
- 5.) A MAXIMUM OF 100 SECTORS MAY BE ENTERED. EACH GRID MAY BE ENTERED INTO ONLY ONE SECTOR.
- 6.) THE SECTOR SEPARATOR CARD MAY BE SKIPPED FOR THE LAST SECTOR.
- 7.) IF THE COORDINATE VALUES ARE ENTERED WITH AN EXPONENT (E FORMAT) THEN THE EXPONENT MUST BE RIGHT JUSTIFIED.

IF SECTOR CARDS ARE USED IN A GRID RUN THEN A MAP OF THE SECTORS IS PRODUCED. THE MAP IS PRINTED ON TWO PAGES. EACH LINE OF THE MAP HAS THE Y COORDINATE GRID LINES PRINTED ON THE LEFT SIDE. THE MINIMUM AND MAXIMUM X COORDINATE GRID LINES ARE ALSO PRINTED AT THE TOP. EACH GRID SQUARE IS REPRESENTED BY A NON-BLANK CHARACTER. GRIDS WHICH ARE NOT ASSIGNED TO A SECTOR ARE REPRESENTED BY THE PERIOD CHARACTER. THE NEXT TEN SECTORS ARE REPRESENTED BY 1-9 AND THEN ZERO. IF MORE THAN TEN SECTORS ARE USED THEN THE NEXT SECTORS ARE REPRESENTED BY ALPHABETIC CHARACTERS.

AN EXAMPLE OF A SECTOR MAP FOLLOWS:



HOUSTON / HARRIS COUNTY 1990 ASSIGNMENT USING MOBILE3

2APR85 0.43.52

IMPACT2

PAGE --

MAP OF GRID SQUARE SECTORS

	265.00000		337.00000
	+		+
402.00000	-	.	.
399.00000	-	.	.
399.00000	-	.	.
.			
.			
.			
342.00000	-	.	.
339.00000	-	.	.
336.00000	-	.	.
333.00000	-	1	1
330.00000	-	1	1
327.00000	-	1	1
324.00000	-	1	1
321.00000	-	1	1
318.00000	-	1	1
315.00000	-	1	1
312.00000	-	1	1
309.00000	-	1	1
306.00000	-	1	1
303.00000	-	1	1
300.00000	-	1	1
297.00000	-	1	1
294.00000	-	1	1
291.00000	-	1	1
288.00000	-	1	1
285.00000	-	1	1
282.00000	-	1	1
279.00000	-	1	1
276.00000	-	1	1
273.00000	-	1	1
270.00000	-	1	1
267.00000	-	1	1
264.00000	-	1	1
261.00000	-	.	.
258.00000	-	.	.

## CORE REQUIREMENTS

THE REGION REQUIREMENT IS DETERMINED BY THE MOBILE2 STEP AND IS 532K.

THE TIME REQUIREMENT IS DOMINATED BY THE FIRST MOBILE2 STEP. IF THE DEFAULTS ON SPEED AND TEMPERATURE STEPS ARE USED, ONE MINUTE AND FIFTEEN SECONDS ARE REQUIRED FOR THIS STEP ON AN ITEL AS-7. ONE MINUTE AND 48 SECONDS ARE REQUIRED FOR THIS STEP ON AN AMDHAL 470/V8 USING MOBILE3 WITH AN ATP PROGRAM.

## SAMPLE TEST RUN SETUPS

MINIMUM INPUT EXAMPLE: THE FOLLOWING EXAMPLE USES THE MINIMUM INPUTS TO HAVE A SUCCESSFUL RUN. ALSO A GRID FILE IS NOT REQUESTED SO ONLY LAVS OF EMISSIONS ARE OUTPUT. REGION AND YEAR ARE REQUIRED. EITHER VCOUNT OR TRIPS ARE REQUIRED. WIPOUT IS NOT REQUIRED UNLESS THERE ARE TOO MANY OLD EMISSION LAVS ON THE ZONE Z-FILE. AT LEAST ONE &TRAVEL CARD IS REQUIRED. DEFAULTS WILL BE TAKEN FOR ALL ELSE.

```
//TEST EXEC IMPACT,
// LIB='DSN=USR.W209.CB.IMPACT,VOL=SER=UMTA2',
// UNITLIB='3350',
// Z1='DSN=USR.W209.CB.Z50.LINK,VOL=SER=UMTA2',
// UNITZ1='3350',
// Z2='DSN=USR.W209.CB.Z50.NODE,VOL=SER=UMTA2',
// UNITZ2='3350',
// Z3='DSN=USR.W209.CB.Z50.ZONE,VOL=SER=UMTA2',
// UNITZ3='3350'
//IMPL.INPUT1 DD *
IMPACT01: IMPACT DEFAULT TESTING
&PARAM REGION=1,YEAR=83,TRIPS=4.0 &END
&OPTION WIPOUT=T &END
&SELECT &END
&DATA
//IMPL.INPUT2 DD *
&TRAVEL
PERIOD=(0001.,0200.),VOLUME='V1','V2',SPEED='S1','S2',
VFAC=2*0.5,VMIX=2*1,P=8*'P',A=8*'A',TFAC=8*2.,STARTS=8*0.5,
TMIX=8*1,PPARK=16*2,APARK=16*2,ATEMP=68,
INTRA=8*'INTRA',SPIN='SPIN',ATL='ATL' &END
```

EXTENSIVE INPUT EXAMPLE: IN THIS EXAMPLE ALL THE INPUTS ARE EXERCISED AND A GRID FILE OUTPUT IS REQUESTED. ALSO MOBILE3 IS USED WITH AN ANTITAMPERING PROGRAM. NO DEFAULTS ARE USED. A GRID REPORT IS REQUESTED WITH 3 KILOMETER GRID SQUARES. A SECTOR EQUIVALENCE IS BUILT FOR HARRIS COUNTY USING BLOCK GRID CARDS.

```

//TEST EXEC IMPACT,MOBIL=MOBILE3,
// LIB='DSN=USR.W209.CB.IMPACT',
// UNITLIB='3350',
// GRID='DSN=USR.W209.CB.GRID',
// UNITGR='3350',
// Z1='DSN=USR.W209.CB.Z1HRS90',
// UNITZ1='3350',
// Z2='DSN=USR.W209.CB.Z2HRS90',
// UNITZ2='3350',
// Z3='DSN=USR.W209.CB.Z3HRS90',
// UNITZ3='3350'
//IMPL.INPUT1 DD *
HOUSTON / HARRIS COUNTY 1990 ASSIGNMENT USING MOBILE3
&PARAM REGION=1, YEAR=90, TEMP=95, ALT=100., HUM=70,
VCOUNT= 1875, 479, 190, 30, 72, 39, 44, 22,
MIX1=(1.,68.20),(2.,17.4),(3.,6.90),(4.,1.10),(5.,2.60),
(6.,1.40),(7.,1.60),(8.,0.80),
MYRP1=6.5,9.8,8.3,9.7,8.5,9.9,9.7,8.4,6.9,4.4,
4.3,3.7,2.6,2.0,1.5,1.1,0.8,0.6,0.5,0.8,
MYRP2=6.8,8.7,11.2,9.5,6.7,9.3,8.6,7.7,5.9,3.6,
4.1,3.6,2.8,2.4,2.0,1.7,1.4,1.0,0.8,2.2,
MYRP3=7.6,9.8,12.6,10.7,7.5,10.4,9.7,8.3,6.1,3.6,
3.6,2.8,1.9,1.5,1.1,0.8,0.6,0.4,0.3,0.7,
MYRP4=3.3,5.7,10.4,10.5,10.1,12.5,10.0,7.5,4.7,4.6,
4.7,4.1,2.8,1.8,1.0,0.8,0.7,0.6,0.5,3.7,
MYRP5=6.5,8.3,9.8,9.7,8.5,9.9,9.7,8.4,6.9,4.4,
4.3,3.7,2.6,2.0,1.5,1.1,0.8,0.6,0.5,0.8,
MYRP6=6.8,8.7,11.2,9.5,6.7,9.3,8.6,7.7,5.9,3.6,
4.1,3.6,2.8,2.4,2.0,1.7,1.4,1.0,0.8,2.2,
MYRP7=3.6,4.4,8.5,12.6,9.3,11.8,9.8,10.3,4.7,5.6,
4.9,4.5,2.9,1.7,0.9,0.7,0.6,0.5,0.4,2.3,
MYRP8=13.3,14.5,13.8,11.6,12.3,11.4,6.9,4.4,2.4,0.9,
8.5,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,
USAGE1= 128, 121, 114, 108, 102, 096, 091, 086, 081, 076, 072,
068, 064, 061, 057, 054, 051, 048, 046, 043,
USAGE2= 174, 161, 150, 139, 129, 119, 111, 103, 095, 088, 082,
076, 070, 065, 061, 056, 052, 048, 045, 042,
USAGE3= 184, 169, 156, 144, 133, 123, 114, 105, 097, 090, 083,
076, 071, 065, 060, 056, 051, 047, 044, 040,
USAGE4= 200, 181, 164, 148, 134, 121, 110, 100, 090, 082, 074,
067, 061, 055, 050, 045, 041, 037, 033, 030,
USAGE5= 128, 121, 114, 108, 102, 096, 091, 086, 081, 076, 072,
068, 064, 061, 057, 054, 051, 048, 046, 043,
USAGE6= 176, 163, 151, 140, 129, 120, 111, 103, 095, 088, 082,
076, 070, 065, 060, 056, 052, 048, 044, 041,
USAGE7= 637, 579, 527, 479, 436, 397, 361, 328, 299, 272, 248,
225, 205, 187, 170, 155, 141, 129, 117, 107,
USAGE8= 041, 028, 021, 016, 012, 008, 006, 004, 002, 002, 002,
000, 000, 000, 000, 000, 000, 000, 000, 000,
ATPIM=84,ATPFMY=80,ATPLMY=90,ATPLG1=1,ATPLG2=1,ATPHGV=1,
ATPLGV=2,ATPHGV=1,
IMYEAR=84, IMFAIL=10, GRID=3.0, REF=190,255 &END
&OPTION DRYRUN=F,METRIC=F,IMMECH=T,TRACE=99*F, DUMP=99*F,
MOBIL3=T, INISPD=5,MAXSPD=55,STPSPD=5,MAXTEM=100,STPTEM=5 &END

```

```
&SELECT REPORT=1,REPORT(2)=-8,POL='HC',
POL(2)='NOX',POL(3)='CO' &END
```

```
&DATA
```

```
HARRIS COUNTY
```

226.	330.	268.	297.
232.	291.	238.	294.
241.	285.	247.	294.
214.	339.	214.	333.
217.	336.		
217.	321.	223.	333.
220.	318.	220.	312.
223.	318.	223.	300.
229.	294.		
247.	282.		
250.	279.	259.	294.
256.	276.	259.	276.
241.	333.	259.	333.
238.	288.		
247.	336.	256.	336.
253.	339.	256.	339.
262.	273.	268.	294.
265.	333.		
271.	327.	274.	327.
283.	327.		
295.	336.	298.	336.
292.	333.	298.	333.
286.	327.	298.	330.
301.	327.		
271.	276.	301.	324.
304.	303.	307.	318.
310.	303.		
304.	300.	313.	282.
271.	273.		
280.	270.	304.	273.
304.	276.	304.	279.
307.	273.	307.	276.
286.	267.	298.	267.
289.	264.	295.	264.

```
//IMPL.INPUT2 DD *
```

```
&TRAVEL
```

```
PERIOD=(0001.,2400.),VOLUME='V2',SPEED='S1',
VFAC=100.0,
VMIX=1,P='P',
A='A',TFAC=100.0,
TMIX=1,PPARK=57,22,
APARK=57,22,ATEMP=95,STARTS=50.,
INTRA='INTRA',
SPIN='SPIN',ATL='ATL' &END
```

```
//IMPL.INPUT3 DD *
```

```
4
```

```
**
```

```
** ANNUAL : INSPECT AIR PUMP, CATALYST, FUEL INLET (AND PLUMBTESMO),
** CANISTER & PCV
```

\*\*

0.30	0.30	0.30	0.30								EVAP/PCV
0.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	AIR/CAT (PR
.00	0.20	.00	0.15	.00	.00	.00	.00	.00	.00	.00	AIR/NCK
.00	.00	0.20	.00	0.15	.00	.00	.00	.00	.00	.00	AIR/TNK
.00	.00	.00	0.05	.00	.00	.00	.00	.00	.00	.00	AIR/CAT/NCK
.00	.00	.00	.00	0.05	.00	.00	.00	.00	.00	.00	AIR/CAT/TNK
.00	.00	.00	.00	.00	0.05	.00	.00	.00	.00	.00	CAT/NCK
.00	.00	.00	.00	.00	.00	0.05	.00	.00	.00	.00	CAT/TNK
0.15	.00	.00	.00	.00	.00	.00	0.20	.00	.00	.00	AIR
.00	.00	.00	.00	.00	.00	.00	.00	0.05	.00	.00	CAT
.00	0.05	.00	0.05	.00	0.20	.00	.00	.00	0.25	.00	NCK
.00	.00	0.05	.00	0.05	.00	0.20	.00	.00	.00	0.25	TNK
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	EGR/CAT (PR
.00	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	EGR/NCK
.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	.00	EGR/TNK
.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	EGR/CAT/NCK
.00	.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	EGR/CAT/TNK
.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	.00	CAT/NCK
.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	CAT/TNK
.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	EGR
.00	.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00	CAT
.00	.00	.00	.00	.00	.00	.00	.00	.00	1.00	.00	NCK
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.00	TNK
0.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	AIR/CAT (SU
.00	0.15	.00	0.10	.00	.00	.00	.00	.00	.00	.00	AIR/NCK
.00	.00	0.15	.00	0.10	.00	.00	.00	.00	.00	.00	AIR/TNK
.00	.00	.00	0.05	.00	.00	.00	.00	.00	.00	.00	AIR/CAT/NCK
.00	.00	.00	.00	0.05	.00	.00	.00	.00	.00	.00	AIR/CAT/TNK
.00	.00	.00	.00	.00	0.05	.00	.00	.00	.00	.00	CAT/NCK
.00	.00	.00	.00	.00	.00	0.05	.00	.00	.00	.00	CAT/TNK
0.15	0.05	0.05	0.05	0.05	.00	.00	0.20	.00	.00	.00	AIR
.00	.00	.00	.00	.00	.00	.00	.00	0.05	.00	.00	CAT
.00	.00	.00	.00	.00	0.10	.00	.00	.00	0.15	.00	NCK
.00	.00	.00	.00	.00	.00	0.10	.00	.00	.00	0.15	TNK
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	EGR/CAT (SU
.00	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	EGR/NCK
.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	.00	EGR/TNK
.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	EGR/CAT/NCK
.00	.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	EGR/CAT/TNK
.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	.00	CAT/NCK
.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	CAT/TNK
.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	EGR
.00	.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00	CAT
.00	.00	.00	.00	.00	.00	.00	.00	.00	1.00	.00	NCK
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.00	TNK



```

//FT11F001 DD DSN=&&FILE1,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(5,5),RLSE),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT12F001 DD DSN=&&FILE2,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(5,5),RLSE),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT13F001 DD DSN=&&FILE3,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(5,5),RLSE),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT14F001 DD DSN=&&FILE4,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(5,5),RLSE),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT15F001 DD DSN=&&FILE5,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(5,5),RLSE),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT19F001 DD DSN=&&DATA,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT20F001 DD DSN=&&CONT,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE),
//          DCB=(RECFM=FB,LRECL=72,BLKSIZE=720)
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT22F001 DD DSN=&&TRAVEL,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(5,5),RLSE),
//          DCB=(RECFM=FB,LRECL=72,BLKSIZE=720)
//FT23F001 DD &GRID,
//          UNIT=&UNITGR,DISP=(NEW,PASS),
//          SPACE=(TRK,(50,1)),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT33F001 DD DSN=&&ATP,
//          UNIT=SYSDA,DISP=(NEW,PASS),
//          SPACE=(TRK,(50,1)),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=800)
//FT49F001 DD DSN=&&PAGE,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE),
//          DCB=(RECFM=FB,LRECL=72,BLKSIZE=720)
//Z1 DD &Z1,
//     DISP=(OLD,PASS),UNIT=&UNITZ1
//Z2 DD &Z2,
//     DISP=(OLD,PASS),UNIT=&UNITZ2
//Z3 DD &Z3,
//     DISP=(OLD,PASS),UNIT=&UNITZ3
//*
//*
//MOB1 EXEC PGM=&MOBILE,REGION=&CORE,COND=(5,LT)
//*****
//*          CALCULATE EMISSION FACTORS FOR          *
//*          VMT-RELATED EMISSIONS,                  *
//*          STARTUP(<1.HR & >4.HRS), CRANKCASE     *
//*****
//STEPLIB DD &LIB,
//          UNIT=&UNITLIB,DISP=SHR
//FT03F001 DD DSN=&&ATP,UNIT=SYSDA,DISP=(OLD,PASS)
//FT05F001 DD DSN=&&FILE1,UNIT=SYSDA,

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```

//          DISP=(OLD,PASS)
//FT06F001 DD DUMMY
//FT07F001 DD DSN=&&OUTFILE,UNIT=SYSDA,
//          DCB=(RECFM=FBA,LRECL=132,BLKSIZE=1320),
//          DISP=(NEW,PASS),SPACE=(TRK,(150,5))
//FT08F001 DD DSN=&&ERRFILE,UNIT=SYSDA,
//          DCB=(RECFM=FBA,LRECL=132,BLKSIZE=1320),
//          DISP=(NEW,PASS),SPACE=(TRK,(1,1))
//FT15F001 DD DUMMY
//FT20F001 DD DUMMY
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT49F001 DD DSN=&&PAGE,DISP=(OLD,PASS),UNIT=SYSDA
//*
//*
//MOB2 EXEC PGM=&MOBILE,REGION=&CORE,COND=(5,LT)
//*****
//*          CALCULATE EMISSION FACTORS FOR          *
//*          CRANKCASE, HOTSOK                        *
//*****
//STEPLIB DD &LIB,
//          UNIT=&UNITLIB,DISP=SHR
//FT03F001 DD DSN=&&ATP,UNIT=SYSDA,DISP=(OLD,PASS)
//FT05F001 DD DSN=&&FILE2,UNIT=SYSDA,
//          DISP=(OLD,PASS)
//FT06F001 DD DUMMY
//FT07F001 DD DSN=&&OUTFILE,
//          DISP=(MOD,PASS)
//FT08F001 DD DSN=&&ERRFILE,
//          DISP=(MOD,PASS)
//FT15F001 DD DUMMY
//FT20F001 DD DUMMY
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT49F001 DD DSN=&&PAGE,DISP=(OLD,PASS),UNIT=SYSDA
//*
//*
//MOB3 EXEC PGM=&MOBILE,REGION=&CORE,COND=(5,LT)
//*****
//*          CALCULATE EMISSION FACTORS FOR          *
//*          CRANKCASE, DIURNAL                      *
//*****
//STEPLIB DD &LIB,
//          UNIT=&UNITLIB,DISP=SHR
//FT03F001 DD DSN=&&ATP,UNIT=SYSDA,DISP=(OLD,PASS)
//FT05F001 DD DSN=&&FILE3,UNIT=SYSDA,
//          DISP=(OLD,PASS)
//FT06F001 DD DUMMY
//FT07F001 DD DSN=&&OUTFILE,
//          DISP=(MOD,PASS)
//FT08F001 DD DSN=&&ERRFILE,
//          DISP=(MOD,PASS)
//FT15F001 DD DUMMY
//FT20F001 DD DUMMY
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT49F001 DD DSN=&&PAGE,DISP=(OLD,PASS),UNIT=SYSDA

```

```

//*
//*
//MOB4 EXEC PGM=&MOBILE,REGION=&CORE,COND=(5,LT)
//*****
//*          CALCULATE EMISSION FACTORS FOR          *
//*          STARTUP 1-4 HRS CATALYTIC (PRE-75 E.F.=0) *
//*****
//STEPLIB  DD &LIB,
//          UNIT=&UNITLIB,DISP=SHR
//FT03F001 DD DSN=&&ATP,UNIT=SYSDA,DISP=(OLD,PASS)
//FT05F001 DD DSN=&&FILE4,UNIT=SYSDA,
//          DISP=(OLD,PASS)
//FT06F001 DD DUMMY
//FT07F001 DD DSN=&&OUTFILE,
//          DISP=(MOD,PASS)
//FT08F001 DD DSN=&&ERRFILE,
//          DISP=(MOD,PASS)
//FT15F001 DD DUMMY
//FT20F001 DD DUMMY
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT49F001 DD DSN=&&PAGE,DISP=(OLD,PASS),UNIT=SYSDA
//*
//*
//MOB5 EXEC PGM=&MOBILE,REGION=&CORE,COND=(5,LT)
//*****
//*          CALCULATE EMISSION FACTORS FOR          *
//*          STARTUP 1-4 HRS NON-CATALYTIC (1975+ E.F.=0) *
//*****
//STEPLIB  DD &LIB,
//          UNIT=&UNITLIB,DISP=SHR
//FT03F001 DD DSN=&&ATP,UNIT=SYSDA,DISP=(OLD,PASS)
//FT05F001 DD DSN=&&FILE5,UNIT=SYSDA,
//          DISP=(OLD,PASS)
//FT06F001 DD DUMMY
//FT07F001 DD DSN=&&OUTFILE,
//          DISP=(MOD,PASS)
//FT08F001 DD DSN=&&ERRFILE,
//          DISP=(MOD,PASS)
//FT15F001 DD DUMMY
//FT20F001 DD DUMMY
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT49F001 DD DSN=&&PAGE,DISP=(OLD,PASS),UNIT=SYSDA
//SYSIN   DD DUMMY
//*
//*
//*
//*
//IMP2 EXEC PGM=IMPACT2,REGION=&CORE,COND=(5,LT)
//*****
//*          COMPUTE LINK AND ZONAL EMISSIONS          *
//*          AND ASSIGN THEM TO ZONES OR GRIDS          *
//*****
//STEPLIB  DD &LIB,
//          UNIT=&UNITLIB,DISP=SHR

```

```
//FT01F001 DD DSN=&&OUTFILE,UNIT=SYSDA,
//          DISP=(OLD,DELETE)
//FT02F001 DD DSN=&&ERRFILE,UNIT=SYSDA,
//          DISP=(OLD,DELETE)
//FT05F001 DD DUMMY
//FT06F001 DD SYSOUT=&CLASS
//FT15F001 DD DUMMY
//FT16F001 DD DUMMY
//FT19F001 DD DSN=&&DATA,DISP=(MOD,DELETE),UNIT=SYSDA
//FT20F001 DD DSN=&&CONT,DISP=(MOD,DELETE),UNIT=SYSDA
//FT21F001 DD DSN=UMTA.AJO.LOG,DISP=SHR
//FT22F001 DD DSN=&&TRAVEL,DISP=(OLD,DELETE),
//          UNIT=SYSDA
//FT23F001 DD DSN=* .IMP1 .FT23F001,DISP=(OLD,KEEP)
//FT49F001 DD DSN=&&PAGE,DISP=(OLD,DELETE),UNIT=SYSDA
//Z1      DD DSN=* .IMP1 .Z1,DISP=(OLD,KEEP)
//Z2      DD DSN=* .IMP1 .Z2,DISP=(OLD,KEEP)
//Z3      DD DSN=* .IMP1 .Z3,DISP=(OLD,KEEP)
//Z4      DD DSN=&&TEMP,DISP=(NEW,DELETE),
//          UNIT=SYSDA,SPACE=(TRK,(50)),
//          DCB=(RECFM=F,BLKSIZE=2000,DSORG=DA,BUFNO=1)
//Z5      DD DSN=&&TEML,DISP=(NEW,DELETE),
//          UNIT=SYSDA,SPACE=(TRK,(5)),
//          DCB=(RECFM=F,BLKSIZE=2000,DSORG=DA,BUFNO=1)
//Z6      DD DSN=&&TGRD,DISP=(NEW,DELETE),
//          UNIT=SYSDA,SPACE=(TRK,(15)),
//          DCB=(RECFM=F,BLKSIZE=2000,DSORG=DA,BUFNO=1)
```

## MESSAGES

## IMP100

5002 I REQUESTED OPERATIONS WERE  
NOT PERFORMED DUE TO:  
<EITHER>  
ERRORS IN &PARAM, &OPTION, &SELECT,  
&TRAVEL, &DATA CARDS AND/OR UNAVAILABILITY OF FILES.  
<OR>  
DRYRUN OPTION CHOSEN.

9001 I CONTROL NOW PASSED TO MOBILE2  
TO COMPUTE EMISSION FACTORS.

## IMP110

0050 E REQUIRED ZFILE XXXX MISSING.  
0160 W GRID FILE MISSING OR INVALID.  
0450 I THERE ARE XXXX LINKS ON Z1.  
0550 I THERE ARE XXXX NODES ON Z2.  
0650 I THERE ARE XXXX ZONES ON Z3.

## IMP120

0410 E NO &PARAM CARD.  
0421 E GRID PARAMETER ON &PARAM CARD  
AND GRID FILE PRESENCE CONFLICT.  
0423 W BECAUSE OF MISSING GRID FILE,  
ONLY ZONE FILE AND REPORT CAN BE WRITTEN.  
0450 E REGION XXXX INVALID: MUST BE 1, 2, OR 3.  
0550 E NO STUDY YEAR ENTERED.  
0750 E YEAR XXXX OUT OF RANGE.  
1250 I VALID YEARS ARE 1970 THRU XXXX.  
1440 W HUMIDITY CORRECTION TO NOX  
CANNOT BE CALCULATED WITHOUT TEMP AND HUM.  
1460 E TEMP NOT ENTERED.  
1550 E TEMPERATURE XXXX NOT IN ACCEPTABLE  
RANGE OF -18 TO 43 DEG-C (0 TO 110 DEG-F).  
1810 E HUM NOT ENTERED.  
2050 E HUMIDITY XXXX INVALID.  
MUST BE 1 TO 100.  
2550 E VEHICLE TYPE XXXX INVALID.  
2650 E PERCENTAGE (XX %) ENTERED FOR  
VEHICLE TYPE XXXX IS INVALID.  
2850 E MIX XXXX DOES NOT TOTAL 100%.  
2950 I VTYPE YYYY = XX %.  
2975 I TOTAL = XX %.  
4150 I NO MIXES ENTERED.  
DEFAULT TAKEN FROM MOBILE2.  
4210 I THE NUMBER OF VEHICLE  
MIXES ENTERED = XXXX.  
4212 E VCOUNT(XXXX) = YYYY IS NEGATIVE.  
4218 E NEITHER VCOUNT NOR TRIPS ENTERED.  
4220 E TRIPS = XXXX IS NEGATIVE.  
4222 E BOTH VCOUNT AND TRIPS ENTERED.  
5050 E SUM OF REGISTRATION PERCENTAGES  
BY MODEL YEAR IS XXXX

FOR VEHICLE TYPE YYYY. (99.<SUM<101.)

5550 E VEHICLE TYPE XXXX USAGE  
VALUE XXXX NOT WITHIN RANGE OF 0 TO 199,999.

6010 I THE NUMBER OF VALID REGISTRATION  
DISTRIBUTIONS ENTERED = XXXX. THE NUMBER OF  
VALID USAGE DISTRIBUTIONS ENTERED = XXXX.

6013 E NO IMYEAR ENTERED.

6014 I VALID IMYEARS ARE 1970 THRU XXXX.

6016 E IMYEAR XXXX OUT OF RANGE.

6100 E IMFAIL NOT ENTERED.

6450 E PERCENT OF VEHICLES FAILING I/M PROGRAM = XX %.  
MUST BE >=10 OR <=50.

6650 E PERCENT OF VEHICLES FAILING I/M PROGRAM = XX %.  
ONLY 50 PERCENT ALLOWED.

7208 E GRID SIZE XXXX IS INVALID.  
GRID MUST BE >0.

7210 W A STPSPD OF LESS THAN 5 MPH  
HAS BEEN SELECTED. STPSPD HAS BEEN  
INCREASED TO 5 MPH.

7220 W INISPD = XXXX OUT OF RANGE.  
MUST BE >4 AND <56 MPH. DEFAULTS USED.

7227 W INISPD CANNOT BE > MAXSPD.  
DEFAULTS USED.

7240 W MAX SPEED VALUE = XXXX OUT OF  
RANGE MUST BE >4 AND <56 MPH. DEFAULTS USED.

7260 W STPSPD = XXXX OUT OF  
RANGE. MUST BE >4 AND <21 MPH. DEFAULTS USED.

7280 W INISPD, MAXSPD, STPSPD MUST BE  
MULTIPLES OF 5. DEFAULTS USED.

7310 W MAX SPEED = XXXX IS NOT EQUAL TO  
INITIAL SPEED = YYYY PLUS A MULTIPLE OF STPSPD = ZZZZ.  
DEFAULTS USED.

7450 W A TEMPERATURE STEP OF LESS THAN  
5 DEG-F HAS BEEN SELECTED. STPTM HAS  
BEEN INCREASED TO 5 DEG-F.

8240 W MAX TEMP VALUE = XXXX OUT OF  
RANGE. MUST BE >0 AND <110 DEG-F. DEFAULTS USED.

8260 W STPTM = XXXX OUT OF  
RANGE. MUST BE >0 AND <20 DEG-F. DEFAULTS USED.

8280 W MAXTEM & STPTM MUST BE  
MULTIPLES OF 5. DEFAULTS USED.

8310 W MAXTEM = XXXX IS NOT EQUAL TO  
A MULTIPLE OF STPTM = YYYY. DEFAULTS USED.

8600 I NO ERRORS DETECTED IN PARAMETER CHECK.

**IMP130**

0007 E SELECTED REPORT XXXX INVALID.

0036 E SELECTED POLLUTANT XXXX INVALID.

0045 E DUPLICATE SELECTION OF POLLUTANT.

0055 E SELECT EITHER HC OR NMHC BUT NOT BOTH.

0131 W NO VALID POLLUTANTS SELECTED.

**IMP140**

0005 I RUN TIME KEYWORD VALUES FOR IMPACT:

```

&PARAM
  REGION = ,NNNN REGION OF U. S. WHOSE EMISSION FACTORS
           ARE TO BE USED
  YEAR   = XXXX STUDY YEAR (NO DEFAULT)

  <EITHER>
  TEMP   = XXXX NOONTIME TEMPERATURE FOR DAY OF STUDY
  HUM    = XX % RELATIVE HUMIDITY AT NOONTIME TEMPERATURE
  ALT    = XXXX ALTITUDE
  <OR>
  NO TEMP OR HUM ENTERED; HUMIDITY CORRECTION NOT USED.

  <EITHER>
  MIX    = VEHICLE MIXES FOR WHICH EMISSION FACTORS
           ARE COMPUTED (IN PERCENTS)
           <TABLE OF MIXES BY EPA VEHICLE TYPE FOLLOWS>
  <OR>
  MIX    = VEHICLE MIX TAKEN FROM DEFAULTS IN MOBILE2

  <EITHER>
  VCOUNT(I) = REGISTRATION FIGURES FOR VEHICLE OF TYPE(I)
             <TABLE OF COUNTS BY EPA VEHICLE TYPE FOLLOWS>
  <OR NOTHING IF COUNTS NOT ENTERED>

  <EITHER>
  MYRP<T>(I) = MODEL YEAR REGISTRATION PERCENTAGE BY
              VEHICLE TYPE
              <TABLE OF MODEL YEARS BY EPA VEHICLE TYPE FOLLOWS>
  <OR>
  MYRP<T>(I) = MODEL YEAR DISTRIBUTIONS
              MOBILE2 DEFAULTS WILL BE USED

  <EITHER>
  USAGE<T>(I) = MODEL YEAR USAGE BY VEHICLE TYPE
               (KILOMETERS, IF METRIC TRUE, ELSE MILES)
               <TABLE FOLLOWS>
  <OR>
  USAGE<T>(I) = MODEL YEAR USAGE BY VEHICLE TYPE
               MOBILE2 DEFAULTS WILL BE USED

  IMYEAR = XXXX YEAR INSPECTION/MAINTENANCE PROGRAM BEGAN
  IMFAIL = XXXX % OF VEHICLES FAILING I/M PROGRAM
  GRID   = XXXX SIZE OF GRID SQUARES(IN COORDINATE
           UNITS) FOR EMISSIONS ASSIGNMENT

  REF    = (XXXX,YYYY) COORDINATES OF GRID ORIGIN

  <IF VCOUNT NOT ENTERED>
  TRIPS  = XXXX TRIPS PER DAY PER VEHICLE
&END

&OPTION
  DRYRUN = (T/F) TO MAKE A TEST RUN
  METRIC = (T/F) TO INPUT AND REPORT FACTORS IN

```

## METRIC UNITS

OUTREV = (T/F) TO REVERSE METRIC OPTION ON REPORTS AND  
OUTPUT FILES  
 IMMECH = (T/F) TO INCLUDE MECHANICS TRAINING AS PART OF  
I/M PROGRAM  
 WIPOUT = (T/F) TO DELETE OLD EMISSION LAVS IF NECESSARY

EMISSION FACTORS TO BE CALCULATED BY MOBILE2 FOR  
SPEEDS FROM XX MPH TO YY MPH IN STEPS OF ZZ  
MPH AND TEMPERATURES FROM 0 TO TT DEG-F IN STEPS  
OF SS DEG-F.

&END

&SELECT

REPORT = XX -YY REPORTS TO BE PRINTED  
 POL = XX YY ZZ POLLUTANTS TO BE INCLUDED IN ANALYSIS

&END

## IMP170

0004 E METRIC = (T/F) ; UNITS ON D LAV = (MI/KM).  
 0004 E NO DISTANCE LAV (D) PRESENT.  
 0008 E NO Z-LAV PRESENT; AGGREGATION  
FROM LINKS TO ZONES CANNOT BE PERFORMED.  
 0022 E NO X COORDINATE LAV ON Z2.  
THERE ARE XXXX NODES ON Z2.  
 0045 E NO Y COORDINATE LAV ON Z2.  
 0056 E THERE ARE XXXX X COORDINATES AND YYYY Y COORDINATES.  
 0064 E NO PERIOD ENTERED  
FOR &TRAVEL NO. NNNN.  
 0066 E PERIOD (XXXX, YYYY) NOT IN RANGE.  
PERIOD START MUST BE GREATER  
OR EQUAL TO 1 AND LESS THAN PERIOD END.  
PERIOD END MUST BE LESS THAN OR EQUAL TO 2400.  
 0070 E ONLY 24 PERIODS ALLOWED.  
REMAINING &TRAVEL CARDS IGNORED.  
 0074 E NO VOLUME LAV SPECIFIED  
FOR &TRAVEL NO. NNNN.  
 0081 E VOLUME LAV XXXX NOT  
FOUND ON Z1 FILE FOR &TRAVEL NO. NNNN.  
 0105 E NO SPEED LAV SPECIFIED  
FOR &TRAVEL NO. NNNN.  
 0121 E SPEED LAV XXXX NOT  
FOUND ON Z1 FILE FOR &TRAVEL NO. NNNN.  
 0139 E NUMBER OF VOLUME LAVS AND  
SPEED LAVS DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF VOLUME LAVS = XXXX. NUMBER OF SPEED LAVS = YYYY.  
 0146 E VFAC(XXXX) = YYYY OUT OF RANGE FOR &TRAVEL NO. NNNN.  
(0<=VFAC<=100.)  
 0156 E VMIX(XXXX) = YYYY OUT OF RANGE  
(1-8) FOR &TRAVEL NO. NNNN.  
 0181 E NUMBER OF VOLUME LAVS, NUMBER OF VFAC,  
AND NUMBER OF VMIX DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF VOLUME LAVS = XXXX.  
NUMBER OF VFAC = YYYY.

NUMBER OF VMIX = ZZZZ.  
0191 E NO PRODUCTION LAV SPECIFIED  
FOR &TRAVEL NO. NNNN.  
0211 E PRODUCTION LAV XXXX NOT  
FOUND ON Z3 FILE FOR &TRAVEL NO. NNNN.  
0221 E NO ATTRACTION LAV SPECIFIED  
FOR &TRAVEL NO. NNNN.  
0241 E ATTRACTION LAV XXXX  
NOT FOUND ON Z3 FILE FOR &TRAVEL NO. NNNN.  
0251 E NO INTRA LAV SPECIFIED  
FOR &TRAVEL NO. NNNN.  
0256 E NUMBERS OF ATTRIBUTES OF A, P, AND  
INTRA DO NOT MATCH. A: XXXX ; P: YYYY ; INTRA: ZZZZ  
0271 E INTRA LAV XXXX NOT  
FOUND ON Z3 FILE FOR &TRAVEL NO. NNNN.  
0305 E NUMBER OF PRODUCTION, ATTRACTION,,  
AND INTRA LAVS DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF PRODUCTION LAVS = XXXX.  
NUMBER OF ATTRACTION LAVS = YYYY.  
NUMBER OF INTRA LAVS = ZZZZ.  
0315 E TFAC(XXXX)= YYYY  
OUT OF RANGE (0<=TFAC<=100.)  
FOR &TRAVEL NO. NNNN.  
0317 E NUMBER OF PRODUCTION LAVS AND  
TFAC DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF PRODUCTION LAVS = XXXX. NUMBER OF TFAC = YYYY.  
0325 E TMIX(XXXX) = YYYY OUT OF RANGE  
(1-8) FOR &TRAVEL NO. NNNN.  
0327 E NUMBER OF PRODUCTION LAVS AND  
NUMBER OF TMIX DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF PRODUCTION LAVS = XXXX.  
NUMBER OF TMIXES = YYYY.  
0335 E STARTS(XXXX)= YYYY  
OUT OF RANGE FOR &TRAVEL NO. NNNN. (0<STARTS<100.)  
0337 E NUMBER OF PRODUCTION LAVS AND  
NUMBER OF STARTS DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF PRODUCTION LAVS = XXXX.  
NUMBER OF STARTS = YYYY.  
0365 E PPARK(1,XXXX)= YYYY ;  
PPARK(2,SSSS)= TTTT NOT IN RANGE 0-100%  
OR SUM NOT LE 100% FOR &TRAVEL NO. NNNN.  
0367 E NUMBER OF PRODUCTION LAVS AND  
NUMBER OF PPARK DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF PRODUCTION LAVS = XXXX.  
NUMBER OF PPARK = YYYY.  
0375 E APARK(1,XXXX)= YYYY ;  
APARK(2,SSSS)= TTTT NOT IN RANGE 0-100%  
OR SUM NOT LE 100% FOR &TRAVEL NO. NNNN.  
0377 E NUMBER OF PRODUCTION LAVS AND  
NUMBER OF APARK DO NOT AGREE FOR &TRAVEL NO. NNNN.  
NUMBER OF PRODUCTION LAVS = XXXX.  
NUMBER OF APARK = YYYY.  
0401 E ALL TFAC AND VFAC ARE ZERO.  
0421 E SPIN LAV XXXX NOT FOUND

FOR &TRAVEL NO. NNNN.  
 0423 E SPIN LAV OR NUMBER NOT SPECIFIED  
 FOR &TRAVEL NO. NNNN.  
 0425 E INTRAZONAL SPEED (SPIN) = XXXX  
 IS NOT IN RANGE 1-65 MPH  
 FOR &TRAVEL NO. NNNN.  
 0431 E INTRAZONAL SPEED  
 NOT IN RANGE OF 1-100 KPH.  
 0445 E ATEMP = YYYY IS INVALID FOR &TRAVEL NO. NNNN.  
 MUST BE >=-18 AND <=43 DEG-C (0 TO 110 DEG-F).  
 0464 E ATL LAV OR NUMBER NOT SPECIFIED  
 FOR &TRAVEL NO. NNNN.  
 0471 E ATL LAV XXXX NOT FOUND  
 FOR &TRAVEL NO. NNNN.  
 0481 E NUMBER OF TMIXES OR VMIXES  
 EXCEEDS THE NUMBER OF MIXES ENTERED FOR &TRAVEL NO. NNNN.  
 NUMBER OF MIXES ENTERED = XXXX.  
 NUMBER OF TMIXES ENTERED = YYYY.  
 NUMBER OF VMIXES = ZZZZ.  
 0530 E NO &TRAVEL CARDS.  
 0622 E INSUFFICIENT SPACE ON Z3 FOR NEW EMISSION LAV(S).  
 1000 I OLD EMISSION LAV XXXX DELETED.

## IMP171

0601 E ONLY XX % OF THE ATTRIBUTES FOR THE  
 LAV YYYY ARE LOADED IN THE LAV. ( ZZ % REQUIRED)  
 <WHEN APPROPRIATE>  
 THIS ERROR OCCURS MORE THAN FIVE TIMES.

## IMP172

0340 E FOR &TRAVEL NO. NNNN,  
 FOR VOLUME LAV= XXXX, AND SPEED LAV= YYYY,  
 THERE IS A SPEED OR ZONE MISSING FOR LINK = ZZZZ.  
 <WHEN APPROPRIATE>  
 THIS ERROR OCCURS MORE THAN FIVE TIMES.

## IMP173

0340 E FOR &TRAVEL NO. NNNN, THERE ARE TOO  
 MANY NON-ZERO VOLUMES FOR LINK = YYYY.

## IMP190

0014 E GRID FILE AND GRID CARDS PRESENT BUT  
 GRID KEYWORD ON &PARAM CARD NOT ENTERED.  
 0022 E GRID CARDS BUT NO GRID FILE PRESENT.  
 0026 E A ZERO PERCENTAGE PRECEDES A  
 NONZERO PERCENTAGE:  
 <PRINT OF PERCENTAGES FOLLOWS>  
 0032 E PERCENTS ATTRIBUTED TO ZONE XXXX  
 TOTAL XXXX. RANGE OF .99.9-100.1 REQUIRED.  
 0036 E ZONES CARDS XXXX,YYYY,  
 ARE NOT IN ASCENDING ORDER.  
 0053 E THE FOLLOWING LINE OF GRID DATA IS  
 MORE THAN 120% OF THE MAX OR MIN ON THE COORDINATE LAVS:  
 <CARD IMAGE FOLLOWS>

2000 I XXXX &DATA CARDS WERE READ AND WRITTEN TO IMPACT2.  
2001 I NO DATA CARDS WRITTEN TO IMPACT2.

IMP200

2500 E PROCESSING CANNOT BE PERFORMED DUE TO ERRORS.  
3000 F PROCESSING STOPPED WITH ERRORS.

IMP210

0101 E UNEXPECTED MESSAGE FROM MOBILE2:  
    <ALL REMAINING MESSAGES PRINTED>  
0200 F UNEXPECTED MESSAGE FROM MOBILE2.  
8001 I NO UNEXPECTED MESSAGES FROM MOBILE2.  
8003 F READ ERROR ON MOBILE2 MESSAGE FILE.

IMP220

1000 F AN ERROR HAS BEEN DETECTED WHICH SHOULD HAVE BEEN DETECTED  
    IN IMPACT1. STEPS SUBSEQUENT TO IMPACT1 SHOULD NOT  
    HAVE RUN. PLEASE SEND A COPY OF THIS OUTPUT TO UMTA/FHWA.

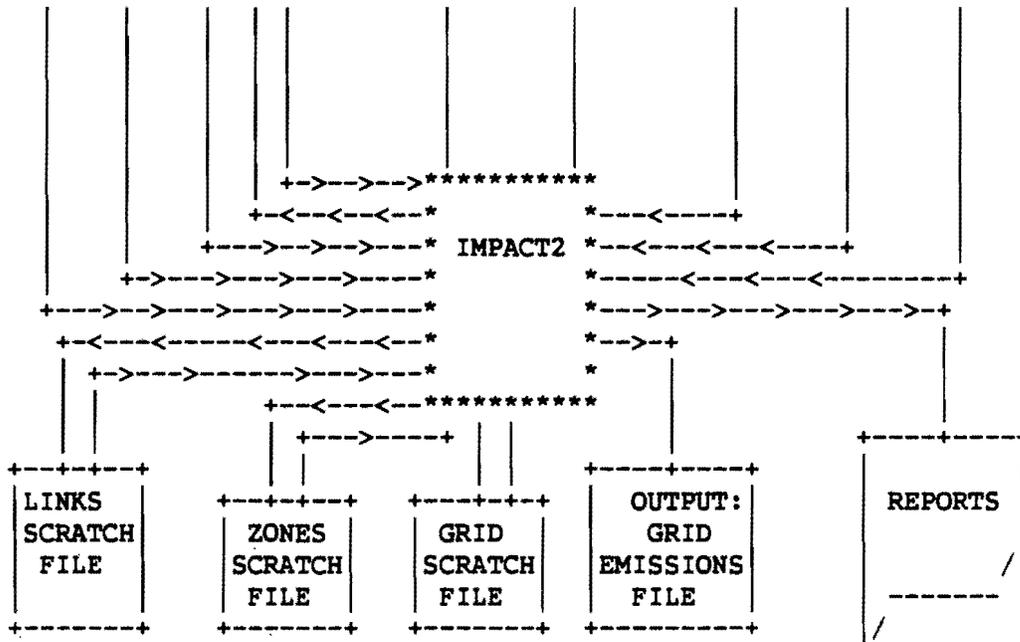
IMP230

0221 I EMISSION FACTORS READ FROM MOBILE2.  
8001 F ERROR IN READING EMISSION FACTORS FROM MOBILE2.

IMP251

0230 E GRID XXXXXXXX YYYYYYY NOT AN X COORDINATE GRID LINE  
0235 E GRID XXXXXXXX YYYYYYY NOT A Y COORDINATE GRID LINE  
0220 E EQUIVALENCE ERROR FOR GRID X= XXXXXXXX Y=YYYYYYYY  
    NEW SECTOR = XX OLD SECTOR = XX KEPT





## IMPACT SYSTEM DESIGN - SYSTEM FLOW

```

EXEC IMPACT1
  INITIALIZE COMMONS
  CALL SIGNON
  WRITE SIGNON FLAGS TO IMPACT2 SCRATCH FILE
  CHECK PRESENCE OF REQUIRED OUTPUT FILES
  EDIT CONTROL CARDS (&PARAM,&OPTION,&SELECT)
  PLAYBACK CONTROL CARDS
  EDIT &TRAVEL CARDS
    IF &TRAVEL CARDS PRESENT
      IF REQUIRED Z-FILES PRESENT
        IF LAVS SPECIFIED ON &TRAVEL CARDS PRESENT
          IF GRID CODED
            AND IF Z-LAV PRESENT ON ZONE Z-FILE
              IF GRID CODED
                AND IF OPTIONAL GRID CARDS NOT INPUT
                  AND IF Z-LAV PRESENT ON LINK Z-FILE
                    GO TO ENDIF
              ELSE
                ELSE
                  ELSE
                    ELSE
                      WRITE ERROR MESSAGES AND SINOFF
                    ELSE
                      WRITE ERROR MESSAGES AND SINOFF
                    ENDIF
          CONVERT REL.HUMIDITY TO ABS.HUMIDITY
          IF NOT MOBIL3
            WRITE TO 5 MOBILE2 INPUT SCRATCH FILES:
            CONTROL, ONE-TIME DATA, SCENARIOS, LDG CORR. FACTORS
            FILE1:VMT-RELATED EMISSIONS,STARTUP(<1.HR & > 4.HRS), CC
              IN CONTROL SET ALHFLG=0, ICEVFG=1
              IN ONE-TIME DATA SET TPD=1, MPD=10**6
              VMT-RELATED EMISSIONS
              IN SCENARIO CARDS STEP THRU SPDS 5-55MPH IN INC OF 5MPH
              IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
              100% HOT STABILIZED
              IN SCENARIO CARDS, SPEED = 25.6MPH
              IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
              100% COLD START
              IN SCENARIO CARDS, SPEED = 25.6MPH
              IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
              100% HOT START
              IN SCENARIO CARDS, SPEED = 25.6MPH
              IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
            FILE2:HOT SOAK + CC
              IN CONTROL SET ALHFLG=0, ICEVFG=1
              IN ONE-TIME DATA SET TPD=10**6, MPD=10**6
              IN SCENARIO CARDS, SPEED = 25.6MPH
            FILE3:DIURNAL + CC
              IN CONTROL SET ALHFLG=0, ICEVFG=1
              IN ONE-TIME DATA SET TPD=0, MPD=1
              IN SCENARIO CARDS, SPEED = 25.6MPH

```

```

IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
FILE4: START-UP, 1-4 HOURS, CATALYST
IN CONTROL SET ALTFLG=1, ICEVFG=3
IN ONE-TIME DATA SET PRE-1975 EF=0
IN SCENARIO SET 25.6MPH,100% HOT STAB, STEPS OF 5 DEG F
IN SCENARIO SET 25.6MPH,100% COLD ST., STEPS OF 5 DEG F
FILE5: START-UP, 1-4 HRS, NON-CATALYST
IN CONTROL SET ALTFLG=1, ICEVFG=3
IN ONE-TIME DATA SET POST-1974 EF=0
IN SCENARIO SET 25.6MPH 100% HOT STAB, STEPS OF 5 DEG F
IN SCENARIO SET 25.6MPH,100% HOT START,STEPS OF 5 DEG F

```

ELSE

```

WRITE TO 5 MOBILE3 INPUT SCRATCH FILES:
CONTROL, ONE-TIME DATA, SCENARIOS, LDG CORR. FACTORS
FILE1:VMT-RELATED EMISSIONS,STARTUP(<1.HR & > 4.HRS), CC
IN CONTROL SET ALHFLG=1, ICEVFG=2
IF ATPIM = 0 THEN ATPFLG = 1 ELSE ATPFLG = 2
IF ATP PROGRAM
  IN ONE-TIME DATA ATP CHARACTERISTICS RECORD
ENDIF
IN ONE-TIME DATA SET TPD=1, MPD=10**6
VMT-RELATED EMISSIONS
IN SCENARIO CARDS STEP THRU SPDS 5-55MPH IN INC OF 5MPH
IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
100% HOT STABILIZED
IN SCENARIO CARDS, SPEED = 25.6MPH
IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
100% COLD START
IN SCENARIO CARDS, SPEED = 25.6MPH
IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
100% HOT START
IN SCENARIO CARDS, SPEED = 25.6MPH
IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
FILE2:HOT SOAK + CC
IN CONTROL SET ALHFLG=1, ICEVFG=2
IF ATP PROGRAM THEN ATPFLG = 1 ELSE ATPFLG = 2
IF ATP PROGRAM
  IN ONE-TIME DATA ATP CHARACTERISTICS RECORD
ENDIF
IN ONE-TIME DATA SET TPD=10**6, MPD=10**6
IN SCENARIO CARDS, SPEED = 25.6MPH
FILE3:DIURNAL + CC
IN CONTROL SET ALHFLG=1, ICEVFG=2
IF ATPIM = 0 THEN ATPFLG = 1 ELSE ATPFLG = 2
IF ATP PROGRAM
  IN ONE-TIME DATA ATP CHARACTERISTICS RECORD
ENDIF
IN ONE-TIME DATA SET TPD=0, MPD=1
IN SCENARIO CARDS, SPEED = 25.6MPH
IN SCENARIO CARDS STEP THRU TEMP 0-110 INC OF 5 DEG F
FILE4: START-UP, 1-4 HOURS, CATALYST
IN CONTROL SET NEWFLG=2, ICEVFG=4
IF ATPIM = 0 THEN ATPFLG = 1 ELSE ATPFLG = 2
IF ATP PROGRAM

```

```

      IN ONE-TIME DATA  ATP CHARACTERISTICS RECORD
    ENDIF
      IN ONE-TIME DATA SET PRE-1975 EF=0
      IN SCENARIO SET 25.6MPH,100% HOT STAB, STEPS OF 5 DEG F
      IN SCENARIO SET 25.6MPH,100% COLD ST., STEPS OF 5 DEG F
    FILE5: START-UP, 1-4 HRS, NON-CATALYST
      IN CONTROL SET NEWFLG=2, ICEVFG=4
      IF ATPIM = 0 THEN ATPFLG = 1 ELSE ATPFLG = 2
      IF ATP PROGRAM
        IN ONE-TIME DATA  ATP CHARACTERISTICS RECORD
      ENDIF
      IN ONE-TIME DATA SET POST-1974 EF=0
      IN SCENARIO SET 25.6MPH 100% HOT STAB, STEPS OF 5 DEG F
      IN SCENARIO SET 25.6MPH,100% HOT START, STEPS OF 5 DEG F
    ENDIF
    EDIT &DATA CARDS AND WRITE TO IMPACT2 SCRATCH FILE

EXEC MOBILE2 OR MOBILE3 5 TIMES
  WRITE FILE OF EMISSION FACTORS AND FILE OF ERROR MESSAGES

EXEC IMPACT2
  EDIT MESSAGES FROM MOBILE2 TO ELIMINATE EXPECTED MESSAGES
  IF ERROR OR WARN MESSAGE REMAINING
    WRITE ERROR MESSAGES TO USER
    WRITE SINOFF-ON-FATAL-ERROR MESSAGE
    SINOFF
  ENDIF
  READ &PARAM, &OPTION, &SELECT, &TRAVEL
  READ EMISSION FACTORS FROM SCRATCH FILE
  FROM RUN1: READ VMT-RELATED EMISSION FACTORS
    HCVMT = HC(TOTAL)
    CC=CCEV
  FROM RUN1: READ 100% HOT STAB. : NAME = STBL
  FROM RUN1: READ 100% COLD START : NAME = COLD
  FROM RUN1: READ 100% HOT START : NAME = HOT
    ESUE>4      = 3.59* (COLD - STBL)
    ESUE<1      = 3.59* (HOT - STBL)
  FROM RUN2: READ HOT SOAK + CC : NAME = HSKCC
  FROM RUN3: READ DIURNAL + CC : NAME = DNLCC
    DNL=DNLCC-CC
    HSK=HSKCC-CC
  FROM RUN4: READ POST-74 100% HOT STAB. : NAME = PSTSTB
  FROM RUN4: READ POST-74 100% COLD START : NAME = PSTCLD
  FROM RUN5: READ PRE-75 100% HOT STAB. : NAME = PRESTB
  FROM RUN5: READ PRE-75 100% HOT START : NAME = PREHOT
    ESUE14 (CAT) = 3.59* (PSTCLD - PSTSTB)
    ESUE14 (NON) = 3.59* (PREHOT - PRESTB)
    ESUE14      = ESUE14 (NON) + ESUE14 (CAT)
  CONVERT TO GRAMS/MIN., /MIN./DEG., /TRIP-START, /TRIP
  EDIT E.F. DIFFERENCES TO ZERO NEG NUMBERS
  FOR EACH VMIX (EXCEPT DIURNAL), COMBINE E.F. WITH VMIX
  WRITE REPORTS 1-3 (E.F.'S COMBINED BY MIXES)

DO KK=1, NTRAVEL

```

## HOTRUNNING INTERZONAL EMISSION COMPUTATION

```

DO I=1,N-CHUNKS-LINKS
  DO J=1,NVMIXES
    READ LAVS FROM LINK Z-FILE IN CHUNKS USING 'ZIO'
    DO K=1,NCHUNKSIZE (998)
      E(K)=E(K)+VOL(J,K)*VFAC(J)*DISTANCE(J,K)*60.
        *EF(SPEED(J,K),TEMP,VMIX(J))/SPEED(J,K)
    END-DO ON J,K
    DO K=1,NCHUNKSIZE
      STORE E(K)
    END-DO'S ON I,K

```

## ZONE-RELATED EMISSIONS COMPUTATIONS

```

DO I=1,N-CHUNKS-ZONES

```

## AGGREGATION OF E(LINKS) INTO E(ZONES)

```

DO L=1,N-ZONE-CHUNKSIZE (99)
  E(L)=0.0
DO M=1,N-CHUNKS-LINKS
  READ E(K)
  READ ZONE LAV ON LINK-FILE
DO K=1,NCHUNKSIZE (998)
  ASSIGN E(K) TO E(ZONES)
END-DO ON K,L,M

```

## HOTRUNNING INTRAZONAL EMISSION COMPUTATION

```

DO J=1,N-TMIX
  READ LAVS FROM ZONE Z-FILE IN CHUNKS USING 'ZIO'
DO L=1,N-ZONE-CHUNKSIZE (99)
  E(L)=E(L)+INTRA(J,L)*TFAC(J)*ATL(L?)
    *EF(SPIN(L?),TEMP,TMIX(J))
END-DO ON J,L

```

## EXCESS STARTUP EMISSION COMPUTATION

```

DO J=1,N-TMIX
  READ LAVS FROM ZONE Z-FILE IN CHUNKS FROM 'ZIO'
DO L=1,N-ZONE-CHUNKSIZE (99)
  APARK*(J)=1.-APARK(1,J)-APARK(2,J)
  PPARK*(J)=1.-PPARK(1,J)-PPARK(2,J)
  E(L)=E(L)+P(J,L)*TFAC(J)*STARTS(J)
    *(PPARK(1,J)*EF(TEMP,TMIX(J),1)
    +PPARK*(J)*EF(TEMP,TMIX(J),2)
    +PPARK2(J)*EF(TEMP,TMIX(J),3))
  +A(J,L)*TFAC(J)*(1.-STARTS(J))
    *(APARK(1,J)*EF(TEMP,TMIX(J),1)
    +APARK*(,J)*EF(TEMP,TMIX(J),2)
    +APARK2(J)*EF(TEMP,TMIX(J),3)
END-DO ON J,L

```

## HOTSOAK EMISSION COMPUTATION

```

DO J=1,N-TMIX
  READ LAVS FROM ZONE Z-FILE IN CHUNKS USING 'ZIO'
DO L=1,N-ZONE-CHUNKSIZE (99)
  HT(L)=(P(J,L))*(1.-STARTS(J))

```

```

      +A(J,L)*STARTS(J))*TFAC(J)*EF(TMIX(J))
    E(L)=E(L)+HT(L)
  END-DO ON J,L

```

MAIN DIURNAL EMISSION COMPUTATION

ONLY IF VCOUNT ENTERED

```

DO J=1,N-TMIX
READ LAVS FROM ZONE Z-FILE IN CHUNKS USING 'ZIO'
COMBINE DIURNAL E.F. WITH MIXES
DO L=1,N-ZONE-CHUNKSIZE (99)
  DO II=1,8
    E(L)=E(L)+VCOUNT(II)*DIURNAL(II)*HT(L)
      *TEMP-INCREMENT/THOT
  END-DO ON J,L,II

```

ALTERNATIVE DIURNAL EMISSION COMPUTATION

ONLY IF VCOUNT NOT ENTERED

```

DO J=1,N-TMIX
READ LAVS FROM ZONE Z-FILE IN CHUNKS USING 'ZIO'
COMBINE DIURNAL E.F. WITH MIXES
DO L=1,N-ZONE-CHUNKSIZE (99)
  E(L)=E(L)+(A(J,L)*TFAC(J)*EF(TMIX(J))
    +P(J,L)*TFAC(J)*EF(TMIX(J)))
      *TEMP-INCREMENT/TRIPS
  END-DO ON J,L

```

```

DO L=1,N-ZONE-CHUNKSIZE (99)
  STORE E(L)
END-DO ON J,L

```

END-DO ON I

IF GRID REQUESTED

```

REASSIGN E(ZONES) TO E(GRID) USING GRID CARDS
WRITE GRID EMISSIONS FILE
PRINT GRID EMISSIONS AS REQUESTED

```

ELSE

```

WRITE ZONAL EMISSION LAVS TO ZONE Z-FILE
PRINT ZONAL EMISSION REPORTS AS REQUESTED

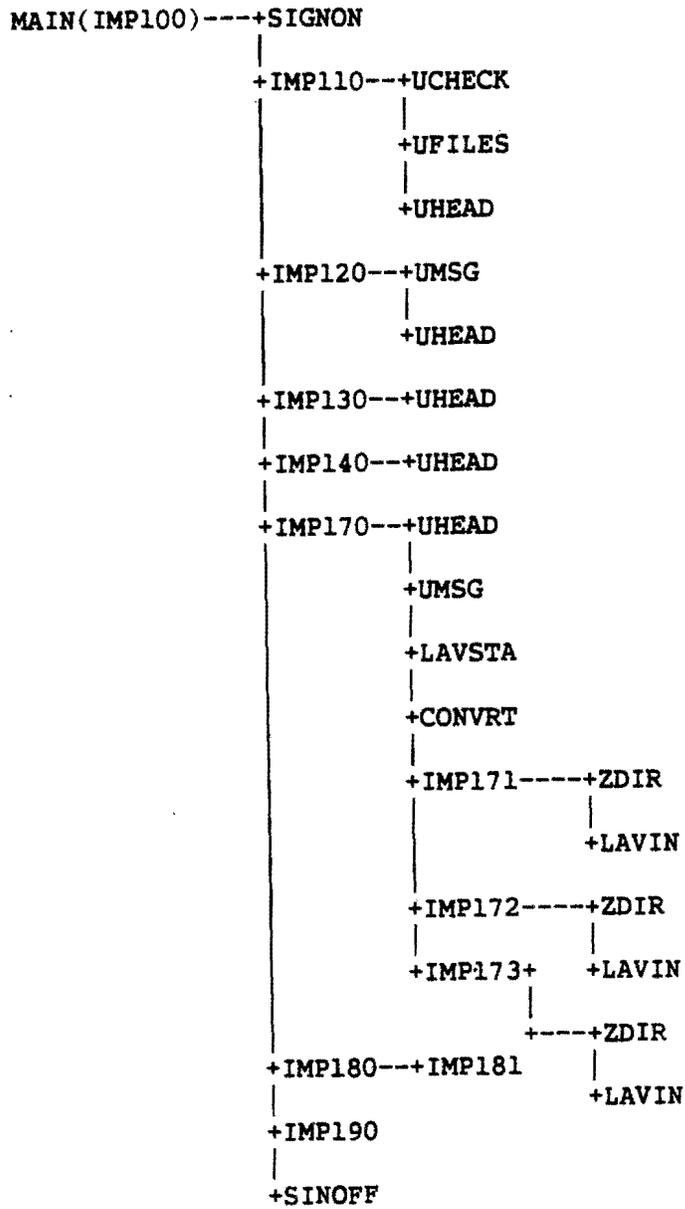
```

END-DO'S ON KK

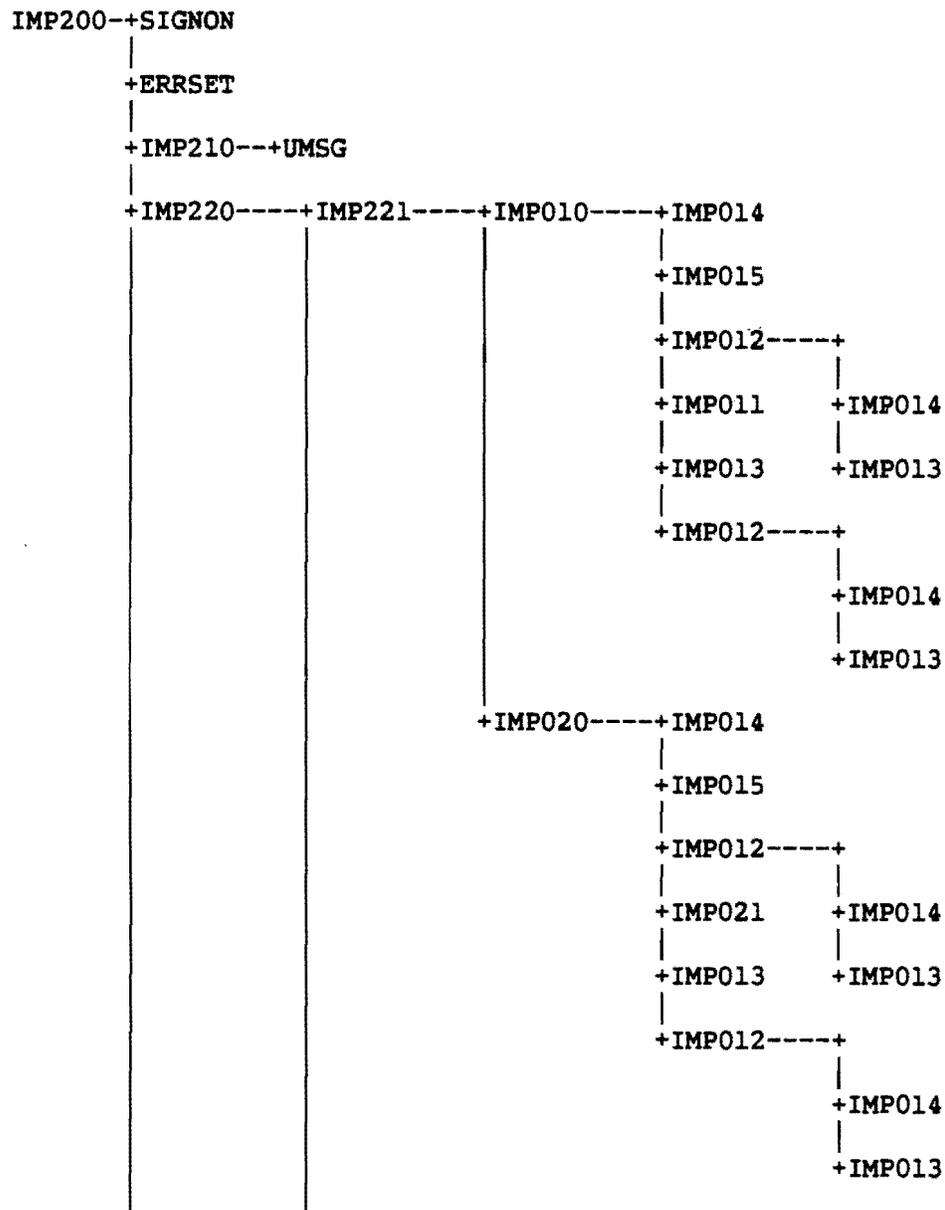
SINOFF

ERASE GRID FILE IF ERROR IN IMPACT2

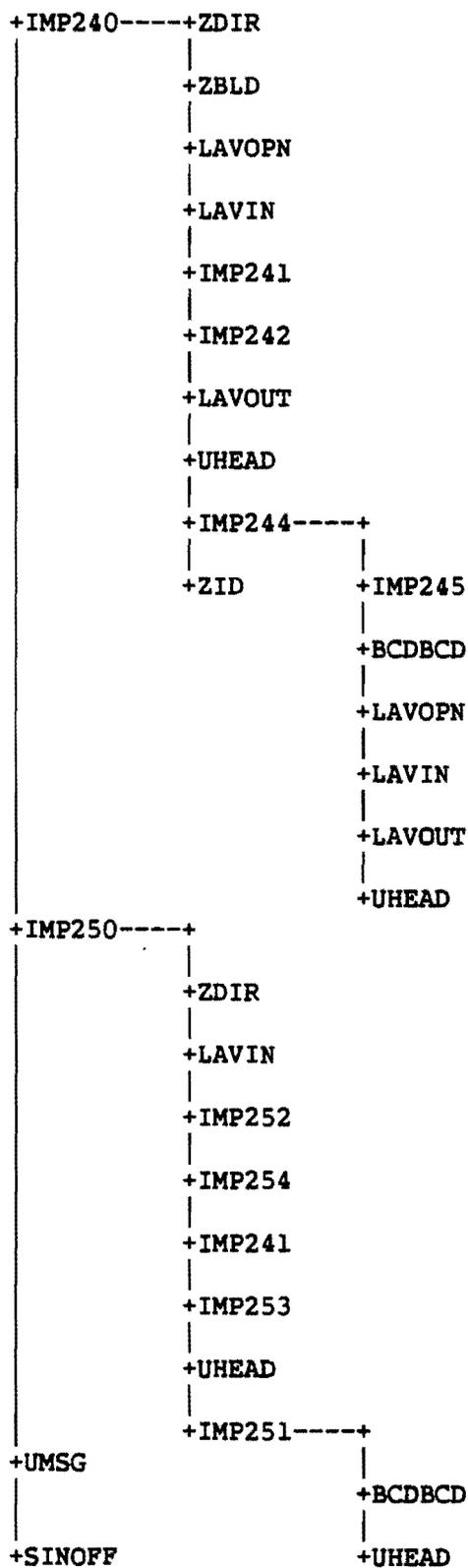
PROGRAM TREE FOR IMPACT1



PROGRAM TREE FOR IMPACT2







**BUILD Z FILES**

THE OUTPUT OF THE TEXAS LARGE NETWORK ASSIGNMENT MODELS IS CONVERTED TO THE LINK Z-FILE FORMAT NEEDED BY IMPACT USING THE THREE PROGRAMS DESCRIBED BELOW.

**1. BUILD Z1 FILE**

THIS PROGRAM CONVERTS AN ASSIGNED NETWORK DATA SET FROM THE TEXAS LARGE NETWORK ASSIGNMENT MODELS TO THE LINK Z-FILE FORMAT NEEDED BY IMPACT. THE INPUT DATA IS AN ASSIGNED NETWORK DATA SET, A Z1-FILE CONTROL CARD IMAGE, HEADER CARD IMAGE AND LAV DESCRIPTION CARD IMAGES. A LAV IS A LIST OF ATTRIBUTE VALUES IMPLICITLY INDEXED BY LINK, NODE, ZONE, OR CELL. EACH LAV STORES AN ATTRIBUTE (E.G., ZONE PRODUCTION) FOR ALL INDICES. EACH ELEMENT IN THE LIST IS THE ATTRIBUTE VALUE FOR ONE INDEX. THE I'TH ELEMENT IN THE LIST STORES THE ATTRIBUTE FOR THE I'TH INDEX. A Z-FILE IS ONE OR MORE LAV'S WITH THE SAME INDEX. THE PROGRAM RUNS IN TWO STEPS. IN STEP ONE THE PROGRAM BUILDS A SINGLE TREE FROM ALL ZONES USING LINK DISTANCE AS THE LINK IMPEDANCE. THIS TREE IS USED TO DETERMINE THE CLOSEST ZONE TO EACH NODE IN THE NETWORK. THE PROGRAM THEN WRITES A DATA SET CONTAINING THE MINIMUM PATH DISTANCES TO EACH NODE IN THE NETWORK AND ALSO THE ZONE WHICH REACHED EACH NODE.

STEP ONE IS DESCRIBED IN THIS PARAGRAPH. THIS PROGRAM FIRST READS THE LINK DATA AND THEN BUILDS A TREE SIMULTANEOUSLY FROM ALL ZONES IN THE NETWORK. THIS TREE STARTS WITH A CUMULATIVE IMPEDANCE OF 0.00 MILES FOR ALL ZONES IN THE NETWORK. THE IMPEDANCE USED FOR BUILDING THE TREE IS MILES. THE TREE IS BUILT WITH A TURN PENALTY OF 0.0 MILES. AFTER THE TREE IS BUILT IT IS TRACED BACK TO AN ORIGIN ZONE FROM EACH NODE CONNECTED IN THE NETWORK AND EACH NODE IN THIS TRACE IS LABELED WITH THE ORIGIN ZONE FOUND FROM THIS TRACE. THEN FOR EACH LINK IN THE NETWORK THE MINIMUM PATH DISTANCE TO BOTH NODES OF THE LINK IS EXAMINED AND THE ZONE CORRESPONDING TO THE NODE WITH THE SMALLEST TREE DISTANCE IS CHOSEN AS THE ASSOCIATED ZONE. TIES FOR MINIMUM PATHS TO A NODE ARE BROKEN BY KEEPING THE FIRST PATH TO THE NODE. THE TREE IS BUILT FROM THE SMALLEST ZONE NUMBERS FIRST, SO THIS WILL FAVOR THE SMALLER ZONE NUMBERS. TIES FOR BOTH NODES OF A LINK HAVING THE SAME DISTANCE ARE CURRENTLY BROKEN BY SELECTING THE ANODE OF THE LINK WHICH WILL FAVOR THE SMALLER NODE NUMBERS. AFTER THE TREE IS BUILT THE PATH FROM EACH NODE IS TRACED BACK TO A ZONE AND THIS ZONE IS ENTERED IN A TABLE OF EQUALS FOR THAT NODE. THEN THIS TABLE OF EQUALS AND THE MINIMUM PATH MILES TO ALL NODES AND ZONES ARE WRITTEN TO A SCRATCH DATA SET, FT03F001, WHICH IS PASSED TO THE SECOND JOB STEP.

IN THE SECOND STEP THE NODE TO ZONE EQUIVALENCE AND THE MINIMUM DISTANCE TO EACH NODE ARE READ FROM THE TEMPORARY DATA SET. THEN THE ASSIGNED NETWORK DATA SET IS READ AND THE PROGRAM OBTAINS AN ASSIGNED LINK VOLUME AND LINK SPEED FROM THE SPECIFIED ASSIGNMENT FOR EACH LINK. THE PROGRAM THEN TAKES THE TABLE OF EQUALS ZONE FOR THE NODE OF THE LINK WHICH HAS THE SMALLEST MINIMUM PATH DISTANCE AS THE ASSOCIATED ZONE FOR THE LINK.

THE PROGRAM WRITES LAV'S FOR ANODE, BNODE, LINK DISTANCE, LINK SPEED, ASSIGNED LINK VOLUME AND ASSOCIATED ZONE FOR THE LINK. ONLY LINKS WHERE THE ANODE IS LESS THAN THE BNODE ARE WRITTEN TO THE Z1 FILE. THE LINKS ARE WRITTEN IN ASCENDING SORTED ORDER OF ANODE AND BNODE. THE ASSIGNED VOLUME

IS THE NONDIRECTIONAL LINK VOLUME. THE PROGRAM TAKES THE NONDIRECTIONAL ASSIGNED LINK VOLUME AND THE LINK SPEED FROM THE ASSIGNMENT NUMBER SELECTED BY THE ITERATION FIELD OF THE ASSIGNMENT CONTROL CARD. THIS NUMBER WILL BE ONE FOR AN ALL OR NOTHING ASSIGNMENT AND FOR A FIVE ITERATION CAPACITY RESTRAINT IT WILL BE SIX TO SELECT THE WEIGHTED ITERATION.

THE FORMAT OF THE ASSIGNMENT CONTROL CARD IMAGE IS:

COLUMN	FORMAT	CONTENTS
1-5	I5	ASSIGNMENT NUMBER TO USE

THE USER MUST BE AWARE THAT HE IS CONTROLLING THE LAV NAMES THAT ARE GENERATED IN THE Z1 FILE FOR ALL VARIABLES AND THAT THESE NAMES MUST BE THE SAME AS THOSE ON THE IMPACT CONTROL CARD IMAGES. THE LAV NAMES THAT THE USER INPUTS TO THIS PROGRAM ARE ON SIX CARD IMAGES. THE FORMAT OF THESE CARD IMAGES FOLLOWS:

COLUMN	FORMAT	CONTENTS
1-8	A8	LAV NAME
11-18	A8	UNITS
21-44	A24	DESCRIPTION OF LAV

THERE ARE SIX LAV NAME DESCRIPTION CARD IMAGES, THE ORDER WHICH THEY COME IN IS ANODE, BNODE, ZONE, LINK DISTANCE, LINK SPEED FROM THE SPECIFIED ASSIGNMENT, AND NONDIRECTIONAL ASSIGNED LINK VOLUME FROM THE SPECIFIED ITERATION.

THE DATA SETS USED BY THIS PROGRAM IN THE SECOND GO STEP ARE:

DDNAME	CONTENTS OF DATA SET
FT01F001	ASSIGNED NETWORK DATA SET FROM THE TEXAS LARGE NETWORK MODELS
FT05F001	CONTROL CARD AND LAV DESCRIPTION CARD IMAGES
FT19F001	PARAMETER CARD IMAGE INPUT (HEADER CARD IMAGE)
FT20F001	SCRATCH COPY OF FT19F001
FT21F001	UTPS LOG FILE.
Z1	Z1 OUTPUT DATA SET (MUST BE ALLOCATED WITH NO DCB)

## 2. BUILD Z2 FILE

THIS PROGRAM READS A SET OF COORDINATES FOR ZONES AND NODES AND BUILDS THE Z2 FILE USED BY IMPACT. THE PROGRAM ALSO READS LAV DESCRIPTIONS FROM UNIT 5. A LAV IS A LIST OF ATTRIBUTE VALUES IMPLICITLY INDEXED BY LINK, NODE, ZONE, OR CELL. EACH LAV STORES AN ATTRIBUTE (E.G., ZONE PRODUCTION) FOR ALL INDICES. EACH ELEMENT IN THE LIST IS THE ATTRIBUTE VALUE FOR ONE INDEX. THE I'TH ELEMENT IN THE LIST STORES THE ATTRIBUTE FOR THE I'TH INDEX. IN ADDITION TO THE VALUES, IDENTIFYING AND LABELING INFORMATION IS STORED FOR EACH LAV. THE LAV DESCRIPTIONS ARE READ FROM CARD IMAGES ON UNIT 5.

THE PROGRAM SETS THE COORDINATES TO MISSING VALUES FOR ANY NODES OR ZONES FOR WHICH THERE ARE NO COORDINATE CARD IMAGES. IF IMPACT IS RUN WITH OUTPUT BY ZONE THEN ALL COORDINATES CAN BE MISSING. THE PROGRAM READS THE

COORDINATE CARD IMAGES FROM FORTRAN UNIT 1.

THE FORMAT OF THE COORDINATE CARD IMAGES IS:

COLUMN	FORMAT	CONTENTS
1-5	I5	NODE NUMBER
6-15	F10.0	X COORDINATE OF NODE
16-25	F10.0	Y COORDINATE OF NODE

THE FORMAT OF THE CONTROL CARD IMAGE IS:

COLUMN	FORMAT	CONTENTS
1	L1	NEW OPTION: TRUE = NEW, FALSE = OLD

BY SETTING THE NEW OPTION TO FALSE THIS PROGRAM CAN ADD MORE LAV'S TO AN EXISTING Z2 FILE. THIS OPTION WOULD BE USED IF A USER WANTS TO USE MORE THAN ONE ASSIGNMENT. WHEN THIS OPTION IS USED THE USER MUST BE CAREFUL TO MAKE NEW LAV NAMES FOR THE X AND Y COORDINATES THAN THOSE USED IN PREVIOUS RUN.

THE USER MUST BE AWARE THAT HE IS CONTROLLING THE LAV NAMES THAT ARE GENERATED IN THE Z2 FILE FOR ALL VARIABLES AND THAT THESE NAMES MUST BE THE SAME AS THOSE ON THE IMPACT CONTROL CARD IMAGES. THE LAV NAMES THAT THE USER INPUTS TO THIS PROGRAM ARE ON TWO CARD IMAGES. THE FORMAT OF THESE CARD IMAGES FOLLOWS:

LAV NAME DESCRIPTION CARD IMAGE

COLUMN	FORMAT	CONTENTS
1-8	A8	LAV NAME
11-18	A8	UNITS
21-44	A24	DESCRIPTION OF LAV

THERE ARE TWO LAV NAME DESCRIPTION CARD IMAGES, THE ORDER WHICH THEY COME IN IS X COORDINATE AND Y COORDINATE.

THE DATA SETS USED BY THIS PROGRAM IN THE GO STEP ARE:

DDNAME	CONTENTS
FT01F001	COORDINATES CARD IMAGES
Z2	Z2 OUTPUT DATA SET (MUST BE ALLOCATED WITH NO DCB)
FT05F001	CONTROL CARD AND LAV DESCRIPTION CARD IMAGES
FT19F001	PARAMETER CARD IMAGE INPUT (HEADER CARD IMAGE)
FT20F001	SCRATCH COPY OF FT19F001
FT21F001	UTPS LOG FILE.

3. BUILD Z3 FILE

THIS PROGRAM READS A TRIP MATRIX, LINK DATA, AND R-VALUE CARD IMAGES AND BUILDS THE Z3 FILE USED BY IMPACT. THE PROGRAM ALSO READS LAV DESCRIPTIONS FROM UNIT 5. A LAV IS A LIST OF ATTRIBUTE VALUES IMPLICITLY INDEXED BY LINK, NODE, ZONE, OR CELL. EACH LAV STORES AN ATTRIBUTE (E.G., ZONE PRODUCTION) FOR ALL INDICES. EACH ELEMENT IN THE LIST IS THE ATTRIBUTE

VALUE FOR ONE INDEX. THE I'TH ELEMENT IN THE LIST STORES THE ATTRIBUTE FOR THE I'TH INDEX. IN ADDITION TO THE VALUES, IDENTIFYING AND LABELING INFORMATION IS STORED FOR EACH LAV. THE LAV DESCRIPTIONS ARE READ FROM CARD IMAGES ON UNIT 5.

THE LINK DATA MUST BE IN CARD IMAGE FORMAT. THE LINK DATA MUST INCLUDE THE PARAMETER CARD IMAGE AND THE L OR ENDLNK CARD IMAGE. IT IS READ TO GET THE INTRAZONAL SPEEDS. AN INTRAZONAL SPEED IS APPROXIMATED BY READING ALL CENTROID CONNECTOR LINK DATA AND SAVING THE SPEED READ FROM THE LAST CENTROID CONNECTOR FOR EACH CENTROID. SPEEDS FOR ANY CENTROID WITH NO LINKS ARE MARKED AS MISSING VALUES.

THE PROGRAM READS A TRIP MATRIX IN THE FORMAT USE BY THE TEXAS LARGE NETWORK ASSIGNMENT MODELS TO GET INTRAZONAL VOLUMES, PRODUCTIONS AND ATTRACTIONS FOR EACH ZONE. THIS PROGRAM MAKES A CROSS CHECK THAT THE NUMBER OF ZONES IN THE TRIP MATRIX DATA SET MATCHES THE NUMBER OF ZONES IN THE PARAMETER RECORD FOR THE TRIP MATRIX DATA SET. IF THE NUMBER OF ZONES DOES NOT MATCH THE THE PROGRAM PRINTS AN ERROR MESSAGE AND THEN STOPS WITH A STOP 1.

THE FORMAT OF THE CONTROL CARD IMAGE IS:

COLUMN	FORMAT	CONTENTS
1	L1	NEW OPTION: TRUE = NEW, FALSE = OLD
3-11	F10.0	ZONE TEMPERATURE IN DEGREES FAHRENHEIT

BY SETTING THE NEW OPTION TO FALSE THIS PROGRAM CAN ADD MORE LAV'S TO AN EXISTING Z3 FILE. THIS OPTION WOULD BE USED IF A USER WANTS TO USE MORE THAN ONE ASSIGNMENT. WHEN THIS OPTION IS USED THE USER MUST BE CAREFUL TO MAKE NEW LAV NAMES FOR THE PRODUCTIONS, ATTRACTIONS, INTRA ZONAL VOLUMES AND INTRAZONAL SPEED. IF THERE IS NOT A NEW INTRAZONAL SPEED IT IS OK TO USE THE SAME LAV NAME FOR THIS SPEED AND IT WILL REPLACE THE INTRAZONAL SPEED LAV FROM A PREVIOUS RUN OF THIS PROGRAM.

THE USER MUST BE AWARE THAT HE IS CONTROLLING THE LAV NAMES THAT ARE GENERATED IN THE Z3 FILE FOR ALL VARIABLES AND THAT THESE NAMES MUST BE THE SAME AS THOSE ON THE IMPACT CONTROL CARD IMAGES. THE LAV NAMES THAT THE USER INPUTS TO THIS PROGRAM ARE ON SIX CARD IMAGES. THE FORMAT OF THESE CARD IMAGES FOLLOWS:

LAV NAME DESCRIPTION CARD IMAGE

COLUMN	FORMAT	CONTENTS
1-8	A8	LAV NAME
11-18	A8	UNITS
21-44	A24	DESCRIPTION OF LAV

THERE ARE SIX LAV NAME DESCRIPTION CARD IMAGES, THE ORDER WHICH THEY COME IN IS PRODUCTION VOLUME, ATTRACTION VOLUME, INTRAZONAL VOLUME, INTRAZONAL SPEED, R-VALUE AND TEMPERATURE.

THE DATA SETS USED BY THIS PROGRAM IN THE GO STEP ARE:

NAME	CONTENTS
------	----------

FT01F001	TRIP MATRIX
FT02F001	LINK DATA CARD IMAGES
FT03F001	R-VALUE CARD IMAGES
Z3	Z3 OUTPUT DATA SET (MUST BE ALLOCATED WITH NO DCB)
FT05F001	CONTROL CARD AND LAV DESCRIPTION CARD IMAGES
FT19F001	PARAMETER CARD IMAGE INPUT (HEADER CARD IMAGE)
FT20F001	SCRATCH COPY OF FT19F001
FT21F001	UTPS LOG FILE.